

ORACLE

# Application Continuity (AC)

应用连续性设计

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## Safe harbor statement

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1. Application Continuity 简介
2. 应用场景：计划内维护
3. 如何部署您的应用程序
4. 演示



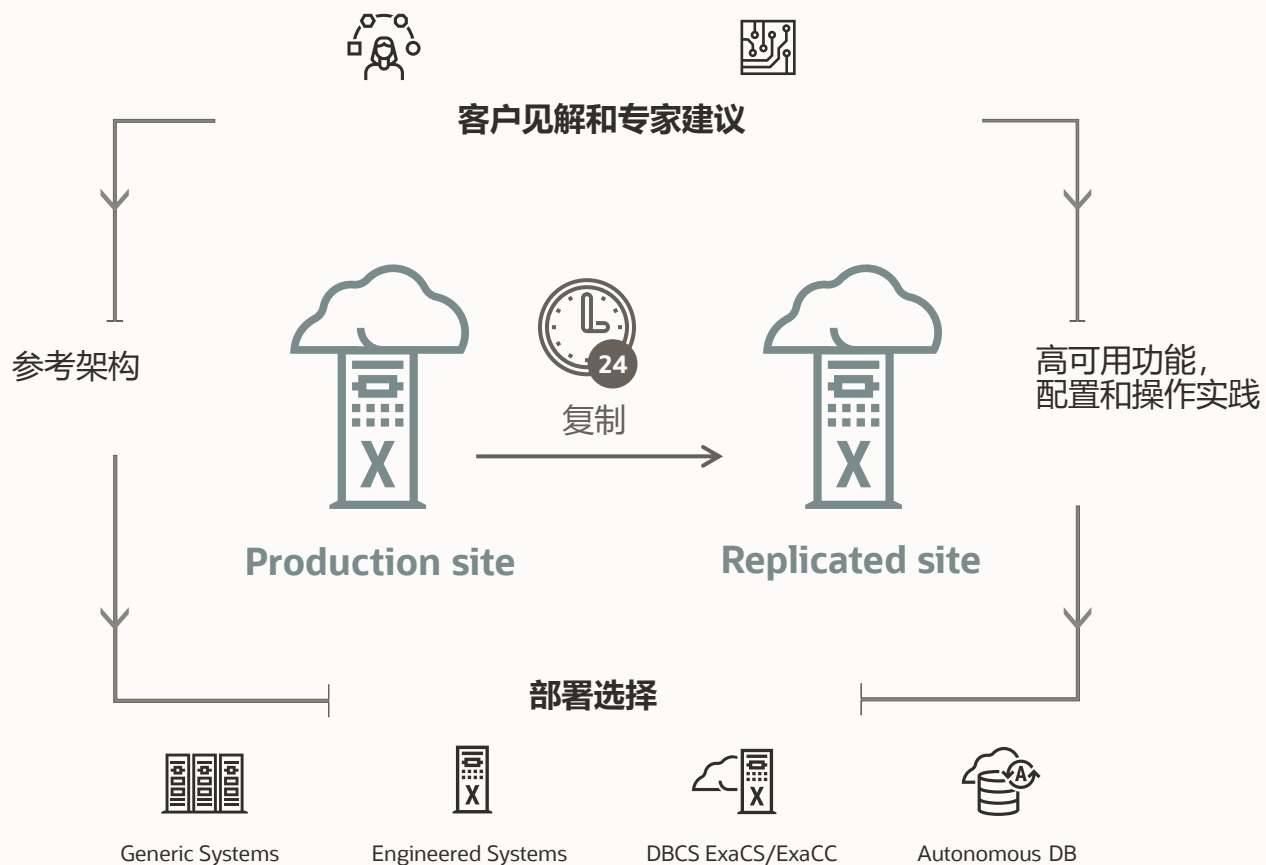
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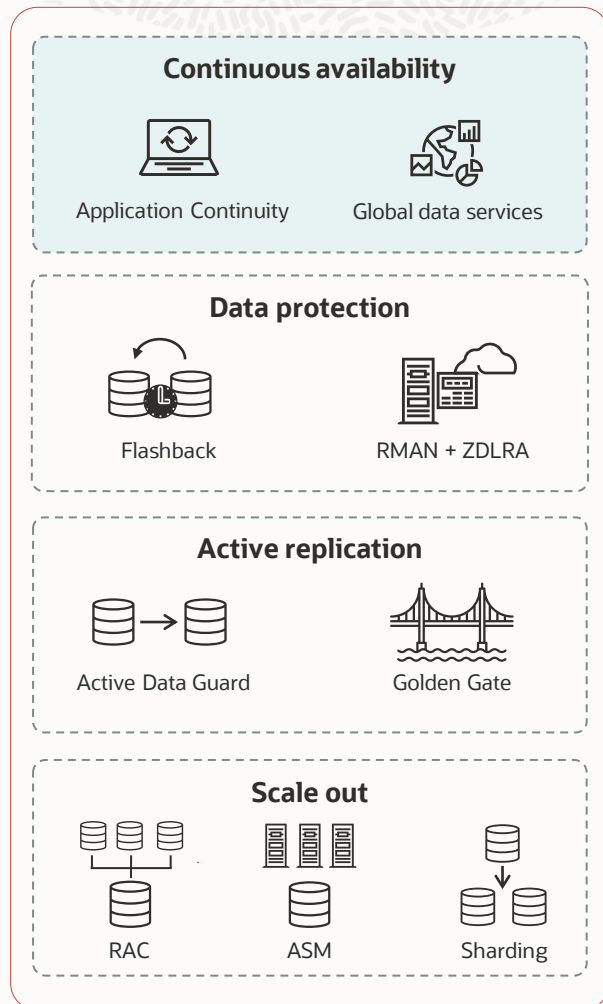
- ➔ **1. Application Continuity 简介**
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# Oracle 高可用架构(MAA)







