



防大于治，做好数据保护的最后一公里

Oracle 19c MAA最佳实践

——

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防大于治，企业客户容灾高可用面临的挑战和诉求



Active Data Guard, **活动数据卫士**。是避免关键Oracle数据库发生**站点故障**的最全面的解决方案。通过在同城或远程位置维护生产数据库的同步副本，从而以**最简单和最经济**的方式**防止**数据丢失和停机。如果生产数据库由于任何原因变为不可用，客户端连接可以迅速地（在某些配置中可以透明地）**故障切换至**同步副本以**恢复服务**

议程



Oracle最大可用性架构和Active Data Guard



Data Guard的发展历程和使用场景



Data Guard的三大特性



Active Data Guard的保护模式和常用架构



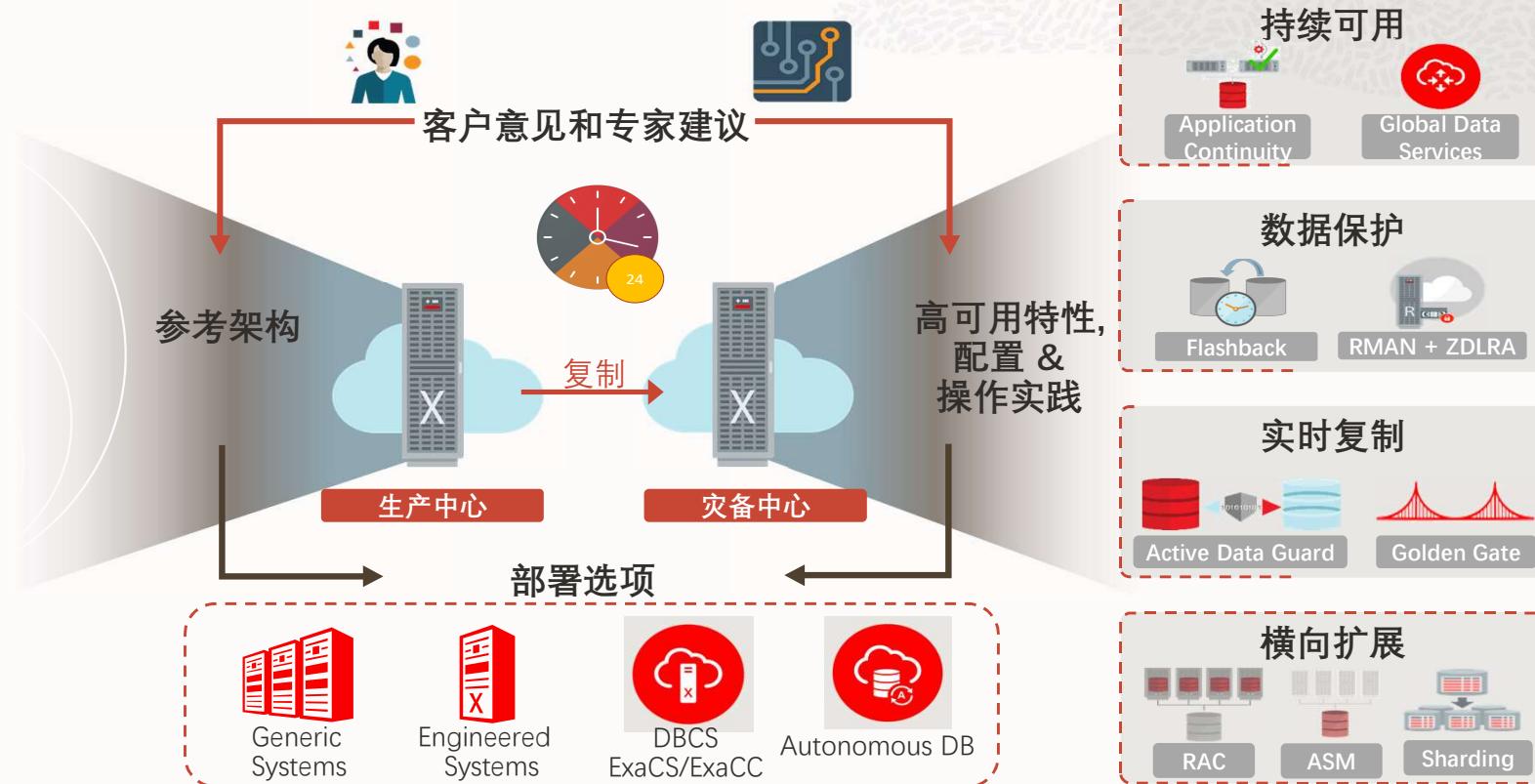
Active Data Guard的管理和监控



Active Data Guard和客户端连接

Oracle最大可用性架构

Oracle MAA(Maximum Availability Architecture)



- 为用户的**Oracle数据库系统**提供架构、配置和生命周期管理，以满足**本地**、**云**或**混合云**环境中**Oracle数据库**的高可用性服务级别。
- 通过多个预集成的技术堆栈，在整合、横向扩展的基础上，避免性能、节点故障、存储故障、站点故障、人为错误、逻辑错误，降低管理复杂度/风险，确保零数据丢失，保障业务持续可用，并最大化资源利用率。

