

High Availability Best Practices with Oracle GoldenGate, DataGuard and XAG

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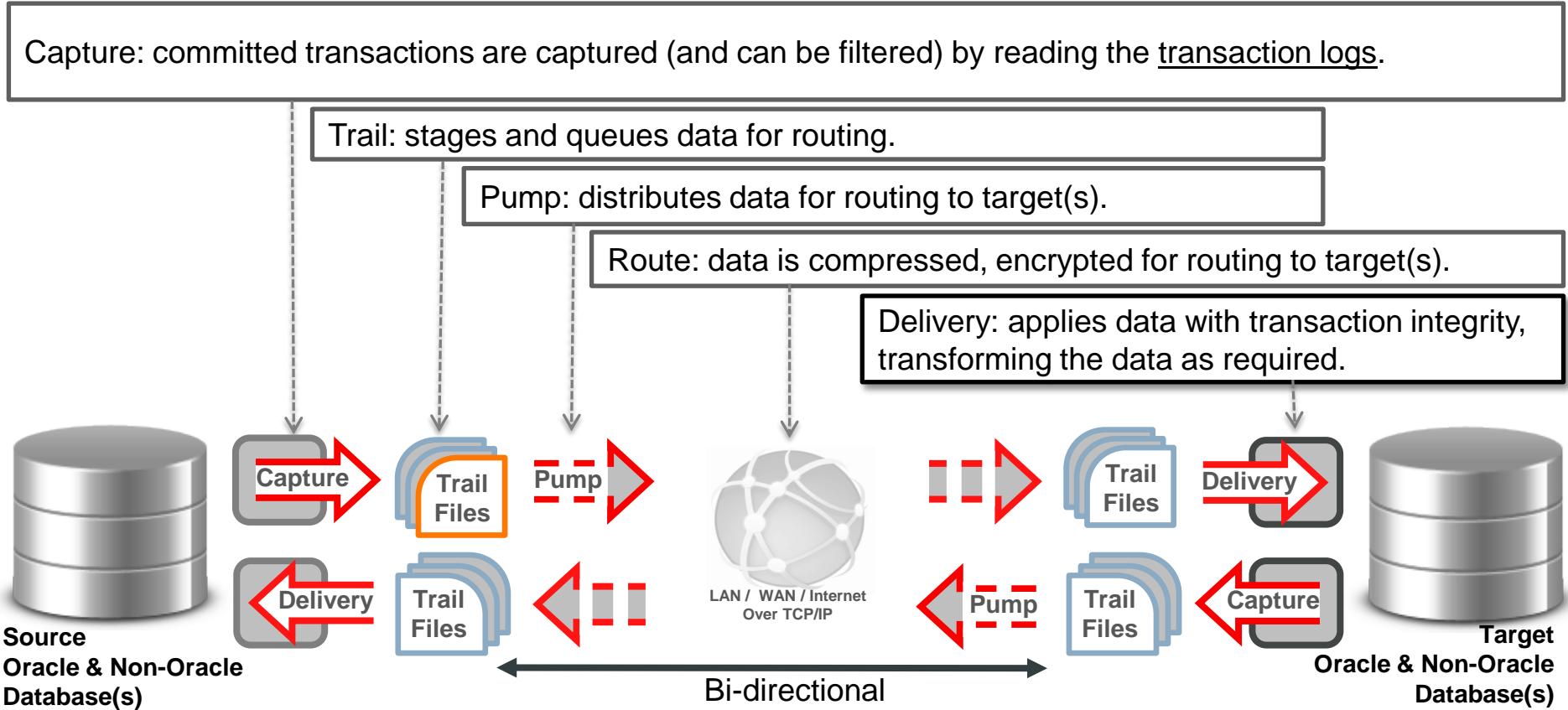
Program Agenda

- 1 Overview of Oracle GoldenGate
- 2 Overview of Oracle Active Data Guard / FSFO
- 3 Overview of the Grid Infrastructure Bundled Agent (XAG)
- 4 Configuration for GoldenGate with Data Guard
- 5 Case Study with GoldenGate and Data Guard
- 6 Summary

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How Oracle GoldenGate Works



Integrated Extract and Integrated Replicat: Overview

- Oracle only
- Integrated Extract introduced in GoldenGate 11.2.1
 - requires 11.2.0.3 RDBMS
 - Integrated Dictionary Support available with 12.1.2.0.0 (requires 11.2.0.4 RDBMS)
- Integrated Replicat introduced in 12.1.2.0.0 (requires 11.2.0.4 RDBMS or above)



Integrated Extract

Key Features

- Flexible Deployment Options
 - Upstream/downstream
- Supports Multitenant Environments
 - Extract can be configured to capture data from any or all PDBs in a multitenant database
- Full Integration with the Database
 - Transparent support for thread events and asymmetric configurations
 - Transparent support for RAC-One
 - Transparent support for resetlog events
 - Transparent handling of redo fuzziness around failover
 - Supports both SYNC and ASYNC role transitions

