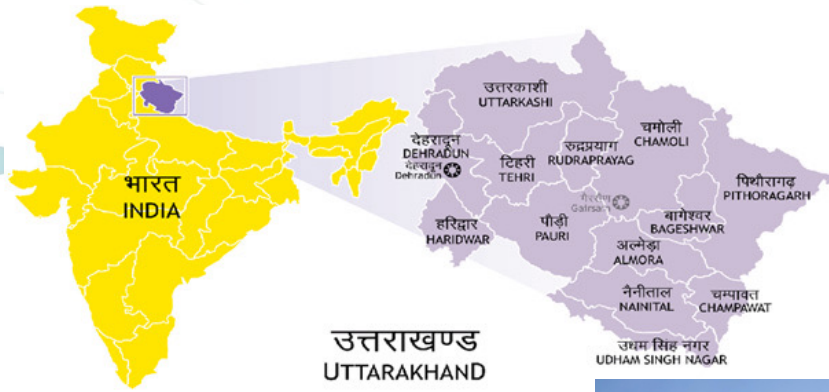


The Almanac for Database Upgrades & Migrations - Tips & Tricks for database migration

Aishwarya Kala



About ME



- Lead Database Consultant with Pythian
- Working with Oracle Technology for over 14 years
- Presenter at Oracle GroundBreakers Tour, EMEA tour, OGYatra, SOUG, AIOUG, Sangam
- AIOUG – Director of Special Projects

 Oracle ACE Associate



 @aishwaryakala13 |  <https://oratrails-aish.com> |  aishwarya-kala-471b3616

About Pythian

25

Years in Business

400+

Experts Across 5 Continents

500+

Customers Globally



Premier Partner

140+ Certifications

8 Specializations



Advanced Partner

175+ Certifications



Gold Partner

15+ Certifications



Platinum Partner

150+ Certifications



SAP Certified Partner

40+ Certifications



500+ technical experts helping peers globally

The **Oracle ACE Program** recognizes and rewards community members for their technical and community contributions to the Oracle community

3 membership tiers

 Oracle ACE Director

 Oracle ACE Pro

 Oracle ACE Associate

For more details on Oracle ACE Program:
ace.oracle.com

 Oracle ACE

Nominate
yourself or someone you know:

ace.oracle.com/nominate



AGENDA



Where To Go ?



Primary Restraint

Application Compatibility



Determine the Details

Application Compatibility

- Database
- OS & Kernel



Primary Restraint

Application Compatibility

- Database
- OS & Kernel
 - Helps in standardizing the OS for your Infrastructure and OS Patching Automations*

19c & OEL



Certification Matrix

The screenshot shows the Oracle My Oracle Support navigation bar. At the top left is the Oracle logo and the text "MY ORACLE SUPPORT". To the right is a "PowerView is Off" button with a dropdown arrow. Below this is a horizontal menu with several items: "Dashboard", "Knowledge", "Service Requests", "Patches & Updates", "Community" (with an external link icon), "Certifications" (which is bolded and highlighted with a blue bar), "Advanced Customer Services" (with an external link icon), and "Settings". Below the navigation bar, the word "Certifications" is displayed in a large, bold, black font, followed by a thick yellow horizontal line.

Do I Need an OS Upgrade ?

ORACLE MY ORACLE SUPPORT PowerView is Off

Dashboard Knowledge Service Requests Patches & Updates Community **Certifications** Advanced Customer Services Settings

Certifications

19c & OEL

Certified With	Number of Releases / Versions
Operating Systems (8 Items)	
Fujitsu BS2000	2 Versions (V11.0, V10.0)
HP-LUX Itanium	1 Version (11.31)
IBM AIX on POWER Systems (64-bit)	2 Versions (7.2, 7.1)
Linux on IBM Z	3 Versions (SLES 12, Red Hat Enterprise Linux 8, Red Hat Enterprise Linux 7)
Linux x86-64	7 Versions (SLES 15, SLES 12, Red Hat Enterprise Linux 8, Red Hat Enterprise Linux 7, Oracle Linux 8.x, Oracle Linux 8, Oracle Linux 7)
Microsoft Windows x64 (64-bit)	5 Versions (8.1, 2019, 2016, 2012 R2, 10)
Oracle Solaris on SPARC (64-bit)	1 Version (11)
Oracle Solaris on x86-64 (64-bit)	2 Versions (11.4, 11)
Agents (1 Item)	
Enterprise Manager Base Platform - Agent	1 Release (13.3.0.0.0)
Application Servers (1 Item)	
Oracle WebLogic Server	5 Releases (14.1.1.0.0, 12.2.1.4.0, 12.2.1.3.0, 12.2.1.2.0, 10.3.6.0.0)
Databases (5 Items)	
JD Edwards EnterpriseOne Database Server	4 Releases (9.2.6.0, 9.2.5.0, 9.2.4.0, 9.2.3.0)
Oracle Application Express	4 Releases (21.1, 20.1, 19.2, 19.1)
Oracle Fail Safe Server	1 Release (4.2.1)
Oracle REST Data Services	7 Releases (21.1.1, 20.4.3, 20.4.1.0.0, 20.3, 20.2.1, 20.2, 19.4)
Oracle TimesTen In-Memory Database	4 Releases (18.1.4, 18.1.3.2.0, 18.1.2.2.0, 11.2.2.8.35)
Desktop Applications, Browsers and Clients (1 Item)	
Oracle Database Client	5 Releases (19.0.0.0.0, 18.0.0.0.0, 12.2.0.1.0, 12.1.0.2.0, 11.2.0.4.0)
Directory/LDAP Services (4 Items)	
Enterprise Applications (18 Items)	
Management and Development Tools (6 Items)	

See Also: Oracle Real Application Clusters 19.0.0.0.0, RAC One Node 19.0.0.0.0, Partitioning 19.0.0.0.0, Database In-Memory Option 19.0.0.0.0 and 8 others

OEL 8 Versions that support 19c

19c & OEL 8



Oracle Database 19.0.0.0.0 is certified on Linux x86-64 Oracle Linux 8.x Update 1+

Notes

Oracle Database 19.0.0.0.0 with Linux x86-64 Oracle Linux 8.x

Product: For general information relating to certification for the Oracle Database product, including virtualization, interoperability, binary compatibility, general release and patch set information, see Core Database Certification Information (Doc ID [1304727.1](#)).

Platform: For details about certifications of Oracle Database on Linux x86-64, see *Certification Information for Oracle Database on Linux x86-64* (Doc ID [1304727.1](#)).

For details about Oracle Linux Ksplice Support with the Oracle Database, see *Oracle Linux Ksplice Support with Oracle Database* (Doc ID [2312257.1](#)).

Minimum RU: 19.7 (or 19.6 with patches, refer to aforementioned certification notes)

Minimum kernel versions:

- Oracle Linux 8.1 with the Unbreakable Enterprise Kernel 6: 5.4.17-2011.0.7.el8uek.x86_64 or later,
or
- Oracle Linux 8.0 with the Red Hat Compatible kernel: 4.18.0-80.el8.x86_64 or later

ACFS: Please refer to *ACFS Supported on OS Platforms* for Oracle ACFS certification details (Doc ID [1369107.1](#))

OEL 8 Versions that support 19c

19c & OEL 8

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RU & Kernel

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For details about Oracle Linux Ksplice Support with the Oracle Database, see [Oracle Linux Ksplice Support with the Oracle Database](#).

Minimum RU: 19.7 (or 19.6 with patches, refer to aforementioned certification notes)

Minimum kernel versions:

- Oracle Linux 8.1 with the Unbreakable Enterprise Kernel 6: 5.4.17-2011.0.7.el8uek.x86_64 or later, or
- Oracle Linux 8.0 with the Red Hat Compatible kernel: 4.18.0-80.el8.x86_64 or later

ACFS: Please refer to [ACFS Supported on OS Platforms](#) for Oracle ACFS certification details (Doc ID [1369107.1](#))

DB - version \geq 19.7

OS - 8.1 UEK 6 : 5.4.17-2011.0.7.el8uek.x86_64
or 8.0 RHC 4.18.0-80.el8.x86_64

Look Carefully

DB version >= 19.7



Oracle Database 19.0.0.0.0 is certified on Linux x86-64 Oracle Linux 8.x Update 1+



Notes

Oracle Database 19.0.0.0.0 with Linux x86-64 Oracle Linux 8.x

Product: For general information relating to certification for the Oracle Database product, including virtualization, interoperability, binary compatibility, general release and patch set information, see Core Database Certification Information (Doc ID [1304727.1](#)).

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ACFS: Please refer to *ACFS Supported on OS Platforms* for Oracle ACFS certification details (Doc ID [1369107.1](#))

Not Only ACFS

ASMFD & ACFS with RedHat Compatible Kernel

DB - version >= 19.12
 OS - OEL 8.0 RHC >= 4.18.0-80.el8.x86_64 & <= 4.18.0-240.el8.x86_64

ACFS and A

Vendor	Version	Update/Kernel	Architecture	ACFS Bug or RU/RUR	AFD Bug or RU/RUR
Oracle Linux - RedHat Compatible Kernel	7	Update 5 3.10.0-862	X86_64	Base	Base
Oracle Linux - RedHat Compatible Kernel	7	Update 6 3.10.0-957 and later 3.10.0 Red Hat Compatible kernels	X86_64	19.5.191015 (Base Bug 29963428)	19.5.191015 (Base Bug 29963428)
Oracle Linux - RedHat Compatible Kernel	8	GA, U1, U2, U3 Updates, 4.18.0-32 through 4.18.0-240 RedHat Compatible Kernels	X86_64	19.12.210720 (Base Bug 29557768, 31019017, 31480077, 31838226, 32408255)	19.12.210720 (Base Bug 29557768, 31019017, 31480077, 31838226, 32408255)
Oracle Linux - Unbreakable Enterprise Kernel	7	All Updates, 4.1.12-112.16.4 and later UEK 4.1.12 kernels	X86_64	Base	Base
Oracle Linux - Unbreakable Enterprise Kernel	7	All Updates, 4.14.35-1902 and later UEK 4.14.35 kernels	X86_64	19.4.190716 (Base Bug 27494830)	19.4.190716 (Base Bug 27494830)
Oracle Linux - Unbreakable Enterprise Kernel	7	All Updates, 5.4.17-2011 and later UEK 5.4.17 kernels	X86_64	19.10.210119 (Base Bug 30590023)	19.10.210119 (Base Bug 30590023)
Oracle Linux - Unbreakable Enterprise Kernel	8	All Updates, 5.4.17-2011 and later UEK 5.4.17 kernels	X86_64	19.10.210119 (Base Bug 30590023)	19.10.210119 (Base Bug 30590023)

ASMFD & ACFS with UEK

DB - version **>= 19.10**
 OS - OEL 8.1 UEK **>= 5.4.17-2011.0.7**

ACFS and

Vendor	Version	Update/Kernel	Architecture	ACFS Bug or RU/RUR	AFD Bug or RU/RUR
Oracle Linux - RedHat Compatible Kernel	7	Update 5 3.10.0-862	X86_64	Base	Base
Oracle Linux - RedHat Compatible Kernel	7	Update 6 3.10.0-957 and later 3.10.0 Red Hat Compatible kernels	X86_64	19.5.191015 (Base Bug 29963428)	19.5.191015 (Base Bug 29963428)
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Oracle Linux - Unbreakable Enterprise Kernel	7	All Updates, 4.1.12-112.16.4 and later UEK 4.1.12 kernels	X86_64	Base	Base
Oracle Linux - Unbreakable Enterprise Kernel	7	All Updates, 4.14.35-1902 and later UEK 4.14.35 kernels	X86_64	19.4.190716 (Base Bug 27494830)	19.4.190716 (Base Bug 27494830)
Oracle Linux - Unbreakable Enterprise Kernel	7	All Updates, 5.4.17-2011 and later UEK 5.4.17 kernels	X86_64	19.10.210119 (Base Bug 30590023)	19.10.210119 (Base Bug 30590023)
Oracle Linux - Unbreakable Enterprise Kernel	8	All Updates, 5.4.17-2011 and later UEK 5.4.17 kernels	X86_64	19.10.210119 (Base Bug 30590023)	19.10.210119 (Base Bug 30590023)

Validate AFD/ACFS Driver Support

```
[root@source01 /]# afddriverstate supported
AFD-620: AFD is not supported on this operating system version: '4.14.35-1818.3.3.el7uek.x86_64'
AFD-9201: Not Supported
```

```
[root@source01 /]# acfsdriverstate supported
ACFS-9459: ADVM/ACFS is not supported on this OS version: '4.14.35-1818.3.3.el7uek.x86_64'
ACFS-9201: Not Supported
```

```
[root@target01 ~]$ acfsdriverstate supported
ACFS-9200: Supported
```

The Options

DB - version \geq 19.12

OS - OEL 8.0 RHC \geq 4.18.0-80.el8.x86_64 & \leq 4.18.0-240.el8.x86_64

OR

DB - version \geq 19.10

OS - OEL 8.1 UEK \geq 5.4.17-2011.0.7 kernels

System Admin Inputs

DB - version \geq 19.12

OS - OEL RHC 8.0 4.18.0-240.el8.x86_64

The RU Question ?

