UWV

MSV detailed design
[Solution Building Block – PRI-04 Oracle RDBMS cluster]
Detailed Design
Author: Zuzana Trskova
Version: 1.1

IMPORTANT NOTICE

Disclaimer

The contents of this document and any ancillary materials provided by DXC Technology (hereinafter: “DXC”) are commercially sensitive and confidential, and, unless agreed in writing by DXC, may not be or copied or communicated in whole or in part to any other party except for the sole purpose of evaluation by UWV and with prior written consent of the DXC VeDaT Program Director.

DXC has prepared this document in good faith based on information made available by UWV ICT Services. This document is provided as part of contractual agreement. Nothing in this document or in any related discussions or correspondences should be construed as an offer or representation that should be relied upon.

DOCUMENT PURPOSE

The detailed design contains a detailed description of the planned infrastructure at a physical level. It identifies the vendors, models, versions, releases, capacities, connections and any other specific information required to enable infrastructure to be purchased and deployed. This document is input for the engineering work orders and or implementation guides in which the configuration level is described. It is assumed the reader has SME level knowledge of the technologies described in the detailed design.

Table of Contents

1. Introduction....5
1.1. Contacts....5
1.2. Related Documentation....6
2. Architecture Overview....7
2.1. Overview....7
2.2. Proposed State....7
3. Design Solution....8
3.1. Standalone – RDBMS cluster....8
3.2. Hardware....13
3.3. OS VM....13
3.4. HW/OS Prerequisites for oracle installation....13
3.5. Oracle Software....15
3.5.1. Licensing....15
3.5.2. Oracle Grid Infrastructure software....15
3.5.3. Oracle Database server software....15
3.5.4. Oracle Enterprise manager cloud control....15
3.6. Storage & Filesystem configuration....16
3.6.1. Storage....16
3.6.2. Filesystem layout....16
3.6.3. Configuration details (ASM) Filesystems....16
3.7. Network....18
3.8. Backup and Restore....18
3.8.1. Backup Overview....18
3.8.2. Backup Schedule....19
3.8.3. Backup Retention Policy....19
3.8.4. Disaster Recovery....19
3.9. Security....20
3.10. Maintenance window....21
3.11. Monitoring Oracle DBs....21

CHANGE HISTORY

The following Change History log contains a record of changes made to this document:

Published / Revised	Version #	Author (optional)	Section / Nature of Change
	0.1	Zuzana Trskova	Draft
	0.4	Zuzana Trskova	Updated after customer review
	1.0	Zuzana Trskova	Updates options, move RAC and DataGuard to separate documents
	1.1	Zuzana Trskova	Updated after Eric Janssen review

Peer Review History (include links to peer review(s):

Document	Location	Engineer	Reviewer	Status	Version

1. Introduction

The purpose of this document is to provide details on design & deployment information for the Service described here - Oracle RDBMS cluster for UWV. Please note that Oracle DataGuard and Oracle RAC clusters are described in separate documents.

This Oracle RDMBS solution shows variability to expand environment using building blocks, which can be added if current capacity is exhausted and such fulfil customer needs to enhance environment gradually.

The Oracle RDBMS environment will be deployed as green field solution and fully dedicated for UWV.

1.1. Contacts

Table 1 Contacts

Role	Name	Email
Technical Transformation Lead	Cora Kuijper	
Lead Architect Security (1)	Edward Matray	
Lead Architect Security (2)	Erwin van Rens	
Lead Architect Hosting and Network	Ivan Forceville	
VMware design (general)	Ivaylo Petkov	
MSV Architect + MSV Catalogue	Jurgen Van Haecht	
Lead Architect SM&I	Keith Eagling	
Automation - Architect	Radovan Rovny	
AT&T architect network (DC Design)	Remco Esveld	
Oracle designer/engineer	Zuzana Trskova	
UWV Account Lead Architect	Hans Kreisel	
AIX architect	Petar Ivanov	
Active Directory Architect	Marcel van Doorn	
Automation – Architect	Roberto Tanzilli	
Infra Apps and Special Care Products (Migration stream)	Ronald Hoogendoorn	

1.2. Related Documentation

Table 2 Related Documentation

Document	Location
UWV HLD VI V2.0.vsdx	https://spf.dxc.com/sites/30087/TT/Docum/Forms/AllItems.aspx?RootFolder=%2Fsites%2F30087%2FTT%2FDocum%2FUWV%20Design%20Office%20%20%28Andre%20Koppenol%20%2D%20Cora%20Kuijper%29%2F03%20HLD%20VI&FolderCTID=0x012000375B62A70E0B25478E4DA82E9887DEB3&View=%7B142B35C2%2D522B%2D4EA1%2DBB7B%2D934E4D965561%7D
DXC_KD Oracle Seggregation_v4.0.docx	https://spf.dxc.com/sites/30087/TT/Docum/Forms/AllItems.aspx?RootFolder=%2Fsites%2F30087%2FTT%2FDocum%2FUWV%20Design%20Office%20%20%28Andre%20Koppenol%20%2D%20Cora%20Kuijper%29%2F05%20Kennis%20documenten&FolderCTID=0x012000375B62A70E0B25478E4DA82E9887DEB3&View=%7B142B35C2%2D522B%2D4EA1%2DBB7B%2D934E4D965561%7D
DXC_KD-landing platforms.docx	https://spf.dxc.com/sites/30087/TT/Docum/Forms/AllItems.aspx?RootFolder=%2Fsites%2F30087%2FTT%2FDocum%2FUWV%20Design%20Office%20%20%28Andre%20Koppenol%20%2D%20Cora%20Kuijper%29%2F05%20Kennis%20documenten&FolderCTID=0x012000375B62A70E0B25478E4DA82E9887DEB3&View=%7B142B35C2%2D522B%2D4EA1%2DBB7B%2D934E4D965561%7D
Oracle Hardening	*https://dxcportal.sharepoint.com/:w:/r/sites/globalDatabaseCoELeadership/Global%20Tech%20Library/Oracle%20Hardening%20Standards/DXC%20Database%20Group%20-%20Oracle%20Hardening%20Standards%20-%20v1.06.docx?d=w9bb04e0ed45647688af967e7cfa3449a&csf=1&web=1&e=BYNhdD*

