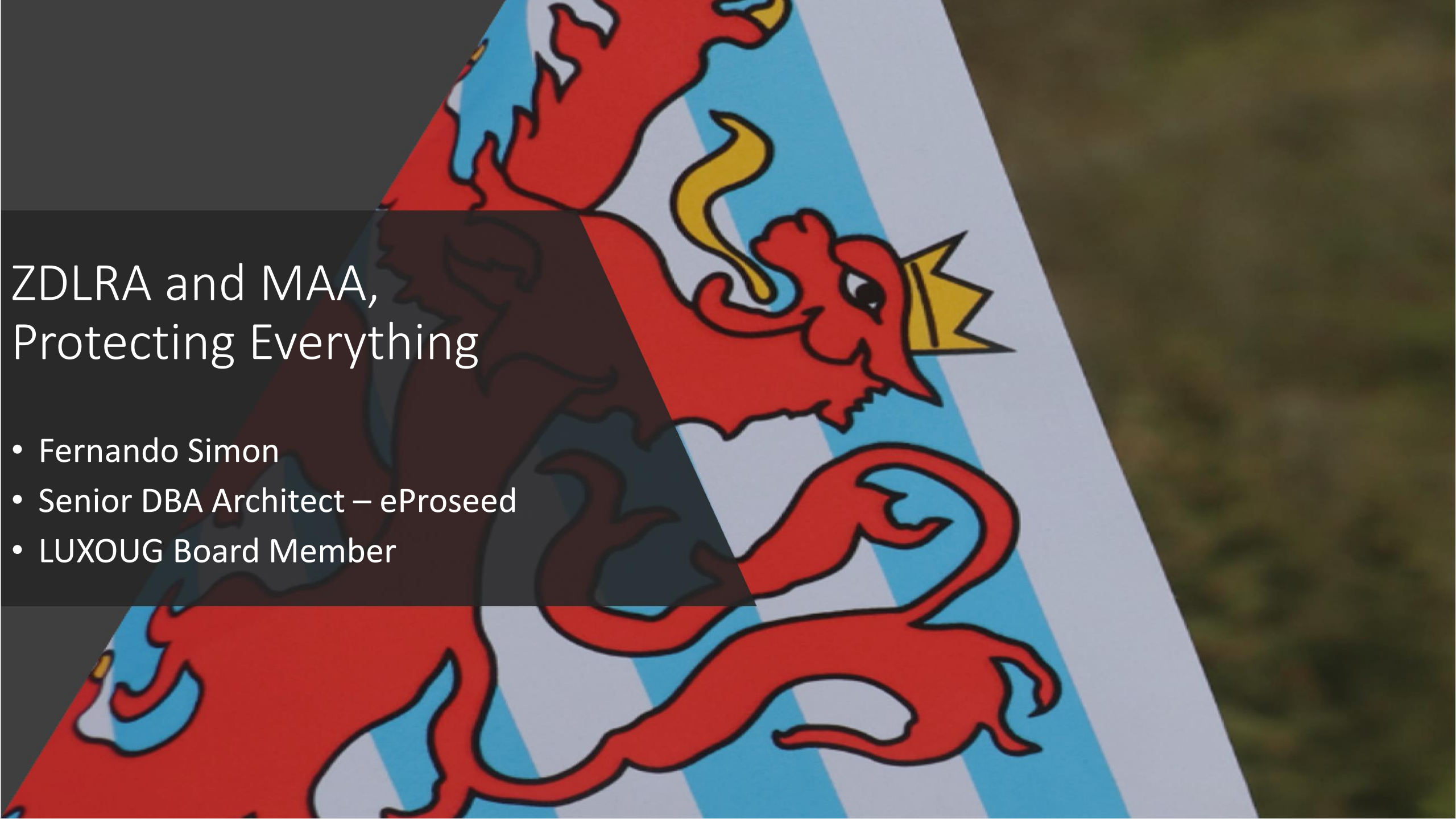




ZDLRA and MAA, Protecting Everything

- Fernando Simon
- Senior DBA Architect – eProseed
- LUXOUG Board Member

Disclaimer

- *“The postings on this document are my own and don’t necessarily represent my actual employer positions, strategies or opinions. The information here was edited to be useful for general purpose, specific data and identifications were removed to allow reach the generic audience and to be useful for the community.”*

Agenda

- About me.
- Protection.
- ZDLRA
 - Real-Time Redo.
 - Replication.
 - Clones/Tape/Cloud.
- Maximum Availability Architecture - MAA
 - Goal levels .
 - ZLDRA + MAA
 - Going Further.
- QA.

450+ Technical Experts Helping Peers Globally



ORACLE®
ACE Director



ORACLE®
ACE



ORACLE®
ACE Associate

bit.ly/OracleACEProgram

Nominate yourself or someone you know: acenomination.oracle.com

About me

- Senior DBA at eProseed Luxembourg.
- OCA, OCP, OCE RAC.
- Founder and Board Member at LuxOUG.
- Contacts:
 - fernando.simon.br@gmail.com
 - <https://fernandosimon.com/blog/>
 - <https://twitter.com/FSimonDBA>
 - <https://www.linkedin.com/in/fernando-simon/>

About me

- DBA since 2004
 - Oracle, PostgreSQL, DB2.
- Oracle Blog since 2010
 - OOW SFO, OOW LA, Brazil User Group Speaker.
- DBA Team Manager at Court of Justice – 2010/2017
 - Exadata since 2010
 - Exadata V2 (third Exadata in Brazil and first OLTP).
 - Exadata X2 (Half HP), Exadata X4 (Full HP), Exadata X5 (Full EF), Exadata X6 (Quarter).
 - High consolidated environment, IORM, Resource Manager, Instance Caging.
 - ZDLRA since 2014/2015
 - First ZDLRA in Brazil, one of the first of the world in replicated mode.
 - MAA Project, Multi-Site protection, RAC+RAC, DG, ZDLRA
 - OOW SFO 2015 Presentation
 - <https://www.oracle.com/technetwork/database/availability/con8830-zdlradeepdive-2811109.pdf>

About me

- Luxembourg 2017
 - eProseed - Senior Database Architect.
- Consulting at European Institution
 - LCM (Life Cycle Management) to the Oracle Products.
 - Supporting the Production Databases.
 - Patch apply for all databases and cluster infrastructure.
- Consulting at Bank Institution
 - Maximum Availability Architecture – MAA – Architect and Support.
 - Multi site environment.
 - Exadata and ZDLRA support.
- LUXOUG Founder and Board Member.
- Oracle ACE.

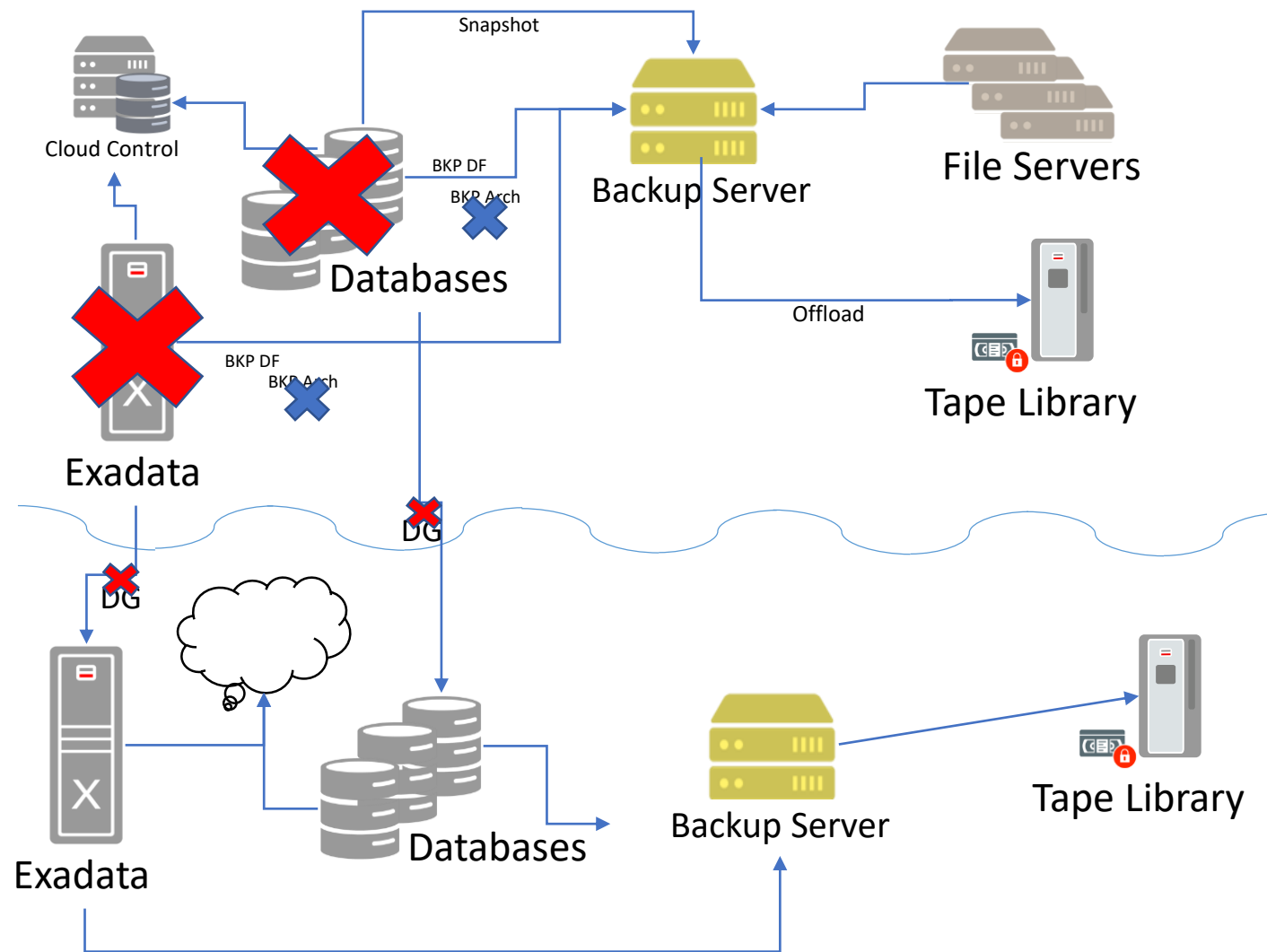
Protection

- Principles and goals
 - Restore every information.
 - Low or zero impact over the environment.
 - Easy to: operate, control, and verify.
 - Data retention and storage to sustain requirements and regulations.
 - Continuous Availability
 - Data and Application Continuity.

Protection

- Real Life
 - Mix of SLA to cover.
 - Uncovered time, lack of synchronization.
 - Data Loss (usually since the last backup).
 - High impact over the environment.
 - A lot of players (Tivoli, EMC, DataProtector, Commvault).
 - Cloud.
 - Validation, test, validation, test, validation, test....
- And it is worst...

Protection



Protection

- Two words
 - **RPO** – Recovery Point Objective
 - What/how much you can lose.
 - **RTO** – Recovery Time Objective
 - Time to put everything running again.
- The goal is zero RPO and zero RTO.

ZDLRA



ZDLRA

- **ZERO DATA LOSS RECOVERY APPLIANCE – ZDLRA**

- Engineered Systems.
- Exadata based.
- Hardware + Software
 - RA Library.
- MML for tape
 - SAN.
 - Oracle Secure Backup.
- Native replication.
- RMAN Catalog – Integration.
- EM/CC or CLI.

- **DOES NOT REDUCES RTO, JUST RPO.**

ZDLRA

- Oracle Database
 - Rman catalog
 - Light modified to cover internal RA tables.
 - Store the configurations
 - Policies, database registrations.
- Delta Store
 - Where the data is stored.
 - **Delta Push** = Virtual Backups + Real Time Redo.
 - Automatic backup index, management, and validation.
- EM/CC/CLI
 - DBMS_RA package to manage everything.
- Backup client library installed in every server that sends backup.

ZDLRA

- Rman Catalog.
- Virtual Full Backup.
- Real-Time Redo.
- Replication.
- Tape Backups.

