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November 11–15, 2007

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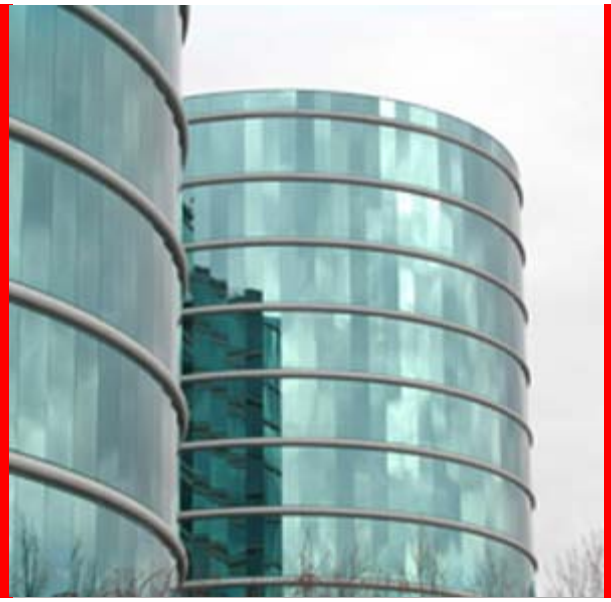

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What's New With Oracle Data Guard? Revolutionizing Data Protection and Availability

Larry M. Carpenter
Oracle Server Technologies
Distinguished Product Manager

Sreekanth Chintala
Dell Inc.
Senior Database Engineer

DELL

Traditional DR – as useful as a . . .

A mirrored copy is not good for. . .

- Up-to-date reporting
- Testing while providing continuous protection
- Fast online backups
- Preventing mirroring of physical corruptions
- Detecting and protecting against lost writes
- WAN deployment for high volume applications
- Fast role transitions
- HA enabled via built-in automatic failover
- Reducing planned downtime using rolling database upgrades
- Peace of mind from continuous knowledge of the database state at your recovery site

Data Guard 11*g*

Revolutionizing Data Protection and Availability

- Synchronized reporting replica
- Snapshot Standby for testing
- Fast incremental backups on standby
- Oracle validation prior to apply
- Lost-write protection
- High WAN throughput
- Fast failover and switchover
- Enhanced automatic failover
- Transient Logical Standby
- Intelligent, Oracle-aware data protection and availability

Data Guard has evolved to be an integral part of IT operations

Data Guard 11*g* Enhancements

ORACLE DATABASE 11*g*

Improved Data Protection

- Faster redo transport
- Advanced Compression
  - Redo compression for gaps
- Lost-write protection

More Manageability

- SQL Apply – More Automation
- Better RMAN Integration
- Better Security
- Mixed Windows/Linux
- Enhanced Data Guard Broker

Higher Availability

- Faster Redo Apply & SQL Apply
- Faster failover & switchover
- Enhanced Fast-Start Failover
- Transient Logical Standby
- New Grid Control HA Console

Increased ROI

- Snapshot Standby
- Active Data Guard
  - Real-time Query
  - Fast Incremental backup

Redo Transport Enhancements

Improved Data Protection

- New streaming protocol
  - Maximum Performance – ASYNC & ARCH transport
  - Eliminates internal network acks during redo transport
  - You get it by default, nothing to do.
- Result:
  - More efficient network utilization
  - Eliminates impact of network latency on throughput
  - Enhance RPO by getting more data to the standby site – less frequent buffering of workload peaks at primary location
  - Faster gap resolution

Network Compression for GAPs

Improved Data Protection

- Data Guard automatically compresses data transmitted to resolve gaps
- Largest benefit in bandwidth constrained environments
  - Reduce transmission time 15-35%, Bandwidth consumption by 35%
  - Faster gap resolution = better data protection
- Requires Oracle Database 11*g* Advanced Compression
- Enabled with the 'COMPRESSION' attribute

```
log_archive_dest='service=dbname ASYNC
COMPRESSION=ENABLE…'
```

- Or Edit the Broker property 'RedoCompression'

```
edit database <dbname> set property
RedoCompression=Enable;
```

Lost Write Detection

Improved Data Protection

- Faulty storage hardware / firmware may lead to lost writes leading to data corruptions
  - Occurs when an I/O subsystem acknowledges the completion of the block write, but the write did not occur in the persistent storage
  - On a subsequent block read, the I/O subsystem returns the stale version of the data block, which might be used to update other blocks of the database
  - Very hard to diagnose such data corruptions when they occur

How to Detect Lost Writes

Improved Data Protection

- Use your Data Guard physical standby!
- Compares versions of blocks
  - Between standby blocks and incoming redo stream
    - Version discrepancy implies lost write on either primary or standby database
- If Primary database corruption is detected, resolve by using the standby to failover and restore data consistency
- Largest increase in protection – lowest (<5%) impact
- Set new Parameter to enable

```
alter system set db_lost_write_protect=typical;
```

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Faster Role Transitions

High Availability

- Faster Failover
  - Failover in seconds with Fast-Start Failover
- Faster Redo Apply for physical standby
  - Optimization to enhance parallelism in media recovery
  - OLTP Workload - 95% Improvement (24MB/sec vs 47MB/sec)
  - Batch Workload – 130% Improvement (48MB/sec vs 112MB/sec)
- Faster SQL Apply for logical standby
  - LOB Inserts – 50% improvement
  - OLTP non-partitioned tables – 22% improvement
  - OLTP with partitioned tables – 19% improvement
  - Support for executing DDL in parallel on standby database

Enhanced Fast-Start Failover

High Availability

- Automatic failover for Maximum Performance Mode
  - Data Guard configurations using ASYNC redo transport
  - Maximum allowable data loss is user configurable via Data Guard Broker property:

```
FastStartFailoverLagLimit
```

  - Default setting = 30 seconds, minimum threshold = 10 seconds)
    - See Session S291917: Today@4:30pm - **103** Moscone South
- High Availability for Fast-Start Failover Observer
  - Grid Control will automatically restart the Data Guard Observer on a second host if the primary Observer host fails

Configurable Fast-Start Failover

High Availability

- Immediate automatic failover for user-configurable health conditions

```
ENABLE FAST_START FAILOVER [CONDITION <value>];
```

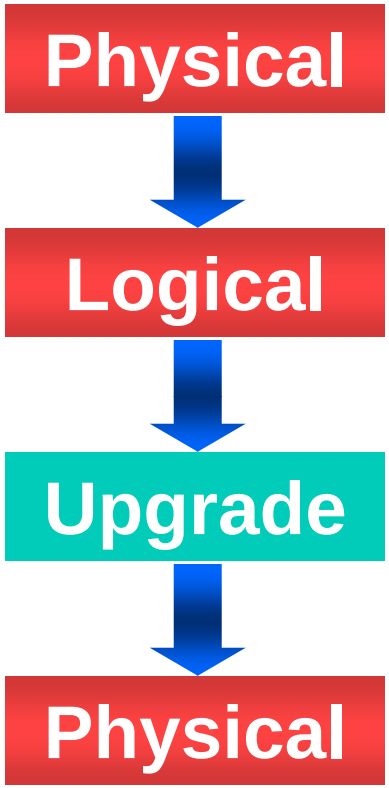
  - Condition examples:
    - Datafile Offline
    - Corrupted Controlfile
    - Corrupted Dictionary
    - Inaccessible Logfile
    - Stuck Archiver
    - Any explicit ORA-xyz error
  - See Session S291917: Today@4:30pm - **103** Moscone South

