



ORACLE CLOUD WORKLOAD MIGRATION - A PRACTITIONER'S POINT OF VIEW

Abstract

Today, enterprises are moving their applications to cloud to achieve benefits of on-demand scalability and continuous reliability at lower cost. When it comes to migrating workloads, organizations have several options such as public, private and hybrid cloud. Oracle Cloud Services provides several offerings for organizations to seamlessly migrate their workloads. However, identifying the right cloud service can be challenging.

This white paper explains how to migrate Oracle workloads from on-premises to Oracle Cloud using the various options available. It also covers the high-level network connectivity between Oracle Cloud, private data centers and other cloud services to connect different applications or interfaces that need to be handled during workload migration.

Introduction

Information technology (IT) departments are under constant pressure to reduce infrastructure cost, improve quality of IT services and ensure compliance to support the company's core business processes. With a majority of applications residing in-house or on-premises, companies have to invest in hardware, maintenance and upgrades, thereby increasing the IT cost to the company. Here, cloud is a useful solution and cloud service providers play a key role in reducing IT costs. The cloud service model optimizes routine operational tasks so companies can focus on improving overall efficiency and their competitive edge.

Migrating to cloud helps companies:

- Lower cost by increasing resource utilization and reducing ongoing management costs
- Increase agility by scaling easily to meet changing business needs and off-loading daily system management tasks

- Maintain flexibility by integrating with on-premises applications, tools and assets so they can move to on-premises when needed
- Reduce risk by provisioning capacity, staying up-to-date, minimizing security risk, and meeting compliance requirements

Security is a key concern when planning workload migration to cloud. Companies also have concerns with system reliability, performance, pricing and billing, and managed services, which need to be addressed efficiently and diligently.

Oracle Cloud Services provides best-in-class and highly available architecture with engineered machines (Exa*) for migrating on-premises data and applications to cloud at lower cost. Oracle Cloud also offers various options such as Infrastructure-as-a-Service (IaaS) and Platform-as-a-Service (PaaS) based on the client's requirement and budget.

Types of cloud options

Some of the cloud options available for companies along with their features are:

Public cloud	Private cloud	Hybrid cloud
Multi-tenancy (shared hardware resources)	Better control (dedicated hardware)	<ul style="list-style-type: none"> • Combination of public and private cloud • Some resources are used in public cloud and others in private cloud • Merges the benefits of both cloud options
Highly elastic and scalable	On-demand scalability	
Standard compliance and security are set-up (PCI/HIPPA/SOC/SSA compliant)	Compliance and security are set-up specific to client needs	
<ul style="list-style-type: none"> • Pay-as-you-go model • Pay only for virtual machines (VMs) that are online/being used 	<ul style="list-style-type: none"> • Limited pay-per-use model • Allocated payment for VMs being used, whether online or offline 	
Time to build VM from existing compute capacity: nearly 2 hours	Time to build VM from existing compute capacity: 3-4 days	