Oracle最大可用性参考架构

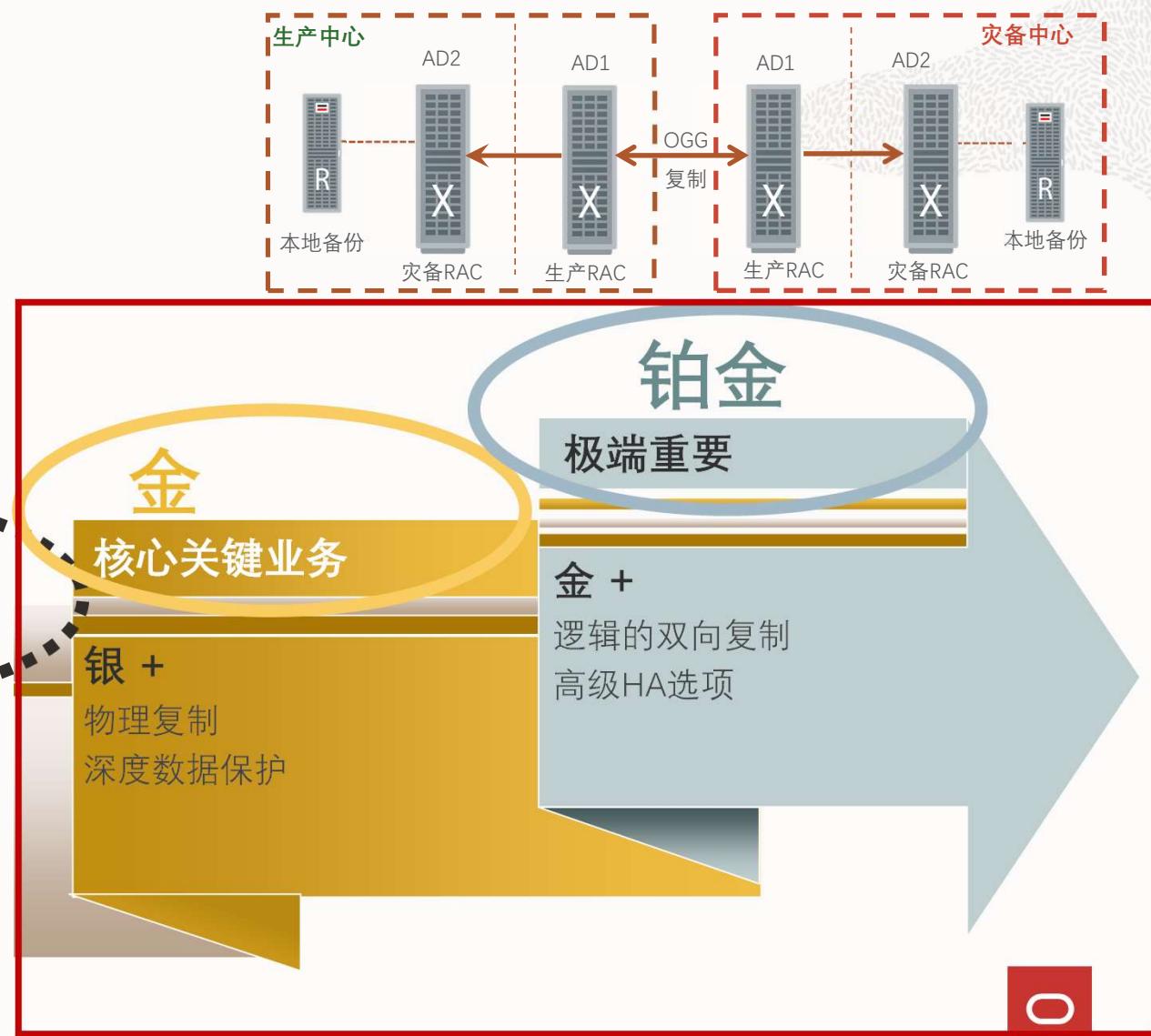
铜

开发, 测试, 生产

单实例数据库(with Restart)
在线维护
验证备份/恢复

铜 +

数据库 HA
双活 集群
应用连续性

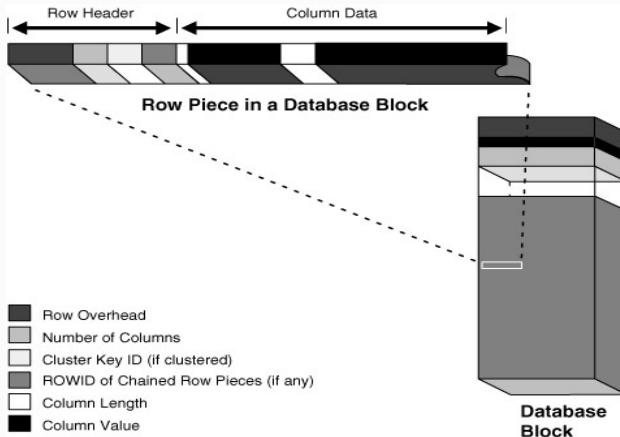


Active Data Guard的多重保护机制

各个级别的数据保护

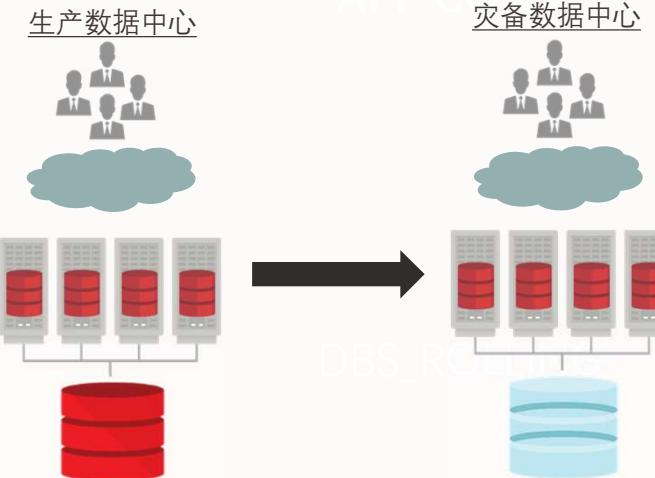
强容错机制
实时校验

实时灾备
所有的组件都是活动的



数据库可感知的物理和逻辑数据一致性检查，以确保端到端数据完整性

Oracle灾备实时接收/应用重做，持续的Oracle集成数据验证

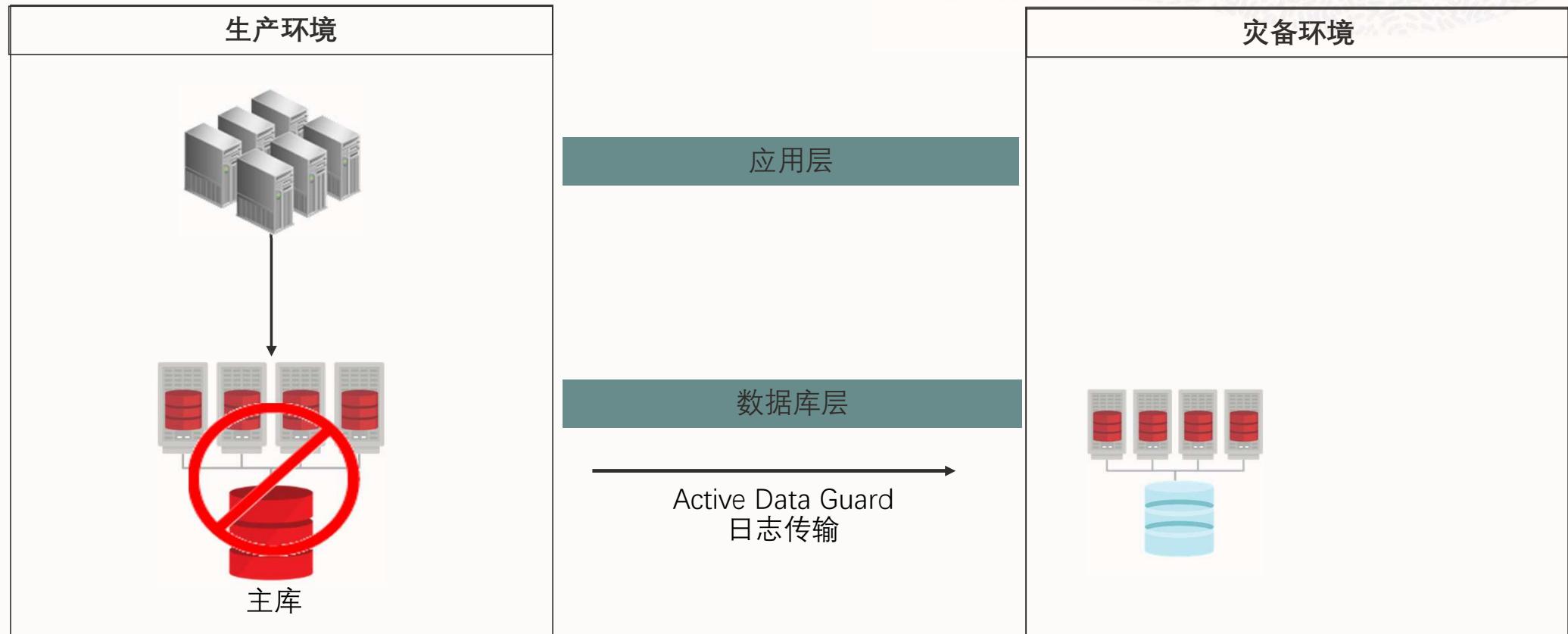


最小的风险，灾备已经在工作了

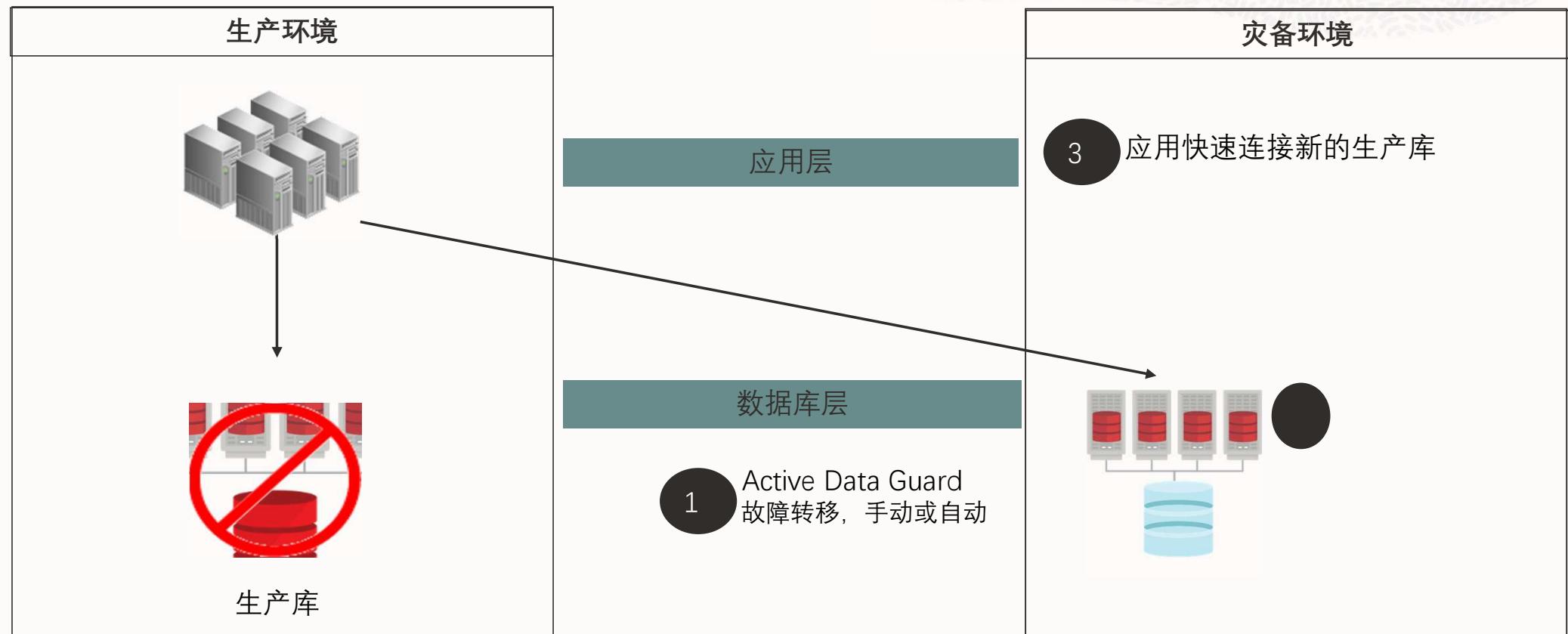
Active Data Guard和第三方在数据保护不同维度的对比

	Oracle Active Data Guard (活动数据卫士)	第三方
与底层硬件、存储、光纤网络要求	低 (版本和字节序一致)	高
预防数据损坏	是	否
自动修复物理块损坏	是	否
RTO 所能容忍的业务中断服务的最长时间	秒至两分钟	高达30分钟
RPO 所能容忍的业务系统数据丢失量	零或接近零	零(有限距离内)或接近零
灾备用于报表	是	否
网络带宽要求	低 (只传输变化的redo, 还可以压缩)	一般来说需要7倍redo的带宽(所有的数据文件, 临时文件, 控制文件, 日志文件, 归档文件等都需要复制)
集成应用故障转移	是 (Application Continuity)	否 (需要定制化)
自动快速故障转移	是	否 (需要定制化)
数据库滚动升级	是	否
架构复杂度和运维管理难度	低	高
零数据丢失, 支持自动故障切换 (容灾等级7级)	是	否

Active Data Guard和集成应用程序故



Active Data Guard和集成应用程序故障转移



议程



Oracle最大可用性架构和Active Data Guard



Data Guard的发展历程和使用场景



Data Guard的三大特性



Active Data Guard的保护模式和常用架构



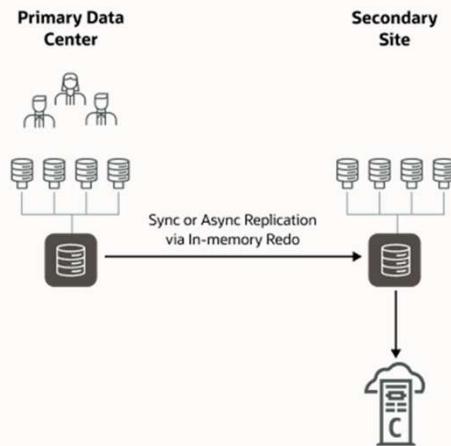
Active Data Guard的管理和监控



Active Data Guard和客户端连接

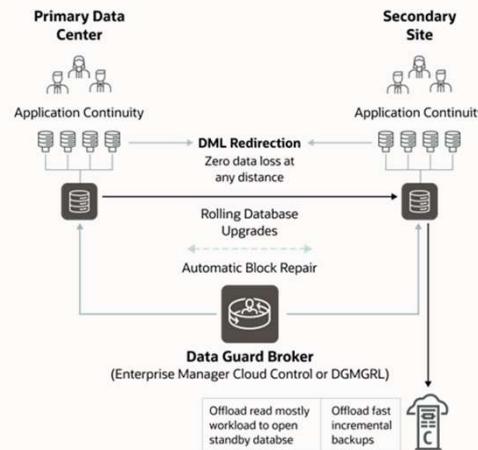
Data Guard和Active Data Guard的区别

Oracle Data Guard (DG)



- **基本DR (包含在DB 企业版中)**
 - 授权主备站点
- **授权主备站点**
 - 备机仅用于故障转移
- **自动故障切换到待机站点**
- **零 /接近零数据丢失**
- **持续数据验证**
- **简单的迁移和升级**

Active Data Guard (ADG)



- **高级灾难恢复**
- **双活***
 - 查询、报告、备份
 - 偶尔更新(19c)
 - 保证系统是可操作的
- **自动块修复**
- **应用连续性**
- **任何距离的零数据丢失**

With Data Guard Broker

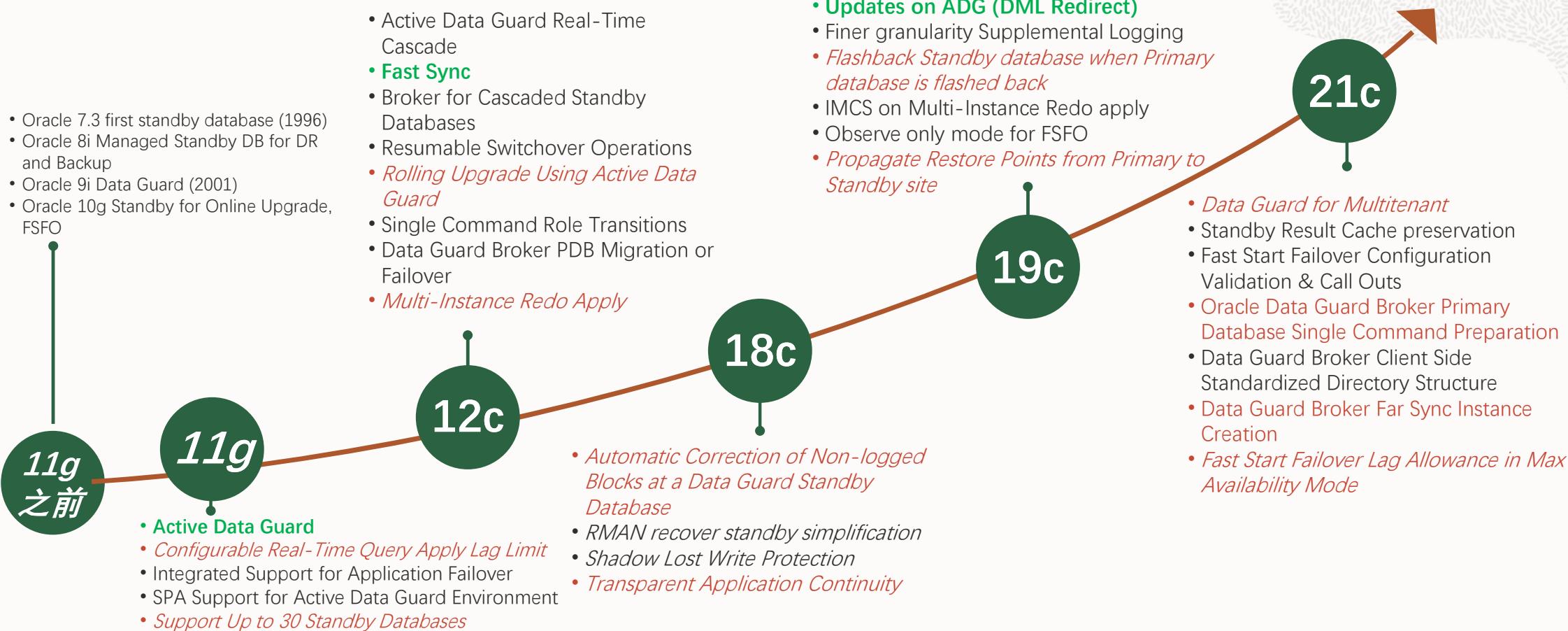
- Connect to the standby with SQL*Plus and execute the following command
 - ALTER DATABASE OPEN;

Without Data Guard Broker

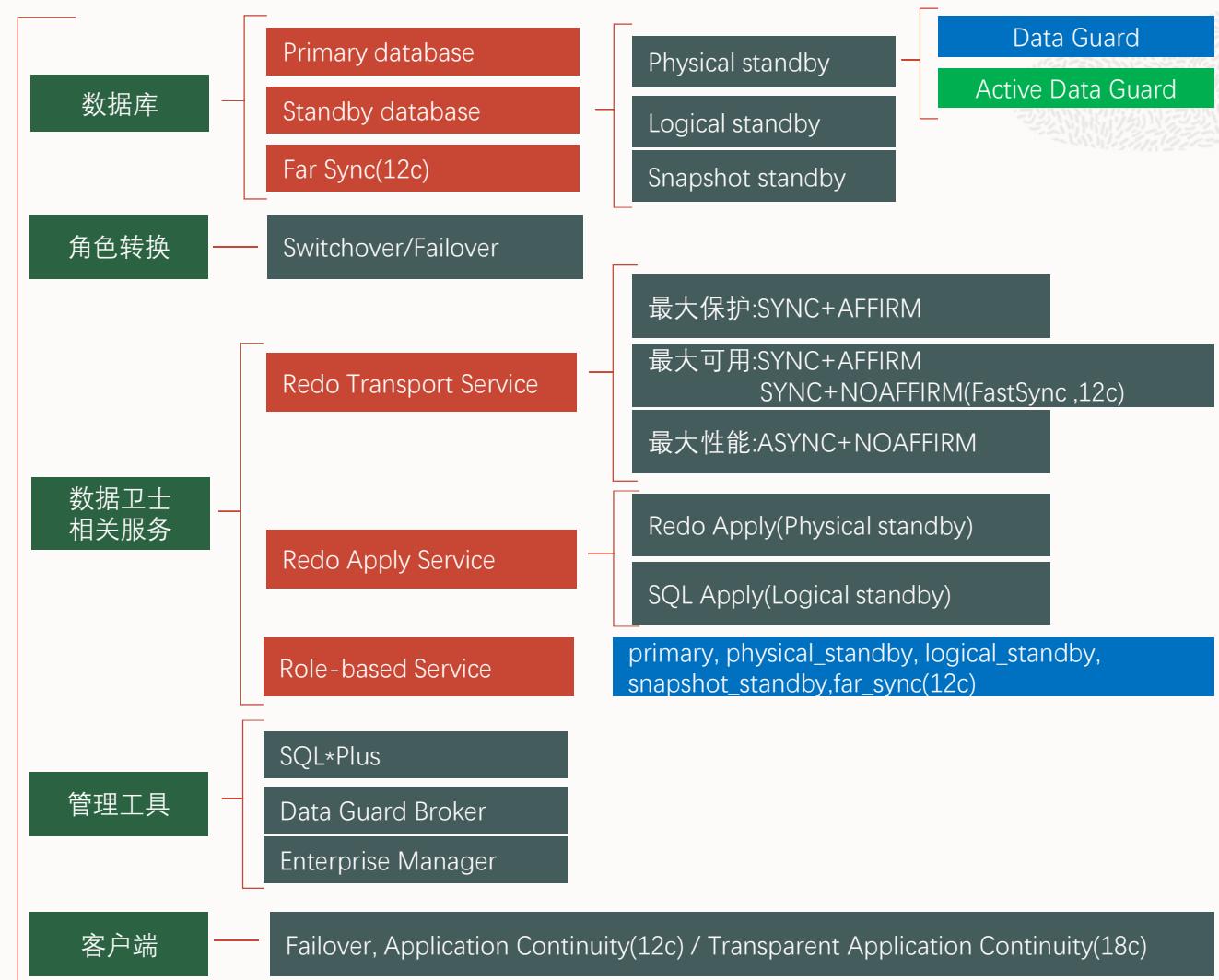
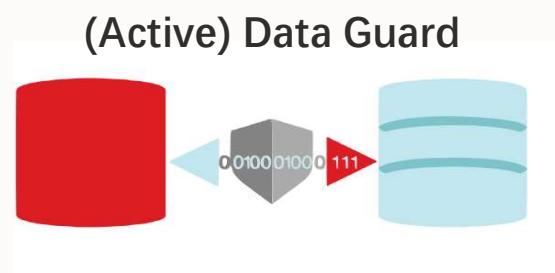
- Connect to the standby with SQL*Plus and execute the following commands
 - ALTER DATABASE RECOVER MANAGED STANDBY DATABASE CANCEL;
 - ALTER DATABASE OPEN;
 - ALTER DATABASE RECOVER MANAGED STANDBY DATABASE DISCONNECT FROM SESSION;