Integrated Replicat

Key Features

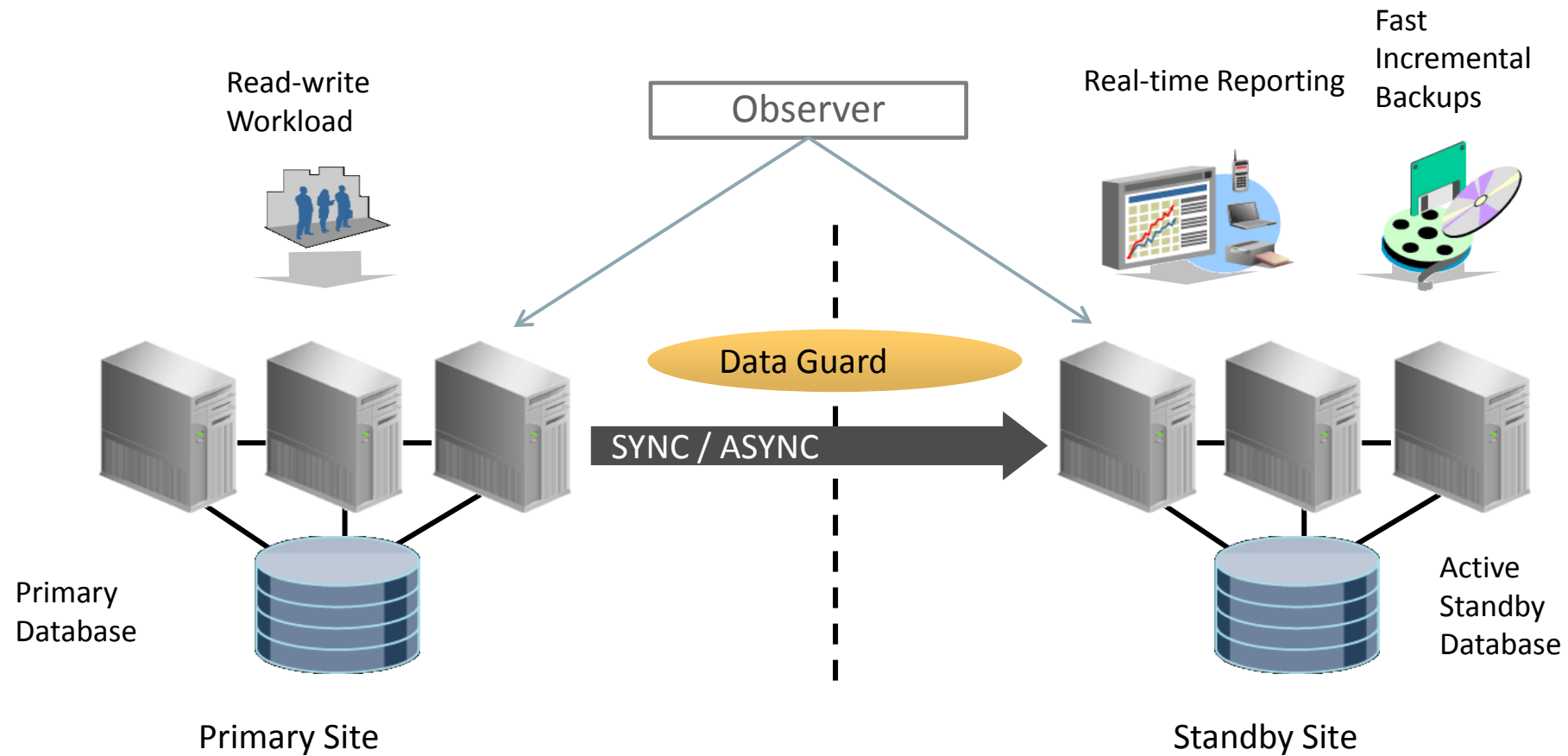
- Improved usability and performance
- Applies source transactions in parallel based on dependencies between transactions
- Automatic tuning of parallelism based on workload
- Conflict detection and resolution
 - GoldenGate CDR, REPERROR, and HANDLECOLLISIONS
 - DML, DDL and error handlers
 - Unhandled errors redirected to Replicat for retry and failure processing
- Session redo tags provide fine-grained filtering, such as cycle prevention in bidirectional replication

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Oracle Active Data Guard

Disaster Recovery and Read-Only Offload to an Active Standby



Oracle Data Guard Concepts

- **Switchover:** Planned role transition from a primary database to one of its standby database.
 - `DGMGRL > SWITCHOVER TO CHICAGO`
 - Requires connectivity to both primary and standby database
 - Ensures all redo has shipped
 - Orderly transition (both databases agree on every thing)
- **Failover:**
 - `DGMGRL > FAILOVER TO CHICAGO`
 - No connectivity with primary
 - New primary becomes the source of truth

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Oracle Grid Infrastructure Bundled Agent (XAG)

- Clusterware specific to managing GoldenGate resources
 - XAG allows you to register a GoldenGate instance with CRS to provide HA
- It solves the key process related issue of ensuring availability of the GoldenGate instance in the face of failures.
 - Loss of instance (RAC node failover)
 - Loss of primary database (Data Guard Failover integration)
- Use AGCTL for registering/starting and stopping resources

Oracle Grid Infrastructure Bundled Agent (XAG)

- Download the latest version (v7.1) available from:
<http://www.oracle.com/technetwork/database/database-technologies/clusterware/downloads/index.html>
- Install outside of Grid Infrastructure ORACLE_HOME and make sure OS user PATH finds this XAG before the GI installed version

