26 Features in Oracle AI Database 26ai You should know about

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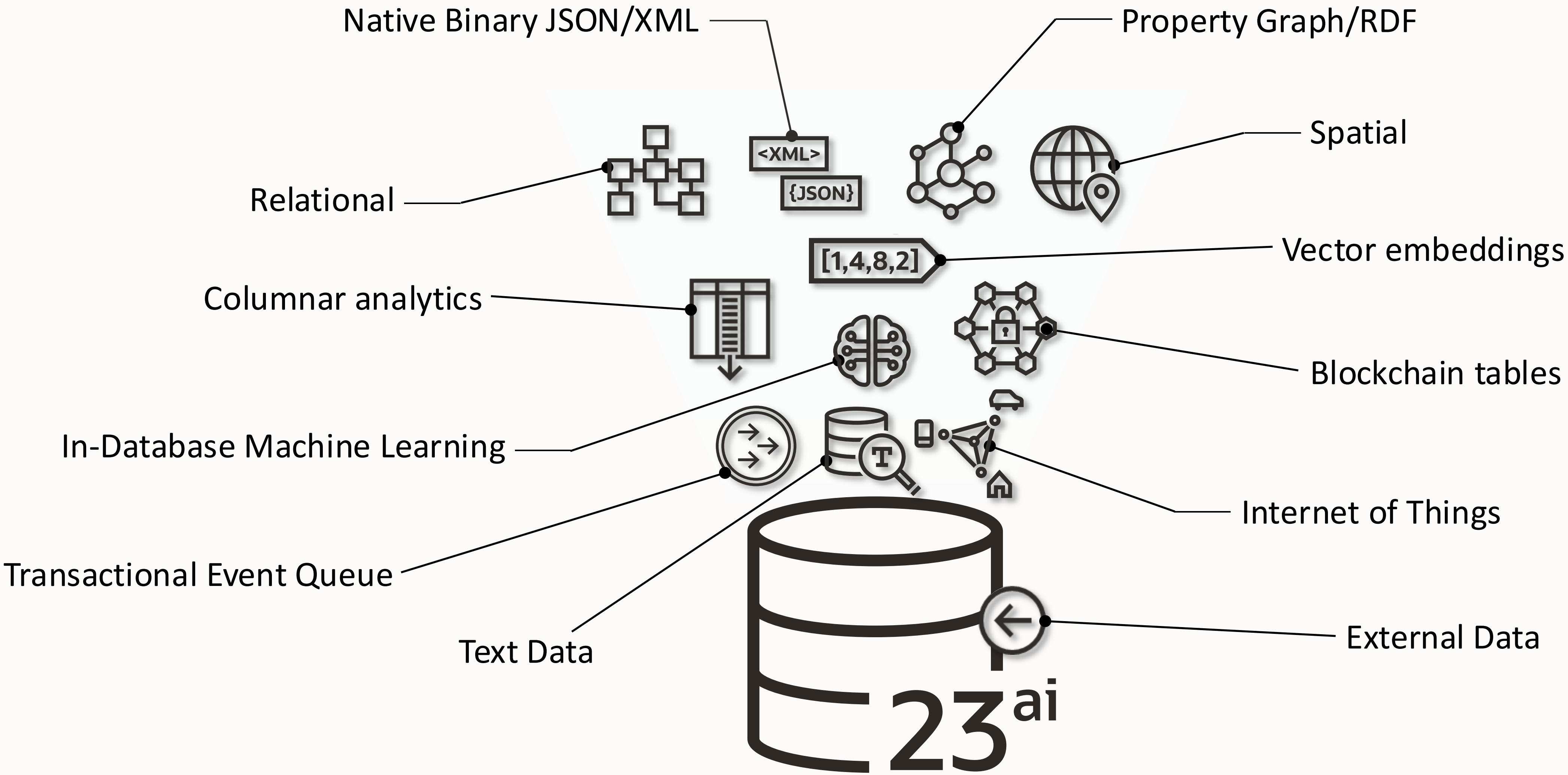
ORACLE

So, what is new in 26ai for HA and DR?

Oracle Converged Database



Native Binary JSON/XML

Property Graph/RDF

Spatial

Relational

Vector embeddings

Columnar analytics

Blockchain tables

In-Database Machine Learning

Internet of Things

Transactional Event Queue

Text Data

External Data

What’s new with Maximum Availability Architecture in 26ai

Fast Start Reconfiguration

Fast Pluggable Database Open

Oracle AI Database 26ai

Support for the latest 23ai HA features

Flashback Time Travel Enhancements

Single-Server Rolling Maintenance

Local Rolling Database Maintenance

Data Guard per Pluggable Database (DGPDB)

Online Database patching support

Smart Connection Rebalancing

Faster Role Transitions

Pluggable Database Recovery Isolation

Manage Data Guard with PL/SQL

Application Continuity Advanced Cursor Handling

DBMS_ROLLING Upgrades without user impact

Gold Image and working copy improvements

RAFT-Based Replication with Sharding

RAC Two-Stage Rolling Update

Simplified AWR Snapshot Creation on Active Data Guard

Minimized Stall in Max Performance FSFO

Strict Database Validation

DB-Initiated Planned Failover during Draining

Application Continuity Driver Updates

Oracle Update Advisor

Real Applications Clusters

Data Guard

Global Distributed DB

Fleet Patching and Provisioning

Application Continuity

Oracle Real Application Clusters

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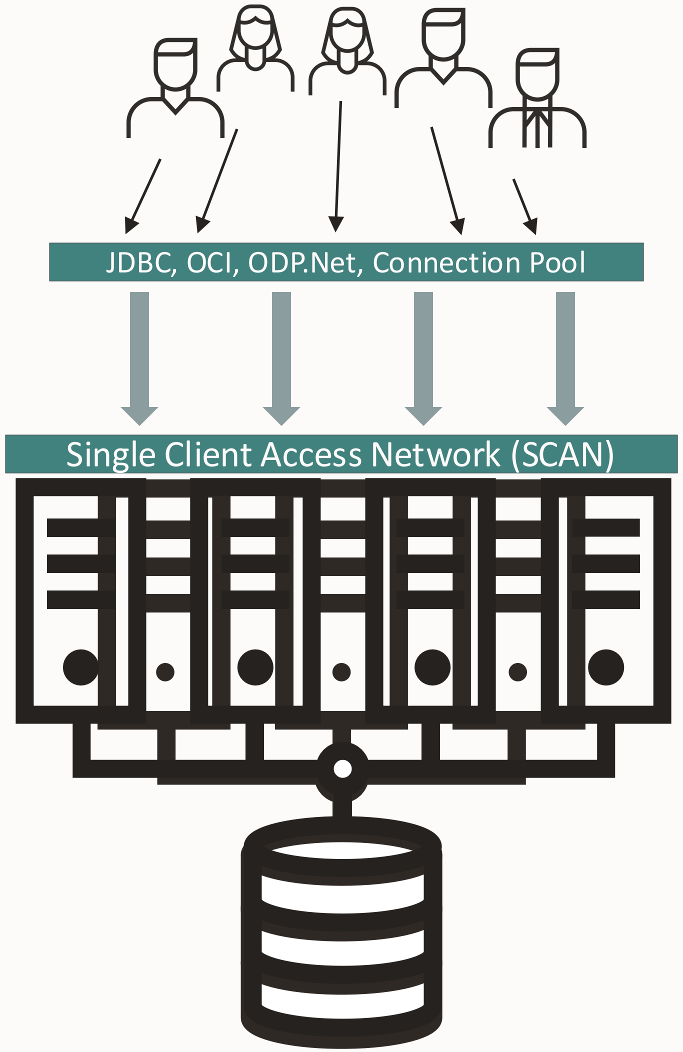
Oracle Real Application Clusters (Oracle RAC)

Active Active instances provide unmatched scalability, performance and availability


JDBC, OCI, ODP.Net, Connection Pool
Single Client Access Network (SCAN)

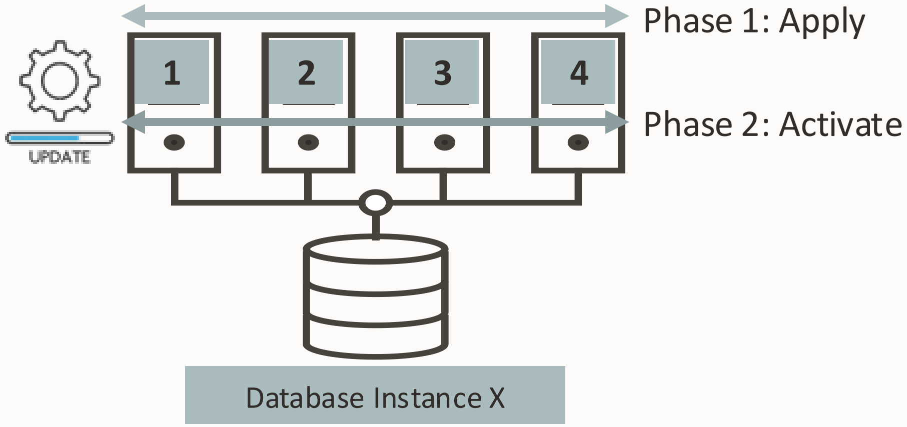
1. Modern database architecture with concurrent active active instances
2. Scales OLTP, DSS, and Hybrid Workloads by simply adding nodes to the cluster without incurring downtime
3. Applications supported on single instance runs without any changes on Oracle RAC
4. Zero downtime rolling patching for OS, Grid Infrastructure, and Oracle Database

1

Two Stage Rolling Patches

Lesser exceptions to “rolling patch-enabled”

New In 26ai



- Two Stage Rolling Patches enable “non-rolling patches” to be applied in a rolling fashion
- The update operation separates applying binary changes and activating the change into phases:
  - Phase 1:
    the patch is applied to all instances but not enabled
  - Phase 2:
    the patch is enabled via a SQL command
- Increase availability by avoiding downtime due to previously non-rolling patches

```
SQL> Alter system enable RAC two_stage rolling updates all;
```

2

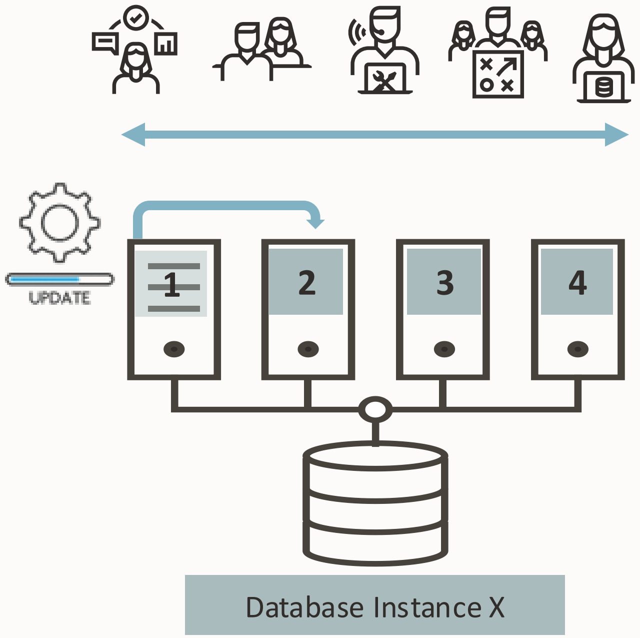
New In 26ai

Single Server Rolling Database Maintenance

Perform Oracle RAC-like Rolling Updates and other rolling maintenance *on a single server*

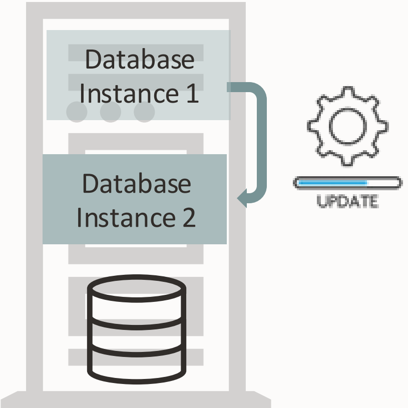
Traditional Rolling Updates using Oracle RAC

- Require two or more nodes
- Relocate work across nodes
- Require an Oracle RAC setup
  - Shared storage, multiple networks, etc.



Single Server Rolling Maintenance

- Requires RAC One Node on one server only
- Uses a single server configuration
  - No shared storage, single network, etc.
  - Needs to temporarily accommodate the second instance in terms of memory/CPU allocation.



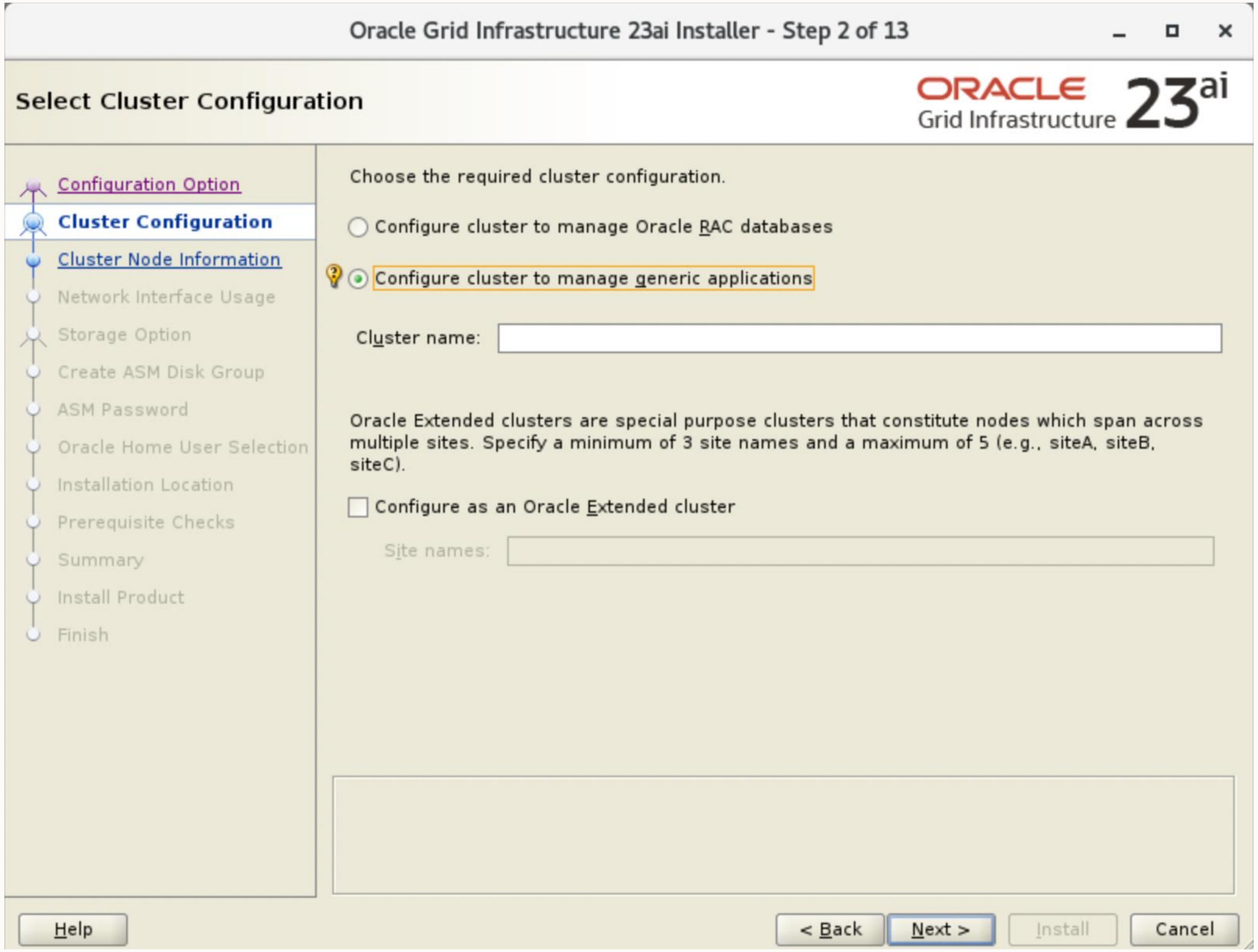
  - In RAC, use “Local Rolling Database Maintenance” for the same functionality on a node in a cluster.

General Purpose Clusterware

3

New In 26ai

- New Clusterware deployment option to provide cluster management services for applications (non-RAC) deployments
- A general-purpose cluster does not require resources like VIP, etc
- Can be converted to a Cluster for Oracle RAC by adding resources like VIP



Oracle Grid Infrastructure 23ai Installer - Step 2 of 13

Select Cluster Configuration

Choose the required cluster configuration.

○ Configure cluster to manage Oracle RAC databases

● Configure cluster to manage generic applications

Cluster name:

Oracle Extended clusters are special purpose clusters that constitute nodes which span across multiple sites. Specify a minimum of 3 site names and a maximum of 5 (e.g., siteA, siteB, siteC).

□ Configure as an Oracle Extended cluster

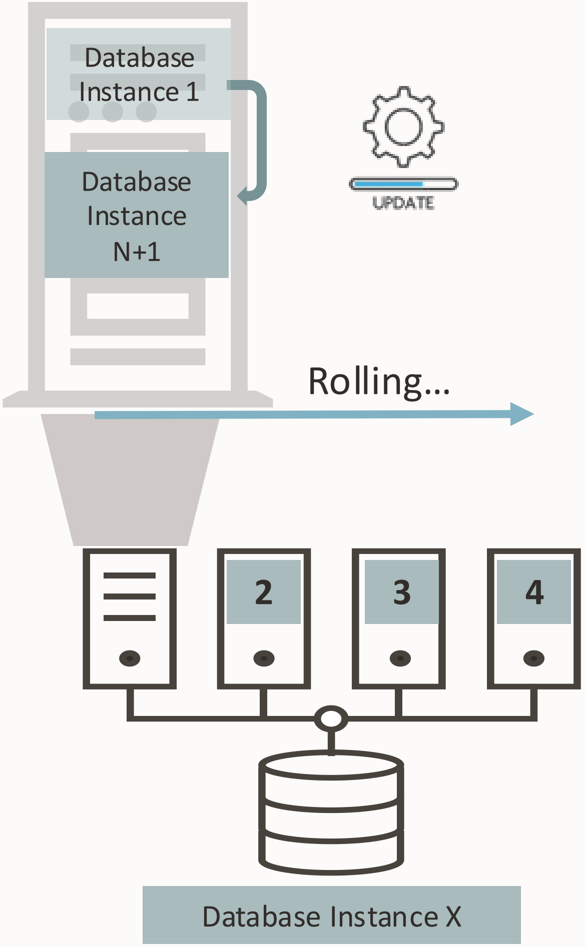
Site names:

