



Multi-AZ High Availability for
Oracle Standard Edition 2



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Introduction

The Tessell Multi-AZ solution provides reliable and cost-effective physical replication for Oracle SE2 databases. This configuration consists of a primary (production) database and one or more replicas that span across different availability zones. The Tessell Availability Machine takes the needed backups, and transaction logs (archive and redo logs) using cloud infrastructure services like block storage, snapshot, and blob/object storage, and makes them available to all replicas. Based on the RPO and RTO SLAs, changes that are captured in the primary will be applied to replica databases. Tessell can provide zero-data loss replicas if customers choose to avail such an RPO. The images below show how you can opt for the Multi-AZ option when provisioning an Oracle SE database.

Let's create a new database

Pick the database engine of your choice



Choose your Database Edition Enterprise Standard

 Software Image: Oracle 12.2.0.1 Create as a Container Database

Version: July 2021 CPU 

* Bring your own license

Oracle SE2 Provisioning

Good job configuring the database

Do you want a Multi-AZ Deployment?

If this is going to be a production database, then it's highly recommended to create a standby instance

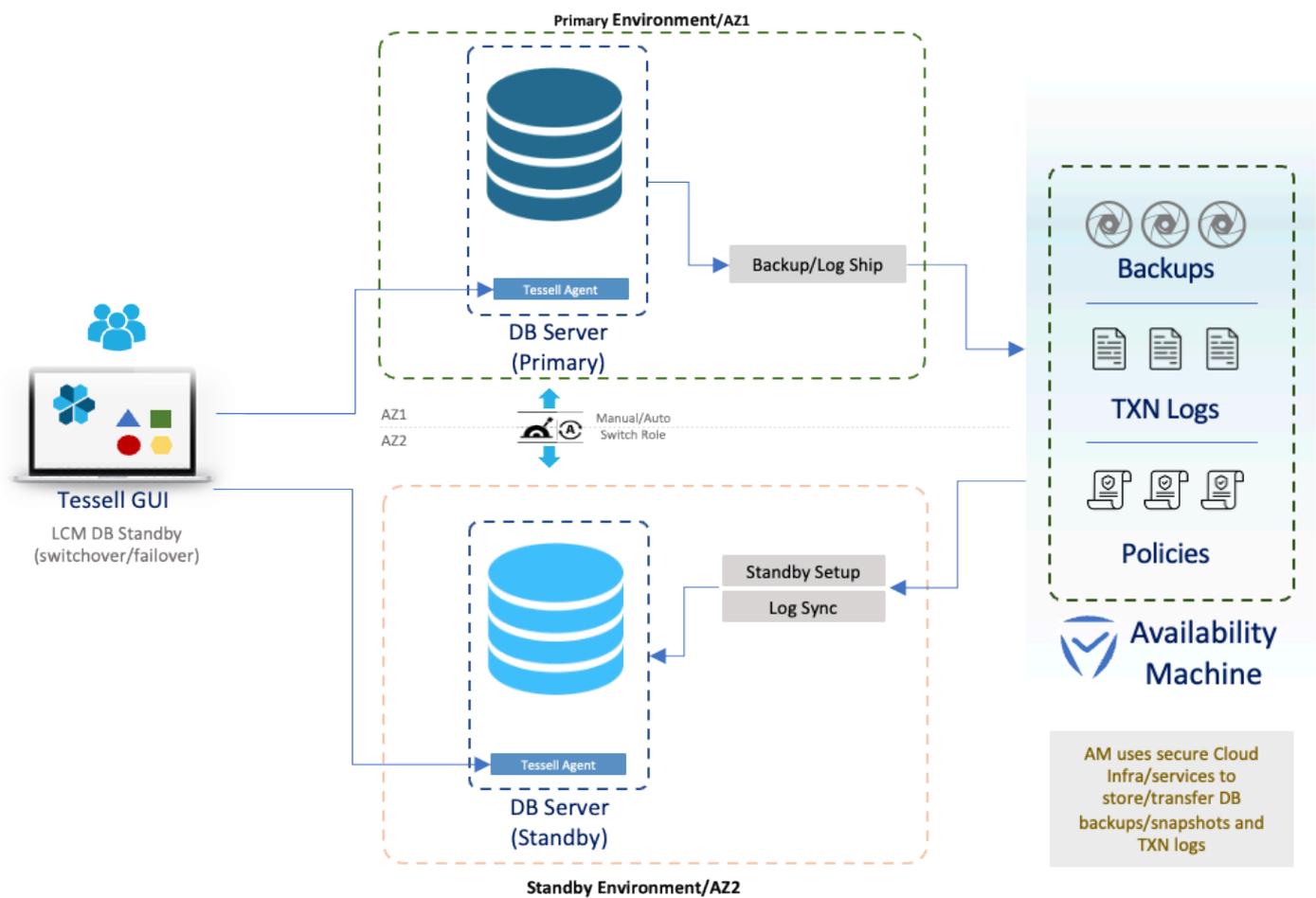
Create a Standby Instance

Creates a standby in a different Availability Zone (AZ) to provide data redundancy, eliminate I/O freezes, and minimize latency spikes during system backups.

Oracle SE2 Provisioning with Multi-AZ Option

The following diagram provides an overview of Tessell's multi-AZ replication, highlighting key steps/components in the replication process.

Tessell Multi - AZ: Oracle (SE2)



Oracle SE2 Multi-AZ HA Architecture

Components

- **The Tessell Control Plane:** This is Tessell's brain that sits in an AWS account owned by Tessell itself.
- **Database Servers (Data Plane):** Primary and Replica instances that form the Multi-AZ highly available database service.
- **The Tessell Availability Machine:** The data collector that's responsible for taking snapshots and continuously capturing the transaction logs.
- **The Tessell Agent:** It's an extremely lightweight process running on the database server that pulls the data from the Availability Machine and applies it to the replicas.

Backups & Log Capture

