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Seamless Application Failover with Oracle Data Guard

Ashish Ray

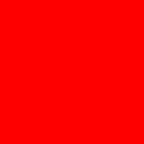
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Database High Availability

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Agenda



- **Overview**
 - Oracle Maximum Availability Architecture (MAA)
 - Application failover types
 - Oracle Data Guard, Switchover / Failover
 - New application failover features in Oracle Database 11g Release 2
- **Seamless Application Failover with Data Guard**
 - Design principles and requirements
 - Best practices: JDBC and OCI
 - Considerations for Oracle Applications & WebLogic
 - Considerations for previous releases
- **VocaLink Case Study**
 - VocaLink: business summary
 - Description of VocaLink MAA configuration
 - Failover configuration & business benefits

Oracle Maximum Availability Architecture

Low cost, Integrated, Fully Active, High ROI

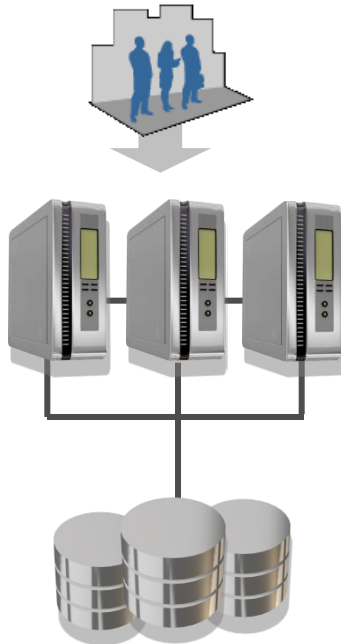
Production Site

RAC

- Scalability
- Server HA

Flashback

- Human error correction



ASM

- Volume Management

RMAN & Fast Recovery Area

- On-disk backups

- Edition-based Redefinition,
- Online Redefinition, Data Guard, GoldenGate
- Minimal downtime maintenance, upgrades, migrations

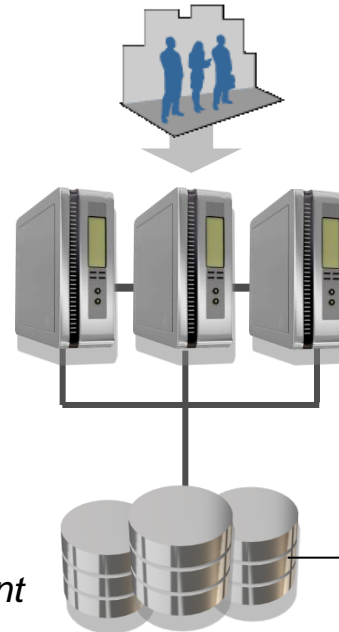
Active Replica

Active Data Guard

- Data Protection, DR
- Query Offload

GoldenGate

- Active-active
- Heterogeneous



Oracle Secure Backup

- Backup to tape / cloud

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

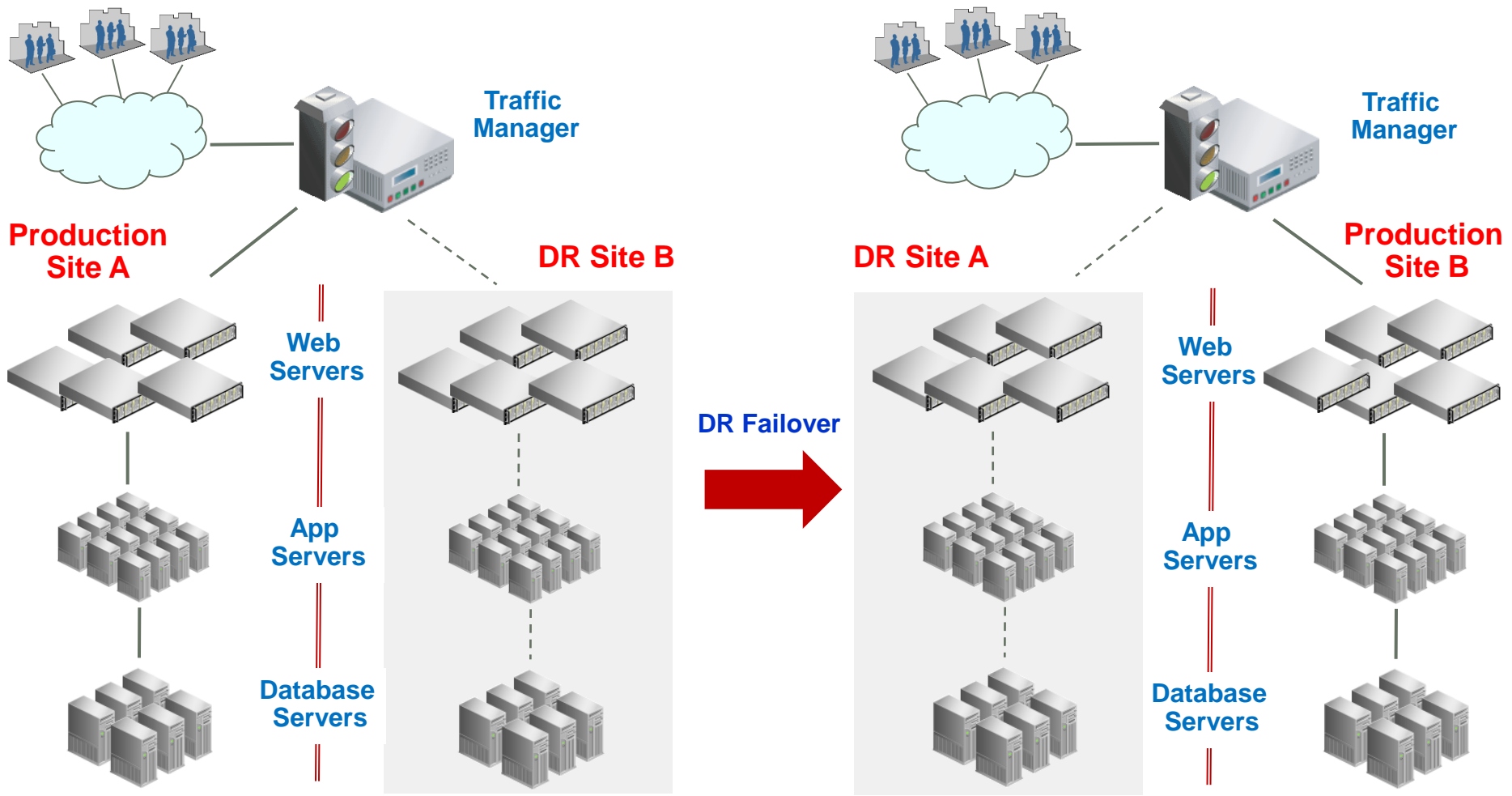
Application Failover

Principles

- Definition
 - In the event of a planned / unplanned outage, how efficiently can user sessions be directed to a secondary site / database, with minimal interruption
- Types
 - Full site failover
 - Partial site failover / Database failover
- Focus of this presentation
 - Application failover when database failover is facilitated by Data Guard

