

The background features abstract, wavy, cloud-like patterns in grey, teal, and orange-red colors.

Oracle Converged Database Continuous Availability

Workshop

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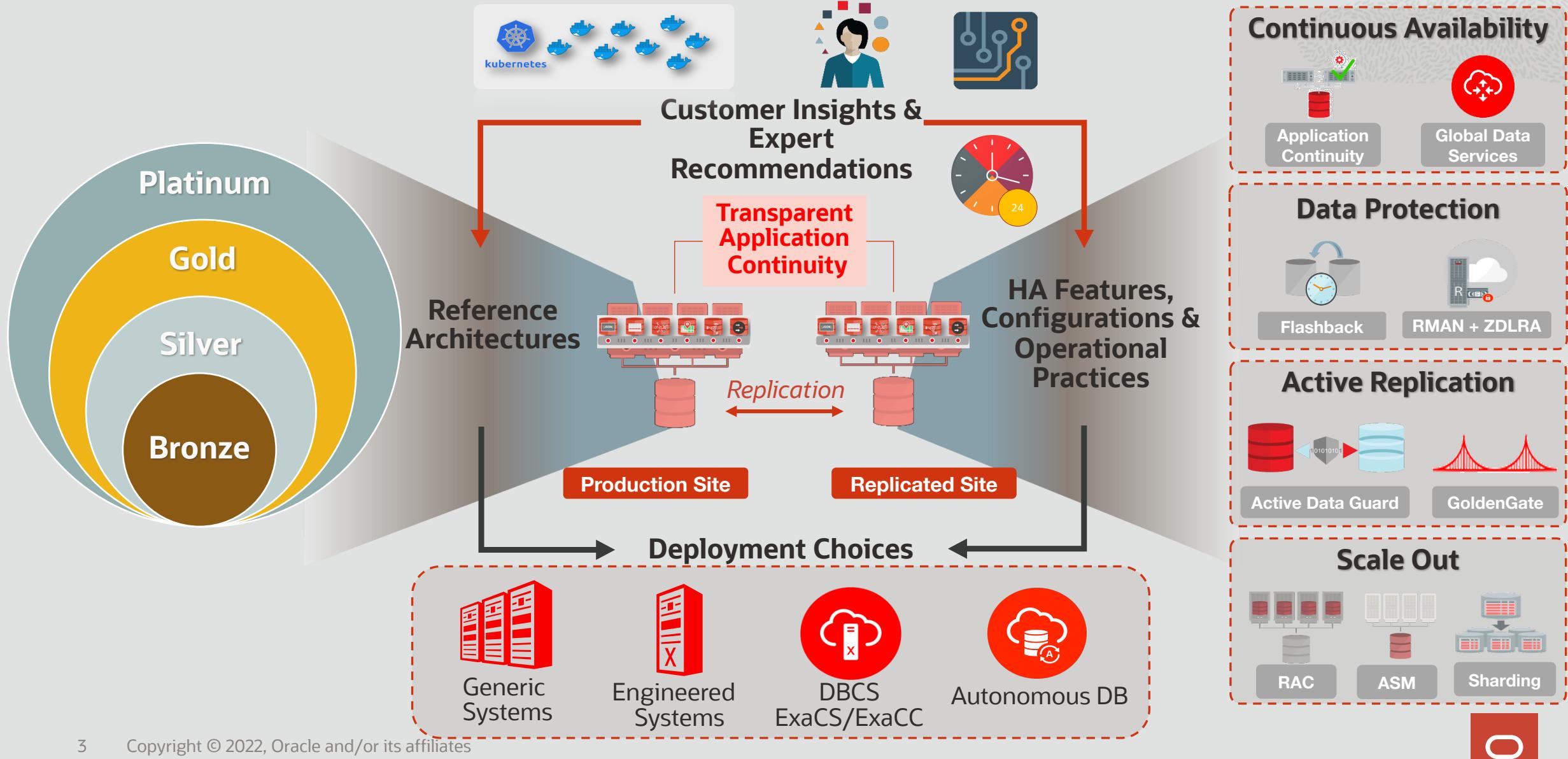
Madrid 26 de Abril de 2022

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Oracle Maximum Availability Architecture (MAA)



Overview

- Real Application Clusters
- Active Data Guard and FSFO
- Database sharding



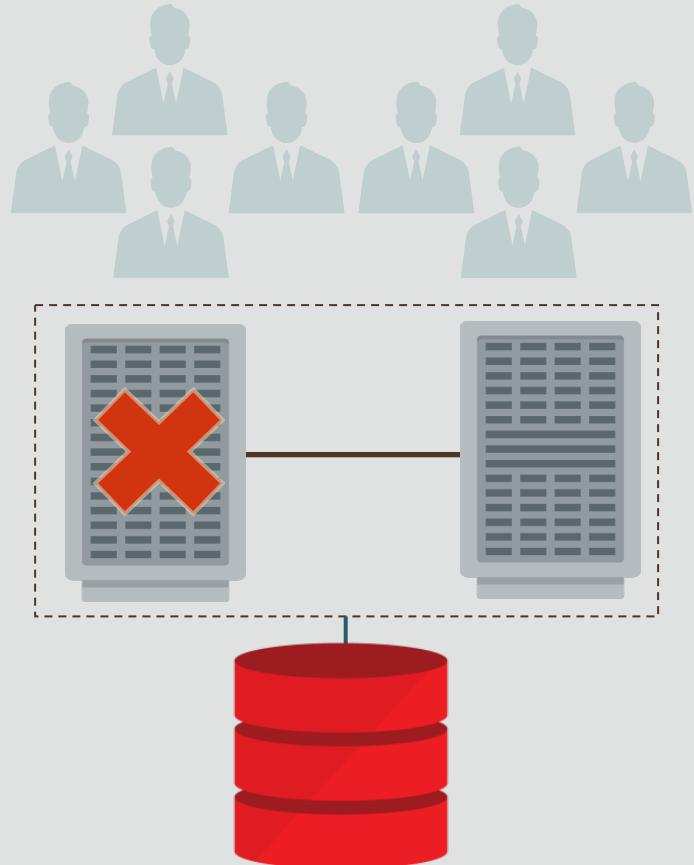
Q & A session before starting each day

Overview

- Real Application Clusters
- Active Data Guard and FSFO
- Database sharding

Day 1 - High Availability (HA)

Localized protection with Oracle Real Application Clusters (RAC) and Transparent Application Continuity (TAC)



- ✓ Create database services
- ✓ Configure services for application continuity
- ✓ Install an application
- ✓ Run the application without application continuity
- ✓ Run the application with application continuity
- ✓ Run the application with transparent application continuity
- ✓ Demonstrate TAC with Sql*Plus
- ✓ Understand and test FAN (Fast Application Notification)

Overview

- Real Application Clusters
- Active Data Guard and FSFO
- Database sharding

Día 2: Dudas sobre TAC y RAC

- ¿Es posible combinar TAF y AC/TAC? → siguientes slides
- ¿Es posible combinar FCF y AC/ TAC? → siguientes slides
- ¿Es posible combinar drain_timeout y AC/ TAC?
- ¿Podemos matar una sesión que se ha conectado a través de un servicio con AC/ TAC?
- Si en 19c tenemos TAC, y tiene menos requerimientos que AC, ¿habría alguna ventaja en usar AC?
- ¿Cómo podemos configurar Weblogic para beneficiarse de TAC?