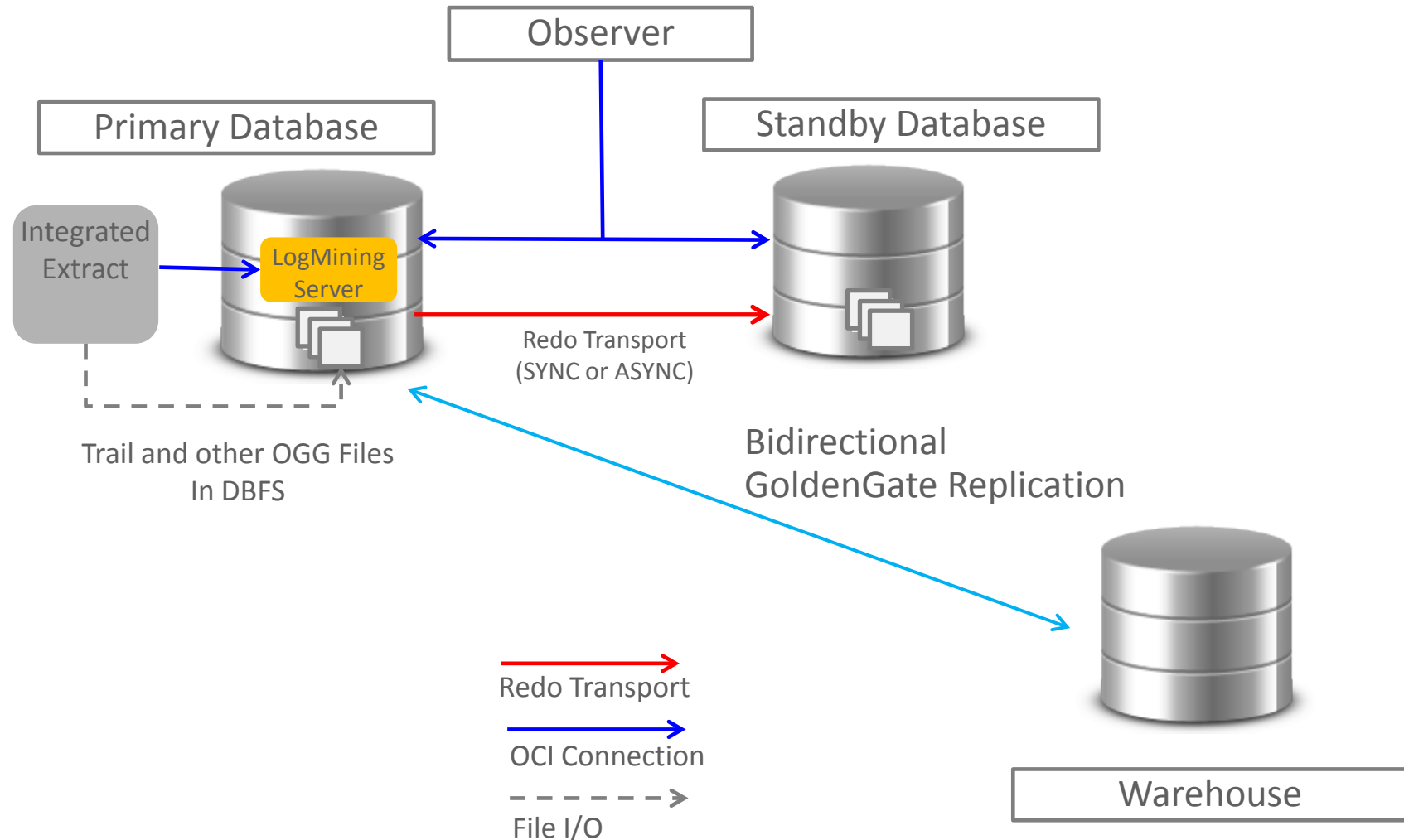
What's new for GoldenGate 12.2

- Support for fetch from ADG
 - Enable with **FETCHUSERID** `ggadmin@adg_inst password pwd` or **FETCHUSERIDALIAS** `ggadmin_adginst`
 - GoldenGate maintains consistency of data fetched from the standby database
- Sourceless Downstream Integrated Extract
 - Improve HA by eliminating back channel to source database (NOUSERID)
requires Integrated Dictionary and a patch on 12.1.0.2 RDBMS and 11.2.0.4 RDBMS
- Tighter Integration with XAG
 - Specify `enable_xag` in globals file
 - Start and stop mgr, extract, pump or replicat from GGSCI not AGCTL
 - View XAG instance info with 'info all' and 'info goldengate [instance_name]' commands