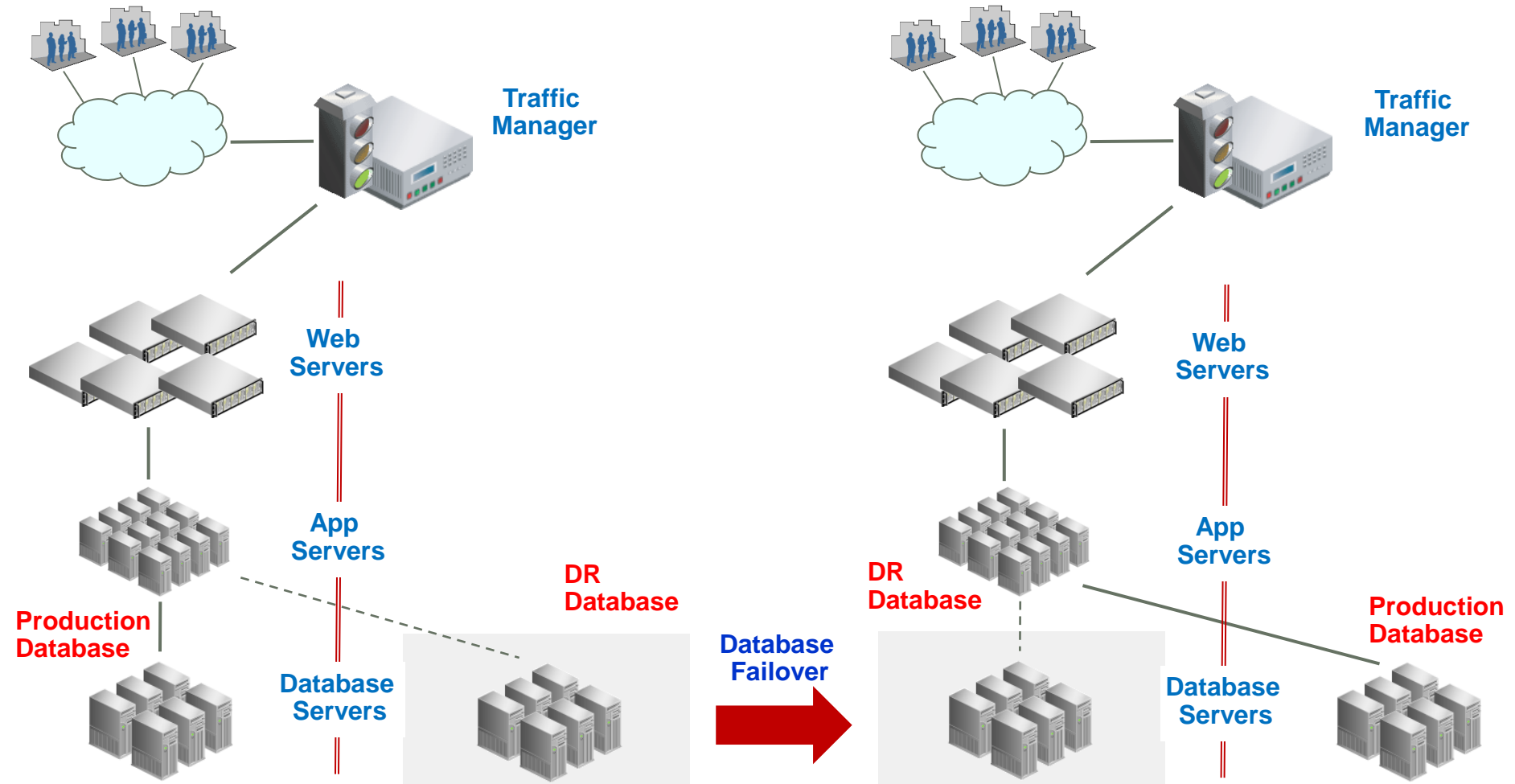
Full Site Failover

Manual, for Disaster Recovery



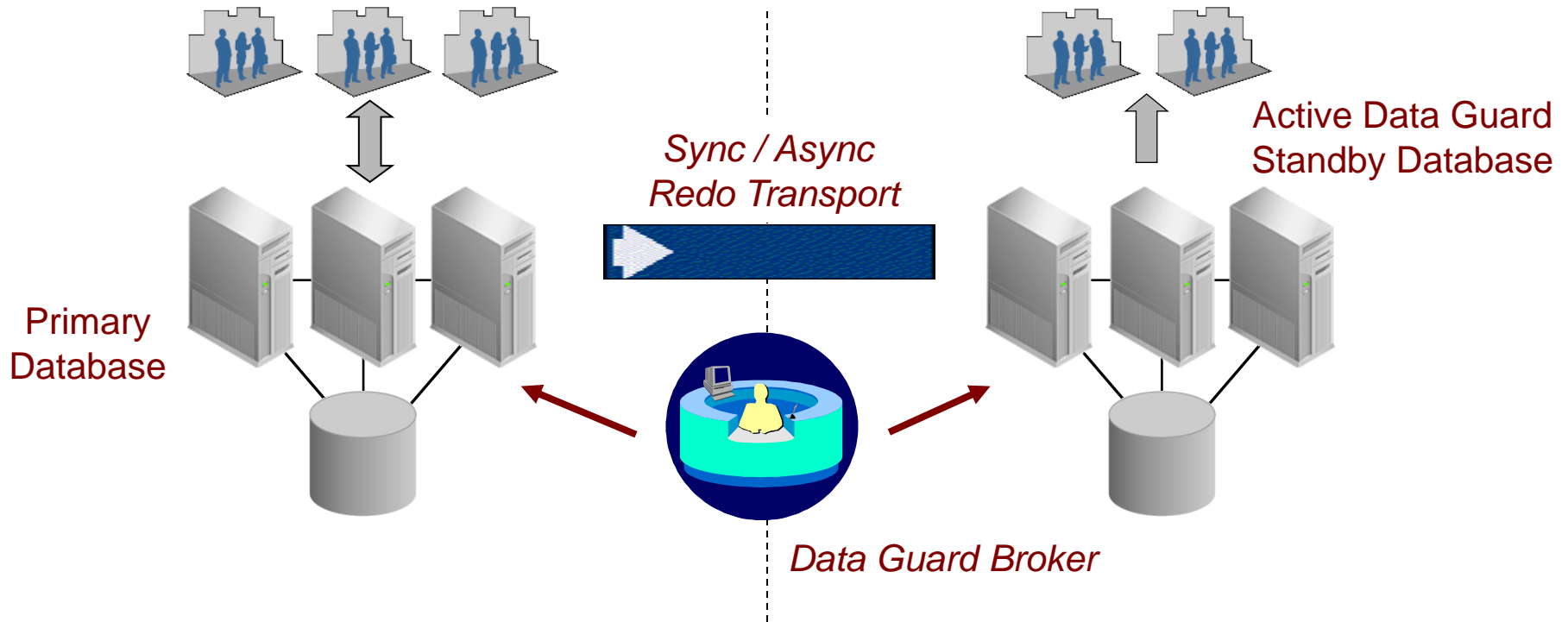
Partial Site / Database Failover

Automated, for Local High Availability



Oracle Data Guard Overview

Best Data Protection



- Data availability and data protection for the Oracle Database
- Up to thirty standby databases in a single configuration
- Standby database used for queries, reports, test, or backups

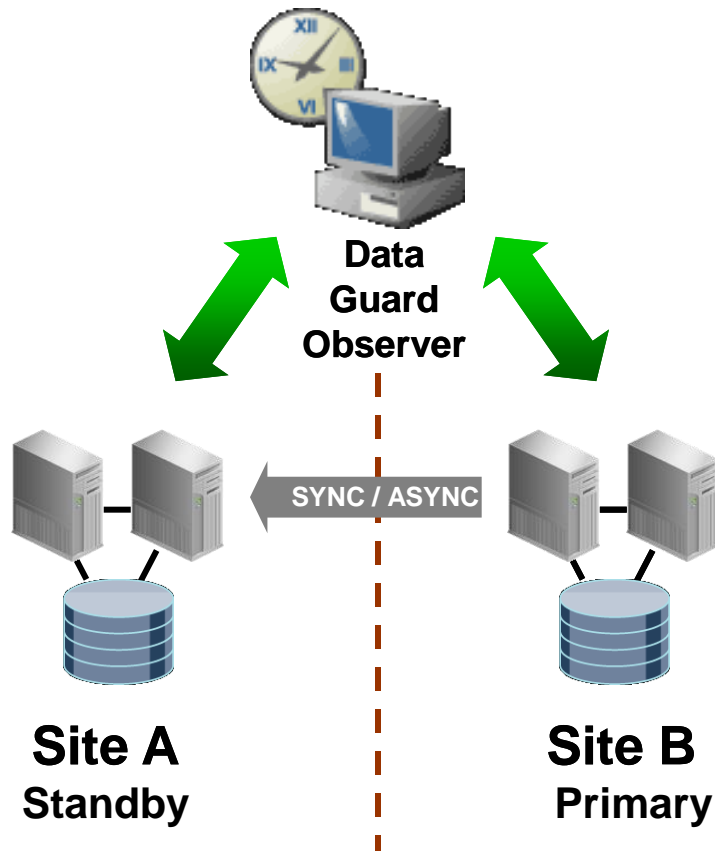
Data Guard Role Transition

Switchover & Failover

- Switchover
 - Planned role reversal, never any data loss
 - No database re-instantiation required
 - Used for database upgrades, tech refresh, data center moves, etc.
 - Manually invoked via Grid Control, DGMGRL, or SQL*Plus
- Failover
 - Unplanned failure of primary
 - Flashback Database used to reinstate original primary
 - Manually invoked via Grid Control, DGMGRL, or SQL*Plus
 - May also be done automatically: Fast-Start Failover

Data Guard Fast-Start Failover

Reduce Unplanned Downtime



- Automatic database failover, upon ...
 - Database down
 - Designated health-check conditions
 - Request of an application
- Supported with
 - Maximum Availability (10.2)
 - Maximum Performance (11.1)

Oracle Database 11.2 Enhancements

Single Client Access Name (SCAN)

- Overview

- Single name for clients to access an Oracle Database running in a cluster
- Configured during the installation of the Grid Infrastructure
- Resolves to 3 IP addresses in the cluster, each associated with a SCAN Listener

```
SALES= (DESCRIPTION=  
  (ADDRESS= (PROTOCOL=tcp) (HOST=Austin-scan) (PORT=1521))  
  (CONNECT_DATA= (SERVICE_NAME=OrderEntry)))
```

- Load Balancing

- Client load balancing: Oracle Net randomly connects clients to one of the 3 SCAN VIPs and connects to that node's SCAN Listener
- Server load balancing: SCAN Listener checks for least loaded instance for the requested service, re-directs connection to the local listener on that node

- Benefits

- No need to change client connection configuration if cluster changes
- Single-name method much more manageable for large clusters – avoids need to list a series of IP address strings in `tnsnames.ora`

Oracle Database 11.2 Enhancements

Role Specific Database Services

- Overview & Benefit

- Services can be automatically active in specific database roles on databases configured with Oracle Clusterware or Oracle Restart
- Data Guard Broker interacts with Oracle Clusterware or Oracle Restart to ensure appropriate services are active after a role transition: no need to write triggers on system startup events

- Example

- Service “OrderEntry” active in primary database role on the primary database Austin
- Service “OrderReport” active in physical standby database role on the standby database Houston

```
srvctl add service -d Austin -s OrderEntry -l PRIMARY -q TRUE -e SELECT  
-m BASIC -w 10 -z 150
```

```
srvctl add service -d Houston -s OrderReport -l PHYSICAL_STANDBY -q TRUE -e SELECT  
-m BASIC -w 10 -z 150
```

Note:

1. For failover / switchover, Service “OrderEntry” should also be configured on Houston in primary role and “OrderReport” be configured on Austin in physical standby role
2. The “OrderReport” service must be explicitly started with **SRVCTL START SERVICE** and stopped with **SRVCTL STOP SERVICE** on primary database to ensure its information is propagated via redo to physical standby

Oracle Database 11.2 Enhancements

Automatic FAN Event Publication by Broker

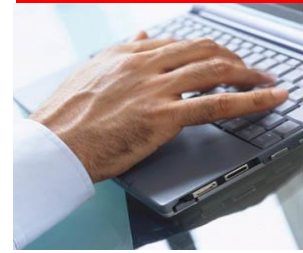
- Overview

- Following a Data Guard Failover (manual or Fast-Start Failover), Data Guard Broker now automatically publishes a FAN (Fast Application Notification) event to clean up connections to the failed primary database
- Upon receipt of that event, FAN client subscribers can automatically reconnect to the service started on the new primary database
- Requires databases configured with Oracle Clusterware or Oracle Restart
- Supports publishing FAN events with either ONS (Oracle Notification Services – for JDBC clients) or AQ (Advanced Queueing – for OCI or ODP.NET clients), for failover to either physical or logical standby database

- Benefit

- Integrated Broker / FAN automation removes the need of an external program to publish these FAN events, and manual triggers to invoke that external program