Local Rolling Database Maintenance

4

New In 26ai

How it works in an Oracle RAC Cluster

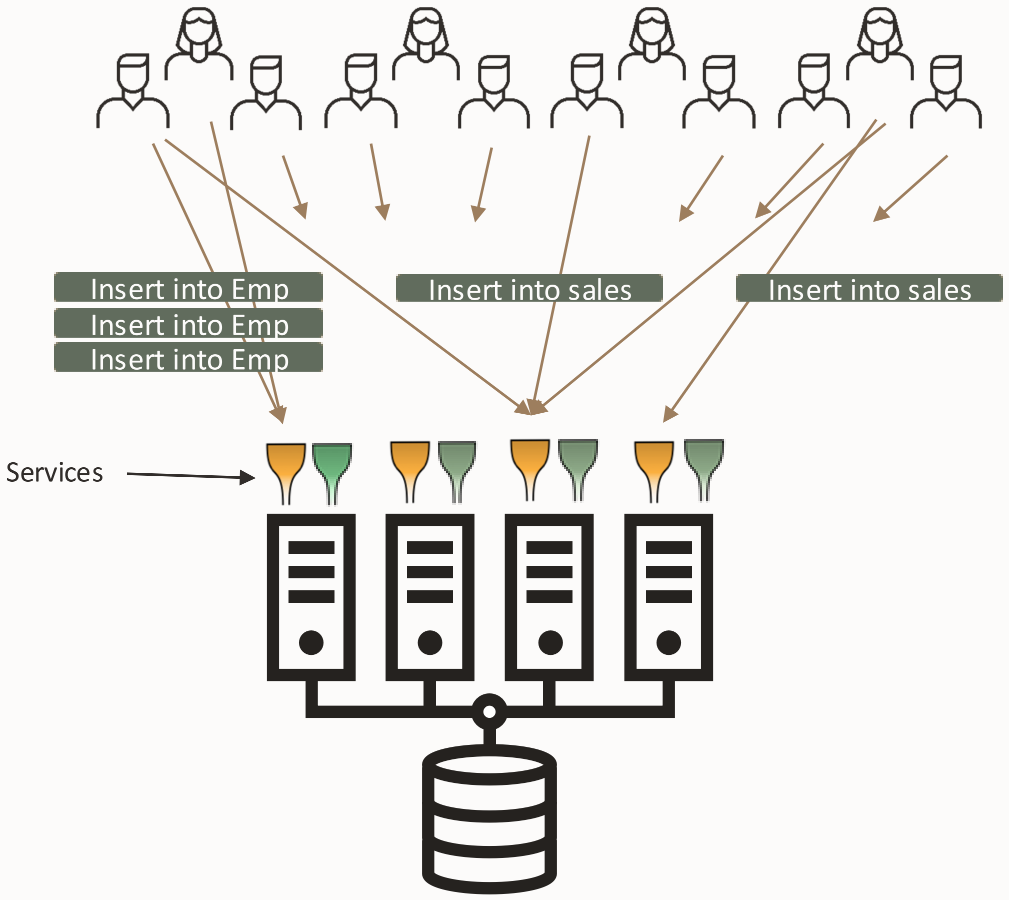


- Local Rolling Database Maintenance prevents interruptions to remaining nodes during a rolling patch application as much as possible
  - It starts another instance on the same node and relocates sessions to the new instance
- Session failover to another instance on the same node reduces CPU and **network overhead**
  - It requires adequate CPU and memory resources on the node to run two instances
  - Use with (Transparent) Application Continuity to hide database downtime from your users
- DBA operations need to take a new ORACLE_HOME and SID into account:
  - `srvctl modify database -d <dbname> -o $NEW_HOME –`**`localrolling`**
  - `srvctl `**`transfer instance`**` -d <dbname>`

Oracle RAC Smart Connection Rebalancing

5

New In 26ai



- Goal: Redirect sessions running workloads accessing the same database objects to the same instance without any interruption
  - Redirects sessions without DBA intervention

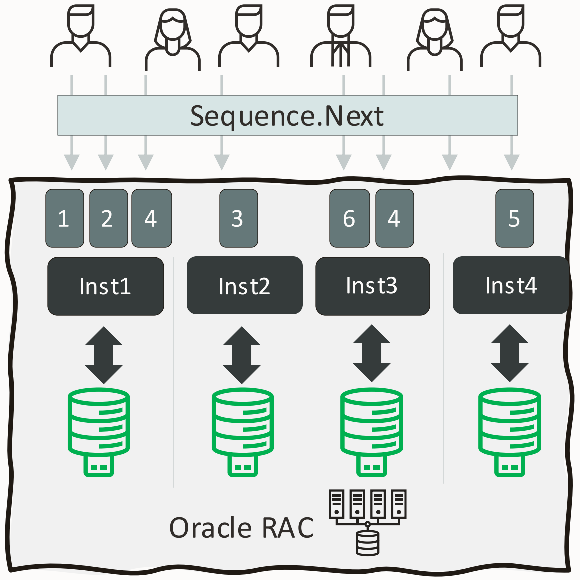
- Enable Smart Connection Rebalancing by setting the RLBGOAL service attribute:
  - $srvctl modify service -d <database> -s <service_name> -rlbgoal **SMART_CONN**

Oracle RAC Ordered Sequences optimization

6

New In 26ai

2x improvement in throughput



Oracle sequences are unique number generators used to generate automatic primary keys

- An ordered sequence enforces ordering across an RAC cluster using an instance lock
- In some cases, heavy contention on this lock, even when the sequence is only used on one instance, impacts throughput

Oracle RAC 23ai allows batched reservations where exclusive lock holders reserve values for waiters

- Batched reservation of values for waiters on the master node
- Sequence access on 1 node: wait time reduced by factor of 3, **~40% increase in throughput**
- Sequence access on 8 nodes: wait time reduced by a factor of 2, **2x increase in throughput**

Oracle RAC on Containers

7

New In 26ai

RAC on Podman

- Podman images allow for fast, lightweight deployment of the RAC cluster
- Supports Oracle Linux 8
- Base 23ai release Podman image distributed on GitHub / Oracle Container Registry
- Customers can manually apply RUs to the base image
- Customers can create custom images with RUs or other patches

RAC on Kubernetes

- Kubernetes orchestrates the deployment of RAC container images across a pod
- Initial support on Oracle Linux Cloud Native Environment (OLCNE)

#OraOperator support for Oracle RAC (Coming Soon)

8

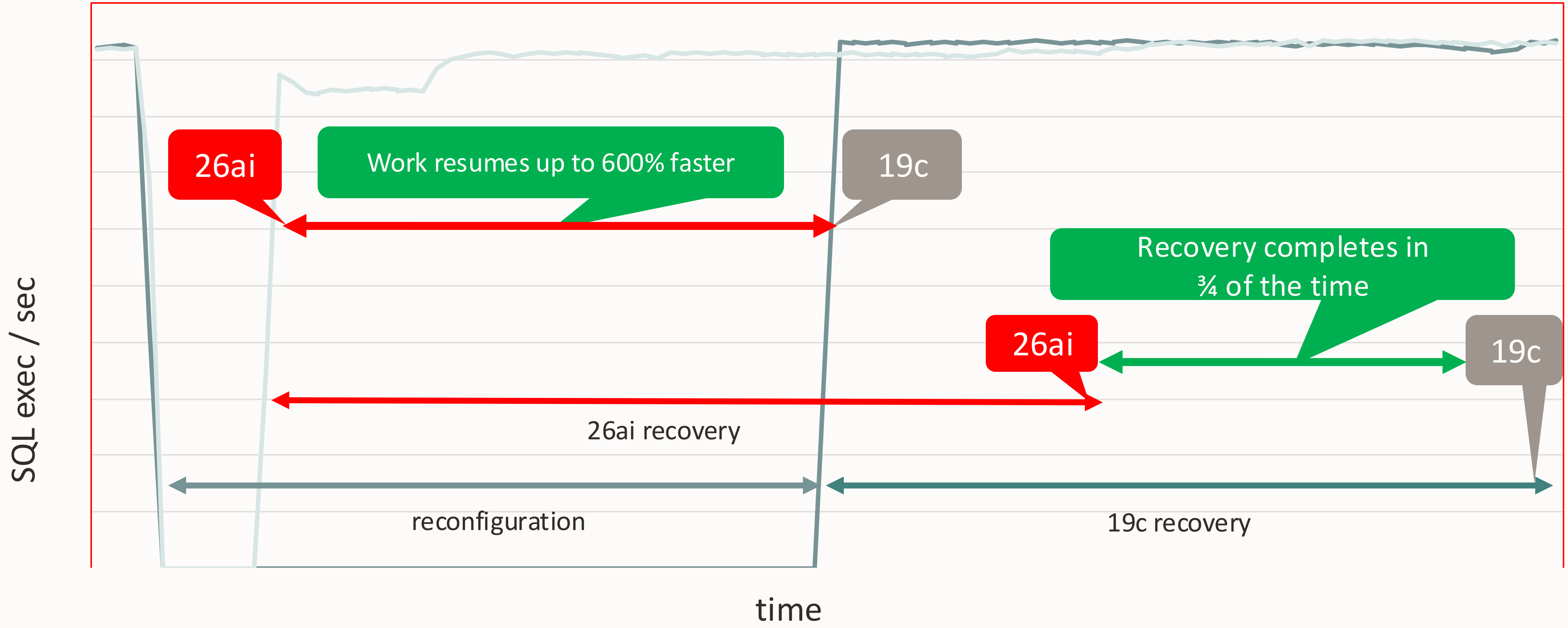
New In 26ai

Oracle RAC Fast Start Reconfiguration

Node failures in a cluster happen – now the recovery is faster

Instead of pausing work for reconfiguration and instance recovery after an instance crash,

- Oracle RAC Fast Start Reconfiguration allows work to start on clean blocks immediately

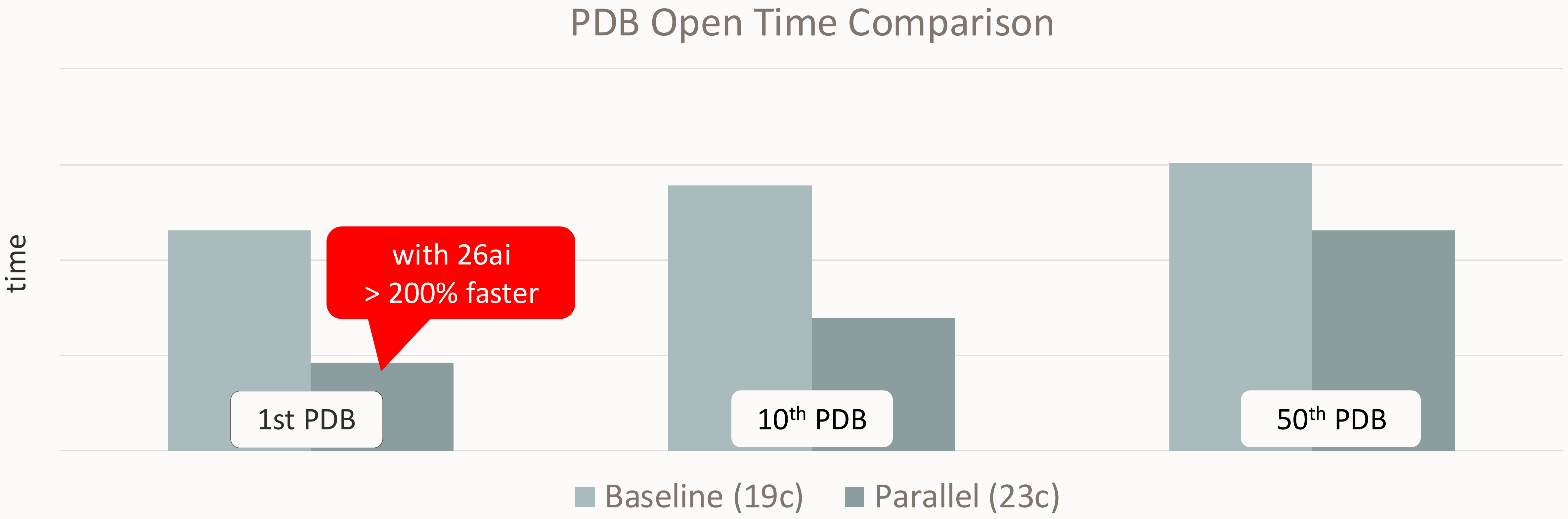


Oracle RAC Fast Pluggable Database Open

9

New In 26ai

- Up to 200% faster PDB open by performing **open in parallel** with DLM reconfiguration



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Oracle Data Guard and Active Data Guard

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Oracle AI Database

26ai

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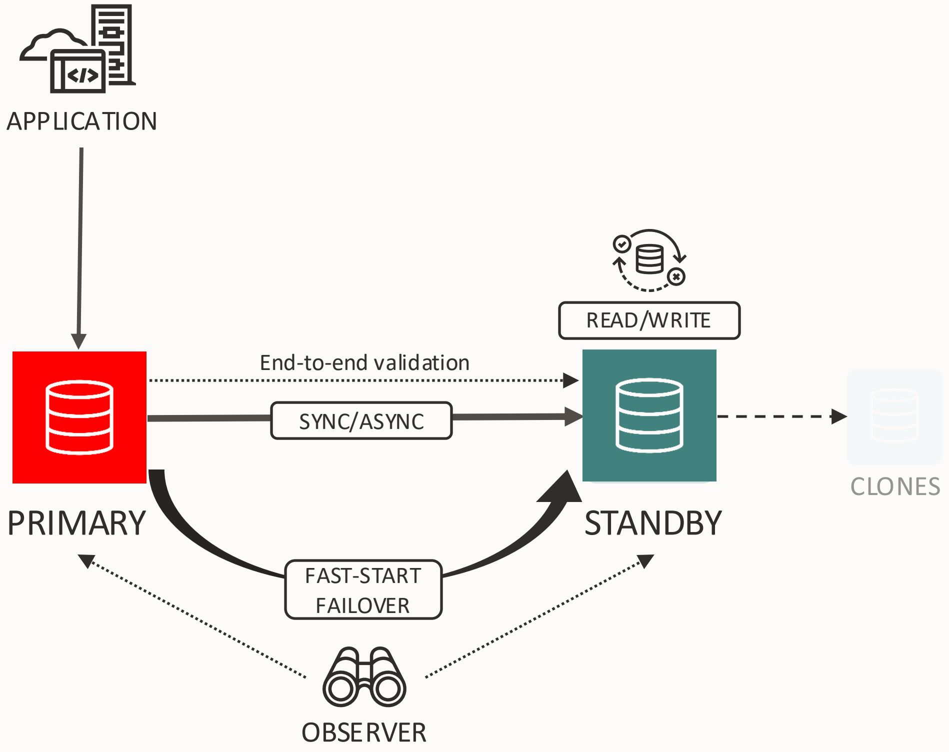
The best disaster recovery solution for the Oracle AI Database



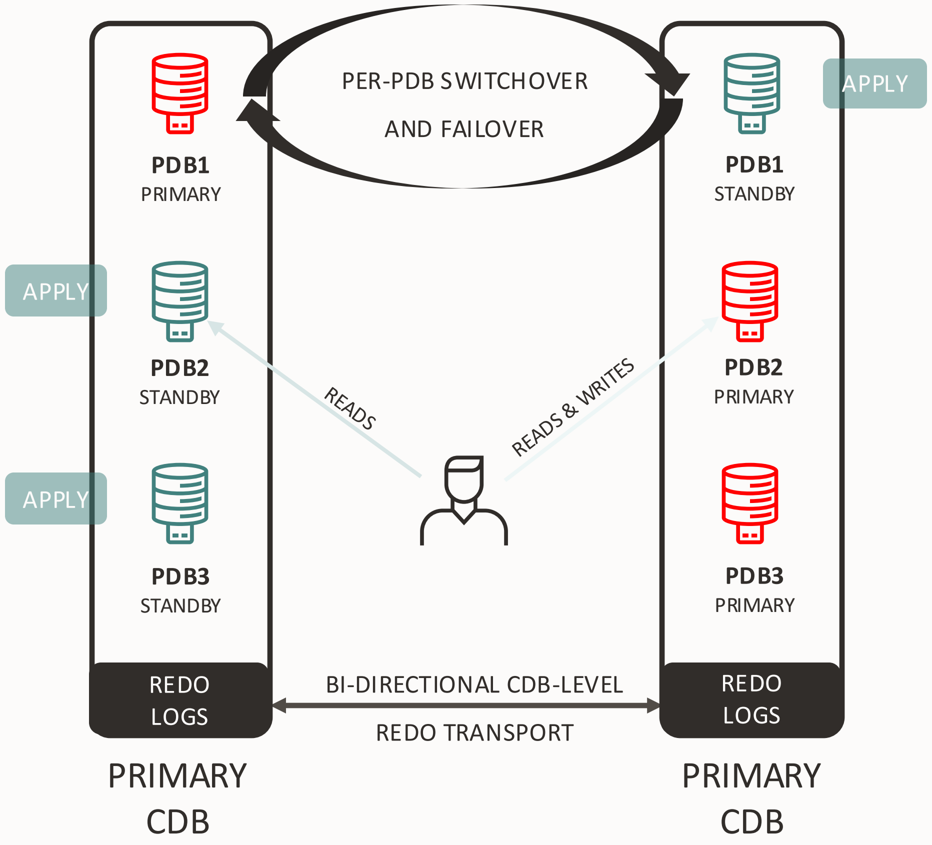
Disaster Recovery

- Standby database(s) ready to take over
- End-to-end validation: corruptions are not replicated
- Synchronous or asynchronous replication
- Zero or near-zero data loss protection
- Automatic failover, low Recovery Time Objective (RTO)

Testing and cloning

- The standby database can be temporarily open read/write
- The standby database can be used as a source for clones

Oracle Data Guard per Pluggable Database



Protection at the PDB level

- Redo transport is shared → Consolidation benefits
- Redo apply is dedicated for each PDB
- Individual PDB switchover and failover

Read-Only Standby PDBs

- Standby PDBs can be opened read-only → Offloading

Setup guide:

Read more:

Don't leave your infrastructure idle

Meet business requirements

Meet real-time reporting requirements and achieve the ultimate read-only scalability without impacting the primary database's performance.

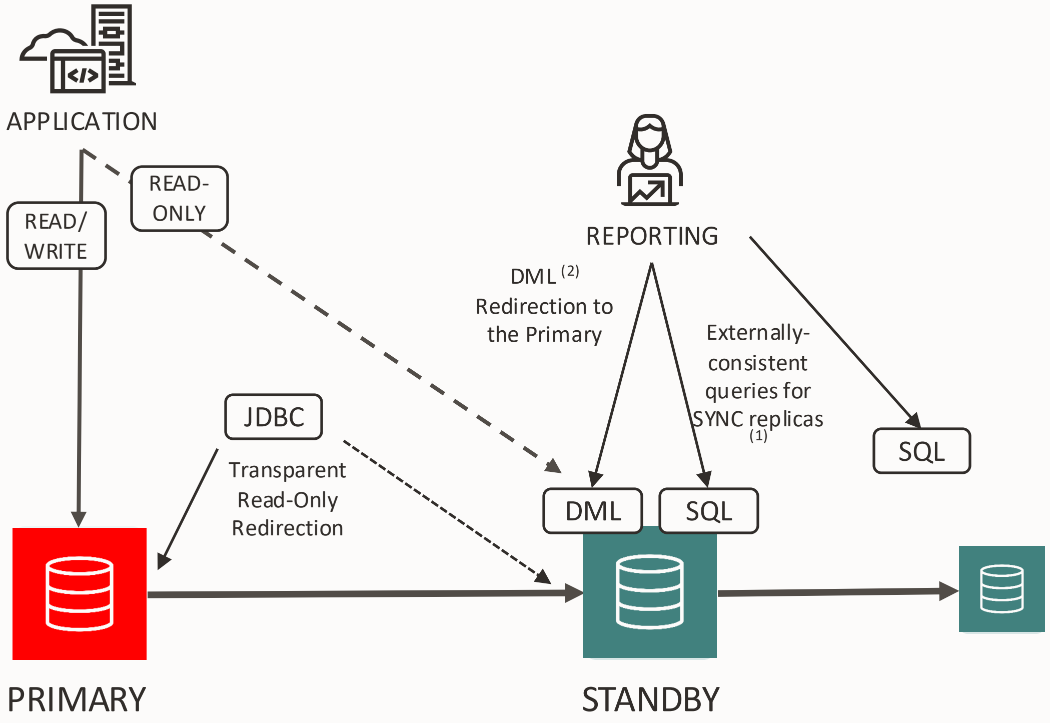
Enhanced data protection

Advanced protection features keep all transactions secured against outages, regional disasters, and corruption.

Higher application availability

The application keeps working during outages, maintenance, and upgrades.

