UKOUG Back To Basics, February 28th 2008

Oracle Security Basics

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
- http://www.petefinnigan.com
- Consultancy and training available
- Author of Oracle security step-by-step
- Published many papers, regular speaker (UK, USA, Slovenia, Norway, more)
- Member of the Oak Table

Agenda

- What is Oracle Security?
- Basic Oracle security tenets
- Why a database must be secured
- How can a database be breached?
- Key security issues
  - Problems
  - Fixes
- Covering the basics
- What to do next

What Is Oracle Security?

- 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…
- Oracle security is about all of these
  - It is about creating a secure database
  - Storing critical / valuable data securely

What's involved in securing data?

- Perform an Oracle Security health audit
- Design a secure installation
- Perform database hardening
  - New database or existing
- Choose and use Security features where relevant e.g.
  - Encryption in the database for credit cards
  - TDE for secure data on disk
  - VPD to enable secure access to critical data

The Basic Tenets Of Oracle Security

- 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

Why Do Hackers Steal Data?

- Data is often the target now not system access; this can be for
- Identity theft to clone identities
- Theft of data to access money / banks
- http://www.petefinnigan.com/weblog/archives/00001129.htm - 25 million child benefit identities lost on two discs (not stolen but lost)
- Scarborough & Tweed SQL Injection - http://doj.nh.gov/consumer/pdf/ScarboroughTweed.pdf
- Insider threat is now greater than external threats

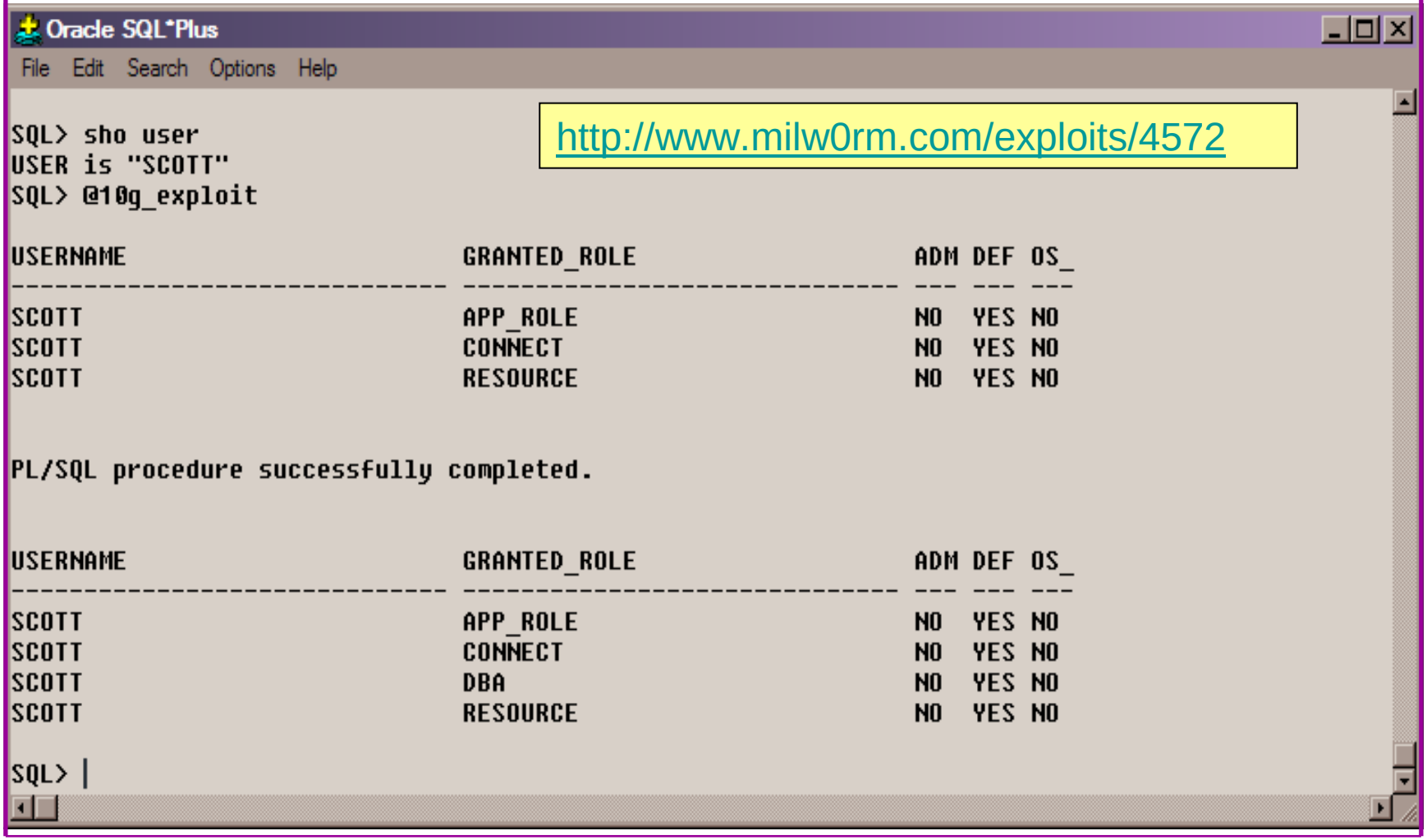
Internal Or External Attacks

- Internal attacks are shown to exceed external attacks in many recent surveys
- The reality is likely to be worse as surveys do not capture all details or all companies
- 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