- Apps can request fast-start failover using API

```
DBMS_DG.INITIATE_FS_FAILOVER
```

Rolling Upgrade & Physical Standby

High Availability

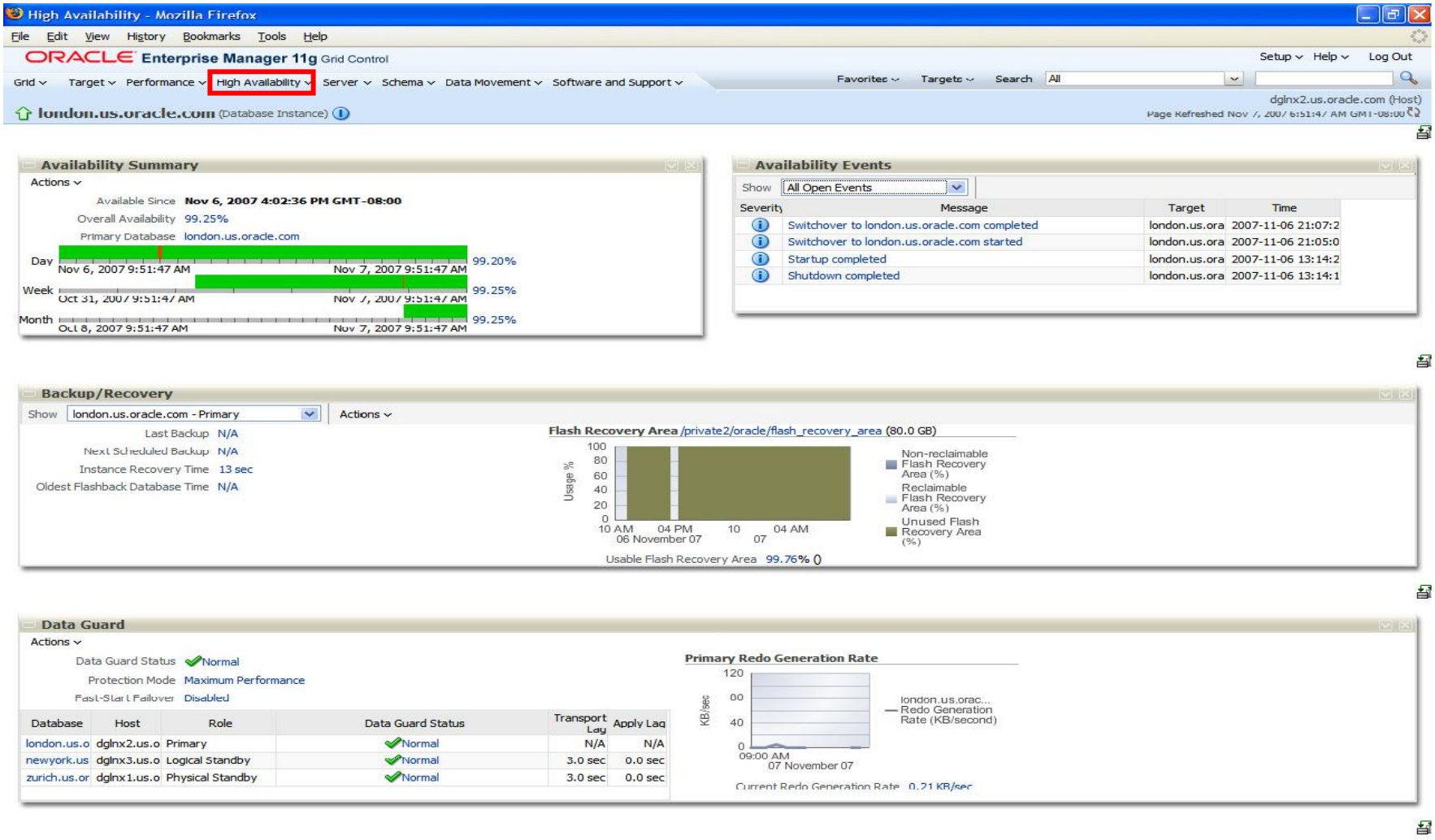


- Transient Logical Standby
  - Execute rolling database upgrades using a physical standby database
  - Temporarily convert physical standby to logical to perform the upgrade

```
SQL> ALTER DATABASE RECOVER TO LOGICAL
     STANDBY KEEP IDENTITY
```

    - Potential impact of SQL Apply data type restrictions limited to shorter upgrade window
    - When upgrade is complete – revert to physical standby
  - No need for separate logical standby
  - See Session S291917: Today@4:30pm - **103** Moscone South

Grid Control High Availability Console



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SQL Apply – Logical Standby

Manageability

- Data Type
  - XMLType data type (CLOB)
- Support for Cross-Functional Oracle features
  - Flash Recovery Area for all archive logs
  - Transparent Data Encryption (TDE)
  - Encrypted Tablespaces
  - DBMS_FGA (Fine Grained Auditing)
  - DBMS_RLS (Virtual Private Database)
- Role-specific DBMS_SCHEDULER jobs
  - (PRIMARY, LOGICAL STANDBY, BOTH)
    - See Session S291917: Today@4:30pm - **103** Moscone South
- SQL Apply engine
  - Dynamic SQL Apply parameter changes
  - No shutdown of RAC instances at switchover or failover

Enhanced RMAN Integration

Manageability

- Direct remote instantiation of remote standby database
  - RMAN duplicate for standby - no intermediate storage
    - See Sessions
      - S291487: Today@11:15am - 304 Moscone South
      - S291917: Today@4:30pm - **103** Moscone South
- Block-change tracking on physical standby databases
  - Enables fast incremental backup on standby
    - Part of the Active Data Guard option
    - See Session S291920: Today@ 3:00pm - 304 Moscone South

Enhanced RMAN Integration

Manageability

- More RMAN Integration with Data Guard
  - One RMAN session connected to the catalog can manage the RMAN configuration of multiple Data Guard configurations
  - Archived logs deletion policies enhanced
    - Delete logs when shipped only or shipped & applied
    - Definable for Mandatory or Optional standby databases
  - Backups taken on any combination of primary or physical standbys
  - Backup control file can be restored directly for any standby database

Enhanced Data Guard Security

Manageability

- SYS user and password files no longer required for redo transmission authentication
  - Authentication possible using SSL - requires ASO, OID
  - Uses PKI Certificates
  - Requires all Data Guard databases to be in the same enterprise domain
- Authentication still possible using a password file (default)
  - Can also specify a user other than SYS for redo transport authentication

```
redo_transport_user
```

  - This user must have the SYSOPER privileges
  - Requires password for this user to be the same at primary and all standbys
  - See Session S291917: Today@4:30pm - **103** Moscone South