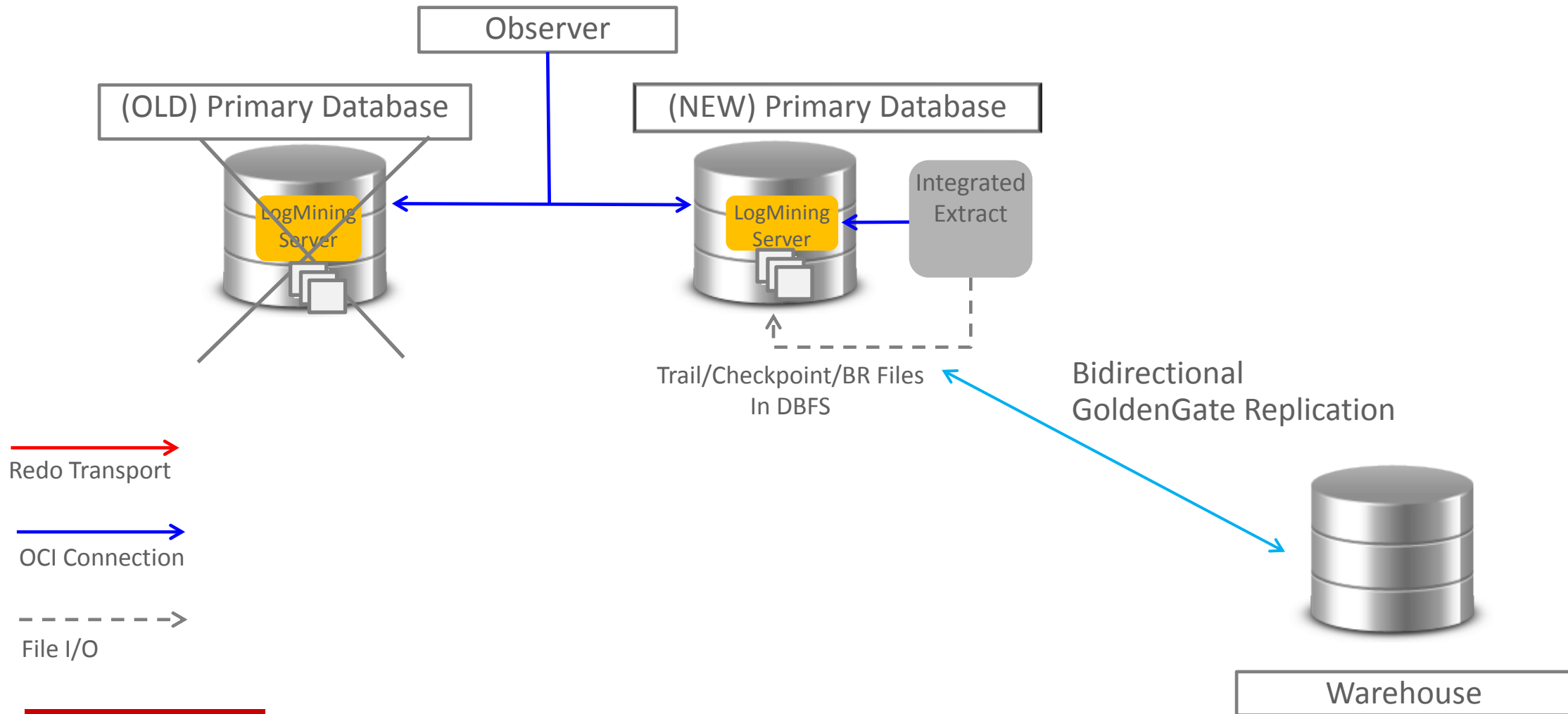
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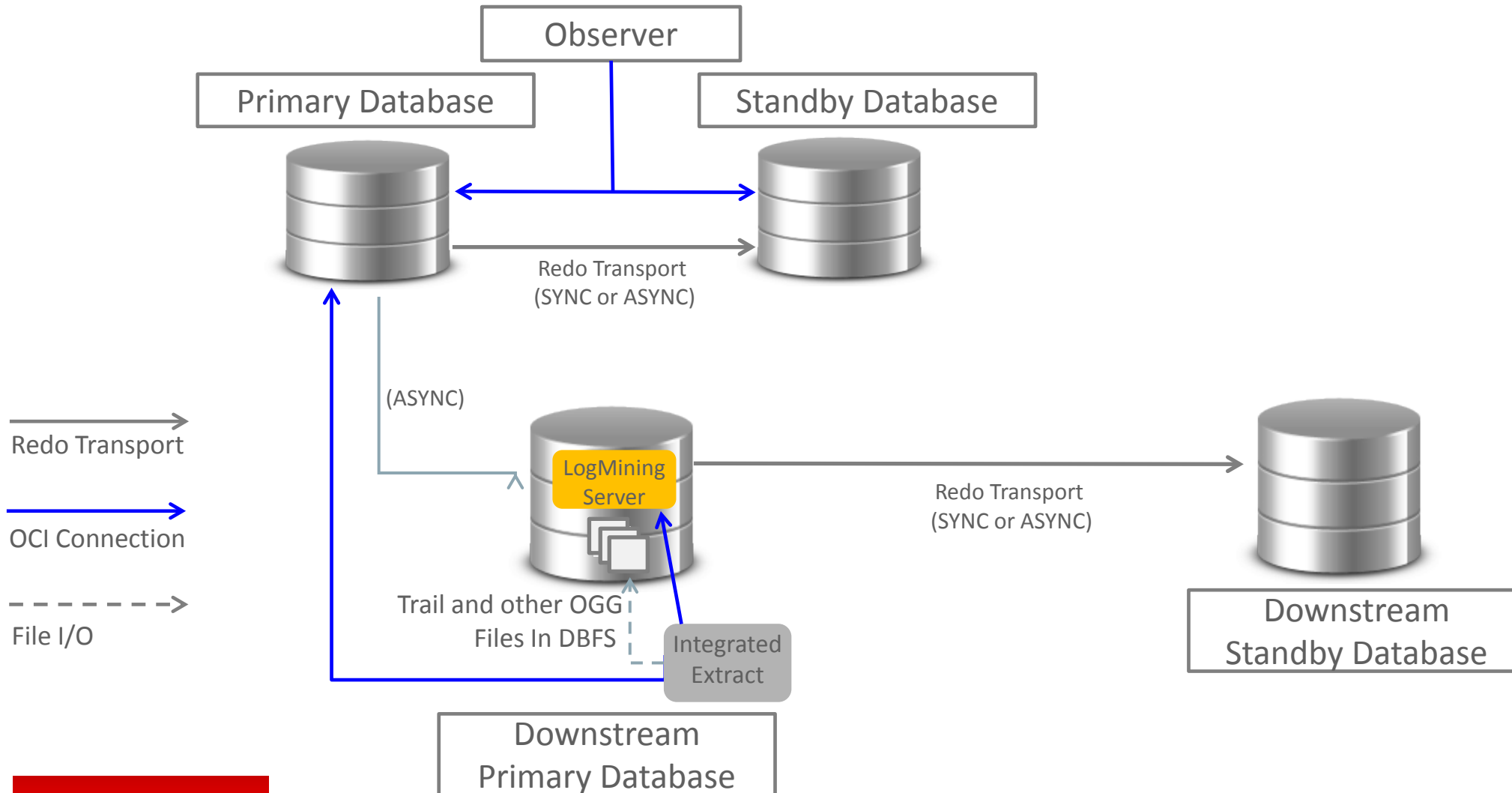
Sample Deployment



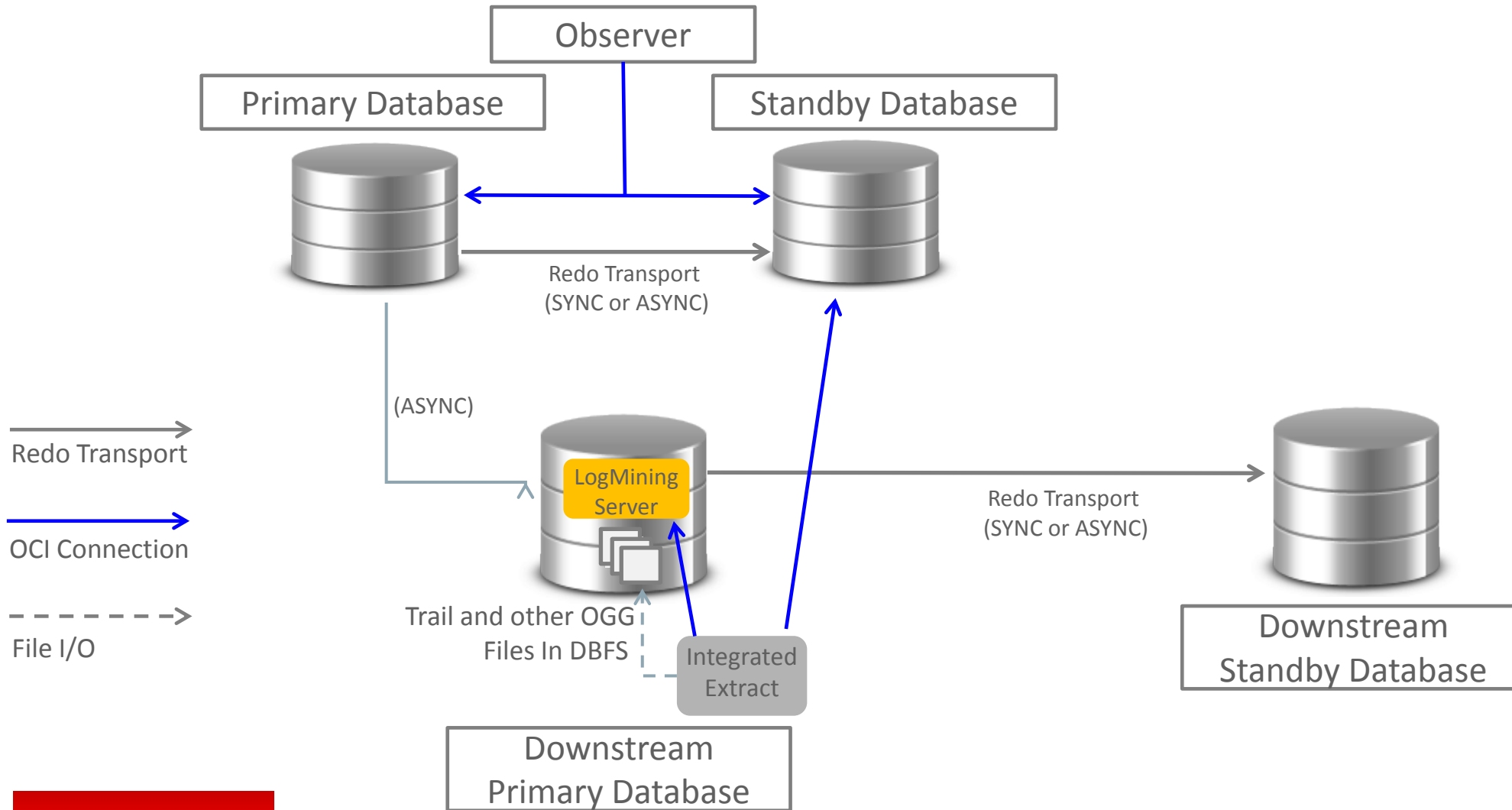
Sample Deployment – Post Role Transition



