Oracle Workloads on VMware Hybrid Multi-Clouds REFERENCE ARCHITECTURE

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Oracle Workloads on VMware Hybrid Multi-Clouds

Customers have successfully run business-critical Oracle workloads with high performance demands on VMware* vSphere* for many years.

Customers deploying business-critical Oracle workloads must often do so while managing to stringent SLAs, continuing to deliver high levels of performance, and maintaining application availability. Managing data storage in this context is a significant challenge, as traditional storage solutions for business-critical applications come with a variety of issues to overcome, including inadequate performance and scalability, storage inefficiency, management complexity, and excessive deployment and operating costs.

With more and more production servers being virtualized, the demand for highly converged server-based storage is surging. VMware vSAN[™] is designed to provide highly scalable, available, reliable, and high-performance storage using cost-effective hardware (i.e., direct-attached disks in VMware ESXi[™] hosts). vSAN adheres to a new policy-based storage management paradigm, simplifying and automating the complex management workflows of traditional enterprise storage systems with respect to configuration and clustering.

vSAN Stretched Cluster enables active/active data centers that are separated by metro distance.

VMware Cloud[™] on AWS is an on-demand service that enables customers to run applications across VMware vSphere cloud environments with access to a broad range of AWS services. Powered by VMware Cloud Foundation[™], this service integrates vSphere, vSAN and VMware NSX^{*} along with VMware vCenter^{*} management, and is optimized to run on dedicated, elastic, bare-metal AWS infrastructure. ESXi hosts in VMware Cloud on AWS reside in an AWS availability zone (AZ) and are protected by vSphere High Availability (HA).

Stretched Clusters for VMware Cloud on AWS is designed to protect against an AWS AZ failure. With Stretched Clusters for VMware Cloud on AWS, business-critical Oracle workloads with exceptionally high SLA, performance, and application availability requirements can take advantage of cloud deployment while simultaneously achieving high availability across multiple AZs.

Solution Overview

This paper describes the deployment, migration, and configuration of business-critical Oracle workloads on VMware Cloud on AWS and Stretched Clusters for VMware Cloud on AWS.

Key Results

The following highlights summarize the deployment and migration strategies available for moving Oracle workloads to VMware Cloud on AWS:

- Deploying Oracle workloads on VMware Cloud on AWS
- Migrating Oracle workloads from VMware on-premises to VMware Cloud on AWS
- Deploying Oracle workloads on Stretched Clusters for VMware Cloud on AWS

Introduction

Purpose

This paper describes the strategies and best practices for deploying or migrating Oracle workloads from on-premises to VMware Cloud on AWS and Stretched Clusters for VMware Cloud on AWS.

Scope

This reference architecture outlines the deployment and migration strategies and use cases involved in movement of Oracle workloads to VMware Cloud on AWS.

- Deploying Oracle workloads on VMware Cloud on AWS
- Migrating Oracle workloads from VMware on-premises to VMware Cloud on AWS
- Deploying Oracle workloads on Stretched Clusters for VMware Cloud on AWS

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Audience

This reference architecture is intended for Oracle database administrators, virtualization and storage architects, or others involved in planning, architecting, and administering Oracle workloads on a VMware SDCC platform, with plans to transition to VMware Cloud on AWS.

Terminology

This paper includes the following terminology:

TERM	DEFINITION
Oracle Single Instance	Oracle Single-Instance database consists of a set of memory structures, background processes, and physical database files, which serves the database users.
Oracle Automatic Storage Management (Oracle ASM)	Oracle ASM is a volume manager and a file system for Oracle database files that support Single-Instance Oracle Database and Oracle Real Application Cluster (RAC) configurations.
Oracle ASMLIB and Oracle ASMFD	Oracle ASMLIB maintains permissions and disk labels that are persistent on the storage device, so that the label is available even after an operating system upgrade. Oracle ASMFD helps prevent corruption in Oracle ASM disks and files within the disk group.

TABLE 1. Terminology

Technology Overview

This section provides an overview of the technologies used in this solution:

- VMware vSphere
- VMware vSAN
- VMware vSAN Storage Policy
- VMware Virtual Disk Provisioning Policies
- Storage Policy-Based Management
- VMware vSAN Stretched Cluster
- VMware SDDC
- Hybrid and Multi-Cloud as the VMware Cloud
- VMware Cloud on AWS
- Stretched Clusters for VMware Cloud on AWS
- VMware Cloud on Dell EMC
- Google Cloud VMware Engine
- Azure VMware Solution
- Oracle Cloud VMware Solution
- VMware Hybrid Cloud Extension
- Oracle Database Architecture
- Oracle ASM, ASMLIB and ASMFD



VMware vSphere

VMware vSphere, the industry-leading virtualization and cloud platform, is the efficient and secure platform for hybrid clouds, accelerating digital transformation by delivering simple and efficient management at scale, comprehensive built-in security, a universal application platform, and a seamless hybrid cloud experience. The result is a scalable, secure infrastructure that provides enhanced application performance and can be the foundation of any cloud.

As the next-generation infrastructure for next-generation applications, vSphere 7.0 has been rearchitected with native Kubernetes, enabling IT admins to use VMware vCenter Server* to operate Kubernetes clusters through namespaces. VMware vSphere with Tanzu allows IT admins to leverage their existing skillset to deliver self-service infrastructure access to their DevOps teams, while providing observability and troubleshooting of Kubernetes workloads. vSphere 7 provides an enterprise platform for both traditional and modern applications, enabling customers and partners to deliver a developer-ready infrastructure, scale without compromise, and simplify operations.

Learn more about VMware vSphere 7.0.

VMware vSAN

VMware vSAN is a software-defined storage solution, built from the ground up, for vSphere VMs.

It abstracts and aggregates locally attached disks in a vSphere cluster to create a storage solution that can be provisioned and managed from vCenter and the vSphere client. vSAN is embedded within the hypervisor, hence storage and compute for VMs are delivered from the same x86 server platform running the hypervisor.

Hyperconverged infrastructure (HCI) backed by VMware vSAN provides a wide array of deployment options, from a two-node setup to a standard cluster supporting up to 64 hosts. Also, vSAN accommodates a stretched cluster topology to serve as an active-active disaster recovery solution. vSAN includes HCI Mesh, which allows customers to remotely mount a vSAN datastore to other vSAN clusters, disaggregating storage and compute. This allows greater flexibility to scale storage and compute independently.

Learn more about VMware vSAN.

VMware vSAN Storage Policy

vSAN requires VMs deployed on vSAN datastores be assigned at least one storage policy. When provisioning a VM, if you do not explicitly assign a storage policy to the VM, the vSAN default storage policy is assigned.

The default policy contains vSAN rule sets and a range of basic storage capabilities typically used for the placement of VMs deployed on vSAN datastores.

vSAN Default Storage Policy Specifications

Specification	Setting
Primary level of failures to tolerate	1
Number of disk stripes per object	1
Flash read cache reservation, or flash capacity used for the read cache	0
Object space reservation	0 Note: Setting the Object space reservation to zero means that the virtual disk is thin provisioned, by default.
Force provisioning	No

FIGURE 1. Default vSAN Storage Policy



Key storage policy rules:

STORAGE POLICY	DESCRIPTION		
Number of Failures to tolerate	Defines the number of host, disk, or network failures a VM object can tolerate. For n failures tolerated, n+1 copies of the VM object are created and 2n+1 hosts with storage are required. The settings applied to the VMs on the Virtual SAN datastore determines the datastore's usable capacity.		
Object Space Reservation (OSR)	Percentage of the object logical size that should be reserved during the object creation. The default value is 0 percent and the maximum value is 100 percent.		
Number of disk stripes per object	This policy defines how many physical disks across each copy of a storage object are striped. The default value is 1 and the maximum value is 12.		
Flash read cache reservation	Flash capacity reserved as read cache for the VM object. Specified as a percentage of the logical size of the VMDK object. It is set to 0 percent by default and Virtual SAN dynamically allocates read cache to storage objects on demand.		

TABLE 2. Key Storage Policy Rules

Object Space Reservation (OSR) – an administrator should always be aware of over-committing storage on vSAN, just as one needs to monitor over-commitment on a traditional SAN or NAS array.

By default, VM storage objects deployed on vSAN are **thinly provisioned**. This capability, *ObjectSpaceReservation*, specifies the percentage of the logical size of the storage object that should be reserved (thick provisioned) when the VM is being provisioned. The rest of the storage object will remain thin provisioned. The default value is 0%, implying the object is deployed as thin. The maximum value is 100%, meaning the space for the object is fully reserved, which can be thought of as full, thick provisioned. Since the default is 0%, all VMs deployed on vSAN are provisioned as thin disks unless one explicitly states a requirement for *ObjectSpaceReservation* in the policy. If *ObjectSpaceReservation* is specified, a portion of the storage object associated with that policy is reserved.

There is no eager-zeroed thick format on vSAN. OSR, when used, behaves similarly to lazy-zeroed thick.

More information on vSAN Object Space Reservation (OSR) can be found in the VMware vSAN Design Guide.

Learn more about vSAN Default Storage Policy.

VMware Virtual Disk Provisioning Policies

When performing certain VM management operations, it's possible to specify a provisioning policy for the virtual disk file. The operations include creating a virtual disk, cloning a VM to a template, or migrating a VM with VMware vSphere* Storage vMotion*.

You can also use VMware vSphere Storage vMotion or cross-host vSphere Storage vMotion to transform virtual disks from one format to another.

OPTION	DESCRIPTION
Thick Provision Lazy Zeroed	Creates a virtual disk in a default thick format. Space required for the virtual disk is allocated when the disk is created. Data remaining on the physical device is not erased during creation but is zeroed out on demand later on first write from the VM. VMs do not read stale data from the physical device.



Thick Provision Eager Zeroed (EZT)	A type of thick virtual disk that supports clustering features such as the multi-writer attribute for Oracle shared disk in an oracle cluster. Space required for the virtual disk is allocated at creation time. In contrast to the thick provision lazy zeroed format, the data remaining on the physical device is zeroed out when the virtual disk is created. Creating virtual disks in this format may take longer than creation of other types of disks. Increasing the size of an eager zeroed thick virtual disk causes a significant stun time for the VM.
Thin Provision	Use this format to save storage space. For the thin disk, provision as much datastore space as the disk would require based on the value entered for the virtual disk size. The thin disk starts small and, at first, uses only as much datastore space as the disk needs for its initial operations. If the thin disk needs more space later, it can grow to its maximum capacity and occupy the entire datastore space provisioned to it. Thin provisioning is the fastest method to create a virtual disk because it creates a disk with only the header information. It does not allocate or zero out storage blocks. Storage blocks are allocated and zeroed out when they are first accessed.

TABLE 3. Virtual Disk Formats Available in vSphere Storage vMotion

VMDK modes are shown in the table below:

OPTION	DESCRIPTION	
Dependent	Dependent disks are included in snapshots.	
Independent-persistent	Disks in persistent mode behave like conventional disks on a physical computer. All data written to a disk in persistent mode is written permanently to the disk.	
Independent- non-persistent	Changes to disks in non-persistent mode are discarded when the VM is turned off or reset. Non-persistent mode enables restarting of the VM with a virtual disk in the same state every time. Changes to the disk are written to and read from a redo log file that is deleted when the VM is turned off or reset.	

TABLE 4. VMDK Modes

Learn more about VMware virtual disk provisioning policies.

Storage Policy-Based Management (SPBM)

Within a software-defined data center (SDDC), storage policy based management (SPBM) plays a significant role, helping to align storage with the application demands of your VMs. SPBM provides a storage policy framework that serves as a single unified control panel across a broad range of data services and storage solutions.

As an abstraction layer, SPBM abstracts storage services delivered by VMware vSphere® Virtual Volumes™, vSAN, I/O filters, or other storage entities.

Rather than integrating with each individual type of storage and data services, SPBM provides a universal framework for different types of storage.



FIGURE 2. Storage Policy-Based Management (SPBM)

SPBM offers the following mechanisms:

- Promotion of storage capabilities and data services that storage arrays and other entities, such as I/O filters, offer
- Bidirectional communications between ESXi and vCenter Server on one side with storage arrays and entities on the other
- VM provisioning based on VM storage policies

Learn more about Storage Policy-Based Management.

VMware vSAN Stretched Cluster

Stretched clusters extend the vSAN cluster from a single data site to two sites for a faster level of availability and intersite load balancing. Stretched clusters are typically deployed in environments where the distance between data centers is limited, such as metropolitan or campus environments.

You can use stretched clusters to manage planned maintenance and avoid disaster scenarios, because maintenance or loss of one site does not affect the overall operation of the cluster. In a stretched cluster configuration, both data sites are active sites. If either site fails, vSAN uses the storage on the other site. vSphere HA restarts any VM that must be restarted on the remaining active site.

You must designate one site as the preferred site. The other site becomes a secondary or nonpreferred site. If the network connection between the two active sites is lost, vSAN continues operation with the preferred site. The site designated as preferred typically is the one that remains in operation unless it is resyncing or has another issue. The site that leads to maximum data availability is the one that remains in operation.

A vSAN stretched cluster can tolerate one link failure at a time without data becoming unavailable. A link failure is a loss of network connection between the two sites or between one site and the witness host. During a site failure or loss of network connection, vSAN automatically switches to fully functional sites.



Configure Stretched Cluster	Configure fault domains Divide the hosts in 2 fault domains that will be used for configuring vSAN stretched cluster.			
1 Configure fault domains	Preferred domain:		Secondary domain:	
 2 Select witness host 3 Claim disks for witness host 4 Ready to complete 	FD 1 FD 1 10.26.233.107 10.26.233.205	× «	FD 2 FD 2 10.26.233.90 10.26.234.76	
			CANCEL	

FIGURE 3. vSAN Stretched Cluster

Each stretched cluster consists of two data sites and one witness host. The witness host resides at a third site and contains the witness components of VM objects. It contains only metadata and does not participate in storage operations.

The witness host serves as a tiebreaker when a decision must be made regarding availability of datastore components and the network connection between the two sites is lost. In this case, the witness host typically forms a vSAN cluster with the preferred site. But if the preferred site becomes isolated from the secondary site and the witness, the witness host forms a cluster using the secondary site. When the preferred site is online again, data is resynchronized to ensure that both sites have the latest copies of all data.

More information on vSAN Stretched Cluster can be found here and here.

VMware SDDC

The mobile cloud era is changing line-of-business expectations of IT. For IT organizations to securely deliver the anticipated improvements in service quality and speed, a software-defined data center (SDDC) approach is required. The VMware approach to the SDDC delivers a unified platform that supports any application and provides flexible control.

The VMware architecture for the SDDC empowers companies to run hybrid clouds and to leverage unique capabilities to deliver key outcomes that enable efficiency, agility, and security. Enterprises using VMware technology have three ways to establish an SDDC and transition at their own pace: build their own using reference architectures, use a converged infrastructure, or use a hyper-converged infrastructure for which the full SDDC is delivered already implemented on the customer's hardware of choice.

Learn more about *VMware SDDC*.

Hybrid and Multi-Cloud as the VMware Cloud

The term *hybrid cloud* describes the use of both private and public cloud platforms, working in conjunction. It can refer to any combination of cloud solutions that work together on-premises and offsite to provide cloud computing services to a company. A hybrid cloud environment allows organizations to benefit from the advantages of both types of cloud platforms and choose which cloud to use based on specific data needs.



A multi-cloud environment is as its name suggests, reflecting multiple and disparate cloud offerings and forms, all of which are part of the ubiquitous VMware Cloud[™].

VMware's *hybrid cloud* portfolio offers a combination of solutions that enable organizations to easily extend, protect, or replace on-premises infrastructure. These hybrid cloud offerings are built on an SDDC architecture, leveraging VMware's industry-leading compute, networking, and storage virtualization technologies.

Any combination of clouds powered by VMware creates a common operating environment across VMware-based on-premises private clouds and VMware-based public clouds. Cloud solutions from VMware Cloud Provider Partners (VCPP) including IBM, Oracle, Microsoft, Google, Amazon Web Services (AWS) and others. Native public clouds such as AWS, Azure, Oracle and Google Cloud Platform using VMware technologies including VMware Cloud Foundation, VMware vRealize^{*} and VMware Cloud Services, along with on-premises managed cloud services such as VMware Cloud on Dell EMC, form the core of VMware Cloud offerings.

This approach enables a diverse set of use cases, including regional capacity expansion, disaster recovery, application migration, data center consolidation, new application development and burst capacity.

Learn more about VMware Hybrid Cloud.

VMware Cloud on AWS

VMware Cloud on AWS is an on-demand service that enables customers to run applications across vSphere-based cloud environments with access to a broad range of AWS services. Powered by VMware Cloud Foundation, this service integrates vSphere, vSAN and VMware NSX along with VMware vCenter management, and is optimized to run on dedicated, elastic, bare-metal AWS infrastructure.

With VMware Hybrid Cloud Extension[™], customers can easily and rapidly perform large-scale bi-directional migrations between on-premises and VMware Cloud on AWS environments.

With the same architecture and operational experience on-premises and in the cloud, IT teams can now quickly derive instant business value from use of the AWS and VMware hybrid cloud experience. VMware Cloud on AWS is ideal for enterprise IT infrastructure and operations organizations looking to migrate on-premises vSphere-based workloads to the public cloud, consolidate and extend data center capacities, and optimize, simplify, and modernize their disaster recovery solutions.



vRealize Suite, ISV ecosystem

FIGURE 4. VMware Cloud on AWS

Learn more about VMware Cloud on AWS.



Stretched Clusters for VMware Cloud on AWS

Amazon's global infrastructure is broken up into regions. Each region supports the services for a given geography. Within each region, Amazon builds isolated and redundant islands of infrastructure called availability zones (AZ). When VMware deploys a vSphere cluster as part of the VMware Cloud on AWS managed service, all hosts for a given cluster are placed into a single AZ.

To protect against AZ failure, customers have the option to deploy a stretched cluster. When selected, a vSAN stretched cluster is created across three AZs, creating a vSphere cluster that can survive the loss of an entire availability zone. To protect against split-brain scenarios and help measure site health, a managed vSAN witness is also created in a third AZ. The third AZ is picked at random from the remaining AZs.

With a copy of the data in each AZ, vSphere HA is empowered to recover from any failure using a simple restart. In summary, stretched clusters simplify the cloud by providing the same trusted controls and capabilities in addition to the scale and flexibility of the AWS infrastructure.

Now applications can span multiple AWS availability zones within a VMware Cloud on AWS cluster. vSAN fault domains are configured to inform vSphere and vCenter which hosts reside in which AZs. Each fault domain is named after the AZ it resides within to increase clarity.

Some of the advantages are:

- Zero RPO high availability for enterprise applications virtualized on vSphere across AWS AZs, leveraging multi-AZ stretched clustering.
- Stretched clusters enable developers to focus on core application requirements and capabilities, instead of infrastructure availability.
- Significantly improve your application's availability without needing to architect it into your application.
- VMware Cloud on AWS infrastructure delivers protection against failures of AWS AZs at an infrastructure level. Stretching an SDDC cluster across two AWS AZs within a region means if an AZ goes down, it is simply treated as a vSphere HA event and the VM is restarted in the other AZ.



FIGURE 5. Stretched Clusters for VMware Cloud on AWS

More information on Stretched Clusters for VMware Cloud on AWS can be found here and here.

VMware Cloud on Dell EMC

VMware Cloud on Dell EMC combines the simplicity and agility of the public cloud with the enhanced security and control of on-premises infrastructure, delivered as-a-service to data center and edge locations. This fully managed VMware Cloud service provides a simple, secure, and scalable infrastructure for customer's on-premises datacenter and edge locations. VMware's industry leading compute, storage, and networking software is integrated with enterprise-class Dell EMC VxRail hardware, empowering you to drive any enterprise workload. The unique approach of this service empowers customers to focus on business innovation and differentiation, while VMware operates the entire infrastructure end-to-end.

VMware Cloud on Dell EMC is a fully managed VMware Cloud Service which includes a physical Dell VxRail hyper-converged infrastructure built to a customer's capacity needs and is delivered onsite preloaded with vSphere, NSX, and vSAN software. Included with this service is full management of the hardware infrastructure, including monitoring, software patching and upgrades, security updates, lifecycle management and break-fix service in the event of a hard failure. This service is backed by an enterprise-grade SLA.



FIGURE 6. VMware Cloud on Dell EMC

Learn more about VMware Cloud on Dell EMC.

Google Cloud VMware Engine (GCVE)

Google Cloud VMware Engine allows organizations to seamlessly migrate their VMware workloads to the cloud. This solution offers flexible on-demand capacity and full operational consistency with your existing on-premises environments, allowing you to harness the power of the Google Cloud Platform to modernize your infrastructure, operations, and processes.

By integrating VMware's flagship compute, storage, network virtualization, and management technologies with dedicated, elastic, bare-metal infrastructure, GCVE allows customers to access the agility, scale, and innovative services of the cloud while maintaining operational consistency and leveraging existing tools and investments.



		🙆 Google Cloud
Customer On-Premises	Google Cloud VMware Engine	Google Services
vCenter	vCenter	Compare Image: Compare Image: Compare Image: Compare Image: Compare Compare Arg Compare Compare Image: Compare Compare Compare Arg Compare Compare Compare Compare Compare Compare Image: Compare Image: Compare Image: Compare C
Customer Data Center	Google Global Infras	tructure

FIGURE 7. Google Cloud VMware Engine

Learn more about Google Cloud VMware Engine.

Azure VMware Solution (AVS)

Azure VMware Solution (AVS) is a first-party Microsoft service that delivers the VMware SDDC stack as a managed service—sold, operated, and supported by Microsoft—running natively on bare-metal infrastructure in the Microsoft Azure Cloud. Azure VMware Solution is a VMware Cloud-verified platform that offers vSphere, vSAN, NSX-T, and more, while being seamlessly integrated into Microsoft Azure infrastructure and management tools.

With Azure VMware Solution, you can modernize your infrastructure by seamlessly moving vSphere-based workloads directly to Microsoft Azure without application changes. Because Azure VMware Solution uses the same VMware SDDC components you use on-premises, you can leverage the same skills and tools you use every day to build an elastic, hybrid, and scalable platform for your existing or new vSphere applications.



FIGURE 8. Azure VMware Solution

Learn more about *Azure VMware Solution*.



Oracle Cloud VMware Solution (OCVS)

Oracle Cloud VMware Solution integrates VMware on-premises tools, skillsets, and processes with public Oracle Cloud services. The solution is a customer-managed, native VMware cloud environment based on VMware Validated Design for use with the public Oracle Cloud. It allows enterprises to access the scale and agility of the Oracle Cloud while extending VMware-based workloads and applications across the Oracle Cloud. It also empowers enterprises to reduce operational costs and complexity, while mitigating operational risk.

Oracle Cloud VMware Solution leverages VMware Cloud Foundation compute, network virtualization, and storage functions deployed to Oracle bare-metal hosts in the Oracle Cloud. This consistent, unified cloud infrastructure and operations platform will enable your enterprise to migrate and modernize applications faster while seamlessly moving workloads between on-premises environments and Oracle Cloud at scale.

Enterprises can now move or extend VMware-based workloads without rearchitecting applications or retooling operations. Your IT teams can also easily leverage Oracle services, such as Oracle Autonomous Database, Exadata Cloud, and Database Cloud, from the same cloud data centers, on the same networks, with consistent portal access and modernized APIs.



FIGURE 9. Oracle Cloud VMware Solution

Learn more about Oracle Cloud VMware Solution.

VMware Hybrid Cloud Extension

VMware Hybrid Cloud Extension is an application mobility platform designed to simplify application migration, workload rebalancing, and business continuity across data centers and clouds.



FIGURE 10. VMware Hybrid Cloud Extension

VMware Hybrid Cloud Extension enables:

- Application migration schedule and migrate thousands of vSphere VMs within and across data centers without requiring a reboot.
- Change platforms or upgrade vSphere versions migrate workloads from vSphere and from non-vSphere (KVM and Hyper-V) environments within and across data centers or clouds to current vSphere versions without requiring an upgrade.
- Workload rebalancing provides a mobility platform across cloud regions and cloud providers to allow customers to move applications and workloads at any time to meet scale, cost management, compliance, and vendor neutrality goals.
- Business continuity and protection with Hybrid Cloud Extension, administrators can protect workloads by replicating them to other Hybrid Cloud Extension-enabled sites. Workload migration is available on-demand, or it can be scheduled for business or for maintenance planning.

Learn more about VMware Hybrid Cloud Extension.

VMware Hybrid Cloud Extension Migration Types

VMs can be moved to and from VMware Hybrid Cloud Extension-activated data centers using multiple migration technologies.

VMware Hybrid Cloud Extension Bulk Migration

This migration method uses the VMware vSphere replication protocols to move the VMs to a destination site.

- The bulk migration option is designed for moving VMs in parallel.
- This migration type can set to complete on a pre-defined schedule.
- The VM runs at the source site until the failover begins. The service interruption with the bulk migration is equivalent to a reboot.



VMware Hybrid Cloud Extension vMotion

This migration method uses the VMware vMotion protocol to move a VM to a remote site.

- The vMotion migration option is designed for moving single VM at a time.
- VM state is migrated. There is no service interruption during the VMware Hybrid Cloud Extension vMotion migration.

VMware Hybrid Cloud Extension Cold Migration

This migration method uses the VMware NFC protocol. It is automatically selected when the source VM is powered off.

VMware Hybrid Cloud Extension Replication Assisted vMotion

VMware Hybrid Cloud Extension Replication-Assisted vMotion (RAV) combines advantages from VMware Hybrid Cloud Extension Bulk Migration (parallel operations, resiliency, and scheduling) with VMware Hybrid Cloud Extension vMotion (zero downtime VM state migration).

VMware Hybrid Cloud Extension OS Assisted Migration

This migration method provides for the bulk migration of guest (non-vSphere) VMs using OS-assisted migration to VMware vSphere on-premises or cloud-based data centers. Activating this service requires additional Hybrid Cloud Extension licensing.

Learn more about VMware Hybrid Cloud Extension Migration Types.

Oracle Database Architecture

Oracle Database 19c, the latest generation of the world's most popular database, provides businesses of all sizes with access to the world's fastest, most scalable, and reliable database technology. These capabilities enable secure and cost-effective deployment of transactional and analytical workloads in the cloud, on-premises, and in hybrid cloud configurations.

An Oracle database server consists of a database and at least one database instance. In a clustered Oracle configuration, an Oracle database will have more than one instance accessing the database.

- A database is a set of files, located on disk, that store data. These files can exist independently of a database instance.
- An instance is a set of memory structures that manage database files. The instance consists of a shared memory area, called the system global area (SGA), and a set of background processes. An instance can exist independently of database files.

The physical database structures that comprise a database are:

- Data files Every Oracle database has one or more physical data files, which contain all database data. The data of logical database structures, such as tables and indexes, is physically stored in the data files.
- **Control files** Every Oracle database has a control file. A control file contains metadata specifying the physical structure of the database, including the database name, along with the names and locations of the database files.
- Online redo log files Every Oracle database has an online redo log, representing a set of two or more online redo log files. An online redo log is made up of redo entries (also called redo log records), which record all changes made to data.
- Many other files, including parameter files, archived redo files, backup files and networking files, are important to any oracle database operation.

Learn more about Oracle database architecture.



Oracle ASM, ASMLIB and ASMFD

ASM

Oracle Automatic Storage Management (ASM) is a volume manager and a file system for Oracle database files that supports singleinstance and clustered Oracle Database configurations.

Oracle ASM is Oracle's recommended storage-management solution that can be used for both single-instance and clustered Oracle databases, providing an alternative to conventional volume managers, file systems, and raw devices.

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. Users can add or remove disks from a disk group while a database continues to access files from the disk group.

Learn more about Oracle Automatic Storage management (ASM).

ASMLIB

Oracle ASMLIB maintains permissions and disk labels that are persistent on the storage device so that the label is available even after an operating system upgrade.

The Oracle ASMLIB driver simplifies the configuration and management of block disk devices by eliminating the need to rebind block disk devices used with Oracle ASM each time the system is restarted.

Learn more about Oracle ASMLIB.

ASMFD

Oracle ASMFD helps prevent corruption in Oracle ASM disks and files within the disk group. Oracle ASMFD simplifies the configuration and management of disk devices by eliminating the need to rebind disk devices used with Oracle ASM each time the system is restarted.

Learn more about Oracle ASMFD.

Linux Device Persistence and udev Rules

Device names in Linux are not guaranteed persistent across reboots. A device (e.g., /dev/sdb) can be renamed on the next reboot (e.g., /dev/sdc).

Linux udev rules may be used to guarantee device persistence across reboot.

Learn more about configuring device persistence for Oracle storage.

Architectural Guidelines and Operational Considerations for Moving Oracle Workloads to VMware Cloud on AWS Solution Configuration

VMware Cloud on AWS allows users to create vSphere-based data centers (SDDCs) on AWS. Each deployed SDDC includes VMware ESXi hosts, VMware vCenter Server, VMware vSAN, VMware NSX components and other software. The same HTML5-based vSphere client is used to manage an SDDC once deployed.

One can rapidly and easily migrate application workloads from on-premises data centers running VMware SDDC to VMware Cloud on AWS using VMware Hybrid Cloud Extension and back with:

- No VM conversions
- No application refactoring and, therefore, no application downtime
- No networking changes with L2VPN capability between on-premises SDDC and VMware Cloud on AWS provided by Hybrid Cloud
 Extension Network Extension appliance

This is key, as some cloud providers require some level of refactoring to achieve the above. In this case, refactoring is not necessary, resulting in significantly reduced time, effort, and man hours in planning migrations between on-premises infrastructure and the cloud.

The planning and design phase is very important in ensuring that migrations of mission-critical application workloads to VMware Cloud on AWS are completed without negatively impacting application SLAs or affecting the performance, availability, manageability and scalability of the workloads themselves. This document provides architectural guidelines to help enterprises in migration planning.

