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Achieving a more Highly Available Environment with Disaster Recovery

Presenter: Anton Els

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Introduction

Anton Els - @aelsnz

ORACLE
Certified Master
Oracle Database 11*g*
Administrator

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- Product Development Manager & Architect
- 13+ years Oracle database experience
- Successfully implemented many projects from small to large scale
- Enjoy technical challenges
- Interest include Linux, Oracle Standby, Oracle Backup and Recovery
- Oracle Database 11g Certified Master
- Qualifications include a B.Sc. Degree with certifications in Solaris and Red Hat administration
- Enjoy playing golf, movies and theatre

Dbvisit Software Limited

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- Dedicated software development company
- Based in New Zealand with sales offices in US and Europe
- Used in 80+ Countries
- Trusted by 500+ Companies
- Worldwide leader in DR solutions for Oracle Standard Edition
- Product Engineers with “real world” DBA Experience
- Two Oracle 11g Certified Masters
- Regular presenters at Oracle events such as OOW and Collaborate
- Passionate about Oracle Technology

Deloitte.
Technology Fast 500™
2012

ORACLE Gold Partner

In this session let's walk through

- What is Disaster Recovery
  - Do I need it?
- Things to consider when planning DR
- Standard vs. Enterprise Edition
- Standby Database Technology
- Flashback Database
- One powerful utility called RMAN
- Q & A

Do you remember Storm Sandy?

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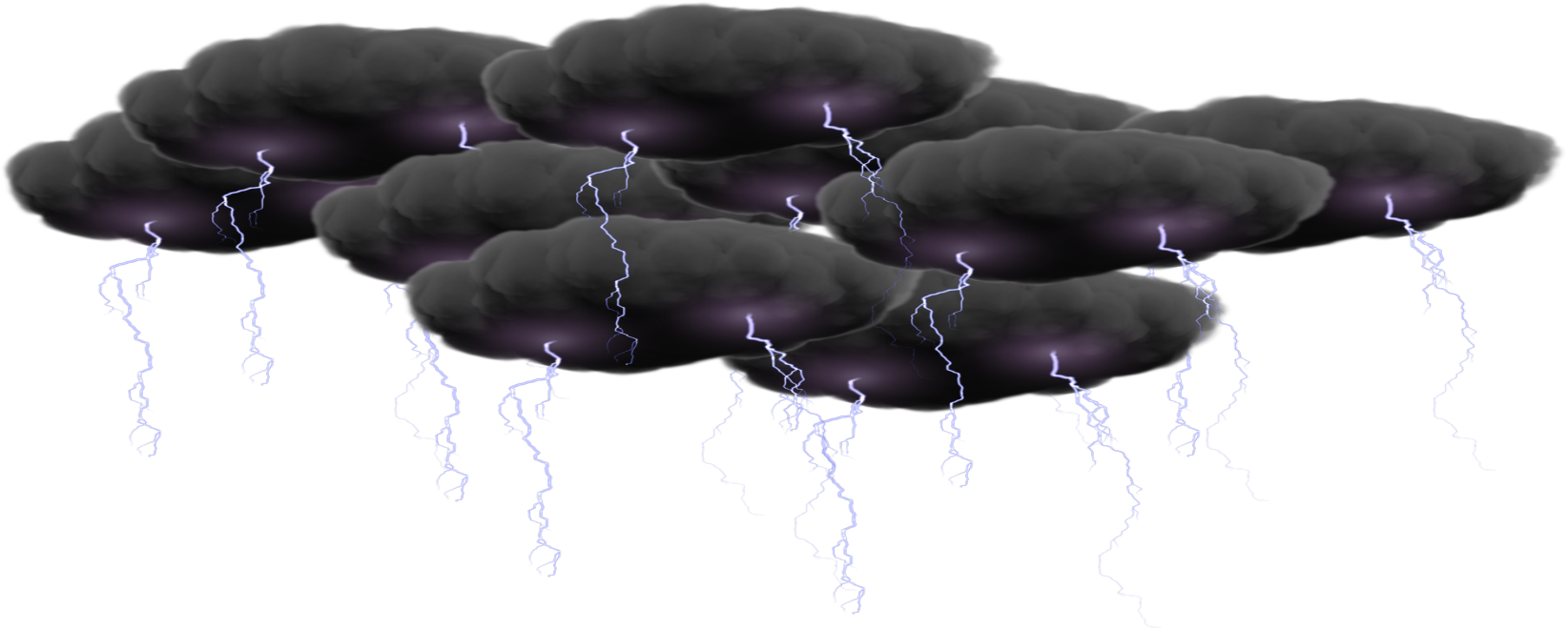

What is Disaster Recovery?

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Disaster Recovery (DR) is seen as

- Processes
- Policies
- Procedures

Established to ensure recovery and continuity of

- Infrastructure
- Applications
- Databases

All of which is critical to the **Business Continuity**

Why bother with Disaster Recovery

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What is the most critical asset of companies today?

DATA

Protection is required against:

- Natural Disasters
- Hardware / Infrastructure Failure
- **Human Error**

But I have Oracle RAC, I don't need DR

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- What if you lose your datacenter due to natural disaster?
- Oracle RAC IS NOT DR!
- What is it then?
  - Oracle RAC provides:
    - High Availability
    - Scalability
    - Fault tolerance from hardware failure
    - Performance

Considerations when planning DR

- Understand Business Requirements
  - Actually talk to the Business! Don't make assumptions!
- What does it mean Zero Data Loss
- Recover Point Objective (RPO)
- Recovery Time Objective (RTO)
- Change Control
- Documentation
- Testing, Testing and more Testing

Zero Data Loss, RPO and RTO

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Zero Data Loss

- No transaction can be lost
- Must be able to recover up until time disaster struck
- Solutions tend to be more expensive and complex

Recovery Point Objective (RPO)

- Maximum acceptable data loss expressed as time

Recovery Time Objective (RTO)

- Maximum time you can spend on recovery
- Also seen as time from disaster until operational again

Change Control, Documentation and Testing

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Change Control

- Critical to successful DR implementation
- Clear indication on who does what? When?

