Oracle10*g* Data Guard: Back to the Future

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Oracle Corporation

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Agenda

- **<u>Oracle Data Guard – a Quick Introduction</u>**
- **Potential Data Guard Configurations**
- Data Guard Features in Oracle Database 10*g*
- Spotlight on Data Guard SQL Apply
- Summary & Q/A

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What is Oracle Data Guard?

- Oracle's disaster recovery solution for Oracle data

- Feature of Oracle Database Enterprise Edition

- Automates the creation and maintenance of one or more transactionally consistent copies (standby) of the production (or primary) database

- If the primary database becomes unavailable (disasters, maintenance), a standby database can be activated and assume the primary role

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Oracle Data Guard Focus

- Data Failures & Site Disasters:

  - Data Protection
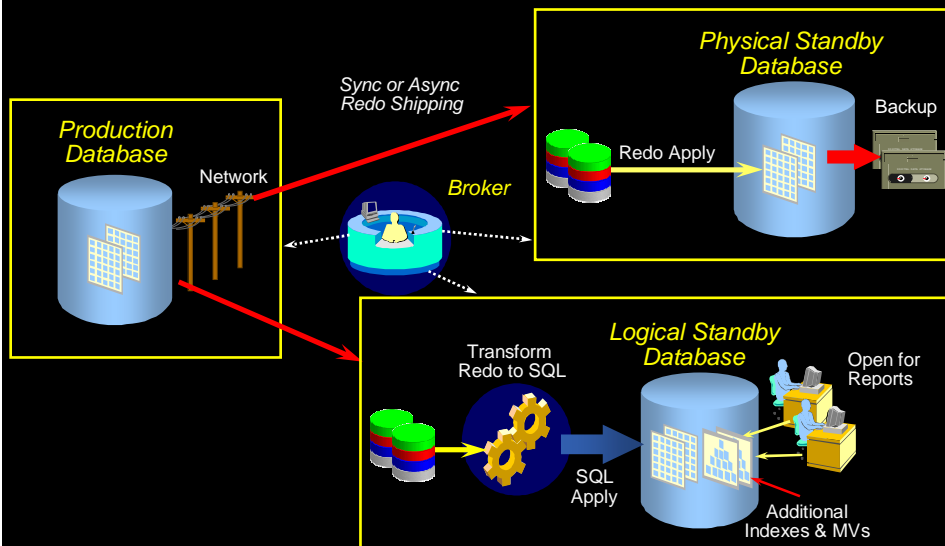 - Data Availability
  - Data Recovery

  All 3 are important!
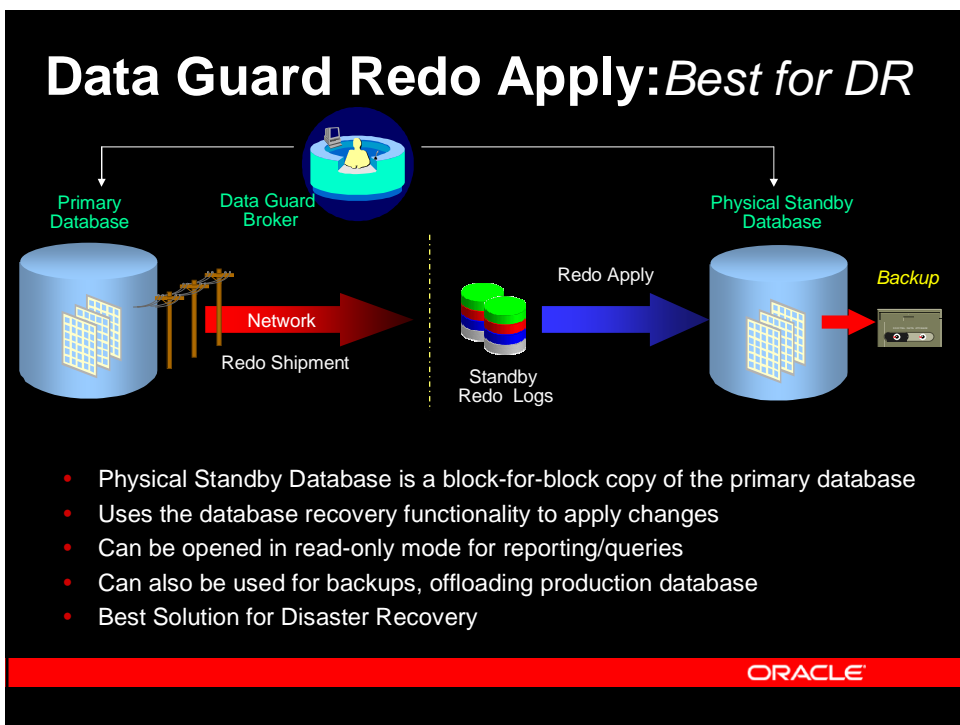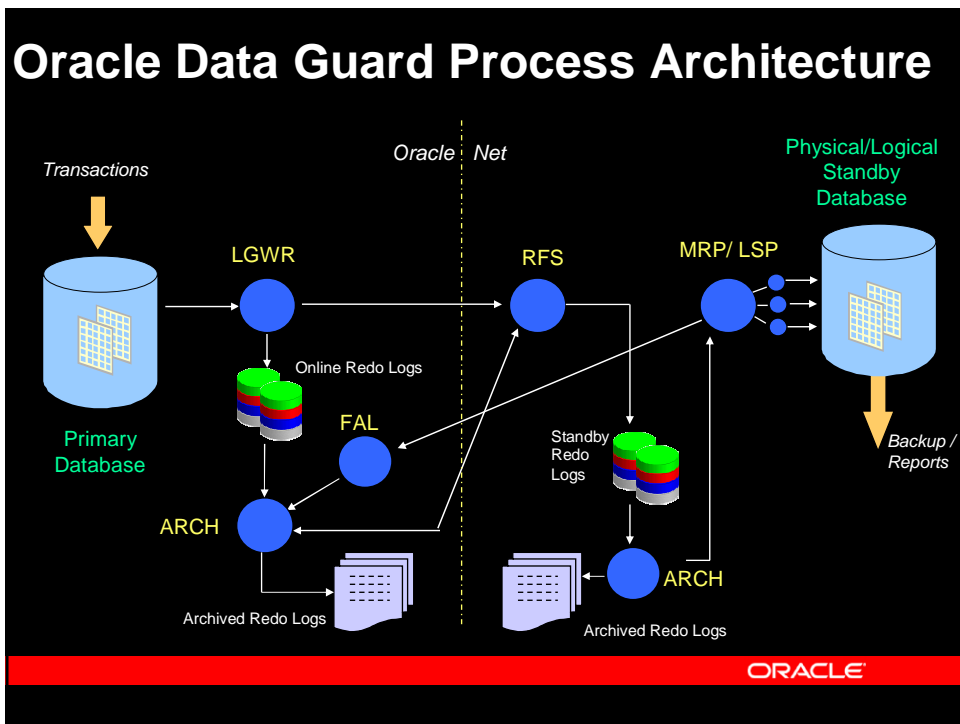
  Data is the core asset of the enterprise!