ZDLRA

- Virtual Full Backup
 - **Incremental Forever Strategy**
 - Initial level 0 backup + just level 1 backups.
 - Merge both to generate a virtual full backup for your datafile.
 - Generate an index for every datafile.
 - Automatically validated against corruption for backup/datafile.
 - Differs from deduplication
 - Better, it is based in context and not in black magic (reverse engineering).
 - A little representation
 - Imagine that you are a Librarian and I deliver to you (every day) one box with books of an encyclopedia
 - As “Normal”, you receive this box but can’t open it to store the books that are inside. But you store the box anyway.
 - As “ZDLRA”, you receive the same box, but you can open and check if you already have this book or no.
 - One day I come back and ask you the full encyclopedia and you deliver to me the box with the books
 - **So, what solution do you think will be better for Oracle backups?**

ZDLRA

```
RMAN> BACKUP INCREMENTAL LEVEL 0 DEVICE TYPE SBT FILESPERSET 1 DATAFILE 1 TAG 'BKP-DB-INC0';
```

```
Starting backup at 05/01/2020 17:37:03
allocated channel: ORA_SBT_TAPE_1
channel ORA_SBT_TAPE_1: SID=60 device type=SBT TAPE
channel ORA_SBT_TAPE_1: RA Library (ZDLRAS1) SID=9B68274176A00FB4E053010310AC363F
channel ORA_SBT_TAPE_1: starting incremental level 0 datafile backup set
channel ORA_SBT_TAPE_1: specifying datafile(s) in backup set
input datafile file number=00001 name=/u01/app/oracle/oradata/ORCL18C/system01.dbf
...
Finished backup at 05/01/2020 17:40:50
...
```

```
RMAN>
```

```
RMAN> list backup of datafile 1;
```

```
List of Backup Sets
=====
```

BS Key	Type	LV	Size	Device	Type	Elapsed Time	Completion Time
14406	Incr	0	330.29M	SBT_TAPE		00:03:16	05/01/2020 17:40:31
BP Key: 14407 Status: AVAILABLE Compressed: YES Tag: BKP-DB-INC0							
Handle: VB\$_1891149551_14397I Media:							
List of Datafiles in backup set 14406							
File	LV	Type	Ckp	SCN	Ckp Time	Abs Fuz	SCN Sparse Name

/u01/app/oracle/oradata/ORCL18C/system01.dbf	1	0	Incr	1885317	05/01/2020 17:37:15		NO

```
RMAN>
```

```
RMAN> BACKUP INCREMENTAL LEVEL 1 DEVICE TYPE SBT FILESPERSET 1 DATAFILE 1 TAG 'BKP-DB';
```

```
Starting backup at 05/01/2020 17:44:20
using channel ORA_SBT_TAPE_1
channel ORA_SBT_TAPE_1: starting incremental level 1 datafile backup set
...
channel ORA_SBT_TAPE_1: backup set complete, elapsed time: 00:00:15
Finished backup at 05/01/2020 17:44:37
```

```
Starting Control File and SPFILE Autobackup at 05/01/2020 17:44:38
...
```

```
RMAN>
```

ZDLRA

```
RMAN> list backup of datafile 1;
```

```
List of Backup Sets
```

```
=====
```

```
BS Key   Type LV Size          Device Type Elapsed Time Completion Time
-----
14406    Incr 0   330.29M      SBT_TAPE    00:03:16      05/01/2020 17:40:31
BP Key: 14407   Status: AVAILABLE Compressed: YES Tag: BKP-DB-INC0
Handle: VB$_1891149551_14397I Media:

List of Datafiles in backup set 14406
File LV Type Ckp SCN      Ckp Time          Abs Fuz SCN Sparse Name
-----
1      0   Incr 1885317    05/01/2020 17:37:15          NO      /u01/app/oracle/oradata/ORCL18C/system01.dbf
```

```
BS Key   Type LV Size          Device Type Elapsed Time Completion Time
-----
14431    Incr 1    56.00K      SBT_TAPE    00:00:02      05/01/2020 17:44:24
BP Key: 14432   Status: AVAILABLE Compressed: YES Tag: BKP-DB
Handle: VB$_1891149551_14430I Media:

List of Datafiles in backup set 14431
File LV Type Ckp SCN      Ckp Time          Abs Fuz SCN Sparse Name
-----
1      1   Incr 1885774    05/01/2020 17:44:22          NO      /u01/app/oracle/oradata/ORCL18C/system01.dbf
```

```
BS Key   Type LV Size          Device Type Elapsed Time Completion Time
-----
14435    Incr 0   329.18M      SBT_TAPE    00:00:02      05/01/2020 17:44:24
BP Key: 14436   Status: AVAILABLE Compressed: YES Tag: BKP-DB
Handle: VB$_1891149551_14430_1 Media:

List of Datafiles in backup set 14435
File LV Type Ckp SCN      Ckp Time          Abs Fuz SCN Sparse Name
-----
1      0   Incr 1885774    05/01/2020 17:44:22          NO      /u01/app/oracle/oradata/ORCL18C/system01.dbf
```

```
RMAN>
```

ZDLRA

- Real-Time Redo
 - Is the “zero data loss” - guarantee the zero RPO.
- ZDLRA it is a log_archive_dest destination
 - It can be SYNC or ASYNC.
- Differ from FARSYNC, just need to config the archive dest at database side.
- Protect in case of outages
 - *If the redo stream terminates unexpectedly, then ZDLRA closes the incoming redo stream and create a partial archived redo log file backup.*

ZDLRA

- Manual

```
SQL> ALTER SYSTEM SET log_archive_dest_2='SERVICE="zdlras1-scan:1521/zdlras1:CAT_ZDLRA" ASYNC NOAFFIRM delay=0 optional compression=disable max_failure=1 max_connections=1 reopen=10 DB_UNIQUE_NAME=zdlras1 net_timeout=8 group=1 priority=1 VALID_FOR=(ONLINE_LOGFILE,ALL_ROLES)' scope = spfile sid = '*';
```

System altered.

SQL>

- Broker – When using DG

```
DGMGRL> add recovery_appliance zdlras1 as connect identifier is 'zdlras1-scan:1521/zdlras1:VPCGOLD';
```

Recovery Appliance "zdlras1" added

```
DGMGRL>
```

```
DGMGRL> enable recovery_appliance zdlras1;
```

Enabled.

```
DGMGRL>
```

- Alertlog

```
ALTER SYSTEM SET log_archive_dest_3='service="zdlras1-scan:1521/zdlras1:VPCGOLD"', 'ASYNC NOAFFIRM delay=0 optional compression=disable max_failure=0 reopen=300 db_unique_name="zdlras1" net_timeout=30', 'valid_for=(online_logfile,all_roles)' SCOPE=BOTH;  
2020-01-01T22:24:17.831947+01:00  
ALTER SYSTEM SET log_archive_dest_state_3='ENABLE' SCOPE=BOTH;
```

ZDLRA

```
RMAN> list copy of archivelog all;
```

```
List of Archived Log Copies for database with db_unique_name OR19DG
```

```
=====
```

Key	Thrd	Seq	S	Low Time
13295	1	90	A	01/01/2020 22:28:18
Name: +RECO/OR19DG/ARCHIVELOG/2020_01_01/thread_1_seq_90.446.1028586681				

```
RMAN> alter system archive log current;
```

```
Statement processed
```

```
RMAN> list backup of archivelog sequence 91;
```

```
List of Backup Sets
```

```
=====
```

BS Key	Size	Device Type	Elapsed Time	Completion Time
13314	21.50K	SBT_TAPE	00:00:01	01/01/2020 22:32:09
BP Key: 13315 Status: AVAILABLE Compressed: YES Tag: TAG20200101T223208				
Handle: \$RSCN_1920977_RTIM_1028557385_THRD_1_SEQ_91_CTKEY_13291_BACKUP Media:				

```
List of Archived Logs in backup set 13314
```

Thrd	Seq	Low SCN	Low Time	Next SCN	Next Time
1	91	2519988	01/01/2020 22:31:20	2520099	01/01/2020 22:31:51

```
RMAN>
```

ZDLRA

```
RMAN> list backup of archivelog sequence 32;
```

```
specification does not match any backup in the repository
```

```
RMAN>
```

```
[oracle@exaclvm01-ORAD18]$ ps -ef |grep pmon_ORAD18
oracle      31646      1  0 22:27 ?        00:00:00 ora_pmon_ORAD18
[oracle@exaclvm01-ORAD18]$ ps -ef |grep smon_ORAD18
oracle      31731      1  0 22:27 ?        00:00:00 ora_smon_ORAD18
[oracle@exaclvm01-ORAD18]$ ps -ef |grep lgwr_ORAD18
oracle      31724      1  0 22:27 ?        00:00:00 ora_lgwr_ORAD18
[oracle@exaclvm01-ORAD18]$ ps -ef |grep dbw0_ORAD18
oracle      31722      1  0 22:27 ?        00:00:00 ora_dbw0_ORAD18
[oracle@exaclvm01-ORAD18]$ ps -ef |grep arc* |grep ORAD18
oracle      31805      1  0 22:27 ?        00:00:00 ora_mark_ORAD18
oracle      32021      1  0 22:27 ?        00:00:00 ora_arc0_ORAD18
oracle      32042      1  0 22:27 ?        00:00:00 ora_arc1_ORAD18
oracle      32050      1  0 22:27 ?        00:00:00 ora_arc2_ORAD18
oracle      32057      1  0 22:27 ?        00:00:00 ora_arc3_ORAD18
[oracle@exaclvm01-ORAD18]$
[oracle@exaclvm01-ORAD18]$ kill -9 31646 31731 31724 31722 32021 32042 32050 32057
[oracle@exaclvm01-ORAD18]$
```

```
####
```

```
At alertlog:
```

```
2019-10-18T22:30:33.160912+02:00
```

```
RMS0 (ospid: 31718): terminating the instance due to ORA error 472
```

```
Cause - 'Instance is being terminated due to fatal process PMON being dead.'
```

```
2019-10-18T22:30:33.290189+02:00
```

```
System state dump requested by (instance=1, osid=31718 (RMS0)), summary=[abnormal instance
termination]. error - 'Instance is terminating.
```

```
'
```

```
System State dumped to trace file
```

```
/u01/app/oracle/diag/rdbms/orad18/ORAD18/trace/ORAD18_diag_31692_20191018223033.trc
```

```
2019-10-18T22:30:34.378356+02:00
```

```
Dumping diagnostic data in directory=[cdmp_20191018223033], requested by (instance=1,
osid=31718 (RMS0)), summary=[abnormal instance termination].
```

```
2019-10-18T22:30:35.642670+02:00
```

```
Instance terminated by RMS0, pid = 31718
```

```
RMAN> list backup of archivelog sequence 32;
```

```
List of Backup Sets
```

```
=====
```

BS Key	Size	Device Type	Elapsed Time	Completion Time
50958220	72.50K	SBT_TAPE	00:00:00	2019-10-18 22-30-42
BP Key: 50958221 Status: AVAILABLE Compressed: YES Tag: TAG20191018T223042				
Handle: \$RSCN_1_RTIM_1022003674_THRD_1_SEQ_32_CTKEY_50958156_BACKUP Media:				

```
List of Archived Logs in backup set 50958220
```

Thrd Seq	Low SCN	Low Time	Next SCN	Next Time
1 32	1025761	2019-10-18_22-28-20	1026104	2019-10-18_22-30-32

```
RMAN>
```

ZDLRA

```
[oracle@exac1vm01-ORAD18]$ for i in {1..100000}
> do
> echo "Insert Data $i - date +%d-%m-%Y-%H%M%S"
> sqlplus -s / as sysdba<<EOF
> set heading on feedback on;
> insert into testIns(c1, c2, c3) values ($i, sysdate, 'Loop');
> commit;
> EOF
> done
Insert Data 1 - 18-10-2019-230723
```

1 row created.

Commit complete.

...

...

Insert Data 1016 - 18-10-2019-230944

1 row created.

Commit complete.

