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The Right Method To Secure An Oracle Database

By

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Why Am I Qualified To Speak

- PeteFinnigan.com Ltd, Est 2003.
- http://www.petefinnigan.com
- First “Oracle security” blog.
- Specialists in researching and securing Oracle databases providing consultancy and training Database scanner software authors and vendors.
- Author of Oracle security step-by-step book; co-author of Expert Oracle practices.
- Published many papers, regular speaker (UK, USA, Slovenia, Norway, Iceland, Finland and more).
- Member of the Oak Table Network.

Quick Quiz!

- How many people here know “**where**” their key data is held?
- How many people here understand exactly “**who**” can see or “**modify**” key data?
- How many people here understand the true “**privilege model**” employed to protect “**key data**”?

Agenda

- Hardening databases by checklist
- Problems with checklists
- “The right method”
- Data flow
- Privilege/access assessment
- conclusions

Why We Need Security

- The target is often data not the “DBA” role
- The exploits we see on the internet work but stealing data is much more “real” and easy
- It is easy to steal, not rocket science, no skill
- Real theft does not require complex techniques either
- What do you think happens in real life?
  - Exploits can be downloaded for free
  - Stealing is easy because systems are open

Traditional Approach

- Hardening by checklist – good idea?
- A number of them available
  - SANS Step-by-step guide
  - SANS S.C.O.R.E.
  - CIS benchmark
  - DoD Stig
  - IT Governance book
  - Oracle's own checklist

Problems With Checklists

- Not many checklists exist for Oracle databases
- Most are from same initial source or are very similar
- Some structure there but not good enough
  - "tip based rather than method based"
- Lists don't focus on securing the data
- Difficult to implement for a large number of databases
- CIS for instance has 158 pages

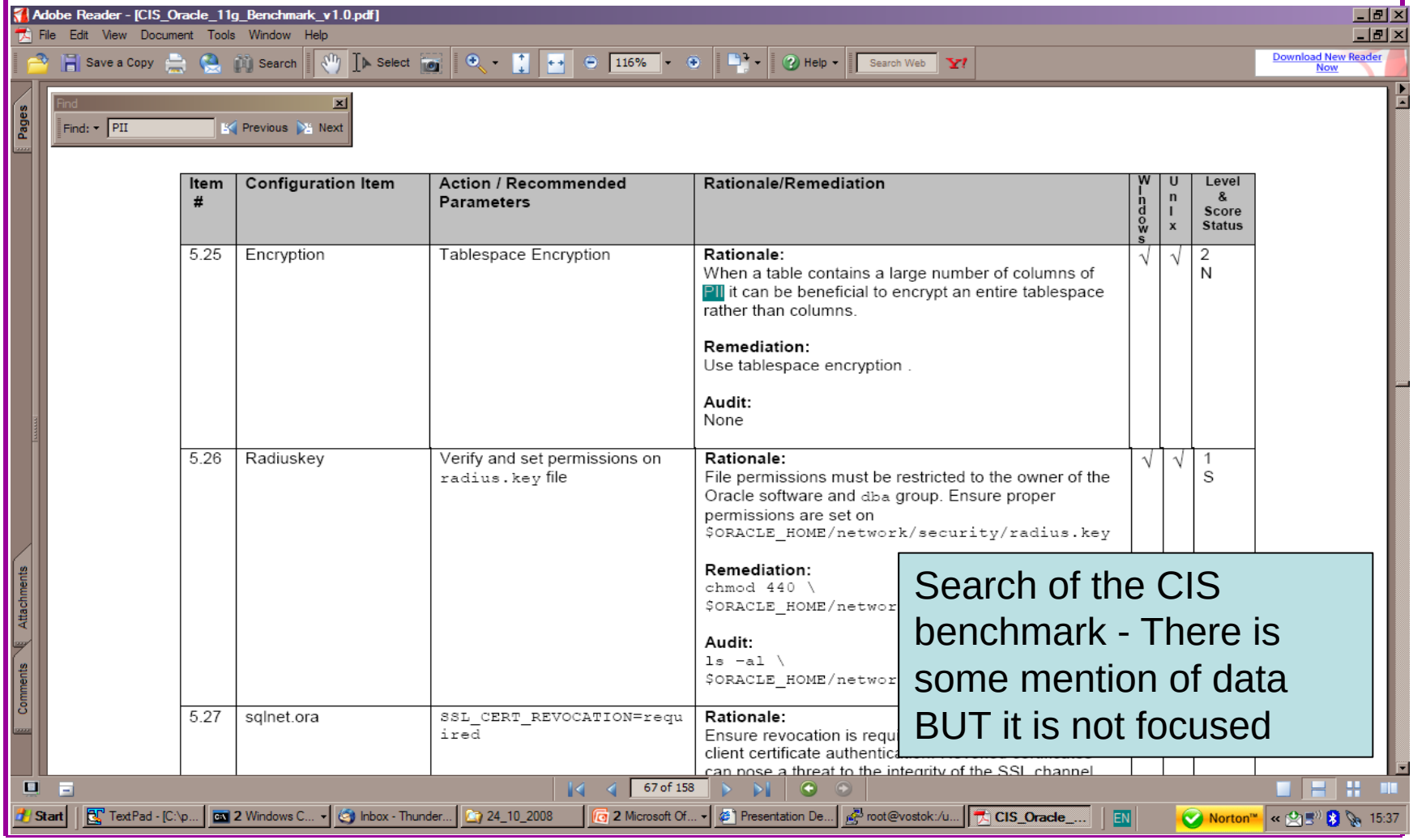
Time “vs” Clever

- Time solution
  - Could spend man years on even a single database
  - Finding solutions for each issue is not as simple as applying what it says in the document
- Clever solution
  - Technical solutions need to be specified
  - Onion based approach is good
  - Basic hardening in parallel

