

An Oracle White Paper
August 2012

Private Database Cloud on Oracle Database Appliance

1.	Executive Overview	1
2.	Introduction.....	1
3.	Unique Features of Oracle Database Appliance	4
3.1	Oracle Appliance Manager	4
3.2	Tighter Integration with Oracle ASM.....	4
3.3	Oracle Integrated Lights Out Management.....	5
3.4	Pay-as-you-grow Model	5
4.	Oracle Database Appliance as Consolidation Platform	5
4.1	Database Consolidation	5
4.2	Schema Consolidation	6
5.	Consolidation Considerations	8
5.1	Sizing Considerations	9
6.	Isolation Considerations.....	10
6.1	Physical Isolation	10
6.2	Logical Isolation	12
7.	Consolidating Databases on Oracle Database Appliance	13
7.1	Provision Oracle Database Appliance	13
7.2	Implementing Database Consolidation	14
7.3	Implementing Schema Consolidation	16
8.	Advanced Multisite Configuration.....	16
8.1	Oracle Data Guard with Oracle Database Appliances	16
8.2	Oracle Golden Gate with Oracle Database Appliances	16
9.	Conclusion.....	17
10.	References	18

1. Executive Overview

Mid-sized organizations continue to face financial and expertise challenges when acquiring and maintaining enterprise class IT infrastructure needed to ensure business continuity around the clock. With the majority of commercial activity happening electronically over the internet from around the globe, business continuity has become a necessity for these organizations to survive and operate profitably. The Oracle Database Appliance (ODA) addresses these challenges by bringing an Engineered System within the reach of these organizations by lowering not only the entry barrier (*CapEx*) but also the expertise (*OpEx*) needed for delivering highly available enterprise class IT infrastructure, as noted by following industry analysts:

High availability, high performance database servers have traditionally been beyond the reach of small and medium-sized businesses with limited financial and IT resources. The ODA brings enterprise-class performance within their reach with an approachable price tag, simplicity, and flexibility. Partners that want to accelerate sales and delivery of applications to their customers are likely to benefit from the appliance as well – [NUCLEUS RESEARCH](#).

Oracle recently announced the Oracle Database Appliance, which offers small and mid-sized organizations a rapidly deployable, highly available platform at an affordable cost. With this new offering, Oracle's Engineered Systems family becomes more complete, with Oracle Exadata Database Machine supporting the needs of larger enterprises and Oracle Database Appliance supporting SMBs, departmental applications, and independent software vendors (ISVs) – [ENTERPRISE STRATEGY GROUP](#).

2. Introduction

According to the National Institute of Standards and Technology (1), Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources or shared services (e.g., networks, servers, storage, applications, and IT services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. The key benefits of cloud computing

are reduced costs, reduced complexity, improved quality of service, and increased flexibility while responding to dynamic changes in workloads.

The Oracle Database Appliance (2) is a complete plug-and-go Engineered System that offers customers a fully integrated system of software, servers, storage and networking in a single box, delivering highly available (HA) database services for a wide range of home grown and packaged OLTP and Data Warehousing applications.