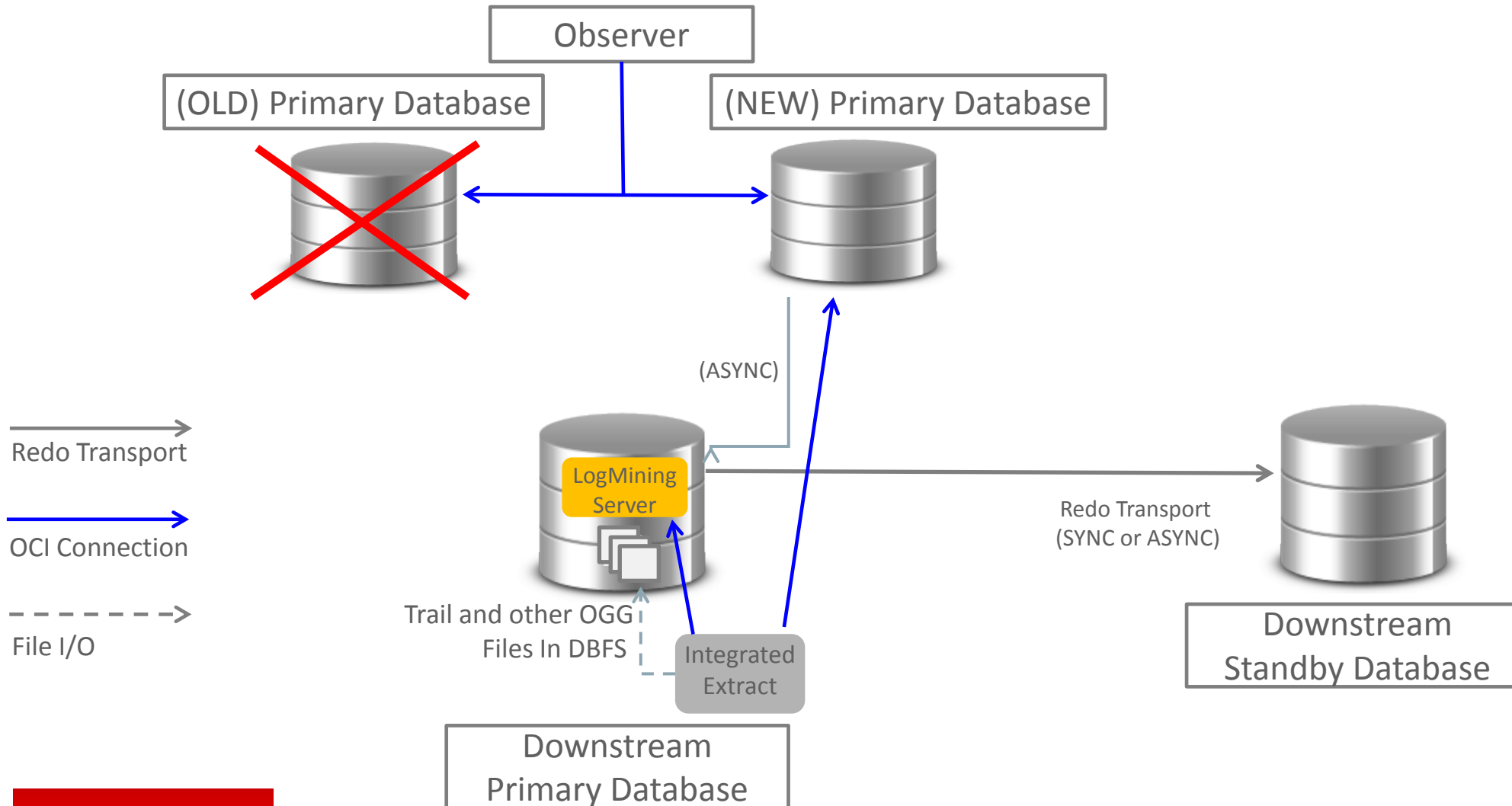
Downstream Sample Deployment for Data Guard