Agenda



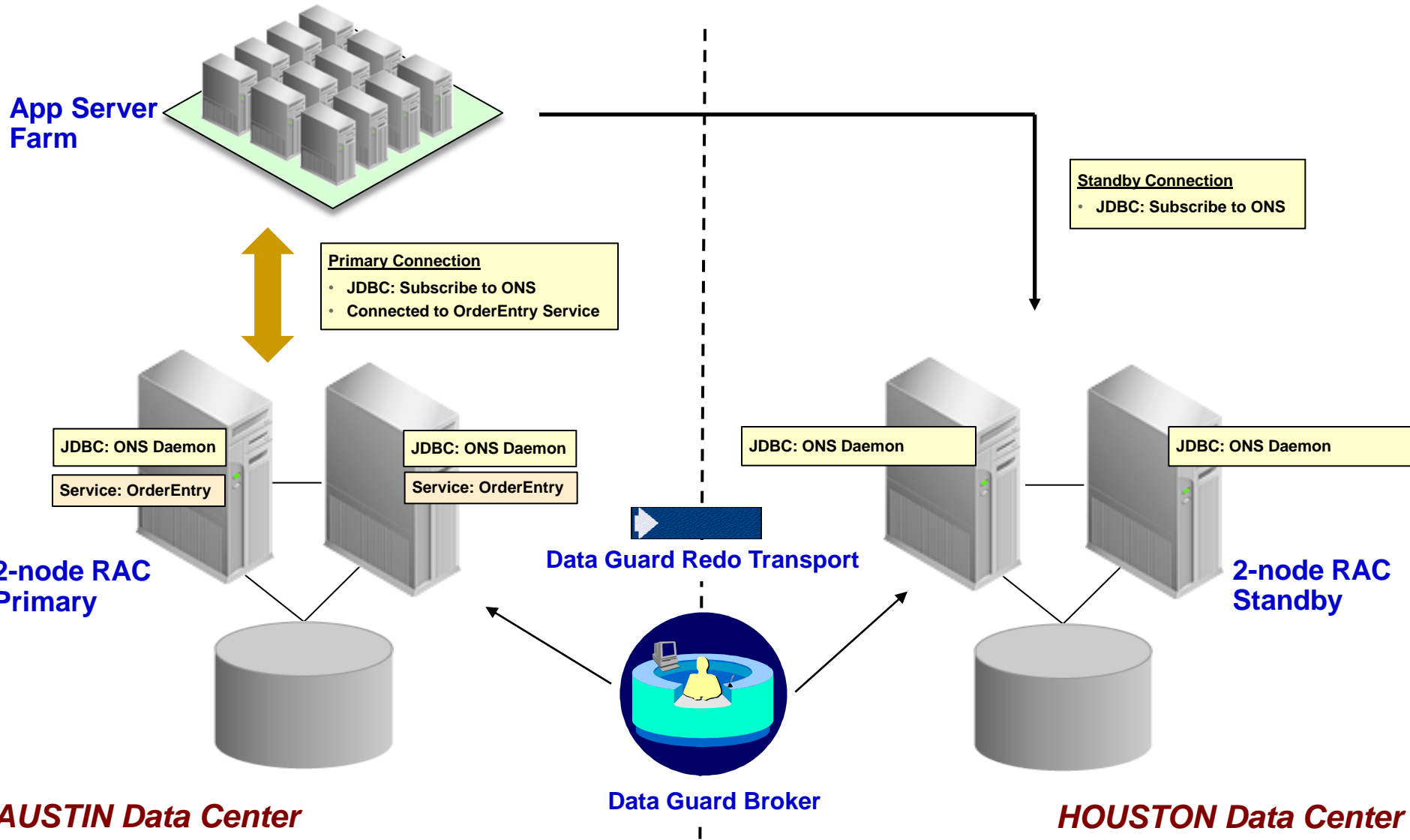
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Seamless Application Failover

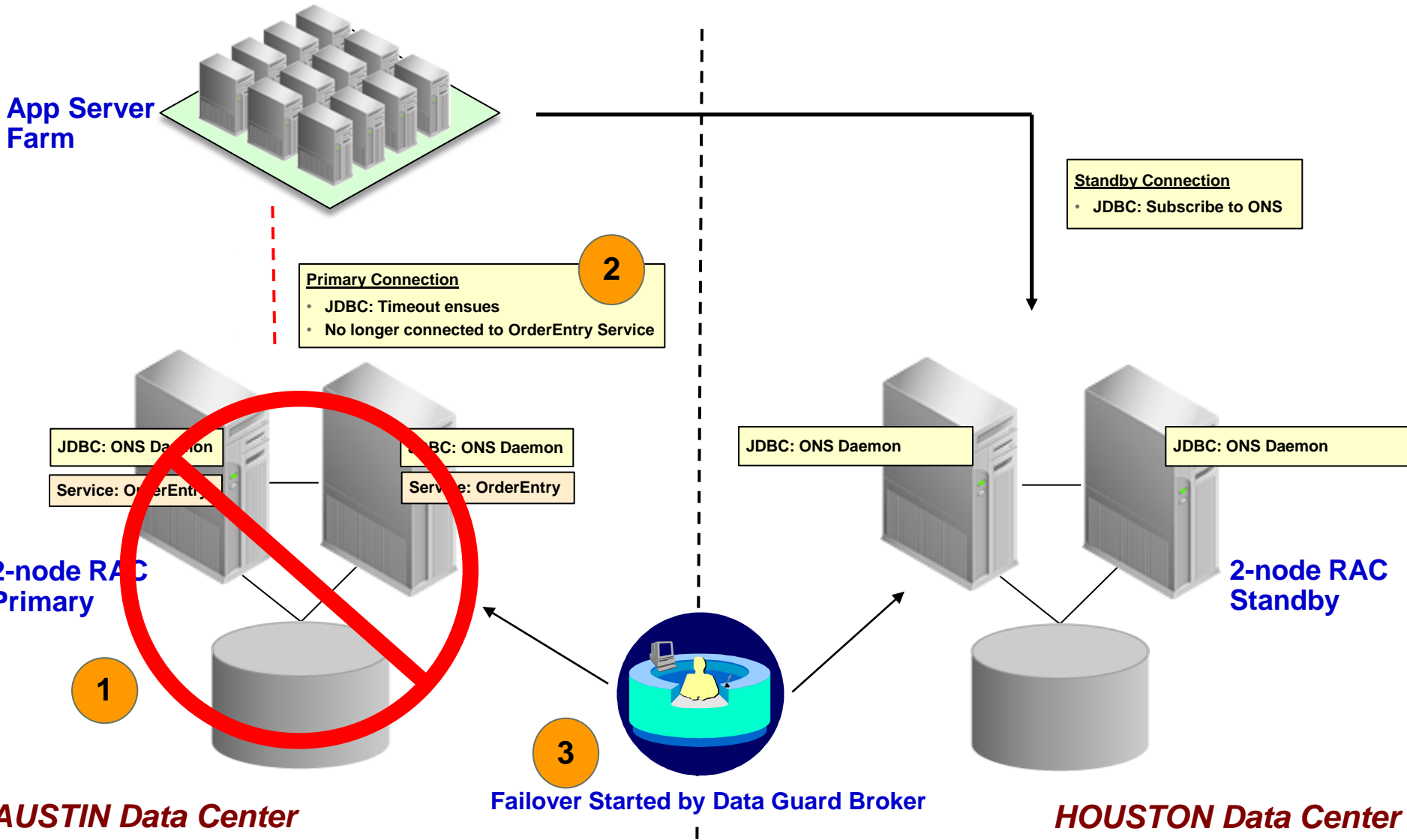
Overall Design Principles

- Focus of this presentation
 - Seamless application redirect during database failover by Data Guard
 - Ideal for maintaining app uptime during local outages
 - Examples: disk failure, data corruption, hardware fault, software hang, etc., much more frequent than site-disasters
- Seamless application failover: three main components
 - Restarting services on the new primary
 - Notifying applications to terminate existing connections
 - Enabling applications to reconnect efficiently
- Required Oracle technologies:
 - Oracle Clusterware
 - Oracle Restart for single instance
 - Oracle Data Guard, including Data Guard Broker