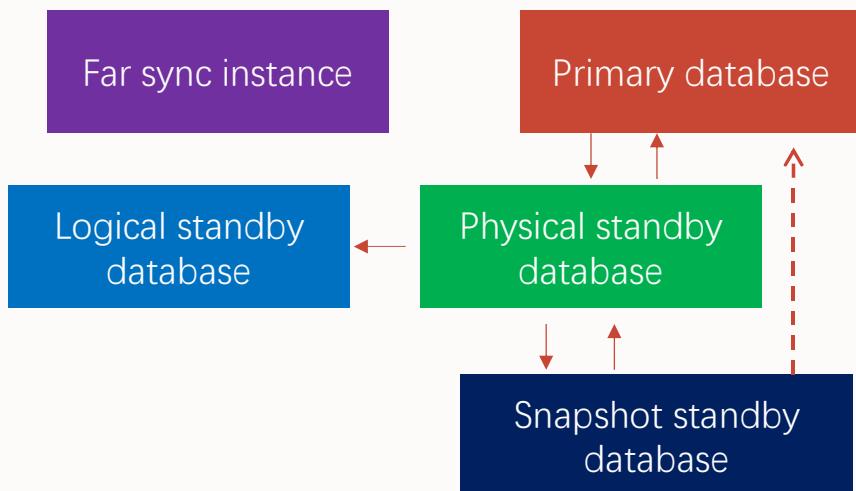
Data Guard 的发展历程



Active Data Guard相关概念



Active Data Guard灾备库的类型



Physical standby:在磁盘上，物理备库数据块和生产库是完全一致的。物理备库通过**Redo Apply**与主库保持同步，恢复从主库接收到的重做数据，并将重做应用到物理备库。

Logical standby:包含与生产库相同的逻辑信息，数据的物理组织和结构可能不同。逻辑备库通过**SQL Apply**与主库保持同步，SQL Apply将从主库接收的重做中的数据转换为SQL语句，然后在备库上执行SQL语句。

```
DGMGRL> show configuration;

Configuration - dg_pgold

Protection Mode: MaxAvailability
Members:
pgold - Primary database
psilver - (*) Physical standby database
ptwcfsl - Far sync instance
ptwcpys - Snapshot standby database
ptwclgs - Logical standby database

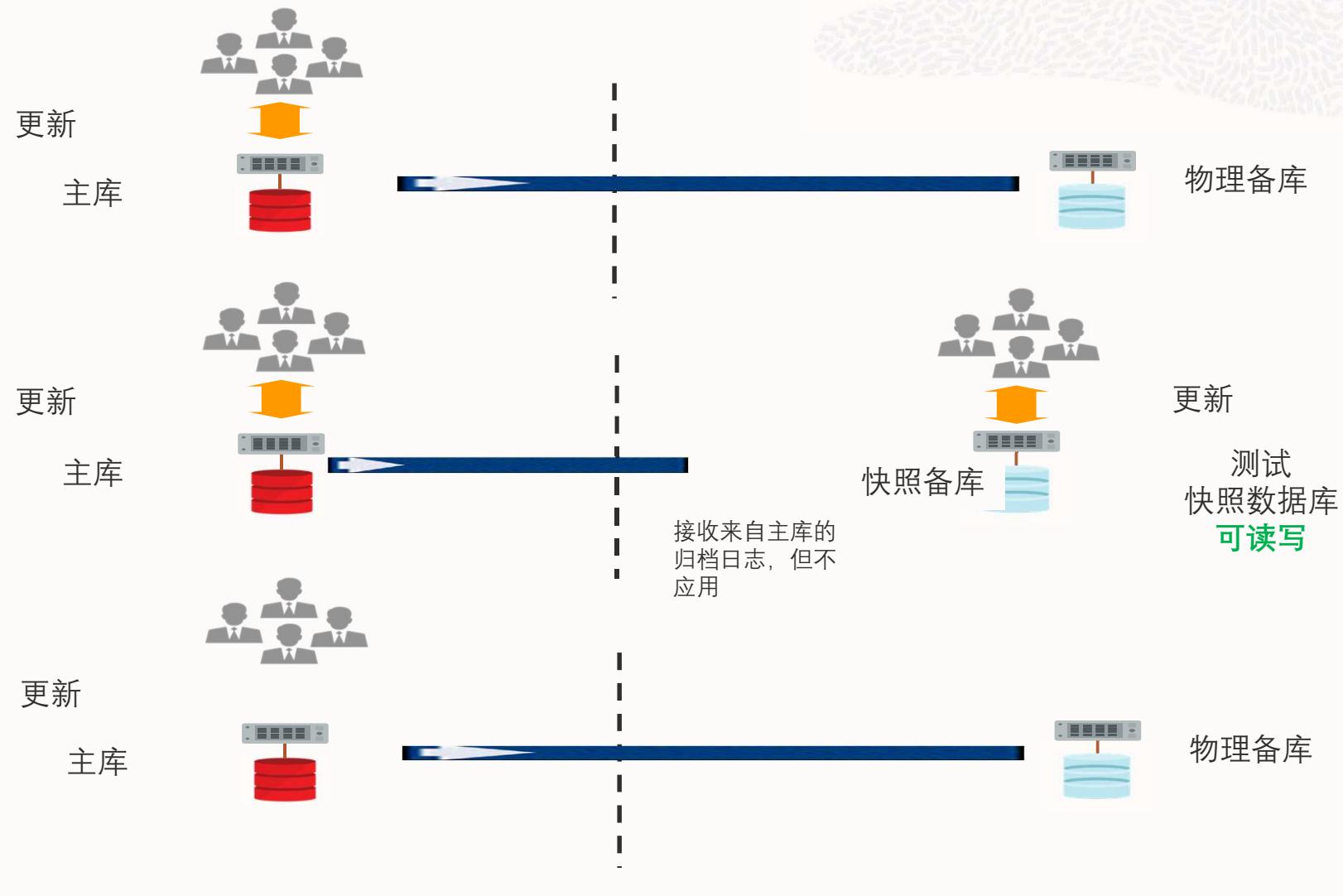
Members Not Receiving Redo:
ptwcfsl2 - Far sync instance (alternate of ptwcfsl)

Fast-Start Failover: Enabled in Zero Data Loss Mode

Configuration Status:
SUCCESS (status updated 26 seconds ago)

DGMGRL>
```

Active Data Guard snapshot standby (快照备库)



Oracle (Active) Data Guard使用场景

Data Guard: 实时数据保护和可用

配置简单

自动数据同步

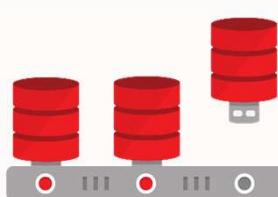
一键快速切换

相互保护

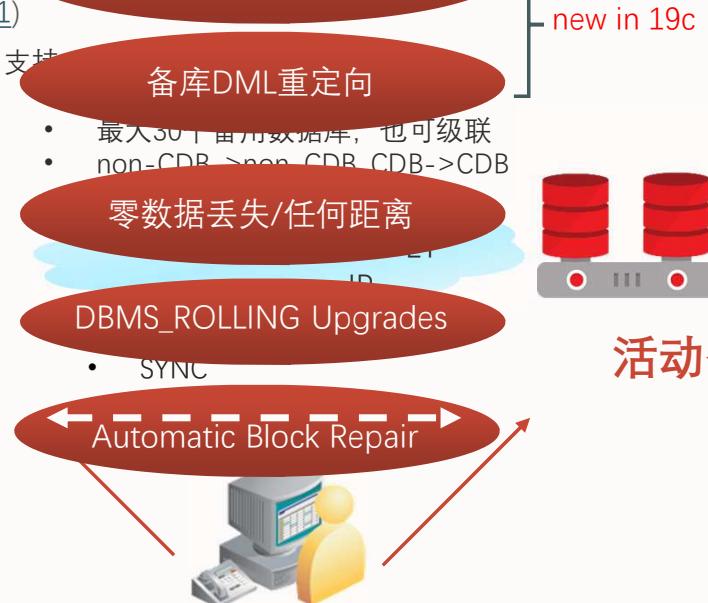
有效利用资源

配置环境要求:

- 相同OS(参见[MOS 413494](#))
- 相同RDBMS Release 随主库闪回Standby自动闪回
**[MOS 1265700.1](#))

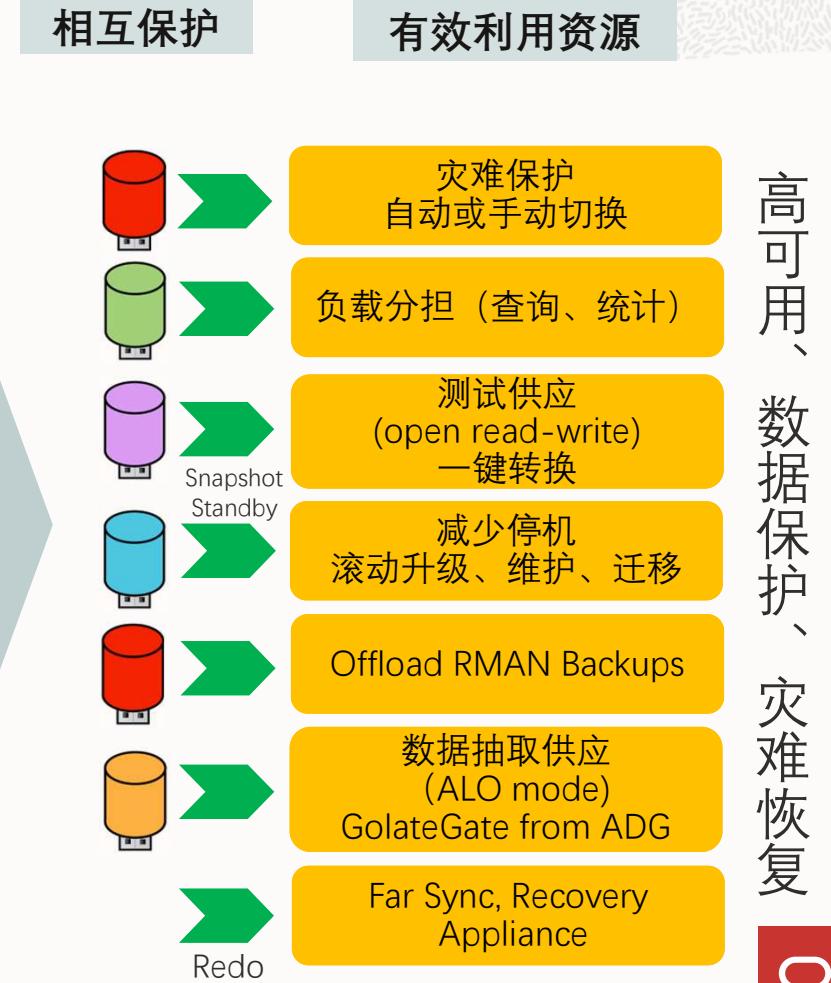


主库



SQL*Plus 或 Data Guard Broker
(Enterprise Manager Cloud Control or DGMGRL)