## Oracle 多租户



# MAA参考架构

## 高可用服务级别



青铜	白银	黄金	铂金
<b>开发, 测试, 生产</b>	<b>生产</b>	<b>Business critical</b>	<b>Mission critical</b>
	<b>青铜 +</b>	<b>白银 +</b>	<b>黄金 +</b>
单实例数据库	Database HA with RAC	DB replication with active data guard	Golden Gate
可重启	Application continuity		Edition based redefinition
备份/还原			
			

All tiers exist with on-premises and cloud. However, platinum currently must be configured manually while bronze to gold are covered with cloud tool automation



# Application continuity

- 着重于用户体验。
- 发生错误时数据库可重放正在进行中事务，应用不会收到错误。
- 屏蔽硬件，软件，网络，存储，等错误。

The screenshot displays a web interface for estimating trip costs. At the top, a section titled "6. Estimated Trip Cost" contains a table of expenses:

Flight Total:	1,536.69 AUD
San Francisco, CA - Hotel Total:	1,800.00 USD ‡
	1,950.65 AUD

Below the table, a summary row shows: Trip Total: 3,487.35 AUD ‡ and 3,218.00 USD. A note below states: "‡ Please note that this total is based on available information. The estimated cost may not include taxes and fees." A bullet point below the note reads: "Remember to obtain an original invoice for all your expenses where required under the Global Travel Policy. The invoice should always include the name and address of your Oracle company. Failure to obtain a proper invoice may increase Oracle's costs by up to 25%." A red box highlights a message: "Your order number is 175634. You are protected by Application Continuity". At the bottom, there are two buttons: "Purchase Trip" and "Start Over".



# Application continuity

## 故障转移解决方案



	TAC	AC	TAF	Draining
<i>I don't know how the application is implemented</i>	Yes	No	No	Yes
<i>My application does transactions</i>	Yes	Yes	No for unplanned Transactional disconnect only	Yes
<i>My application uses Oracle state (temp lobs, PL/SQL, temp tables.)</i>	Yes	Yes No for static mode	No	Yes
<i>My application does not use connection pools</i>	Yes	No	Yes	Yes
<i>My application has side effects (such as file transfers)</i>	Yes Side effects are not replayed	Customizable	No	Yes
<i>My app needs Initial State Restored</i>	Yes and custom	Yes and custom	Yes and custom	Yes
<i>Future proofed for application changes</i>	Yes	No	No	Yes

会话故障转移的标准解决方案是 Transparent Application Continuity (TAC) 。 **19c New**

如果您使用的是Oracle Database 12c第2版，或者要在事务中使用回调进行自定义，需要使用Application Continuity (AC) 。

如果您的应用程序是只读的，并且在初始设置后未更改会话中的Oracle会话状态，请使用Transparent Application Failover (TAF) 。





