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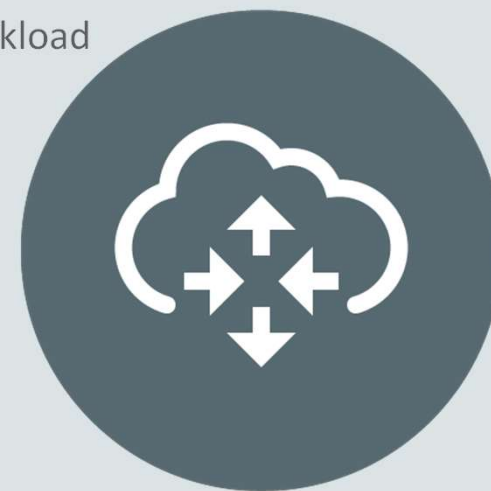
# Oracle全局数据服务 (GDS) Oracle Global Data Services (GDS)

复制数据库的自动化工作负载管理 Automated Workload  
Management for Replicated Databases

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Vice President Product Management, Oracle



## Safe harbor statement

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# 项目议程 Program Agenda

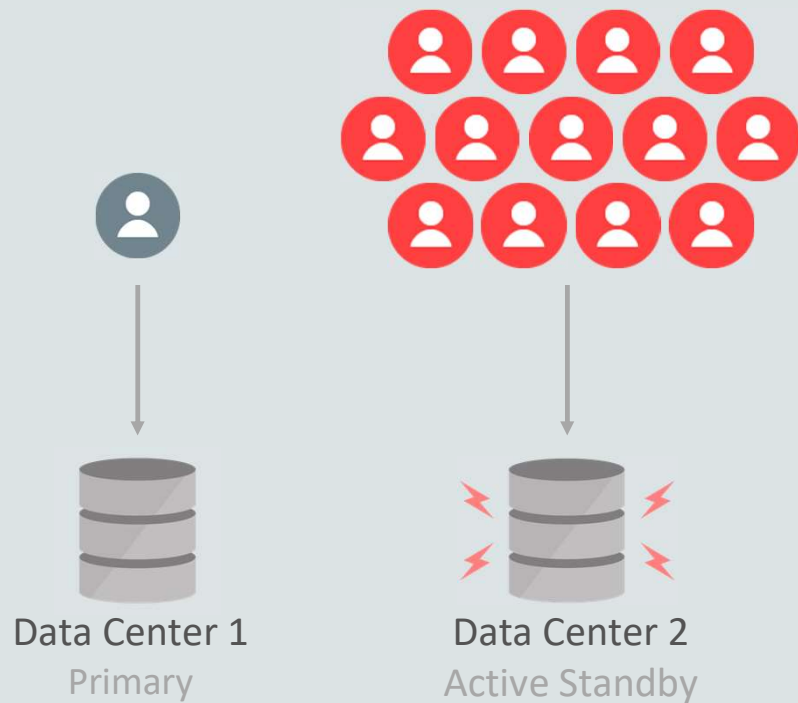
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- 副本的工作负载管理挑战 Workload management challenges of replicas
- 全局数据服务（GDS）简介 Introduction to Global Data Services (GDS)
- GDS概念和体系结构 GDS concepts and architecture
- GDS用例 GDS use cases
- 总结 Summary

# 副本的挑战—工作负载平衡

## Challenges of Replicas – Workload Balance

不平衡 Unbalanced



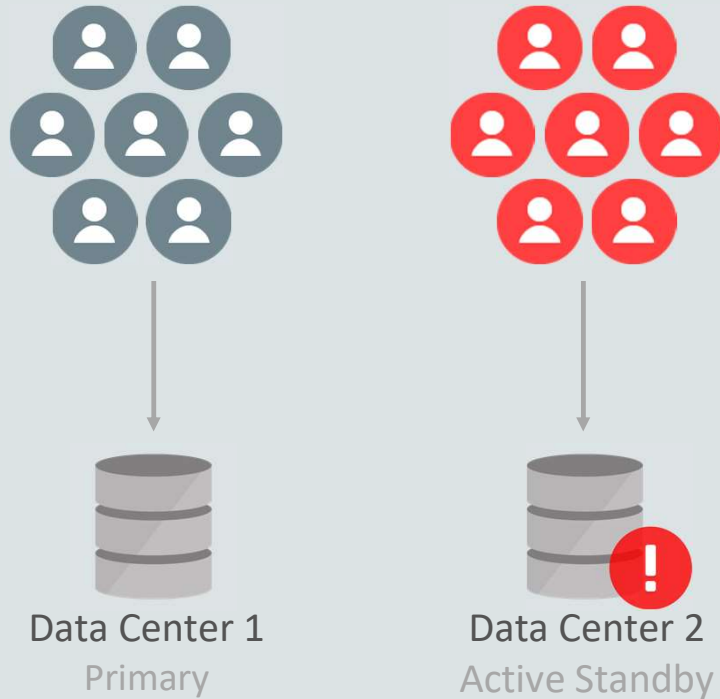
- 没有自动负载均衡 No automated load balancing
- 次优资源利用 Sub-optimal resource utilization

# 副本的挑战—服务故障切换

## Challenges of Replicas – Service Failover

### 无全局服务故障切换

No Global Service Failover



- 副本失败时应用程序中断 App outages when replicas fail
- 无服务HA No Service HA

# 项目议程 Program Agenda

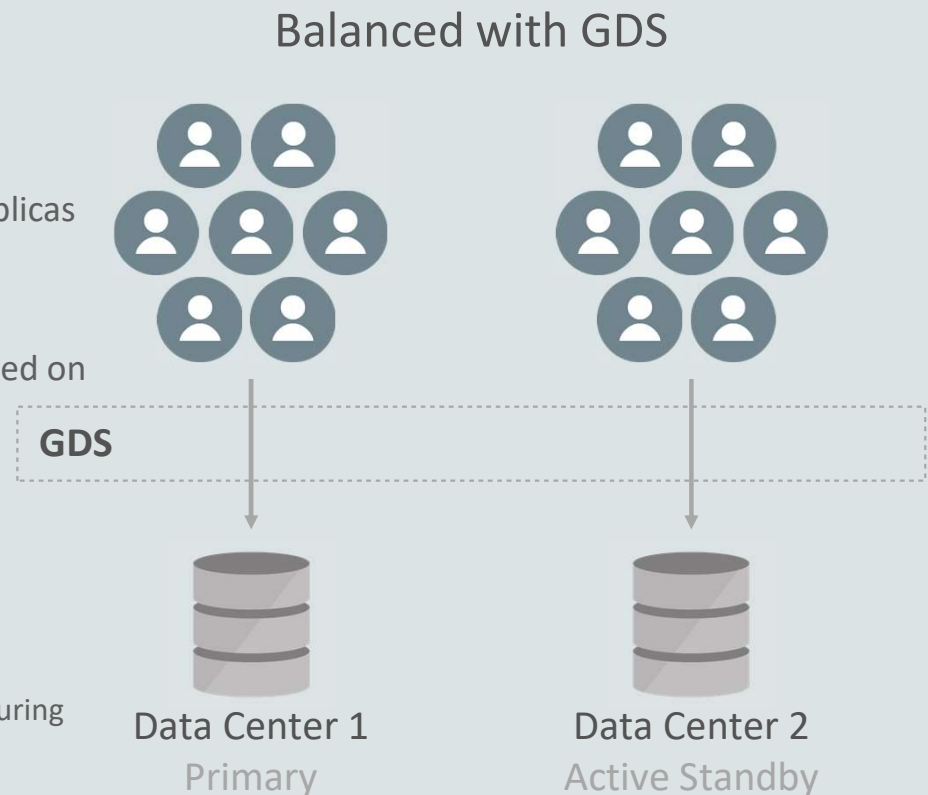
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- ▶ 副本的工作负载管理挑战 Workload management challenges of replicas
- ▶ **全局数据服务（GDS）简介 Introduction to Global Data Services (GDS)**
- ▶ GDS概念和体系结构 GDS concepts and architecture
- ▶ GDS用例 GDS use cases
- ▶ 总结 Summary

# Oracle 全局数据服务 (GDS)

## Oracle Global Data Services (GDS)

- 跨副本的自动透明客户端工作负载管理 Automatic and transparent client workload management across replicas
- 将**服务的概念**扩展到副本 Extends the **concept of services** to replicas
- 能力 Capabilities
  - 基于负载、位置或延迟的工作负载路由 Workload routing based on load, locality or lag
  - 跨副本的服务故障切换 Service failover across replicas
- 收益 Benefits
  - 最大化应用程序性能 Maximize application performance
  - 减少计划内和计划外停机期间的停机时间 Mitigate downtime during planned and unplanned outages
  - 一个界面管理副本资源 Manage resources of replicas with one interface

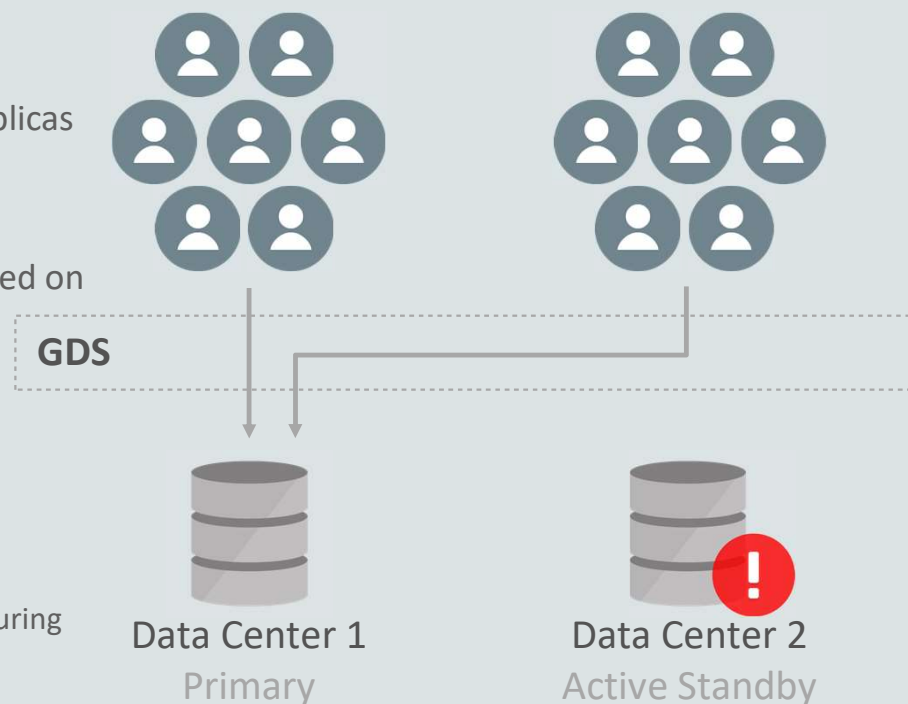


# Oracle 全局数据服务 (GDS)

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### Global Service Failover with GDS