活动备库更多的附加价值



O

议程



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Data Guard的发展历程和使用场景



Data Guard的三大特性



Active Data Guard的保护模式和常用架构



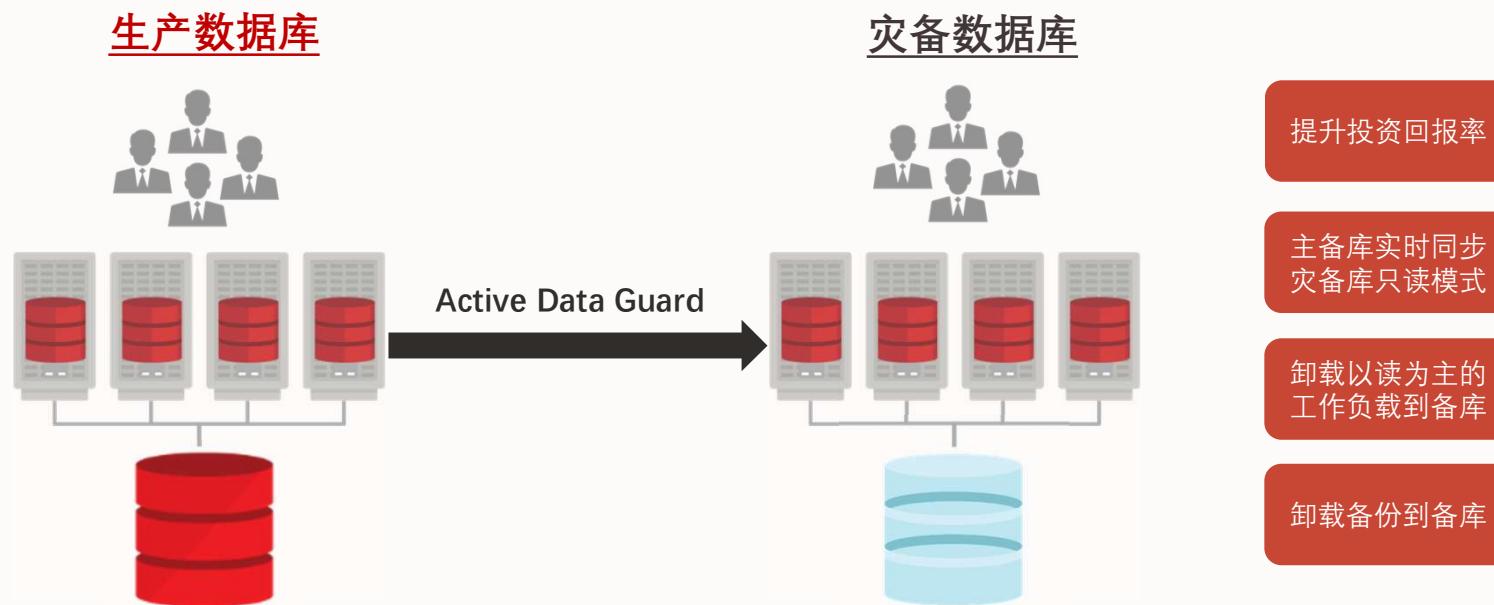
Active Data Guard的管理和监控



Active Data Guard和客户端连接

Active Data Guard (活动数据卫士)

APP CONT



Active Data Guard 远程同步 (Far sync)

任意距离零数据丢失



Active Data Guard DML重定向

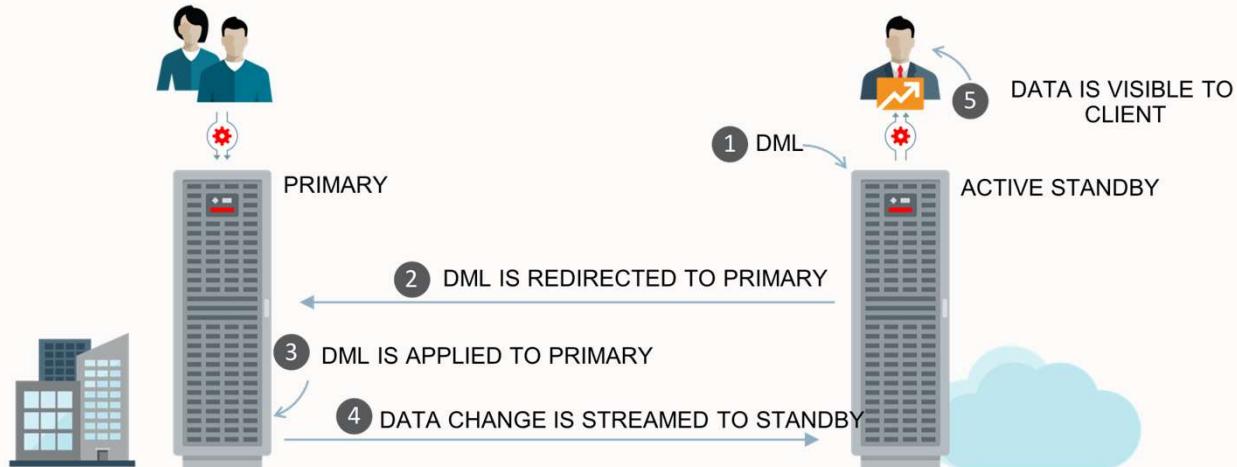
DML重定向

自动从ADG的备库执行到主库(保持ACID)

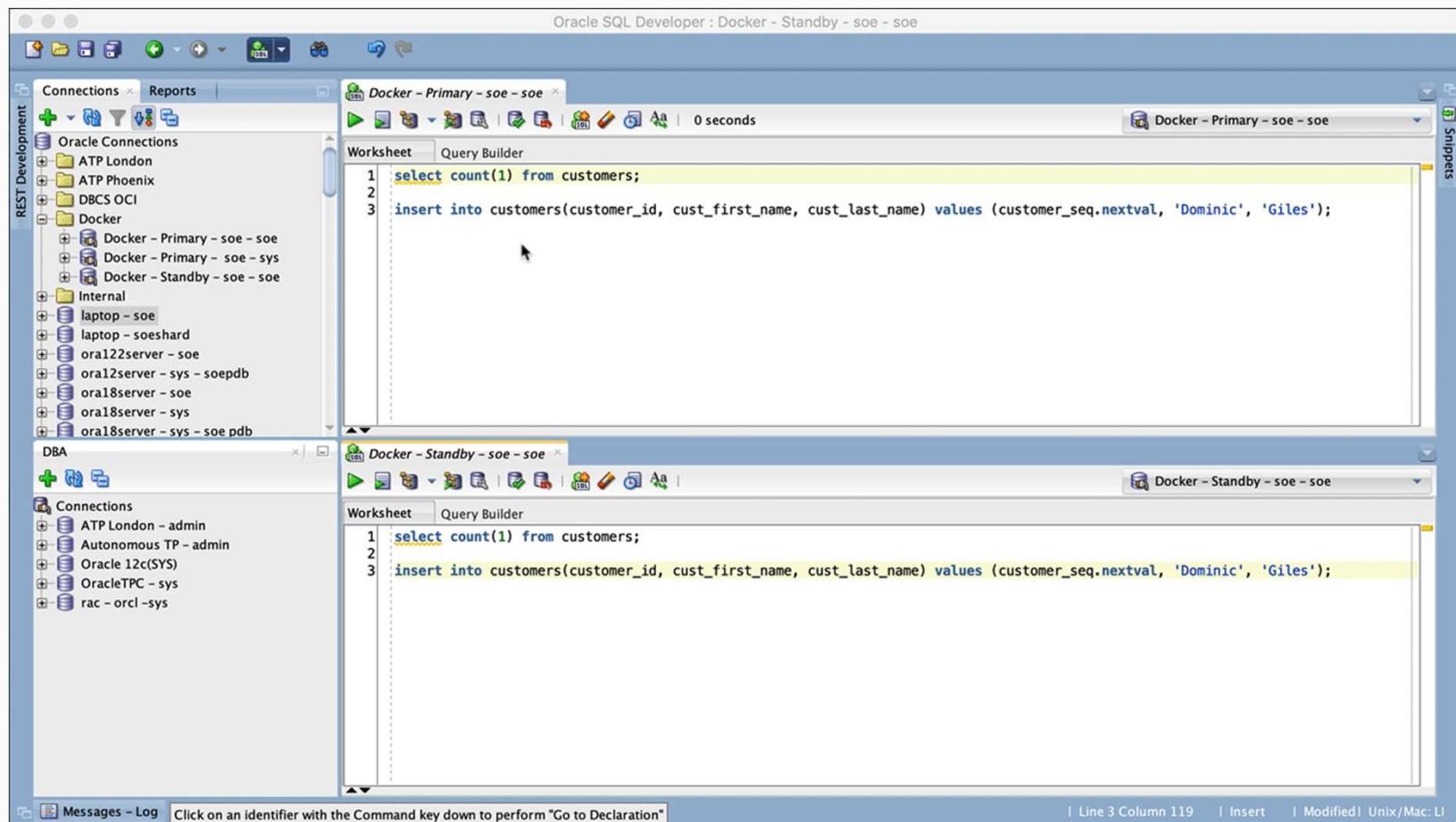
- 通过参数ADG_REDIRECT_DML来控制
- ADG_REDIRECT_DML
- ADG_REDIRECT_PLSQL

适用于“**读多写少**”的应用场景

Oracle数据库19c之后开始支持



Active Data Guard DML重定向演示



议程



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Active Data Guard的保护模式和常用架构



Active Data Guard的管理和监控



Active Data Guard和客户端连接

Active Data Guard的保护模式

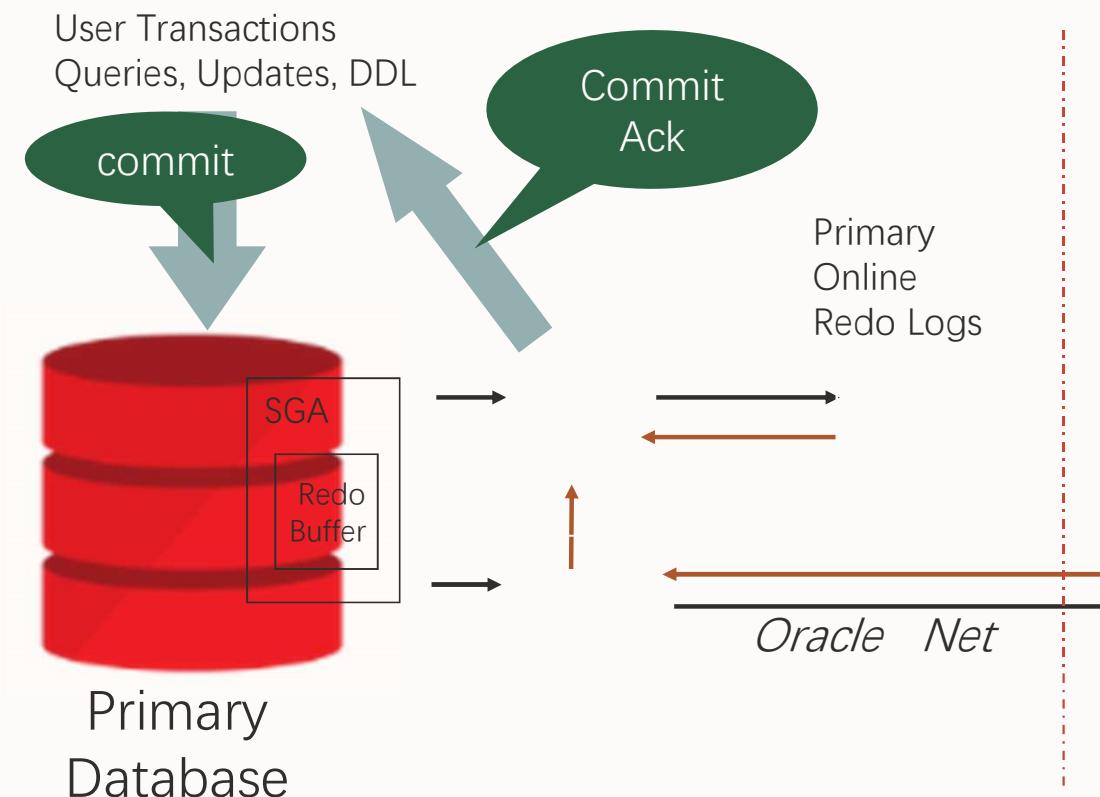
平衡数据保护、性能、可用性



保护模式	数据丢失的风险	传输方式/备库确认方式	如果备库未确认
最大保护	零数据丢失	SYNC AFFIRM	主库上的事务在commit前，必须确认redo已经应用到至少一个备库上，否则主库会挂起
最大可用	零数据丢失	SYNC AFFIRM SYNC NOAFFIRM(FASTSYNC 12c) Far Sync	在正常情况下，和最大保护模式一样。如果备库不可用时，备库故障不会导致主库不可用。只要有一个备库可用的情况下，即使主库挂了，也能保证不丢失数据。 推荐使用该方式
最大性能	潜在的最小数据丢失	ASYNC/NOAFFIRM	主库上的事务commit前，不需要从备库上收到反馈信息。在主库故障时，可能丢失数据，但备库对主库的性能影响最小