More Flexible Configurations

Manageability

- Increased flexibility in Data Guard configurations
  - Data Guard 10*g* supports mixed word-sizes (32-bit and 64-bit) in the same configuration
- Data Guard 11*g* supports mixed Windows/Linux in the same Data Guard configuration
  - Physical standby only
  - Same endianess required on all platforms
- See MetaLink Note 413484.1 Data Guard Support for Heterogeneous Primary and Standby Systems

Data Guard Broker

Manageability

- All the Fast-Start Failover enhancements
  - See Session S291917: Today@4:30pm - **103** Moscone South
- No bounce required to change protection modes from Maximum Performance to Maximum Availability
  - Also available in 10.2.0.3
- Support for single instance databases configured for HA using Oracle Clusterware (cold failover cluster)
  - Also available in 10.2.0.4
- New Property `DGConnectIdentifier` simplifies database connection definitions
  - Previously known as the InitialConnectIdentifier property.
    - Was only used for initial configuration creation
  - Now is retained as the connection string
    - Relates to the 'SERVICE' attribute of log_archive_dest_n
  - Enables use of all OracleNet capabilities

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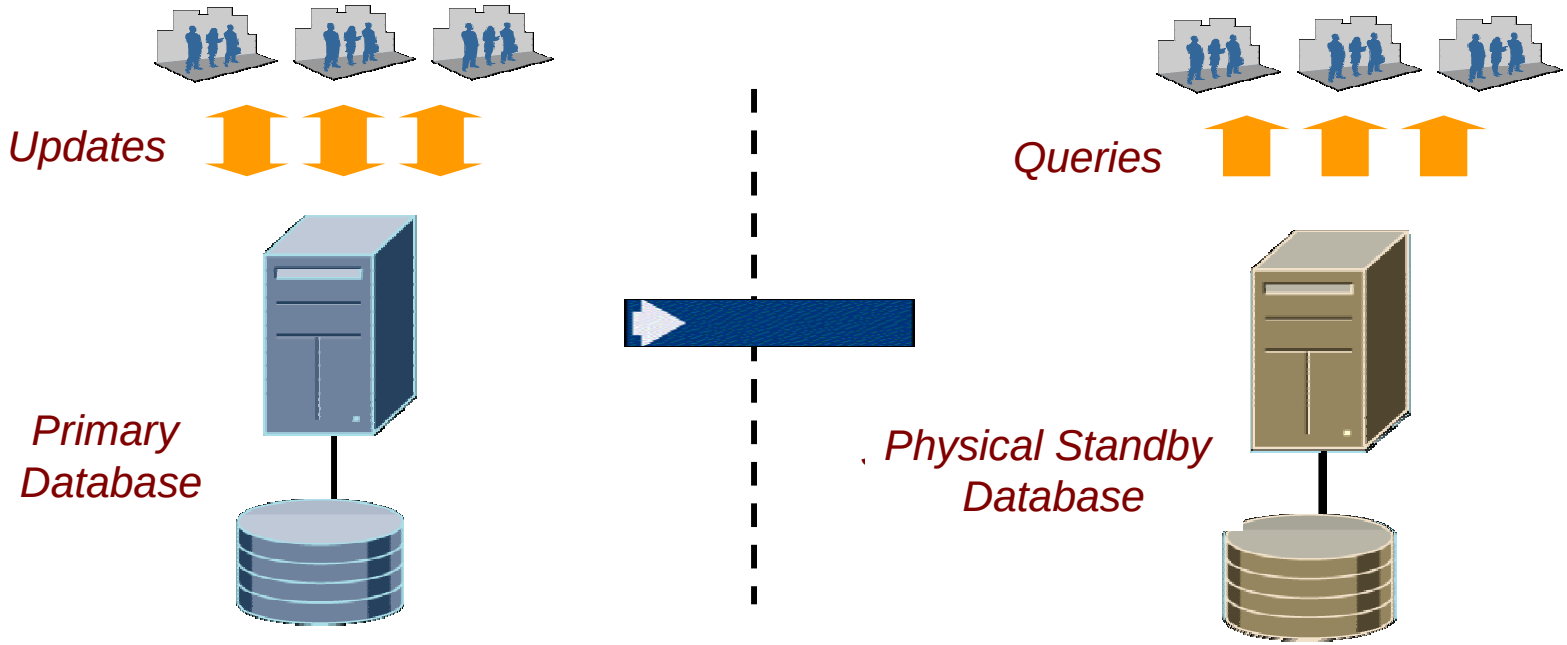
Snapshot Standby

Increase ROI



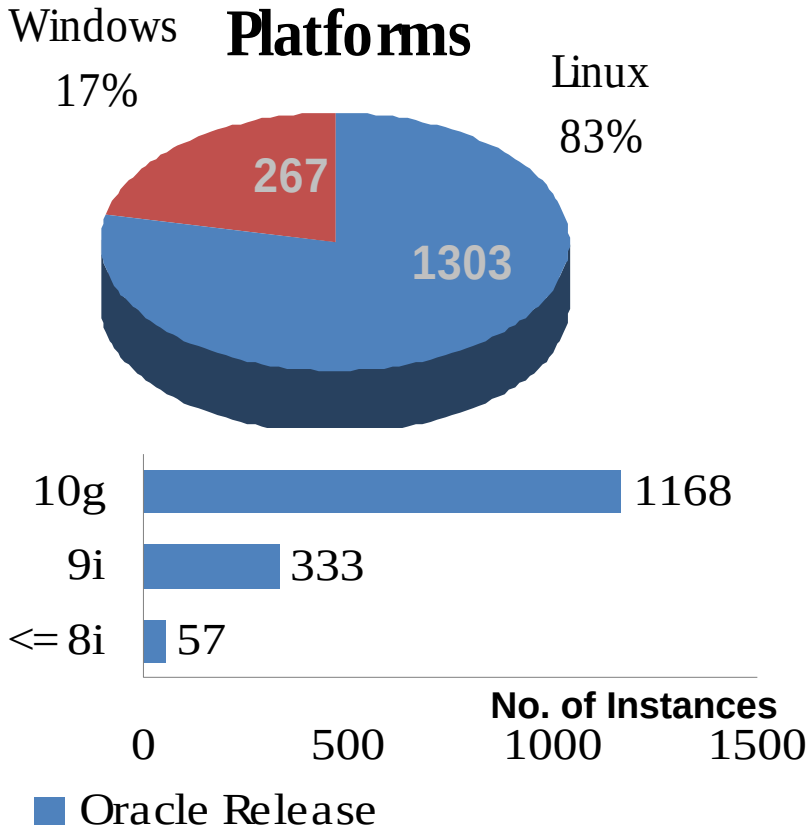
- **Preserves zero data loss – continuous redo transport while open read-write**
- **Truly leverages standby database and DR hardware for multiple purposes**
- **Similar to storage snapshots, but provides DR at the same time and uses single copy of storage**