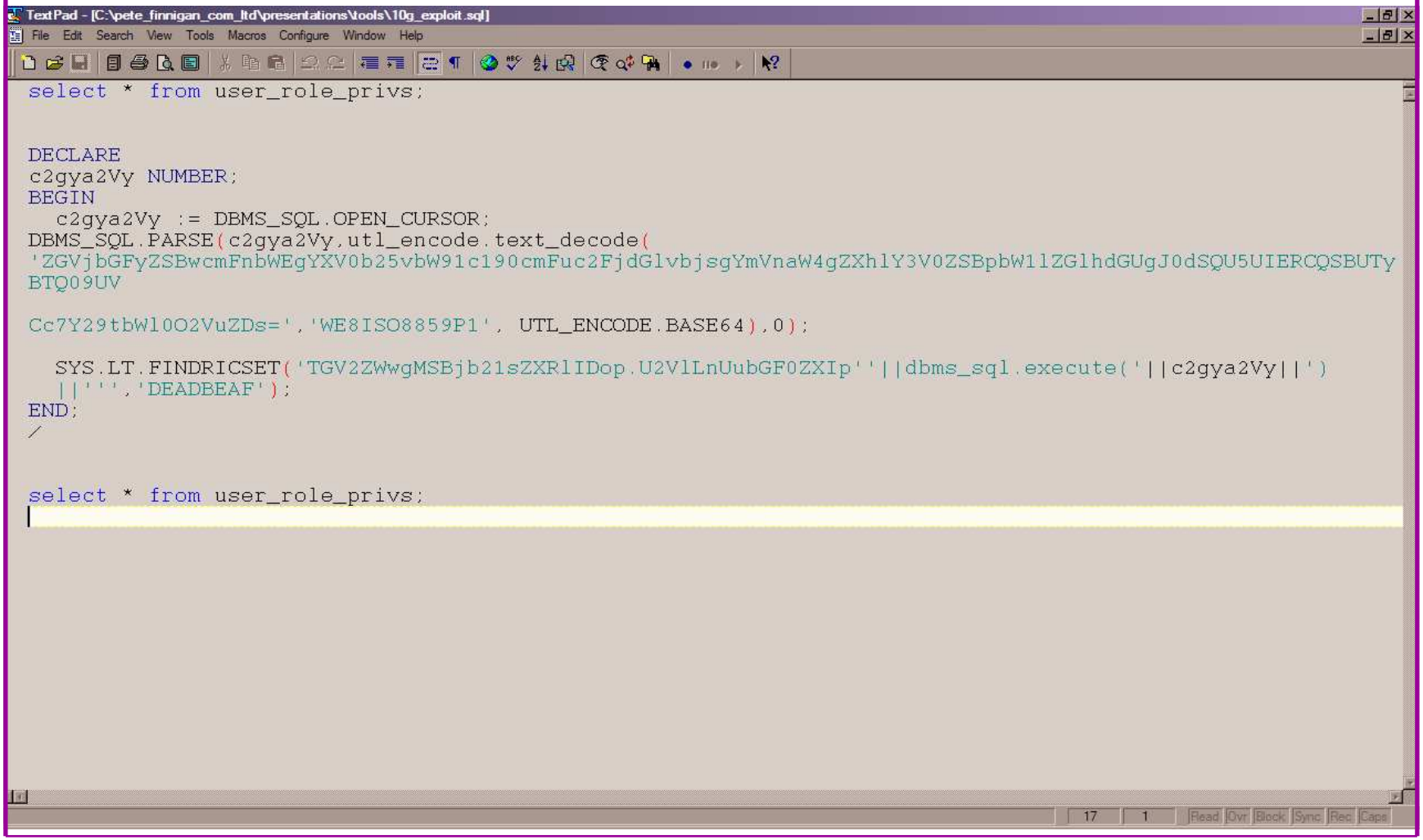
How Easy Is It To Attack?

- Many and varied – the world is your lobster
- 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
- ?

Second Example Exploit



Second Example Exploit (2)



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 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

General Oracle Security Info

- Vulnerabilities and exploits:
  - SecurityFocus – www.securityfocus.com
  - Milw0rm – www.milw0rm.com
  - PacketStorm – www.packetstorm.org
  - FrSirt – www.frsirt.com
  - NIST – http://nvd.nist.gov
  - CERT – www.kb.cert.org/vulns
- Tools – http://www.petefinnigan.com/tools.htm
  - Who_has scripts, CIS benchmark, Scuba, rorascanner, Metacortex, cqure, many more
- Papers, blogs, forums, books
- Checklists
  - 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
- Websites – petefinnigan.com, cqure, RDS, Argeniss, databasesecurity.com

The Basic Security Measures

- The access issue
- The key security issues (market knowledge)
- Key issues to investigate
- Get the basics right

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
- Lots of sites I see do:
  - 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

What to audit (First?)

- Perform a password audit – use a tool such as woraauthbf – http://www.soonerorlater.hu/index.khtml?article_id=513
- Reduce network access and leakage
- Review the listener
- File system
  - look for passwords
  - permissions
- Audit basic configuration
  - Parameters
  - User accounts that exist
  - Privileges on objects
  - Privileges assigned to users
- Use one of the free tools – CIS, OScanner, Scuba
- Or one of my scripts, who_can_access.sql, find_all_privs.sql, who_has_role.sql, who_has_priv.sql – see http://www.petefinnigan.com/tools.htm

Password Cracker (1)

Run in SQL*Plus

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

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

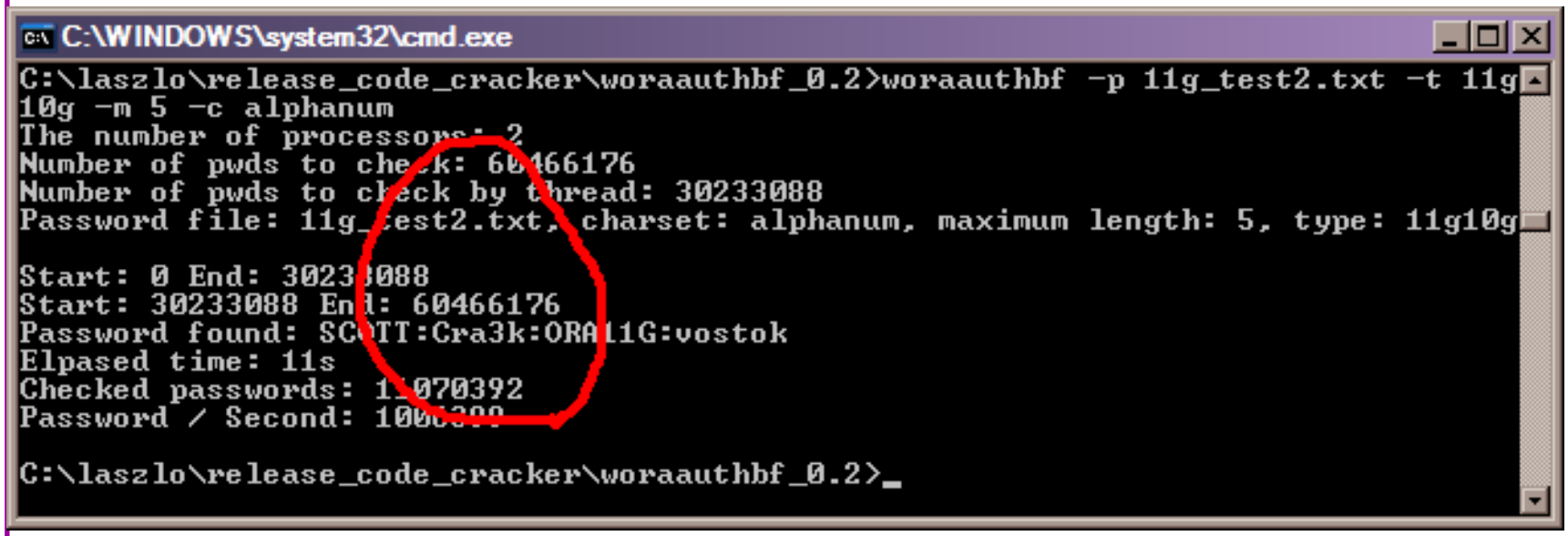
```
Select u.name||':'||u.password
   ||':'||substr(u.spare4,3,63)
   ||':'||d.name||':‘
   ||sys_context('USERENV','SERVER_HOST')||':'
from sys.user$ u, sys.V_$DATABASE d where u.type#=1;
```