Every replication mechanism consists of building a replica and ensuring it is in (near) real-time sync with its primary. Tessell uses an industry-proven Oracle RMAN backup and logging mechanism to achieve multi-AZ replication. The Tessell Availability Machine maintains a series of backups (for general data protection) and

captures Oracle archive logs periodically. The Availability Machine leverages cloud infrastructure (block storage, snapshots, and blob storage) to make its content available across availability zones and also across regions. Customers can set the RPO/RTO SLAs to meet their needs. In addition to the archive logs captured regularly (say every 5 minutes), Tessell maintains the REDO logs on cloud storage disks. This gives us the ability to also make this data available for recovery (zero data loss) at the replica if needed.

Availability Machine

As the primary database produces archive logs, the Tessell Agent sitting on the primary database server pushes these transaction logs to the Availability Machine. The Availability Machine, as the name suggests, is central to Tessell's data management architecture. It maintains a catalog of different kinds of data: snapshots, archive logs, database dumps, sanitized data, traditional backups, and more. For the current discussion, backups and transaction logs are of interest to us. The Availability Machine helps users define "what," "where," "when," "to whom," and "how much" of their data to be made available based on policies. For Multi-AZ-based replication, agents on replica databases can fetch the archive (transaction) logs as they get accrued on the availability machine (by the primary database). Customers can avail themselves of multiple knobs to control the replication process (delayed or instant application).

Secure Communication and Resilience

The Tessell Availability Machine architecture leverages an industry-standard security architecture. The Tessell Agent pushes logs from the primary using HTTPS; the data stored in the Availability Machine is encrypted (by the user's key), and the Tessell Agents at replicas receive these logs via HTTPS. It should be clarified that there is no need for SSH across primary and replica sites. If the replication agent is unable to communicate for some time, the Availability Machine continues to accrue the transaction logs and keeps them for a specified period (based on SLAs, e.g., 2 days or 7 days of continuous availability).

Standby Synchronization

In the Multi-AZ replication mode, each standby database server has a preconfigured Tessell Agent.