Examples Of Problems

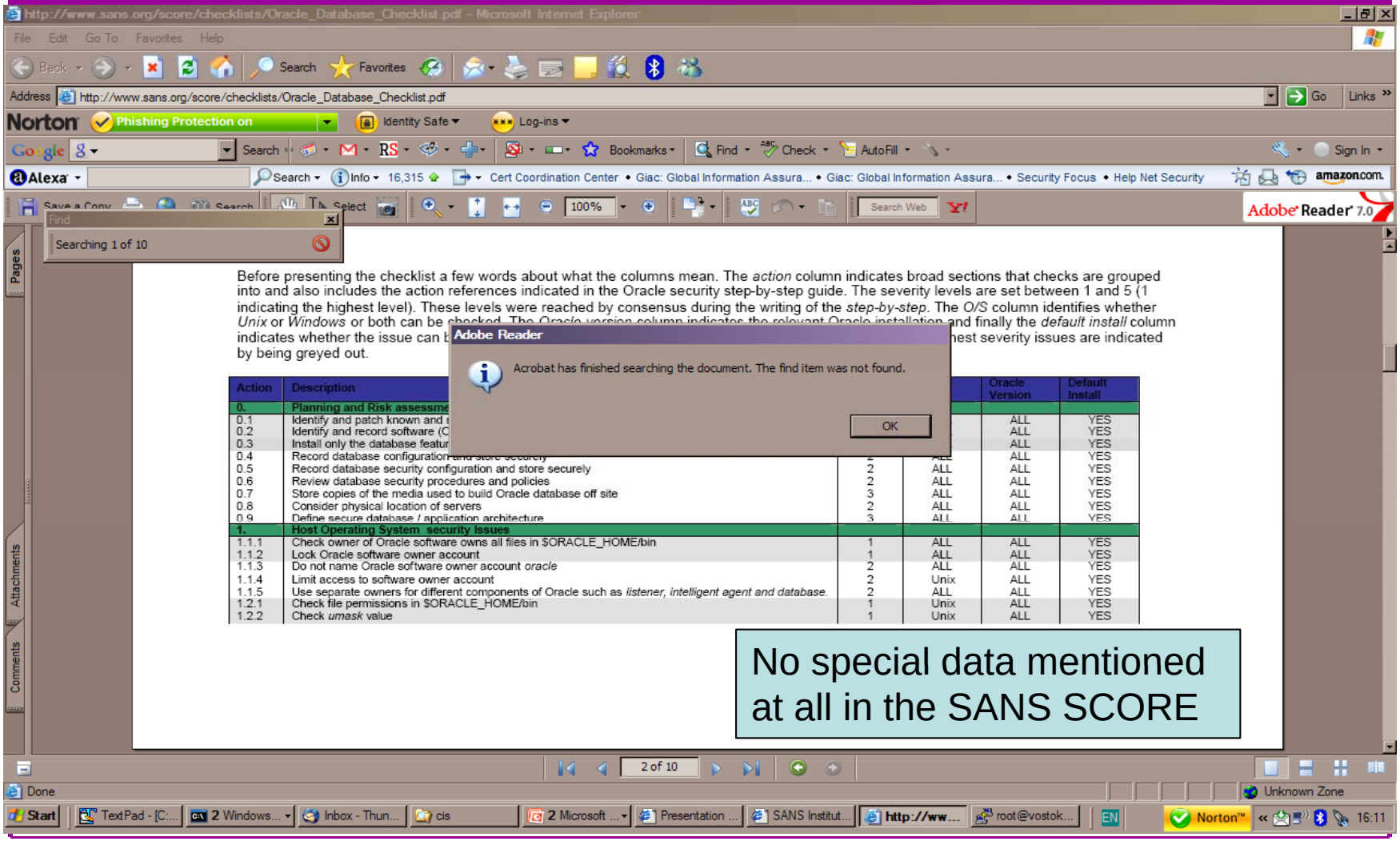
- Two examples:
  1) Check 3.0.2 in CIS states “all files in $ORACLE_HOME/bin directory must have privileges of 0755 or less – fine - but the solution states “chmod 0755 $ORACLE_HOME/bin/*” – is it a good idea?
  2) Solutions are not as simple as indicated. For instance fixing a weak password should also include, fix the password, management, hard coded passwords, audit, policy….

Checklists And PII Data



Item #	Configuration Item	Action / Recommended Parameters	Rationale/Remediation	Windows	Unix	Level & Score Status
5.25	Encryption	Tablespace Encryption	**Rationale:** When a table contains a large number of columns of PII it can be beneficial to encrypt an entire tablespace rather than columns. **Remediation:** Use tablespace encryption . **Audit:** None	√	√	2 N
5.26	Radiuskey	Verify and set permissions on `radius.key` file	**Rationale:** File permissions must be restricted to the owner of the Oracle software and `dba` group. Ensure proper permissions are set on `$ORACLE_HOME/network/security/radius.key` **Remediation:** `chmod 440 \ $ORACLE_HOME/networ` **Audit:** `ls -al \ $ORACLE_HOME/networ`	√	√	1 S
5.27	sqlnet.ora	`SSL_CERT_REVOCATION=required`	**Rationale:** Ensure revocation is requ client certificate authentica can pose a threat to the integrity of the SSL channel			

Checklists And Special Data



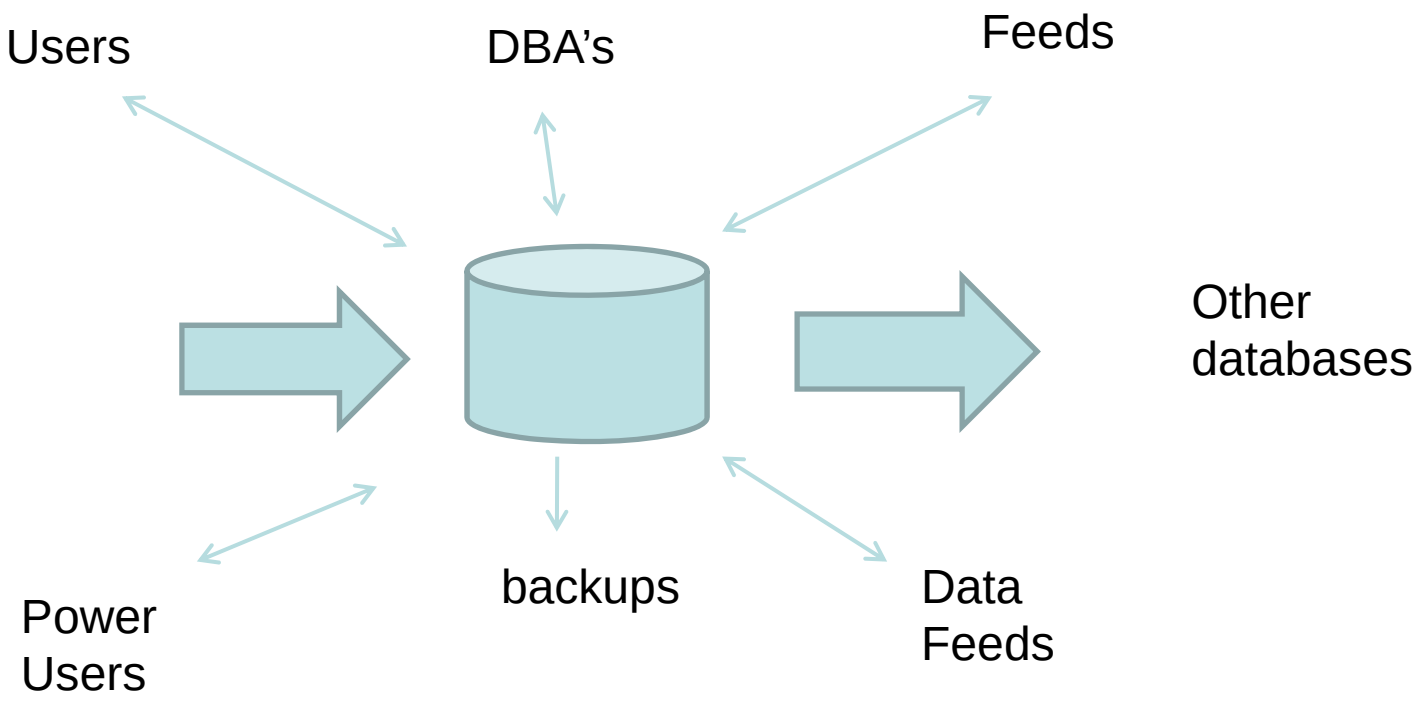
The Right Method To Secure

- Start with "**the data**"
- Understand "**data flow**" and "**access**"
- Understand the problem of securing "**your data**"
- Hardening should be part of the solution **BUT** not **THE** solution
- Checklists do not mention "**your**" data