SNAPSHOT STANDBY

SREEKANTH CHINTALA
SENIOR DATABASE ENGINEER
GLOBAL DATABASE ENGINEERING

A GLANCE AT DELL IT

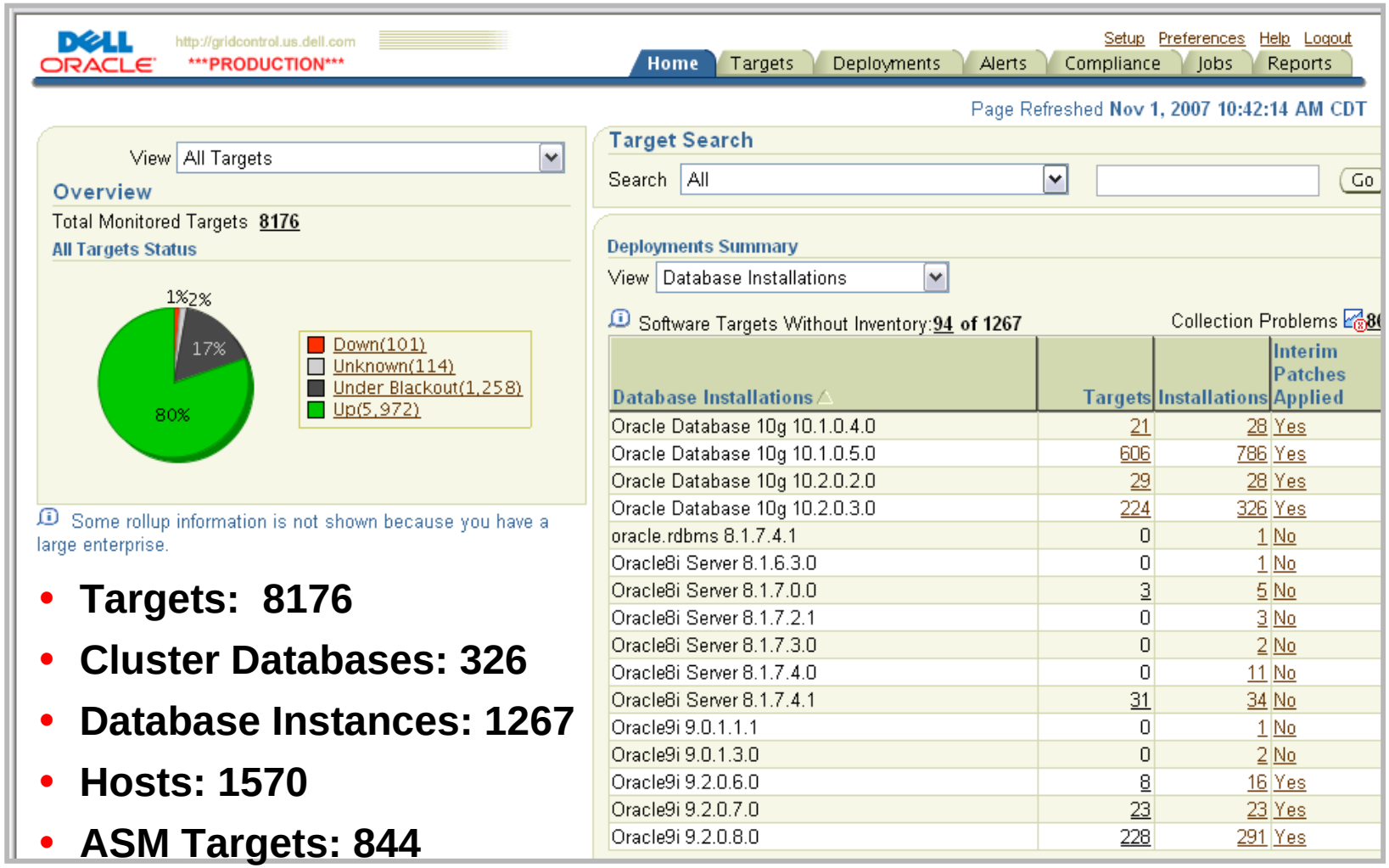
DELL IT PRODUCTION DB ENVIRONMENT



Types of Applications

- **Manufacturing**
  - Highly transactional
  - Performance is key
- **Corporate**
  - HR, Financial
  - Security is key
- **Sales & Support**
- **Marketing**
- **Internal applications**

MONITORED METRICS



- **Targets: 8176**
- **Cluster Databases: 326**
- **Database Instances: 1267**
- **Hosts: 1570**
- **ASM Targets: 844**

SNAPSHOT STANDBY

SNAPSHOT STANDBY

- Fully updatable standby
- Provides disaster recovery and data protection
- Requires Flashback Database
- Single command in 11gR1

BENEFITS

- Use as a Performance Testing environment
  - Eliminate the guesswork
  - Reliable and dependable results
  - Save time and effort in data movement
  - Save money through consolidation
- Know the impact of change
  - On production infrastructure and production data
  - Realistic view on resource consumption
  - No surprises. Implement changes with confidence.
- Tuning isn't a guess anymore
  - Best execution plan from real data or use SQL Performance Analyzer (SPA)