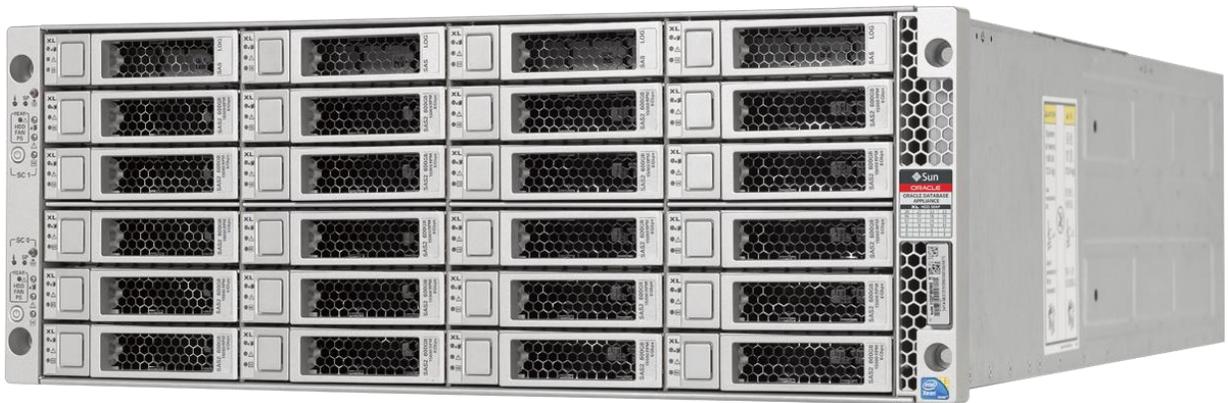


Figure 1: Oracle Database Appliance

Oracle Database Appliance (5) is pre-installed with Oracle Linux and Oracle Appliance Manager Software and delivers major savings in time and money by simplifying deployment, maintenance, and support of highly available database solutions.

Every component of Oracle Database Appliance (2) is redundant and engineered to be fault tolerant. Similarly, Oracle Database Appliance comes pre-built in “*balanced configuration*” of compute, network and storage resources. Its compute capacity can be scaled up on demand, thus providing the necessary agility to match organizational workload growth. These features are the key ingredients to making Oracle Database Appliance a perfect building block for database clouds. For a detailed datasheet on Oracle Database Appliance, refer to the following document:

<http://www.oracle.com/us/products/database/oracle-database-appliance-ds-495410.pdf>

In this whitepaper, we'll describe the best practices for consolidating multiple database workloads onto Oracle Database Appliance and how to deploy it as the building block for database clouds.

3. Unique Features of Oracle Database Appliance

Oracle Database Appliance has specific and unique capabilities that make it an ideal consolidation platform for mid-sized organizations. The Oracle Appliance Kit software shipped on Oracle Database Appliance contains tools for managing the lifecycle of the appliance from initial deployment of the operating system, firmware, Oracle Grid Infrastructure and Oracle Database software to patching and upgrade of the entire Oracle Database Appliance. Other unique capabilities of the Oracle Database Appliance are described in details below.

3.1 Oracle Appliance Manager

To help customers easily deploy and manage their databases, the Oracle Database Appliance features Appliance Manager for one-button automation to provision, patch, and diagnose database servers. The Appliance Manager feature greatly simplifies the deployment process and ensures that database configurations adhere to Oracle's best practices. It also drastically simplifies maintenance by patching the entire appliance, including all firmware and software, in one operation, using an Oracle-tested patch engineered specifically for the appliance.

Additionally, the Oracle Appliance Manager has built-in diagnostics that interrogate the system and detect any component failures, configuration issues, and deviation from best practices. The system collects all relevant log files and environmental data into a single compressed file for easy upload to Oracle Support. Oracle Automatic Service Request automatically logs service requests for failures, proactively notifying Oracle Support and speeding resolution of issues.

3.2 Tighter Integration with Oracle ASM

Oracle Automatic Storage Management (ASM) provides triple-mirrored shared storage for Oracle databases deployed on the Oracle Database Appliance. Oracle ASM has been enhanced to automatically detect that it is operating in an Oracle Database Appliance environment and enable certain appliance-specific features. For example, to help preserve the simplified deployment of ASM on Oracle Database Appliance, ASM rejects *ASMADMIN* user's attempt to alter the setting of ASM parameters, such as *ASM_DISKSTRING*. It also rejects user's attempt to alter the storage topology on Oracle Database Appliance if the user issues a SQL command to drop a disk from a Diskgroup. In the Oracle Database Appliance environment, an ASM disk can be dropped from an ASM Diskgroup only if that command is issued to ASM by Oracle Appliance Manager.

The Oracle Appliance Manager monitors the status of the storage array to ensure consistent IOPS performance. If a disk is observed to be failing, then Appliance Manager takes that disk OFFLINE and notifies ASM to drop that disk from its current Diskgroup. Similarly, when a failed disk is replaced, it is automatically brought ONLINE and ASM is notified to add that disk to its preconfigured Diskgroup based on the slot number of the disk without any intervention by the storage administrator.

