Dell EMC PowerProtect Software: Oracle Application Integration

Abstract

This white paper explains Power Protect Data Manager Application Direct Integration with Oracle. It discusses architecture workflow of installation, backup and restore of Oracle RMAN.

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Revisions

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Executive summary

Dell EMC PowerProtect Software is a data management solution for database applications, VMware VMs, and File Systems. PowerProtect Software offers DBA self-service data protection and recovery through Application Direct (formerly DD Boost for Enterprise Applications). Along with data protection, PowerProtect Software provides data management services including compliance, governance, security, visibility, and analytics for data under management.

Currently, Application Direct is integrated into PowerProtect Data Manager to protect Oracle, Microsoft SQL database with the following benefits:

Application Integration: Application Direct leverages the native application tools to empower application owners to protect their data, directly to protection storage (Data Domain system or PowerProtect X400), using the same familiar tools.

Optimized Data Mobility: Application Direct uses DD Boost as the data mover allowing only unique data to be sent over the network to the protection storage (Data Domain system or PowerProtect X400 Integrated Storage).

Audience

This white paper is intended for customers, partners, and employees who want to better understand, evaluate, and explore Power Protect Data Manager Application Direct Integration with Oracle. It discusses architecture workflow of installation, backup and restore of Oracle RMAN. Familiarity with Power Protect Software, Data Domain and PowerProtect X400 is required.

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1 Introduction

1.1 Oracle RMAN Agent

The Oracle application agent allows an application administrator to protect and recover the Oracle/RMAN application data on the application host. Oracle RMAN agent can be used alone by DBA to backup using RMAN scripts and transfer the data to protection storage. PowerProtect Data Manager ADM agent integrates with the RMAN agent to check and monitor backup compliance against protection policies.

The Oracle RMAN agent installation is a command line process whereby the oracle user installs the required Oracle RMAN agent and root user installs PowerProtect Data Manager software. You must use the Oracle RMAN agent version 19.1 with PowerProtect version 19.1. If a previous version of Oracle RMAN agent is installed, you must upgrade to version 19.1 by using the following instructions

1.2 PowerProtect Data Manager ADM Agent

PowerProtect Application Data Manager (ADM) agent is installed with Oracle RMAN agent. With the help of PowerProtect Data Manager ADM agent we can monitor, manage, or analyze the Oracle RMAN agent backups on Linux. PowerProtect Data Manager ADM agent can create and manage replication copies based on the protection policies.
PowerProtect Data Manager ADM agent performs these operations whether the backup is created by the DBA or by the PowerProtect Data Manager centralized backup scheduler. PowerProtect Data Manager with Oracle integration supports the following features and functionalities.

- PowerProtect Data Manager Centralized protection policy.
- PowerProtect Data Manager Self-Service protection policy.
- Oracle databases can be discovered by PowerProtect Data Manager automatically
- Single Protection Policy (PLC) to manage the entire life cycle of data protection for Oracle database.

1.3 Protection Storage

The first step in Oracle integration with PowerProtect Data Manager is to ensure that you have a protection storage target that is configured to store the backup data. You can accomplish this by adding either a Data Domain system or Integrated Storage PowerProtect X400 to the PowerProtect environment.

The Data Domain system or Integrated Storage PowerProtect X400 can be discovered and added to the PowerProtect environment through the PowerProtect Data Manager.

1.4 PowerProtect Data Manager Software

PowerProtect Data Manager integrates multiple data protection products within the Dell EMC Data Protection portfolio to enable data protection as a service. PowerProtect Data Manager enables new data paths with provisioning, automation, and scheduling that enable a data protection team to embed protection engines into the infrastructure for high-performance backup and recovery.

The backup metadata is stored in Elastic Search Node of the PowerProtect Data Manager server and data is stored in Protection storage (Data Domain or PowerProtect X400).

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# 2 Install and Configure PowerProtect Application Direct for Oracle

2.1 Deployment Requirements

- To enable PowerProtect Data Manager with Oracle RMAN Agent integration, the following two software components need to be installed on the Oracle database host:
  - ➢ Oracle RMAN Agent
  - ➢ PowerProtect Data Manager ADM Agent

- In an Oracle RAC - or Real Application Clusters - environment, the Oracle RMAN Agent and the PowerProtect Data Manager ADM Agent must be installed on each node in the Oracle RAC environment.

- Ensure the Oracle database host and the PowerProtect Data Manager virtual appliance network can ping/resolve each other (nslookup).

- Ensure all clocks on the Oracle database host, PowerProtect Data Manager virtual appliance, and domain controller are time-synced to the local NTP server.

- Ensure the port 7000 is open on the Oracle database host in both directions.

- If protection storage is Data Domain, ensure all Data Domain ports are open 111,2049 and 2052 are open.