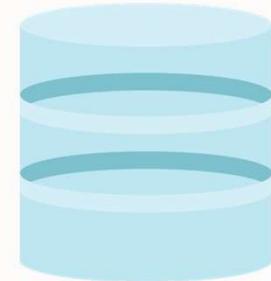
用于零数据丢失的数据保护传输

SYNC传输方式的流程



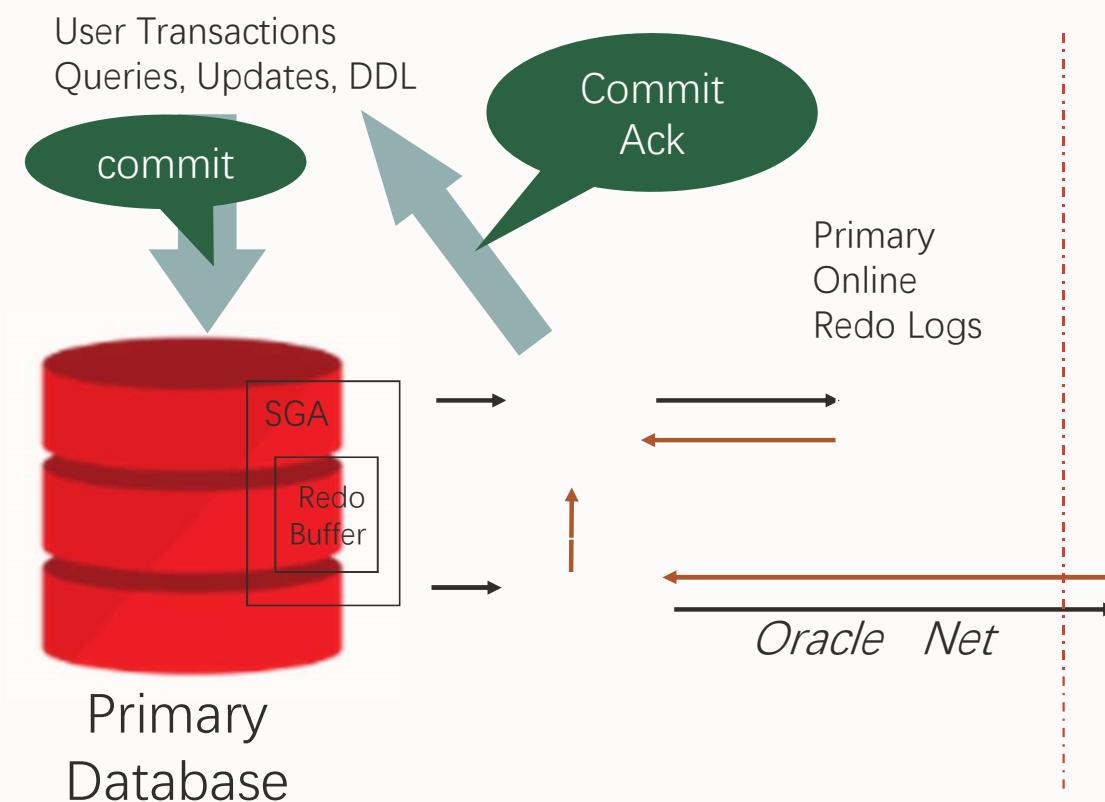
Data Guard Processes

1. NSS (NSSn - SYNC Redo Transport process) – transmits redo from primary log buffer
2. RFS (Remote file server) – receives redo, writes to log file, **sends ACK back**
3. MRP (MRP0 - Detached recovery server process) – recovery process on standby database



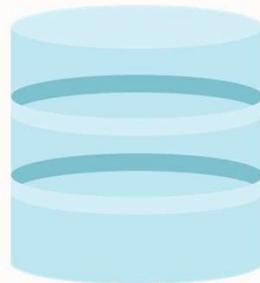
用于零数据丢失的数据保护传输

FASTSYNC传输方式的流程



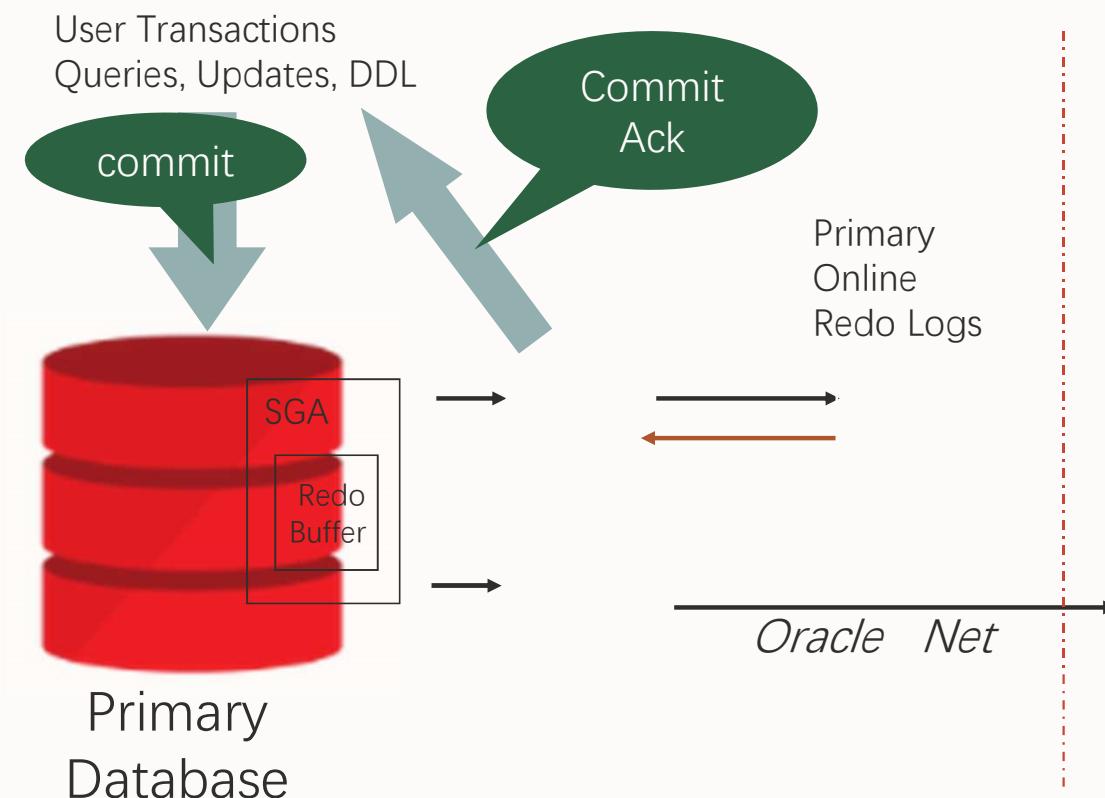
Data Guard Processes

1. NSS (NSSn - SYNC Redo Transport process) – transmits redo from primary log buffer
2. RFS (Remote file server) – receives redo, **sends ACK back**, writes to log file
3. MRP (MRP0 - Detached recovery server process) – recovery process on standby database



用于零数据丢失的数据保护传输

ASYNC传输方式的流程



Data Guard Processes

1. TT (TTnn - Redo Transport Slave Process) – transmits redo from primary log buffer
2. RFS (Remote file server) – receives redo from primary and writes to log file
3. MRP (MRP0 - Detached recovery server process) – recovery process on standby database

简单的主备模式



```
DGMGRL> show configuration

Configuration - dg_pgold

  Protection Mode: MaxAvailability
  Members:
    pgold    - Primary database
    ptwcpys - Physical standby database

  Fast-Start Failover: Disabled

  Configuration Status:
    SUCCESS  (status updated 60 seconds ago)

DGMGRL>
```

简单的主备模式



```
DGMGRL> show configuration

Configuration - dg_pgold

  Protection Mode: MaxAvailability
  Members:
    pgold    - Primary database
    ptwcfsl - Far sync instance
    ptwcpys - Physical standby database

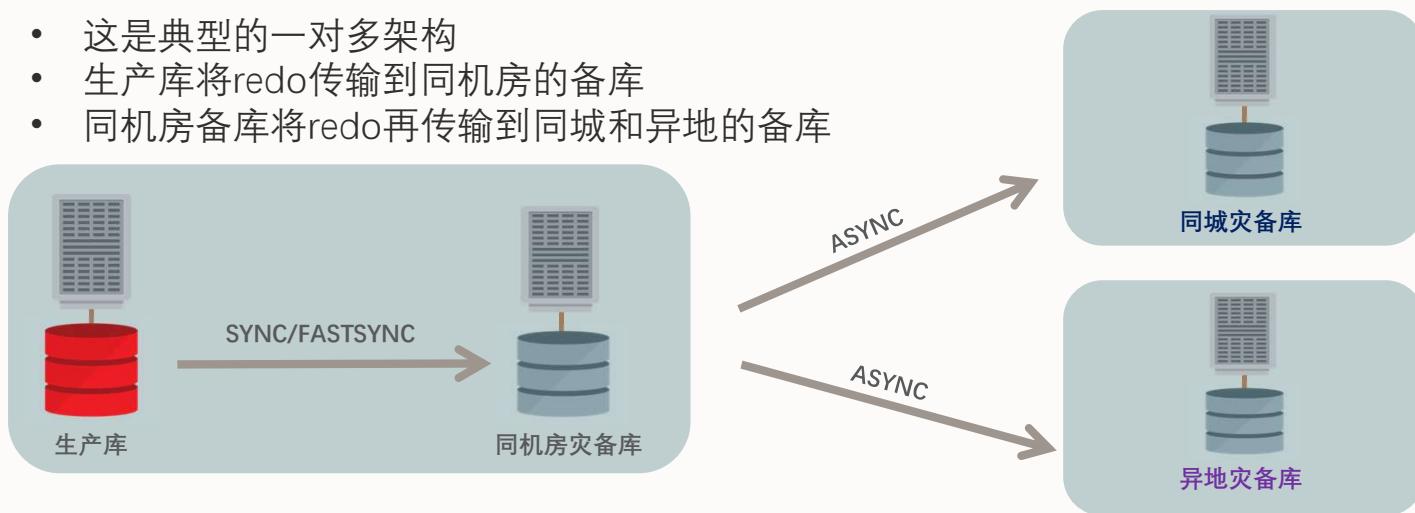
  Fast-Start Failover: Disabled

Configuration Status:
  SUCCESS  (status updated 54 seconds ago)

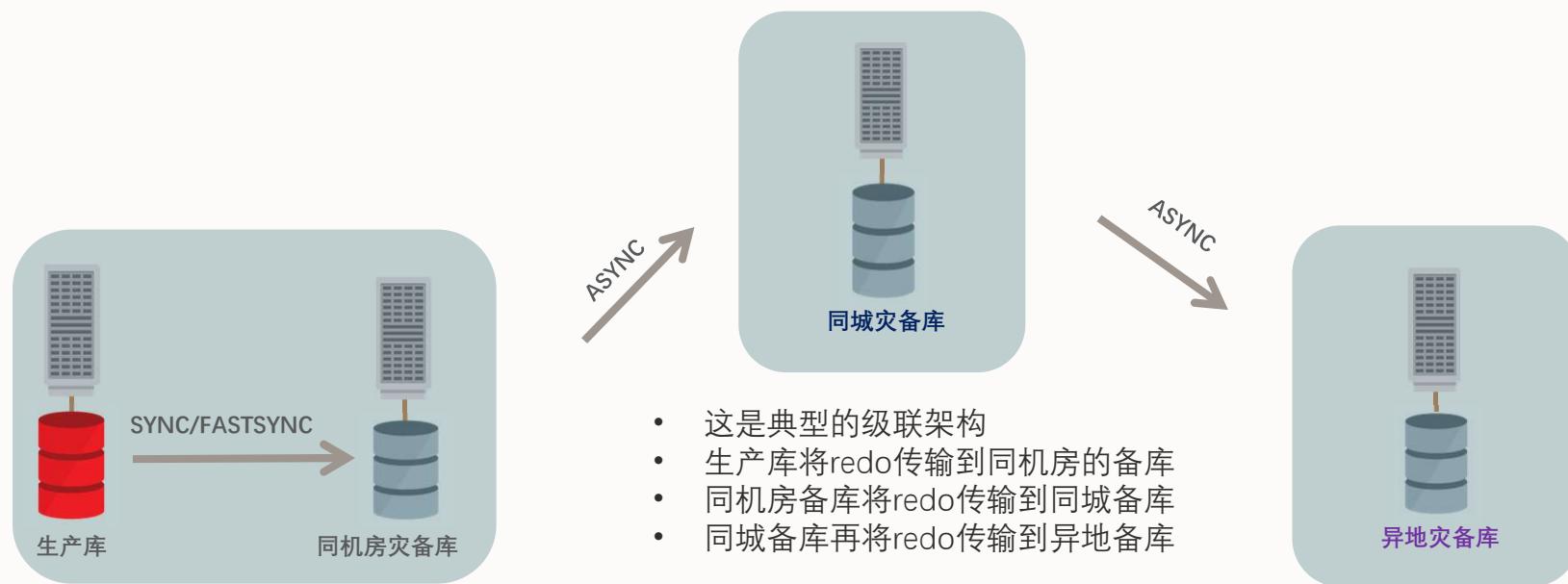
DGMGRL>
```