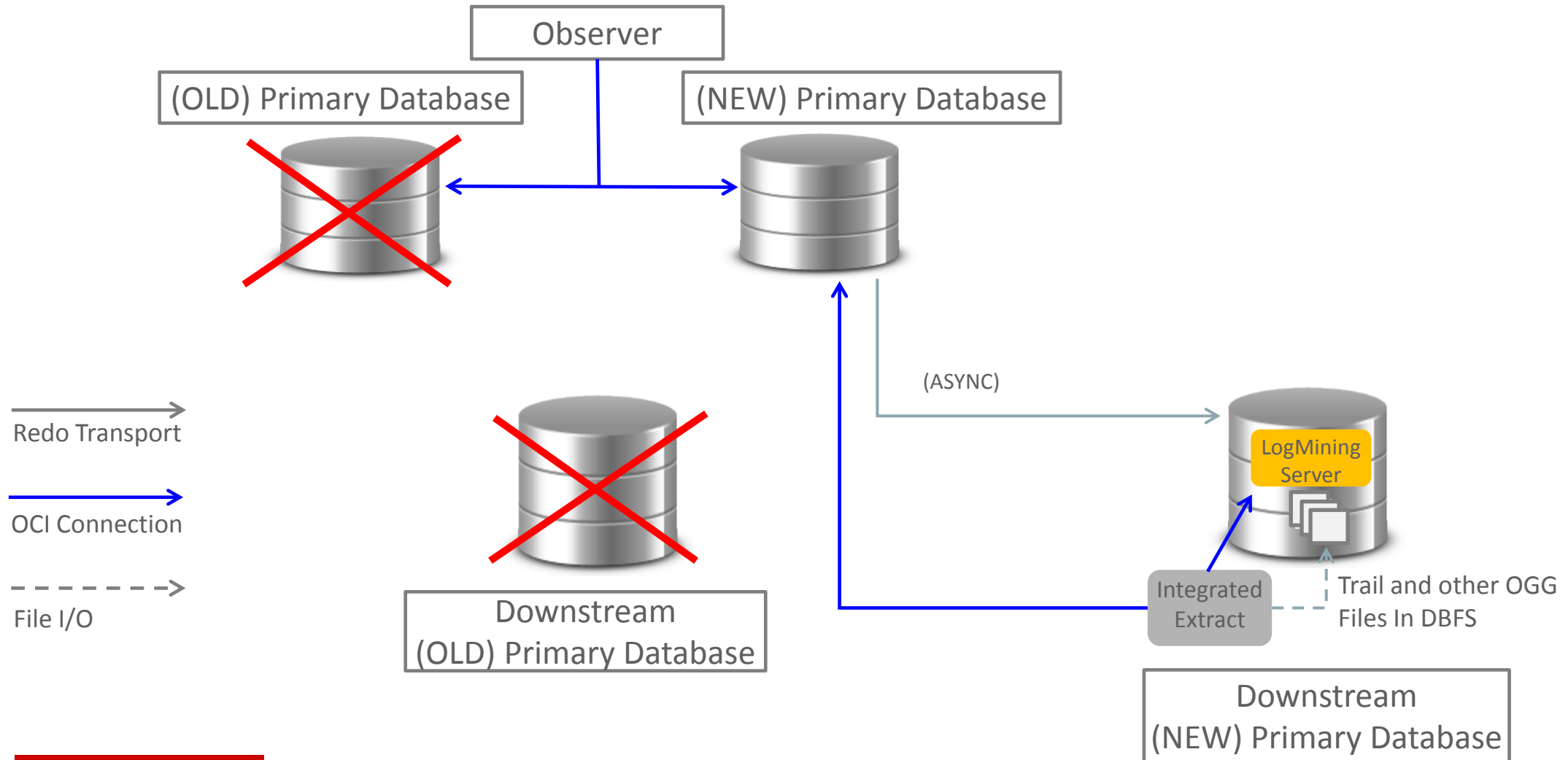
Downstream Sample Deployment for Data Guard



Downstream Sample Deployment Post Failover



Downstream Sample Deployment Post Failover #2



Database Connectivity

- Make all OGG components connect to database using Role-Based Services
 - Declarative way to specify a service should be published only when the database has a specific role
 - **Publish a service only when database has the PRIMARY role**
- Create role-based service (12c syntax):

```
srvctl add service -db GG2PRMY -service oggserv -role PRIMARY  
-preferred GGS21 -available GGS22
```

```
srvctl add service -db GG2STBY -service oggserv -role PRIMARY  
-available GGS21
```

GoldenGate Configuration

- XAG seamlessly relocates GoldenGate on instance or primary failure
- Consistency of GoldenGate data and metadata ensured with DBFS
 - Store trail and checkpoint data on DBFS to guarantee consistency on role transitions
- Provides flexible routing of trail data post role transition
 - Use a Virtual IP to identify the TARGET host machine
 - Transferred between primary and standby on role transition
 - See MOS note 1950121.1 for automatically redirecting Data Pump after TARGET database role transition if VIP not available
 - Enable AUTOSTART of the Data Pump process on the SOURCE
 - After a role transition completes Data Pump will restart sending trails to new primary

Create DBFS CRS Resource

- DBFS is mounted on RAC node that will run GoldenGate
- Create CRS action script (MOS note 1054431.1)
 - Must contain START, STOP, CHECK functions
- Create CRS resource:

```
crsctl add resource dbfs_mount -type cluster_resource \  
-attr "ACTION_SCRIPT=$ACTION_SCRIPT, CHECK_INTERVAL=30,RESTART_ATTEMPTS=10, \  
START_DEPENDENCIES='hard(ora.$DBNAME.db)pullup(ora.$DBNAME.db)',\  
STOP_DEPENDENCIES='hard(ora.$DBNAME.db)', SCRIPT_TIMEOUT=300"
```

- DBFS service will be managed from Bundled Agent

Register GoldenGate with Bundled Agent (XAG)

- Register with XAG at the primary creating the VIP (as root)

```
agctl add goldengate ggprmy --gghome /u01/oracle/goldengate --oracle_home $ORACLE_HOME  
--db_services ora.oggserv.svc--filesystems dbfs_mount --monitor_extracts ext1,dpump1  
--monitor_replicats rep1--environment_vars 'TNS_ADMIN=...' --dataguard_autostart yes  
--nodes prmy1A,prmy1B --user oracle --group oinstall --network 1 --ip 192.168.0.54
```

- Register with XAG at the standby (as oracle, without creating a VIP)

```
agctl add goldengate ggstby --gghome /u01/oracle/goldengate --oracle_home $ORACLE_HOME  
--db_services ora.oggserv.svc --filesystems dbfs_mount --monitor_extracts ext1,dpump1  
--monitor_replicats rep1 --environment_vars 'TNS_ADMIN=...' --dataguard_autostart yes  
--nodes stdb1
```