Choosing the right cloud option

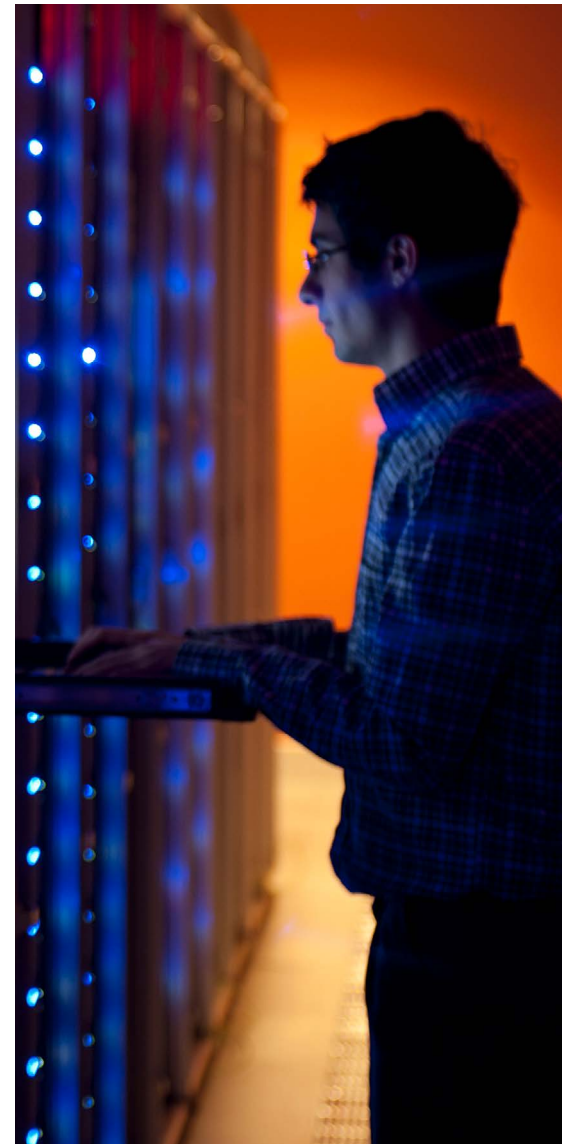
As public and private cloud have different features, organizations can decide which is appropriate for them based on several factors. These include:

- 1. Budget:** For small businesses looking to quickly set-up their IT infrastructure, public cloud is the best option. For large companies, private cloud is better as it offers complete control over security, compliance, hardware, virtual servers, and service level agreements (SLAs). Further, it reduces rental cost of computing incurred during lengthy projects.
- 2. Security and compliance:** When adhering to regional/country compliance standards like the International Traffic in Arms Regulations (ITAR) or payment card security standards, private cloud helps keep data secure as other tenants cannot access private data. This is advisable in cases where security and compliance are paramount.
- 3. Hardware virtual machine (VM) control:** Private cloud is recommended for organizations that want complete control over hardware and where set-up is client-specific. In cases where the budget is limited and there is no need to control the hardware, public cloud can be used.

4. Failover control: Private cloud gives clients complete control over the failover server during sudden spikes or server connection failures. Clients can choose the server and region for fail-over in case of performance and connection issues. In cases where server or server location is absent, public cloud can be used.

5. SLA management: Private cloud offers complete control over SLA management and clients can see what metrics are used in each SLA for system availability. In public cloud, the cloud service provider has control over SLAs across tenants i.e. across databases/applications hosted on the server.

Hybrid cloud is best-suited for clients who want to undertake migration of secure data to private cloud and applications to public cloud. This is useful in cases where data is not sensitive and does not need to reside on a multi-tenant system. Hybrid cloud reduces cost while providing complete control over databases, thereby securing data for data security compliance. Oracle provides an option called 'Exadata Cloud Machine' for clients who are unable to migrate to cloud or where the Oracle Cloud data center is not available to fulfill data privacy compliances due to regional restrictions. With this, clients can use high-performance engineered machines on-premises.



Choosing the right cloud option

Once the company chooses the right cloud option, the next step is to choose which cloud service will be used to migrate the application and/or database to the cloud. Oracle provides three IaaS hosting options for clients looking to migrate their workloads:

Option 1: Oracle IaaS

Option 2: Oracle IaaS along with Database-as-a-Service (DBaaS)

Option 3: Oracle IaaS along with ExaData-as-a-Service (EXDaaS)

The following parameters can help organizations choose which service is most applicable to them:

Parameters	Oracle IaaS	Oracle IaaS + DBaaS	Oracle IaaS + EXDaaS
Security	Medium to high	Medium to high	High
High availability	Medium to high	Medium to high	High
Scalability/elasticity	High	Medium	High
Time to scale up/down	High	High	Medium
Performance	Medium to high	Medium to high	High
Cost	Low	Medium	High

Drivers for cloud adoption

Here are some of the key drivers that make cloud an attractive option for organizations:

1. Robust data center resilience

- The primary data center hosts production and pre-production environments while the secondary site hosts non-production and disaster recovery (DR) environments
- Each data center is equipped with state-of-the-art power and network backup, thereby ensuring interruption-free data center operations
- **Redundant power:** Typically, each region (such as the US central region) has three locations running on three separate power grids. This ensures that in case one power grid fails, the other two locations continue running. This is known as an 'availability domain'. Availability domains are interconnected using dark fiber, ensuring a latency of only less than 10 milliseconds. Regions are also connected to other regions over a fiber link. This offers different degrees of redundancy and

high availability within one region and across regions

- **Redundant network:** Network designs involve redundant circuits from different carriers, firewall pairs, switch pairs, and load balancer pairs
- **Redundant storage:** The data from Oracle Cloud service providers reside on redundant storage configurations with in-built protection against individual disk/array failure
- **Redundant back-up:** Database backups are stored at the primary site and an alternate location for redundancy purposes. A back-up is retained online and/or offline for a period of 60 days (recommended) or based on the business requirements. This retention period may be customized based on business requirements

2. Physical and logical security on Oracle Cloud data centers

- **Physical security:** Oracle uses innovative and state-of-the-art engineering approaches to design data centers. The perimeter of each data center has concrete vehicle barriers, closed-circuit television coverage, alarm

systems, and manned guard stations to defend against attacks. Oracle only allows employees and contractors to access information in the data center based on legitimate business need. Authorized staff must pass a two-factor authentication to access data. Further, all physical access to data centers by Oracle employees is logged and routinely audited. Entrances are manned 24/7 by security guards who perform visual identity recognition and visitor escort management.

- **Logical security:** The multi-tenant elastic compute service by Oracle provides logical tenant isolation through virtualization, as previously mentioned. Oracle also offers a dedicated compute solution that is a fully isolated elastic compute service. It provides dedicated physical servers, cores and a network within the Oracle data center. Thus, clients get complete I/O, CPU and network isolation.

3. Network and security

Oracle allows clients to connect to Oracle Public Cloud Services through various methods. These are:

- a. **Virtual private network (VPN):** Site-to-site internet protocol security (IPsec) VPN services are available from the organization's data center to Oracle Public Cloud. All Oracle VPN concentrators support the IPsec standard. Any layer 3 device that also supports the IPsec standard can be used to initiate the tunnel from the client end.
- b. **FastConnect:** Oracle has a dedicated access service called FastConnect that provides dual dedicated 1GBPS or 10GBPS ports to Oracle Public Cloud. FastConnect is available in three versions:
 - FastConnect standard edition
 - FastConnect partner edition
 - FastConnect partner edition MPLS Verizon Secure Cloud Interconnect

4. Performance

System performance is a key business concern whether for batch job, order processing or reporting. On the one hand, EXDaaS is useful for clients that need to process a large number of transactions every day. The pay-as-you-grow dedicated Exadata services is quite popular and the infrastructure is supported by Oracle experts. On the other hand, hybrid cloud service is the best option for low-cost and high-performance migration. While the standard application code with custom code can be deployed in public cloud on the commodity server, the database can be migrated to a high-end engineered database machine.

5. Existing license contract

Oracle customers who already own applications like Oracle E-Business Suite may use Oracle Cloud to host instances of their applications. The Oracle Compute Cloud uses a 'bring-your-own-license' model. Thus, clients who wish to use the

Oracle Compute Cloud must own a valid license for the software being deployed on virtual machines in Oracle Compute Cloud.

6. Workflow process for provisioning the VM

The following process is used to subscribe the VM in the required size on IaaS:

- **Subscription details:** Identify the version of compute (OCPU, memory and storage) and OS
- **Validate the resource quota:** Once the shape is selected based on the requirement, add the storage to the machine and validate the same against the application requirement
- **Validate finance quota:** Once the machine and compute is selected based on the requirement, validate the pricing and follow the appropriate approval process before provisioning



Pre-requisites for migrating to cloud

Before carrying out migration of applications and databases from on-premises to cloud, it is important to understand the cloud reference architecture.