19.12 TO 19.16

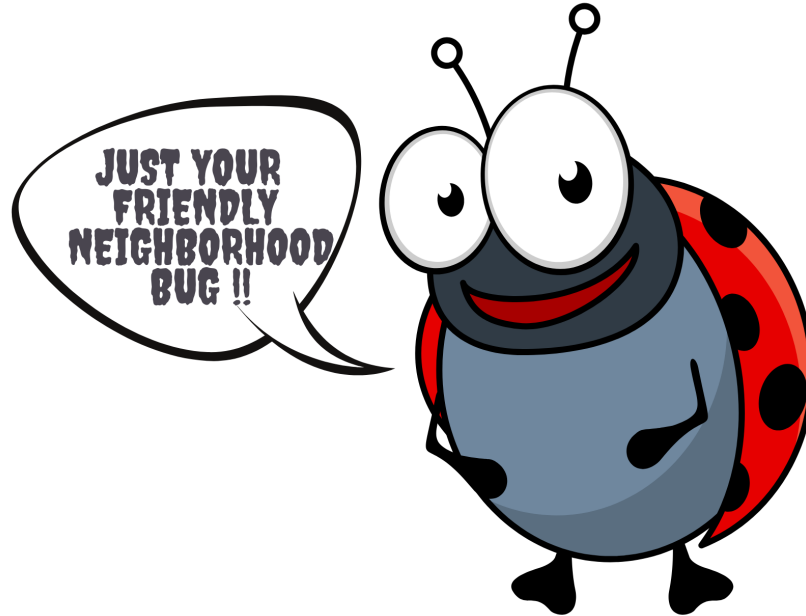
Tie Breaker !

19.12 TO 19.16

Latest & Greatest ??



Known Issues

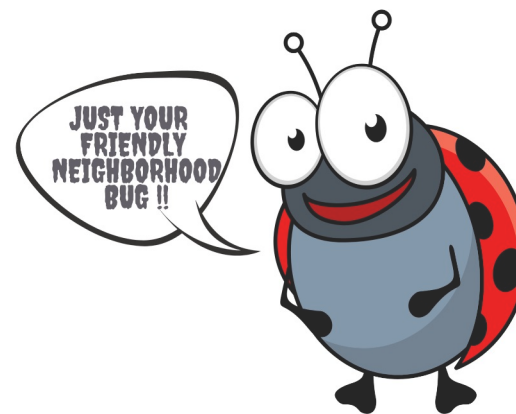


19.12 TO 19.16

Review & Compare Critical/Known Issue Advisory

19.14

- 19c January 2021 Critical Issues
(Doc ID 2725758.1)
- 19c April 2021 Known Issues
(Doc ID 19202104.9)



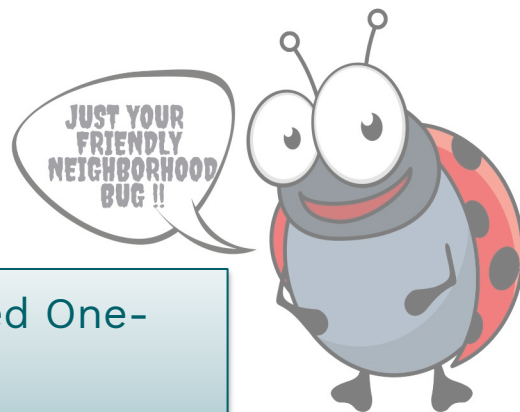
Lookout for Bugs that can Crash the system or affect query result .

Identify One Off Patches

19.14

E.g. Performance, Optimizer...

Oracle Database 19c Important Recommended One-off Patches (Doc ID 555.1)



Identify One Off Patches

TARGET

19.14

Oracle Database 19c Important Recommended One-off Patches (Doc ID 555.1)

Oracle Exadata: Exadata and Linux Important Recommended Fixes (Doc ID 556.1)



Identify One Off Patches - Source

SOURCE

19.14

Patches to apply before upgrading Oracle GI and DB to 19c or downgrading to release (Doc ID 2539751.1)

E.g. Datapump, DBUA, RAC upgrade



Grid Infrastructure Compatibility

19.14

Oracle Clusterware (CRS/GI) - ASM - Database Version
Compatibility (Doc ID 337737.1)



If Running DB <12.1 on 12c RAC Cluster then be aware of Flex ASM

Modify The Cardinality

```
[grid@target01 ~]$ asmcmd showclustermode
```

```
ASM cluster : Flex mode enabled - Direct Storage Access
```

```
[grid@target01 ~]$ srvctl config asm -a
```

```
ASM home: <CRS home>
```

```
Password file: +OCR/orapwASM
```

```
Backup of Password file: +MGMT/orapwASM_backup
```

```
ASM listener: LISTENER
```

```
ASM is enabled.
```

```
ASM is individually enabled on nodes:
```

```
ASM is individually disabled on nodes:
```

```
ASM instance count: 3
```

```
Cluster ASM listener: ASMNET1LSNR_ASM
```

```
[grid@target01 ~]$ srvctl modify asm -count 4
```

Enable Bug Fixes

- Bug Fixes Shipped with PSU/RU but **DISABLED**.

Potential to CHANGE Optimizer Behaviour !!!

- Enable these using **DBMS_OPTIM_BUNDLE** during Upgrades or New Builds **AND** conduct thorough application testing.

```
SQL> execute dbms_optim_bundle.enable_optim_fixes('ON','BOTH', 'YES')
```

Choosing the Version - Checklist

- Application Compatibility
- OS Version Restrictions
- ASMF/ACFS Compatibility
- Bugs & RU
- ASM/CRS Compatibility
- Enable Bug Fixes

Prepare



OS Security Patches

```
$ yum updateinfo list security installed
Loaded plugins: ulninfo
ELSA-2015-2315      Moderate/Sec.  NetworkManager-1:1.0.6-27.0.1.el7.x86_64
ELSA-2016-2581      Low/Sec.       NetworkManager-1:1.4.0-12.el7.x86_64
ELSA-2017-2299      Moderate/Sec.  NetworkManager-1:1.8.0-9.el7.x86_64
ELSA-2018-3665      Important/Sec. NetworkManager-1:1.12.0-8.el7_6.x86_64
ELSA-2015-2315      Moderate/Sec.  NetworkManager-config-server-1:1.0.6-27.0.1.el7.x86_64
ELSA-2016-2581      Low/Sec.       NetworkManager-config-server-1:1.4.0-12.el7.x86_64
ELSA-2017-2299      Moderate/Sec.  NetworkManager-config-server-1:1.8.0-9.el7.noarch
ELSA-2018-3665      Important/Sec. NetworkManager-config-server-1:1.12.0-8.el7_6.noarch
ELSA-2015-2315      Moderate/Sec.  NetworkManager-libnm-1:1.0.6-27.0.1.el7.x86_64
ELSA-2016-2581      Low/Sec.       NetworkManager-libnm-1:1.4.0-12.el7.x86_64
ELSA-2017-2299      Moderate/Sec.  NetworkManager-libnm-1:1.8.0-9.el7.x86_64
ELSA-2018-3665      Important/Sec. NetworkManager-libnm-1:1.12.0-8.el7_6.x86_64
ELSA-2015-2315      Moderate/Sec.  NetworkManager-team-1:1.0.6-27.0.1.el7.x86_64
ELSA-2016-2581      Low/Sec.       NetworkManager-team-1:1.4.0-12.el7.x86_64
ELSA-2017-2299      Moderate/Sec.  NetworkManager-team-1:1.8.0-9.el7.x86_64
ELSA-2018-3665      Important/Sec. NetworkManager-team-1:1.12.0-8.el7_6.x86_64
ELSA-2015-2315      Moderate/Sec.  NetworkManager-tui-1:1.0.6-27.0.1.el7.x86_64
ELSA-2016-2581      Low/Sec.       NetworkManager-tui-1:1.4.0-12.el7.x86_64
ELSA-2017-2299      Moderate/Sec.  NetworkManager-tui-1:1.8.0-9.el7.x86_64
ELSA-2018-3665      Important/Sec. NetworkManager-tui-1:1.12.0-8.el7_6.x86_64
```



RPM's Tools & Standards

- List of RPM's that you use.
- OS Tools & Utilities that you might need.

MFA , Monitoring or Cloud Agent ?

Tcpdump, telnet, strace,dtrace-utils, perf



TimeZone

```
$ timedatectl
    Local time: Wed 2021-10-20 00:18:42 EDT
    Universal time: Wed 2021-10-20 04:18:42 UTC
        RTC time: Wed 2021-10-20 04:18:42
        Time zone: America/New_York (EDT, -0400)
    NTP enabled: no
NTP synchronized: yes
    RTC in local TZ: no
        DST active: yes
    Last DST change: DST began at
                    Sun 2021-03-14 01:59:59 EST
                    Sun 2021-03-14 03:00:00 EDT
    Next DST change: DST ends (the clock jumps one hour backwards) at
                    Sun 2021-11-07 01:59:59 EDT
                    Sun 2021-11-07 01:00:00 EST
```

TimeZone

```
$ timedatectl
```

```
Local time: Wed 2021-10-20 00:18:42 EDT
```

```
Universal time: Wed 2021-10-20 04:18:42 UTC
```

```
RTC time: Wed 2021-10-20 04:18:42
```

```
Time zone: America/New_York (EDT, -0400)
```

```
NTP enabled: no
```

```
NTP synchronized: yes
```

```
RTC in local TZ: no
```

```
DST active: yes
```

```
Last DST change: DST began at
```

```
Sun 2021-03-14 01:59:59 EST
```

```
Sun 2021-03-14 03:00:00 EDT
```

```
Next DST change: DST ends (the clock jumps one hour backwards) at
```

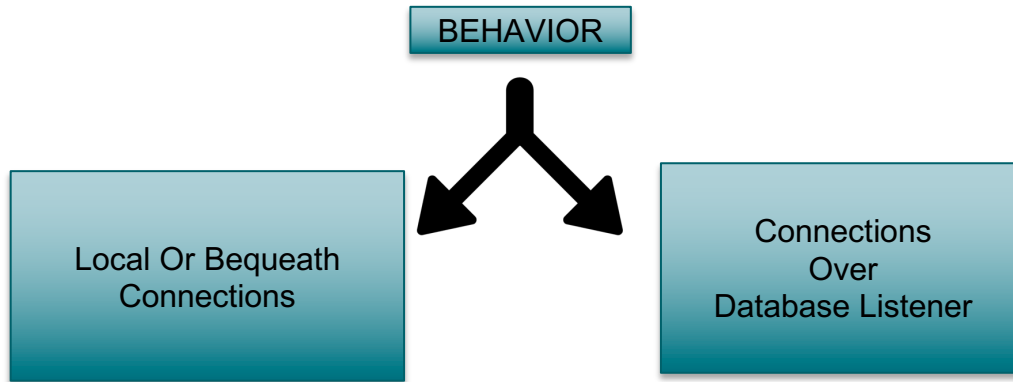
```
Sun 2021-11-07 01:59:59 EDT
```

```
Sun 2021-11-07 01:00:00 EST
```

Why Do we Care ?