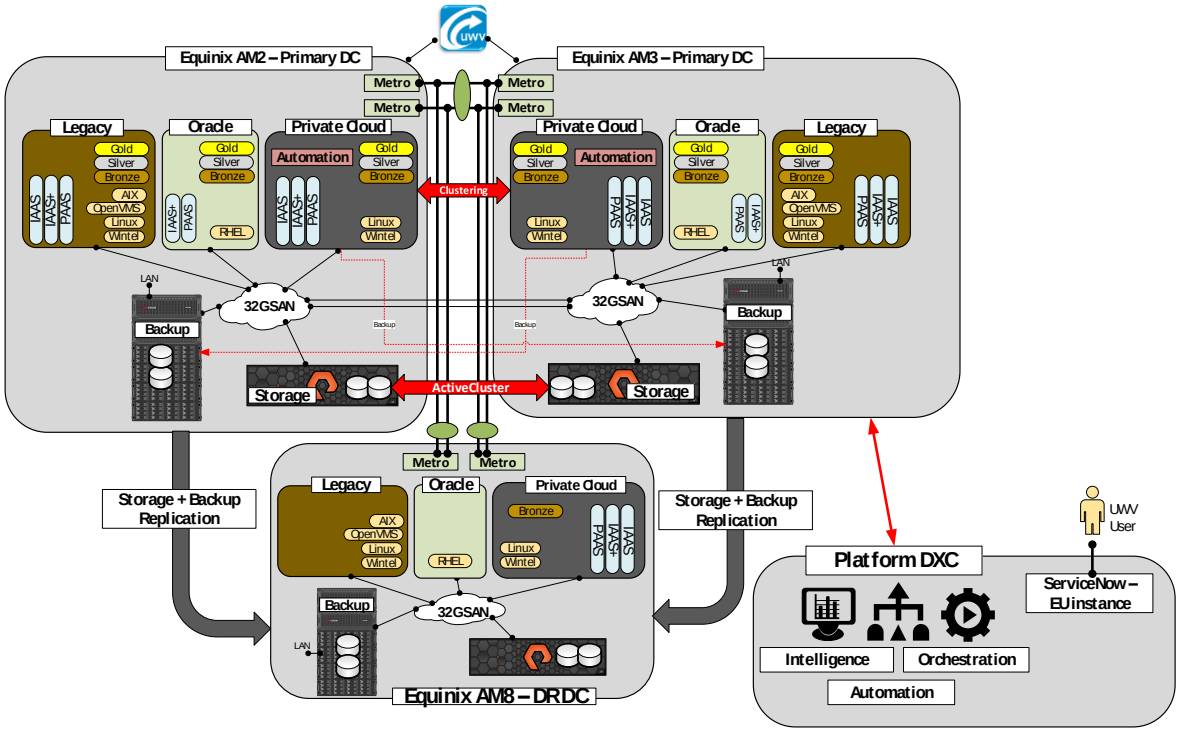
2. Architecture Overview

2.1. Overview

- Future state will be hosted on few clusters, each cluster will be dedicated for specific licensed Oracle products
- 3 datacentre implementation where AM2 and AM3 are primary active/active datacenters which host gold, silver and bronze applications and AM8 is a disaster recovery datacenter for bronze applications from datacenter AM2 or AM3
- All Oracle servers are DXC Managed (IaaS+)
- Each cluster will be isolated on several layers to comply with the Oracle Licensing regulations for VMware Virtual environments. This design has been formally approved to UWV by Oracle corporation.
- Initial capacity of the clusters can be extended by adding nodes in the clusters when resources are exhausted

2.2. Proposed State

The UWV platform will be created as a greenfield approach. Below is high level diagram of new environment.



3. Design Solution

3.1. Standalone – RDBMS cluster

- 2 nodes of the cluster will be hosted on physical hardware in DC AM2, another 2 nodes will be hosted on physical hardware in DC AM3. In addition 2 nodes in DC AM8 which is disaster recovery site for bronze Oracle DB will be active only in case AM2 or AM3 DC down
- Management of Oracle workload is done by dedicated vCenter, which is running on stretched vSphere cluster, dedication must be done to comply with Oracle licensing policy
- Each node in the cluster has a maximum of vCPU and RAM it can host. When the maximum threshold is reached, additional nodes and licenses need to be added to cover UWV needs. All nodes have the same configuration.
- Cluster is dedicated to run VM's for Oracle databases
- Cluster is proposed to host only single instance DB running on Linux
- One VM will be dedicated for one DB, which means one set of binaries with one Oracle database
- The private cloud hosting platform must be able to handle Silver and Bronze business applications, Gold applications will be handled in separate Data Guard cluster. The agreed availability Service Levels are:
    - Silver >=99,5% - During normal operations oracle workloads will run in either AM2 or AM3. In case a DR is necessary for one of the datacenters, these workloads will failover with VMware HA to opposite DC
    - Bronze >=98% - During normal operations oracle workloads will run in either AM2 or AM3. In case a DR is necessary for one of the datacenters, these workloads will be restored from backup in AM8.
- The Oracle cluster has dedicated storage which resides on Pure Storage

ESX Nodes for Oracle Cluster	***AM2 Datacenter*** UWVAM2ESXORA01 UWVAM2ESXORA02 ***AM3 Datacenter*** UWVAM3ESXORA01 UWVAM3ESXORA02 **AM8 Datacenter** UWVAM8ESXORA01 UWVAM8ESXORA02	***IP addresses***