3.3 Oracle Integrated Lights Out Management

Oracle Database Appliance comes preconfigured with Oracle Integrated Lights Out Management (ILOM) that enables remote management and administration of Oracle Database Appliance. This capability to manage Oracle Database Appliance remotely helps to reduce operating expenses for customers by allowing skilled administrators located in remote locations to administer the appliance.

3.4 Pay-as-you-grow Model

On Oracle Database Appliance, customers can purchase database and its options licenses starting from a minimum of 2 processor cores (on server for non-RAC) or 4 cores (2 cores on each server in case of RAC) up to the system maximum of 24 processor cores. This enables customers to license only required cores initially and purchase additional licenses as business demand grows. The benefit of this on-demand enabling of cores means customers pay only for licenses and processing power they need, and as their business grows, their Oracle Database Appliance can grow with it.

While Oracle Database Appliance ships with all 24 cores enabled, it is possible for a customer to reduce licensing cost by shutting down cores at the time of initial deployment. The initially licensed core count can be as low as 2 cores for a non-RAC or 4 cores for a RAC deployment. As their compute capacity needs grow, the customers can then enable additional cores in increments of four (two cores each on two servers) up to system maximum of 24 cores. For detailed information on capacity licensing and configuring CPU core count on Oracle Database Appliance, please refer to the following document.

http://docs.oracle.com/cd/E22693_01/doc.21/e25375/chapter1.htm#BABIABIB

4. Oracle Database Appliance as Consolidation Platform

There are two consolidation models (6) that customers can implement while consolidating their database workloads on the current version (*v2.1*) of Oracle Database Appliance.

4.1 Database Consolidation

Organizations pursue database consolidation as a means to reduce both the server and operating system footprints in their data centers by standardizing on server and OS

architectures. This means that fewer server platforms will be used to run existing workloads.

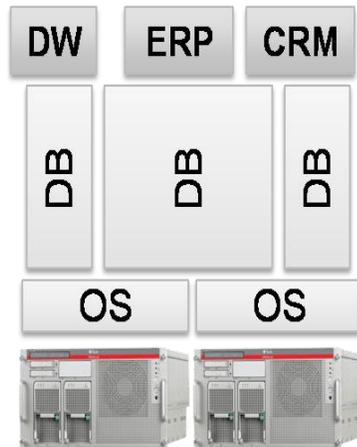


Figure 2. Database Consolidation model

The primary drivers for adopting the database consolidation model include:

- Higher database to server consolidation density without causing operating system sprawl
- Reduced server footprint with increased storage and server utilization, providing higher return on investment
- Databases do not incur virtualization overhead thereby delivering higher performance
- All applications are supported, and fine-grained workload management can be enforced

Deployment considerations include

- Standardization on a common operating system and server platform is required

Typically, database consolidation is implemented by migrating existing workloads to the standardized operating system on a particular server architecture. The Oracle Database Appliance comes pre-installed with *Oracle Enterprise Linux 5.5* on Intel-based *x86-64* servers as a standardized platform, therefore, it is an ideal platform for consolidating database workloads that can be migrated with no or minimal changes onto *OL5.5* on *x86-64* hardware architecture.

As deployment simplification and ease of use are guiding principles for ODA design, Oracle Database Appliance supports one `ORACLE_HOME` owned by a single operating system user for simplifying the entire lifecycle management of the appliance and software deployed on it. These ease of use design decisions enable Oracle Database Appliance to be a great standardized platform for consolidating workloads within line-of-businesses (LOBs) where the need for physical, logical, security and operational isolation aligns with each LOB within an organization.

4.2 Schema Consolidation

Organizations pursue schema consolidation as a means to reduce the number of databases in their data centers by standardizing on a few database versions on standardized server and operating system architectures. This type of database consolidation comes in two flavors.

4.2.1 Schema Consolidation

Schema consolidation is a database consolidation technique whereby the number of databases is reduced by consolidating separate databases as schemas within a

single large database. This helps customers reduce their operating expenses by having fewer databases to manage.