Complex But Simple Solutions Needed

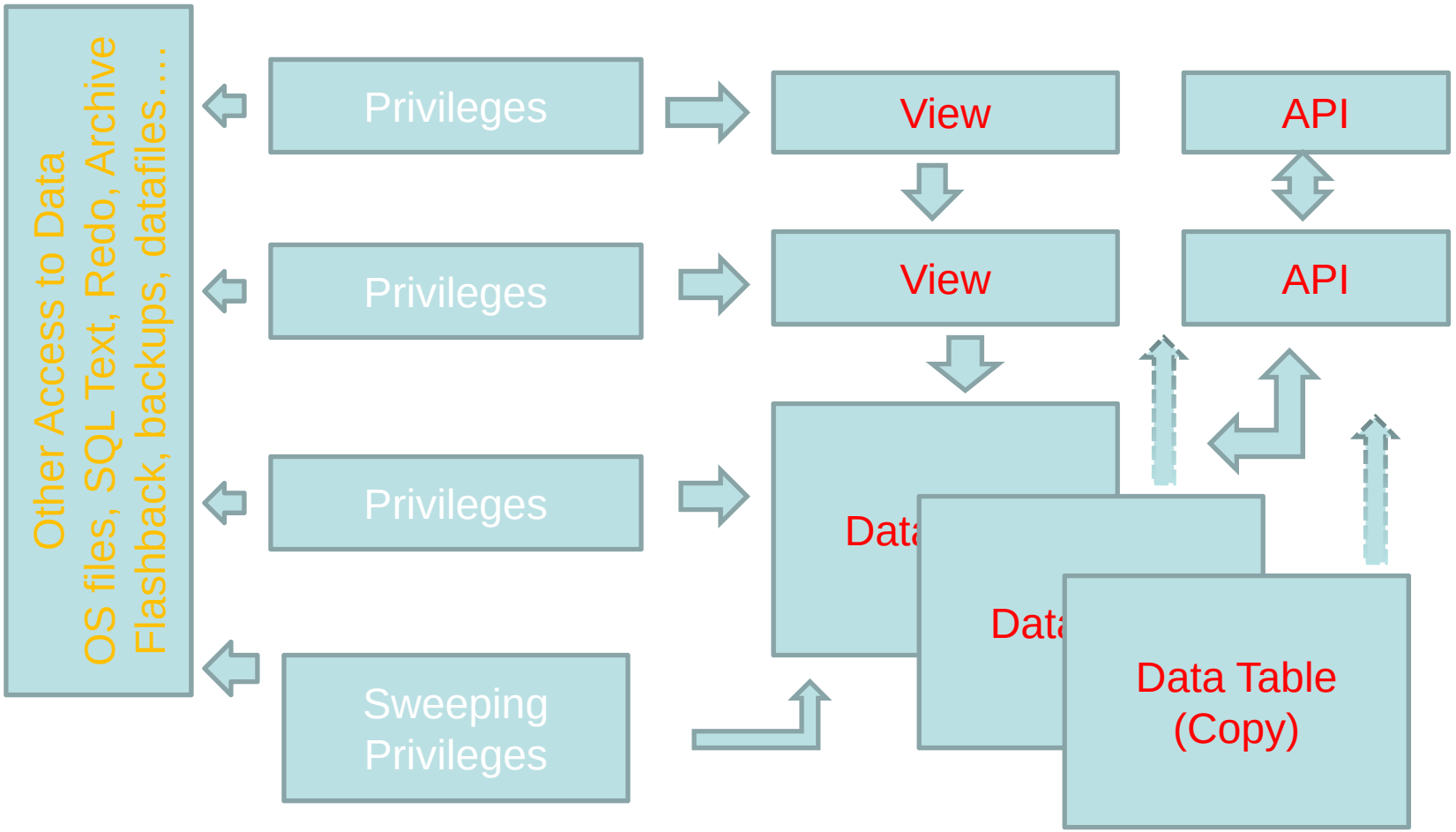
- Overarching solutions are needed
- Remove all types of access from the data
- Ensure only those who should see, can see the data
- Unfortunately it’s not that simple as there are:
  - Many paths to the data
  - Many copies of data
  - Data stored or in transit that is accessible
  - Data copied outside of the database

Understand Architecture



Identify each type of person and a sample account for each

Data Access Models



Data Access Is Not “Flat”

- Data model is not flat – remove the blinkers
- Access rights are also not flat
- Data is often replicated
  - In other tables – in interfaces – flexfields …
  - Indexes
  - Shared memory
  - Data files
  - Operating system
  - Many more…

