Oracle Maximum
Availability Architecture

SOA Cloud Service Automatic Service Migration

SOACS 12.2.1.2

ORACLE

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Introduction

Oracle's Maximum Availability Architecture (Oracle MAA) is the best practices blueprint for data protection and availability of Oracle products (Database, Fusion Middleware, Applications) deployed on on-premises, private, public or hybrid clouds. Implementing Oracle Maximum Availability Architecture best practices is one of the key requirements for any Oracle deployment. Oracle Fusion Middleware and Oracle Databases include an extensive set of high availability features, such as process death detection and restart, clustering, server migration, clusterware integration, GridLink, load balancing, failover, backup and recovery, rolling upgrades, and rolling configuration changes, which protects application deployments from unplanned downtime and minimize planned downtime.

Oracle Service-Oriented Architecture (SOA) Cloud Service is a Platform as a Service (PaaS) computing platform solution for running Oracle SOA Suite in the cloud. This computing platform uses Oracle Compute Cloud Service, Oracle Database Cloud Service and Oracle Java Cloud Service as its basic infrastructure Oracle SOA Suite requires an Oracle Database to store Oracle Platform Security Services information, instance tracking, composite and document metadata and other Oracle FMW Infrastructure schemas.

Oracle SOA Cloud Service (SOACS) provides the best Recovery Time Objective (RTO) and Recovery Point Objective (RPO) by utilizing high availability and disaster protection capabilities provided by Oracle Fusion Middleware and Oracle Database. By default the main mechanisms to protect a SOACS service from outages are Node manager restart of failed servers and VM restart by the Cloud Infrastructure. Node manager is a critical part of Oracle FMW High Availability. Node Manager is a WebLogic Server utility that runs as a separate process and enables you to manage the WebLogic Server environment that hosts applications with high availability requirements. Node Manager, enables you to start, shut down, and restart Administration Server and Managed Server instances from a remote location. If a server instance that was started using Node Manager fails, Node Manager automatically restarts it. At the same time, the Oracle Cloud infrastructure automates the restart of service when they stop unexpectedly. Both Node Manager's restart of failed servers and VM restart imply a full start of the WebLogic Server involved (and even more time for VM restart). This incurs in a recovery time that may not be acceptable for some applications with short life expectancy for JMS messages and transactions. If the SOACS instance is using pinned services such as JMS or JTA their recovery by NM or after a VM start may incur in more time than the application expects and the pending messages and transactions may just become obsolete. For these cases, Oracle recommends using Automatic Service migration. Automatic Service Migration allows failing over services across weblogic servers. Since a full restart of

a weblogic server is not required, the fail over process takes just a few seconds. This approach provides the best Recovery Time Objective for applications using JMS and JTA.

This Oracle MAA blueprint details Oracle MAA Best Practices and provides a procedural overview for enabling Automatic Service Migration for SOA Cloud Service.

This paper is intended for a technical audience having knowledge of Oracle Weblogic Server, Oracle FMW SOA and Oracle Database. This paper also assumes a basic understanding of services offered on the Oracle Cloud[1].

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1 https://cloud.oracle.com/home

Configuring Automatic Service Migration for a 12.2.1.2 SOACS Cluster

Automatic Service Migration provides protection for different subsystems in a weblogic server by migrating those (when there is a failure) to other weblogic servers that remain available. The failure detection mechanism is based on a "leasing schema" created in the Database to which the members of a cluster report their "aliveness" by writing timestamps on a regular basis. A standard DB connection is used to write alive signals in the DB. Servers or services fail when these time stamps are not updated periodically (Admins can configure intervals and repetitions).

In summary, configuring Automatic Service Migration involves the following steps:

- Create a Datasource for Leasing
- Setting the Leasing Mechanism and Data Source for an Enterprise Deployment Cluster
- Changing the Migration Settings for the Managed Servers in the Cluster
- Configure the OSB transports as application-scoped singletons (if applicable)
- Setting the Service Migration Policy for Each Managed Server in the Cluster

The following sections provide the details for each step above

Create a Datasource for Leasing

Whole Server Migration and Automatic Service Migration require a data source for the leasing table, this table is created automatically as part of the Oracle WebLogic Server schemas by the Repository Creation Utility (RCU).