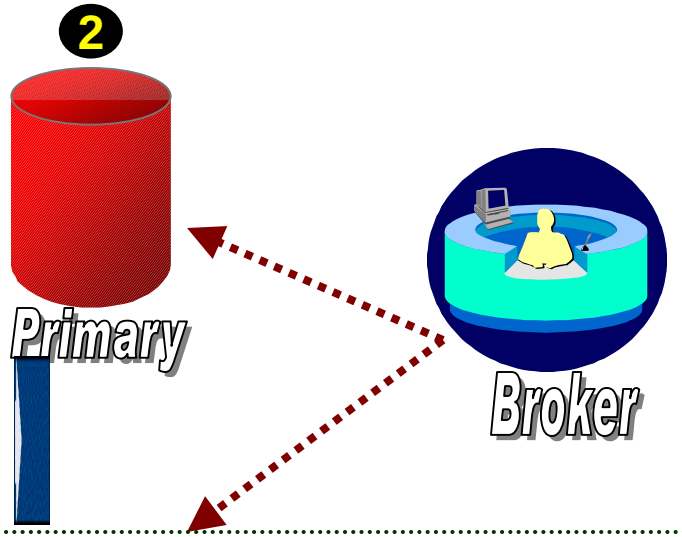
CHARACTERISTICS

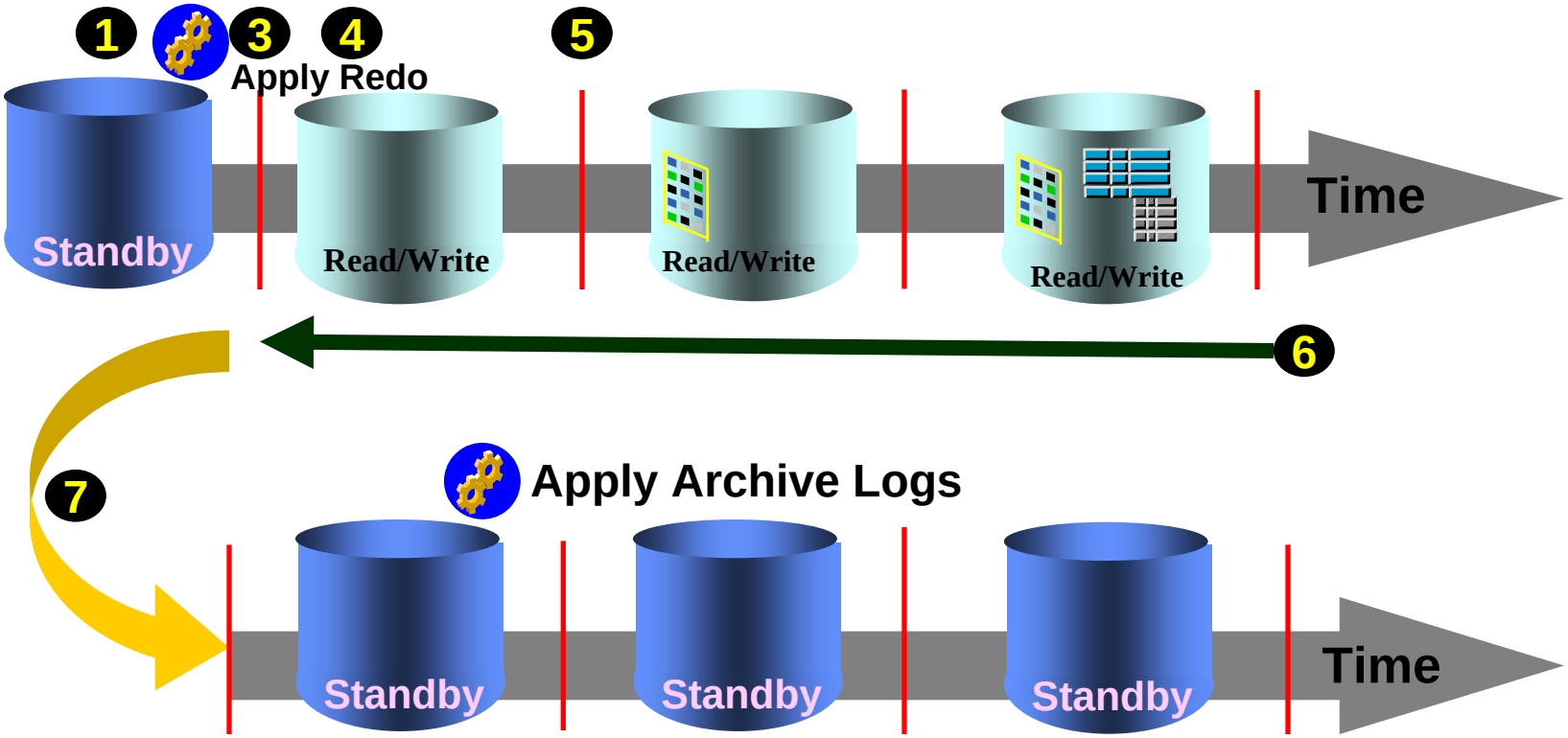
- Automatic redo gap detection and resolution
- Will accept redo from new primary branch
- Will accept redo from a new primary in the configuration
- Can not be part of switchover/failover until it returns to a physical standby
  - In 11g the Data Guard Broker will convert it back to a Physical standby automatically upon manual failover.
- Flashback database limitations apply
- No Real-Time Query
- No Fast-Start FailOver

10gR2

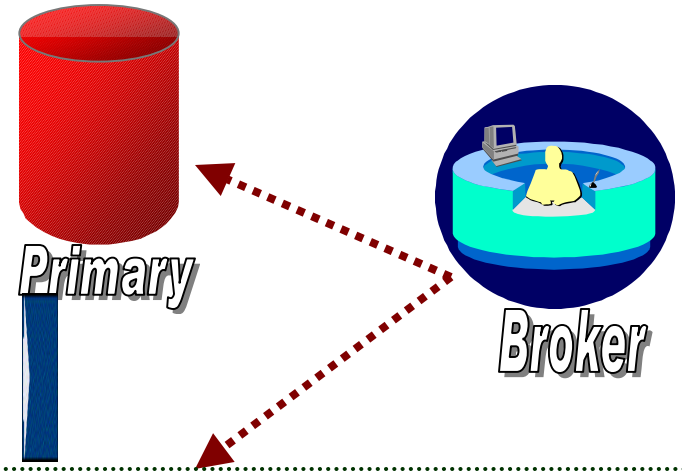
- Not really called “Snapshot Standby” in 10gR2
  - Referred to a “Opening a Physical Standby Read Write”
- Manual conversion
  http://www.oracle.com/technology/deploy/availability/pdf/dellprofile.pdf

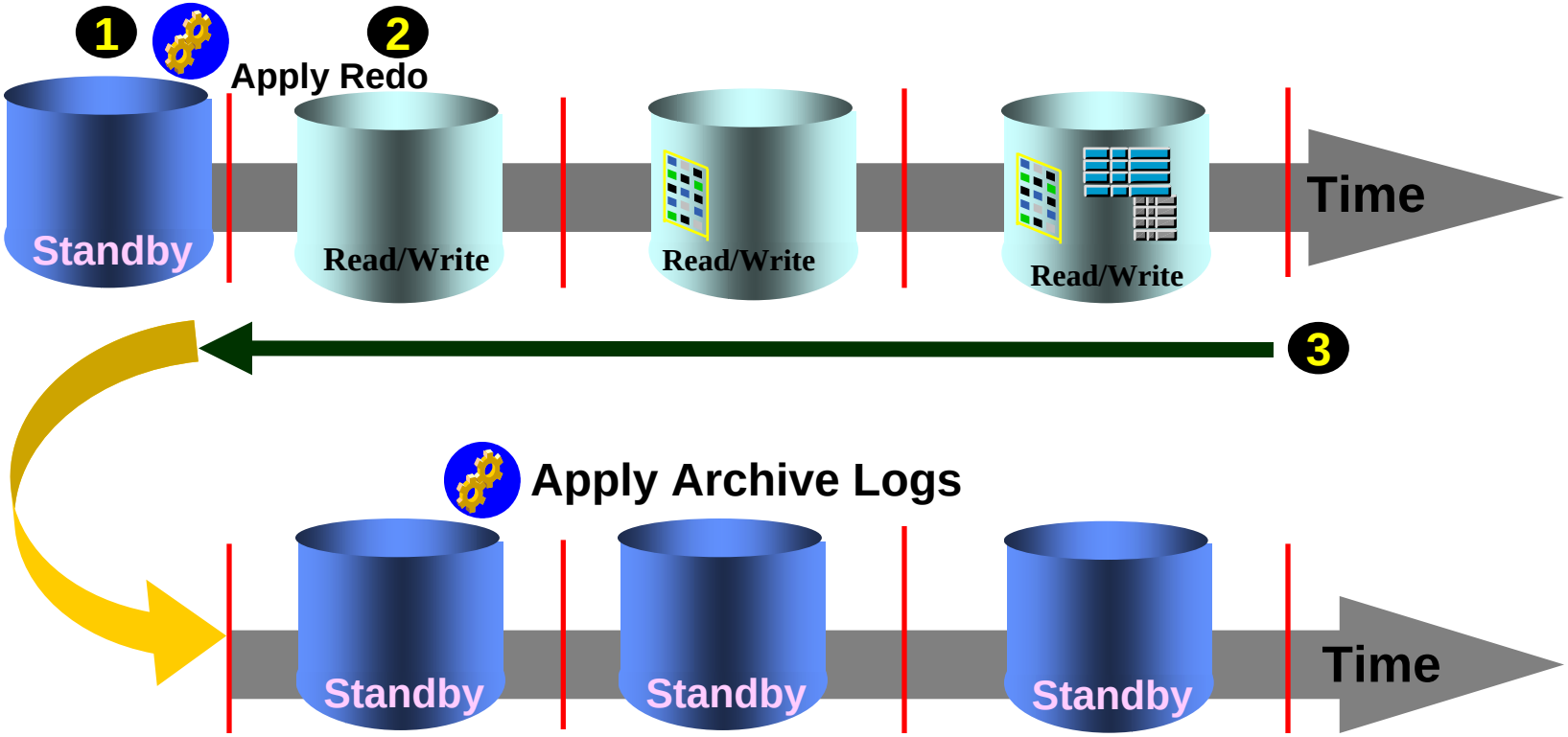
1. Prepare the Standby
2. Prepare the Primary
3. Create Guaranteed Restore Point
4. Convert Physical Standby to Read Write
5. Use Read Write Standby
6. Flashback to Restore Point
7. Convert standby back to Physical Standby





