ORACLE

Oracle Active Data Guard - Overview

Greg Walters
Sr. Technology Sales Consultant
INOUG – April 28, 2011

indiana ORACLE users group

Agenda

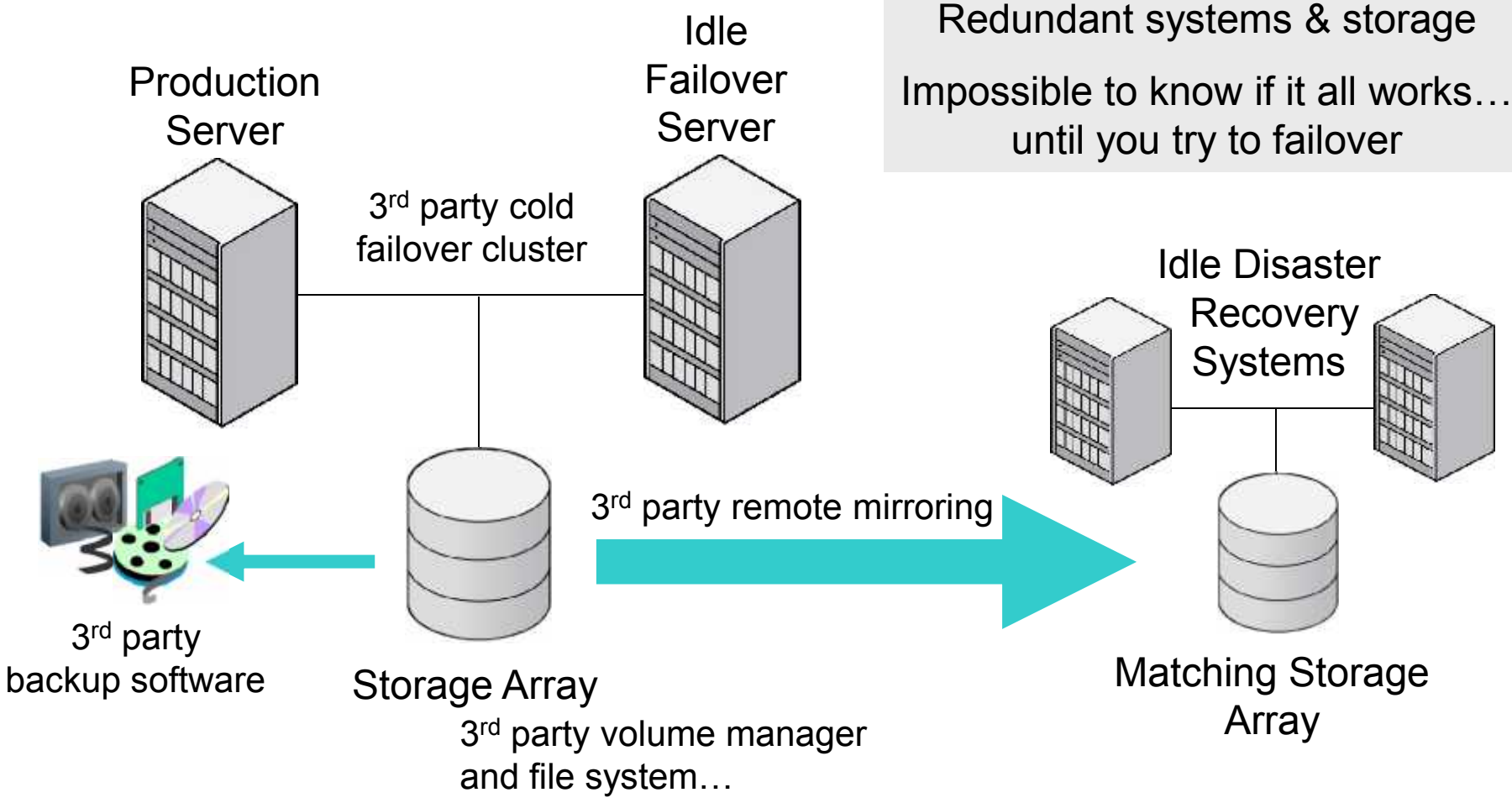
- Oracle Database High Availability
- Data Guard Overview
- Active Data Guard Details
- Customer Deployments
- Summary & Resources

Traditional High Availability

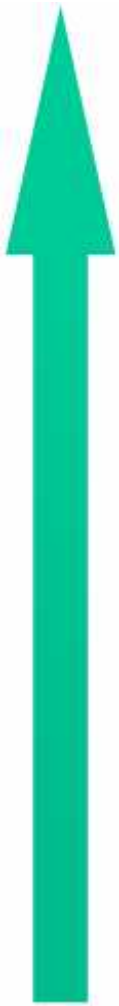
Expensive, Idle Redundancy

Redundant systems & storage

Impossible to know if it all works… until you try to failover



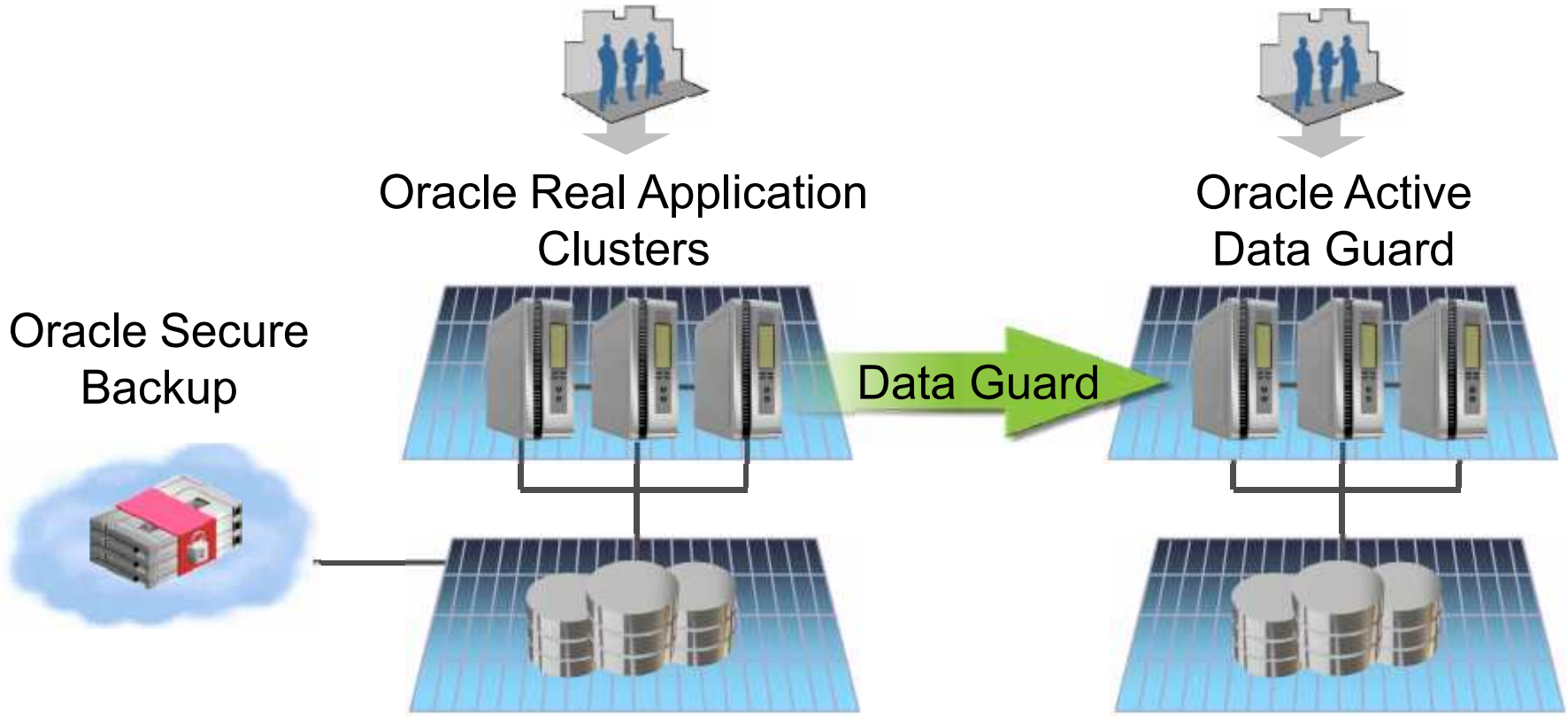
Oracle's HA Design Principles



- Complete
  - Minimize all planned and unplanned downtime
  - Offer a standard validated platform for maximum availability
- Application oriented
  - Protect and recover application objects
  - Enable online application changes
- Scale-out model
  - Low-cost commodity hardware
  - All components active in a grid infrastructure
- Integrated and simple
  - Built-in HA with pluggable components
  - Automatic - eliminate manual processes

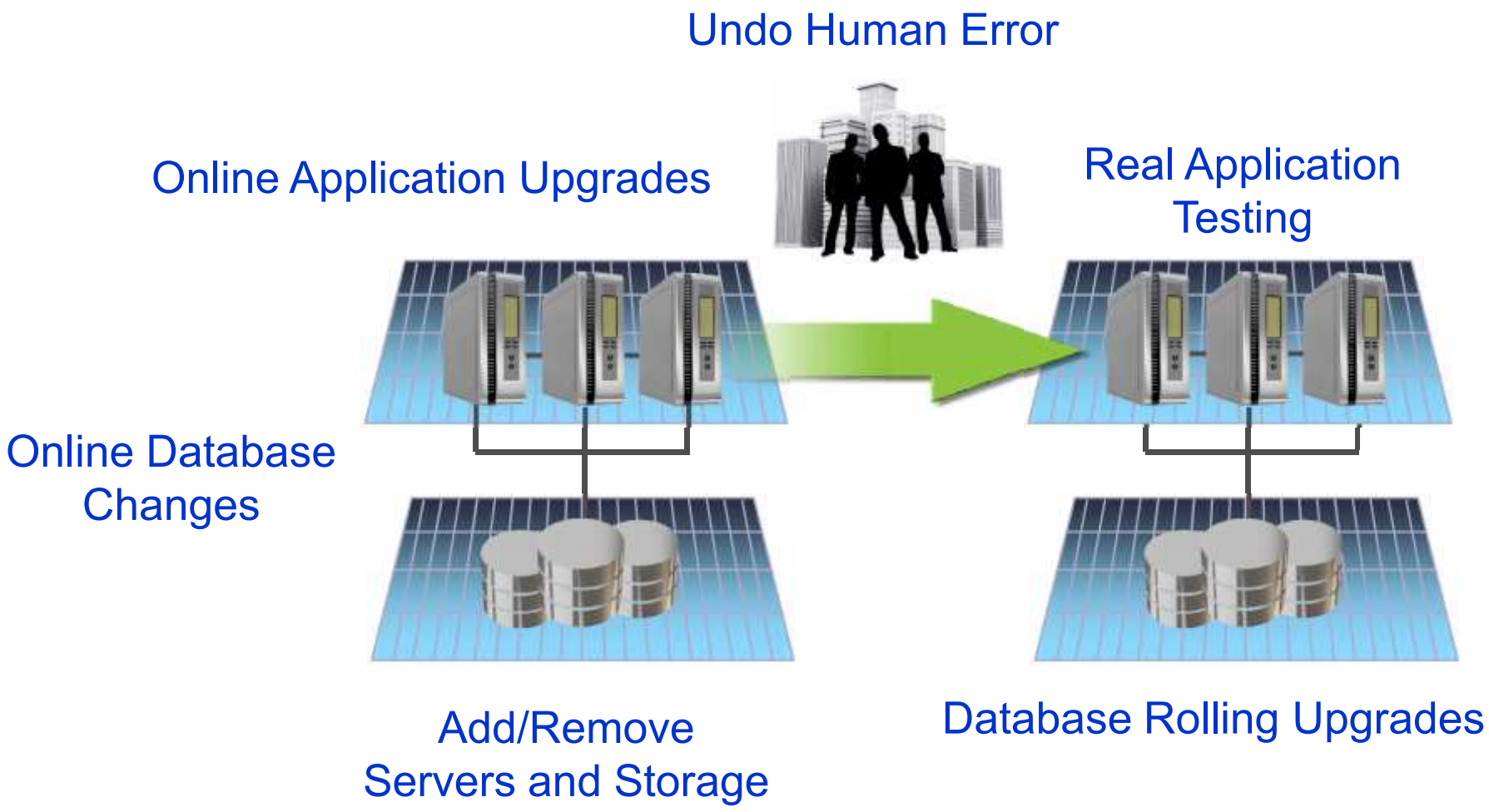
Oracle Maximum Availability Architecture

Low-cost, Integrated, Fully Active, High ROI



Oracle Maximum Availability Architecture

Eliminate Planned Downtime



Jon Waldron
Executive Architect
Commonwealth Bank of Australia

"High availability is absolutely essential for us…we now use Oracle RAC for instance failover, Data Guard for site failover, ASM to manage our storage, and Oracle Clusterware to hang the whole thing together."