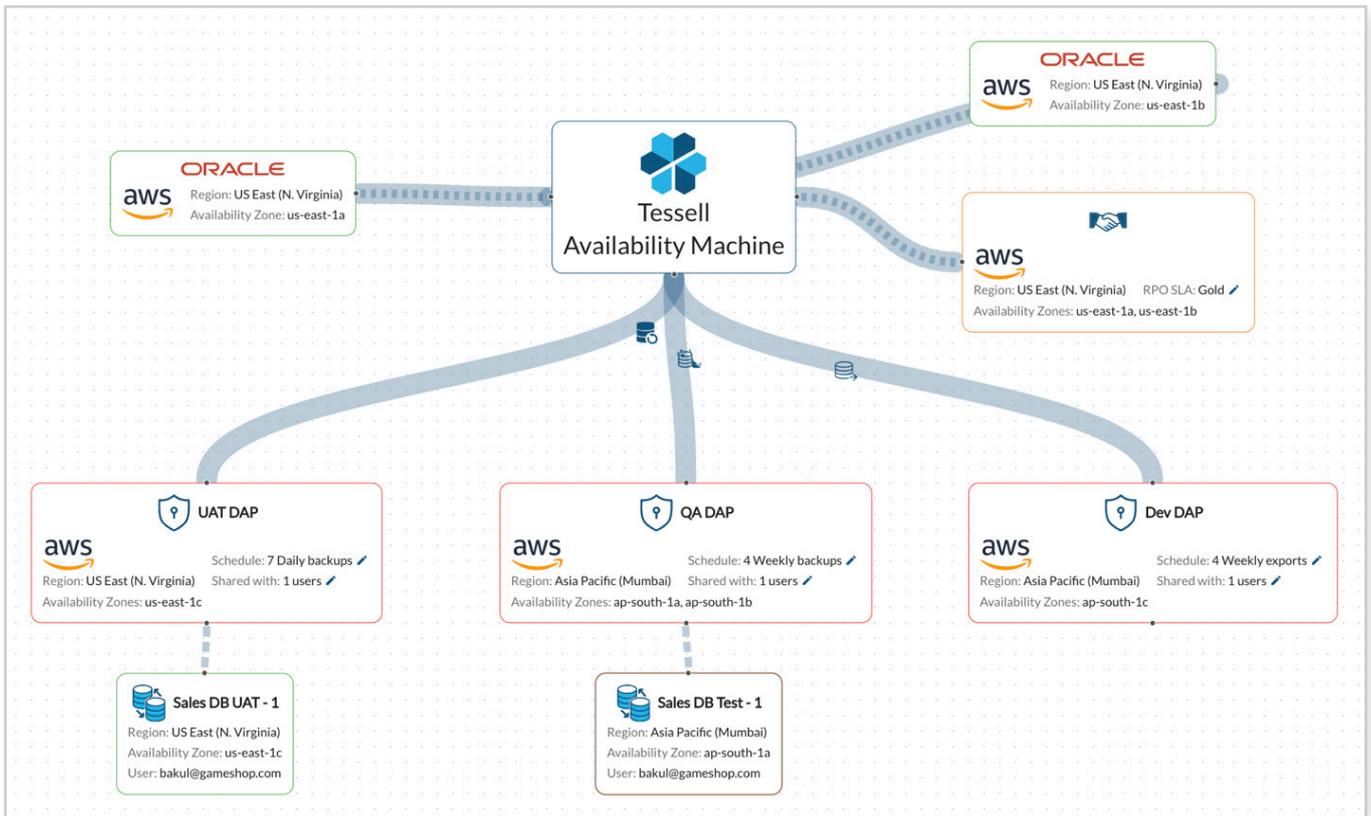
This agent pulls the logs from the Availability Machine (AWS S3/Azure Blob Storage) and applies them to the database. The standby database is in continuous recovery mode. The replication between primary and standby is not synchronous and can be delayed by up to 5 minutes.

There is no requirement to open any ports for communication between the primary and the standby servers.

Tessell provides multiple knobs to control the replication process and supports the ability to have multiple replicas (in different availability zones) exist in the system. In addition, Tessell provides capabilities like backup and cloning on these DR copies.

This helps customers achieve reporting, QA, and development environments that can be created on-demand with one click.

The picture below illustrates how the Tessell Availability Machine continuously captures data from the primary and applies it to the replica, while also supplying the data for secondary environments.