# 使用 GDS 管理数据库副本的工作负载

## Workload Management for Database Replicas with GDS



集中服务管理 Centralized  
service management



工作负载路由（基于区域和  
基于滞后） Workload routing  
(region-based & lag-based)



数据库间服务故障转移 Inter-  
database service failover

基于角色的全局服务 Role  
based global services



负载均衡（连接时和运行  
时） Load balancing (connect-  
time & run-time)



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# GDS 架构

## GDS Architecture

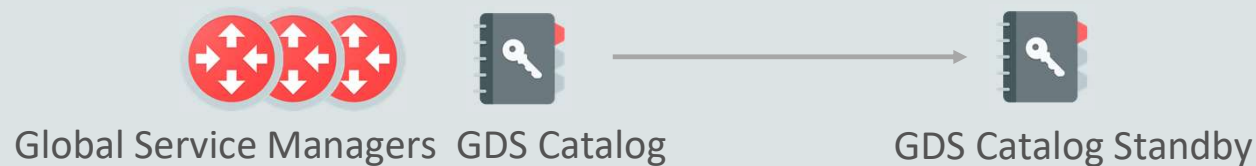
应用程序/中间层  
App/Mid-Tier



Data Center 2



全局数据服务  
Global Data Services



数据库层  
DB-Tier

Sales GDS Pool  
(order\_entry\_service)



Active DataGuard or  
Oracle GoldenGate



# 一个GDS基础架构用于多个复制配置

## One GDS Infrastructure For Many Replicated Configurations

应用程序/中间层  
App/Mid-Tier



全局数据服务  
Global Data Services



数据库层  
DB-Tier

Sales GDS Pool  
(order\_entry\_service)



Active DataGuard or  
Oracle GoldenGate



HR GDS Pool  
(payroll\_service)



Oracle GoldenGate



...



# GDS 组件

## GDS Components

### 全局服务管理（GSM）：Global Service Manager (GSM)

- 传入数据库连接的区域侦听器 Regional listener to the incoming database connections
- 执行连接时负载均衡 Performs Connect-time load balancing
- 发布 FAN 事件（通过 ONS）用于服务故障切换和运行时负载均衡咨询 Publishes FAN events (via ONS) for service failovers and run-time load balancing advisory
- 数据库间服务故障切换与管理 Inter-database Service failover & management

**GDS Catalog:** 存储 GDS 配置元数据 stores GDS configuration metadata

**GDS Region:** 网络位置接近的一组数据库和客户端，如东部、西部 Group of databases and clients in close network proximity, e.g., East, West

**GDS Pool:** 提供一组通用全局服务的数据库，如人力资源、销售 Databases that offer a common set of global services, e.g., HR, Sales

**Global Service:** 由具有复制数据的多个数据库提供的数据库服务 Database Service provided by multiple databases with replicated data

- 本地服务+{本地性、复制延迟、角色、数据库基数、负载均衡目标} Local service + {Locality, replication lag, role, database cardinality, load balancing goals}
- 通过服务属性建立工作负载管理策略 Establish workload management policies via Service attributes

# GDS – 共享基础设施

GDS – A shared infrastructure

单个GDS管理 A Single GDS manages

- 20 (\*5000) GDS Pools
- 10 GDS Regions
- 5 GSMs per Region
- 1000 (\*10000) Database instances
- 5000 (\*10000) Global Services (for a single GDS deployment)

\*21c限制；适用于18c的更高限值的补丁；可以为19c制作 *21c limits; patch for higher limits available for 18c; can be made for 19c*

GDS 数据库 GDS Databases

- 必须是 Oracle 数据库 EE 12.1+ Must be Oracle Database EE 12.1+
- 可以是单实例或 RAC Can be Single Instance or RAC
- 可以是 CDB 或非 CDB Can be CDB or Non-CDB
- 可以在商用或集成系统（Oracle Exadata、ODA）上运行 Can run on commodity or Engineered systems (Oracle Exadata, ODA)
- 使用 GDSCTL CLI 或 Enterprise Manager DB 插件管理 Managed with GDSCTL CLI or Enterprise Manager DB Plug-in
- 必须获得 Active Data Guard 或 Oracle GoldenGate 的许可 Must be licensed for Active Data Guard or Oracle GoldenGate



# GDS部署 GDS Deployment

## 高级步骤 High Level Steps

- 在GSM服务器上安装GSM软件 Install GSM software on GSM servers
  - 每个区域至少1 GSM Min of 1 GSM per region
  - 建议3个GSM/地区 Recommended 3 GSMs/region
- 预创建GDS目录数据库 Pre-create GDS catalog database
- 设置GDS管理员帐户和权限 Setup GDS Administrator accounts & privileges
- 配置GDS Configure GDS
  - 创建GDS目录 Create GDS Catalog
  - 添加GSM、区域、池、数据库、全局服务 Add GSMs, Regions, Pools, Databases, Global Services
- 设置客户端连接 Setup client connectivity

# GDS部署 GDS Deployment

## 设置GDS帐户和权限 Setup GDS Accounts & Privileges

- 在GDS目录数据库上 On the GDS Catalog database:

```
SQL> create user mygdsadmin identified by passwd_mygdsadmin;
```

```
SQL> grant gsmadmin_role to mygdsadmin;
```

```
SQL> alter user gsmcatuser account unlock;
```

```
SQL> alter user gsmcatuser identified by passwd_gsmcatuser;
```

- 在每个 GDS 池数据库上 On each of the GDS Pool databases:

```
SQL> alter user gsmuser account unlock;
```

```
SQL> alter user gsmuser identified by passwd_gsmuser;
```



# GDS部署 GDS Deployment

## 配置GDS Configure GDS

- 从 GSM 节点，使用 GDSCTL 配置 GDS From a GSM node, use GDSCTL to configure GDS

```
- create catalog -database <host_name>:1521:catdb.acme.com -user  
  mygdsadmin/passwd_mygdsadmin -region siteA, siteB  
- add gsm -gsm gsm1 -listener 1571 -catalog <host_name>:1521:catdb -region siteA  
- start gsm -gsm gsm1  
...  
- add gdspool -gdspool sales  
- add database -connect <host_name>:1521:db01 -gdspool sales -region SiteA  
- add database -connect <host_name>:1521:db02 -gdspool sales -region SiteB  
- add service -service sales_qry_srvc -gdspool sales -preferred db01 -available db02  
- start service -service sales_qry_srvc -gdspool sales  
- For Data Guard, use “add brokerconfig” instead of “add database”
```