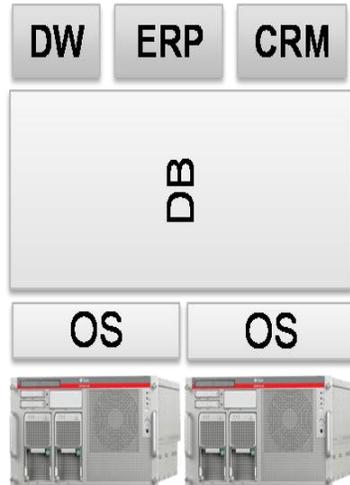


Figure 3. Schema Consolidation model

Primary drivers for adopting the schema consolidation model include

- Provisioning a database service via a schema is extremely fast
- Consolidation into a larger database reduces operating system and memory overhead
- By reducing the number of servers, operating systems, and database deployments, this model enables dense consolidation and provides the highest return on investment

Deployment considerations include

- Standardization on a common operating system and database version is required
- Some applications have stringent schema naming standards, and schema consolidation is vulnerable to namespace collisions, therefore application certification may be required
- There is limited resource, fault, and security isolation; however, technologies such as Oracle Database Vault and Oracle Database 11g's Quality of Service Management feature can minimize these isolation impacts

4.2.2 Extreme Schema Consolidation

A variant of the schema consolidation technique whereby multiple replicated databases that support business intelligence or operational data store systems are merged into a single database shared across those applications via multiple database services.

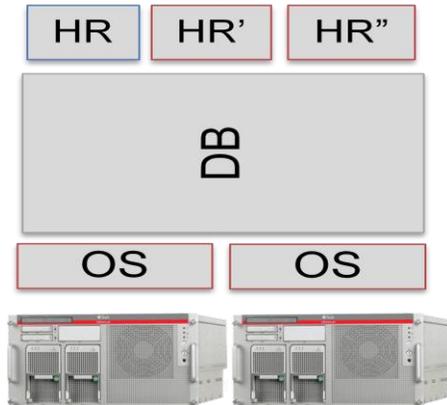


Figure 4. Extreme Schema Consolidation model

Primary drivers for adopting the extreme schema consolidation model include

- Extreme consolidation density by consolidating multiple replicated databases into a larger database reduces databases, operating system and server footprint
- Highest return on investment

Deployment considerations include

- Similar to schema consolidation considerations above.

By consolidating replicated databases into a single database, the customer benefits not only from reduced operating expenses from having to manage fewer databases but also from the reduced number of database licenses.

Since Oracle Database Appliance is pre-built and pre-tested as a standardized two node cluster-in-a-box with standardized versions of hardware servers, operating system, Oracle Grid Infrastructure and Database, these standardizations make it an ideal building block platform for schema consolidation in database clouds. Customers will benefit from increased consolidation density achieved via schema consolidation on Oracle Database Appliance. The ability to scale up the compute capacity on demand is another unique feature that makes Oracle Database Appliance an ideal consolidation platform for database clouds.

Just like schema consolidation on other Engineered Systems or build-it-your-own systems, the isolation requirements of consolidated workloads and their users can be addressed by using Oracle Advanced Security Option for “data at rest” and Oracle Data Vault for authentication and access control. Additionally, Oracle Audit Vault can be used for auditing users’ database activities.

5. Consolidation Considerations

Having decided on Oracle Database Appliance as standardized building block, a customer should have a fair idea on the target consolidation workloads and consolidation density that can be achieved on that platform without sacrificing quality of service (QoS) and service level agreements (SLAs). A customer should consider how physical and logical resources in the building block are going to be sized and shared amongst various competing workloads. Also, it is important to consider how these workloads are going to be isolated from one another so that one runaway workload doesn’t starve other workloads from their fair share of the shared resources. These considerations are described in details in the following subsections.

5.1 Sizing Considerations

When consolidating database workloads on a target platform, compute, storage and network resources are the critical resources that should be sized for optimal sharing so that target SLAs are met. On Oracle Database Appliance, these resources are of fixed size and quantity and their physical configuration cannot be altered. The only exception is that compute resources (CPU cores) can be sized up from a minimum of 2 cores to a maximum of 24 cores across two compute nodes.

When provisioning Oracle Database Appliance, these resources are sized in a pre-built balanced configuration based on the user selected template from **Extra Small**, **Small**, **Medium**, **Large** and **Extra Large**. This standardized sizing is implemented to help reduce the expertise required for deployment and management of database workloads on Oracle Database Appliance. The following table details the sizing of compute and storage resources (6) in a server node based on the selected template.