- Also addresses human errors & planned maintenances

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Oracle Data Guard Architecture

Physical Standby Database

Sync or Async Redo Shipping

Backup

Production Database

Network

Redo Apply

Broker

Logical Standby Database

Open for Reports

Transform Redo to SQL

SQL Apply

Additional Indexes & MVs

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Oracle Data Guard Process Architecture

Data Guard Redo Apply:*Best for DR*

- Physical Standby Database is a block-for-block copy of the primary database
- Uses the database recovery functionality to apply changes
- Can be opened in read-only mode for reporting/queries
- Can also be used for backups, offloading production database
- Best Solution for Disaster Recovery

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Data Guard SQL Apply

- Logical Standby Database is an open, independent, active database
    - Contains the same logical information (rows) as the production database
    - Physical organization and structure can be very different
    - Can host multiple schemas
- Can be queried for reports while logs are being applied via SQL
- Can create additional indexes and materialized views for better query performance
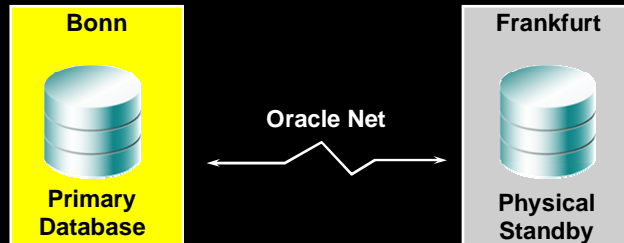
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A Simple Setup (The Fire Extinguisher)

Bonn

Primary Database

Oracle Net

Frankfurt

Physical Standby

- Transport?
    - ARCH or LGWR depending on your needs
    - If it's LGWR then ASYNC.

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A Standby you can use

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Primary Database

Oracle Net

Frankfurt

Logical Standby
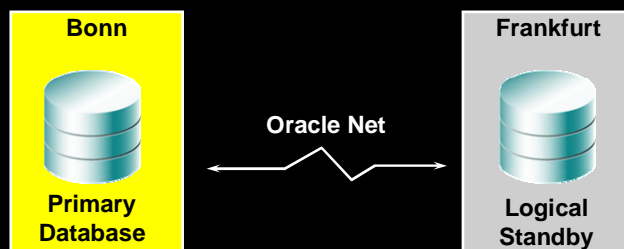
- Transport?
    - LGWR
    - ASYNC for the least impact

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DR and Reporting

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Frankfurt

Primary Database

Oracle Net

Physical Standby

Koln

Logical Standby
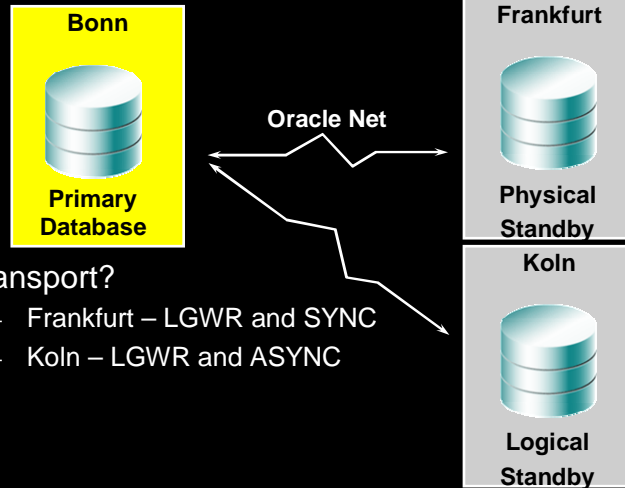
- Transport?
  - Frankfurt – LGWR and SYNC
  - Koln – LGWR and ASYNC

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Cannot Lose a Transaction

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Primary Database

Oracle Net

Physical Standby

Koln

Physical Standby
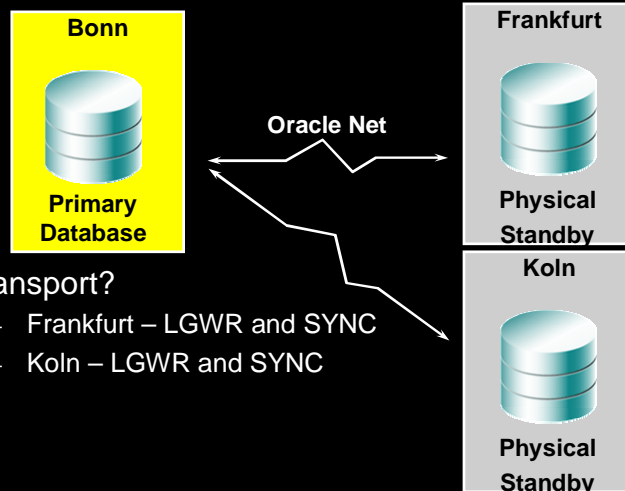
- Transport?
  - Frankfurt – LGWR and SYNC
  - Koln – LGWR and SYNC