Documentation

- Who likes documentation?
- It takes time, but it is worth it! (Especially at 3am)

Testing, Testing and more Testing!

- Schedule Regular Testing
- Update schedule to cater for application code releases

Do I need Enterprise Edition for DR

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NO! Oracle Enterprise **and** Standard Edition can provide DR

• Standby Database	• **Possible with SE1, SE and EE**
• Backup and Recovery (RMAN)	• **Available in SE1, SE and EE**
• Oracle RAC	• **Free with SE, Extra License with EE**
• Flashback Database	• **Only Available with EE**
• Flashback Query	• **Available with SE1, SE and EE**

Some Differences

Database Features [1]	Standard Edition One	Standard Edition	Enterprise Edition
Maximum CPU's	2 CPU Sockets	4 CPU Sockets	No Limit
Oracle Real Application Clusters (RAC)	✗	✔ (Included with SE up to Max. Total of 4 Sockets in Cluster)	✔ (Extra License Cost Option)
Oracle Data Guard	✗ (3rd party options available)	✗ (3rd party options available)	✔ (Active Data Guard requires additional license)
Flashback (Table, Database, Transaction)	✗	✗	✔

Some Differences

Database Features [1]	Standard Edition One	Standard Edition	Enterprise Edition
Parallel Options (Example: Parallel Data Pump)	✗	✗	✔
Recovery Manager (RMAN)	✔	✔	✔
	Some key options not available in SE1/SE: • Parallel Backups • Fast incremental backups with Block Change Tracking • Block-level media recovery		

Reasons to consider Standard Edition

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- SE & SE1 is proven database technology
- Cut costs, NOT quality of the service!
- Oracle RAC at your fingertips
  - NO additional cost!
- Disaster Recovery – Standby Databases
- Performance Tuning
  - 3rd Party options is available / Statspack
- Processing Power
  - Remember 1 Socket can have Many Cores!!!

A Few Standard Edition Restrictions

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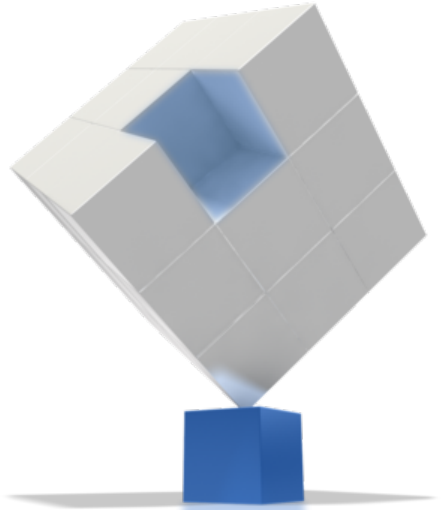
- CPU Limitation
  - But, is it really a restriction in your own environment?
  - 1 CPU Socket can have MANY Cores
- Flashback Database
- No Data Guard
  - But, Standby Databases is still possible
- Block change tracking for fast incremental backups
- Parallel Backup and Recovery
- AWR (Performance Tuning and Diagnostics)
  - Don’t forget statspack!!! It is still available in SE

The Core of Disaster Recovery

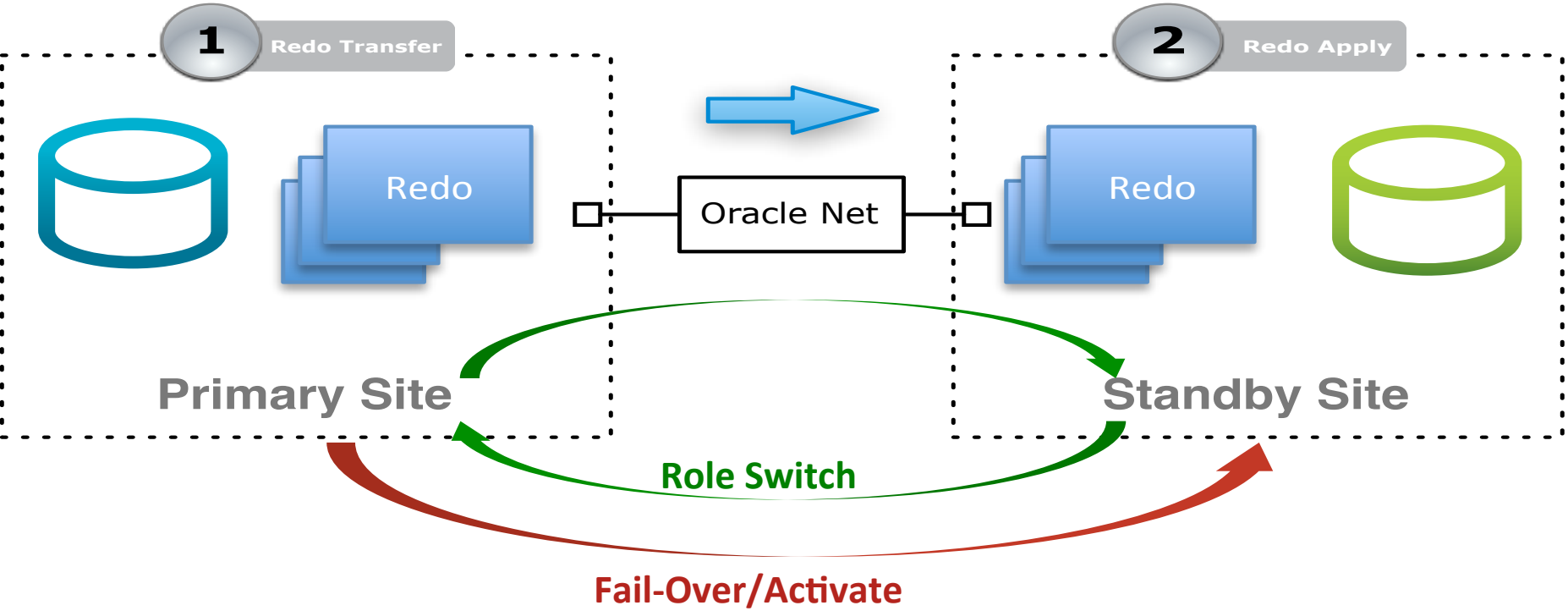


Standby Databases

Can be implemented using:

- Data Guard
- Custom Scripts
- Third Party Products

Overview of Physical Standby Database



Data Guard – Standby Database Features

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- 3 Protection Modes
- Log Gap Detection
- Open Standby Read-Only
  - Offload queries to standby
  - Free up primary resources
  - Ideal for Read-Mostly applications
- Quick and easy role-switch or activation
- Backup off-loading onto standby database
- Data Guard Broker
  - Easy configuration/management interface

Data Guard – Protection Modes

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Maximum Protection

- Zero Data Loss
- Synchronous
- Transaction must be written to disk on standby
- Failure to write to standby result in outage on primary!

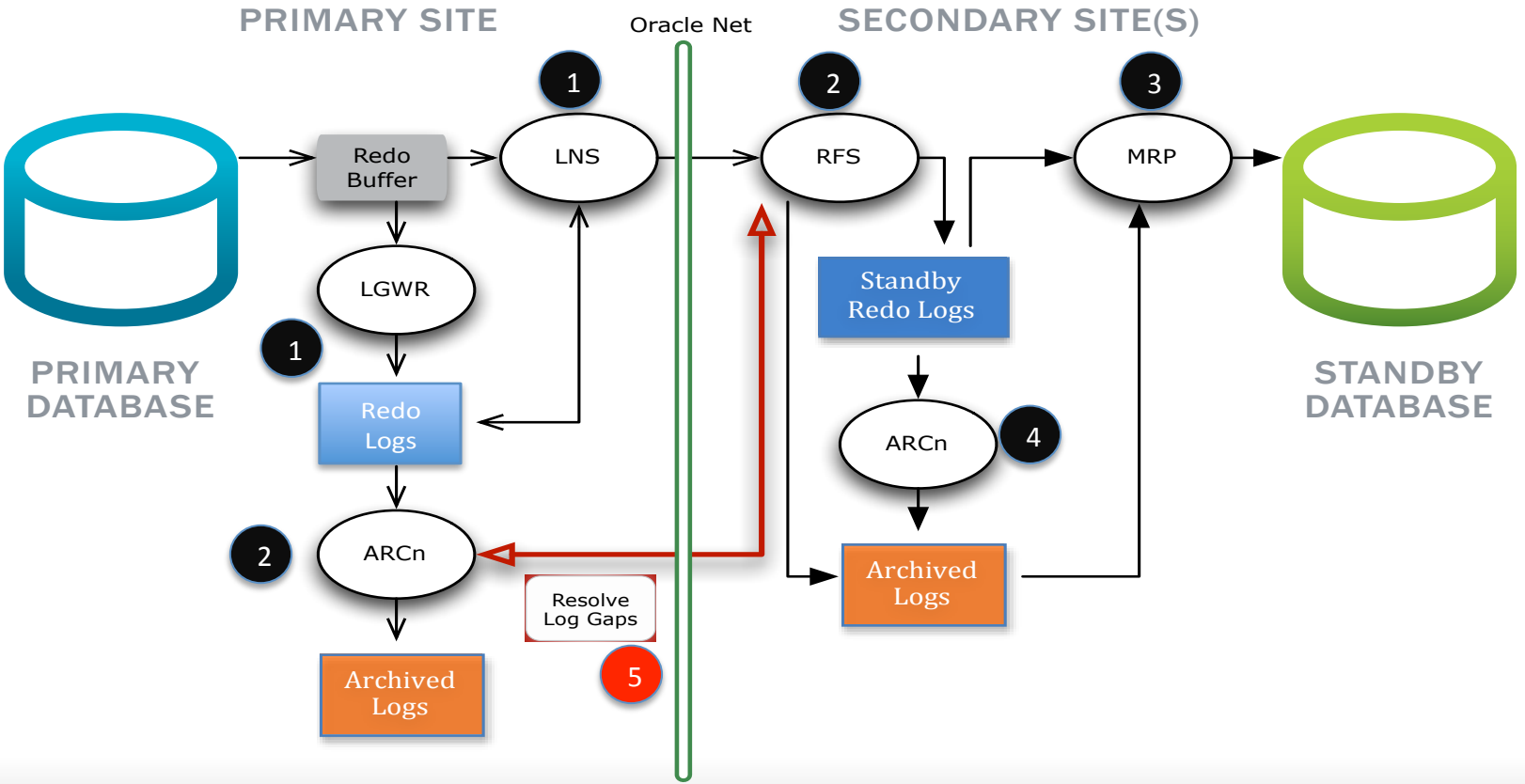
Maximum Availability

- Same as Maximum Protection
- But, Failure to write to standby, switch to Maximum Performance

Maximum Performance

- Asynchronous and does not guarantee zero data loss
- Default option

Data Guard - Overview



Data Guard – Prerequisite Steps

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- Archivelog Mode

```
alter database archivelog;
```

- Password File

```
$ORACLE_HOME/bin/orapwd
```

- Highly Recommended – Force Logging

```
alter database force logging;
```

- Optional - Flashback Database

```
alter database flashback on;
```

Data Guard – Standby Redo Logs

- Total Standby Redo Logs = Total Redo Logs + 1

- Add to Primary before creating Standby Database

```
Alter database add standby
 logfile '<file_name>'
  size <size_bytes>;
```