ORACLE

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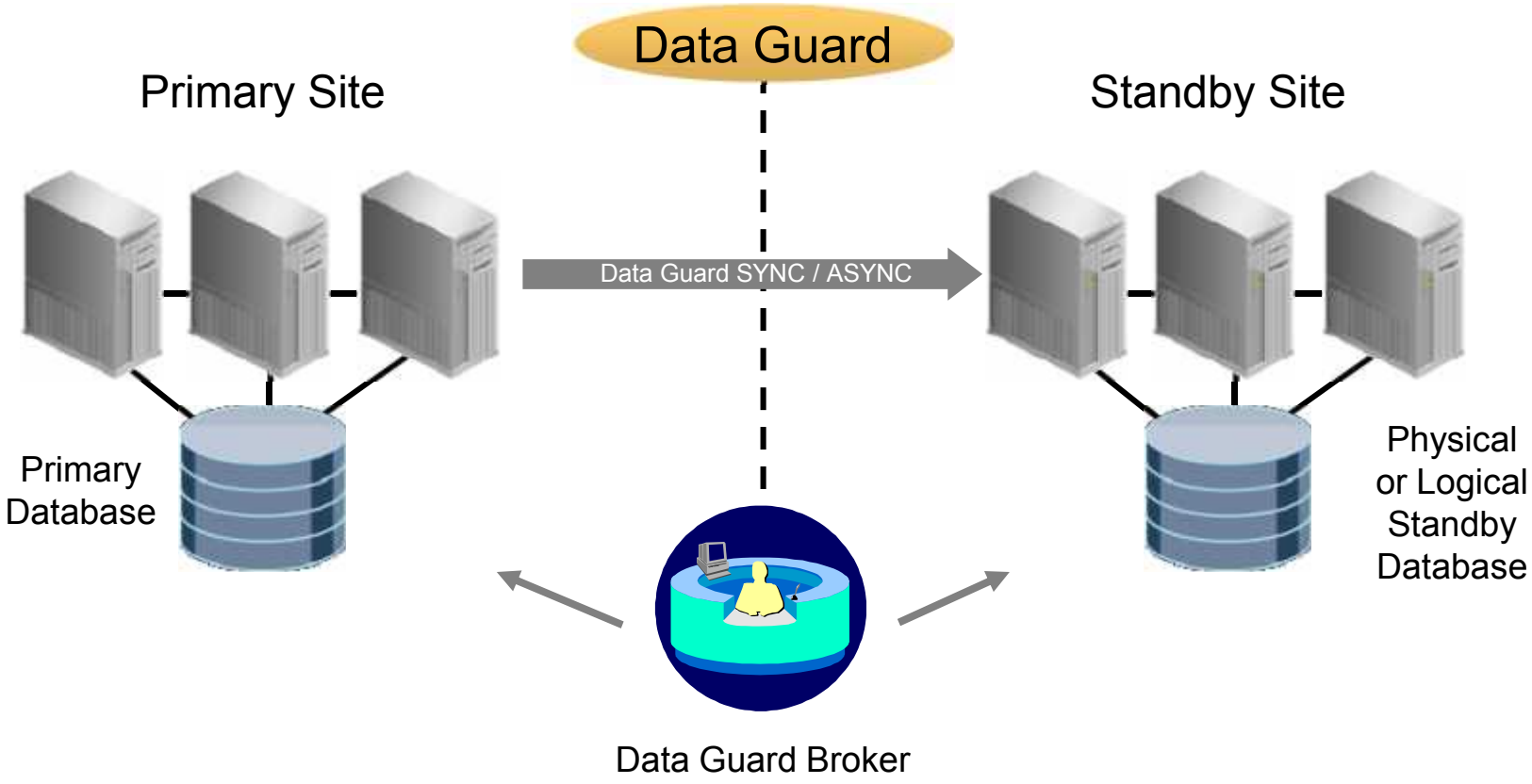
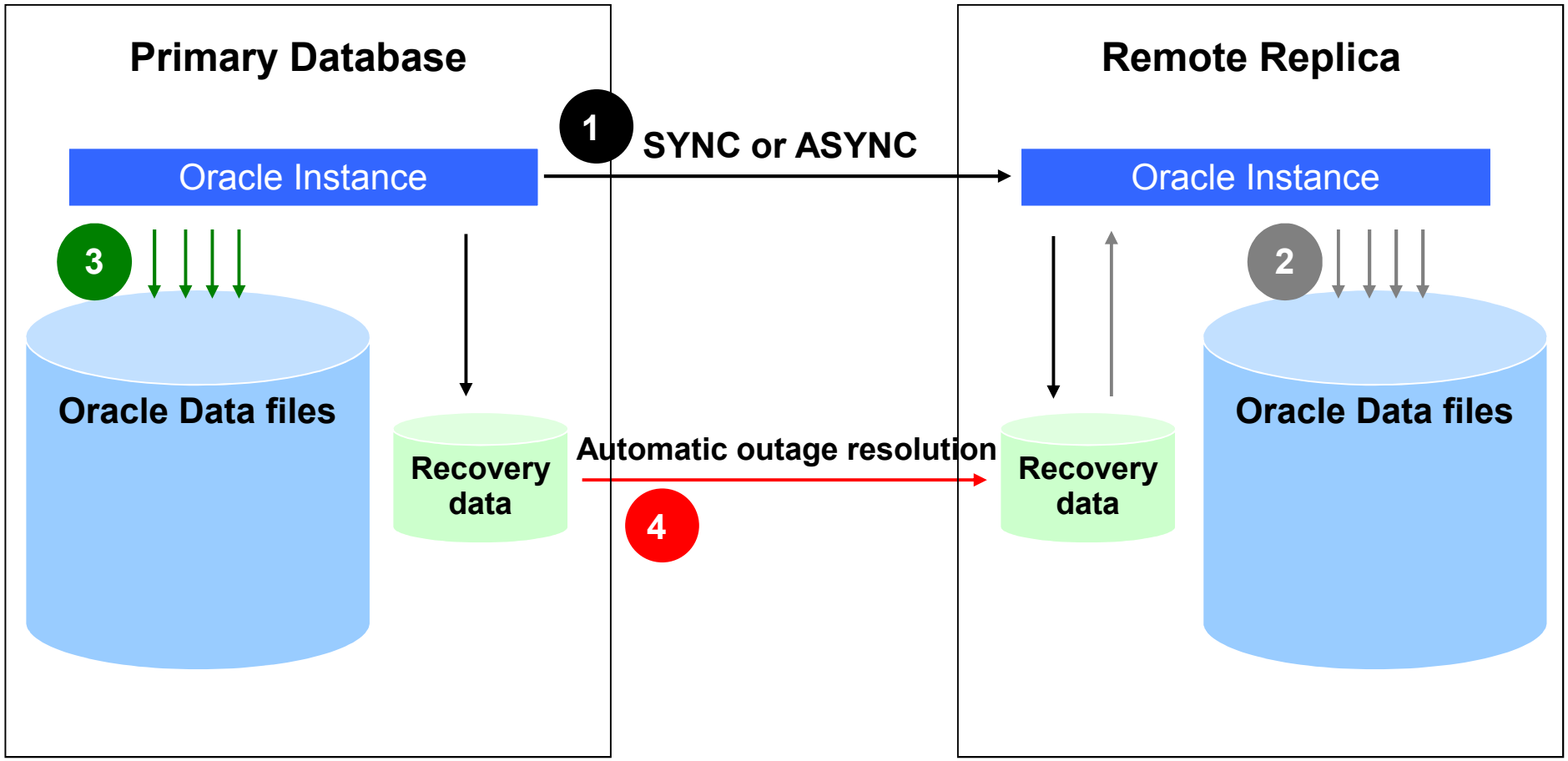
What is Oracle Data Guard?

Best Data Protection and Availability for Oracle Databases



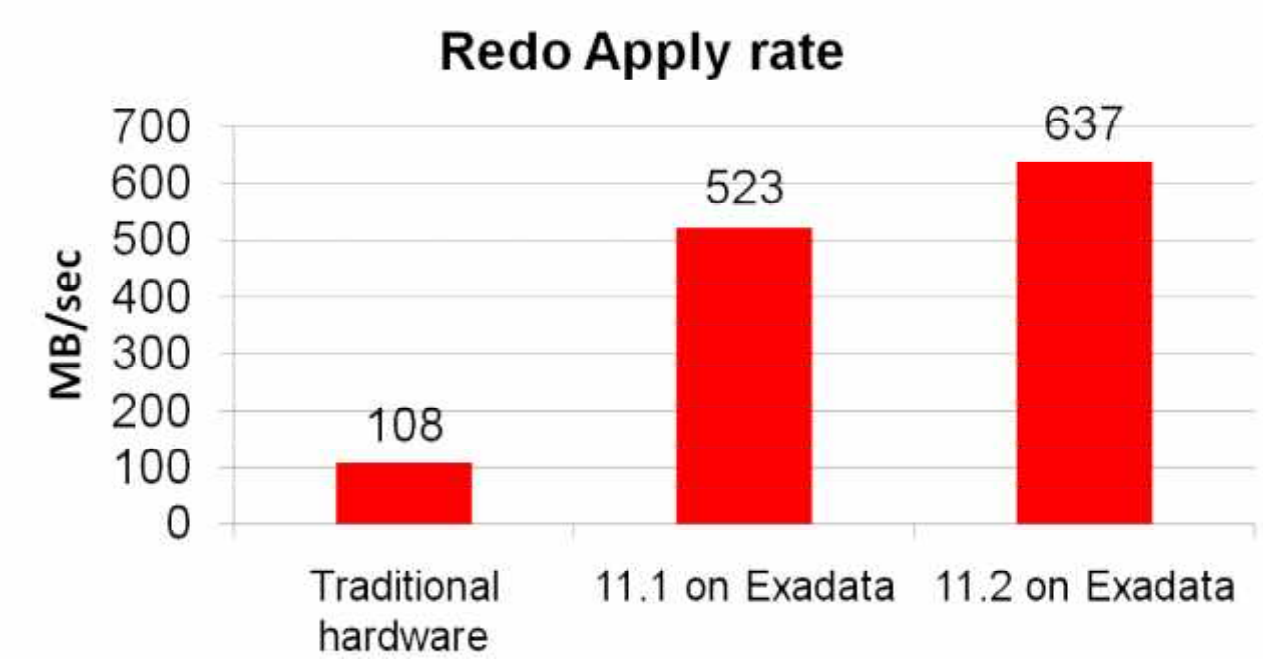
Data Guard Architecture

Simple, Integrated, Reliable, Fast



Data Guard Redo Apply Rate

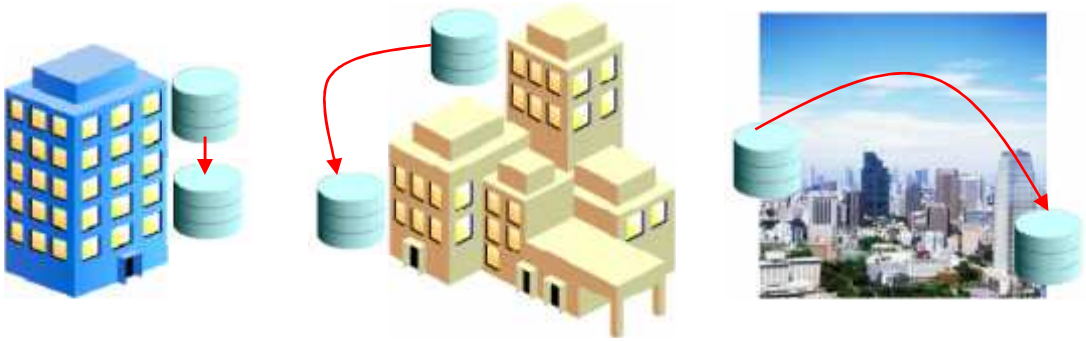
Extreme Performance on Exadata



Two Terabytes/hour

Data Guard

Essential for High Availability



LAN & MAN deployments provide Local HA and DR

Extend to a Wide Area Network and add remote DR

Data Guard Capabilities

1. Built-in Oracle integration: ensures transactional consistency
2. Extremely high performance
3. Transparent operation, supports all Oracle features and data types
4. Application-integrated failover
5. Combined HA/DR solution
6. Loosely coupled architecture: ensures fault isolation
7. Protection from data corruptions
8. Ensures zero data loss
9. DR servers can be utilized for testing while providing DR
10. Addresses both planned and unplanned downtime
11. No vendor lock-in for storage
12. Minimal network consumption
13. No distance limitation