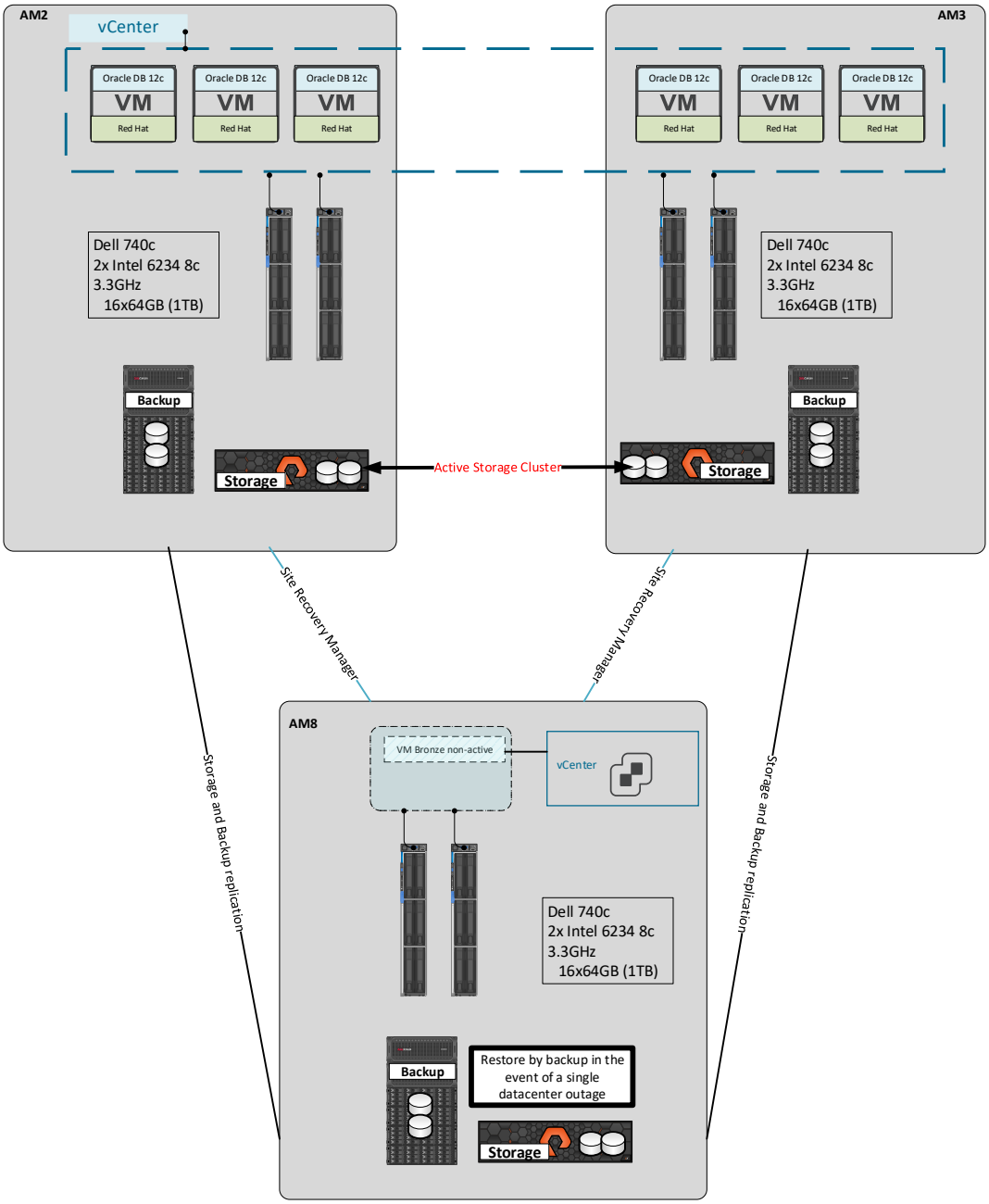


Fig. Standalone –RDBMS oracle cluster

Isolation of RDBMS oracle cluster is done on more levels:

Management Layer

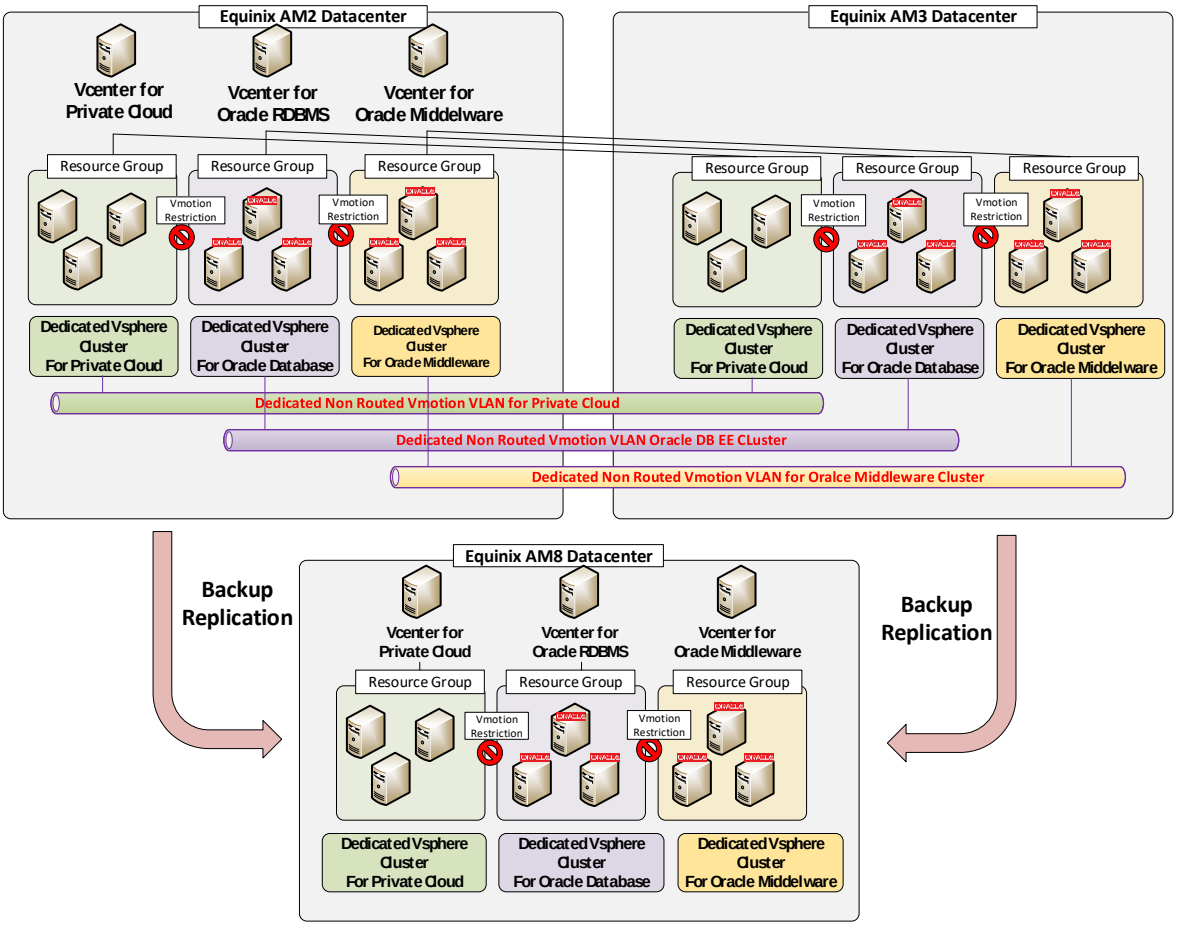
DXC implemented separate Vcenter appliances (**non-linked**) for each of the vSphere clusters in order to have full management separation.