Data Guard – Networking

- Estimating Bandwidth Requirements
  - See Support Note: 736755.1
  - Assumption 30% TCP/IP overhead
  - Good source for redo rate – Statspack / AWR

```
((redo rate bytes per sec / 0.7) * 8 / 1,000,000
```

  - Example with redo rate of 1Mb/sec

```
((1048576 / 0.7) * 8 / 1,000,000 = 11.98Mbps
```

- Update Listener – Add Static Entries
- Update tnsnames.ora (add both primary and standby)

Data Guard – Create Standby Database

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- Using RMAN Duplicate from Active Database

```
{
   allocate channel ch1 type disk;
   allocate auxiliary channel ach1 type disk;
   duplicate target database for standby from active database
   spfile
   parameter_value_convert 'prod','proddr'
   set db_unique_name='proddr'
   set db_file_name_convert='/u01/app/oracle/oradata/prod','/u01/app/oracle/oradata/proddr'
   set log_file_name_convert='/u01/app/oracle/oradata/prod','/u01/app/oracle/oradata/proddr'
   set control_files='/u01/app/oracle/oradata/proddr/control01.ctl'
   set log_archive_max_processes='4'
   set db_recovery_file_dest='/u01/app/oracle/fast_recovery_area'
   set db_recovery_file_dest_size='10G';
}
```

Data Guard – Monitoring

- On Primary

```
select al.dest_id as ArchiveDestination
    , al.thread# as Thread
    , max(al.sequence#) as LastSequenceArchived
from  v$archived_log al
where al.resetlogs_change# = (select resetlogs_change# from v$database)
group by al.dest_id, al.thread#
order by 1,2;

ARCHIVEDESTINATION     THREAD LASTSEQUENCEARCHIVED
------------------ ---------- --------------------
                 1          1                   24
                 2          1                   24
```

Data Guard – Standby Process Monitoring


```
SQL> select process, status, client_process, thread#, sequence#, delay_mins
       from v$managed_standby
       order by 1,4,5;
```

PROCESS	STATUS	CLIENT_P	THREAD#	SEQUENCE#	DELAY_MINS
ARCH	CONNECTED	ARCH	0	0	0
ARCH	CLOSING	ARCH	1	22	0
ARCH	CLOSING	ARCH	1	23	0
ARCH	CLOSING	ARCH	1	24	0
MRP0	**APPLYING_LOG**	**N/A**	**1**	**25**	**0**
RFS	IDLE	UNKNOWN	0	0	0
RFS	IDLE	UNKNOWN	0	0	0
RFS	IDLE	ARCH	0	0	0
RFS	IDLE	LGWR	1	25	0

Data Guard Broker

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- Manage and Maintain Data Guard
- Easy to configure
  - DGMGRL command line interface
  - Enterprise Manager
- Set DG_BROKER=TRUE on both Primary and Standby
- Quick and easy Failover / Switchover
- Commands can be executed on Primary or Standby

Data Guard Broker - Configuration

```
DGMGRL> connect sys/<password>

DGMGRL> create configuration 'MyDR' as
          primary database is prod
          connect identifier is prod;

DGMGRL> add database proddr as
          connect identifier is proddr;

DGMGRL> enable configuration;
```

```
DGMGRL> show configuration;

Configuration - MyDR

  Protection Mode: MaxPerformance
  Databases:
    prod   - Primary database
    proddr - Physical standby database

Fast-Start Failover: DISABLED

Configuration Status:
SUCCESS
```

Data Guard Broker – Overview

```
DGMGRL> show database prod;

Database - prod

  Role:            PRIMARY
  Intended State:  TRANSPORT-ON
  Instance(s):
    prod

Database Status:
SUCCESS

DGMGRL> show database proddr LogXptMode;
  LogXptMode = 'ASYNC'
DGMGRL>
```

```
DGMGRL> show database proddr

Database - proddr

  Role:            PHYSICAL STANDBY
  Intended State:  APPLY-ON
  Transport Lag:   0 seconds
  Apply Lag:       0 seconds
  Real Time Query: OFF
  Instance(s):
    proddr

Database Status:
SUCCESS

DGMGRL> show database proddr LogXptMode;
  LogXptMode = 'ASYNC'
DGMGRL>
```