# GDS 中的客户端连接 – TNS 入口

## 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 =
      (LOAD_BALANCE=ON)
      (ADDRESS = (PROTOCOL = TCP) (HOST = gsm-host1a) (PORT = 1571))
      (ADDRESS = (PROTOCOL = TCP) (HOST = gsm-host2a) (PORT = 1571))
      (ADDRESS = (PROTOCOL = TCP) (HOST = gsm-host3a) (PORT = 1571))
    )
    (ADDRESS_LIST =
      (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)
    )
  )
```

← DatacenterA's GSMS

← DatacenterB's GSMS

← Client Region

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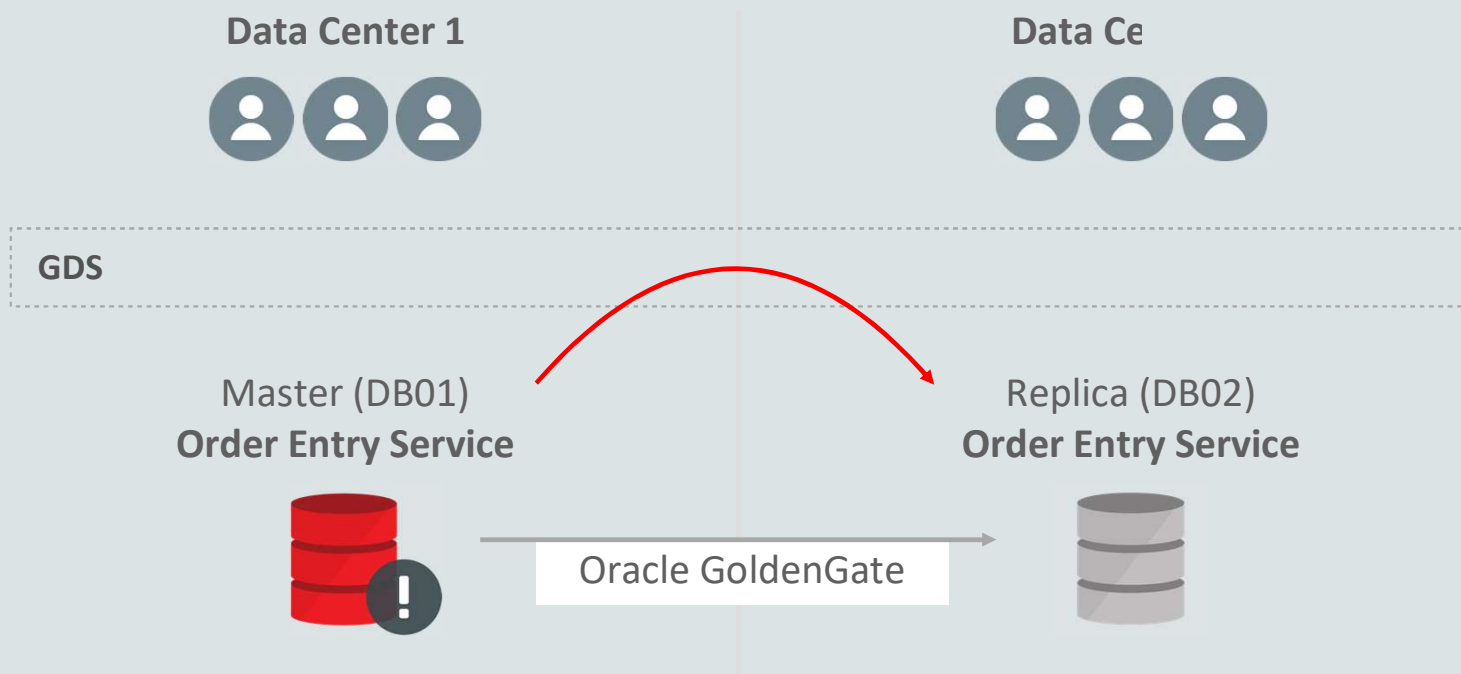
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# Oracle GoldenGate主副本的服务故障切换

## Service Failover for Oracle GoldenGate Master-Replica

- 区域内和区域间的数据库间服务故障切换 Inter-database Service failover within and across regions
- 更高的可用性和更好的可管理性 Higher availability and improved manageability



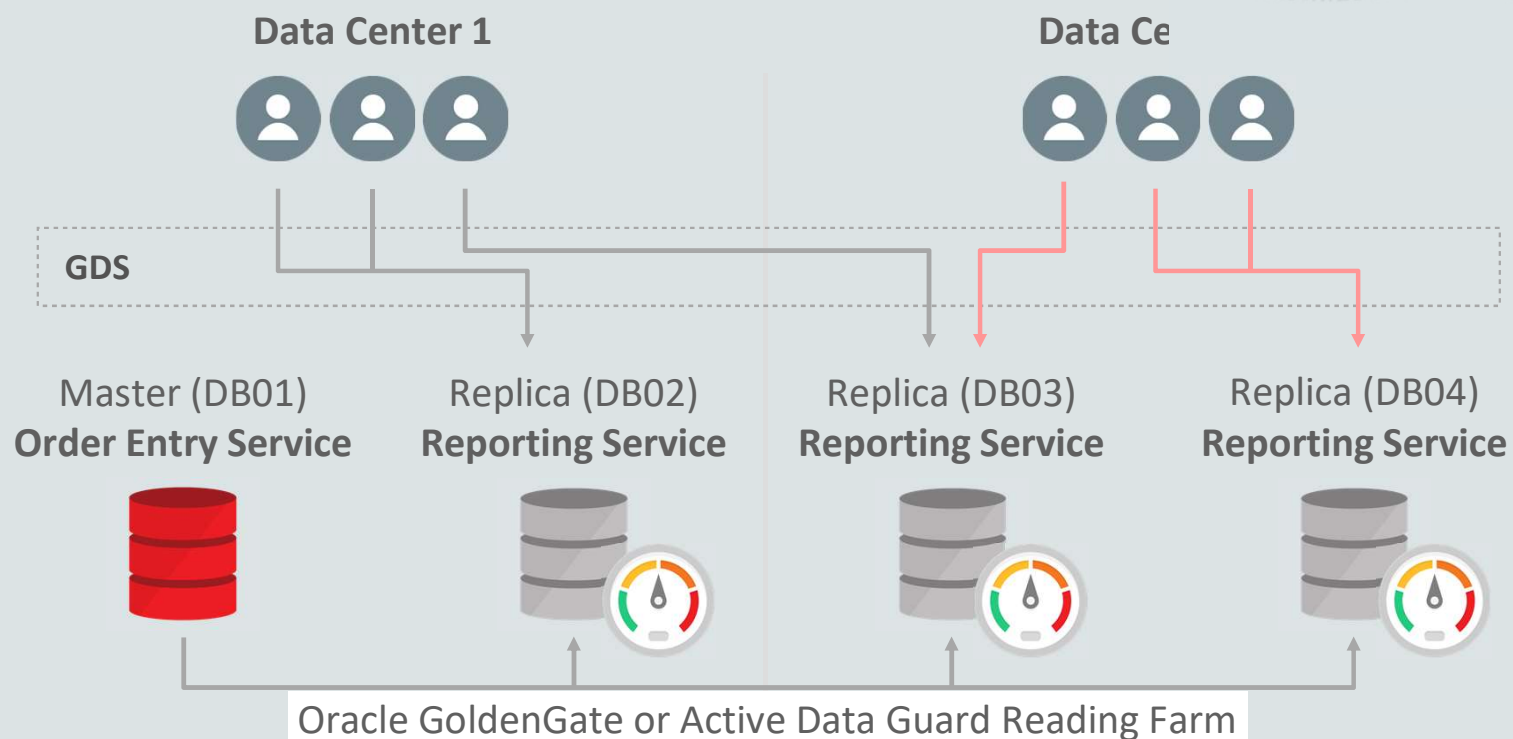
```
GDSCTL>add service -service order_entry_service -gdspool sales  
-preferred DB01 -available DB02
```



# Reader Farms的负载平衡

## Load Balancing for Reader Farms

- 使用GDS, 将读写工作负载路由到primary/master  
With GDS, route Read Write workload to primary/master
- 平衡reader farm上的只读工作负载 Balance Read Only workload on the reader farm
- 提高了读取工作负载的资源利用率和更高的可扩展性 Improved resource utilization and higher scalability for Read workloads

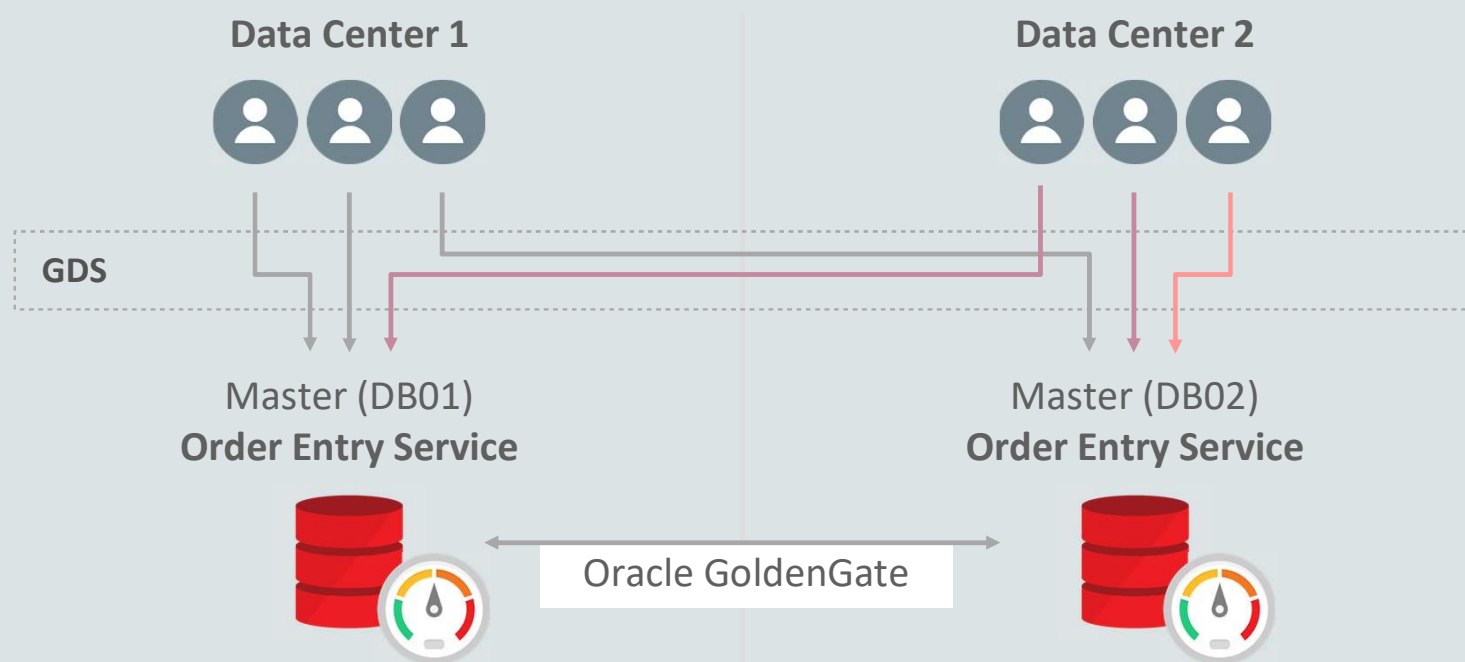