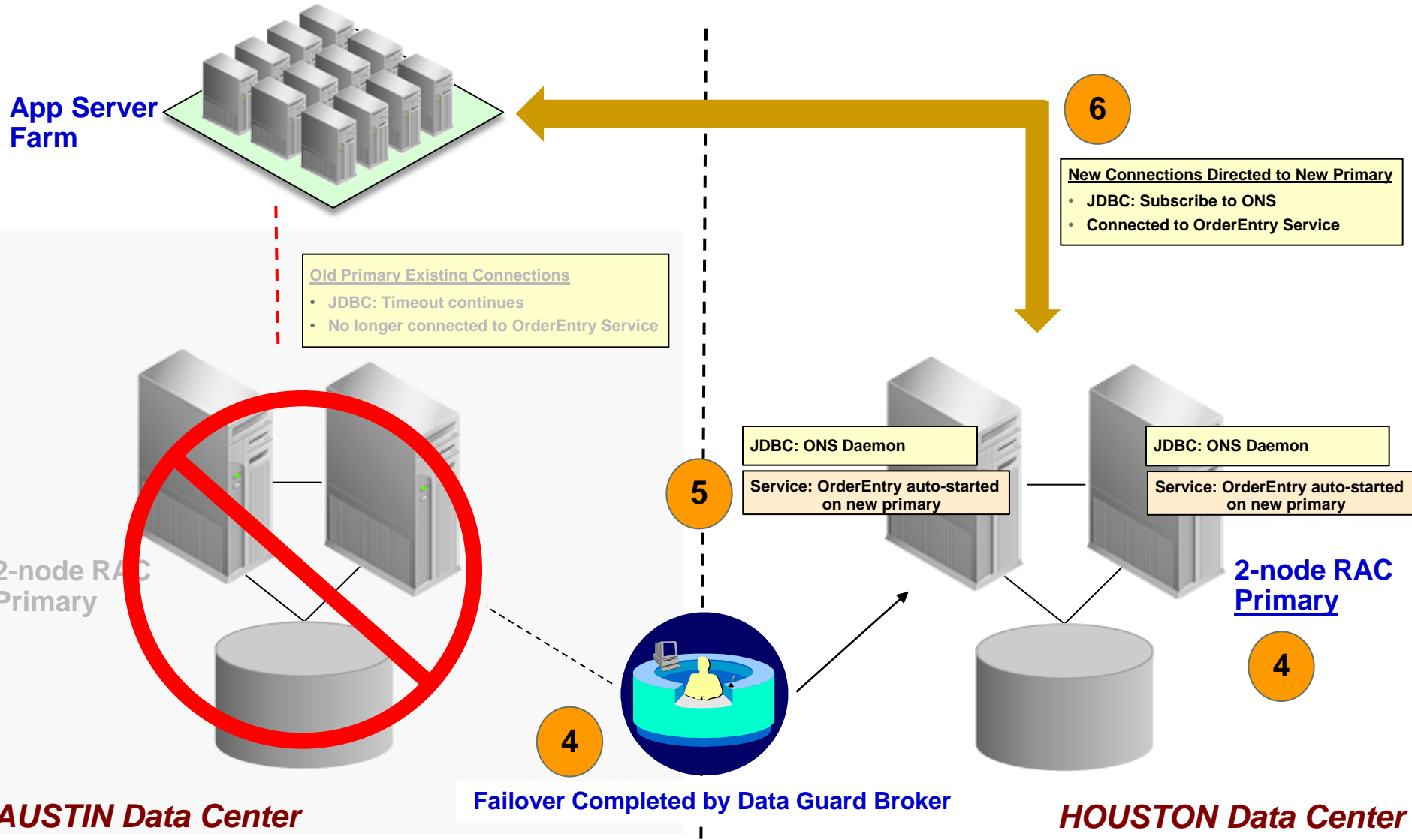
Partial Site Failover – Steady State



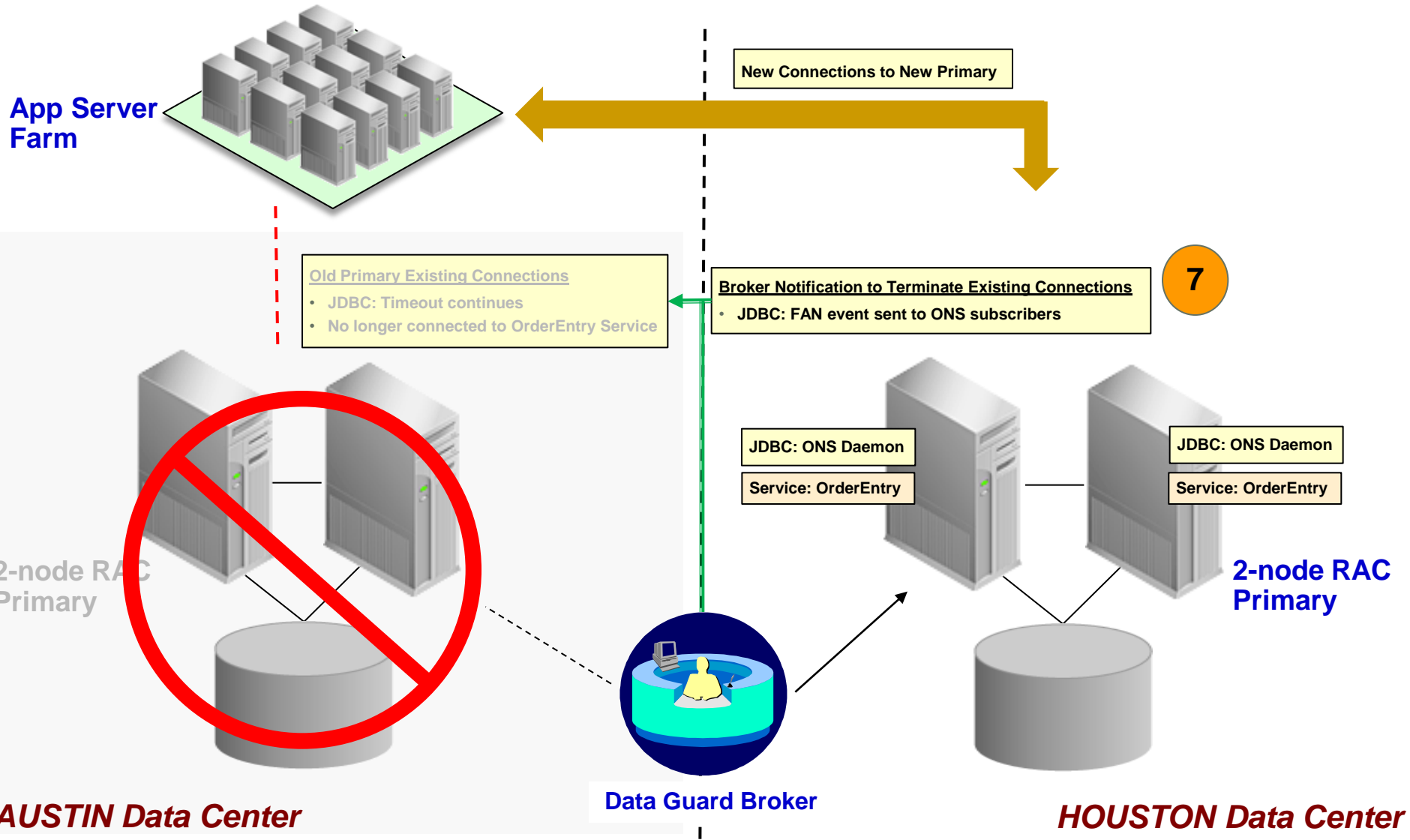
Partial Site Failover – Database Failover