Insert Data 1017 - 18-10-2019-230944

1 row created.

commit

*

ERROR at line 1:

ORA-03113: end-of-file on communication channel

Process ID: 142277

Session ID: 53 Serial number: 30197

```
[oracle@exac1vm01-ORAD18]$ for i in {1..100000}
> do
> echo "Insert Data $i - date +%d-%m-%Y-%H%M%S"
> sqlplus -s / as sysdba<<EOF
> set heading on feedback on;
> insert into testIns(c1, c2, c3) values ($i, sysdate, 'Loop2');
> commit;
> EOF
> done
Insert Data 1 - 18-10-2019-230816
```

1 row created.

Commit complete.

...

Insert Data 646 - 18-10-2019-230944

1 row created.

Commit complete.

Insert Data 647 - 18-10-2019-230944

1 row created.

commit

*

ERROR at line 1:

ORA-03113: end-of-file on communication channel

Process ID: 142274

Session ID: 41 Serial number: 3186

KILL ALL!!!

ZDLRA

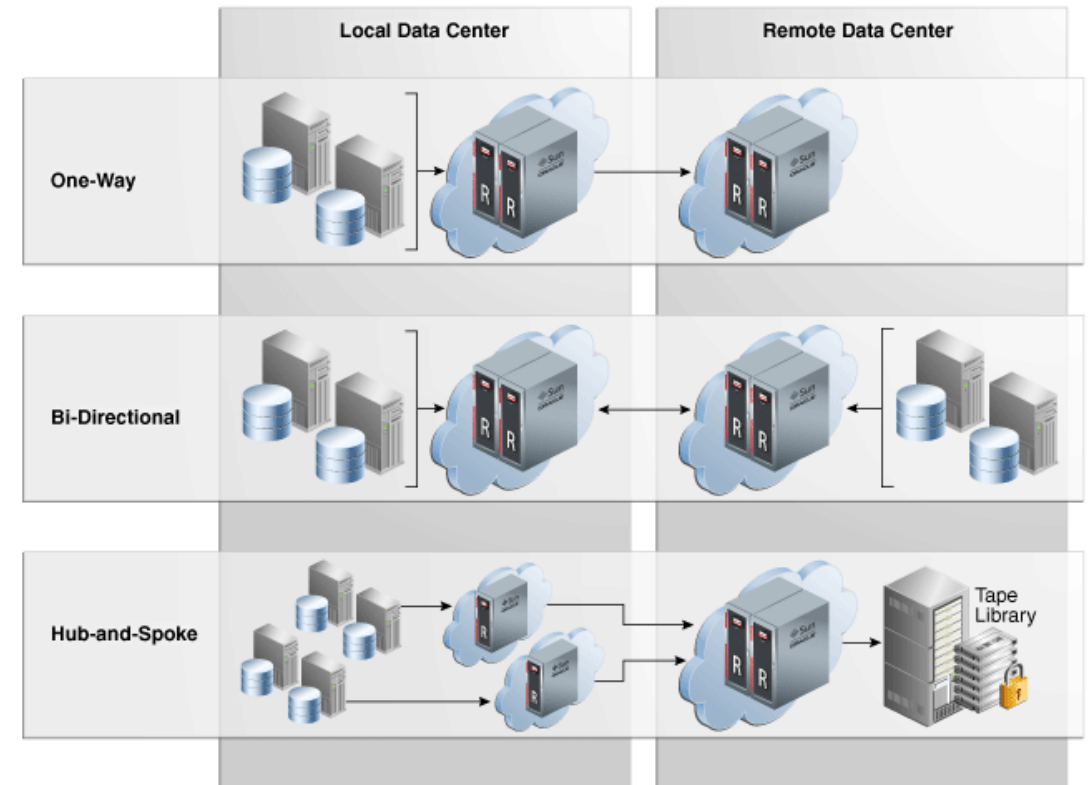
```
ASMCMD> cd +DATA1/ORAD18/  
ASMCMD> rm -rf CONTROLFILE/  
ASMCMD> rm -rf DATAFILE/  
ASMCMD> rm -rf ONLINELOG/  
ASMCMD> rm -rf TEMPFILE/  
ASMCMD>  
ASMCMD> cd +RECO1/ORAD18/  
ASMCMD> rm -rf ARCHIVELOG/  
ASMCMD> rm -rf AUTOBACKUP/  
ASMCMD> rm -rf CONTROLFILE/  
ASMCMD> rm -rf ONLINELOG/  
ASMCMD>
```

```
RMAN> list backup of archivelog all completed after "sysdate - 15/1440";  
...  
...  
BS Key   Size      Device Type Elapsed Time Completion Time  
-----  
50958809 2.05M       SBT_TAPE    00:00:00    2019-10-18_23-10-12  
          BP Key: 50958810   Status: AVAILABLE Compressed: YES  Tag: TAG20191018T231012  
          Handle: $RSCN_1129803_RTIM_1022011106_THRD_1_SEQ_5_CTKEY_50958757_BACKUP Media:  
  
List of Archived Logs in backup set 50958809  
Thrd Seq   Low SCN   Low Time      Next SCN   Next Time  
----  
1      5        1131667    2019-10-18_23-05-09 1135762    2019-10-18_23-09-44  
  
RMAN>  
  
RMAN> run(  
2> set until scn 1135762;  
3> restore database;  
4> recover database;  
5> )
```

```
SQL> select count(*) from testIns group by c3;  
  
COUNT(*)  
-----  
646  
1016  
  
SQL>
```

ZDLRA

- Replication
 - One-Way
 - One master and one destination.
 - Bi-Directional
 - Both sides replicate each other.
 - Hub/Spoke
 - One to many.



ZDLRA

- Replication
 - Upstream (source) and Downstream (destination)
 - Uses specific VPC to do the replication.
 - VPC on each side is different.
 - **Every ZDLRA can have different policies and recovery windows.**
 - **ZDLRA replication occurs just over backupsets.**
 - Replication can be by Database or Policy.
 - The rman restore/recover can use any side
 - Since can exists different recovery windows, backupset can exist in just one side.
 - The database can connect on both sides.

ZDLRA

```
RMAN> BACKUP INCREMENTAL LEVEL 0 DEVICE TYPE SBT FILESPERSET 1 DATAFILE 1 TAG 'BKP-DB-INC0';

Starting backup at 22-12-2019_21:54:44
allocated channel: ORA_SBT_TAPE_1
channel ORA_SBT_TAPE_1: SID=62 device type=SBT_TAPE
channel ORA_SBT_TAPE_1: RA Library (ZDLRAS1) SID=9A521EDF1FE73C47E053010310AC5B4E
channel ORA_SBT_TAPE_1: starting incremental level 0 datafile backup set
channel ORA_SBT_TAPE_1: specifying datafile(s) in backup set
input datafile file number=00001 name=/u01/app/oracle/oradata/ORCL19/system01.dbf
channel ORA_SBT_TAPE_1: starting piece 1 at 22-12-2019_21:54:47
channel ORA_SBT_TAPE_1: finished piece 1 at 22-12-2019_21:57:32
piece handle=ORCL19_16uk3h97_1_1 tag=BKP-DB-INC0 comment=API Version 2.0,MMS Version 12.2.0.2
channel ORA_SBT_TAPE_1: backup set complete, elapsed time: 00:02:45
Finished backup at 22-12-2019_21:57:32

Starting Control File and SPFILE Autobackup at 22-12-2019_21:57:32
piece handle=c-323177095-20191222-01 comment=API Version 2.0,MMS Version 12.2.0.2
Finished Control File and SPFILE Autobackup at 22-12-2019_21:57:44

RMAN>
```

After the retention window for policy

```
RMAN> list backupset 9221;
```

```
List of Backup Sets
=====
```

BS Key	Type	LV	Size	Device	Type	Elapsed Time	Completion Time
9221	Incr	0	321.61M	SBT_TAPE		00:05:32	22/12/2019 22:00:19
BP Key: 9674 Status: AVAILABLE Compressed: YES Tag: BKP-DB-INC0							
Handle: VB\$_2127575003_7524I Media: ZDLRAS2_REP							

```
List of Datafiles in backup set 9221
File LV Type Ckp SCN Ckp Time Abs Fuz SCN Sparse Name
-----
```

1	0	Incr	2064007	22/12/2019 21:54:47			NO	/u01/app/oracle/oradata/ORCL19/system01.dbf
---	---	------	---------	---------------------	--	--	----	---

```
RMAN>
```

```
RMAN> list backup of datafile 1 completed before "to_date('22/12/2019 22:05:00','dd/mm/yyyy hh24:mi:ss')";
```

```
List of Backup Sets
=====
```

BS Key	Type	LV	Size
--------	------	----	------

9221	Incr	0	321.61M
------	------	---	---------

```
List of Datafiles in backup set 9221
```

File	LV	Type	Ckp	SCN	Ckp Time	Abs	Fuz	SCN	Sparse	Name
1	0	Incr	2064007	22/12/2019 21:54:47					NO	/u01/app/oracle/oradata/ORCL19/system01.dbf

```
Backup Set Copy #1 of backup set 9221
```

Device	Type	Elapsed Time	Completion Time	Compressed	Tag
--------	------	--------------	-----------------	------------	-----

SBT_TAPE		00:05:32	22/12/2019 22:00:20	YES	BKP-DB-INC0
----------	--	----------	---------------------	-----	-------------

```
List of Backup Pieces for backup set 9221 Copy #1
```

BP Key	Pc#	Status	Media	Piece Name
--------	-----	--------	-------	------------

9222	1	AVAILABLE		VB\$_1891149551_9211I
------	---	-----------	--	-----------------------

```
Backup Set Copy #2 of backup set 9221
```

Device	Type	Elapsed Time	Completion Time	Compressed	Tag
--------	------	--------------	-----------------	------------	-----

SBT_TAPE		00:05:32	22/12/2019 22:00:19	YES	BKP-DB-INC0
----------	--	----------	---------------------	-----	-------------

```
List of Backup Pieces for backup set 9221 Copy #2
```

BP Key	Pc#	Status	Media	Piece Name
--------	-----	--------	-------	------------

9674	1	AVAILABLE	ZDLRAS2_REP	VB\$_2127575003_7524I
------	---	-----------	-------------	-----------------------

```
RMAN>
```

```
RMAN> BACKUP INCREMENTAL LEVEL 1 DEVICE TYPE SBT FILESPERSET 1 DATAFILE 1 TAG 'BKP-DB';
```

```
Starting backup at 22-12-2019_22:08:43
allocated channel: ORA_SBT_TAPE_1
channel ORA_SBT_TAPE_1: SID=84 device type=SBT_TAPE
channel ORA_SBT_TAPE_1: RA Library (ZDLRAS1) SID=9A5250DE33813FE9E053010310AC4FCE
channel ORA_SBT_TAPE_1: starting incremental level 1 datafile backup set
channel ORA_SBT_TAPE_1: specifying datafile(s) in backup set
input datafile file number=00001 name=/u01/app/oracle/oradata/ORCL19/system01.dbf
channel ORA_SBT_TAPE_1: starting piece 1 at 22-12-2019_22:08:46
channel ORA_SBT_TAPE_1: finished piece 1 at 22-12-2019_22:08:53
...
Finished Control File and SPFILE Autobackup at 22-12-2019_22:09:02
```

```
RMAN> list backup of datafile 1 completed between "to_date('22/12/2019 22:05:00','dd/mm/yyyy hh24:mi:ss')
and "to_date('22/12/2019 22:10','dd/mm/yyyy hh24:mi:ss')";
```