Tessell Availability Machine for Multi-AZ Oracle SE2

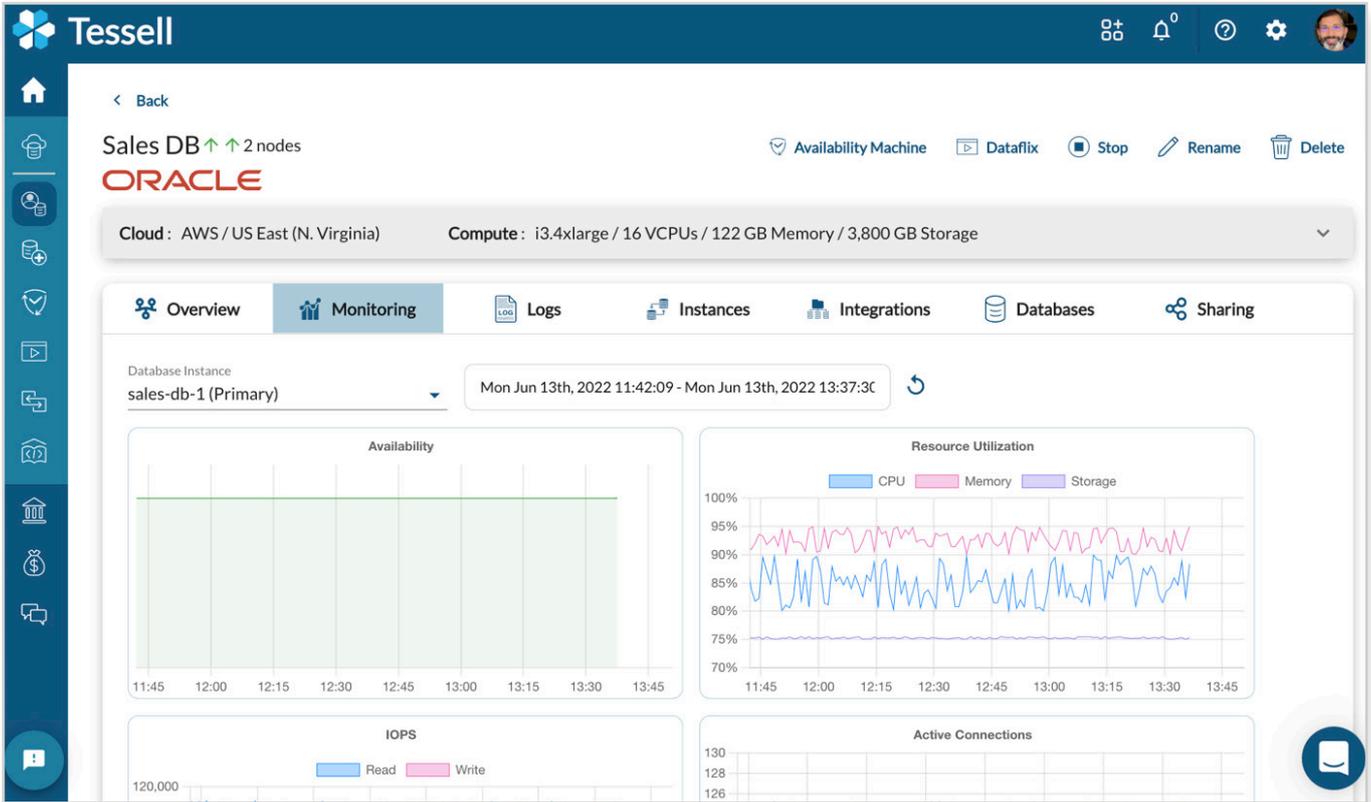
Monitoring and Log Viewing

For every database that you create in Tessell, you get a fully-managed database service that entails advanced monitoring and live log viewing. Tessell collects a wide range of monitoring metrics, including infrastructure metrics such as CPU utilization, memory utilization, storage utilization, IOPS, etc., and database metrics such as active connections, idle connections, buffer cache, etc. All the metrics are exported to a Grafana dashboard, while a select number of key metrics are available within the Tessell GUI itself. The monitoring data is available for the last 30 days. See the picture below.