Meet your business requirements: offload and scale


APPLICATION
READ/ WRITE
READ-ONLY
REPORTING
DML (2) Redirection to the Primary
Externally-consistent queries for SYNC replicas (1)
JDBC
Transparent Read-Only Redirection
SQL
DML
SQL
PRIMARY
STANDBY

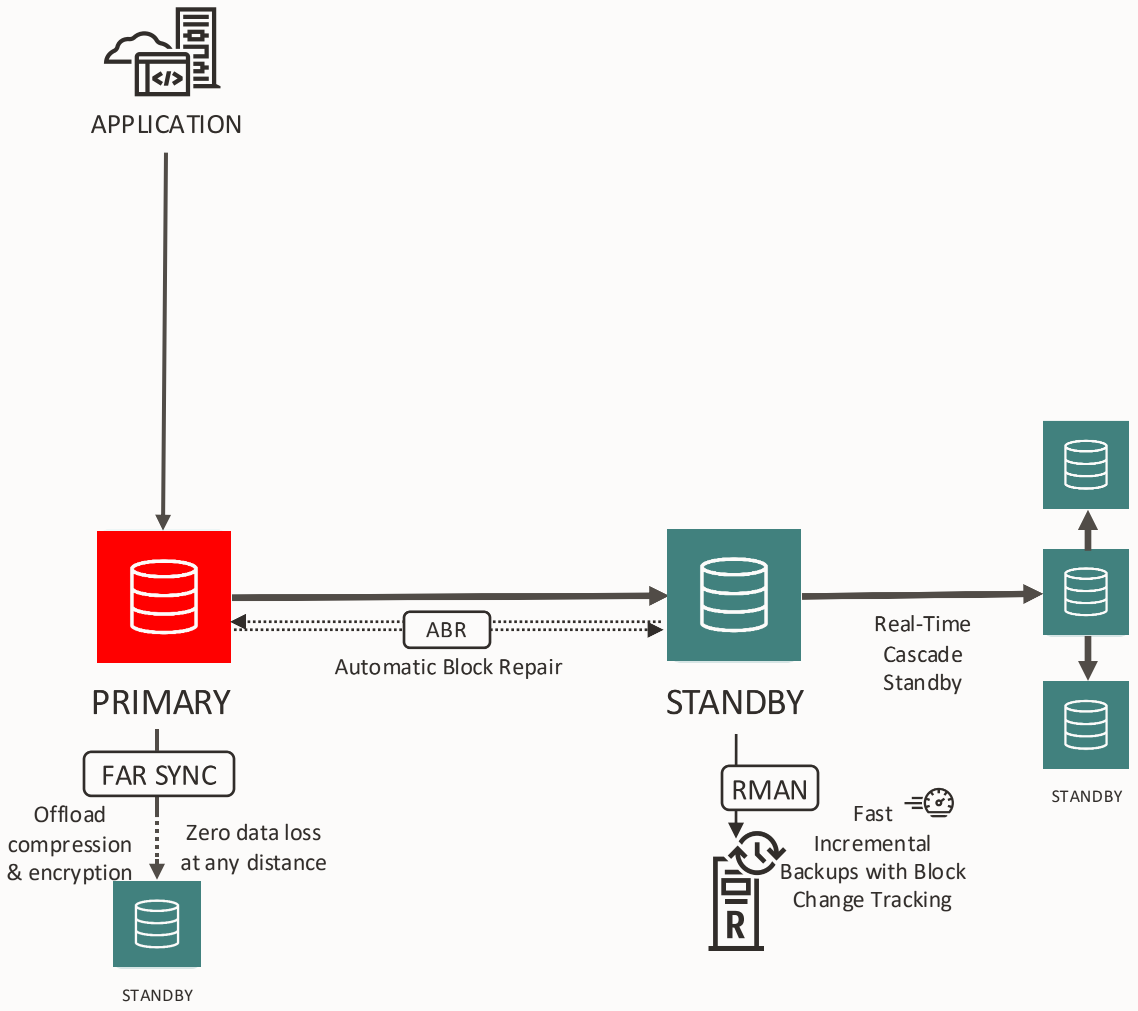
Offload & scale

Don't leave your standby infrastructure idle:

- **Offload** queries, reports, and backups
- **Linearly scale** the application's read-only activity
- **Increase** read/write **throughput** by freeing important resources
- Transparently load balance across replicas

(1) Full support for Vectors, Graph, Spatial, JSON, In-memory, etc.
(2) And PL/SQL, and some DDLs such as CREATE GLOBAL TEMPORARY TABLE

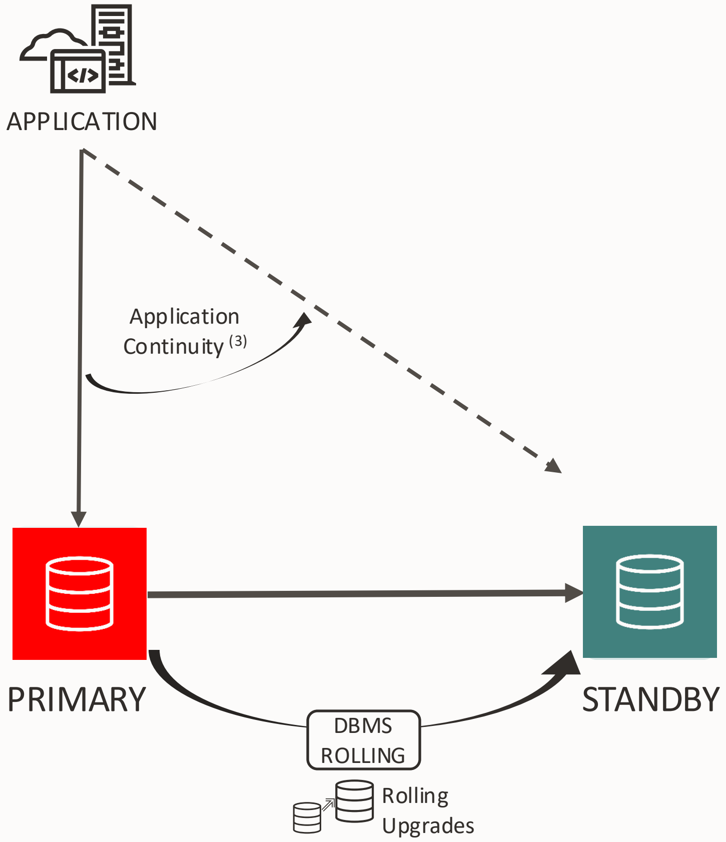
Achieve superior data and transaction protection



Enhanced protection

- All your transactions are **protected regardless of the distance**
- Block corruptions are **fixed** on the fly **without application errors**
- Cascaded standbys protect your transactions without delay
- Backups are **incredibly fast**, also on the standby database

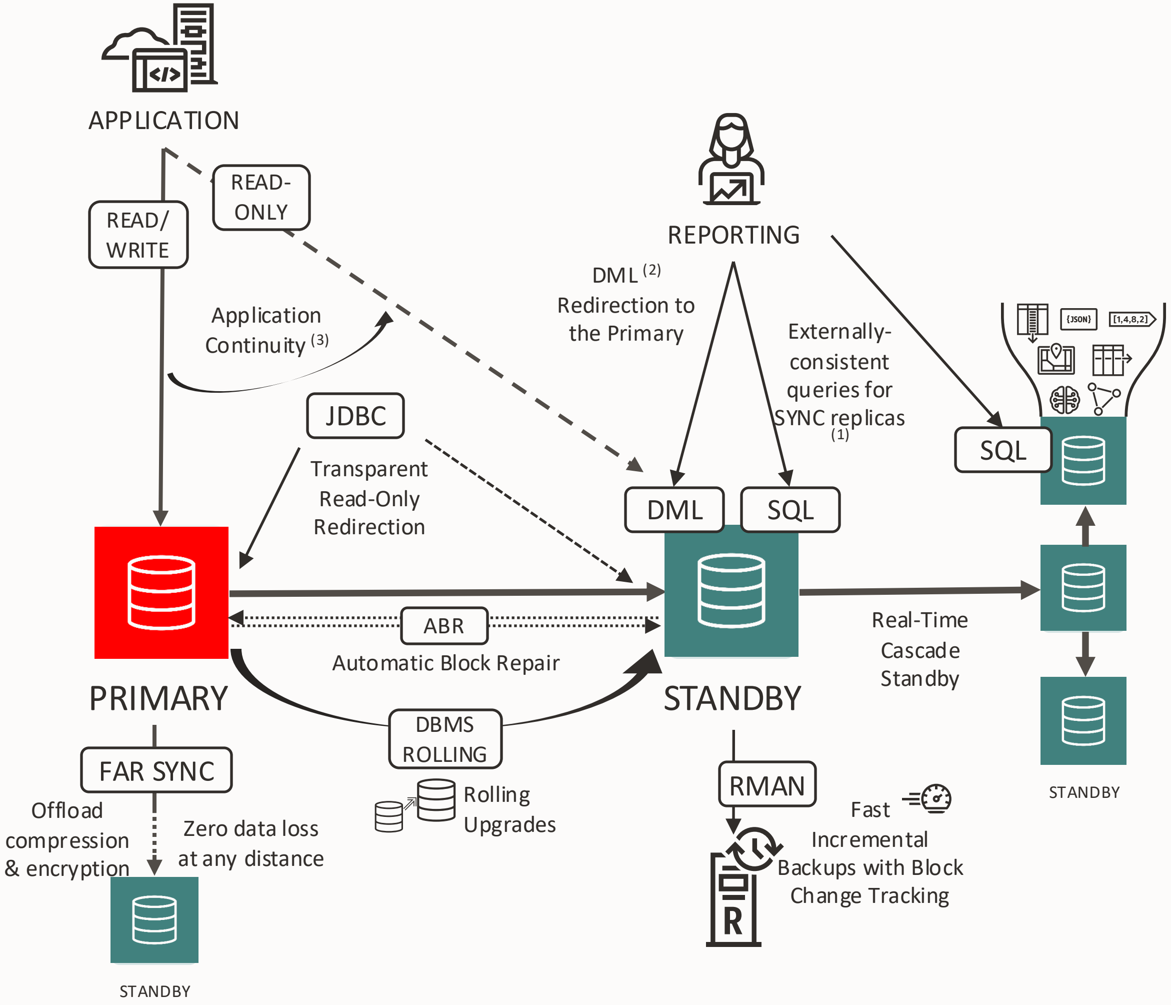
Keep your business running without interruption



Higher availability

- Major **upgrades are transparent** or require minimal downtime
- **Mask failovers** to the application **without additional coding**

Oracle Active Data Guard features


APPLICATION
READ/ WRITE
READ-ONLY
Application Continuity (3)
JDBC
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REPORTING
DML (2) Redirection to the Primary
Externally-consistent queries for SYNC replicas (1)
DML
SQL
SQL
PRIMARY
ABR
Automatic Block Repair
DBMS ROLLING
Rolling Upgrades
STANDBY
Real-Time Cascade Standby
STANDBY
FAR SYNC
Offload compression & encryption
Zero data loss at any distance
STANDBY
RMAN
Fast Incremental Backups with Block Change Tracking

(1) Full support for Vectors, Graph, Spatial, JSON, In-memory, etc.

(2) And PL/SQL, and some DDLs such as CREATE GLOBAL TEMPORARY TABLE

(3) Mask outages and failovers to the application with minimal or no additional coding

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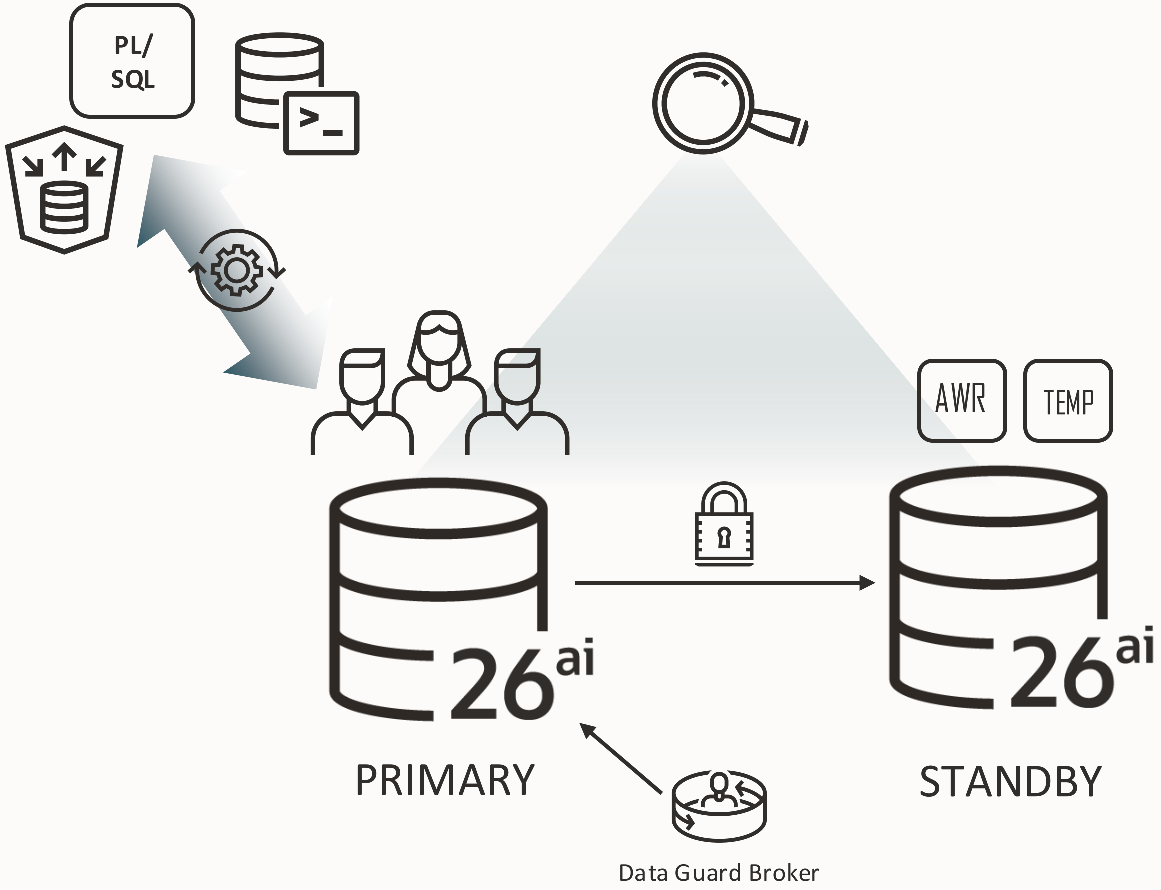
10

New In 26ai

Active Data Guard 26ai furtherly enhances the experience

Enhanced performance, observability, and manageability



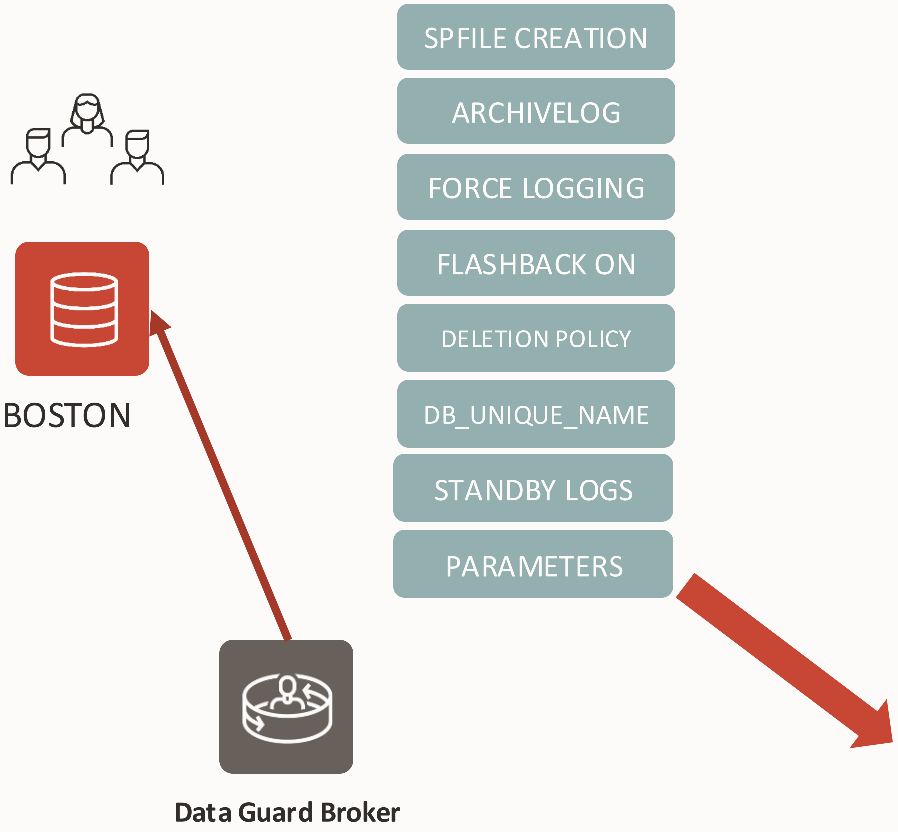
- Automatic preparation of the primary
- PL/SQL APIs for better automation
- SQLcl command-line integration
- REST APIs for easier DevOps integration
- 4 new SQL views to monitor Data Guard
- Support for mixed Transparent Data Encryption
- Automatic temp file creation on the standby
- Simplified AWR snapshots on the standby DB

Oracle Data Guard 26ai is Simple

10

New In 26ai

Automatic preparation of the primary for a faster and easier creation of Data Guard environments.



```
DGMGRL> PREPARE DATABASE FOR DATA GUARD
WITH DB_UNIQUE_NAME IS boston
DB_RECOVERY_FILE_DEST IS "+FRA"
DB_RECOVERY_FILE_DEST_SIZE is "400G"
BROKER_CONFIG_FILE1 IS "+DATA/BOSTON/dg1.dat"
BROKER_CONFIG_FILE2 IS "+FRA/BOSTON/dg2.dat";
```

- If the parameters are good enough, they are not modified
- It restarts the database for:
  - Changes to static parameters
  - Enabling the Archivelog mode

```
DB_FILES                      = 1024
LOG_BUFFER                    = 256M
DB_BLOCK_CHECKSUM             = TYPICAL
DB_LOST_WRITE_PROTECT         = TYPICAL
DB_FLASHBACK_RETENTION_TARGET = 120
PARALLEL_THREADS_PER_CPU      = 1
STANDBY_FILE_MANAGEMENT       = AUTO
DG_BROKER_START               = TRUE
```

Oracle Data Guard 26^{ai} is Simple

10

New In 26^{ai}

PL/SQL APIs for better automation: Manage Data Guard configurations from any SQL*Net connection using the DBMS_DG PL/SQL package (more than 30 new functions) .

```
DECLARE
       severity BINARY_INTEGER;
       retcode  BINARY_INTEGER;
BEGIN

       retcode := DBMS_DG.CREATE_CONFIGURATION (
       config_name    =>      'mydb'
              primary_ci      =>      'site1-scan:1521/mydb'
              severity        =>      severity
       );

       IF retcode != 0 THEN
              /* handle error code */
       END IF;

       retcode := DBMS_DG.ADD_DATABASE (
              database_name   =>      'mydb_site2'
              database_ci     =>      'site2-scan:1521/mydb'.
              severity        =>      severity
       );
END
```

Create the configuration

Add the standby database

Oracle Data Guard 26^{ai} is Simple

10

New In 26^{ai}

REST APIs for easier DevOps integration, making Data Guard ready for modern DevOps deployments (New in ORDS 21.4 for 21c databases)

```
POST /database/dataguard/configuration/
{
        “primary_connection_identifier”: “site1-scan:1521/mydb”,
        “primary_database”: “mydb_site1”
}
```

Create the configuration

```
POST /database/dataguard/databases/
{
        “connection_identifier”: “site2-scan:1521/mydb”,
        “database_name”: “mydb_site2”
}
```

Add the standby database

```
PUT /database/dataguard/configuration/
{
        “operation”: “ENABLE”
}
```