1. Convert to Snapshot Standby
2. Use Snapshot Standby
3. Convert to Physical Standby





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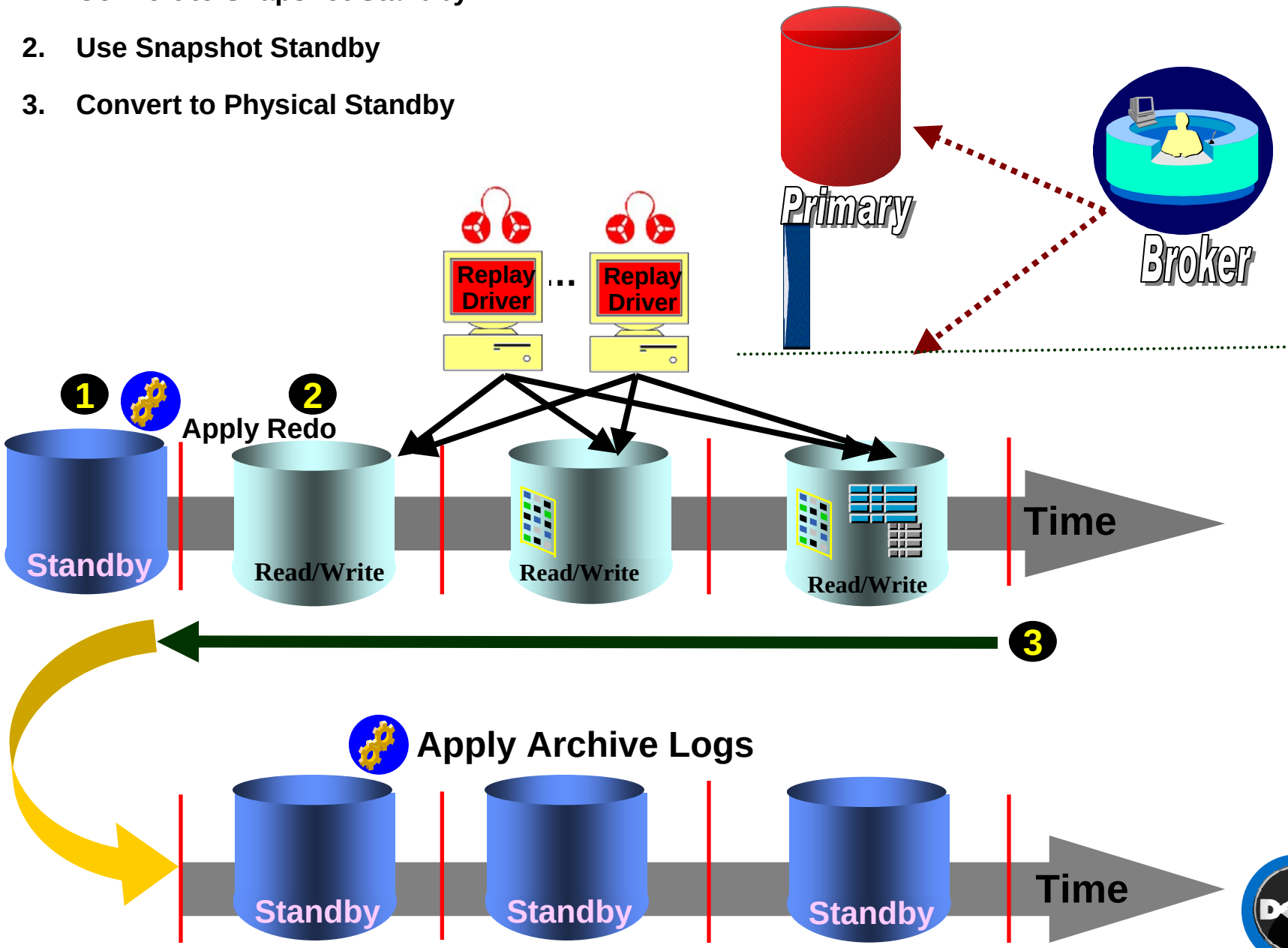
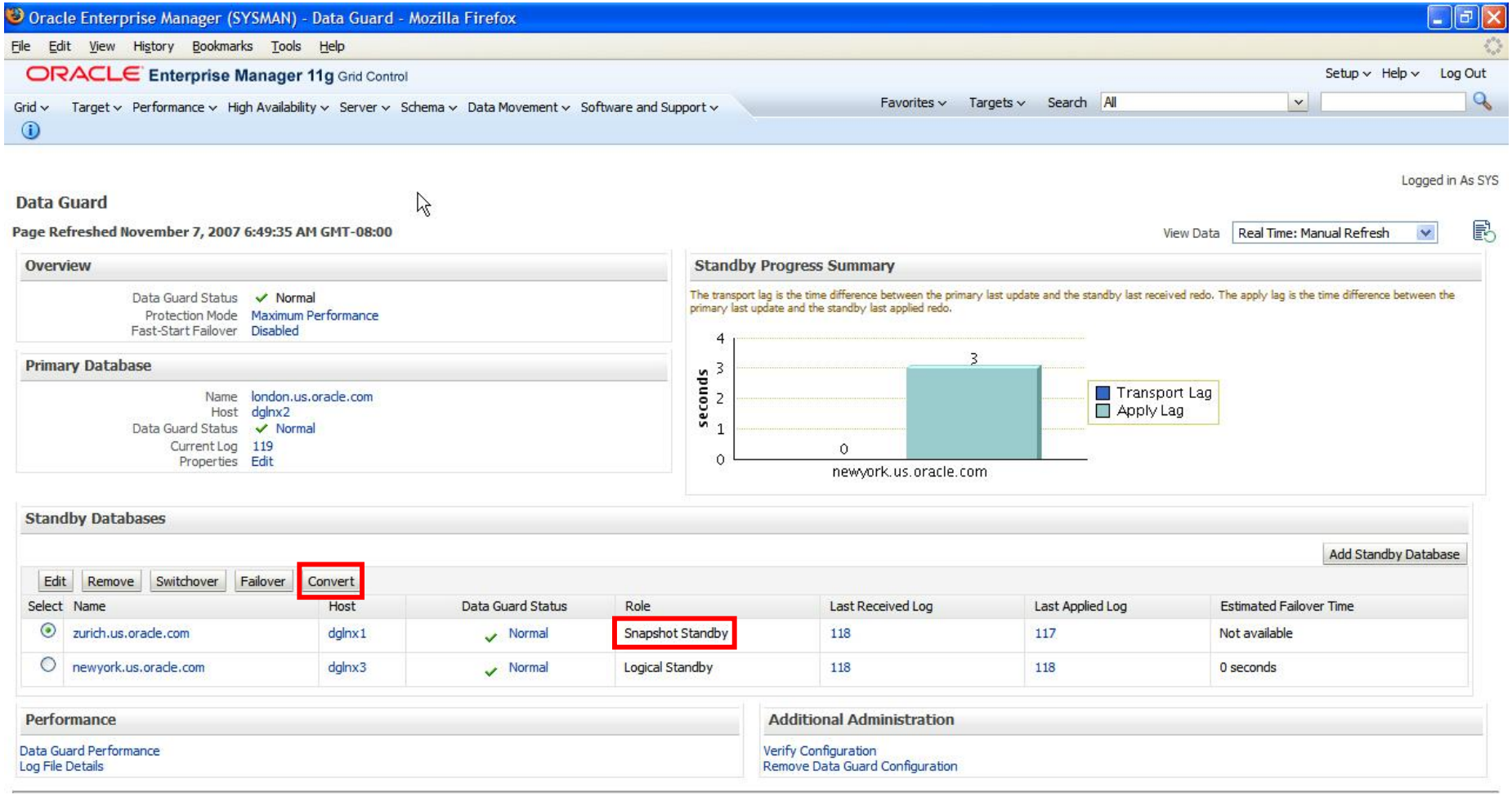