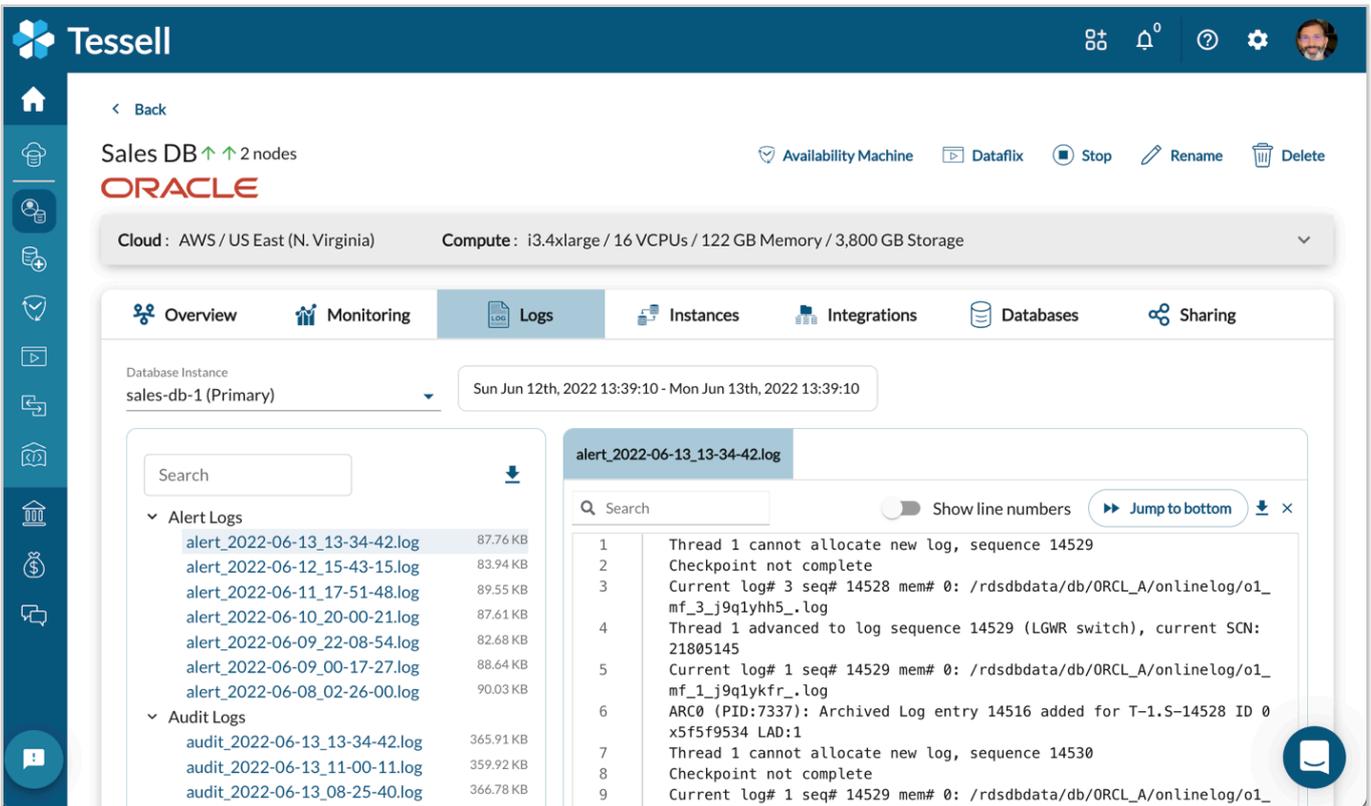
In addition to the metrics, Tessell also continuously collects the database and the system logs. The database logs, such as alert.log, listener.log, etc., are visible to the enduser, whereas the system logs are only meant for internal operational use. The user can view the logs live or see the historical logs for up to the last 30 days.

Both the monitoring metrics and live logs are available for all the instances in the Multi-AZ system. You can switch at any time between the primary instance or any of the replica instances to view the corresponding metrics or logs.

Tessell also supports integrating monitoring and logging with third-party services. For example, if you use an external service such as Datadog for monitoring, then you can bring the corresponding endpoint and Tessell will continuously ship the metric data to Datadog. See pictures below.