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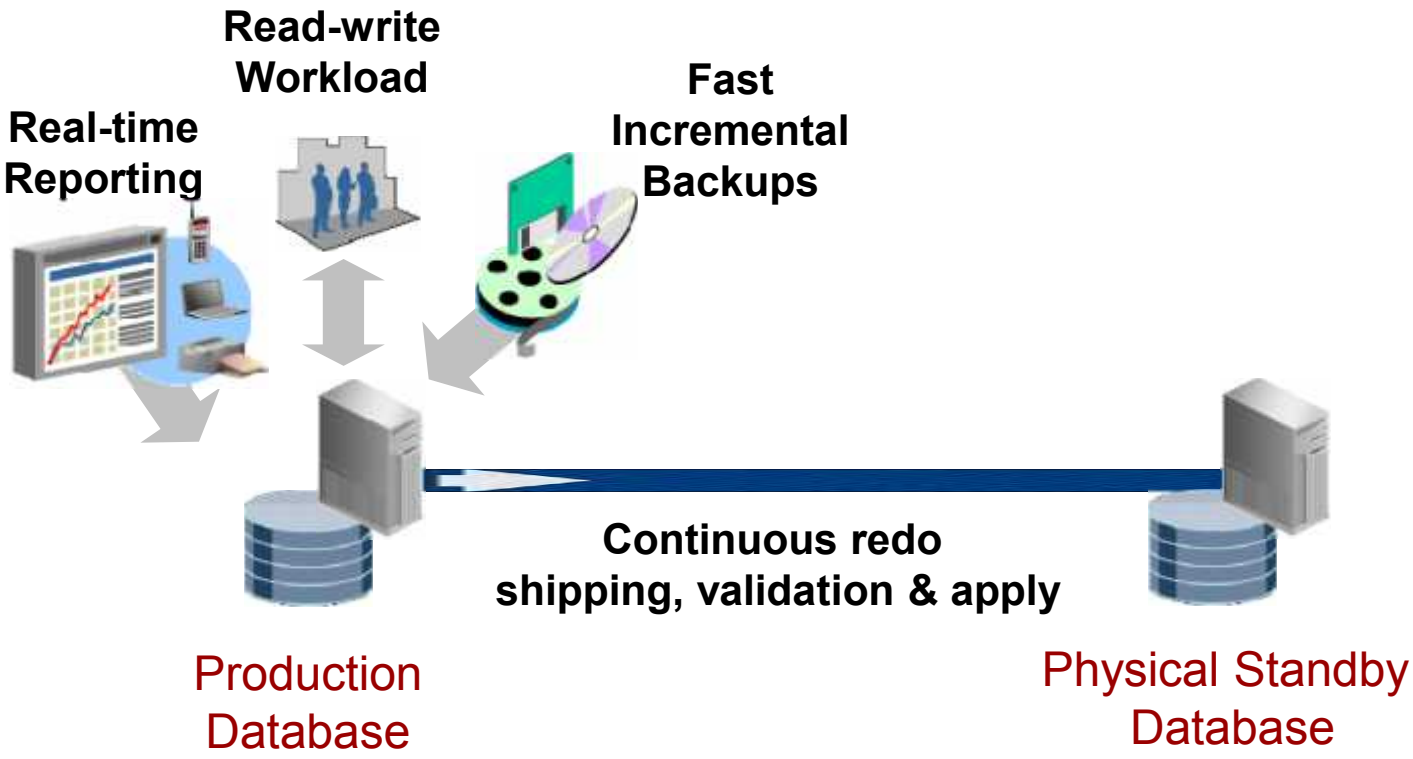
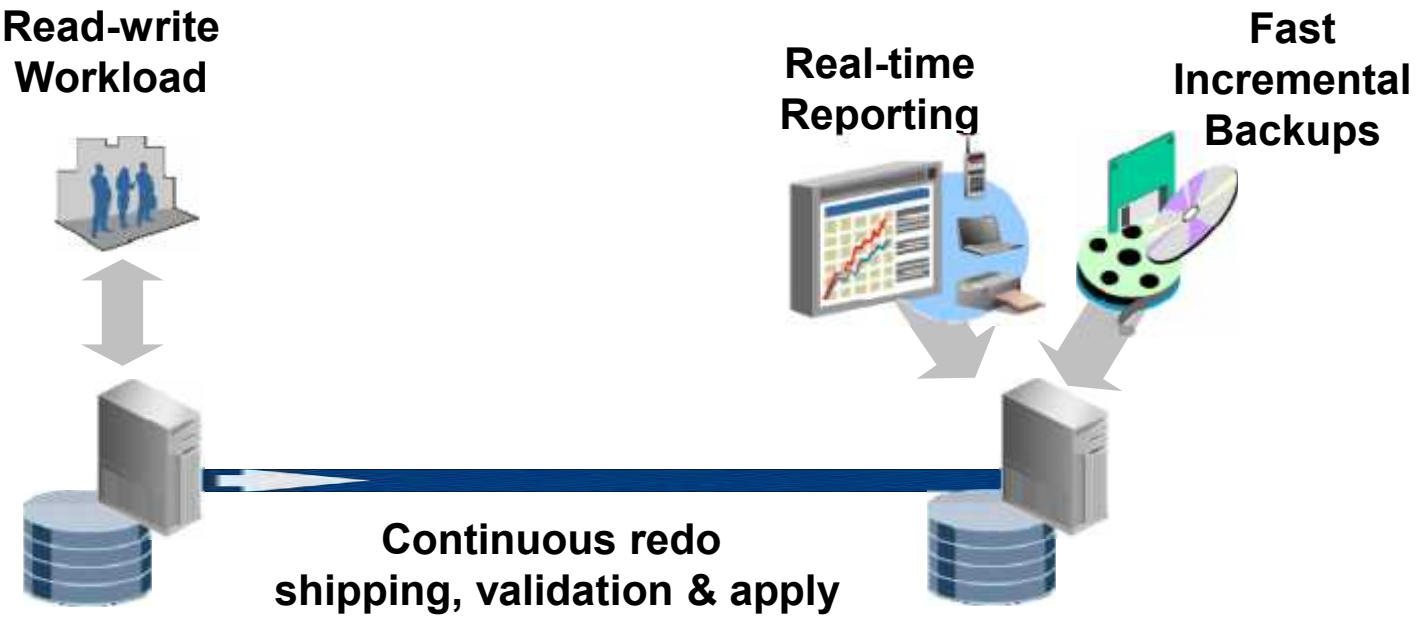
Data Guard

Standby Database: Failover Target



Active Data Guard

Standby Database: Offload Production + Failover Target



Sue Merrigan
Director, Information Management
Intermap Technologies

"Oracle Active Data Guard was a quick win. We easily dual-purposed our ten terabyte standby database for both disaster protection and for secure read-only access to our public-facing eCommerce applications."

Active Data Guard Use Examples

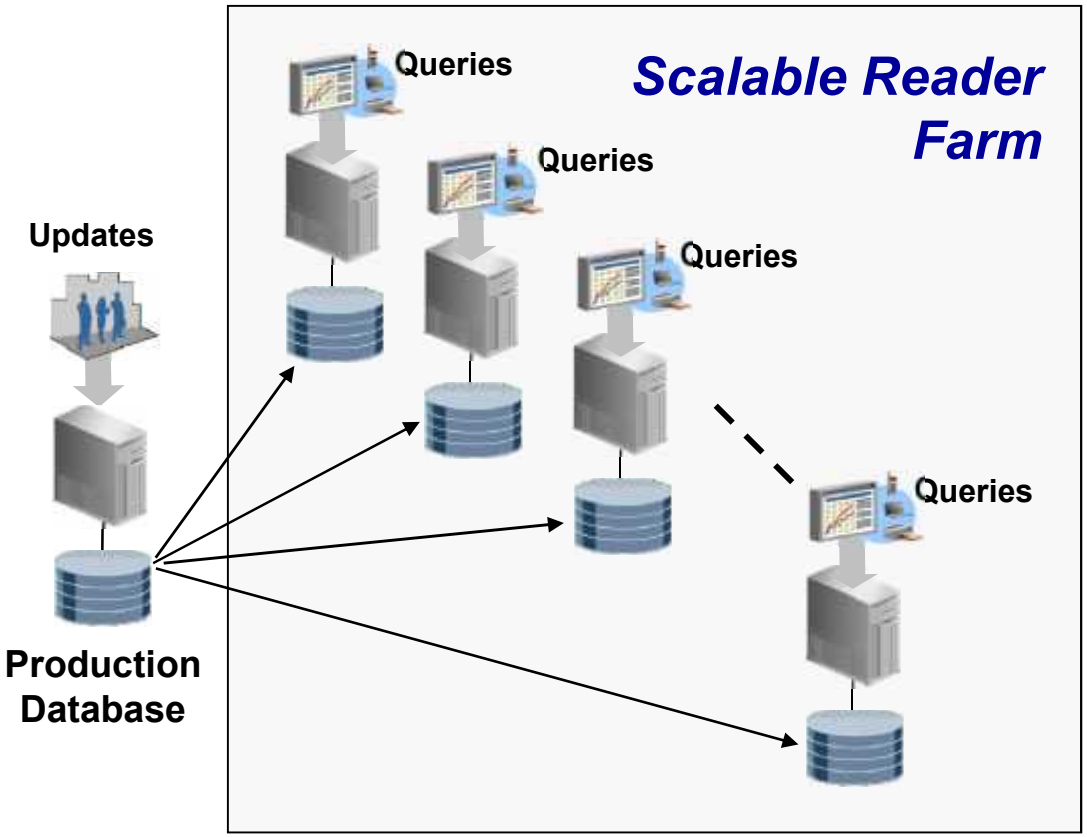
- **Education** – Report student grades, campus directory, course catalogs, …
- **Financial** – View past transactions, market prices, archived statements, …
- **Healthcare** – Access medical records, search doctors, facilities, …
- **Legal** – Access legal reports, trial histories, jury verdicts, …
- **Telecommunications** – View usage history, unused minutes, billing rates, …
- **Transportation** – Track packages, view delivery rates, …
- **Web-business** – Browse catalogs, web downloads, enquire order status, …

Bottom Line …

- Most businesses require significant number of read-only operations
- Use Active Data Guard to:
  - Offload these operations to physical standbys, and thus
  - Unlock additional processing power of the production database