Data Guard Broker – Overview

- Example Switchover (Role Switch)

```
DGMGRL> switchover to proddr;
```

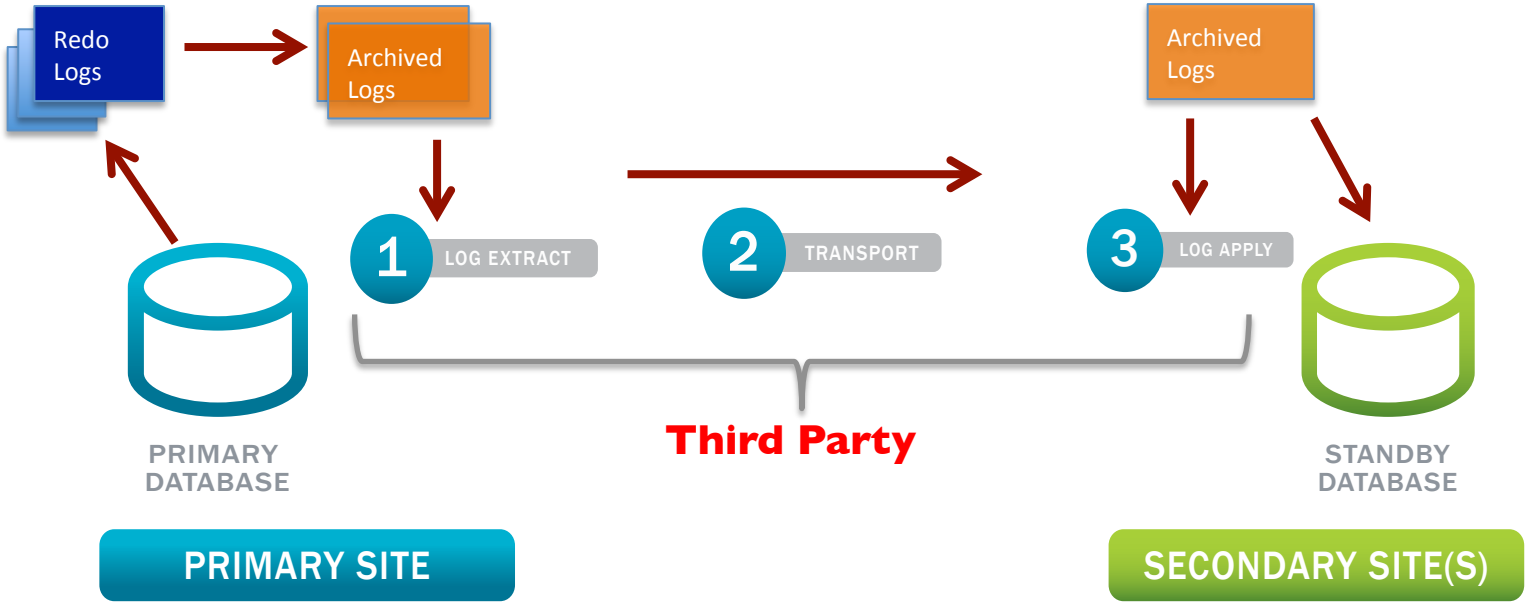
- Example Failover (Standby Activation)

```
DGMGRL> failover to proddr;
```

What is “Active Data Guard”?

- Requires additional license
- Provides two key functionalities
  - Real-Time Query
    - » Redo apply on read-only database
  - RMAN Block Change Tracking on Standby Database
    - » Implement fast incremental backups
- Offload reporting to Physical Standby Database
- Ideal for Read-Mostly applications

What about Standard Edition?