This means that DXC has implemented the following dedicated Vcenters for Oracle products:

1) Dedicated Vcenter for the Oracle Database Cluster(s) managing vSphere hosts in AM2 and AM3
2) Dedicated Vcenter for Oracle Middleware Cluster(s) managing vSphere hosts in AM2 and AM3

3) Dedicated Vcenter for Oracle Database Cluster(s) managing vSphere hosts in AM8 only in case of DR

4) Dedicated Vcenter for Oracle Middleware Cluster(s) managing vSphere hosts in AM8 only in case of DR



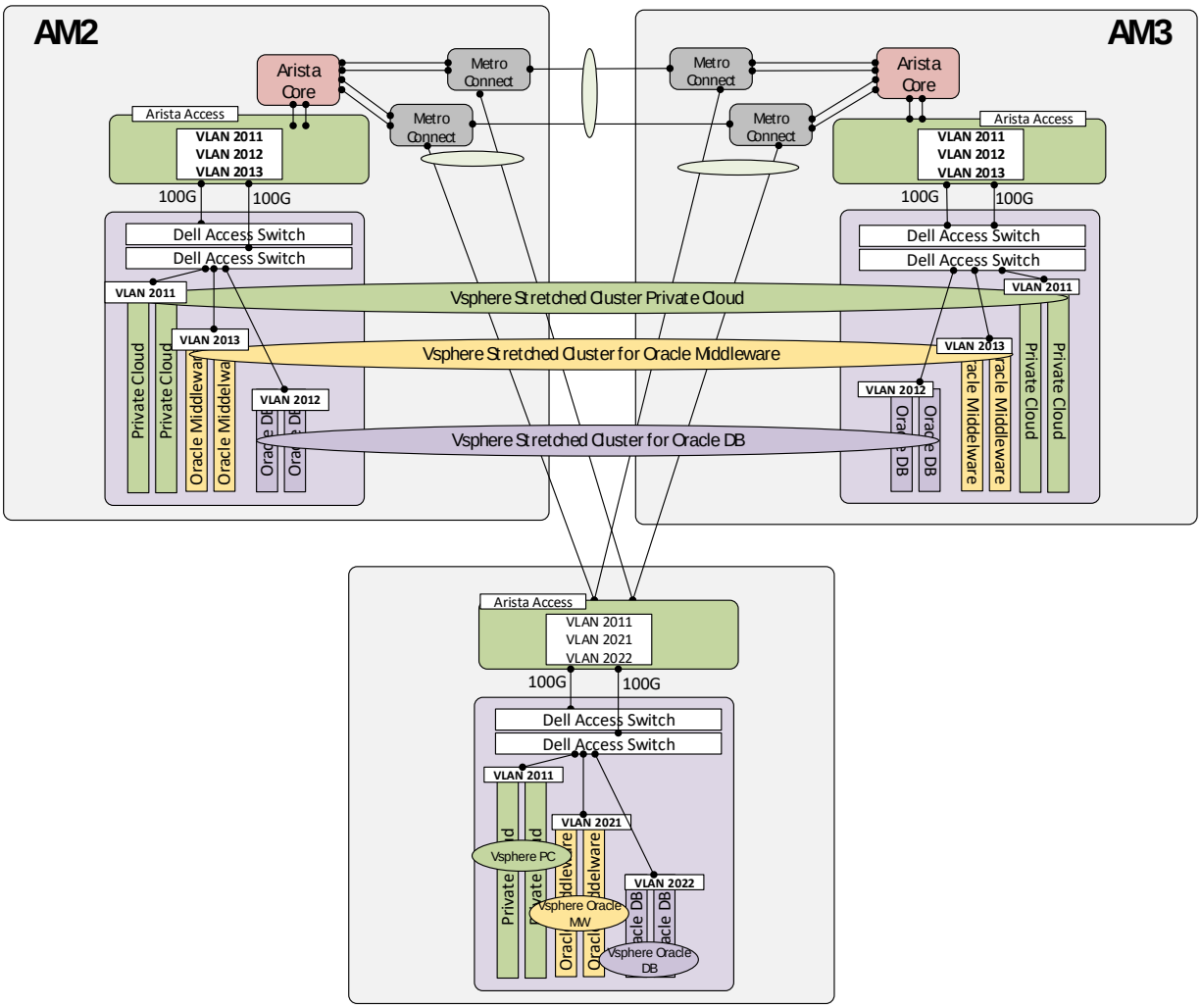
Network Layer

Each of the vSphere clusters have different VMotion VLANs configured in order to enforce that Virtual Machine migration is limited to the cluster the Virtual Machines are running on!