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Send the REDO once, apply twice

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Primary Database

Oracle Net

Koln

Physical Standby
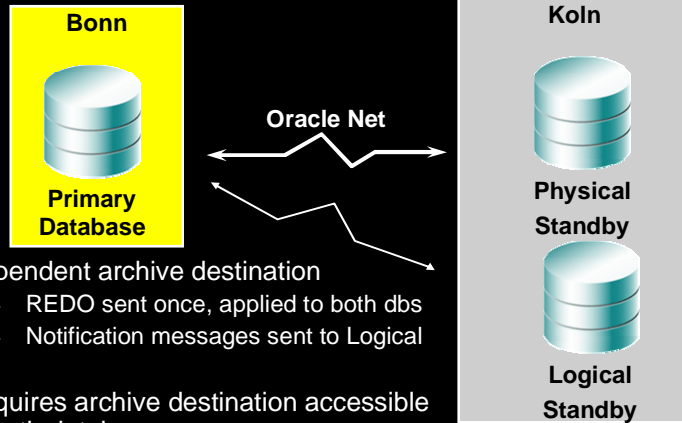
Logical Standby

- Dependent archive destination
    - REDO sent once, applied to both dbs
    - Notification messages sent to Logical

- Requires archive destination accessible to both databases.

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Bank #1 –Web Site

← **Internet Users**

FireWall

Logical Standby

Logical Standby
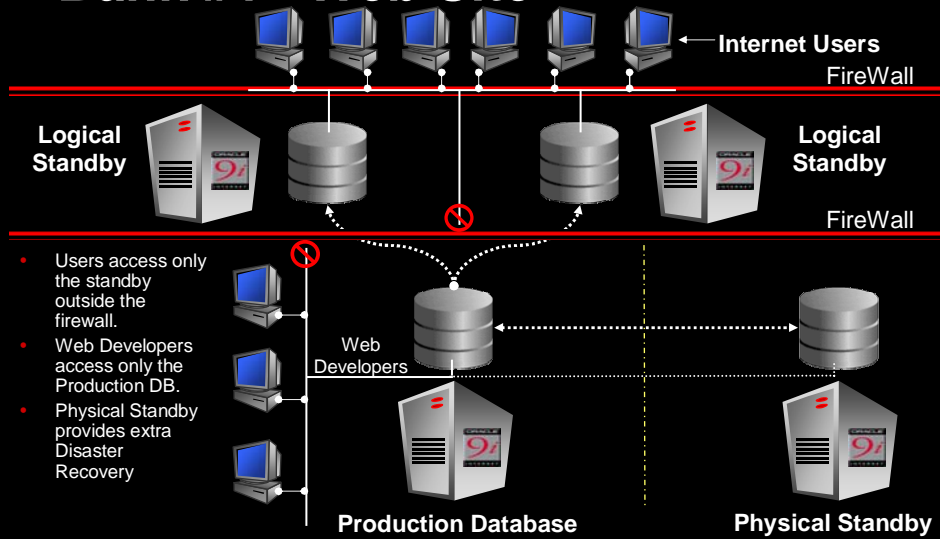
FireWall

- Users access only the standby outside the firewall.
- Web Developers access only the Production DB.
- Physical Standby provides extra Disaster Recovery
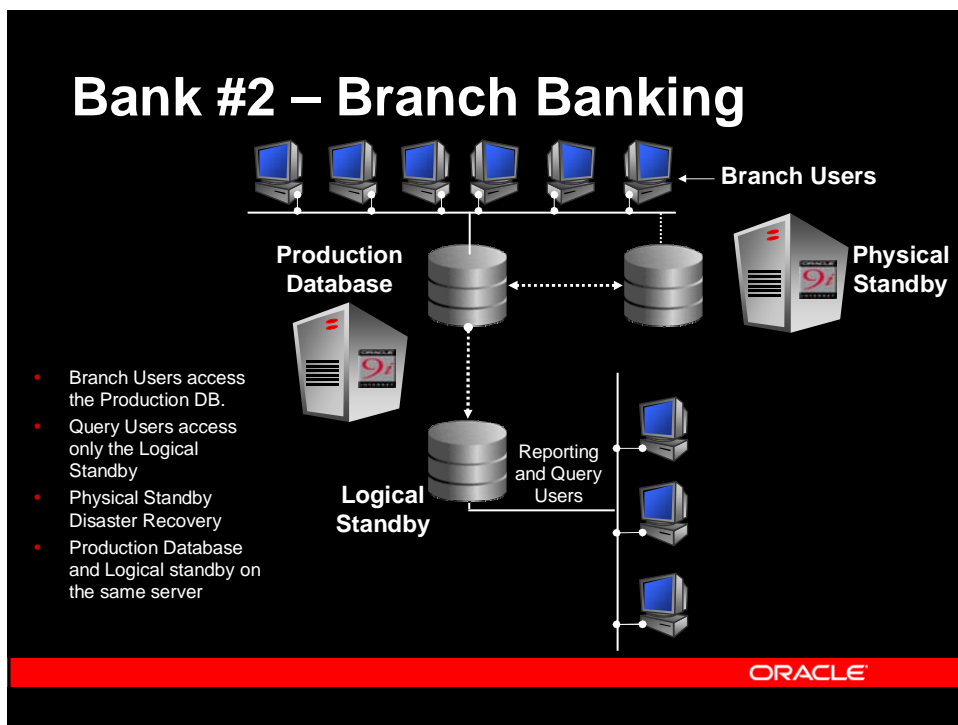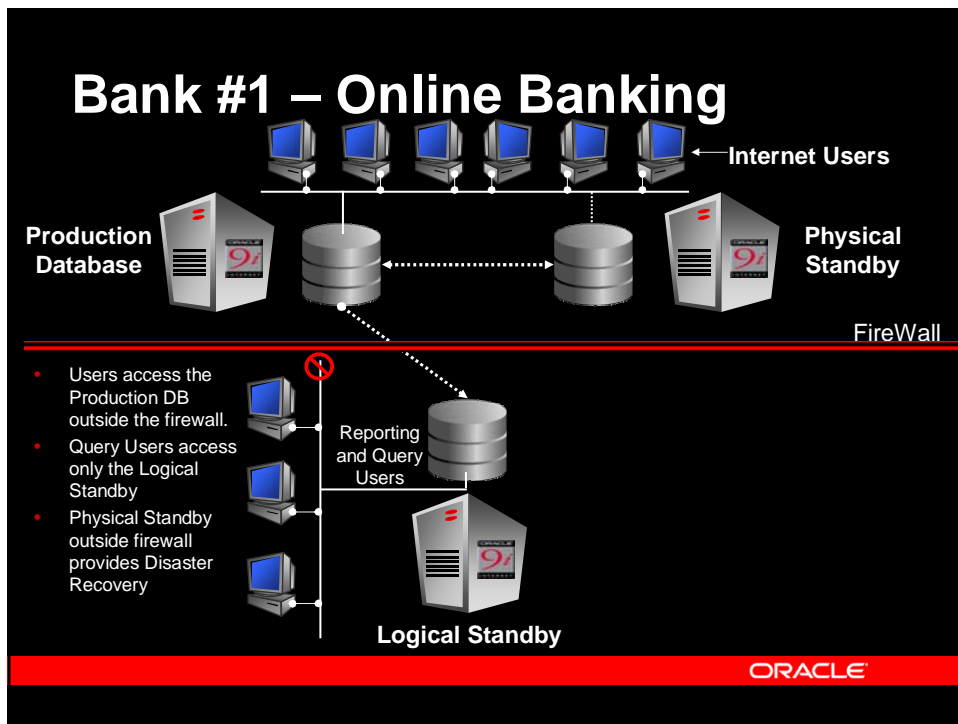
Web Developers

Production Database

Physical Standby

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Oracle Data Guard 10g Objectives

- Establish Data Guard as an extremely
  - easy-to-use
  - low-cost
  - comprehensive
  - reliable

  Disaster Recovery solution for enterprise data

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10*g*