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)



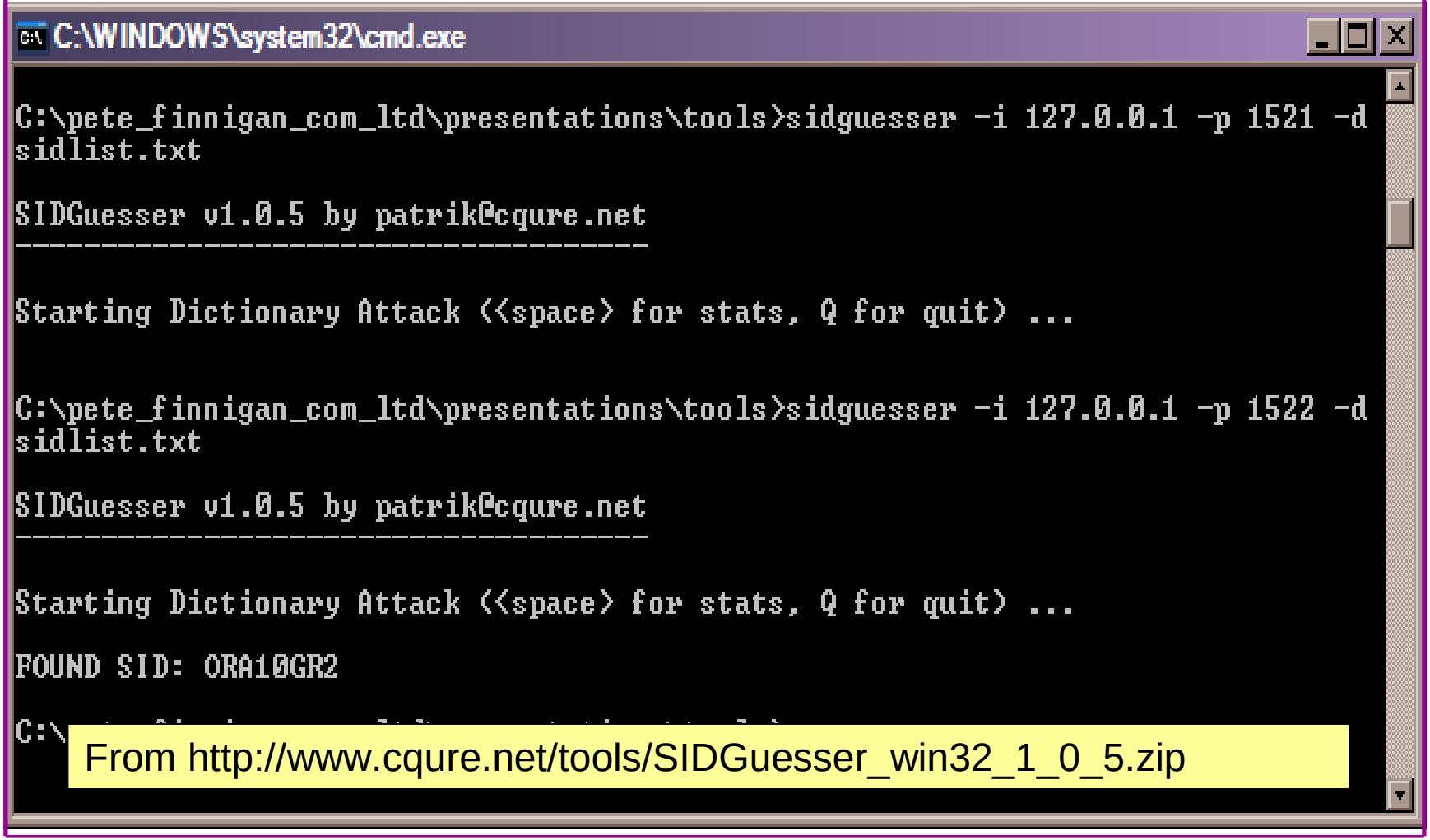
As you can see the password is found – running at over 1million hashes per second

Woraauthbf can also be used to crack from authentication sessions

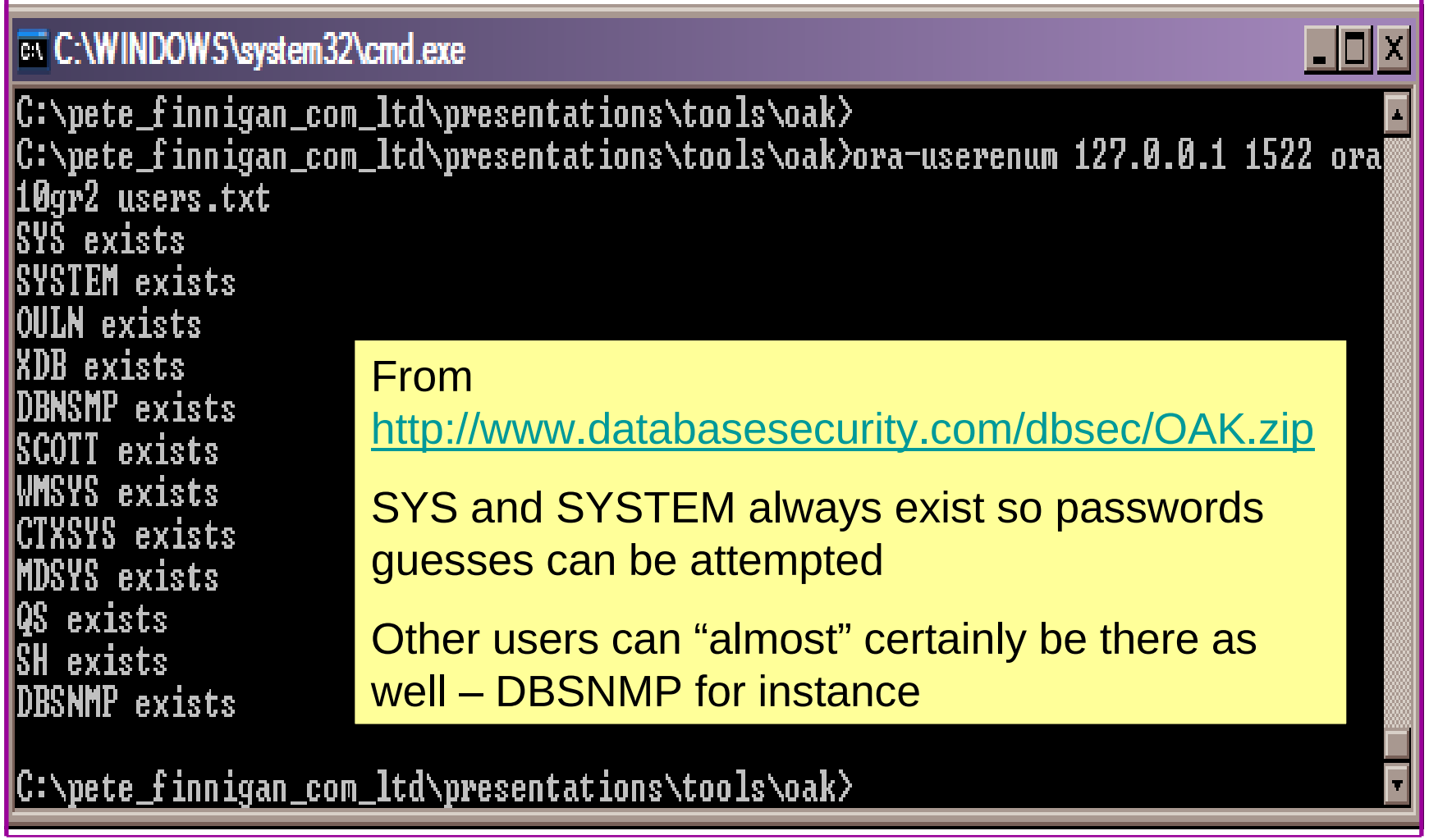
Woraauthbf can be used in dictionary or brute force mode