Failover technologies

- **TAF (transparent application failover)** : It is enabled while creating the dynamic service (clauses "-failovertype", "-failovermethod"). It is simple, and based on SQL*Net capabilities. It works as a reactive system, reconnecting the client connection after an error. Transactions are rolled back, unless Transparent Application Continuity is enabled (19c).

Example: `srvctl add service -d my_db -s myservice -preferred node1,node2 -failovermethod BASIC -failovertype SELECT`

- **FCF (Fast Connection Failover)**: It is enabled while creating the dynamic service (clauses "-clbgoal" and "-rlbgoal"). It is specially designed for connection pools. It works proactively, redirecting clients through a different pool channel (to a surviving instance) in case of notified failure. No need to create new connections, thus greatly speeding up failure response time. Pending transactions - if any - would be rolled back unless Application Failover (18c) or Transparent Application Failover (19c) is in place.

Uses the database internal “Load Balancing Advisory”. Services can be tuned to choose how this advisory recommends the best instance for a specific service :

“-rlbgoal” clause (Runtime Load Balancing goal): Whether load balancing is focused on “SERVICE_TIME” (how efficiently a single transaction completes) or “THROUGHPUT” (how efficiently a complete job or long-running query completes).

“-clbgoal” clause (Connection Load Balancing goal): If it is set to “LONG”, it will try to keep the same number of connections on every instance (that offers the service). If set to “SHORT”, it will evaluate each nodes load.

Example: `srvctl add service -d my_db -s myservice -preferred node1,node2 -clbgoal LONG -rlbgoal throughput`

Failover technologies

- ✓ TAF is an old technology. You should use FCF whenever possible.
- ✓ Oracle recommends not to use both TAF and Fast Connection Failover in the same application.
- ✓ You may have one service configured for TAF and other service configured for FCF. ← Remember this!
- ✓ FCF requieres appropriate drivers. The integrated clients for FAN events include Oracle JDBC Universal Connection Pool, ODP.NET connection pool, OCI session pool, Oracle WebLogic Server Active Gridlink for Oracle RAC, and OCI and ODP.NET clients. The integrated Oracle clients must be Oracle Database 10g release 2 (10.2) or later.

Background info: FCF works using "FAN events", which are in turn published by ONS (Oracle Notification Service). This ONS service is configured and enabled by default with the RAC installation. There is no need to configure it.

Application Continuity

- ✓ Application Continuity is implemented IN the database. Not in the application nor in any intermediate layer.
- ✓ Is is, again, enabled by properly defining the dynamic service:

```
srvctl add service -d mydb -s service_with_ac -commit_outcome TRUE -failover_type TRANSACTION -failover_restore LEVEL1 -preferred node01,node02 -clbgoal LONG -rlbgoal throughput
```

- ✓ 2 Types :
 - Application Continuity is available since 18c release. Requires a connection pool. Requires some coding.
 - Transparent Application Continuity is available since 19c. Does not require a connection pool. Does not require modifying the application. Some decisions are taken by Oracle (transaction boundaries).
- ✓ Get additional [information here](#).

Día 2: Dudas sobre TAC y RAC

- ¿Es posible combinar TAF y TAC?
- ¿Es posible combinar FCF y TAC?
- ¿Es posible combinar drain_timeout y AC/TAC? → sí
- ¿Podemos matar una sesión que se ha conectado a través de un servicio con TAC?
- Si en 19c tenemos TAC, y tiene menos requerimientos que AC, ¿habría alguna ventaja en usar AC?
- ¿Cómo podemos configurar Weblogic para beneficiarse de TAC?

Día 2: Dudas sobre TAC y RAC

- ¿Es posible combinar TAF y TAC?
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- Si en 19c tenemos TAC, y tiene menos requerimientos que AC, ¿habría alguna ventaja en usar AC?
- ¿Cómo podemos configurar Weblogic para beneficiarse de TAC?

```
alter system kill session 'sid, serial#, @inst' noreplay;
```

Día 2: Dudas sobre TAC y RAC

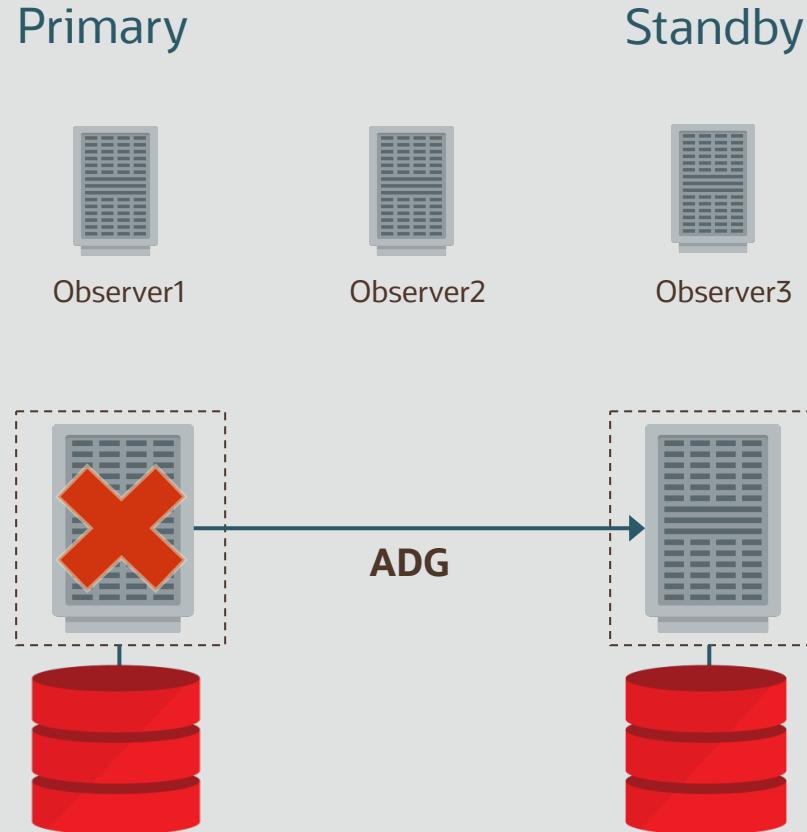
- ¿Es posible combinar TAF y TAC?
- ¿Es posible combinar FCF y TAC?
- ¿Es posible combinar drain_timeout y TAC?
- ¿Podemos matar una sesión que se ha conectado a través de un servicio con TAC?
- Si en 19c tenemos **TAC**, y tiene menos requerimientos que AC, ¿habría alguna ventaja en usar AC?
→ sí en casos muy puntuales donde se deseen definir los transaction boundaries en el código. En la gran mayoría de casos los clientes finalmente acaban usando TAC ya que no requiere modificación del aplicativo.
- ¿Cómo podemos configurar Weblogic para beneficiarse de TAC?

Día 2: Dudas sobre TAC y RAC

- ¿Es posible combinar TAF y TAC?
- ¿Es posible combinar FCF y TAC?
- ¿Es posible combinar drain_timeout y TAC?
- ¿Podemos matar una sesión que se ha conectado a través de un servicio con TAC?
- Si en 19c tenemos TAC, y tiene menos requerimientos que AC, ¿habría alguna ventaja en usar AC?
- ¿Cómo podemos configurar Weblogic para beneficiarse de TAC? → definiendo el servicio con TAC y empleando un driver soportado y actualizado.