```
GDSCTL>add service -service reporting_srvc -gdspool sales  
-preferred_all -role PHYSICAL_STANDBY -clbgoal LONG -rlbgoal SERVICE_TIME
```

# 双活Oracle GoldenGate 的负载平衡

## Load Balancing for Active/Active Oracle GoldenGate

- 应用程序处理多主冲突解决方案  
Application handles multi-master conflict resolution
- GDS为所有工作请求提供连接时和运行时负载平衡（在数据中心内部和跨数据中心）  
GDS provides connect-time and run-time load balancing (within and across data centers) for all work requests



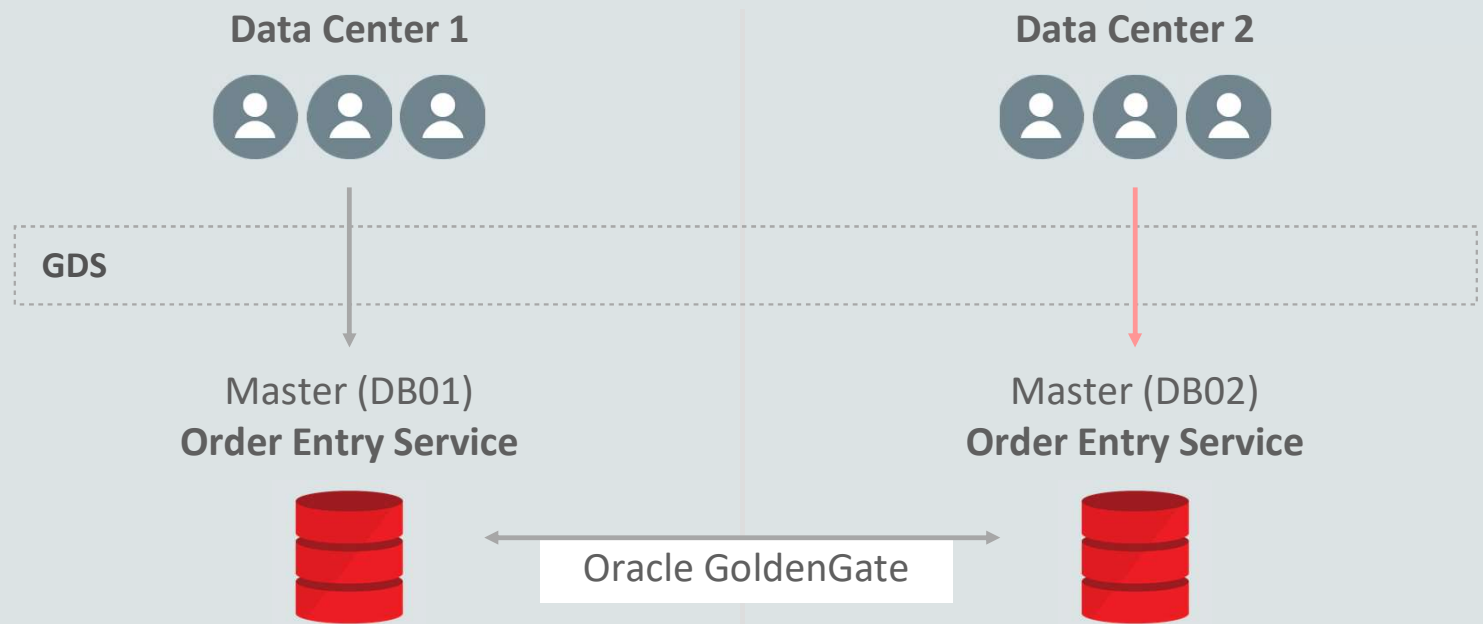
```
GDSCTL>add service -service order_entry_srvc -gds pool sales  
-preferred_all -clbgoal LONG
```



# 双活Oracle GoldenGate中的区域关联

## Region Affinity in Active/Active Oracle GoldenGate

- 应用程序处理多主冲突解决方案  
Application handles multi-master conflict resolution
- GDS可以将所有工作负载路由到客户所在地区最近和最好的数据库  
GDS can route all workloads to nearest and best database in the client's region

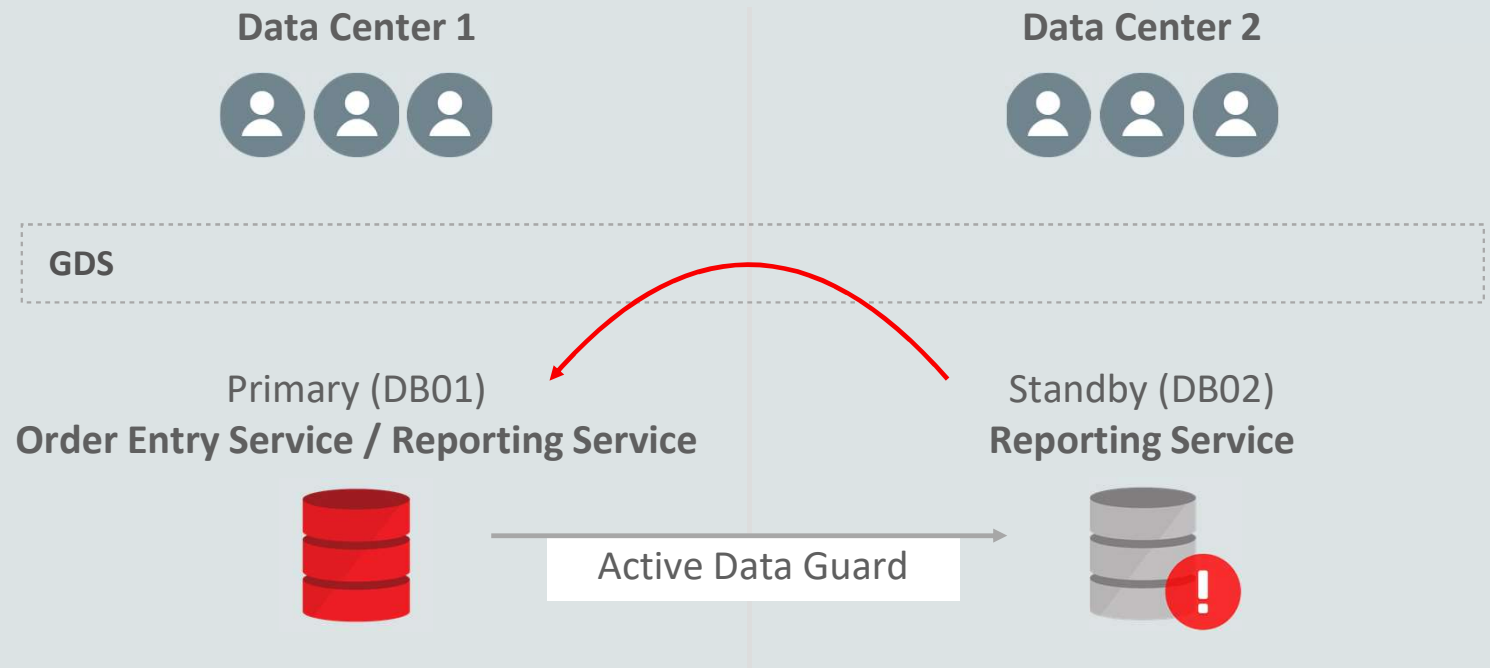