- After installing the Oracle RMAN Agent, do NOT configure the Lockbox manually. The Lockbox is automatically configured when you create the Protection Policy.

- On the Oracle database host, ensure the /etc/oratab file contains a complete list of all the Oracle SIDs. The Oracle RMAN agent uses the information in the file to discover the Oracle database resources on the system.

2.2 Installation Overview

The Oracle RMAN Agent integrates with the Oracle Recovery Manager (RMAN) to enable application owners to protect the Oracle databases they manage directly. The Oracle RMAN Agent, which contains Data Domain Boost libraries, enables the Oracle database hosts to communicate with Data Domain systems or PowerProtectX400 Integrated Storage directly without the backup application.

The following steps highlight the procedures to install the Oracle RMAN Agent, PowerProtect Data Manager ADM Agent, approve, register the Oracle RMAN Agent and Discover to view all databases:
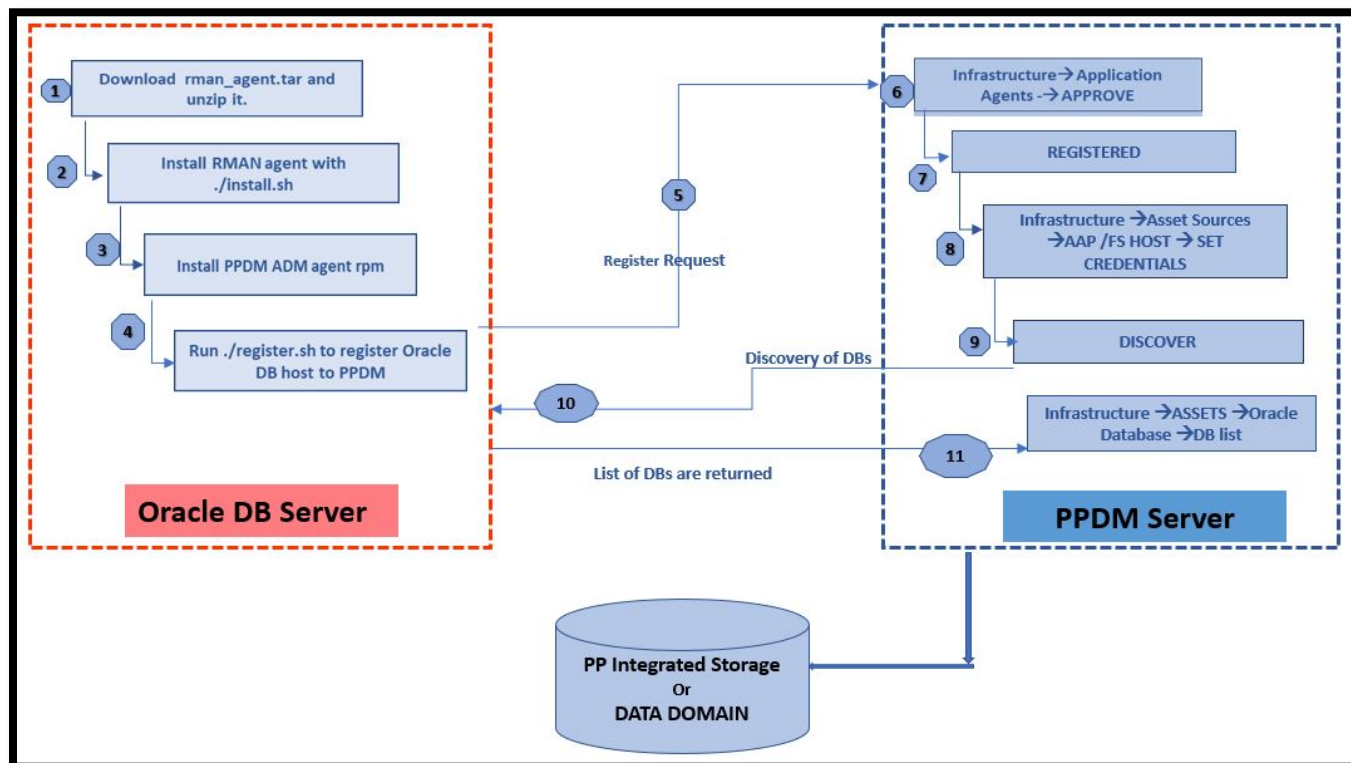
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1. Prior to using the Oracle RMAN Agent, download the .tar for linux or .zip for windows file on the Oracle database host from the Dell EMC Support Site. After you have downloaded the .tar file for linux server or .zip file for windows server, login to Oracle server as root or administrator and unzip the .tar or zip file.

2. Install the Oracle RMAN Agent using command ./install.sh on Linux server and run the Oracle RMAN agent.exe for windows.