Day 2 - Disaster Recovery (DR)

Site failover with Oracle Active Data Guard (ADG) and Fast Start Fail Over (FSFO)



- ✓ Use Data Guard **Broker**
 - Switchover/Failover/Reinstate
- ✓ Active Data Guard and **TAC**
- ✓ Create a **FSFO** configuration
 - Configure observers
 - Start observers in background
- ✓ **Resilience testing** with FSFO and observers

Overview

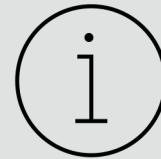
- Real Application Clusters
- Active Data Guard and FSFO
- Database sharding

Día 3: Dudas sobre ADG

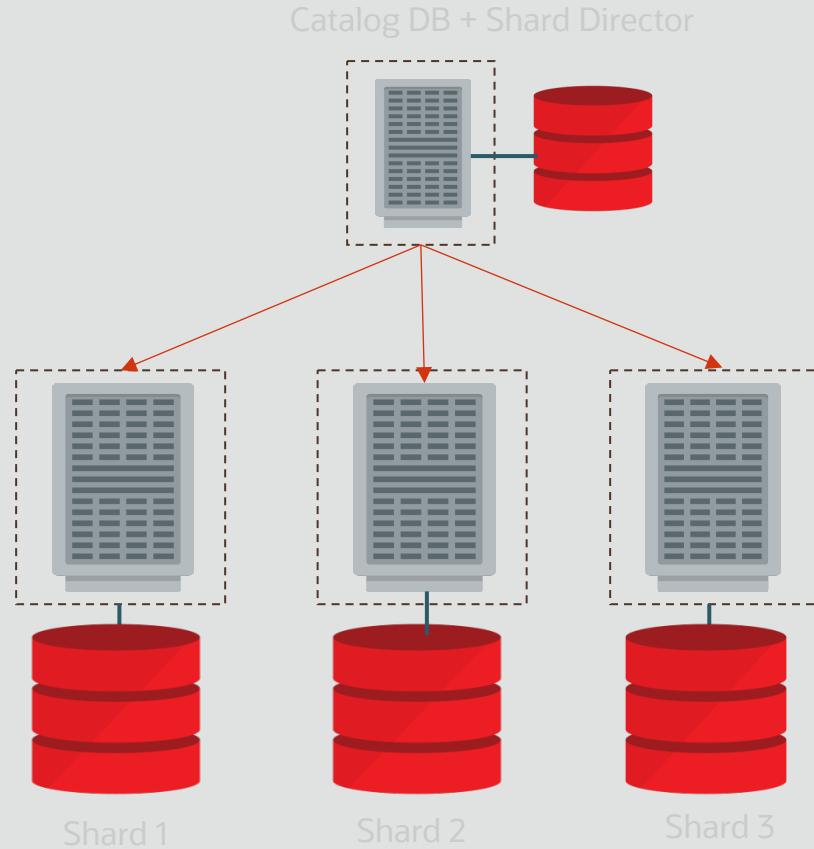
- ¿Por qué cuando queremos cambiar el modo de protección a maximum availability, primero tenemos que cambiar nosotros el modo de transporte y luego cambiar el modo de protección, en lugar de que Oracle me cambie toda la configuración cambiando el modo de protección?. → el modo de protección afecta a toda la configuración de DG. El modo de transporte a un destino concreto.
- En la página 12 indica que "Now we will startup the new standby database, in order to perform a reinstate. *In a real crash situation, after a failover, the new standby needs to be restored from a backup.*". ¿ Es correcto ? → Hacemos reinstate si los datafiles no se han destruido. Si se hubieran destruido, podemos reconstruir de cero la standby con un duplicate from service.
- Hola podrían mañana explicar el parámetro role de este tipo de cadenas que es lo que realmente hace o que valores puede tomar??
`srvctl add service -d $(srvctl config database) -s svc_tac -pdb PDB1 -role primary -replay_init_time 1800 -failoverretry 30 -failoverdelay 3 -commit_outcome TRUE -failovertype AUTO -failover_restore AUTO` → creamos un servicio asignado a un rol para que se arranque automáticamente en el servidor donde se encuentre la primaria ante un swithover/failover o ante el arranque del GI.
- El licenciamiento de FAST START FAILOVER tiene algo especial ? → No requiere licencia de ADG.
- ¿TAC Requiere licenciamiento? → Requiere licencia de RAC o de Active Dataguard “ADG”

Day 3 – Database Sharding

Resilience and horizontal scalability with DB Sharding



Specific technical
introduction



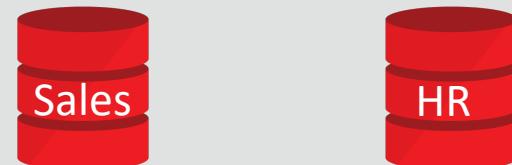
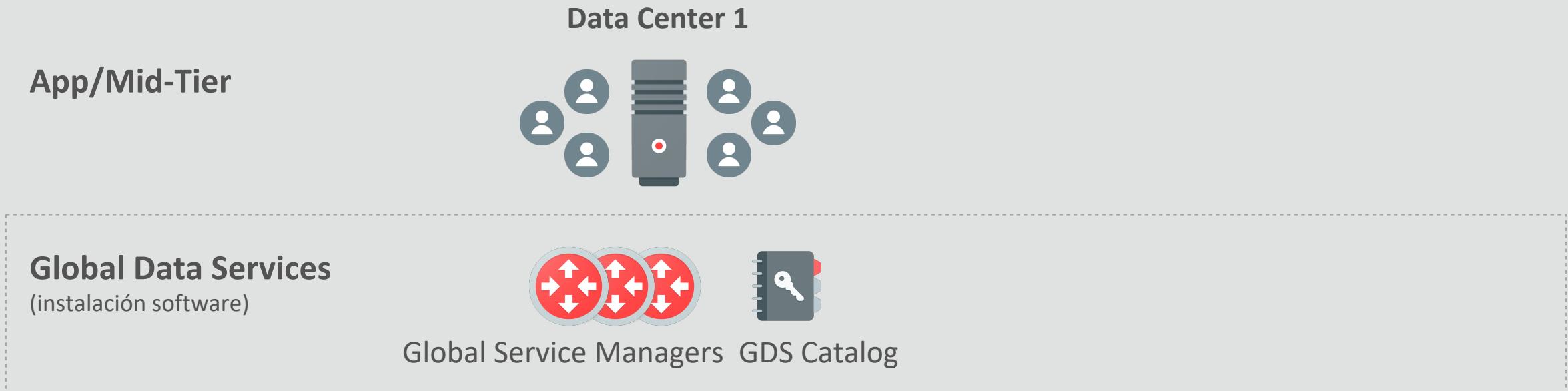
- ✓ Check environment
 - Cata, shd1, shd2, shd3
- ✓ Install shard director software
 - Global Service Manager (GSM)
 - Global Data service (GDS)
- ✓ Configure catalog database
- ✓ Deploy a sharded database on shd1 and shd2
- ✓ Create a non sharded application on shd3
- ✓ Migrate the non-sharded application to the sharded database on shd1 and shd2
- ✓ Setup and run the demo application
- ✓ Add shd3 to the sharded database

Oracle Global Data Services (GDS)