# 目录



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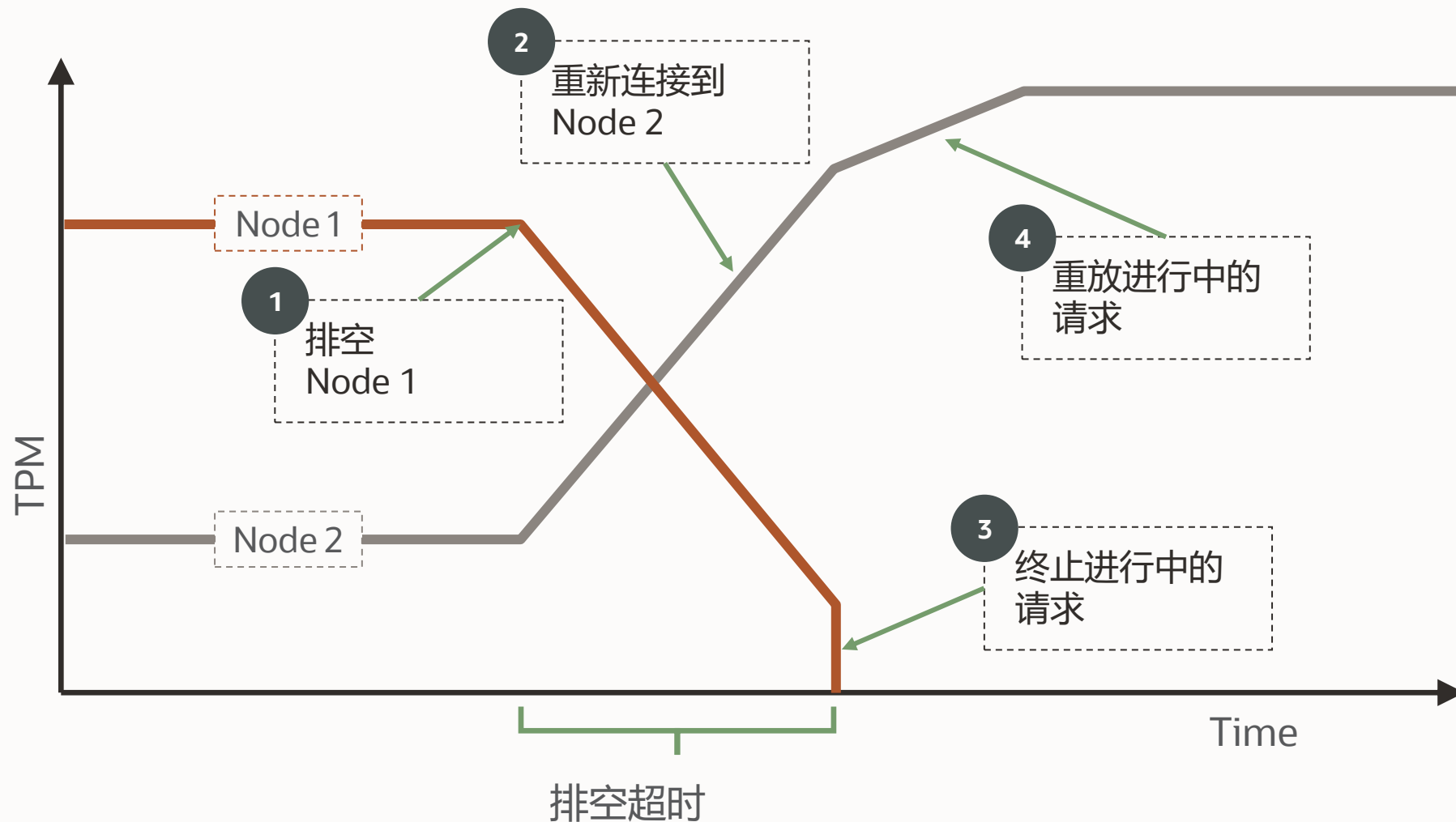
3. 如何部署您的应用程序

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# 计划内维护

排空... 重新连接... 故障转移



- 数据库服务重定位 (relocate)
- 自动的, 用户的工作排空
- 很多阶段可以排空:
  - ✓ 归还连接给连接池
  - ✓ 连接测试
  - ✓ 注销
- 计划的故障转移



# 计划内维护

DBA commands: Group commands (12.2 and later)

## 指定数据库/节点/PDB，迁移所有服务

- `srvctl relocate service -database -instance -drain_timeout.. -stopoption [immediate|transactional]`
- `srvctl relocate service -node . -drain_timeout.. -stopoption`  
`srvctl stop service -pdb . -drain_timeout.. -stopoption`

## 停止单个节点的服务或数据库实例

- `srvctl stop service -node <node_name> -drain_timeout.. -stopoption`  
`srvctl stop database -node <node_name> -drain_timeout.. -stopoption`

## Data Guard 切换

- **Switchover** to <db\_resource\_name> **[wait [xx]];**

# 如何实现排空/重新连接/故障转移?

## 先决条件

- ✓ 实现的基础：正确配置的数据库和集群架构
- ✓ 快速感知数据库相关事件：Fast Application Notification(FAN)
- ✓ 设计良好的应用程序：请求界限（Request Boundaries）
- ✓ 客户端堆栈(driver, pool, or app server)