For a typical high-end deployment where DbaaS is using a RAC database, you should create a GridLink data source. Since the Database is used as the main reliable point for triggering migration, it is highly recommended using a RAC database for it. The following steps describe the process to create a Gridlink Datasource for leasing for a 12c Databse. For 11g Databases, refer to the Fusion Middleware Enterprise Deployment Guide for Orace SOA Suite

1. Log in to the Oracle WebLogic Server Administration Console.
2. If you have not already done so, in the Change Center, click Lock & Edit.
3. In the Domain Structure tree, expand Services, then select Data Sources.
4. On the Summary of Data Sources page, click New and select GridLink Data Source, and enter the following:
    - Enter a logical name for the data source in the Name field. For example, Leasing.
    - Enter a name for JNDI. For example, jdbc/leasing.
    - For the Database Driver, select Oracle's Driver (Thin) for GridLink Connections Versions: Any.
    - Click Next.
5. In the Transaction Options page, **clear** the Supports Global Transactions check box, and then click Next.

    ☐ **Supports Global Transactions**

6. In the GridLink Data Source Connection Properties Options screen, select "Enter complete JDBC URL " and click next
7. In the connection properties screen enter the following information:

- Complete JDBC URL: The JDBC URL can be obtained from the SOACS node with the following command:

```
grep url /u01/data/domains/domain_name/config/jdbc/SOADataSource-jdbc.xml

    <url>jdbc:oracle:thin:@//drdb3a-scan-
int:1522/SOAPDB.us6z12opcsoa01.oraclecloud.internal</url>
```

In this example, the url would be

```
 jdbc:oracle:thin:@//drdb3a-scan-
int:1522/SOAPDB.us6z12opcsoa01.oraclecloud.internal
```

- Database User Name: Enter *SCHEMA_PREFIX*_WLS_RUNTIME

```
SCHEMA_PREFIX is the prefix your SOA schemas use and it can be
found in the middle tier node with the following command

-bash-4.1$ grep SOAINFRA
/u01/data/domains/domain_name/config/jdbc/*.xml
/u01/data/domains/domain_name /config/jdbc/BamDataSource-
jdbc.xml:        <value>SP128394412_SOAINFRA</value>
```

In this case *SP128394412* would be the prefix, hence the Database user name to be used for leasing would be

SP128394412_WLS_RUNTIME

Note that in previous versions of Oracle Fusion Middleware, you had to manually create a user and tablespace for the migration leasing table. Starting Fusion Middleware 12c (12.2.1), the leasing table is created automatically when you create the WLS schemas with the Repository Creation Utility (RCU).

- Password: Enter the password you used when you created the SOA service.
- Confirm Password: Enter the password again and click Next.

8. On the Test Gridlink Database Connection page, review the connection parameters and click Test All Listeners.

Here is an example of a successful connection notification:

✅ Connection test for jdbc:oracle:thin:@//drdb3a-scan-int:1522/SOAPDB.us6z12opcsoa01.oraclecloud.internal succeeded.

Click Next.

9. In the ONS Client Configuration page, do the following:
- Select FAN Enabled to subscribe to and process Oracle FAN events.