Resource /Template		X-Small	Small	Medium	Large	X-Large
Compute (Physical)	CPU Cores	1	2	4	6	12
	CPU_COUNT	2	4	8	12	24
	RAM (GB)	8	16	32	48	96
Compute (Logical)	PROCESSES	200	400	800	1200	2400
	SGA_TARGET (GB)	4-8	8-16	16-24	24-48	>=48
	PGA_AGGREGATE_TARGET(GB)	2-4	4-8	8-12	12-24	>=24
	LOG_BUFFER(MB)	16	16	32	64	64
	REDO LOG (GB)	1	1	2	4	4
Storage	DB Count	12	6	3	2	1
	DB Size(GB)	136	273	546	819	1638

Table 1: Resources Sizing on Oracle Database Appliance

The pre-installed physical networks in Oracle Database Appliance are shared across the deployed database workloads. If there is a need for network traffic isolation or higher network bandwidth, then additional network resources can be configured on the additional three bonded networks on the appliance. Please refer to the Network Isolation section 6.1.2 below for details.

6. Isolation Considerations

When multiple entities (i.e. tenants) are consolidated on a shared infrastructure, it is important to make sure that operation of one entity doesn't impact or overwhelm that of the other entities by starving them of their share of the shared resources. Resource isolation can be used as an effective technique to ensure that each entity gets its fair share of the shared resources. Resource isolation can be done at the physical and logical level.

6.1 Physical Isolation

Physical isolation can be achieved by partitioning the compute, network, and storage resources into appropriate slices and deploying the workloads within their respective slices. We'll describe some of the physical isolation techniques below.

6.1.1 Compute Resources Isolation

Physical compute resources in Oracle Database Appliance can be partitioned by using the following technique and workloads can be assigned to the appropriate partition to achieve physical isolation.

6.1.1.1 Instance Caging

Oracle11g Database Instance Caging feature can be used for managing CPU resources in consolidated environments where database servers host multiple database instances, such as on Oracle Database Appliance. Instance caging uses the `CPU_COUNT` initialization parameter to specify the maximum number of CPU cores that a database can simultaneously use.

Instance caging can be used to guarantee that database instances do not compete with each other for CPU resources and to prevent runaway processes and applications from consuming too much CPU while starving the rest to standstill.

Instance caging can be configured in (1) *partitioning* or (2) *over-provisioning* approach. In partitioning approach, physical cores on a server machine are partitioned across (divided up among) database instances configured on the server. For example a server with 12 cores could host three databases with `CPU_COUNT` setting of 2, 4, and 6 respectively. Partitioning configuration is ideal for workloads that need to have guaranteed allocation of compute resources for meeting strict SLAs.

Alternatively, Instance Caging could be configured so that CPU allocations are *over-provisioned*. For example, a server with 32 CPU cores could host 4 databases each having a `CPU_COUNT` setting of 16. Over-provisioning configuration is reasonable in cases where the databases are mostly idle or have different usage patterns. It guarantees that no single database can flood the entire system. But if all of the databases become heavily loaded at the same time, then obviously there would be contention for CPU resources and degraded performance would result.

On Oracle Database Appliance, CPU_COUNT of Instance Caging feature is configured by default in partitioning approach and CPU resources on each server are assigned to the database instances based on the template selected during database deployment. Please refer the sizing table (Table 1) for more information.

However, you must enable an appropriate Resource Manager Plan (e.g. *DEFAULT_PLAN*, *DEFAULT_MAINTENANCE_PLAN*, etc.) to activate Instance Caging feature.

6.1.2 Network Isolation

Physical network resources can be partitioned by using the following techniques, and workloads can be assigned to the appropriate partition to achieve physical isolation of network traffic.

6.1.2.1 Multiple Physical Networks

Multiple physical networks can be configured in a server cluster to achieve physical isolation of server and client network traffic. Oracle Database Appliance comes preconfigured with three bonded networks. These networks can be set up, by defining Virtual Internet Protocols (VIPs) and Oracle listeners on these networks, to provide physical isolation of client traffic to the databases deployed on the Oracle Database Appliance.