```
GDSCTL>add service -service order_entry_service -gds pool sales  
-preferred_all -locality LOCAL_ONLY -region failover
```

# Active Data Guard 的服务故障切换

## Service Failover for Active Data Guard

- 区域内和区域间的数据库间服务故障切换  
Inter-database Service failover within and across regions
- 更高的可用性和更好的可管理性  
Higher availability and improved manageability



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

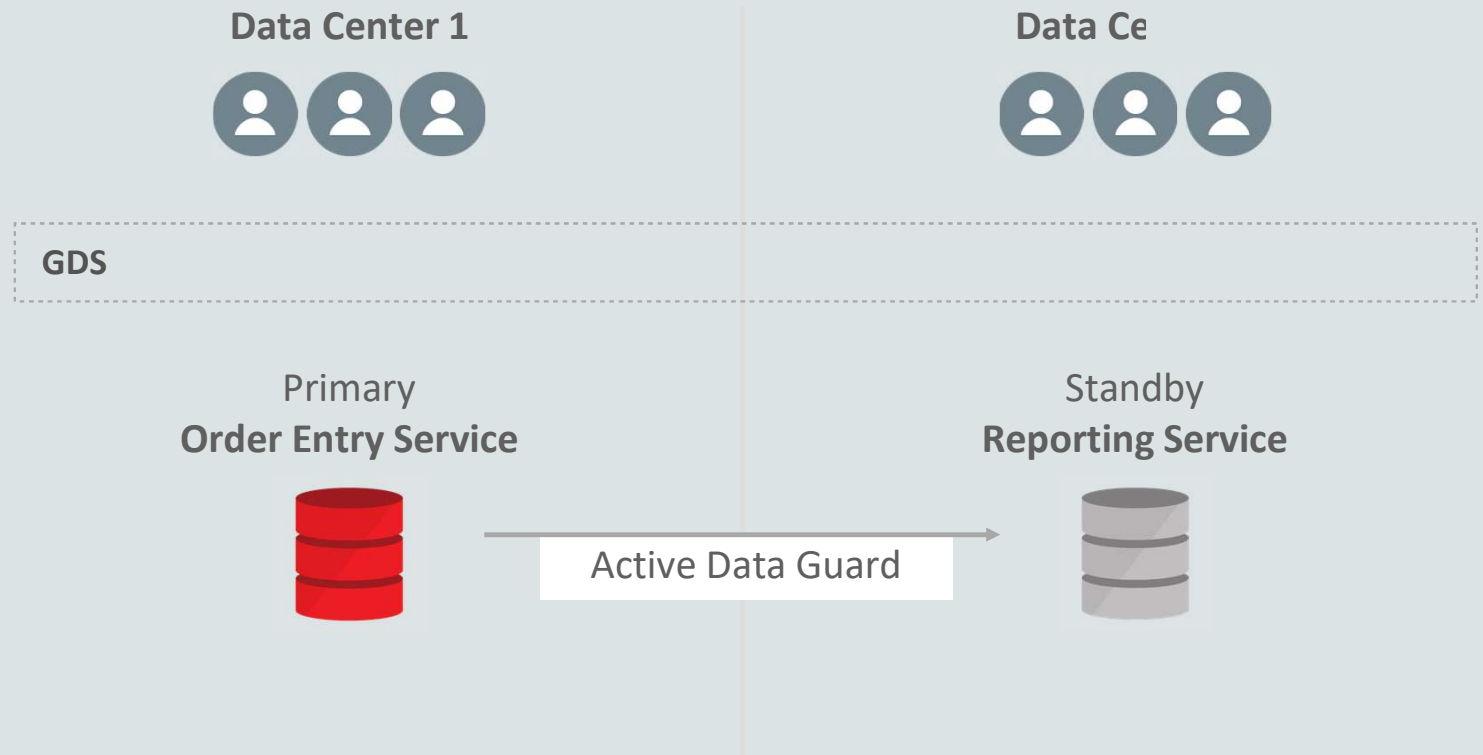


# 基于角色的全局服务

## Role based Global Services

对于 Active Data Guard For Active Data Guard

- 订单输入服务在主服务器上运行 Order Entry Service runs on Primary
- 报表服务在Standby服务器上运行 Reporting Service runs on Standby

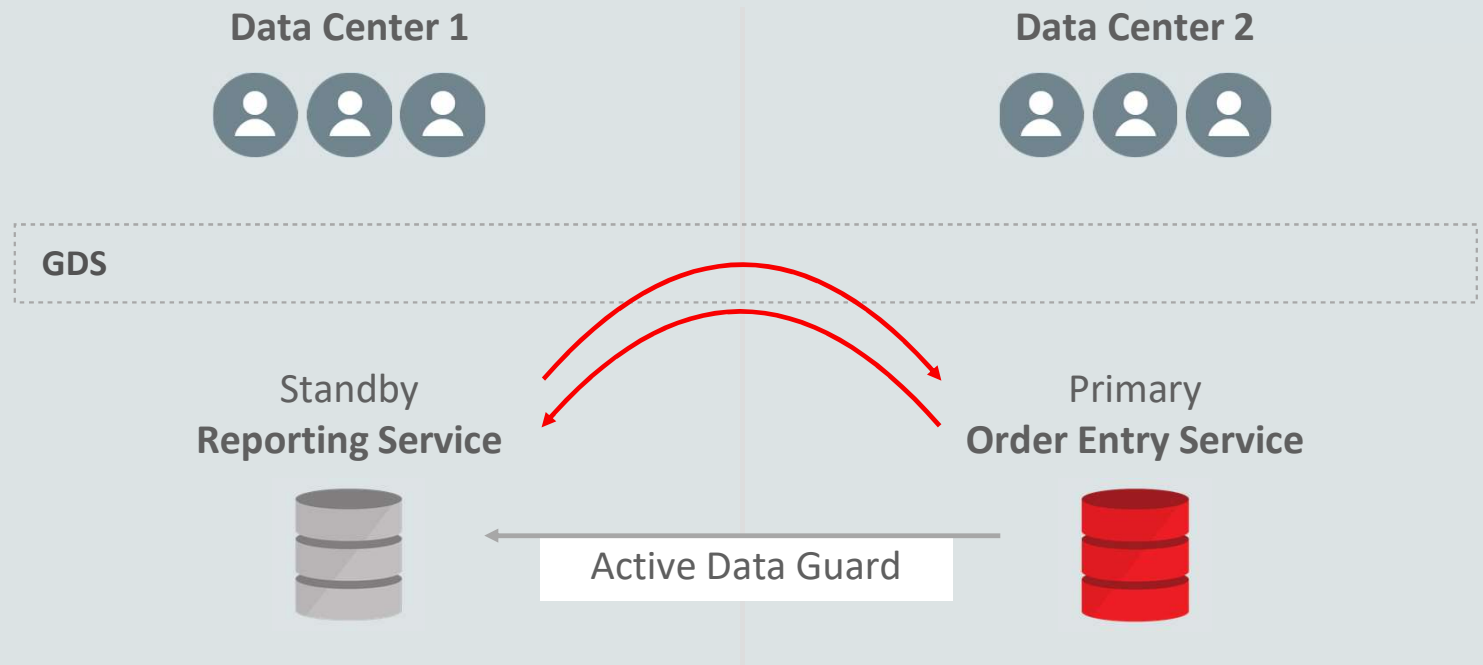


# 基于角色的全局服务

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- 订单输入服务在主服务器上运行 Order Entry Service runs on Primary
- 报表服务在Standby服务器上运行 Reporting Service runs on Standby
- Data Guard 角色更改后, GDS 将根据角色切换服务 Upon Data Guard role change, GDS fails over services based on Role



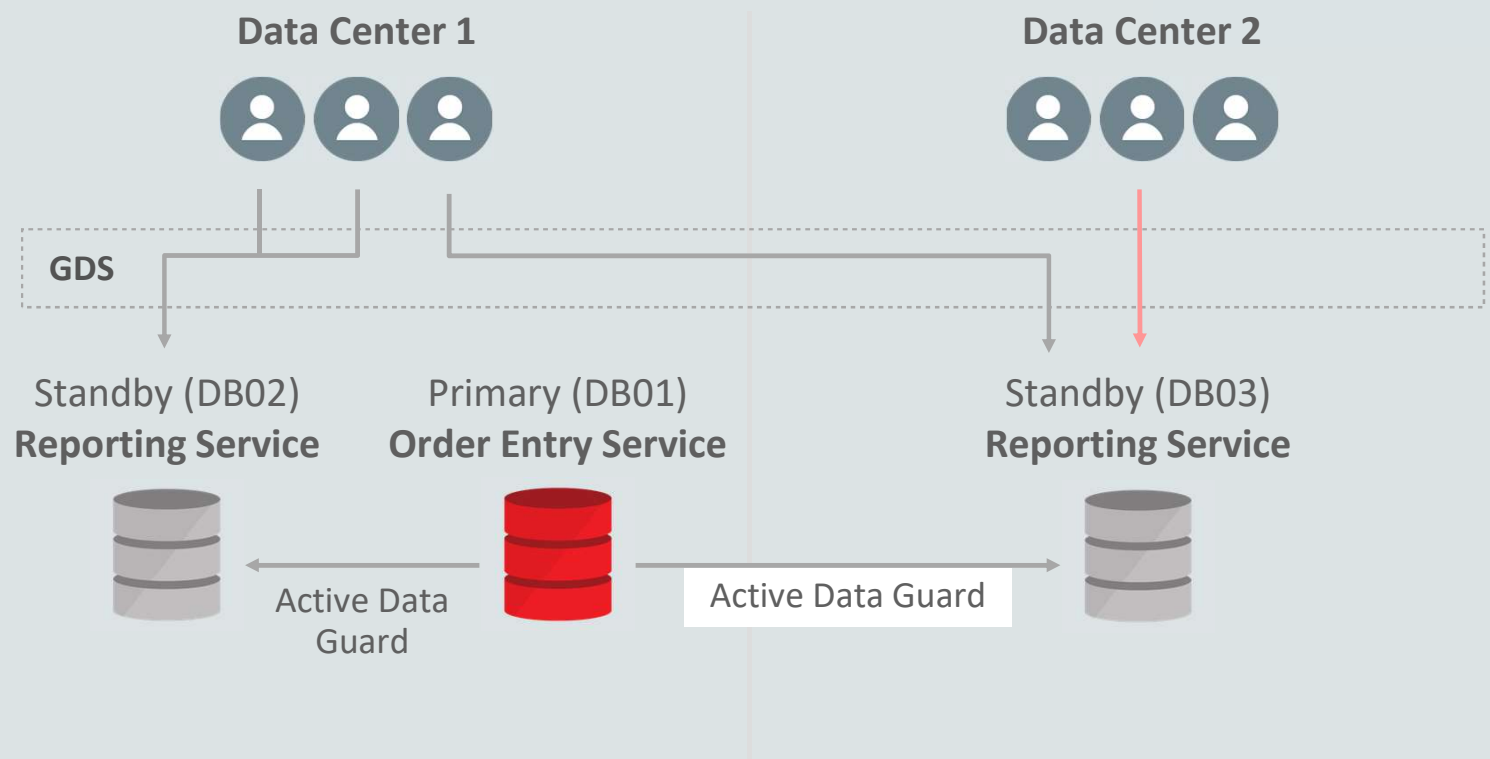
```
GDSCTL>add service -service order_entry_service -gdspool sales -preferred_all -role PRIMARY
GDSCTL>add service -service reporting_service -gdspool sales -preferred_all -role PHYSICAL_STANDBY
```

# 基于复制延迟容忍的路由选择

## Routing based on Replication Lag Tolerance

对于 Active Data Guard For Active Data Guard

- 指定服务的复制延迟限制。Specify replication lag limit for a service.
- GDS 确保服务在 Active Data Guard 备用数据库上运行，延迟小于此限制 GDS ensures that service runs on Active Data Guard standby(s) with lag less than this limit
- 提高数据质量 Improved data quality

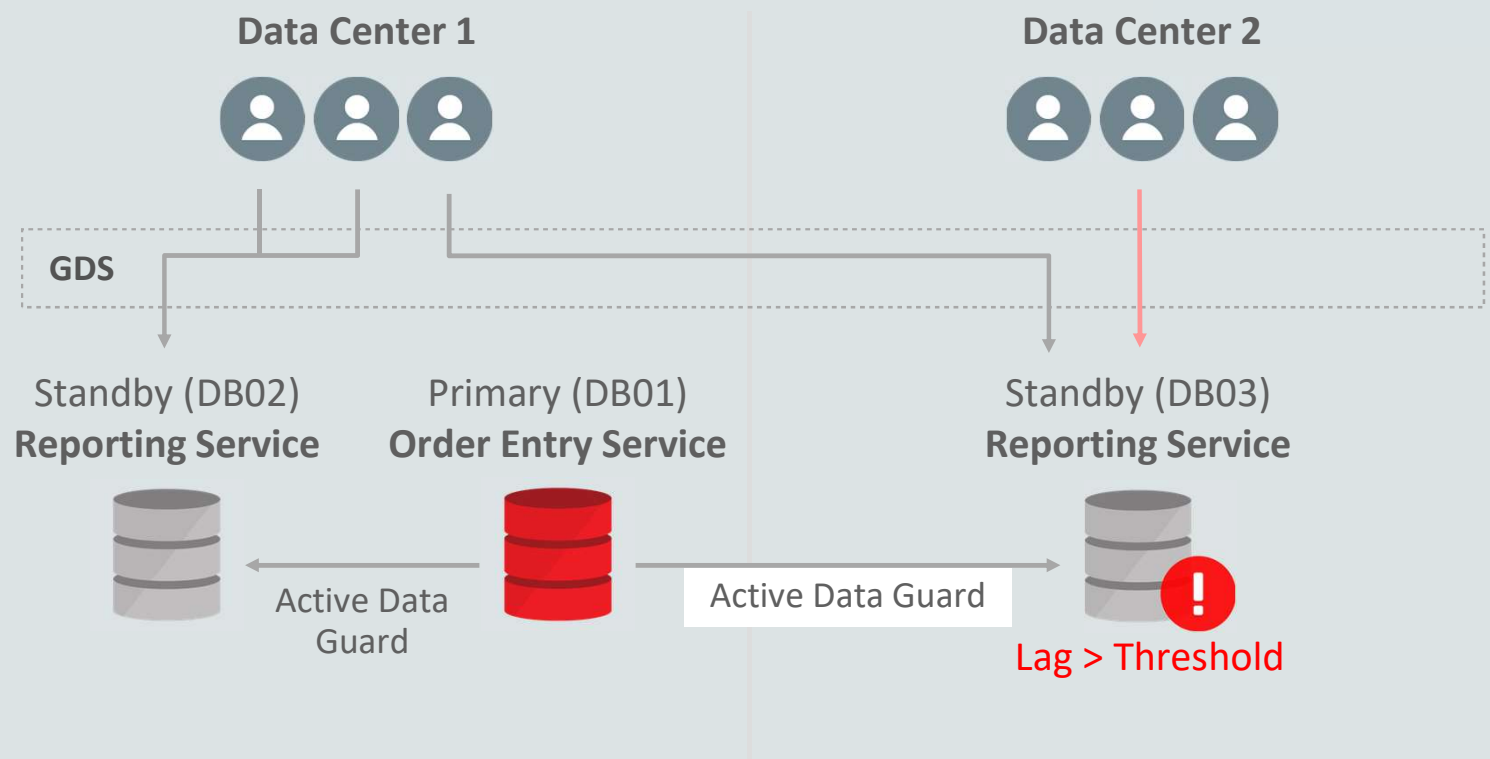


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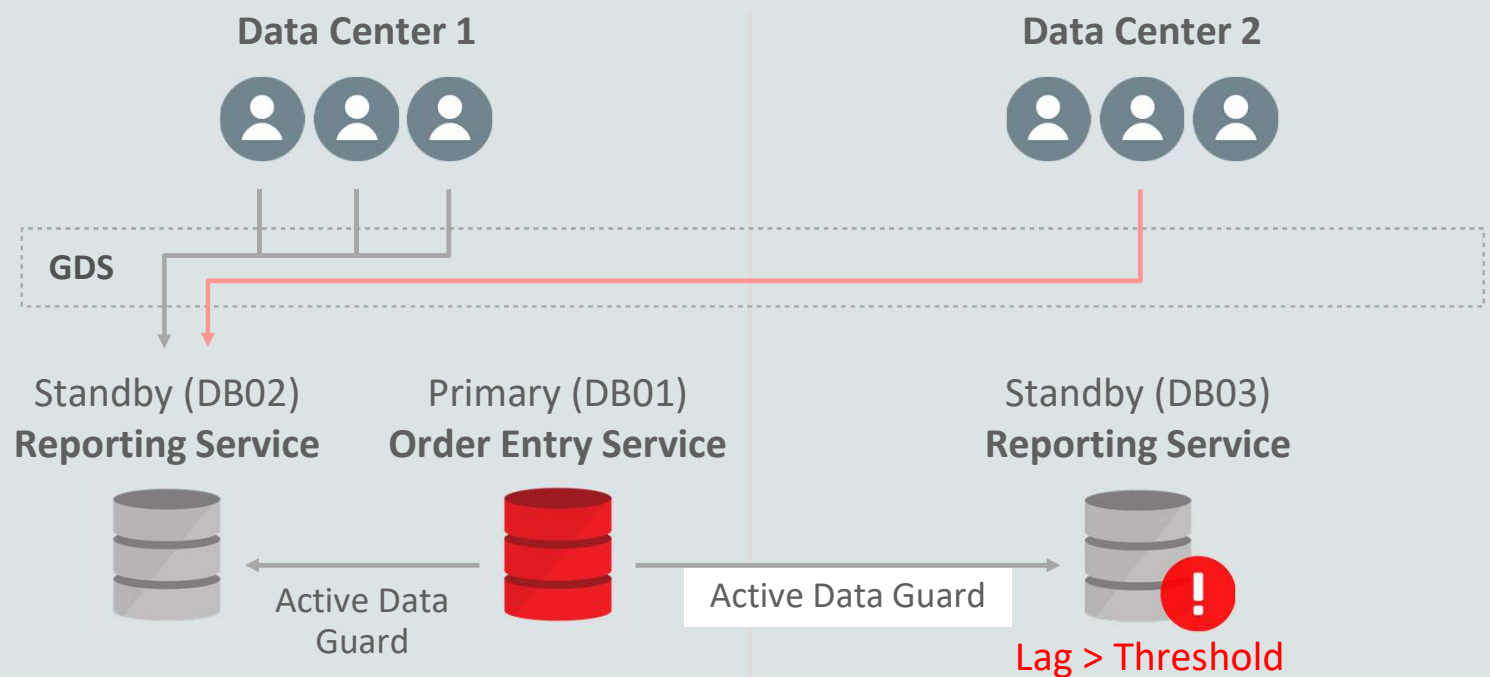


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- 提高数据质量 Improved data quality