Enable the configuration

Oracle Data Guard 26^{ai} is Simple

10

New In 26ai

Data Guard management for SQLcl, everything under control with a single command-line tool (New on SQLcl 22.1)

```
SQL> help dg
DG
------
 Run DG commands

 DG ADD DATABASE "<database name>" AS CONNECT IDENTIIFIER IS <connect identifier> [ INCLUDE CURRENT DESTINATIONS ];
 DG CREATE CONFIGURATION "<config_name>" AS PRIMARY DATABASE IS <database name> CONNECT IDENTIIFIER IS <connect_identifier>
        [ INCLUDE CURRENT DESTINATIONS ];
 DG DISABLE CONFIGURATION;
 DG DISABLE { DATABASE | RECOVERY_APPLIANCE | FAR_SYNC | MEMBER } <member name>;
 DG EDIT CONFIGURATION SET PROPERTY <property name> = '<property value>';
 DG EDIT { DATABASE | RECOVERY_APPLIANCE | FAR_SYNC | MEMBER } <member name> SET PROPERTY <property name> = '<property value>' ;
 DG ENABLE CONFIGURATION;
 DG ENABLE { DATABASE | RECOVERY_APPLIANCE | FAR_SYNC | MEMBER } <member name>;
 DG FAILOVER TO <database name> [IMMEDIATE];
 DG REINSTATE DATABASE <database name>;
 DG REMOVE CONFIGURATION [PRESERVE DESTINATIONS];
 DG REMOVE { DATABASE | RECOVERY_APPLIANCE | FAR_SYNC | MEMBER } <name> [PRESERVE DESTINATIONS];
 DG SHOW CONFIGURATION [<property name>];
 DG SHOW DATABASE <database name> [<property name];
 DG SWITCHOVER TO <database name> [WAIT [<timeout in seconds]];
```

10

Oracle Data Guard 26ai is Simple

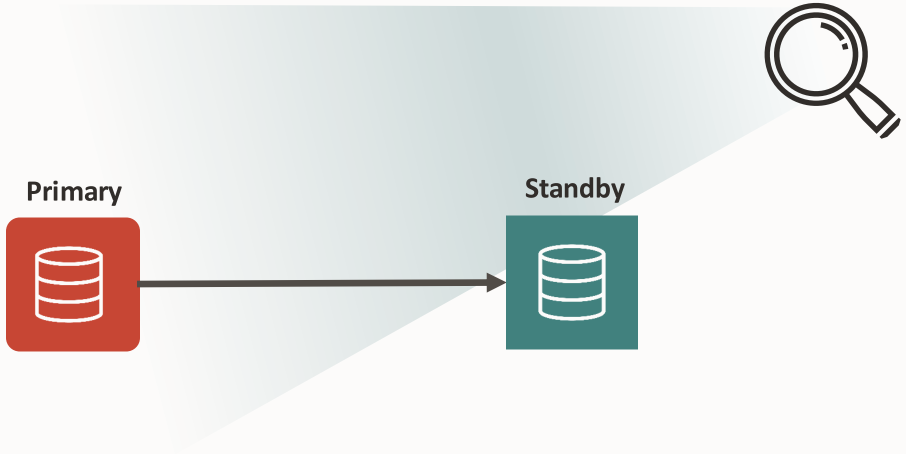
New In 26ai

New SQL views to monitor Data Guard

V$DG_BROKER_PROPERTY, contains the properties of the configuration and all the members

```
SQL> select member, property, value
from v$DG_BROKER_PROPERTY
where value is not null;

MEMBER          PROPERTY                       VALUE
-------------   ----------------------------   ----------
mydb            FastStartFailoverThreshold     180
mydb            OperationTimeout               30
mydb            TraceLevel                     USER
mydb            FastStartFailoverLimit         300
mydb            CommunicationTimeout           180
mydb            ObserverReconnect              0
mydb            ObserverPingRetry              0
…
mydb_site1      DGConnectIdentifier            mydb_site1
mydb_site1      FastStartFailoverTarget        mydb_site2
mydb_site1      LogShipping                    ON
mydb_site1      LogXptMode                     ASYNC
mydb_site1      DelayMins                      0
…
mydb_site1      StaticConnectionIdentifier      (DESCRIPTION=<….>)))
mydb_site1      TopWaitEvents                   (monitor)
mydb_site1      SidName                         (monitor)
mydb_site1      DGConnectIdentfier             mydb_site2
…
66 rows selected
```



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New In 26ai

Oracle Data Guard 26ai is Simple

New SQL views to monitor Data Guard

V$DG_BROKER_ROLE_CHANGE that displays information about the last ten role changes across a Data Guard broker configuration;

```
SQL> select * from V$DG_BROKER_ROLE_CHANGE;

EVENT               STANDBY_TYPE OLD_PRIMARY NEW_PRIMARY FS_FAILOVER_REASON   BEGIN_TIME           END_TIME
------------------- ------------ ----------- ----------- -------------------- -------------------- --------------------
Failover            Physical     mydb1       mydb1b      Manual Failover      30-SEP-2022 19:01:14 30-SEP-2022 19:01:35
Switchover          Physical     mydb1b      mydb1                            30-SEP-2022 19:04:53 30-SEP-2022 19:05:15
Switchover          Physical     mydb1       mydb1b                           30-SEP-2022 20:51:38 30-SEP-2022 20:52:03
Failover            Physical     mydb1b      mydb1       Manual Failover      30-SEP-2022 20:52:46 30-SEP-2022 20:53:04
Switchover          Physical     mydb1       mydb1c                           30-SEP-2022 19:53:14 30-SEP-2022 19:54:14
Switchover          Physical     mydb1c      mydb1                            30-SEP-2022 20:03:14 30-SEP-2022 20:04:04
Switchover          Logical      mydb1       mydb1d                           30-SEP-2022 20:24:46 30-SEP-2022 20:26:32
Switchover          Logical      mydb1d      mydb1                            30-SEP-2022 20:35:27 30-SEP-2022 20:35:48
Fast-Start Failover Physical     mydb1       mydb1b      Primary Disconnected 30-SEP-2022 20:13:51 30-SEP-2022 20:14:53
```

TRACK
SWITCHOVER
TRACK

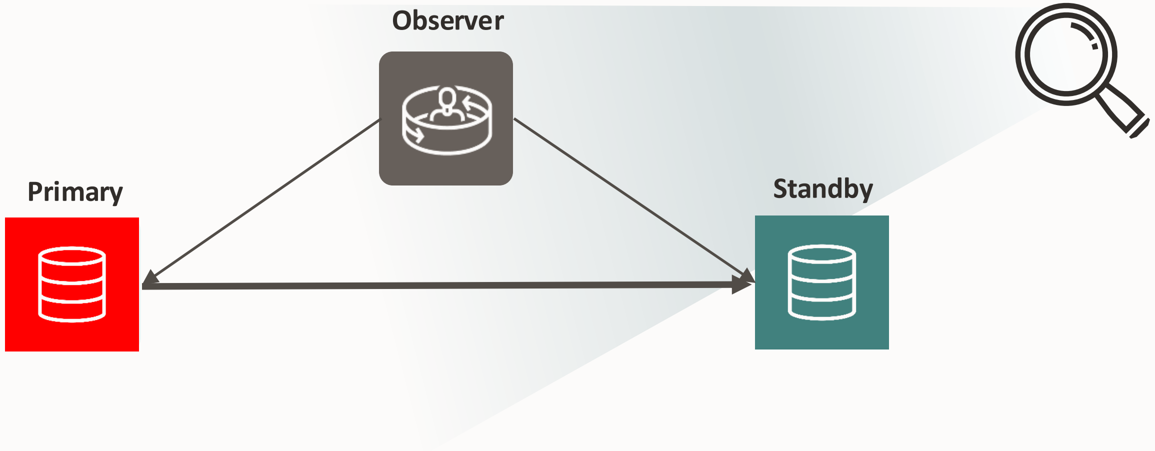
10

New In 26ai

Oracle Data Guard 26ai is Simple

New SQL views to monitor Data Guard

V$FAST_START_FAILOVER_CONFIG which displays configuration details about Oracle Data Guard Fast-Start-Failover



```
SQL> desc V$FAST_START_FAILOVER_CONFIG;
 Name                       Null?    Type
 -------------------------- -------- ------------------
 FSFO_MODE                           VARCHAR2(19)
 STATUS                              VARCHAR2(22)
 CURRENT_TARGET                      VARCHAR2(30)
 THRESHOLD                           NUMBER
 OBSERVER_PRESENT                    VARCHAR2(7)
 OBSERVER_HOST                       VARCHAR2(512)
 PING_INTERVAL                       NUMBER
 PING_RETRY                          NUMBER
 PROTECTION_MODE                     VARCHAR2(30)
 LAG_LIMIT                           NUMBER
 AUTO_REINSTATE                      VARCHAR2(5)
 OBSERVER_RECONNECT                  NUMBER
 OBSERVER_OVERRIDE                   VARCHAR2(5)
 SHUTDOWN_PRIMARY                    VARCHAR2(5)
 CON_ID                              NUMBER
```

```
SQL> SELECT fsfo_mode, status, current_target, threshold, observer_present, observer_host,
 2> protection_mode, lag_limit, auto_reinstate, observer_override, shutdown_primary FROM V$FAST_START_FAILOVER_CONFIG;

FSFO_MODE           STATUS                 CURRENT_TARGET THRESHOLD OBSERVE OBSERVER_HOST PROTECTION_MODE  LAG_LIMIT AUTO_ OBSER SHUTD
------------------- ---------------------- -------------- --------- ------- ------------- ---------------- --------- ----- ----- -----
POTENTIAL DATA LOSS TARGET UNDER LAG LIMIT mydb_site2           180 YES     mydb-obs      MaxPerformance         300 TRUE  FALSE TRUE
```

Note: V$DATABASE columns starting with FS_FAILOVER_ are therefore deprecated.

10

New In 26^{ai}

Oracle Data Guard 26^{ai} is Simple

New SQL views to monitor Data Guard

V$FS_LAG_HISTOGRAM displays statistics that are based on the frequency of range of Fast-Start-Failover lag time. Lag time is assessed by the primary database every minute only, and no rows are shown if Fast-Start-Failover is disabled

```
SQL> select * from v$fs_lag_histogram;

   THREAD# LAG_TYPE      LAG_TIME  LAG_COUNT LAST_UPDATE_TIME        CON_ID
---------- ----------- ---------- ---------- -------------------- ----------
         1 APPLY                5        122 01/23/2023 10:46:07           0
         1 APPLY               10          5 01/02/2023 16:12:42           0
         1 APPLY               15          2 12/25/2022 12:01:23           0
         1 APPLY               30          0                               0
         1 APPLY               60          0                               0
         1 APPLY              120          0                               0
         1 APPLY              180          0                               0
         1 APPLY              300          0                               0
         1 APPLY            65535          0                               0
```

- Useful to calculate the optimal `FastStartFailoverLagTime` property.
- It shows also the most recent occurrence for each bucket.
- `LAG_TIME` is the upper bound of the bucket:
  - 5 -> between 0 and 5 seconds
  - 10 -> between 5 and 10 seconds
  - etc.
- It's calculated every minute, only when Fast-Start Failover is enabled (also in observe-only mode)

10

New In 26^{ai}

Oracle Data Guard 26^{ai} is Simple

New command: VALIDATE DGConnectIdentifier to check network resolution, connectivity, password, and service name from the database

```
DGMGRL> validate dgconnectidentifier mydb_site2;
At instance 'mydb' of member 'mydb_site1'
  Connect Descriptor:
(DESCRIPTION=(ADDRESS_LIST=(ADDRESS=(PROTOCOL=tcp)(HOST=host2)(PORT=1521)))(CONNECT_DATA=(SERVICE_NAME=mydb_site2.mydomain)(SERVER=DEDICATED)))

  Environment Variables:
             TNS_ADMIN: /u01/app/oracle/product/23.1.0.0/network/admin
           ORACLE_HOME: /u01/app/oracle/product/23.1.0.0
           ORACLE_BASE: /u01/app/oracle

  Initialization Parameters:
        LOCAL_LISTENER: host1:1521

  Connected to instance 'mydb' at member 'mydb_site2'

At instance 'mydb' of member 'mydb_site2'
  Connect Descriptor:
(DESCRIPTION=(ADDRESS_LIST=(ADDRESS=(PROTOCOL=tcp)(HOST=host2)(PORT=1521)))(CONNECT_DATA=(SERVICE_NAME=mydb_site2.mydomain)(SERVER=DEDICATED)))

  Environment Variables:
             TNS_ADMIN: /u01/app/oracle/product/23.1.0.0/network/admin
           ORACLE_HOME: /u01/app/oracle/product/23.1.0.0
           ORACLE_BASE: /u01/app/oracle

  Initialization Parameters:
        LOCAL_LISTENER: host2:1521

 Connected to instance 'mydb' at member 'mydb_site2'
```

service_name == db_unique_name

10

New In 26ai

Strict validation of switchover readiness

New command VALIDATE DATABASE STRICT (Available from 23.6)

```
DGMGRL> VALIDATE DATABASE mydb_site2

  Database Role:     Physical standby database
  Primary Database:  mydb_site1

  Ready for Switchover:  Yes
  Ready for Failover:    Yes (Primary Running)

  Flashback Database Status:
    Database       Status            Retention Target
    mydb_site1     Off               1440
    mydb_site2     Off               1440

...
```

No strict validation

The DB shows as `Ready for Switchover` if no conditions would prevent the switchover from working.

```
DGMGRL> VALIDATE DATABASE mydb_site2 STRICT ALL

  Database Role:     Physical standby database
  Primary Database:  mydb_site1

  Ready for Switchover:  No
  Ready for Failover:    Yes (Primary Running)

 Flashback Database Status:
    Database       Status            Retention Target
    mydb_site1     Off               1440
    mydb_site2     Off               1440

...
```

Strict validation

No conditions would prevent the switchover from working, but the new primary would miss some important configurations.

Syntax:

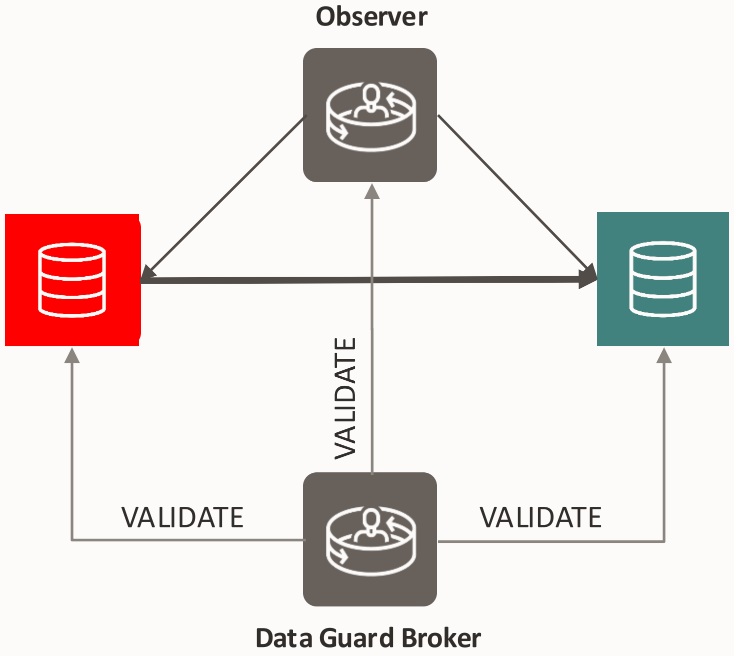
```
VALIDATE DATABASE [VERBOSE] <database> STRICT
{TEMP_FILES | FLASHBACK | LOG_FILES_CLEARED | LOG_FILE_CONFIGURATION | APPLY_PROPERTY | TRANSPORT_PROPERTY | ALL}
```

Fast Start Failover Configuration Validation

10

New In 26ai

Ensure everything is configured properly for the automatic failover



```
DGMGRL> VALIDATE FAST_START FAILOVER;
  Fast-Start Failover:  Enabled in Potential Data Loss Mode
  Protection Mode:     MaxPerformance
  Primary:                   North_Sales
  Active Target:          South_Sales

Fast-Start Failover Not Possible:
  Fast-Start Failover observer not started

Post Fast-Start Failover Issues:
  Flashback database disabled for database ‘dgv1’

Other issues:
  FastStartFailoverThreshold may be too low for RAC databases.

Fast-start failover callout configuration file "fsfocallout.ora" has
the following issues:
  Invalid lines
    foo=foo
  The specified file "./precallout" contains a path.
```

10

New In 26ai

Oracle Data Guard 26ai is Simple

New SQL views to monitor Data Guard

New commands: SHOW | EDIT ALL MEMBERS to easily manage members properties and parameters

```
-- DATA GUARD PROPERTIES
DGMGRL> SHOW ALL MEMBERS logxptmode
  mydb_site1: logxptmode = 'ASYNC'
  mydb_site2: logxptmode = 'ASYNC'

DGMGRL> EDIT ALL MEMBERS SET PROPERTY logxptmode ='SYNC';
Property "logxptmode" updated for member "mydb_site1".
Property "logxptmode" updated for member "mydb_site2".

DGMGRL> SHOW ALL MEMBERS logxptmode
 mydb_site1: logxptmode = 'SYNC'
 mydb_site2: logxptmode = 'SYNC'


-- DB PARAMETERS
DGMGRL> SHOW ALL MEMBERS PARAMETER fast_start_mttr_target
 mydb_site1: fast_start_mttr_target = '0'
 mydb_site2: fast_start_mttr_target = '0'

DGMGRL> EDIT ALL MEMBERS SET PARAMETER fast_start_mttr_target=15;
Parameter "fast_start_mttr_target" updated for member "mydb_site1".
Parameter "fast_start_mttr_target" updated for member "mydb_site2".

DGMGRL> SHOW ALL MEMBERS PARAMETER fast_start_mttr_target
 mydb_site1: fast_start_mttr_target = '15'
 mydb_site2: fast_start_mttr_target = '15'
```

Get and set Data Guard broker properties

Get and set Database parameters

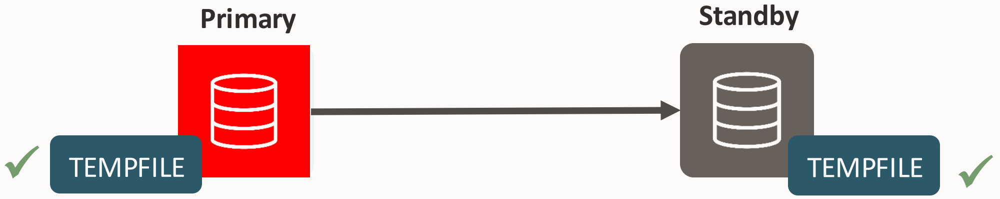
10

New In 26ai

Automatic tempfile creation on the standby database

Temporary tablespace creation during recovery:

STANDBY PRIMARY	Non-OMF	OMF
Non-OMF	**Standby_file_management AUTO:** ✓Creates **one** tempfile with the default size using `db_file_name_convert`. **Standby_file_management MANUAL:** ✗Does not create a tempfile.	**Standby_file_management AUTO:** ✓Creates **one** tempfile with the default size with OMF naming. **Standby_file_management MANUAL:** ✗Does not create a tempfile.(?)
OMF	✗Does not create a tempfile.	✓Creates **one** tempfile with the default size with OMF naming.



When the standby opens and a temporary tablespace has no tempfiles:

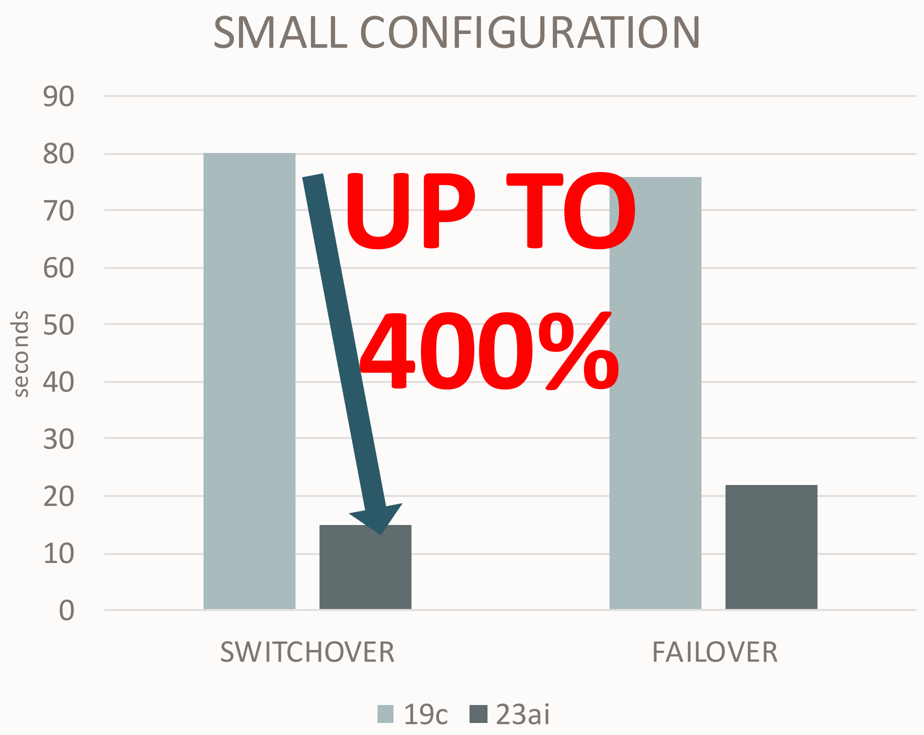
Non-OMF	✗Does not create a tempfile.
OMF	✓Creates **one** tempfile with the default size with OMF naming.