3. Install PowerProtect Data Manager ADM Agent rpm -ivh <adm_agent.rpm>, only for linux.

4. For Linux servers run the /usr/local/ecdm/ecdm-agent/bin/register.sh command to register the Oracle database host to the PowerProtect Data Manager. For windows server, registration option will be available in last step of the install.

5. Registration request will go to PowerProtect Data Manager appliance, login to PPDM as admin.

6. On PowerProtect Data Manager console select Infrastructure > Application Agents-->Select Oracle Host-->APPROVE.

7. The Status of the Oracle database host displays Registered.

8. Add (or select) the Oracle credentials.

Select Infrastructure > Asset Sources > APP/FILE SYSTEM HOST tab. Select the desired Oracle database host, and click EDIT CREDENTIALS. You can select OS, DB or wallet authentication method.

9. Run the discovery operation manually.

Infrastructure > Asset Sources > APP/FILE SYSTEM HOST> Oracle database host and click DISCOVER. Select Manually and click Discover Now.

10. PowerProtect Data Manager will send a discovery request to Oracle client and list of databases will be returned from PowerProtect ADM agent on client.

11. On PowerProtect Data Manager appliance verify that Oracle databases are discovered and listed.

Infrastructure > Assets > ORACLE DATABASES tab.

2.3   Authentication

During the Oracle RMAN Agent installation, the configuration file template, rman_agent.cfg, is installed in the $RMAN_AGENT_HOME/config directory. To enable a particular authentication method, you must set the required parameters in the rman_agent.cfg configuration file. In other words, the rman_agent.cfg configuration file is used to configure the authentication method of the Oracle RMAN Agent.

Before the ddbmcon program can connect to a local Oracle database, you must complete the required configuration settings to enable the authentication method that you want the ddbmcon program to use for the connection. Each authentication method has its own parameter settings requirements in the rman_agent.cfg configuration file.

To enable a particular authentication method, some parameters need to be set accordingly in the rman_agent.cfg configuration file.

- **Database Authentication**

    1. Set the ORACLE_SERVICE and the ORACLE_USER parameters. The ORACLE_USER parameter must match the username that is saved in the lockbox.
    2. If the Oracle Net configuration files reside in a non-default directory, set the TNS_ADMIN parameter to the directory pathname.
    3. If an RMAN catalog is used, set the RMAN_CATALOG_SERVICE and the RMAN_CATALOG_USER parameters.

- **Oracle Wallet Authentication**

    1. Set the ORACLE_SERVICE parameter to the TNS or Net service name.
    2. If the Oracle Net configuration files reside in a non-default directory, set the TNS_ADMIN parameter to the directory pathname.
    3. If an RMAN catalog is used, set the RMAN_CATALOG_SERVICE and the RMAN_CATALOG_USER parameters.

- **Operating System Authentication**

    1. If the username to be used for the connection is different than ORACLE_OSDBA_USER, set the ORACLE_OS_USER parameter.
    2. If an RMAN catalog is used, set the RMAN_CATALOG_SERVICE and the RMAN_CATALOG_USER parameters.

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The ddbmcon program tries all of these authentication methods for each Oracle database instance. The program reports a connection error if it cannot connect to the Oracle database instance by using any of these methods. If one of these methods succeed, the ddbmcon program ignores the other authentication methods and goes to retrieve the information as used by the PowerProtect software.

Ensure that you enable one of these three authentication methods for the ddbmcon program. For the easiest way of use, the Operating System Authentication method is recommended.

After you have set the authentication method you can select the same in PowerProtect Data Manager UI during discovery and Policy Lifecycle (PLC) creation.

Note: Kindly refer PowerProtect Oracle RMAN Agent Administration Guide for detailed information.

2.4 Verifying Database Connectivity

Log in to Oracle database host and go to the $HOME/oracle/opt/dpsapps/rmanagent/bin directory.
Run the ./ddutil -v host command to verify the host connectivity.
Run the ./ddutil -v inst command to verify the instance connectivity.

```
/home/oracle/opt/dpsapps/rmanagent/bin
[root@oracle-01 bin]# ./ddutil -v host
Reported application instance:
        Version: 12.1.0.2.0
        Install location: /u01/app/oracle/12.1/db
        Database identifier: 507257167
        Oracle SID: oradev1
        Authentication type: operating system user

[root@oracle-01 bin]# ./ddutil -v inst
Reported application instance:
        Version: 12.1.0.2.0
        Install location: /u01/app/oracle/12.1/db
        Database identifier: 507257167
        Oracle SID: oradev1
        Authentication type: operating system user


Application instance detailed information:
        Database name: oradev1
                Database object: SYSAUX
                Database object: SYSTEM
                Database object: UNDOTBS1
                Database object: USERS
[root@oracle-01 bin]# █
```

3 Protection Policy

With PowerProtect Data Manager, the Oracle database protection task has been transferred from a backup administrator to the Oracle database administrator (or Oracle database owner). PowerProtect Data Manager creates Oracle database backups and manages remote replication copies based on the Protection Policy (PLC). PowerProtect Data Manager performs the backup and replication operations based on the protection policy and governed by the SLA. Oracle databases can be backed up through:

- Automatic backup by the PowerProtect Centralized Protection policy.
- Manual backup by the Oracle database administrator and governed by the PowerProtect Self-Service Protection policy.