DATABASE

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Data Guard 10g New Features

- **General new features**
  - Real Time Apply
  - Flashback Database Integration

- **SQL Apply new features**
  - Zero Downtime Instantiation
  - Rolling Upgrades
  - Additional Datatypes

- **Data Guard Broker & Enterprise Manager new features**
  - RAC integration
  - Simplified browser-based interface focused on best practices

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Real Time Apply

- Redo data is applied to the standby database as soon as it is received from the primary database
  - In Oracle9*i* Data Guard this apply has to wait till an archivelog is created on the standby database

- For Redo Apply:
  ```
  ALTER DATABASE RECOVER MANAGED STANDBY DATABASE USING
    CURRENT LOGFILE
  ```

- For SQL Apply:
  ```
  ALTER DATABASE START LOGICAL STANDBY APPLY IMMEDIATE
  ```

- When real time apply is enabled, `RECOVERY_MODE` column in `V$ARCHIVE_DEST_STATUS` displays "`MANAGED REAL TIME APPLY`"

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Real Time Apply Architecture
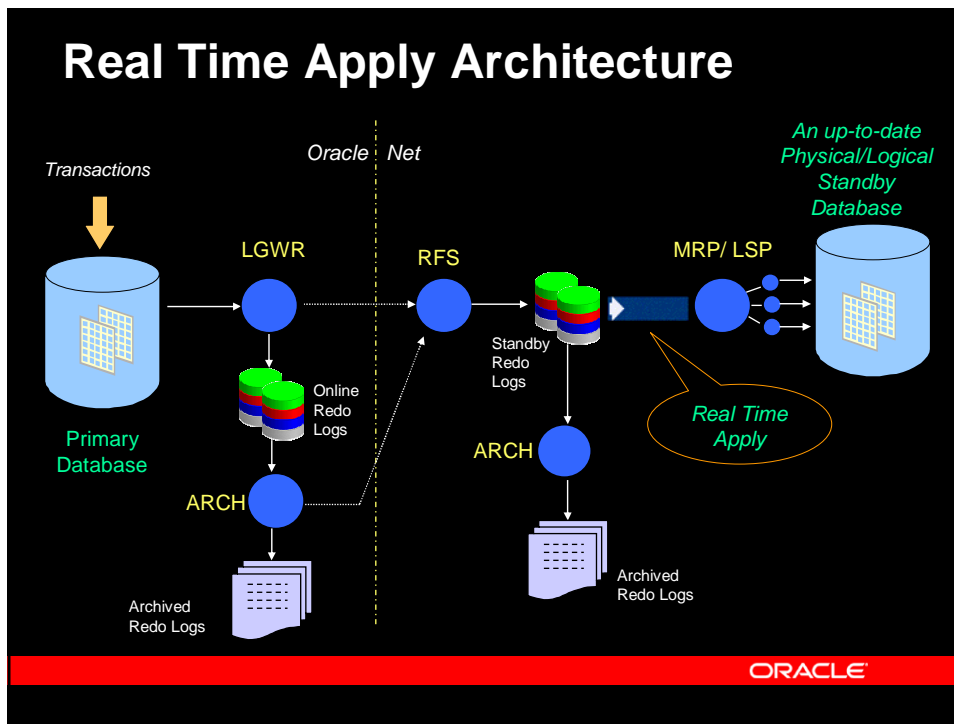
Real Time Apply – Benefits