Use it to check user=pwd and defaults

SIDGuesser



User Enumeration



From http://www.databasesecurity.com/dbsec/OAK.zip

SYS and SYSTEM always exist so passwords guesses can be attempted

Other users can “almost” certainly be there as well – DBSNMP for instance

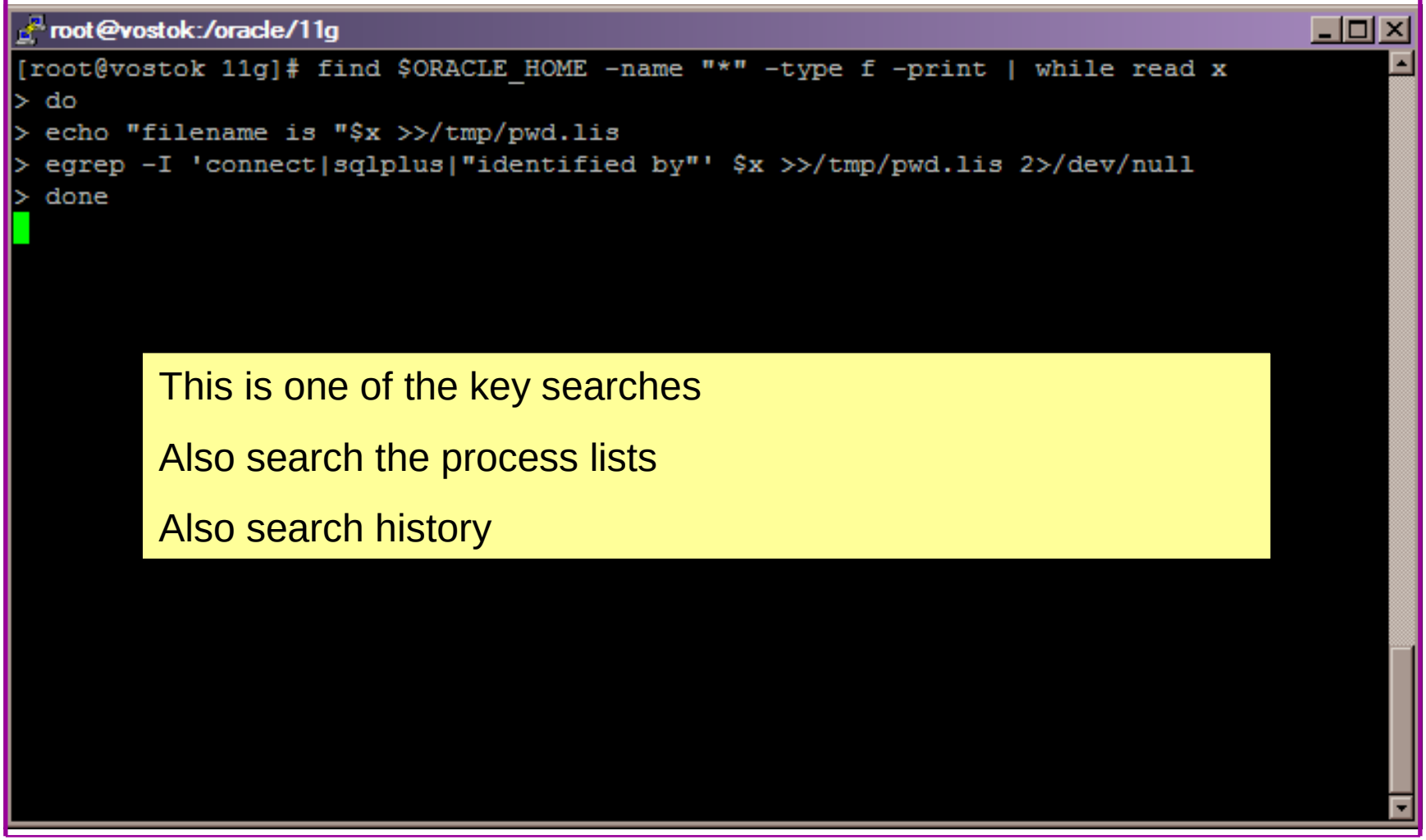
RBAC

- Review the complete RBAC model
- 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
  - reduce attack surface

Secure Listener by Default

```
STATUS of the LISTENER
------------------------
Alias                     LISTENER
Version                   TNSLSNR for Linux: Version 11.1.0.6.0 -
   Production
Start Date                31-OCT-2007 09:06:14
Uptime                    0 days 4 hr. 56 min. 27 sec
Trace Level               off
Security                  ON: Local OS Authentication
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...
```