Definition of the VLAN's is outside the NSX virtualization technology on the Arista and Dell network switches.

In the below picture you see 5 different VMotion VLANs defined. Each VMotion VLAN is defined on the Arista switches and configured on the 100Gigabit trunk towards the Dell Chassis Switches.

Each Blade receives a "Blade Profile" which includes a set of VLANs it needs to use. For each vSphere Cluster a different set of VMotion VLANs are defined in order to prevent Virtual Machine mobility towards other clusters.

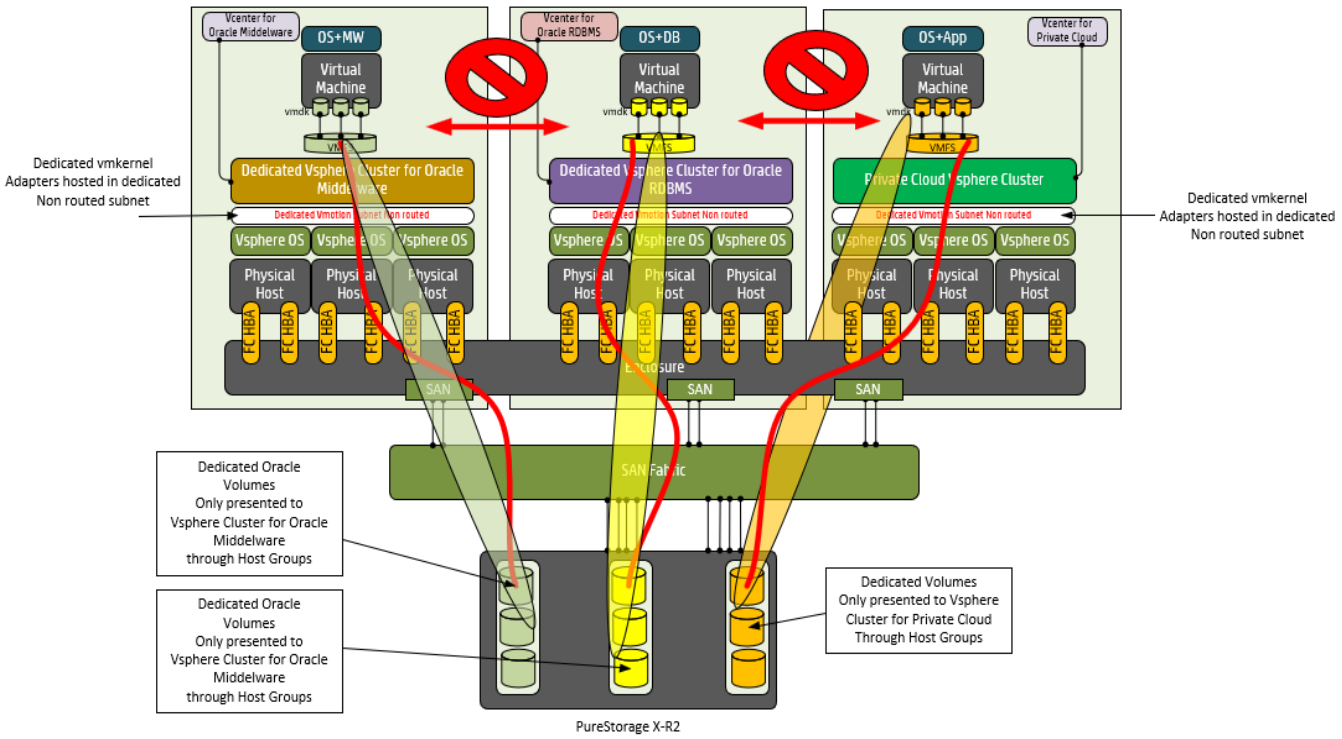


Storage Layer

DXC uses Purestorage X90-R2 arrays to foresee the Oracle Database and Oracle Middleware Clusters from block storage.

DXC implemented a combination of Hard Zoning on the SAN together with dedicated Host Groups on PureStorage so that volumes on the PureStorage are dedicated to their respective vSphere Cluster.

This configuration is implemented in all 3 datacenters



3.2. Hardware

COMPONENT	TYPE	CAPACITY	DESCRIPTION
Vsphere cluster for Oracle workloads	Dell MX7000: 740c	1 Blade-based server configuration: **2x8core** (Intel 6234 3.3Ghz) 16x64GB (**1TB**) 2x SD card 32GB 1x Dual port 25G LAN 1x Dual port 16G FC adapter	Contains virtual machines ordered by the customer. Initial amount of Blade-based servers per cluster: Datacenter1: 2x Datacenter2: 2x Datacenter3: 2x

3.3. OS VM

Operating System – **Red Hat Enterprise Linux (RHEL) 7.3 64-Bit or later**, plus required RPMs for Oracle software.