3.1 Centralized Protection Policy

When PowerProtect admin creates a protection policy for Oracle databases, the Centralized Protection option enables the PowerProtect Data Manager to centrally manage the entire life cycle of data protection operations for the Oracle databases.

The data protection attributes are specified when the Centralized Protection policy is created: Type, Purpose, Assets, Schedule, Retention and SLA. After the Protection Policy creation is completed the Lockbox is automatically created.

Attributes	Attribute Options
Type of application	Oracle database
Purpose of the Protection policy	Centralized Protection
Application login Credentials	<Specify or select the application login credentials>
Application Assets	<Select the desired Oracle databases>
Schedule	Backup level Retention period Backup start/end time
SLA	<Specify or select the desired SLA>

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3.2 Self Service Protection Policy

When the PowerProtect admin creates a protection policy for Oracle databases, the Self-Service Protection option enables the data owner to perform the manual backup operation from the command-line interface. The PowerProtect Data Manager prepares the PowerProtect environment to accommodate the manual backup operations. A few examples of these operations are: creating a Data Domain user with a password, creating a Data Domain storage unit, enforcing the backup data retention. After the Protection Policy creation is completed the Lockbox is automatically created.

The data protection attributes are specified when the Self-Service protection policy is created: Type, Purpose, Assets, Retention and SLA. It is important to note that only the retention period can be specified in the Schedule attribute in the Self-Service Protection Policy.

Attributes	Attribute Options
Type of application	Oracle database
Purpose of the Protection policy	Self-Service Protection
Application login Credentials	<Specify or select the application login credentials>
Application Assets	<Select the desired Oracle databases>
Schedule	Retention period
SLA	<Specify or select the desired SLA>

Note: For step by step instruction please refer to PowerProtect Data Manager Administration Guide

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4 Oracle Database Backup Workflow

Oracle Database can be backed up using Centralized Protection Policy and Self-Service Protection Policy. Based on the type of Protection Policy backup workflow will change. This section will discuss workflow in each case.

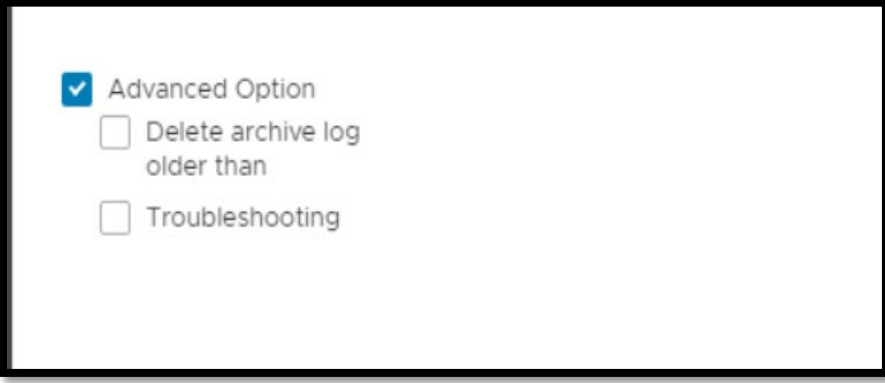## 4.1 Centralized Protection Backup Workflow
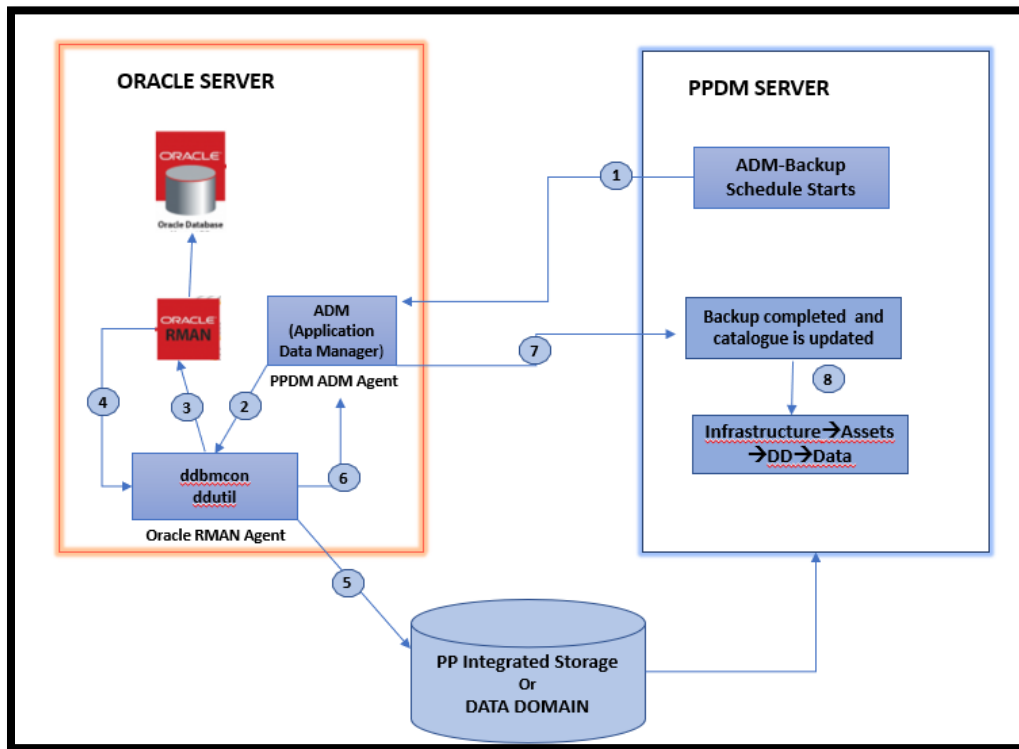
In Centralized Protection Backup the entire backup lifecycle is governed by PowerProtect Data Manager , there is no need for DBA to create any RMAN scripts as all parameters are passed by PowerProtect Data Manager ADM agent as per the backup options selected during protection policy creation. The backup workflow is as follows:

1. Backup schedule starts and triggers the Protection policy. Power Protect ADM agent on server contact the ADM agent on oracle client to start the backup.

2. PowerProtect Data Manager ADM agent connects with ddbmcon (Oracle RMAN agent) and passes the backup request.

3. Ddbmcon then connects with Oracle RMAN which in turn starts the Oracle DB backup.

4. Oracle RMAN passes the backed-up data to ddbmcon which then initiate the connection to data protection storage using ddutil.

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5. Oracle RMAN agent (ddbmcon and ddutil) sends the data to Data Domain or PowerProtect X400 Integrated Storage.

6. Once data is successfully backed up Oracle RMAN agent informs PowerProtect ADM agent that backup is completed and gives the catalogue details.

7. On PowerProtect Data Manager appliance the catalogue is updated with successful backup.

8. Backed up data will now be available under Infrastructure→Assets→Oracle host→Data Domain/Integrated Storage.
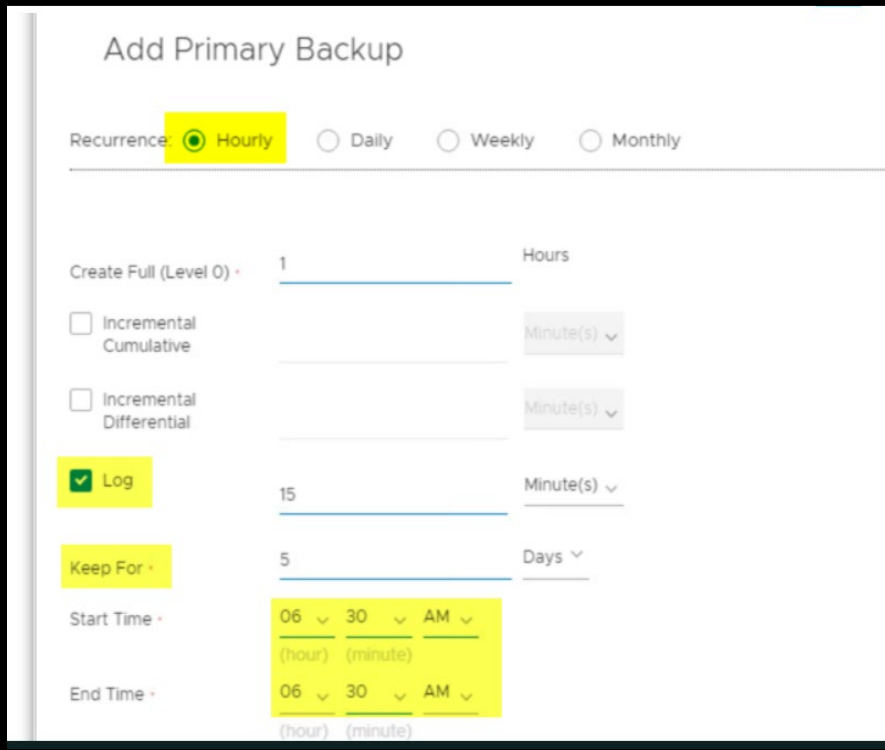
Backup Options available during Centralized Backup – Create Full (Level 0), Incremental Cumulative, Incremental Differential and Log backup. You can define in what intervals these backups should run.