Architecture Guidelines

This section provides a summary of the guidelines and approaches to consider when planning a migration of Oracle workloads to VMware Cloud on AWS, including use cases to aid requirements gathering and technical prerequisites to facilitate migration.

Use Case Definition

The following uses cases reflect those most frequently employed for Oracle workloads on VMware Cloud on AWS:

- Data center extension
 - Footprint expansion or on-demand capacity within few hours (no over-provisioning or complex demand forecasting with reduction in cost)
 - Run test/development workloads and stream database backups to the cloud
 - Run Oracle workloads in the cloud
- Disaster recovery
 - Oracle DR workloads can be scaled in storage and compute
 - Use VMware site recovery service for replication and orchestration
 - Use traditional methods as well, such as Oracle Data Guard, Oracle GoldenGate, or other third-party solution
 - Complement existing DR with existing solutions based on VMware Site Recovery Manager[™] or vSphere replication
- Cloud migrations
 - Simple, low-risk, seamless migration of Oracle workloads to VMware Cloud on AWS using known tools (e.g., VMware Hybrid Cloud Extension, VMware vMotion, Oracle Data Guard, Oracle RMAN backup/restore)
 - Connect Oracle workloads on VMware Cloud on AWS workloads to on-premises or AWS environments EC2, RDS
 - Data center wide evacuations mass migrations
 - Hardware/software refresh cycle or Oracle re-implementation



- Application modernization
 - Leverage native AWS services (e.g., AWS Simple Storage Service (S3) for Oracle backups)
 - Update existing investments (e.g., extract data out of Oracle workloads and leverage analytics services)

Each particular use case, or combination of use cases, influences the general solution design and necessitates appropriate requirements gathering. This document focuses on the first three use cases, namely data center extension, disaster recovery and cloud migrations.

Rightsizing

Before considering where to place Oracle workloads on a cloud platform, ensure your VM container is rightsized. A workload's performance profile should be collected over a sufficient period of time to reflect application spikes in resource utilization. While defining the required time range to collect time series data, consult with DBAs and application owners to understand the workload profile. At least a full month of *non-rolled up* time series data is recommended prior to executing the performance analysis.

Utilizing VMware vRealize True Visibility Suite[™] is proven to be very helpful in this preparation phase. While analyzing captured data, make sure your rightsizing approach has been agreed upon by administrators, application owners and business owners, and that it comprehends both spikes (high performance) and average utilization (higher density).

The following should be considered while sizing Oracle workloads:

- For CPU and memory resources allocation, check the *host configuration* for VMware Cloud on AWS to verify the workload will fit and not overcommit host resources.
- Account for differences in physical CPU architectures between your current environment and the *host instances* used in VMware Cloud on AWS.
- Always size the CPU resource based on the actual workload.
- The storage layer in VMware Cloud on AWS is provided by VMware vSAN or hyperconverged infrastructure solution, if using an Amazon EC2 I3.metal instance. Adding storage will require the addition of compute resources (hosts) as well. As an alternative, for workloads with the primary capacity requirements, use Amazon i3en.metal hosts. An I3 instance should remain your primary choice for a performance OLTP workloads.

Requirements

A crucial part of a successful migration is collecting business and technical requirements, allowing you to properly design a cloud platform. For guidance, review *Preparing for VMware Cloud on AWS* before beginning your requirements gathering.

Business requirements are an important part of the requirements gathering process. Input examples include:

- RTO/RPO targets
- Business SLAs
- Licensing considerations
- Security and data-management considerations

Technical requirements will directly influence logical design and should be collected and validated with care. Pay special attention to the following bullet points:

- Performance requirements of the workload (e.g., transactions-per-second, number of user connections, expected future workloads changes)
- · Capacity requirements (e.g., future growth, other projects to be served)
- Manageability requirements (e.g., providing access to a SDDC to appropriate user groups, reconfiguring monitoring tools, backup solution in use, modifying scripting, vRealize Operations workflows)



- Scalability requirements (e.g., method for increasing capacity of a SDDC, scale-out versus scale-in approach)
- Availability requirements (e.g., Oracle high-availability solutions in use, DRS groups, host-isolation response, number of availability zones required)
- Application requirements (e.g., type of workloads [e.g., OLTP/data warehouse], dependencies between on-premises components and network flow between them)

Risks and Constraints

Ensure that risks and constraints are identified and documented and that the risk-mitigation plan has been agreed by all groups involved.

- An example of a constraint: available network bandwidth between on-premises and SDDC (e.g., is DirectAccess available?)
- An example of a risk: different CPU generations between on-premises ESXi hosts and hosts in an SDDC

High Level Architecture

A high-level solution architecture should include enough information to capture the on-premises environment hosting the Oracle workloads and planned SDDC(s) with multiple AZs, while also providing enough details to work on logical design.

Standalone Oracle Workload on VMware Cloud on AWS : Reference Architecture



FIGURE 11. VMware Cloud on AWS

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High Availability Options

VMware Cloud on AWS provides infrastructure level vSphere HA for Oracle workloads across non-stretched VMware Cloud on AWS which is turned on by default on all clusters in an SDDC on VMware Cloud on AWS.

With Stretched Clusters for VMware Cloud on AWS, in addition to the infrastructure-level high availability provided by vSphere HA, site-level high availability is provided by stretching across multiple AZs.



FIGURE 12. Stretched Clusters for VMware Cloud on AWS

Logical Design

A logical design describes all technical decisions made and addresses identified technical requirements while minimizing risk. The level of detail included should be sufficient to create an implementation guide for the solution. While specifics of each logical design are unique, it's important to ensure all technical prerequisites are met. The following prerequisites have been identified as crucial to the successful migration of Oracle workloads to VMware Cloud on AWS:

- For on-premises-located VMs, ESXi hosts, or vSphere clusters hosting Oracle workloads, check and document all advanced settings configured. Ensure corresponding options are available in VMware Cloud on AWS. For example, DRS anti-affinity groups and rules must be re-created in an SDDC as they cannot be migrated.
- Check the Hybrid Migration with vMotion Checklist and ensure all requirements are met.
- If a Hybrid Cloud Extension appliance will be used to migrate the workload, review *Hybrid Cloud Extension in the VMware Cloud on AWS* and ensure all requirements are met.
- Hybrid Cloud Extensions Network Extension (NE) provides a Layer 2 VPN (L2VPN) to extend a broadcast domain from a customer site into an AWS based SDDC. NE functionality is provided by a dedicated virtual appliance at both sites.
- It's recommended to ensure that *Hybrid Linked Mode* will be configured to allow managing both on-premises and public SDDCs within a single vSphere client interface. Verify that all required user accounts are added to the cloud administration group.

Operational Considerations

Post-implementation maintenance and operation guidelines are a key component of any well-prepared infrastructure architecture. While incorporating VMware Cloud on AWS SDDCs in an existing infrastructure, it's critical that Day 2 operational routines are updated accordingly, including:

- Backup configurations
- Monitoring configurations
- Operational documentations

If vRealize Operations Manager is used to monitor the environment, confirm that all SDDCs are added to vRealize Operations-managed resources and configured using vCenter adapter with the public cloud option.



Solution Configuration

This section introduces the resources and configurations for the solution:

- Architecture diagram
- Hardware resources
- Software resources
- Network configuration
- Storage configuration
- VMware and Oracle configuration
- VMware Hybrid Cloud Extension Configuration

Architecture Diagram

This solution architecture relies on a three-site scenario:

- On-premises vSphere cluster on Site A (Santa Clara)
- On-premises vSphere cluster on Site B (Wenatchee)
- Stretched Clusters for VMware Cloud on AWS



FIGURE 13. On-Premises Sites A and B with Connectivity to Stretched Clusters for VMware Cloud On AWS

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The on-premises setup features two separate and dedicated vSphere cluster configurations: Site A and Site B.

- Site A is hosting production single-instance workloads.
- Site B is hosting disaster recovery (DR) single-instance workloads
- Both Site A and Site B are in hybrid linked mode.
- Both sites are connected to Stretched Clusters for VMware Cloud on AWS.

Site A infrastructure details are as follows:

- Virtual Center sc2wvc03.vslab.local version 7.0.2 Build 17694817
- vSphere Cluster BCA-SiteC with 4-nodes running ESXi version 7.0.2 Build 17867351
- Each ESXi server is a Dell PowerEdge R640 Server with Intel[®] Xeon[®] Platinum 8168 CPU @ 2.70GHz with 2x24 cores, and 384GB RAM with hyperthreading
- Each ESXi server has access to a Pure Storage FlashArray//x50 (Purity/FA 6.1.6) for both block FC storage and vVols
- Each ESXi server features:
 - 2 x QLogic ISP2812-based 64/32G Fibre Channel to PCIe Controller for FC storage
 - 2 x Intel[®] Ethernet Controller X710 for 10GbE SFP+ for network connection

Site B infrastructure details are as follows:

- Virtual Center az2wvc01.vslab.local version 7.0.2 Build 17694817
- vSphere Cluster AZ2-DC with 3-nodes running ESXi version 7.0.2 Build 17867351
- Each ESXi server is a Dell PowerEdge R740 Server with Intel[®] Xeon[®] Platinum 8168 CPU @ 2.70GHz with 2x24 cores, and 1TB RAM with hyperthreading
- Each ESXi server has access to a Pure Storage FlashArray//x50 (Purity/FA 6.1.6) for both block FC storage and vVols
- Each ESXi server features:
 - 2 x Emulex LightPulse LPe32000 Gen 6 16/32G PCIe Fibre Channel Adapter for FC storage
 - 2 x Intel® Ethernet Controller X710 for 10GbE SFP+ for network connection

The Stretched Clusters for VMware Cloud on AWS setup has the following configuration:

- Virtual Center vcenter.sddc-44-232-220-144.vmwarevmc.com Version 7.0.2 Build 18231847
- A 6-node stretched cluster for VMware Cloud on AWS is setup across two AZs, with three servers in AZ **us-west-2b** and three servers in AZ **us-west-2c**, with each ESXI server version 7.0.2 Build 18226209
- Each ESXi server is an Amazon EC2 i3.metal with two sockets, 18 cores each with Intel Xeon processor E5-2686 v4 at 2.30GHz without hyperthreading and 512GB RAM memory
- Storage is provided by the HCI vSAN instance

✓ 🛄 SDDC-Datacenter	Cluster-1 ACTIONS *				
✓ ☐ Cluster-1	Summary Monitor Configure Permissions Hosts VI	As Datastores Networks			
10.73.80.68	Total Processors: 216			QPU	Free: 477.17 GHz
10.73.80.69	Total vMotion Migrations: 9			Used: 19.52 GHz	Capacity: 496.69 GHz
10 73 80 70	A KT			Memory	Free: 2.42 TB
10.75.00.70	**			Used: 596.4 GB	Cepecity: 3 TB
10.73.80.84					Caracter 134 43 78
10.73.80.85				0900.2100.10	CigoUy, 124,42 10
10.73.80.86	Related Objects	^	vSphere DRS		~
> 🥏 Compute-ResourcePool	Datacenter 🔯 SDDC-Datacenter		Cluster Consumers		~
> 🔗 Mgmt-ResourcePool	vSphere HA	~	Custom Attributes		~
	Tags	×.	vSAN Overview		~
	Cluster Resources	~			
	Hosts 6 Hosts				
	EVC mode Disabled				

FIGURE 14. 6-Node Stretched Clusters for VMware Cloud on AWS

An L2VPN is used to extend the on-premises data center on Site A to VMware Cloud on AWS and to migrate application workloads rapidly and easily from on-premises to the VMware Cloud on AWS and back. This offers the following advantages:

- No VM conversions
- No application refactoring and, therefore, no application downtime
- No networking changes with L2VPN capability between the on-premises SDDC and VMware Cloud on AWS

Hardware Resources

Below are the hardware resources for the vSphere cluster on Site A):

DESCRIPTION	SPECIFICATION
Server	4 x ESXi Server
Server Model	Dell Inc. PowerEdge R640
CPU	2 sockets with 24 cores each, Intel [®] Xeon [®] Platinum 8168 CPU @ 2.70GHz with hyperthreading enabled
RAM	384GB RAM
Storage controller 2 x QLogic ISP2812-based 64/32G Fibre Channel to PCIe Controller for FC storage	
Storage Array Pure x50 AFA (Purity/FA 6.1.6)	
Network	2 x Intel* Ethernet Controller X710 for 10GbE SFP+ for network connection
Internal Disk Controller	Dell HBA330 Mini
Internal Disks	Cache—1 x 372.61GB SSD ATA Capacity—2 x 894.25GB SSD ATA
vSAN Disk Group 1 vSAN Disk Group per ESXi Server	

TABLE 5. Site A Hardware Resources



The following summarizes the virtual center **sc2wvc03.vslab.local**, vSphere cluster (**BCA-SiteC**), and one of the ESXi servers in the vSphere cluster on Site A:

🕑 sc2\	wvc03.v	slab.local	ACTIONS V								
Summary	Monitor	Configure	Permissions	Datacenters	Hosts & Clusters	VMs	Datastores	Networks			
Hosts	Clusters	Host Profiles									
Name ↑					م ~	vailable CPU	~ Av	ailable Memory			
[]] BCA	-SiteC				5	11.65 GHz	1,3	40.05 GB			
				🔸 🕻 🗓 BCA-	SiteC	~					
				Summary	Monitor Configu	re Perm	issions Hosts	VMs Datas	stores Networks	Upd	dates
				Hosts	Resource Pools						
				Name ↑			✓ State	~	Status	~	Cluster
				sc2es:	x09.vslab.local		Connec	ted	🗸 Normal		BCA-SiteC
				sc2es:	x10.vslab.local		Connec	ted	Vormal		[]] BCA-SiteC
				sc2es	x11.vslab.local		Connec	ted	Vormal		[]] BCA-SiteC
				sc2es	x12.vslab.local		Connec	ted	Vormal		BCA-SiteC

FIGURE 15. Site A vCenter and vSphere Cluster

sc2es	sx09.vsl	ab.local	ACTIONS V						
Summary	Monitor	Configure	Permissions	VMs	Datastores	Networks	Updates		
0	Hypervi Model: Process Logical NICs: Virtual N State: Uptime:	sor: V P or Type: Ir Processors: 9 6 Aachines: 8 C 4 4	Mware ESXI, 7.0.2 owerEdge R640 ttel(R) Xeon(R) Plat 6 onnected 6 days	, 17867351 tinum 8168	CPU @ 2.70GHz				
Hardware									
Manufa	acturer		[Dell Inc.					
Model			ţ	PowerEdge R640					
✓ CPU									
CPU C	Cores		[48 CPU:	s x 2.69 GHz				
Proce	ssor Type			Intel(R) Xeo	on(R) Platinum 81	68 CPU @ 2.70	GHz		
Socke	ets			2					
Cores	per Socket			24					
Logica	al Processors	5		96					
Hyper	rthreading			Active					
Memor	у		[58.29 GE	3 / 383.44 GB				
Persist	ent Memory		[1.28 GB ,	′ 95.98 GB				
> Virtual	Flash Resou	rce	٤	8.58 GB / 11	9.75 GB				
> Netwo	rking		s	c2esx09.v	slab.local				
> Storag	e		1	0 Datastor	e(s)				

FIGURE 16. Site A VMware ESXI Server Summary



DESCRIPTION	SPECIFICATION
Server	3 x ESXi Server
Server Model	Dell Inc. PowerEdge R740
CPU	2 sockets with 24 cores each, Intel [®] Xeon [®] Platinum 8168 CPU @ 2.70GHz with Hyperthreading enabled
RAM	1TB RAM
Storage controller	2 x Emulex LightPulse LPe32000 Gen 6 16/32G PCIe Fibre Channel Adapter for FC storage
Storage Array	Pure x50 AFA (Purity/FA 5.3.10)
Network	2 x Intel* Ethernet Controller X710 for 10GbE SFP+ for network connection
Internal Disk Controller	Dell HBA330 Mini
Internal Disks	Cache—1 x 372.61GB Samsung SSD ATA Capacity—3 x 894.25GB SSD ATA
vSAN Disk Group	1 vSAN Disk Group per ESXi Server

Below are the hardware resources for the vSphere cluster on Site B:

TABLE 6. Site B Hardware Resources

The following summarizes the Virtual Center **az2wvc01.vslab.local**, vSphere Cluster (**AZ2-DC**), and one of the ESXi servers in the vSphere cluster on Site B:

🕑 az2v	wvc01.vs	slab.local	ACTIONS V								
Summary	Monitor	Configure	Permissions	Datacenters	Hosts & Clusters	VMs	Datastores	Networks			
Hosts	Clusters	Host Profiles									
Name ↑					~	Available C	PU ~	Available Memory			
[]] AZ2	BCA11					387.52 GH	z	3,412.97 GB			
				🗈 AZ2-DC 🗋	ACTIONS ¥						
				Summary Monitor	Configure Pern	nissions	Hosts & Clusters	VMs Datastore	s Networks	Updates	
				Hosts Clusters	Resource Pools Ho	ost Folders					
				Name ↑			~	State	✓ Status	~	Cluster
				az2esx22.vslab.loo	cal			Connected	V Normal		[]] AZ2BCA11
				az2esx23.vslab.loc	cal			Connected	Vormal		[]] AZ2BCA11
				az2esx24.vslab.loc	cal			Connected	Vormal		[]] AZ2BCA11

FIGURE 17. Site B vCenter and vSphere Cluster

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az2es	sx22.vslab.loca		actions \checkmark					
Summary	Monitor Configu	ire	Permissions	VMs	Datastores	Networks	Updates	
0	Hypervisor: Model: Processor Type: Logical Processors: NICs: Virtual Machines: State: Uptime:	VMv Pow 96 6 0 Con 41 d	vare ESXI, 7.0.2, rerEdge R740 (R) Xeon(R) Plat nected ays	17867351 inum 8168	CPU @ 2.70GHz			
Hardware								
Manufa	cturer		De	ll Inc.				
Model			PowerEdge R740					
✓ CPU								
CPU C	ores			48 CPUs	x 2.69 GHz			
Proces	ssor Type		Int	el(R) Xeor	n(R) Platinum 816	8 CPU @ 2.70G	Hz	
Socke	ts		2					
Cores	per Socket		24	ŀ				
Logica	I Processors		96	5				
Hyper	threading		Ad	tíve				
Memor	У			9.31 GB / 1	I.12 TB			
> Virtual	Flash Resource		16.	29 GB / 10	3.5 GB			
> Networ	king		az.	2esx22.vsl	ab.local			
> Storage	2		2 [Datastore(s)			

FIGURE 18. Site B VMware ESXI Server Summary

The following hardware resources are utilized for VMware Cloud on AWS:

DESCRIPTION	SPECIFICATION
Server	6 ESXi servers
Server model	Amazon EC2 i3.metal
CPU	2 sockets, 18 cores each, Intel Xeon Processor E5-2686 v4 at 2.30GHz without hyperthreading
RAM	512GB
Disks	8 NVMe drives, each drive 1.73TB across 2 vSAN disk groups
vSAN disk groups	2 disk groups, each disk group with 1 NVMe for cache and 3 NVMe for capacity
Network	One 25G Amazon Elastic network adapter

TABLE 7. VMware Cloud on AWS Hardware Resources



The Stretched Clusters for VMware Cloud on AWS features 6 ESXi servers across two fault domains (FD) or AZs for site-level HA, with three ESXi servers in each AZ.

vSAN fault domains are configured to inform vSphere and vCenter which hosts reside in which AZs. Each fault domain is named after the AZ it resides within to increase clarity.

vm vSphere Client Menu ∨	Q Search in all environments			
 vcenter.sddc-35-155-246-32.vmc.vmware.c via SDDC-Datacenter 	Summary Monitor Configure Permissions Hosts VMs Datastores	Networks		
✓ □ Cluster-1	Hosts Resource Pools			
10.73.80.69				
10.73.80.70				
 10.73.80.71 10.73.80.84 	Name 🔨 🗸 🗸	State ~	Status v	Cluster v
10.73.80.85	073.80.69	Connected	 Normal 	Cluster-1
10.73.80.86	1073.8070	Connected	 Normal 	Cluster-1
> Ol Compute-ResourcePool	1073.8071	Connected	 Normal 	Cluster-1
> 10.73.81.5	1073.80.84	Connected	 Normal 	Cluster-1
	1073.80.85	Connected	🗸 Normal	Cluster-1
	073.80.86	Connected	🗸 Normal	Cluster-1

FIGURE 19. Stretched Clusters for VMware Cloud on AWS ESXi Servers

The two fault domains or AZs are us-west-2b and us-west-2c with three ESXi servers in each AZ.

Services Configuration	Stretched Cluster		CHANGE DISABLE	Fault Domains
More vSAN Services Disk Management	Status Preferred fault domain	Enabled us-west-2b		Configuration can tolerate 1 fault domain failures (maximum
ISCSI Target Service	WILINGSS INOST	10.73.01.3		
	Fault Domain / Hoct			

FIGURE 20. Fault Domains in Stretched Clusters for VMware Cloud on AWS

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To protect against split-brain scenarios and help measure site health, a managed vSAN witness is also created in a third AZ. The third AZ is picked at random from the remaining AZs. The witness has been engineered to run on an EC2 m5.xlarge AMI to reduce the cost to the customer.

vm vSphere Client Menu ∽	Q Search in all environments
 vcenter.sddc-35-155-246-32.vmc.vmware.c SDDC-Datacenter Cluster-1 10.73.80.69 10.73.80.70 10.73.80.71 10.73.80.84 10.73.80.85 10.73.80.85 10.73.80.86 Ompute-ResourcePool Maret DescursePool Maret DescursePool 	IO.73.81.5 ACTIONS ~ Summary Monitor Configure Permissions VMs Resource Pools Datastores Networks Updatestime Model: Amazon EC2 m5.xlarge Processor Type: Intel(R) Xeon(R) Platinum 8259CL CPU @ 2.50GHz Logical Processors: 2 NICs: 1 Virtual Machines: 0 State: Connected Uptime: 57 days
> 0 Mgmt-ResourcePool > 10.73.81.5	SSH for the host has been enabled
	Hardware
	Manufacturer Amazon EC2
	Model Amazon EC2 m5.xlarge
	→ CPU 2 CPUs x 2.5 GHz
	Memory 8.01 GB / 15.7 GB
	> Virtual Flash Resource 2.85 GB / 9.75 GB
	> Networking witness-1.sddc-44-232-220-144.vmwarevmc.com
	> Storage 0 Datastore(s)

FIGURE 21. Witness in Stretched Clusters for VMware Cloud on AWS

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The graphic below captures one of the ESXi servers in the Stretched Clusters for VMware Cloud on AWS environment:

mmary M	Ionitor Configur	e Permissions VMs Datasto	res Net	works		
	Hypervisor:	VMware ESXi, 7.0.2, 18226209			CPU	Free: 7
0	Model:	Amazon EC2 i3.metal			Used: 3.51 GHz	Capacity:
	Processor Type:	Intel(R) Xeon(R) CPU E5-2686 V4 @ 2.30	GHZ		Memory	Free: 4
	NICs:	1			Lised: 96.01 GB	Capacity: 5
	Virtual Machines:	6			Storage	Free:
	State:	Connected			Storage	Fiee.
	Uptime:	2 hours			Used: 33.45 TB	Capacity: 1
	Fault Domain:	us-west-2b				
lardware			^	Configuration		
ardware Manufactu	ırer	Amazon EC2	^	Configuration Image Profile	(Updated) ESXI-6.8.0-8493	1082-physical-amz
ardware Manufactu Model	irer	Amazon EC2 Amazon EC2 i3p.16xlarge	^	Configuration Image Profile	(Updated) ESXI-6.8.0-8493 ena	1082-physical-amz
Manufactu Model	irer	Amazon EC2 Amazon EC2 i3p.16xlarge	^	Configuration Image Profile > vSphere HA State	(Updated) ESXI-6.8.0-8493 ena ✓ Connected (Slave)	082-physical-amz
ardware Manufactu Model > CPU Memory	irer	Amazon EC2 Amazon EC2 i3p.16xlarge 36 CPUs x 2.3 GHz 96.01 GB / 511.89 GB	^	Configuration Image Profile > vSphere HA State > Fault Tolerance (Legacy)	(Updated) ESXI-6.8.0-8493 ena ✓ Connected (Slave) Unsupported	1082-physical-amz
Aardware Manufactu Model > CPU Memory > Virtual Fla	sh Resource	Amazon EC2 Amazon EC2 i3p.16xlarge 36 CPUs x 2.3 GHz 96.01 GB / 511.89 GB 0 B / 0 B	^	Configuration Image Profile > vSphere HA State > Fault Tolerance (Legacy) > Fault Tolerance	(Updated) ESXI-6.8.0-8493 ena ✓ Connected (Slave) Unsupported Unsupported	082-physical-amz
Aardware Manufactu Model > CPU Memory > Virtual Fla > Networkin	arer sh Resource	Amazon EC2 Amazon EC2 i3p.16xlarge 36 CPUs x 2.3 GHz 96.01 GB / 511.89 GB 0 B / 0 B esx-0.sddc-35-155-246-32.vmc.vmware.cr	~	Configuration Image Profile > vSphere HA State > Fault Tolerance (Legacy) > Fault Tolerance > EVC Mode	(Updated) ESXI-6.8.0-8493 ena ✓ Connected (Slave) Unsupported Unsupported Disabled	1082-physical-amz

FIGURE 22. ESXi Server in Stretched Clusters for VMware Cloud on AWS

Software Resources

The following is a summary of the software resources used:

SOFTWARE	VERSION	PURPOSE
VMware vCenter Server	7.0.2 Build 17694817	VMware vCenter Server provides a centralized platform for managing VMware vSphere environments
VMware ESXi Server	7.0.2 Build 17867351	ESXi servers to host VMs
ESXi Datastores	Purity//FA 6.1.6	Pure AFA provides both VMFS and vVol datastores
Oracle Linux	8.3 UEK	Oracle database server nodes
Oracle Database 19c	19.12.0.0.0	Grid Infrastructure and Oracle database

TABLE 8. Software Resources

Network Configuration

A VMware vSphere[®] Distributed Switch[™] acts as a single virtual switch across all associated hosts in the datacenter. This setup enables VMs to maintain a consistent network configuration as they migrate across multiple hosts.

A port group defines properties regarding security, traffic-shaping, and network adapter-teaming. Jumbo frames (MTU=9000 bytes) are enabled on the VMware vSphere vMotion interface, and the default port group setting is used.

For Site A, VDS **dVSwitch** uses 2 x 10GbE adapter per host:

• 2 x 10GbE uplinks for VM traffic and VMkernel non-VM traffic

The following distributed switch-port groups were created for Oracle VM traffic to balance traffic across the available uplinks:

- Port group APPS-1614 with VLAN ID 1614 (Subnet 172.16.14.1/24) is for VM user traffic
- Port group APPS-1605 with VLAN ID 1605 (Subnet 172.16.05.1/24) and APPS-1606 with VLAN ID 1606 (Subnet 172.16.06.1/24) for Oracle Private traffic with two active/active uplinks set to Route based on originating virtual port.
- Port group APPS-1631 with VLAN ID 1631 for Management traffic
- Port group APPS-1632 with VLAN ID 1632 for vMotion traffic
- Port group APPS-1635 with VLAN ID 1635 for vSAN traffic

🖽 dVSwitch 🛛	ACTIONS 🗸								
Summary Monitor	Configure	Permissions	Ports	Hosts	VMs	Networks			
Distributed Port Grou	ups Uplink Pol	t Groups							
Name ↑	~	VLAN ID			~ NSX	Port Group ID	~	VNI ~	Port Binding
(APPS-1601		VLAN access: 1	501						Static binding (elastic)
(APPS-1602		VLAN access: 1	502						Static binding (elastic)
🚇 APPS-1603		VLAN access: 1	603						Static binding (elastic)
🚇 APPS-1604		VLAN access: 1	504						Static binding (elastic)
(APPS-1605		VLAN access: 1	605						Static binding (elastic)
(APPS-1606		VLAN access: 1	606						Static binding (elastic)
(≗) APPS-1607		VLAN access: 1	607						Static binding (elastic)
🚇 APPS-1608		VLAN access: 1	508						Static binding (elastic)
(APPS-1609		VLAN access: 1	609						Static binding (elastic)
(APPS-1610		VLAN access: 1	510						Static binding (elastic)
(APPS-1611		VLAN access: 1	511						Static binding (elastic)
(APPS-1612		VLAN access: 1	512						Static binding (elastic)
(APPS-1613)		VLAN access: 1	613						Static binding (elastic)
(APPS-1614		VLAN access: 1	514						Static binding (elastic)

FIGURE 23. Site A vSphere Distributed Switch Port Group Configuration

For Site B, VDS az2-dvSwitch uses 2x 10GbE adapters per host:

• 2 x 10GbE uplinks for VM traffic and VMkernel non-VM traffic

The following distributed switch-port groups were created for Oracle VM traffic to balance traffic across the available uplinks:

- Port group APPS-1810 with VLAN ID 1810 (Subnet 172.18.10.1/24) is for VM user traffic
- Port group **APPS-1805** with VLAN ID 1805 (Subnet 172.18.05.1/24) and **APPS-1806** with VLAN ID 1806 (Subnet 172.18.06.1/24) for Oracle Private traffic with two active/active uplinks set to **Route based on originating virtual port**.
- Port group APPS-1809 with VLAN ID 1809 (Subnet 172.18.09.1/24) is for SRM Test Network
- Port group AZ2-COMP-MGMT with VLAN ID 1631 for Management traffic
- Port group AZ2-COMP-VMOTION with VLAN ID 1632 for vMotion traffic
- Port group AZ2-COMP-NFS with VLAN ID 1635 for NFS and vSAN traffic

📾 az2-dvSwitch 🛛 Астіон		
Summary Monitor Configure	Permissions Ports Hosts VMs Networks	
Distributed Port Groups Uplink F	Port Groups	
Name ↑	VLAN ID VNI VNI VNI VNI V	Port Binding
(음) APPS-1801	VLAN access: 1801	Static binding (elastic)
(음) APPS-1802	VLAN access: 1802	Static binding (elastic)
(음) APPS-1803	VLAN access: 1803	Static binding (elastic)
(船) APPS-1804	VLAN access: 1804	Static binding (elastic)
(음) APPS-1805	VLAN access: 1805	Static binding (elastic)
(船) APPS-1806	VLAN access: 1806	Static binding (elastic)
(음) APPS-1807	VLAN access: 1807	Static binding (elastic)
(음) APPS-1808	VLAN access: 1808	Static binding (elastic)
(음) APPS-1809	VLAN access: 1809	Static binding (elastic)
(≗) APPS-1810	VLAN access: 1810	Static binding (elastic)
AZ2-COMP-MGMT	VLAN access: 1631	Static binding (elastic)
AZ2-COMP-NFS	VLAN access: 1635	Static binding (elastic)
	VLAN access: 1632	Static binding (elastic)

FIGURE 24. Site B vSphere Distributed Switch Port Group Configuration

For VMware Cloud on AWS, each ESXi server contains (1) 25GbE adapter per host.