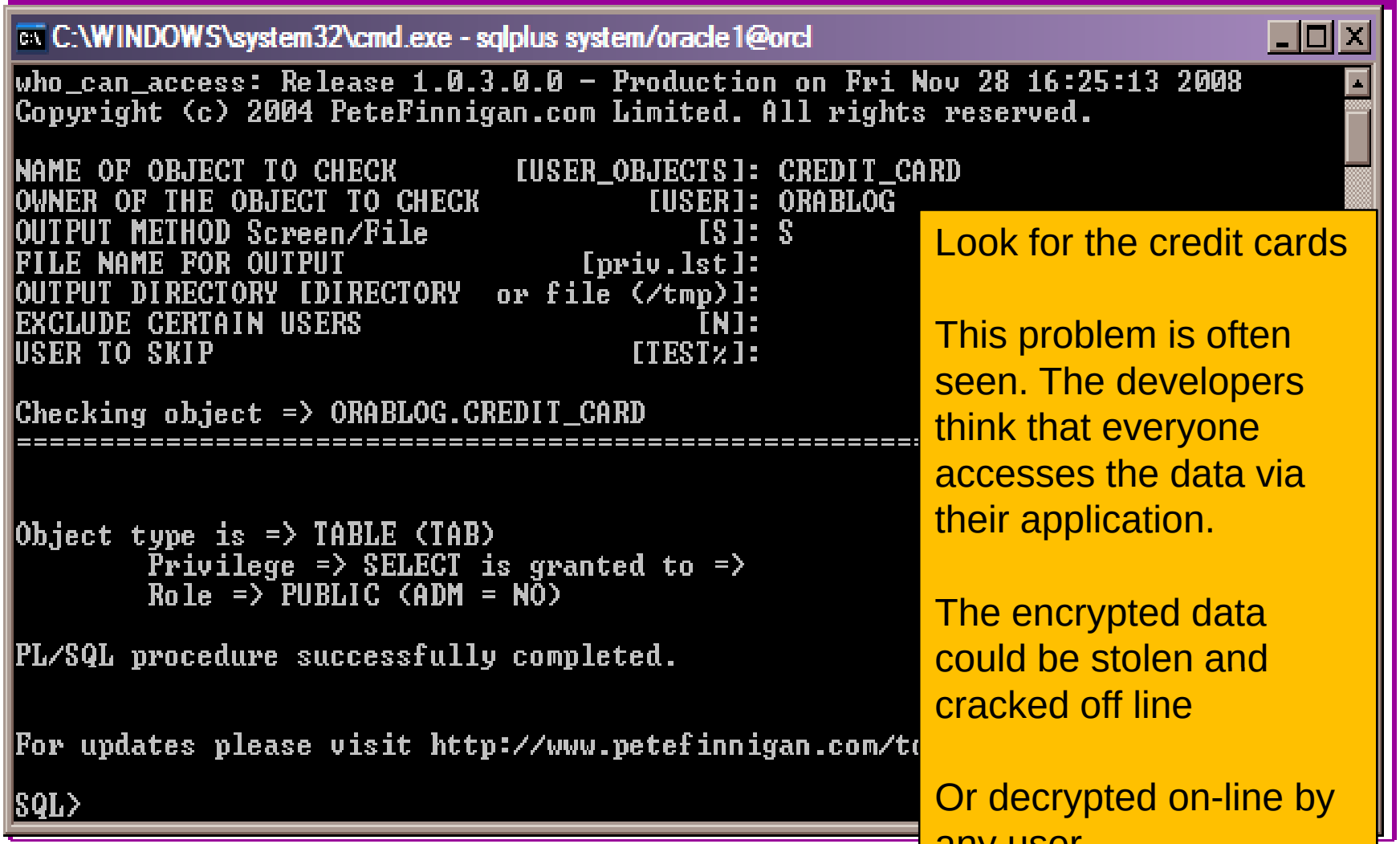
How / Who

- The data must be identified (found?)
- The access paths must be found
- The “people” – real people identified
- Map to these to database user accounts
- Assess who can access data and how
- Only now can we hope to secure data

Securing Data

- We are going to investigate in depth the issues around a simple credit card table
- We need to
  - find the credit card details table
  - Find duplicate copies of credit card data
  - Assess who can access all of the data
  - Look for other places the data exists
  - More…
- Even these issues are only the "***tip of the iceberg***" though!
- Lets dig deeper

Securing Data - 2



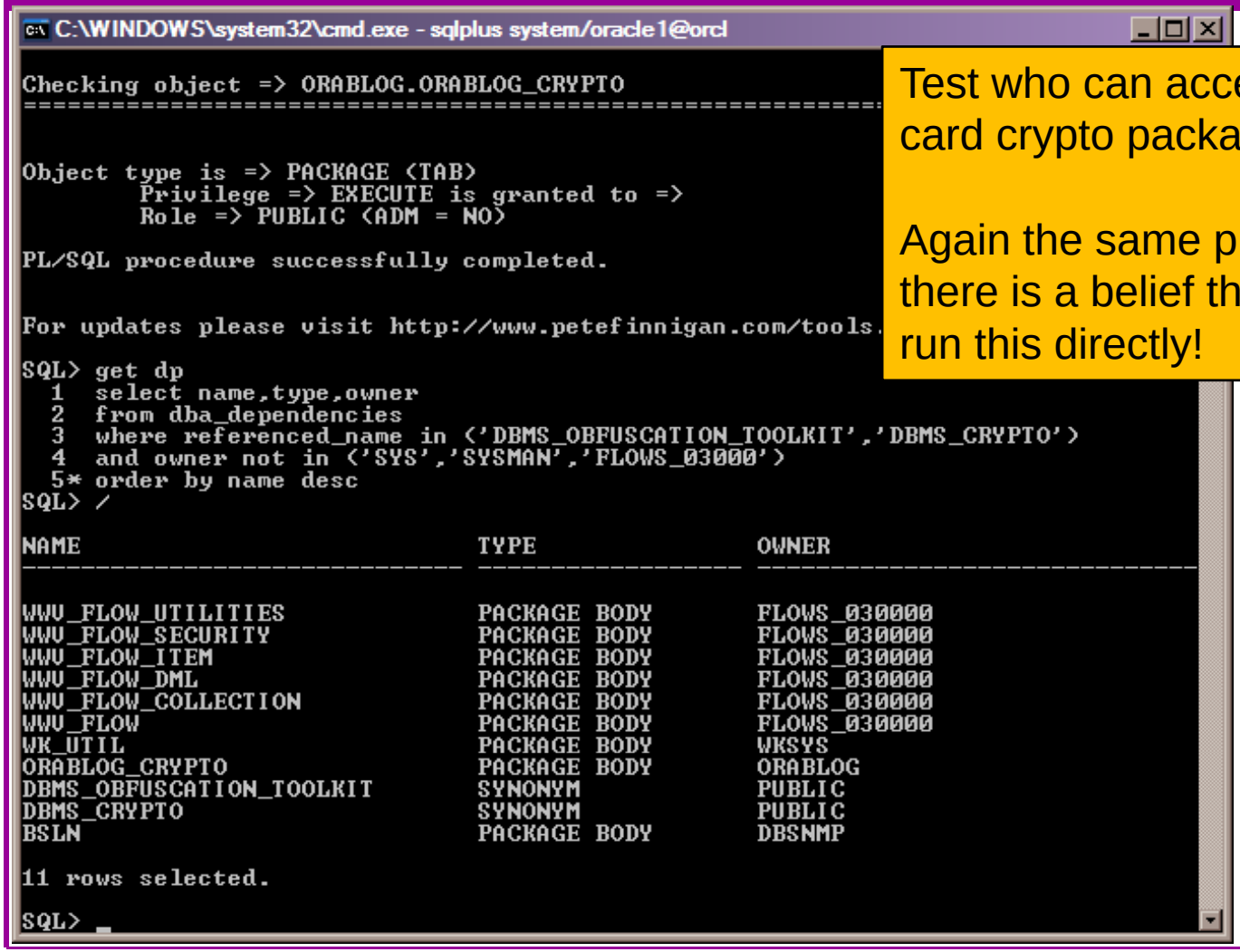
Look for the credit cards

This problem is often seen. The developers think that everyone accesses the data via their application.