Finding Passwords



This is one of the key searches

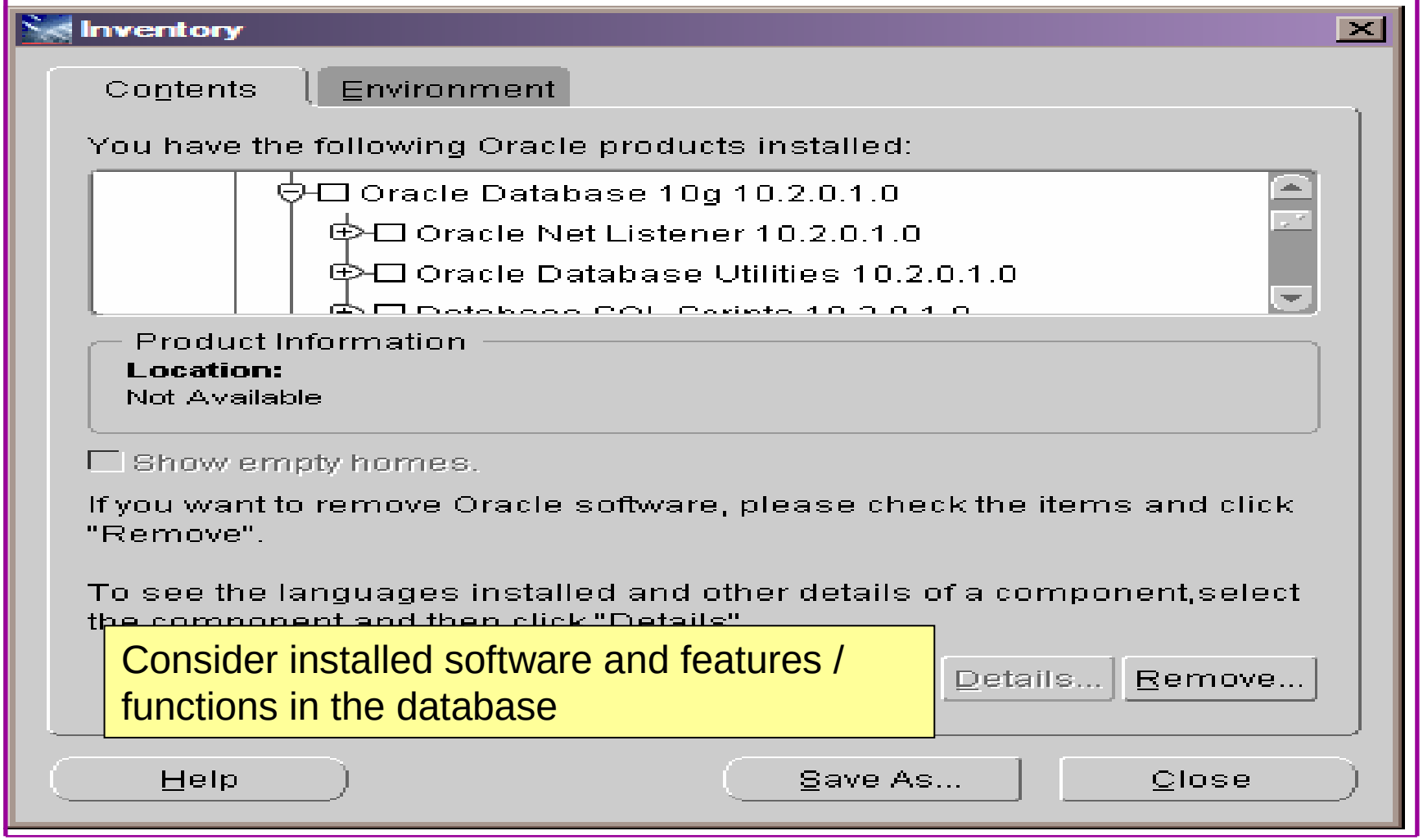
Also search the process lists

Also search history

Clean Up

- This is the security killer in most systems I see
- Often file systems include
  - Scripts with passwords
  - Use tools such as
    - Oracle Password Repository
    - Mkstore from Oracle
    - DBMS_JOBS, DBMS_SCHEDULER
    - OS authenticated users under certain circumstances
- Clean up
  - ad-hoc scripts
  - Maintenance evidence
  - Trace files
  - Data files, exports..
  - Audit logs….

Features



Defaults

- Defaults are one of the biggest issues in Oracle
- Most default accounts in 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