Active Data Guard Reader Farms

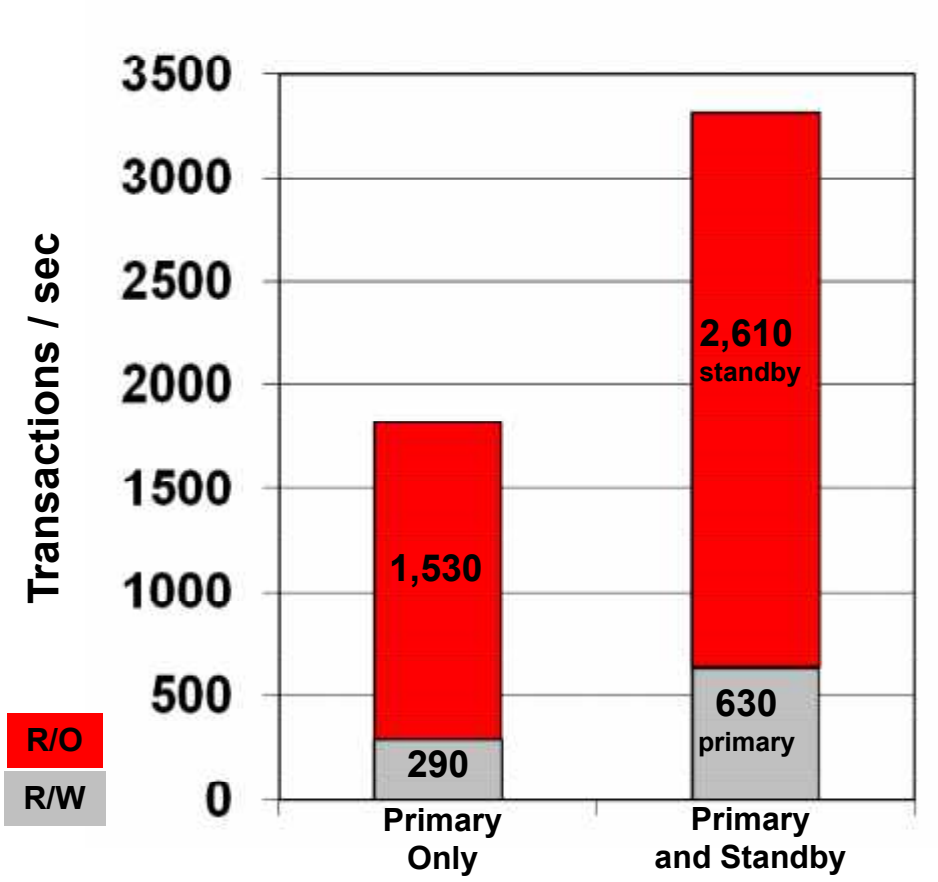
Unlimited Read Scalability, with DR



- Up to 30 active standby databases
- Flexible options to scale read performance
  - Add more single-node active standby databases, or
  - Scale an active standby database using Oracle RAC

Active Data Guard - Scale all Workloads

Utilize Primary and Standby Databases



- Double read-write throughput
- Increase read-only throughput by 70%
- Eliminate contention between read-write and read-only workload
- Simplify performance tuning

Data Guard vs. Active Data Guard

Zero Impact to Recovery Time Objective (RTO)

Data Guard 11*g*

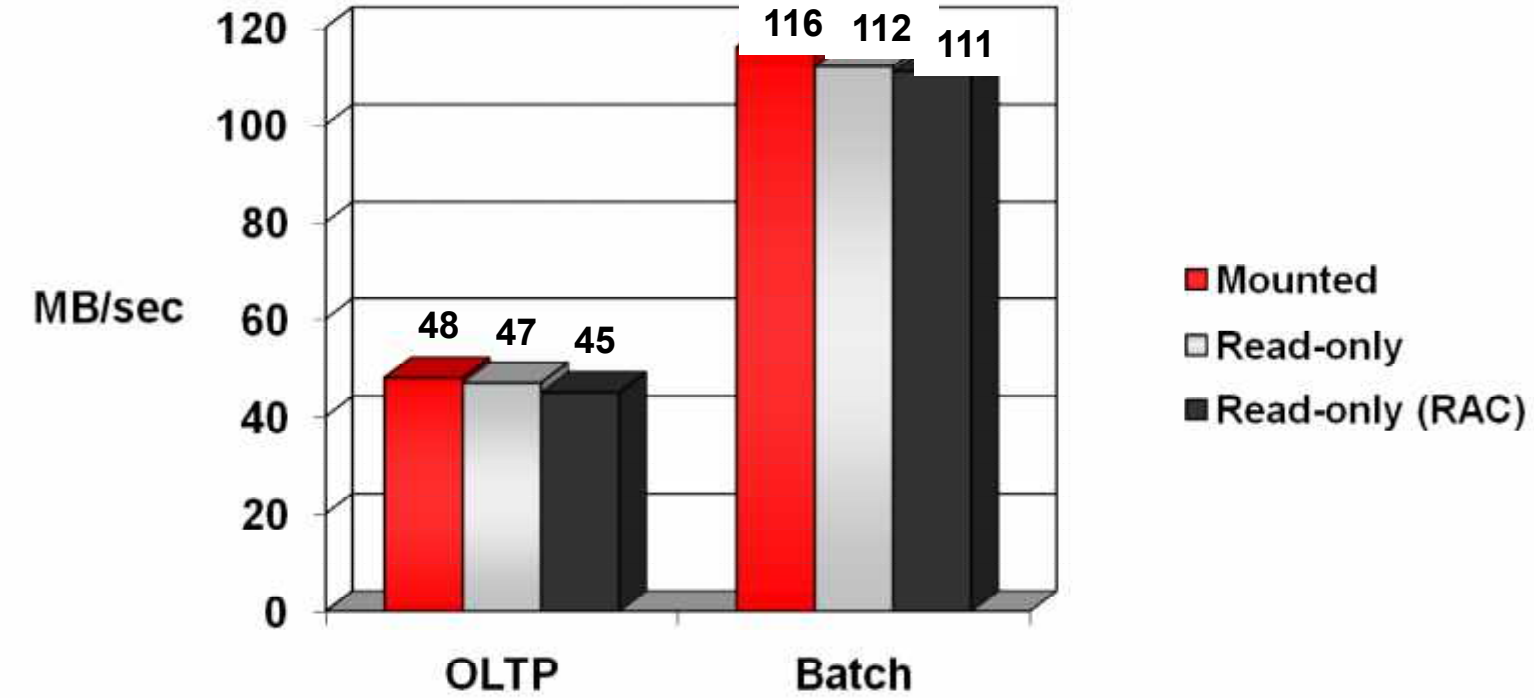
- Stop redo apply at 8am
- Open read-only for queries
- By 4pm, data on physical standby is 8 hours old
- Any failover will be delayed due to backlog of data that must be applied

Active Data Guard 11g

- Redo apply is always on
- Always open read only
- Queries and reports always see latest data
- Failover is immediate when needed, standby database always up-to-date

Maintain Recovery Time Objective

Even at Very High Recovery Rates



- No significant performance impact on redo apply when apply instance is simultaneously open read-only

Enabling Active Data Guard

Using SQL*Plus

- If physical standby database is shutdown
  - Open database read-only and start redo apply

```
SQL> STARTUP;
SQL> ALTER DATABASE RECOVER MANAGED STANDBY DATABASE
  2  USING CURRENT LOGFILE DISCONNECT;
```

- If Redo Apply is running
  - Stop redo apply, open database read-only, restart redo apply

```
SQL> ALTER DATABASE RECOVER MANAGED STANDBY DATABASE
  2  CANCEL;
SQL> ALTER DATABASE OPEN READ ONLY;
SQL> ALTER DATABASE RECOVER MANAGED STANDBY DATABASE
  2  USING CURRENT LOGFILE DISCONNECT;
```

Enabling Active Data Guard

Using Data Guard Broker

- Oracle Database 11g Release 1

```
DGMGRL> edit database ADG set state='apply-off';

SQL> alter database open read only;

DGMGRL> edit database ADG set state='apply-on';
```

- Oracle Database 11g Release 2

```
SQL> alter database open read only;
```

  - The Broker will automatically stop Redo Apply and the restart it after the open has completed

Confirming Active Data Guard is Enabled

- Verify whether physical standby open read-only and Redo Apply is running:

```
SQL> SELECT OPEN_MODE FROM V$DATABASE;

OPEN_MODE
--------------------
READ ONLY WITH APPLY
```

Determining Query Latency

Manually Monitor and Respond to Apply Lag

- Query **V$DATAGUARD_STATS** to calculate lag

```
SQL> SELECT name, value, datum_time, time_computed
  2 FROM V$DATAGUARD_STATS WHERE name like 'apply lag';
NAME       VALUE         DATUM_TIME            TIME_COMPUTED
---------- ------------ -------------------- --------------------
apply lag +00 00:00:00  09/25/2009 13:14:11 09/25/2009 13:14:11
```

- New 11.2 **V$STANDBY_EVENT_HISTOGRAM** view

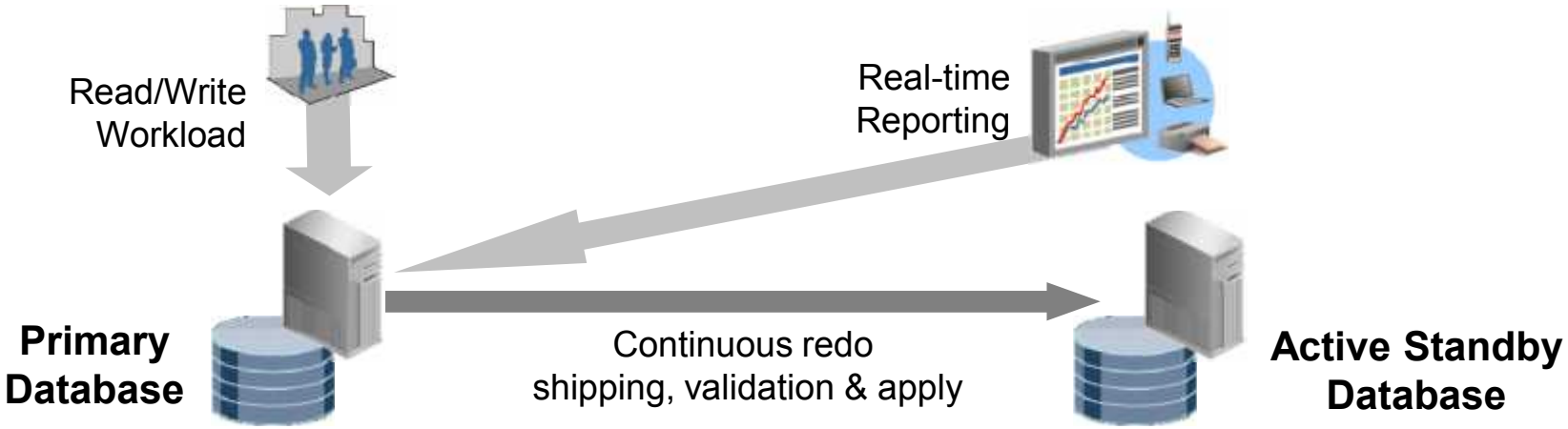
```
SQL> SELECT * FROM V$STANDBY_EVENT_HISTOGRAM
  2 WHERE NAME = 'apply lag' AND COUNT > 0;
NAME          TIME UNIT  COUNT  LAST_TIME_UPDATED
------------ ---------- ------ -------------------
apply lag    0 seconds  48612  09/25/2009 13:20:02
apply lag    1 seconds    102  09/25/2009 13:15:09
apply lag    2 seconds     16  09/25/2009 12:20:58
apply lag    3 seconds      4  09/25/2009 11:15:56
```