11

New In 26ai

Faster Role Transitions in Oracle Data Guard 26ai

Between 50% and 85% faster role transition

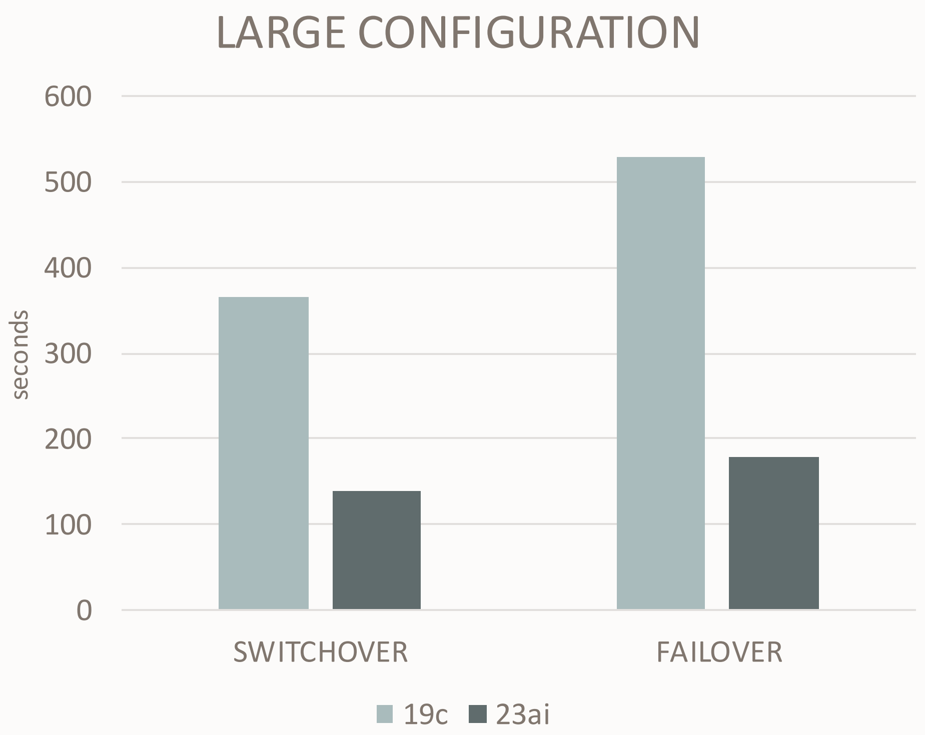


UP TO 400%

2-node Exadata RAC
5 PDBs
50 data files

10 services

60MB redo/sec



4-node Exadata RAC
100 PDBs
10k data files

1200 services

100MB redo/sec

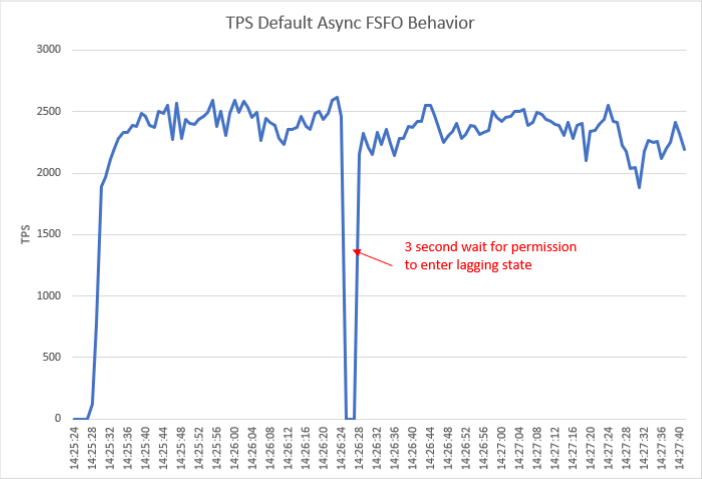
12

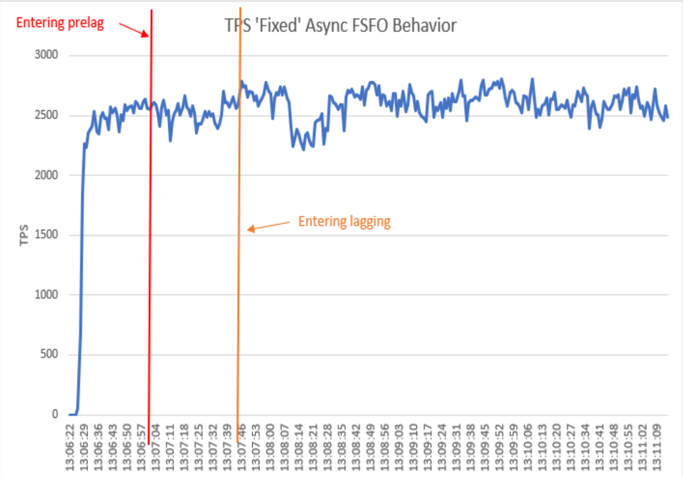
New In 26ai

Faster Observer acknowledgment in Maximum Performance

Pre-emptive actions to prevent FSFO stalls.

Zero-stall observer acknowledgment





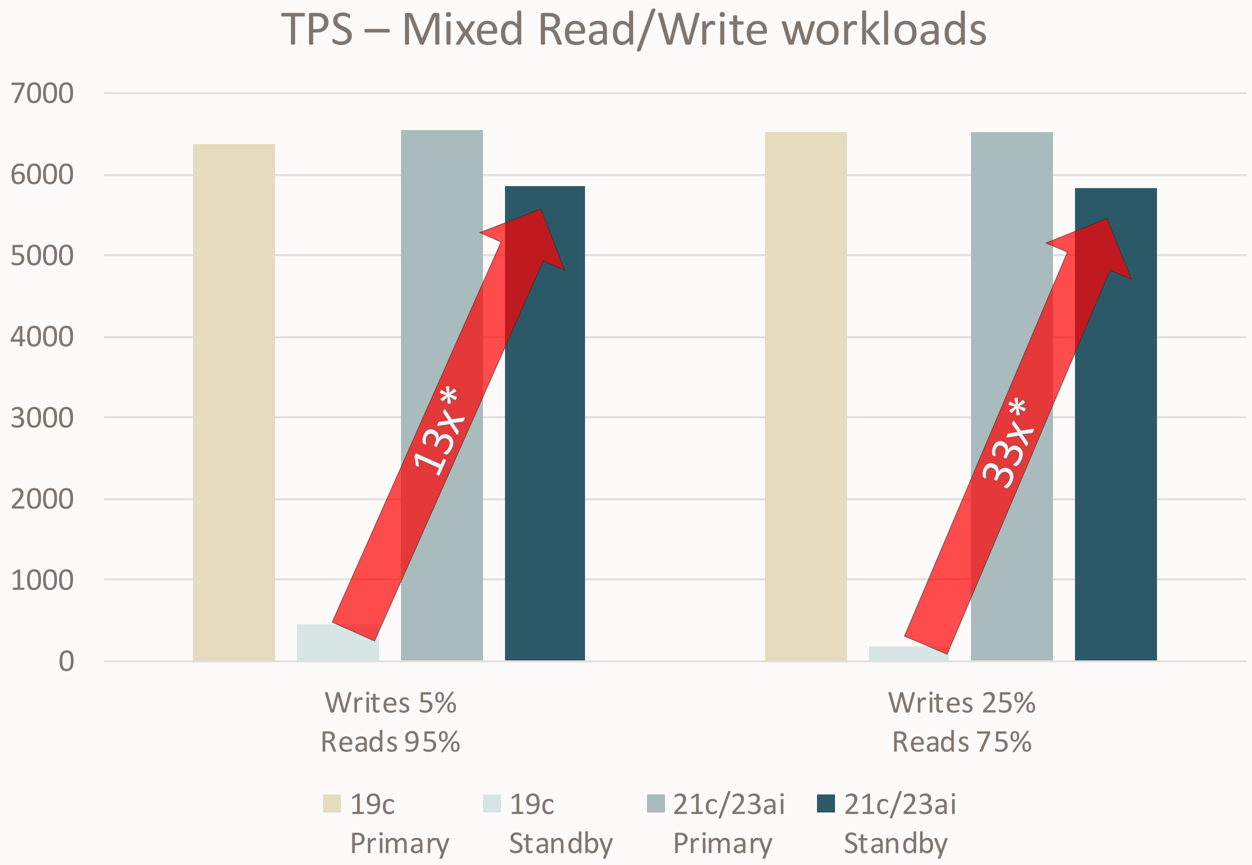
19c **26ai**

in Fast-Start Failover Max Performance

Improved Performance of Redirected Transactions

13

New In 26ai



- 19c redirected statements wait for the DML to be applied on the standby before returning to the application.
  - Wait event: `"standby query scn advance"`
- From **21c** onwards, the statement returns as soon as it's executed on the primary.
  - The session waits only at commits or when the modified data is needed for consistent reads.
  - The non-documented parameter: `"_alter_adg_redirect_behavior"` can be set to `"sync_each_dml"` to restore the previous behavior.

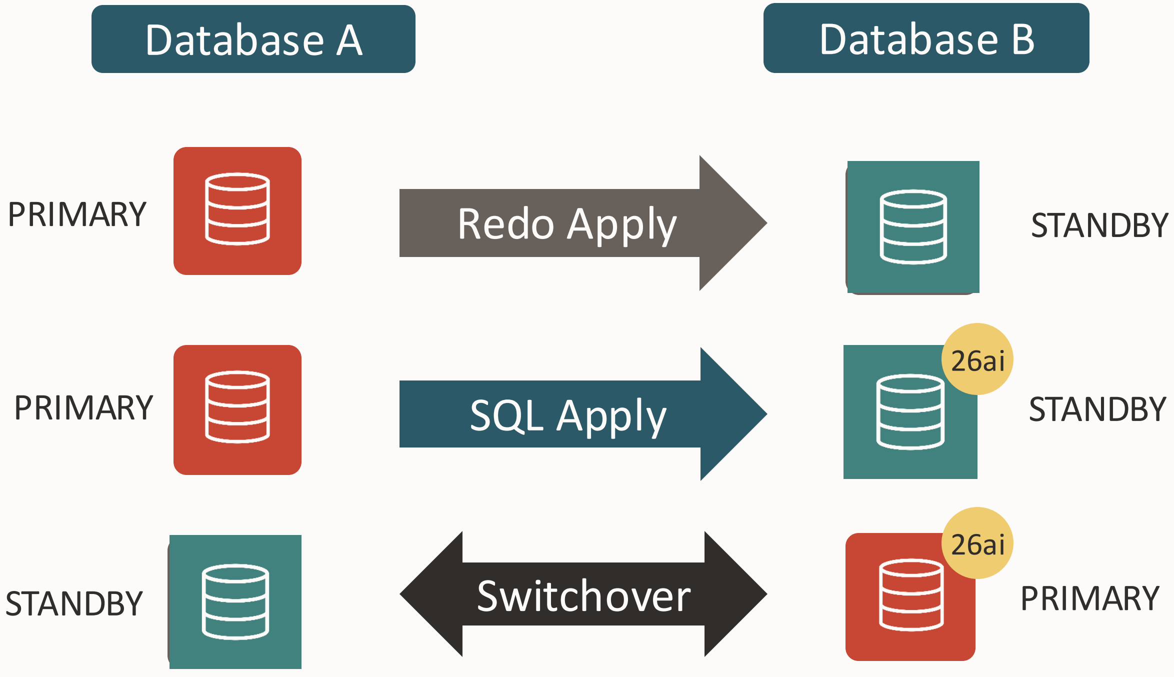
* 16 concurrent Order Entry sessions simulated with Swingbench with mixed 'NewCustomerProcess' and 'BrowseProducts' transactions.

14

New In 26ai

Zero Application Downtime for Database Release Upgrades

Minimizes application impact throughout the entire database upgrade process



Transparently with Application Continuity

(Transparent) Application Continuity

- Hides database downtime from your users
  - It rebuilds the session state
  - It replays in-flight transactions

DBMS_ROLLING

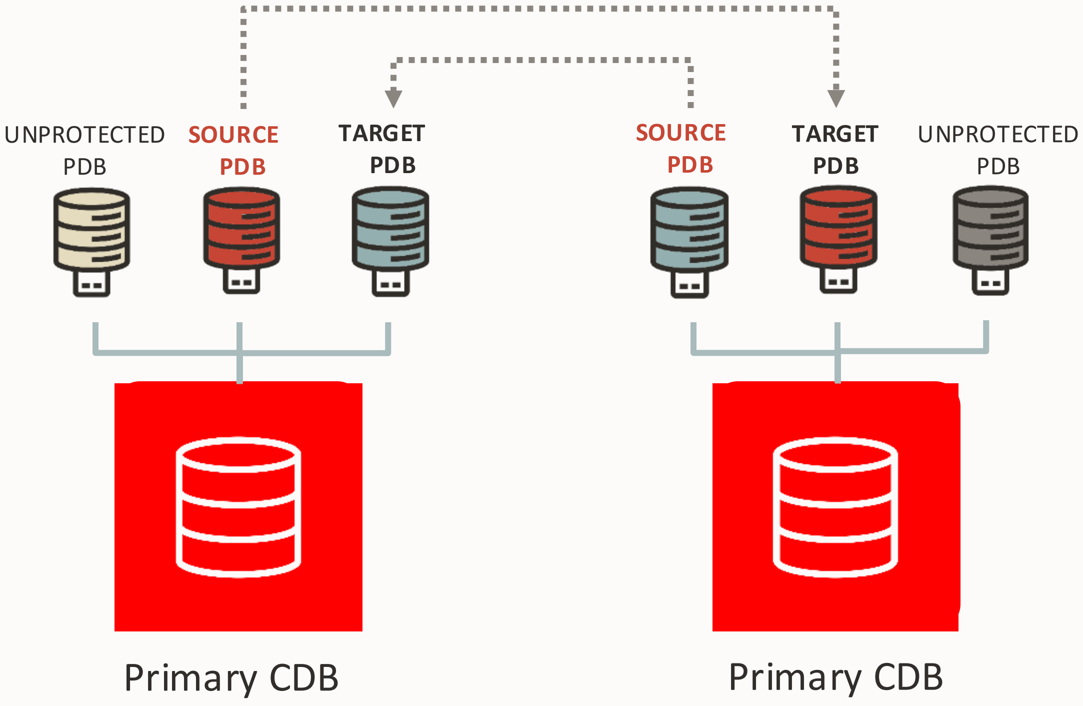
- Enables the automated rolling application of version-changing upgrades and patch sets

Together they hide the final switchover needed at the end of the automated process

Oracle Data Guard per Pluggable Database (DGPDB)

15

New In 26ai



Features

- PDB replication between two primary CDBs
- Switchover at the PDB level
- Redo apply is per-PDB
- Asynchronous redo transport
- Zero data loss PDB failover if the source CDB is still available
- Automatic gap fetching from the source
- One target PDB per source PDB
- Real-Time Query on the target PDB (23.4)

Enhanced observer diagnostic

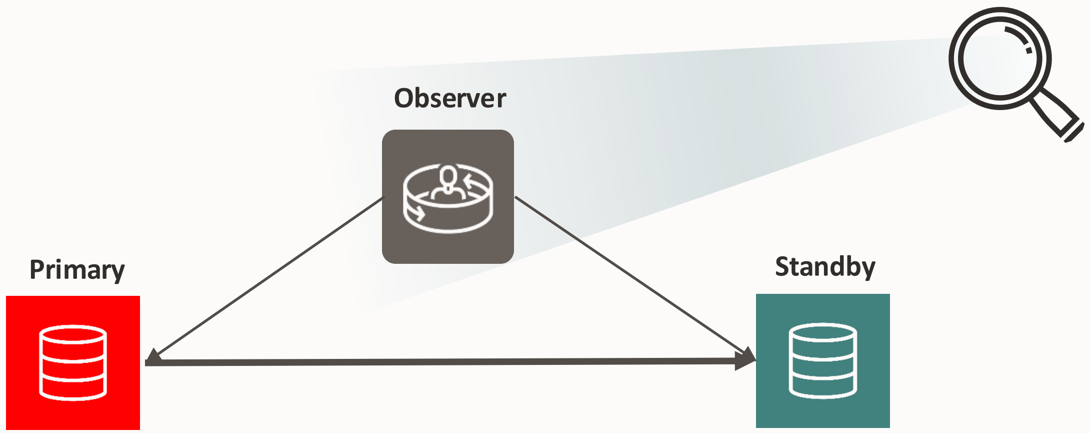
16

New In 26ai

New columns in V$FS_FAILOVER_OBSERVERS with additional details

New columns:

LAST_PING_PRIMARY
LAST_PING_TARGET
LOG_FILE
STATE_FILE
CURRENT_TIME



```
SQL> select name, registered, host, ismaster, pinging_primary, pinging_target ,
 2> last_ping_primary, last_ping_target, log_file, state_file, current_time
 3> from V$FS_FAILOVER_OBSERVERS where host is not null;

NAME     REGI HOST     ISMA PING PING LAST_PING_PRIMARY LAST_PING_TARGET LOG_FILE           STATE_FILE        CURRENT_TIME
-------- ---- -------- ---- ---- ---- ----------------- ---------------- ------------------ ----------------- -------------------------------
host-obs YES  host-obs YES  YES  YES                  0                2 /.../observer.lst  /.../observer.dat 06-OCT-22 06.38.14.000000000 AM
```

Switchover and Failover Readiness

16

New In 26ai

Checking if the database is ready for a role transition is as easy as selecting a column

Two new columns, SWITCHOVER_READY and FAILOVER_READY, computed every minute by the broker.