FIGURE 25. VMware Cloud on AWS ESXi Server Networking Details

To create a logical segment, navigate to the VMware Cloud on AWS portal and click **Networking & Security**. Click **Segments**, then Add **Segments**. The illustration below provides an example:

< ALL SDDCs OPEN VCENTER VSLAB-SDDC01 VMC on AWS © US West (Oregon) Summary Networking & Security Add Ons Maintenance Troubleshooting Settings Support										
Overview Network Segments VPN	9	Segn	mer ent Lis	nts st	Segment Profiles			EXPAND ALL	Q Search	
NAT Tier-1 Gateways Transit Connect					Segment Name	Туре	Subnets		Status ()	
Security Gateway Firewall		1	>	6	OraclePrivate	Disconnected	192.168.140.1/24		 Success C Success C 	
Inventory		÷	>	E	L2E_SC2-COMP-ORACLE-1637-878db786	Disconnected	172.16.37.1/24		Success C	

FIGURE 26. Logical Network Details



Fill in the required details as shown above. Select the Disconnected option and specify the CIDR block of the segment in the Gateway/ Prefix Length field. Click Save when done.

As mentioned before, a disconnected network segment has no uplink and provides an isolated network accessible only to the VMs connected to it.

< ALL SDDCs Commany Networking Overview	B v⊮ & Securi Seg	con AV	vs ⊚ ∖dd C ts	US West (Oregon) Dhs Maintenance Tr	oubleshooting Set	ings Support					OPEN VC	ENTER	ACTIONS Y															
Network	Segm	ent Lis		Segment Profiles																								
Segments VPN NAT	ADD	SEGMEI	τ								COLLAPSE ALL	Q Sea	arch															
Tier-1 Gateways				Segment Name			Туре			Subnets			Status (j)															
Transit Connect	- 1	~	-	Apps Team 01			Routed			172.16.115.1/24			● Success C															
Gateway Firewall Distributed Firewall				VPN Tunnel ID	Not Set			Domain Name	Not Set				VIEW STATISTICS															
Inventory Groups			>	SEGMENT PROFILES	Not Set			Tags	0				EW RELATED GROUPS															
Services Virtual Machines			>	DHCP STATIC BINDINGS																								
Tools		~	: v (~	~	~	~		Oracle Private			Disconnected			192.168.115.1/24			● Success C										
Port Mirroring				VPN Tunnel ID	Not Set			Domain Name	Not Set				VIEW STATISTICS															
System DNS DHCP Global Configuration Public IPs Direct Connect																			Description	Not Set			Tags	0			VIE	EW RELATED GROUPS
			>	SEGMENT PROFILES																								
			>	DHCP STATIC BINDINGS																								
Connected VPC																												

FIGURE 27. Logical Segments for Public and Private Network

Learn more about VMware Cloud on AWS logical networks.

The following are logical segments for Oracle VM traffic on VMware Cloud on AWS:

- Logical Segment Apps Team 01 (Subnet 172.16.115.1/24) for VM user traffic
- Logical Segment Oracle Private (Subnet 192.168.115.1/24) for VM private traffic

The following extended segments were created for Oracle VM traffic between on-premises Site A and VMware Cloud on AWS:

- Port group **BCA-L2VPN** for **L2VPN** for **VM user traffic** (non-Hybrid Cloud Extension traffic) enables VMs to keep the same subnet when migrating from on-premises data centers to the cloud and back.
- Port group **BCA-VPN-Network** for routed VM: traffic enables VMs to communicate—or ping each other—without being on the same subnet.

vSphere vMotion enables live migration of running (i.e., powered on) VMs from an on-premises host to a host in VMware Cloud on AWS, with zero downtime for the application (less than one second switchover time), continuous service availability, and complete transaction integrity. Furthermore, by enabling certain advanced configurations, vMotion migration between on-premises VMs and VMware Cloud on AWS can be enabled across various VDS versions.

VMware Cloud on AWS provides multiple ways to establish network connectivity from on-premises environments, including different types of VPNs and AWS Direct Connect (DX). AWS DX is a service provided by AWS that allows creation of a high-speed, low-latency connection between an on-premises data center and AWS services, including VMware Cloud on AWS.



Learn more about AWS Direct Connect.

Learn more about live vSphere vMotion migration between on-premises data centers and VMware Cloud on AWS.

If a custom MTU size has been configured for on-premises port groups, it's important to recheck the MTU size and packet defragmentation after migrating to VMware Cloud on AWS.

For now, the default MTU size for inter-SDDC networks is 8950 and is configurable on direct access-based connections (should be set equally on all VIFs). For VPN-based connections, the MTU will be 1500. After changing the MTU size (switching to jumbo frames), always test the final configuration to ensure that no defragmentation is happening along the path. Defragmentation may have higher negative impact on the performance compared to gains from using jumbo frames.

Learn more about VMware Cloud on AWS MTU.

Storage Configuration

On Site A, each of the 4 ESXi servers contains 2 x QLogic ISP2812-based 64/32G Fibre Channel to PCIe Controllers for FC storage.

sc2esx	Sc2esx09.vslab.local Actions V																				
Summary	Monitor	Co	nfigure	Permissions	VMs	Datastores	Network	s Up	dates												
Storage		~	Storage Adapters																		
Storage Ada	pters		+ Add So	ftware Adapter	🗟 Refresh	🗓 Rescan Sto	rage 🖓	Rescan A	dapter	× Remo	ve										
Storage Devices Adapter T Ty										r Stetus		٣	r Identifie	er				Ŧ	Targets		T Devices
Host Cache	Configurati	on	 Mode 	I: Dell BOSS-S1 Ad	dapter																
Protocol End	dpoints		 Mode 	I: Dell HBA330 Mi	ini																
I/O Filters			.⊿ Mode	I: ISP2812-based	64/32G Fibr	e Channel to PCI	e Controller														
Networking		>		🔆 vmhba4			Fibre	Channel		Onlin	ıe		20:00	0:34:80:0d:70:3	36:c0 21	1:00:34:80:0d:70:36:c0			8		7
Virtual Machin	0.5	、		🗇 vmhba5			Fibre	Channel		Onlin	ie		20:00	0:34:80:0d:70:3	36:c1 21	:00:34:80:0d:70:36:c1			7		7
VII Codi Macrini	iea	<i>_</i>		🗢 vmhba64			Fibre	Channel		Onlin	1e		20:00	0:34:80:0d:70:3	36:c0 21	1:00:34:80:0d:70:36:c0			0		0
System		>		🔆 vmhba65			Fibre	Channel		Onlin	ıe		20:00	0:34:80:0d:70:3	36:c1 21	:00:34:80:0d:70:36:c1			0		0
Hardware		>	 Mode 	I: Lewisburg SATA	AHCI Cont	oller															
Material Electron																					
Virtual Flash		>	Droportio	Devices	Daths																
Alarm Definitio	ons		Propertie	5 Devices	Pauls																
Scheduled Tas	sks		🗟 Refrest	n 🛛 🗟 Attach	🗒 Detach	🖉 Rename															
Pure Storage		>	Name ↑				~	LUN	\sim	Туре	~	Capacity	~	Datastore	~	Operational State	∼ Har	dware Acc	eleration	~	Drive Type
INFINIDAT			NFINIDAT	Fibre Channel Di	sk (naa.674	2b0f000006d0	000000000	11		disk			45.47 TB	🖯 Orainfi	nidat	Attached	S	upported			HDD
			NFINIDAT	Fibre Channel R	AID Ctir (naa	6742b0f00000)6d000000	0		array cor	ntrol			Not Consur	ned	Attached	N	lot suppor	ted		HDD
			PURE Fib	re Channel Disk (naa.624a93	70a841b405a3a3	48ca000118ff)	253		disk			1.00 MB	Not Consur	ned	Attached	S	upported			Flash
			PURE Fib	re Channel Disk (naa.624a93	70a841b405a3a3	48ca000119	254		disk			10.00 TB	Not Consur	ned	Attached	S	upported			Flash
			PURE Fib	re Channel Disk (naa.624a93	70a841b405a3a3	48ca00012	251		disk			20.00 TB	🗐 OraPu	re	Attached	S	upported			Flash
			PURE Fib	re Channel Disk (naa.624a93	70a841b405a3a3	48ca00012a	252		disk		Ę	500.00 GB	Not Consur	ned	Attached	S	upported			Flash
			PURE Fib	re Channel Disk (naa.624a93	70a841b405a3a3	48ca000130	250		disk			20.00 TB	🗎 OraSC	2	Attached	S	upported			Flash

FIGURE 28. Site A ESXi Server Storage Adapter


sc2esx09.	slab.l								
Summary Monito	r Co	nfigure Permissions VMs Datastores Networks	s Up	dates					
Storage	~	Storage Adapters							
Storage Adapters		+ Add Software Adapter R Befrech R Bescen Storage	Deccan A	Hanter X Pernove					
Storage Devices			(escuri A	T Status	▼ Identifie	r		Targets	T Devices
Host Cache Config	iration	Model: Dell BOSS-S1 Adapter		,	,	•		, laget	,
Protocol Endpoints		Model: Dell HBA330 Mini							
I/O Filters		Model: ISP2812-based 64/32G Fibre Channel to PCIe Controller							
Networking	>	🔶 vmhba4 Fibre 0	hannel	Online	20:00	:34:80:0d:70:36:c0 2	1:00:34:80:0d:70:36:c0	8	7
			hannel	Online	20:00	:34:80:0d:70:36:c1 21	:00:34:80:0d:70:36:c1	7	7
virtual Machines	>		hannel	Online	20:00	:34:80:0d:70:36:c0 2	1:00:34:80:0d:70:36:c0	0	0
System	>		hannel	Online	20:00	:34:80:0d:70:36:c1 21	:00:34:80:0d:70:36:c1	0	0
Hardware	>	Model: Lewisburg SATA AHCI Controller							
Virtual Flash	>								
Alarm Definitions		Properties Devices Paths							
Scheduled Tasks		Refresh							
Pure Storage	>	Name V	LUN	V Type V	Capacity ~	Datastore V	Operational State	 Hardware Acceleration 	✓ Drive Type
INFINIDAT		NFINIDAT Fibre Channel Disk (naa.6742b0f0000006d0000000000	11	disk	45.47 TB	Crainfinidat	Attached	Supported	HDD
		NFINIDAT Fibre Channel RAID Ctlr (naa.6742b0f0000006d000000	0	array control		Not Consumed	Attached	Not supported	HDD
		PURE Fibre Channel Disk (naa.624a9370a841b405a3a348ca000130	250	disk	20.00 TB	OraSC2	Attached	Supported	Flash
		PURE Fibre Channel Disk (naa.624a9370a841b405a3a348ca00012	251	disk	20.00 TB	CraPure	Attached	Supported	Flash
		PURE Fibre Channel Disk (naa.624a9370a841b405a3a348ca00012a	252	disk	500.00 GB	Not Consumed	Attached	Supported	Flash
		PURE Fibre Channel Disk (naa.624a9370a841b405a3a348ca000118ff)	253	disk	1.00 MB	Not Consumed	Attached	Supported	Flash
		PURE Fibre Channel Disk (naa.624a9370a841b405a3a348ca000119	254	disk	10.00 TB	Not Consumed	Attached	Supported	Flash

FIGURE 29. Site A ESXi Server FC Storage Connections

Site A contains the following VMFS, vVOL, NFS and vSAN datastores as shown below:

Deca-Sitec Actions V													
Summary Monitor Configure	Permissions	Hosts	VMs	Datastores	Networks	Updates							
Datastores Datastore Clusters													
Name							√ Stat	itus 🗸	Туре ↑ ~	Datastore C 👻	Capacity	~	Free
SC2-TINTRI-EC6090							~	Normal	NFS 3		125.16 TB		83.96 TB
OraTintri							\checkmark	/ Normal	NFS 3		125.16 TB		83.96 TB
datastore1 (7)							\checkmark	/ Normal	VMFS 6		95.5 GB		94.09 GB
OraSC2							\checkmark	Normal	VMFS 6		20 TB		18.57 TB
datastore1 (4)							\checkmark	/ Normal	VMFS 6		95.5 GB		94.09 GB
SC2-Pure-Templates							\checkmark	/ Normal	VMFS 6		20 TB		12.24 TB
OraPure							\checkmark	Normal	VMFS 6		50 TB		41.57 TB
datastore1 (8)							\checkmark	Normal	VMFS 6		95.5 GB		94.09 GB
Oralnfinidat							\checkmark	/ Normal	VMFS 6		45.47 TB		45.47 TB
datastore1 (3)							\checkmark	/ Normal	VMFS 6		95.5 GB		94.09 GB
MSPure							\checkmark	Normal	VMFS 6		20 TB		19.52 TB
BCA-SiteC-vSAN							\checkmark	Normal	VSAN		6.99 TB		5.63 TB
CraVVOL							\checkmark	/ Normal	vVol		8,192 TB		8,191.16 TB

FIGURE 30. Site A Datastores



On Site B, each of the 4 ESXi servers contains 2 x Emulex LightPulse LPe32000 Gen 6 16/32G PCIe Fibre Channel Adapters for FC storage.

az2esx2	az2esx22.vslab.local Actions V																				
Summary M	Monitor	Co	nfigure P	ermissions	VMs	Datastores	Networ	ks L	pdate	es											
Storage		~	Storage	e Adapter	ſS																
Storage Adap	pters		+ Add Softw	vare Adapter 🗧	Refresh	🗓 Rescan Storag	e] 🛇	Rescan	Adapte	er × Remo	ve										
Storage Devi	ices		Ada	apter		т	Туре		Т	Status		Ŧ	Identifi	ier				т	Targets	۲	r Devices
Host Cache Configuration + Model: Dell BOSS-S1 Adapter																					
Protocol End	lpoínts		Model: D	Dell HBA330 Ada	apter																
I/O Filters			▲ Model: E	Emulex LightPuls	e LPe3200	0 PCle Fibre Chann	el Adapte	r													
Networking		>	¢	÷vmhba4			Fibre C	hannel		Online			20:0	0:00:10:9b:34	:45:70 10	0:00:00:10:9b:34:45:70)		8		3
Virtual Machines	、	¢	÷vmhba5			Fibre C	hannel		Online			20:0	0:00:10:9b:34	:45:71 10	:00:00:10:9b:34:45:71			7		3	
VII COOL PROCEEDING	63	<i></i>	¢	≻ vmhba64			Fibre C	hannel		Online			20:0	0:00:10:9b:34	:45:70 10	0:00:00:10:9b:34:45:70)		0		0
System		>	¢	≻ vmhba65			Fibre C	hannel		Online			20:0	0:00:10:9b:34	:45:71 10	:00:00:10:9b:34:45:71			0		0
Hardware		>	 Model: L 	ewisburg SATA A	AHCI Conti	roller															
			 Model: U 	Jltrastar SN100/S	SN150 NVM	le SSD															
Virtual Flash		>																			
Alarm Definition	ns		Properties	Devices	Paths																
Scheduled Task	ks		C Defrech			12 Panema															
Pure Storage		>	Name	E Attach 6	-4 Detach	E Kename	~	LUN	~	Turne	~ ~	apacitu	~	Datastoro	~	Operational State	~	Hardwara Ac	coloration	~	Drive Turne
			NEINIDAT EI	hen Channel DAI	D Cilc/nee	6742500000064	00000	0	-	Type	- 0	apacity	-	Not Const	umod	Attached	-	Net support	uted	-	
				Okaman Diala (m	- 604-00	70(-1007-040144-	E00011	252		airay contro			100 MR	Not Const	umod	Attached		Commenter	1		Flash
			PURE FIbre (Channel Disk (na	1024893	701ab1667e849b44c	500011	253		disk			1.00 MB		amed DeeDee	Autoched		Supported	1		Flash
			PURE Fibre (Channel Disk (na	aa.o∠4a93.	/UIabibb/e849b44c	50004	∠54		CISK			30.00 TB	E A22-0	JraPu	Attached		Supported	1		Flash

FIGURE 31. Site B ESXi Server Storage Adapter

az2es	az2esx22.vslab.local Actions ✓									
Summary	Monitor	Co	n figure Permissions VMs I	Datastores Networks Upda	etes					
Storage		~	Storage Adapters							
Storage A	Adapters		+ Add Software Adapter 🛛 🗟 Refresh 🛛	🗒 Rescan Storage 🛛 🖓 Rescan Ada	pter × Remove					
Storage D	Devices		Adapter	т Туре	▼ Status	▼ Identi	fier		▼ Targets	T Devices
Host Cach	he Configurat	lon	Model: Dell BOSS-S1 Adapter							
Protocol B	Endpoints		Model: Dell HBA330 Adapter							
I/O Filters	s		 Model: Emulex LightPulse LPe32000 	PCle Fibre Channel Adapter						
Networking	9	>	🔶 vmhba4	Fibre Channel	Online	20:0	00:00:10:9b:34:45:70 10	:00:00:10:9b:34:45:70	8	3
Virtual Mac	hines:	>	⇔ vmhba5	Fibre Channel	Online	20:0	00:00:10:9b:34:45:71 10:	00:00:10:9b:34:45:71	7	3
			↓ vmhba64	Fibre Channel	Online	20:0	00:00:10:9b:34:45:70 10	:00:00:10:9b:34:45:70	0	0
System		>	√ vmhba65	Fibre Channel	Online	20:1	00:00:10:9b:34:45:71 10:	00:00:10:9b:34:45:71	0	0
Hardware		>	 Model: Lewisburg SATA AHCI Controll 	er						
Virtual Elaci	h	`	 Model: Ultrastar SN100/SN150 NVMe 	SSD						
virtual Flas										
Alarm Defin	nitions		Properties Devices Paths							
Scheduled	Tasks		Refresh 🛛 🗮 Attach 🖳 Detach	🖞 Rename						
Pure Storag	ge	>	Name	~ LUN ~	Type v	Capacity ~	Datastore 🗸	Operational State ~	Hardware Acceleration	✓ Drive Type
			NFINIDAT Fibre Channel RAID Ctlr (naa.67	42b0f000006d00000 0	array contro		Not Consumed	Attached	Not supported	HDD
			PURE Fibre Channel Disk (naa.624a9370f	abf667e849b44c500011 253	disk	1.00 ME	Not Consumed	Attached	Supported	Flash
			PURE Fibre Channel Disk (naa.624a9370f	abf667e849b44c50004 254	disk	30.00 TE	AZ2-OraPu	Attached	Supported	Flash

FIGURE 32. Site B ESXi Server FC Storage Connections

Site B contains the following VMFS, vVOL, NFS and vSAN datastores as shown below:

AZ2-DC Actions V								
Summary Monitor Configure Permission	Hosts & Clusters VMs Datastore	es Networks Upd	ates					
Datastores Datastore Clusters Datastore Fo	lders							
Name	~	Status ∽ Type ↑	∽ Datastore ∽	Capacity 🗸	Free			
AZ2-TINTRI-EC6090		✓ Normal NFS 3		125.18 TB	83.99 TB			
AZ2-OraPure		✓ Normal VMFS 6		30 TB	29.85 TB			
AZ2-vSAN		✓ Normal vSAN		7.86 TB	772 TB			
					1.72 10			

FIGURE 33. Site B Datastores

As indicated earlier, VMware vSAN can set availability, capacity, and performance policies per VM.

In the case of VMware Cloud on AWS, which uses vSAN storage internally, all VMs running inside the cloud SDDC consume storage capacity and leverage storage services from the vSAN datastore. Management workloads and the workloads belonging to a single VMware Cloud on AWS customer are located on the same vSAN cluster.

However, the cloud SDDC introduces a new vSAN capability that provides two logical datastores instead of one. One of these datastores, **vsanDatastore**, is used to store the management VMs; the other datastore, **WorkloadDatastore**, is used for the customer VMs.

■ SDDC-Datacenter ACTIONS Y									
Summary Monitor Configure	Permissions	Hosts &	Clusters	VMs	Datastore	es Netw	orks	Update	es
Datastores Datastore Clusters	Datastore Folde	ers							
Name ↑	∼ Statu	s v	Туре	~ Da	tastore 🗸	Capacity	\sim	Free	~
vsanDatastore	\checkmark	Normal	vSAN			20.74 TB		14.39 TB	
UvrkloadDatastore	\checkmark	Normal	vSAN			20.74 TB		14.39 TB	

FIGURE 34. VMware Cloud on AWS vSAN Datastore

VMware creates and operates a separate resource pool to manage customer workloads. Customers have the option of creating child resource pools but cannot configure compute policies at initial availability.

 V center.sddc-35-155-246-32.vmc.vmware.com Image: SDDC-Datacenter 	Compute-ResourcePool	
✓ ☐ Cluster-1	Summary Monitor Configure Permissions Resource Pools VMs	
 № 10.73.80.68 № 10.73.80.69 № 10.73.80.70 № 10.73.80.84 № 10.73.80.85 № 10.73.80.85 	This pool / Total VMs and Templates: 17 / 17 Powered on VMs: 13 / 13 Child Resource Pools: 0 / 0 Child vApps: 0 / 0	
 Compute-ResourcePool 	Resource Settings	Related Objects
> 🤗 Mgmt-ResourcePool	CPU Shares Normal (4000) Reservation Expandable Limit Unlimited Worst Case Allocation 165,600 MHz	
	Memory Shares Normal (163840) Reservation Expandable Limit Unlimited Worst Case Allocation 165,600 MB	
	Tags	•

FIGURE 35. VMware Cloud on AWS Compute Resource Pool

The default vSAN storage policy, vSAN Default Storage Policy, on VMware Cloud on AWS is shown below:

VM Storage Policies								
CREA	TE EDIT	CLONE	СНЕСК	REAPI	PLY	RESET		
	Name Eg Managemen	it storage	Joincy - Erici	ypr	VC	center.suuc-44-232-220-144.viitwareviito.com		
	🗟 Managemei	nt Storage I	Policy - Larg	e	e۷	/center.sddc-44-232-220-144.vmwarevmc.com		
	🗟 Managemei	nt Storage I	Polícy - Regu	ılar	e۷	/center.sddc-44-232-220-144.vmwarevmc.com		
	🗟 Managemei	nt Storage I	Policy - Singl	е	<mark>ل</mark> ا ب	vcenter.sddc-44-232-220-144.vmwarevmc.com		
	🔒 Managemei	nt Storage I	Policy - Stret	ch	e۷	vcenter.sddc-44-232-220-144.vmwarevmc.com		
	🗟 Manageme	nt Storage I	Policy - Stret	ch	e۷	vcenter.sddc-44-232-220-144.vmwarevmc.com		
	🗟 Manageme	nt Storage	policy - Thin		e۷	vcenter.sddc-44-232-220-144.vmwarevmc.com		
	🗟 VM Encrypt	ion Policy			e v	/center.sddc-44-232-220-144.vmwarevmc.com		
	🗟 VMC Workl	oad Storage	e Policy - Clu	ıst	<mark>ه</mark> ۷	vcenter.sddc-44-232-220-144.vmwarevmc.com		
	🗟 vSAN Defau	ult Storage	Policy		e۷	vcenter.sddc-44-232-220-144.vmwarevmc.com		
	🗟 VVol No Re	quirements	Policy		🕑 v	/center.sddc-44-232-220-144.vmwarevmc.com		
1								
Rules	VM Compli	iance	VM Templa	te s	Stora	ge Compatibility		
Gener	al							
Nan	ne		V	SAN Def	ault S	Storage Policy		
Des	cription		S	torage p	olicy	used as default for vSAN datastores		
Rule-s	et 1: VSAN							
Placen	hent							
Stor	age Type		V	SAN				
Site	disaster tolerar	ice	Ν	lone - sta	andar	rd cluster		
Failu	ures to tolerate		1	faílure - I	RAID-	-1 (Mirroring)		
Nun	nber of disk strij	pes per obj	ect 1					
IOP:	S limit for object		0					
Obje	ect space reserv	ation	Т	hin provi	isionir	ng		
Flas	h read cache re	servation	0	%				
Disa	ible object chec	ksum	N	0				
For	Force provisioning			No				
Spa	Encryption services			No preference				
Stor	age tier		N	lo prefer	ence			
	-				-			

FIGURE 36. VMware Cloud on AWS Default vSAN Storage Policy

Learn more about vSAN Storage Policies and RAID configuration options on VMware Cloud on AWS.

VMware and Oracle Configuration

For on-premises Site A, two VMs were configured:

- One VM for production single-instance Oracle VM Oracle19c12-OEL83
- One VM for production single-instance Oracle VM Oracle19c-OL8-Primary

For on-premises Site B, one VM was configured:

One VM for DR single-instance physical standby Oracle VM Oracle19c-OL8-Standby for the primary database Oracle VM
 Oracle19c-OL8-Primary on Site A



Storage for the three on-premises VMs was provisioned as indicated below:

- Production single-instance Oracle VMs **Oracle19c12-OEL83** and **Oracle19c-OL8-Primary** are provisioned on Pure Storage X50 All-Flash FC Block VMFS6 datastore.
- DR single-instance physical standby Oracle VM **Oracle19c-OL8-Standby** is provisioned on Tintri T880 All-Flash NFS Storage with support for vSphere APIs for array integration (VAAI).

The on-premises Site A and Site B single-instance and physical standby VMs were created with the following components and settings:

- 8 vCPUs and 32GB memory
- Oracle Enterprise Linux 8.3 OS
- Oracle 19.12 Grid infrastructure and RDBMS binaries installed on all VMs
- Oracle SGA set to 16GB, and PGA set to 6GB for all database instances
- Oracle ASM and Oracle ASMLib
- All ASM disk groups disks are presented on different PVSCSI controllers for purposes of performance and queue depth.
- All database-related VMDKs are partitioned using Linux utilities, with proper alignment offset and labeled Oracle ASMLib.
- For sake of simplicity and illustration, one ASM Disk Group was created (**DATA_DG**), housing all datafiles, control files, redo log files and archive log files. Separate ASM diskgroups for these components are recommended per best practice.
- All VMs host both Oracle Grid and RDBMS 19.12 multi-tenant production database ora19c with a pluggable database pdb1.

Network details for VM Oracle19c-OL8-Primary are as follows:

- VM network adapter is connected to port group APPS-1614 and assigned an IP address 172.16.14.50

Network details for VM Oracle19c-OL8-Standby are as follows:

- VM network adapter is connected to port group APPS-1810 and assigned an IP address 172.18.10.51

🕏 Oracle19c-OL8-Prin	nary 🛛 Þ 🗖 🛱 🚳 🛛 actions 🗸	🚯 Oracle19c-OL8-St	andby 🖻 🖬 🧔 🐼 actions 🗸
Summary Monitor Config	gure Permissions Datastores Networks Snapshots Updates	Summary Monitor Con	figure Permissions Datastores Networks Snapshots Updates
Powered On LAUNCH WEB CONSOLE LAUNCH REMOTE CONSOLE	Guest OS: Oracle Linux 8 (64-bit) Compatibility: ESXI 7.0 U2 and later (VM version 19) VMware Tools: Running, version:11328 (Guest Managed) Most INFO DNS Name oracle19c-olis-primary.vslab.local IP Addresses 172.16.14.50 Host: sc2esx/D.Vslab.local	Powered On LAUNCH WEB CONSOLE LAUNCH REMOTE CONSOLE	Guest OS: Oracle Linux 8 (64-bit) Compatibility: ESXI 7.0 U2 and later (VM version 19) VMware Toois: Running, version:11328 (Guest Managed) MORE_INEC oracle19c-oi8-standby.vslab.local IP Addresses: 172.18.10.51 Host: azzesre24.vslab.local
VM Hardware		VM Hardware	
> CPU	8 CPU(s)	> CPU	8 CPU(s)
> Memory	32 GB, 0.32 GB memory active	> Memory	32 GB, 0.32 GB memory active
> Hard disk 1	80 GB	> Hard disk 1	80 GB
Total hard disks	3 hard disks	Total hard disks	3 hard disks
> Network adapter 1	APPS-1614 (connected)	> Network adapter 1	APPS-1810 (connected)
CD/DVD drive 1	Disconnected K	CD/DVD drive 1	Disconnected
> Video card	8 MB	> Video card	8 MB
VMCI device	Device on the virtual machine PCI bus that provides support for the virtual machine communication interface	VMCI device	Device on the virtual machine PCI bus that provides support for the virtual machine communication interface
> Other	Additional Hardware	> Other	Additional Hardware
Compatibility	ESXi 7.0 U2 and later (VM version 19)	Compatibility	ESXI 7.0 U2 and later (VM version 19)
Edit Settings		Edit Settings	

FIGURE 37. Single-Instance Oracle19c-OL8-Primary and Physical Standby Oracle19c-OL8-Standby VM Details



Details for VM Oracle19c12-OEL83 are as follows:

- VM network adapter is connected to port group APPS-1614 and assigned an IP address 172.16.14.45

🕆 Oracle19c12-OEL83 🛛 Þ 🗖 🛱 🖓 🕸 📔 астіоля м							
Summary Monitor Confi	gure Permis	sions Datastores	Networks	Snapshots	Updates		
Powered On LAUNCH WEB CONSOLE LAUNCH REMOTE CONSOLE	Guest OS: Compatibility: VMware Tools: DNS Name: IP Addresses: Host: &	Oracle Linux 8 (64-bit) ESXi 7.0 and later (VM & Running, version:11328 (MORE INFO oracle19c12-oel83 172.16.14.45 sc2esx10.vslab.local	version 17) Guest Managed)				
VM Hardware							
> CPU		8 CPU(s)					
> Memory		32 GB, 0.64 GB r	nemory active				
> Hard disk 1		80 GB					
Total hard disks		3 hard disks					
> Network adapter 1		APPS-1614 (connect	ed)				
CD/DVD drive 1		Disconnected					
> Video card		8 MB					
VMCI device		Device on the virtua virtual machine com	al machine PCI b nmunication inter	us that provides face	support for the		
> Other		Additional Hardware	e				
Compatibility		ESXi 7.0 and later (VM version 17)				
Edit Settings							

FIGURE 38. Single-Instance Oracle19c12-OEL83 VM Details

The table below details the Oracle VM Oracle19c12-OEL83, Oracle19c-OL8-Primary and Oracle19c-OL8-Standby disk layout and ASM disk group configuration:

NAME	SCSI TYPE	SCSI ID (CONTROLLER, LUN)	SIZE	ТҮРЕ	HARD DISK	DISK NAME
Operating System (OS) /	Paravirtual	SCSI (0:0)	80 GB	ext4 file system	1	/dev/sda1
Oracle binary disk /u01	Paravirtual	SCSI (0:1)	80 GB	ext4 file system	2	/dev/sdb1
DATA Disk 1	Paravirtual	SCSI (1:0)	500 GB	DATA_DG	3	DATA_DISK01

TABLE 9. VMs Oracle19c12-OEL83, Oracle19c-OL8-Primary and Oracle19c-OL8-Standby Disk Layout



The table below summarizes the network details:

- Production single-instance Oracle VM Oracle19c12-OEL83
- Production single-instance Oracle primary VM Oracle19c-OL8-Primary with production single-instance Oracle physical standby
 Oracle19c-OL8-Standby

NETWORK	SITE A VM	SINGLE-INSTANCE PRIMARY	SINGLE-INSTANCE STANDBY
VM Name	Oracle19c12-OEL83	Oracle19c-OL8-Primary	Oracle19c-OL8-Standby
Public FDQN	oracle19c12-oel83.vslab.local	oracle19c-ol8-primary.vslab.local	oracle19c-ol8-standby.vslab.local
Public IP	172.16.14.45	172.16.14.50	172.18.10.51

For VMware Cloud on AWS, one single-instance Oracle VM Oracle19c12-OEL83-VMC was configured.