Option to delete the logs after successful backup is also available under Advanced Tab.

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4.2 Self Service Protection Backup Workflow

When the PowerProtect admin creates a protection policy for Oracle databases, the Self-Service Protection option enables the data owner to perform the manual backup operation from the command-line interface. In this option the DBA creates their own RMAN scripts to backup the data directly to Protection Storage using only Oracle RMAN agent and PowerProtect Data Manager ADM agent will just do the discovery every 1 hour to check if the RMAN catalogue is updated with any new backups.

The following information is needed before performing the Self-Service protection of Oracle database. These parameters are required in the RMAN scripts. For example, the RMAN backup script for Self-Service protection and the RMAN recovery script.

- SBT_LIBRARY-The installation directory of the DD Boost library file - libddobk.so. The default installation directory is: $RMAN_AGENT_HOME/lib
- STORAGE_UNIT-The name of Data Domain storage unit, which is created automatically when you add the protection policy
- BACKUP_HOST-The hostname or IP address of the Data Domain system
- RMAN_AGENT_HOME-The Oracle RMAN Agent software installation directory.

```
RMAN> @/rman_script/backup_db

RMAN> # PPDM 19.1 and Oracle RMAN Agent 19.1
2>
3> run {
4> ALLOCATE CHANNEL CH1 DEVICE TYPE SBT TAPE PARMS
5> 'BLKSIZE=1048576, SBT_LIBRARY=/home/oracle/opt/dpsapps/rmanagent/lib/libddobk.so,
6> ENV=(STORAGE_UNIT=/PLC-PROTECTION-1558814214821, BACKUP_HOST=192.168.1.138,
7> RMAN_AGENT_HOME=/home/oracle/opt/dpsapps/rmanagent)'
8> FORMAT 'TargetDB_%d.%s';
9> BACKUP DATABASE;
10> RELEASE CHANNEL CH1;
11> }
```

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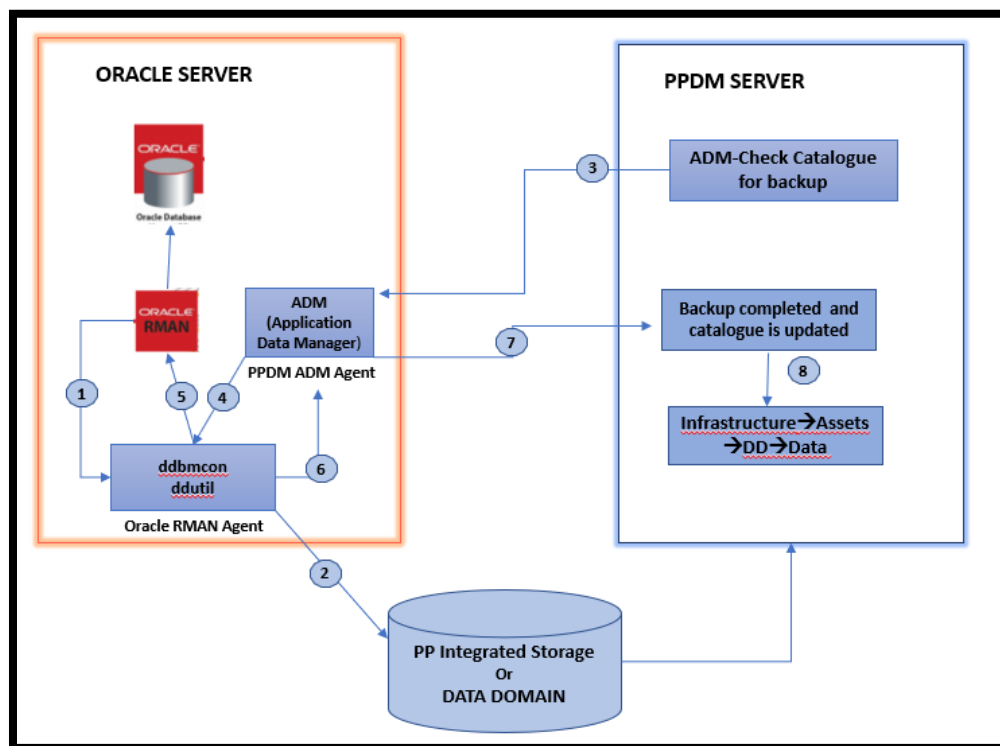
The backup workflow is as follows:

1. Oracle RMAN script starts the backup as per the schedule selected by DBA and connects with Oracle RMAN Agent.

2. Oracle RMAN agent connects with the Protection storage (Data Domain or PowerProtectX400 Integrated Storage) and starts sending the data until backup completes successfully.