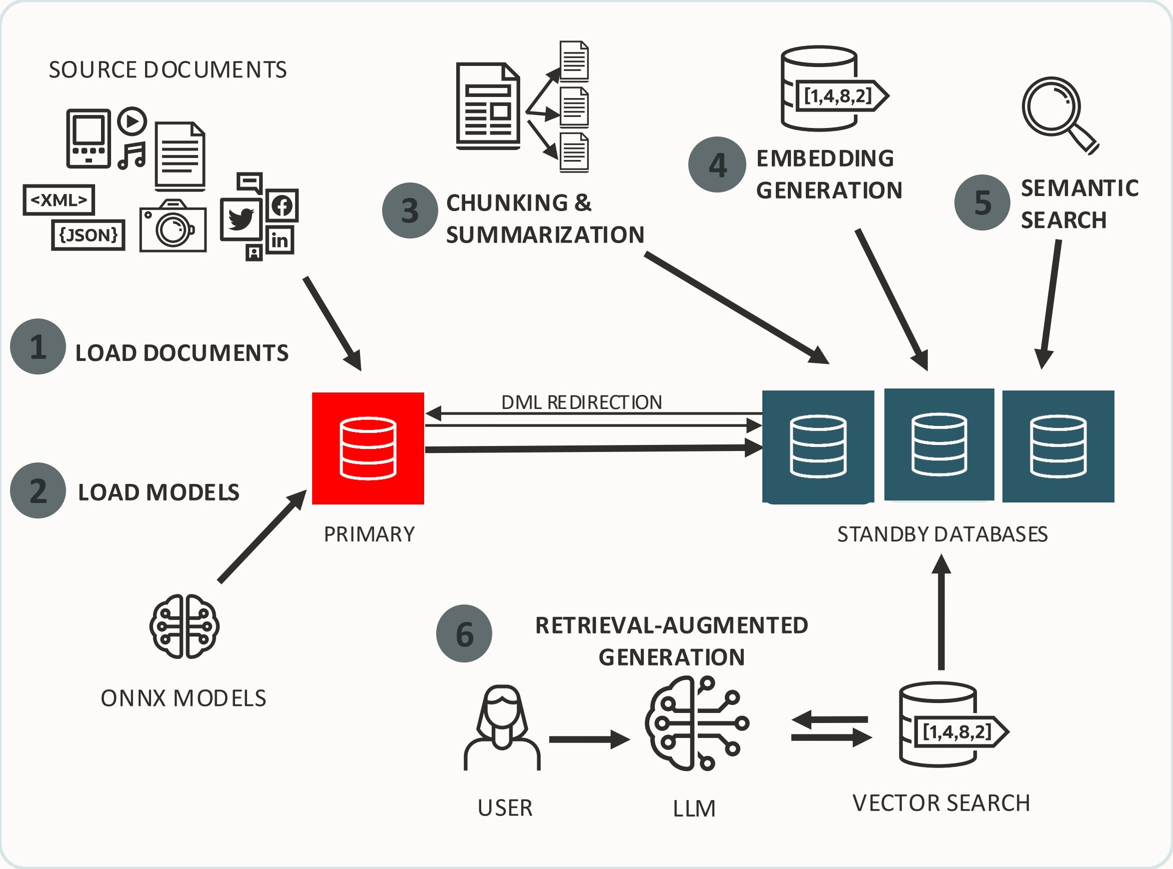
```
SQL> select database, dataguard_role, status, severity, switchover_ready, failover_ready, transport_mode
  2> from v$dg_broker_config;


DATABASE   DATAGUARD_ROLE       STATUS SEVERITY       SWITCHOVER_READY FAILOVER_READY TRANSPORT_MODE
---------- ---------------- ---------- -------------- ---------------- -------------- ---------------
boston     PRIMARY                   0 SUCCESS        YES              UNKNOWN        -N/A-
chicago    PHYSICAL STANDBY          0 SUCCESS        YES              YES            ASYNC
```

The checks done by the broker are a superset of the ALTER DATABASE SWITCHOVER VERIFY command:

```
SQL> alter database switchover to chicago verify;
alter database switchover to chicago verify
*
ERROR at line 1:
ORA-16470: Redo Apply is not running on switchover target
```

Offload Inferencing and AI Vector Search to Oracle Active Data Guard

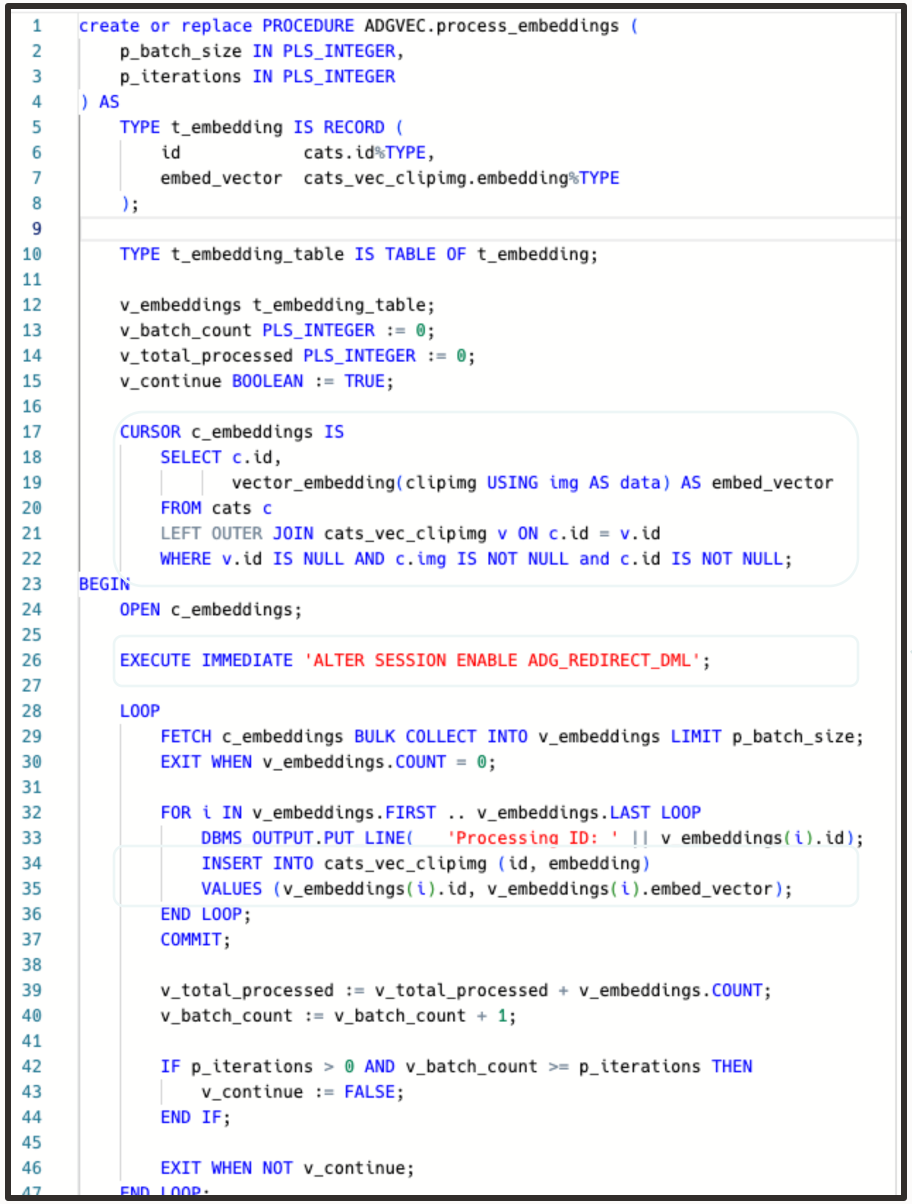
Load documents and models on the primary. Create and query embeddings on the standby.



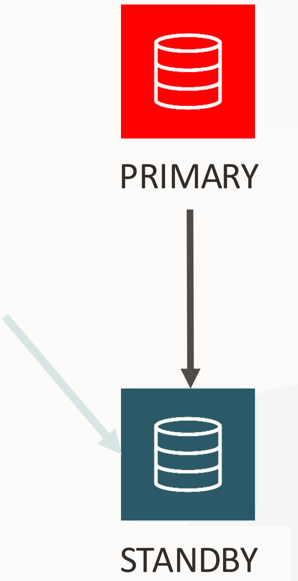
- Offload CPU-intensive workloads
  - Inferencing
  - Chunking and summarization
  - AI Vector Search

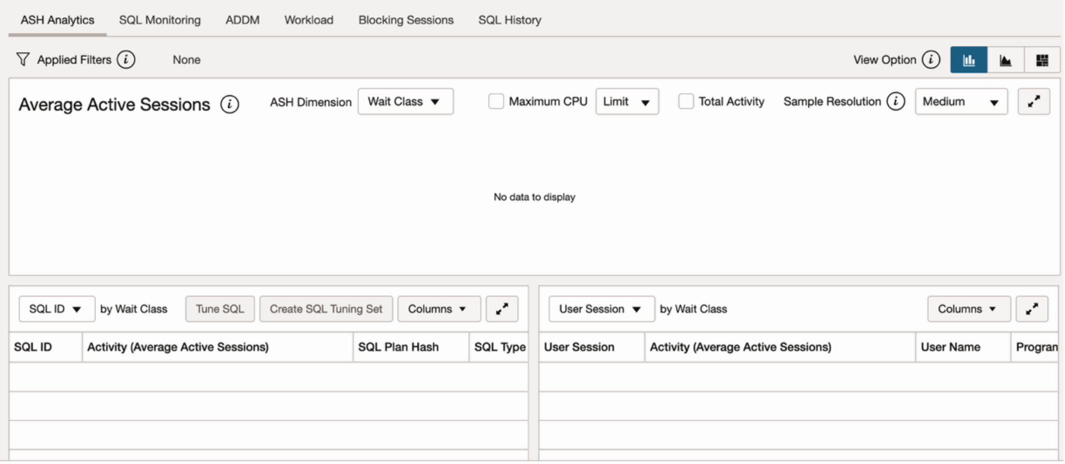
- Embeddings are created on the standby database
- Vectors are inserted via DML Redirection
- Standby resources are fully utilized

- **Primary database performance is unaffected**



```
create or replace PROCEDURE ADGVEC.process_embeddings (
    p_batch_size IN PLS_INTEGER,
    p_iterations IN PLS_INTEGER
) AS
    TYPE t_embedding IS RECORD (
        id             cats.id%TYPE,
        embed_vector   cats_vec_clipimg.embedding%TYPE
    );

    TYPE t_embedding_table IS TABLE OF t_embedding;

    v_embeddings t_embedding_table;
    v_batch_count PLS_INTEGER := 0;
    v_total_processed PLS_INTEGER := 0;
    v_continue BOOLEAN := TRUE;

    CURSOR c_embeddings IS
        SELECT c.id,
               vector_embedding(clipimg USING img AS data) AS embed_vector
        FROM cats c
        LEFT OUTER JOIN cats_vec_clipimg v ON c.id = v.id
        WHERE v.id IS NULL AND c.img IS NOT NULL and c.id IS NOT NULL;
BEGIN
    OPEN c_embeddings;

    EXECUTE IMMEDIATE 'ALTER SESSION ENABLE ADG_REDIRECT_DML';

    LOOP
        FETCH c_embeddings BULK COLLECT INTO v_embeddings LIMIT p_batch_size;
        EXIT WHEN v_embeddings.COUNT = 0;

        FOR i IN v_embeddings.FIRST .. v_embeddings.LAST LOOP
            DBMS_OUTPUT.PUT_LINE(   'Processing ID: ' || v_embeddings(i).id);
            INSERT INTO cats_vec_clipimg (id, embedding)
            VALUES (v_embeddings(i).id, v_embeddings(i).embed_vector);
        END LOOP;
        COMMIT;

        v_total_processed := v_total_processed + v_embeddings.COUNT;
        v_batch_count := v_batch_count + 1;

        IF p_iterations > 0 AND v_batch_count >= p_iterations THEN
            v_continue := FALSE;
        END IF;

        EXIT WHEN NOT v_continue;
    END LOOP;
```





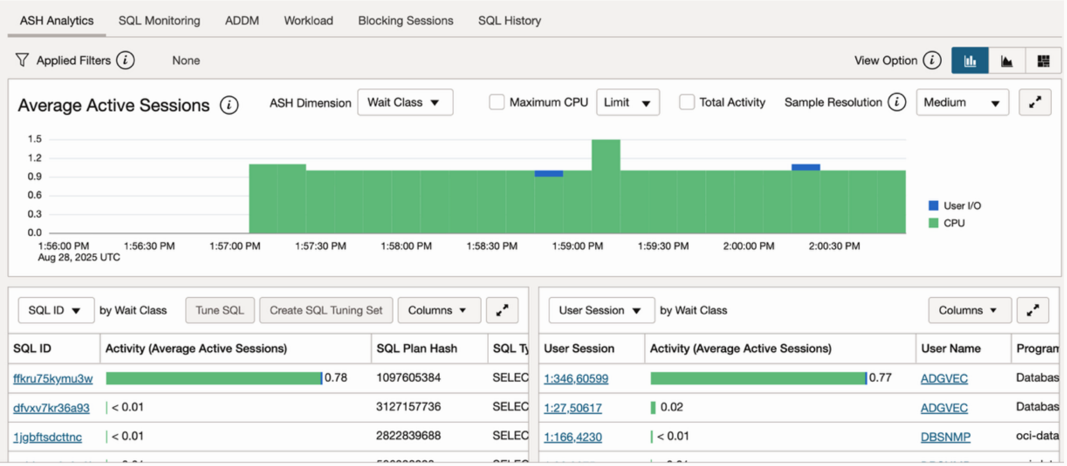
Applied Filters: None

Average Active Sessions — ASH Dimension: Wait Class; □ Maximum CPU; Limit; □ Total Activity; Sample Resolution: Medium

No data to display

SQL ID	Activity (Average Active Sessions)	SQL Plan Hash	SQL Type

User Session	Activity (Average Active Sessions)	User Name	Progran



Applied Filters: None

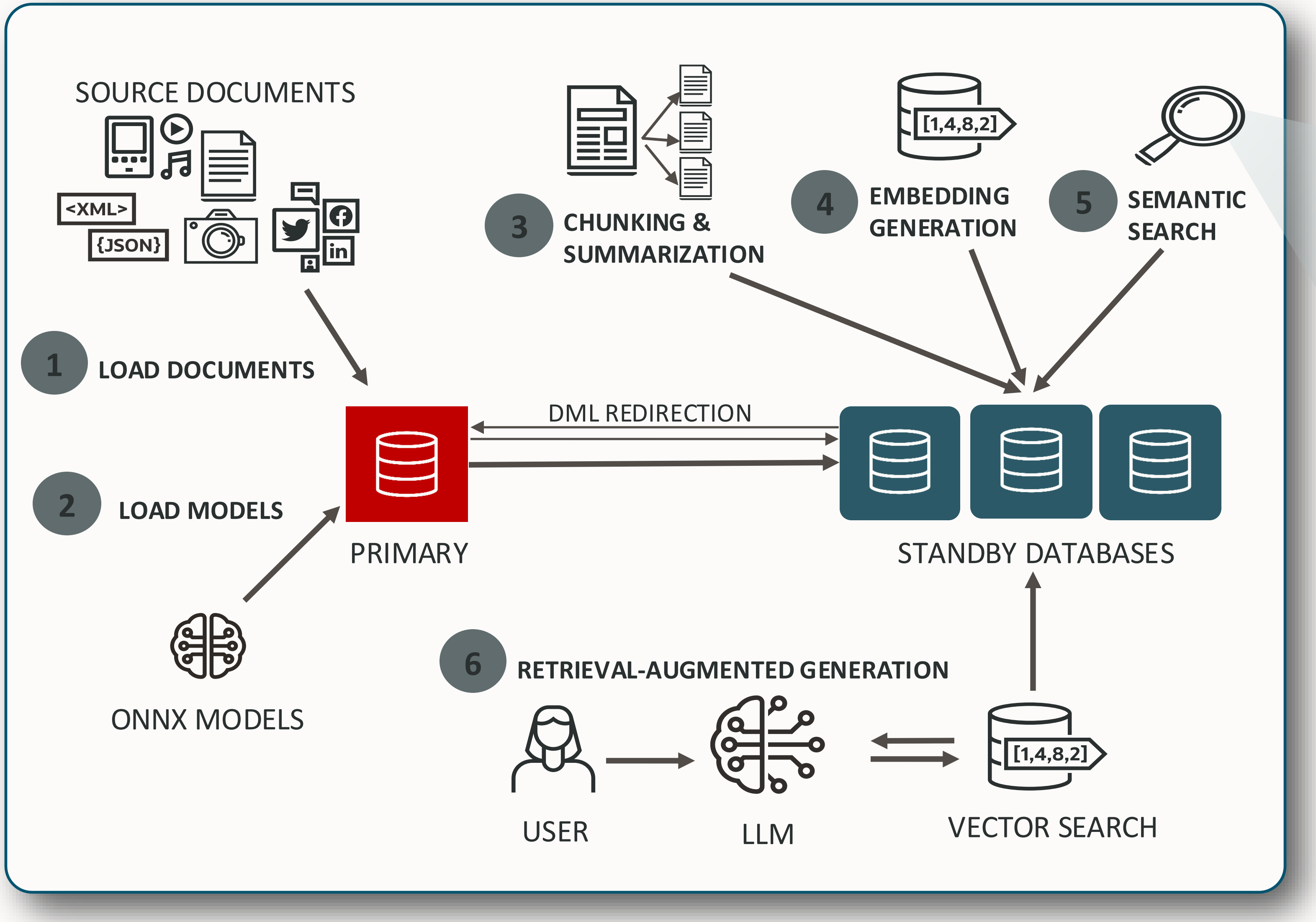
Average Active Sessions — ASH Dimension: Wait Class; □ Maximum CPU; Limit; □ Total Activity; Sample Resolution: Medium

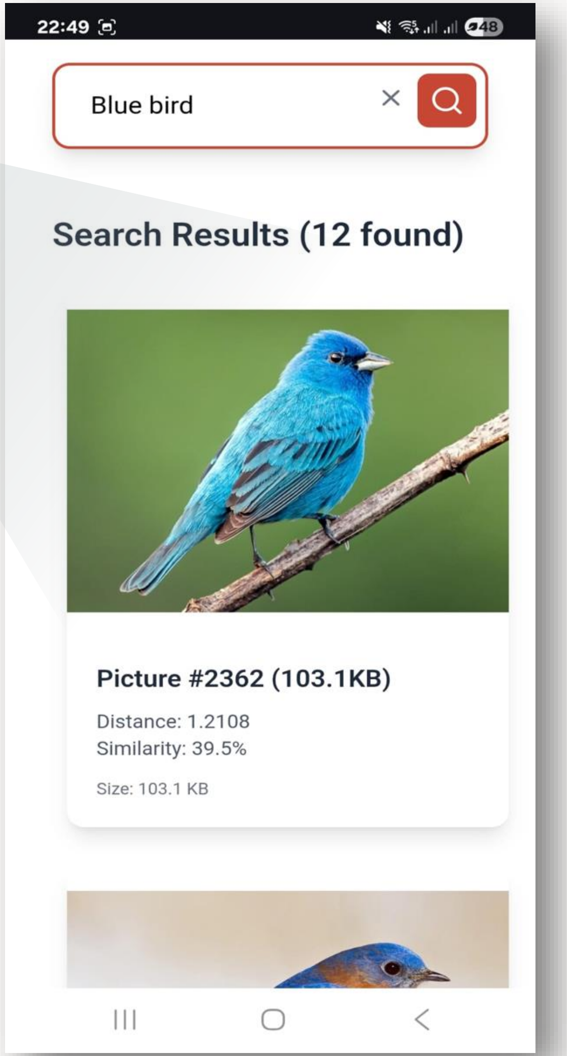
SQL ID	Activity (Average Active Sessions)	SQL Plan Hash	SQL Ty
ffkru75kymu3w	0.78	1097605384	SELEC
dfvxv7kr36a93	< 0.01	3127157736	SELEC
1jgbftsdcttnc	< 0.01	2822839688	SELEC

User Session	Activity (Average Active Sessions)	User Name	Progran
1:346,60599	0.77	ADGVEC	Databas
1:27,50617	0.02	ADGVEC	Databas
1:166,4230	< 0.01	DBSNMP	oci-data

Come try the **Oracle Active Data Guard** AI demo at the **Oracle AI World Hub**

Demo booth: MAA with Oracle RAC, Data Guard, ZDM, ZRCV and Full Stack DR





Picture #2362 (103.1KB)

Distance: 1.2108
Similarity: 39.5%

Size: 103.1 KB

Application Continuity

What’s new with Maximum Availability Architecture in 26ai

Fast Start Reconfiguration

Fast Pluggable Database Open

Oracle AI Database

26ai

Support for the latest 23ai HA features

Flashback Time Travel Enhancements

Single-Server Rolling Maintenance

Local Rolling Database Maintenance

Data Guard per Pluggable Database (DGPDB)