两地三中心数据库层推荐架构（一）

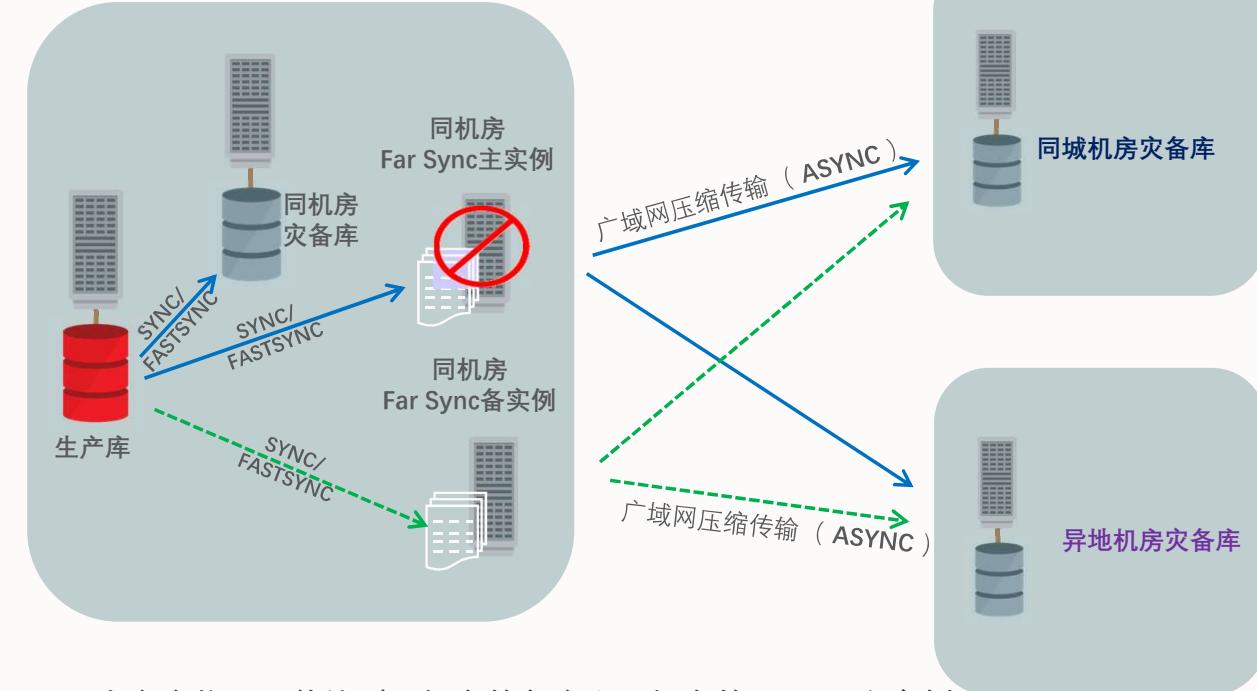
- 这是典型的一对多架构
- 生产库将redo传输到同机房的备库
- 同机房备库将redo再传输到同城和异地的备库



两地三中心数据库层推荐架构（二）



两地三中心数据库层推荐架构 (三)



- 生产库将redo传输到同城房的备库和同城房的far sync主实例
- far sync主实例将redo传输到同城和异地的备库
- 如果far sync主实例出现异常, far sync备实例可接管
- 同城房备库作为首选故障转移目标
- 同城备库作为第二故障转移目标

```
DGMGRL> show configuration;

Configuration - dg_pgold

Protection Mode: MaxAvailability
Members:
  pgold    - Primary database
  psilver - (*) Physical standby database
  ptwcfsl - Far sync instance
  ptwcpys - Physical standby database
  ptwclgs - Physical standby database

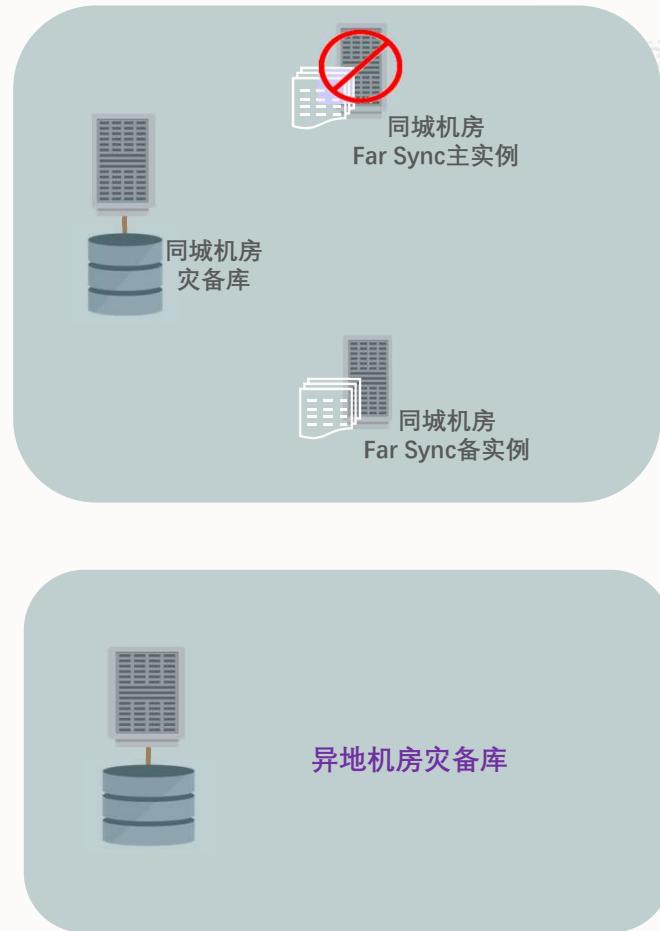
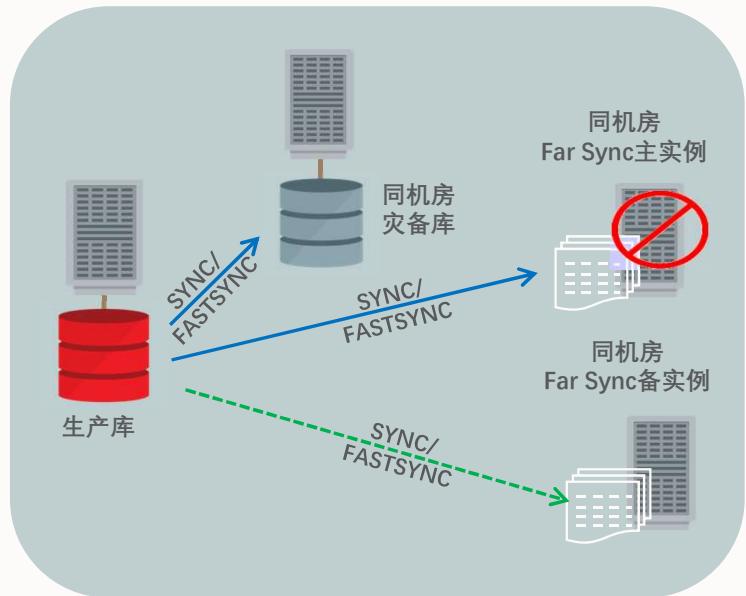
Members Not Receiving Redo:
  ptwcfsl2 - Far sync instance (alternate of ptwcfsl)

Fast-Start Failover: Enabled in Zero Data Loss Mode

Configuration Status:
  SUCCESS  (status updated 40 seconds ago)

DGMGRL>
```

两地三中心数据库层推荐架构 (四)



- 生产库将redo传输到同城房的备库和同城房的far sync主实例
- far sync主实例将redo传输到同城和异地的备库
- 如果far sync主实例出现异常, far sync备实例可接管
- 同城房备库作为首选故障转移目标
- 同城备库作为第二故障转移目标
- 同城灾备中心还配置了far sync实例 (用于当同城为主库时, 启用灾备中心的far sync实例)

议程



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Data Guard的发展历程和使用场景



Data Guard的三大特性



Active Data Guard的保护模式和常用架构



Active Data Guard的管理和监控



Active Data Guard和客户端连接

Active Data Guard的管理和监控

```
DGMGRL> show configuration;

Configuration - dg_pgold

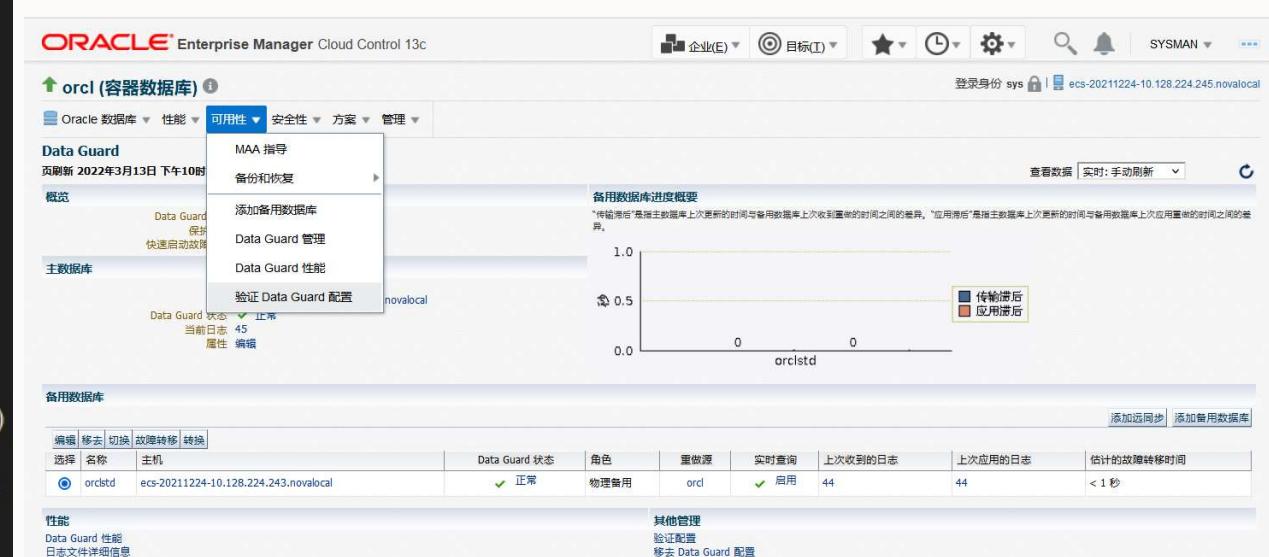
Protection Mode: MaxAvailability
Members:
pgold - Primary database
psilver - (*) Physical standby database
ptwcfsl - Far sync instance
ptwcpys - Physical standby database
ptwclgs - Physical standby database

Members Not Receiving Redo:
ptwcfsl - Far sync instance (alternate of ptwcfsl)

Fast-Start Failover: Enabled in Zero Data Loss Mode

Configuration Status:
SUCCESS (status updated 40 seconds ago)

DGMGRL>
```



使用Data Guard Broker的优势

从12.1.0.2开始，如果是Oracle Restart，Oracle RAC One Node或者是Oracle RAC，Oracle集群会自动处理Data Guard Broker相关的StaticConnectIdentifier、DGConnectIdentifier、listener.ora和tnsnames.ora的相关工作，通过使用"+"_DGMGRL"或"+"_DGB"。这就大大简化了配置工作。

```
alter system set dg_broker_config_file1='+DATA/pgold/dr1pgold.dat' scope=both sid='*';
alter system set dg_broker_config_file2='+DATA/pgold/dr2pgold.dat' scope=both sid='*';
alter system set dg_broker_start=true scope=both sid='*';
```

```
SQL> alter system set dg_broker_config_file1='+DATA/pgold/dr1pgold.dat' scope=both sid='*';
System altered.

SQL> alter system set dg_broker_config_file2='+DATA/pgold/dr2pgold.dat' scope=both sid='*';
System altered.

SQL> alter system set dg_broker_start=true scope=both sid='*';
System altered.

SQL> ■
```

```
SQL> show parameter broker

NAME          TYPE      VALUE
-----        -----
connection_brokers      string    ((TYPE=DEDICATED) (BROKERS=1)),
                           ((TYPE=EMON) (BROKERS=1))
dg_broker_config_file1  string    +DATA/PGOLD/dr1pgold.dat
dg_broker_config_file2  string    +DATA/PGOLD/dr2pgold.dat
dg_broker_start         boolean   TRUE
use_dedicated_broker   boolean   FALSE
SQL>
```

```
DGMGRL> create configuration 'dg_pgold' as primary database is 'pgold' connect identifier is pgold;
Connected to "pgold"
Configuration "dg_pgold" created with primary database "pgold"
DGMGRL>
DGMGRL> add database psilver as connect identifier is psilver;
Database "psilver" added
DGMGRL>
DGMGRL> enable configuration;
Enabled.
DGMGRL>
DGMGRL> show configuration;

Configuration - dg_pgold

Protection Mode: MaxPerformance
Members:
  pgold - Primary database
  psilver - Physical standby database
Fast-Start Failover: Disabled
Configuration Status:
  SUCCESS  (status updated 17 seconds ago)
DGMGRL>
```



使用Data Guard Broker的优势

redoroutes:(redo source : redo destination)