# 如何实现排空/重新连接/故障转移?

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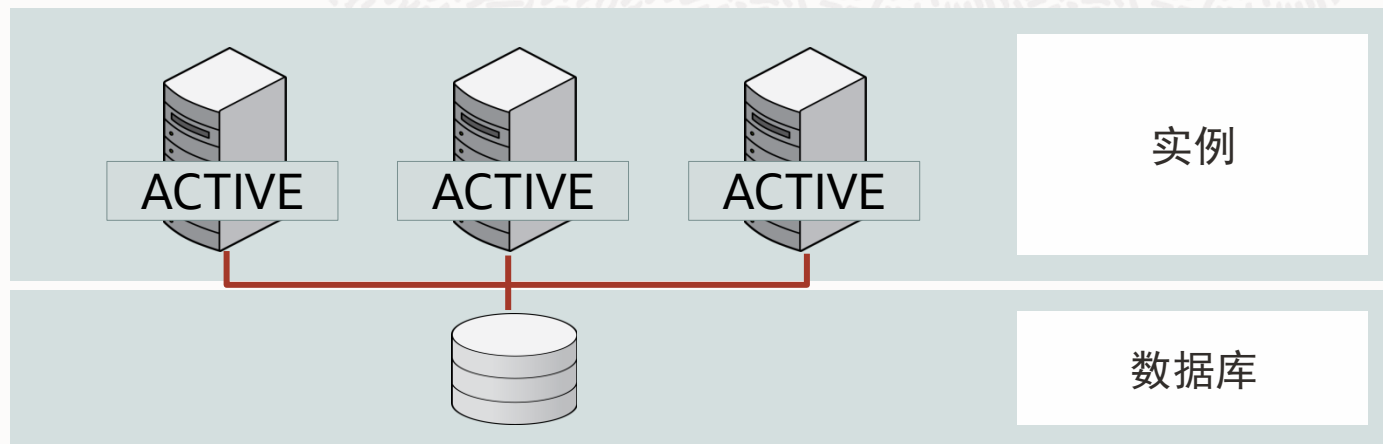


# 根据Oracle MAA最佳实践进行配置

## 数据库层高可用方案

### Real Application Cluster (RAC)

- 使用多个实例操作一个数据库的功能
- 所有节点都处于活动状态的共享磁盘类型的群集数据库



### Data Guard

- 将主数据库重做日志 (Redo) 传输到容灾端的备用数据库，然后在备用数据库中应用重做日志以保持数据和主数据库同步。
- 可以切换到备库。

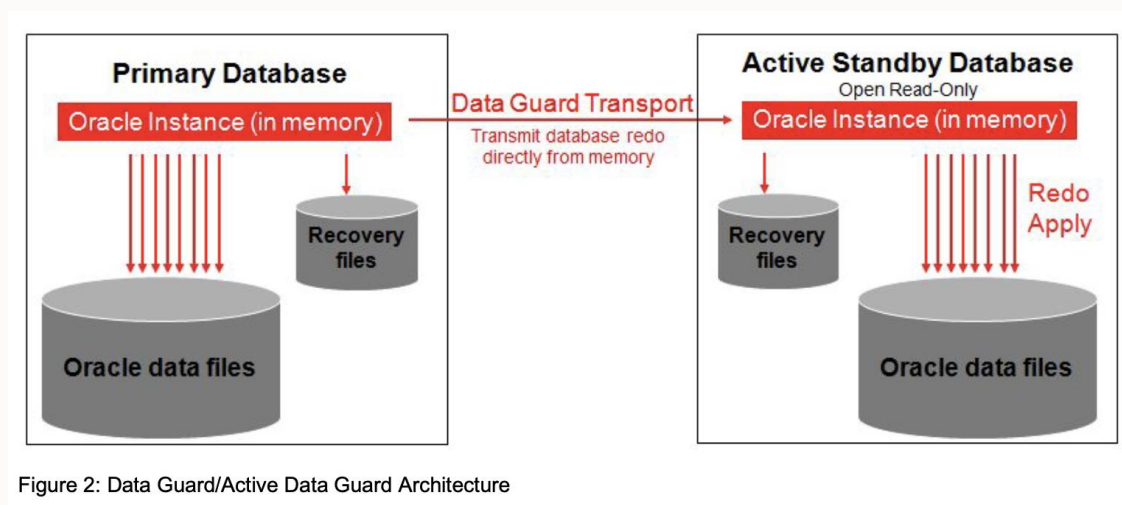


Figure 2: Data Guard/Active Data Guard Architecture



# 如何实现排空/重新连接/故障转移?

## 先决条件



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- ➔ ✓ **快速感知数据库相关事件：Fast Application Notification(FAN)**
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# Fast Application Notification (FAN)