List of Backup Sets

```
BS Key Type LV Size
```

```
-----
```

```
9265 Incr 1 88.00K
```

```
List of Datafiles in backup set 9265
```

```
File LV Type Ckp SCN Ckp Time Abs Fuz SCN Sparse Name
```

```
-----
```

```
1 1 Incr 2066326 22/12/2019 22:08:46 NO /u01/app/oracle/oradata/ORCL19/system01.dbf
```

```
Backup Set Copy #1 of backup set 9265
```

```
Device Type Elapsed Time Completion Time Compressed Tag
```

```
-----
```

```
SBT_TAPE 00:00:42 22/12/2019 22:08:49 YES BKP-DB
```

```
List of Backup Pieces for backup set 9265 Copy #1
```

```
BP Key Pc# Status Media Piece Name
```

```
-----
```

```
9266 1 AVAILABLE VB$_1891149551_9264I
```

```
Backup Set Copy #2 of backup set 9265
```

```
Device Type Elapsed Time Completion Time Compressed Tag
```

```
-----
```

```
SBT_TAPE 00:00:42 22/12/2019 22:09:28 YES BKP-DB
```

```
List of Backup Pieces for backup set 9265 Copy #2
```

```
BP Key Pc# Status Media Piece Name
```

```
-----
```

```
9676 1 AVAILABLE ZDLRAS2_REP VB$_2127575003_7641I
```

```
BS Key Type LV Size
```

```
-----
```

```
9269 Incr 0 320.50M
```

```
...
```

```
...
```

```
BS Key Type LV Size
```

```
-----
```

```
9269 Incr 0 320.50M
```

```
List of Datafiles in backup set 9269
```

```
File LV Type Ckp SCN Ckp Time Abs Fuz SCN Sparse Name
```

```
-----
```

```
1 0 Incr 2066326 22/12/2019 22:08:46 NO /.../system01.dbf
```

```
Backup Set Copy #1 of backup set 9269
```

```
Device Type Elapsed Time Completion Time Compressed Tag
```

```
-----
```

```
SBT_TAPE 00:00:42 22/12/2019 22:08:49 YES BKP-DB
```

```
List of Backup Pieces for backup set 9269 Copy #1
```

```
BP Key Pc# Status Media Piece Name
```

```
-----
```

```
9270 1 AVAILABLE VB$_1891149551_9264_1
```

```
Backup Set Copy #2 of backup set 9269
```

```
Device Type Elapsed Time Completion Time Compressed Tag
```

```
-----
```

```
SBT_TAPE 00:00:42 22/12/2019 22:09:28 YES BKP-DB
```

```
List of Backup Pieces for backup set 9269 Copy #2
```

```
BP Key Pc# Status Media Piece Name
```

```
-----
```

```
9690 1 AVAILABLE ZDLRAS2_REP VB$_2127575003_7641_1
```

```
RMAN>
```

ZDLRA

```
RMAN> list backup of archivelog all;
```

```
List of Backup Sets
=====
```

```
BS Key   Size
-----
9315     91.00K
```

```
List of Archived Logs in backup set 9315
```

Thrd	Seq	Low SCN	Low Time	Next SCN	Next Time
1	7	2074788	22-12-2019_23:06:16	2075182	22-12-2019_23:09:09

```
Backup Set Copy #1 of backup set 9315
```

Device Type	Elapsed Time	Completion Time	Compressed	Tag
SBT_TAPE	00:57:30	22-12-2019_23:09:40	YES	TAG20191222T230939

```
List of Backup Pieces for backup set 9315 Copy #1
```

BP Key	Pc#	Status	Media	Piece Name
9316	1	AVAILABLE		\$RSCN_2029050_RTIM_1021856938_THRD_1_SEQ_7_CTKEY_9313_BACKUP

```
Backup Set Copy #2 of backup set 9315
```

Device Type	Elapsed Time	Completion Time	Compressed	Tag
SBT_TAPE	00:57:30	22-12-2019_22:12:09	YES	TAG20191222T230939

```
List of Backup Pieces for backup set 9315 Copy #2
```

BP Key	Pc#	Status	Media	Piece Name
9319	1	AVAILABLE	Recovery Appliance (ZDLRAS2)	RA_SBT_ORCL19_323177095_9191_8iuk31lj_1_2_9315

```
RMAN>
```

ZDLRA

- Tape and Cloud
 - Can copy to tapes directly, is MML
 - It can be by OSB or Third Part (since it is compatible with rman).
 - Oracle Secure Backup (OSB), is used
 - SAN connection.
 - Can copy backups to Oracle Cloud, Object Store
 - Uses Key Vault.
- Offload/copy backupsets.
- Totally integrated with RMAN catalog.
- Based at dbms_scheduler to call OSB

ZDLRA

```
SQL> BEGIN
 2    DBMS_RA.CREATE_SBT_JOB_TEMPLATE (
 3        template_name => 'BRONZE_FULL_ARCH',
 4        protection_policy_name => 'ZDLRA_BRONZE',
 5        attribute_set_name => 'bronzerepfull',
 6        backup_type => 'FULL,ARCH',
 7        priority => DBMS_RA.SBT_PRIORITY_LOW,
 8        window => INTERVAL '4' HOUR
 9    );
10 END;
11 /

PL/SQL procedure successfully completed.

SQL>
SQL> BEGIN
 2    DBMS_SCHEDULER.CREATE_JOB(
 3        job_name => 'SBTJOB_BRONZE_FULL_ARCH',
 4        job_type => 'PLSQL_BLOCK',
 5        job_action => 'dbms_ra.queue_sbt_backup_task(''BRONZE_FULL_ARCH'');',
 6        start_date => SYSDATE+(1/1440),
 7        enabled => TRUE,
 8        auto_drop => TRUE,
 9        repeat_interval => 'freq=WEEKLY; BYDAY=SUN; BYHOUR=20'
10    );
11 END;
12 /

PL/SQL procedure successfully completed.

SQL>
```

```
[root@zdlrasln1 ~]# obtool lsjob
Job ID          Sched time  Contents                                     State
-----
oracle/3         none       database ORCL19 (dbid=323177095) processed; Oracle job(s) scheduled
oracle/3.1       none       datafile backup                            running since 2019/12/29.23:35
oracle/3.2       none       datafile backup                            running since 2019/12/29.23:35
[root@zdlrasln1 ~]#
[root@zdlrasln1 ~]# cat /usr/etc/ob/xcr/oracle@3.2
[4100000001]2019/12/29.23:35:16
[4100000001]2019/12/29.23:35:16
[4100000002]2019/12/29.23:35:16      Transcript for job oracle/3.2 running on zdlrasln1
[4100000002]2019/12/29.23:35:16
[1100000003]2019/12/29.23:35:16 (amh) qdv__automount_in_mh entered
...
[4100000092] Client host:                zdlrasln1
[4100000093] Backup level:                0
[4100000094] S/w compression:             no
[4100000095] Archive created:             Sun Dec 29 23:35:18 2019
[4100000096] Archive owner:               oracle (UUID bbad0004-01a9-1038-abb2-080027b2a93d)
[4100000097] Owner class:                 oracle (UUID a43aa638-01a9-1038-8809-080027b2a93d)
[4100000098] Backup piece name:           RA_SBT_ORCL19_323177095_11398_8nukm54b_1_2_11371
[4100000099] Backup db name:             ORCL19
[410000009A] Backup db id:                323177095
...
[41000000BF]piece RA_SBT_ORCL19_323177095_11398_8nukm54b_1_2_11371 completed, status 0
[root@zdlrasln1 ~]#
```

ZDLRA

```
RMAN> list backupset 12631;
```

```
List of Backup Sets
=====
```

```
BS Key   Type LV Size
-----
```

```
12631    Incr 0   336.35M
```

```
List of Datafiles in backup set 12631
```

File	LV	Type	Ckp	SCN	Ckp Time	Abs Fuz	SCN	Sparse	Name
1	0	Incr	2452316		01/01/2020 20:25:20			NO	+DATA/OR19DG/DATAFILE/system.265.1028557261

```
Backup Set Copy #1 of backup set 12631
```

Device	Type	Elapsed Time	Completion Time	Compressed	Tag
SBT_TAPE		01:50:05	01/01/2020 20:25:23	YES	BKP-DB

```
List of Backup Pieces for backup set 12631 Copy #1
```

BP Key	Pc#	Status	Media	Piece Name
12632	1	AVAILABLE		VB\$_1891149551_12626_1

```
Backup Set Copy #2 of backup set 12631
```

Device	Type	Elapsed Time	Completion Time	Compressed	Tag
SBT_TAPE		01:50:05	01/01/2020 22:15:25	NO	BKP-DB

```
List of Backup Pieces for backup set 12631 Copy #2
```

BP Key	Pc#	Status	Media	Piece Name
13361	1	AVAILABLE	zdlras1-osbmf-000001	RA_SBT_OR19DG_41954437_13318_qsuktnpg_1_2_12631

```
RMAN>
```

ZDLRA

- **Real-Time Redo**

- Databases need to have the same REDO_TRANSPORT_USER value as VPC username
 - If you use Multi-Site protection, both ZDLRA's and DB need to have the same user.

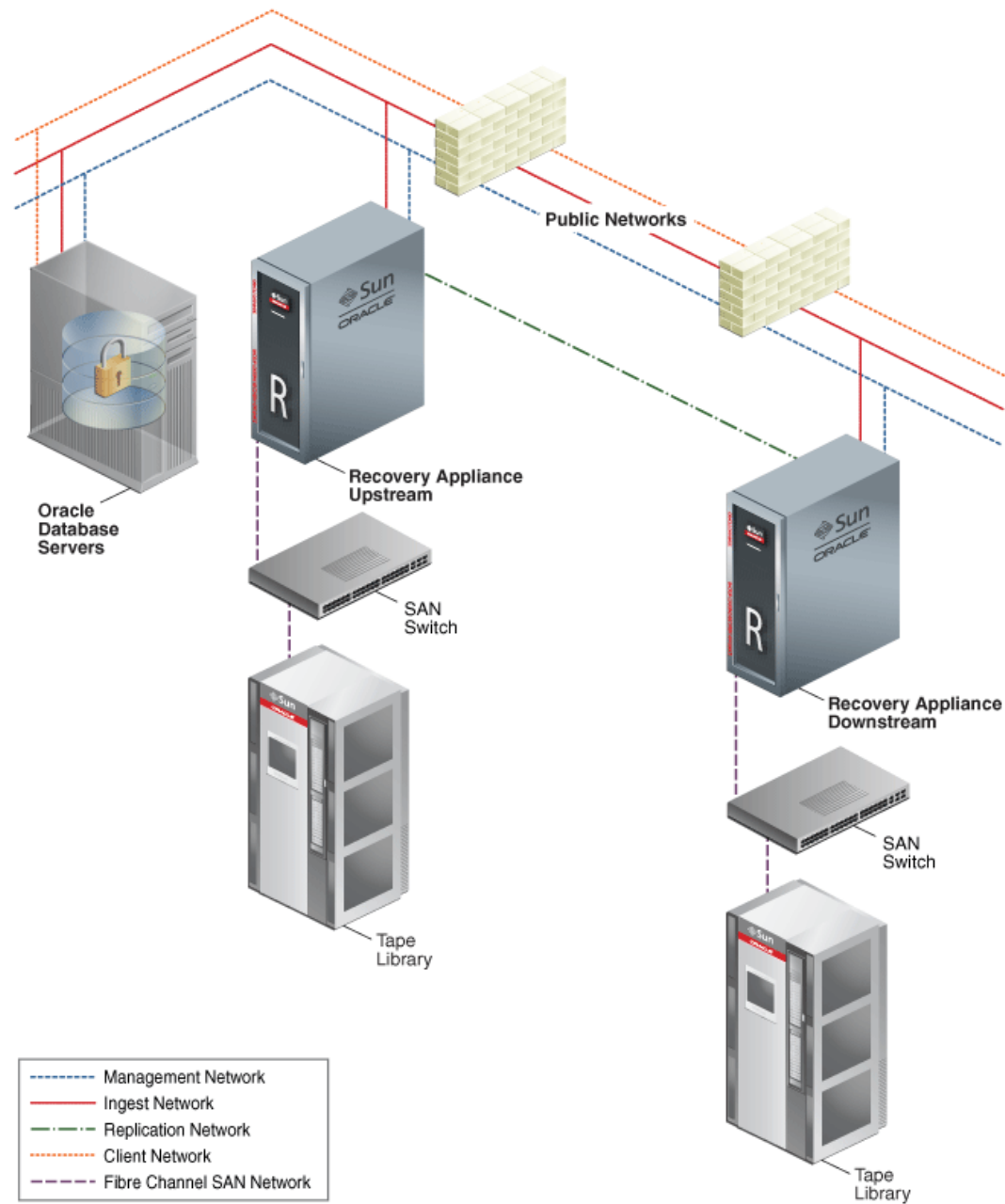
- **Replication**

- Based in policies, so, maybe you need different policies inside ZDLRA.
- Based in backupsets, will not be RPO zero between replicated ZDLRA's
 - This is the duty for DG.
- Not based in dbms_schedule, tends to be ASAP.
- Not replicate full/level0 backups. Just incremental, each side creates the virtual full backup.