The encrypted data could be stolen and cracked off line

Or decrypted on-line by any user

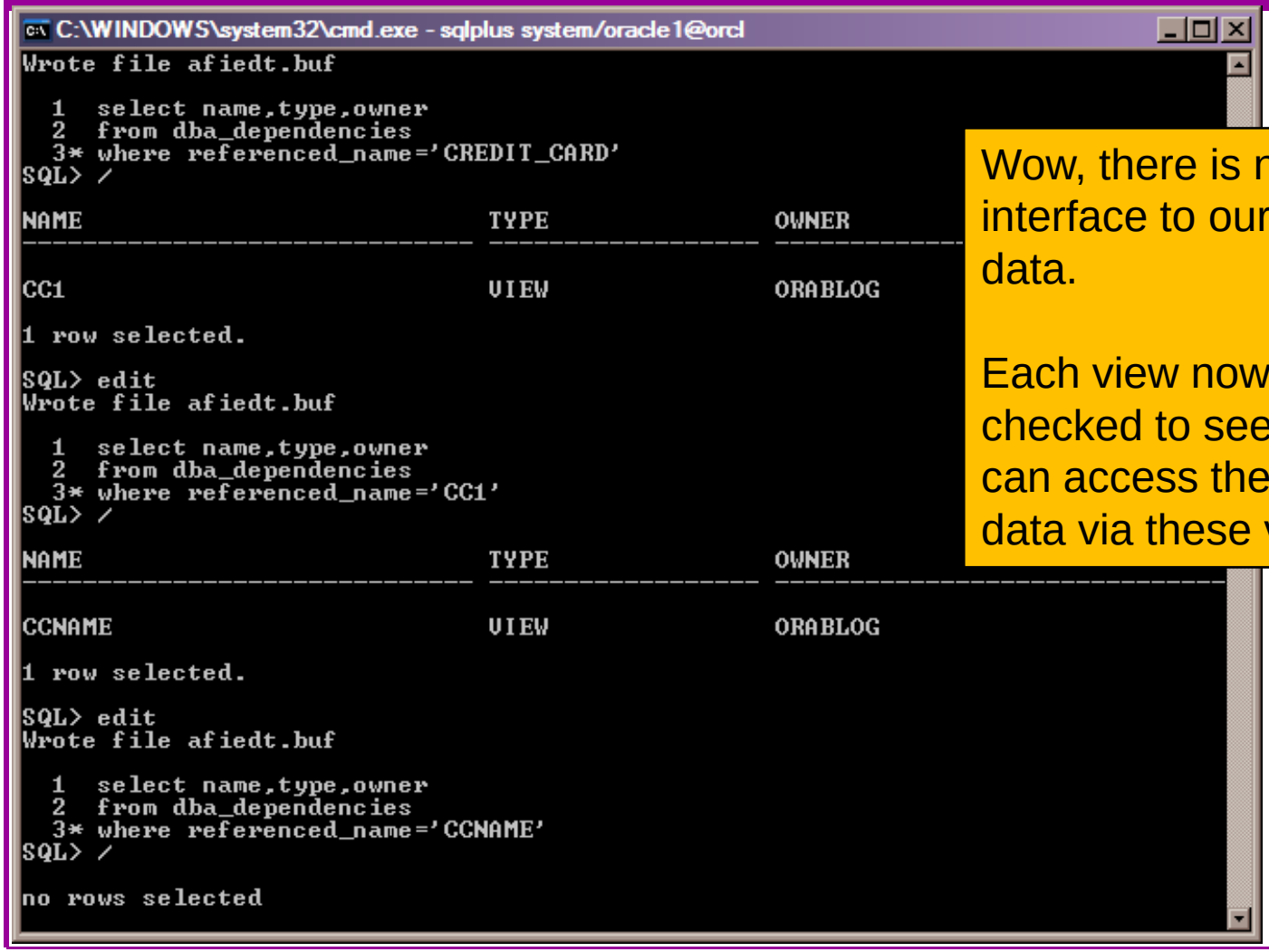
Securing Data - 3



Test who can access the credit card crypto package

Again the same problem applies; there is a belief that no one will run this directly!

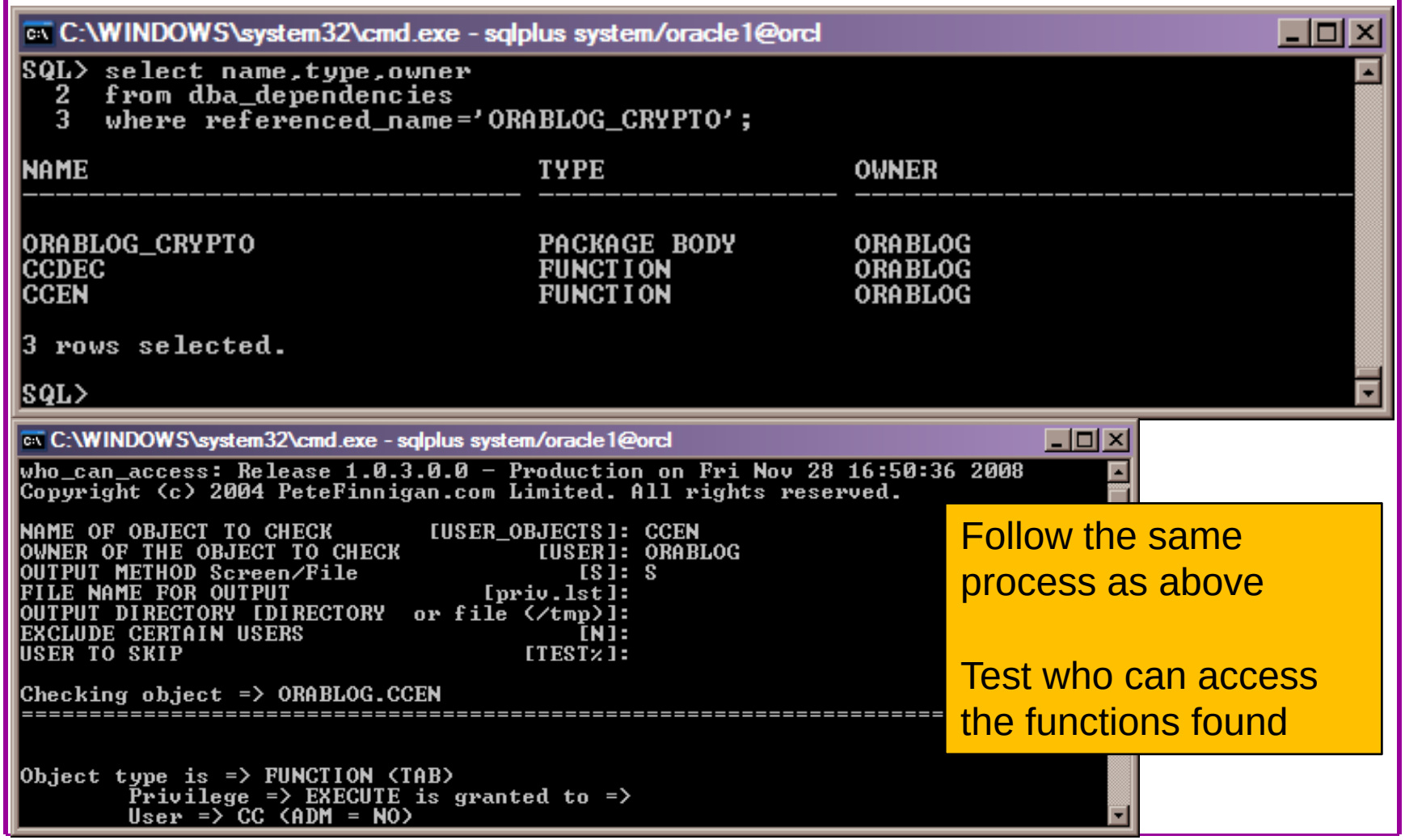
Securing Data - 4



Wow, there is not a single interface to our credit card data.