Storage for the VMware Cloud on AWS VM was provisioned on HCI vSAN storage.

The VMware Cloud on AWS single instance was created with the following components and settings:

- 8 vCPUs and 32GB memory
- Oracle Enterprise Linux 8.3 OS
- Oracle 19.12 Grid infrastructure and RDBMS binaries installed on all VMs
- Oracle SGA set to 16GB, and PGA set to 6GB for all database instances
- Oracle ASM and Oracle ASMLib
- All ASM disk groups disks are presented on different PVSCSI controllers for purposes of performance and queue depth.
- All database-related VMDKs are partitioned using Linux utilities, with proper alignment offset and labeled Oracle ASMLib.
- For sake of simplicity and illustration, one ASM disk group was created (**DATA_DG**) housing all datafiles, control files, redo log files and archive log files. Separate ASM diskgroups are recommended for these components per best practice.
- VM hosts both Oracle Grid and RDBMS 19.12 multi-tenant standby production database ora19c with a pluggable database pdb1.

Network details for VM Oracle19c12-OEL83-VMC are as follows:

- VM network adapter is connected to port group Apps Team 01 and assigned an IP address 172.16.115.45

Summary Monitor Cor	nfigure Permis	ssions Datastores Networks Snapshots	
 Powered On LAUNCH WEB CONSOLE LAUNCH REMOTE CONSOLE 	Guest OS: Compatibility: VMware Tools: DNS Name: IP Addresses: Host: Most:	Oracle Linux 8 (64-bit) ESXi 7.0 and later (VM version 17) Running, version:11328 (Guest Managed) MORE INFO oracle19c12-oel83 172.16.115.45 10.129.32.5	
VM Hardware			
> CPU		8 CPU(s)	
> Memory		32 GB, 0.32 GB memory active	
> Hard disk 1		80 GB	
Total hard disks		3 hard disks	
> Network adapter 1		Apps Team 01 (connected)	
CD/DVD drive 1		Disconnected	Ģ
> Video card		8 MB	
VMCI device		Device on the virtual machine PCI bus that provides support for the machine communication interface	virtua
> Other		Additional Hardware	
		ECV: 7.0 and later (VM varian 17)	

FIGURE 39. Single-Instance Oracle19c12-OEL83-VMC VM Details

The table below details the Oracle VM Oracle19c12-OEL83-VMC disk layout and ASM disk group configuration:

NAME	SCSI TYPE	SCSI ID (CONTROLLER, LUN)	SIZE	ТҮРЕ	HARD DISK	DISK NAME
Operating System (OS) /	Paravirtual	SCSI (0:0)	80 GB	ext4 file system	1	/dev/sda1
Oracle binary disk /u01	Paravirtual	SCSI (0:1)	80 GB	ext4 file system	2	/dev/sdb1
DATA Disk 1	Paravirtual	SCSI (1:0)	500 GB	DATA_DG	3	DATA_DISK01

TABLE 10. VMs Oracle19c12-OEL83-VMC Disk Layout



The table below summarizes the network details for cloud single-instance Oracle VM Oracle19c12-OEL83-VMC:

NETWORK	VMWARE CLOUD ON AWS VM
VM Name	Oracle19c12-OEL83-VMC
Public FDQN	oracle19c12-oel83-vmc.vslab.local
Public IP	172.16.115.45

TABLE 11. VMs Oracle19c12-OEL83-VMC Network Details

See Appendix A for the complete list of Oracle initialization parameters for the RAC vmcrac database.

All best practices for Oracle workloads on a VMware SDDC were followed in accordance with the *Oracle Databases on VMware Best Practices Guide*.

VMware Hybrid Cloud Extension Configuration

VMware Hybrid Cloud Extension was used for migrating Oracle workloads from Site A to VMware Cloud on AWS.

The hybrid cloud extension connector at Site A (VSLAB) initiates site pairing and the service mesh appliances initiate the interconnect tunnels. The Hybrid Cloud Extension Cloud Manager and the service mesh appliances at the public cloud (VMware Cloud on AWS – **VMC-VSLAB**) are the receivers.

Learn more about VMware Hybrid Cloud Extension Deployment types.

Refer to *Hybrid Cloud Extension Installation Workflow for Hybrid Cloud Extension Public Clouds* for activating Hybrid Cloud Extension on VMware Cloud on AWS.

Download, deploy and activate the Hybrid Cloud Extension Manager in the source environment using the Hybrid Cloud Extension Connector OVA as per *Hybrid Cloud Extension Installation Workflow for Hybrid Cloud Extension Public Clouds*.

Pair Hybrid Cloud Extension Connector with Hybrid Cloud Extension Cloud as outlined in Adding a Site Pair.



FIGURE 40. Hybrid Cloud Extension Site Pairing Between Site A (VSLAB) and VMware Cloud on AWS (VMC-VSLAB)

The Hybrid Cloud Extension Manager (connector) on Site A and Hybrid Cloud Extension Cloud Manager on VMware Cloud on AWS are as shown below:

VMware-HCX-Connector-	4.2.0.0-18422311 Þ 🗆 🗳 🖓 🚳 actions y	🚯 hcx_cloud_manager 🛛 🖻	🖾 🖗 🔞 ACTIONS 🗸
Summary Monitor Configure Pe	rmissions Datastores Networks Snapshots Updates	Summary Monitor Configure Perm	issions Datastores Networks Snapshots
Guest OS: Competibili VMware To DNS Name P Address Host: LAUNCH WEB CONSOLE	Other 4.x or later Linux (64-bit) ty: ESXI 5.0 and later (VM version 8) ESXI 5.0 and later (VM version 8) MOBE INFO hox, vslab local tr2.16.31.150 sczesx09, vslab local	Guest OS: Compatibility: VMware Tools VMware Tools VMMMA VMWARE Tools VMMMA VMMARE Tools VMMMARE Tools VMMAR	Other 4.x or later Linux (64-bit) ESXI 5.0 and later (VM version 8) :: Running, version:10309 (Guest Managed) MORE_INFO hcx.sddc-44-232-220-144.vmwarevmc.com 10.129.224.25 T0.1293.274
VM Hardware		VM Hardware	
> CPU	4 CPU(s)	> CPU	4 CPU(s)
> Memory	12 GB, 1.68 GB memory active	> Memory	12 GB, 3.12 GB memory active
> Hard disk 1	60 GB	> Hard disk 1	60 GB
> Network adapter 1	APPS-1631 (connected)	> Network adapter 1	mgmt-app-network (connected)
CD/DVD drive 1	Disconnected	CD/DVD drive 1	Disconnected d
> Video card	4 MB	> Video card	4 MB
VMCI device	Device on the virtual machine PCI bus that provides support for the virtual machine communication interface	VMCI device	Device on the virtual machine PCI bus that provides support for the virtual machine communication interface
> Other	Additional Hardware	> Other	Additional Hardware
Compatibility	ESXI 5.0 and later (VM version 8)	Compatibility	ESXI 5.0 and later (VM version 8)

FIGURE 41. Hybrid Cloud Extension Manager (Connector) on Site A and Hybrid Cloud Extension Cloud Manager on VMware Cloud on AWS

Hybrid Cloud Extension Network profiles for Site A are as shown below:

Compute Profiles Service Mesh Network Profiles	Sentinel Management							
HCX-Apps-VLAN1614								
Network Details Backing: APPS-1614	MTU 1500	IP Pools	IP Ranges	IP Usage(Used/Total)	Prefix Length	Galeway		
vCenter:sc2vvvc03.vslab.local Switch dVSwitch hide			172.16.14.140 - 172.16.14.150	0/ 11	24	172.16.14.1		
EDIT DELETE								
HCX-Mgmt-Uplink-Repl-VLAN1631								
Network Details Backing: SC2-COMP-MGMT	MTU 1500	IP Pools	IP Ranges	IP Usage(Used/Total)	Prefix Length	Galeway		
vCenter: sC2wvC03.vslab.local Switch dVSwitch hide			172.16.31.200 - 172.16.31.220	2/21	24	172.16.31.1		
EDIT DELETE								
4 HCX-vMotion-VLAN1632								
Network Details Backing: SC2-COMP-VMOTION	мт U 1500	IP Pools	IP Ranges	IP Usage(Used/Total)	Prefix Length	Gateway		
vCenter'sczwvCO3,stab.l0C81 Switch dVSwitch hide			172.16.32.200 - 172.16.32.220	1/ 21	24	172.16.32.1		
EDIT DELETE								

FIGURE 42. Hybrid Cloud Extension Network Profiles for Site A

Hybrid Cloud Extension Network profiles for VMware Cloud on AWS are as shown below:

iterconnect						
Multi-Site Service Mesh Compute Profiles Service Mesh Network Profiles						
directConnectNetwork1						
Network Details Backing: 35d0ed3d-d9f0-45d6-a546-17d630517e88 vCenter: vcenter.sddc-44-232-220-144.vmwarevmc.com hide	мти 1500	IP Pools	IP Ranges 12.16.205.2 - 172.16.205.100	IP Usage(Used/Total) 2/99	Prefix Length 24	Gateway 172.16.205.1
EDIT DELETE						
🛟 externalNetwork						
Network Details Backing: 16a41420-3575-4ba7-955b-0e53d084cd3e vCenter: vcenter.sddc-44-232-220-144.vmwarevmc.com	мти 1500	IP Pools	IP Ranges 44,241,200,216	IP Usage(Used/Total) O/ 1	Prefix Length	Gateway
			52.26.30.69	0/1		
EDIT DELETE						
mgmt-app-network						
Network Details Backing: mgmt-app-network	мтU 1500	IP Pools	IP Ranges	IP Usage(Used/Total)	Prefix Length	Gateway
vuenter: vuenter:sodic-44-232-220-144.vmwarevmc.com hide		10	0.129.224.26 - 10.129.224.185	2/160	19	10.129.224.1

EDIT DELETE

FIGURE 43. Hybrid Cloud Extension Network Profiles for VMware Cloud on AWS

Hybrid Cloud Extension network mapping for Site A and VMware Cloud on AWS is as shown below:

NETWORK	SOURCE SITE	NETWORK PROFILE	DESTINATION SITE	DESTINATION NETWORK
VM Network	Site A	Hybrid Cloud Extension-Apps-VLAN1614	VMware Cloud on AWS	Apps Team 01
Management, Replication	Site A	Hybrid Cloud Extension-Mgmt-Uplink-Repl-VLAN1631	VMware Cloud on AWS	directConnectNetwork1
vMotion	Site A	Hybrid Cloud Extension-vMotion-VLAN1632	VMware Cloud on AWS	Part of the Service Mesh

TABLE 12. Hybrid Cloud Extension Network Details Between Site A and VMware Cloud on AWS

The compute profile for Site A is as shown below:



FIGURE 44. Site A Compute Profile

The summary of HCX-Compute-Profile is shown below:







The compute profile for VMware Cloud on AWS is as shown below:

i-Site Service Mesh		
ComputeProfile(vcenter)		
Service Resources vcenter.sddc-44-232-220-144.vmwarevmc.com SDDC-Datacenter	Deployment Container	Networks Solution (Management) (Motion) (Motion
	Datastore vsanDatastore Cpu/Memory Reservations 0% J 0%	Network Container (Network Extension Appliance Limit) RSX-T Enabled Distributed Switch (Unlimited)
This Compute Profile is being used in 1 Service Mesh(es). Service Mesh	Paired Site	HCX Services
	hcx.vslab.local-enterprise	

FIGURE 46. VMware Cloud on AWS Compute Profile

The summary of VMware Cloud on AWS HCX-Compute-Profile is shown below:

Summary of ComputeProfile(vcente	er)	\times
Clusters for Service Enablement	Resources for deploying HCX Appliances	
Pvcenter.sddc-44-232-220-144.vmwarevmc.com	Pvcenter.sddc-44-232-220-144.vmwarevmc.com	
[]]SDDC-Datacenter	⊘Mgmt-ResourcePool	
Services selected	Storage	
	⊜vsanDatastore	
	Folder	
Switches configured		
NSX-T Enabled Distributed Switch	Appliance Count:	
Network profiles configured		
mgmt-app-network Management vMotion	Network Backing: mgmt-app-network IP Ranges: 10.129.224.26 - 10.129.224.185 (158) Prefix Length: 19 Gateway: 10.129.224.1	
externalNetwork Uplink	Network Backing: 16a41420-3575-4ba7-955b-0e53d084cd3e IP Ranges: 44.241.200.216 (1), 52.26.30.69 (1) Prefix Length: 0	

CLOSE

FIGURE 47. Summary of HCX-Compute-Profile



The service mesh topology on Site A is as shown below:





The service mesh appliances view on Site A is as shown below:

Interconnect Multi-Site Service Mesh											
Comp	Compute Profiles Service Mesh Network Profiles Sentinel Management										
~		HCX-Service-Mesh		~						EDIT	SERVICE MESH
-81	Fopol	ogy 🖾 Appliances	🖄 Tasks								
An	oliar	aces on box vslab k	ocal-enterprise								
, db	pinen										С
		Appliance Name					T Appliance Type	т	IP Address	Tunnel Status	Current Version
) >	 HCX-Service-Mesh-IX-II Id: 19994f70-0cd0-4b Compute: BCA-SiteC Storage: SC2-TINTRI-E 	a0-8447-a9ab2d3b6ccf :c6090				HCX-W/	/AN-IX	172:16.31.200 Management VSphere Replication Uplink Overridden () 172:16.32.200 VMotion ()	qU	4.2.0.0
) >	HCX-Service-Mesh-WC Id: 73108b34-5c0b-47 Compute: BCA-SiteC Storage: SC2-TINTRI-E	-i1 89-ba3e-7c45be6ab733 :c6090				G HCX-W/	AN-OPT			7.3.9.0
) >	HCX-Service-Mesh-NE- Id: ef2e28d5-1c7c-4b2 Compute: BCA-SiteC Storage: SC2-TINTRI-E Network Container: dV Extended Networks: 0/	11 22-8fa7-77c1026b4d42 :C6090 Switch 18				HCX-NE	ET-EXT	172.16.31.201 Management Uplink Overridden)	Up	4.2.0.0
											3 Appliance(s)
Applia	ance	es on HCX Cloud - \	VMC-VSLAB								
Applia	nce Na	ame				Appliance Type	IP Address				Current Version
HCX-S	Servic	e-Mesh-IX-R1				HCX-WAN-IX	10.129.224.26 Management VMotion 172.16.205.2 Uplink Overricden 169.254.105.2 Uplink Overricden				4.2.0.0
HCX-S	Servic	e-Mesh-WO-R1				HCX-WAN-OPT					7.3.9.0
HCX-5	Servic	e-Mesh-NE-R1				HCX-NET-EXT	10.129.224.27 (Management) 169.254.105.3 (Uplink Overridden) 172.16.205.3 (Uplink Overridden)				4.2.0.0
											3 Appliance(s)

FIGURE 49. Site A Service Mesh Appliances

The service mesh on VMware Cloud on AWS is as shown below:

lerconnec	:t			
/lulti-Site Service N	lesh			
Compute Profiles	Service Mesh	Network Profiles		
HCX-Service-	Mesh			
				HCX Services
Site Pairing				
Site Pairing HCX Clou ©US West (ComputePro	d - VMC-VSLAB Dregon) file(vcenter)	←	hcx.vslab.local-enterprise	() () () () ()
Site Pairing HCX Clour US West (ComputePro Uplinks (Override	d - VMC-VSLAB Dregon) file(vcenter) den)	\leftarrow	hcx.vslab.local-enterprise Santa Clara HCX-Compute-Profile Uplinks (Overridden)	

FIGURE 50. VMware Cloud on AWS Service Mesh

The service mesh appliances on VMware Cloud on AWS are as shown below:

Interco	nnect				
Multi-Site S	Service Mesh				
Compute P	Profiles Service Mesh Network Profiles				
~	HCX-Service-Mesh 🗸				
P Applianc	es 🖾 Tasks				
Appliar	nces on HCX Cloud - VMC-VSLAB				~
CREDE	PLOY 🛱 FORCE-SYNC 🖉 CHANGE PASSWORD 📑 RENAME APPLIA	NCE			G
	Appliance Name		Y Appliance Type Y IP Address	Tunnel Status	Current Version
	HCX-Service-Mesh-IX-R1 Id: 83b6accd-58cf-487d-4840b-6e3c785fa1b5 Compute: Mgmt-ResourcePool Storage: vsanDatastore		ICX-WAN-IX 10.129.224.26 Management VMotion () 172.16.205.2 (Uplink (Oversidee)) ()	Up	4.2.0.0
	HCK-Service-Mesh-WO-R1 Itr: 10d25590-dd54-d095-af96-ce918e50ce64 Compute: MgmT-ResourcePool Storage: vsanDatastore		INCX-WAN-OPT		7.3.9.0
• •	HCK-Service-Mesh-NE-R1 Mc/bbC3ec0b-ee95-4dd7-934d-eb5ef85fC33a Compute-MgmT-ResourcePool Storage: VsanDatastore Network Containsr: ISSX-TEabled Distributed Sw/tch Extended Networks: 0/8		VCX-NET-EXT 10.129.224.27 Management () 172.16.205.3 (Updink (Owindeer) ()	qU	4.2.0.0
					3 Appliance(s)
Appliance	es on hcx.vslab.local-enterprise				
Appliance Na	ame	Appliance Type	IP Address		Current Version
HCX-Service-Mesh-IX-II		HCX-WAN-IX	172:16:31:200 Management vSphere Replication Uplink (Overridden) 172:16:32:200 vMotion		4.2.0.0
HCX-Servic	ze-Mesh-WO-II	HCX-WAN-OPT			7.3.9.0
HCX-Servic	ze-Mesh-NE-II	HCX-NET-EXT	172.16.31.201 Management Uplink Overrideen		4.2.0.0
					3 Applia

FIGURE 51. VMware Cloud on AWS Service Mesh Appliances



Solution Validation

This solution is designed and deployed three separate environments:

For on-premises Site A, one VM was configured:

One VM for production single-instance Oracle VM Oracle19c12-OEL83

For on-premises Site A and Site B, one primary-standby VM pair was configured:

- One VM for production single-instance Oracle primary VM Oracle19c-OL8-Primary on Site A
- One VM for DR single-instance Oracle physical standby VM Oracle19c-OL8-Standby on Site B

For VMware Cloud on AWS, one single-instance Oracle VM Oracle19c12-OEL83-VMC was configured.

In this section, we present the test methodologies and processes used in this reference architecture.

Solution Test Overview

The solution validated the following:

- Deployment of a:
 - Production single-instance Oracle VM Oracle19c12-OEL83 on Site A
 - Production single-instance Oracle VM Oracle19c-OL8-Primary on Site A and single-instance physical standby Oracle VM Oracle19c-OL8-Standby on Site B
 - Production single-instance Oracle VM Oracle19c12-OEL83-VMC in VMware Cloud on AWS
- Understanding VMware Hybrid Cloud Extension and Oracle migration methods to migrate Oracle workloads from on-premises to VMware Cloud on AWS
- Migration of a:
 - Production single-instance Oracle VM Oracle19c12-OEL83 from on-premises Site A to VMware Cloud on AWS
 - Production single-instance physical standby Oracle VM Oracle19c-OL8-Standby from on-premises Site B to VMware Cloud on AWS

Test and Performance Metrics Data Collection Tools

The test and performance metrics data collection tools are as indicated below:

Test Tools and Configuration

SLOB Workload

SLOB is an Oracle workload generator designed to stress test storage I/O capability, specifically for Oracle Database using OLTP workload. SLOB is not a traditional transactional benchmark tool. It is used to validate performance of the storage subsystem without application contention.

SLOB Configuration

- Database VM with a 16GB SLOB schema
- SLOB parameter UPDATE_PCT set to 100 to reflect very heavy I/O workload
- Think Time was set 0 to hit database with maximum requests concurrently to generate extremely intensive batch workload
- SLOB parameter SCALE for the workload set to 16GB with Oracle SGA set to 16GB
- SLOB parameter REDO_STRESS for the workload set to HEAVY
- SLOB parameter RUN_TIME set to 30 minutes

The detailed SLOB configuration is included in Appendix C: SLOB Configuration.



Key Metrics Data Collection Tools

The following monitoring tools are used in this solution:

- Oracle Automatic Workload Repository
 - (AWR) reports with Automatic Database Diagnostic Monitor (ADDM). AWR collects, processes, and maintains performance statistics for problem-detection and self-tuning purposes for Oracle Database. This tool can generate reports for analyzing Oracle performance. ADDM analyzes data in AWR to identify potential performance bottlenecks. For each of the identified issues, it locates the root cause and provides recommendations for correcting the problem. Learn more about *Oracle AWR*.
- Oracle dynamic performance (V\$) views and Oracle Alert log to check for errors
- Linux system activity report (SAR)
 - Linux SAR helps collect and evaluate a variety of information regarding system activity. With performance problems, SAR also
 permits retroactive analysis of the load values for various subsystems (e.g., CPUs, memory, disks, interrupts, network interfaces).
 Learn more about *Linux SAR*.

Deploying Oracle Workloads on On-premises

Successful deployment of Oracle workloads on VMware vSphere platform using VMDKs, regardless of the underlying storage (VMFS, iSCSI, NFS, vSAN, vVOL) is not significantly different from deploying Oracle on physical servers. Oracle DBAs can fully leverage their current skill set while also delivering the benefits associated with virtualization.

A VM template **Template-OL8-ORA19C** with all of the required OS patches was used to provision the below VMs. Oracle ASM with Oracle ASMLib was used to provision the database storage.

The steps to deploy a production single-instance Oracle database **ora19c** on VM **Oracle19c12-OEL83** Oracle database on Site A are no different than deploying a single-instance Oracle database on any physical architecture.



FIGURE 52. Oracle Database ora19c in VM Oracle19c12-OEL83 on Site A

The steps to deploy a production single-instance Oracle database **ora19c** on VM **Oracle19c-OL8-Primary** on Site A and single-instance physical standby database **ora19c** on VM **Oracle19c-OL8-Standby** on Site B are no different than deploying the same on any physical architecture.

Two VMs are utilized for this use case:

- Primary Oracle database VM Oracle19c-OL8-Primary with IP address 172.16.14.50 on Site A
- Physical standby database VM Oracle19c-OL8-Standby with IP address 172.18.10.51 on Site B

oracle@oracle19c-ol8-primary:ora19c:/home/oracle> ifconfig -a	oracle@oracle19c-o18-standby:ora19csb:/home/oracle> ifconfig -a
eth0; flags=4163 <up, broadcast,="" multicast="" running,=""> mtu 1500</up,>	eth0: flags=1163=UP, BROADCAST, RUNNING, MULTICAST> mtu 1500
inet 172.16.14.50 netmask 255.255.255.0 broadcast 172.16.14.255	inet 172,18,10,51 netmask 255,255,255.0 broadcast 172,18,10,255
ether 00:50:56:80:7d:17 txgueuelen 1000 (Ethernet)	The second secon
BX packets 126861 bytes 110854760 (105.7 MiB)	PV packate 128251 buttas 142822193 (136 2 MiR)
RX errors 0 dropped 0 overrups 0 frame 0	BV experse 0 deepped 0 eventure 0 from 0
Ty packets (2015 bytes 2/02/2010 / 22 2 MiR)	The problem of a complete the contraction of the matter of the contraction of the contrac
The packets 40010 bytes 04002019 (00.2 MB)	TA packets 44949 bytes 351/519 (5.1 Mib)
ix errors o dropped o overruis o carrier o corrisions o	TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
lo: flags=73 <up,loopback,running> mtu 65536</up,loopback,running>	lo: flags=73 <up,loopback,running> mtu 65536</up,loopback,running>
inet 127.0.0.1 netmask 255.0.0.0	inet 127.0.0.1 netmask 255.0.0.0
loop txgueuelen 1000 (Local Loopback)	loop txqueuelen 1000 (Local Loopback)
RX packets 16328 bytes 1434738 (1.3 MiB)	BX packets 16232 bytes 1416535 (1.3 MiB)
RX errors 0 dropped 0 overrups 0 frame 0	RX errors 0 dropped 0 overrups 0 frame 0
TX packets 16328 butes 1434738 /1 3 MiB)	The product of 16232 but as 1416535 (1.3 MiR)
TY parkets 0 dropped o proping 0 carrier 0 colligions 0	TX parkets 0 dyce 1410000 (1.5 Mp)
ix errors of aropped o overruns of carrier of corrisions of	ix errors of aropped o overruns of carrier of confisions of
oracle@oracle19c-o18-primary:ora19c:/home/oracle>	oracle@oracle19c-o18-standbv:ora19csb:/home/oracle>
oracle@oracle19c-ol8-primary:ora19c:/home/oracle> sglplus / as sysdba	oracle@oracle19c-o18-standby:ora19csb:/home/oracle>_sqlplus / as_sysdba
SOL*Plus: Release 19.0.0.0.0 - Production on Sat Aug 21 20:21:15 2021	SQL*Plus: Release 19.0.0.0.0 - Production on Sat Aug 21 20:21:35 2021
Version 19.12.0.0.0	Version 19.12.0.0.0
Copyright (c) 1982, 2021, Oracle. All rights reserved.	Copyright (c) 1982, 2021, Oracle. All rights reserved.
Connected to:	Connected to:
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production	Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19 12 0 0 0	Version 19.12.0.0.0
SQL> select name,database_role,open_mode from v\$database;	SQL> select name,database_role,open_mode from v\$database;
	NAME - DATERAGE PALE OPEN MODE -
NAME DATABASE ROLE OPEN MODE	
ORA19C PRIMARY READ WRITE	ORA19C PHYSICAL STANDBY MOUNTED
SQL> exit	SQL> exits
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production	Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0	Version 19.12.0.0.0
	oracleWoraclel9c-ol8-standby.oral9csb:/home/oracle>

FIGURE 53. Primary and Standby Oracle Database Details

Setup of Oracle Data Guard and Oracle GoldenGate are beyond the scope of this paper. Learn more about Oracle Data Guard.

The primary and standby database statuses are as shown below. There is no archive log gap on the standby database.