DIFFERENCES

10gR2	11gR1
Manual Steps (OTN Paper)	Single Command
Does not receive Redo from Primary during ‘Snapshot’ period	Receives Redo from Primary all the time
Can not use OEM/Grid Control	Can use OEM/Grid Control (Requires Data Guard Broker)

Using 11g Grid Control



Snapshot Standby

Increase ROI

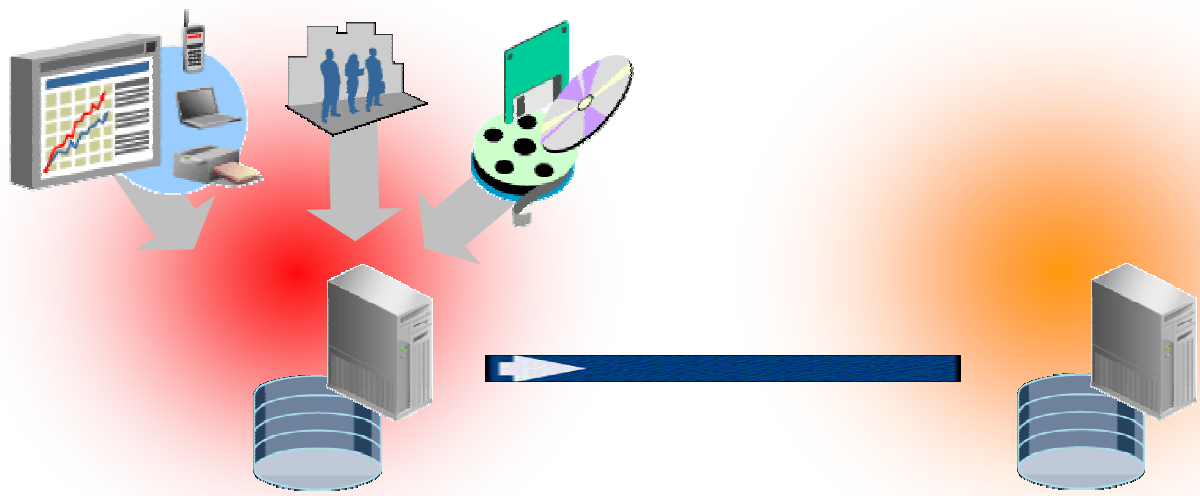
- In Summary
  - Simpler to implement
  - Much better RTO/RPO
  - Oracle Database 11g – only 2 Steps Required
    - On the Physical Standby Database
      - alter database convert to snapshot standby;
        - PERFORM TESTING
        - ARCHIVE LOGS CONTINUE TO BE SHIPPED
      - alter database convert to physical standby;
  - See Session S291917: Today@4:30pm - **103** Moscone South

Get the most boost from your Standby

- A final look at
  - ‘Investing in Traditional Disaster Recovery’
- And a look forward to
  - ‘Investing in Improved Quality of Service’
- Data Guard has always provided a certain level of service from the standby databases.
- With Oracle Database 11g we’ve blown the lid off of that one!