Introducción



GDS Architecture



Client Connectivity in GDS – Basic TNS Entry

```
sales_reporting_srvc =  
  (DESCRIPTION =(CONNECT_TIMEOUT=90) (RETRY_COUNT=30) (RETRY_DELAY=3) (TRANSPORT_CONNECT_TIMEOUT=3)  
   (FAILOVER=ON)  
   (ADDRESS_LIST =  
    (LOAD_BALANCE=ON)  
    (ADDRESS = (PROTOCOL = TCP) (HOST = gsm-host1a) (PORT = 1571))  
    (ADDRESS = (PROTOCOL = TCP) (HOST = gsm-host2a) (PORT = 1571))  
    (ADDRESS = (PROTOCOL = TCP) (HOST = gms-host3a) (PORT = 1571))  
   )  
   (CONNECT_DATA =  
    (SERVICE_NAME = sales_reporting_srvc.sales.oradbcloud) )  
)
```

Benefits



Centralized service management



Workload routing
(region-based & lag-based)

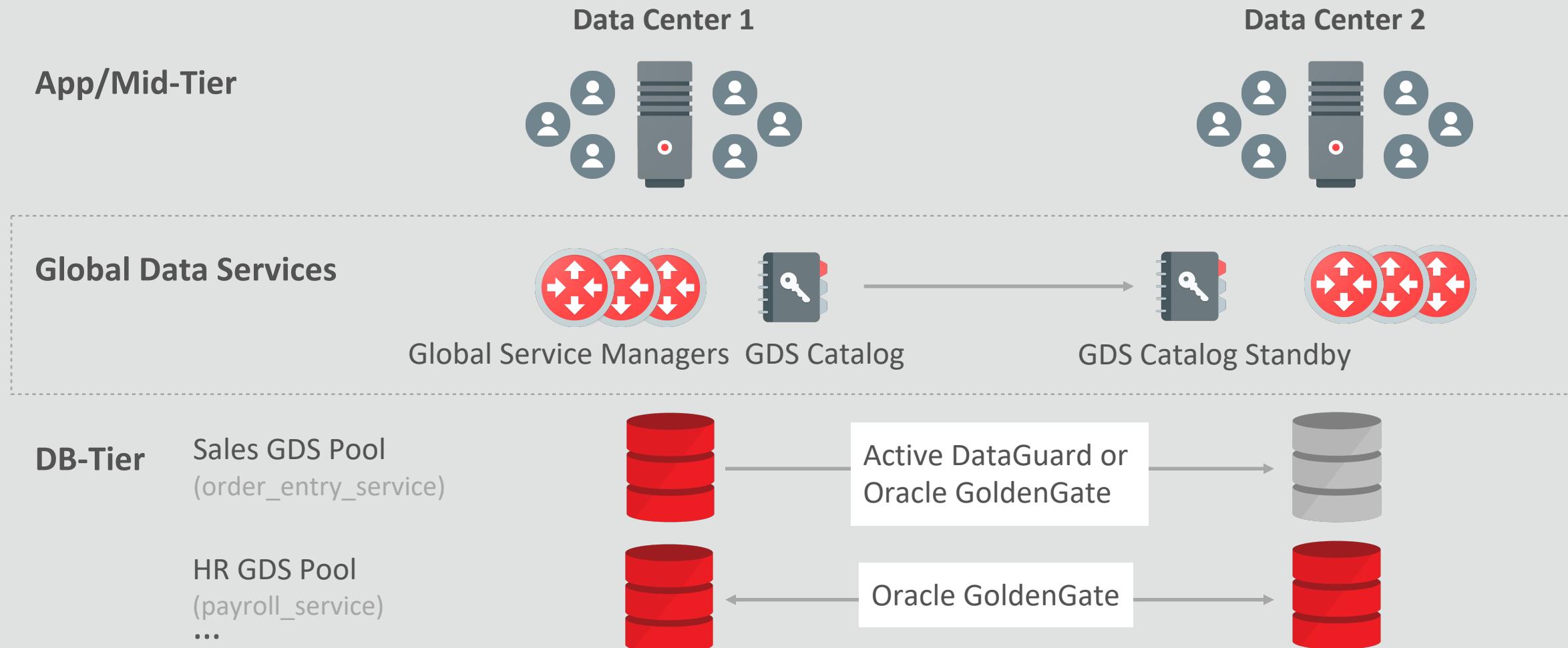


Inter-database service failover
Role based global services



Load balancing
(connect-time & run-time)

One GDS Infrastructure For Many Replicated Configurations



Client Connectivity in GDS – TNS Entry

```
sales_reporting_srvc =  
  (DESCRIPTION =(CONNECT_TIMEOUT=90) (RETRY_COUNT=30) (RETRY_DELAY=3) (TRANSPORT_CONNECT_TIMEOUT=3)  
   (FAILOVER=ON)  
   (ADDRESS_LIST = ← DatacenterA's GSMS  
    (LOAD_BALANCE=ON)  
    (ADDRESS = (PROTOCOL = TCP) (HOST = gsm-host1a) (PORT = 1571))  
    (ADDRESS = (PROTOCOL = TCP) (HOST = gsm-host2a) (PORT = 1571))  
    (ADDRESS = (PROTOCOL = TCP) (HOST = gms-host3a) (PORT = 1571))  
  )  
  (ADDRESS_LIST = ← DatacenterB's GSMS  
   (LOAD_BALANCE=ON)  
   (ADDRESS = (PROTOCOL = TCP) (HOST = gsm-host1b) (PORT = 1572))  
   (ADDRESS = (PROTOCOL = TCP) (HOST = gsm-host2b) (PORT = 1572))  
   (ADDRESS = (PROTOCOL = TCP) (HOST = gsm-host3b) (PORT = 1572))  
  )  
  (CONNECT_DATA =  
   (SERVICE_NAME = sales_reporting_srvc.sales.oradbcloud) (REGION=WEST)  
  )  
)
```

GDS Components

Global Service Manager (GSM):

Regional listener to the incoming database connections

Performs Connect-time load balancing through a connection pool.

Publishes FAN events (via ONS) for service failovers and run-time load balancing advisory

Inter-database Service failover & management

GDS Catalog: stores GDS configuration metadata

GDS Region: Group of databases and clients in close network proximity, e.g., East, West

GDS Pool: Databases that offer a common set of global services, e.g., HR, Sales

Global Service: Database Service provided by multiple databases with replicated data