Primary Oracle Database VM Oracle19C-OL8-Primary	Standby Oracle Database VM Oracle19C-OL8-Standby
SQL> SELECT sequence#, first_time, next_time, applied FROM v\$archived_log ORDER BY sequence#; SEQUENCE# FIRST_TIM_NEXT_TIME_APPLIED 	SQL> SELECT ARCH.THREAD# "Thread", ARCH.SEQUENCE# "Last Sequence Received", APPL.SEQUENCE# "Last Sequence Applied", ARCH.SEQUENCE# - APPL.SEQUENCE# "Difference" FROM (SELECT THREAD#,SEQUENCE# FROM V\$ARCHIVED_LOG WHERE (THREAD#,FIRST_TIME) IN (SELECT THREAD#,MAX(FIRST_TIME) FROM V\$LOG_HISTORY WHERE (THREAD#,FIRST_TIME) IN (SELECT THREAD#,MAX(FIRST_TIME) FROM V\$LOG_HISTORY WHERE (THREAD#,FIRST_TIME) IN (SELECT THREAD#,MAX(FIRST_TIME) FROM V\$LOG_HISTORY GROUP BY THREAD#, MAX(FIRST_TIME) IN (SELECT THREAD#, MAX(FIRST_TIME) FROM V\$LOG_HISTORY GROUP BY THREAD#, MAX(FIRST_TIME) IN (SELECT THREAD#, MAX(FIRST_TIME) FROM V\$LOG_HISTORY GROUP BY THREAD#, MAX(FIRST_TIME) IN (SELECT THREAD#, MAX(FIRST_TIME) FROM V\$LOG_HISTORY GROUP BY THREAD#, MAX(FIRST_TIME) IN (SELECT THREAD#, MAX(FIRST_TIME) FROM V\$LOG_HISTORY GROUP BY THREAD#, MAX(FIRST_TIME) IN (SELECT THREA LAST Sequence ARCHARAD#, SEQUENCE APPLICE AND A SECURATED A SECU
17 02-AUG-21 02-AUG-21 NO 17 02-AUG-21 03-AUG-21 NO 18 03-AUG-21 03-AUG-21 NO 19 03-AUG-21 03-AUG-21 NO 20 03-AUG-21 03-AUG-21 NO 20 03-AUG-21 03-AUG-21 NO 20 03-AUG-21 04-AUG-21 NO 48 04-AUG-21 04-AUG-21 NO 48 04-AUG-21 04-AUG-21 NO 48 04-AUG-21 04-AUG-21 NO 70 rows selected:	1 49 49 10 SQL> SQL> SELECT * FROM V\$ARCHIVE_GAP; no rows selected SQL>

FIGURE 54. Primary and Standby Oracle Database Status



The standby Oracle VM **Oracle19c-OL8-Standby** alert log for the database **ora19c** on Site B shows no errors and shows redo log application as they are generated on primary database on Site A.

started with pid=50, OS id=3599 $\,$ tarting background process ARC7 021-08-04T12:37:59.207328-07:00 RC9 started with pid=53, OS id=3610 021-08-04T12:37:59.233589-07:00 MON (PID:3546): ARC3: Archival started MON (PID:3546): ARC4: Archival started MON (FID:3546): ARC5: Archival started MON (PID:3546): ARC5: Archival started MON (PID:3546): ARC6: Archival started MON (PID:3546): ARC8: Archival started MON (PID:3546): ARC9: Archival started MON (FID:3546): MRCS, HEOR VALUE MON (FID:3546): STARTING ARCH PROCESSES COMPLETE 021-08-04T12:38:03.477307-07:00 rfs (FID:3628): krsr_rfs_atc: Identified database type as 'PHYSICAL STANDBY': Client is Foreground (FID:3584) 021-08-04T12:38:03.477329-07:00 rfs (PID:3631): krsr_rfs_atc: Identified database type as 'PHYSICAL STANDBY': Client is ASYNC (PID:3632) rfs (PID:3631): Primary database is in MAXIMUM PERFORMANCE mode 021-08-04T12:38:03.540775-07:00 rfs (PID:3634): krsr_rfs_atc: Identified database type as 'PHYSICAL STANDBY': Client is FAL (PID:3599)
021-08-04T12:38:03.691470-07:00 021-08-04T12:38:03.790533-07:00 RC0 (PID:3572): Archived Log entry 32 added for T-1.S-49 ID 0x437cbe33 LAD:1 IRPO started with pid=57, OS id=3643 021-08-04T12:38:06.411115-07:00 Started logmerger process 021-08-04T12:38:11.445963-07:00 ax pdb is 3 ROO (PID:3646): Media Recovery Log +DATA_DG/ORA19CSB/ARCHIVELOG/2021_08_04/thread_1_seq_49.318.1079699883 ROO (PID:3646): Media Recovery Waiting for T-1.S-50 (in transit) 021-08-04T12:38:11.881635-07:00 ecovery of Online Redo Log: Thread 1 Group 5 Seq 50 Reading mem 0 Mem# 0: +DATA_DG/ORA19CSB/stdby_group05_redo01.log Mem# 1: +DATA_DG/ORA19CSB/stdby_group05_redo02.log

FIGURE 55. Alert log for Standby Oracle Database on Site B



Primary-standby log shipping can be tested by switching log files on the primary database on Site A and observing the same log sequence being applied on the standby database on Site B.



FIGURE 56. Log Switch on Primary Database Results in Changes Applied on Standby Database

Oracle Data Guard role transitions switchover and failover are the same as those for any physical architecture. Learn more about *role transitions*.

The Oracle Databases on VMware Best Practices Guide provides best practice guidelines for deploying Oracle workloads on a VMware SDDC.

In addition to this guide, VMware has created separate best practice documents for storage, networking, and performance. They can be found for the versions specific to vSphere *here*.

Deploying Oracle Workloads on VMware Cloud on AWS

The steps to deploy production single-instance Oracle database **ora19c** on VM **Oracle19c12-OEL83-VMC** Oracle database on VMware Cloud on AWS are no different than those required to deploy a single-instance Oracle database on any VMware vSphere platform.

A VM template **Template-OL8-ORA19C** with all of the required OS patches is used to provision the below VM. Oracle ASM with Oracle ASMLib was used to provision the database storage.

```
bracle@oraclel9012-oel83-vmc:oral9ci/home/oracle> inconfig -a
eth0: flags=4163:Up, BKOADCAST, RUNNINGS/ mULTICAST> mtu 1500
inet 172.16.115.45 netmask 255.255.05 broadcast 172.16.115.255
ether 00:505:63:0:a2:f9 txqueuelen 1000 (Ethernet)
RX packets 4044 bytes 719944 (703.0 KlB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 32:1 bytes 618036 (603.6 KLB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
lo: flags=73<UpLoOPBACK,RUNNING> mtu 65536
inet 127.0.0.1 netmask 255.0.0.0
loop txqueuelen 1000 (Local Loopback)
RX packets 15735 bytes 1556182 (1.4 MLB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 15735 bytes 1556182 (1.4 MLB)
RX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
oracle@oracle19c12-oel83-vmc:oral9c:/home/oracle>
pracle@oracle19c12-oel83-vmc:oral9c:/home/oracle>
connected to:
Dracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
SQL> select name from v$database;
NAME
SQL> exit
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.122.0.0.0
SQL> exit
Disconnected 19c12-oel83-vmc:oral9c:/home/oracle>
SQL> exit
Disconnected 10c Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
SQL> exit
Disconnected 10c Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
SQL> exit
Disconnected 10c Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
SQL> exit
Disconnected 10c Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
SQL> exit
Disconnected 10c Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
SQL> exit
Disconnected 10c Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
SQL> exit
Disconnected 10c Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
SQL> exit
Disconnected 10c Oracle Database 19c Enterprise Edition Release 19.0.0.
```

FIGURE 57. Oracle Database ora19c in VM Oracle19c12-OEL83-VMC on VMware Cloud on AWS

The steps to deploy a production single-instance physical standby database ora19c on VM Oracle19c-OL8-Standby on VMware Cloud on AWS are no different than those required to deploy the same physical standby architecture on Site B, with the primary instance on VM Oracle19c-OL8-Primary on Site A.

Two VMs are utilized for this use case:

- Primary Oracle database VM Oracle19c-OL8-Primary with IP address 172.16.14.50 on Site A
- Physical standby database VM Oracle19c-OL8-Standby with IP address 172.16.115.51 on VMware Cloud on AWS



FIGURE 58. Primary and Standby Oracle Database Details

Setup of Oracle Data Guard and Oracle GoldenGate are beyond the scope of this paper. Learn more about Oracle Data Guard.

The standby Oracle VM **Oracle19c-OL8-Standby** alert log for the database **ora19c** on VMware Cloud on AWS shows no errors and shows redo log application as generated on the primary database on Site A.

ARC3 started with pid=47, OS id=4536 Starting background process ARC5 2021-08-23T10:51:08.244937-07:00 ARC6 started with pid=50, OS id=4545 Starting background process ARC7 Completed: ALTER DATABASE MOUNT 2021-08-23T10:51:08.279167-07:00 Starting background process ARC8 alter database recover managed standby database disconnect from session nodelay ARC8 started with pid=38, OS id=4552 2021-08-23T10:51:08.309609-07:00 Attempt to start background Managed Standby Recovery process (oral9csb) ARC9 started with pid=53, OS id=4556 2021-08-23T10:51:08.323701-07:00 TMON (PID:4492): ARC1: Archival started TMON (PID:4492): ARC1: Archival started Starting background process MRPO TMON (PID:4492): ARC2: Archival started TMON (PID:4492): ARC3: Archival started TMON (PID:4492): ARC4: Archival started TMON (PID:4492): ARC5: Archival started TMON (PID:4492): ARC6: Archival started TMON (PID:4492): ARC7: Archival started TMON (PID:4492): ARC8: Archival started TMON (PID:4492): ARC8: Archival started TMON (PID:4492): ARC9: Archival started MRPO started with pid=54, OS id=4559 2021-08-23T10:51:08.339725-07:00 Background Managed Standby Recovery process started (ora19csb) 2021-08-23T10:51:13.361132-07:00 Started logmerger process 2021-08-23T10:51:13.400193-07:00 PROO (PID:4562): Managed Standby Recovery starting Real Time Apply max_pdb is 3 2021-08-23T10:51:13.617769-07:00 Parallel Media Recovery started with 8 slaves 2021-08-23T10:51:13.654057-07:00 Stopping change tracking 2021-08-23T10:51:13.817537-07:00 Mem# 0: +DATA_DG/ORA19CSB/stdby_group05_redo01.log Mem# 1: +DATA_DG/ORA19CSB/stdby_group05_redo02.log database for recovery-related files, and does not reflect the amount of space available in the underlying filesystem or ASM diskgroup. racle@oracle19c-ol8-standby:ora19csb:/hom

```
FIGURE 59. Alert Log for Standby Oracle Database on VMware Cloud on AWS
```



Primary-standby log shipping can be tested by switching log files on the Site A primary database and observing the same log sequence being applied on the VMware Cloud on AWS standby database.



FIGURE 60. Log Switch on Primary Database Results in Changes Applied on Standby Database

Oracle Data Guard role transitions switchover and failover are the same when working with any physical architecture. Learn more about *role transitions*.

The Oracle Databases on VMware Best Practices Guide provides best practice guidelines for deploying Oracle workloads on a VMware SDDC.

In addition to this guide, VMware has created separate best practice documents for storage, networking, and performance. They can be found for the versions specific to vSphere *here*.

Migration methodology for Oracle Workloads to VMware Cloud on AWS

Existing single-instance Oracle workloads can be migrated transparently and seamlessly, without any application refactoring, from on-premises Site A or Site B to VMware Cloud on AWS.

There are broadly two ways existing Oracle workloads can be migrated from on-premises to VMware Cloud on AWS, depending on certain restrictions:

- Using VMware and Oracle native tools
- Using VMware Hybrid Cloud Extension

Using VMware and Oracle Native Tools

The section below describes the methods for migrating Oracle single-instance workloads to VMware Cloud on AWS using a mix of VMware vSphere and Oracle native tools.

Using Oracle Native Tools

Migrating Oracle single-instance workloads to VMware Cloud on AWS using Oracle native tools can be achieved by using any of the below tools:

- Oracle Data Guard to set up replication between the two sites and failover to VMware Cloud on AWS after replication is complete
- Oracle GoldenGate
- Backup and recovery of on-premises Oracle databases using Oracle RMAN to VMware Cloud on AWS



All of these Oracle utilities operate at an Oracle application level and are therefore completely transparent to the underlying physical infrastructure.

Oracle Data Guard role transitions switchover and failover are the same when working with any physical architecture. Learn more about *role transitions*.

Set up of Oracle Data Guard and Oracle GoldenGate are beyond the scope of this paper. Learn more about Oracle Data Guard.

Using VMware vSphere Native Tools

Migrating Oracle single-instance workloads to VMware Cloud on AWS using VMware vSphere native tools can be achieved by using regular Cross vCenter vMotion.

Click Edit Settings on VM Oracle19c12-OEL83 and select Cross vCenter Server export,



 \bigcirc Change both compute resource and storage

Migrate the virtual machines to a specific host or cluster and their storage to a specific datastore or datastore cluster.

Cross vCenter Server export

Migrate the virtual machines to a vCenter Server not linked to the current SSO domain.

FIGURE 61. Cross vCenter vMotion for VM Oracle19c12-OEL83



Select a target vCenter, compare resource and storage.



FIGURE 62. Target vCenter, Compare Resource and Storage for VM Oracle19c12-OEL83

Select target network details for VM Oracle19c12-OEL83.

Migrate Oracle19c12	-OEL83			
 ✓ 1 Select a migration type ✓ 2 Select a target vCenter 	Select folder Select the destination virtual machine folder for the virtual machine migration.	VM origin ()		
Select a migration type Select a compute resour. Select a compute resour. Select arcage Select arcage Select networks Select networks Ready to complete	Select the desthation virtual machine folder for the virtual machine migration. Select location for the virtual machine migration.	vi engin u		
	Competibility checks succeeded. Migrate Oracle19c12-	CANCEL BACK NEXT		
	 1 Select a migration type 2 Select a target vCenter 3 Select a compute resour 4 Select storage 5 Select folder 6 Select networks 7 Ready to complete 	Select networks Select destination networ Migrate VM networking b Source Network APPS-1614	its for the virtual machine migration. y selecting a new destination network for all VM net Used By 1 VMs / 1 Network adapters	WM origin Work adapters attached to the same source network. Destination Network Apps Team 01

FIGURE 63. Target Network Details for VM Oracle19c12-OEL83

The migration summary for VM Oracle19c12-OEL83 is as shown below:

Migrate | Oracle19c12-OEL83

1 Select a migration type

Ready to complete Verify that the information is correct and click Finish to start the migration.

- 2 Select a target vCenter ...3 Select a compute resour...
- 4 Select storage
- 🗸 5 Select folder
- 6 Select networks

7 Ready to complete

Migration Type	Change compute resource and storage
Virtual Machine	Oracle19c12-OEL83
Cluster	Cluster-1
Resource Pool	Compute-ResourcePool
Storage	WorkloadDatastore
Disk Format	As defined in the VM storage policy
Networks	Virtual network adapters from APPS-1614 will be reassigned to "Apps Team 01"



The VM Oracle19c12-OEL83 has been successfully migrated to VMware Cloud on AWS.

🔂 Oracle19c1	2-OEL8	3 ▷ □ ⊑	2 🖗		ons 🗸		
Summary Monito	or Conf	igure Permis	sions	Datastores	Networks	Snapshots	
Powered On LAUNCH WEB CONSOL LAUNCH REMOTE CON	e Sole (j)	Guest OS: Compatibility: VMware Tools: DNS Name: IP Addresses: Host: &	Oracle ESXí 7 Runnir MORE I oracle 172.16. 10.129.	Linux 8 (64-bit) .0 and later (VM ag, version:11328 INFO 19c12-oel83 115.45 32.5	l version 17) (Guest Managec	1)	
VM Hardware							
> CPU				8 CPU(s)			
> Memory				<mark>-</mark> 32 GB, 24 GE	3 memory active		
> Hard disk 1				80 GB			
Total hard disks	5			3 hard disks			
> Network adapte	er 1			Apps Team 01 (connected)		
CD/DVD drive 1				Disconnected			q
> Video card				8 MB			
VMCI device				Device on the w machine comm	rirtual machine PC unication interfac	CI bus that provides support for the e	virtua
> Other				Additional Hard	ware		
Compatibility				ESXí 7.0 and lat	er (VM version 17	7)	

FIGURE 65. VM Oracle19c12-OEL83 on VMware Cloud on AWS

Migration of production single-instance physical standby Oracle VM **Oracle19c-OL8-Standby** from on-premises Site B to VMware Cloud on AWS is no different than the above scenario in which VM **Oracle19c12-OEL83** is migrated from Site A to VMware Cloud on AWS.

Using VMware Hybrid Cloud Extension

VMware Hybrid Cloud Extension abstracts on-premises versus cloud notions and presents capabilities to VMs as a continuous hybrid cloud. VMs can be moved to and from VMware Hybrid Cloud Extension-activated data centers using multiple migration technologies.

Currently, the five different Hybrid Cloud Extension methods are:

- VMware Hybrid Cloud Extension Bulk Migration
- VMware Hybrid Cloud Extension Cold Migration
- VMware Hybrid Cloud Extension vMotion
- VMware Hybrid Cloud Extension Replication Assisted vMotion
- VMware Hybrid Cloud Extension OS Assisted Migration

Learn more about VMware Hybrid Cloud Extension migration types.

The methods mentioned above (except Hybrid Cloud Extension OS Assisted Migration) can be used to migrate standalone Oracle workloads as SLA requirements dictate.

The migration of Oracle VMs using Hybrid Cloud Extension OS Assisted Migration is outside the scope of this paper.

VMs with shared disks using multi-writer attribute are NOT supported because of the shared disk restriction (i.e., VMs with shared .vmdk files) using VMware Hybrid Cloud Extension migration methods. More information on this restriction can be found in *Hybrid Migration with VMware Hybrid Cloud Extension Checklist*. In any event, if VMs with multi-writer attribute can be migrated, the resulting multi-writer configuration is no longer functional, as outlines in the restrictions section of *Understanding VMware Hybrid Cloud Extension Bulk Migration*.

The production single-instance Oracle VM Oracle19c12-OEL83 on Site A was used for all Hybrid Cloud Extension deployments.

Some caveats that one may encounter during Hybrid Cloud Extension migration:

 Migration of VMs between ESXi hosts with different CPU models may create an issue because vMotion requires the same family of CPUs among the ESXi hosts to ensure the same CPU feature set is presented to all VMs. Refer to KB 1003212 "The target host does not support the VM's current hardware requirements" error during vMotion migration of a VM (1003212). One can enable per-VM EVC as shown below:

🔁 Oracle19c12-OEL83 ▷ 🗆 🛱 🧔 🐼 астіоня м								
Summary Monitor	Configure Permissions Datastores Networks Snapshots Updates							
Settings 🗸 🗸	VMware EVC is Enabled							
VM SDRS Rules	> CPU Mode	Intel® "Broadwell" Generation						
vApp Options Alarm Definitions	> CPU Feature Set	<i>57 Features</i>						
Scheduled Tasks								
Policies								
VMware EVC								
Guest User Mappings								
Pure Storage 🛛 🗸								
Virtual Volumes								
INFINIDAT								

FIGURE 66. VMware EVC CPU Mode

- Occasionally, an issue may arise using bulk migration at the time of cutover because a guest OS may not reach a fully powered off state within 100 seconds of the initial Shutdown Guest OS call (as part of bulk migration cutover). If the 100 second period elapses and the VM does not reflect a powered off status, the migration will fail. If VMware Tools is not detected on the guest OS, premigration validation will prompt a user to select Force Power Off.
- With Force Power Off selected, VMware Hybrid Cloud Extension Bulk Migration still utilizes VMware Tools (if present) to gracefully shutdown a guest OS. After 100 seconds has elapsed since the initial **Shutdown Guest OS** call, an immediate power off will be performed (if necessary) on the VM to move forward with the migration.

Refer to KB 82269 Unable to Power Off Guest OS during Switchover Using Hybrid Cloud Extension Bulk Migration (82269).

• Using the on-premises vSphere client (Hybrid Cloud Extension plug-in), one may occasionally encounter a message during bulk migration validation check: "Non-VMware or out of date tools detected on [VM name]. Hybrid Cloud Extension will attempt a graceful shutdown" is displayed during the bulk migration validation check.

Refer to KB 74740 for more details.



Migrating Oracle Single-Instance Workloads Using Hybrid Cloud Extension Bulk Migration

Bulk migration uses the host-based replication to move a VM between Hybrid Cloud Extension data centers. To reduce the downtime, the source VM remains online during the replication and is bootstrapped on the destination ESX host after replication completes.

Learn more about Hybrid Cloud Extension Bulk Migration.

The production single-instance Oracle VM **Oracle19c12-OEL83** on Site A was used for the Hybrid Cloud Extension bulk migration deployment use case.

Oracle VM Oracle19c12-OEL83 was powered up with IP Address 172.16.14.45 with database ora19c online. Click Migrate and add VM Oracle19c12-OEL83 to the migration process.

VM VMware HCX			
Obstand O	C WEANYE C C		
Remote Site Connection: Reverse Migration Image: Source: hcx.vslab.local-enterprise / Vi https://hcx.sdde-44-232-220-14_vmm/arevmc.com / Vi	C: sc2wvc03.vslab.local → 😰 Destination: HCX Cloud - VMC-VSLAB / VC: v	vcenter.sddc-44-232-220-144.vmwarevmc.com	C Reload Connections
Group Name: Oracle-VM-HCX			No VMs is selected for migration 🖀 Select VMs for Migration
Image: Second	86092/2/10 #837155/c6	Besources (stat/steary / cm) 0 000 058 32 08 / 8 0 000 08 / 32 08 / 8 0	Selection size: 1/vis/ 650 cs/ 32 cs/ 8/cgu CANCEL
			► GO Ø VALIDATE H SAVE CLOSE

FIGURE 67. Add VM Oracle19c12-OEL83 to Migration Process

Select the target Compute-Resource Pool.

Workload Mobility

Remote Site Connection: Reverse Migration					
> Ø Source: hcx.vslab.local-enterprise / VC: sc2wvc03.vslab.local → Ø Destination: HCX Cl https://hcx.sdc-44-232-220-144.vmwarevmc.com	loud - VMC-VSLAB / VC:	vcenter.sddc-44-232-220-144.vmwarevmc.com			C Reload Connections
Group Name: Oracle-VM-HCX				Batch size: 1 VM / 660 GE	B / 32 GB / 8 vcPU Select VMs for Migration
Transfer and Placement: (Mandatory: Compute Container) (Secret/Destination Folder) Construction Folder)	들 (Mandatory: S 들 잠 Same format a	torage) sis source	*	(Migration Profile) (Optional: Switchover Schedule)	°.
Simulation Section 2010 Control Contro Control Control Contro		Destination Compute Container SDDC:Datacenter I Output			Q.
VM for Migration Concentration	Disk / Memory / v C 660 GB /	Concerte Resources Compute ResourcesPool Migmil-ResourcesPool 10.129.32.4 10.129.32.5 10.129.128.4		Migration profile is not specified!)	

► GO VALIDATE H SAVE CLOSE

FIGURE 68. Select Target Compute-Resource Pool

Select the target Destination Folder.

Workload Mobility

Remote Site Connection: Reverse Migration						
Source: hcx.vslab.local-enterprise / VC: sc2wvc03.vslab.local → Destination: H https://hcx.sdde-44-232-220-144.vmwarevmc.com	ICX Cloud - V	MC-VSLAB / VC:	vcenter.sddc-44-232-220-144.vmwarevmc.com			C Reload Connections
Group Name: Oracle-VM-HCX					Batch size: 1 VM / 660 GB /	32 GB / 8 vCPU Select VMs for Migration
✓ Transfer and Placement:						
Compute-ResourcePool	-	📋 (Mandatory: SI	torage)	-	(Migration Profile)	~
(Specify Destination Folder)	-	Same format a	as source	~	(Optional: Switchover Schedule)	0
> Switchover:						
✓ Extended Options:			Destination Folder			
Edit Extended Options			×			
			V BSDDC-Datacenter			Q
VM for Migration	~	Disk (Memory (10	Discovered virtual machine Management VMs		Migration Info	
VM for Migration	_	Disk / Memory / vo	Templates		Migration into	
U Soracle19c12-OEL83	ڻ ا	660.GB/	VMs migrated to cloud		(Migration profile is not specified!)	
			Workloads			
			× ×			
			SELECT CANCEL			

► GO Ø VALIDATE H SAVE CLOSE

FIGURE 69. Select Destination Folder

Select the target datastore **WorkloadDatastore**.

Workload Mobility

Source: hcx.vslab.local-enterprise / VC: sc2wvc03.vslab.local- https://hcxsddc-44-232-220-144.vmwarevmc.com	al → 📴 Destination: HCX Cloud - VMC-VSLAB / VC: vcenter.sddc-44-232-220-144.vmwa	irevmc.com		
roup Name: Oracle-VM-HCX			Batch size: 1 VM /	560 GB / 32 GB / 8 vCPU Select VMs for Migration
 Transfer and Placement: 				
Compute-ResourcePool	(Mandatory: Storage)	-	(Migration Profile)	~
Workloads	Same format as source	~	(Optional: Switchover Schedule)	٥
> Switchover:				
✓ Extended Options:	Destination Storage			
Edit Extended Options	Storage profile: Datastore Default Storage Policy 🗸		^	
	show inapplicable (1)	9		٩
/M for Migration	Datastore / Storage Cluster	Space (Free / Tot	etal) n Info	
b. Oracle (0.42, 0.71, 0.3)	vsanDatastore (SDDC Datacenter)	14 TB (68%) / 20.7 TB	in profile is not apprified().	
> Oradelaciz-DEE83	🗸 🗹 WorkloadDatastore (SDDC-Datacenter)	14 TB (68%) / 20.7 TB	in prome is not specifiedly	
		SELECT CANG	CEL	

GO VALIDATE SAVE CLOSE

► GO Ø VALIDATE H SAVE CLOSE

FIGURE 70. Select Target Datastore

Select the migration profile **Bulk Migration**.

Workload Mobility

Remote Site Connection: C Reverse Migration				
> Ø Source: hcx.vslab.local-enterprise / VC: sc2wvc03.vslab.local → Ø Destination: HCX Cle https://hcx.scic.44-232-220-144.vmwsrevmc.com	oud - VN	IC-VSLAB / VC: vcenter.sddc-44-232-220-144.vmwarevmc.com		C ¹ Reload Connections
Group Name: Oracle-VM-HCX				Batch size: 1VM / 660 GB / 32 GB / 8 vCPU 🖀 Select VMs for Migration
✓ Transfer and Placement:				
Compute-ResourcePool	-	WorkloadDatastore (14 TB / 20.7 TB)	-	(Migration Profile) V
Workloads	-	Same format as source	~	(Migration Profile)
> Switchover:			-	VMotion
✓ Extended Options:			-	Penication assisted vMotion
Edit Extended Options				
				٩
VM for Migration		Disk / Memory / vCPU		Migration Info
Coracle19c12-OEL83	Ċ	660 GB / 32 GB / 8 vCPU		(Migration profile is not specifiedt)

FIGURE 71. Select Migration Profile


Select target network port group Apps Team 01. The Force Power-off VM is optional (refer to KB 82269).

Workload Mobility

Remote Site Connection: U Reverse Migration					
Source: hcx.vslab.local-enterprise / VC: sc2wvc03.vslab.local - https://hcx.sdic-44-232-220-144.vmwarevmc.com	→ ② Destination: HCX Cloud - VMC-VSLAB / VC: vcenter.sddc-44-232-220-144.vmv	varevmc.com			C Reload Connection:
Group Name: Oracle-VM-HCX				Batch size: 1 VM	/ 660 GB / 32 GB / 8 vCPU
✓ Transfer and Placement:					
Compute-ResourcePool	WorkloadDatastore (14 T8 / 20.7 T8)		-	Bulk Migration	~
Workloads	🚍 👫 Same format as source		v	(Optional: Switchover Schedule)	0
> Switchover:	Map Virtual Machine Networks				
> Extended Options:	Network adapter 1 (APPS-1614) → Apps Team 01				
	Hide lower level backing networks.		Q		٩
VM for Migration	Network Name	VLAN / VNI	Switch	n Info	
	Apps Team 01				
♦ Oraclelaciz-OEEas	🗲 🗹 Apps Team 01		NSX Logical Switch		
Compute-ResourcePool	AWS Connected VPC CIDR		NSX Logical Switch	gration	v
Workloads	Cross-vpc-Is			lai, switchover schedule)	0
C Z Force Power-off VM	direct-connect-is				
Enable Seed Checkpoint	hcx-a8fdf7ce-8483-45c5-9213-c6f3ebf991af				
Edit Extended Options Retain MAC *	mgmt-app-network				
>	mgmt-is			- I	-
	nsx-dlinkO-vis				
	o-vmk0-is				
	Oracle Private			*	
			SELECT	EL	
					► GO Ø VALIDATE H SAVE CLOSE

FIGURE 72. Select Target Network Port Groups

Assign target IP address 172.16.115.45 with gateway and netmask information to the VM as shown below:

Workload Mobility

Remote Site Connection: U Reverse Migration					
Source: hcx.vslab.local-enterprise / VC: sc2wvc03.vslab.l https://hcx.sddc-44-232-220-144.vmwerevmc.com	local → 📴 Destination: HCX Cloud - VMC-VSLAB / \	/C: vcenter.sddc-44-232-220-144.vmwarevmc.com			C Reload Connections
Group Name: Oracle-VM-HCX				Batch size: 1 VM / 260 GB /	32 GB / 8 vCPU Select VMs for Migration
✓ Transfer and Placement:					
Compute-ResourcePool	Sector Se	Datastore (14.1 TB / 20.7 TB)	Bulk Migration		~
Workloads	🚍 👘 Same form	at as source	✓ (Optional: Switcher)	over Schedule)	O
V Switchover:					
Force Power-off VM	Remove Force un	Snapshots mount ISO Images			
✓ Extended Options:					
Edit Extended Options Retain MAC					
VM for Migration	Disk / Memory ,	(vCPU	Migration Info		
1. V Orade19c12-OEL83	(U) 260 GB/	32 GB / 8 vCPU			
Compute-ResourcePool	Section Workload	Datastore (14.1 TB / 20.7 TB)	Bulk Migration		~
Workloads	🚍 🎂 Same form	at as source	✓ (Optional: Switch)	over Schedule)	0
Force Power-off VM Enable Seed Checkpoint Edit Extended Callons Retain MAC *					
×	🖌 Network	adapter 1 (APPS-1614) → Apps Team 01			
Primary Connec	NIC: 💋 IP Address: 172.16.115.45 ted: 🗹	Gateway: 172.16.115.1	Subnet Mask	255.255.255.0	
				► GO	VALIDATE SAVE CLOSE

FIGURE 73. Assign Target IP address 172.16.115.45

Assign DNS information to the workflow.