Server Name(s)	Software	Vendor	Version	Description	Licensing / Owner	Supported by
Virtual Servers	RHEL 7.x, 64 bit	RedHat	7.x	Operating System	DXC	DXC
	Oracle 12.2.0.1 Enterprise Edition	Oracle	12.2.0.1	Database	UWV	DXC
	Enterprise Manager Agent 13c	Oracle	13.3	Database	UWV	DXC
	CVA	DXC	Latest version	Monitoring	DXC	DXC
	NetWorker v9.x	DXC	9.x	Backup / Restore Agent	DXC	DXC

3.4. HW/OS Prerequisites for Oracle installation

Check	Task
Disk space allocated to the /tmp directory	At least 1 GB of space in the /tmp directory.
Swap space allocation relative to RAM (Oracle Restart)	Between 8 GB and 16 GB: Equal to the size of the RAM More than 16 GB: 16 GB
Minimum RAM	8GB
Huge Pages	Disabled

Oracle Preinstallation RPMs are available from the Oracle Linux Network. Using the Oracle Preinstallation RPM is not required, but Oracle recommends it to save time during setup.

When installed, the Oracle Preinstallation RPM does the following:

- Automatically downloads and installs any additional RPM packages needed for installing Oracle Grid Infrastructure and Oracle Database, and resolves any dependencies
- Creates an Oracle user, and creates the oraInventory (oinstall) and OSDBA (dba) groups for that user
- As needed, sets sysctl.conf settings, system startup parameters, and driver parameters to values based on recommendations from the Oracle RDBMS Pre-Install program
- Sets hard and soft resource limits
- Sets other recommended parameters, depending on your kernel version

If Oracle preinstallation RPM is not available, these are required to set/check (in attached document):

Oracle software mounts

```
# mkdir -p /a01/app

# mkdir -p /a01/app/oraInventory

# mkdir -p /a01/app/oracle

# mkdir -p /a01/app/grid
```

3.5. Oracle Software

All databases will run on Oracle 12c Release 2 and have ASM storage as default storage management system.

3.5.1. Licensing

- All Oracle Software licenses are owned by UWV – UWV provides Customer Support Identified (CSI) to DXC.

RDBMS cluster will be licensed by Oracle Enterprise Edition, Oracle Diagnostics &Tuning pack and Oracle Partitioning.

3.5.2. Oracle Grid Infrastructure software

The oracle grid Infrastructure for a standalone server is the Oracle software that provides system support of an Oracle database including volume management, file system and automatic restart capabilities. Includes Oracle Restart and Oracle ASM, needs to be installed before installing Oracle Database 12c and patched at least N-1, where N is the latest RU/PSU.

- Oracle Grid infrastructure version 12.2 (from OTN)
  - linuxx64_12201_grid_home.zip
- Oracle GI Release Update (MOS)
  Patch 30920127: GI APR 2020 RELEASE UPDATE 12.2.0.1.200414

3.5.3. Oracle Database server software

The edition of Oracle DB server software that will be used is – **Enterprise Edition.**
The database's Release Update/PSU patch level should be at least N-1, where N is the latest RU/PSU.

Oracle Database EE 12.2.0.1 (from OTN):
linuxx64_12201_database.zip

Release	Patching End Date	Premier Support Ends (PS)	Extended Support Ends (ES)
12.2.0.1	20-Nov-2020	31-Mar-2023	Not Available

3.5.4. Oracle Enterprise manager cloud control

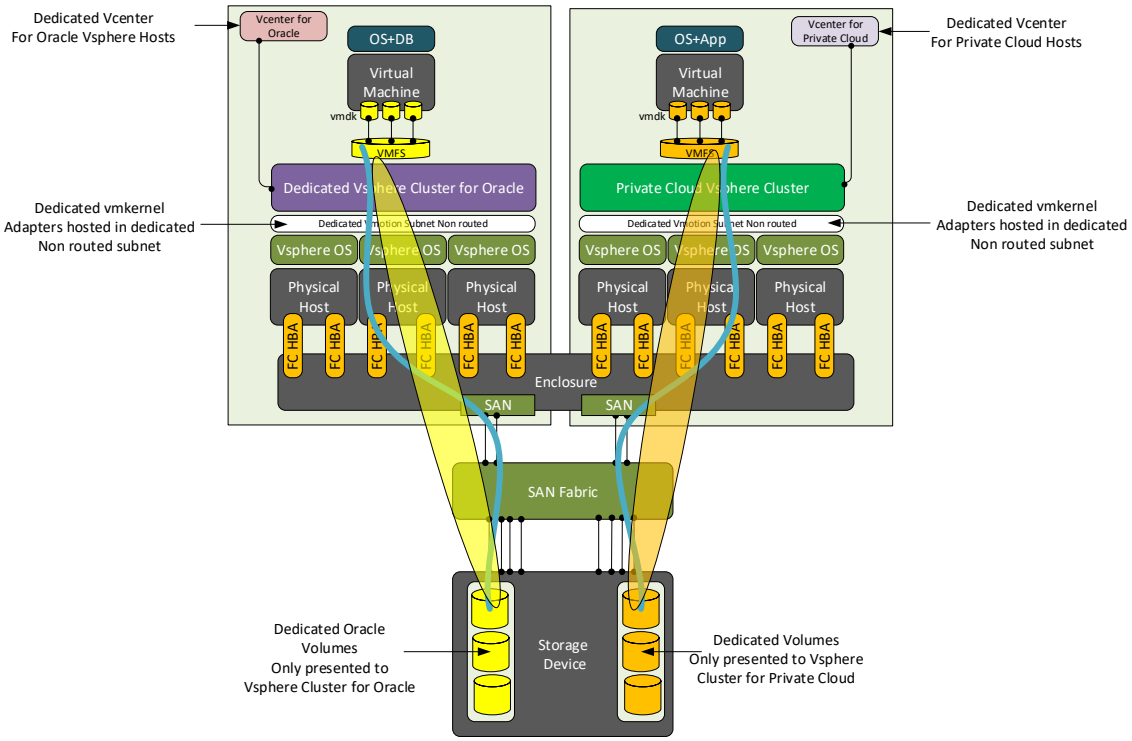
Oracle Enterprise Manager is Oracle's on premises management platform, providing a single pane of glass for managing all of a customer's oracle deployments.