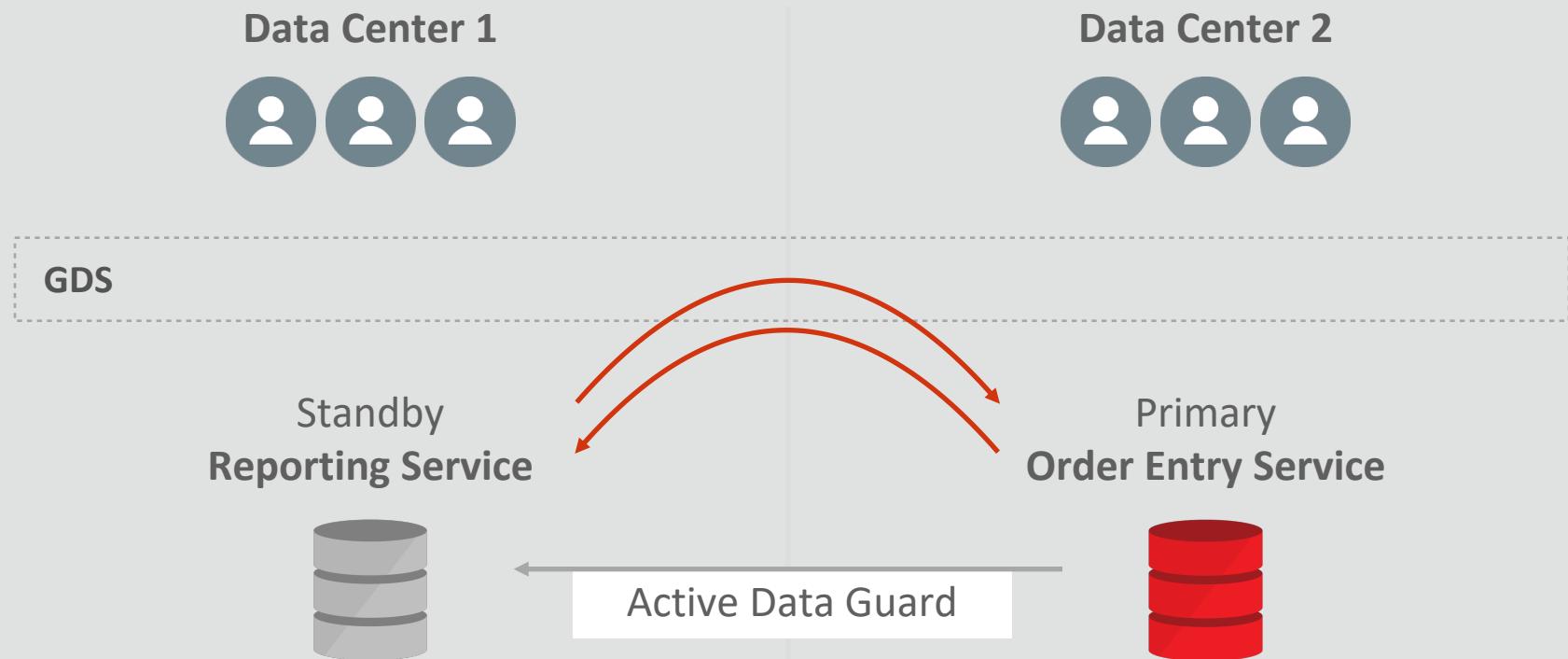
Local service + {Locality, replication lag, role, database cardinality, load balancing goals}

Establish workload management policies via Service attributes

Role based Global Services

For Active Data Guard

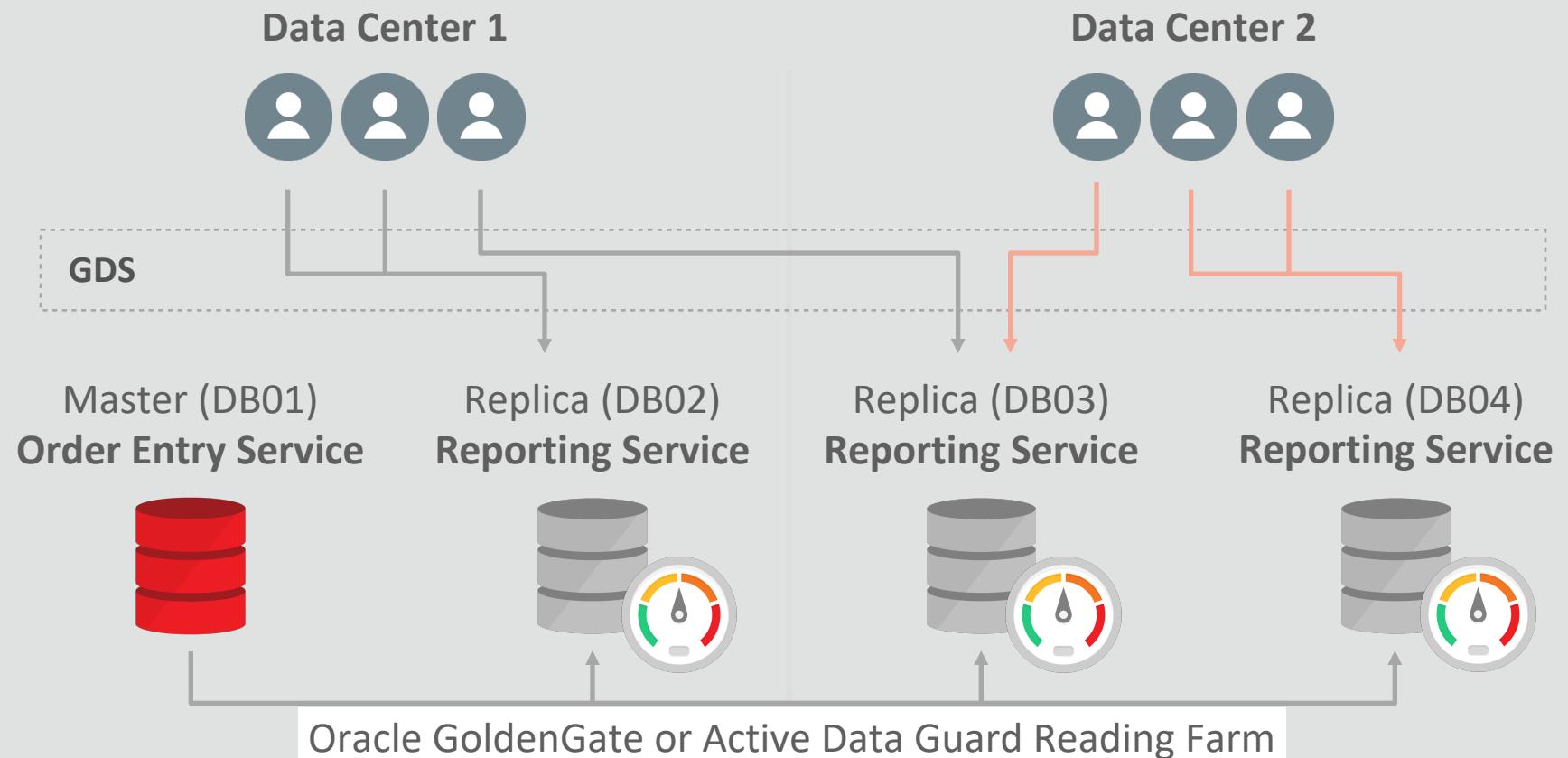
- Order Entry Service runs on Primary
- Reporting Service runs on Standby
- Upon Data Guard role change, GDS fails over services based on Role



```
GDSCTL>add service -service order_entry_service -gdspool sales -preferred_all -role PRIMARY  
GDSCTL>add service -service reporting_service -gdspool sales -preferred_all -role PHYSICAL_STANDBY
```