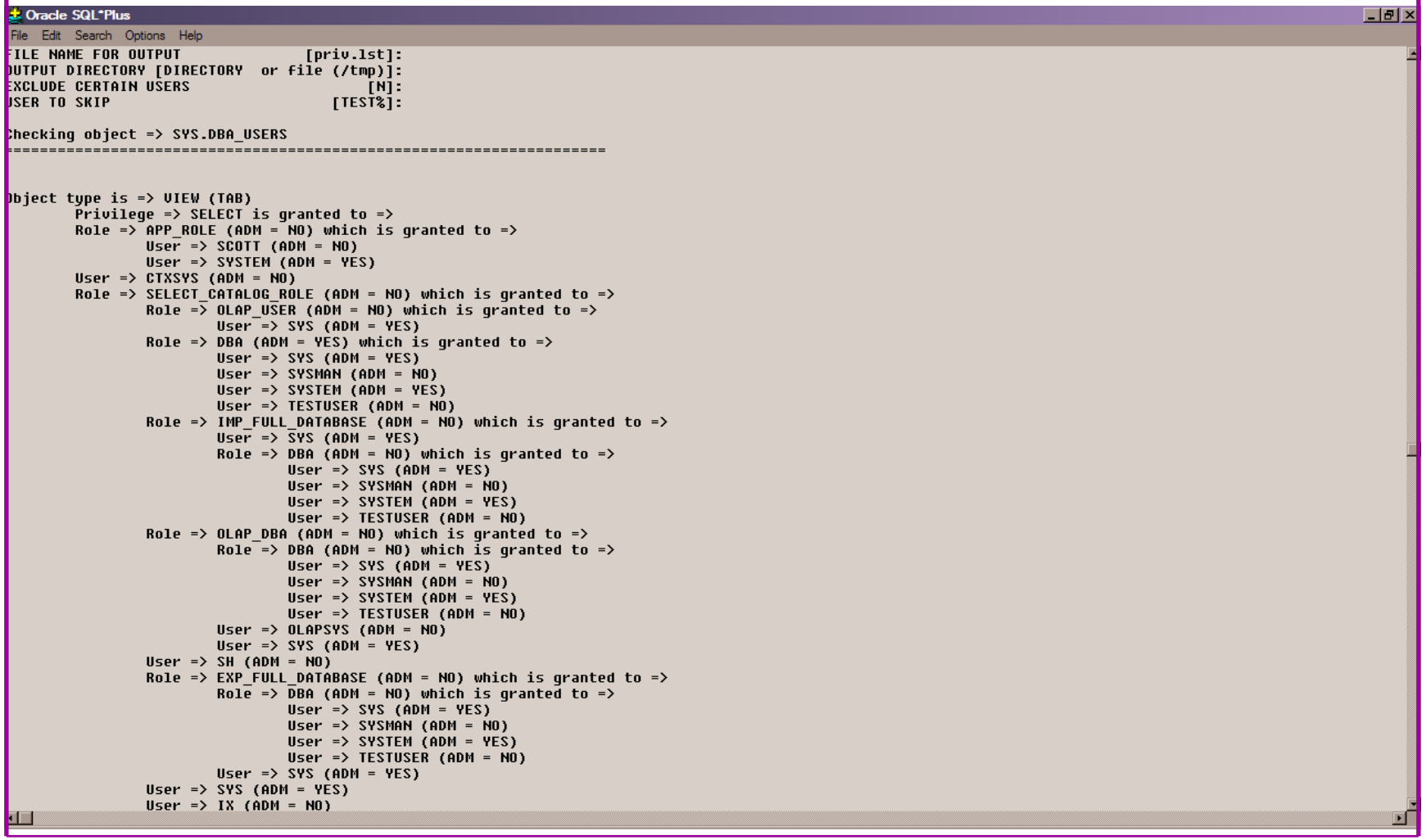
Database Configuration

- Default database installations cause some weak configurations
- Review all
  - configuration parameters
  - File permissions
- Some examples
  - No audit configuration by default (fixed in 10gR2 for new installs)
  - No password management (fixed in 10gR2 new installs)

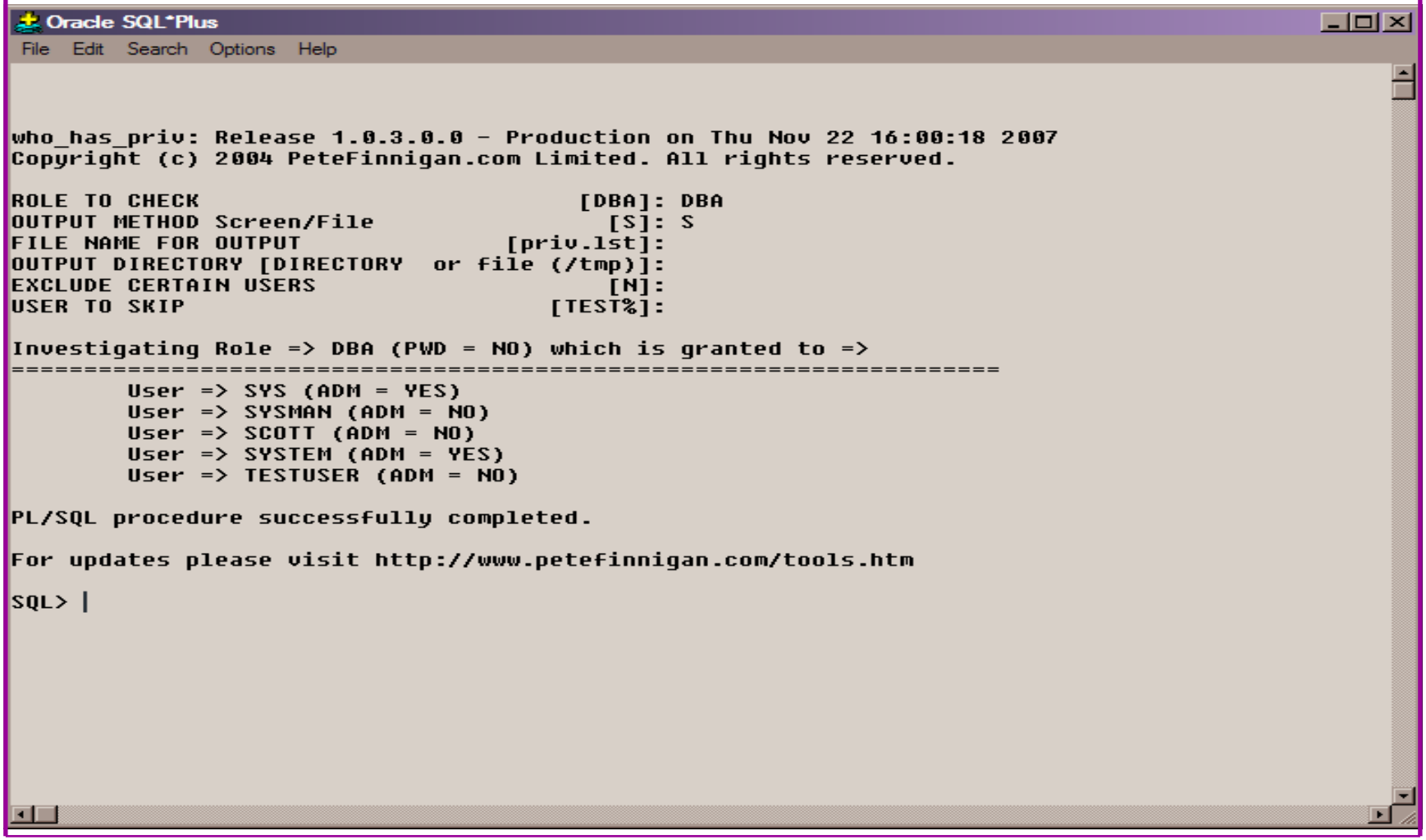
The Public Issue

- Just some examples not everything!
- Public gets bigger – (figures can vary based on install)
  - 9iR2 – 12,132
  - 10gR2 – 21,530 – 77.4% more than 9iR2
  - 11gR1 – 27,461 – 27.5% more than 10gR2
- Apex is installed by default in 11g
  - Good example of attack surface increase – BAD!
  - Unless you are writing an Apex application you don't need it
  - There are other examples as well
- More default users with each version!