Tessell Availability Machine for Multi-AZ Oracle SE2



Database Logs

Notifications and Alerts

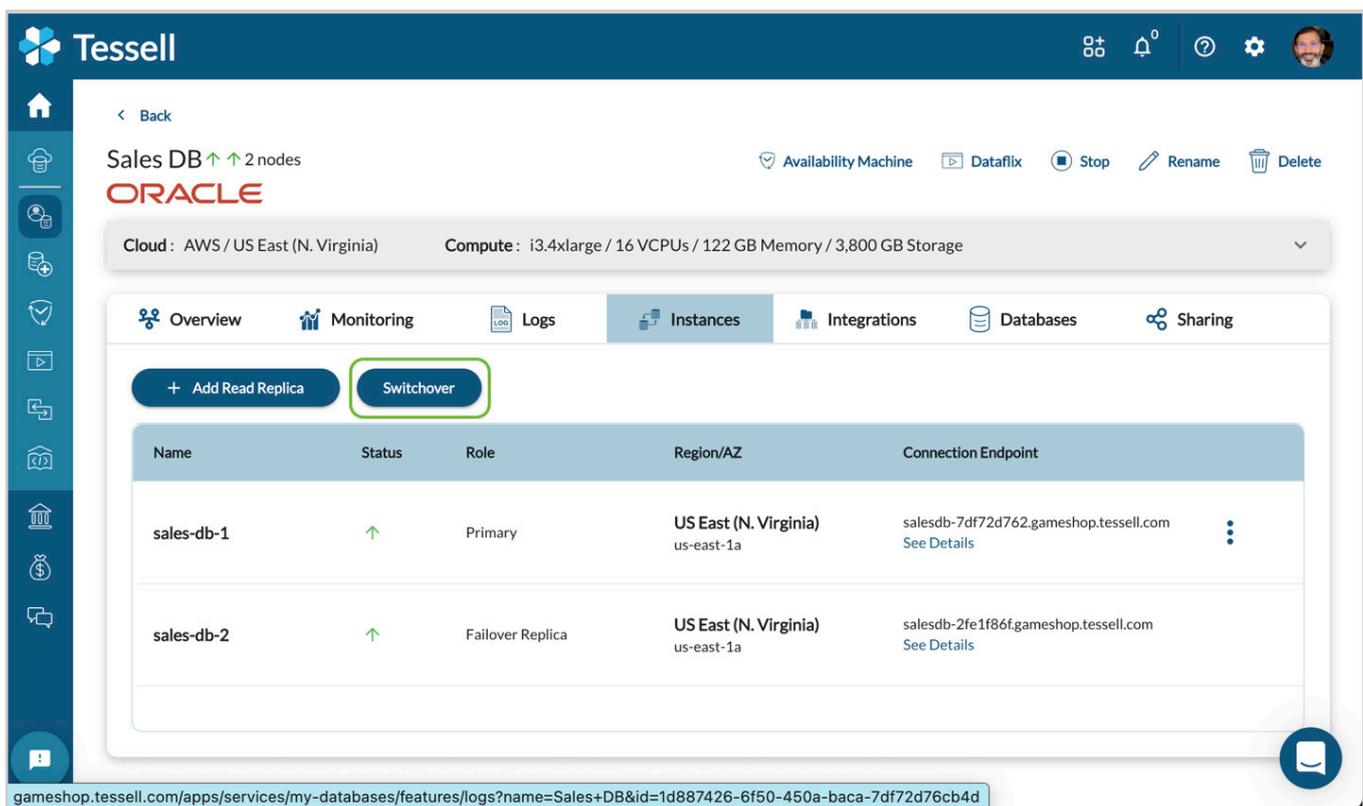
Tessell maintains an event trail of both system-triggered and user-triggered actions on the database service (primary and replicas) and the corresponding Availability Machine. Some of the important events that are tracked include snapshot creation, start/stop of the service, and failover. Users can see all these events on the Activity Log page. Tessell also provides an option for the user to be notified of these events via email.

Leveraging the notification framework, Tessell meticulously monitors the status of the primary instance in the Multi-AZ service. If there's ever any failure detected in the primary instance, then the service automatically fails over to one of the replicas. The user is alerted about the failure at the beginning of the failover, and then again notified once the process is complete.

Failure Detection and Management

Tessell provides “zero data loss” switchover and failover mechanisms. With the advanced monitoring and notification framework in place, Tessell proactively looks for instance failures and automatically fails over the primary to one of the replica instances in the event of a failure. Tessell also provides a first-class option to manually test the switchover capabilities. You can inject switchover as many times as you want without the loss of any data.

Planned Switchover



The screenshot displays the Tessell console interface for a database service. The main content area shows the 'Instances' tab for a database named 'Sales DB'. A 'Switchover' button is highlighted with a green border. Below this, a table lists the database instances:

Name	Status	Role	Region/AZ	Connection Endpoint
sales-db-1	↑	Primary	US East (N. Virginia) us-east-1a	salesdb-7df72d762.gameshop.tessell.com See Details
sales-db-2	↑	Failover Replica	US East (N. Virginia) us-east-1a	salesdb-2fe1f86f.gameshop.tessell.com See Details

Instances in Oracle HA

1. Users can trigger switchover for primary and standby database instances on demand from the Tessell UI/API.
2. This is a graceful operation, and Tessell can provide “0” RPO for switchover operation.
3. Tessell also takes care of updating the service endpoint names so that applications have a transparent failover.

Automatic Failover

1. Tessell has “observer” services to monitor the health of the primary and standby instances.
2. On detection of unavailability of the primary instance, the Tessell service will perform an automatic failover to convert the standby instance to the primary. Tessell provides options for “0” data loss options for failover operation.
3. Tessell also takes care of updating the service endpoint names so that applications have a transparent failover.
4. Tessell also has “healing” mechanisms to bring the system back to Multi-AZ after a failover operation.

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