- Standby databases now more closely synchronized with the primary
  - More up-to-date, real-time reporting
  - Faster switchover and failover times
    - Reduces planned and unplanned downtime
    - Better Recovery Time Objective (RTO) for DR

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Existing Site Recovery Tradeoffs

Primary Database   Redo Shipment   Standby Database   Reporting on delayed data
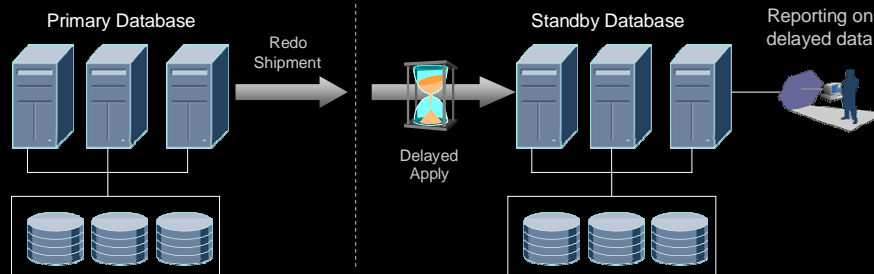
Delayed Apply

- Log apply may be delayed to protect from user errors but:
  - Switchover/Failover gets delayed
  - Reports run on old data
- After failing over to standby, production DB must be rebuilt

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Flashback Database
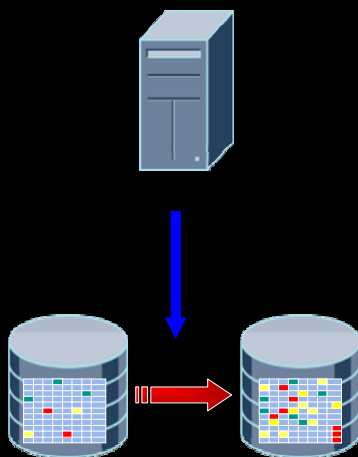
- A new strategy for point in time recovery
- Eliminate the need to restore a whole database backup
- Integrated seamlessly with RMAN
  - Think of it as a continuous backup
  - Restores just <u>changed</u> blocks
- It's <u>fast</u> - recover in minutes, not hours
- It's <u>easy</u> - single command restore

```
RMAN> FLASHBACK DATABASE
      TIMESTAMP to_timestamp
      ('2003-08-15 16:00:00',
      'YYYY-MM-DD HH24:MI:SS');
SQL> FLASHBACK DATABASE
      TO <SCN>;
```

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Enhanced DR with Flashback Database

| Primary Database | Redo Shipment | **Real Time Apply** | Standby Database | **Real Time Reporting** |

No Delay!

Flashback Log

Flashback Log

Primary: No reinstantiation after failover!

- Flashback DB removes the need to delay application of logs
- Flashback DB removes the need to reinstantiate primary after failover
- Real-time apply enables real-time reporting on standby

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Enterprise Manager New Features

- Streamlined browser-based interface that enables complete standby database lifecycle management

- Focus on:
    - Ease of use
    - Management based on best practices
    - Pre-built integration with other HA features

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RAC Support – Broker

- Now possible to use the Broker to create and manage configurations that contain RAC primary and RAC standby databases

- Data Guard Broker interfaces with Oracle Clusterware such that it has control over critical operations during specific Data Guard state transitions

  - Switchovers, failovers, protection mode changes, state changes

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Example – Ease of Use

- Switchover using Enterprise Manager is now literally two mouse clicks

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SQL Apply Engine Architecture

Mining Group

LSP

Applying Group

PX — PX

PX — PX

Redo

SQL

Log Transport Services

RFS

Remote Archived or Standby REDO Logs

Logical Standby Database

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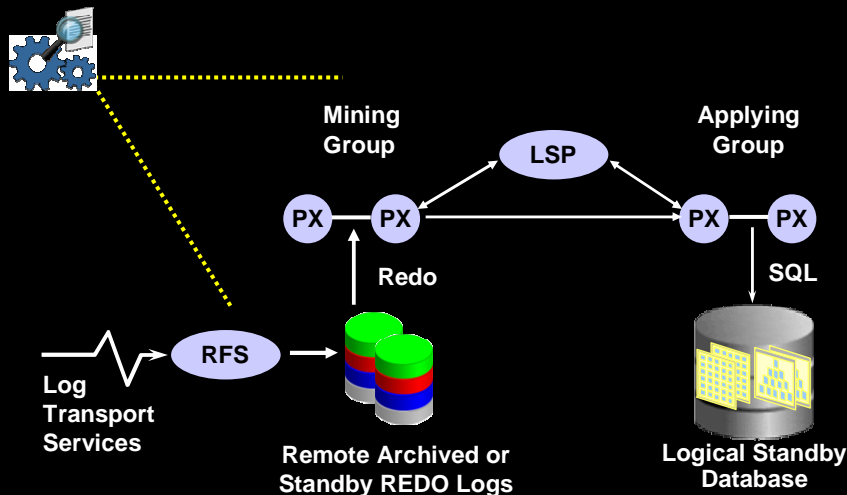
Data Guard SQL Apply

- Zero Downtime Logical Standby Database Creation
  - Faster, Easier, Bulletproof
- Support for more datatypes
  - Support for wider range of applications and functionality
- Improved Ease of Use
- Rolling Database Upgrades – Going Forward
- Real Time Apply
- Integration with Flash Back Database