大大的简化了redo传输和主备切换的配置工作, 比如下面的配置

```
edit database pgold set property 'redoroutes'='(local : (ptwcfs1 fastsync priority=1, ptwcfs2 fastsync priority=2), psilver sync');
```

```
DGMGRL> edit database pgold set property 'redoroutes'='(local : (ptwcfs1 fastsync priority=1, ptwcfs2 fastsync priority=2), psilver sync)';
Property "redoroutes" updated
DGMGRL>
```

```
DGMGRL> show configuration;

Configuration - dg_pgold

Protection Mode: MaxPerformance
Members:
pgold - Primary database
psilver - Physical standby database
ptwcfs1 - Far sync instance
ptwcfs2 - Far sync instance
ptwcpys - Physical standby database
ptwclgs - Physical standby database

Fast-Start Failover: Disabled

Configuration Status:
SUCCESS (status updated 28 seconds ago)

DGMGRL>
```

```
DGMGRL> show configuration;

Configuration - dg_pgold

Protection Mode: MaxPerformance
Members:
pgold - Primary database
ptwcfs1 - Far sync instance
ptwcpys - Physical standby database
ptwclgs - Physical standby database
psilver - Physical standby database

Members Not Receiving Redo:
ptwcfs2 - Far sync instance (alternate of ptwcfs1)

Fast-Start Failover: Disabled

Configuration Status:
SUCCESS (status updated 25 seconds ago)

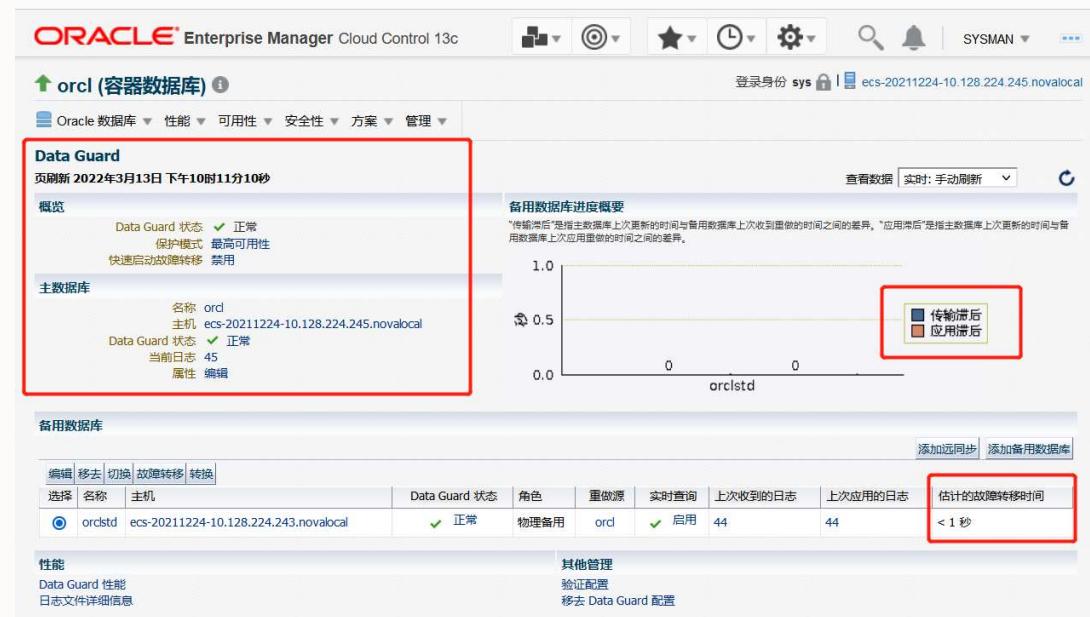
DGMGRL>
```

使用Data Guard Broker的优势

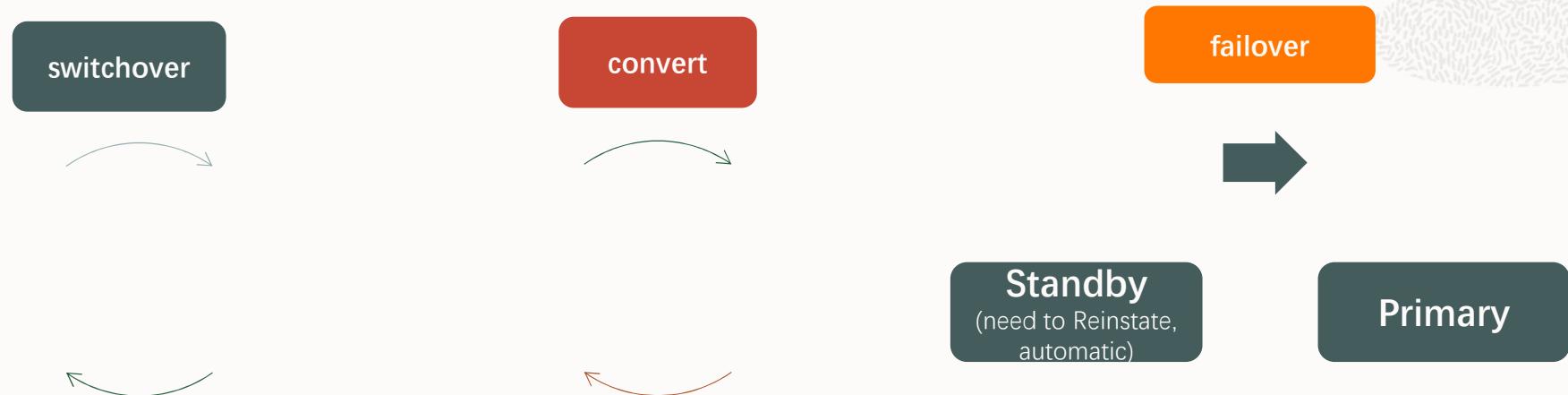
```
DGMGRL> validate database pgoldadg;  
  
Database Role: Physical standby database  
Primary Database: pgold  
  
Ready for Switchover: Yes  
Ready for Failover: Yes (Primary Running)  
  
Managed by Clusterware:  
  pgold : YES  
  pgoldadg: YES  
  
DGMGRL> switchover to pgoldadg;  
Performing switchover NOW, please wait...  
Operation requires a connection to database "pgoldadg"  
Connecting ...  
Connected to "pgoldadg"  
Connected as SYSDBA.  
New primary database "pgoldadg" is opening...  
Oracle Clusterware is restarting database "pgold" ...  
Connected to "pgold"  
Connected to "pgold"  
Switchover succeeded, new primary is "pgoldadg"  
DGMGRL>
```

自带健康检查功能，通过validate命令就可以很方便DG配置是否存在问题，也可以检查是否具备切换的validate database verbose <数据库unique_name>;

和企业管理器 (Oracle Enterprise Manager Cloud Control) 完美的结合，通过浏览器就可以做所有的工作，更直观，更便捷



Active Data Guard常用的操作



	单实例	集群	集群 (使用了500个连接)	集群 (使用了1000个连接)
Failover (故障切换)	9s	16s	24s	28s
Switchover (正常切换)	19s	34s	46s	52s

生产数据中心主库切换为备库 (pgold--->psilver)

```
DGMGRL> show configuration;

Configuration - dg_pgold

  Protection Mode: MaxAvailability
  Members:
    pgold - Primary database
    ptwcfs1 - Far sync instance
    ptwcpys - Physical standby database
    ptwclgs - Physical standby database
    psilver - Physical standby database

  Members Not Receiving Redo:
    ptwcfs2 - Far sync instance (alternate of ptwcfs1)

  Fast-Start Failover: Disabled

  Configuration Status:
    SUCCESS (status updated 34 seconds ago)

DGMGRL>
```

```
DGMGRL> switchover to psilver;
2021-09-11T17:03:25.797+08:00
Performing switchover NOW, please wait...

2021-09-11T17:03:27.415+08:00
Operation requires a connection to database "psilver"
Connecting ...
Connected to "psilver"
Connected as SYSDBA.

2021-09-11T17:03:27.772+08:00
Continuing with the switchover...

2021-09-11T17:03:53.120+08:00
New primary database "psilver" is opening...

2021-09-11T17:03:53.120+08:00
Oracle Clusterware is restarting database "pgold" ...
Connected to "pgold"
Connected to "pgold"
Connected to "pgold"
2021-09-11T17:04:45.734+08:00
Switchover succeeded, new primary is "psilver"

2021-09-11T17:04:45.759+08:00
Switchover processing complete, broker ready.
DGMGRL>
```

```
Switchover processing complete, broker ready.
DGMGRL>
DGMGRL> show configuration;

Configuration - dg_pgold

  Protection Mode: MaxAvailability
  Members:
    psilver - Primary database
    ptwcfs1 - Far sync instance
    ptwcpys - Physical standby database
    ptwclgs - Physical standby database
    pgold - Physical standby database

  Members Not Receiving Redo:
    ptwcfs2 - Far sync instance (alternate of ptwcfs1)

  Fast-Start Failover: Disabled

  Configuration Status:
    SUCCESS (status updated 59 seconds ago)

DGMGRL>
```



生产数据中心备库切换为主库 (psilver--->pgold)

```
Switchover processing complete, broker ready.
DGMGRL>
DGMGRL> show configuration;

Configuration - dg_pgold

Protection Mode: MaxAvailability
Members:
psilver - Primary database
  ptwcfsl - Far sync instance
  ptwcpys - Physical standby database
  ptwclgs - Physical standby database
  pgold - Physical standby database

Members Not Receiving Redo:
  ptwcfsl - Far sync instance (alternate of ptwcfsl)

Fast-Start Failover: Disabled

Configuration Status:
  SUCCESS  (status updated 59 seconds ago)

DGMGRL>
```

```
DGMGRL> switchover to pgold;
2021-09-11T17:16:01.174+08:00
Performing switchover NOW, please wait...

2021-09-11T17:16:03.118+08:00
Operation requires a connection to database "pgold"
Connecting ...
Connected to "pgold"
Connected as SYSDBA.

2021-09-11T17:16:03.471+08:00
Continuing with the switchover...

2021-09-11T17:16:28.903+08:00
New primary database "pgold" is opening...

2021-09-11T17:16:28.903+08:00
Oracle Clusterware is restarting database "psilver" ...
Connected to "psilver"
Connected to "psilver"
Connected to "psilver"
2021-09-11T17:17:28.430+08:00
Switchover succeeded, new primary is "pgold"

2021-09-11T17:17:28.609+08:00
Switchover processing complete, broker ready.

DGMGRL>
```

```
Switchover processing complete, broker ready.
DGMGRL>
DGMGRL> show configuration;

Configuration - dg_pgold

Protection Mode: MaxAvailability
Members:
  pgold - Primary database
  ptwcfsl - Far sync instance
  ptwcpys - Physical standby database
  ptwclgs - Physical standby database
  psilver - Physical standby database

Members Not Receiving Redo:
  ptwcfsl - Far sync instance (alternate of ptwcfsl)

Fast-Start Failover: Disabled

Configuration Status:
  SUCCESS  (status updated 61 seconds ago)

DGMGRL>
```



物理备库转化为快照备库（临时测试使用）

```
DGMGRL> convert database ptwcpys to snapshot standby;
2021-09-11T16:43:25.790+08:00
Converting database "ptwcpys" to a Snapshot Standby database, please wait...

2021-09-11T16:43:41.294+08:00
Database "ptwcpys" converted successfully

2021-09-11T16:43:41.294+08:00
DGMGRL>
```

```
DGMGRL> convert database ptwcpys to physical standby;
2021-09-11T16:47:52.884+08:00
Converting database "ptwcpys" to a Physical Standby database, please wait...

2021-09-11T16:47:54.361+08:00
Oracle Clusterware is restarting database "ptwcpys" ...
Connected to "ptwcpys"
Connected to "ptwcpys"
2021-09-11T16:48:16.116+08:00
Continuing to convert database "ptwcpys" ...

2021-09-11T16:48:44.157+08:00
Database "ptwcpys" converted successfully

2021-09-11T16:48:44.157+08:00
DGMGRL>
```

```
DGMGRL> show configuration;

Configuration - dg_pgold

Protection Mode: MaxAvailability
Members:
pgold - Primary database
ptwcfs1 - Far sync instance
ptwcpys - Snapshot standby database
ptwclgs - Physical standby database
psilver - Physical standby database

Members Not Receiving Redo:
ptwcfs2 - Far sync instance (alternate of ptwcfs1)

Fast-Start Failover: Disabled

Configuration Status:
SUCCESS (status updated 40 seconds ago)

DGMGRL>
```

```
DGMGRL> show configuration;

Configuration - dg_pgold

Protection Mode: MaxAvailability
Members:
pgold - Primary database
ptwcfs1 - Far sync instance
ptwcpys - Physical standby database
ptwclgs - Physical standby database
psilver - Physical standby database

Members Not Receiving Redo:
ptwcfs2 - Far sync instance (alternate of ptwcfs1)

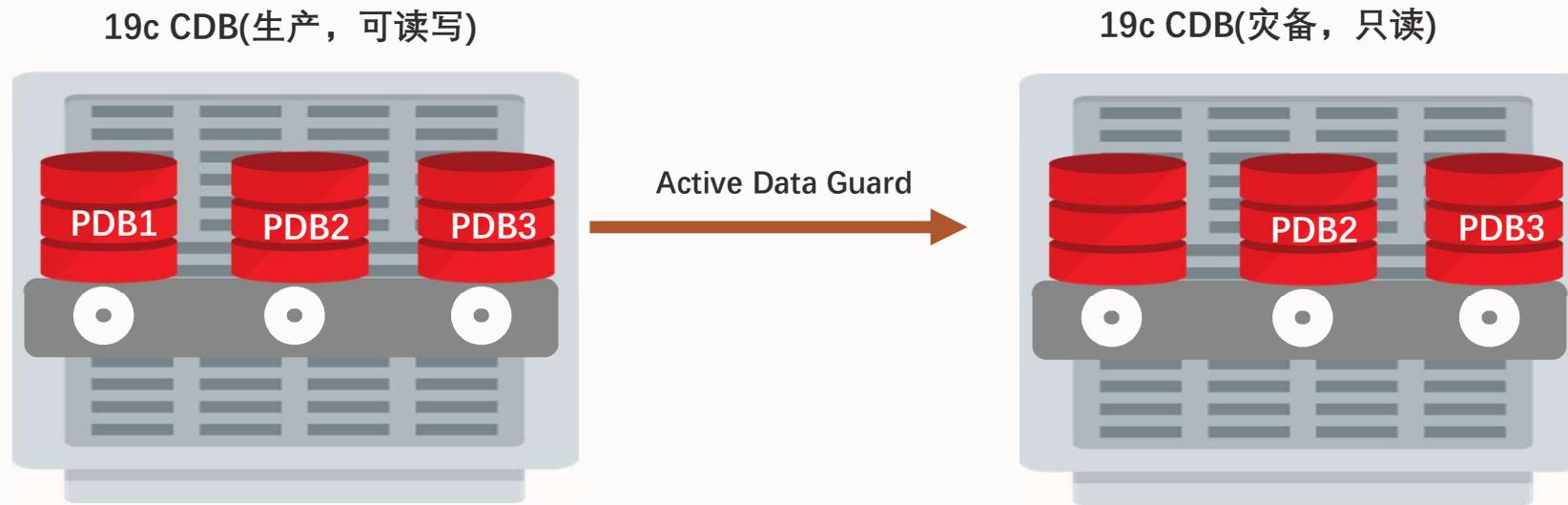
Fast-Start Failover: Disabled

Configuration Status:
SUCCESS (status updated 40 seconds ago)

DGMGRL>
```