Load Balancing for Reader Farms

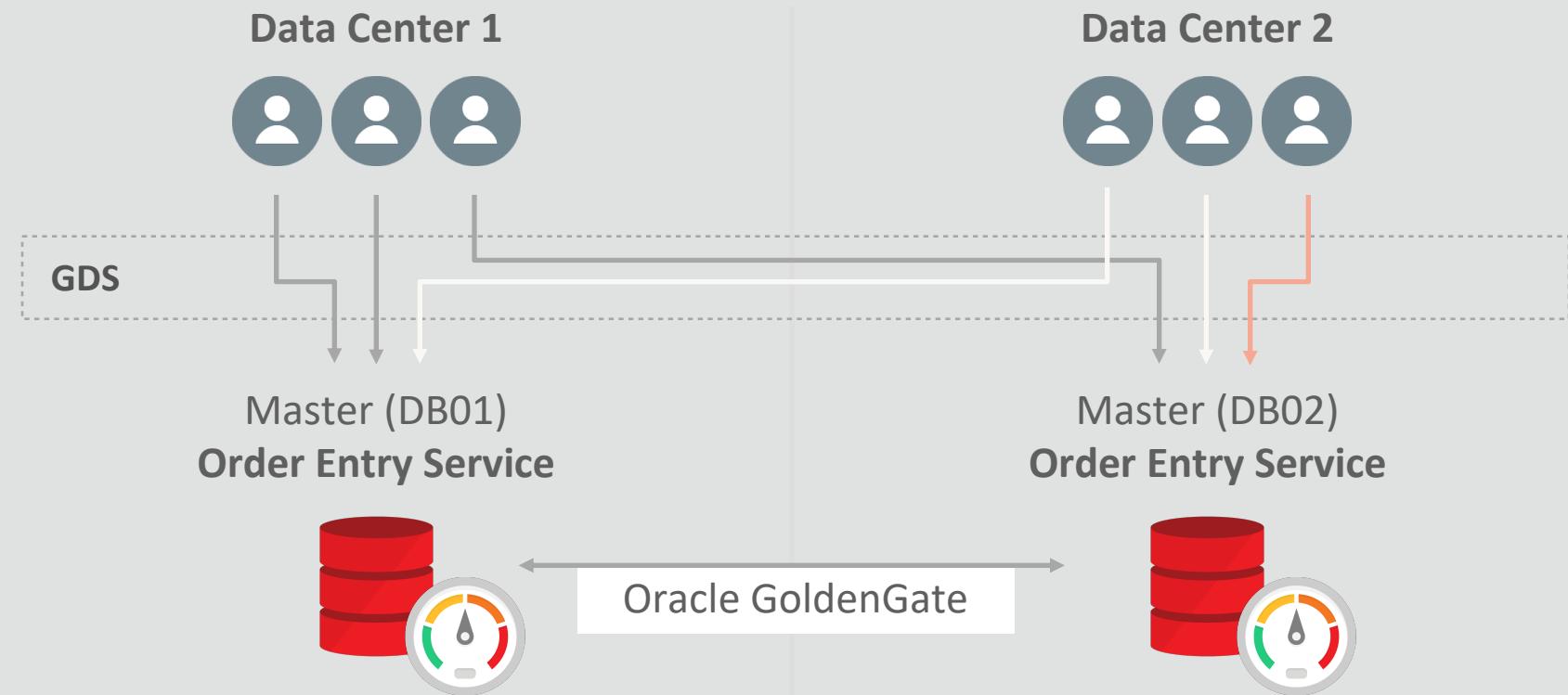
- With GDS, route Read Write workload to primary/master
- Balance Read Only workload on the reader farm
- Improved resource utilization and higher scalability for Read workloads



```
GDSCTL>add service -service reporting_srvc -gdspool sales  
-preferred_all -role PHYSICAL_STANDBY -clbgoal LONG -rlbgoal SERVICE_TIME
```

Load Balancing for Active/Active Oracle GoldenGate

- Application handles multi-master conflict resolution
- GDS provides connect-time and run-time load balancing (within and across data centers) for all work requests



```
GDSCTL>add service -service order_entry_srvc -gdspool sales  
-preferred_all -clbgoal LONG
```

Resources

OTN GDS Portal:

<http://www.oracle.com/goto/gds>

OTN HA Portal:

<http://www.oracle.com/goto/availability>

Maximum Availability Architecture (MAA):

<http://www.oracle.com/goto/maa>

MAA Blogs:

<http://blogs.oracle.com/maa>

Exadata on OTN:

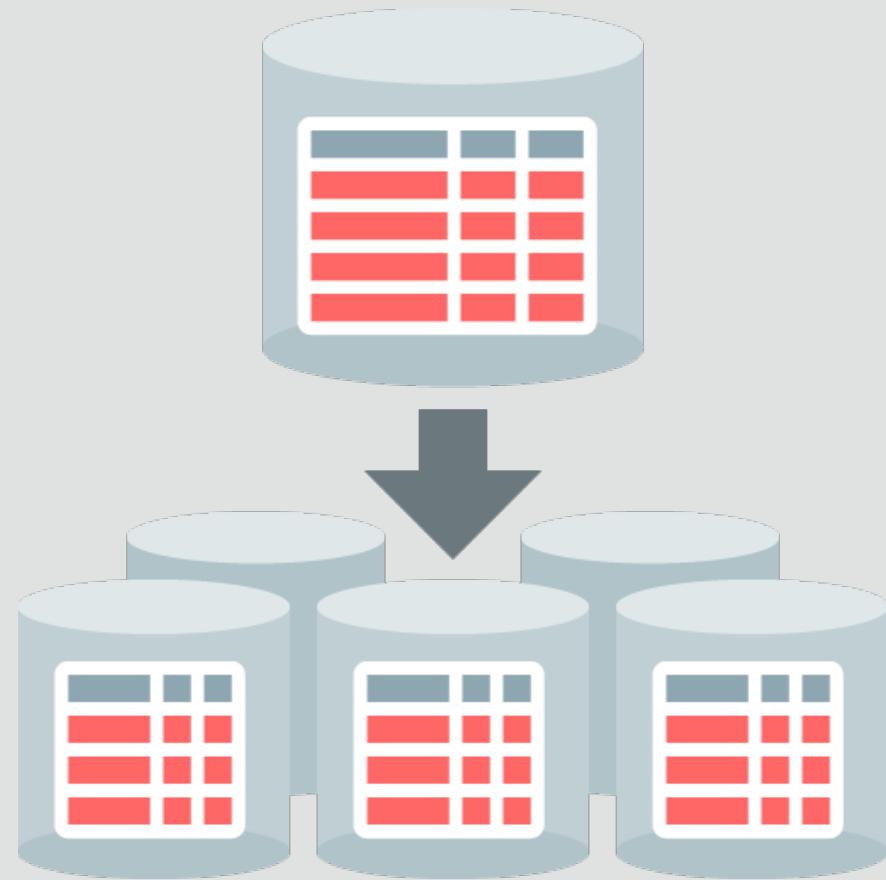
<http://www.oracle.com/technetwork/database/exadata/index.html>

Oracle HA Customer Success Stories on OTN:

<http://www.oracle.com/technetwork/database/features/ha-casestudies-098033.html>

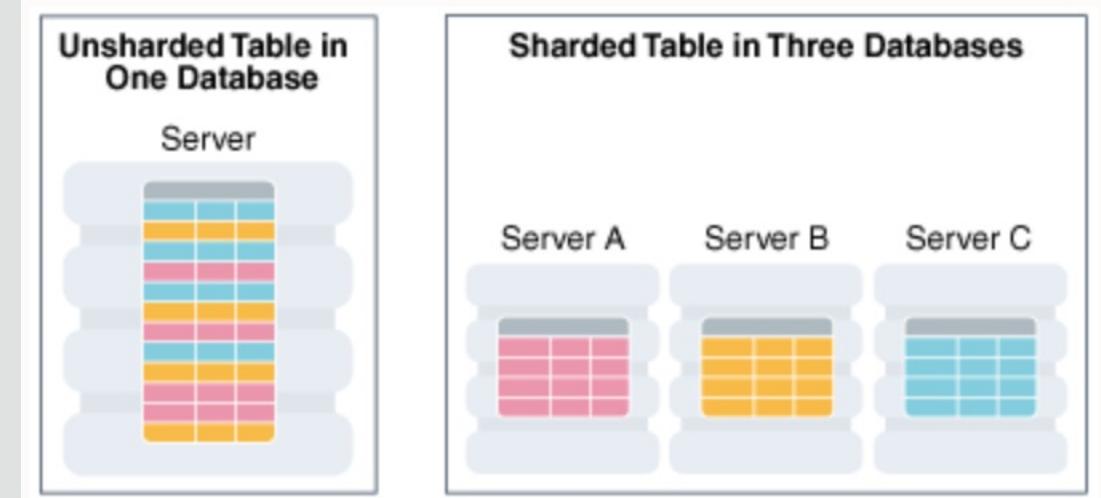
Sharding

Introducción



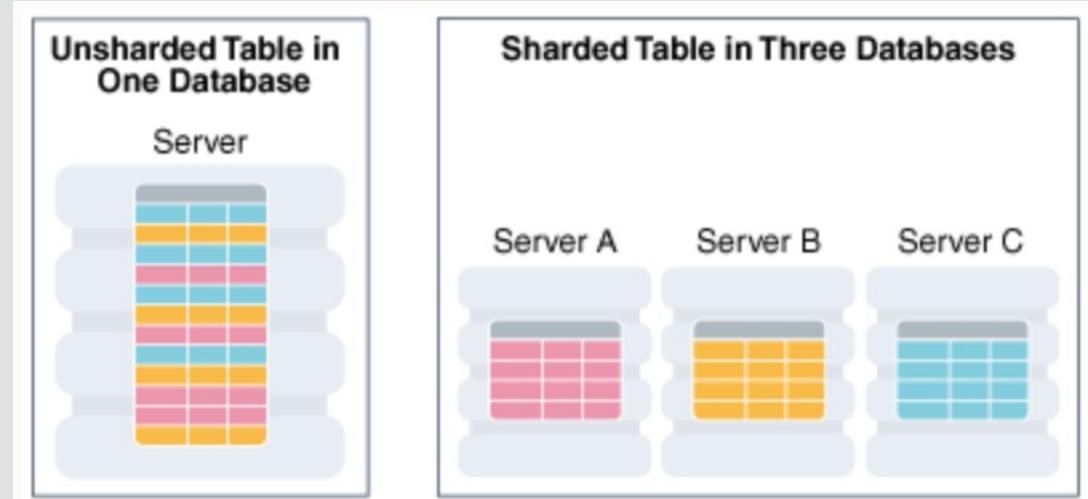
Architecture

- Horizontal partitioning of data across up to 1000 independent Oracle Databases (shards)
- Shared-nothing hardware architecture
 - Each shard runs on commodity server
 - No shared storage
 - No clusterware
 - Can run different RDBMS releases
- Data is partitioned using a sharding key (i.e. account_id)



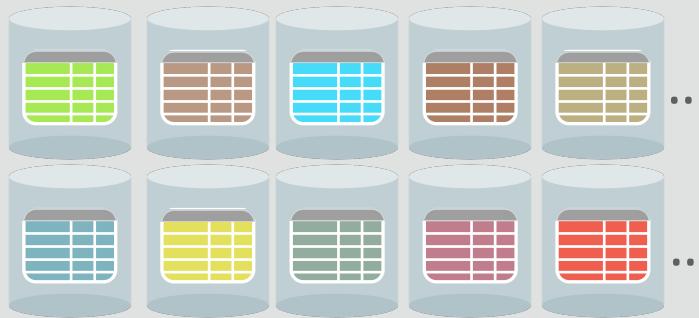
Architecture

Sharding is intended for custom applications that are suitable for a sharded database architecture. Applications that use sharding must have a well-defined data model and data distribution strategy (consistent hash, range, list, or composite) that primarily accesses data using a sharding key. Examples of a sharding key include customer_id, account_no, or country_id.



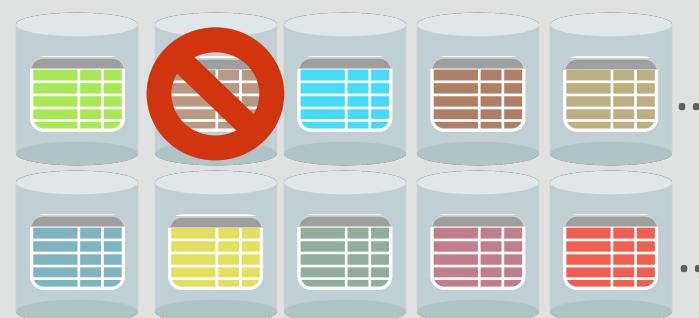
Benefits

Linear Scalability



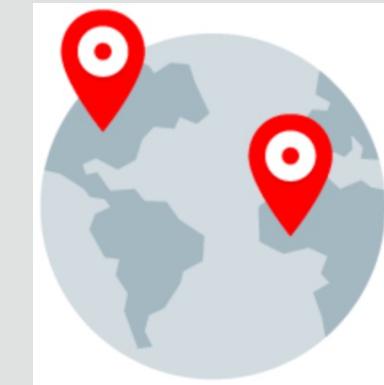
Add shards online to increase database size and throughput.
Online split and rebalance.

Extreme Availability



Shared-nothing hardware architecture. Fault of one shard has no impact on others.