Active Data Guard Query SLA

Automatically Monitor and Respond to Apply Lag

- Pre-configure the maximum apply lag allowed
- Data Guard automatically enforces the limit you set

- Query receives error if apply lag exceeds SLA
- Applications can be coded to redirect query to primary database to satisfy SLA



Oracle Database 11g Release 2

Query SLA Options

- Session setting: **STANDBY_MAX_DATA_DELAY**
  - **NONE**: queries will be executed regardless of apply lag (Default)
  - **Non-zero** (seconds): queries will be executed only if the apply lag is less than or equal to **STANDBY_MAX_DATA_DELAY**.
    - If delay setting exceeded an error is returned

```
ORA-03172: STANDBY_MAX_DATA_DELAY of 2 seconds exceeded
```

    - Application then decides what to do.
  - **Zero**: queries guaranteed to return the exact same result as if the query were issued on the primary database, otherwise the error ORA-03172 is returned
    - Requires Maximum Availability and Real-Time Apply

Enabling an SLA

- Use a logon trigger to set the maximum delay whenever a user logs into the standby

```
SQL> connect sys/oracle@prod as sysdba
Connected.
SQL> CREATE OR REPLACE TRIGGER hr_logon_set_SLA_trigger
  2  AFTER LOGON ON hr.schema
  3  BEGIN
  4   IF (SYS_CONTEXT('USERENV','DATABASE_ROLE')
  5      IN ('PHYSICAL STANDBY'))
  6   THEN
  7    execute immediate 'ALTER SESSION SET STANDBY_MAX_DATA_DELAY=2;'
  8   END IF;
  9   END;
 10  /

Trigger created.
```

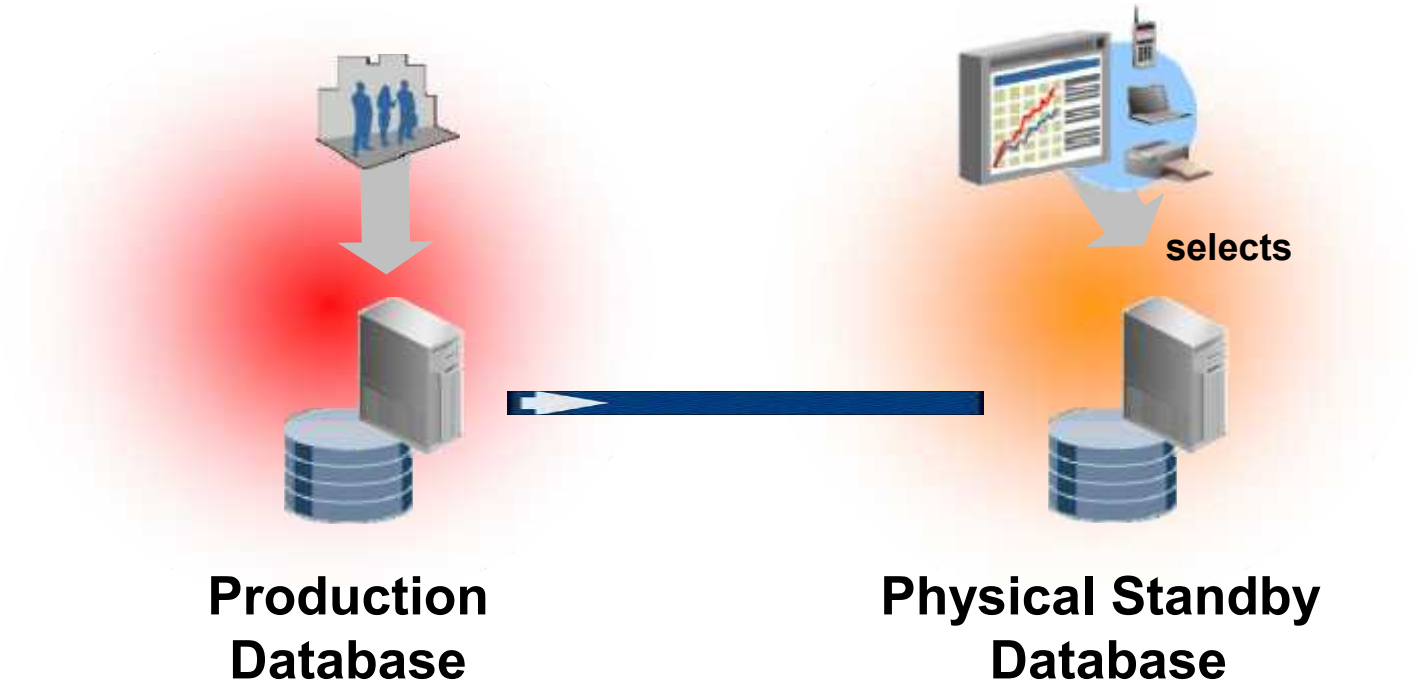
Routing User Connections

Role Transitions – Switchover or failover

- At the Active Data Guard standby (new primary)
  - User connections to read-only services are disconnected
  - Read-write services appropriate to primary role are enabled automatically when standby becomes primary
    - Any services not appropriate for primary role are stopped
  - Clients connect to primary services
- At the new Active Data Guard standby (old primary)
  - Read-only services are enabled automatically
  - Clients connect to read-only services
- Simplified using role-based database services
  - New in Oracle Database 11g Release 2
    - Replaces triggers used to start/stop services in previous releases
    - Requires Data Guard Broker

Applications & Active Data Guard

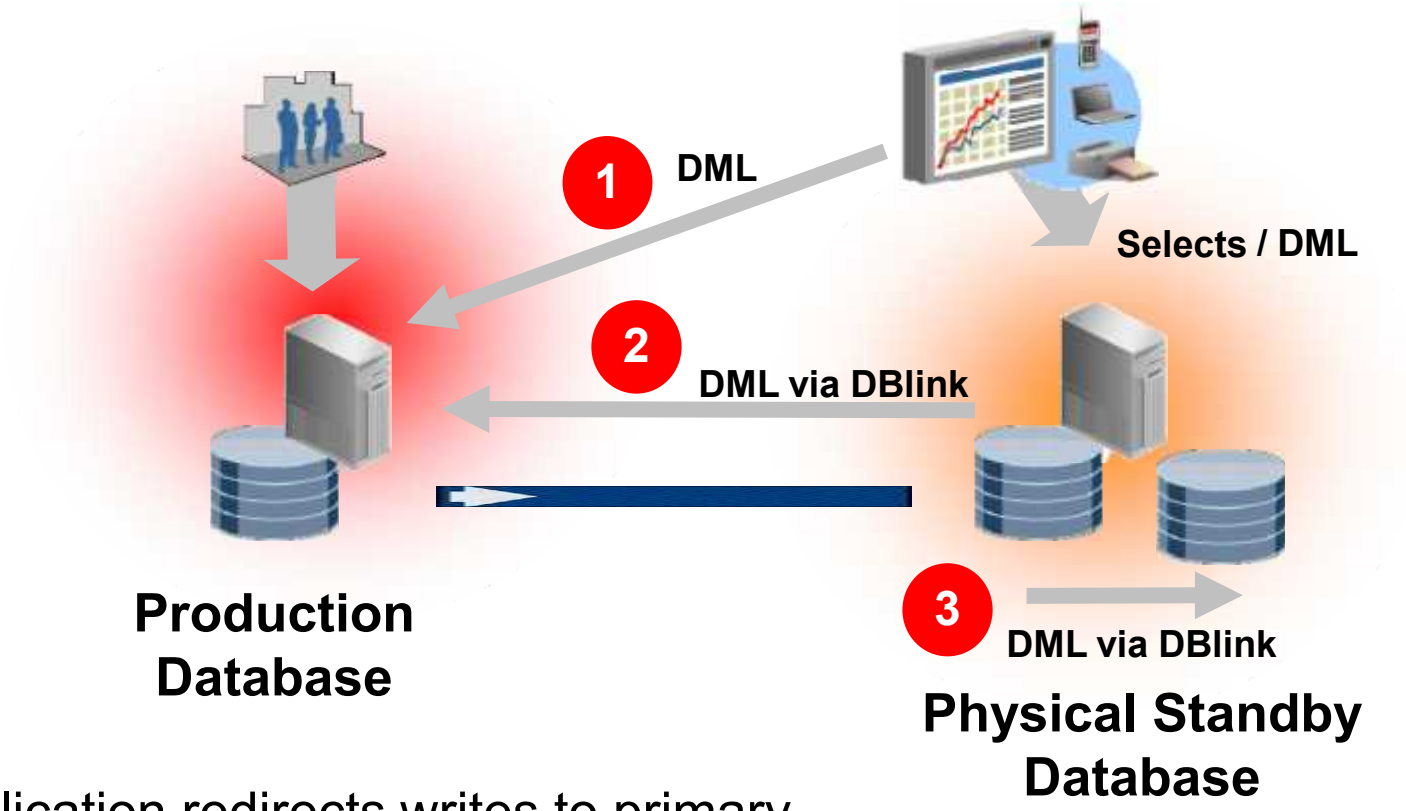
Pure Read-Only Application Model



- Application directs read-only access to the standby

Applications & Active Data Guard

Three Read-Mostly Application Models



1. Application redirects writes to primary
2. Writes redirected to primary via database link
3. Writes redirected to a separate database via a database link

Creating DBlinks for the Standby

- DBlinks used by the standby to redirect writes to the primary, are created on the primary and propagated to the standby via redo
  - On the Primary

```
SQL> CREATE DATABASE LINK sales_prmy USING 'sales_rw';
```

  - On the standby

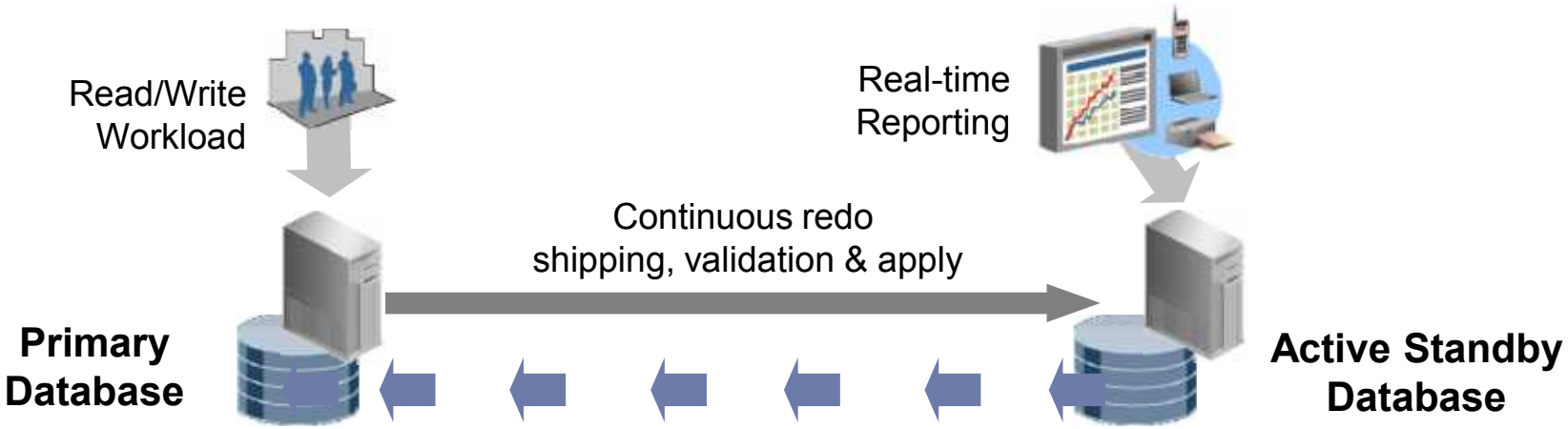
```
SQL> insert into emp@sales_prmy values (999,'SMITH','GEEK',999,sysdate,1,0);
SQL> commit;
SQL> select * from emp where empno=999;

     EMPNO ENAME      JOB              MGR HIREDATE         SAL       COMM
---------- ---------- --------- ---------- --------- ---------- ----------
       999 SMITH      GEEK             999 23-OCT-07          1          0
```