Partial Site Failover – New Primary



Partial Site Failover – Notification

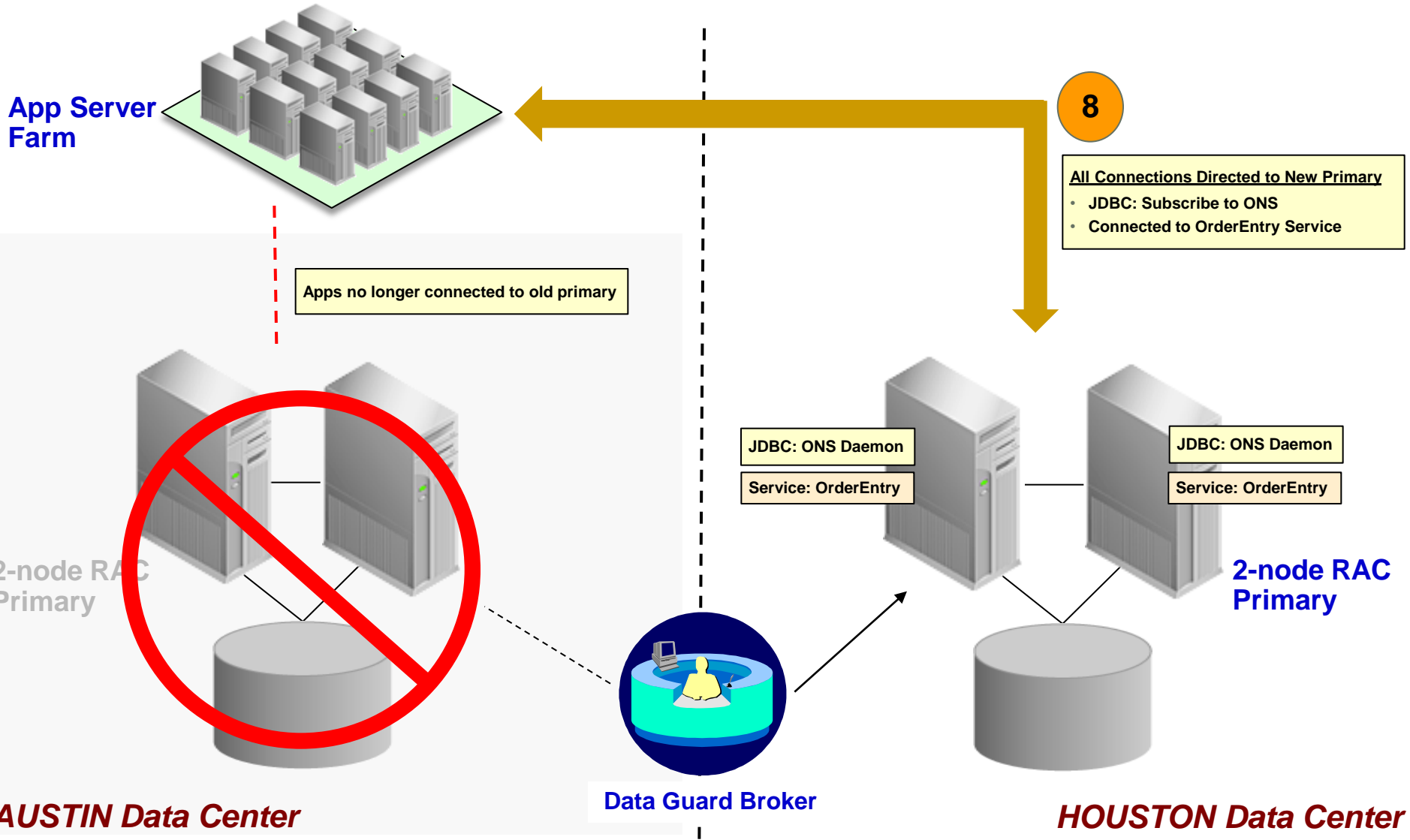


AUSTIN Data Center

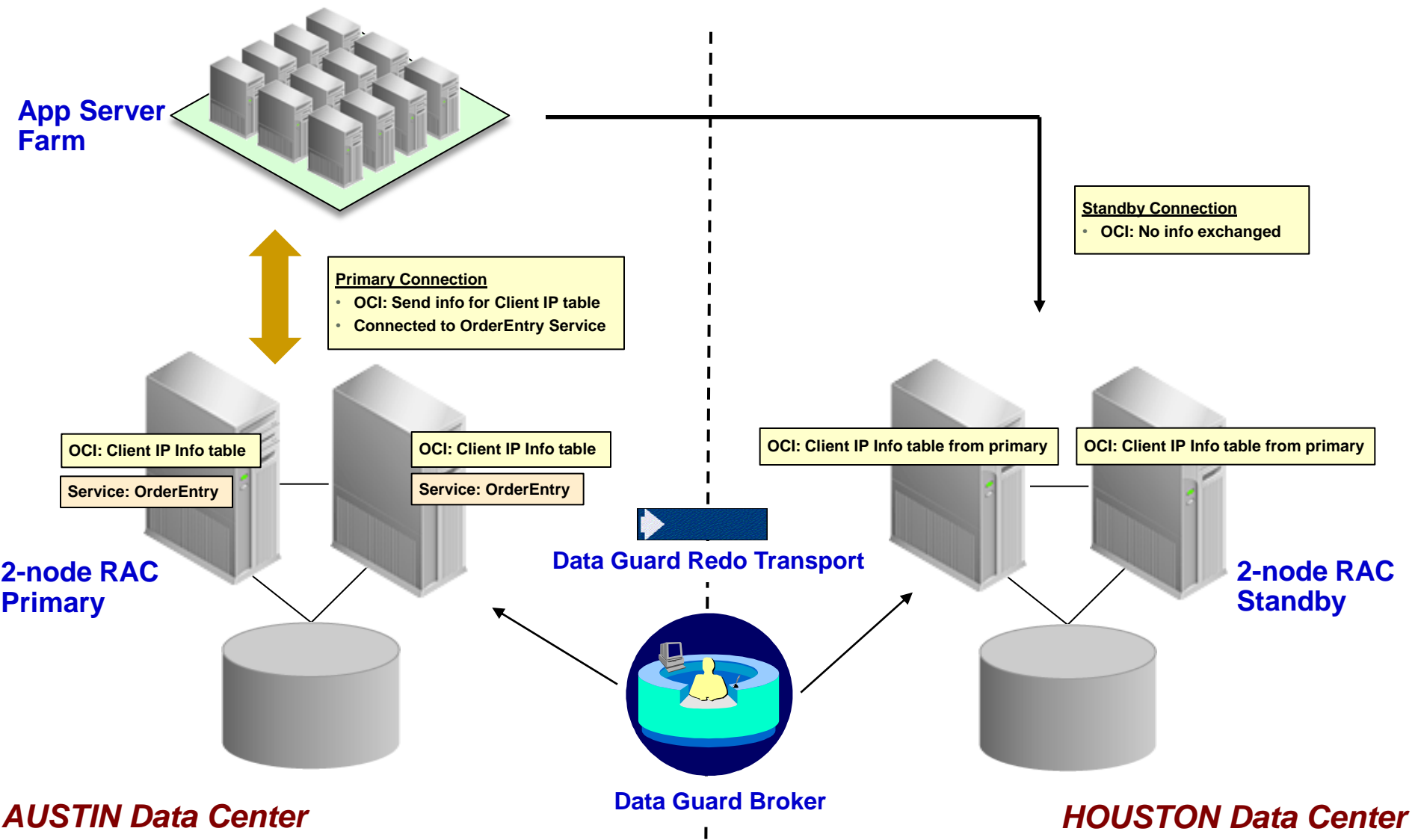
Data Guard Broker

HOUSTON Data Center

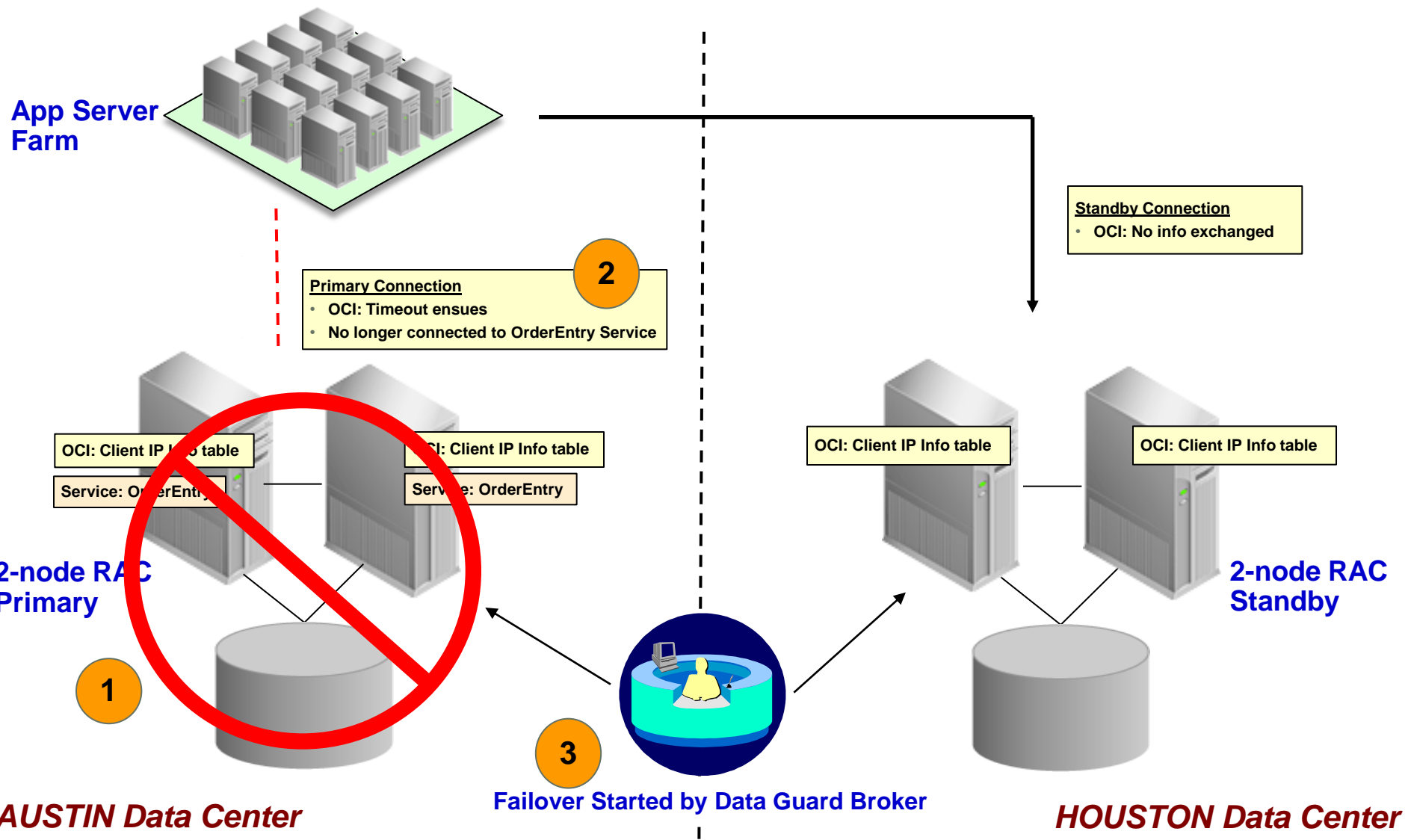
Partial Site Failover – Application Redirect