- Start Extract using Agent Control

– agctl start goldengate ggprmy

Data Guard – Bounded Data Loss (ASYNC)

- Data Guard in MaxPerformance(ASYNC) mode permits data loss on the standby
- Amount of data loss with FSFO controlled by FastStartFailoverLagLimit (default is 30seconds)
- Extract must only mine from redo already applied to Standby
 - Prevents data being replicated to a target database and then missing from the source after a failover
- Add Integrated Extract parameter `TRANLOGOPTIONS HANDLEDLFAILOVER`

Configuration Recommendation Summary

- Bundled Agent version 7.1 and above
- GoldenGate 12.1 and above
- GoldenGate Integrated Extract and Integrated Replicat
- Role-based services for GoldenGate database connectivity
- DBFS for GoldenGate shared file system
- Integrated Extract parameter `TRANLOGOPTIONS HANDLEDLFAILOVER` for ASYNC Data Guard

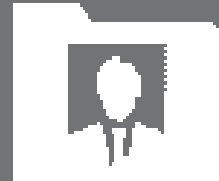
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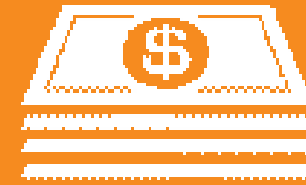
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Core HCM
Customers



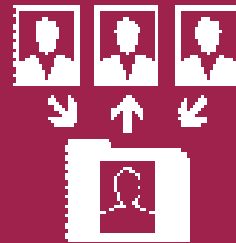
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Enterprise
Talent
Customers