The dead thing cannot tell you it is dead

- ✓ 当数据库、节点和网络发生停机的时候，FAN提供对客户端的立即通知响应。
- ✓ FAN对在故障时解决客户端TCP/IP超时问题至关重要。
- ✓ FAN启动数据库会话的排空，因此客户端在计划维护期间不会出现中断。当资源再次可用时，FAN会立即通知客户端。

## All Oracle uses ONS

JDBC Universal Connection Pool

OCI/OCCL driver

ODP.NET Unmanaged Provider (OCI)

ODP.NET Managed Provider (C#)

OCI Session Pool

WebLogic Active GridLink

Tuxedo

JDBC Thin Driver **(new 12.2)**

**CMAN in Traffic Manager mode (new 18c)**

## Auto-Configured

```
DESCRIPTION =  
  (CONNECT_TIMEOUT=90)  
    (RETRY_COUNT=20)(RETRY_DELAY=3)  
    (TRANSPORT_CONNECT_TIMEOUT=3)  
  
  (ADDRESS_LIST =  
    (LOAD_BALANCE=on)  
    ( ADDRESS = (PROTOCOL = TCP)  
      (HOST=primary-scan) (PORT=1521)))  
  
    (ADDRESS_LIST =  
    (LOAD_BALANCE=on)  
    ( ADDRESS = (PROTOCOL = TCP) (HOST=  
      scan)(PORT=1521)))  
  
(CONNECT_DATA=(SERVICE_NAME=gold)))
```

ONS Node Set 1

ONS Node Set 2





# 如何实现排空/重新连接/故障转移?

## 先决条件



- ✓ 实现的基础：正确配置的数据库和集群架构
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- ✓ 客户端堆栈(driver, pool, or app server)



# 新概念: 请求界限 (Request Boundaries)

描绘工作单位



Oracle Pools 12c+, Java Standard (JDK9+), Transparent Application Continuity (TAC)

```
PoolDataSource pds = GetPoolDataSource();  
Connection conn = pds.getConnection();  
PreparedStatement pstmt = ...
```

```
...  
SQL, PL/SQL, local calls,  
...
```

```
conn.commit();  
conn.close();
```

**我们如何使用请求?**

- 排空 (Draining)
- 负载均衡 (Load Balancing)
- 恢复进行时工作
- 计划的故障转移
- 重置会话状态
- 性能指标
- 防护等级

开始请求

请求正文通常以  
COMMIT结尾

结束请求



# 如何实现排空/重新连接/故障转移?

## 先决条件



- ✓ 实现的基础：正确配置的数据库和集群架构
- ✓ 快速感知数据库相关事件：Fast Application Notification(FAN)
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- ➔ ✓ **客户端堆栈(driver, pool, or app server)**



# Use Oracle Pools with FAN

## Full Lifecycle - Drain and Rebalance

### 应用程序使用...

Oracle – WebLogic Active GridLink, UCP, ODP.NET managed and unmanaged, OCI Session Pool, Tuxedo

使用UCP的第三方App Server: IBM WebSphere and Liberty, Apache Tomcat, NEC WebOTX, Red Hat WildFly (JBoss), Spring

### FPP or srvctl ...

```
srvctl [relocate|stop] service -  
drain_timeout
```

### 排空会话

Immediately new work is redirected

Gradually idle are drained

**Active sessions are released when returned to pools**

FAN Planned

Drain &  
rebalance



# UCP与其他基于Java的应用程序服务器

A simple data source replacement

## General Properties

Scope  
cells:expe-was:nodes:ee001a:servers:ST6AppServerEE001A

Name  
Oracle JDBC Driver UCP ST6\_QC02P01

Description  
Oracle JDBC Driver UCP ST6\_QC02P01

Class path  
\${WAS\_INSTALL\_ROOT}/jdbc/ojdbc7.jar  
\${WAS\_INSTALL\_ROOT}/jdbc/ucp.jar  
\${WAS\_INSTALL\_ROOT}/jdbc/ons.jar

Native library path

Isolate this resource provider

Implementation class name  
oracle.ucp.jdbc.PoolDataSourceImpl

Apply OK Reset Cancel

## Additional Properties

Data sources

- IBM WebSphere
- IBM Liberty
- Apache Tomcat
- NEC WebOTX
- Red Hat WildFly (JBoss)
- Hibernate
- Spring
- Your own