6.1.2.2 Multiple Listeners

In addition to multiple public networks, customers can achieve some degree of physical isolation for client access by opening multiple ports on the default public network and adding respective Oracle TNSLSNR listeners to listen on those ports. Similarly, TNSLSNR configuration can be set up to grant or deny access to the database services based on the physical locations (servers) of the database clients. For more information, please refer to following documentation.

http://docs.oracle.com/cd/E11882_01/network.112/e10836/profile.htm#i485056

For additional information, please refer to the following white paper on Network Isolation in Private Database Cloud.

<http://www.oracle.com/technetwork/database/focus-areas/database-cloud/ntwk-isolation-pvt-db-cloud-1447122.pdf>

6.1.3 Storage Isolation

Physical storage resources on Oracle Database Appliance can be partitioned and software images and data can be stored on appropriate partitions to achieve physical storage isolation. This isolation helps to ensure partition ownerships and sizing quotas are adhered to.

6.1.3.1 Software Storage Isolation

The hard disk storage reserved for software images can be partitioned and formatted with file systems into which the software images can be installed to achieve software storage isolation.

Oracle Database Appliance comes preinstalled with Oracle Enterprise Linux 5.5 on root (/) file system and one /u01/app file system partition on internal hard disk storage for Oracle database software. As such, you don't need to worry about software storage isolation considerations for supported software deployed on Oracle Database Appliance.

6.1.3.2 Data Storage Isolation

The hard disk storage reserved for data can be partitioned and logical volumes created on those partitions before these volumes are assigned to respective database workloads to achieve data storage isolation.

Oracle Database Appliance comes pre-configured with *20 x 600 GB SAS Hard Disk Drives (HDD)* for data storage. Oracle11gR2 Automated Storage Management (ASM) provides the logical volumes on these disks. These volumes are configured into two ASM Diskgroups, named +DATA and +RECO. A third Diskgroup, named +REDO, is configured on four 73GB Solid State Disks (SSDs). These three Diskgroups provide triple mirrored highly available storage out-of-box for all databases deployed on Oracle Database Appliance.

6.2 Logical Isolation

Logical isolation can be achieved by software based-partitioning of compute, network, and storage resources. We'll describe the logical isolation techniques below and how these can be implemented on Oracle Database Appliance.

6.2.1 Operational Isolation

In a consolidated environment, it is important to control which operator user can operate on which resources on the same shared infrastructure. We'll discuss operational isolation techniques below.

6.2.1.1 Multiple OS Owner Users Identities

When deploying multiple database workloads on a shared infrastructure, multiple operating system users and groups can be used to own different database environments on that infrastructure to control which user(s) can operate on which database(s).

Because of ease of use and extreme simplification design considerations of Oracle Database Appliance, it supports one ORACLE_HOME owned by one OS user per appliance. If a customer has need to allow another OS user to

operate his/her database environment, then such a user can be granted SYSOPER role to achieve operational isolation, just as on other platforms. For more information, refer to the following documentation:

http://docs.oracle.com/cd/E11882_01/server.112/e25494/dba006.htm#i1006554

6.2.1.2 Multiple Database Users Identities

To control operational access to the database and various objects within the database, multiple database users and roles can be created and assigned. Similarly, object privileges can be assigned to database objects to control which user can create, access and modify these objects. These users can be authenticated via database password file or via Database Vault.

For more information, please refer to the following documentation:

http://docs.oracle.com/cd/E11882_01/server.112/e10897/users_secure.htm

6.2.2 Database Resource Management Isolation

Oracle Database Resource Management (DBRM) can be implemented on Oracle Database Appliance just as on other platforms. For more information, please refer to following documentation:

http://docs.oracle.com/cd/E11882_01/server.112/e17120/dbrm.htm

6.2.3 Network Security Considerations

The network connections on Oracle Database Appliance can be secured just as on other platforms. For more information, refer to the following documentation:

http://docs.oracle.com/cd/E11882_01/server.112/e10575/tdpsg_network_secure.htm

7. Consolidating Databases on Oracle Database Appliance

Having reviewed the consolidation considerations above, the next logical step is to decide the type of consolidation to implement so that the desired level of consolidation density can be achieved while delivering or exceeding the QoS and SLAs of the existing environments. In this section, we'll describe the guidelines for implementing database and schema consolidations.