- There is no need to enter the SCAN address in the ONS Host and Port field, since Oracle 12c provides auto ONS registration
- Click Next

10. In the Select Targets page, select the cluster that you are configuring for Whole Server Migration or Automatic Service Migration, and then select All Servers in the cluster.
11. Click Finish.
12. In the Summary of JDBC Data Sources, click the name of the new data source.
13. In the Configuration > Connection Pool tab, expand Advanced.
14. Check the "Test Connection On Reserve" checkbox:
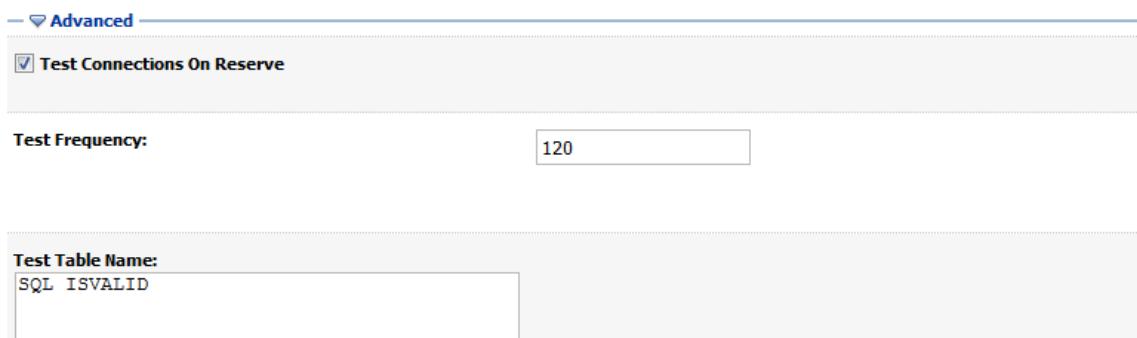
15. Click Save.
16. Click Activate Changes.

If a single instance database is used for the SOA schemas, you can use these steps to create the leasing Datasource:

1. Log in to the Oracle WebLogic Server Administration Console.
2. If you have not already done so, in the Change Center, click Lock & Edit.
3. In the Domain Structure tree, expand Services, then select Data Sources.
4. On the Summary of Data Sources page, click New and select Generic Data Source, and enter the following:
   - Enter a logical name for the data source in the Name field. For example, "Leasing".
   - For the Scope, select Global
   - Enter a name for JNDI. For example, "jdbc/leasing".
   - For the Database Type select "Oracle".
   - Click Next.
5. In the JDBC Data Source Properties page, select "Oracle's Driver(Thin) for Service connections;Versions: Any"
6. In Transaction Options page, clear the Supports Global Transactions check box, and then click Next.

7. In the Connection Properties enter the following connection properties:

The Database Name, Host name and Port can be determined by running the following command in the SOACS nodes

```
grep url
/u01/data/domains/maa2_domain/config/jdbc/SOADataSource-
jdbc.xml

<url>jdbc:oracle:thin:@drDB2a:1521/PDB1.us6z12opcsoa01.oraclec
loud.internal</url>
```

- Database Name: Enter the service of the DbaaS database with lowercase characters. The service used for accessing your DbaaS can be determined with the following command in the SOACS node. In the example above:

  PDB1.us6z12opcsoa01.oraclecloud.internal

- Host Name: Enter the local address for the database. For example

  drDb2a

- Port: Enter the port for the database. For example:

  1521

- Database User Name: Enter *SCHEMA_PREFIX*_WLS_RUNTIME

```
SCHEMA_PREFIX is the prefix your SOA schemas use and it can be
found in the middle tier node with the following command

-bash-4.1$ grep SOAINFRA
/u01/data/domains/maa2_domain/config/jdbc/*.xml
/u01/data/domains/maa2_domain/config/jdbc/BamDataSource-
jdbc.xml:          <value>SP128394412_SOAINFRA</value> when you
created the schemas as you prepared to configure the initial
enterprise manager domain.
```

  In this case SP128394412 would be the prefix, hence the Database user name to be used for leasing would be

  SP128394412_WLS_RUNTIME

  Note that in previous versions of Oracle Fusion Middleware, you had to manually create a user and tablespace for the migration leasing table. Starting Fusion Middleware 12c (12.2.1), the leasing table is created automatically when you create the WLS schemas with the Repository Creation Utility (RCU).

- Password: Enter the password you used when you created the SOA service.
- Confirm Password: Enter the password again and click Next.

8. On the Test Database Connection page, review the connection parameters and click Test All Listeners.

  Here is an example of a successful connection notification:

Click Next.