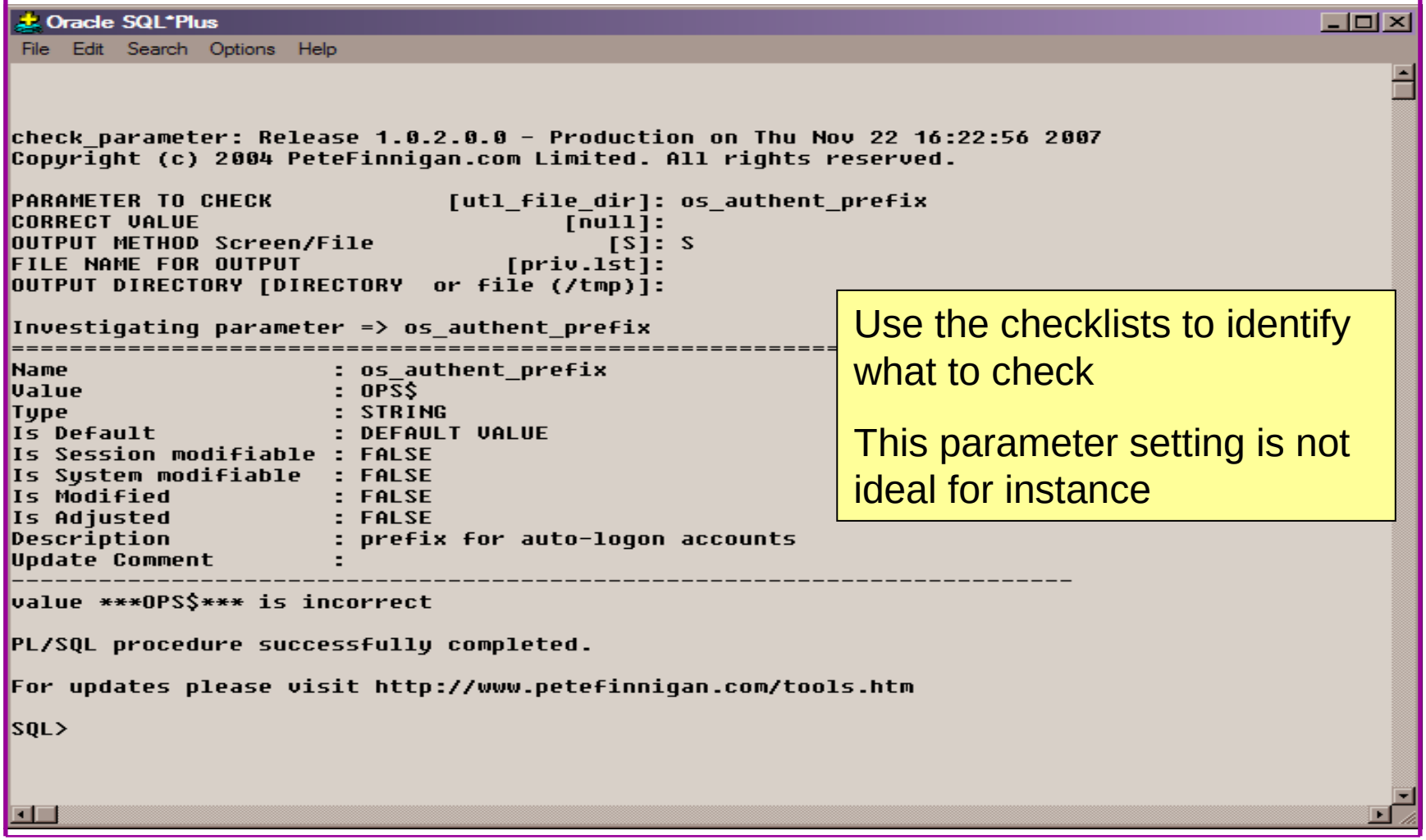
Access To Key Data (DBA_USERS)