- **Clone**

- It is not online, it is scheduled
 - You need to control to avoid overlaps the time window
 - Can use priority to do that.
- By default, clones the last backup
 - Can you TAG's to control what will be a clone.

ZDLRA



Maximum Availability Architecture - MAA

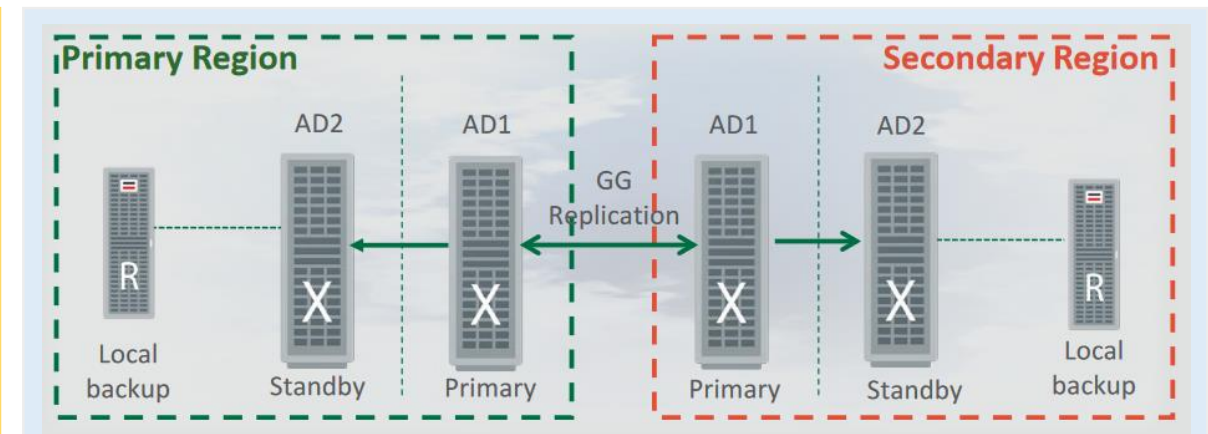
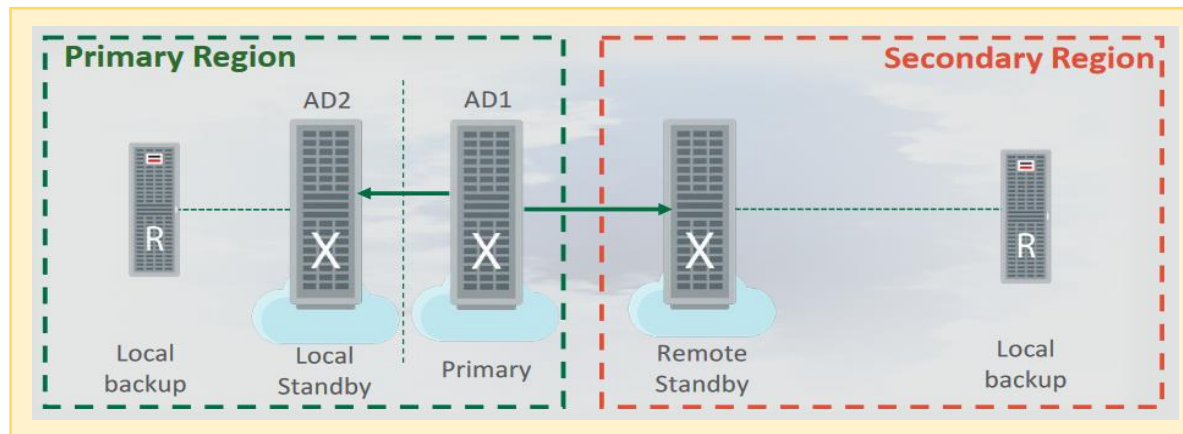
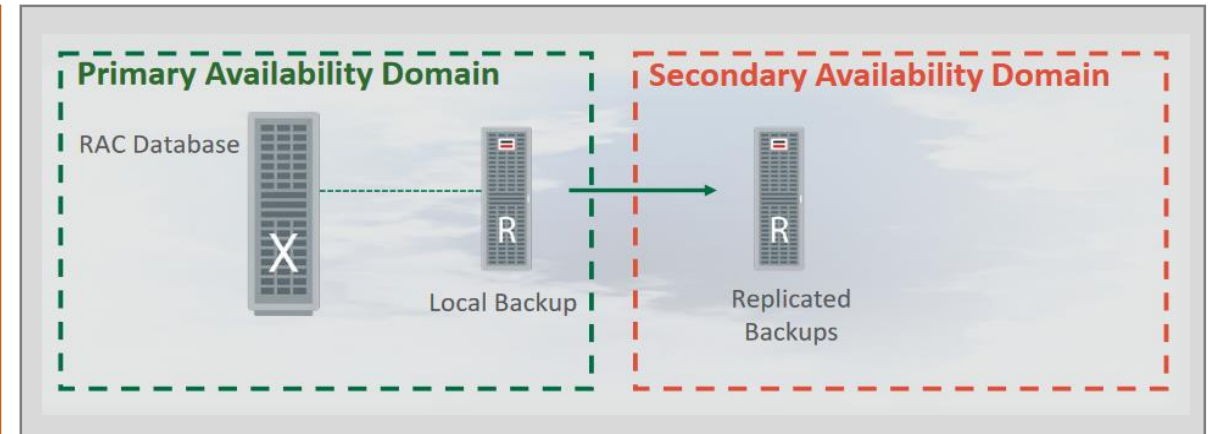
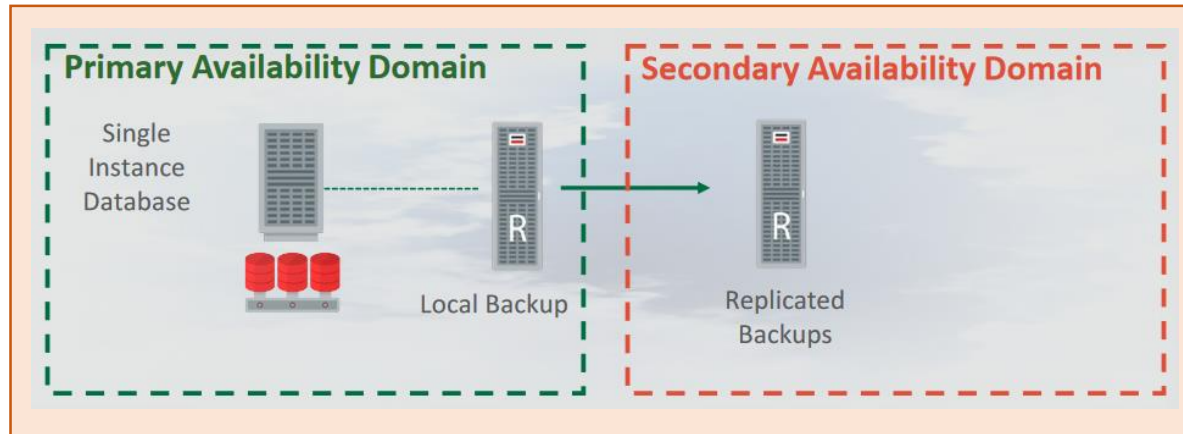
- Reduce planned and unplanned downtime for databases.
- Reduce data loss.
- ZERO RPO and ZERO RTO.
- Reference architecture for On-Premises
 - From single instances to multi-site DG.
 - <https://www.oracle.com/a/tech/docs/maa-overview-onpremise-2019.pdf>
 - <https://www.oracle.com/technetwork/database/availability/maa-reference-architectures-2244929.pdf>
- Think BIG.

Maximum Availability Architecture - MAA

- Continuous Availability.
- Data Protection.
- Active Replication.
- Scale Out.

Maximum Availability Architecture - MAA

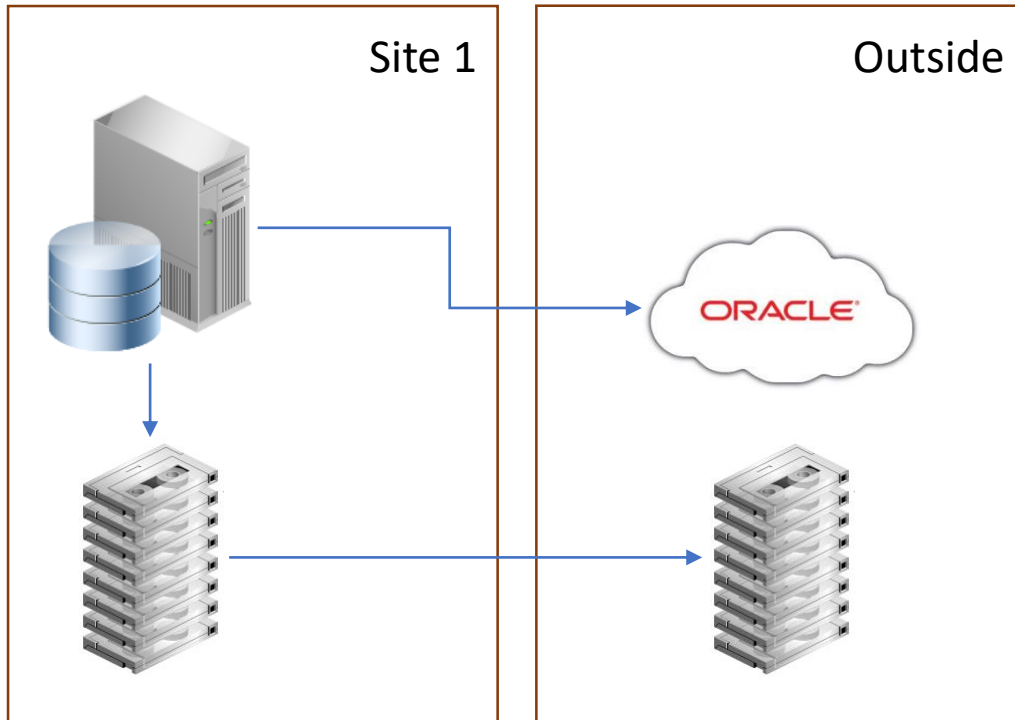
- Goals



Maximum Availability Architecture - MAA

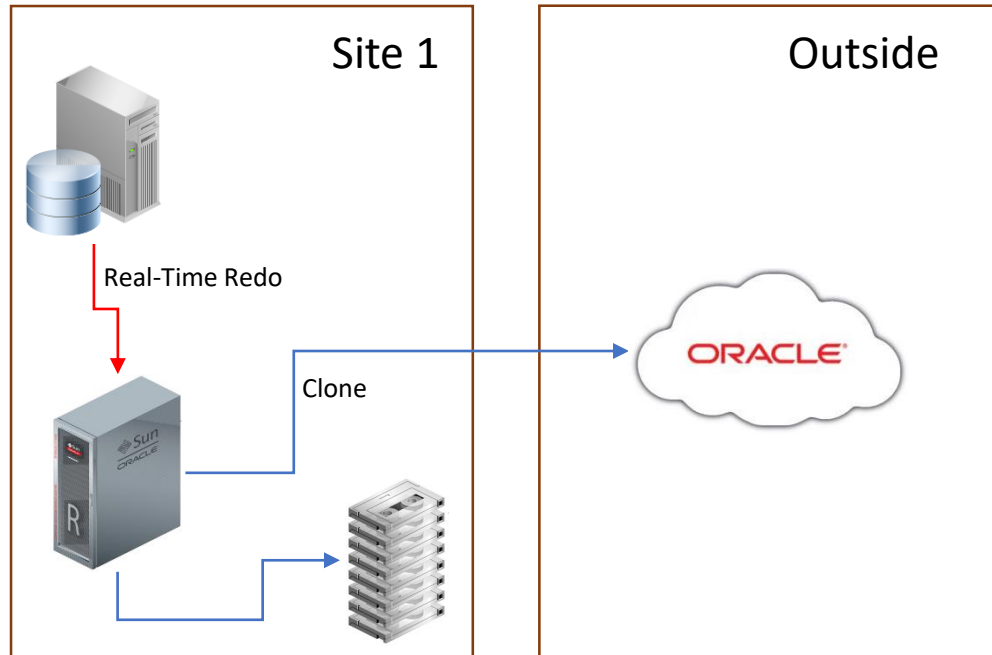
- BRONZE
 - Where/When the restore from the last backup is enough.
 - Single instances.
 - Traditional environment
 - Not Engineering systems.
 - It can be more susceptible to HW errors.
 - RTO and RPO will not be Zero
 - RPO can be zero with ZDLRA
 - If was not a complete site loss (like fire/water).
 - **With ZDLRA you can have ZERO RPO and multi-site protection for a Standard Edition.**