Standard Edition and Standby Databases

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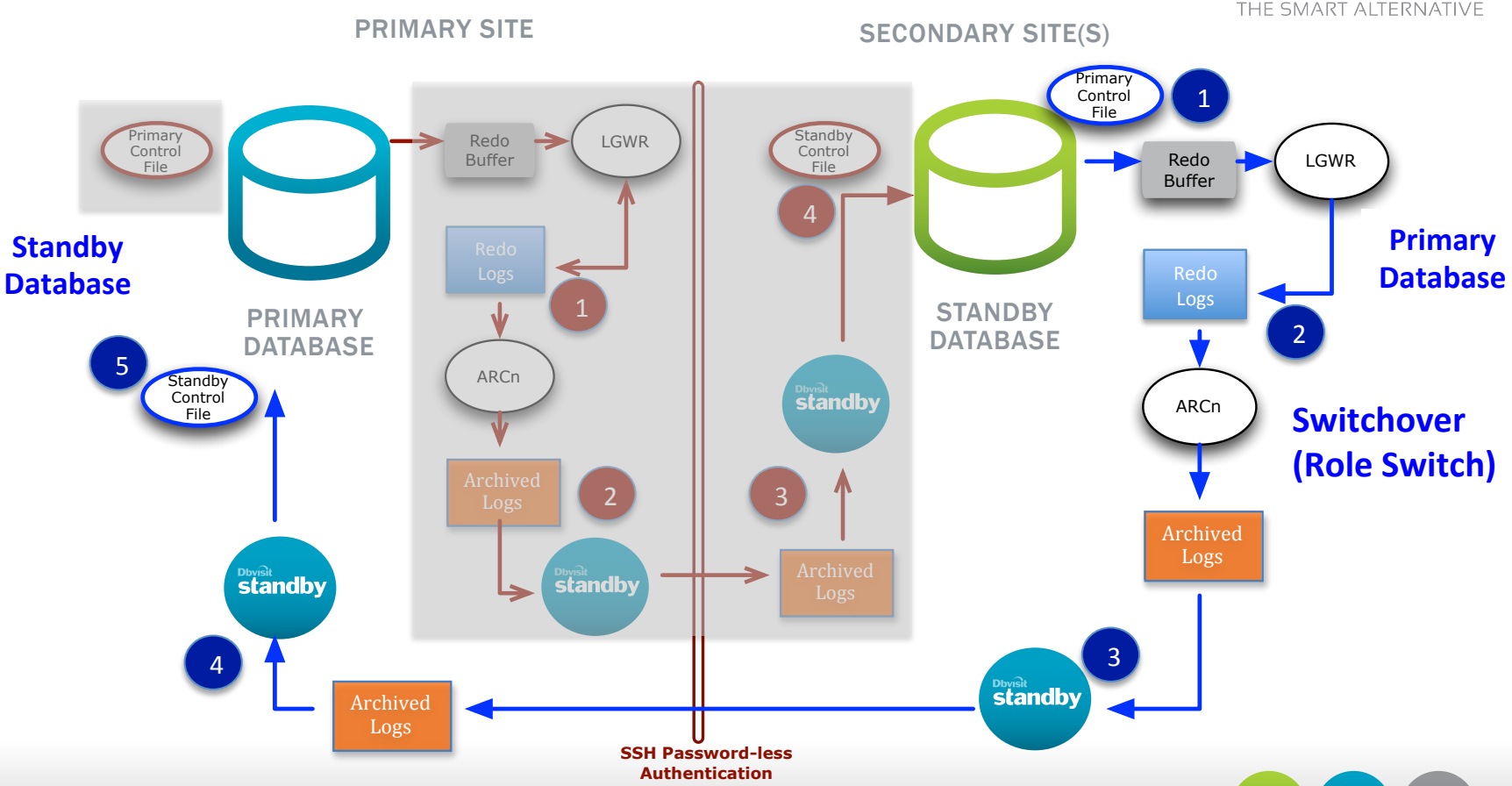
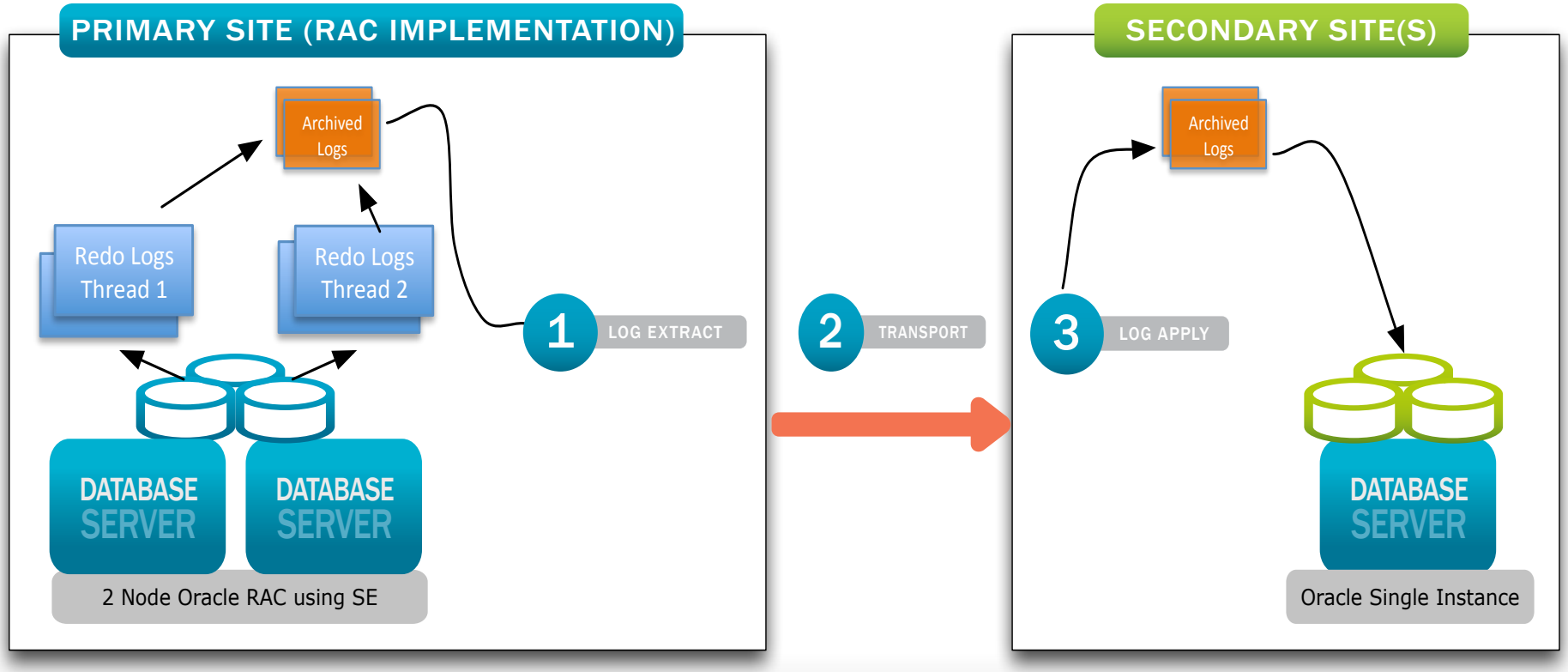
- Basic Redo Copy / Redo Apply
- Challenges when using custom Scripts
  - Documentation and Training
  - Complexities around ASM, OMF and Oracle RAC
  - Error handling (network or node outages)
- Why consider 3rd Party Products
  - Documentation and Support is available
  - It is proven and well tested (Role Switch / Activation)
  - Caters for ASM, OMF and Oracle RAC
  - Other options are provided (Create Standby Database)

Example 3rd Party Standby Management



Oracle RAC & Standby Database with SE



Flashback Database

- Have you ever wanted to rewind your database?
- You Can with Flashback Database!
- Key requirements
  - Enterprise Edition Only
  - Flash Recovery Area (FRA) must be configured
  - Applies to whole database
- Recommend good, fast storage for FRA
- Enable Monitoring
- Enable with command: `alter database flashback on;`

Flashback Database Functionality

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- Point-in-time recovery (restore points)
- Guaranteed Restore Points
  - Useful when doing code releases
  - Useful for Training or Testing environments
- Reinstate a primary database after standby Activation
- Integrated with RMAN
- Snapshot Standby Database

Example - Using Flashback Database

```
DGMGRL> failover to proddr;
Performing failover NOW, please wait...
Failover succeeded, new primary is "proddr"

DGMGRL> show configuration;

Configuration - MyDR

  Protection Mode: MaxPerformance
  Databases:
    proddr - Primary database
    prod   - Physical standby database (disabled)
      ORA-16661: the standby database needs to be reinstated

Fast-Start Failover: DISABLED

Configuration Status:
SUCCESS
```