```
GDSCTL>add service -service reporting_srvc -gdspool sales  
-preferred_all -role PHYSICAL_STANDBY -lag 180
```

# 使用 Oracle GDS 缓解计划外中断

## Mitigate Unplanned Outage with Oracle GDS

将客户端工作负载自动故障切换到另一个数据中心 Automatic Failover of Client Workload to another Datacenter

应用程序使用...  
Applications using  
...

Oracle pools or drivers : UCP, ODP.NET, OCI, WebLogic Active GridLink

3<sup>rd</sup> party App Servers using UCP: IBM WebSphere, Apache Tomcat

应用配置  
Application config

- Subscribe to FAN events (published by GDS via ONS) by enabling Fast Connection Failover (FCF)
- TNS entry to include RETRY\_COUNT, CONNECT\_TIMEOUT and TRANSPORT\_CONNECT\_TIMEOUT

计划外事件  
Unplanned events

For Oracle GoldenGate and Active Data Guard: Global Service failovers

For Active Data Guard: Data Guard role change

# 使用 Oracle GDS 实现零停机计划维护

## Zero-downtime Planned Maintenance with Oracle GDS

透明地将客户端工作负载移动到另一个数据中心 Transparently move Client Workload to :

应用程序使用...  
Applications using ...

**Oracle pools or drivers : UCP, ODP.NET, OCI, WebLogic Active GridLink**

**3<sup>rd</sup> party App Servers using UCP: IBM WebSphere, Apache Tomcat**

应用配置 Application  
config

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- TNS entry to include RETRY\_COUNT, CONNECT\_TIMEOUT and TRANSPORT\_CONNECT\_TIMEOUT

计划外事件 Unplanned  
events