3. PowerProtect ADM agent on PowerProtect Data Manager sends a request hourly to check the backup catalogue if there were any backups taken by RMAN agent.

4. PowerProtect ADM agent on client checks with Oracle RMAN agent.

5. Oracle RMAN agent ddbmcon gets the updated catalogue from Oracle RMAN.

6. The backup catalogue information is passed from Oracle RMAN agent to PowerProtect ADM agent.

7. PowerProtect ADM agent then updates to PowerProtect appliance and updates the catalogue information and sets the retention for application agent backup.

8. You can now see the backups under Infrastructure→Assets→Oracle host→DD or PowerProtect X400→Data.

Note: PowerProtect Data Manager can create and manage replication copies based on the protection policies. PowerProtect Data Manager performs these operations whether the backup is created by the DBA or by the PowerProtect Data Manager centralized backup scheduler.
Because PowerProtect Data Manager controls the replication, when the OracleRMAN agent is deployed with PowerProtect Data Manager, the following selfservice replication operations are disabled:
- Creation of multiple backup copies with the RMAN BACKUP COPIES command.
- MTree replication to create backup copies on a secondary Data Domain or PowerProtect X400 system.
- You can restore from replicated copies of backups that were performed with a previous version of Oracle RMAN agent.
- When you perform a self-service backup managed by PowerProtect Data Manager, the PowerProtect Data Manager protection policy settings for the given database will override the target protection storage settings specified in theRMAN backup script, including the Data Domain server hostname and storage unit name.

4.3   Oracle RAC Backup Workflow

- In an Oracle RAC - or Real Application Clusters - environment, the Oracle RMAN Agent and the PowerProtect Data Manager ADM Agent must be installed on each node in the Oracle RAC environment using the same installation steps and both nodes should be registered with PowerProtect Data Manager.

- RAC Node that will do the backup needs to be set by the DBA after the installation is complete using IS_RAC_BACKUP_NODE =NODENAME in rman_agent.cfg located in $RMAN_AGENT_HOME/config.

- Make sure that all the nodes can access the configuration file, lockbox, and RMAN script through a shared file system or NFS/CIFS share.

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Note: If the configuration file or RMAN script is not accessible through a shared file system or NFS/CIFS share, you must copy and maintain an identical configuration file or RMAN script on each node involved in the backups and restores. This requirement does not apply to stored RMAN scripts because the Oracle software can access a stored RMAN script from any node.

- All the cluster hosts are granted the lockbox access.

- In an Oracle RAC environment, if the archived redo logs are not accessible from all the nodes (which is not an Oracle best practice), then you have created an RMAN script in which each channel is allocated to connect to a different node. Oracle RMAN backs up all the archived redo logs of all the nodes if the logs are located on shared storage.

- Backup runs using the same method as single node backup depending on self-service or centralized protection policy from the configured node.

- If you are going to register Oracle RAC nodes to PowerProtect Data Manager, set the db_domain parameter on every RAC node in the RAC database instance:

  1. Use sqlplus to log in to your database.
  2. Run the command: sqlplus / as sysdba
  3. Run the command: show parameters db_domain
  The following output is displayed:
  NAME TYPE VALUE -----------------------------------
  ----------- ------------------------------
  db_domain string SQL> alter system set db_domain='admdb'
  scope=spfile sid='*';
  System altered.
  1. shutdown immediate;
  2. startup;

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5 Oracle Database Recovery

5.1 Oracle DB Restore Workflow

With PowerProtect Data Manager, you can perform an Oracle database recovery on the Oracle database host by running one of the supported Oracle backup or recovery tools.

- Oracle Recovery Manager (RMAN) with rman command

- Oracle Enterprise Manager UI

For the database application agent operations, you must modify the RMAN scripts to allocate the required channels and include the correct commands. The latest version of the Database Application Agent Installation and Administration Guide provides details on the RMAN scripts to use with the database application agent.

The following information is needed before the Oracle database recovery operation.