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Zero Downtime Instantiation

- Logical standby databases easy to create
  - Using an On-line backup!
  - No shut down and no quiesce of the Primary
  - No shutdown = no downtime of production system
  - No quiesce = no wait on quiesce
    - No dependence on Resource Manager

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Support for more Data
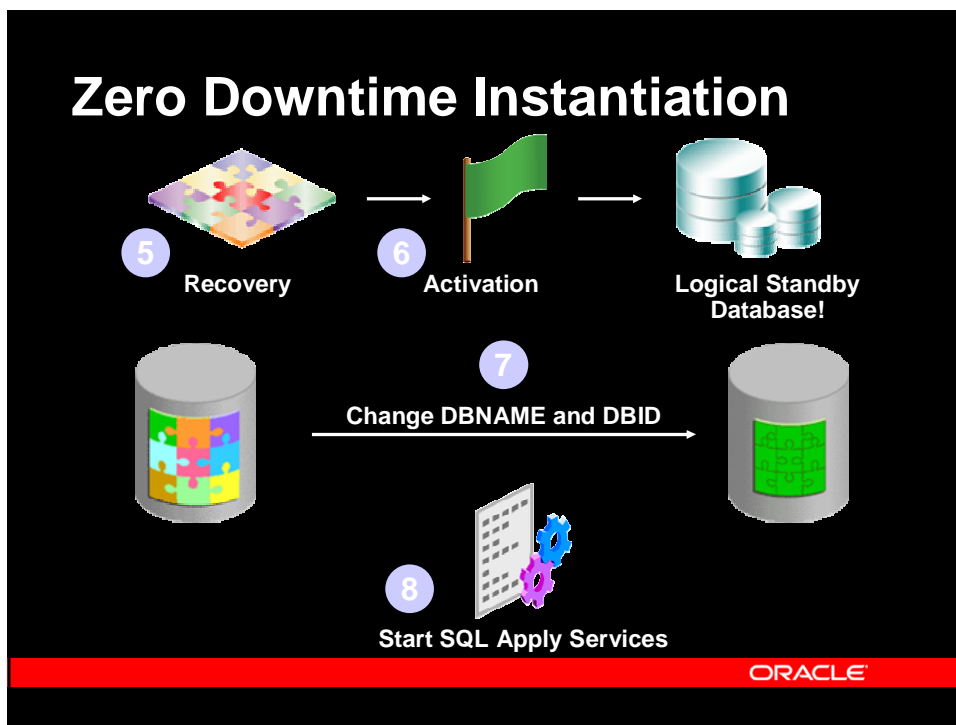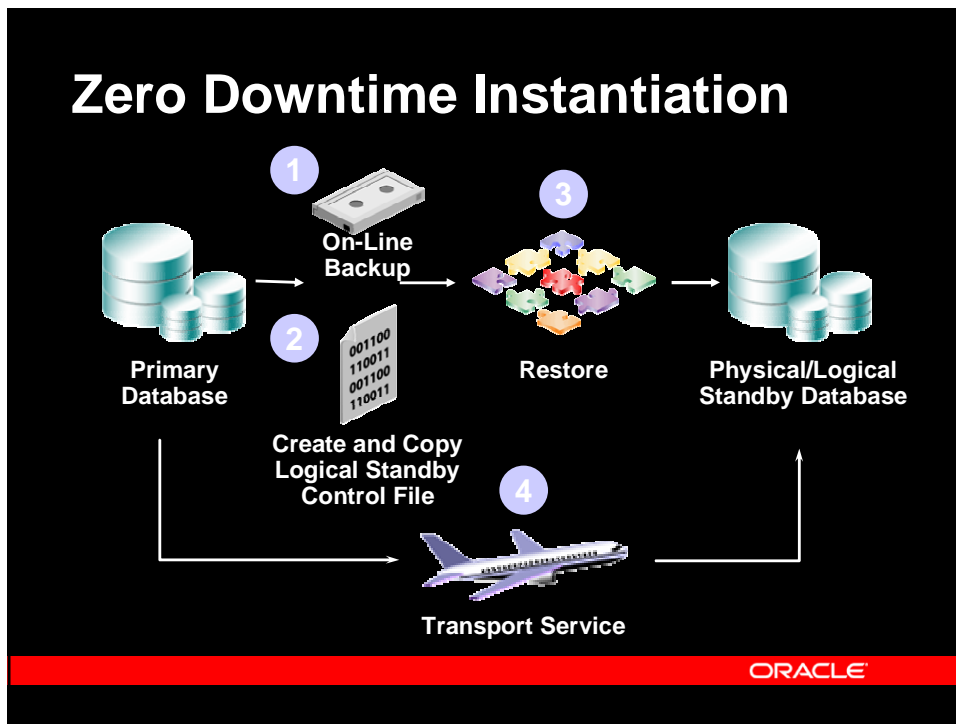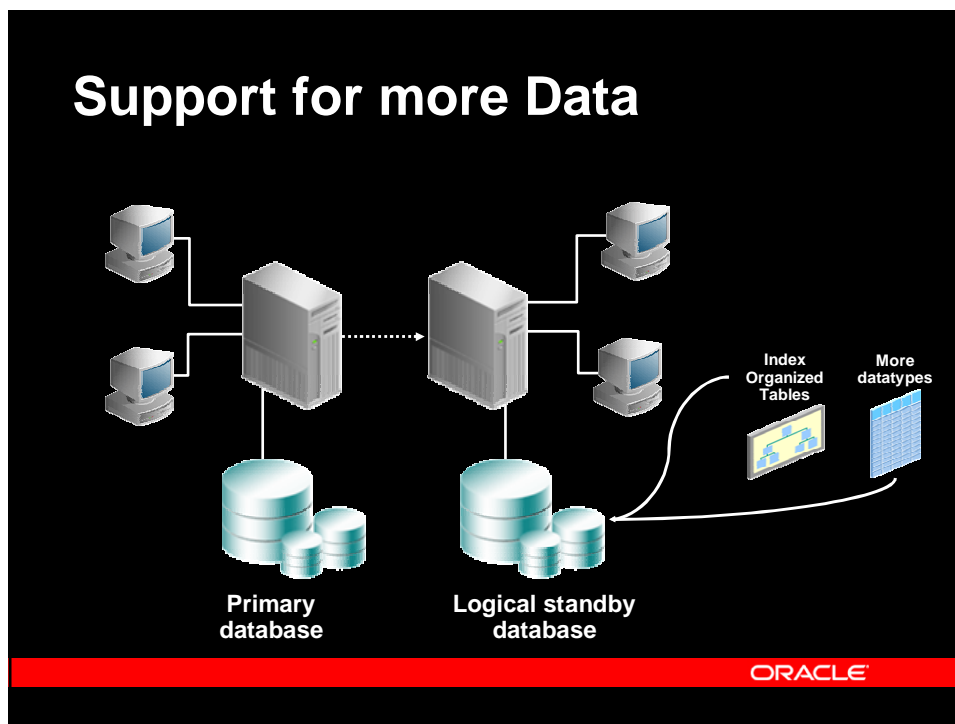
New Datatypes Support