9. In the Select Targets page, select the cluster that you are configuring for Automatic Service Migration, and then select All Servers in the cluster.
10. Click Finish.
11. In the Summary of JDBC Data Sources, click the name of the new data source.
12. In the Configuration > Connection Pool tab, expand Advanced.
13. Check the "Test Connection On Reserve" checkbox:

14. Click Save.
15. Click Activate Changes.

Setting the Leasing Mechanism and Data Source for a SOACS Cluster

Use these steps for setting the datasource

1. Log in to the Oracle WebLogic Server Administration Console.
2. Click Lock & Edit.
3. In the Domain Structure window, expand Environment and select Clusters.

   The Summary of Clusters page appears.

4. In the Name column of the table, click the cluster for which you want to configure migration.
5. Click the Migration tab.
6. Verify that Database is selected in the Migration Basis drop-down menu.
7. From the Data Source for Automatic Migration drop-down menu, select the Leasing.
8. Click Save.
9. Activate changes.
10. This change requires the restart of the managed servers for the changes to be effective. If you are configuring other aspects of ASM in the same configuration change session, you can use a final unique restart to reduce downtime.

Changing the Migration Settings for the Managed Servers in the Cluster

After you set the leasing mechanism and data source for the cluster, you can then enable automatic JTA migration for the Managed Servers that you want to configure for service migration. Note that this topic applies only if you are using JTA services in your system.

To change the migration settings for the Managed Servers in each cluster:

1. If you haven't already, log in to the Administration Console, and click Lock & Edit.
2. In the Domain Structure pane, expand the Environment node and then click Servers.

    The Summary of Servers page appears.

3. Click the name of the server you want to modify in Name column of the table.

    The settings page for the selected server appears and defaults to the Configuration tab.

4. Click the Migration tab.
5. From the JTA Migration Policy drop-down menu, select Failure Recovery.
6. Leave the JTA Candidate Servers and the JMS Service Candidate Servers lists empty (If no servers are selected all available servers in the cluster are candidate for JTA/JMS migration).
7. Click Save.
8. Restart the managed servers and the Administration Server for the changes to be effective. If you are configuring other aspects of ASM in the same configuration change session, you can use a final unique restart to reduce downtime.

Setting the Service Migration Policy for Each Managed Server in the Cluster

After you modify the migration settings for each server in the cluster set the migration policy for each Managed Server in the cluster, using the WebLogic Administration Console:

1. If you haven't already, log in to the Administration Console, and click Lock & Edit.
2. In the Domain Structure pane, expand Environment, then expand Clusters, then select Migratable Targets.
3. Click the "Name_of _the_first_Managed _Server (migratable)" in the cluster.
4. Click the Migration tab.
5. From the Service Migration Policy drop-down menu, select the Auto-Migrate Failure-Recovery Services policy for the cluster.
6. Click Save.
7. Repeat steps 2 through for each of the additional Managed Servers in the cluster.
8. In the Domain Structure pane, select Environment > Clusters > cluster_name > Configuration tab > General tab > Advanced.
9. In the Service Activation Request Response Timeout field, type 0.

10. Activate the changes.
11. Restart the managed servers for the changes to be effective. If you are configuring other aspects of ASM in the same configuration change session, you can use a final unique restart to reduce downtime.

Configuring OSB's application-scoped singletons

Oracle Service Bus uses some singleton services that should run only in one of the managed servers in the OSB_Cluster. To configure the required application-scoped singleton behavior, enable ASSM in Oracle Enterprise Manager Fusion Middleware Control:

1. Log in to Oracle Fusion Middleware Enterprise Manager.
2. Navigate to SOA > service-bus (*name of the admin_server*) >Home> Global Settings and select Automatic Singleton Service Migration.[2]
3. Click "Apply"
4. Restart the managed servers to make the change effective.