- SBT_LIBRARY -The installation directory of the DD Boost library file - libddobk.so. The default installation directory is: $RMAN_AGENT_HOME/lib

- STORAGE_UNIT-The name of Data Domain storage unit, which is created automatically when you add the protection policy

- BACKUP_HOST-The hostname or IP address of the Data Domain system

- RMAN_AGENT_HOME-The Oracle RMAN Agent software installation directory

Those parameters are required in the RMAN scripts

The following steps highlight the procedures to recover Oracle databases
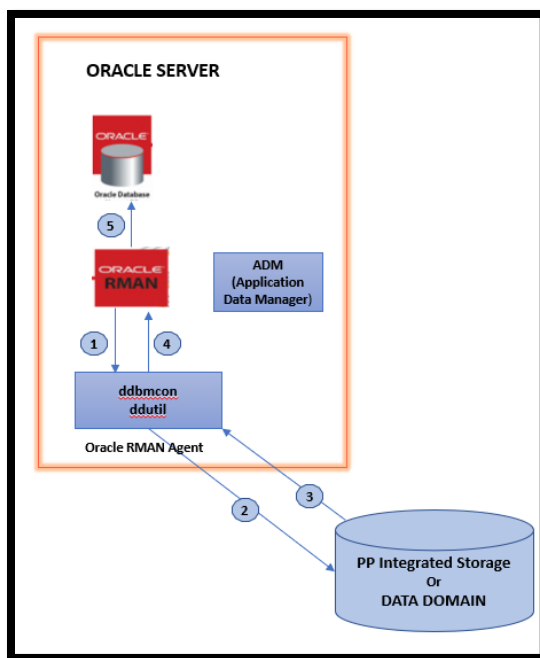
1. Start Oracle RMAN interface and run the RMAN script to recover Oracle database.It will connect with Oracle RMAN agent.

```
RMAN> @/rman_script/recover_db

RMAN> # PPDM 19.1 and Oracle RMAN Agent 19.1
2>
3> run {
4> ALLOCATE CHANNEL CH0 DEVICE TYPE SBT_TAPE PARMS
5> 'BLKSIZE=1048576, SBT_LIBRARY=/home/oracle/opt/dpsapps/rmanagent/lib/libddobk.so,
6> ENV=(STORAGE_UNIT=/PLC-PROTECTION-1558545277166, BACKUP_HOST=192.168.1.138,
7> RMAN_AGENT_HOME=/home/oracle/opt/dpsapps/rmanagent)';
8> RESTORE DATABASE;
9> RECOVER DATABASE;
10> RELEASE CHANNEL CH0;
11> }
using target database control file instead of recovery catalog
allocated channel: CH0
channel CH0: SID=124 device type=SBT_TAPE
channel CH0: Data Domain Boost API

Starting restore at 23-MAY-19
```

2. Oracle RMAN agents will then connect with Protection Storage

3. Protection Storage will then start sending the data to Oracle RMAN agent.

4. RMAN restore command completes successfully.

5. Verify - Run sqlplus command to verify that the Oracle database has been recovered successfully.

```
[oracle@oracle ~]$ sqlplus / as sysdba

SQL*Plus: Release 12.1.0.2.0 Production on Tue May 21 01:03:41 2019

Copyright (c) 1982, 2014, Oracle.  All rights reserved.


Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.2.0 - 64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real Application Testing options

SQL> alter database open;

Database altered.

SQL> select tablespace_name, status from dba_tablespaces;

TABLESPACE_NAME                 STATUS
------------------------------- ---------
SYSTEM                          ONLINE
SYSAUX                          ONLINE
UNDOTBS1                        ONLINE
TEMP                            ONLINE
USERS                           ONLINE
EXAMPLE                         ONLINE
SOE                             ONLINE

7 rows selected.

SQL>
```

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6 Disaster Recovery

The database application agent and Oracle support disaster recovery to the extent that RMAN supports the functionality. The Oracle and RMAN documentation provides details on the best practices for disaster recovery.

To prepare an Oracle server for disaster recovery, back up the following minimum list of files:

-Oracle database (all the datafiles)

-Archived redo logs

-Control file

-Initialization parameter file

Note: RMAN only backs up the server-managed parameter file (SPFILE).

The Oracle documentation provides an exhaustive list of all the files (other than the Oracle database) that you must back up. RMAN does not back up the other files that might be required for disaster recovery, such as the Oracle network files, password file, and so on.

Use the following guidelines to prepare for disaster recovery:

- Institute mirrored control files.
- Back up the archived redo logs frequently between database backups.
- Back up the Recovery Catalog after every target database backup if you have a Recovery Catalog.

For more information refer to Oracle RMAN guide on oracle website or PowerProtect Oracle RMAN guide.

Conclusion

This paper provided information on Power Protect Software Application Integration for Oracle. This paper thoroughly discussed the concepts of Oracle RMAN backup configuration, setup and backup/restore workflows.

References

The following documents were used in writing this whitepaper. All documents are available on https://support.emc.com.

Data Domain Operating System 6.2 Administration Guide

Data Domain Operating System 6.1 Administration Guide

PowerProtect Data Manager Administration Guide link

PowerProtect Data Manager Oracle RMAN guide

Database Application Agent Installation and Administration Guide

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