Workload Mobility

Validation is Successful, You can proceed with Migration Migration could fail as one or more Virtual Machines have warning(s). Please review them before proceedin	ıg.	Hide all (8)
Group Name: Oracle-VM-HCX		Batch size: 1 vm / 260 GB / 32 GB / 8 vcRv 🖀 Select VMs for Migration
✓ Transfer and Placement:		
Compute-ResourcePool Workloads	Extended Options	Bulk Migration V (Optional: Switchover Schedule)
✓ Switchover:	✓ Retain MAC 🏶	A
Force Power-off VM	Upgrade Virtual Hardware	
v Extended Ontions:	Upgrade VMware Tools	
	Deactivate Per-VM EVC	
Recail made	Host Name	
	Domain Name	Q
VM for Migration	Personalization Script	ligration Info
¹ ✔ Oracle19c12-OEL83	Generate a new Security Identifier (SID)	
Compute-ResourcePool	Resize CPU	Extended Options: DNS Customization
Workloads	Resize Memory	
Force Power-off VM Enable Seed Checkpoint	Replicate Security Tags	Apply Option
Edit Extended Collicos Retain MAC 🐐	Migrate Custom Attributes	Primary DNS servers host controlling zone files, while secondary DNS servers are used for reliability and redundancy.
Primary NIC: 2 IP Address: 172.16.11 Connected: 2	5.45	DNS Suffix : vslab.local Primary DNS : 172.16.31.6 Secondary DNS 172.16.31.7
Non VMware or out of date tools detected on Oracle19ct2-OEL83. HCX will attempt a graceful shutdown DNS is not provided for as part of quest customization, it will be reset	L .	1. Network adapter 1 (APPS-1614) → Apps Team 01
		Primary DNS : 172.16.31.6 Secondary DNS : 172.16.31.7
		SAVE

FIGURE 74. Assign DNS Information

Click Validate to validate the configuration.

Workload Mobility Remote Site Connection: Reverse Migration S 2 Source: hcx.vslab.local-enterprise / VC: sc2wvc03.vslab.local → 2 Destination: HCX Cloud - VMC-VSLAB / VC: vcenter.sddc-44-232-220-144.vmwarevmc.com Group Name: Oracle-VM-HCX Batch size: 1 vM / 660 GB / 32 GB / 8 vcPU ✓ Transfer and Placement: Compute-ResourcePool WorkloadDatastore (14 TB / 20.7 TB) Same format as source Bulk Migration -(Optional: Switchover Schedule) 0 > Switchover: > Extended Options: VM for Migration Disk / Memory / vCPU Migration Info 0 660 GB/ 32 GB/ 8 VCPU V Oracle19c12-OEL83 Compute-ResourcePool WorkloadDatastore (14 TB / 20.7 TB Same format as source Bulk Migration (Optional: Switchover Schedule) ***** 0 Force Power-off VM Enable Seed Checkpoint Edit Extended Options Retain MAC * > Network adapter 1 (APPS-1614) → Apps Team 01 2 GOT @ VALIDATE SAVE CLOSE

FIGURE 75. Validate the Configuration



Refer to KB 74740 for more details regarding the VMware Tools message shown below:

Workload Mobility

Validation is Successful, You can proceed with Migration Aligration could fail as one or more Virtual Machines have warning(a). Please review them before proceedin				Hide all 🛞
Group Name: Oracle-VM-HCX			Batch size: 1 VM / 660 GB /	32 GB / 8 vCPU Select VMs for Migration
✓ Transfer and Placement:				
Compute-ResourcePool	WorkloadDatastore (14 T8 / 20.7 T8)	-	Bulk Migration	×
Workloads 5	Same format as source	~	(Optional: Switchover Schedule)	٥
> Switchover:				
> Extended Options:				
				Q
VM for Migration	Disk / Memory / vCPU		Migration Info	
¹ . ✓ Oracle19c12-OEL83	0 660 GB / 32 GB / 8 VCPU			
Compute-ResourcePool	WorkloadDatastore (14 TB / 20.7 TB)	-	Bulk Migration	, ,
Workloads	Same format as source	~	(Optional: Switchover Schedule)	0
Force Porger off VM Force Porger off VM Force Porger of VM Retain MAC Retain MAC Retain MAC	Network edunter 1 (APPS-IGIA) ->Apps Team 01			-
A Non VMware or out of date tools detected on Oracle19ct2-OEL83, HCX will attempt a graceful shutdown				
			► 00	VALIDATE H SAVE CLOSE

FIGURE 76. VMware Tools Message

Click **Go** to start the migration.

Steps for the migration start are as shown below:

Migration								
E Tracking E Management C D ARCHIVE								
Migrating VM	Storage/ Memory/ CPUs	Progress		Start 🖉 E	End	Status		
\sim \bigcirc sc2wvc03.vslab.local → \bigcirc vcenter.sddc-44-232-22	0-144.vmwarevmc.co	m						
Cracle19c12-OEL83	660 GB / 32 GB /	8 7% Base Sync	() +1h:11m est.time	1:24 PM PDT Aug 24		Transfer Started		
Destination Resource Pool : O Compute-ResourcePool	Datastore :	G WorkloadDatastore		Migratio	on ID : 97660485-f673-4ae7-809	99-93df4ca83440		
Destination Datacenter : B SDDC-Datacenter	Disk Format :	Same format as source		Migration Grou	up ID : 2ff4a4a8-0abf-4940-9b0d	5-0a1b9c3715ea		
Destination Folder : D Workloads				Migration Pr	rofile : 🗁 Bulk Migration			
				Maintenance Win	ndow : 🛗 Not Scheduled			
Migration Options : Force Power-Off VM (Retain Mac)								
\bigcirc APPS-1614 \rightarrow	🖵 Apps Team 01		Transfer Country		CEVENTS			
			Transfer Events:		Start Validating course details			
			2 11 ago		+17c Validating target details			
			3. 2 hr ago		1776 Collecting course details			
			4 2 hr ago		+47c Collecting source details			
			2 m ago		Collecting target details			
			2 11 ago		+555 Resolving iX appliance			
			2 hr ago		+1m Requesting lock on IX app	plance		
			2 hr ago		+1m Received lock request on	n IX appliance		
			2 hr ago		+1m Granted lock on IX applia	ince		
			2 hr ago		+2m Preparing target side for r	migration		
			2 hr ago		+2m Reserving storage for dis	sks		
			2 hr ago		+2m Creating disks on target of	datastore		
			2 hr ago		+2m Setting disk UUIDs on tar	rget		
			2 hr ago		+2m Initiated Replication confi	ig push on target side IX appliance		
			14. 2 hr ago		+3m Preparing source side for	r migration		
			¹⁵ . 2 hr ago		+3m Initiated Replication confi	ig push on source side IX appliance		
			¹⁶ . 2 hr ago		+3m Enabling replication on so	purce VM		
			¹⁷ . 2 hr ago		+3m Base Sync Initiated			
					(Show less)			
						🔛 Schedule switchover 🛛 🗙 Cancel Migra	tion () Force Power-off	



The migration completes successfully.

Migration	C) @				Search
Name	VMs/ Storage/ Memory/ CPUs	Progress	Start	End	Status
\sim \bigcirc sc2wvc03.vslab.local \rightarrow \bigcirc vcenter.sddc-4	4-232-220-144.vmwarevmc.com				
V Oracle-VM-HCX	1 / 260 GB / 32 GB / 8	O Migration Complete		-	🖂 🖉 🗇
0 / 1 selected			▶ GO SCHEDULE × CA	NCEL ARCHIVE SFOR	CE CLEANUP
1. Oracle19c12-OEL83	260 GB / 32 GB / 8	O Migration Complete	07:49 PM Aug 24	08:44 PM Aug 24	Migration completed
Destination Resource Pool : ⓒ Compute-ResourcePoo Destination Datacerter : 🛄 SDDC-Datacenter Destination Folder : È Workloads Migration Options : Face Power-Off VM F	Datastore :	41. 18 hr ago 42. 18 hr ago 43. 18 hr ago	Migration ID : c2b69999-6259-4 Migration Group ID : 93686ed5-ca87-4 Migration Profile : 3: Buk Migration intenance Window : III Not Scheduled CEVENTS (S) CEVENTS (S) Removing Reptice +53m Migration complet	268-8919-614029039704 aa 1-8a44-0578b 13930e5 lion config on target side IX appliance tilon transfer target side completed ad	2



Oracle VM Oracle19c12-OEL83 is now on VMware Cloud on AWS with IP address 172.16.115.45.

🕆 Oracle19c12-OEL8	33 Þ 🗆 🛃 🖓		ons 🗸		
Summary Monitor Con	ifigure Permissions	Datastores	Networks	Snapshots	
Powered On LAUNCH WEB CONSOLE	Guest OS: Oracl Compatibility: ESXi VMware Tools: Runn DNS Name oracl IP Addresses: 172.16 Host: 10.129 M To Tu	e Linux 8 (64-bit) 7.0 and later (VM ing, version:11328 EINFO e19c12-oei83.vsiat 5.115.45	version 17) (Guest Managec Jocal))	
VM Hardware					
> CPU		8 CPU(s)			
> Memory		32 GB, 3.84 G	6B memory activ	e	
> Hard disk 1		80 GB			
Total hard disks		3 hard disks			
> Network adapter 1		Apps Team 01 (connected)		
CD/DVD drive 1		Disconnected			Q.
> Video card		8 MB			
VMCI device		Device on the v machine commu	irtual machine PO unication interfac	CI bus that provides suppo e	rt for the virtual
> Other		Additional Hard	ware		
Compatibility		ESXi 7.0 and lat	er (VM version 17)	
Edit Settings					

FIGURE 79. Oracle VM Oracle19c12-OEL83 Migration Summary



The database ora19c is up.

FIGURE 80. Database ora19c Alert Log

The alert log for the database shows no errors. Oracle crash recovery is performed when the database starts up, which is normal and expected.

oracle@oracle19c12-oel83:ora19c:/home/oracle> tail -1050 alert ora19c.log
Starting background process TMON
2021-08-25715.43:55.739190-07:00
NOTE: ASMB (index:0) registering with ASM instance as Standard client 0xffffffffffffffffffffffffffffffffffff
2021-08-25T15:43:55.748101-07:00
IMON started with pid=36, OS id=3590
2021-08-25T15:43:55.754935-07:00
NOTE: Loaded library: /opt/oracle/extapi/64/asm/orcl/1/libasm.so
2021-08-25115:43:55,758930-07:00
Setting CPU count to 8
Setting Fig. Form environment = $(u01/ann/oracle)$
D121-08-25#15-43-55_816419-07-00
NOTE: 6 SMB (index:0) (3571) connected to ASM instance +ASM ogid: 3583 (Standard mode: client id Oxfffffffffffffffffffff)
Wile Abide (MRCA (557)) Connected to Abid Instance (Abid, 5555 (Standard Rode) Citche in Caritterittitititi)
Vola Initia background process MADY
Dealterny Demiser of the process mark
JULI OG ZATERARDAGE MAINM
LLIER DATABASE ROOM
2021-00-20110143:03.040053-07:00
MARKA SLATLED WITH PID=36, US IC=3595
2021-06-20110143:05.04039/-0/:00
VOTE: MARK HAS SUBSCILEG
2021-08-25115:43:59-036350-07:00
VOTE: ASMB mounting group 1 (DATA_DG)
NOTE: Assigning number (1,1) to disk (ORCL:DATA_DISK02)
SUCCESS: mounted group 1 (DATA_DG)
NOTE: grp 1 disk 1: DATA_DISK02 path:ORCL:DATA_DISK02
2021-08-25T15:43:59.218575-07:00
GRROR: failed to establish dependency between database ORA19C and diskgroup resource ora.DATA_DG.dg
2021-08-25T15:44:03.287143-07:00
(PID:3592): Redo network throttle feature is disabled at mount time
2021-08-25T15:44:03.339159-07:00
Successful mount of redo thread 1, with mount id 1134691451
2021-08-25T15:44:03.341098-07:00
Database mounted in Exclusive Mode
Lost write protection disabled
(PID:3592): Using STANDBY_ARCHIVE_DEST parameter default value as USE_DB_RECOVERY_FILE_DEST [krsd.c:18222]
Completed: ALTER DATABASE MOUNT
2021-08-25T15:44:03.475764-07:00
ALTER DATABASE OPEN
Ping without log force is disabled:
instance mounted in exclusive mode.
Buffer Cache Full DB Caching mode changing from FULL CACHING DISABLED to FULL CACHING ENABLED
2021-08-25T15:44:03.576891-07:00
Trash Recovery excluding pdb 2 which was cleanly closed.
2021-08-25T15:4:03.581420-07:00
Provincial crash recovery of 1 threads
narallel recovery started with 7 processes
Thread 1. Becovery starting at checknoint the (logser 19 block 49614) son 0
Andrada I. Recovery Statisting at the experime is a (region is brock 45614), Sen o
Solar tode ande eagn
5/21-02-2515.4.02 (21400-07.00
Source and a set of the set of th
pend 29 MB rede 15 deta bloaka read recevery
Teau 29 KB Teau, 13 Gata biotks need Tecovery
started redo application at
Infreda 1: logsed 19, block 49014, offset 0
Recovery of Online Redo Log: Thread I Group 3 Sed 19 Reading mem 0
Mem# 0: +DATA_DG/ORA19C/group03_redoU1.log
Mem# 1: +DATA_DG/ORA19C/group03_redo02.log
2021-08-25715:44:03.694071-07:00
Completed redo application of 0.01MB
2021-08-25115:44:03.725623-07:00
Completed crash recovery at
Thread 1: RBA 19.49672.16, nab 49672, scn 0x000000000189c1d
15 data blocks read, 15 data blocks written, 29 redo k-bytes read
Indian type of dictionary set to little
2021-08-25T15:44:03.794030-07:00
LGWR (PID:3525): STARTING ARCH PROCESSES
2021-08-25T15:44:03.810338-07:00
PT00 (PID:3646): Gap Manager starting

FIGURE 81. Database ora19c Alert Log

As stated earlier, VMware Hybrid Cloud Extension copies the original VM to the migrated VMs folder in vSphere Templates view.

	βC	vracle19	9c12-0E	EL83	-1629862	952832	2 Þ 🗆	r 🖓 🛱	ACTIONS '	~
✓ 🗗 sc2wvc03.vslab.local	Summ	ary M	onitor	Configi	ure Permis	ssions	Datastores	Networks	Snapshots	Updates
✓ I SC2-DC										
> 🗅 A-Master-Templates										
> 🗅 AVS				(Guest OS:	Oracle Lir	nux 8 (64-bit)			
> 🛅 Bitfusion Templates				(Compatibility:	ESXI 7.0	and later (VM	version 17)		
> 🛅 Deji-VMs	F	owered O	f		VMware Tools:	Not runni	ing, version:113	328 (Guest Mana	aged)	
> 🗋 Discovered virtual machine					DNS Name	MORE INF	.0			
🗅 GCVE					IP Addresses:					
> 🛅 gntest	LAUNC	H WEB CO	NSOLE	I	Host:	sc2esx12.	vslab.local			
> 🛅 Infrastructure	LAUNC	H REMOTE	CONSOLE ((i)	Δæ					
> 🛅 JumpBoxes				0	<u>.</u>					
> 🗋 Oracle										
> 🗋 Parallel_works	VM H	lardware								
> 🛅 pks_templates										
> 🛅 pks_vms	> (:PU				8 CPU	J(s)			
> 🗅 PWX	> 1	demory				32	GB, 0 GB me	mory active		
> 🗅 SAP		In walk officially of				00.01	-			
> 🛅 ScaleGrid	> 1	Hard disk I				80 Gi	3			
> 🖆 VCLS	1	otal hard	disks			3 har	d disks			
> 🗋 VMC Solution Lab		laturark ar	lantar 1				(disconnector	45		
✓ ☐ VMs migrated to cloud	~ ~ ~	Network ac	lapter i			none	(disconnected	1)		
🔂 Oracle19c12-OEL83-1629862952832	(CD/DVD dr	ive 1			Disco	nnected			
ScaleGridEnterprise	~ ~ ~	lideo card				8 MB				
🔂 az2wvc01		nueo caru				0 MID				
🔂 bf-client-centos8	N	/MCI devic	e			Devic	e on the virtu	al machine PCI I	bus that provide	s support for the
🔂 bf-client-centos8-Jimbo						vírtua	al machine con	nmunication inte	erface	
🗇 bf-client-chi-ub20	> (Other				∆ddit	ional Hardwar	e		
🗇 bf-client-phi-centos8						Addit		-		
🗊 bf-client-pi-ub20	(Compatibili	ty			ESXi	7.0 and later (VM version 17)		
🕃 bf-client-rho-ub20	Edit S	ettings								



The steps to perform the reverse migration from VMware Cloud on AWS to Site A are the same as those required for migration from Site A to VMware Cloud on AWS.

Select the **Reverse Migration** checkbox and select the Oracle VM **Oracle19c12-OEL83**. The remaining steps are the same as those previously outlined.

Workload Mobility			
Remote Site Connection:			
> @ Destination: hcx.vslab.local-enterprise / VC: sc2wvc0 https://hcx.sidic-44-232-220-144.vmwarevmc.com	3.vslab.local ← 🕢 Source: HCX Cloud - VMC-VSLAB / VC: vcenter.sddc-44-	232-220-144.vmwarevmc.com	C Reload Connection
Group Name:			No VMs is selected for migration 😂 Select VMs for Migration
0 9 8	poweron/off, match:value X Show unselect	table 🔘	Selection size: 1 VMs/ 260 GB/ 32 GB/ 8 vCPU <
✓ I SDDC-Datacenter	Name	Resources (Disk / Memory / CPU)	Message
 Discovered virtual machine Management VMs 	> Oracle 19c12-OEL83	(J) 280 GB / 32 GB / 8	
Templates	2 Oracle19c12-OEL83-VMC	() 660 GB / 32 GB / 8	
VMs migrated to cloud			
Workloads			
Cluster-1			
Resources Res Resources Resources Resources Resources			
Compute-ResourcePool			
Mgmt-ResourcePool			
10.129.32.4			
10.129.32.5			
10.125.120.4			



The summary of the reverse migration is as shown below:

Workload Mobility

 Validation is Successful, You can proceed with Migration Migration could fail as one or more Virtual Machines have ware 	ning(s). Please review them before proceeding.				Hide all 🛞
Group Name: Oracle-VM-HCX-Reverse				Batch size: 1 VM / 260 GB	3/ 32 GB / 8 vCPU 🖀 Select VMs for Migration
✓ Transfer and Placement:					
Oracle-RP	-	OraPure (4L5 TB / 50 TB)	-	Bulk Migration	~
Cracle Oracle	2	Bame format as source	~	(Optional: Switchover Schedule)	0
✓ Switchover:					
Force Power-off VM		Remove Snapshots Force unmount ISO Images			
✓ Extended Options:					
Edit Extended Options Retain MAC					
					٩
VM for Migration	1	Disk / Memory / vCPU		Migration Info	
¹ Voracle19c12-OEL83	Ċ	260 GB / 32 GB / 8 vCPU			
Oracle-RP	=	OraPure (41.5 TB / 50 TB)	a	Bulk Migration	~
Oracle	7	Same format as source	~	(Optional: Switchover Schedule)	0
Force Power-off VM					
Edit Extended Options Retain MAC Domain Nan	me DNS Customization				
×	×	Network adapter 1 (Apps Team 01) → APPS-1614			=
F	Primary NIC: V IP Address: 172.16.14.45 Connected: V	Gateway: 172.16.14.1		Subnet Mask: 255.255.255.0	
Non VMware or out of date tools detected on Oracle19c12-	OEL83. HCX will attempt a graceful shutdown.				
				► G	O VALIDATE H SAVE CLOSE

FIGURE 84. Oracle VM Oracle19c12-OEL83 Reverse Migration Summary

The reverse migration is successful.

Migration						
Tracking 🗄 Management 🖉 MIGRATE C	2					Search
Name	VMs/Storage/Memory/CPUs	Progress	Start		End	Status
\sim \bigcirc sc2wvc03.vslab.local \leftarrow \bigcirc vcenter.sddc-44-23	32-220-144.vmwarevmc.com					
V Oracle-VM-HCX-Reverse	1 / 260 GB / 32 GB / 8	O Migration Complete	-		-	🖂 🖉 🛍
0 / 1 selected			► GO 🗍 SC	HEDULE X CANCEL	ARCHIVE SFORCE	
1. Oracle19c12-OEL83	260 GB / 32 GB / 8	O Migration Complete	04:10 PM Aug 25		05:00 PM Aug 25	Migration completed
Destination Resource Pool : Oracle-RP Destination Datacenter : D SC2-DC Destination Folder : D Oracle Migration Options : Farce Power-Off VM (Retain	Datastore : 🗐 OraPure Disk Format : 🖨 Same format as source Mac		Migration ID Migration Group ID Migration Profile Maintenance Window	: e9a38a23-b76b-4ef6-a : 75d04a60-cc1d-4427-5 :	4e7-f816a08a7150 9efb-518bfc626916	
Apps Team	01 → ♀ APPS-1614	 41. 58 min ago 42. 57 min ago 43. 57 min ago 	+47m +48m +48m	C EVENTS (Show p Removing Replication Clearing up replication Migration completed	revious 40 events) config on target side IX appliance transfer target side completed	

FIGURE 85. Migration Complete



The Oracle VM Oracle19c12-OEL83 is now back on Site A with the IP address 172.16.14.45.

🔂 Oracle19c12-OEL83 🛛 Þ 🗖 🛱 🕷 💰 🛛 астіоля м						
Summary Monitor Cor	figure Permissi	ons Datastores	Networks	Snapshots	Updates	
Powered On LAUNCH WEB CONSOLE LAUNCH REMOTE CONSOLE	Guest OS: Compatibility: VMware Tools: DNS Name IP Addresses: Host:	Oracle Linux 8 (64-bit) ESXi 7.0 and later (VM Running, version:11328 MORE IMFO oracle19c12-oel83.vslab oracle19c12-oel83.vslab t72_16.14.45 sc2esx12.vslab.local	version 17) (Guest Managed	3)		
VM Hardware						
> CPU		8 CPU(s)				
> Memory		32 GB, 3.84 GB	memory active			
> Hard disk 1		80 GB				
Total hard disks		3 hard disks				
> Network adapter 1		APPS-1614 (connec	ted)			
CD/DVD drive 1		Disconnected				
> Video card		8 MB				
VMCI device		Device on the virtu virtual machine cor	al machine PCI I nmunication inte	ous that provide erface	s support for the	
> Other		Additional Hardwar	e			
Compatibility		ESXi 7.0 and later (VM version 17)			
Edit Settings						

FIGURE 86. Site A VM Oracle19c12-OEL83

The database ora19c is up.

FIGURE 87. Database ora19c Alert Log

The alert log for the database shows no errors. Oracle crash recovery is performed when the database starts up, which is normal and expected.



FIGURE 88. Database ora19c Alert Log

As stated earlier, VMware Hybrid Cloud Extension copies the original VM to the migrated VMs folder in the vSphere Templates view.

□ ₽		3-16299358572	251 D 🗆 🛱 🖓 🔞 actions 🗸
 @ vcenter.sddc-44-232-220-144.vmwarevmc.com SDDC-Datacenter Cluster-1 10.129.32.4 	Summary Monitor Confi	igure Permissions Guest OS: Oracl	Datastores Networks Snapshots e Linux 8 (64-bit)
□ 10.129.32.5 ✓ ✓ Compute-ResourcePool □ □ □ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○	Powered Off	Compatibility: ESXi VMware Tools: Not r MORE DNS Name: IP Addresses:	7.0 and later (VM version 17) unning, version:11328 (Guest Managed) EINFO
	LAUNCH WEB CONSOLE	A 6	9.92.5
10.129.224.26	VM Hardware		8 CPU/s)
	> Memory		32 GB, 0 GB memory active
	> Hard disk 1		80 GB
	Total hard disks		3 hard disks
	> Network adapter 1		none (disconnected)
	CD/DVD drive 1		Disconnected
	> Video card		8 MB
	VMCI device		Device on the virtual machine PCI bus that provides support for the virtual machine communication interface
	> Other		Additional Hardware
	Compatibility		ESXi 7.0 and later (VM version 17)
	Edit Settings		

FIGURE 89. VM Oracle19c12-OEL83 Summary

Migrating Oracle Single-Instance Workloads Using Hybrid Cloud Extension Cold Migration

Cold migration uses the same network path as VMware Hybrid Cloud Extension vMotion to transfer a powered-off VM. During a cold migration, the VM IP address and MAC address are preserved. Cold migrations must satisfy the vMotion requirements.

Learn more about Hybrid Cloud Extension Cold Migration.

The production single-instance Oracle VM **Oracle19c12-OEL83** on Site A was used for the Hybrid Cloud Extension Cold Migration deployment use case.

Oracle VM Oracle19c12-OEL83 was powered down with database ora19c offline. Click Migrate and add VM Oracle19c12-OEL83 to the migration process.

Workload Mobility



FIGURE 90. VM Oracle19c12-OEL83 Migration Start

Follow the same steps when selecting the target resource pool, datastore, folder, extended options, and network options. Click **Go** to start the migration process.

Note that adding the target IP address 172.16.115.45 with gateway and netmask information is not a supported option and target networking information will not be applied.

Workload Mobility

Validation is Successful, You can proceed with Migration					۲
https://hcx.sddc-44-232-220-144.vmwarevmc.com	-				Ŭ
Group Name: Oracle-VM-Cold-Migration-HCX				Batch size: 1 VM /	260 GB / 32 GB / 8 vCPU Select VMs for Migration
✓ Transfer and Placement:					
Compute-ResourcePool	-	WorkloadDatastore (14.1TB / 20.7TB)	-	(Migration Profile)	~
Workloads	7	Bame format as source	~	(Optional: Switchover Schedule)	٥
✓ Switchover:					
Force Power-off VM		Remove Snapshots Force unmount ISO Images			
✓ Extended Options:					
Edit Extended Options					
					Q
VM for Migration		Disk / Memory / vCPU		Migration Info	
1. V Oracle19c12-OEL83	Ċ	260 GB / 32 GB / 8 vCPU			
Compute-ResourcePool	-	WorkloadDatastore (141TB/207TB)	-	MigrationProfile: Cold Migration	
Workloads	-	Bame format as source	~		
Force Power-off VM					
Enable Seed Checkpoint					
Edit Extended Options					
×	<u>×</u>	Network adapter 1 (𝔩 APPS-1614) → Apps Team 01			a
	Primary NIC: V IP Address: 172.16.115.45	Gateway: 172.16.115.1		Subnet Mask: 255.255.255.0	
	Connected: Connec				
					GO Ø VALIDATE H SAVE CLOSE

FIGURE 91. Targeting IP Address 172.16.115.45 with Gateway and Netmask Not Supported

The steps for the migration start are as shown below:

Migration Tracking E Management C MIGRATE C					Search		
Name	VMs/ Storage/ Memory/ CPUs	Progress	Start	End	Status		
> osc2wvc03.vslab.local → ovcenter.sddc-44-232-220-144.vmwarevmc.com							
V Oracle-VM-Cold-Migration-HCX	1 / 260 GB / 32 GB / 8	54% Base Sync 0 of 1 Migrated			🖂 🖉 🗇		
O / 1 selected			► GO SCH	EDULE × CANCEL & ARCHIVE	SFORCE CLEANUP		
^{1.} ○ V Oracle19c12-OEL83 (Cod)	260 GB / 32 GB / 8	54% Base Sync	© +39m est. time 07:54 PM Aug 25	-	vMotion Transfer In Progress		
Destination Resource Pool : 🕝 Compute-ResourcePool Destination Datacenter : 🖽 SDDC-Datacenter Destination Folder : 🎦 Workloads Migration Options :	Datastore : 📄 WorkloadDatastore Disk Format : 🖨 Same format as source		Migration ID : Migration Group ID : Migration Profile : Maintenance Window :	211d2c67-2710-4320-a1c5-8406b359208f 058b55b7-8dd2-43db-a7da-d3867fa716d3 <i>Ca</i> r Cold Migration			
△ APPS-16	14 \rightarrow \bigcirc Apps Team 01	Switchover Events: 1. 6 min ago 2. 6 min ago 3. 6 min ago 4. 5 min ago 5. 1 min ago 6. 1 min ago 7. 1 min ago	Start +21s +20s +40s +54s +1m +1m	C EVENTS Collecting source details Collecting target details Resolving IX appliance Windron concurrency lock acquired Reconfiguring target Mobility Agent Creating placeholder VM for vMotion at target (Show less)	t side		

FIGURE 92. VM Oracle19c12-OEL83 Migration Start



The migration completes successfully.

Migration							
Tracking Hanagement	0				Search		
Name	VMs/ Storage/ Memory/ CPUs	Progress	Start	End	Status		
× esc2wvc03.vslab.local → evcenter.sddc-44-232-220-144.vmwarevmc.com							
V Oracle-VM-Cold-Migration-HCX	1 / 260 GB / 32 GB / 8	O Migration Complete	-	-	🖂 🖉 🗓		
0 / 1 selected			► GO SCH	EDULE X CANCEL BARCHIVE	FORCE CLEANUP		
^{1.}	260 GB / 32 GB / 8	O Migration Complete	07:54 PM Aug 25	08:08 PM Aug 25	Migration completed		
Destination Resource Pool : ⓒ Compute-ResourcePool Destination Datacenter : 🔝 SDDC-Datacenter Destination Folder : 🖻 Workloads Migration Options :	Datastore : 🗎 WorkloadDatastore Disk Format : 🏳 Same format as source		Migration ID : Migration Group ID : Migration Profile : Maintenance Window :	211d2c67-2710-4320-a1c5-8406b359208f 058b55b7-8dd2-43db-a7da-d3867fa716d3 3f Cold Migration 1 Not Scheduled			
△ APPS-16 ⁻	14 → Q Apps Team 01	Switchover Events: 5 6 min ago 6 min ago 6 6 min ago 6 5 min ago 6 1 min ago 7 1 min ago 7 1 min ago	Start +21s +29s +40s +54s +1m +1m	C EVENTS Collecting source details Collecting target details Resolving IX appliance Whotion concurrency lock acquired Reconfiguring target Mobility Agent Reconfiguring source Mobility Agent Creating placeholder VM for vMotion at target sidd	8		

FIGURE 93. VM Oracle19c12-OEL83 Migration Successful

The Oracle VM **Oracle19c12-OEL83** is now on VMware Cloud on AWS and powered off as Hybrid Cloud Extension Cold Migration was performed. Power on the VM and assign IP address 172.16.115.45.