- SYSDATE/SYSTIMESTAMP **DO NOT** use the DATABASE TIMEZONE
- Behavior or output can differ depending on the type of connection

Gettimeofday()



BEQUEATH Connections

```
$ sqlplus / as sysdba

SQL> select to_char(systimestamp , 'TZH:TZM') from dual;

TO_CHA
-----
-04:00

$ export TZ=UTC

$ sqlplus / as sysdba

SQL> select to_char(systimestamp , 'TZH:TZM') from dual;

TO_CHA
-----
+00:00
```



TZ when your session begins

Listener Connections

- Affected Time-zone Variable Used when the **INSTANCE WAS STARTED**
TZ
- RAC or GI this is controlled via the configuration file in `$GI_HOME/crs/install`

`s_crsconfig_<hostname>_env.txt`

CRS Environment Configuraiton

```
$ cd /u01/app/19c/grid/crs/install
$ cat s_crsconfig_target03_env.txt
#####
#This file can be used to set values for the NLS_LANG and TZ environment
#variables and to set resource limits for Oracle Clusterware and
#Database processes.
#1. The NLS_LANG environment variable determines the language and
#   charset used for messages. For example, a new value can be
#   configured by setting NLS_LANG=JAPANESE_JAPAN.UTF8
#2. The Time zone setting can be changed by setting the TZ entry to
#   the appropriate time zone name. For example, TZ=America/New_York
#3. Resource limits for stack size, open files and number of processes
#   can be specified by modifying the appropriate entries.
#
#Do not modify this file except as documented above or under the
#direction of Oracle Support Services.
#####
TZ=America/New_York
NLS_LANG=AMERICAN_AMERICA.AL32UTF8
CRS_LIMIT_STACK=2048
CRS_LIMIT_OPENFILE=65536
CRS_LIMIT_NPROC=65536
TNS_ADMIN=
```

Changes require restart of
the Clusterware stack

Troubleshooting Tip

```
target01 SQL> select to_char(sysdate, 'DD/MM/YYYY HH24:MI:SS'), to_char(sysimestamp, 'DD/MM/YYYY HH24:MI:SS TZR') from dual;
TO_CHAR(SYSDATE,'DD TO_CHAR(SYSTIMESTAMP,'DD/MM/YYYYHH24:MI:SSTZR')
-----
17/09/2020 23:28:01 17/09/2020 23:28:01 -07:00

target02 SQL> select to_char(sysdate, 'DD/MM/YYYY HH24:MI:SS'), to_char(sysimestamp, 'DD/MM/YYYY HH24:MI:SS TZR') from dual;
TO_CHAR(SYSDATE,'DD TO_CHAR(SYSTIMESTAMP,'DD/MM/YYYYHH24:MI:SSTZR')
-----
17/09/2020 23:27:53 17/09/2020 23:27:53 -07:00

target03 SQL> select to_char(sysdate, 'DD/MM/YYYY HH24:MI:SS'), to_char(sysimestamp, 'DD/MM/YYYY HH24:MI:SS TZR') from dual;
TO_CHAR(SYSDATE,'DD TO_CHAR(SYSTIMESTAMP,'DD/MM/YYYYHH24:MI:SSTZR')
-----
17/09/2020 23:27:31 17/09/2020 23:27:31 -07:00

target04 SQL> select to_char(sysdate, 'DD/MM/YYYY HH24:MI:SS'), to_char(sysimestamp, 'DD/MM/YYYY HH24:MI:SS TZR') from dual;
TO_CHAR(SYSDATE,'DD TO_CHAR(SYSTIMESTAMP,'DD/MM/YYYYHH24:MI:SSTZR')
-----
18/09/2020 00:27:16 18/09/2020 00:27:16 -06:00
```

The CRS Env Config file had the correct TimeZone

Troubleshooting Tip

```
oracle@target04 install]$ps -ef | grep smon
root      7194      1  0 Aug22 ?        03:50:43 /opt/app/12.2/grid/bin/osysmond.bin
oracle    7590      1  0 18:15 ?        00:00:00 asm_smon +ASM4
oracle    9366    8422  0 18:50 pts/4    00:00:00 grep smon
oracle    17620     1  0 18:22 ?        00:00:00 ora_smon_db04
```

```
[oracle@target04 install]$strings /proc/17620/environ
```

```
_CLSAGFW_TYPE_NAME=ora.diskgroup.typeORA_CRS_HOME=/opt/app/12.2/gridHOSTNAME=[REDACTED]TERM=xtermSHELL=/bin/bash_CRSD_CONNECT_STR=(ADDRESS=(PROTOCOL=IPC)(KEY=CRSD_IPC_SOCKET_11))HISTSIZ=100
ONLS_LANG=AMERICAN AMERICA.AL32UTF8CRF_HOME=/opt/app/12.2/gridWAS_ROOTMACRO_CALL_MADE=YESGIPCD_PASSTHROUGH=falseORA_DAEMON_TRACING_LEVELS=AGENT=0,AGFW=0,CLSFRAME=0,CLSV=0,CLUCLS=0,COMMCRS=0,COMMS=0
,CRSAPP=0,CRSACL=0,CRSCEVT=0,CRSCOMM=0,CRSD=0,CRSEVT=0,CRSM=0,CRSOCR=0,CRSPE=0,CRSPLACE=0,CRSRES=0,CRSRPT=0,CRSRTI=0,CRSSE=0,CRSSEC=0,CRSTIMER=0,CRSUI=0,CSSCLNT=0,SuiteTes=0,UiServer=0,OCRAPI=1,OCR
CLI=1,OCRSRV=1,OCRMS=1,OCRMSG=1,OCRAC=1,OCRRAW=1,OCRUTL=1,OCROSD=1,OCRASM=1LC_ALL=_CRSD_AGENT_NAME=/opt/app/12.2/grid/bin/oraagent_oracle_ORA_AGENT_ACTION=TRUE_CRSD_MSG_FRAME_VERSION=2USER=rootLD
LIBRARY_PATH=LS_COLORS=no=00:fi=00:di=00:34:ln=00:36:pi=40:33:so=00:35:bd=40:33:01:cd=40:33:01:or=01:05:37:41:mi=01:05:37:41:ex=00:32:*.cmd=00:32:*.exe=00:32:*.com=00:32:*.btm=00:32:*.bat=00:32:*.sh=0
0:32:*.csh=00:32:*.tar=00:31:*.tgz=00:31:*.arj=00:31:*.zip=00:31:*.z=00:31:*.2=00:31:*.gz=00:31:*.bz2=00:31:*.bz=00:31:*.tz=00:31:*.rpm=00:31:*.cpio=00:31:*.jpg=00:35:*.gif=00:
35:*.bmp=00:35:*.x=00:35:*.xpm=00:35:*.png=00:35:*.tif=00:35:_CLSAGENT_INCARNATION=1CRS_LIMIT_MEMLOCK=unlimitedORASYM=/opt/app/12.2/grid/bin/oraagent_binPATH=MAIL=/var/spool/mail/rootFWD=/INFUTRC=/
etc/inputrcENV_FILE=/opt/app/12.2/grid/crs/install/s_crsconfig[REDACTED].env.txtCRS_LIMIT_OPENFILE=65536LANG=en_US.UTF-8TZ=America/Denver_IS_HASD_AGENT=_CLSAGENT_LOG_NAME=ora.diskgroup.type_oracleORA
PCW_AGENTS=trueORA_DAEMON_LOGGING_LEVELS=AGENT=1,AGFW=0,CLSFRAME=0,CLSV=0,CLUCLS=0,COMMCRS=0,COMMS=0,CRSAPP=0,CRSACL=0,CRSCEVT=0,CRSCOMM=0,CRSD=0,CRSEVT=0,CRSM=0,CRSOCR=0,CRSPE=0,CRSPLACE=0,CRS
ES=0,CRSRPT=0,CRSRTI=0,CRSSE=0,CRSSEC=0,CRSTIMER=0,CRSUI=0,CSSCLNT=0,SuiteTes=1,UiServer=0,OCRAPI=1,OCRCLI=1,OCRSRV=1,OCRMS=1,OCRMSG=1,OCRAC=1,OCRRAW=1,OCRUTL=1,OCROSD=1,OCRASM=1SRVM_TRACE=SSH_ASKPA
SS=/usr/libexec/openssh/gnome-ssh-askpassHOME=/rootSHLVL=3_CLSAGENT_LOGDIR_NAME=crsld_ASSUME_KERNEL=CRS_LIMIT_CORE=unlimited_CLSAGENT_USER_NAME=oracleLOGNAME=rootCVS_RSH=sshLOG=/opt/app/12.2/grid/i
ninstall/root[REDACTED]-2020-08-22 04:17-27.logLESSOPEN=|/usr/bin/lesspipe.sh %sORACLE_HOME=/opt/app/oracle/product/12.2/dbhome_1G_BROKEN_FILENAMES=1CRS_LIMIT_STACK=2048ORACLE_SID=[REDACTED]ORA_N
ET2_DESC=57,60ORACLE_SPANNED_PROCESS=1SKGP_SPAWN_DIAG_PRE_FORK_TS=1600564961SKGP_SPAWN_DIAG_POST_FORK_TS=1600564961SKGP_HIDDEN_ARGS=<FATAL/S/SMON/x0/x14/x0/x9A4FE00C/17577/17564/x13/x15/x1/x9A4FE57A/1
600564961/1600564961>OSKGP_SPAWN_DIAG_PRE_EXEC_TS=1600564961
```

Set the time Zone Explicitly

```
$ srvctl getenv listener
LISTENER:
$ srvctl getenv database -d demo
demo:

$ srvctl setenv database -d demo -t 'TZ=America/Phoenix'
$ srvctl getenv database -d demo
demo:
TZ=America/Phoenix

$ srvctl setenv listener -t 'TZ=America/Phoenix'
$ srvctl getenv listener
LISTENER:
TZ=America/Phoenix
```

Restart the affected Instance

Tempfiles.d

- Linux 7+ Introduces Tempfiles.d daemon
 - Defaults
 - Delete from /tmp files not accessed >10 days
 - Delete from /var/tmp files not accessed > 30 days

```
$ cat /usr/lib/tmpfiles.d/tmp.conf
# This file is part of systemd.
#
# systemd is free software; you can redistribute it and/or modify it
# under the terms of the GNU Lesser General Public License as published by
# the Free Software Foundation; either version 2.1 of the License, or
# (at your option) any later version.
#
# See tmpfiles.d(5) for details
#
# Clear tmp directories separately, to make them easier to override
v /tmp 1777 root root 10d
v /var/tmp 1777 root root 30d
```

Why Should We Care ?

- Oracle stores **SOCKET FILES** in /var/tmp
- Consequences of deleting these files



Inter Process
Communication (IPC)

<https://tinyurl.com/pythian-tempfiles>
Mos Note - 2498572.1

The Fix

- Update Configuration `tmp.conf`
 - `x /tmp/.oracle*`
 - `x /var/tmp/.oracle*`
 - `x /usr/tmp/.oracle*`

`x`

Ignore a path during cleaning. Use this type to exclude paths from clean-up as controlled with the `Age` parameter

Steps

```
$ vi /usr/lib/tmpfiles.d/tmp.conf
$ systemctl restart systemd-tmpfiles-clean.timer

$ systemctl status systemd-tmpfiles-setup.service
● systemd-tmpfiles-setup.service - Create Volatile Files and Directories
   Loaded: loaded (/usr/lib/systemd/system/systemd-tmpfiles-setup.service; static; vendor preset: disabled)
   Active: active (exited) since Mon 2020-02-24 03:44:53 EST; 1 years 8 months ago
     Docs: man:tmpfiles.d(5)
           man:systemd-tmpfiles(8)
  Main PID: 1170 (code=exited, status=0/SUCCESS)
    CGroup: /system.slice/systemd-tmpfiles-setup.service

Warning: Journal has been rotated since unit was started. Log output is incomplete or unavailable.

$ tail -5 /usr/lib/tmpfiles.d/tmp.conf

## Add Entries to exclude Oracle Files
x /tmp/.oracle*
x /var/tmp/.oracle*
x /usr/tmp/.oracle*
```


Steps

```
$ vi /usr/lib/tmpfiles.d/tmp.conf

$ systemctl restart systemd-tmpfiles-clean.timer

$ systemctl status systemd-tmpfiles-setup.service
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$ tail -5 /usr/lib/tmpfiles.d/tmp.conf

## Add Entries to exclude Oracle Files
x /tmp/.oracle*
x /var/tmp/.oracle*
x /usr/tmp/.oracle*
```