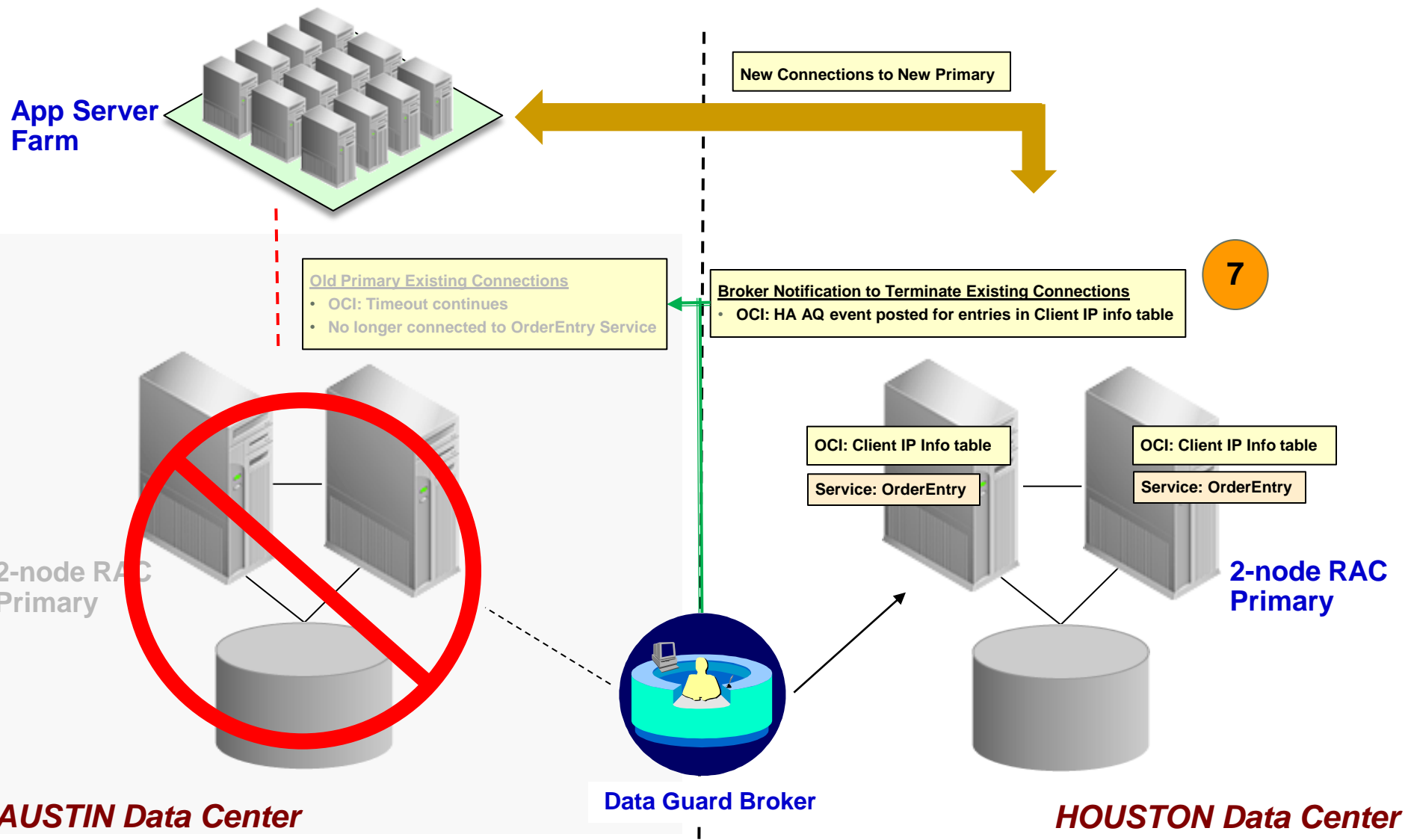
Partial Site Failover – Steady State



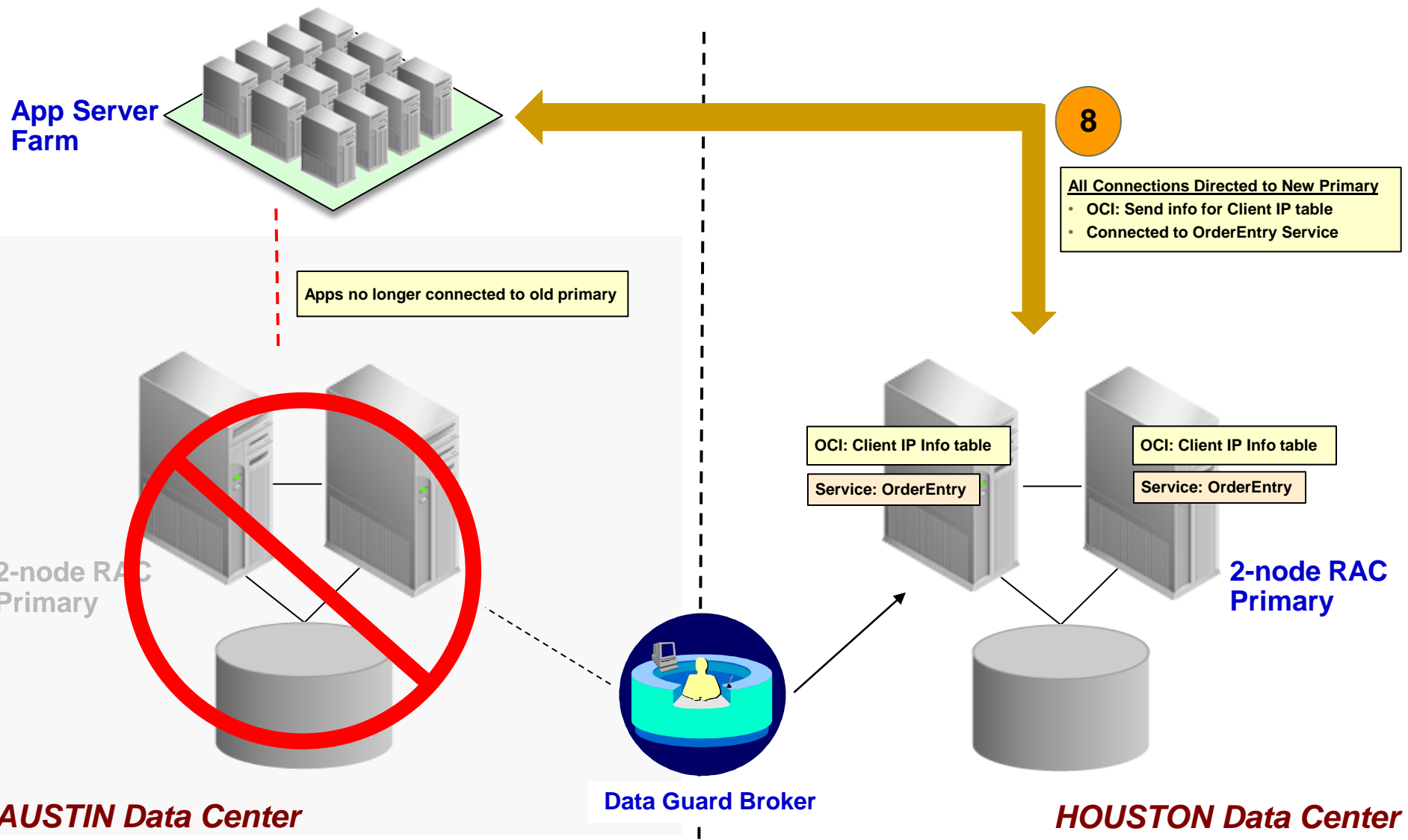
Partial Site Failover – Database Failover



Partial Site Failover – Notification



Partial Site Failover – Application Redirect



Application Failover

JDBC / OCI Requirements

- Application notification is done via Fast Application Notification (FAN)
- Application configuration for FAN includes
 - JDBC
 - Install Oracle JDBC driver
 - Enable Fast Connection Failover (FCF)
 - Use Implicit Connection Cache
 - OCI
 - Enable OCI_EVENTS and OCI_THREADED mode
 - Link application with threads library
 - Note additional requirements for ODP.Net and OLEDB

Configuration Example – JDBC App

Create Role Based Services

- Services only start up on appropriate database role
- Must be created on both primary and standby clusters

Primary cluster:

```
srvctl add service -d Austin  
-s OrderEntry -r ssa1,ssa2 -l PRIMARY  
-q FALSE -e NONE -m NONE -w 0 -z 0
```

Standby cluster:

```
srvctl add service -d Houston  
-s OrderEntry -r ssb1,ssb2 -l PRIMARY  
-q FALSE -e NONE -m NONE -w 0 -z 0
```

*Do not enable TAF or OCI HA Event
(**aq_ha_notifications**)*

Configuration Example – JDBC App

Create Role Based Services

- Services that are to be active on standby must be also created on primary in anticipation of switchover / failover

Primary cluster:

```
srvctl add service -d Austin -s OrderReport  
-r ssa1,ssa2 -l PHYSICAL_STANDBY  
-q FALSE -e NONE -m NONE -w 0 -z 0
```

Standby cluster:

```
srvctl add service -d Houston -s OrderReport  
-r ssb1,ssb2 -l PHYSICAL_STANDBY  
-q FALSE -e NONE -m NONE -w 0 -z 0
```

- For OrderReport service, must run **SRVCTL START SERVICE** and **SRVCTL STOP SERVICE** on the primary: that's how standby knows about this service through redo transmission

Configuration Example – JDBC App

Configure JDBC URL

- Configure JDBC clients to use a connect descriptor that includes an address list that includes the SCAN address for each site

```
"jdbc:oracle:thin:@" +  
"(DESCRIPTION_LIST=" +  
"(LOAD_BALANCE=off)" +  
"(FAILOVER=on)" +  
"(DESCRIPTION=" +  
  "(ADDRESS_LIST=" +  
    "(LOAD_BALANCE=on)" +  
    "(ADDRESS=(PROTOCOL=TCP)(HOST=Austin-scan)(PORT=1521))" +  
    "(CONNECT_DATA=(SERVICE_NAME=OrderEntry))" +  
"(DESCRIPTION=" +  
  "(ADDRESS_LIST=" +  
    "(LOAD_BALANCE=on)" +  
    "(ADDRESS=(PROTOCOL=TCP)(HOST=Houston-scan)(PORT=1521))" +  
    "(CONNECT_DATA=(SERVICE_NAME=OrderEntry))" );
```

Configuration Example – JDBC App

SCAN Connection Flow

- After connection made using the JDBC URL:
 - Oracle Net contacts DNS and resolves primary SCAN to a total of 3 IP addresses
 - Randomly picks one of the 3 IP address and attempts to make a connection
 - If the connection to primary site is unsuccessful, it then contacts DNS and resolves standby SCAN to 3 addresses
 - It then randomly picks up one of the IP addresses and tries to connect

Configuration Example – JDBC App

Configure for Fast Reconnect

- Setting the **TCP_CONNTIMEOUT_STR** property enables the JDBC client to quickly traverse an `address_list`

```
Properties prop = new Properties();  
prop.put(oracle.net.ns.SQLnetDef.TCP_CONNTIMEOU  
T_STR, ""+5000); // 5000ms  
pds.setConnectionProperties(prop);
```

Configuration Example – JDBC App

Configure Fast Connection Failover

- Enable Fast Connection Failover (FCF) to receive FAN events
- Configure Application to connect to all primary and standby ONS daemons

```
pds.setFastConnectionFailoverEnabled(true);  
pds.setONSConfiguration("nodes=hasun05:6200,has  
un06:6200,hasun07:6200,hasun08:6200");
```

Considerations for OCI

Services

- Service created on both primary and standby clusters
- Must enable TAF and OCI HA Event (**aq_ha_notifications**)
- Configure DELAY and RETRY parameters

Primary cluster:

```
srvctl add service -d Austin -s OrderEntry  
-r ssa1,ssa2 -l PRIMARY  
-q TRUE -e SESSION -m BASIC -w 10 -z 150
```

Standby cluster:

```
srvctl add service -d Houston -s OrderReport  
-r ssb1,ssb2 -l PRIMARY  
-q TRUE -e SESSION -m BASIC -w 10 -z 150
```

Considerations for OCI

Enabling FAN

- Enable FAN for OCI clients by initializing the environment with the OCI_EVENTS parameter
`OCIEnvCreate (...OCI_EVENTS...)`
- Link the OCI client applications with thread library `libthread` or `libpthreads`
- Configure application to check for events and register a callback whenever events are received

Considerations for OCI

Oracle Net Alias

- Oracle Net alias should specify both the primary and standby SCAN hostnames

```
SALES=  
  (DESCRIPTION_LIST=  
    (LOAD_BALANCE=off) (FAILOVER=on)  
    (DESCRIPTION=  
      (LOAD_BALANCE=on) (CONNECT_TIMEOUT=10) (RETRY_COUNT=3)  
      (ADDRESS_LIST=  
        (ADDRESS=(PROTOCOL=TCP) (HOST=Austin-scan) (PORT=1521)))  
      (CONNECT_DATA=(SERVICE_NAME=OrderEntry)))  
    (DESCRIPTION=  
      (LOAD_BALANCE=on) (CONNECT_TIMEOUT=10) (RETRY_COUNT=3)  
      (ADDRESS_LIST=  
        (ADDRESS=(PROTOCOL=TCP) (HOST=Houston-scan) (PORT=1521)))  
      (CONNECT_DATA=(SERVICE_NAME=OrderEntry))))
```

Considerations for OCI

New Oracle Net Parameters

- Three new parameters in Oracle Database 11g Release 2 used in previous example
 - **CONNECT_TIMEOUT** controls the overall time to connect to the service
 - **TRANSPORT_CONNECT_TIMEOUT** is the amount of time for the TCP connection to complete
 - **CONNECT_TIMEOUT** set to a value slightly greater than **TRANSPORT_CONNECT_TIMEOUT**
 - **RETRY_COUNT** parameter specifies the number of times an address list is traversed before the connection attempt is terminated

Considerations for OCI

New Oracle Net Parameters – Example

- Be careful with optimal values, e.g. if Austin server/clusterware is down:

```
SALES=  
  (DESCRIPTION_LIST=  
    (LOAD_BALANCE=off) (FAILOVER=on)  
    (DESCRIPTION=  
      (LOAD_BALANCE=on) (CONNECT_TIMEOUT=5) (RETRY_COUNT=2)  
      (ADDRESS_LIST=  
        (ADDRESS=(PROTOCOL=TCP) (HOST=Austin-scan) (PORT=1521)))  
      (CONNECT_DATA=(SERVICE_NAME=OrderEntry)))  
    (DESCRIPTION=  
      (LOAD_BALANCE=on) (CONNECT_TIMEOUT=5) (RETRY_COUNT=2)  
      (ADDRESS_LIST=  
        (ADDRESS=(PROTOCOL=TCP) (HOST=Houston-scan) (PORT=1521)))  
      (CONNECT_DATA=(SERVICE_NAME=OrderEntry))))
```