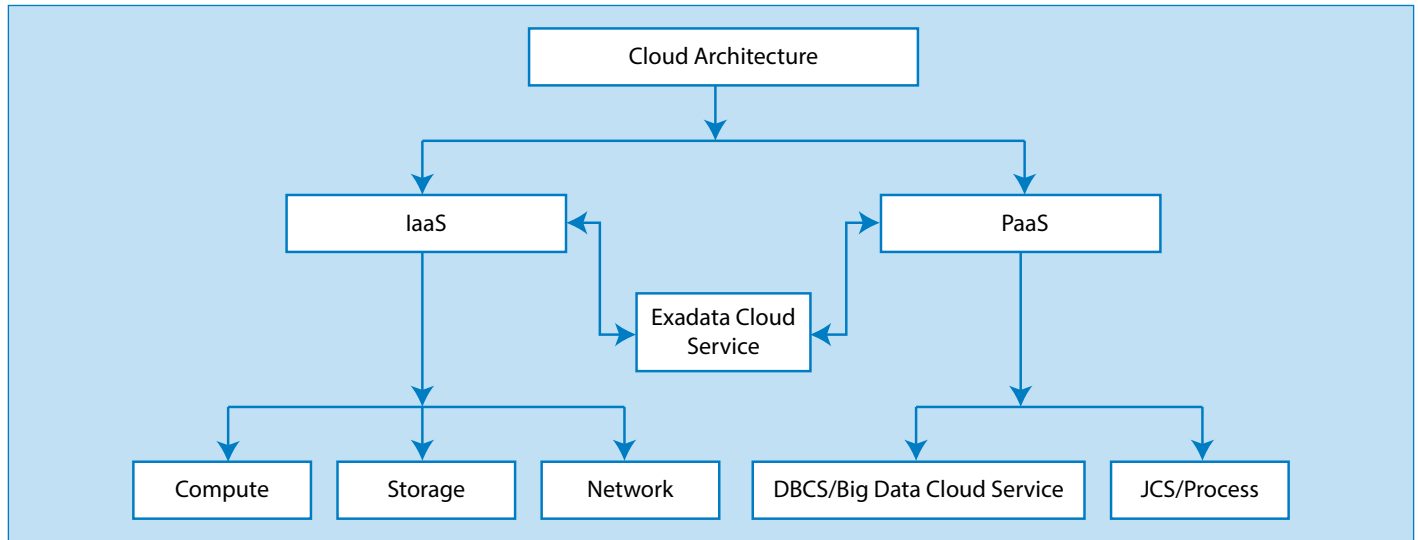


Fig 1: A typical decision tree for cloud reference architecture

As the diagram shows, it is important to analyze and plan provisioning on the cloud depending on the existing application architecture and size of the existing

database. After analyzing the current size, the organization can choose the right database cloud service using the selection criteria shown below. These criteria are

designed based on our experience along with feedback from customers as well as Oracle.

Criteria	Database Cloud Service
Apps unlimited application (EBS application)	Database cloud service on elastic compute
< 16 CPUs and < 30 TB raw storage	Database cloud service on Baremetal
>16 CPUs and >30 TB raw storage	Exadata Cloud Service
Mission-critical availability	Exadata Cloud Service

For critical instances in medium to large organizations, Exadata Cloud Service is advisable. Once the service is finalized, the next step is to plan the compute, storage and networking architecture to migrate the existing application to cloud. This is done as follows:

Compute: A range of shapes are available to choose the combination of CPU and memory for VMs that fit the existing application. This includes the number of Oracle Compute Units (OCPU) and the amount of RAM available for a VM. An OCPU provides CPU capacity equivalent to

one physical core of a modern Intel Xeon processor and is hyper threading-enabled. Based on the Oracle Automatic Workload Repository (AWR) or server load report, one can decide the compute requirement and then scale up or down when needed.