Maximum Availability Architecture - MAA

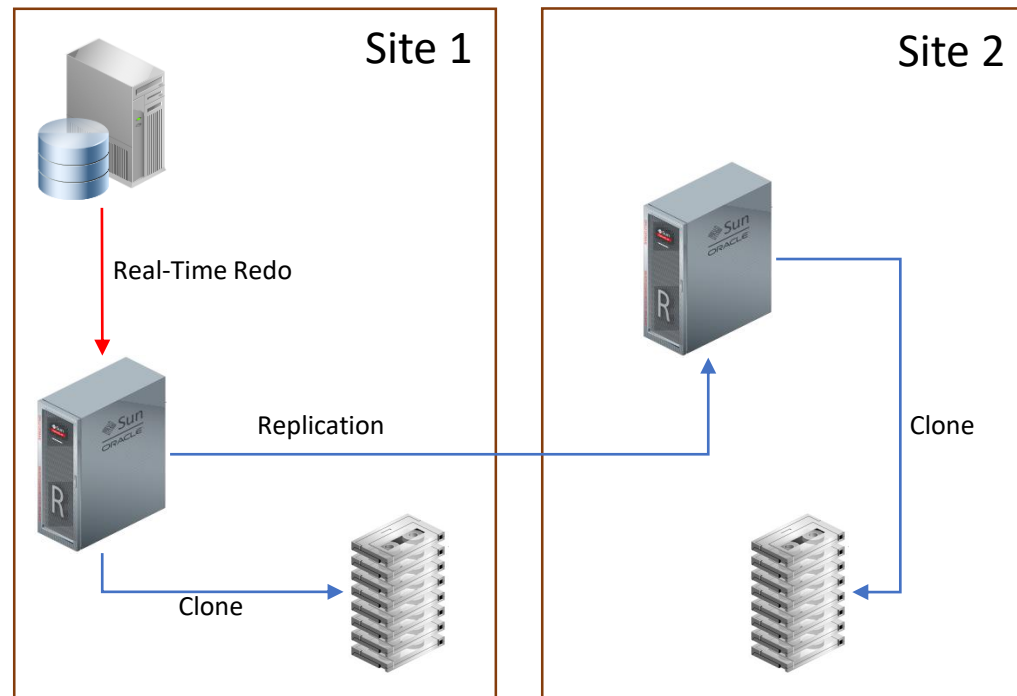


Event	RPO	RTO
Site Outage	Can be > then Zero	> Zero
Database Error (SW)	Zero	> Zero
Data Corruption	Since last backup	> Zero
Hardware error	> Zero	> Zero

Maximum Availability Architecture - MAA



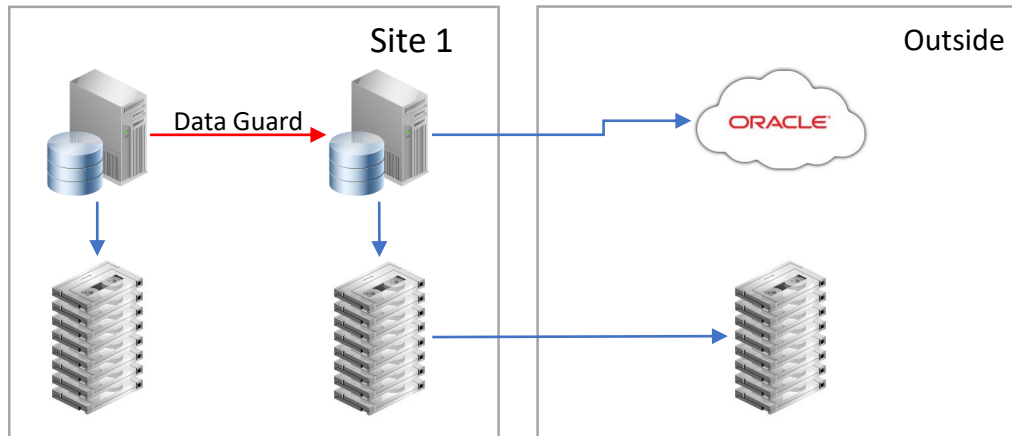
Event	RPO	RTO
Site Outage	Zero*	> Zero
Database Error (SW)	Zero	> Zero
Data Corruption	Zero	> Zero
Hardware error	Zero	> Zero



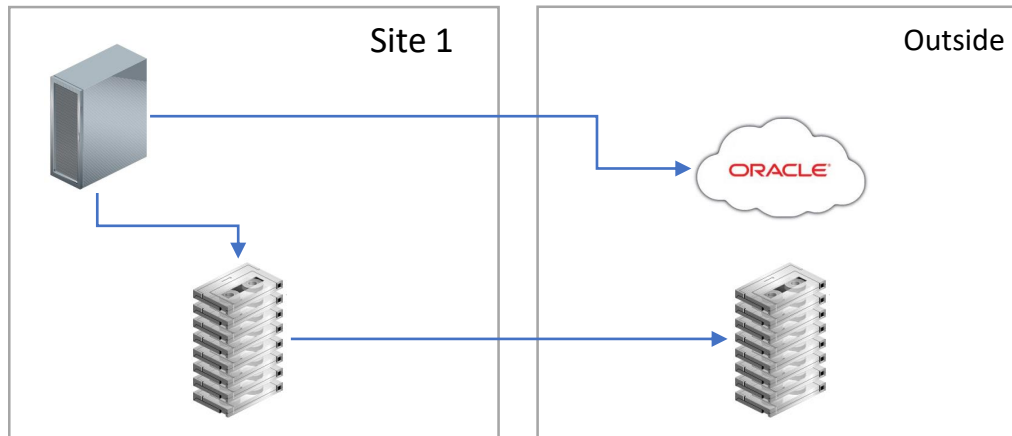
Maximum Availability Architecture - MAA

- SILVER
 - Focus on Application Continuity.
 - RAC or Single instance (With DG).
 - Two patterns for HA
 - Traditional environment, but with DG
 - Not Engineer systems.
 - Can be more susceptible to HW errors.
 - Engineer systems, RAC.
 - RTO can reach zero and RPO will not be Zero
 - RPO can be zero with ZDLRA.

Maximum Availability Architecture - MAA

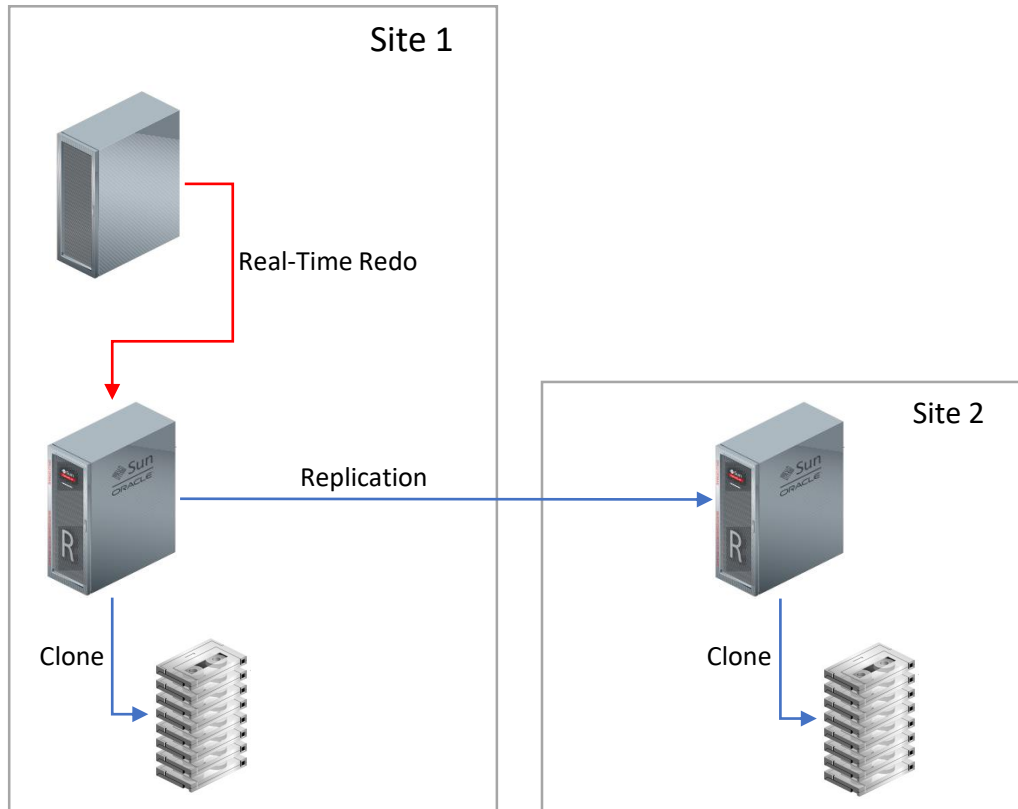


Event	RPO	RTO
Site Outage	Can be > then Zero	> Zero
Database Error (SW)	Zero	Can be Zero
Data Corruption	Zero	Zero
Hardware error	Zero	Zero



Event	RPO	RTO
Site Outage	Can be > then Zero	> Zero
Database Error (SW)	Zero	Can be Zero
Data Corruption	Since last backup	> Zero
Hardware error	Zero*	Can be Zero

Maximum Availability Architecture - MAA



Event	RPO	RTO
Site Outage	Zero*	> Zero
Database Error (SW)	Zero	Can be Zero
Data Corruption	Zero	> Zero
Hardware error	Zero	Zero

```
RMAN> list backupset 11346;
```

```
List of Backup Sets
```

```
=====
```

```
BS Key   Type LV Size
```

```
-----
```

```
11346    Incr 0   323.67M
```

```
List of Datafiles in backup set 11346
```

```
File LV Type Ckp SCN      Ckp Time          Abs Fuz SCN Sparse Name
```

```
-----
```

```
1       0   Incr 2241766    29/12/2019 23:23:48          NO      /u01/app/oracle/oradata/ORCL19/system01.dbf
```

```
Backup Set Copy #1 of backup set 11346
```

```
Device Type Elapsed Time Completion Time          Compressed Tag
```

```
-----
```

```
SBT_TAPE     00:37:25      29/12/2019 23:23:54 YES          BKP-DB
```

```
List of Backup Pieces for backup set 11346
```

```
Copy #1
```

```
BP Key   Pc# Status      Media          Piece Name
```

```
-----
```

```
11347    1   AVAILABLE          VB$ _1891149551_11341_1
```

```
Backup Set Copy #2 of backup set 11346
```

```
Device Type Elapsed Time Completion Time          Compressed Tag
```

```
-----
```

```
SBT_TAPE     00:37:25      29/12/2019 22:36:28 NO          BKP-DB
```

```
List of Backup Pieces for backup set 11346
```

```
Copy #2
```

```
BP Key   Pc# Status      Media          Piece Name
```

```
-----
```

```
11417    1   AVAILABLE  zdlras1-osbmf-000003  RA_SBT_ORCL19_323177095_11398_nmukm544_1_2_11346
```

```
Backup Set Copy #3 of backup set 11346
```

```
Device Type Elapsed Time Completion Time          Compressed Tag
```

```
-----
```

```
SBT_TAPE     00:37:25      29/12/2019 23:25:13 YES          BKP-DB
```

```
List of Backup Pieces for backup set 11346
```

```
Copy #3
```

```
BP Key   Pc# Status      Media          Piece Name
```

```
-----
```

```
11521    1   AVAILABLE  ZDLRAS2_REP          VB$ _2127575003_8554_1
```

```
Backup Set Copy #4 of backup set 11346
```

```
Device Type Elapsed Time Completion Time          Compressed Tag
```

```
-----
```

```
SBT_TAPE     00:37:25      29/12/2019 22:46:23 NO          BKP-DB
```

```
List of Backup Pieces for backup set 11346
```

```
Copy #4
```

```
BP Key   Pc# Status      Media          Piece Name
```

```
-----
```

```
11645    1   AVAILABLE  ZDLRAS2_REP          RA_SBT_ORCL19_323177095_8206_nmukm544_1_2_8559
```

```
RMAN>
```