Active Data Guard Auto Block Repair

High Availability by Repairing Corruptions Online

- Automatic Block Repair
  - When Oracle detects corrupt blocks at the primary database, it will repair online by copying the good version from an active standby database (and vice versa)
  - Transparent to the user and application



Oracle Database 11g Release 2

Active Standby Performance Statistics

- Standby statspack in Oracle Database 11g
  - Uses DBlink to write back to the primary database
  - Create stdbyperf user on primary
  - Add standby databases and instances
  - Execute snaps
  - Generate reports
  - Requires perfstat user and statspack installation
  - See Support Note 454848.1
- In-memory Active Session History (ASH) support for real-time stats for Active Standby Database
  - Included in Oracle Database 11g Release 2
  - Available via back port for Oracle Database 11.1.0.7

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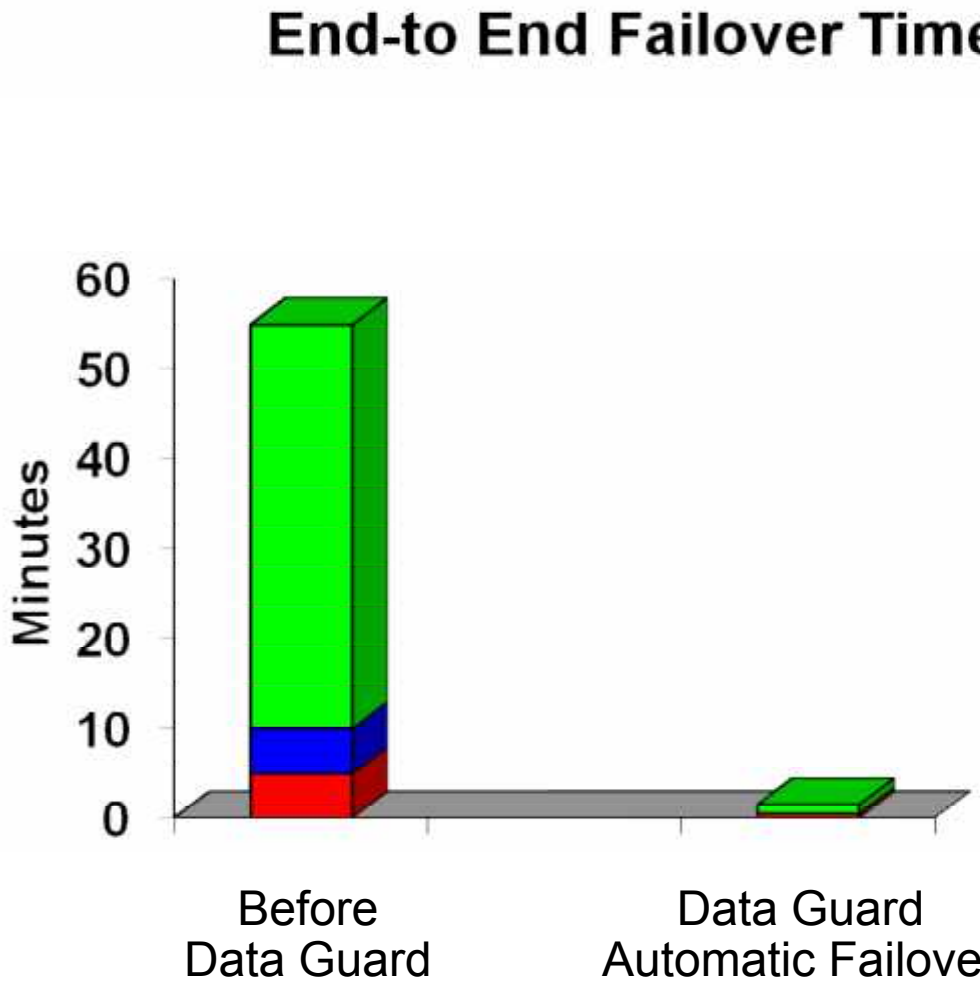
Amazon.com

High Availability Integrated with Disaster Recovery



With Data Guard HA/DR

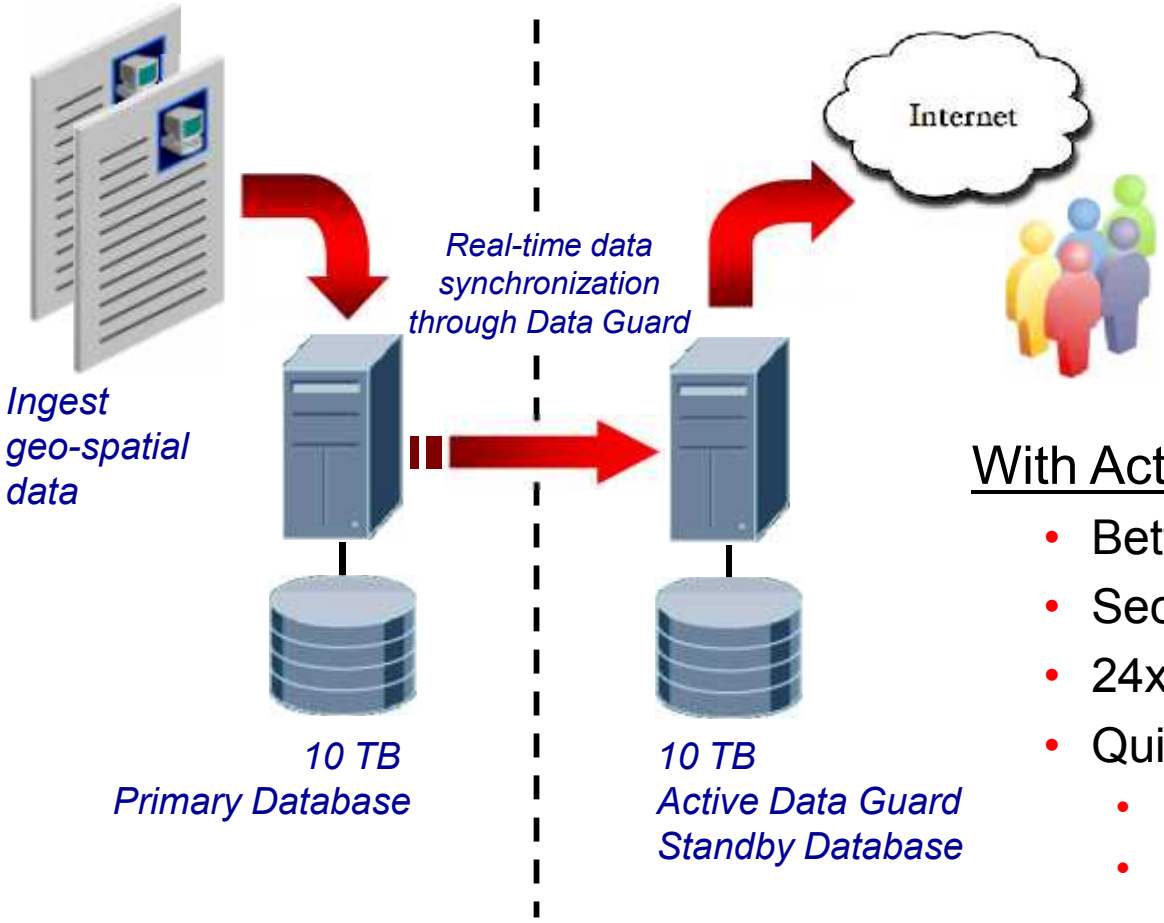
Database failover: 20 secs

Apps redirected: 2 mins

Standby site distance: 15 miles

Intermap Technologies Inc.

Active Data Guard - Secure Access to Real-time Data



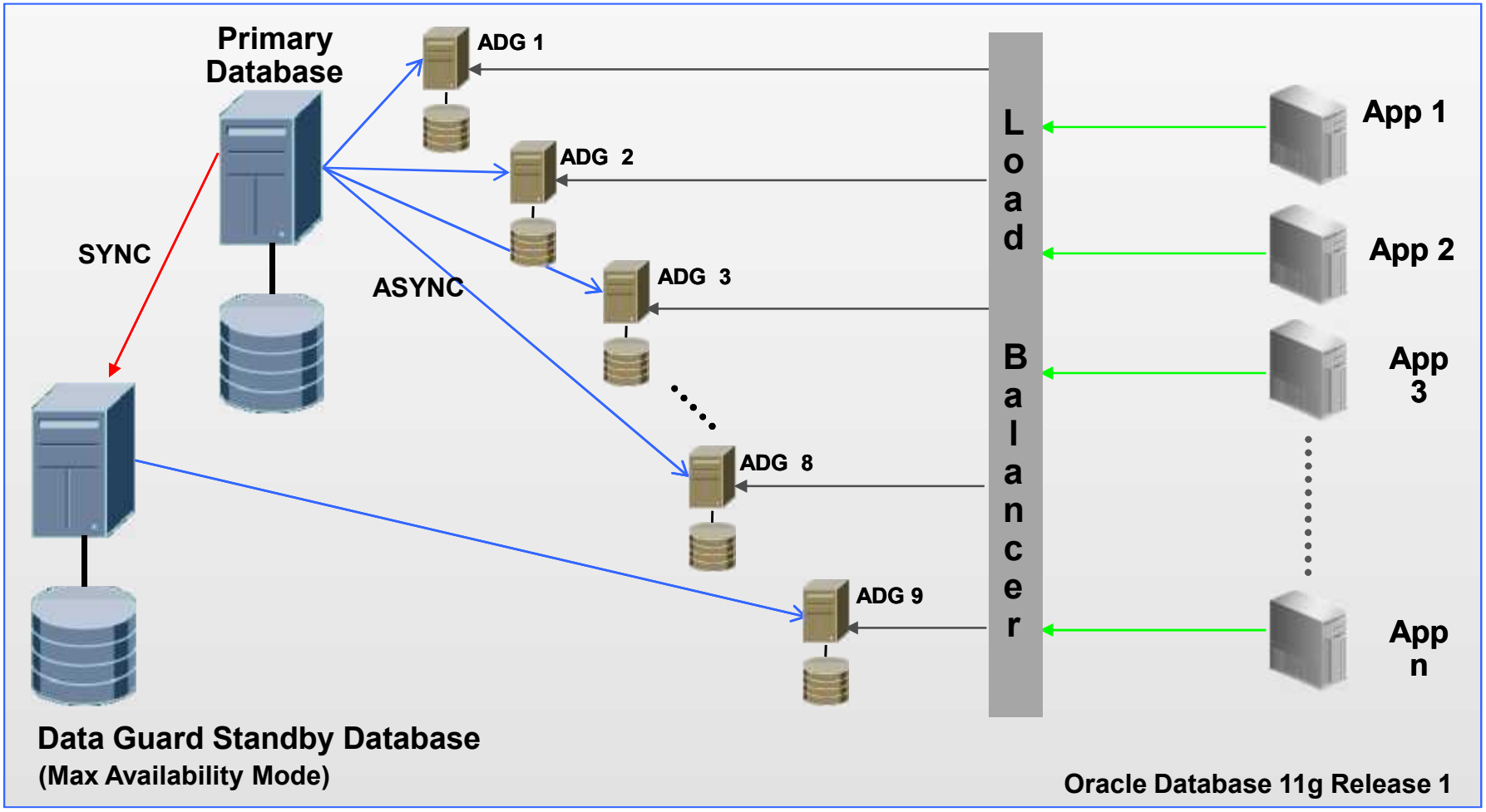
Use Active Data Guard to offload public Internet access to high-res 3D digital data
- *Auto Safety & Fuel Efficiency*
- *Insurance Flood Modeling*
- *Global Positioning Systems*
- *Environmental Planning*
- *Wireless Communications*

With Active Data Guard 11*g*

- Better performance
- Secured Internet access
- 24x7 - standby always up-to-date
- Quick win!
  - Easy to implement
  - Utilize existing DR system