Tuning database leasing retries

When Automatic Service Migration is configured, the leasing table becomes a critical resource. In an event of a database outage, the SOA servers configured with database leasing will shut down themselves if they are not able to update the leasing table. The server goes to FAILED state because the JTA critical subsystem fails and it is automatically shut down. This can take less than 1 minute. Two parameters can be tuned to increase the resiliency to a database outage when Automatic Service Migration is used in the cluster. These parameters are:
- database-leasing-basis-connection-retry-count - the maximum number of times Database Leasing tries to obtain a valid connection from the Data Source. (1 by default)
- database-leasing-basis-connection-retry-delay - the length of time, in milliseconds, Database Leasing waits before attempting to obtain a new connection from the Data Source when a connection has failed. (1000 milliseconds by default).

If the product of the (database leasing retry count) * (database leasing retry delay) is higher than the database outage total time, the servers will not be restarted and they will reconnect to the leasing table once the database is available again.

Use WLST to connect to the admin server and tune these parameters. This is an example to increase them to 10 leasing retries and 10 seconds of delay between retries.

```
cd /u01/app/oracle/middleware/oracle_common/common/bin
./wlst.sh
connect('weblogic','password','t3://soacs-wls-1:9071')
edit()
startEdit()
cd('/Clusters/' + 'soacs_cluster')
cmo.setDatabaseLeasingBasisConnectionRetryCount(10)
cmo.setDatabaseLeasingBasisConnectionRetryDelay(10000)
save()
activate()
disconnect()
exit()
```

Managed servers must be restarted for this change to take effect.

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2 In SOACS 12.2.1.2 two patches are required for the appropriate behavior of this change. Check patch #26448284 and #28305370 (see Doc ID 2295631.1 for information regarding this patch)

In case the total number of retries for updating the leasing table are reached, the servers go to FAILED state and they are automatically restarted by the node manager. The number of restart attempts performed by the node manager can be tuned as well. In the server's Health Monitoring tab, use the parameter "Max Restarts Within Interval" to define the number of times that the node manager can restart this server within the interval specified in Restart Interval.

Validating Automatic Service Migration

After you configure automatic service migration for your cluster and Managed Servers, validate the configuration, as follows:

1. If you have not already done so, log in to the Administration Console.
2. In the Domain Structure pane, select Environment, then Clusters.
3. In the Domain Structure pane, expand Environment, and then expand Clusters.
4. Click Migratable Targets.
5. Click the Control tab.

   The console displays a list of migratable targets and their current hosting server.

6. In the Migratable Targets table, select a row for the one of the migratable targets.
7. Note the value in the Current Hosting Server column.
8. Use the operating system command line to stop the first Managed Server.

   Use the following command to end the Managed Server Process and simulate a crash scenario:

   ```
   kill -9 pid
   ```

   In this example, replace pid with the process ID (PID) of the Managed Server. You can identify the PID by running the following UNIX command:

   ```
   ps -ef | grep managed_server_name
   ```

   Note that after you kill the process, Node manager is configured to restart automatically after you initially kill the process. In this case, you must kill the second process using the kill –9 command again.

9. Watch the terminal window (or console) where the Node Manager is running.

   You should see a message indicating that the selected Managed Server has failed. The message will be similar to the following:

   ```
   <INFO> <domain_name> <server_name>
   <The server 'server_name' with process id 4668 is no longer
   alive; waiting for the process to die.>
   <INFO> <domain_name> <server_name>
   <Server failed during startup. It may be retried according to the
   auto restart configuration.>
   <INFO> <domain_name> <server_name>
   ```

10. Return to the Oracle WebLogic Server Administration Console and refresh the table of migratable targets; verify that the migratable targets are transferred to the remaining, running Managed Server in the cluster:
    o Verify that the Current Hosting Server for the process you killed is now updated to show that it has been migrated to a different host.

o   Verify that the value in the Status of Last Migration column for the process is "Succeeded". Clicking on the "Succeeded" link should show a screen like this:

Task Results for MigrationData-maa2_dom_server_2 (migratable)1516370314038-adminServer5

This page allows you to view status information related to this server life cycle transition task.