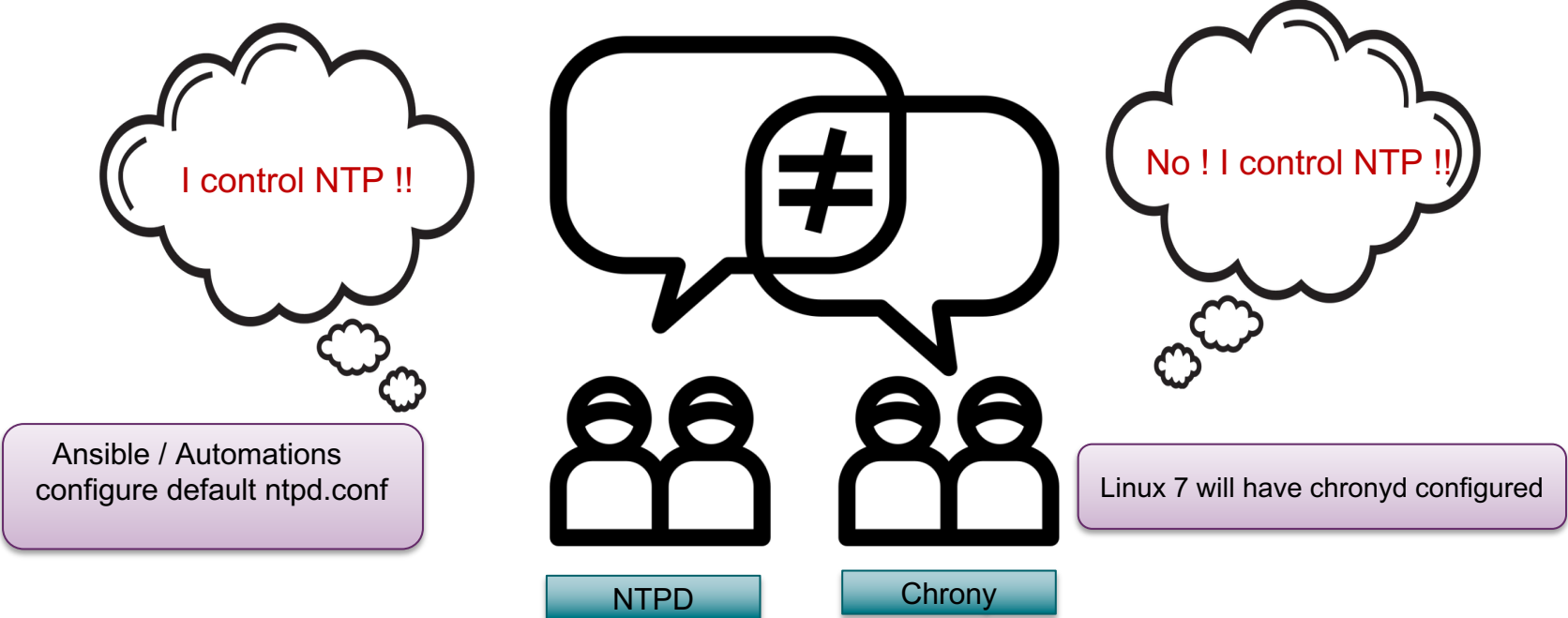
TimeServer

- Linux 7 Introduced Chrony as the new option for NTP Time synchronization
- Warnings and errors in CRS Logs

```
CRS-10051: CVU found following errors withClusterware setup
PRVF-5414 : Check of NTP Config file failed on all nodes. Cannot proceed further for the NTP tests

PRVF-5415 : Check to see if NTP daemon or service is running failed
```

Conflicts



Disable the Service you do not need

- Fix your timeserver (either NTPD or Chrony)
- Disable NTPD

Chrony

```
[root@server01 ~]## systemctl stop ntpd

[root@server01 ~]## systemctl disable ntpd
Removed symlink /etc/systemd/system/multi-user.target.wants/ntpd.service.

[root@server01 ~]## systemctl is-enabled ntpd
disabled
```

Configure NTP Server

- Configure your NTP Timeserver

```
root@server01 ~]# grep server /etc/chrony.conf | grep -v ^#  
server time1.acme.com  
server time2.acme.com
```

```
## Restart the chrony daemon
```

```
[root@server01 ~]# systemctl stop chronyd  
[root@server01 ~]# systemctl start chronyd
```

```
## Review the chrony sources
```

```
[root@server01 ~]# chronyc sources
```

```
210 Number of sources = 2
```

```
MS Name/IP address          Stratum Poll Reach LastRx Last sample
```

```
=====
```

^* time1.acme.com	1	10	377	764	-26us [-35us]	+/- 1164us
^+ time2.acme.com	1	10	377	191	-35us [-35us]	+/- 1106us

On RAC do check NTP Slew

<https://tinyurl.com/chrony-linux7>

Storage - Best Practices

- Stick with the same sized disks.
- Consolidating a DB

```
./associate_asmdisk_to_devices.sh
ASM disk "DATA01" based on /dev/sdf1 [8 81]
ASM disk "DATA02" based on /dev/sdg1 [8 97]
ASM disk "DATA03" based on /dev/sdh1 [8 113]
ASM disk "DATA04" based on /dev/sdi1 [8 129]
ASM disk "DATA05" based on /dev/sdj1 [8 145]
ASM disk "OCR01" based on /dev/sdc1 [8 33]
ASM disk "OCR02" based on /dev/sdd1 [8 49]
ASM disk "OCR03" based on /dev/sde1 [8 65]
ASM disk "REDO01" based on /dev/sdl1 [8 177]
ASM disk "REDO02" based on /dev/sdm1 [8 193]
ASM disk "FRA01" based on /dev/sdv1 [8 137]

$kfed read /dev/sdv1 | grep dskname
kfdhdb.dskname:          FRA_0000 ; 0x028: length=8
```



Partitions Are Alligned

```
lsblk
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
sda 8:0 0 142G 0 disk
├─sda1 8:1 0 1G 0 part /boot
├─sda2 8:2 0 109G 0 part /
└─sda3 8:3 0 32G 0 part [SWAP]
sdb 8:16 0 150G 0 disk
├─sdb1 8:17 0 150G 0 part
│   └─ol_dent--t--ax7db01-u01 249:0 0 150G 0 lvm /u01
sr0 11:0 1 1024M 0 rom
sdc 8:32 0 3G 0 disk
├─sdc1 8:33 0 3G 0 part
sdd 8:48 0 3G 0 disk
├─sdd1 8:49 0 3G 0 part
sde 8:64 0 3G 0 disk
├─sde1 8:65 0 3G 0 part
sdf 8:80 0 256G 0 disk
├─sdf1 8:81 0 256G 0 part
sdg 8:96 0 256G 0 disk
├─sdg1 8:97 0 256G 0 part
sdh 8:112 0 256G 0 disk
├─sdh1 8:113 0 256G 0 part
sdi 8:128 0 256G 0 disk
├─sdi1 8:129 0 256G 0 part
sdj 8:144 0 256G 0 disk
├─sdj1 8:145 0 256G 0 part
sdk 8:160 0 20G 0 disk
sdl 8:176 0 30G 0 disk
├─sdl1 8:177 0 30G 0 part
sdm 8:192 0 30G 0 disk
└─sdm1 8:193 0 30G 0 part
```

```
parted /dev/sdm align-check optimal 1
1 aligned
```


Label your Disks & Add !!

```
$ asmcmd afd_label DATA06 /dev/sdm1
```

```
su root
cd /u01/app/19c/grid/bin
export ORACLE_HOME=/u01/app/19c/grid/bin
export ORACLE_BASE=/tmp
export PATH=$ORACLE_HOME/bin:$PATH

$ORACLE_HOME/bin/asmcmd afd_label OCR_001 /dev/sdp1 --init
$ORACLE_HOME/bin/asmcmd afd_label OCR_002 /dev/sdq1 --init
$ORACLE_HOME/bin/asmcmd afd_label OCR_003 /dev/sdr1 --init
$ORACLE_HOME/bin/asmcmd afd_label DATA_001 /dev/sds1 --init

$ORACLE_HOME/bin/asmcmd afd_lesdk

$ORACLE_HOME/bin/asmcmd afd_lslbl1 '/dev/sd*'

unset ORACLE_BASE
```

New Installation

Review Memory Config

- Pre-install sets the defaults
- Configure the memory limits based on your configuration requirements
- Do Not Forget HugePages on Linux Systems

Do not forget USE_LARGE_PAGES

```
grep -i memlock /etc/security/limits.conf
# - memlock - max locked-in-memory address space (KB)
oracle soft memlock 29332242
oracle hard memlock 29332242
```

```
grep HugePages /proc/meminfo
AnonHugePages:      0 kB
ShmemHugePages:    0 kB
FileHugePages:     0 kB
HugePages_Total:   8214
HugePages_Free:    4120
HugePages_Rsvd:    6
HugePages_Surp:    0
```

```
USE_LARGE_PAGES = { TRUE | FALSE | AUTO | ONLY | AUTO_ONLY }
```

Shell Script to
Calculate Values
Recommended
.....Doc ID 401749.1

Server Restart

- **REBOOT** - After configuration is completed

Validates persistent configuration



Configure AutoStart

- Integrate **DBSHUT** & **DBSTART** Scripts with Systemd Services

Depend on ORATAB (set autostart field to “Y”)

Handles Database + Listener Restarts



Modify/Add configuration for non-default listeners

Configure AutoStart

- Integrate DBSHUT & DBSTART Scripts with Systemd Services
- Create a service file called oracleDB.service

```
$ systemctl cat oracleDB.service

# /etc/systemd/system/oracleDB.service

[Unit]
Description=Oracle Database
After=syslog.target network.target

[Service]
Type=forking
User=oracle
LimitMEMLOCK=infinity
LimitNOFILE=65536
Group=dba
TimeoutSec=300
EnvironmentFile=/etc/sysconfig/env_oracledb
ExecStart=/u00/oracle/product/19c/bin/dbstart /u00/oracle/product/19c
ExecStop=/u00/oracle/product/19c/bin/dbshut /u00/oracle/product/19c

[Install]
WantedBy=multi-user.target
```

Configure AutoStart

- Integrate DBSHUT & DBSTART Scripts with Systemd Services
- Create a service file called oracleDB.service
- Reload systemd so it can see the new service.

```
$ systemctl daemon-reload
```

Configure AutoStart

- Integrate DBSHUT & DBSTART Scripts with Systemd Services
- Create a service file called oracleDB.service
- Reload systemd so it can see the new service.
- Enable the Service

```
$ systemctl enable oracleDB.service

$ systemctl list-unit-files --type service | grep oracle
oracleDB.service                enabled
```

REBOOT TO TEST !!

Prepare - Checklist

- OS Security Patches
- RPM's Tools & Standards
- Timezone Implications
- Tempfiles.d Daemon
- TimeServer
- Disk Labeling
- Disk Alignment
- Memory & HugePages
- Autostart & Reboot

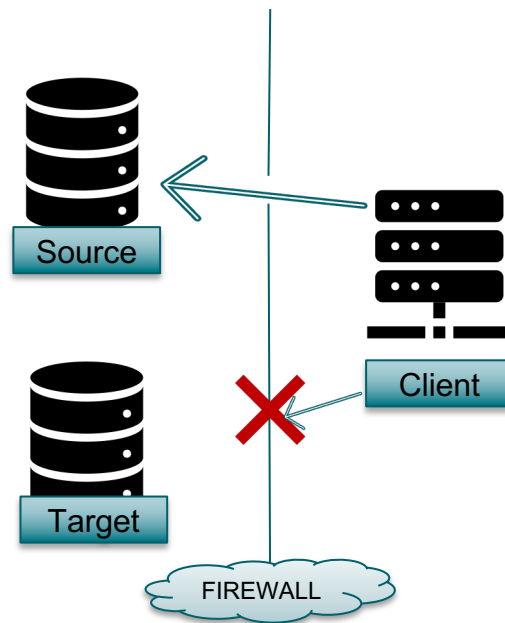
Identify the Clients



Why ?