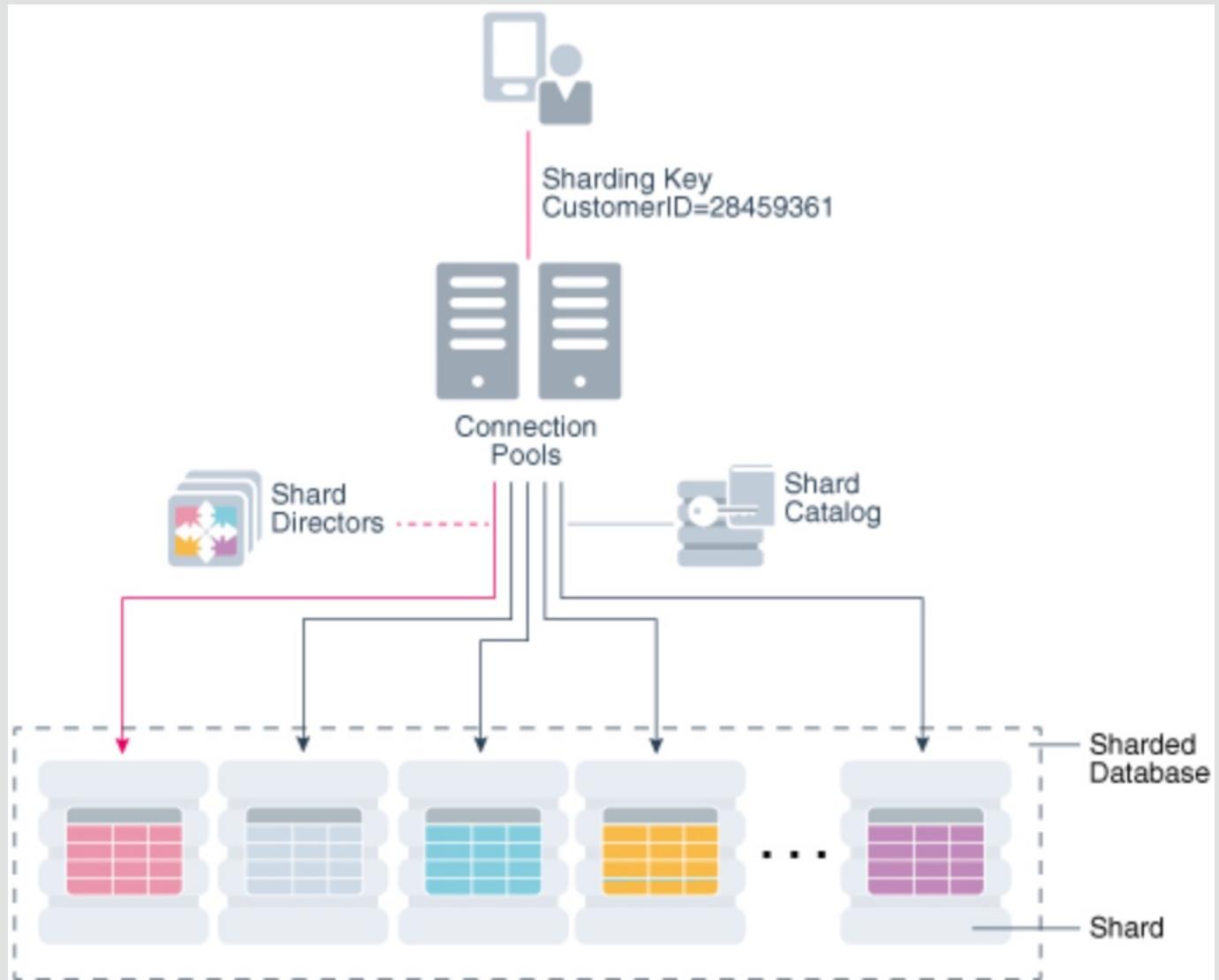
Geographic Distribution



User defined data placement for performance, availability, DR or to meet regulatory requirements.

Components

- **Shard catalog** – an Oracle Database that supports automated shard deployment, centralized management of a sharded database, and multi-shard queries.
- **Shard directors** – network listeners that enable high performance connection routing based on a sharding key.
- **Connection pools** - at runtime, act as shard directors by routing database requests across pooled connections. They are required.



Routing in an Oracle Sharded Environment

Direct Routing based on sharding_key

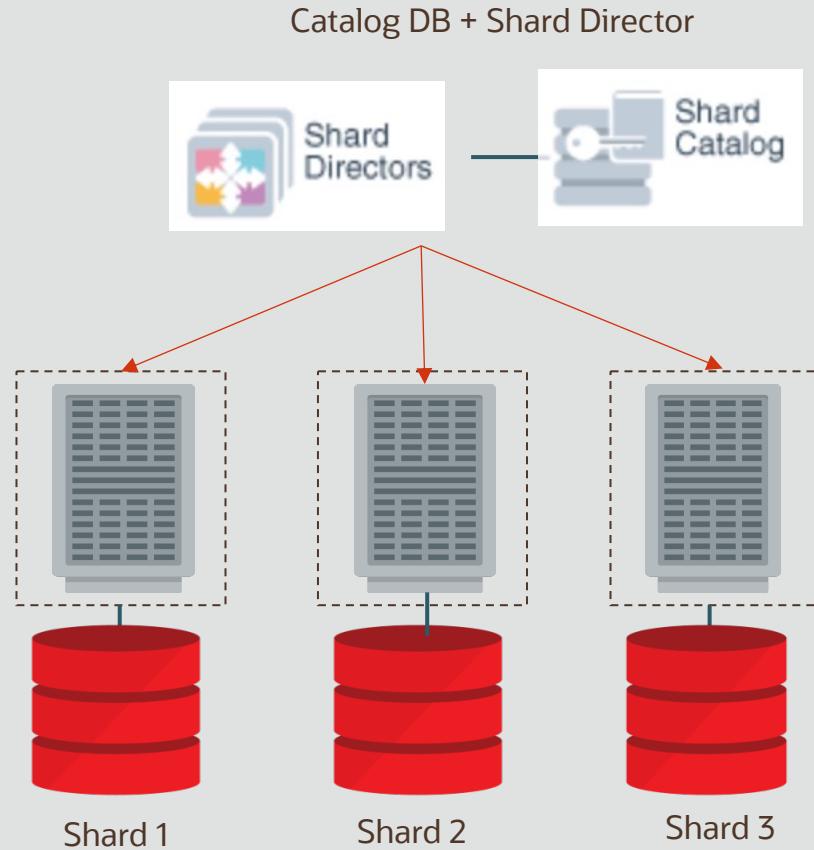
For OLTP workloads that specify sharding_key (e.g. customer_id) during connect
Enabled by enhancements to mid-tier connection pools and drivers

Proxy Routing via coordinator (shard catalog)

For workloads that cannot specify sharding_key (as part of connection)
Applies to reporting, batch jobs
Queries can span 1 or more or all shards. Performed in parallel across shards (e.g. aggregates on sales data)

Day 3 – Database Sharding

Resilience and horizontal scalability with DB Sharding



- ✓ Check environment
 - Cata, shd1, shd2, shd3
- ✓ Install shard director software (Global Data Service GDS)
 - Global Service Manager (GSM) = Shard Directors
 - GDS Catalog = Shard Catalog
- ✓ Configure catalog database
- ✓ Deploy a sharded database on shd1 and shd2
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Overview

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<https://github.com/OracleDataManagementSpain/ConvergedDatabase/tree/master/ContinuousAvailability>

Day 1:

[WORKSHOP_MAA_Part1_RAC_ENG_v1.3.pdf](#)

Day 2:

[WORKSHOP_MAA_Part2_ADG_ENG_v1.5.pdf](#)

Day 3:

[WORKSHOP_MAA_Part3_Sharding_ENG_v1.3.pdf](#)



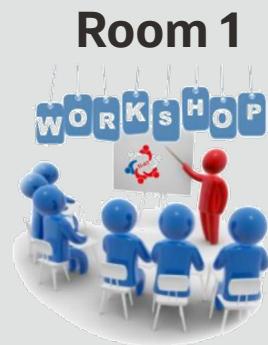
Hand-on Labs Breakout Rooms



Francisco



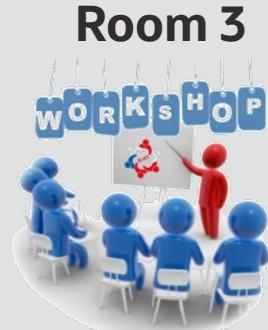
José



Room 1



Paco



Room 3



Andrés



Room 2



Room 4

Inspiration & Innovation



ORACLE

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*Workshop Virtual BD Convergente:
Continuous Availability*



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<https://bit.ly/37BgfR7>

Our mission is to help people
see data in new ways, discover
insights, unlock endless possibilities.



Thank you

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