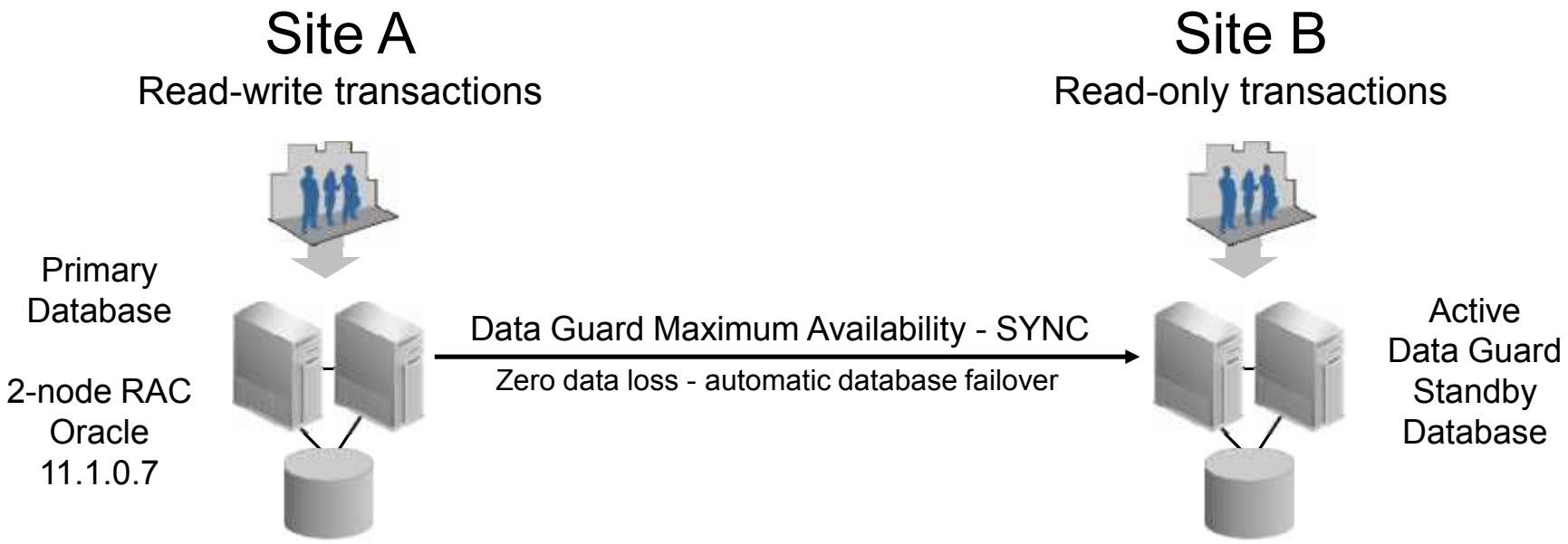
Apple Inc

Reader Farm Scale Out using Active Data Guard



MorphoTrak

Cut $100,000 in System Cost with Active Data Guard



- Printrak Biometrics Identification
- 15 Terabyte database
- Mixed OLTP – read intensive

- Read-only transactions directed to active standby
  - Full utilization reduces acquisition cost
  - Simpler deployment reduces admin cost

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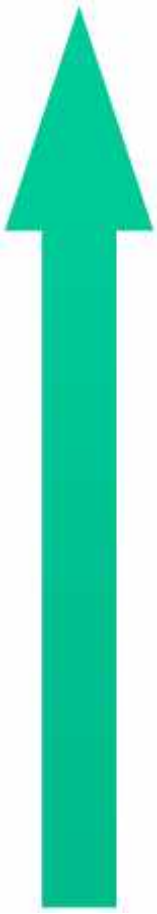
Summary

Validating Oracle's HA Design Principles



1. Complete
   - A validated next-generation platform
2. Application oriented
   - Integrated application failover, online application changes
3. Scale-out model
   - Basis of Oracle's grid infrastructure
4. Integrated and simple
   - Database with built-in HA capabilities

Resources: HA & Active Data Guard

Best Practices, Oracle Tools and Applications

- Maximum Availability Architecture (MAA)
  - http://otn.oracle.com/goto/maa
- Active Data Guard Best Practices
  - http://www.oracle.com/technology/deploy/availability/pdf/maa_wp_11gr1_activedataguard.pdf
- OpenWorld 2009: Oracle Active Data Guard Best Practices
  - http://www.oracle.com/technology/deploy/availability/pdf/oracle-openworld-2009/311400.pdf
- Active Data Guard Hands-On Lab
  - http://www.oracle.com/technology/deploy/availability/htdocs/adg_hol_2009.html
- Oracle Business Intelligence Enterprise Edition
  - Offload queries to active standby
    http://www.oracle.com/technology/deploy/availability/pdf/maa_wp_11g_biee_activedataguard.pdf
- Oracle TopLink Applications
  - Easily retrofit TopLink Applications to utilize an active standby
    http://www.oracle.com/technology/deploy/availability/pdf/maa_tech_wp_toplinkwithadg.pdf
- PeopleSoft and E-Business Suite Applications
  - Transparently redirect read-only queries/reports to active standby – planned for future release
  - Prototypes demonstrated at OpenWorld 2009

Questions..

greg.walters@oracle.com

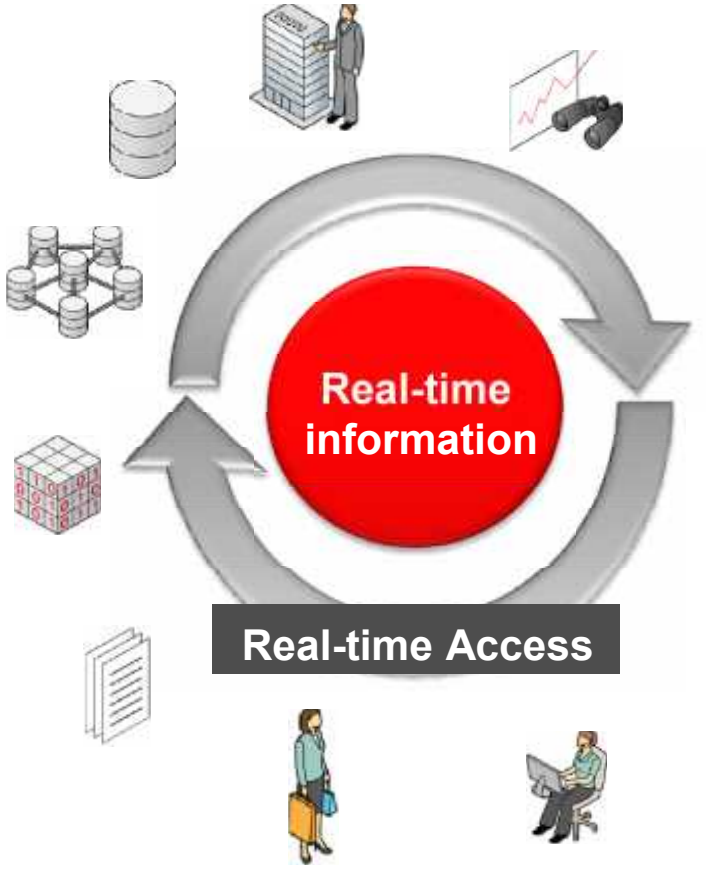
Appendix

GoldenGate vis-a-vis Active Data Guard

Data Guard vis-à-vis Storage Remote-Mirroring

Oracle GoldenGate

The Oracle Solution for Information Integration



- Best-in-class real-time data replication
- Flexible solution for minimal/zero downtime upgrades and migrations
- Over 500 customers with 4,000+ implementations

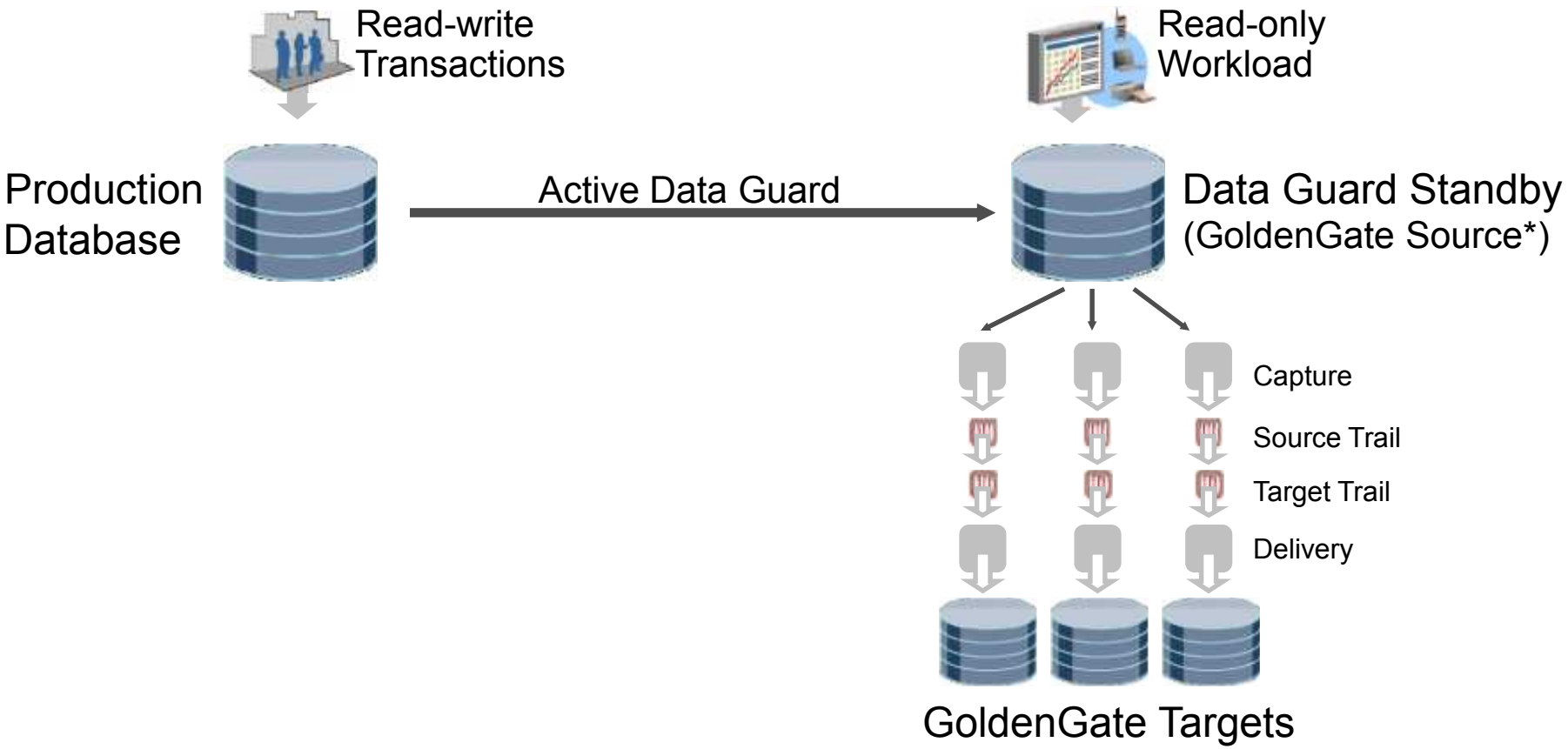
High Availability for Oracle Database

When to Use Active Data Guard vs. GoldenGate

- Disaster Recovery / Data Protection
  - ➢ Active Data Guard: simple full Oracle Database protection
    - ✓ High-performance, simple, drop-in solution for HA and DR, readable at standby
    - ✓ Zero data loss, integrated data corruption protection, switchover / failover
    - ✓ DR for all data types & apps including packaged apps that can't be changed
- Information Distribution, Flexible HA
  - ➢ GoldenGate: heterogeneous, active-active, migrations
    - ✓ Heterogeneous replication, transformations, subsetting, multiple topologies
    - ✓ All sites fully active (read/write): avoid or manage conflicts at application level
    - ✓ Enable minimal downtime app migrations with 2nd database copy