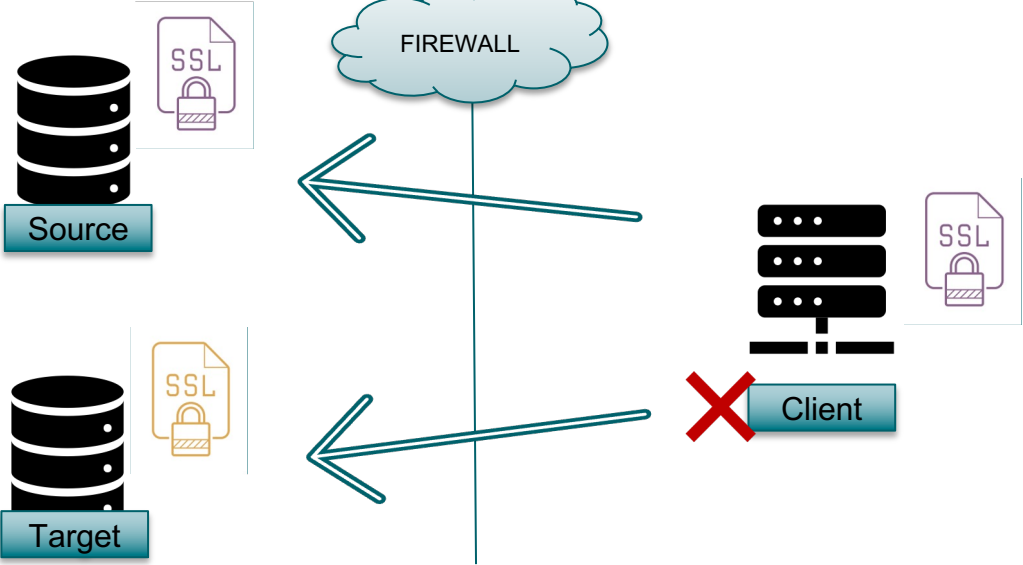
Where to make Changes

- Servers for TNS Updates
- Firewall Rules



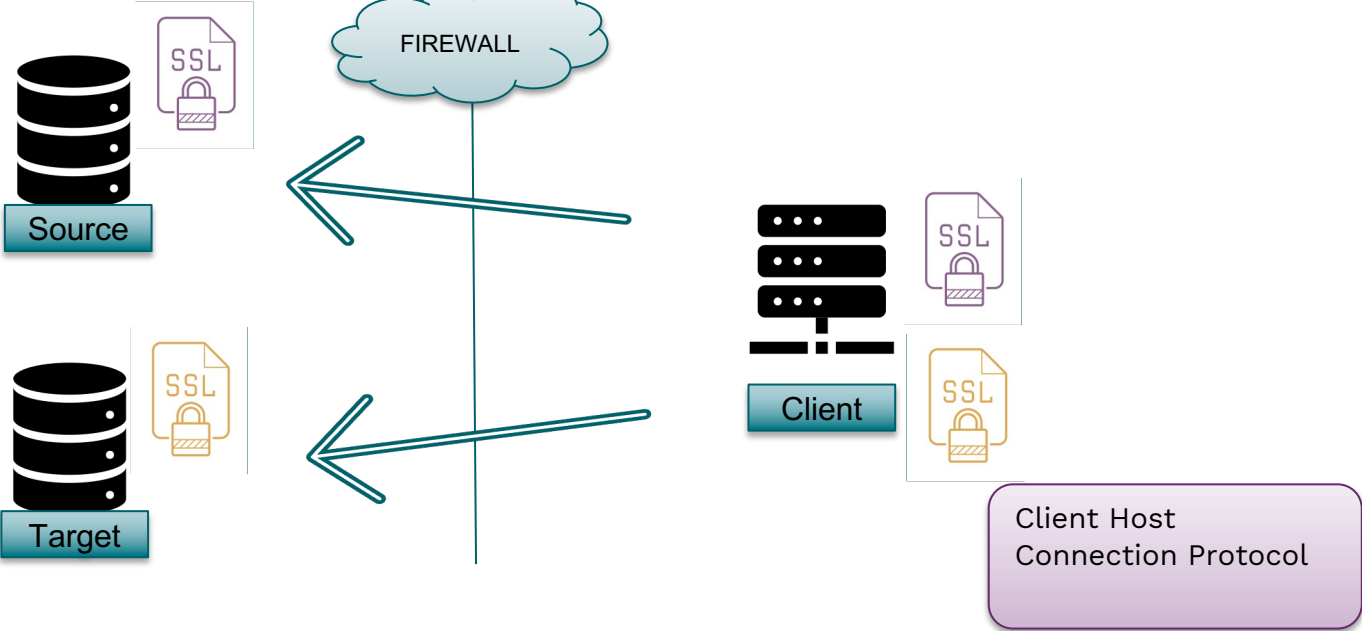
Client Host

SSL Certificates



ORA-12560 : TNS : protocol adapter error - when using SSL

SSL Certificates



ORA-12560 : TNS : protocol adapter error - when using SSL

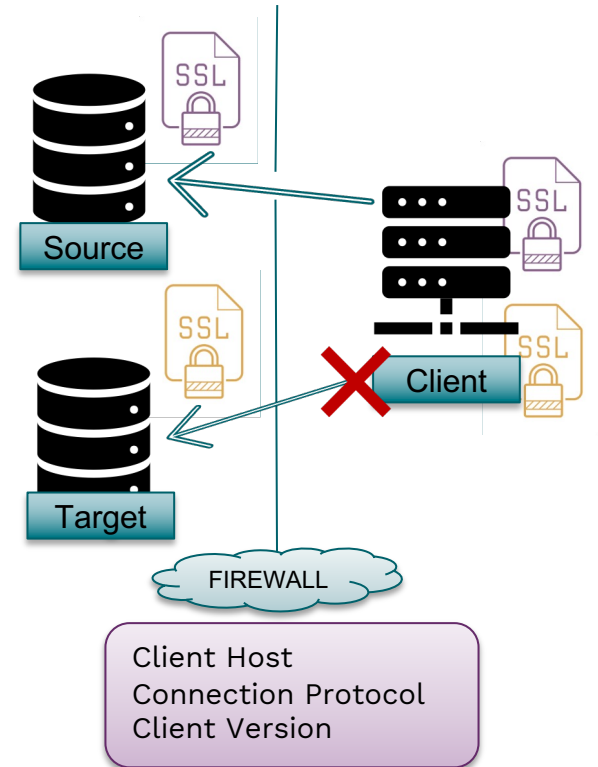
SSL – Handshake

De-supported Cipher suites

- `SSL_DH_anon_WITH_DES_CBC_SHA`
- `SSL_RSA_EXPORT_WITH_DES40_CBC_SHA`
- `SSL_RSA_EXPORT_WITH_RC4_40_MD5`
- `SSL_RSA_WITH_DES_CBC_SHA`



ORA-28859 : SSL negotiation failure



What to Identify?

Client Host
Connection Protocol
Client Version
Client Characterset

How To Identify?

- AUDIT

```
SYS @ db >select privilege, success, failure from DBA_PRIV_AUDIT_OPTS where privilege like 'CREATE SESSION';
```

PRIVILEGE	SUCCESS	FAILURE
CREATE SESSION	BY ACCESS	BY ACCESS

Audit Views

Client Host
Connection Protocol
Client Version

```
SYS @ db > select distinct USERHOST,USERNAME from dba_audit_session order by 2;
```

USERHOST	USERNAME
target.org.acme.edu	DBSNMP
AD\CL001-D-MODULE	SCOTT AD\CL00IT-J-NEW
AD\CL00ORA-VEND4	SCOTT
AD\CL00P-WIND16	SCOTT
AD\CL00P-WIND18	SCOTT
AD\CL00P-CIT01	SCOTT
AD\CL00XA-DEV-001	SCOTT
AD\CL00XA-MEM-001	SCOTT
AD\CL00XA-MEM-002	SCOTT
POOL\CL001-D-MODULE	SCOTT
target.org.acme.edu	SCOTT
target.org.acme.edu	HR
target.org.acme.edu	HR
target.org.acme.edu	HR
target.org.acme.edu	HR



With Unified Auditing query UNIFIED_AUDIT_TRAIL

V\$SESSION_CONNECT_INFO

```
SELECT
  b.username,
  a.client_version, a.osuser,
  b.machine, b.module, b.program,
  a.client_charset , a.client_driver,
  b.service_name
FROM gv$session_connect_info a, gv$session b
WHERE a.sid = b.sid
      and a.serial# = b.serial#
      and a.AUTHENTICATION_TYPE != 'INTERNAL'
ORDER BY client_version, username;
```

USERNAME	CLIENT_VERSION CLIENT_DRIVER	OSUSER SERVICE_NAME	MACHINE	MODULE	PROGRAM	CLIENT_CHARSET
SCOTT	12.1.0.2.0	abc001 SALES	AD\APP-P-REM033	salesforce.exe	salesforce.exe	WE8MSWIN1252
SCOTT	12.1.0.2.0	abc360 SALES	AD\APP-P-REM033	salesforce.exe	salesforce.exe	WE8MSWIN1252
SCOTT	12.1.0.2.0	abc360 SALES	AD\APP-P-REM033	salesforce.exe	salesforce.exe	WE8MSWIN1252
SCOTT	12.1.0.2.0	abc591 SALES	AD\APP-P-REM013	salesforce.exe	salesforce.exe	WE8MSWIN1252
SCOTT	12.1.0.2.0	abc591 SALES	AD\APP-P-REM013	salesforce.exe	salesforce.exe	WE8MSWIN1252
SCOTT	19.0.16.0.0 ODPM.NET : 19.1.0.0.0	salesforceconnect OE	APPPPOOL\APP-P-BOOKI01	booking.exe	booking.exe	WE8MSWIN1252
SCOTT	19.0.16.0.0 ODPM.NET : 19.1.0.0.0	salesforceconnect OE	APPPPOOL\APP-P-BOOKI02	booking.exe	booking.exe	WE8MSWIN1252
SCOTT	19.0.16.0.0 ODPM.NET : 19.1.0.0.0	salesforceConnect OE	APPPPOOL\APP-P-BOOKI02	booking.exe	booking.exe	WE8MSWIN1252
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V\$SESSION_CONNECT_INFO

```

SELECT
  b.username,
  a.client_version, a.osuser,
  b.machine, b.module, b.program,
  a.client_charset , a.client_driver,
  b.service_name
FROM gv$session_connect_info a, gv$session b
WHERE a.sid = b.sid
  and a.serial# = b.serial#
  and a.AUTHENTICATION_TYPE != 'INTERNAL'
ORDER BY client_version, username;
    
```

HOST

USERNAME	CLIENT_VERSION CLIENT_DRIVER	OSUSER SERVICE_NAME	MACHINE	MODULE	PROGRAM	CLIENT_CHARSET
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V\$SESSION_CONNECT_INFO

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```

Version

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SCOTT	12.1.0.2.0	abc591 SALES	AD\APP-P-REM013	salesforce.exe	salesforce.exe	WE8MSWIN1252
SCOTT	19.0.16.0.0 ODPM.NET : 19.1.0.0.0	salesforceconnect OE	APPPPOOL\APP-P-BOOKI01	booking.exe	booking.exe	WE8MSWIN1252
SCOTT	19.0.16.0.0 ODPM.NET : 19.1.0.0.0	salesforceconnect OE	APPPPOOL\APP-P-BOOKI02	booking.exe	booking.exe	WE8MSWIN1252
SCOTT	19.0.16.0.0 ODPM.NET : 19.1.0.0.0	salesforceConnect OE	APPPPOOL\APP-P-BOOKI02	booking.exe	booking.exe	WE8MSWIN1252
SCOTT	19.0.16.0.0 ODPM.NET : 19.1.0.0.0	salesforceconnect OE	APPPPOOL\APP-P-BOOKI02	booking.exe	booking.exe	WE8MSWIN1252

V\$SESSION_CONNECT_INFO

```
SQL> select sid,program,
  case when program not like 'ora_@% (P%)' then
    (select max(case
when NETWORK_SERVICE_BANNER like '%TCP/IP%'
  then 'TCP'
when NETWORK_SERVICE_BANNER like '%Bequeath%'
  then 'BEQUEATH'
when NETWORK_SERVICE_BANNER like '%IPC%'
  then 'IPC'
when NETWORK_SERVICE_BANNER like '%SDP%'
  then 'SDP'
when NETWORK_SERVICE_BANNER like '%NAMED P%'
  then 'Named pipe'
when NETWORK_SERVICE_BANNER is null
  then 'TCPS' end)
  from V$SESSION_CONNECT_INFO i
 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 where i.sid=s.sid) end protocol
18 from v$session s;
```

PROTOCOL

SID	PROGRAM	PROTOCOL
14	waagp.exe	TCPS
16	Rpomp.exe	TCPS



How To Determine If A Database Connection Is Using SSL (Doc ID 2305195.1)