7.1 Provision Oracle Database Appliance

1) Initial Set Up

For setting up Oracle Database Appliance for the first time, please refer to the Oracle Database Appliance Installation, Configuration and User's Guide below.

http://docs.oracle.com/cd/E22693_01/doc.21/e22692/toc.htm

2) Diagnostic and Validation Tool

Once initial set up of Oracle Database Appliance has been performed, you should perform a sanity check on it before deploying database workloads on it. Please refer to the following chapter for detailed information on troubleshooting Oracle Database Appliance.

http://docs.oracle.com/cd/E22693_01/doc.21/e22692/trouble.htm

7.2 Implementing Database Consolidation

To implement database consolidation on Oracle Database Appliance, you should review the existing source database on your standalone environment and map its current characteristics such as database size, workload it is supporting now and anticipated growth factor into one of the ODA deployment templates, mentioned in section 5.1. You should select the resulting deployment template to create a target (shell) database on ODA. Once the database has been created successfully, you can use one of the following techniques to migrate the contents of the source database into the target database on ODA.

7.2.1.1 Physical Migration Methods

- 1) *Physical Standby*: This approach involves using the source database as the primary database in Oracle Data Guard configuration, and target database on ODA as the physical standby database. Once the physical standby database has been synchronized, you can complete the migration by performing Oracle Data Guard switchover. Oracle Data Guard supports a limited number of heterogeneous standby configurations. Check My Oracle Support (MOS) note [413484.1](#) for details of the supported platform combinations.

This database migration approach results in very little downtime as measured by the amount of time it takes to perform the switchover. The source database must be in *archive* mode, and all changes to the database must be logged. This is best accomplished by enabling FORCE LOGGING on the source database.

- 2) *Transportable Database*. Can be used when migrating from any little endian platform to ODA. However, the source system must be running Oracle Database version 11.2. For detailed information, refer to MAA white paper, titled [Platform Migration Using Transportable Database](#), on the Oracle Technology Network that provides guidance for using transportable databases. However, if the physical standby approach can be used, consider using that instead of transportable database.
- 3) *Transportable Tablespace (TTS)*: This physical migration method can be used if the source system is big endian format, which would include platforms such as IBM AIX, HP-UX, or Solaris SPARC. The TTS method involves using the Recovery Manager (RMAN) to copy the data files from the source database to ODA storage, then “plugging” those tablespaces into the shell database that we

just created above. If the source platform is big endian, then the tablespaces have to be converted into little endian format using RMAN before these tablespaces can be plugged in. For detailed information, refer to MAA white paper [Platform Migration Using Transportable Tablespaces](#) on the Oracle Technology Network that provides guidance for migrating to a new platform using TTS.

7.2.1.2 Logical Migration Methods

- 1) *Logical Standby*: This approach is very similar to the physical standby method described above, including the outage time required for the migration. However, because it is a logical standby, the underlying structure of tables can be altered in preparation for the migration while the primary remains online. My Oracle Support Note [737460.1](#) explains how to change the underlying storage characteristics of objects in a logical standby.
- 2) *Oracle Golden Gate (OGG)*: Offers the least amount of migration downtime. At a high level, OGG approach is similar to logical standby in that it replicates changes from the source database to the target database on ODA. However, OGG is more flexible in that it supports the source database running on any platform, little endian or big endian, and it supports a source database as old as version 9.2 with OGG version 11.
- 3) *Oracle Data Pump (ODP)*: Oracle Data Pump loads data using direct path. ODP works in either file mode or network mode. File mode is the traditional approach of exporting data to a dump file on the source system, then transferring the dump file to the target Oracle Database Appliance system, then importing the contents of the dump file into the target/shell database. Network mode eliminates the intermediate dump file by exporting the data out of the source system to a network link. A process on the target ODA system reads concurrently from the network link and imports the data directly into the target database.
- 4) *Insert As Select SQL Statement*: This migration method performs database loads using the Insert As Select SQL statement. It is the simplest method but also the most intensive because each table has to be migrated individually. When used with the APPEND hint, Insert As Select will load data using direct path, like that in Oracle Data Pump. The data to be migrated should be staged in DBFS and loaded into the target database using external tables.