- New Support for:
    - LONG
    - LONG_RAW
    - Multi-byte CLOB
    - NCLOB
    - BINARY_FLOAT (New in Oracle Database 10g)
    - BINARY_DOUBLE (New in Oracle Database 10g)

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Index-Only Tables Support

- IOT Support in a Logical standby database
  - No LOB columns in the IOT
  - No IOT with Overflow

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Automatically Skipping the Last Failed Transaction

Logical Standby Database

Redo from primary

Skip Failed transaction
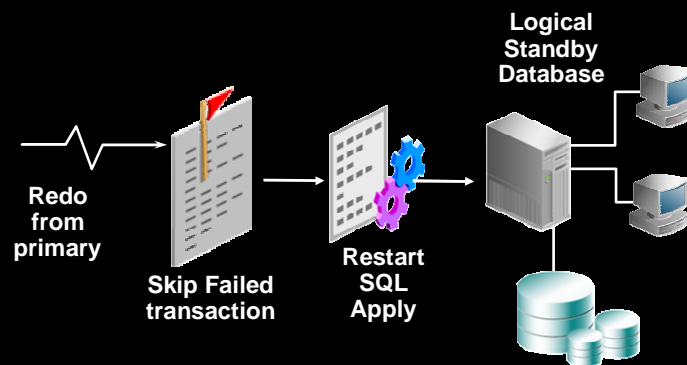
Restart SQL Apply

```
ALTER DATABASE START STANDBY APPLY
SKIP FAILED TRANSACTION;
```

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Rolling Database Upgrades

- In Oracle Database 10g, SQL Apply provides the starting point for performing rolling upgrades of the Oracle RDBMS software and database with minimal interruption of service

- By utilizing a Logical standby database customers can upgrade one database while running on the original production database and then run in a mixed version environment before returning to the original, but upgraded, configuration!

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Original Setup

Production Database Version X — Node One

Logical Standby Version X — Node Two
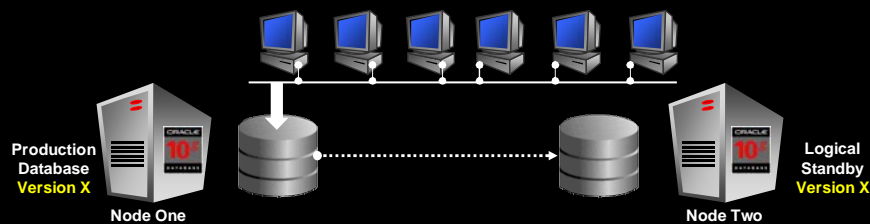
- Initial Data Guard Setup with all databases at Version X
- Applications running on Node One, the Production Database.
- Reporting and Query Applications running on the Logical standby

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Upgrade the Logical Standby

Production Database **Version X**

Node One

Logical Standby **Version X+1**
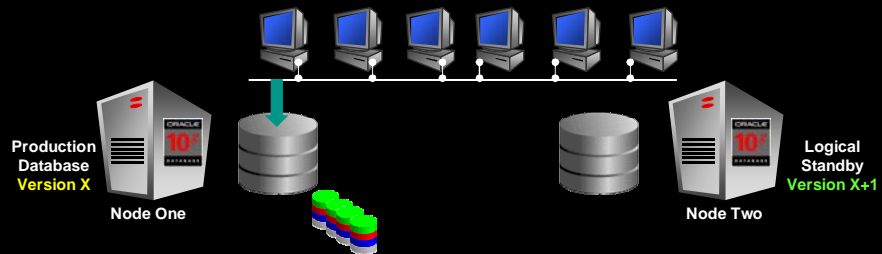
Node Two

- Stop Redo shipping to the Logical Standby on Node Two.
- Archive logs stack up on Node One.
- Upgrade Logical Standby
- Test General reporting and queries on the upgraded logical standby
- Applications still running on Node One, the Production Database.