General Purpose Shapes			
Shape	OCPU	vCPU	Memory (GB)
OC3	1	2	7.5
OC4	2	4	15
OC5	4	8	30
OC6	8	16	60
OC7	16	32	120

High-Memory Shapes			
Shape	OCPU	vCPU	Memory (GB)
OC1M	1	2	15
OC2M	2	4	30
OC3M	4	8	60
OC4M	8	16	120
OC5M	16	32	240

Fig 2: Sample OCPU, VCPU and memory models to assess compute requirements

Storage: To ensure that data remains safe during migration, Oracle Storage Cloud Service is used. This is a secure, elastic, reliable, and cost-effective public cloud storage solution that can be accessed 24/7 from any location and from any device connected to the internet. While traditional on-premises storage solutions present challenges in scalability, performance, integrity, and management, Oracle Storage Cloud Service ensures reliability and availability with multiple and redundant copies of data. It offers scalability with on-demand capacity as well as automatic integrity of data for the high durability and performance. With different storage

types for structured and unstructured data, Oracle Storage Cloud Service addresses the challenges of on-premises storage.

Network: Oracle supports fast and smooth connectivity for data migration from on-premises to cloud. The network topology should support interconnections for the core applications on cloud as well as other applications residing on-premises for point-to-point networking. There are multiple options to connect to Oracle IaaS Cloud through MPLS provider/Equinix Cloud Exchange leveraging FastConnect at speeds from 1GB to 10GB. Oracle supports a number of connectivity methods into Oracle Public Cloud Services. These include:

- **VPN:** Site-to-site IPsec VPN services are available from on-premises datacenters into Oracle Public Cloud. All Oracle VPN concentrators support the IPsec standard. Any layer 3 device that also supports the IPsec standard can be used to initiate the tunnel on the client end
- **Network-to-network interface (NNI):** Oracle has built a layer 2 NNI with the Verizon Secure Cloud Interconnect service. Verizon MPLS clients can purchase Secure Cloud Interconnect (SCI) from Verizon in addition to FastConnect and route traffic from their MPLS network directly into Oracle Public Cloud