Online Database patching support

Smart Connection Rebalancing

Faster Role Transitions

Pluggable Database Recovery Isolation

Manage Data Guard with PL/SQL

Application Continuity Advanced Cursor Handling

DBMS_ROLLING Upgrades without user impact

Gold Image and working copy improvements

RAFT-Based Replication with Sharding

RAC Two-Stage Rolling Update

Simplified AWR Snapshot Creation on Active Data Guard

Minimized Stall in Max Performance FSFO

Strict Database Validation

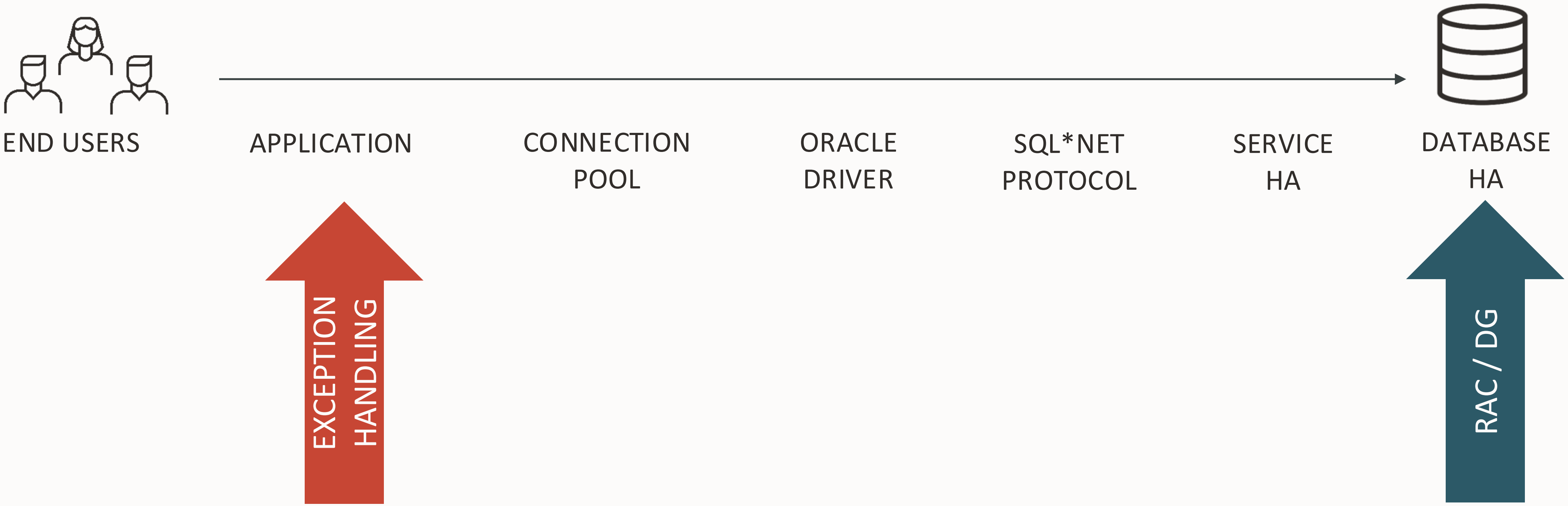
DB-Initiated Planned Failover during Draining

Application Continuity Driver Updates

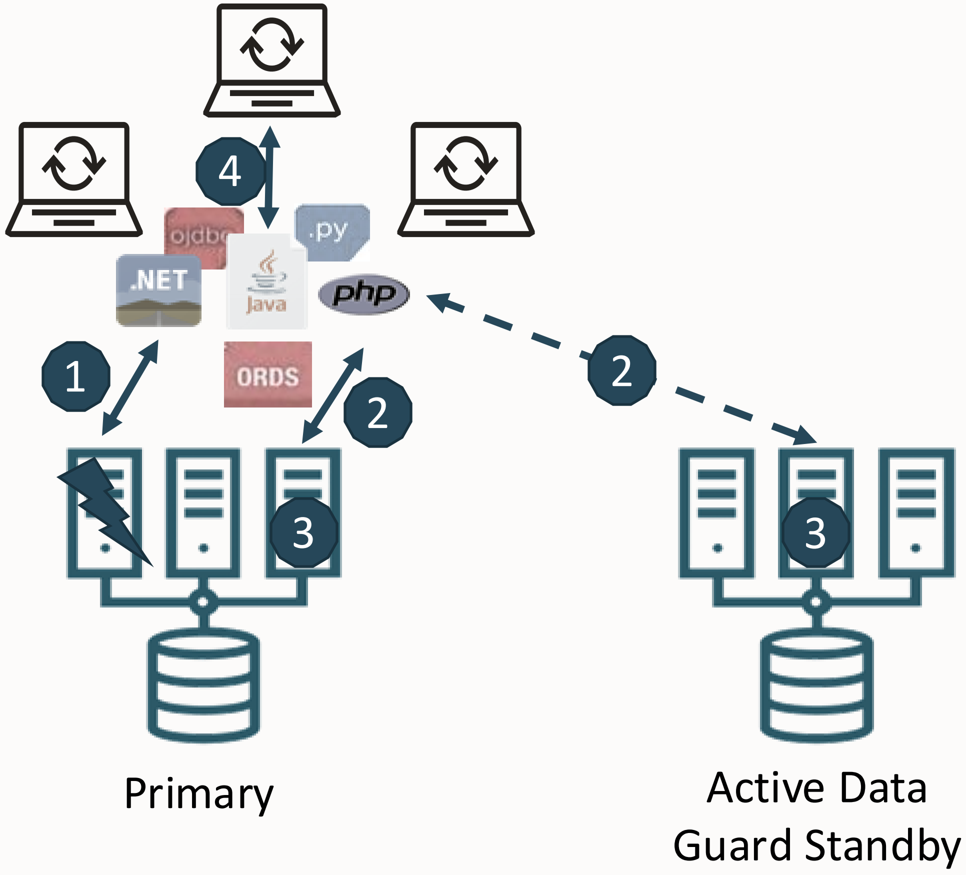
Oracle Update Advisor

Real Applications Clusters | Data Guard | Global Distributed DB | Fleet Patching and Provisioning | Application Continuity

Masking Errors to End Users is Essential: Error Handling!



Unplanned Outages and Planned Failover



Actions on database level:

1. DB Request interrupted by an error or FAN or Drain
2. Session reconnects to the available service
3. Database Request replays automatically
4. Result from Database Request returned to user

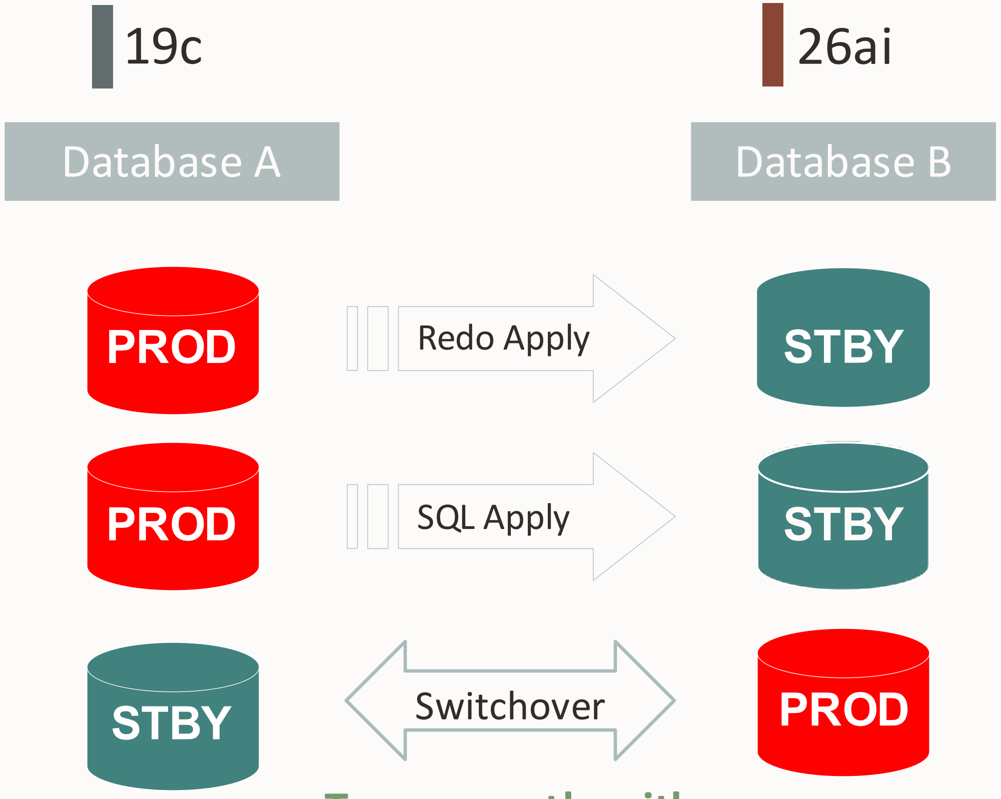
(Transparent) Application Continuity

- Guarantees commit at most once
- Verifies:
  - Correct database
  - Correct session state
  - Correct results

New In 26ai

(Transparent) Application Continuity DBMS_ROLLING Support

Minimizes application impact throughout the entire database upgrade process



Transparently with Application Continuity

(Transparent) Application Continuity

- Hides database downtime from your users
  - It rebuilds the session state and replays in-flight transactions as part of the automated session failover for planned and unplanned downtime.

DBMS_ROLLING

- Enables the automated rolling application of version-changing upgrades and patch sets.

- Together they hide the final switchover needed at the end of the automated process.

17

New In 26ai

Database-Initiated Planned Failover during Draining

Let the database determine when to best fail over workload during planned maintenance

Draining

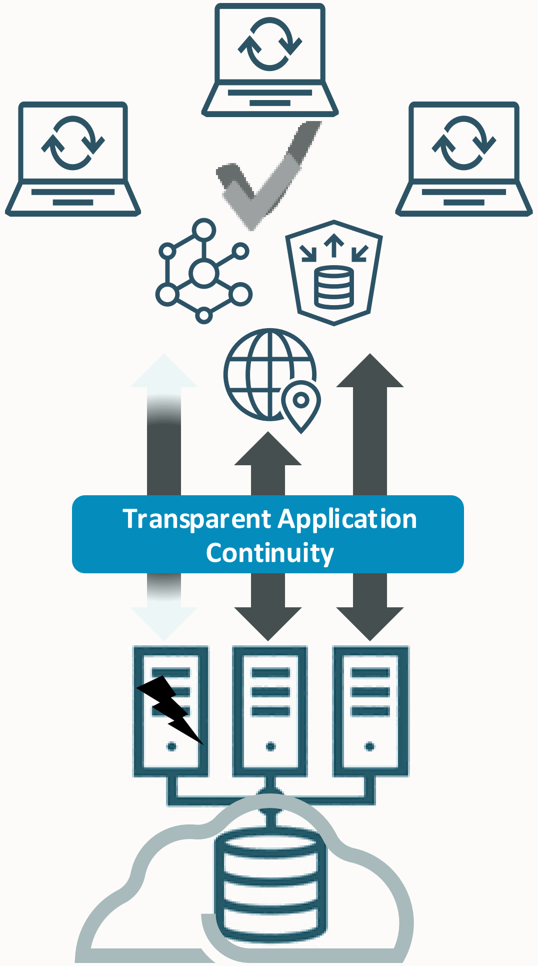
- Lets sessions complete their work on a given instance to prepare the stack for maintenance. The drain timeout can be defined per database service.

For Oracle Database Cloud Services, the database

- Detects sessions that will not drain and can fail over
- Proactively chooses failover sessions based on rules.

Selected sessions fail over and continue with Application Continuity when a service is available

- Minimizes ungraceful session termination
- Reduces drain timeout and replay time on failover
- Enables shorter maintenance windows
  - Most requests reach failover conditions quickly



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New In 26ai

Application Continuity (AC) Advanced Cursor Handling

Enhanced to let developers focus on functionality, not high availability

Resumable Cursors with TAC

Example

```
SELECT order_id FROM orders
WHERE order_date > sysdate - 7
order by order_id;

  while (!end_of_fetch)

  { FETCH order_id INTO :order_num;

    <Perform transactional work for an order>

  commit;}
```

- On capture:
  - Operators evaluated for a stable state
  - HYBRID on service allows all operators
- On replay:
  - Execution state restored (if not the same)
  - Cursor repositioned: Full fetch and verify

RESET_STATE

- Applications use state in requests
  - Temporary tables
  - PL/SQL globals
  - *Cursors in fetch…*

Starting with Oracle Database 21c

- The database resets state at the end of the request with AC on, so that the next request starts with a clean state

Starting with Oracle Database 23cai

- Any user can set the service attribute (RESET_STATE)

19

New In 26ai

Application Continuity Driver Updates

ODP.NET Support for managed clients and JDBC consolidated driver

ODP.NET managed clients

- Fully supported for Application Continuity
  - Previously only supported for draining
- Most popular client for new developments
- The equivalent of the JDBC thin client

vs. ODP.NET unmanaged clients

  - Legacy client for many ODP.NET deployments
  - Fully supported for draining and Application Continuity since 12.2
  - Deprecated with Oracle Database 23ai; desupport scheduled for sometime in future

JDBC Consolidated Driver

- Avoids using the JDBC driver specific to use the required functionality OJDBC.jar or OJDBC8.jar
  - No swapping out jar files
    - UCP.jar, ONS.jar, and simplefan.jar may still be required

- Oracle Database 21c and 23ai only use the JDBC consolidated driver
- Driver will dynamically determine which code path to use dependent on the configuration (the service)
- Makes the adoption of Application Continuity simpler

New In 26ai

Transparent Application Continuity 26ai

More reliable and faster than ever

40% Faster	• With Transparent Application Continuity repositioning cursors at failover query execution time
Up to 50% lower DB CPU cost	• Compared to 19c running SPEC-J • With new Native Transaction Guard using native XID when possible to send to client before COMMIT • 45% savings with Application Continuity reduced code path alone
Up to 55% lower client CPU cost	• With OCI driver using OCI_THREADED_V2

Oracle Globally Distributed Database

What’s new with Maximum Availability Architecture in 26ai

- Fast Start Reconfiguration
- Fast Pluggable Database Open
- Oracle AI Database 26ai
- Support for the latest 23ai HA features
- Flashback Time Travel Enhancements
- Single-Server Rolling Maintenance
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- DBMS_ROLLING Upgrades without user impact
- Gold Image and working copy improvements
- RAFT-Based Replication with Sharding
- RAC Two-Stage Rolling Update
- Simplified AWR Snapshot Creation on Active Data Guard
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- Application Continuity Driver Updates
- Oracle Update Advisor

Real Applications Clusters | Data Guard | Global Distributed DB | Fleet Patching and Provisioning | Application Continuity

Oracle Globally Distributed Database Customer Use Cases

Global Data Distribution

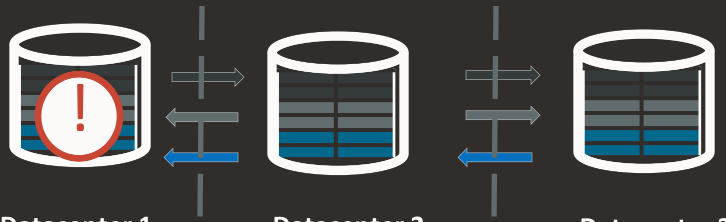
Data distributed across multiple countries

Data replicated within or across regions

Benefits

Complies with Data Residency

User or Device Proximity



Regional Data Distribution

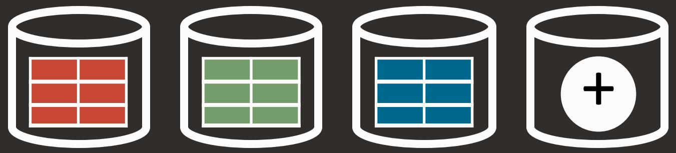
Data distributed across multiple data centers

Data replicated across data centers

Benefits

Active/Active/Active Never Down Architecture

DR, HA, zero downtime for planned & unplanned outages



Local Data Distribution

Data distributed center across multiple servers

Data replicated within a data center

Benefits

Horizontal Scalability

Elasticity for seasonality

HA, zero downtime for planned & unplanned outages

Oracle AI Database 26ai

20

Raft-Based Replication

New In 26ai

- Built-in replication integrated with transaction execution
- Sub-3-second failover with zero data loss
- Active-active, symmetric configuration

  Each shard accepts writes and reads for a subset of data
- Distributed Database is divided into multiple replication units (RUs)

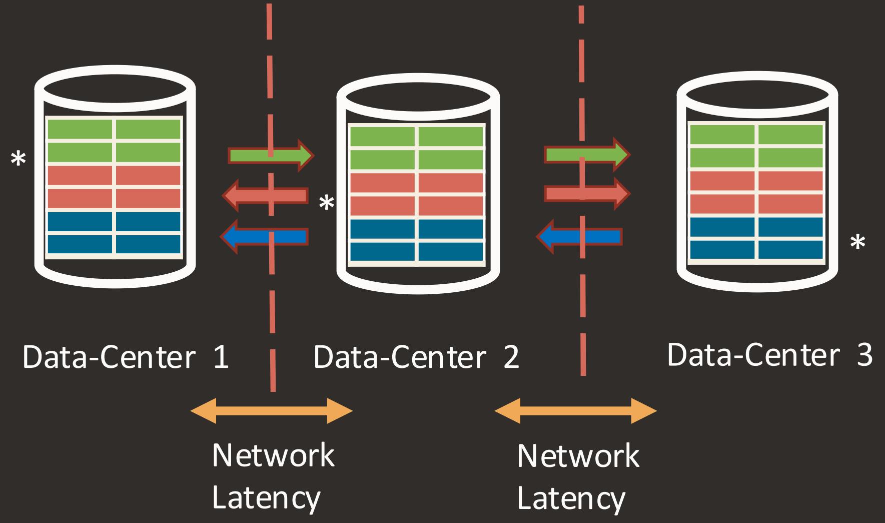
  Replicas of RUs are spread evenly across 3 (or more) shards

  Each shard is leader for some RUs and follower for other RUs

  Shards can be distributed across multiple data centers
- Builds on popular Raft distributed consensus protocol

  Consistency among replicas in case of failures, network partition, message loss, or delay

  Automatic reconfiguration after failure or change of shards



Oracle Globally Distributed Database

Oracle Globally Distributed Database addresses the use cases of all the special purposes sharded data stores

Distributed SQL Stores

Google Spanner

Cockroach DB

yugabyteDB

Azure Hyperscale

Key Value Stores

mongoDB

Azure Cosmos DB

AEROSPIKE

SCYLLA

cassandra

Amazon DynamoDB

Analytics Stores

SingleStore

snowflake

Azure Synapse Analytics

VERTICA

teradata.

APACHE Spark

Text Stores

Elasticsearch

Apache Solr

splunk>

Oracle Globally Distributed Database

ORACLE

MAA-Compliant Fleet Patching

Manages the lifecycle of your complete Oracle Database Stack

Rich feature set

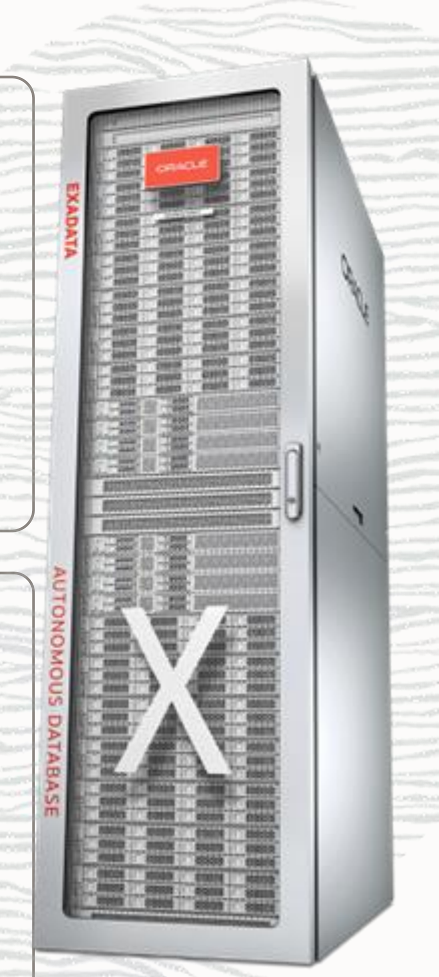
- Install
- Remove
- Series
- Drift detection
- FPP peering
- REST APIs
- Role separation
- Exadata Updates
- Custom User Actions

Oracle Database (SI, RAC, RACONE)

- Provision
- Patch
- Upgrade
- Scale

Oracle Grid Infrastructure

- Provision
- Patch
- Upgrade
- Scale



What’s new with Maximum Availability Architecture in 26ai

Fast Start Reconfiguration

Fast Pluggable Database Open

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Oracle AI Database

26ai

Manage Data Guard with PL/SQL

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Support for the latest 23ai HA features

Online Database patching support

Gold Image and working copy improvements

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Real Applications Clusters | Data Guard | Global Distributed DB | Fleet Patching and Provisioning | Application Continuity

New In 26ai

Fleet Patching and Provisioning (FPP)

Support for the latest 23ai HA features

Oracle Fleet Patching and Provisioning 23ai supports Local Rolling Database Maintenance and Oracle Two Stage Rolling Updates.