Each view now needs to be checked to see which users can access the credit card data via these views

Securing Data - 5



Follow the same process as above

Test who can access the functions found

Securing Data - 6

C:\WINDOWS\system32\cmd.exe - sqlplus system/oracle1@orcl

```
SQL> select owner,table_name from dba_tables
  2  where table_name like '%CREDIT%';

OWNER                          TABLE_NAME
------------------------------ ------------------------------
ORABLOG                        CREDIT_CARD

1 row selected.

SQL> col owner for a10
SQL> col table_name for a30
SQL> col column_name for a5
SQL> select owner,table_name,column_name from dba_ta
  2  where column_name='PAN';

OWNER      TABLE_NAME                     COLUM
---------- ------------------------------ -----
ORABLOG    BIN$SFV0AmZ7LGngQAB/AQB5+w==$0 PAN
ORABLOG    BIN$SFV2LPPq6wHgQAB/AQB6GA==$0 PAN
ORABLOG    BIN$SFYmOpXjnWngQAB/AQAFSg==$0 PAN
ORABLOG    BIN$SFYqtq+wIp3gQAB/AQAGEA==$0 PAN
ORABLOG    BIN$SFYv3FNLr0DgQAB/AQAGQA==$0 PAN
ORABLOG    BIN$SFY2dIAeFVIgQAB/AQAGeA==$0 PAN
ORABLOG    BIN$SFY3HrgmcFrgQAB/AQAGgQ==$0 PAN
ORABLOG    BIN$SFY5dvNjVRrgQAB/AQAG1w==$0 PAN
ORABLOG    BIN$SFY74g46F9fgQAB/AQAG8w==$0 PAN
ORABLOG    BIN$SFY/AtrNeRngQAB/AQAHGw==$0 PAN
ORABLOG    BIN$SFZJq3Itvb7gQAB/AQAHtw==$0 PAN
ORABLOG    BIN$SFZNmEOKfpjgQAB/AQAH+g==$0 PAN
ORABLOG    BIN$SFZSz8RAdAPgQAB/AQAIZg==$0 PAN
ORABLOG    BIN$SFZUh/pQIyfgQAB/AQAIew==$0 PAN
ORABLOG    BIN$SFZYZjtXVwngQAB/AQAIoQ==$0 PAN
ORABLOG    BIN$SFZZhezhGdPgQAB/AQAIsA==$0 PAN
ORABLOG    CREDIT_CARD                    PAN
ORABLOG    CC1                            PAN
IMPORTER   C23                            PAN

19 rows selected.
```

There are a number of issues here

The data is copied – we can check by looking at IMPORTER.PAN

The data is again duplicated in the recycle bin – this needs to be handled

Each table found has to be checked for hierarchy and access

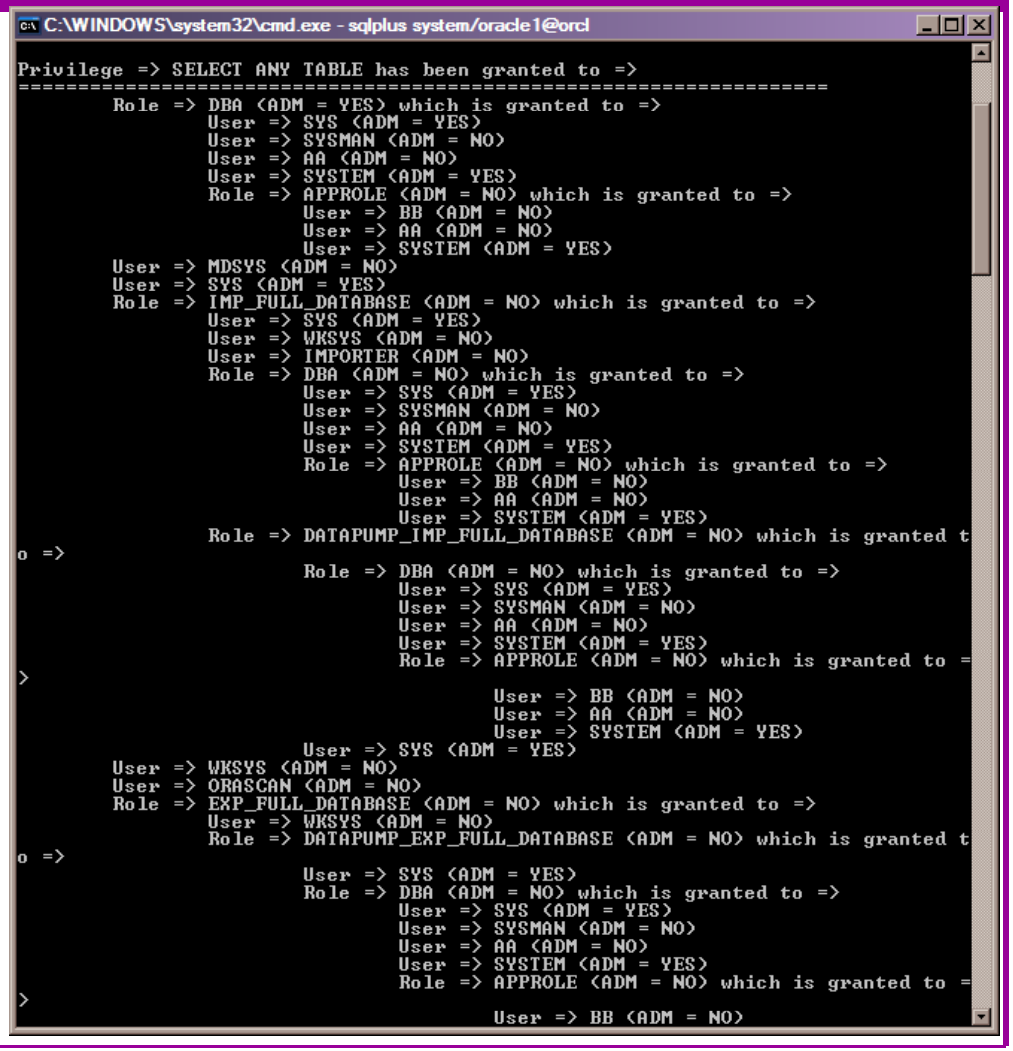
If we could not find using simple ideas as here we would need to sample data or use specific algorithms

Securing Data - 7

Sweeping privileges are still dangerous for our data – o7_dictionary_accessibility prevents some hacks but does not stop sweeping data access

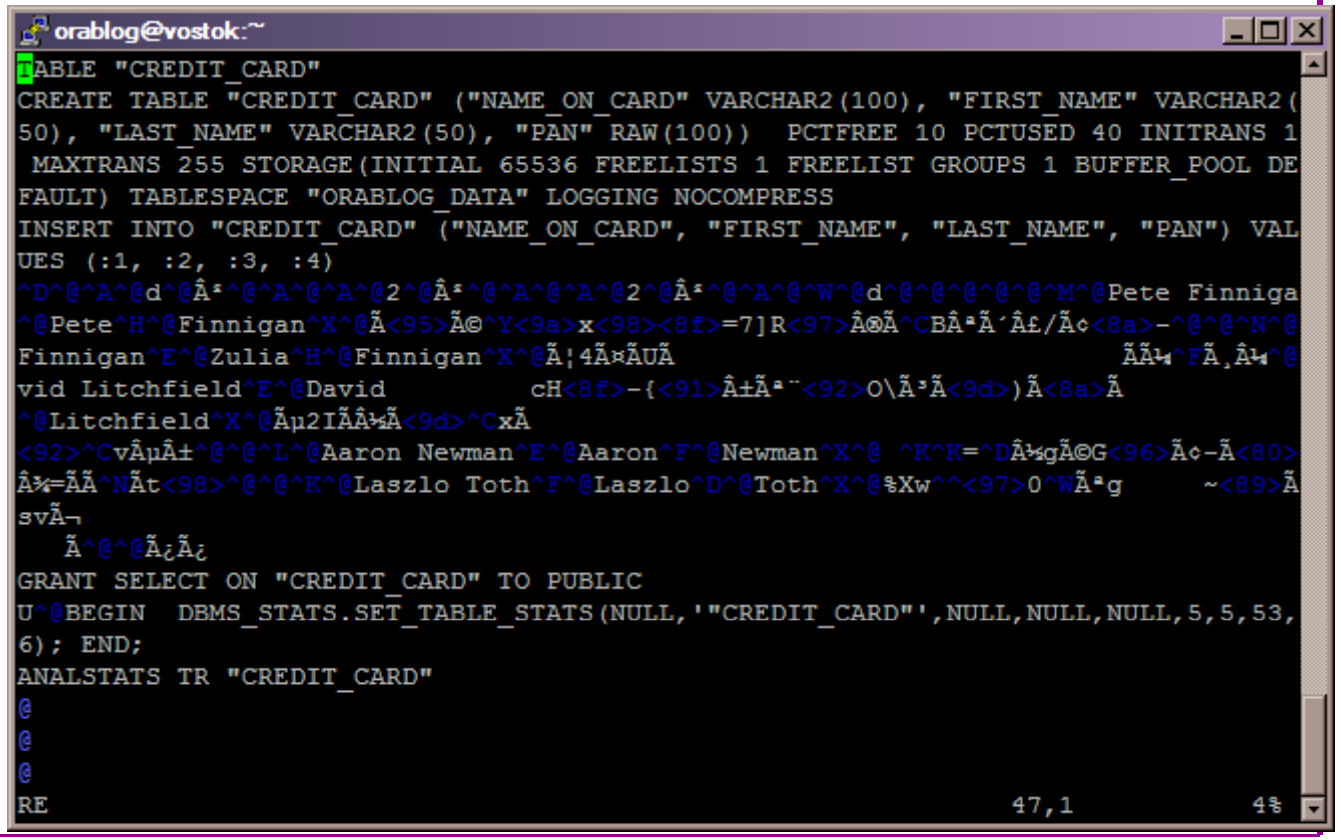
Remember there are other privileges; INSERT, UPDATE, DELETE…