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Run In Mixed Environment

Production Database **Version X**

Node One

Logical Standby **Version X+1**

Node Two

- Re-enable Redo Shipping to the Logical Standby on Node Two
- Stacked Archive logs automatically sent to resynchronize the Logical Standby (Bring it up to date)
- Applications still running on Node One, the Production Database.
- Reporting and Query Applications running on upgraded Logical standby

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Switch Over Applications
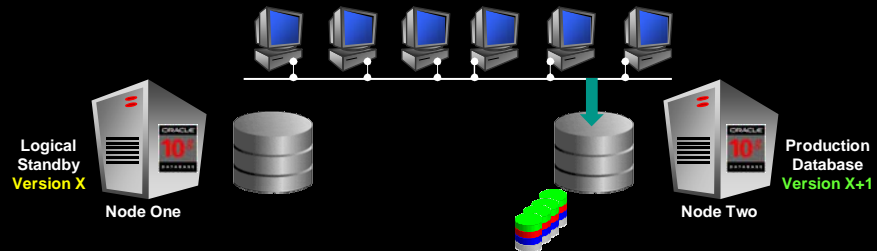
- Switch over databases from Node One to Node Two.
- Original Production Database is now a Logical Standby.
- Redo Shipping to Node One is stopped.
- Archive logs stack up on Node Two.
- Applications running on Node Two, the Upgraded Production Database.

Logical Standby **Version X** — **Node One**
Production Database **Version X+1** — **Node Two**

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Upgrade Node One

- Upgrade the Logical Standby database on Node One.
- Applications still running on Node Two, the Upgraded Production Database.

Logical Standby **Version X+1** — **Node One**
Production Database **Version X+1** — **Node Two**

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Re-Enable Redo Shipping

Logical Standby
Version X+1

Node One

Production Database
Version X+1

Node Two

- Re-enable Redo Shipping to the Logical Standby on Node One
- Stacked Archive logs automatically sent to resynchronize the Logical Standby (Bring it up to date)
- Applications still running on Node Two, the Production Database.
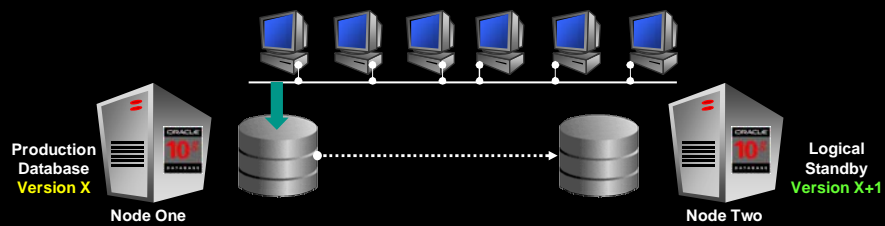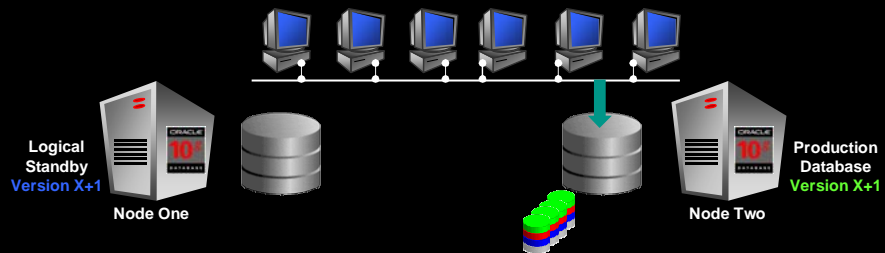- Reporting and Query Applications running on upgraded Logical standby

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Switch Back to Original Setup

Production Database
Version X+1

Node One

Logical Standby
Version X+1

Node Two
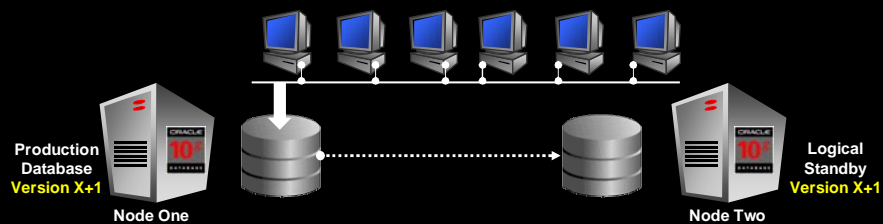
- Initial Data Guard Setup with all databases at Version X+1
- Applications running on Node One, the Production Database.
- Reporting and Query Applications running on the Logical standby

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SQL Apply and
Oracle Database 10*g*

- Improving upon a great foundation!
  - Creating Logical Standby databases is a snap!
  - Querying up-to-date data with Real-Time Apply!
  - Supporting more and more Applications!
  - Moving forward to Rolling Upgrades!

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10*g* Beta Testimonial – Airbus

- *"The Airbus global procurement process requires highly available and very powerful database systems. We've been testing Oracle Data Guard 10g since July 2003 and we are very excited with the new features in Data Guard.*

  We expect to have the highest degrees of data availability and data protection with Data Guard, which will help us achieve our business continuity goals throughout our organization."

Thomas Brunken
IT Project Manager
Airbus Deutschland GmbH
Infrastructure Design & Projects

www.airbus.com

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Maximum Availability Architecture

- Best Practices on:
  - ✓ General Data Guard configuration
  - ✓ Redo data transport mechanisms
  - ✓ Protection modes
  - ✓ Switchover/Failover
  - ✓ Media recovery
  - ✓ SQL Apply configuration
  - ✓ Network configuration
  - ✓ Integration with other HA technologies

- White papers[1]:
  - ✓ MAA – detailed
  - ✓ Media Recovery
  - ✓ Site/Network configuration
  - ✓ Fast-Start Checkpointing
  - ✓ SQL Apply Best Practices
  - ✓ Role Management

1. *Ref. http://otn.oracle.com/deploy/availability/htdocs/maa.htm for latest updates*

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Resources

- Maximum Availability Architecture white papers:
  http://otn.oracle.com/deploy/availability/htdocs/maa.htm

- HA Portal on OTN: http://otn.oracle.com/deploy/availability

- Data Guard home page on OTN:
  http://otn.oracle.com/deploy/availability/htdocs/odg_overview.html

- Oracle Consulting Services: http://otn.oracle.com/consulting

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**QUESTIONS
ANSWERS**

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