- Oracle Enterprise Manager Cloud Control 13c (from OTN)

3.6. Storage & Filesystem configuration

3.6.1. Storage

Pure storage will have dedicated replicated volumes presented for Oracle Vsphere cluster. See *DXC_KD Oracle Seggregation_v4.0.docx*



3.6.2. Filesystem layout

The Oracle software will be residing on each database server as follows:

Mount point	Size (GB)	Directories	Purpose	OS User owner	Required
/a01/app	100GB	/a01/app/oracle	Oracle Base	oracle	Yes
		/a01/app/oraInventory	Oracle Global Inventory	oracle	Yes
		/a01/app/oracle/<DB_NAME>	Oracle database home	oracle	Yes
/a01/app/grid	100GB	/a01/app/grid	Grid Infrastructure home	oracle	Yes
/export	100GB		Oracle datapump dump files	oracle	No (only if needed)

3.6.3. Configuration details (ASM) Filesystems

Oracle ASM is a volume manager and a file system for Oracle Database files that supports single-instance Oracle Database and Oracle Real Application Clusters (Oracle RAC) configurations. Oracle ASM uses disk groups to store data files; an Oracle ASM disk group is a collection of disks that Oracle ASM manages as a unit. Within a disk group, Oracle ASM exposes a file system interface for Oracle Database files. The content of files that are stored in a disk group is evenly distributed to eliminate hot spots and to provide uniform performance across the disks. The performance is comparable to the performance of raw devices.

For standalone databases ASM will be configured with “EXTERNAL redundancy” for all diskgroups as duplication of data will be done on storage level. The AU size should be equal to, or a multiple of underlying storage block size. For all databases will be set to 4MB.
Two groups in each database will be created +DATA and +FRA.
+DATA is created for database files
+FRA is created for fast recovery area files

For +DATA size of disks used must be defined according expected database size as in ASM, disks in a given disk group should have similar size and performance characteristics, preferably same.

The disk requirement to satisfy FRA for the Oracle 12c is much reduced by using external backup therefore making available more Grid Disk capacity for database data in the DATA disk group. Using RMAN for external backups the ratio of DATA to FRA can be considered to 80:20 (DATA:FRA).

Diskgroup name	Multipath name	#of disks	Disk size [GB] high performance	Purpose	redundancy
+DATA	rasmdat3001…6	2-6	50,100,150,200, 250,500	datafiles, controlfiles	External
+FRA	rasmfra3001…2	2	50,100,150,200, 250,500	archive logs, flashback logs	External

Multipathing solutions provide failover by using redundant physical path components.

These redundant physical path components include adapters, cables, and switches that reside between the server and the storage subsystem. If one or more of these components fails, then applications can still access their data, eliminating a single point of failure

In order to configure multipathing on RHEL 7 for ASM disks, follow the instructions in MOS Doc ID 1538626.1.

Red Hat’s native device manager udev rules will be used for configuring Oracle ASM disks.

Details for ASM Storage Preparation

The following are guidelines for preparing storage for use with Oracle ASM:
(Oracle Automatic Storage Management Administrator's Guide 12c)

- Configure a separate disk group for the following:
  - Database data files
  - Fast recovery area
- An I/O path is a distinct channel or connection between storage presenting LUNs and the server. An *active* I/O path is an I/O path in which the I/O load on a LUN is multiplexed through multipathing software.
  - Ensure that all Oracle ASM disks in a disk group have similar storage performance and availability characteristics. In storage configurations with mixed speed drives, such as flash memory and hard disk drives (HDD), I/O performance is constrained by the slowest speed drive.
  - Oracle ASM data distribution policy is capacity-based. Ensure that Oracle ASM disks in a disk group have the same capacity to maintain balance.
  - Configure a minimum of three failure groups for normal redundancy disk groups and five failure groups for high redundancy disk groups to maintain the necessary number of copies of the Partner Status Table (PST) to ensure robustness with respect to storage hardware failures.
  - Create external redundancy disk groups when using high-end storage arrays. High-end storage arrays generally provide hardware RAID protection. Use Oracle ASM mirroring redundancy when not using hardware RAID, or when you need host-based volume management functionality, such as mirroring across storage systems. You can use Oracle ASM mirroring in configurations when mirroring between geographically-separated sites (extended clusters).

- Minimize I/O contention between Oracle ASM disks and other applications by dedicating disks in Oracle ASM disk groups.
- Choose a hardware RAID stripe size that is a power of 2 and less than or equal to the size of the Oracle ASM allocation unit.

3.7. Network

Database is communicating with application over network via Listener. One listener per DB is needed with name LISTENER using non default port.

3.8. Backup and Restore

3.8.1. Backup Overview

- *BUR Software Environment* - NetWorker v9.x

NetWorker as environment backup solution will be integrated with standard Oracle backup and recovery tool Recovery Manager (RMAN). This integration allows using full advantage of RMAN features – archivelogs, incremental and full backups and recovery.

For DB backup configuration the BUR team need following details which can be provided after DB creation:

Parameter	Note
Server name	Mandatory
Oracle SID	Mandatory
Oracle OS user	oracle
Oracle OS group	oinstall
Oracle Home directory	/a01/app/oracle/product/12.2
Target DB user	rman
Target DB password	Mandatory
Target DB service	Mandatory

Sample of archiving scripts (can be adjusted):

ARCHIVE REDO LOG BACKUP

```
run {
allocate channel 'dev_0' type 'sbt_tape'
parms
'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=application,OB2BARLIST=Archive_Delete)';
backup
format 'Archive_Delete<application_%s:%t:%p>.dbf'
archivelog all
delete input;
backup
format 'Archive_Delete<application_%s:%t:%p>.dbf'
current controlfile;
}
```

DB FULL ONLINE BACKUP

```
run {
allocate channel 'dev_0' type 'sbt_tape'
parms
'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=application,OB2BARLIST=Database_Switch_Arc
hive)';
backup incremental level 0
format 'Database_Switch_Archive<application_%s:%t:%p>.dbf'
database;
sql 'alter system archive log current';
backup
format 'Database_Switch_Archive<application_%s:%t:%p>.dbf'
archivelog all;
```

```
backup
format 'Database_Switch_Archive<application_%s:%t:%p>.dbf'
current controlfile;
}
```

3.8.2. Backup Schedule

- *Maintenance Window - TBD*
- *Backup Window – 19:00 to 6:00*
- *Backup Type*
  - Archive Backup – every 4 hours
  - Incremental Backup – daily except day when full backup running
  - Full Backup – daily or once a week for large DBs (rest incremental daily)

3.8.3. Backup Retention Policy

Retention can be changed based on customer decision or BUaaS standard which is 14, 30, 60 and 90 days.