Who Has Key Roles



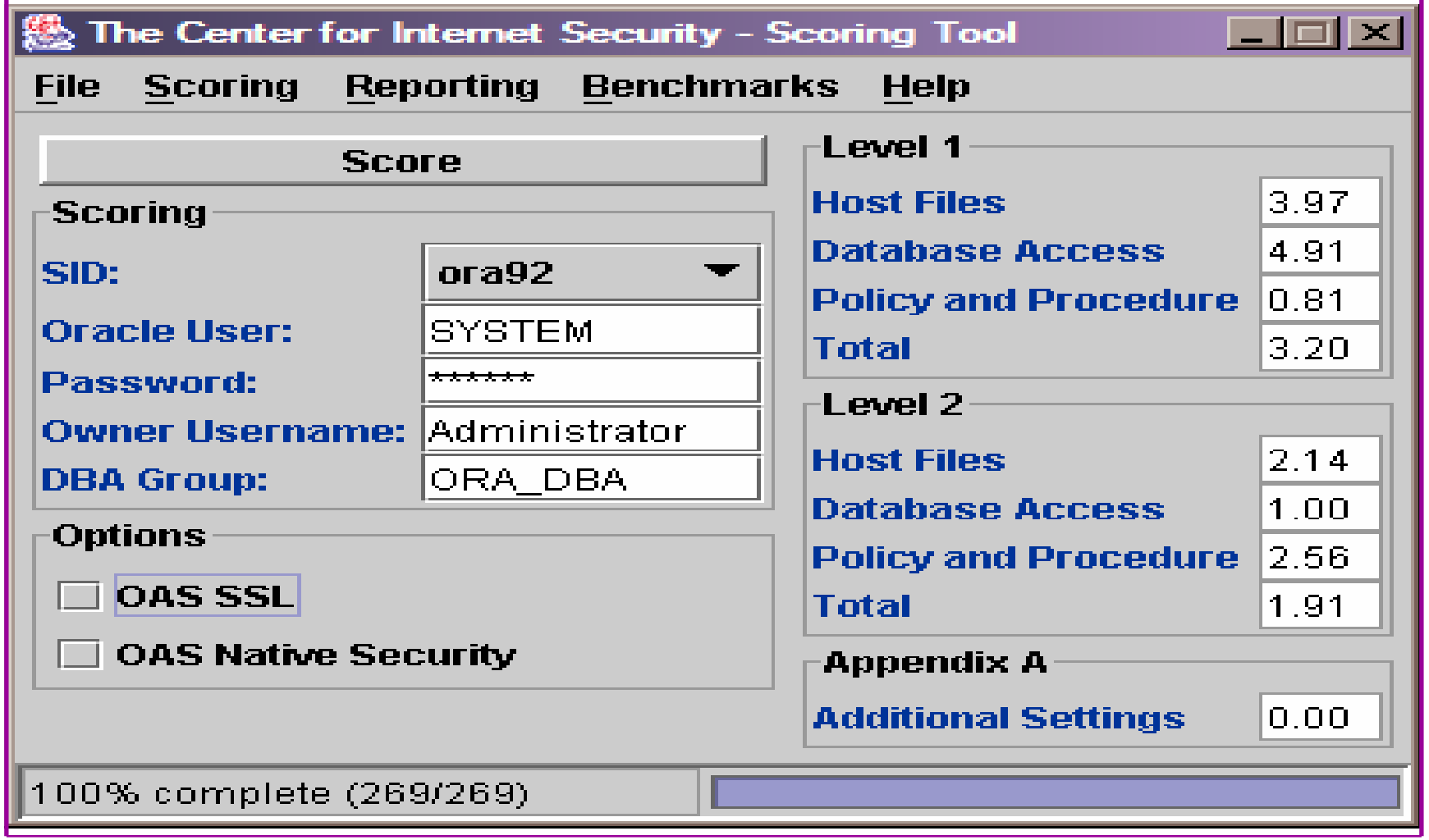
Check Parameters



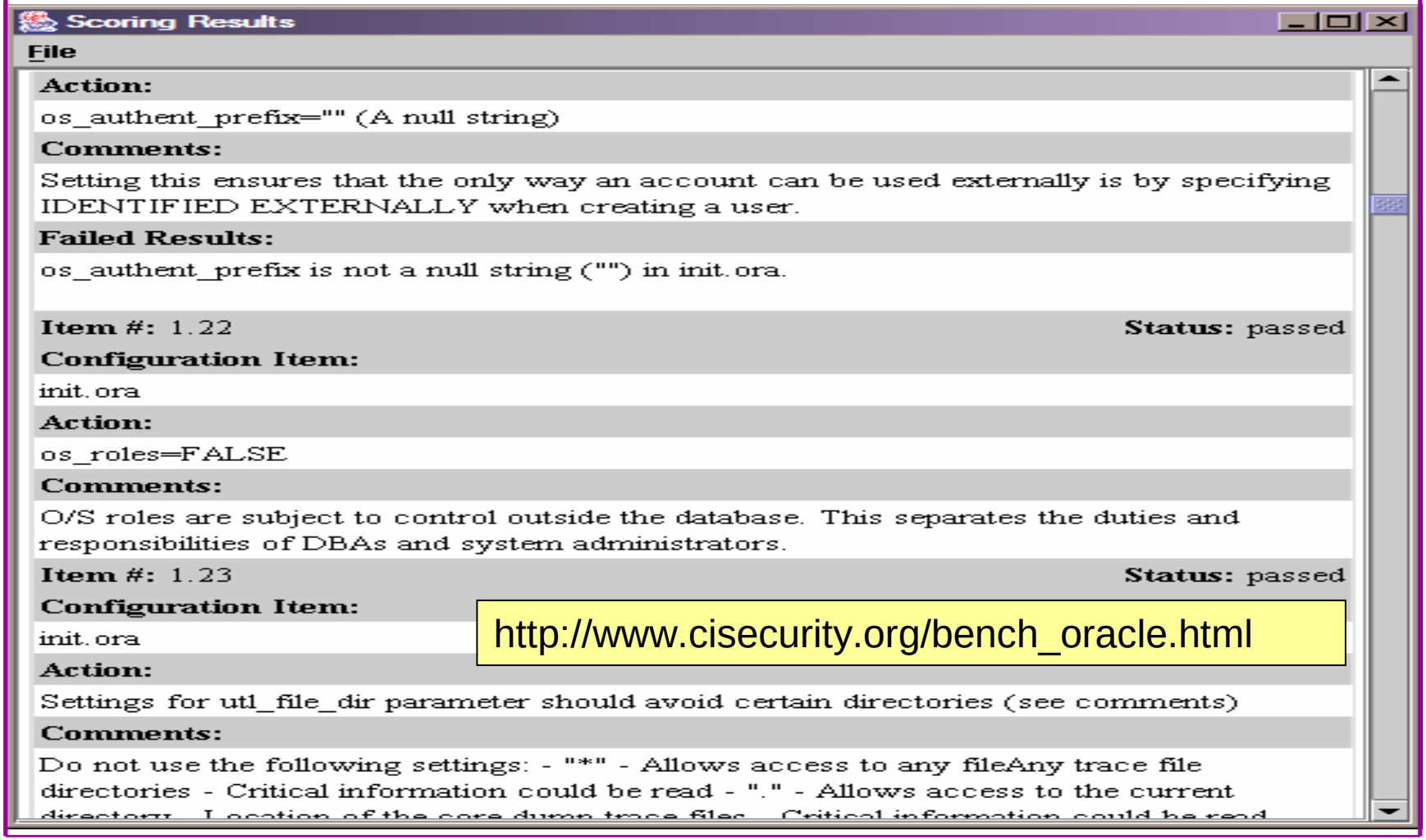
Use the checklists to identify what to check

This parameter setting is not ideal for instance

CIS Benchmark



CIS Benchmark



Get The Basics Right

- OK, we have covered a lot of information
- Concentrate on
  - Checking users passwords
  - Removing default schemas and software not needed
  - Reduce leakage of critical data (passwords and more) from the database and filesystems

Get The Basics Right (2)

- Don’t leak network data to allow connection attempts
- Use firewalls or valid node checking to protect the database
- Review privileges and access to key data
- Confirm key configuration is set correctly

What To Do Next

- Fix the basics, then what?
- Use a top 10 / 20 approach
- Use the project lockdown or one of the good checklists to do a more detailed review
- Ensure sound audit plan is in place
- Monitor the security

What To Do Next (2)

- Read around the subject
- Read the checklists
- Understand how hackers may steal your data
- This way YOU can understand how to protect it

Decide what to fix (Top 10)

- 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

Auditing an Oracle Database

- Operating security Checklists
  - CIS benchmarks for Windows, Linux, Solaris and more
  - OS check tools – The CIS benchmarks are useful – others are available
- Oracle security checks
  - Most tools are windows centric – don't install them on the prod database servers if you run Windows
  - Audit by hand to gain understanding
  - Audit using a free or commercial tool
  - Get professional help
- Oracle security checklists
  - use and work through
  - these are great resources to start with

Perform Hardening

- Reduce the features and functions installed – OS and DB
- Harden the OS
- Review RBAC for all users
- Remove defaults – settings, users, passwords
- Decide on secure configuration settings
- Clean up
- Create processes and policies to ensure secure data going forward

Enable Database Auditing

- Every database I have ever audited has no database audit enabled – ok a small number do, but usually the purpose if for management / work / ??? but not for audit purposes.
- Core audit doesn't kill performance
  - Oracle have recommended 24 core system audit settings since 10gR2 – these can be enabled and added to in earlier databases
  - Avoid object audit unless you analyse access trends then its Ok
- On Windows audit directed to the OS goes to the event Log
- By default all SYSDBA connections are audited – also to the event log on Windows
- VBScript / SQL can be used to access the event log

Create A Monitoring Process

- Once you are secure or on the way to being secure
- Realise its not a “one-off” process
- Constant monitoring of the database is necessary because
  - New issues arise
  - The database can change shape
  - Your knowledge increases
- Create a monitoring process – this can be a policy, a set of scripts, a commercial tool

Conclusions

- We didn't mention CPU's – Apply them – they are only part of the process
- Think like a hacker
- Get the basics right first – stop connections or cracking
- Sort out the RBAC, config, installed software and privileges
- Use a top 10 approach, it works!

Any Questions?

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