X\$ksusecon (V<12)

Version



```
SYS @ db >select ksuseunm, ksuseclvsn, sys_op_version(ksuseclvsn) from x$ksusecon where ksuseclvsn <> 0 ;
```

KSUSEUNM	KSUSECLVSN	SYS_OP_VERSION(KSUSECLVSN)
scott	202375680	12.1.0.2.0
hr	202375680	12.1.0.2.0
dev	318832640	19.0.16.0.0

Other Options

```
26-OCT-2021 02:29:36 * (CONNECT_DATA=(CID=(PROGRAM=) (HOST=target.org.acme.edu) (USER=oracle)) (COMMAND=status) (ARGUMENTS=64) (SERVICE=LISTENER) (VERSION=318767104)) * status *
0
2021-10-26T02:29:46.692777-04:00
26-OCT-2021 02:29:46 * (ADDRESS=(PROTOCOL=tcps) (HOST=10.46.24.35) (PORT=30834)) * <unknown connect data> * 542
TNS-00542: SSL Handshake failed
TNS-12560: TNS:protocol adapter error
2021-10-26T02:30:00.672089-04:00
26-OCT-2021 02:30:00 * (CONNECT_DATA=(CID=(PROGRAM=) (HOST=target.org.acme.edu) (USER=monitor)) (COMMAND=status) (ARGUMENTS=64) (SERVICE=LISTENER) (VERSION=318767104)) * status
* 0
26-OCT-2021 02:30:01 * (CONNECT_DATA=(CID=(PROGRAM=) (HOST=target.org.acme.edu) (USER=oracle)) (COMMAND=status) (ARGUMENTS=64) (SERVICE=LISTENER) (VERSION=318767104)) * status *
0
2021-10-26T02:30:04.949551-04:00
26-OCT-2021 02:30:04 * (CONNECT_DATA=(CID=(PROGRAM=) (HOST=target.org.acme.edu) (USER=monitor)) (COMMAND=status) (ARGUMENTS=64) (SERVICE=LISTENER) (VERSION=318767104)) * status
* 0
2021-10-26T02:30:06.299445-04:00
26-OCT-2021 02:30:06 * (CONNECT_DATA=(CID=(PROGRAM=) (HOST=target.org.acme.edu) (USER=monitor)) (COMMAND=status) (ARGUMENTS=64) (SERVICE=LISTENER) (VERSION=202375680)) * status
* 0
2021-10-26T02:30:25.468586-04:00
```



Review Listener & SCAN Logs

SYS_OP_VERSION

```
26-OCT-2021 02:30:04 * (CONNECT_DATA=(CID=(PROGRAM=) (HOST=target.org.acme.edu) (USER=monitor)) (COMMAND=status) (ARGUMENTS=64) (SERVICE=LISTENER)(VERSION=318767104)) * status
* 0
2021-10-26T02:30:06.299445-04:00
26-OCT-2021 02:30:06 * (CONNECT_DATA=(CID=(PROGRAM=) (HOST=target.org.acme.edu) (USER=monitor)) (COMMAND=status) (ARGUMENTS=64) (SERVICE=LISTENER)(VERSION=202375680)) * status
* 0
2021-10-26T02:30:25.468586-04:00
```

```
SYS @ db >select sys_op_version(202375680) from dual;
```

```
  SYS_OP_VER
```

```
-----
```

```
12.1.0.2.0
```

```
SYS @ db >select sys_op_version(318767104) from dual;
```

```
  SYS_OP_VER
```

```
-----
```

```
19.0.0.0.0
```


Crawling through listener log

```
$ ./get-client-version.sh listener.log
202375680 : 12.1.0.2.0
318767104 : 19.0.0.0.0
$
$
$ ./get-host-protocol.sh listener.log

Host 10.46.24.35 uses tcp
Host 10.46.19.6 uses tcps
Host 10.46.21.21 uses tcps
Host 10.46.21.32 uses tcps
Host 10.46.23.140 uses tcps
Host 10.46.23.142 uses tcps
Host 10.46.24.35 uses tcps
Host 192.168.28.126 uses tcps
```

Crawling through listener log

```
$ cat get-client-version.sh
#!/bin/bash

grep VERSION $1 | cut -d "=" -f10 | cut -d ")" -f1 | sort -u > client_versions.txt

while read -r ver;
do
c_var=`sqlplus -s / as sysdba <<EOF
set heading off feedback off pages 0 verify off
select sys_op_version($ver) from dual;
EOF`
echo "$ver : $c_var"
done < client_versions.txt
```

Further Troubleshooting

- Listener Analyzer Tool
 - <https://tinyurl.com/zb9ccnak>
- Tracing the session & identifying the connection information
 - <https://tinyurl.com/hhj5rk4j>

Checking Compatibility

Starting With Oracle JDBC Drivers - Installation, Certification, and More! (Doc ID 401934.1)

Client / Server Interoperability Support Matrix for Different Oracle Versions (Doc ID 207303.1)

JDBC drivers	Oracle database
21c	21c 19c 18c 12.2.0 12.1.0
19c	21c 19c 18c 12.2.0 12.1.0 11.2.0 *
18c	21c 19c 18c 12.2.0 12.1.0

Identify the client - Checklist

- IP Address
- Reachability
- Certificate Renewal
- Password Version
- Client Version
- Track Client Connections
 - Audit
 - Listener Log Files
 - Trigger
- Compatible Drivers

Migrating



Service Migration

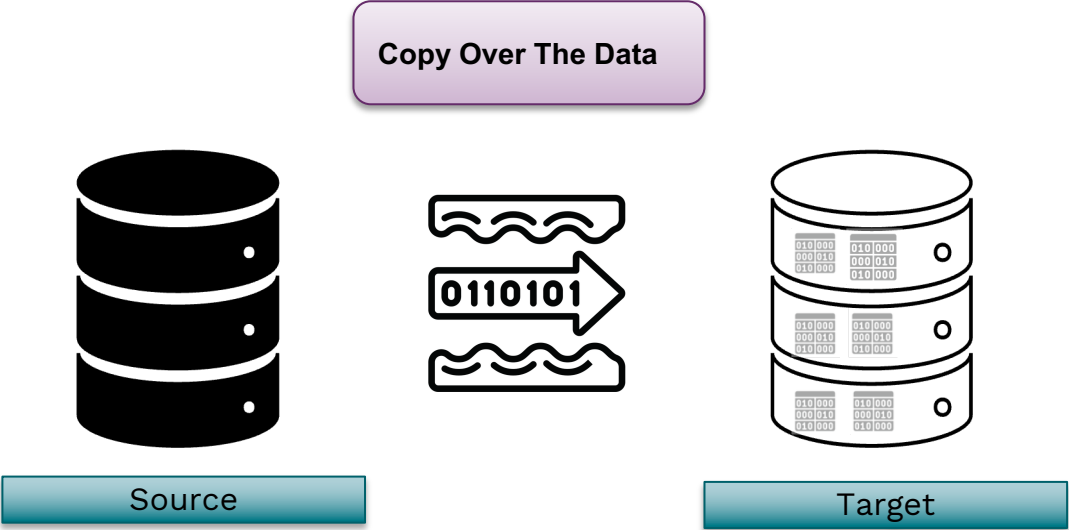
- Identify and Isolate the clients using `V$session_connect_info`
- Update the clients to use an Application specific service
- Monitor Usage

Immutable Properties

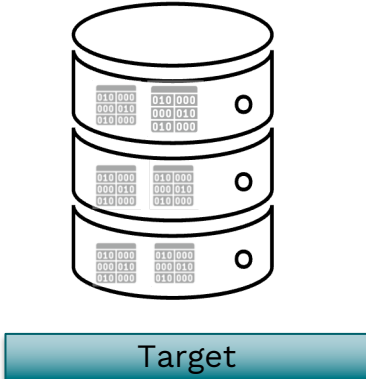
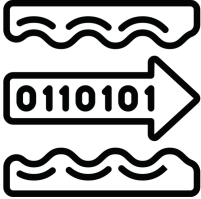
Logical Migration e.g. GoldenGate, Datapump, CTAS, SQL Developer



Immutable Properties



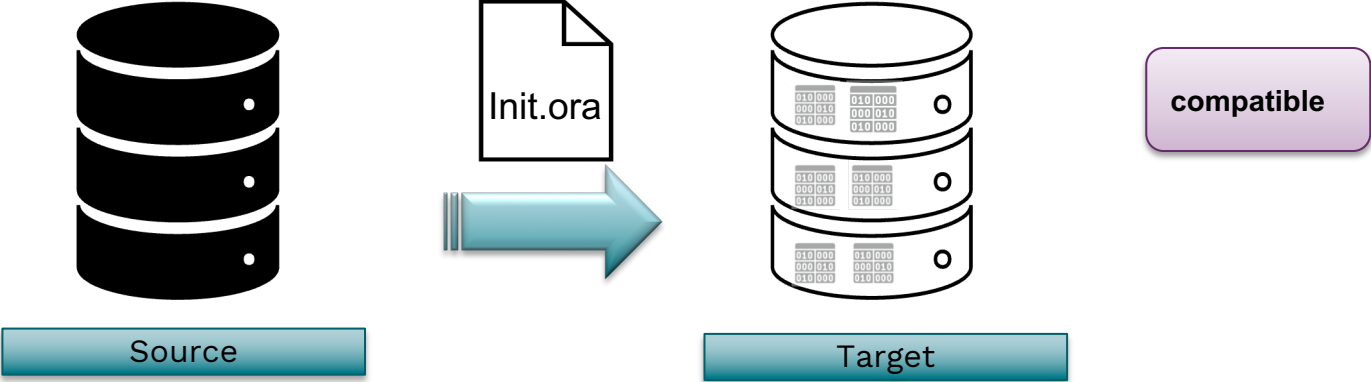
Immutable Properties



**Review
Immutable
Properties**

`DB_BLOCK_SIZE`
`CHARACTERSET`

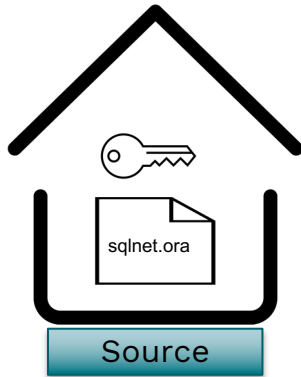
Initialization Parameters



Encryption Wallet

- Wallet Files should exist & be accessible before Upgrades or Migrations

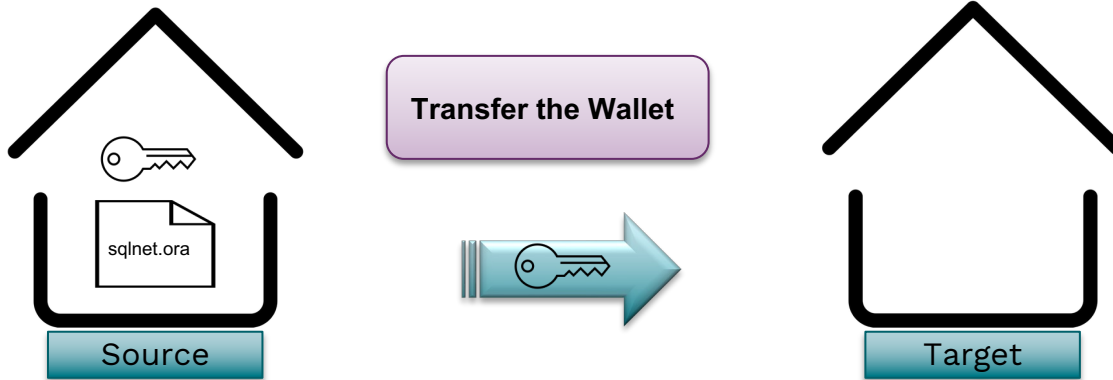
```
SQLNET.ENCRYPTION_WALLET_LOCATION=$ORACLE_BASE/admin/<SID>/wallet
```