1. Local Copy

2. Local Clone to Tape

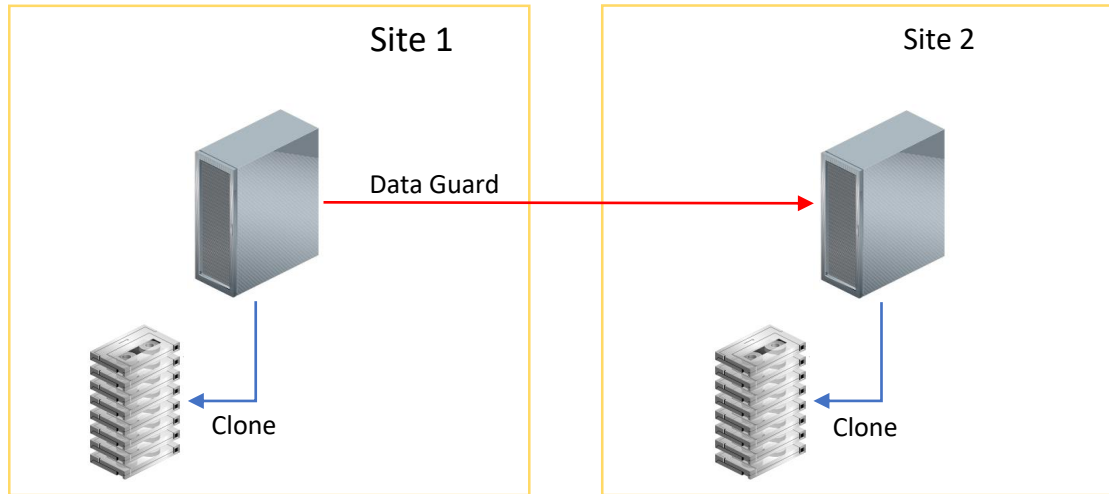
3. Remote Copy

4. Remote Copy Cloned to Tape

Maximum Availability Architecture - MAA

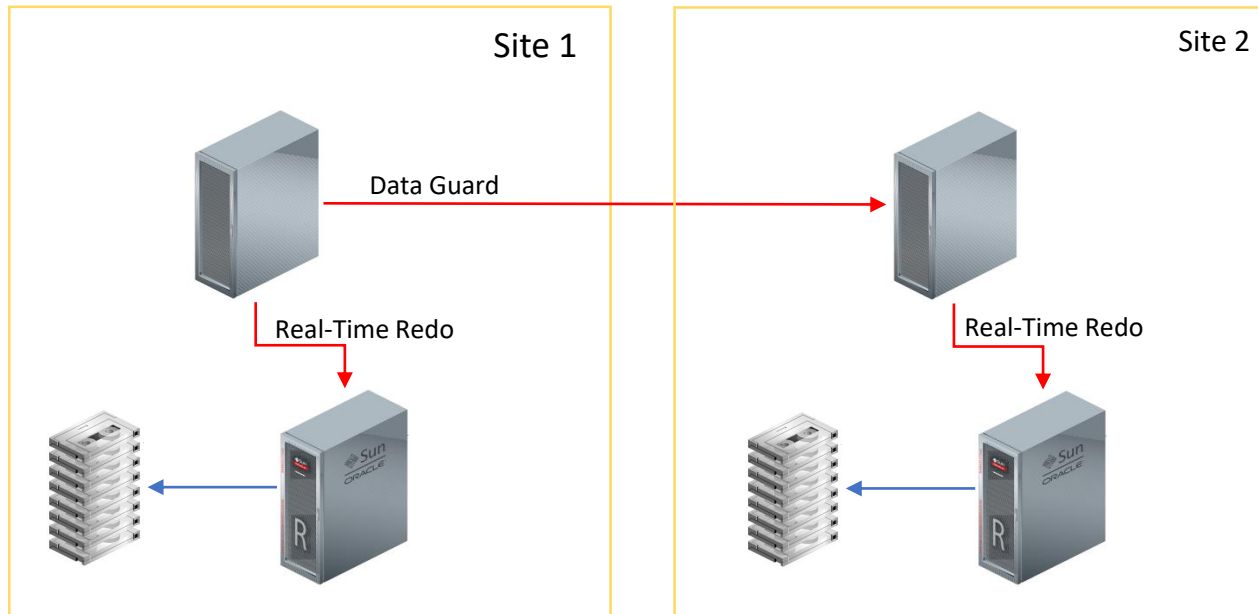
- GOLDEN and PLATINUM
 - Focus in Continuity
 - Eliminate a single point of failure.
 - Multi Site, Data Guard
 - RAC on both sides.
 - Engineer systems.
- Platinum adds replication inside site and multi-region replication
 - Can use Golden Gate to reach zero RTO even for binary version upgrade.
- RTO and RPO zero
 - Replication is done by DG, not by ZDLRA.
 - Backup at Standby allowed with ZDLRA, BCT at standby only when have ADG license.
 - RPO zero depends on the DG protection.
 - Sometimes data protection is more important than application continuity.

Maximum Availability Architecture - MAA



Event	RPO	RTO
Site Outage	Zero	Zero
Database Error (SW)	Zero	Zero
Data Corruption	Zero	Zero
Hardware error	Zero*	Zero

Maximum Availability Architecture - MAA



Event	RPO	RTO
Site Outage	Zero	Zero
Database Error (SW)	Zero	Zero
Data Corruption	Zero	Zero
Hardware error	Zero	Zero

Maximum Availability Architecture - MAA

```
RMAN> list backupset 12631;
```

```
List of Backup Sets
=====
```

```
BS Key   Type LV Size
----- --
```

```
12631    Incr 0   336.35M
```

```
List of Datafiles in backup set 12631
```

File	LV	Type	Ckp	SCN	Ckp Time	Abs Fuz	SCN	Sparse	Name
1	0	Incr	2452316	01/01/2020 20:25:20				NO	+DATA/OR19DG/DATAFILE/system.265.1028557261

```
Backup Set Copy #1 of backup set 12631
```

Device	Type	Elapsed Time	Completion Time	Compressed	Tag
SBT_TAPE		01:50:05	01/01/2020 20:25:23	YES	BKP-DB

```
List of Backup Pieces for backup set 12631 Copy #1
```

BP Key	Pc#	Status	Media	Piece Name
12632	1	AVAILABLE		VB\$_1891149551_12626_1

```
Backup Set Copy #2 of backup set 12631
```

Device	Type	Elapsed Time	Completion Time	Compressed	Tag
SBT_TAPE		01:50:05	01/01/2020 22:15:25	NO	BKP-DB

```
List of Backup Pieces for backup set 12631 Copy #2
```

BP Key	Pc#	Status	Media	Piece Name
13361	1	AVAILABLE	zdlras1-osbmf-000001	RA_SBT_OR19DG_41954437_13318_qsuktnpg_1_2_12631

```
RMAN>
```

```
RMAN> list backupset 9500;
```

```
List of Backup Sets
=====
```

```
BS Key   Type LV Size
```

```
----- --
```

```
9500     Incr 0   336.36M
```

```
List of Datafiles in backup set 9500
```

File	LV	Type	Ckp	SCN	Ckp Time	Abs Fuz	SCN	Sparse	Name
1	0	Incr	2452089	01/01/2020 20:24:22				NO	+DATA/OR19DGS/DATAFILE/system.265.1028562437

```
Backup Set Copy #1 of backup set 9500
```

Device	Type	Elapsed Time	Completion Time	Compressed	Tag
SBT_TAPE		02:14:00	01/01/2020 20:26:41	YES	BKP-DB

```
List of Backup Pieces for backup set 9500 Copy #1
```

BP Key	Pc#	Status	Media	Piece Name
9501	1	AVAILABLE		VB\$_2127575003_9492_1

```
Backup Set Copy #2 of backup set 9500
```

Device	Type	Elapsed Time	Completion Time	Compressed	Tag
SBT_TAPE		02:14:00	01/01/2020 22:40:31	NO	BKP-DB

```
List of Backup Pieces for backup set 9500 Copy #2
```

BP Key	Pc#	Status	Media	Piece Name
10125	1	AVAILABLE	zdlras2-osbmf-000002,zdlras2-osbmf-000005	RA_SBT_OR19DG_41954437_10086_gjuktnrn_1_2_9500

```
RMAN>
```

```
RMAN> list backup of archivelog sequence 91;
```

```
List of Backup Sets
=====
```

```
BS Key   Size
-----
13314    21.50K
```

```
List of Archived Logs in backup set 13314
```

Thrd Seq	Low SCN	Low Time	Next SCN	Next Time
1 91	2519988	01/01/2020 22:31:20	2520099	01/01/2020 22:31:51

```
Backup Set Copy #1 of backup set 13314
```

Device Type	Elapsed Time	Completion Time	Compressed Tag
SBT_TAPE	00:06:42	01/01/2020 22:32:09	YES TAG20200101T223208

```
List of Backup Pieces for backup set 13314 Copy #1
```

BP Key	Pc#	Status	Media	Piece Name
13315	1	AVAILABLE		\$RSCN_1920977_RTIM_1028557385_THRD_1_SEQ_91_CTKEY_13291_BACKUP

```
Backup Set Copy #2 of backup set 13314
```

Device Type	Elapsed Time	Completion Time	Compressed Tag
SBT_TAPE	00:06:42	01/01/2020 22:25:26	YES TAG20200101T223208

```
List of Backup Pieces for backup set 13314 Copy #2
```

BP Key	Pc#	Status	Media	Piece Name
13672	1	AVAILABLE	zdlras1-osbmf-000004	RA_SBT_OR19DG_41954437_13318_ctuktv78_1_2_13314

```
RMAN> list backup of archivelog sequence 92;
```

```
List of Backup Sets
=====
```

BS Key	Size	Device Type	Elapsed Time	Completion Time
13697	2.80M	SBT_TAPE	00:00:01	01/01/2020 23:29:22
BP Key: 13698 Status: AVAILABLE Compressed: YES Tag: TAG20200101T232921				
Handle: \$RSCN_1920977_RTIM_1028557385_THRD_1_SEQ_92_CTKEY_13299_BACKUP Media:				

```
List of Archived Logs in backup set 13697
```

Thrd Seq	Low SCN	Low Time	Next SCN	Next Time
1 92	2520099	01/01/2020 22:31:51	2530992	01/01/2020 23:29:08

```
RMAN>
```

```
RMAN> list backup of archivelog sequence 91;
```

```
List of Backup Sets
=====
```

```
BS Key   Size
-----
10039    21.50K
```

```
List of Archived Logs in backup set 10039
```

Thrd Seq	Low SCN	Low Time	Next SCN	Next Time
1 91	2519988	01/01/2020 22:31:20	2520099	01/01/2020 22:31:51

```
Backup Set Copy #1 of backup set 10039
```

Device Type	Elapsed Time	Completion Time	Compressed Tag
SBT_TAPE	00:13:36	01/01/2020 22:32:13	YES TAG20200101T223213

```
List of Backup Pieces for backup set 10039 Copy #1
```

BP Key	Pc#	Status	Media	Piece Name
10040	1	AVAILABLE		\$RSCN_1920977_RTIM_1028557385_THRD_1_SEQ_91_CTKEY_10032_BACKUP

```
Backup Set Copy #2 of backup set 10039
```

Device Type	Elapsed Time	Completion Time	Compressed Tag
SBT_TAPE	00:13:36	01/01/2020 22:45:49	YES TAG20200101T223213

```
List of Backup Pieces for backup set 10039 Copy #2
```