Name:	Service Migration for maa2_dom_server_2 (migratable)	The name of this configuration. WebLogic Server uses an MBean to implement and persist the configuration. More Info...
Status:	Succeeded	Status of the migration (SUCCESSFUL, IN_PROGRESS, or FAILED) More Info...
Begin Time:	1/19/18 1:58:34 PM UTC	Start time of migration More Info...
End Time:	1/19/18 1:58:45 PM UTC	End time of migration More Info...
Server:	maa2_dom_server_2 (migratable)	Name of the object migrated More Info...
Cluster:	maa2_cluster	Name of the cluster More Info...
Migrated From:	maa2_dom_server_2	Where this object was migrated from More Info...
Migrated To:	maa2_dom_server_1	Where this object was migrated to More Info...
Destinations Attempted:	maa2_dom_server_1	Get all the destinations attempted for migration. More Info...
Coordinator:	maa2_dom_server_1	Name of the server that acted as the coordinator for this migration. More Info...

11. Open and review the log files for the Managed Servers that are now hosting the services; look for any JTA or JMS errors.

Note:

For JMS tests, it is a good practice to get message counts from destinations and make sure that there are no stuck messages in any of the migratable targets:

For example, for uniform distributed destinations (UDDs):

1. Access the JMS Subdeployment module in the Administration Console:

   In the Domain Structure pane, select Services, then Messaging, and then JMS Modules.

2. Click the JMS Module.
3. Click the destination in the Summary of Resources table. destination->Select monitoring and get the Messages Total and Messages Pending Counts
4. Select the Monitoring tab, and review the Messages Total and Messages Pending values in the Destinations table.

Failing Back Services After Automatic Service Migration

When Automatic Service Migration occurs, Oracle WebLogic Server does not fail back services to their original server when that server is back online and rejoins the cluster.

As a result, after the Automatic Service Migration migrates specific JMS services to a backup server during a fail-over, it does not migrate the services back to the original server after the original server is back online. Instead, you must migrate the services back to the original server manually.

To fail back a service to its original server, follow these steps:

1. If you have not already done so, log in to the Administration Console.
2. If you have not already done so, in the Change Center of the Administration Console, click Lock & Edit.
3. In the Domain Structure tree, expand Environment, expand Clusters, and then select Migratable Targets.
4. To migrate one or more migratable targets at once, on the Summary of Migratable Targets page:
    1. Click the Control tab.
    2. Use the check boxes to select one or more migratable targets to migrate.
    3. Click Migrate.
    4. Use the New hosting server drop-down to select the original Managed Server.
    5. Click OK.

        A request is submitted to migrate the JMS-related service and the configuration edit lock is released. In the Migratable Targets table, the Status of Last Migration column indicates whether the requested migration has succeeded or failed.

5. To migrate a specific migratable target, on the Summary of Migratable Targets page:
    1. Select the migratable target to migrate.
    2. Click the Control tab.
    3. Reselect the migratable target to migrate.
    4. Click Migrate.
    5. Use the New hosting server drop-down to select a new server for the migratable target.
    6. Click OK.

Considerations for Automatic Service Migration when scaling up a SOACS Cluster

After scaling up or out a SOACS cluster, it is required to update the migratable target automatically created for the new server with the recommended migration policy, because by default it is set to Manual Service Migration Only.

1. If you have not already done so, log in to the Administration Console.
2. Go to Environment > Cluster > Migratable Servers.
3. Click Lock & Edit
4. Click *service_name_dom_serverN* (migratable). (where *service_name_dom_serverN* is the name of the server just added)
5. Go to the tab Configuration > Migration.
6. Change the Service Migration Policy to the value listed in the table.
7. Leave the Constrained Candidate Server list blank in case there are chosen servers. If no servers are selected, you can migrate this migratable target to any server in the cluster.
8. Click Save, and then click Activate Changes.

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White Paper Title: SOA Cloud Service Disaster Recovery - Production and DR in the Cloud
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