🕏 Oracle19c12-OEL8	3 🛛 🖂 🛱 🐼 🕹 actions 🗸	
Summary Monitor Con	igure Permissions Datastores Networks Snapshots	
Powered On Launch web console	Guest OS: Oracle Linux 8 (64-bit) Compatibility: ESXI 7.0 and later (VM version 17) VMware Tools: Running, version:11328 (Guest Managed) MORE INFO oracle19c12-oe183.vslab.local IP Addresses: 172.165.45 Host: 10.129.32.5	
VM Hardware		
> CPU	8 CPU(s)	
> Memory	32 GB, 3.84 GB memory active	
> Hard disk 1	80 GB	
Total hard disks	3 hard disks	
> Network adapter 1	Apps Team 01 (connected)	
CD/DVD drive 1	Disconnected	q
> Video card	8 MB	
VMCI device	Device on the virtual machine PCI bus that provides support for the vir machine communication interface	rtua
> Other	AddItional Hardware	
Compatibility	ESXi 7.0 and later (VM version 17)	
Edit Settings		

FIGURE 94. VM Oracle19c12-OEL83 Summary



The database ora19c is up.

oracle@oracle19c12-ce183:ora19ci/home/oracle> ifconfig -a
eth0: flags=4163:vtp.BRoADCAST, RUNNING, MULTICAST> mtu 1500
 inet 172.16.115.45 netmask 255.255.255.0 broadcast 172.16.115.255
 ether 00:50:56:80:a2:f9 txgueuelen 1000 (Ethernet)
 RX packets 740 bytes 66603 (65.0 K1B)
 RX errors 0 dropped 0 overruns 0 frame 0
 TX packets 714 bytes 111302 (108.6 K1B)
 TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
 inet 127.0.0.1 netmask 255.0.0.0
 loop txgueuelen 1000 (Local Loopback)
 RX errors 0 dropped 0 overruns 0 frame 0
 TX packets 228 bytes 28133 (27.4 K1B)
 TX errors 0 dropped 0 overruns 0 frame 0
 TX packets 228 bytes 28133 (27.4 K1B)
 TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
oracle@oracle19c12-oe183:ora19c:/home/oracle>
oracle@oracle19c12-oe183:ora19c:/home/oracle>
Copyright (c) 1982, 2021, Oracle. All rights reserved.
Connected to:
 Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
 Version 19.12.0.0.0
 SQL> select name from v\$database;
NAME
 SQL> exit
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
 Version 19.12.0.0.0
 SQL> exit
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
 Version 19.12.0.0.0
 SQL> exit
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
 SQL> exit
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
 SQL> exit
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
 SQL> exit
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
 SQL> exit
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0

FIGURE 95. Database ora19c Alert Log

The alert log for the database shows no errors. Oracle database is started normally when the database starts up, which is normal and expected.

oracle@oracle19c12-oe183:ora19c:/home/oracle> tail -1050 alert ora19c.log
SMON started with pid=23, OS id=4679
LGWR slave LGO1 created with pid=24, OS pid=4684
Starting background process SNCO
2021-06-23120:11:22.93/99-01:00 9MO started with hid=25.05.id=4687
Starting background process RECO
2021-08-25#20:17:23.972059-07:00
RECO started with pid=26, OS id=4690
Starting background process LREG
2021-08-25T20:17:24.001016-07:00
LARUS Staffed With Pid=28, US 1d=4696
PXMN started with pid=30, OS id=4704
Starting background process RBAL
2021-08-25T20:17:24.065947-07:00
RBAL started with pid=31, OS id=4707
ASWB started with hid=32. OS id=712
Starting background process FENC
2021-08-25720:17:24.113478-07:00
FENC started with pid=33, OS id=4717
Starting background process MMON
2021-08-25/20:1/:24.128013-07:00
MNON Statted With Pid-34, OS 10-4724
NOTE: ASMB (index:0) registering with ASM instance as Standard client 0xffffffffffffffffffffffffffffffffffff
2021-08-25T20:17:24.146124-07:00
NOTE: Loaded library: /opt/oracle/extapi/64/asm/orcl/1/libasm.so
2021-08-25T20:1/:24.1466/8-0/:00
Munu startea With pia=35, OS 1a=4/28
TMON started with pid=36, OS id=4731
2021-08-25T20:17:24.168653-07:00
Setting CPU count to 8
ORACLE BASE from environment = /uU/app/oracle
2021-06-23120.11.24.11.3260-0.00 MMTF: Light (index:0) (212) connected to 19M instance +19M osid: 4722 (Standard mode: client id Ovffffffffffffffffffffff
NOTE: initiating MARK startup
Starting background process MARK
2021-08-25T20:17:24.196135-07:00
MARK started with pid=37, OS id=4734
2021-08-25T20:1/:24.198543-0/:00
NOTE: MARK HAS SUBSCILDED
LITER DATABASE MOUNT
2021-08-25T20:17:27.351502-07:00
NOTE: ASMB mounting group 1 (DATA_DG)
NOTE: Assigning number (1,1) to disk (ORCL:DATA_DISKO2)
SUCCESS: mounted group 1 (DATA DG)
NOTA: 910 I UISA I. DATA_DISAO2 DALLIORCH.DATA_DISAO2
RROR: failed to establish dependency between database ORA19C and diskgroup resource ora.DATA DG.dg
2021-08-25T20:17:31.591366-07:00
(PID:4735): Redo network throttle feature is disabled at mount time
2021-08-25T20:17:31.633581-07:00
Successful mount of redo thread 1, with mount 1d 1134//1860
2021-06-23120:1:53.633431-0:100 Database mounted in Evolucive Mode
Lost write protection disabled
(PID:4735): Using STANDBY_ARCHIVE_DEST parameter default value as USE_DB_RECOVERY_FILE_DEST [krsd.c:18222]
Completed: ALTER DATABASE MOUNT
2021-08-25720217:31.763348-07:00
Anther Darkanse Open
instance mounted in exclusive mode.
Buffer Cache Full DB Caching mode changing from FULL CACHING DISABLED to FULL CACHING ENABLED
2021-08-25720:17:31.830980-07:00

FIGURE 96. Database ora19c Alert Log

In the case of cold migration, we do not see Hybrid Cloud Extension copying the original VM to the migrated VMs folder in the **vSphere Templates** view.

The steps to perform the reverse migration from VMware Cloud on AWS to Site A are the same as those required to migrate from Site A to VMware Cloud on AWS.

Select the **Reverse Migration** checkbox and select the Oracle VM **Oracle19c12-OEL83**. The remaining steps are the same as those previously outlined.

The summary of the reverse migration is as shown below:

Workload Mobility

Validation is Successful, You can proceed with Migration					۲
Destination: hcx.vslab.local-enterprise / VC: sc2wvc0 https://hcx.sddc-44-232-220-144.vmwarevmc.com	B.vslab.local ← 📴 Source: HCX Cloud - VMC	-VSLAB / VC: vcenter.sddc-44-232-220-144.vmwarevmc.com			C Reiosa connections
Group Name: Oracle-VM-Cold-Migration-HCX				Batch size: 1 vM / 2	50 GB / 32 GB / 8 vCPU 🖀 Select VMs for Migration
✓ Transfer and Placement:					
Oracle-RP	a	OraPure (41.5 TB / 50 TB)	2	(Migration Profile)	~
Oracle	-	Same format as source	~	(Optional: Switchover Schedule)	0
V Switchover:					
Force Power-off VM		Remove Snapshots Force unmount ISO Images			
✓ Extended Options:					
Edit Extended Options					
					9
Vite for Minister		Side (Manager (1999))		Attending to fa	
VM for migration		nsk / Memory / VCPO		Migration into	
Oracle19c12-OEL83	0	260 GB / 32 GB / 8 vCPU			
Oracle-RP	-	OraPure (41.5 TB / 50 TB)	7	MigrationProfile: Cold Migration	
Cracle Oracle	a	Same format as source	v		
E Force Power-off VM					
Enable Seed Checkpoint					
Edit Extended Options					
	🗹 Ne	work adapter 1 (^q _D , Apps Team 01) → APPS-1614			<u> 1</u>
Prim Con Warning: This option is not supported by selected mis	ary NIC: Alpha Address: 172.16.14.45	Gateway: 172.16.14.1		Subnet Mask: 255.255.255.0	
					► GO Ø VALIDATE H SAVE CLOSE

FIGURE 97. VM Oracle19c12-OEL83 Summary

The reverse migration is successful.

Migration	C MIGRATE	Ø				Search
Name		VMs/ Storage/ Memory/ CPUs	Progress	Start	End	Status
✓ osc2wvc03.vslab.local ←	vcenter.sddc-44-23	2-220-144.vmwarevmc.com				
V Oracle-VM-Cold-Migration-HCX		1 / 260 GB / 32 GB / 8	Migration Complete		-	🖂 🖉 🗇
0 / 1 selected				► GO	× CANCEL BARCHIVE SF	FORCE CLEANUP
1. Voracle19c12-OEL83	Cold	260 GB / 32 GB / 8	O Migration Complete	08:30 PM Aug 25	08:42 PM Aug 25	Migration completed
Destination Resource Pool : Destination Datacenter : Destination Folder : Migration Options :	Oracle-RP SC2-DC Oracle	Datastore :	20 5 min ago 21 5 min ago 22 5 min ago	Migration ID : od21fc7. Migration Croup ID : 382493 Migration Profile : 42 Codd Maintenance Window : 11 Not 5 C EVEN +10m Cleaning +10m Migratio	3-9666-4090-8666-13b7ce1de1a2 7c-75814-80a-8385-cef0c042027d Migration Checkuled TS (Show previous 19 events) up Wildion switchover source side complet oncomuencey lock released in completed	ted

FIGURE 98. VM Oracle19c12-OEL83 Reverse Migration Successful



The Oracle VM Oracle19c12-OEL83 is now back on Site A and powered off. Power on the VM and assign it IP address 172.16.14.45.

🕏 Oracle19c12-OEL	.83 ▷ □	4	🖾 АСТІО	ns 🗸		
Summary Monitor Co	nfigure Perr	nissions	Datastores	Networks	Snapshots	Updates
 Powered On LAUNCH WEB CONSOLE LAUNCH REMOTE CONSOLE 	Guest OS: Compatibility VMware Too DNS Name r IP Addresses Host: ()	Oracle : ESXi : Runni MORE oracle : 1Z2_16 sc2es	e Linux 8 (64-bit) 7.0 and later (VM ng, version:11328 19470 19512-oel83.vslab 14.45 x12.vslab.local	version 17) (Guest Managed	3)	
VM Hardware						
> CPU		8	CPU(s)			
> Memory			32 GB, 3.84 GB	memory active		
> Hard disk 1		80) GB			
Total hard disks		3	hard disks			
> Network adapter 1		А	PPS-1614 (connec	ted)		
CD/DVD drive 1		D	isconnected			
> Video card		8	MB			
VMCI device		D vi	evice on the virtu rtual machine cor	al machine PCI I nmunication inte	ous that provide erface	s support for t
> Other		А	dditional Hardwar	'e		
Compatibility		E	SXi 7.0 and later (VM version 17)		
Edit Settings						

FIGURE 99. VM Oracle19c12-OEL83 Summary

The database ora19c is up.

oracle@oracle19012-0e19310ra190://DOMP/Oracle> ifconfig -a
eth0: flags=41633Up, BROADCAST, RUNNING, MULTICAST> mtu 1500
inet 172.16.14.45 netmask 255.255.255.0 broadcast 172.16.14.255
ether 00:50561801:32149 txqueuelen 1000 (Ethernet)
RX packets 806 bytes 67438 (65.8 KiB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 657 bytes 121092 (118.2 KiB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
lo: flags=73CUP,LOOEBACK, RUNNING> mtu 65536
inet 127.0.0.1 netmask 255.0.00
loop txqueuelen 1000 (Local Loopback)
RX packets 343 bytes 48505 (47.3 KiB)
TX errors 0 dropped 0 overruns 0 frame 0
TX packets 343 bytes 48505 (47.3 KiB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
oracle@oracle19c12-0e183:ora19c:/home/oracle> sqlplus / as sysdba
SQL*Plus: Release 19.0.0.0 - Production on Wed Aug 25 20:54:09 2021
Version 19.12.0.0.0
Copyright (c) 1982, 2021, Oracle. All rights reserved.
Connected to:
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
SQL> select name from v\$database;
NAME
Suppose the form oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
Sylo exit
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
Sylo exit
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
Sylo exit
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
Sylo exit
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
Sylo exit
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
Sylo exit
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.12.0.0.0
Sylo exit
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Sylo exit
Disconnected from Oracle Database 19c Enterprise Edition Re

FIGURE 100. Database ora19c Alert Log

The alert log for the database shows no errors. Oracle crash recovery is performed when the database starts up, which is normal and expected.

oracle@oracle19c12-oel83:ora19c:/home/oracle> tail -1050 alert_ora19c.log
2021-08-25T20:53:28.838694-07:00
SMCO started with pid=25, OS id=3823
Starting background process RECO
2021-08-25T20:53:28.849838-07:00
RECO started with pid=26, OS id=3826
Starting background process LRBG
[2021-08-20120:53:20:075134-07:00
Starting background process RVMN
2021-08-25T20:53:28.899499-07:00
PXMN started with pid=30, OS id=3840
Starting background process RBAL
2021-08-25720:53:28.912440-07:00
RBAL started with pid=31, OS id=3843
Starting background process ASMB
2021-08-25T20:53:28.924760-07:00
ASME started with pid=32, OS 1d=3848
Starting background process FENC
2/2/-/05-2572/:53:26.936619-0//:00
Find statled with pid-3, 08 fu-3035
2021-05-25720-53-08 951441-07-00
MMON started with bid=34, OS id=3858
Starting background process MMNL
2021-08-25T20:53:28.962519-07:00
MMNL started with pid=35, OS id=3863
Starting background process TMON
2021-08-25T20:53:28.968160-07:00
NOTE: ASMB (index:0) registering with ASM instance as Standard client Uxffffffffffffffffffffffffffffffffffff
2021-08-201201503120-09141/9-0/100
1004 Stateed with Paulos, 08 10-300/ 2021-08-25870-153-28 980738-07-00
Setting CPU count to 8
ORACLE BASE from environment = /u01/app/oracle
2021-08-25T20:53:28.982090-07:00
NOTE: Loaded library: /opt/oracle/extapi/64/asm/orcl/1/libasm.so
2021-08-25T20:53:29.012322-07:00
NOTE: ASMB (index:0) (3848) connected to ASM instance +ASM, osid: 3861 (Standard mode; client id Oxffffffffffffffffffffff
NOTE: Initiating MARK startup
Starting background process Mark
2027-06-20120:50:25-050-00-000 MBEK started with hid=38_DS id=3872
12021-08-25T20153129.036083-07:00
NOTE: MARK has subscribed
2021-08-25T20:53:29.040320-07:00
ALTER DATABASE MOUNT
2021-08-25T20:53:32.158394-07:00
NOTE: ASMB mounting group 1 (DATA DG)
NOTE: Assigning number (1,1) to disk (OKCL:DATA_DISKO2)
-SUCCESS: MOUNTED GEODE I (DATA DG) MORE: eran 1 diek 1: nami nekko nath-orch: nama nekko2
2021-08-25T20153:32.263426-07:00
ERROR: failed to establish dependency between database ORA19C and diskgroup resource ora.DATA DG.dg
2021-08-25T20:53:36.293427-07:00
(PID:3869): Redo network throttle feature is disabled at mount time
2021-08-25T20:53:36.325658-07:00
Successful mount of redo thread 1, with mount id 1134750729
2021-08-25120:53:36.328502-07:00
Last with protection disabled
2 (PID:3869): Using STANDBY ARCHIVE DEST parameter default value as USE DB RECOVERY FILE DEST [krsd.c:18222]
Completed: Alter DATABASE MOUNT
2021-08-25720:53:36.433733-07:00
ALTER DATABASE OPEN

FIGURE 101. Database ora19c Alert Log

Migrating Oracle Single-Instance Workloads Using Hybrid Cloud Extension vMotion

VMware Hybrid Cloud Extension vMotion can transfer a live VM from a VMware Hybrid Cloud Extension-activated vCenter server to a VMware Hybrid Cloud Extension-activated destination site (or from the VMware Hybrid Cloud Extension destination site towards the local site). The vMotion transfer captures the VM's active memory, its execution state, its IP address, and its MAC address. Migration duration depends on the connectivity, including both the bandwidth available and the latency between the two sites.

Learn more about Hybrid Cloud Extension vMotion Migration.

The production single-instance Oracle VM **Oracle19c12-OEL83** on Site A was used for the Hybrid Cloud Extension vMotion Migration deployment use case.

Oracle VM Oracle19c12-OEL83 was powered up with IP Address 172.16.14.45 with database ora19c online. Click Migrate and add VM Oracle19c12-OEL83 to the migration process:

As mentioned earlier, Hybrid Cloud Extension Network Extension (NE) provides a Layer 2 VPN (L2VPN) to extend a broadcast domain from a customer site into an AWS based SDDC. NE functionality is provided by a dedicated virtual appliance at both sites.

Workload Mobility



FIGURE 102. Add VM Oracle19c12-OEL83 for Migration

Follow the same steps when selecting the target resource pool, datastore, folder, extended options, and network options. Click **Go** to start the migration process.

Note that adding the target IP address 172.16.115.45 with gateway and netmask information is not a supported option and target networking information will not be applied.

Workload Mobility

Validation is Successful, You can proceed with Migration					۲
https://hcx.sdid-44-232-220-144.vmwarevmc.com					
Group Name: Oracle-VM-vMotion-HCX				Batch size: 1 vM / 260 GB /	32 GB / 8 vCPU Select VMs for Migration
✓ Transfer and Placement:					
Compute-ResourcePool	-	WorkloadDatastore (14.18/20.7.18.)	-	vMotion	~
Workloads	-	Same format as source	~	(Optional: Switchover Schedule)	O
V Switchover:					
Force Power-off VM		Remove Snapshots Force unmount ISO Images			
✓ Extended Options:					
Edit Extended Options Retain MAC					
					a
VM for Migration		Disk / Memory / vCPU		Migration Info	
¹ V Oracle19c12-OEL83	Ċ	260 GB / 32 GB / 8 vCPU			
Compute-ResourcePool	-	WorkloadDatastore (14 TB / 20.7 TB)		vMotion	~
Workloads	-	B Same format as source	~		
E Force Power-off VM					
Enable Seed Checkpoint					
Edit Extended Options Retain MAC 🏶					
	∠	Network adapter 1 (APPS-1614) → Apps Team C1			2
Primary NIC: 🗹 IP Address: 172	2.16.115.45	Gateway: 172.16.115.1		Subnet Mask: 255.255.2550	
Connected:					
wanning. This option is not supported by selected migration type and will not be app					
				► GO	Ø VALIDATE H SAVE CLOSE

FIGURE 103. Targeting IP Address 172.16.115.45 with Gateway and Netmask Not Supported

The steps for the migration start are as shown below:

Migration									
Tracking Hanagement	Ø								Search X
Name	VMs/ Storage/ Memory/ CPUs	Progress			Start		End	Status	
\sim \bigcirc sc2wvc03.vslab.local \rightarrow \bigcirc vcenter.sddc-44-23	2-220-144.vmwarevmc.com								
V Oracle-VM-vMotion-HCX	1 / 260 GB / 32 GB / 8	27% Base Sync	0 of 1 Migrated		-		-		🖂 🖉 前
0 / 1 selected				► GO		EDULE X CANCE	L ARCHIVE	⊗ FORCE CLEANUP	U FORCE POWER-OFF
^{1.}	260 GB / 32 GB / 8	27% Base Sync		C +44m est. time	09:44 PM Aug 25			vMotion Tra	nsfer in Progress
Destination Resource Pool (Destination Datacenter : D SDDC-Datacenter Destination Folder : D Workloads Migration Options : Retain Mac	Datastore :	Swim 1. 2. 3. 4. 5. 6. 7. 8. 8. 2.	tchover Events: 4 min ago 3 min ago 3 min ago 3 min ago 3 min ago 3 min ago 2 min ago 1 min ago 1 min ago	M Migrato Maintenanc	Igration ID : 1 Group ID : ition Profile : ce Window : Start +22s +34s +42s +55s +1m +1m +2m	6e42265-5477-48545 b1e951ce-3391-465e 2* Motion Not Scheduled Celecting source deta Collecting sarget detail Resolving IX appliance Vikolion concurrency I Reconfiguring source Creating placeholder V Starting relocate task Starting relocate task (Show less)	IIS Sec-648ecf814a1d Pefo-648ecf814a1d Sec-648ecf814a1d Sock acquired tobility Agent Mi for vMotion at target si on target side	side	

FIGURE 104. VM Oracle19c12-OEL83 Migration Start

The migration completes successfully.

Migration					
= Tracking Hanagement					Search
Name	VMs/ Storage/ Memory/ CPUs	Progress	Start	End	Status
\sim \bigcirc sc2wvc03.vslab.local → \bigcirc vcenter.sddc-44-23	32-220-144.vmwarevmc.com				
V Oracle-VM-vMotion-HCX	1 / 260 GB / 32 GB / 8	O Migration Complete	-	-	✓ Ø 前
0 / 1 selected			► GO		SFORCE CLEANUP
^{1.}	260 GB / 32 GB / 8	O Migration Complete	09:44 PM Aug 25	10:03 PM Aug 25	Migration completed
Destination Resource Pool : O Compute-ResourcePool Destination Datacenter : D SDDC-Datacenter Destination Folder : D Workloads Migration Options : Retain Mac	Datastore : 🗐 WorkloadDatastore Disk Format : 🖨 Same format as source		Migration ID: 64 Migration Group ID: 5 Migration Profile: 4 Maintenance Window: fill	e42c8b5-64f7-485d-907d-b4436ee24221 1e951ce-3d91-4d6e-9efc-648ecf814a1d 2 ¹ Wollon 2 ¹ Not Schedulied 2 ¹ EVENTS	
△ APPS-16 ⁻	14 → 🤤 Apps Team 01	Switchover Events: 1 17 min ago 2 16 min ago 3 16 min ago 4 16 min ago 5 16 min ago 6 16 min ago 7 17 min ago 8 16 min ago 9 17 min ago 10 min ago 11 min ago 9 10 min ago	Start C +22s C +34s R +42s V +42s N +1m C +1m S +1m S +1m S +2m S	Sollecting source details Sollecting target details Motion concurrency lock acquired Accordiguing target Mobility Agent Accordiguing source Mobility Agent Acetating paleotaker VM for vMotion at target side starting relocate task on target side tarting relocate task on source side	ide

FIGURE 105. VM Oracle19c12-OEL83 Migration Successful

The Oracle VM **Oracle19c12-OEL83** is now on VMware Cloud on AWS with IP address 172.16.14.45. Change the IP address to 172.16.115.45 as adding the target IP address with gateway and netmask information is not a supported option and target networking information will not be applied (as noted in the migration process above).

Summary Monitor Con	figure Permission	s Datastores Networks	Snapshots
P Powered On LAUNCH WEB CONSOLE	Guest OS: Orr Compatibility: ES: VMware Tools: Ru Mo DNS Name or IP Addresses: 172 Host: 10	icle Linux 8 (64-bit) (i 7.0 and later (VM version 17) inling, version:1328 (Guest Managed) RE INFO cle9oE2-cel83.vsiab.locat 16.115.45 293275	
VM Hardware			
> CPU		8 CPU(s)	
> Memory		32 GB, 3.84 GB memory active	
> Hard disk 1		80 GB	
Total hard disks		3 hard disks	
> Network adapter 1		Apps Team 01 (connected)	
CD/DVD drive 1		Disconnected	d ^b
> Video card		8 MB	
VMCI device		Device on the virtual machine PCI machine communication interface	bus that provides support for the virtual
> Other		Additional Hardware	

FIGURE 106. VM Oracle19c12-OEL83 Summary



The database ora19c is up.

FIGURE 107. Database ora19c Alert Log

The alert log for the database shows no errors. Oracle database has been online during the entire migration process.



FIGURE 108. Database ora19c Alert Log



The steps to perform the reverse migration from VMware Cloud on AWS to Site A are the same as those required for migration from Site A to VMware Cloud on AWS.

Select the **Reverse Migration** checkbox and select the Oracle VM **Oracle19c12-OEL83**. The remaining steps are the same as previously outlined.

The summary of the reverse migration is as shown below:

Workload Mobility

Validation is Successful, You can proceed with Migration proceed with Migration (Constraint) (C	WYCU3.VSIAD.IOCAI 🤆 📴 Source: HCX Cloud - VM	-VSLAB / VC: Vcenter.3ddc-94-232-220-194.vmwarevmc.com			C Keload Connections
Group Name: Oracle-VM-vMotion-HCX				Batch size: 1 VM / 26	D GB / 32 GB / 8 vCPU Select VMs for Migration
✓ Transfer and Placement:					
Oracle-RP	7	OraPure (415 T8/50 TB)	-	vMotion	~
Oracle	7	Same format as source	*	(Optional: Switchover Schedule)	O
✓ Switchover:					
Force Power-off VM		Remove Snapshots Force unmount ISO Images			
✓ Extended Options:					
Edit Extended Options Retain MAC					
					Q
VM for Migration		Disk / Memory / vCPU		Migration Info	
				-	
V Oracle19c12-OEL83	0	260 GB / 32 GB / 8 VCPU			
Oracle-RP		OraPure (415 TB / 50 TB)	2	vMotion	×
	-		•		
Force Power-off VM Enable Seed Checkpoint					
Edit Extended Options Retain MAC *					
	<u>~</u>	Network adapter 1 (Apps Team 01) → APPS-1614			a
	Primary NIC: V IP Address: 172.16.14.45 Connected: V	Gateway: 172.16.14.1		Subnet Mask: 255.255.255.0	
Warning: This option is not supported by selected	d migration type and will not be applied.				
					GO VALIDATE H SAVE CLOSE

FIGURE 109. VM Oracle19c12-OEL83 Reverse Migration Summary

The reverse migration is successful.

Migration	C MIGRATE							Search
Name		VMs/ Storage/ Memory/ CPUs	Prog	gress	Start	E	End	Status
✓ asc2wvc03.vslab.local	← 🌀 vcenter.sddc-44-23	32-220-144.vmwarevmc.com						
✓ Oracle-VM-Cold-Migration-HCX		1 / 260 GB / 32 GB / 8	⊗ N	Vigration Complete	-	-		🖂 🖉 🗇
0 / 1 selected					► GO	EDULE X CANCEL	ARCHIVE SFORCE	CLEANUP
1. V Oracle19c12-OEL83	Cold	260 GB / 32 GB / 8	⊘ N	ligration Complete	08:30 PM Aug 25	08	8:42 PM ug 25	Migration completed
Destination Resource Pool Destination Datacenter Destination Folder Migration Options	: ⊘ Oracle-RP : III SC2-DC : ID Oracle : ∴ Apps Team (Detastore :)raPure ame format as source	20. 5 min ago 21. 5 min ago 22. 5 min ago	Migration ID : Migration Group ID : Migration Profile : Maintenance Window : +10m +10m +10m	cd21fc73-9b6b-409b-8cb6 3824937c-758f-480a-838 2 Cold Migration Not Scheduled C EVENTS (Show prev Clearing up vMotion switct vMotion concurrency lock Migration completed	5-13b7ce1de1a2 -5-cef0c042027d vious 19 events) hover source side completed released	

FIGURE 110. VM Oracle19c12-OEL83 Reverse Migration Successful



The Oracle VM **Oracle19c12-OEL83** is now back on Site A with IP address 172.16.115.45. Change the IP address to 172.16.14.45.

🕆 Oracle19c12-OEL	83 Þ 🗆 🛱	🖗 🖾 🛛 Астіо	NS 🗸		
Summary Monitor Cor	nfigure Permissi	ons Datastores	Networks	Snapshots	Updates
P Powered On LAUNCH WEB CONSOLE LAUNCH REMOTE CONSOLE	Guest OS: C Compatibility: E VMware Tools: F DNS Namer IP Addresses: 1 Host: S M M M M M	Dracle Linux 8 (64-bit) ESXi 7.0 and later (VM Running, version:11328 MgRE INFO pracle19c12-oel83.vslab pracle19c12-oel83.vslab pracle19c12-oel83.vslab pracle19c12-oel83.vslab pracle19c12-oel83.vslab	version 17) (Guest Managec	3)	
VM Hardware					
> CPU		8 CPU(s)			
> Memory		32 GB, 3.84 GB	memory active		
> Hard disk 1		80 GB			
Total hard disks		3 hard disks			
> Network adapter 1		APPS-1614 (connec	ted)		
CD/DVD drive 1		Disconnected			
> Video card		8 MB			
VMCI device		Device on the virtu virtual machine cor	al machine PCI b nmunication inte	ous that provide erface	s support for the
> Other		Additional Hardwar	e		
Compatibility		ESXi 7.0 and later (VM version 17)		
Edit Settings					

FIGURE 111. VM Oracle19c12-OEL83 Summary

The database ora19c is up.

FIGURE 112. Database ora19c Alert Log

The alert log for the database shows no errors. Oracle database has been online during the entire migration process.



FIGURE 113. Database ora19c Alert Log



Migrating Oracle Single-Instance Workloads Using Hybrid Cloud Extension Replication Assisted vMotion

VMware Hybrid Cloud Extension Replication Assisted vMotion (RAV) uses the Hybrid Cloud Extension interconnect appliance along with replication and vMotion technologies to provide large scale, parallel migrations with zero downtime.