```
GDSCTL> relocate service -gdspool sales -service sales_global_srvc -old_db ogg1 -new_db ogg2
```

会话消耗 Sessions Drain

FAN posts planned downtime event (REASON: USER) and FCF drains sessions as work completes

- New work is redirected by GSM listeners immediately
- Idle sessions are released immediately
- Active sessions are released when returned to pools



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# 客户案例研究 Customer Case Studies





# 大型SaaS临床试验提供商 Large SaaS Provider for Clinical Trials

基于云的平台，供客户构建自己的临床试验和进行医学研究 Cloud-based platform for clients to build their own clinical trials and perform medical research



目标：用于分析临床操作患者相关数据的可扩展体系结构 Goal: Scalable architecture for analysis of patient-related data for clinical operations



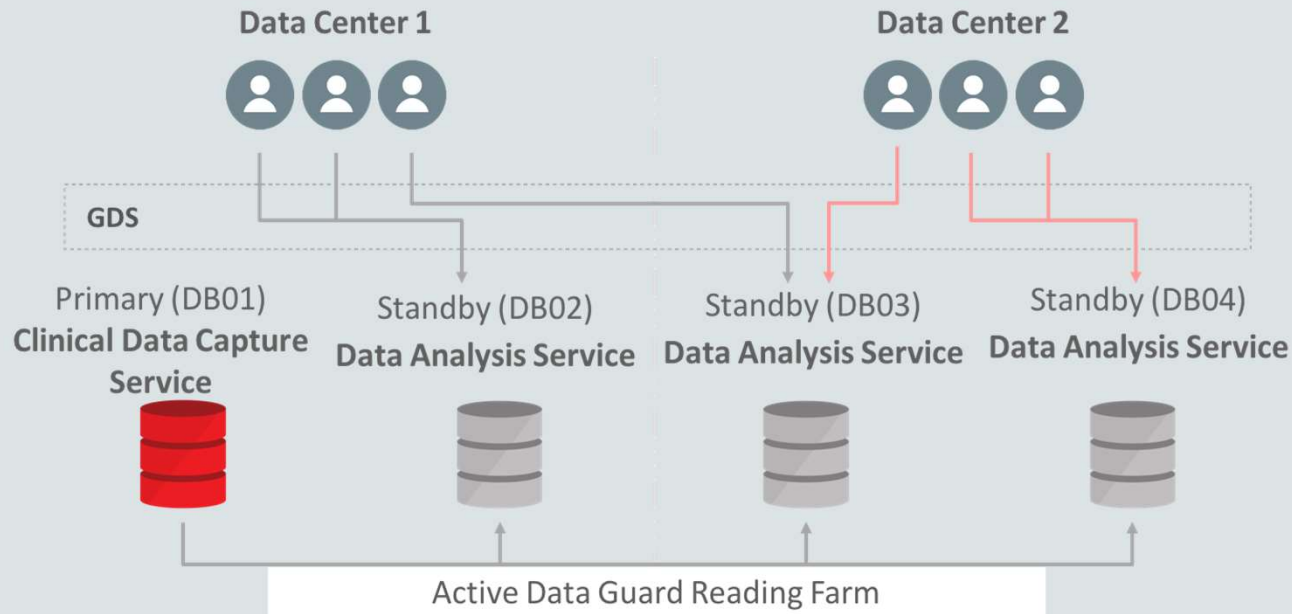
**Global Load Balancing**



**Centralized Service Management**

## 挑战 Challenges

- 数据分析的高可扩展性 High scalability for data analysis
- 平衡reader farm上的只读工作负载 Balance read-only workload on the reader farm



## 结果/收益 Results/Benefits

- GDS为临床数据分析提供了一个可扩展的SaaS平台 GDS allowed a scalable SaaS platform for clinical data analysis
- 零许可成本 - 因为Oracle GDS包含在Active Data Guard中 Zero licensing cost - as Oracle GDS is included with Active Data Guard



# 在35个国家/地区运营的全局酒店/度假村公司

Global Hotel/Resorts Company Operating in 35 Countries

值机和积分兑换的关键任务应用程序 Mission Critical Application for Check-in and Points-exchange



目标：为计划外和计划中断提供持续可用性的分布式基础架构 Goal: Distributed infrastructure that provides continuous availability for unplanned and planned outages



**Global Service Failover**



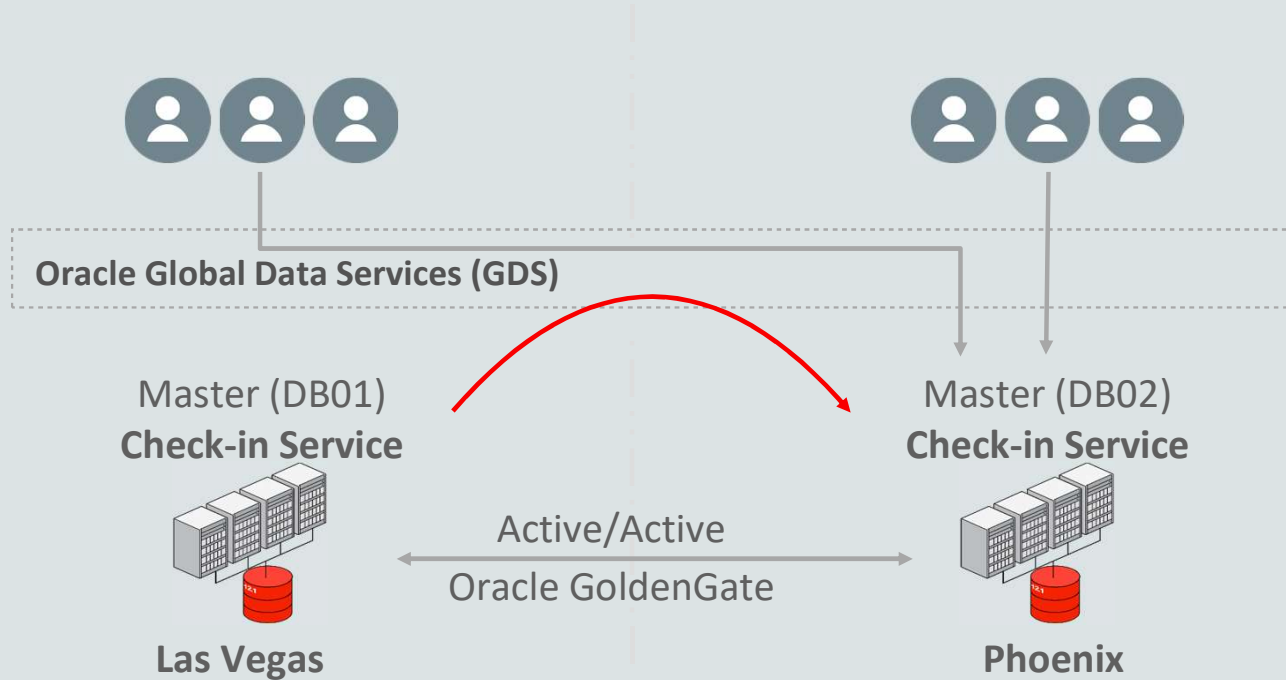
**Centralized Service Management**



**Continuous Availability**

## 挑战 Challenges

- 应用程序停机会影响客户签到。  
Application downtime impacts customer check-in.
- 应用程序需要每周打补丁多次（有时一天打一次）  
Application needs to be patched numerous times a week (sometimes in a day).
- 需要几个小时的停机时间 Takes couple of hours of downtime .



## 结果/收益 Results/ Benefits

- DBA应用补丁并将全局服务故障转移到补丁环境。  
DBA applies the patch and fails over the global service to the patched environment .
- 使用 Oracle GDS, 消除了应用程序停机时间。 With Oracle GDS, application downtime has been eliminated.



# 未指明的美国政府机构 Unspecified US Government Agency

## 任务敏感型应用程序 Mission Sensitive Application



**目标: 为在复制环境中运行的所有工作负载实现数据库高可用性** Goal: Achieve database high availability for all workloads running in a replicated environment



**Automatic Global Service Failover**



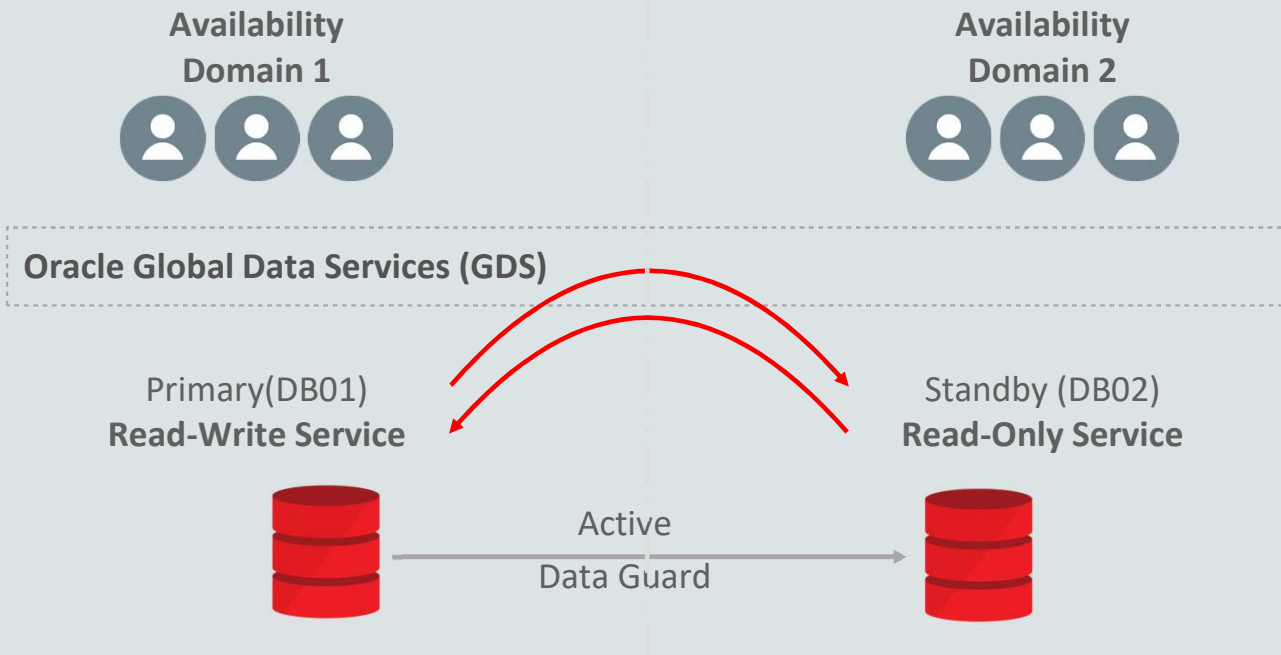
**Downtime Reduction**



**Locality-based Routing**

### 挑战 Challenges

- 数据库宕机会影响应用程序的可用性 Database downtime impacts the application's availability
- 应用程序需要很高的正常运行时间和性能 Application requires high uptime and performance



### 结果/收益 Results/ Benefits

- 利用Oracle GDS的基于角色的全局服务 Leveraged Role-based global services with Oracle GDS.
- 角色转换时, 全局服务将自动重新定位 Global services are automatically relocated upon role transition.
- 通过基于GDS位置的路由改进应用程序性能 Improved application performance via GDS locality based routing.





“全局数据服务将通过在跨分布式数据中心的复制数据库之间动态平衡应用程序查询来帮助 MorphoTrak 提高系统利用率。我们已经通过部署 Oracle RAC 和 Active Data Guard 消除了闲置容量的成本，而 Oracle Database 12c 将我们带到了另一个层次。它用智能、实时的自动化取代了数据中心之间的静态负载平衡，有效利用了所有可用容量，从而产生了更大的投资回报率。” “Global Data Services will help MorphoTrak improve systems utilization by dynamically load balancing application queries between replicated databases across distributed data centers. We had already eliminated the cost of idle capacity by deploying Oracle RAC and Active Data Guard, and Oracle Database 12c takes us to another level. It replaces static load balancing between data centers with intelligent, real-time automation that efficiently utilizes all available capacity yielding greater ROI.”

Aris Prassinos, Chief Engineer, MorphoTrak, SAFRAN Group

# 项目议程 Program Agenda

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- ▶ 副本的工作负载管理挑战 Workload management challenges of replicas
- ▶ 全局数据服务（GDS）简介 Introduction to Global Data Services (GDS)
- ▶ GDS概念和体系结构 GDS concepts and architecture
- ▶ GDS用例 GDS use cases
- ▶ 总结 Summary

# Oracle 副本的数据库工作负载管理

## Database Workload Management for Oracle Replicas

	网络负载均衡器 Network Load Balancers	Oracle GDS
基于位置的路由 Locality based routing	✓	✓
连接时数据库负载平衡 Connect-time database load balancing	✓	✓
向客户端发布路由和故障转移情报 Publish routing and failover intelligence to clients	○	✓
基于复制延迟的数据库工作负载路由 Replication lag based database workload routing	○	✓
数据库间全局服务故障切换 Inter-database global Service failover	○	✓
自动基于角色的全局服务 Automatic role based global Services	○	✓
跨副本集中管理数据库服务 Centralized management of database Services across replicas	○	✓
Active Data Guard 的原生集成 Native integration for Active Data Guard	○	✓
成本效益 Cost Effectiveness	Additional \$\$\$	Included with Active Data Guard or Oracle GoldenGate



# Oracle 最高可用性架构

## Oracle Maximum Availability Architecture (MAA)

### 生产环境

#### Production Site

##### RAC

- 可伸缩性 Scalability
- 服务器高可用性 Server HA

##### ASM

- 本地存储保护 Local storage protection

##### Flashback

- 人为错误校正 Human error correction

### 全局数据服务 Global Data Services

- Service Failover / Load Balancing

### 应用程序连续性 Application Continuity

- Application HA

### 企业管理器云控制 Enterprise Manager Cloud Control

站点防护, 协调站点故障切移 Site Guard, Coordinated Site Failover

### 活动副本

#### Active Replica

##### Active Data Guard

- 数据保护、灾难恢复 Data Protection, DR
- 查询分流 Query Offload

##### GoldenGate

- 双活复制 Active-active replication
- 异构 Heterogeneous

### 恢复设备 RMAN、Oracle 安全备份

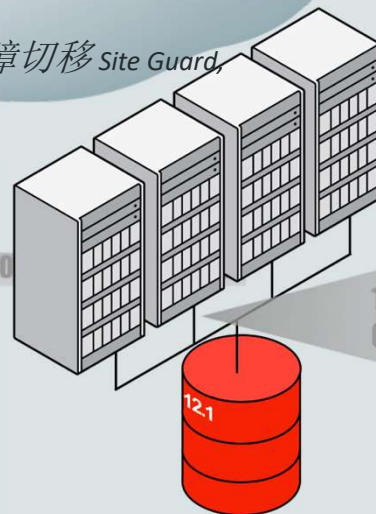