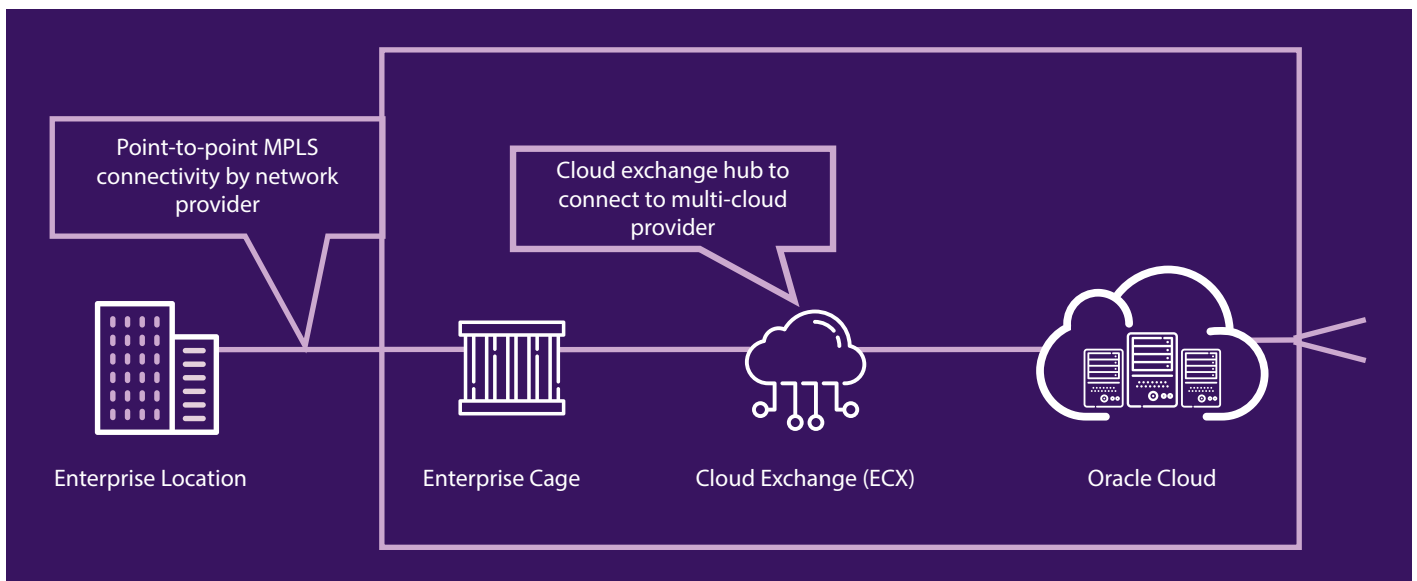


Fig 3: FastConnect via ECX

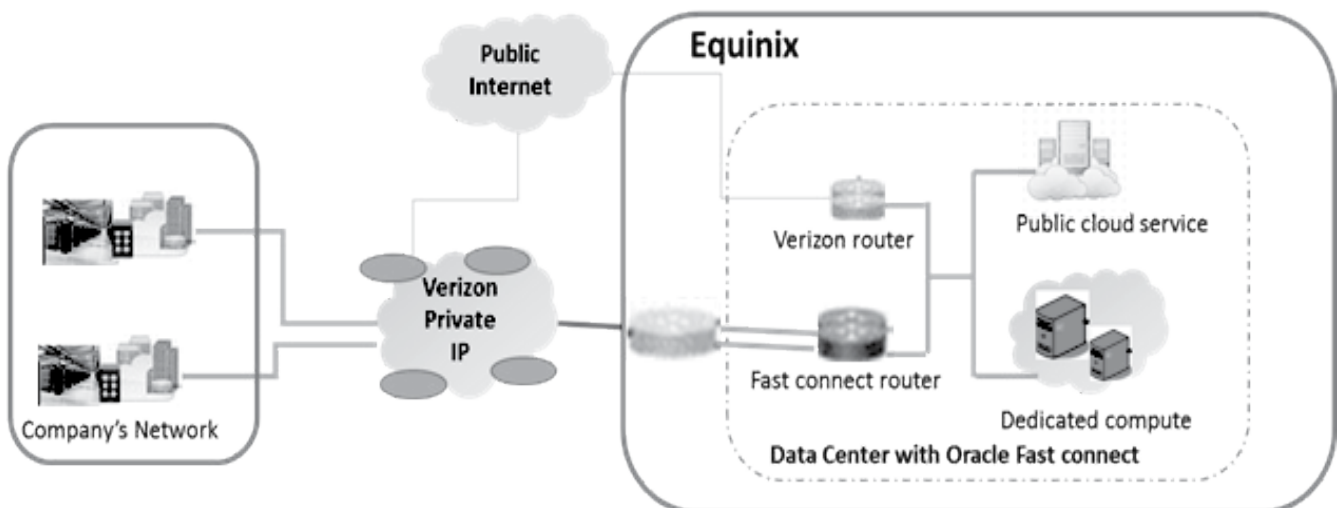


Fig 4: FastConnect via Verizon

Best practices in migrating applications to cloud

A structured approach can integrate several best-practices when migrating existing Oracle applications from on-premises to cloud. Such an approach involves the following phases:

1. Assessment: This identifies server, application and existing performance issues. It validates security and compliance and identifies the gaps between the current on-premises architecture and target cloud architecture. During the assessment phase, the following activities must be carried out:

- Understand current operations
- Analyze the as-is IT landscape including hardware, software and operating systems
- Identify security-related issues for data, networking and OS
- Institute back-up and recovery
- Ensure data integrity and security during migration
- Select the right cloud services

2. Proof-of-concept: The goal of this phase is to understand Oracle Cloud features, design the architecture and create high-level migration steps to build the

instance on the cloud. When designing infrastructure, one should also:

- Build various application instances in the new data center including the data migration strategy
- Set-up interfaces to point to appropriate sources
- Build recovery infrastructure
- Prepare a run-book to be used during production go-live

3. Test strategy for the migrated instance:

Here, a testing strategy is used to test each migrated instance.