Learn more about Hybrid Cloud Extension Replication Assisted vMotion (RAV) Migration.

The production single-instance Oracle VM **Oracle19c12-OEL83** on Site A was used for the Hybrid Cloud Extension Replication Assisted vMotion (RAV) migration deployment use case.

Oracle VM Oracle19c12-OEL83 was powered up with IP Address 172.16.14.45 with database ora19c online. Click Migrate and add VM Oracle19c12-OEL83 to the migration process.

As mentioned earlier, Hybrid Cloud Extension Network Extension (NE) provides a Layer 2 VPN (L2VPN) to extend a broadcast domain from a customer site into an AWS based SDDC. NE functionality is provided by a dedicated virtual appliance at both sites.

Workload Mobility



FIGURE 114. Add VM Oracle19c12-OEL83 for Migration

Follow the same steps when selecting the target resource pool, datastore, folder, extended options, and network options. Click **Go** to start the migration process.

Note that adding the target IP address 172.16.115.45 with gateway and netmask information is not a supported option and target networking information will not be applied.

Workload Mobility

Validation is Successful, You can proceed with Migration					۲
> Gource: hcx.vsiab.local-enterprise / VC: sc2wvc03.vsiab.local → go Destination: HC2 https://hcx.sdo-44-232-220-144.vmwarevmc.com	Cloud - VMC-VSLAB / VC: Vcenter.sdd	-44-232-220-144.vmwarevmc.com			C Reload Connections
Group Name: Oracle-VM-RAV-HCX			E	8atch size: 1 VM / 260 GB / 32 GB / 8 vCPU 🖀 S	Select VMs for Migration
✓ Transfer and Placement:					
Compute-ResourcePool	WorkloadDatastore (14.15	/ 20.7 TB)	Replication-assisted vMotion		~
Workloads	Same format as source	·	 (Optional: Switchover Schedu 	ie)	0
V Switchover:					
Force Power-off VM	Remove Snapshots Force unmount ISO Image	5			
✓ Extended Options:					
Edit Extended Options Retain MAC					
					~
VM for Migration	Disk / Memory / vCPU		Migration Info		(H
VM for Migration	Disk / Memory / vCPU	U	Migration Info		Č.
VM for Migration VM for Migration V oracle18ct2-0EL63 @ Compute-NessurceNool	Disk / Memory / vCPU O 260 GB / 32 GB / 8 vCF WorkloadDatastore (%17)	U J/2027B)	Migration info		~
VM for Migration VM for Migration Voraclefol2: 0ELB3 Compute-ResourcePool Workods	Disk / Memory / vCPU O 260 GB / 32 GB / 8 vCF Image: State of the state of	U 1/28718)	Migration Info Replication-assisted vMotion (Optional: Switchover Schedu	ie)	× O
VM for Migration VM for Migration Compute-ResourcePool Writeds Porce Power-off VM	Disk / Memory / vCPU C 260 GB / 32 GB / 8 vCF Image: Serie format as source Image: Serie format as source	U 1/28/18)	Migration info Replication-assisted vMotion (Optionel: Switchover Schedu	(e)	× ©
VM for Migration v Orace19ct2-OELB3 Compute -ResourcePool Workload3	Disk / Memory / vCPU C 260 GB / 32 GB / 8 vCF Image: Second Datastore (MT Image: Second Datastore (MT Image: Second Datastore (MT Image: Second Datastore (MT	U (280718) 3	Migration Info Replication-assisted vMotion (Optional: Switchover Schedu	(e)	× 0
VM for Migration 	Disk / Memory / vCPU O 260 GB / 22 GB / B vCF Image: State of the state of	U 1/20/183	Migration Info Replication-assisted vMotion (Optional: Switchover Schedu	(0)	× 0
VM for Migration VM for Migration Vorkedfid2-OEL83 Ompute-ResourcePool Wirkloads Porce Power-off VM Emails Seed Checopoint Exit Exitended Octoom Retem MAC:	Disk / Memory / vCPU O 260 GB / 22 GB / 8 vC7 O Workcadobtastore (41 O Workcadobtastore (41 O Workcadobtastore (41 Network adapter 1 (AP)	U 1/207183 2 25-1614) → Apps Team 01	Migration info Replication-assisted vMotion (Optional: Switchover Schedu	(0)	~ 0
VM for Mignation VM for Mignation	Diak / Memory / vCPU	U 1/20718) 2 25-1614) → Apps Team 01 Geteway: 172.16.115.1	Migration info Replication estilated vMotion (Optional: Switchover Schedu Subnet Mask: 255.255.2	re) 255.0	

FIGURE 115. Targeting IP Address 172.16.115.45 with Gateway and Netmask Not Supported

The steps for the migration start are as shown below:

Migration					
Tracking					Search >
Name	VMs/Storage/Memory/CPUs	Progress	Start	End	Status
 ✓ [†] sc2wvc03.vslab.local → [†] vcenter.sddc-44-2 	32-220-144.vmwarevmc.com				
V Oracle-VM-RAV-HCX	1 / 260 GB / 32 GB / 8	0% Base Sync 0 of 1 Migrated	-	-	🖂 🖉 前
0/1 selected			► GO	EDULE X CANCEL	SFORCE CLEANUP
1.	260 GB / 32 GB / 8	0% Base Sync	10:40 PM Aug 25		Transfer Started
Destination Resource Pool : O Compute-ResourcePool Destination Datacenter : D SDDC-Datacenter Destination Folder : D Workloads Migration Options : Retain Mac	Datastore :	Transfer Events: 1 1 min ago 2 56 sec ago 3 46 sec ago 4 23 sec ago 5 17 sec ago 6 9 sec ago	Migration Group ID Migration Group ID Migration Profile : Maintenance Window : Start +16s +26s +47s +47s +64s +1m	85d04fa=e32f-40fc-987b-1df5e76dddf5 5e256ec5-5e02-4724-ae0c-4dd7410e9e3 C2: Replication-assisted VMotion D Not Scheduled C Events Validating source details Collecting target details Collecting target details Collecting target details Resolving IX appliance Requesting lock on IX appliance (Show liss)	33

FIGURE 116. VM Oracle19c12-OEL83 Migration Start

GO VALIDATE H SAVE CLOSE

The migration completes successfully.

Migration					
Tracking					Search
Name	VMs/ Storage/ Memory/ CPUs	Progress	Start	End	Status
 ✓ Sc2wvc03.vslab.local → Ovcenter.sddc-44-23 	32-220-144.vmwarevmc.com				
V Oracle-VM-RAV-HCX	1 / 260 GB / 32 GB / 8	O Migration Complete		-	🖂 🖉 🖞
O/1 selected			► GO SCHEDULE × CANO	EL 🔄 ARCHIVE 🛛 🛞 FORC	E CLEANUP
1.	260 GB / 32 GB / 8	O Migration Complete	10:40 PM Aug 25	11:39 РМ Aug 25	Migration completed
Destination Resource Pool : Destination Datacenter : Destination Folder : Migration Options : Retain Mac APPS-16	Datastore :	Transfer Events: 1 12 hr ago 2 12 hr ago 3 12 hr ago 4 23 sec ago 6 17 sec ago 6 9 sec ago	Migration ID: 85d0d4fa-e32t-40fc Migration Group ID: 62566e5-660-477 Migration Proteil: - 427 Replication-assi Maintenance Window: ID: Not Scheduled C EVENTS Start Validating source do 4475 Collecting source do 4475 Collecting source do 4475 Collecting source do 4475 Resolving IX appliar +1m Requesting lock on (Show less)	987b-1d15e766ddf5 4=66e0-4d77410e9e33 ted vMotion tells tells tells ce ce X appliance	

FIGURE 117. VM Oracle19c12-OEL83 Migration Successful

Oracle VM **Oracle19c12-OEL83** is now on VMware Cloud on AWS with IP address 172.16.14.45. Change the IP address to 172.16.115.45 as adding target IP address with gateway and netmask information is not a supported option and target networking information will not be applied (as noted in the migration process above).

🕏 Oracle19c12-OEL8	3 D 🗖 🛱 🖗 🔞 actions 🗸	
Summary Monitor Con	gure Permissions Datastores Networks	Snapshots
Powered On LAUNCH WEB CONSOLE	Guest OS: Oracle Linux 8 (64-bit) Compatibility: ESXI 7.0 and later (VM version 17) VMware Tools: Running, version:11328 (Guest Managed) MORE INFO DNS Name: oracle19c12-oeIB3.vsiab.local IP Addresses: I72.16.15.45 Host: 10.129.32.5	
VM Hardware		
> CPU	8 CPU(s)	
> Memory	32 GB, 3.84 GB memory active	
> Hard disk 1	80 GB	
Total hard disks	3 hard disks	
> Network adapter 1	Apps Team 01 (connected)	
CD/DVD drive 1	Disconnected	q
> Video card	8 MB	
VMCI device	Device on the virtual machine PCI machine communication interface	bus that provides support for the virtual
> Other	Additional Hardware	
Compatibility	ESXi 7.0 and later (VM version 17)	
Edit Settings		

FIGURE 118. VM Oracle19c12-OEL83 Summary



The database ora19c is up.

FIGURE 119. Database ora19c Alert Log

The alert log for the database shows no errors. Oracle database has been online during the entire migration process.



FIGURE 120. Database ora19c Alert Log

The steps to perform the reverse migration from VMware Cloud on AWS to Site A are the same as those required to migrate from Site A to VMware Cloud on AWS.

Select the **Reverse Migration** checkbox and select the Oracle VM **Oracle19c12-OEL83**. The remaining steps are the same as previously outlined.



The summary of the reverse migration is as shown below:

Workload Mobility

Validation is Successful, You can proceed with Mig	gration VC: sc2wvc03.vsiab.iocal ← [2ª Source: HCX Cloud - V	MC-VSLAB / VC: vcenter.sddc-44-232-220-144.vmwarevmc.com		C Reload Connections
https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https//https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https://https:/			Ba	ch size: 1 VM / 260 GB / 32 GB / 8 vCPU 🖀 Select VMs for Migration
✓ Transfer and Placement:				
 Octoble BB 	_		Depleation assisted attetion	
D Oracle		Same format as source	(Optional: Switchover Schedule)	Ŷ
	-	<u>ل</u>		U U U U U U U U U U U U U U U U U U U
✓ Switchover:				
E Force Power-off VM		Remove Snapshots Force unmount ISO Images		
✓ Extended Options:				
Edit Extended Options Retain MAC				
				Q
VM for Migration		Disk / Memory / vCPU	Migration Info	
1. V Oracle19c12-OEL83	c	260 GB / 32 GB / 8 vCPU		
Oracle-RP	-	OraPure (415 T8 / 50 TB)	Replication-assisted vMotion	v
Oracle	7	Same format as source	✓ (Optional: Switchover Schedule)	0
Force Power-off VM Enable Seed Checkpoint				
Edit Extended Options Retain MAC *				
~	×	Network adapter 1 (Apps Team 01) → APPS-1614		
Warning: This option is not supported b	Primary NIC: P Address: 172.16.14.45 Connected: P Address: 172.16.14.45 by selected migration type and will not be applied.	Network adapter 1 (Apps Team 01) → APPS-1614 Gateway: 172.16.14.1	Subnet Mask: 255.255.25	5.0
Warning: This option is not supported b	Primary NIC: IP Address: 172.16.14.45 Connected: IP address: 172.16.14.45 by selected migration type and will not be applied.	Network adapter1 (Apps Team O) → APPS-1614 Gateway: 172,16.14.1	Subnet Mask: 255.255.25	5.0
Warning: This option is not supported b	Primary NIC: 2 Connected: 2 by selected migration type and will not be applied.	Network adapter1 (Apps Team 01) → APPS-1614 Gateway: 172.1614.1	Subnet Masik: 255.255.25	50

FIGURE 121. VM Oracle19c12-OEL83 Reverse Migration Summary

The reverse migration is successful:

Migration										
Tracking	RATE C					Search				
Name	VMs/Storage/Memory/	CPUs	Progress	Start	End	Status				
✓ ③ sc2wvc03.vslab.local ← (④) vcenter.sddc-44-232-220-144.vmwarevmc.com										
✓ 2021-08-26 11:24 FWCAL	1/ 260 GB/ 3	22 GB/ 8	Migration Complete	-	-	2 0				
0 / 1 selected				GO SCHED	ULE X CANCEL ARCHIVE SFORCE	CLEANUP () FORCE POWER-OFF				
1. Oracle19c12-OEL83	(RAV) 260 GB / 3	32 GB / 8	O Migration Complete	11:24 AM Aug 28	12:17 PM Aug 28	Migration completed				
Destination Resource Pool : O Oracle-RP Destination Datacenter : B SC2-DC Destination Folder : D Oracle Migration Optione : Retain Mac	Da Disk	tastore : 📄 OraPure Format : 🗁 Same format as source	Transfer Events: 1 58 min ago 2 57 min ago 4 57 min ago 5 56 min ago 6 56 min ago 7 56 min ago 8 56 min ago 9 56 min ago 10 56 min ago 11 56 min ago 12 56 min ago 13 55 min ago 14 55 min ago 15 56 min ago 16 54 min ago 17 54 min ago 18 54 min ago 19 56 min ago 10 56 min ago 11 56 min ago 12 56 min ago 13 57 min ago 14 57 min ago 15 54 min ago 16 min ago 16 min ago	Migration Coup Display Migration Formation Coup Coup Display Display	Hab270b-e2a4-4a22-bda1-13e139b38931 7/30862-2068-4659-667t-E5a1266798911 27 Repication-ssisted Wildotin IN Not Scheduled 28 VENTS Validating source details Collecting target details Collecting source details Collecting target details Requesting lock on IX appliance Requesting lock on IX appliance Granted lock on IX appliance Preparing target side for migration Reserving Is draget for disks Creating disks on target datalsore Setting disk UUIDs on target Initiated Replication config push on source side IX appliance Preparing target side for migration Initiated Replication config push on source side IX appliance Preparing source side for migration Initiated Replication config push on source side IX appliance Preparing source side for migration Initiated Replication config push on source side IX appliance Preparing source side for migration Initiated Replication config push on source side IX appliance Preparing source side for migration Initiated Replication config push on source side IX appliance Preparing to completed Replication coyle (RPO) is actt	.e ce				

FIGURE 122. VM Oracle19c12-OEL83 Revers Migration Successful


The Oracle VM Oracle19c12-OEL83 is now back on Site A with IP address 172.16.115.45. Change the IP address to 172.16.14.45.

Immary Monitor Con	figure Permissio	ns Datastores	Networks	Snapshots	Updates
Powered On AUNCH WEB CONSOLE	Guest OS: O Compatibility: ES VMware Tools: R DNS Namey or IP Addresses: 7 Host: sc	racle Linux 8 (64-bit) SXI 7.0 and later (VM unning, version:11328 ORE INFO racle19c12-oel83.vslab (2,16,14,45 :2esx12.vslab.local	version 17) (Guest Managed	1)	
/M Hardware					
> CPU		8 CPU(s)			
> Memory		32 GB, 3.84 GB	memory active		
> Memory> Hard disk 1		32 GB, 3.84 GB	memory active		
 > Memory > Hard disk 1 Total hard disks 		 32 GB, 3.84 GB 80 GB 3 hard disks 	memory active		
Memory Hard disk 1 Total hard disks Network adapter 1		32 GB, 3.84 GB (80 GB 3 hard disks APPS-1614 (connect	memory active		
 > Memory > Hard disk 1 Total hard disks > Network adapter 1 CD/DVD drive 1 		32 GB, 3.84 GB (80 GB 3 hard disks APPS-1614 (connect Disconnected	nemory active		
 > Memory > Hard disk 1 Total hard disks > Network adapter 1 CD/DVD drive 1 > Video card 		3 GB 3.84 GB 3 80 GB 3 hard disks APPS-1614 (connected Disconnected 8 MB	memory active		
 > Memory > Hard disk 1 Total hard disks > Network adapter 1 CD/DVD drive 1 > Video card VMCI device 		32 GB, 3.84 GB I 80 GB 3 hard disks APPS-1614 (connect Disconnected 8 MB Device on the virtue virtual machine corr	nemory active ted) al machine PCI b	bus that provide	s support for the
 > Memory > Hard disk 1 Total hard disks > Network adapter 1 CD/DVD drive 1 > Video card VMCI device > Other 		32 GB, 3.84 GB i 80 GB 3 hard disks APPS-1614 (connect Disconnected 8 MB Device on the virtu virtual machine corr Additional Hardware	memory active ted) al machine PCI b nmunication inte e	pus that provide	s support for th

FIGURE 123. VM Oracle19c12-OEL83 Summary

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The database ora19c is up.

FIGURE 124. Database ora19c Alert Log

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The alert log for the database shows no errors. Oracle database has been online during the entire migration process.





Summary

Deploying Oracle Workloads on on-premises and VMware Cloud on AWS is different than deploying a single-instance Oracle database on any physical architecture.

Deploying a production single-instance primary database on Site A and single-instance physical standby database on Site B is no different than deploying the same on any physical architecture.

Deploying a production single-instance primary database or single-instance physical standby database on VMware Cloud on AWS is no different than deploying the same on any physical architecture.

Migrating Oracle workloads to VMware Cloud on AWS can be achieved using Oracle native tools (e.g., Data Guard, GoldenGate) OR with VMware-native tools using VMware Cross vCenter vMotion technology.

Migrating Oracle workloads to VMware Cloud on AWS using VMware Hybrid Cloud Extension can be achieved using:

- VMware Hybrid Cloud Extension Bulk Migration
- VMware Hybrid Cloud Extension Cold Migration
- VMware Hybrid Cloud Extension vMotion
- VMware Hybrid Cloud Extension Replication Assisted vMotion
- VMware Hybrid Cloud Extension OS Assisted Migration

The migration of Oracle VMs using Hybrid Cloud Extension OS-assisted migration is outside the scope of this paper.

Best Practices

VMware Cloud on AWS is an on-demand service that enables customers to run applications across vSphere-based cloud environments with access to a broad range of AWS services. Powered by VMware Cloud Foundation, this service integrates vSphere, vSAN and NSX along with VMware vCenter management, and is optimized to run on dedicated, elastic, bare-metal AWS infrastructure. ESXi hosts in VMware Cloud on AWS reside in an AWS availability Zone (AZ) and are protected by vSphere HA.

All best practices for running Oracle workloads on a VMware SDDC also apply to Oracle workloads on VMware Cloud on AWS and Stretched Clusters for VMware Cloud on AWS and can be found *here*, along with the *vSphere Performance Best Practices Guide*, for specific version of vSphere. Additional best practices for running Oracle workloads on VMware Cloud on AWS can be found in *Optimize Virtual Machine Configurations in VMware Cloud on AWS for Enterprise Applications Workload*.

In addition to the above best practices, with vSAN as the underlying storage component for VMware Cloud on AWS, a well-designed HCl cluster powered by vSAN is key to a successful implementation of mission-critical Oracle databases.

VMware vSAN Design Guide provides a comprehensive set of guidelines for designing vSAN and most of these guidelines apply to VMware Cloud on AWS with some subtle nuances.

Refer to the key guidelines relevant to Oracle Database in section 5.1 vSAN All-Flash Configuration Guidelines in the Oracle Database on VMware vSAN 6.7 guide.

Conclusion

Customers have successfully run business-critical Oracle workloads with high performance demands on VMware vSphere for many years.

VMware Cloud on AWS is an on-demand service that enables customers to run applications across VMware vSphere cloud environments with access to a broad range of AWS services. Powered by VMware Cloud Foundation[™], this service integrates vSphere, vSAN and VMware NSX along with VMware vCenter management, and is optimized to run on dedicated, elastic, bare-metal AWS infrastructure. ESXi hosts in VMware Cloud on AWS reside in an AWS availability zone and are protected by vSphere high availability.

Stretched Clusters for VMware Cloud on AWS is designed to protect against an AWS AZ failure. With Stretched Clusters for VMware Cloud on AWS, business-critical Oracle workloads with exceptionally high SLA, performance, and application availability requirements can take advantage of cloud deployment while simultaneously achieving high availability across multiple AZs.

This reference architecture outlines the deployment and migration strategies and use cases involved in movement of Oracle workloads to VMware Cloud on AWS.

- Deploying Oracle workloads on VMware Cloud on AWS
- Migrating Oracle workloads from VMware on-premises to VMware Cloud on AWS
- Deploying Oracle workloads on Stretched Clusters for VMware Cloud on AWS

Appendix A: On-Premises Oracle Configuration

Production Oracle Oracle19c12-OEL83 Initialization Parameters

- *.audit_file_dest='/u01/admin/ORA19C/adump'
- *.audit_trail='db'
- *.audit_sys_operations=TRUE
- *.compatible=12.1.0.0.0
- *.control_files='+DATA_DG/control01.ctl','+DATA_DG/control02.ctl','+DATA_DG/control03.ctl'
- *.db_block_size=8192
- *.db_domain="
- *.db_name='ORA19C'
- *.db_create_file_dest='+DATA_DG'
- *.db_recovery_file_dest='+DATA_DG'
- *.db_recovery_file_dest_size=10G
- *.diagnostic_dest='/u01/admin/ORA19C'
- *.enable_pluggable_database=true
- *.instance_number=1
- *.instance_name='ORA19C'
- *.log_archive_format='%t_%s_%r.dbf'
- *.open_cursors=1000
- *.processes=2000
- *.parallel_instance_group='ORA19C'
- *.parallel_max_servers=100
- *.pga_aggregate_target=256M
- *.pga_aggregate_limit=6G
- *.remote_login_passwordfile='exclusive'
- *.resource_manager_plan=''
- *.result_cache_max_size=4M
- *.sec_case_sensitive_logon=FALSE
- *.sga_max_size=16G
- *.sga_target=16G
- *.shared_pool_size=0
- *.thread=1
- *.undo_tablespace='UNDOTBS01'
- *.USE_LARGE_PAGES=only

Production Oracle Oracle19c-OL8-Primary Initialization Parameters



- *.audit_file_dest='/u01/admin/ORA19C/adump'
- *.audit_sys_operations=TRUE
- *.audit_trail='db'
- *.compatible='12.1.0.0.0'
- *.control_files='+DATA_DG/control01.ctl','+DATA_DG/control02.ctl','+DATA_DG/control03.ctl'
- *.db_block_size=8192
- *.db_create_file_dest='+DATA_DG'
- *.db_domain=''
- *.db_file_name_convert='+DATA_DG/ORA19CSB','+DATA_DG/ORA19C'
- *.log_file_name_convert='+DATA_DG/ORA19CSB','+DATA_DG/ORA19C'
- *.db_name='ORA19C'
- *.db_unique_name='ora19c'
- *.db_recovery_file_dest='+DATA_DG'
- *.db_recovery_file_dest_size=10G
- *.diagnostic_dest='/u01/admin/ORA19C'
- *.enable_pluggable_database=true
- *.fal_client='ORA19C'
- *.fal_server='ORA19CSB'
- *.instance_name='ora19c'
- *.instance_number=1
- *.log_archive_config='dg_config=(ora19c,ora19csb)'
- *.log_archive_dest_1='location=use_db_recovery_file_dest valid_for=(all_logfiles,all_roles) db_unique_
- name=ora19c'
- *.log_archive_dest_2='service=ora19csb async valid_for=(online_logfiles,primary_role) db_unique_name=ora19csb'
- *.log_archive_dest_state_2='ENABLE'
- *.log_archive_format='%t_%s_%r.dbf'
- *.log_archive_max_processes=10
- *.job_queue_processes=0
- *.open_cursors=1000
- *.parallel_instance_group='ORA19C'
- *.parallel_max_servers=100
- *.pga_aggregate_limit=6G
- *.pga_aggregate_target=256M
- *.processes=2000
- *.remote_login_passwordfile='exclusive'
- *.resource_manager_plan="
- *.result_cache_max_size=4M
- *.sga_max_size=16G



- *.sga_target=16G
- *.standby_file_management='AUTO'
- *.thread=1
- *.undo_tablespace='UNDOTBS01'

Production Oracle Oracle19c-OL8-Standby Initialization Parameters

- *.audit_file_dest='/u01/admin/ORA19CSB/adump'
- *.audit_sys_operations=TRUE
- *.audit_trail='db'
- *.compatible='12.1.0.0.0'
- *.control_files='+DATA_DG/stdby_control01.ctl','+DATA_DG/stdby_control02.ctl','+DATA_DG/stdby_control03.ctl'
- *.db_block_size=8192
- *.db_create_file_dest='+DATA_DG'
- *.db_domain="
- *.db_file_name_convert='+DATA_DG/ORA19C','+DATA_DG/ORA19CSB'
- *.log_file_name_convert='+DATA_DG/ORA19C','+DATA_DG/ORA19CSB'
- *.db_name='ORA19C'
- *.db_unique_name='ora19csb'
- *.db_recovery_file_dest='+DATA_DG'
- *.db_recovery_file_dest_size=10G
- *.diagnostic_dest='/u01/admin/ORA19CSB'
- *.enable_pluggable_database=true
- *.fal_client='ORA19CSB'
- *.fal_server='ORA19C'
- *.instance_name='ora19csb'
- *.instance_number=1
- *.log_archive_config='dg_config=(ora19c,ora19csb)'

```
*.log_archive_dest_1='location=use_db_recovery_file_dest valid_for=(all_logfiles,all_roles) db_unique_
name=ora19csb'
```

- *.log_archive_dest_2='service=ora19c async valid_for=(online_logfiles,primary_role) db_unique_name=ora19c'
- *.log_archive_dest_state_2='ENABLE'
- *.log_archive_format='%t_%s_%r.dbf'
- *.log_archive_max_processes=10
- *.job_queue_processes=0
- *.open_cursors=1000
- *.parallel_instance_group='ORA19C'
- *.parallel_max_servers=100



- *.pga_aggregate_limit=6G
- *.pga_aggregate_target=256M
- *.processes=2000
- *.remote_login_passwordfile='exclusive'
- *.resource_manager_plan=''
- *.result_cache_max_size=4M
- *.sga_max_size=16G
- *.sga_target=16G
- *.standby_file_management='AUTO'
- *.thread=1
- *.undo_tablespace='UNDOTBS01'

Appendix B: VMware Cloud on AWS Oracle Configuration

Production Oracle Oracle19c12-OEL83-VMC Initialization Parameters

- *.audit_file_dest='/u01/admin/ORA19C/adump'
- *.audit_trail='db'
- *.audit_sys_operations=TRUE
- *.compatible=12.1.0.0.0
- *.control_files='+DATA_DG/control01.ctl','+DATA_DG/control02.ctl','+DATA_DG/control03.ctl'
- *.db_block_size=8192
- *.db_domain=''
- *.db_name='ORA19C'
- *.db_create_file_dest='+DATA_DG'
- *.db_recovery_file_dest='+DATA_DG'
- *.db_recovery_file_dest_size=10G
- *.diagnostic_dest='/u01/admin/ORA19C'
- *.enable_pluggable_database=true
- *.instance_number=1
- *.instance_name='ORA19C'
- *.log_archive_format='%t_%s_%r.dbf'
- *.open_cursors=1000
- *.processes=2000
- *.parallel_instance_group='ORA19C'
- *.parallel_max_servers=100
- *.pga_aggregate_target=256M
- *.pga_aggregate_limit=6G



- *.remote_login_passwordfile='exclusive'
- *.resource_manager_plan=''
- *.result cache max size=4M
- *.sec_case_sensitive_logon=FALSE
- *.sga_max_size=16G
- *.sga_target=16G
- *.shared_pool_size=0
- *.thread=1
- *.undo_tablespace='UNDOTBS01'
- *.USE_LARGE_PAGES=only

Appendix C: SLOB Configuration

SLOB Configuration

SLOB 2.4.0 slob.conf

UPDATE PCT=100 SCAN_PCT=0 RUN_TIME=1800 WORK_LOOP=0 SCALE=16G SCAN TABLE SZ=1M WORK_UNIT=64 REDO_STRESS=HEAVY LOAD_PARALLEL_DEGREE=5

THREADS_PER_SCHEMA=1

DATABASE_STATISTICS_TYPE=awr # Permitted values: [statspack|awr]

Settings for SQL*Net connectivity: #### Uncomment the following if needed: ADMIN_SQLNET_SERVICE=ora19c-pdb1 SQLNET_SERVICE_BASE=ora19c-pdb1 #SQLNET_SERVICE_MAX="if needed, replace with a non-zero integer"

Note: Admin connections to the instance are, by default, made as SYSTEM

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with the default password of "manager". If you wish to use another # privileged account (as would be the cause with most DBaaS), then # change DBA_PRIV_USER and SYSDBA_PASSWD accordingly. #### Uncomment the following if needed: DBA_PRIV_USER=sys SYSDBA_PASSWD=vmware123

The EXTERNAL_SCRIPT parameter is used by the external script calling feature of runit.sh.
Please see SLOB Documentation at https://kevinclosson.net/slob for more information

EXTERNAL_SCRIPT="

DO_HOTSPOT=FALSE HOTSPOT_MB=8 HOTSPOT_OFFSET_MB=16 HOTSPOT_FREQUENCY=3

The following controls operations on Hot Schema
Default Value: 0. Default setting disables Hot Schema

HOT_SCHEMA_FREQUENCY=0

The following parameters control think time between SLOB
operations (SQL Executions).
Setting the frequency to 0 disables think time.

THINK_TM_FREQUENCY=0 THINK_TM_MIN=.1 THINK_TM_MAX=.5



Reference

White Papers

For additional information, see the following white papers:

- Oracle Databases on VMware Best Practices Guide
- Optimize Virtual Machine Configurations in VMware Cloud on AWS for Enterprise Applications Workload
- Oracle Database 12c on VMware vSAN 6.7 All-Flash
- Oracle Database 12c on VMware vSAN Day 2 Operations and Management

Product Documentation

For additional information, see the following product documentation:

- Oracle Database Documentation
- VMware Cloud on AWS

Other Documentation

For additional information, see the following document:

SLOB Resources

Author Info and Acknowledgements

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