21

Online Database patching support

Online patches don’t require relinking the Oracle Binaries and can thus be installed without shutting the database instance. FPP allows these patches to be installed on existing working copies.

22

Gold Image and working copy improvements

Gold images can be stored in a compressed (zip) format, saving space on the FPP server and reducing network transfer time.

Gold images that have no working copies tied to them can be archived in external storage, freeing space on the centralized repository and, at the same time, making it possible to keep the old gold images for compliance reasons..

23

Oracle Update Advisor

24

Accurate Software Health Status: Obtain an exact, real-time assessment of your software’s health and adherence to standards.

Up-to-Date Version Guidance: Receive tailored, expert guidance and recommendations for your next version updates.

Streamlined Access to Updates: Access and deploy the right updates with unmatched ease.

What’s new with Maximum Availability Architecture in 26ai

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26ai

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Flashback Time Travel Enhancements

New In 26ai

Manage Flashback Database Logs Outside the Fast Recovery Area (FRA)

Managing flashback database logs outside the fast recovery area lowers the operational costs related to space management and guarantees the best performance for workloads that are typically impacted by flashback logging on traditional storage.

25

Blockchain Table Log History

Flashback Data Archive History tables are now blockchain tables. This feature allows changes to one or more regular user tables to be tracked in a blockchain table maintained by the Oracle database as part of the Flashback Data Archive.

This feature allows you to record changes to regular user tables in a cryptographically secure and verifiable fashion.

25

General Flashback Time Travel Enhancements

Flashback Time Travel helps to meet compliance requirements based on record-stage policies and audit reports by tracking and storing transactional changes to a table, which has also been made more efficient and performant in this release.

26

Oracle MAA 26ai

PLUS

Oracle AI Database26ai – The Next Long Term Support Release

Data Use Case Domains

Boolean Datatype

Oracle AI Database

26ai

Bring AI to your data

Property Graphs

Real-time SQL Plan Management

JSON Schema

Microservice Sagas

JSON / Relational Duality

AI Vector Search

Shrink Tablespace

SQL Firewall

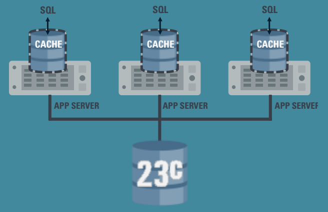
Priority Transactions

JS Stored Procedures

Developer Role

Schema Privileges

True Cache



Reference Material

Where to find more

- **New Parameter to Control the TDE Rekey Operations for Oracle Data Guard** - View Documentation
- **Oracle Data Guard Redo Decryption for Hybrid Disaster Recovery Configurations**, - View Documentation
- **Per-PDB Data Guard Integration Enhancements** - View Documentation
- **Optimized Fast-Start Failover Delay Detection in Maximum Performance Mode** – View Documentation
- **Database Native Transaction Guard –** View Documentation
- **Application Continuity Support for DBMS_ROLLING** – View Documentation
- PL/SQL APIs for better automation **–** View Documentation
- REST APIs for easier DevOps integration **–** View Documentation
- Data Guard management for SQLcl, - View Documentation
- **Manage Flashback Database Logs Outside the Fast Recovery Area (FRA)** – View Documentation
- **Flashback Time Travel Enhancements –** View Documentation
- **Blockchain Table Log History** – View Documentation
- Oracle Data Guard Best Practices – View Documentation

Plus

- Oracle Flashback Best Practices
- Using Flashback Technology
- Oracle Data Guard Best Practices
- Oracle Active Data Guard Workshop
- Configure Fast Start Fail Over (FSFO)
- Redo Transport Troubleshooting and Tuning
- Redo Apply Best Practices
- Using DBMS_ROLLING to Perform a Rolling Upgrade
- Using Far Sync Instances
- Managing Data Guard PDB

Take the first step with Oracle AI Database 26ai

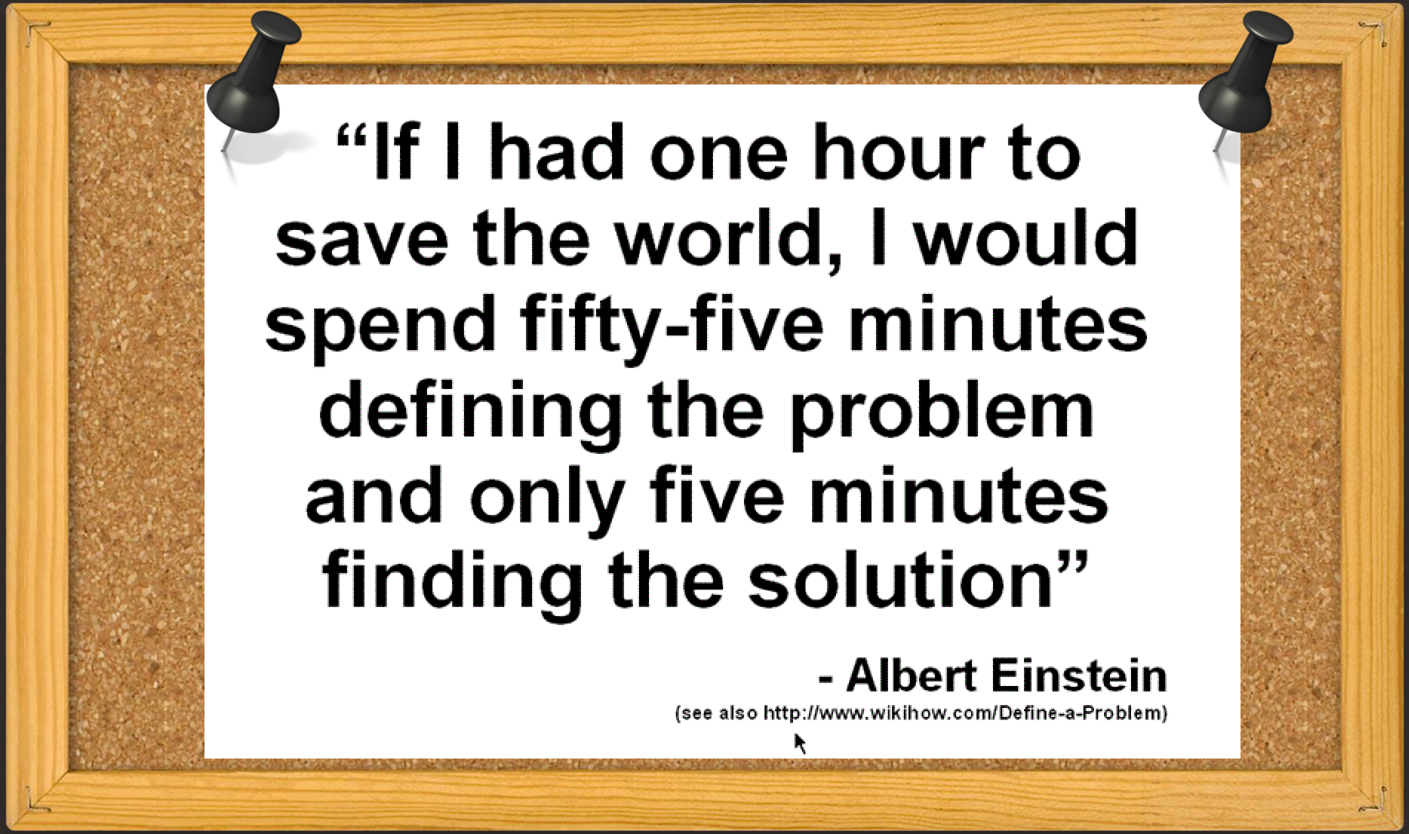
Get Oracle AI Database 26ai Hands-on experience for free with LiveLabs

https://livelabs.oracle.com

Try Oracle AI Database 26ai for Free

Do a Deep Dive on Autonomous Database and Multicloud

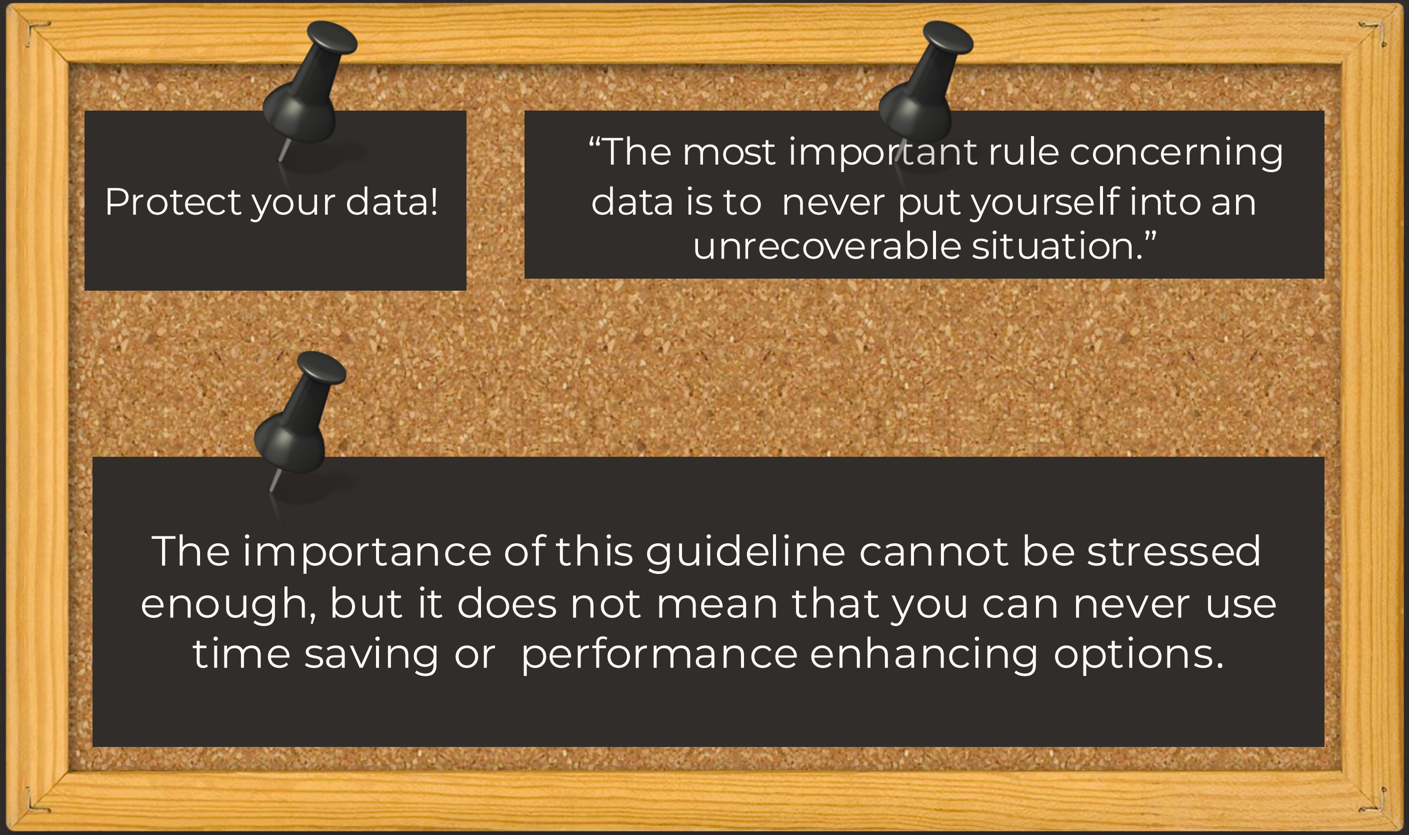
OCI Azure Google Cloud Amazon



“If I had one hour to save the world, I would spend fifty-five minutes defining the problem and only five minutes finding the solution”

- Albert Einstein

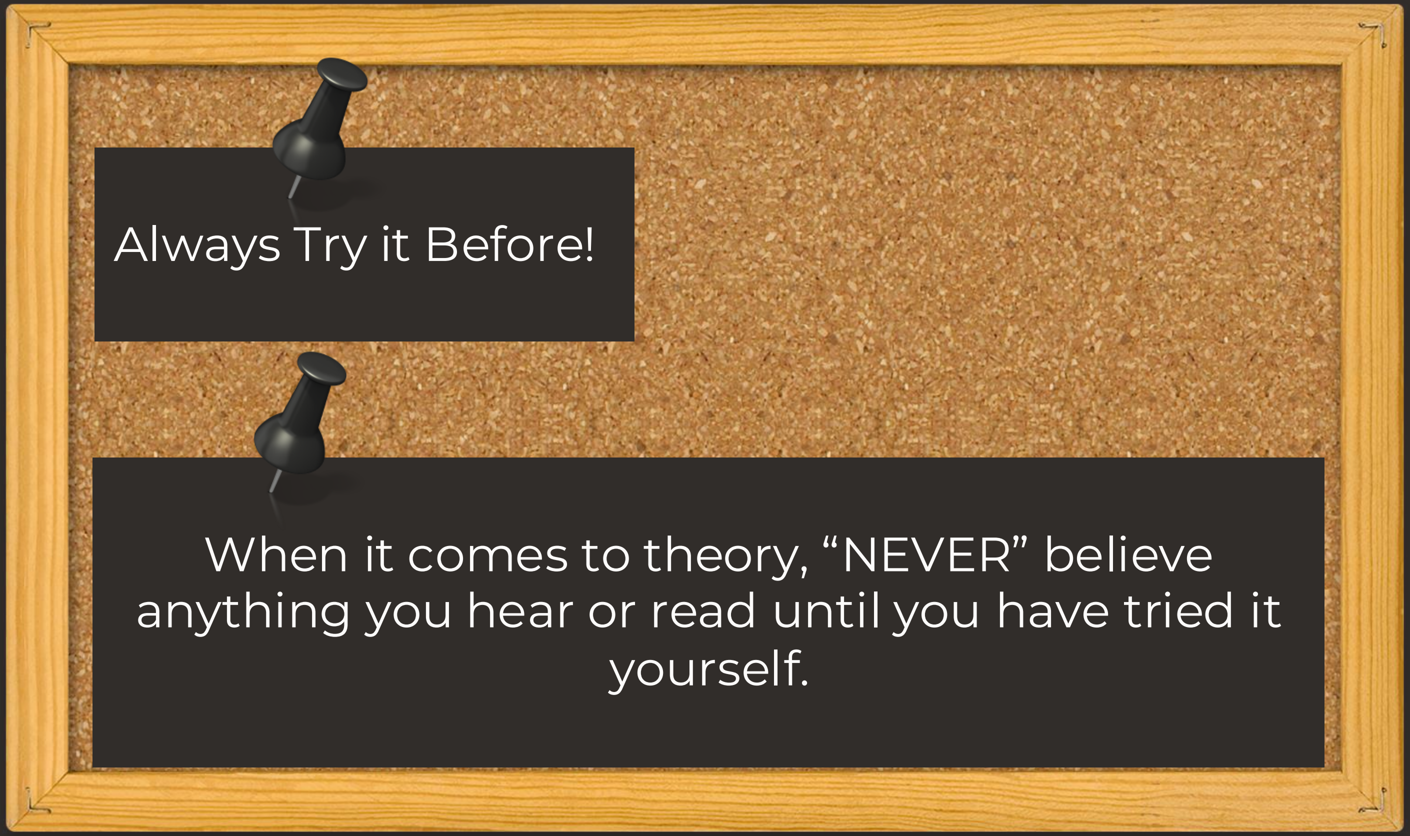
(see also http://www.wikihow.com/Define-a-Problem)



Protect your data!

“The most important rule concerning data is to never put yourself into an unrecoverable situation.”

The importance of this guideline cannot be stressed enough, but it does not mean that you can never use time saving or performance enhancing options.



Always Try it Before!

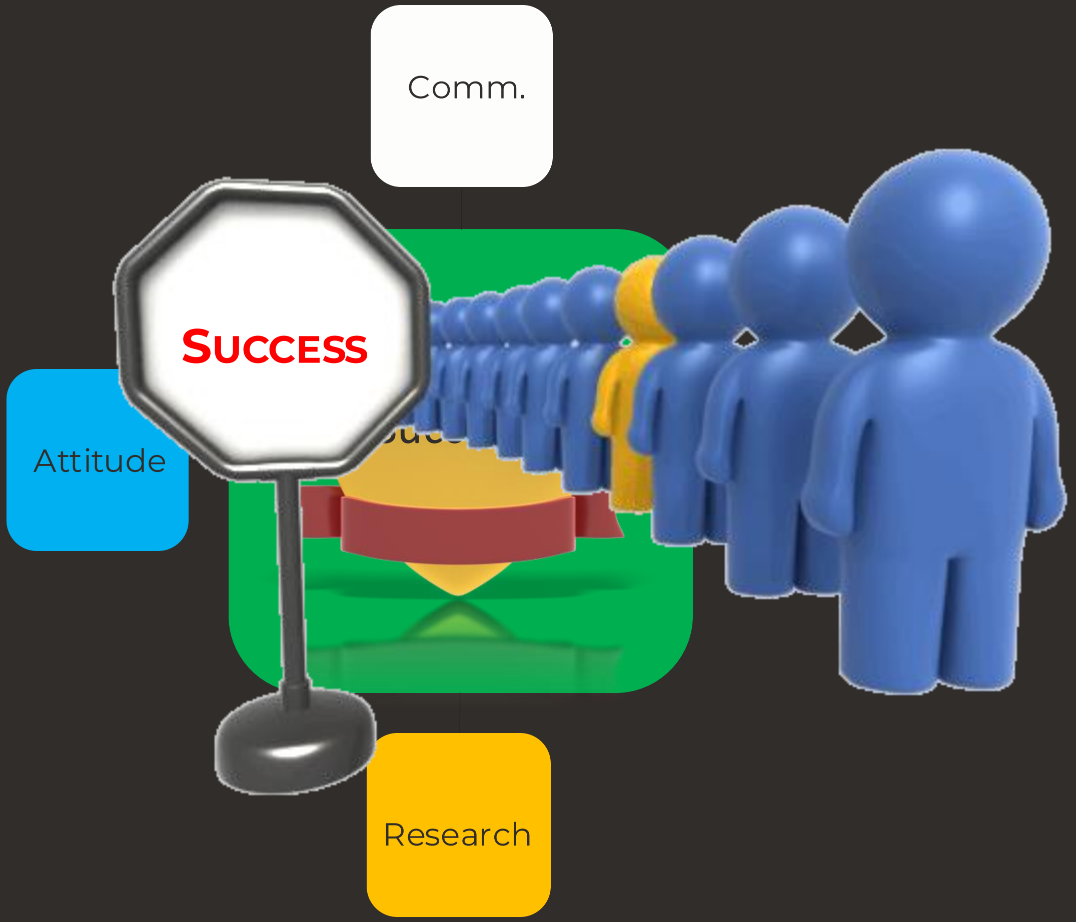
When it comes to theory, “NEVER” believe anything you hear or read until you have tried it yourself.

Backup, Backup & Backup

Why? Because bad stuff happens…

Learn to Improve Yourself

- If you want to become a successful professional, first you need to educate yourself to be successful!
- Your future success depends only on your attitude today! You control your life, nobody else!



La Motivacion nos impulsa a empezar, pero el habito nos hace GANAR

Kilometers

363.72

Hours

8,323

Kilometers

1,429

Training Camps

11

Desire is Power!

Nothing is easy in life without sacrifice and dedication!

AURORAS
AUSTRALIA
17th World Dragon Boat Racing Championships
Brandenburg, Germany July 2025
AUSTRALIA
17th IDBF World Dragon Boat Racing Championships
2025
Brandenburg an der Havel Germany

ORACLE

Oracle MAA 26ai

Questions & Answers

Oracle MAA 26ai

Thanks for your participation