Failover to (Activate) Standby Database

Example - Using Flashback Database

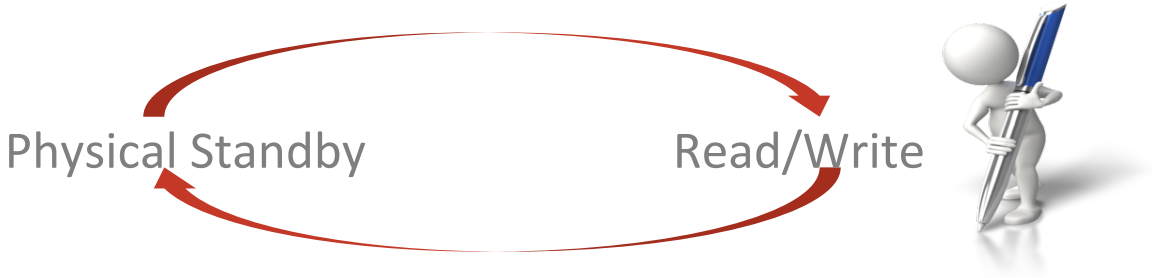
```
DGMGRL> reinstate database prod;
Reinstating database "prod", please wait...
Operation requires shutdown of instance "prod" on database "prod"
Shutting down instance "prod"...
Database closed.
Database dismounted.
ORACLE instance shut down.
Operation requires startup of instance "prod" on database "prod"
Starting instance "prod"...
ORACLE instance started.
Database mounted.
Continuing to reinstate database "prod" ...
Operation requires shutdown of instance "prod" on database "prod"
Shutting down instance "prod"...
ORA-01109: database not open
Database dismounted.
ORACLE instance shut down.
Operation requires startup of instance "prod" on database "prod"
Starting instance "prod"...
ORACLE instance started.
Database mounted.
Continuing to reinstate database "prod" ...
Reinstatement of database "prod" succeeded
```

Reinstate / Convert original primary database to standby

Example - Using Flashback Database

```
DGMGRL> show configuration;

Configuration - MyDR

  Protection Mode: MaxPerformance
  Databases:
    proddr - Primary database
    prod   - Physical standby database

Fast-Start Failover: DISABLED

Configuration Status:
SUCCESS

DGMGRL>
```

Snapshot Standby Database



- Requires Physical Standby Database
- Flashback Database enabled
- Standby receive archive logs, but do not apply
- Created from EM, DGMGRL or SQL*Plus
- Useful for:
  - Test Application upgrades
  - Performance Testing

Creating a Snapshot Standby Database

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- Convert Physical Standby to Snapshot Standby

```
DGMGRL> convert database proddr to snapshot standby;
```

- Convert Snapshot Standby back to Physical Standby

```
DGMGRL> convert database proddr to physical standby;
```

RMAN - Powerful Utility

- Ever lost an archive log before being applied to standby?
- What about a corrupt archive log?
- Or deleted the archive log by accident?

From 10gR2 no need to rebuild standby anymore!

- Resynchronize your Standby Database using RMAN
  - Unrecoverable Archive Gap
  - Nologging Operations

Roll forward a Standby Database

- Obtain current SCN on standby

```
SQL> select current_scn from v$database;
```

- Compare standby SCN with current primary SCN

```
SQL>  select scn_to_timestamp(1172500) PRODDR_SCN_TIMESTAMP
           , scn_to_timestamp(current_scn) PROD_SCN_TIMESTAMP
      from v$database;

PRODDR_SCN_TIMESTAMP          PROD_SCN_TIMESTAMP
----------------------------- -----------------------------
19/02/13 20:33:23.000000000   19/02/13 22:13:39.000000000
```

Run on Primary

Roll forward a Standby Database

- Start Incremental backup using standby database obtained SCN

```
RMAN> backup as compressed backupset
      incremental from scn 1172500 database
      format '/backup/rman/prod_inc_rolling_%U' tag 'FIXSTDBY';
```

- Catalog incremental backup on standby

```
RMAN> catalog start with '/backup/rman/';
```

- Start recovery on standby database

```
RMAN> recover database from tag 'FIXSTDBY' noredo;
```

Roll forward a Standby Database

- Recreate standby controlfile
  - On Primary

```
RMAN> backup current controlfile for standby format '/backup/rman/standby_ctl.bak';
```

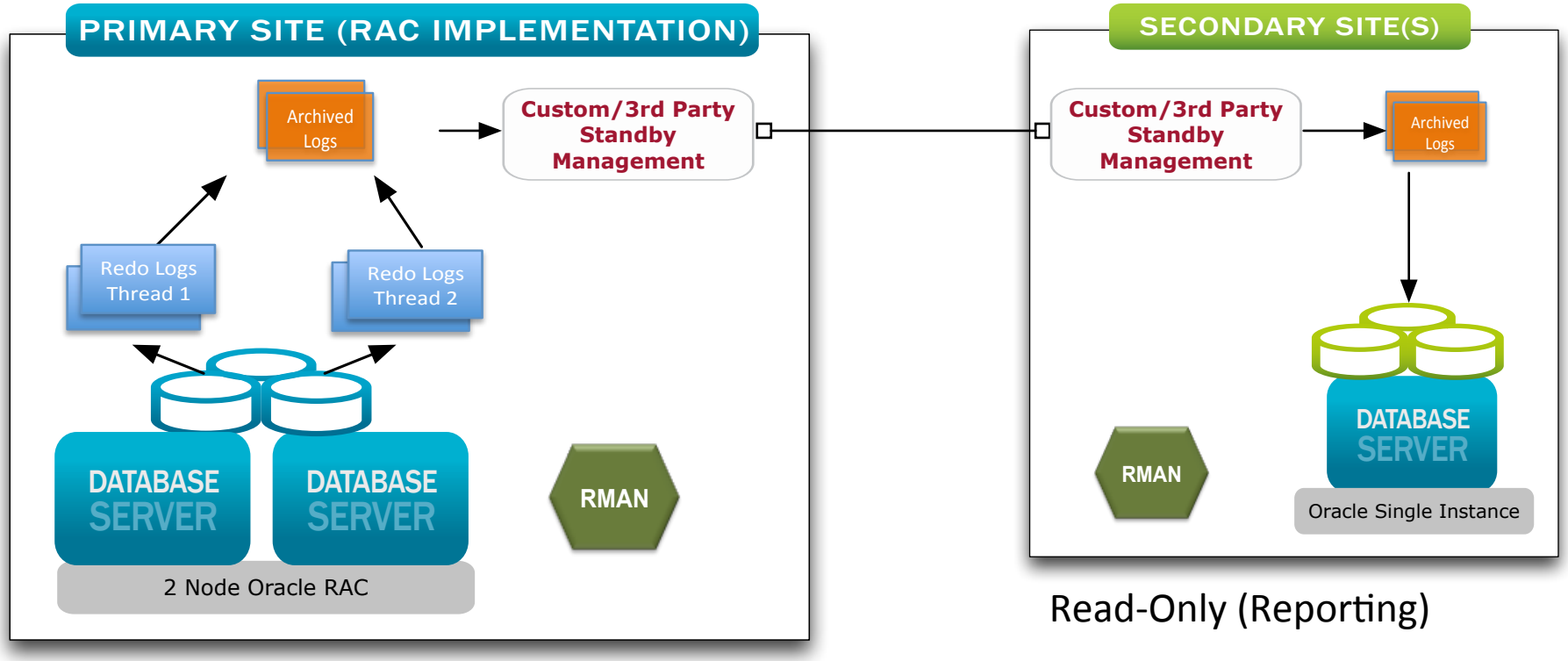
  - On Standby

```
RMAN> restore standby controlfile from '/backup/rman/standby_ctl.bak';
```