Encryption Wallet

- Migrations

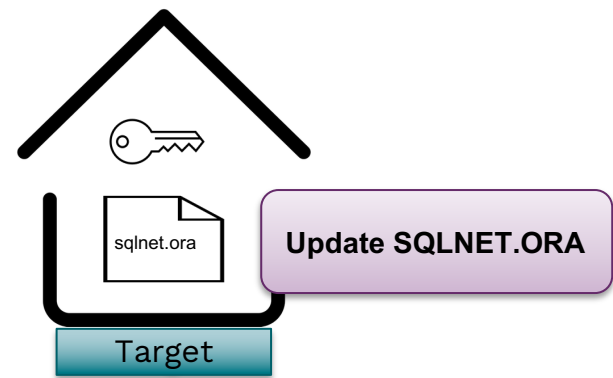
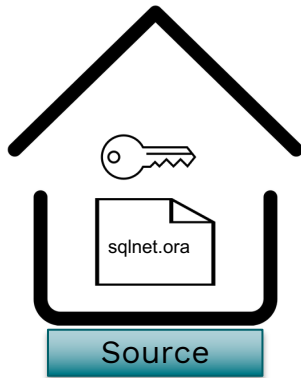
```
SQLNET.ENCRYPTION_WALLET_LOCATION=$ORACLE_BASE/admin/<SID>/wallet
```



Encryption Wallet

- Migrations

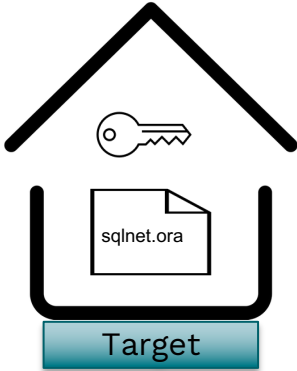
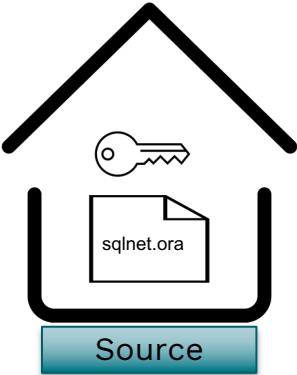
```
SQLNET.ENCRYPTION_WALLET_LOCATION=$ORACLE_BASE/admin/<SID>/wallet
```



Encryption Wallet

- Upgrades

Copy sqlnet.ora from Source to Target HOME



Encryption Wallet

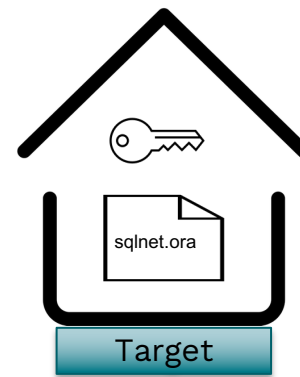
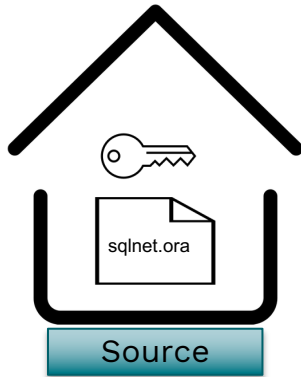
Validate Passwords
in Certificates

- Upgrades

Copy sqlnet.ora from Source to Target HOME

- Migrations

Copy Wallet from Source to Target server & update sqlnet.ora



Statistics

- Gather Data Dictionary & Fixed Object Statistics

```
exec DBMS_STATS.GATHER_DICTIONARY_STATS ();  
exec DBMS_STATS.GATHER_FIXED_OBJECTS_STATS ();
```

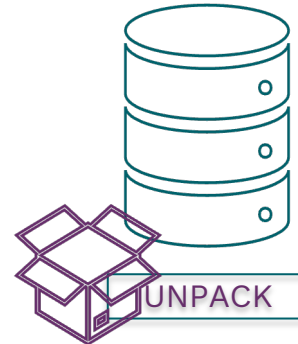
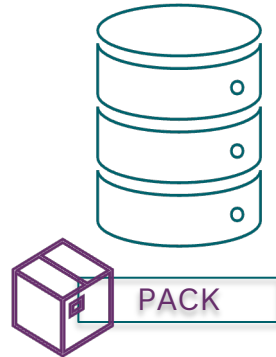
- Transfer Statistics (Logical Migrations)
 - DBMS_STATS Quicker vs DATAPUMP Statistics Export/Import

DBMS_STATS Package

```
[EX|IM]PORT_COLUMN_STATS  
[EX|IM]PORT_DATABASE_STATS  
[EX|IM]PORT_DICTIONARY_STATS  
[EX|IM]PORT_FIXED_OBJECTS_STATS  
[EX|IM]PORT_INDEX_STATS  
[EX|IM]PORT_SCHEMA_STATS  
[EX|IM]PORT_SYSTEM_STATS  
[EX|IM]PORT_TABLE_STATS
```

SQL Plan Management

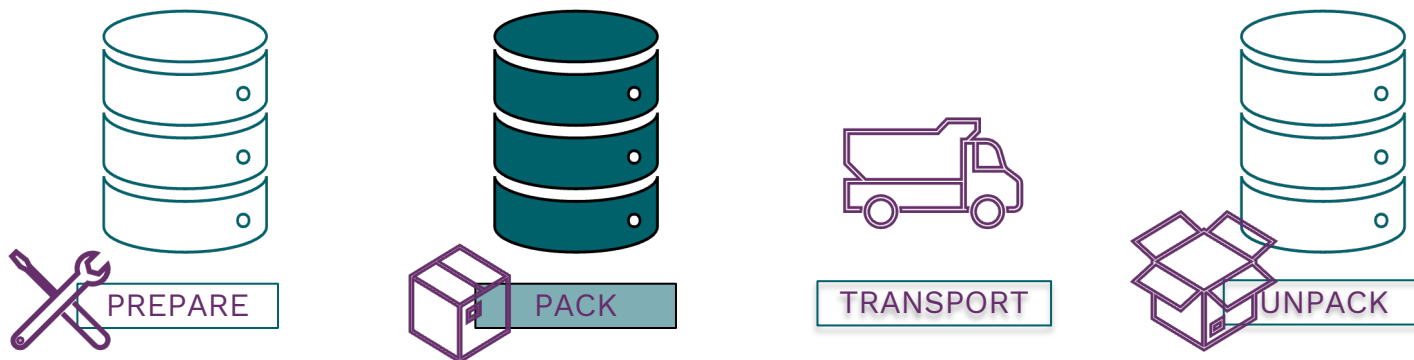
- Capture & Transfer SQL Baselines & Profiles



DBMS_SPM.CREATE_STGTAB_BASELINE
DBMS_SQLTUNE.CREATE_STGTAB_SQLPROF

SQL Plan Management

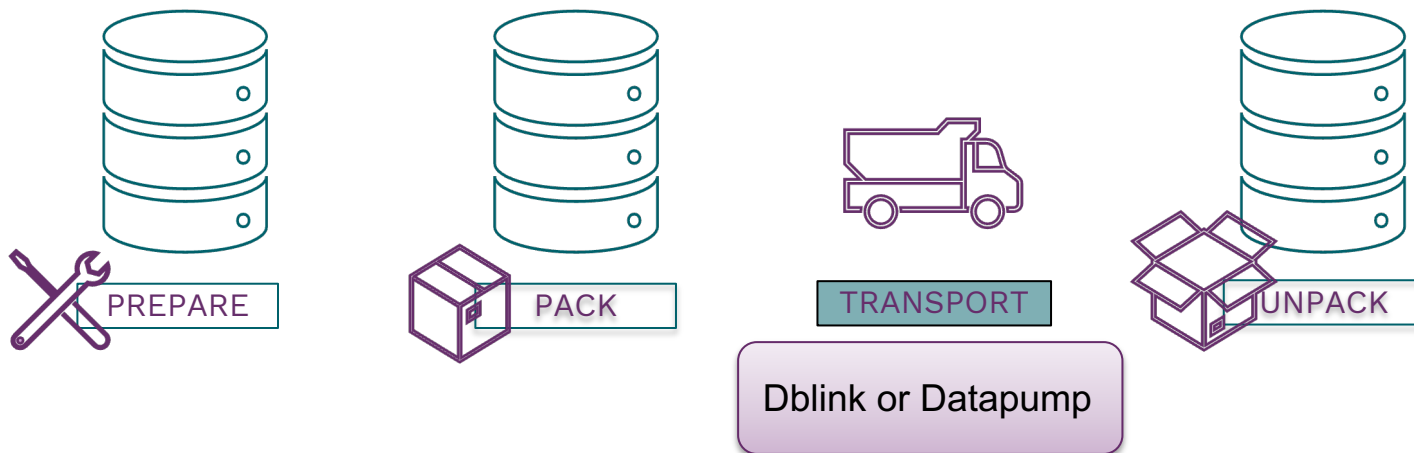
- Capture & Transfer SQL Baselines & Profiles



DBMS_SPM.PACK_STGTAB_BASELINE
DBMS_SQLTUNE.PACK_STGTAB_SQLPROF

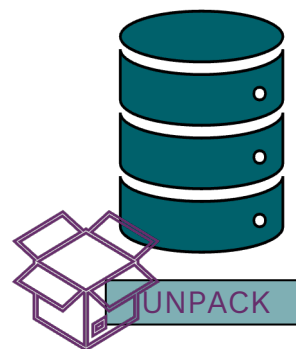
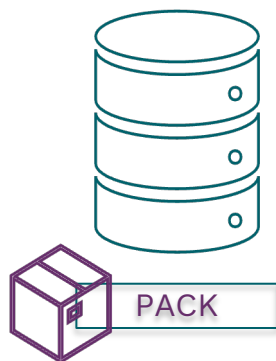
SQL Plan Management

- Capture & Transfer SQL Baselines & Profiles



SQL Plan Management

- Capture & Transfer SQL Baselines & Profiles



DBMS_SPM.UNPACK_STGTAB_BASELINE
DBMS_SQLTUNE.UNPACK_STGTAB_SQLPROF

Data & Database Validations

- Object Validation
- Check Archivelog Mode
- Sizing of Redo Log Groups
- FRA Sizing
- Use of Spfile

Migrating - Checklists

- Service Migration
- Immutable Properties
- Initialization Parameters
- Encryption Wallet
- Gather Statistics
- SQL Plan Management
- Data Validation
- Database Validation

Getting the
Last Pieces
Together



Access Control Lists

- Upgrading from 11g

SOURCE

- Identify the Privileged Users

```
SQL> SELECT OWNER,NAME, TYPE, REFERENCED_NAME FROM DBA_DEPENDENCIES WHERE referenced_name IN  
( 'UTL_TCP', 'UTL_SMTP', 'UTL_MAIL', 'UTL_HTTP', 'UTL_INADDR', 'DBMS_LDAP' ) AND owner NOT IN ( 'SYS', 'PUBLIC', 'ORDPLUGINS' );
```

OWNER	NAME	TYPE	REFERENCED_NAME
HR	EMAIL_PKG	PACKAGE BODY	UTL_HTTP
SCOTT	PKG2	PACKAGE BODY	UTL_INADDR
SCOTT	PKG2	PACKAGE BODY	UTL_HTTP
HR	EMAIL_PKG	PACKAGE BODY	UTL_MAIL

Access Control Lists

- Create the required ACLS

TARGET

```
SQL> BEGIN
DBMS_NETWORK_ACL_ADMIN.APPEND_HOST_ACE(
  host      => 'mailserver.acme.com',
  lower_port => 80,
  upper_port => 80,
  ace       => xs$ace_type(privilege_list => xs$name_list('http'),
                          principal_name => 'SCOTT',
                          principal_type => xs_acl.ptype_db,
                          granted        => true));

DBMS_NETWORK_ACL_ADMIN.APPEND_HOST_ACE(
  host      => 'mailserver.acme.com',
  lower_port => 80,
  upper_port => 80,
  ace       => xs$ace_type(privilege_list => xs$name_list('http'),
                          principal_name => 'HR',
                          principal_type => xs_acl.ptype_db,
                          granted        => true));

END;
/
```

PL/SQL procedure successfully completed.

```
SQL> SELECT PRINCIPAL, PRIVILEGE, GRANT_TYPE FROM DBA_HOST_ACES ;
```

PRINCIPAL	PRIVILEGE	GRANT
SCOTT	RESOLVE	GRANT
SCOTT	HTTP	GRANT
HR	HTTP	GRANT
HR	SMTP	GRANT

Resource Role

- UNLIMITED TABLESPACE no longer provided with RESOURCE
 - Before Upgrade
 - Determine the users that have Resource Privilege
 - Identify the tablespaces on which the user will need the Quota
 - After Upgrade
 - Grant the pre-determined Quota or Unlimited Tablespace As Required

```
DBA_TAB_PRIVS ; DBA_ROLE_PRIVS
```

Cron Jobs

- Migrate ALL cron Jobs before-hand

Do Not forget Non-Database/App accounts

- Simplify scheduling via TAGs

```
%s-##MIG--g
```

- Keep the same schedule to avoid Conflicts / Noisy Neighbours

e.g. Backup jobs should run at the same time post migration

- TEST, Debug & Implement bug fixes before hand

Possible changes in script variables

Database & Scheduler Jobs

- Validate the Scheduler Jobs Including the Transformed JOBS
- Review Statistics Job – Eliminate Duplicate If Any
- Post Upgrade – Review DB Performance during the Maintenance Window
- Validate Materialized View Refreshes and underlying database links.