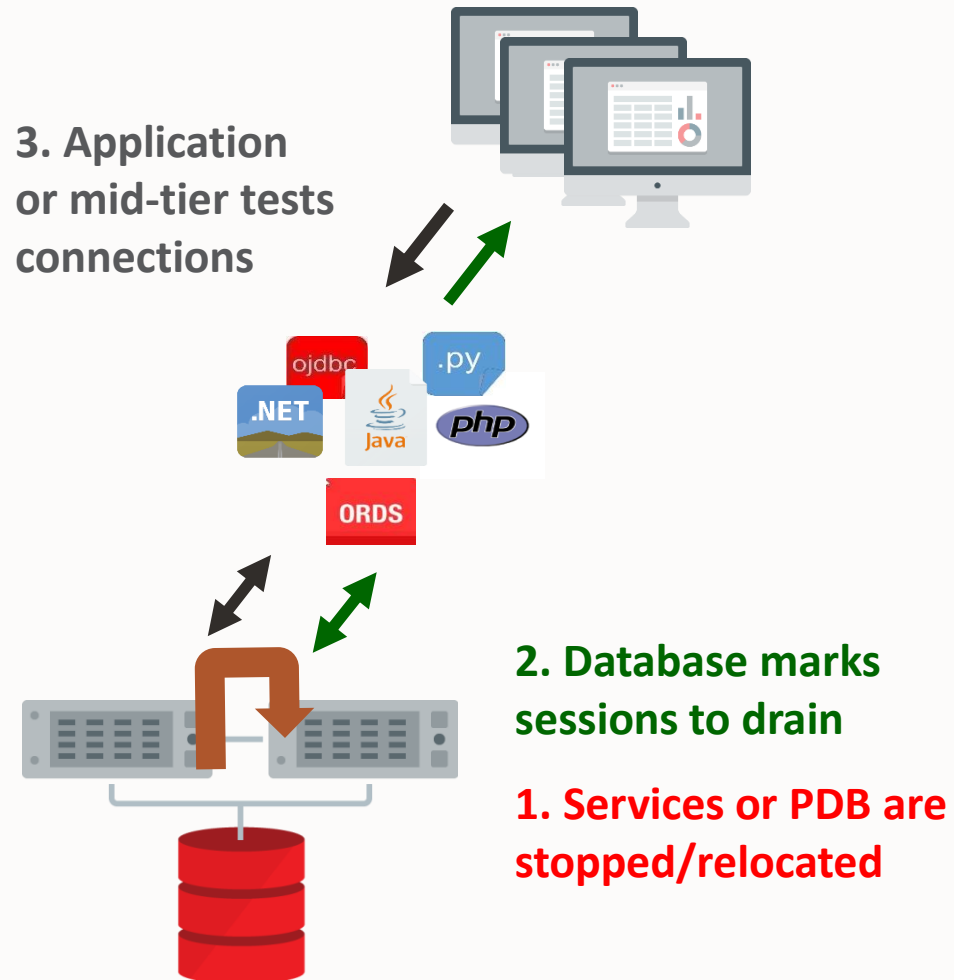
Class path to be set for UCP JDBC Provider  
\${WAS\_INSTALL\_ROOT}/jdbc/ojdbc7.jar  
\${WAS\_INSTALL\_ROOT}/jdbc/ucp.jar  
\${WAS\_INSTALL\_ROOT}/jdbc/ons.jar

Tip: Excludes TP Managed 2PC XA



# 由Oracle Database 来排空

## Connection Tests, All Drivers



### Plan B

- 应用程序“测试”连接
- 数据库响应连接错误
- 新的工作在另一个新连接上继续

Tip: enable more with  
`DBMS_APP_CONT_ADMIN`  
view in `DBA_CONNECTION_TESTS`

# DBA\_CONNECTION\_TESTS

Database Side ONLY. CDB, PDB, Service Levels



```
select connection_test_type, sql_connection_test, enabled from  
dba_connection_tests;
```

CONNECTION_TEST	SQL_CONNECTION_TEST	ENABLED
SQL_TEST	SELECT 1 FROM DUAL	Y
SQL_TEST	SELECT COUNT(*) FROM DUAL	Y
SQL_TEST	SELECT 1	Y
SQL_TEST	BEGIN NULL;END	Y
PING_TEST	NA	N
ENDREQUEST_TEST	NA	N



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# 部署您的应用程序

4 easy steps to success

## 1. 配置应用程序 – (TAC 无代码更改)

- 使用推荐的连接串
- 使用最新的客户端版本

## 2. 为您的工作负载配置数据库端服务(DBA)

- 为特定工作负载创建数据库服务
- 确保连接字符串使用此数据库服务

## 3. Issue grants for mutables used by your application (DBA)

- Identify mutables used by your application, DBA will issue grants

## 4. 测试和评估重放保护

- 检查AWR以获取保护统计信息
- 使用ACCHK实用程序识别重放异常



应用程序开发人员和所有者，以及DBA。

# 应用程序部署说明

## 使用推荐的连接串

将推荐的连接串与内置的超时，重试和延迟一起使用，以便传入的连接在中断期间不会看到错误。

Use this Connection String for ALL Oracle driver version 12.2 or higher:

```
Alias (or URL) =  
  (DESCRIPTION =  
    (CONNECT_TIMEOUT= 90) (RETRY_COUNT=50) (RETRY_DELAY=3) (TRANSPORT_CONNECT_TIMEOUT=3)  
    (ADDRESS_LIST =  
      (LOAD_BALANCE=on)  
      (ADDRESS = (PROTOCOL = TCP) (HOST=primary-scan) (PORT=1521)))  
    (ADDRESS_LIST =  
      (LOAD_BALANCE=on)  
      (ADDRESS = (PROTOCOL = TCP) (HOST=standby-scan) (PORT=1521)))  
    (CONNECT_DATA=(SERVICE_NAME = YOUR_SERVICE)) )
```