多租户 (Multitenant) 和活动数据卫士 (Active Data Guard)



- 硬件成本和授权成本会明显降低
- 降低运维的难度和复杂度
- 数据库管理员可以更轻松地管理和监控数据库，应用补丁，数据库升级迁移更容易

议程



Oracle最大可用性架构和Active Data Guard



Data Guard的发展历程和使用场景



Active Data Guard的三大特性



Active Data Guard的保护模式和常用架构

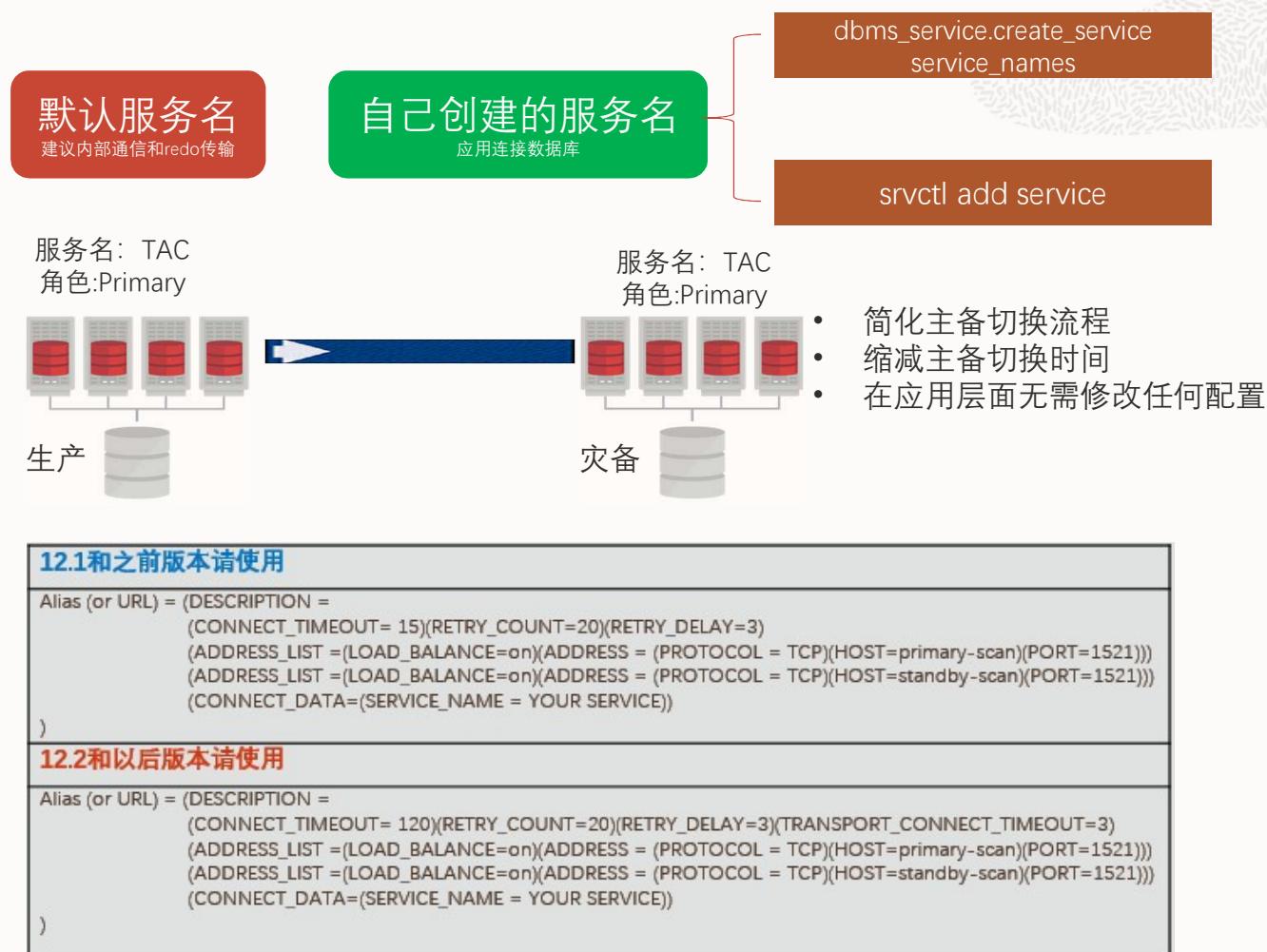
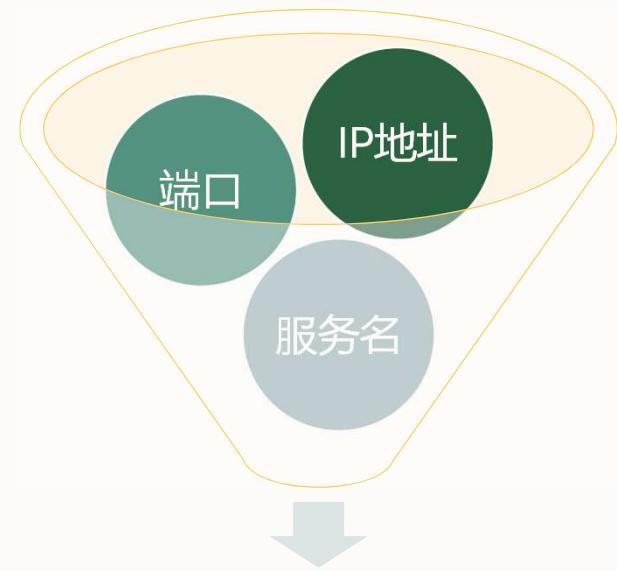


Active Data Guard的管理和监控



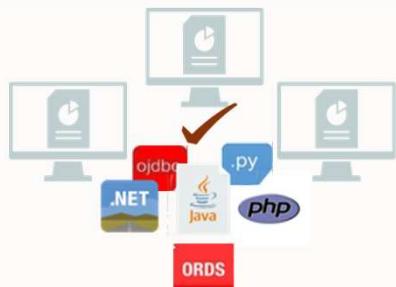
Active Data Guard和客户端连接

数据库服务名



应用连续性/透明应用连续性

Application Continuity / Transparent Application Continuity



Application Continuity
uses Oracle pools, customizable

Transparent Application Continuity
works without Oracle pools, some decisions are made for you

- 事务卫士 (Transaction Guard)
- 应用程序连续性继续读取并重放正在运行的数据库事务
(Application Continuity continues reads and replays in-flight database transactions)
- 对用户和应用程序100%透明-全自动 (100% transparent to the users and the applications – Fully automatic)
- Oracle数据库独有的 (Unique to Oracle!)
- 可与RAC和ADG一起使用 (Available with RAC and Active Data Guard)

解决高可用的最后一公里，保障业务的连续性

主备切换可以实现业务不中断

```
[oracle@xd08mdb01 AC]$ export ORACLE_HOME=/u01/ordb/oracle/product/193
[oracle@xd08mdb01 AC]$ export JAVA_HOME=$ORACLE_HOME/jdk
[oracle@xd08mdb01 AC]$ export CLASSPATH=$JAVA_HOME/lib:$ORACLE_HOME/jdbc/lib/ojdbc8.jar
[oracle@xd08mdb01 AC]$ export PATH=$ORACLE_HOME/bin:$JAVA_HOME/bin:$PATH
[oracle@xd08mdb01 AC]$ javac OHSTAC.java
[oracle@xd08mdb01 AC]$ 

[oracle@xd08mdb01 AC]$ time java -cp $CLASSPATH:. OHSTAC 3500
*****
You are connected to RAC/DG Instance - pgold2
Press any key to continue...
Performing transactions, hold on, wait a minute
```

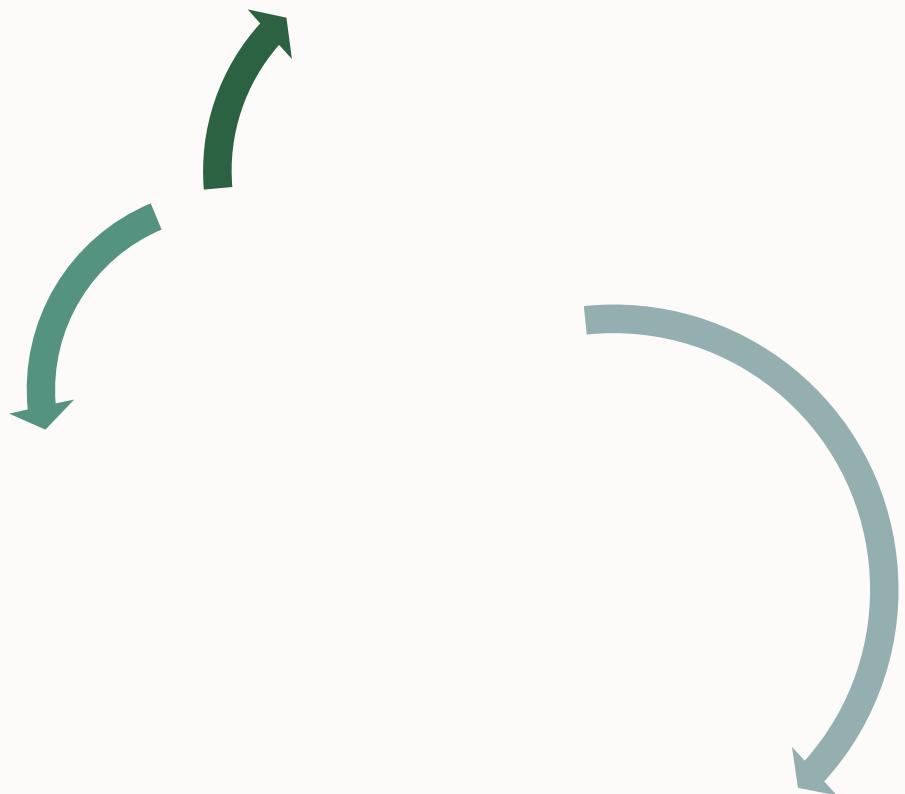
```
[oracle@xd08mdb01 AC]$ time java -cp $CLASSPATH:. OHSTAC 3500
*****
You are connected to RAC/DG Instance - pgold2
Press any key to continue...
Performing transactions, hold on, wait a minute
After Replay, You are connected to RAC/ADG Instance - pgoldadg1
*****

real 20m41.792s
user 0m6.216s
sys 0m1.623s
[oracle@xd08mdb01 AC]$
```

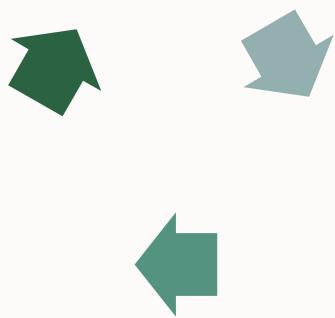
```
DGMGRL> validate database pgoldadg;
Database Role: Physical standby database
Primary Database: pgold
Ready for Switchover: Yes
Ready for Failover: Yes (Primary Running)
Managed by Clusterware:
  pgold : YES
  pgoldadg: YES

DGMGRL> switchover to pgoldadg;
Performing switchover NOW, please wait...
Operation requires a connection to database "pgoldadg"
Connecting ...
Connected to "pgoldadg"
Connected as SYSDBA.
New primary database "pgoldadg" is opening...
Oracle Clusterware is restarting database "pgold" ...
Connected to "pgold"
Connected to "pgold"
Switchover succeeded, new primary is "pgoldadg"
DGMGRL>
```

Oracle Active Data Guard的特点



规划、实施和演练





防大于治，做好数据保护的最后一公里

原创 韩朝阳 甲骨文云技术 2022-02-22 06:45



小编荐语

今天的这篇文章，介绍的是Oracle最高可用性架构中的一个重要成员：Oracle Active Data Guard。Oracle Active Data Guard可以确保企业数据的高可用性，实现数据保护和灾难恢复。在创建、维护和管理一个或多个同步备用数据库的同时避免灾难和数据损坏。Active Data Guard从Oracle 11g开始推出，历经多代发展，是一个非常成熟的数据库组件，保护着全球众多的关键业务系统和核心数据。

<http://www.ohsdba.cn>



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