BP Key	Pc#	Status	Media	Piece Name
10334	1	AVAILABLE	zdlras2-osbmf-000003	RA_SBT_OR19DG_41954437_10086_65uktv7d_1_2_10039

```
RMAN>
```

```
RMAN> list backup of archivelog sequence 92;
```

List of Backup Sets

=====

BS Key	Size	Device Type	Elapsed Time	Completion Time
13697	2.80M	SBT_TAPE	00:00:01	01/01/2020 23:29:22
BP Key: 13698 Status: AVAILABLE Compressed: YES Tag: TAG20200101T232921				
Handle: \$RSCN_1920977_RTIM_1028557385_THRD_1_SEQ_92_CTKEY_13299_BACKUP Media:				

List of Archived Logs in backup set 13697

Thrd Seq	Low SCN	Low Time	Next SCN	Next Time
1	92	2520099	01/01/2020 22:31:51	2530992 01/01/2020 23:29:08

```
RMAN>
```

```
RMAN> list backup of archivelog sequence 92;
```

List of Backup Sets

=====

BS Key	Size
10082	2.80M

List of Archived Logs in backup set 10082

Thrd Seq	Low SCN	Low Time	Next SCN	Next Time
1	92	2520099	01/01/2020 22:31:51	2530992 01/01/2020 23:29:08

Backup Set Copy #1 of backup set 10082

Device Type	Elapsed Time	Completion Time	Compressed Tag
SBT_TAPE	00:43:14	01/01/2020 23:29:24	YES TAG20200101T232923

List of Backup Pieces for backup set 10082 Copy #1

BP Key	Pc#	Status	Media	Piece Name
10083	1	AVAILABLE		\$RSCN_1920977_RTIM_1028557385_THRD_1_SEQ_92_CTKEY_10033_BACKUP

Backup Set Copy #2 of backup set 10082

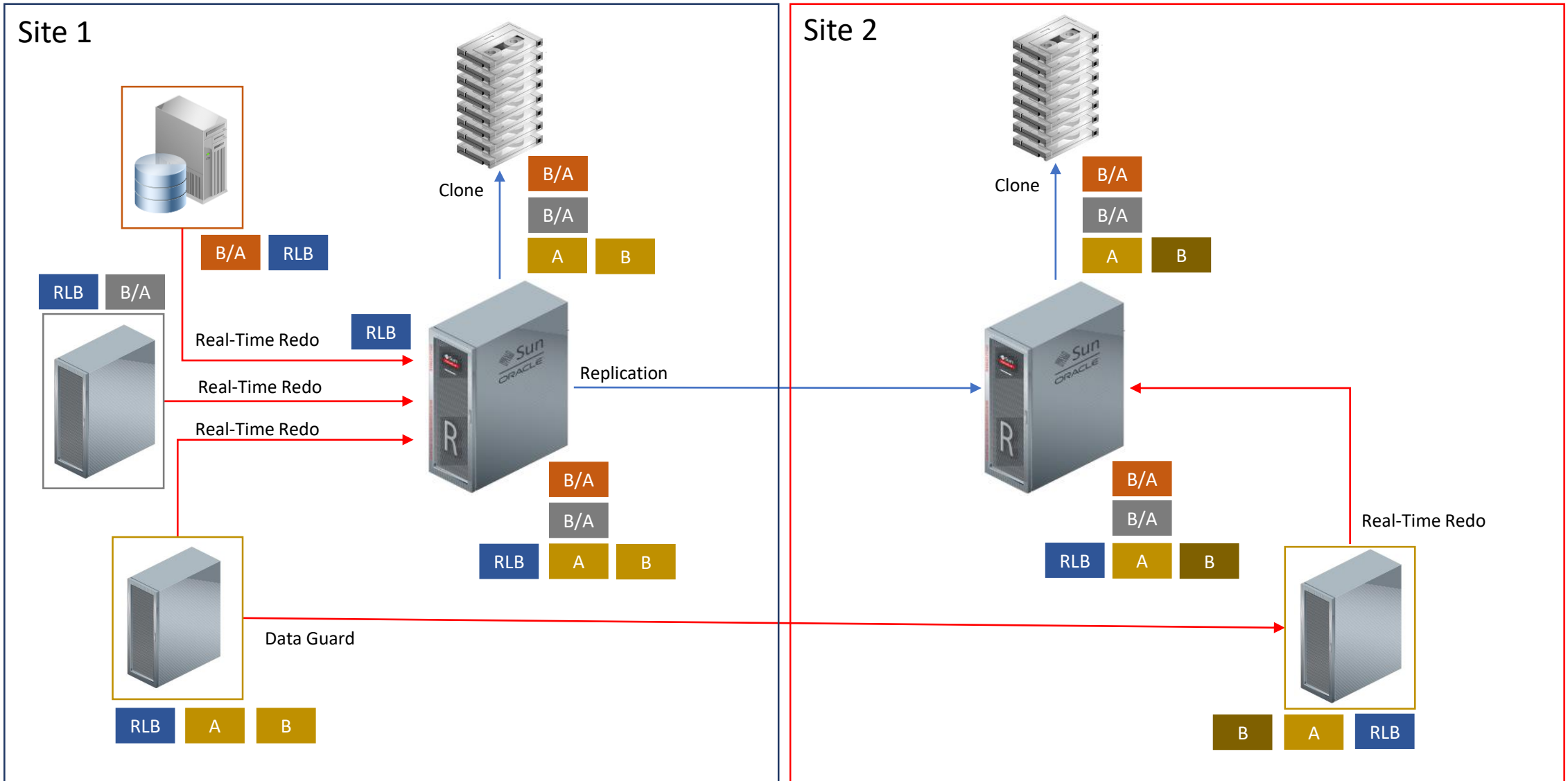
Device Type	Elapsed Time	Completion Time	Compressed Tag
SBT_TAPE	00:43:14	01/01/2020 22:46:09	YES TAG20200101T232923

List of Backup Pieces for backup set 10082 Copy #2

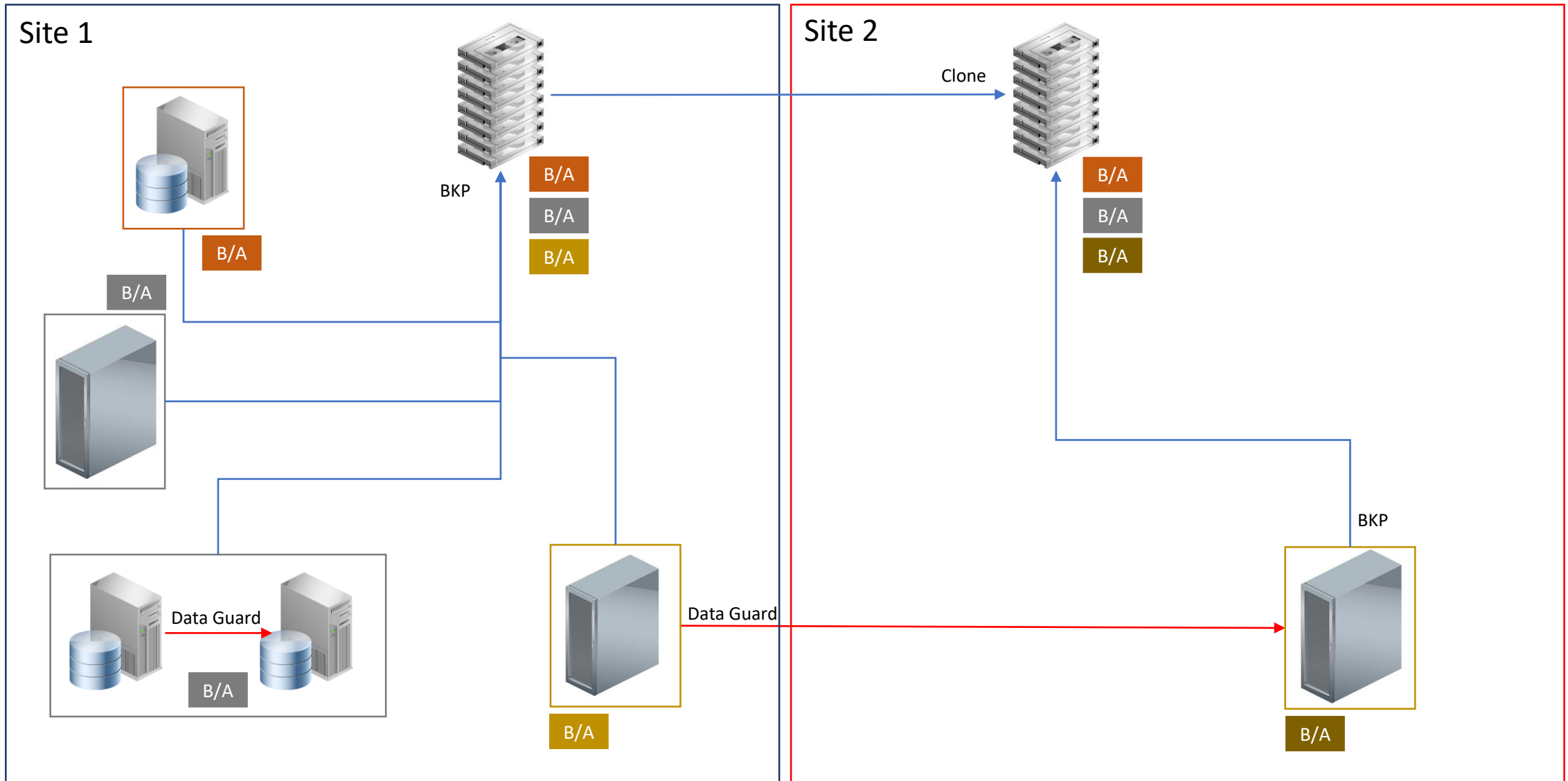
BP Key	Pc#	Status	Media	Piece Name
10338	1	AVAILABLE	zdlras2-osbmf-000003	RA_SBT_OR19DG_41954437_10086_66uku2ij_1_2_10082

```
RMAN>
```

Maximum Availability Architecture - MAA



Maximum Availability Architecture - MAA



Internal details

- Check more details at my blog:
 - [ZDLRA, How to enroll a database](#)
 - [ZDLRA, Virtual Full Backup and Incremental Forever](#)
 - [ZDLRA Internals, INDEX BACKUP task in details](#)
 - [ZDLRA Internals, Virtual Full Backup](#)
 - [ZDLRA, Real-Time Redo and Zero RPO](#)
 - [ZDLRA, Multi-site protection – ZERO RPO for Primary and Standby](#)

Next Webinars



LUXOUG

**ORACLE
MULTITENANT
19C CONSOLIDATION**

Speaker: Rodrigo Mufalani
When: 23/01/2020 19:00 CEST

The poster features a scenic background of a river flowing through a lush green valley with a stone bridge. A circular inset on the right shows a portrait of Rodrigo Mufalani, a man with a beard and sunglasses, wearing a dark blue Lacoste polo shirt. The text is overlaid on the image in white and blue.

Next Webinars



The poster features a scenic background of a river flowing through a lush green valley with steep, forested hills under a blue sky with scattered clouds. The river's surface is calm, reflecting the surrounding landscape. Overlaid on the right side of the poster is a circular inset photograph of Bruno Reis, a man with short dark hair and a beard, wearing a dark jacket over a patterned shirt. In the background of this inset, a banner for 'OTUG scope19' is visible. The text 'LUXOUG' is prominently displayed at the top in a large, white, sans-serif font. Below it, the title 'ORACLE DATABASE ON AWS RDS' is written in a similar white font. At the bottom left, the speaker's name and the event date and time are listed in white text.

LUXOUG

**ORACLE DATABASE
ON AWS RDS**

Speaker: Bruno Reis
When: 13/02/2020 19:00 CEST

A word cloud on a dark blue background. The central element is 'Q&A' in large, white, bold letters. Surrounding it are various question words in different colors (blue, green, orange, white) and sizes. The words include: 'What?', 'Where?', 'When?', 'How?', 'Who?', 'Why?', 'Where?', 'When?', 'How?', 'What?', 'Where?', 'When?', 'How?', 'Who?', 'Why?'. The words are arranged in a circular pattern around the center, with some words appearing multiple times.