# 应用程序部署说明

## 使用服务

使用非默认数据库服务（默认服务与数据库或PDB具有相同的名称）。您创建的服务提供了位置透明性和HA功能。

For example:

### Transparent Application Continuity

```
$ srvctl add service -db mydb -service GOLD -preferred inst1,inst2 - failover_restore AUTO -failoverretry 1 -failoverdelay 3 - commit_outcome TRUE -failovertyp AUTO -replay_init_time 600 -retention 86400 -notification TRUE -drain_timeout 300 - stopoption IMMEDIATE
```

### Application Continuity

```
$ srvctl add service -db mydb -service SILVER -preferred inst1 -available inst2 -failover_restore LEVEL1 -failoverretry 1 -failoverdelay 3 - commit_outcome TRUE -failovertyp TRANSACTION -replay_init_time 1800 - retention 86400 -notification TRUE - drain_timeout 300 -stopoption IMMEDIATE
```

### Transparent Application Failover

```
$ srvctl add service -db mydb -service BRONZE -preferred inst1 -available inst2 -failover_restore LEVEL1 -failoverretry 1 - failoverdelay 3 - commit_outcome TRUE -failovertyp SELECT -retention 86400 -notification TRUE -drain_timeout 300 -stopoption IMMEDIATE
```

**To add with the Data Guard role, here is the TAC example:**

```
$ srvctl add service -db mydb -service GOLD -preferred inst1 -available inst2 -failover_restore AUTO -failoverretry 1 -failoverdelay 3 - commit_outcome TRUE -failovertyp AUTO -replay_init_time 600 -retention 86400 -notification TRUE -role PHYSICAL_STANDBY - drain_timeout 300 - stopoption IMMEDIATE
```

# 应用程序部署说明

## 服务例子



Service Name	Description	Draining	FAN	TAC
TPURGENT	OLTP Highest Priority	Yes	Yes	Yes
TP	OLTP General Priority Recommended to be used as main service	Yes	Yes	Yes
HIGH	Reporting or Batch Highest Priority	Yes	Yes	
MEDIUM	Reporting or Batch	Yes	Yes	



# 应用程序部署说明

## Grant Mutables

```
ALTER SEQUENCE.. [sequence object] [KEEP|NOKEEP];  
CREATE SEQUENCE.. [sequence object] [KEEP|NOKEEP];
```

For other database users accessing these items :

```
GRANT [KEEP DATE TIME | KEEP SYSGUID].. [TO USER];  
REVOKE [KEEP DATE TIME | KEEP SYSGUID][FROM USER];  
GRANT KEEP SEQUENCE on [sequence object] [TO USER];  
REVOKE KEEP SEQUENCE on [sequence object] [FROM USER];
```

# Always Know Your Protection Level



AWR, system, session, service statistics

Your application is fully protected when

*cumulative user calls in request = cumulative user calls protected*

<b>Statistic</b>	<b>Total</b>	<b>per Second</b>	<b>per Trans</b>
cumulative begin requests	1,500,000	14,192.9	2.4
cumulative end requests	1,500,000	14,192.9	2.4
cumulative user calls in request	6,672,566	63,135.2	10.8
cumulative user calls protected	6,672,566	63,135.2	10.8



# Always Know Your Protection Level



```
SELECT a.name,  
a.value as "Total",  
b.name, b.value as "AC calls",  
(b.value/NULLIF(a.value,0) * 100) as "Protected%"  
FROM v$sysstat a, v$sysstat b  
WHERE a.name = 'cumulative user calls in requests'  
and b.name =  
'cumulative user calls protected by Application Continuity'
```

NAME	TOTAL	NAME	AC calls	Protected%
<b>cumulative user calls in requests</b>	1247074	cumulative user calls protected by Application Continuity	1246395	99.9455525



# Killing Sessions

## Extended



DBA Command	Replays
srvctl stop service -db orcl -instance orcl2 -force	YES
srvctl stop service -db orcl -node rws3 -force	YES
srvctl stop service -db orcl -instance orcl2 <b>-noreplay</b> -force	
srvctl stop service -db orcl -node rws3 <b>-noreplay</b> -force	
alter system kill session ... immediate	YES
alter system kill session ... <b>noreplay</b>	
dbms_service.disconnect_session([service], dbms_service. <b>noreplay</b> )	