3.8.4. Disaster Recovery (FINAL DECISION ON THIS BEGINNING OF JUNE 2012)

The AM8 disaster recovery site is configured as follows:

- DR-site configuration: The disaster recovery site (DR-site) contains a storage layer and a VMware layer (as described above)
- Storage replication: The storage units on the primary sites (AM2 and AM3) are replicated in near real time to the backup storage units at the AM8-site. As such, the AM8-site functions solely as a data backup for the primary site until the moment a recovery is required.
- During normal operations the AM8 datacenter is not running any workloads nor active Virtual Machines. Also the storage in AM8 is set to read-only.
- Due to this configuration, Oracle software is never installed and/or running at AM2/3 and AM8 simultaneously

DR-mechanics:
In case a disaster (an event causing one of the primary sites to stop functioning, e.g. fire, explosion, power failure that cannot be compensated by the backup facilities, etc.) occurs at one of the primary sites, the following actions are set in motion – in the order as below:

1. The (remainder of the) primary site is deactivated (insofar as this has not yet fully happened as a consequence of the disaster), so that no Oracle cluster hardware is active anymore and no software is running anymore;
2. The LUN permissions of the back-up storage unit at the DR-site are reconfigured to read/write;
3. The backup storage unit is connected to the VMware layer at the disaster recovery site, at which moment the backup data can be used for processing activities via (virtual) processors;
4. VM's equivalent to the production VM's that were running at the primary site prior to the disaster, are reconstructed on the basis of the latest backup data on the ESX cluster at the DR-site;
5. The DR-site is made available to end users, and now functions as the primary production environment for the bronze workloads of the impacted site

Recovery of the primary site:

After the primary site has been recovered, the storage LUNs on the DR-site are replicated in real time to the storage LUNs at the primary-site. After this replication is completed, the above steps 1. – 5. are followed to bring down the DR-site and bring up the primary site as the primary production environment.

Testing of the AM8 DR-mechanics:

The functioning of these DR-mechanics is being tested for a maximum of 4 times each calendar year. These tests take place under controlled circumstances, where no environment is available to end users. The test is performed in a weekend and requires two days or less to complete. As in the situation of a real DR, no Oracle program will run in the entire primary site.

3.9. Security

The following User IDs in database are required with special privileges.

User ID	Name	Tablespace Name	Privilege/Rights	Notes
sys	oracle dba	SYSTEM	ALL	administrative account with sysdba priviledges
rman	rman user	USER	ALL	backup

For all user accounts these settings are set via password verify function. It can be lowered on request (e.g. if application can't handle 12 character password)

all accounts have a strong password:

Minimal 12 characters;

password complexity:

The password contains characters from three of the following categories:

Uppercase letters (A through Z,)

Lowercase letters (a through z)

Base 10 digits (0 through 9)

Non-alphanumeric characters (special characters): (~!@#$%^&*_-+=`|\(){}[]:;'"<>,.?/) .

Complexity requirements are enforced when passwords are changed or created.

Account lockout period (after 10 failed logins) 1 hour.

Maximum password age 6 Months.

The default passwords for SYS, SYSTEM, PERFSTAT, OUTLN, SCOTT, CTXSYS, and DBSNMP will be changed from the installation default.
The user accounts OUTLN, SCOTT and CTXSYS will be locked and their passwords set to expired.
The passwords for SYS and SYSTEM will be changed on production servers on a semi-annual basis and/or when a database administrator leaves the database team. Must be different.
Restrict the number of users who can make SYS-privileged connections to the database.
Restrict the number of users who have SYSDBA/SYSOPER/SYSASM etc access

Security services used (only on DXC managed systems):

- PAM => yes all high privileged access to OS and database will be going through PAM

- SIEM => all logs are forwarded to the SIEM security services (all security loges are stored (according the retention periods required) when needed the logs are processed within the SIEM when specific use cases require Oracle log files
- MEP => all Windows and Linux operating systems are provided with malware protection SPCM (TCM) => compliancy scans will be run on the operating system
- Vulnerability scanning => Oracle systems will be scanned for vulnerabilities.

The BIR/DIGIG/SUWI Controls (described in the Security baselines) are all integrated within the GRC tooling. And described within the designs of the GRC.

More about security see *Oracle Hardening.*

3.10. Maintenance window

- OTA first full weekend of the month.
- P third full weekend of the month.

3.11. Monitoring Oracle DBs

CVA (Customer Virtual Appliance) for monitoring of oracle databases will be implemented. The customer virtual appliance is a mandatory DXC deliverable where DXC is engaged to deploy solutions and services.

The CVA is the set of **stateless** (strongly desired) PDXC standard tooling that is deployed as a whole, or in some cases individually, to the required customer network zones. This local deployment allows for the management and administration of the client's infrastructure and applications through the suite of containerized PDXC tools, such as Nagios used for oracle databases.

Metrics are stored in templates which can have different warning levels for development, test, acceptance and production environments. Metrics covers database state, tablespace/datafile size, state, ASM storage, logs, backups etc.

Metrics now monitored can be found: https://github.dxc.com/Platform-DXC/monitoring-catalog/blob/master/Database/Oracle/Oracle.md