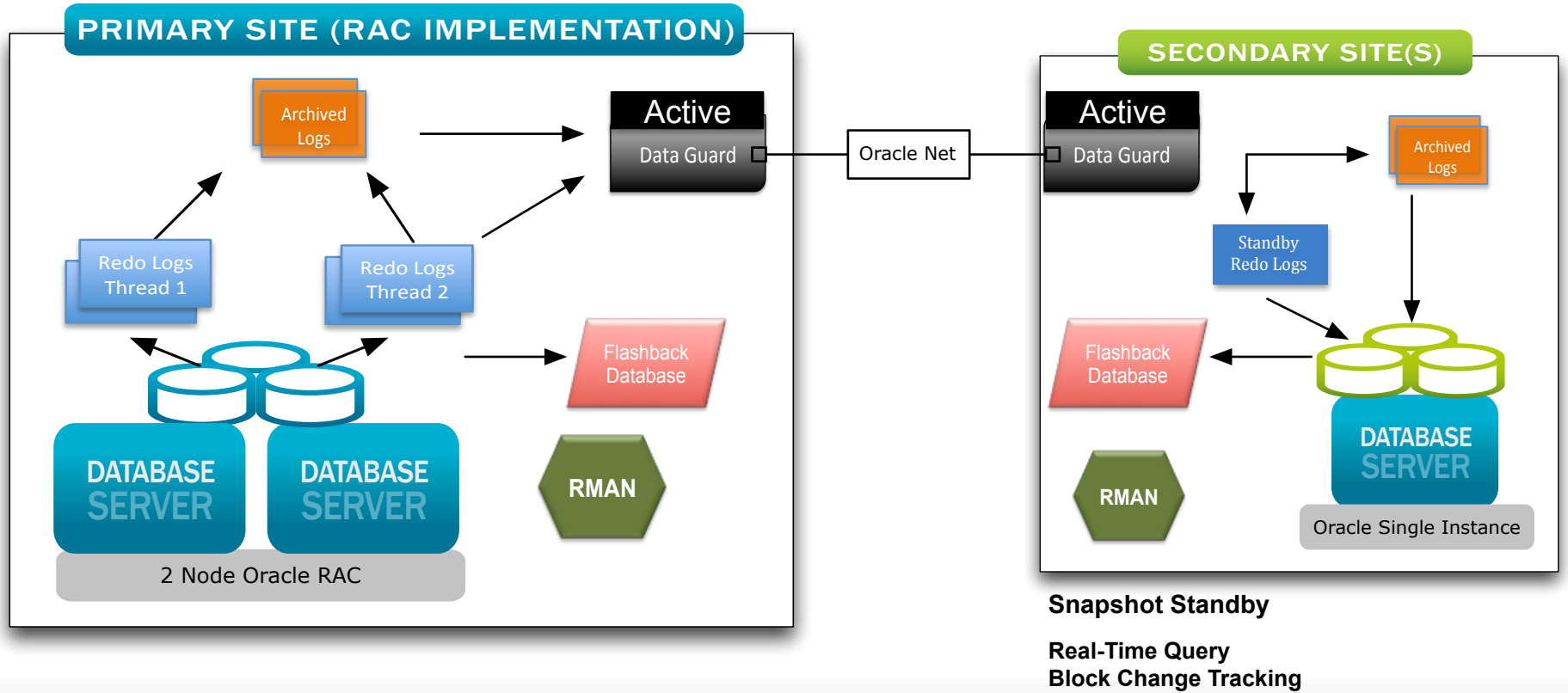
- If using Data Guard, clear the standby redo logs (Standby Server)

```
sql> alter database clear logfile group <standby_logfile_group>;
Example:
                SQL> alter database clear logfile group 4;
                Database altered.
```

Bringing it all together – Standard Edition



Bringing it all together - Enterprise Edition



Snapshot Standby

Real-Time Query
Block Change Tracking

Conclusion

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Oracle RAC

Standby Databases

Flashback Database

RMAN

What do they have in common

They will help you achieve a more Highly Available environment!

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Questions?

Thank you for attending

Achieving a more Highly Available Environment with Disaster Recovery?

Presented by

Anton Els
Dbvisit Software Limited
Email: anton.els@dbvisit.com
Twitter: @aelsnz
Blog: blog.dbvisit.com