- A new connection spends $5 \times 3 = 15$ seconds to iterate through 3 Austin-SCAN VIPs
- This is retried 2 times: additional $2 \times 15 = 30$ seconds
- So connection fails over to Houston after $15 + 30 = 45$ seconds

Considerations for Oracle Applications

- PeopleSoft supports seamless client failover
 - Simply follow OCI configuration steps
 - PeopleSoft PeopleTools version 8.50.09 and higher supports FAN
 - Consult MAA whitepaper: “Reducing PeopleSoft Downtime Using a Local Standby Database”,
<http://www.oracle.com/technetwork/database/features/availability/maa-peoplesoft-local-standby-128609.pdf>

Considerations for Oracle Applications

- E-Business Suite and Siebel
 - Create role based services
 - Follow Oracle Net alias and JDBC URL examples
 - On the mid tier tune the OS TCP timeout for faster disconnects

Considerations for Oracle WebLogic

- For Current Release
 - Use Multi Pool Data source
 - Multi Pool Data Source contains data sources for both primary and secondary sites
 - Requires Database Service available at primary site only
 - Configure connect timeout at each data source level
 - Does not use FAN: uses a polling mechanism instead
- Upcoming enhancement
 - Grid Link
 - Integrates with usage of FAN
 - Can consume Data Guard specific FAN events
 - Can integrate with best practices for SCAN addresses with Oracle Database 11.2

*Ref. "Oracle Fusion Middleware Configuring and Managing JDBC for Oracle WebLogic Server",
http://download.oracle.com/docs/cd/E14571_01/web.1111/e13737/toc.htm*

Considerations for Data Guard Switchover

JDBC and OCI

- You get client failover for switchover free if you have followed the steps (*well....sorta*)
- Physical standby
 - Clients disconnected as primary is converted to a standby
 - Clients go through TAF retry logic (OCI) or application retry logic (JDBC)
 - Clients connected to the standby disconnected as it is converted to primary
 - Once both databases come up in new roles, services start and clients reconnect
- Logical standby
 - Services are stopped automatically if Data Guard Broker switchover
 - Manually disconnect connections to both primary and standby
 - Perform switchover
 - Once both databases come up in new roles, services start and clients reconnect

Efficient Routing of New Connections

JDBC and OCI

- The example Oracle Net Alias / JDBC URL discussed previously connects to SCAN address as an ordered list

- Disable **LOAD_BALANCE** at the **DESCRIPTION_LIST** level

```
SALES=  
  (DESCRIPTION_LIST=  
    (LOAD_BALANCE=off) (FAILOVER=on)  
    (DESCRIPTION=
```

- First **DESCRIPTION** is always processed first
- Second **DESCRIPTION** is only attempted once all attempts in first **DESCRIPTION** fail
- This is the optimal method if failover / switchovers are rare

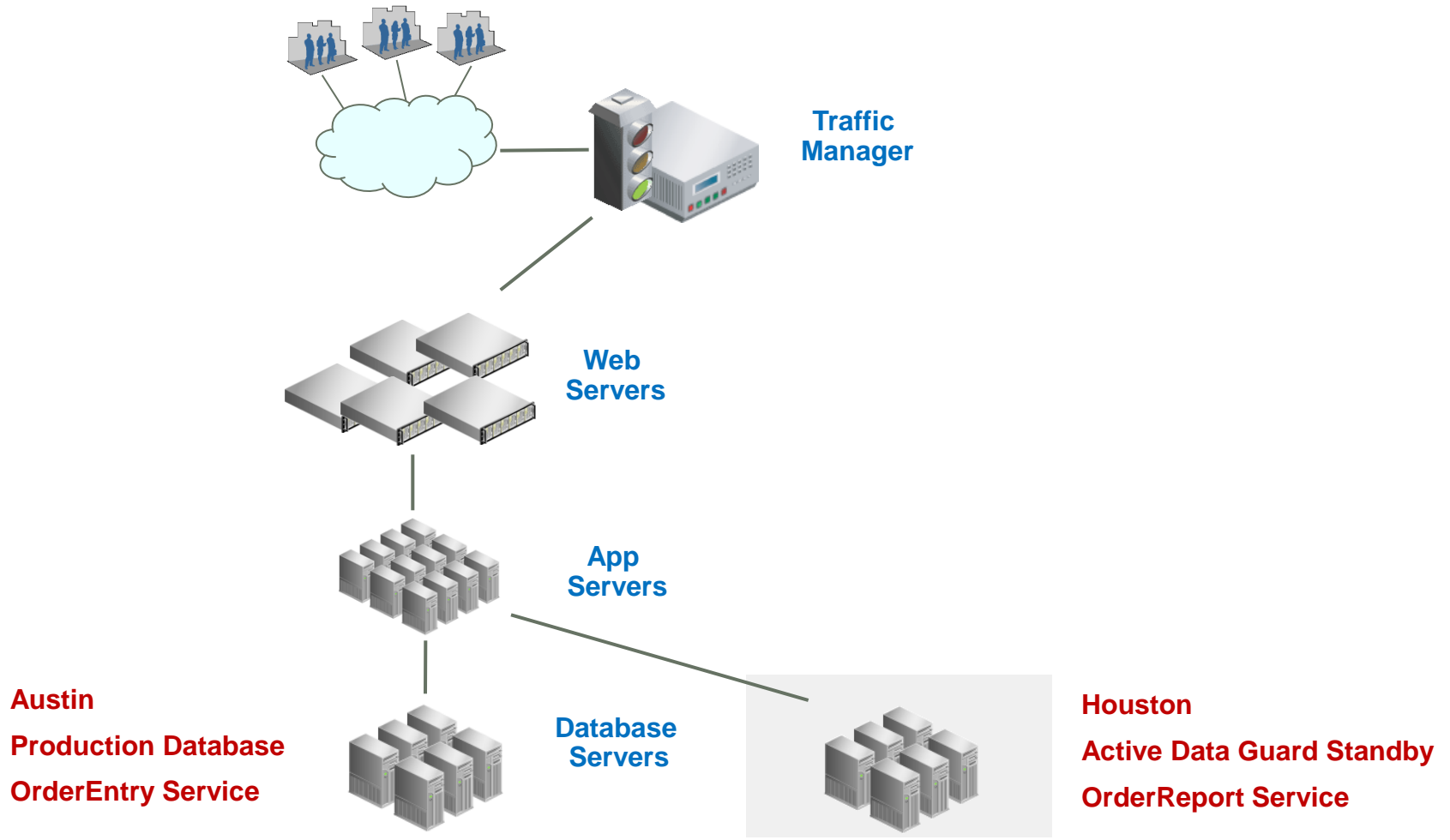
- If role transitions occur frequently consider randomizing connections between **DESCRIPTION**

- Enable **LOAD_BALANCE** at the **DESCRIPTION_LIST** level

```
SALES=  
  (DESCRIPTION_LIST=  
    (LOAD_BALANCE=on) (FAILOVER=on)  
    (DESCRIPTION=
```

Efficient Routing of New Connections

Active Data Guard Configuration Example



Efficient Routing of New Connections

Active Data Guard: JDBC and OCI

- For environments that include Active Data Guard disable **LOAD_BALANCE** at the **DESCRIPTION_LIST** level
- Oracle Net alias / JDBC URL for the primary application should list the primary SCAN hostname in the first **DESCRIPTION**
- Oracle Net alias / JDBC URL for the read only connections going to Active Data Guard list the standby SCAN hostname in the first **DESCRIPTION**

Efficient Routing of New Connections

Active Data Guard TNSNAMES Example

SALES=

```
(DESCRIPTION_LIST=  
(LOAD_BALANCE=off) (FAILOVER=on)  
(DESCRIPTION=  
(LOAD_BALANCE=on) (CONNECT_TIMEOUT=10) (RETRY_COUNT=3)  
(ADDRESS_LIST=  
(ADDRESS=(PROTOCOL=TCP) (HOST=Austin-scan) (PORT=1521)))  
(CONNECT_DATA=(SERVICE_NAME=OrderEntry)))  
(DESCRIPTION=  
(LOAD_BALANCE=on) (CONNECT_TIMEOUT=10) (RETRY_COUNT=3)  
(ADDRESS_LIST=  
(ADDRESS=(PROTOCOL=TCP) (HOST=Houston-scan) (PORT=1521)))  
(CONNECT_DATA=(SERVICE_NAME=OrderEntry))))
```

Primary Database Connection

Austin: Primary Database,
listed earlier

OrderEntry: Read/Write Service

REPORTS=

```
(DESCRIPTION_LIST=  
(LOAD_BALANCE=off) (FAILOVER=on)  
(DESCRIPTION=  
(LOAD_BALANCE=on) (CONNECT_TIMEOUT=10) (RETRY_COUNT=3)  
(ADDRESS_LIST=  
(ADDRESS=(PROTOCOL=TCP) (HOST=Houston-scan) (PORT=1521)))  
(CONNECT_DATA=(SERVICE_NAME=OrderReport)))  
(DESCRIPTION=  
(LOAD_BALANCE=on) (CONNECT_TIMEOUT=10) (RETRY_COUNT=3)  
(ADDRESS_LIST=  
(ADDRESS=(PROTOCOL=TCP) (HOST=Austin-scan) (PORT=1521)))  
(CONNECT_DATA=(SERVICE_NAME=OrderReport))))
```

Active Standby Database Connection

Houston: Active Standby Database,
listed earlier

OrderReport: Read-only Service

Considerations for Previous Releases

JDBC and OCI

- Oracle Database 11g Release 2 greatly simplified client failover setup and configuration over previous releases
- Earlier releases need some manual configuration for services and FAN events
 - Configure Oracle Net alias to include all node VIP names instead of SCAN names
 - Create triggers that manage application services so that application services are started for the correct database role
 - Configure wrapper script and configuration file for the ONS Publisher
 - Create trigger based on the **DB_ROLE_CHANGE** system event to execute the ONS Publisher wrapper script

Considerations for Previous Releases

Other Noteworthy Items

- **RETRY_COUNT** : new in Oracle Database 11.2
 - Previous releases may need to specifically code additional retries for new connection attempts
- **SQLNET.OUTBOUND_CONNECT_TIMEOUT** in Oracle Database 11.1 and Oracle Database 10.2 can only be set in the sqlnet.ora
 - That means all Oracle Net aliases inherit that one value