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## ➤ 计划内维护演示

- 使用TAC实现故障转移

```
Cluster Node 2
File Edit View Search Terminal Help
-bash-4.1$
```

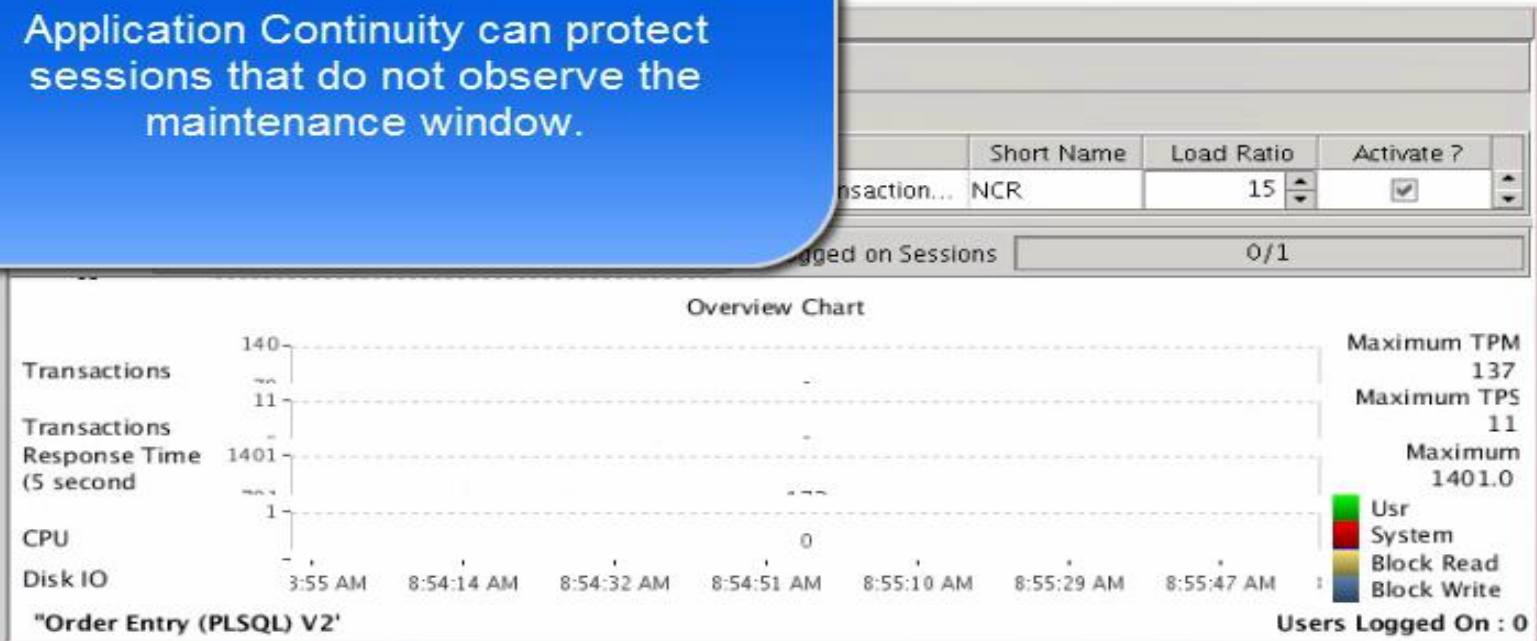
```
Cluster Node 1
File Edit View Search Terminal Help
SQL>
SQL>
SQL>
SQL>
SQL>
SQL>
SQL>
SQL>
SQL>
SQL>
SQL>
```

```
Client Node
File Edit View Search Terminal Help
[Fri Sep 09 08:53:40][/scratch/HADemo/SwingBench/swingbench/bin]
$
```

This demonstration shows how specifying drain\_timeout and stopoption allows for no impact to running applications.

Application Continuity can protect sessions that do not observe the maintenance window.

End of benchmark requested	8:52:58 AM
All users logged on	8:52:32 AM



# 其他资源



Application Continuity product page -> <https://www.oracle.com/goto/ac>

Technical briefs (how to/explanations/details) ->

Deployment Checklist (for developers, dba's and application owners)

- <https://www.oracle.com/technetwork/database/clustering/checklist-ac-6676160.pdf>

Fast Application Notification (FAN) – everything anyone would want to know about FAN

- <https://www.oracle.com/technetwork/database/options/clustering/applicationcontinuity/learnmore/fastapplicationnotification12c-2538999.pdf>

Q&A

谢谢!

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