Traditional Physical Standby Databases

Investment in Disaster Recovery only



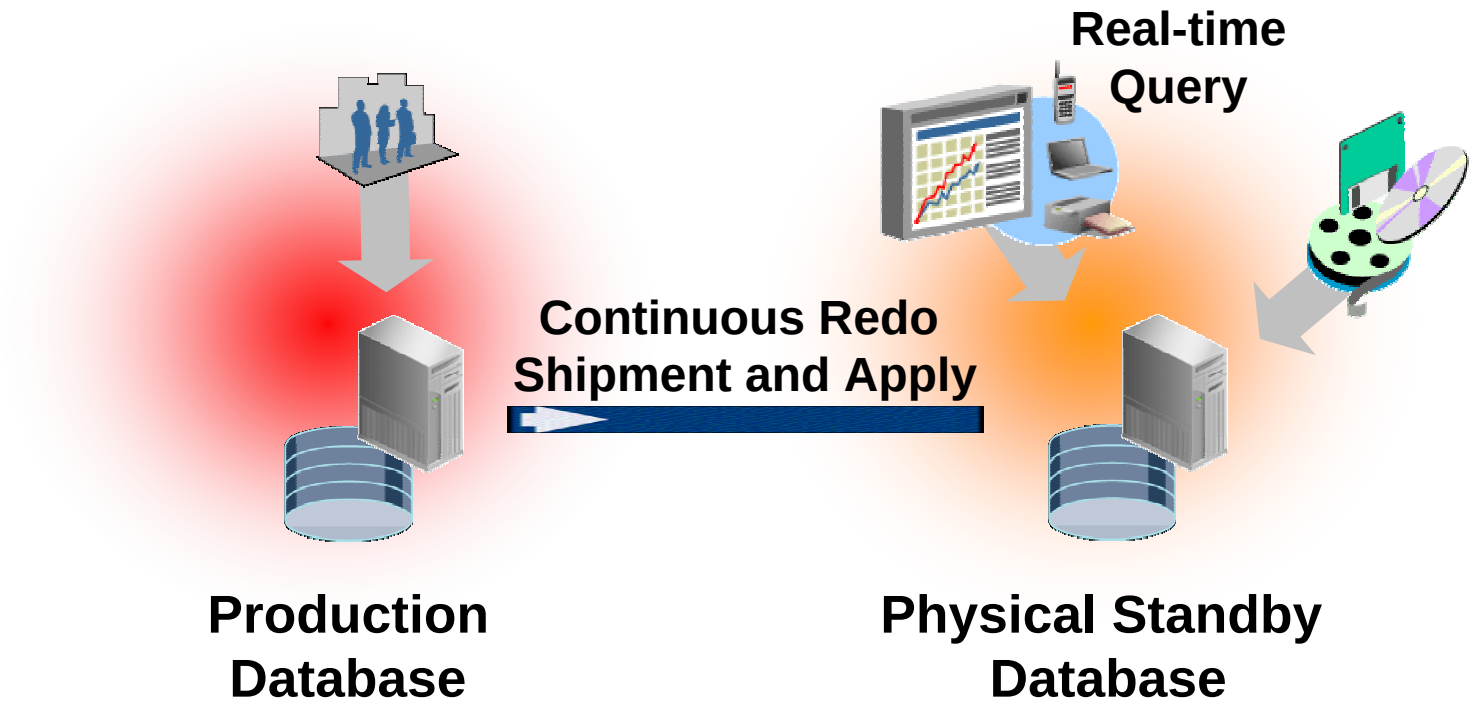
Production Database

Standby Database

- Applications, backups, reports run on production only

Active Data Guard 11g

Increase ROI - Real-time Query



- Offload read-only queries to physical standby
- Offload fast incremental backups to physical standby

Active Data Guard Benefits

Increase ROI - Invest in Improving Quality of Service

Physical standby in recovery	Simultaneous read & recovery
All read activity on production	Shift read-only workload to standby
Disaster protection only	Performance protection
Standby systems rarely used	Regularly used for production
Complex replication used to create reporting replica	Simple replication with very high performance and no restrictions

Active Data Guard - Licensing

- A Database Option for Oracle Enterprise Edition
- Active Data Guard license is required when using either:
  - Real-time Query
  - RMAN block-change tracking on a standby database
- Active Data Guard is 100% compatible with Data Guard functionality included with Oracle Database 11*g* Enterprise Edition

How do you turn it on?

- Just about as simple as it gets.
  - Stop Redo Apply

```
alter database recover managed standby database cancel;
```

  - Open the Physical Standby Read Only

```
alter database open read only;
```

  - Restart Redo Apply

```
alter database recover managed standby database using
current logfile disconnect;
```

  - Don't open other Standby RAC instances until you restart the apply
- But there is a lot more you can do with Active Data Guard!
  - See Session S291920: Today@ 3:00pm - 304 Moscone South

Conclusion

Data Guard 11*g* Delivers

- *Maximum return on investment* - All standby databases can be utilized for productive purposes while in standby role. Idle resources are eliminated WITHOUT increasing complexity
- *Optimum data protection and availability* - You always know the state of your standby database and it can very quickly (in seconds), assume the primary role
- *Lower cost and complexity* - rich management interface, mature capabilities, integrated with the Oracle Database

Database HA Sessions From Oracle Development

Monday, Nov 12

- S291483 - The Fastest and the Most Cost-Effective Backup for Oracle Database: What's New in Oracle Secure Backup 10.2, 11:00 am - 12:00 pm, Moscone South 304
- S291492 - Oracle Database 11*g*: Next-Generation High Availability, 12:30 - 1:30 pm, Moscone South 103
- S291923 - Implementing Oracle Maximum Availability Architecture (MAA) at Allstate Insurance Using Oracle 10*g* RAC, ASM, Oracle Data Guard and Oracle Grid Control, 3:15 - 4:15 pm, Moscone South 304
- S291484 - Oracle Database 11*g* Data Repair Technologies: Comprehensive, Intelligent Recovery, 4:45 - 5:45 pm, Moscone South 304

Tuesday, Nov 13

- S290710 - Maximum Availability Architecture Best Practices: Oracle E-Business Suite 12, 12:15 - 1:15 pm, Marriott Salon 10 & 11

Wednesday, Nov 14

- S291915 - What's New in Oracle Data Guard 11*g*: Revolutionizing Data Protection and Availability, 9:45 - 10:45 am, Moscone South 304

Database HA Sessions From Oracle Development

Wednesday, Nov 14

- S291487 - Backup and Recovery Best Practices for Very Large Databases (VLDB), 11:15 am - 12:15 pm, Moscone South 304
- S291920 - Oracle Active Data Guard: How to Utilize Your Standby Databases for Production Workload - What They Didn't Print in the Manuals, 3:00 - 4:00 pm, Moscone South 304
- S291917 - Oracle Data Guard Tips and Tricks: Direct From Oracle Development, 4:30 - 5:30 pm, Moscone South **103**

Thursday, Nov 15

- S291495 - Oracle Streams Replication and Advanced Queuing (AQ): What's New in Oracle Database 11*g*, 8:30 - 9:30 am, Moscone South 304
- S291499 - Best Practices for Implementing Replication with Oracle Streams in Oracle Database 10*g* and 11*g*, 10:00 - 11:00 am, Moscone South 304
- S291525 - Maximum Availability Architecture (MAA) Best Practices: Online Patching, Rolling Upgrades and Planned Maintenance with Minimal Downtime with Oracle Database, 11:30 am - 12:30 pm, Moscone South 104
- S290542 - Maximum Availability Architecture (MAA) Best Practices for Siebel 8.0, 2:30 pm - 3:30 pm, Marriott Salon 10 & 11

Database HA Demos From Oracle Development

Monday, Nov 12 – Thursday, Nov 15
Oracle DEMOgrounds, Moscone West

Oracle Active Data Guard

Oracle Streams: Replication and Advanced Queuing

Oracle Secure Backup

Recovery Manager (RMAN) and Flashback Technologies

Maximum Availability Architecture

Resources

- **Oracle Data Guard 11*g* - technical white paper**
  http://www.oracle.com/technology/deploy/availability/pdf/twp_dataguard_11gr1.pdf
- **Oracle Active Data Guard 11*g* - data sheet**
  http://www.oracle.com/technology/products/database/oracle11g/pdf/active-data-guard-11g-datasheet.pdf
- **Oracle HA Portal on OTN:**
  http://www.oracle.com/technology/deploy/availability/
- **Maximum Availability Architecture white papers:**
  http://www.oracle.com/technology/deploy/availability/htdocs/maa.htm
- **Oracle HA Customer Success Stories on OTN:**
  http://www.oracle.com/technology/deploy/availability/htdocs/HA_CaseStudies.html
  - **How Dell I.T. Implements Snapshot Standby Functionality Using Oracle Data Guard 10*g* Release 2**
    http://www.oracle.com/technology/deploy/availability/htdocs/Dell_CaseStudy.html
- **Taneja Group - New Approaches to Data Protection and DR**
  http://www.oracle.com/technology/deploy/availability/htdocs/analysts/tanejagroupdatabasestorage.pdf
- **Enterprise Strategy Group – Data Protection and Disaster Recovery**
  http://www.oracle.com/technology/deploy/availability/htdocs/analysts/enterprisestrategygroupdataguard.pdf

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