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VOCALINK

VocaLink and BGC Application Failover

Martin McGeough

Database Technical Architect

VocaLink: at the heart of the transaction

A specialist provider of payment transaction services

Our history	<p>Driving automated payments for more than 40 years From domestic supplier to large-scale international provider of modern payment services</p>
Our scale	<p>We securely process over 9 billion payments a year, including 15% of all European bank-to-bank payments</p> <p>On a peak day the payment platform processes over 90 million transactions and its switching technology powers the world's busiest network of over 60,000 ATMs</p>
Our customers	<p>The world's top banks, their corporate customers and Government departments</p>
Our services	<p>Real-Time Payments Euro Services Sterling clearing services Connectivity Cards and ATM services</p>
2009 awards	<p> Best payment system deployment (Faster Payments Service) Best outsourcing partnership (BGC) Overall winner (Faster Payments Service)</p>

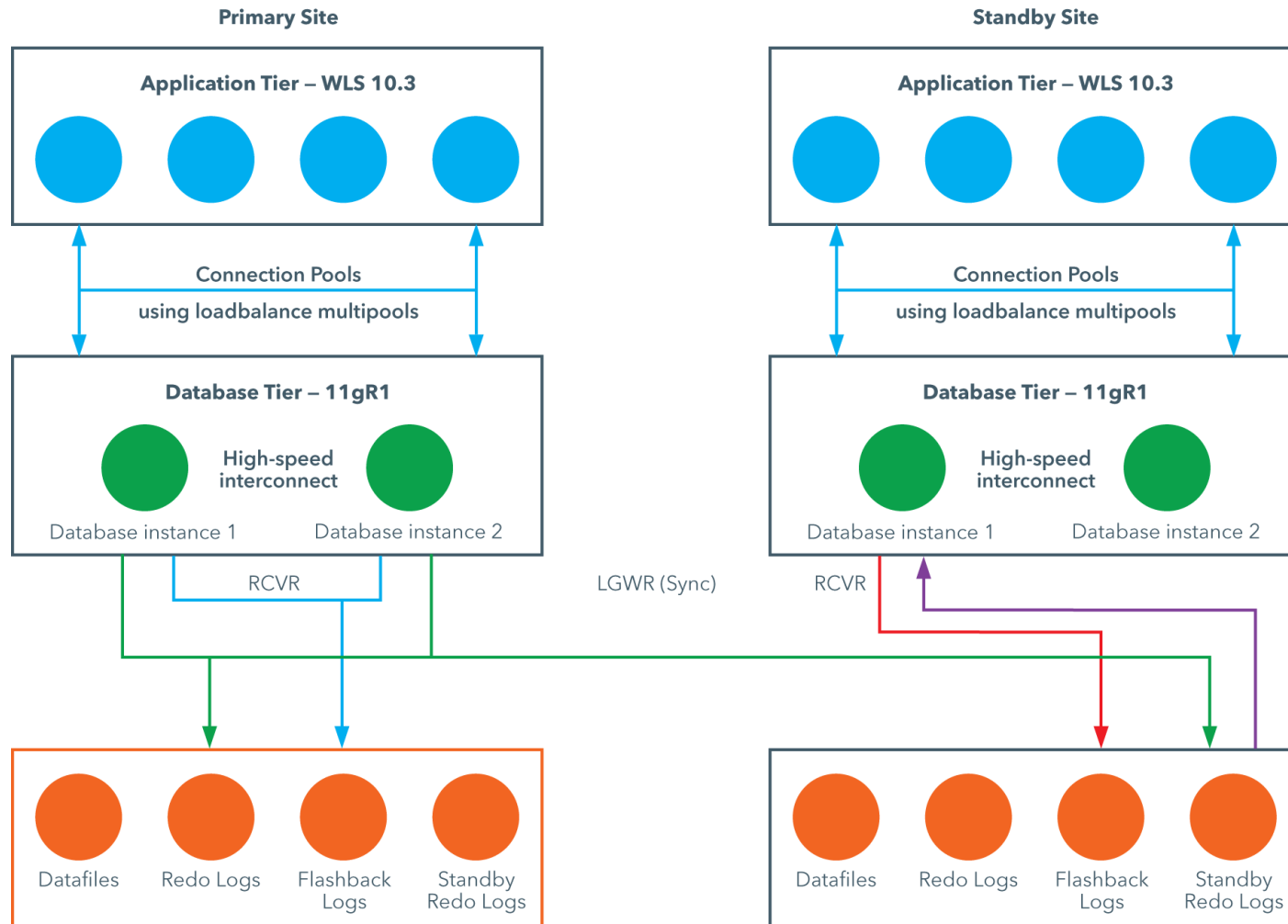
VocaLink's history with Oracle

- In 2007 VocaLink initiated a joint programme with BGC – the Swedish clearing house - to renew the BGC Service – the goal was to replace the heritage mainframe technology with a highly scalable, highly available and modular infrastructure that would reduce costs while simultaneously improving performance.
- Main Architecture requirements
 - High Availability
 - Disaster Recovery
 - Site Failover
 - High Throughput
 - Manageability
 - No single points of failure
 - remote site with zero data loss
 - Site failover SLA is 15 minutes
 - Process payments within very tight SLA's
 - Ability to manage independent payments services

VocaLink's history with Oracle contd.

- Technology
 - WebLogic Server was chosen to provide the Application Server software
 - Sun/Oracle was chosen to provide the hardware.
 - Oracle Database was chosen to provide the Database software using RAC (Real Application Cluster) for a solution that provided high availability and performance and Data Guard + Data Guard Broker provided an easily managed DR solution.
- Oracle's MAA framework promotes and supports VocaLink's Architecture requirements by providing the tools and a tested and supported set of configurations.

BGC Architecture



BGC Architecture – Explained

- The Standby site has two DWDM links the longest is 90Km and the network latency has been measured at just under 3ms, the Data Guard protection level is set to Max Availability – this allows the primary to keep processing even through loss of the standby servers or the inter-site link.

BGC Architecture - Explained

- At present the Active Data Guard standby is not used for anything other than ensuring the Standby application has a warm cache of Reference Data to enable VocaLink to meet the 15 minute SLA, however for a future release of the BGC service it is being considered for providing read-only reporting application. This is reliant on 11gR2 and the automated monitoring of the latency between the primary and standby databases providing a suitable framework.



BGC Architecture - Explained

- Each site is mutually exclusive at present therefore the WLS tiers are only configured to connect to the local database servers. However with the use of the load-balanced multipools configurations has reduced the amount of manual interventions required after the old primary databases are restarted after a Switchover or other failure scenarios i.e. an instance crash or a physical server crash.



VocaLink – BGC Service Site Failover

- Control of the Failover/Switchover process are controlled by a job scheduler (Tivoli Workload Scheduler) due to the external dependencies above the Application and Database tiers – this controls the Data Guard Broker and the application restart processes.
- A failover has been timed at 12 mins whilst a switchover has been timed at just under 15mins (14:45).
- The failover includes network, proxy, application and database tiers. The database failover takes about 5 minutes and the application tier takes about a further 3 minutes. The rest of the time was taken by the network and some ancillary systems switching sites.



VocaLink – BGC Service Site Failover

- During a Site Failover of the BGC Service VocaLink use the following Oracle technologies to meet the strict 15 minutes SLA - Data Guard, Data Guard Broker, Flashback and Active Data Guard.
- The Data Guard configuration allows for the data to be replicated to VocaLink's standby site without data loss.
- Data Guard Broker is used to simplify the process of performing a Failover/Switchover – one command to control the whole process.

VocaLink – BGC Service Site Failover

- Active Data Guard is implemented along with a custom caching application to keep the reference data up to date on the standby site – allowing the application to restart very quickly after a failover is initiated.
- Flashback is implemented to allow us to quickly rebuild a failed primary database.
- The WLS multi pool configuration along with Active Data Guard allows the standby site to be maintained and kept up to date with the minimal interaction from the system administrators.

Key HA Sessions, Labs, & Demos by Oracle Development

Monday, 20 Sep – Moscone South *

- 3:30p Extreme Consolidation with RAC One Node, Rm 308
- 4:00p Edition-Based Redefinition, Hotel Nikko, Monterey I / II
- 5:00p Five Key HA Innovations, Rm 103
- 5:00p GoldenGate Strategy & Roadmap, Moscone West, Rm 3020

Tuesday, 21 Sep – Moscone South *

- 11:00a App Failover with Data Guard, Rm 300
- 12:30p Oracle Data Centers & Oracle Secure Backup, Rm 300
- 12:30p Oracle Net Services: Best Practices, Rm 302
- 2:00p ASM Cluster File System, Rm 308
- 2:00p Exadata: OLTP, Warehousing, Consolidation, Rm 103
- 3:30p Deep Dive into OLTP Table Compression, Rm 104
- 3:30p MAA for E-Business Suite R12.1, Moscone West, Rm 2020
- 5:00p Instant DR by Deploying on Amazon Cloud, Rm 300

Wednesday, 22 Sep – Moscone South *

- 11:30a RMAN Best Practices, Rm 103
- 11:30a Database & Exadata Smart Flash Cache, Rm 307
- 11:30a Configure Oracle Grid Infrastructure, Rm 308
- 1:00p Top HA Best Practices, Rm 103
- 1:00p Exadata Backup/Recovery Best Practices, Rm 103
- 4:45p GoldenGate Architecture, Hotel Nikko, Peninsula

Thursday, 23 Sep – Moscone South *

- 10:30a Active Data Guard Under the Hood, Rm 103
- 1:30p Minimal Downtime Upgrades, Rm 306
- 3:00p DR for Database Machine, Rm 103

Demos Moscone West DEMOGrounds

Mon & Tue 9:45a - 5:30p; Wed 9:00a - 4:00p

- Maximum Availability Architecture (MAA)
- Oracle Active Data Guard
- Oracle Secure Backup
- Oracle Recovery Manager & Flashback
- Oracle GoldenGate
- Oracle Real Application Clusters
- Oracle Automatic Storage Management

Hands-on Labs Marriott Marquis, Salon 10 / 11

Monday, Sep 20, 12:30 pm - 1:30 pm Oracle Active Data Guard

Tuesday, Sep 21, 5:00 pm - 6:00 pm Oracle Active Data Guard

* All session rooms are at Moscone South unless otherwise noted

* After Oracle OpenWorld, visit
<http://www.oracle.com/goto/availability>



Q&A

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