Remember other privileges still that would allow data theft; TRIGGERS, EXECUTE PROCEDURE…

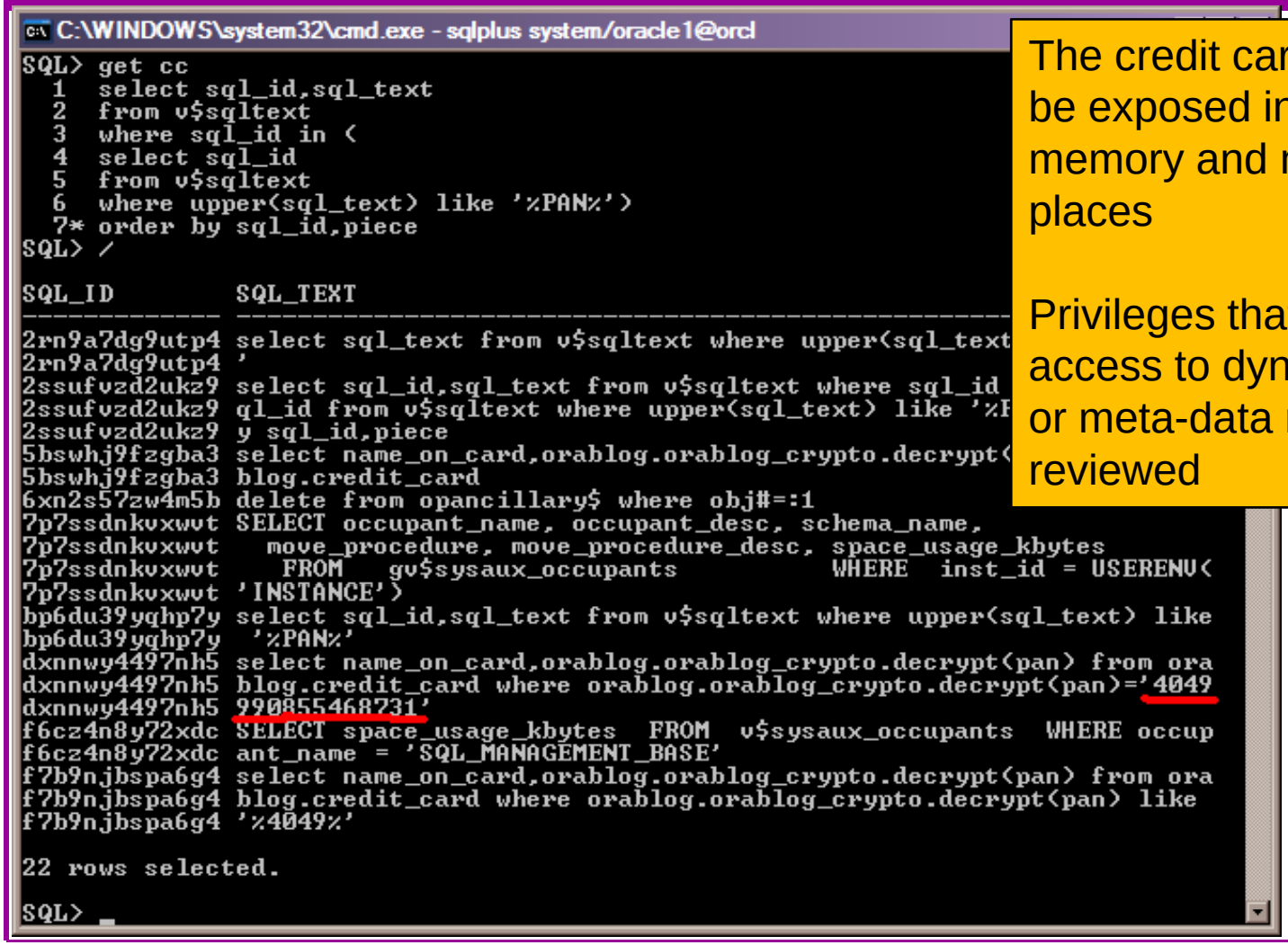


Securing Data - 8

- The credit card data can be exposed via export, list files or any other OS / client based resource