Complementary Technologies

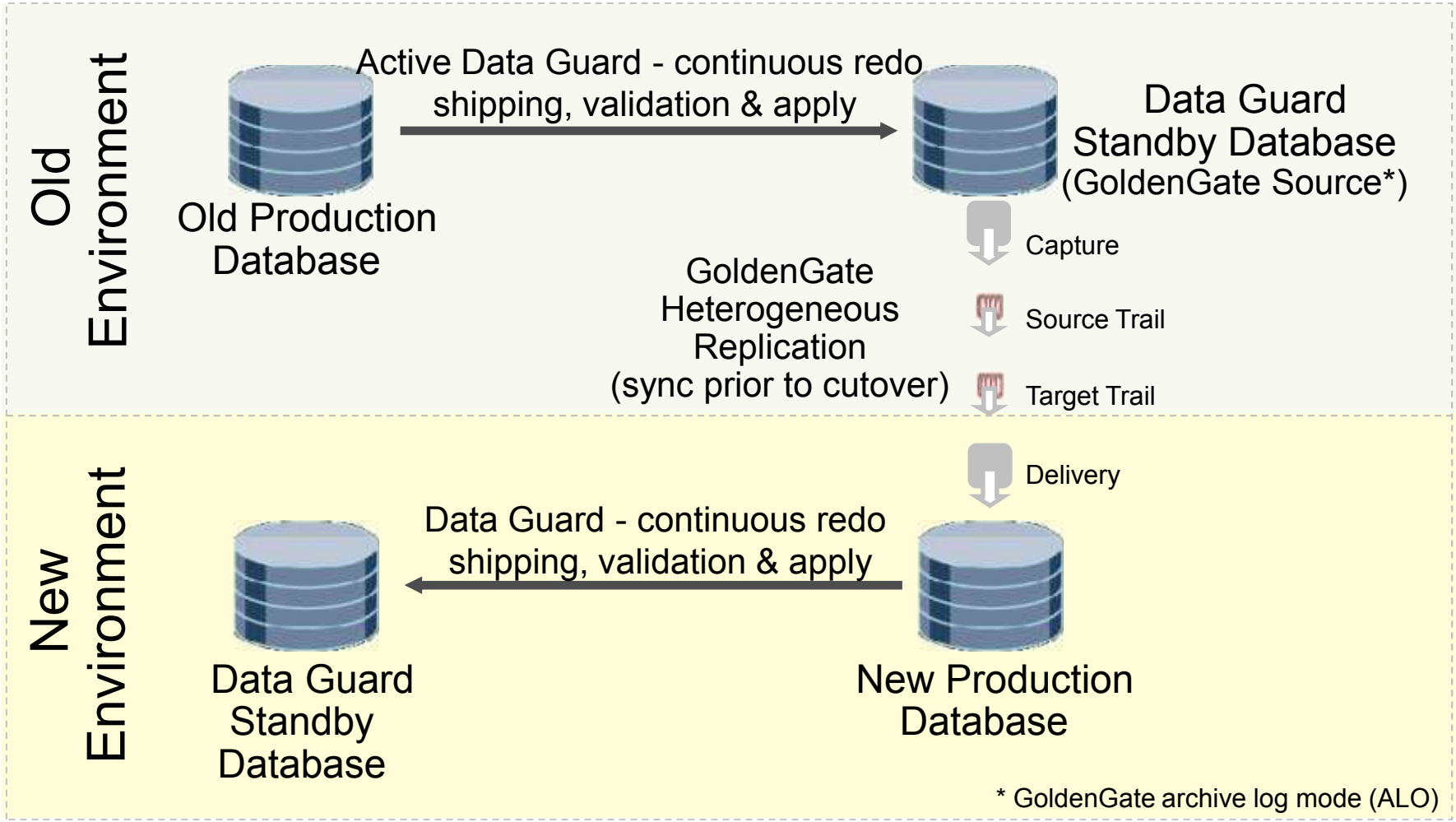
DR, Production Offload, Heterogeneous Replication



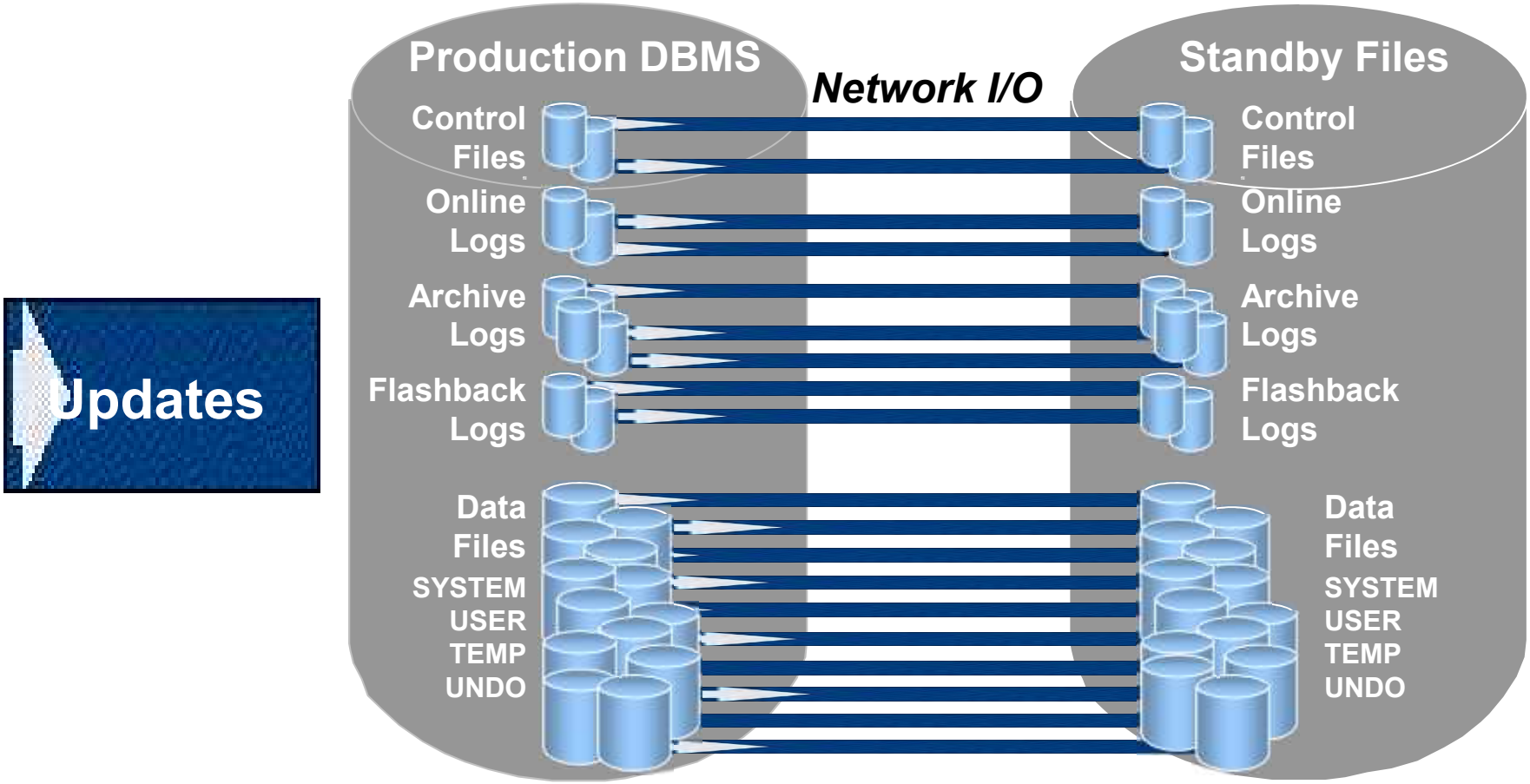
* GoldenGate archive log mode (ALO)

Complementary Technologies

Minimizing Planned Downtime

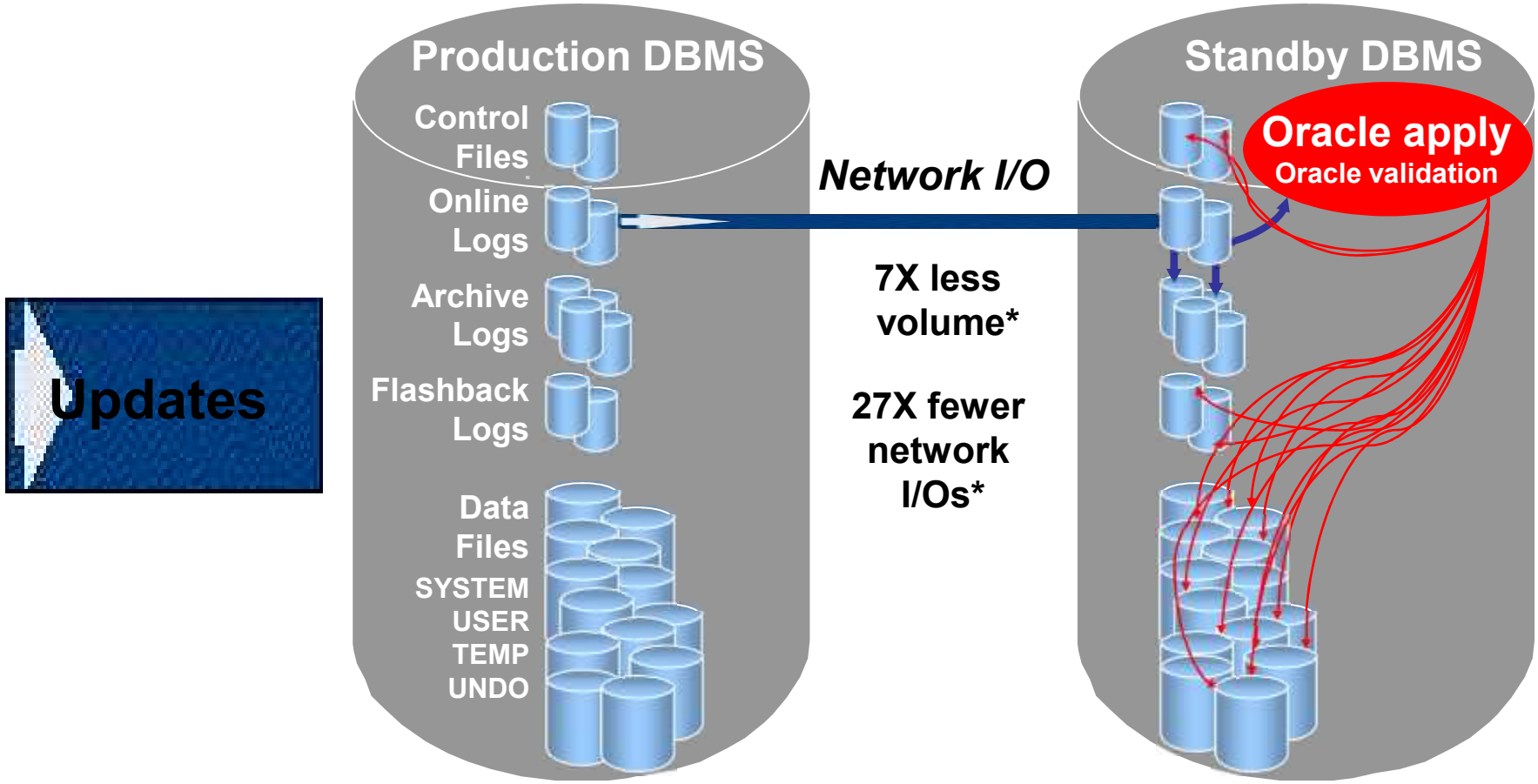


Storage Remote-Mirroring



Data Guard

Database-Aware Transport and Apply



*www.oracle.com/technology/deploy/availability/htdocs/DataGuardRemoteMirroring.html