If you decide to perform the Insert As Select in parallel mode over a database link to the source system, even though the insert and the select will run in parallel, the flow of data will serialize over the database link. To improve performance, consider manually parallelizing the work using multiple Insert As Select statements at the partition or sub-partition level.

7.3 Implementing Schema Consolidation

Having reviewed compute, network and storage resources available on Oracle Database Appliance, you should review the existing source databases on your standalone environments, like above in section 7.2, and decide on the number of database schemas that will be consolidated into a single database on ODA. From this consolidation density number and anticipated growth factor, derive the size of the target database that can accommodate the intended schemas. Next map the resulting size into one of the ODA deployment templates, mentioned in section 5.1. Finally, you should select the resulting deployment template to create a shell (target) database on ODA. Once the target (shell) database has been created successfully, you can use one of the migration techniques, such as Physical Standby, to migrate the contents of the first source database into the target database on ODA.

Thereafter, migrate the schema and associated database objects from other source databases into target database on ODA using a SQL script manually. Then create a high availability database service for each of these schemas and update the database clients to connect to the database using schema service.

8. Advanced Multisite Configuration

To safeguard data centers hosting enterprise IT infrastructure against natural and man-made disasters, customers should build advanced multi-site configurations by setting up data replication between geographically separated data centers built on Oracle Database Appliance. In this section, we describe the enabling technologies for setting up Oracle Database Appliance in multi-site configurations.

8.1 Oracle Data Guard with Oracle Database Appliances

Setting up Oracle Data Guard between databases configured on Oracle Database Appliances within or across sites is similar to that for regular Oracle RAC or RAC One Node databases. Refer to the **Oracle® Data Guard Broker 11g Release 2 (11.2)** Part Number E17023-06, specifically the following chapter on how to set up Data Guard:

http://docs.oracle.com/cd/E11882_01/server.112/e17023/cli.htm#i1005573

8.2 Oracle Golden Gate with Oracle Database Appliances

To set up Oracle Golden Gate (OGG) between databases on Oracle Database Appliances across sites, refer to My Oracle Support Doc ID [1391398.1](#) and **Oracle Golden Gate Best Practices: Oracle Golden Gate high availability using Oracle Clusterware [ID [1313703.1](#)]**.

To satisfy the shared storage requirement for Oracle Golden Gate data capture and extract, Oracle Database Appliance comes pre-configured with ASM Cloud filesystem (ACFS) under `/cloudfs` partition with an initial capacity of **50GB**. If needed, the `/cloudfs` filesystem can be extended online by adding more disk space.

In Oracle Grid Infrastructure configuration, such as that on Oracle Database Appliance, OGG runs on a single server at any time. If that server goes down, then OGG manager will be failed over to the other server in ODA. In order for OGG to resume processing after failover, you must configure the recovery related OGG files such as

- *checkpoint files* ($\$GGATE_HOME/dirchk$)
- *trail files*

on a shared ACFS file system under/cloudfs partition when setting up OGG on Oracle Database Appliance.

9. Conclusion

Acquiring and maintaining an enterprise class IT infrastructure to ensure business continuity has been both a financial and an expertise challenge for mid-sized organizations. Oracle Database Appliance addresses these challenges by offering a pre-built two node cluster-in-a-box engineered system at much lower price and expertise entry points.

In this white paper, we have discussed how mid-sized organizations and cost conscious LOBs within big organizations can successfully deploy Oracle Database Appliance as a standardized cloud building block for achieving cost and operational efficiencies while delivering highly available and agile IT infrastructure to ensure business continuity and meet dynamic business needs.

10. References

- (1) *National Institute of Standards and Technology*
<http://www.nist.gov/itl/cloud/index.cfm>
- (2) *Inside the Oracle Database Appliance (ODA) (Doc ID 1385831.1)*
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Private Database Cloud on Oracle Database
Appliance

August 2012

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