Securing Data - 9



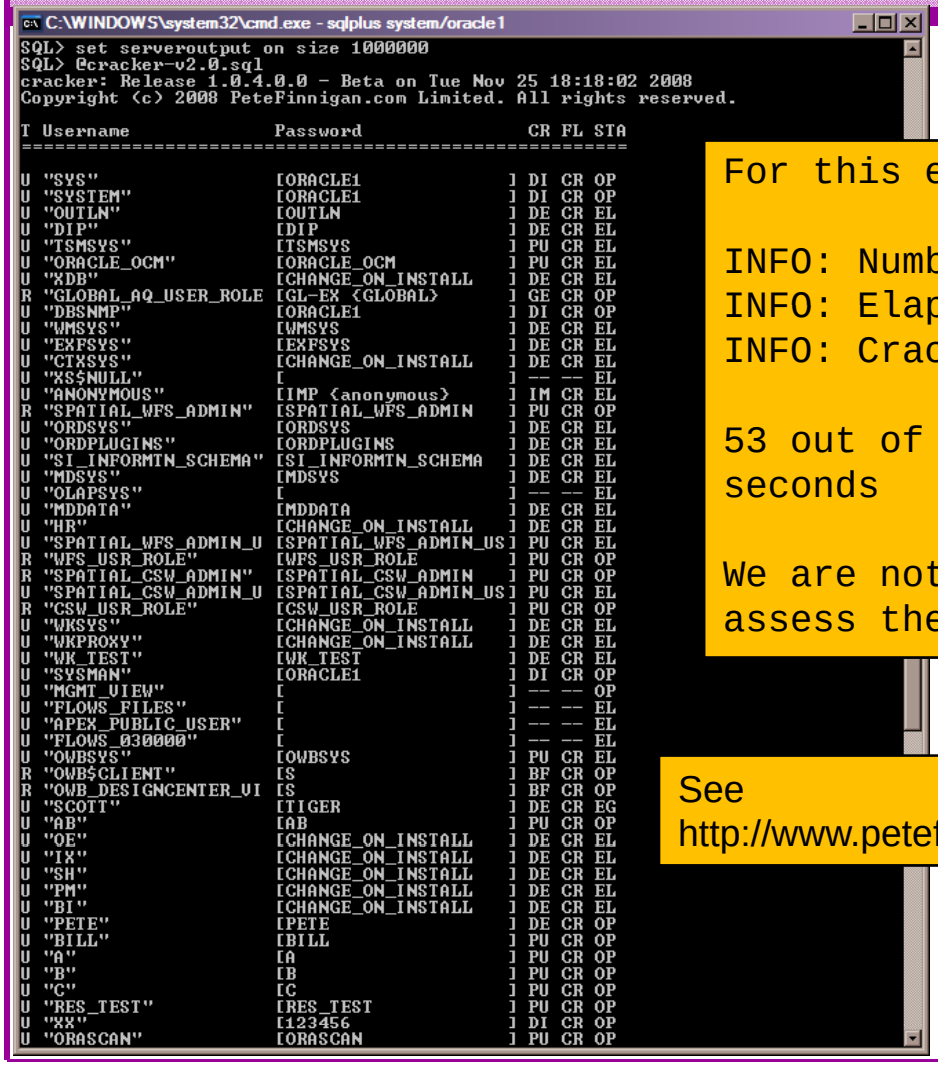
The credit cards can also be exposed in shared memory and many other places

Privileges that allow access to dynamic data or meta-data must be reviewed

Securing Data - 10

- Securing data is not complex but we must take care of all access paths to the data
- We must consider the hierarchy
- We must consider sweeping privileges
- We must consider data leakage
- We must consider data replication
- There is more…unfortunately…
- In summary securing specific data ("***any data***") is first about knowing where that data is and who can access it and how it "***flows through the system***"

Users – The Opposite Problem



For this example run

```
INFO: Number of crack attempts = [61791]
INFO: Elapsed time = [4.36 Seconds]
INFO: Cracks per second = [14170]
```

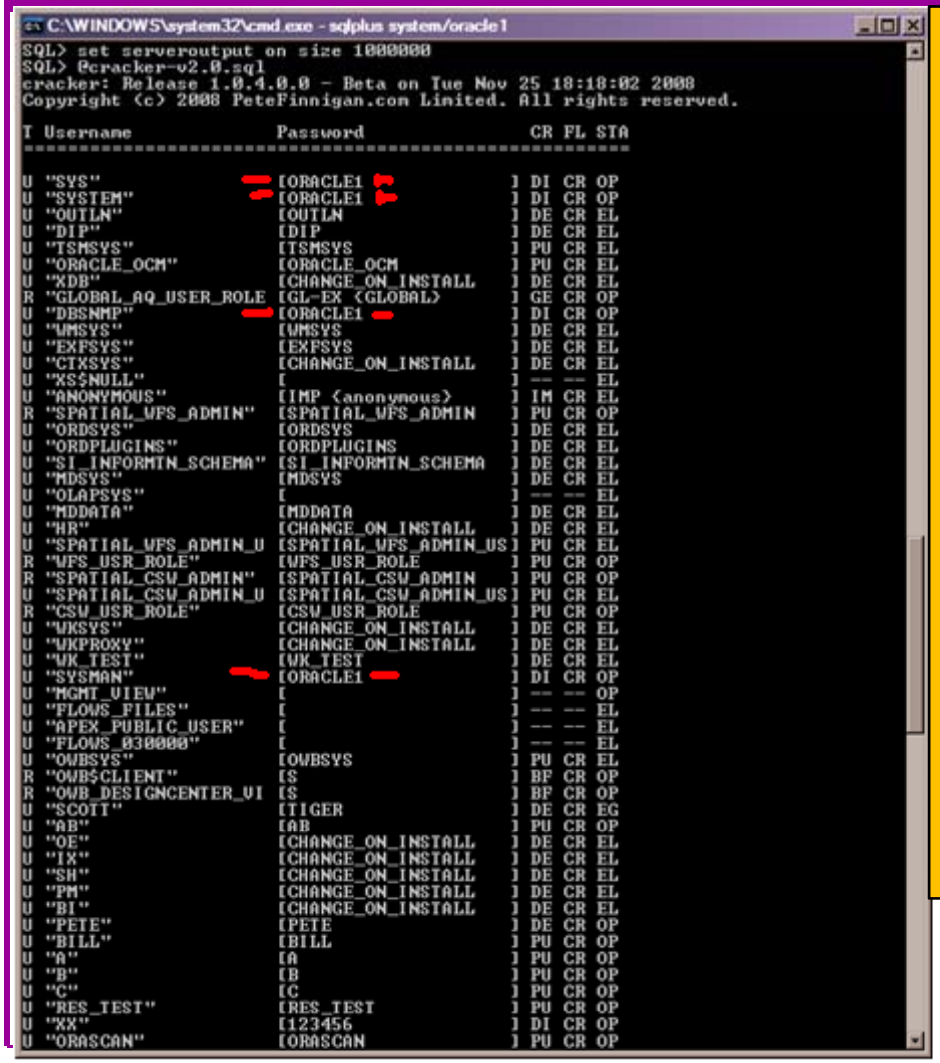
53 out of 60 accounts cracked in 4.3 seconds

We are not trying to break in BUT trying to assess the “**real security level**”

See http://www.petefinnigan.com/oracle_password_cracker.htm

This is called the “Access Issue”

User Password Analysis



- Shared passwords are a problem
- All privileged accounts have the same password
- This often implies that the same people do one job or multiple people share passwords
- If database links exist they possibly share the same passwords (check dump files)
- Assess not just **"what"** you see BUT also the implications in terms of management and administration
- This is an example of just one issue

Rounding Up

- A simple picture is built of all access to the key data
- All users are assessed and mapped to the data access
- Solutions are very specific but generally
  - Reduce default accounts
  - Reduce access to data
  - Remove duplicate privileges
  - Simplify privilege and access models
  - Generalise

Conclusions

- There are a few important lessons we must learn to secure data held in an Oracle database
  - We must secure the "**data**" not the software (quite obviously we MUST secure the software to achieve "**data**" security)
  - We must start with the "**data**" not the software
  - We must understand who/how/why/when "**data**" could be stolen
- Oracle security is complex though because we must consider "**where**" the "**data**" is and "**who**" can access it and "**how**"
- Often there are "**layers**" and "**duplication**"
- Careful detailed work is often needed

Quick Quiz – Again!

- How many people know "**where**" their key data is held?
- How many people understand exactly "**who**" can see or "**modify**" key data?
- How many people understand the true "**privilege model**" employed to protect "**key data**"?

Any Questions?

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