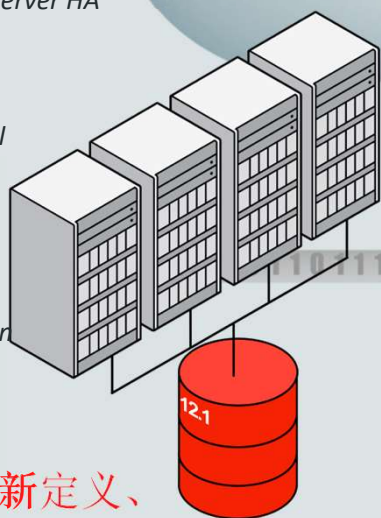
Recovery Appliance, RMAN, Oracle Secure Backup,

- 备份到磁带/云 Backup to disk, tape or cloud

基于编辑重新定义、  
在线重新定义、Data Guard、GoldenGate

Edition-based Redefinition,  
Online Redefinition, Data Guard, GoldenGate

- 最短停机的维护、升级、迁移 Minimal downtime maintenance, upgrades, migrations



# 总结

## Summary

- **GDS为复制数据库提供工作负载路由、负载均衡、服务故障切换和管理 GDS provides workload routing, load balancing, service failover & management for replicated databases**
- **主要优势 Key benefits**
  - 应用程序使用 GDS 来最大化性能和可用性 Applications use GDS to maximize performance and availability
  - 减少计划内和计划外停机期间的停机时间 Mitigate downtime during planned and unplanned outages
  - 更好的副本资源利用率 Better resource utilization of replicas



## 其他资源 Additional Resources



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

**Oracle** Maximum  
Availability Architecture

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

The logo for Oracle Blogs, featuring the word "ORACLE" in red above the word "Blogs" in black.

**ORACLE** Blogs

<https://nageshbattula.com/category/global-data-services/>

Social Media Links:

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[@nageshbattula](https://twitter.com/nageshbattula)

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Thank you



# Backup Slides

# Global Service Attributes – Service Placement

- **Preferred**

- Databases designated to provide the Global Service

- **Available**

- Databases that provide Global Service if not enough *Preferred* databases are running
- If one of the preferred databases fails, then GSM maintains the cardinality of the Global service by starting the service on an *Available* database

- **Preferred\_All**

- All databases in a GDS Pool are preferred for the Global Service

- **Options for Add Service:**

- `{-preferred_all | -preferred dbname_list [-available dbname_list] }`
- `GDSCTL>add service -service sales_qry_srvc -gdspool sales -preferred sfo -available bos`
- `GDSCTL>add service -service sales_reporting_srvc -gdspool sales -preferred_all`

# Global Service Attributes – Service Placement (cont'd)

- **Role based Global Service**

- Service should be active only when the database is either a primary or standby
- Can be started on a database if its role matches global service's role attribute
- Options for **Add Service**:
  - `[-role {PRIMARY | PHYSICAL_STANDBY [-failover_primary] | LOGICAL_STANDBY | SNAPSHOT_STANDBY}]`
- `GDSCTL>add service -gdspool sales -service sales_reporting_srvc - preferred_all -role physical_standby`

- **Lag Tolerance**

- Establish application's tolerance for non-current data
- Specify the lag limit for the Global Service in seconds
- Options for **Add or Modify Service**:
  - `-lag {lag_value | ANY}`
- `GDSCTL>add service -service sales_reader_lag180_srvc -gdspool sales - preferred_all -role physical_standby -lag 180`

# Global Service Attributes - Locality Based Routing

- Achieve geographical affinity between clients and databases
- Options for **Add or Modify Service**
  - [-locality {ANYWHERE | LOCAL\_ONLY [-region\_failover]}]
- **Locality ANYWHERE**
  - Client connections and work requests are routed to any region for load balancing or failover
  - GDSCTL>add service -service *sales\_reader\_srvc* -gdspool *sales* -preferred\_all -  
**locality ANYWHERE**
- **Locality LOCAL\_ONLY**
  - Regardless of load, GDS will not route to databases in other regions
  - GDSCTL>add service -service *sales\_reader\_srvc* -gdspool *sales* -preferred\_all -  
**locality LOCAL\_ONLY**
- **Locality LOCAL\_ONLY -region\_failover**
  - Client connections and work requests are routed to another region when all databases in a region have failed
  - GDSCTL>add service -service *sales\_reader\_srvc* -gdspool *sales* -preferred\_all -  
**locality LOCAL\_ONLY -region\_failover**

# Global Service Attributes – Load Balancing

## Connect-time Load Balancing (CLB)

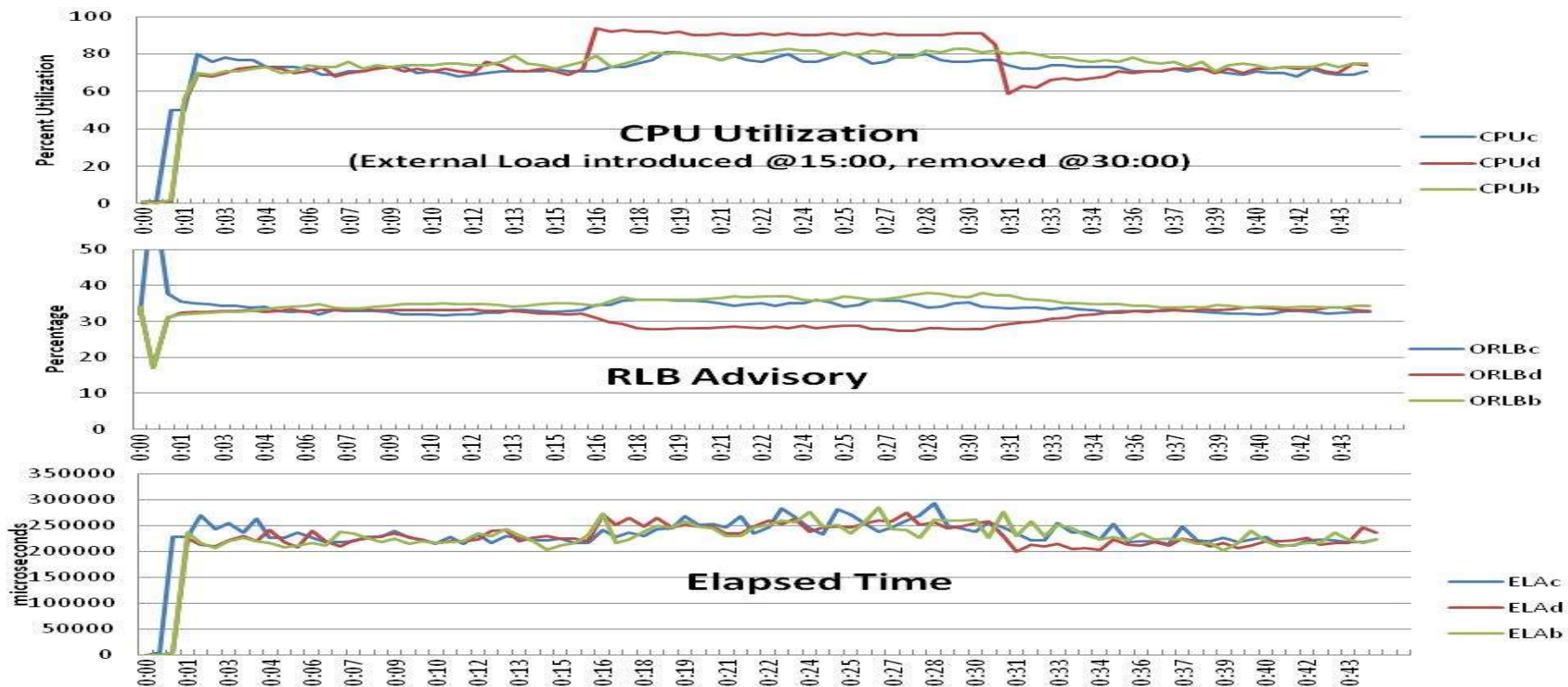
- GDS support CLB for all clients
  - Directs connection requests to the best database instance in GDS pool
  - Takes into account
    - Load statistics from all GDS pool databases
    - Inter-region network latency, locality and CLB goal
  - Options for Add Service :
    - [-clbgoal {SHORT | LONG}]
    - GDSCTL>add service **-service sales\_clb\_srvc** -gdspool sales -preferred\_all **-clbgoal LONG**

## Run-time Load Balancing (RLB)

- GDS supports RLB feature of connection pools for OCI, JDBC/UCP, ODP.NET, WLS
  - Publishes RLB Advisory to clients
  - Based on advisory, clients distribute workload requests across persistent connections spanning GDS Pool database instances
  - Takes into account
    - Per-service performance data from pool databases
    - Inter-region network latency, locality and RLB goal
  - Options for Add Service :
    - [-rlbgoal {SERVICE\_TIME | THROUGHPUT}]
    - GDSCTL>add service **-service sales\_rlb\_srvc** -gdspool sales -preferred\_all **-rlbgoal SERVICE\_TIME**

# Run-time Load Balancing with GDS

## Standalone Identical Database Servers with External Load



Routing responds gracefully to changing system conditions



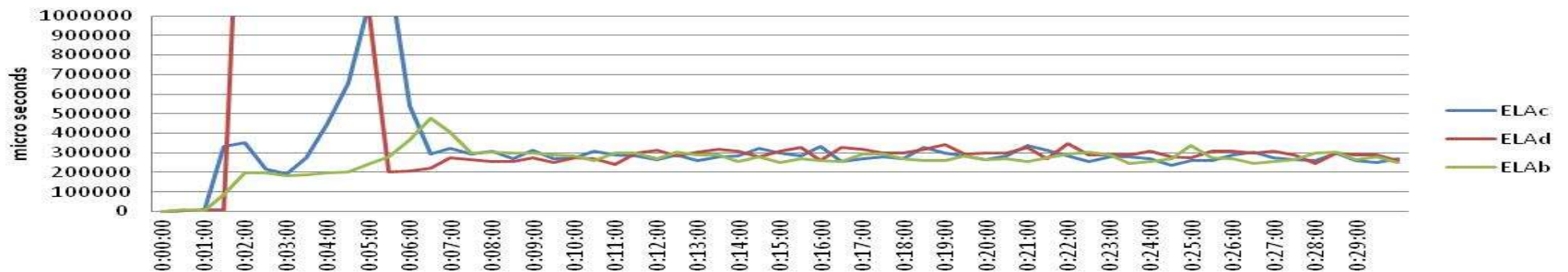
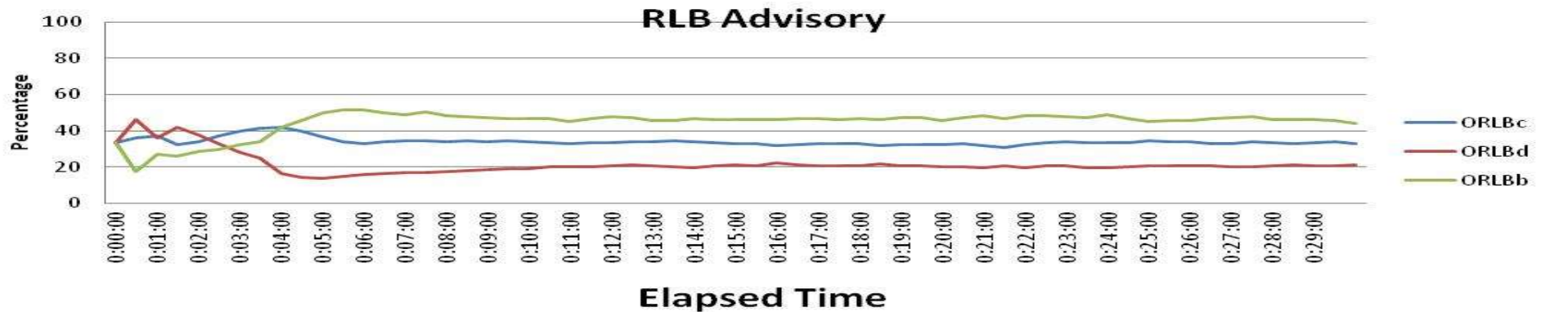
# Run-time Load Balancing with GDS

## Standalone Asymmetrical Database Servers

DB b: 4 CPUs

DB c: 3 CPUs

DB d: 2 CPUs



GDS does intelligent load balancing even across asymmetrical database servers

# Integrated Cloud

## Applications & Platform Services