>125
Global Payroll
Customers



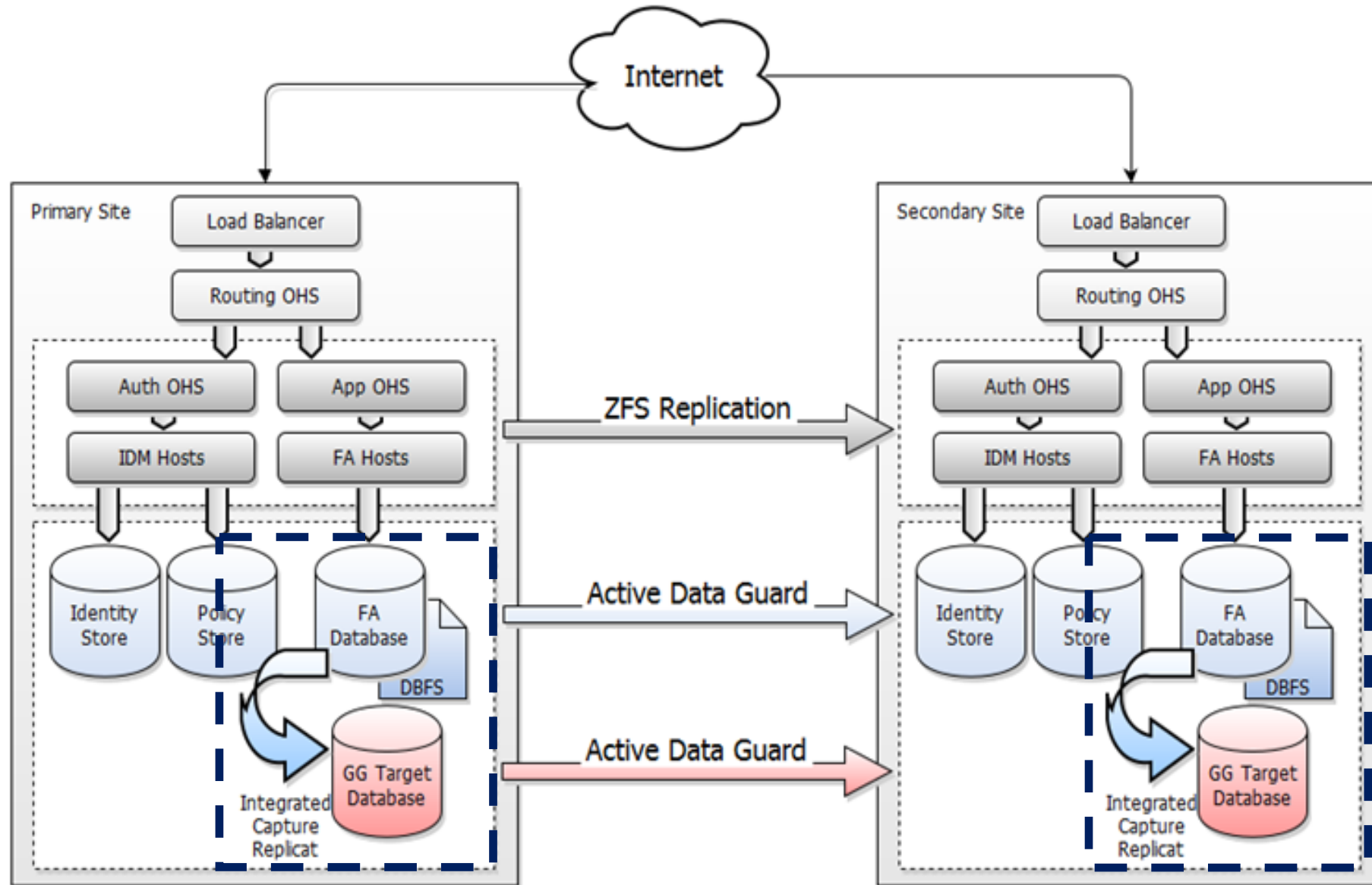
7,000+
HCM Cloud
Service
Customers



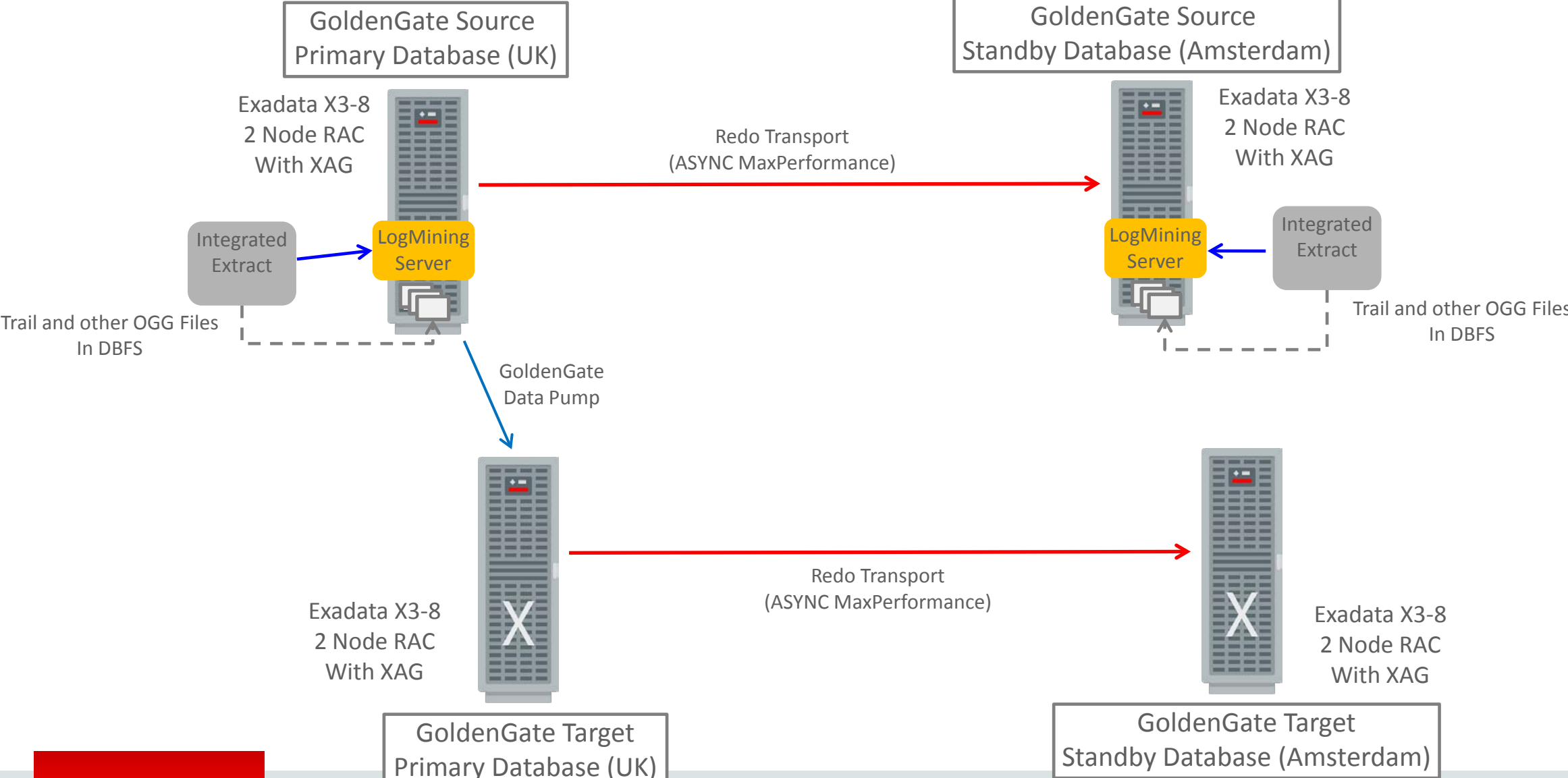
>5500 Mid-
Market Talent
Customers



>930
Learning
Customers



High Level Architecture



Environment

- Four Exadata X3-8 servers
- Oracle Enterprise Database 11.2.0.4.16
- Oracle Grid Infrastructure 11.2.0.4.0
- Oracle Grid Infrastructure Bundled Agent (XAG) 6.1
- Oracle GoldenGate 12.1.2.0.0
- Source database peak load redo generation of 8.1TB/hour
 - Replicating 7146 database tables
- Trail file generation rate of 7GB/hour

GoldenGate Configuration

- Integrated Extract with `TRANLOGOPTIONS HANDLEDLFAILOVER`
- Non-integrated Replicat
- DBFS configured in source and target databases storing BR, dirdat, dirtmp and dirchk directories
- GoldenGate processes registered with XAG to handle automatic failover between RAC nodes
- XAG handles Data Guard role transitions (switchover and failovers)
- Heartbeat table used to monitor and alert GoldenGate lag

Failures covered by MAA configuration

- XAG seamlessly relocates GoldenGate processes to any node in the cluster
- XAG automatically fails over GoldenGate processes in the event of instance failure
- XAG manages GoldenGate starting on new Data Guard primary database after role transition without user interaction
 - No need for database role transition triggers
- RAC failures and DG role transitions all carried out inside of required Recovery Point Objectives (RPO) and Recovery Time Objectives (RTO)
 - All without manual intervention

Looking to the Future

- Upgrade GoldenGate to 12.1.2.1.8
- Upgrade XAG to latest version (7.1)
- Convert non-integrated Replicat to integrated Replicat
 - Take advantage of apply auto-parallelism and enhancements
- Upgrade database to Database 12c next year
- Implement this MAA configuration for additional clients in our Cloud offering

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Summary

- Seamless Data Guard role transitions with GoldenGate
- No manual intervention is required with FSFO and DG Broker
- Configuration makes use of:
 - Oracle Grid Infrastructure Bundled Agent (XAG)
 - DBFS for shared GoldenGate files (trails and checkpoint files)
 - Role based services
 - Integrated Extract (with HANDLEDLFAILOVER option for ASYNC DG)
 - Integrated Replicat is recommended

Further Reading

- Important MOS Notes/White Papers
 - Transparent Role Transitions with Oracle Data Guard and Oracle GoldenGate
 - <http://www.oracle.com/technetwork/database/availability/ogg-adg-2422372.pdf>
 - Client Failover Best Practices for Highly Available Oracle Databases: Oracle Database 12c
 - <http://www.oracle.com/technetwork/database/availability/client-failover-2280805.pdf>
 - Oracle GoldenGate with Real Application Clusters Configuration
 - <http://www.oracle.com/technetwork/database/features/availability/maa-goldengate-rac-2007111.pdf>