Broken DBA_JOBS remain unscheduled in the DBMS_SCHEDULER with their interval unset.

External Credentials

- After Migration – OS Credentials likely to change

```
SELECT owner, credential_name,  
       username,  
       enabled  
FROM   dba_credentials  
where  username in ('oracle','pythian')  
ORDER BY credential_name;
```

OWNER	CREDENTIAL_NAME	USERNAME	ENABL
SYS	EXT_CREDENTIAL	oracle	TRUE

```
BEGIN  
-- Basic credential.  
  DBMS_CREDENTIAL.UPDATE_CREDENTIAL (  
    credential_name => 'EXT_CREDENTIAL',  
    attribute       => 'password',  
    value           => '&new_password');  
END;  
/
```

Database Directories or NFS Mounts

- Match the existence of external directories between source and target.
- This could be NFS, ACFS or Database Directories
- Verify the privileges of supplemental users and their privileges on the directories

e.g. Directories for ETL Loads, Privileges to users to create files, execute scripts

Backups

- Install Backup Agent (If Required)
- Validate Free Space for Disk Backups.
- Test RMAN Catalog Connectivity
- Upgrade Catalog
- Be **BACKUP READY !!**



ORACHK & AHF

- Install AHF
- Generate Orachk Report



```
$ ls -larth /u01/app/19c/grid/suptools/tfa/release/tfa_home/bin/tfactl  
-rwxr-x---. 1 oracle oinstall 0 Jun  4 06:09 /u01/app/19c/grid/suptools/tfa/release/tfa_home/bin/tfactl
```

19c GI

ORACHK & AHF

- Install AHF

```
$ ./ahf_setup -ahf_loc /u01/app/ahf/oracle.ahf
```

ORACHK & AHF

- Install AHF
- Review Status

```
$tfactl toolstatus
-----
|                                TOOLS STATUS - HOST : target01                                |
-----+-----+-----+-----+
| Tool Type                       | Tool           | Version       | Status      |
-----+-----+-----+-----+
| Development Tools               | orachk         | 19.3.0.0.0   | DEPLOYED   |
|                                 | oratop         | 14.1.2       | DEPLOYED   |
-----+-----+-----+-----+
| Support Tools Bundle           | darda          | 2.10.0.R6036 | DEPLOYED   |
|                                 | oswbb          | 8.3.2        | RUNNING    |
|                                 | prw            | 12.1.13.11.4 | NOT RUNNING|
-----+-----+-----+-----+
| TFA Utilities                  | alertsummary   | 19.3.0.0.0   | DEPLOYED   |
|                                 | calog          | 19.3.0.0.0   | DEPLOYED   |
|                                 | dbcheck        | 18.3.0.0.0   | DEPLOYED   |
|                                 | dbglevel       | 19.3.0.0.0   | DEPLOYED   |
|                                 | grep           | 19.3.0.0.0   | DEPLOYED   |
|                                 | history        | 19.3.0.0.0   | DEPLOYED   |
|                                 | ls             | 19.3.0.0.0   | DEPLOYED   |
|                                 | managelogs     | 19.3.0.0.0   | DEPLOYED   |
|                                 | menu           | 19.3.0.0.0   | DEPLOYED   |
|                                 | param          | 19.3.0.0.0   | DEPLOYED   |
|                                 | ps             | 19.3.0.0.0   | DEPLOYED   |
|                                 | pstack         | 19.3.0.0.0   | DEPLOYED   |
|                                 | summary        | 19.3.0.0.0   | DEPLOYED   |
|                                 | tail           | 19.3.0.0.0   | DEPLOYED   |
|                                 | triage         | 19.3.0.0.0   | DEPLOYED   |
|                                 | vi             | 19.3.0.0.0   | DEPLOYED   |
-----+-----+-----+-----+

Note :-
DEPLOYED      : Installed and Available - To be configured or run interactively.
NOT RUNNING   : Configured and Available - Currently turned off interactively.
RUNNING       : Configured and Available.
```

ORACHK & AHF

- Install AHF
- Review Status
- Configure Orachk Daemon

```
$ ./orachk -d start  
orachk is using TFA Scheduler. TFA PID: 3450  
  
Daemon log file location is : /u01/app/ahf/oracle.ahf/data/target01/orachk/orachk_daemon.log
```

ORACHK & AHF

- Install AHF
- Review Status
- Configure Orachk Daemon

```
$ ./orachk -d info
-----
orachk daemon information
-----

Install node = target01

orachk daemon version = 20.1.2

Install location = /u01/app/ahf/oracle.ahf/orachk

Started at = Tue Apr 21 12:44:40 EDT 2020

Scheduler type = TFA Scheduler

Service type = orachk Service
```

ORACHK & AHF

- Install AHF
- Review Status
- Configure Orachk Daemon
- Schedule Orachk for 1st of every month

```
$ ./orachk -set "AUTORUN_SCHEDULE=0 1 1 * *"  
Id[DEFAULT]:Scheduler created
```

```
$ ./orachk -d nextautorun  
ID:orachk.DEFAULT  
  
Next auto run starts on May 1, 2020 01:00:00 * *"
```

ORACHK & AHF

- Install AHF
- Review Status
- Configure Orachk Daemon
- Schedule Orachk for 1st of every month
- Configure Email Notification

```
$ ./orachk -set "NOTIFICATION_EMAIL=abc@acme.com"

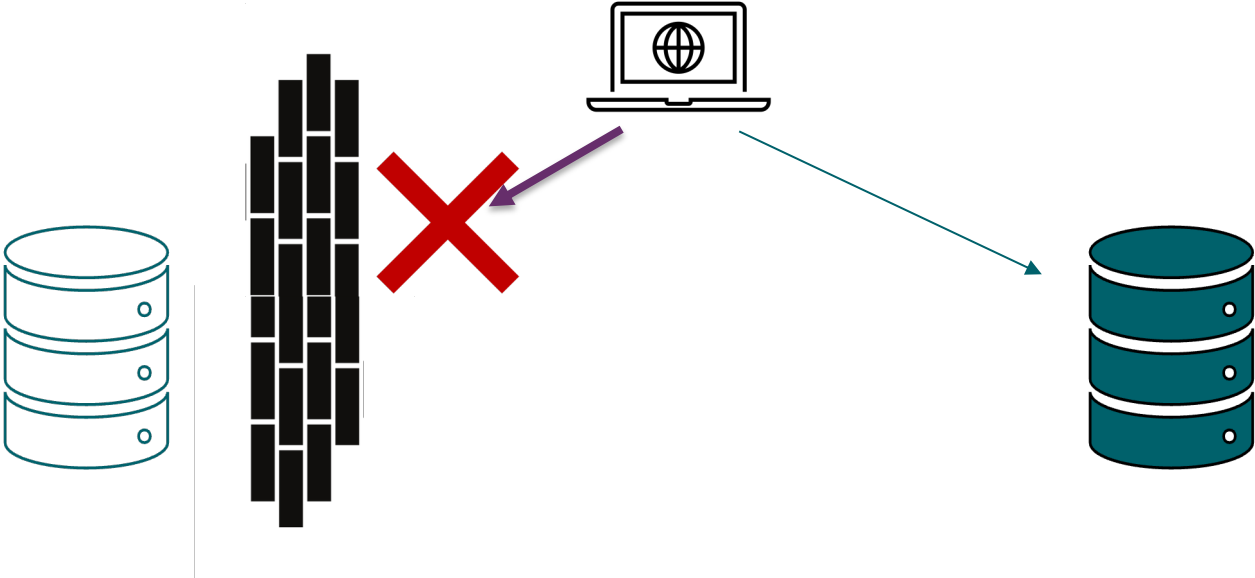
$ ./orachk -get NOTIFICATION_EMAIL,AUTORUN_SCHEDULE,COLLECTION_RETENTION
-----
ID: orachk.autostart_client
-----
NOTIFICATION_EMAIL = abc@acme.com
COLLECTION_RETENTION = 14
AUTORUN_SCHEDULE = 0 1 1 * *
-----
```

Review Retention – Can consume space

Post Migration Checklist

- ACL
- Resource Role
- Cron Jobs
- Database & Scheduler Jobs
- Database Credentials
- NFS Mounts
- Database Directories
- Backups
- AHF/ORCHK
- Shutdown source

SHUTDOWN SOURCE



Good To Check

- Migrate to Secure LOBs
- Consider Migrating to Read Only Homes
- Disable NUMA on database servers to improve performance of Linux file system utilities. You can refer Doc ID 1053332.1
- Manage Audit & Trace Files
- Run DBSAT Report & review the Security
- Review New Features of the Release to avoid Pitfalls

TEST, TEST, TEST & Then TEST some more !!

RELAX



The background is a solid teal color with a network of white lines and dots. The dots are of varying sizes and are connected by thin white lines, creating a complex, interconnected pattern that resembles a molecular structure or a data network. The overall aesthetic is clean and modern.

QUESTIONS ?

The background is a solid teal color with a network of white lines and dots. The dots are of varying sizes and are connected by thin white lines, creating a complex, interconnected pattern that resembles a molecular structure or a network diagram. The overall aesthetic is clean and modern.

APPENDIX

Optimizing

- Improving Performance (E.g. Datapump)
 - Parallel
 - EXPDP – Affects the number of dumpfiles
 - Optimize SCP of the files
 - Gather Dictionary Statistics
 - Exclude Statistics (Table & Index)
Instead transfer them using DBMS_STATS
 - During Import Evaluate Use Of
TRANSFORM=DISABLE_ARCHIVE_LOGGING:Y

Be-aware Of the Limitations

- Generic
 - Be-aware of Compression – License Violations

```
COMPRESSION=[ALL | DATA_ONLY]  
COMPRESSION_ALGORITHM
```

Advanced Compression License

- Recommended to **NOT** use SYS or / SYSDBA
- Review Data Consistency (USE FLASHBACK_TIME)

Capture Timings

Gather Diagnostics

- LOGTIME=ALL
- METRICS=YES

```
expdp DIRECTORY=DATA_PUMP_DIR tables=HR.TAB1, HR.TAB2 dumpfile=expdp_data.dmp logfile=expdp_Data.log logtime=all metrics=yes
```

```
27-OCT-21 08:59:38.889: Completed 2 CONSTRAINT objects in 4 seconds
27-OCT-21 08:59:38.896: Processing object type TABLE_EXPORT/TABLE/INDEX/STATISTICS/INDEX_STATISTICS
27-OCT-21 08:59:41.003: Completed 3 INDEX_STATISTICS objects in 0 seconds
27-OCT-21 08:59:41.019: Processing object type TABLE_EXPORT/TABLE/STATISTICS/TABLE_STATISTICS
27-OCT-21 08:59:41.063: Completed 2 TABLE_STATISTICS objects in 3 seconds
27-OCT-21 08:59:41.067: Processing object type TABLE_EXPORT/TABLE/STATISTICS/MARKER
27-OCT-21 08:59:42.845: Completed 1 MARKER objects in 1 seconds
27-OCT-21 08:59:48.903: . . exported "HR"."TAB1" 147.6 MB 941130 rows in 6 seconds
27-OCT-21 08:59:51.735: . . exported "HR"."TAB2" 98.39 MB 2812898 rows in 3 seconds
27-OCT-21 08:59:52.161: Completed 2 TABLE_EXPORT/TABLE/TABLE_DATA objects in 9 seconds
27-OCT-21 08:59:52.358: Master table "SYS"."SYS_EXPORT_TABLE_01" successfully loaded/unloaded
27-OCT-21 08:59:52.360: *****
07-OCT-21 08:59:52.360: *****
```


Pythian

L♥VE YOUR DATA

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