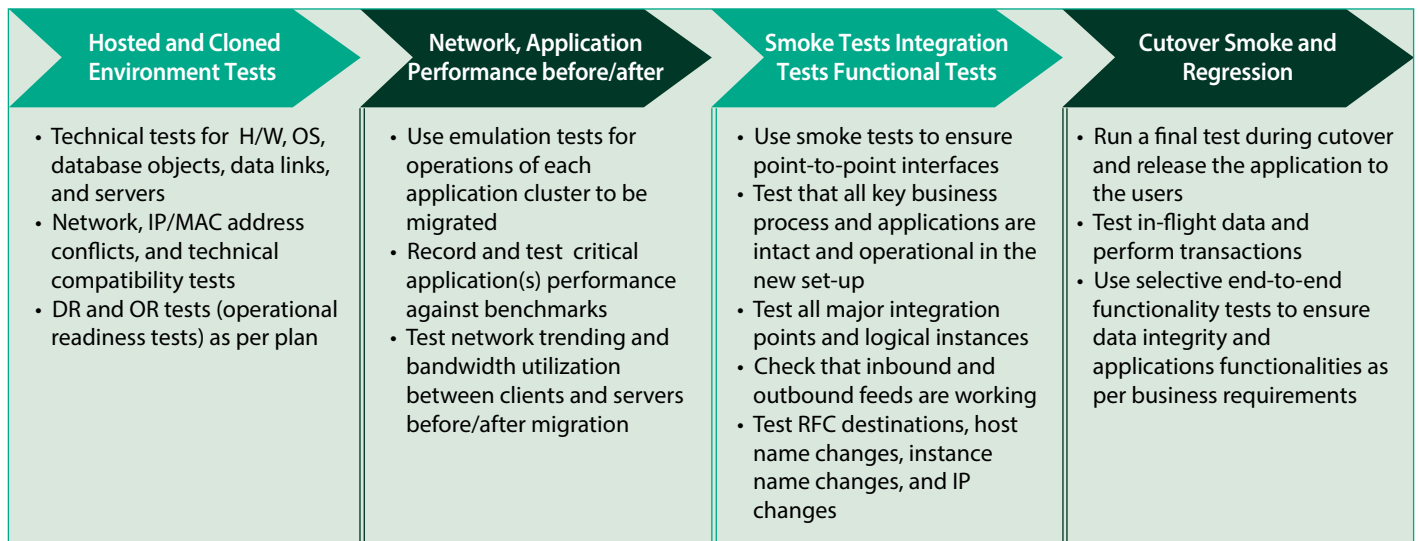


Fig 5: Key focus areas for different types of testing

4. Production application and database cutover plan: A robust plan is needed to limit application downtime when moving the production application from one stable state to another. The cutover plan should include step-by-step migration tasks by owners, roll-backs, decision checkpoints, and detailed information about the timing of trivial cutovers.



Migration to cloud – A use case

Here is an example to highlight high-level migration steps when moving from on-premises to Oracle Cloud.

Migration scenario

Source : EBS 12.1.x on Solaris on two-node

Target : EBS 12.1.x on Linux on Oracle IaaS

Source : Database 11.2.0.x on Linux

Target : 11.2.0.x database on Linux on Oracle IaaS

Preparation steps

- 1. Verify the supported Oracle E-Business Suite and database releases:** Use release 12.1.x with database 11.2.0.x where the database is at the level of July 2016 PSU or earlier.
- 2. Determine target application tier location:** The application tier should be placed on the Oracle Compute Cloud Service (IaaS). To avoid network latency, the application and DB should be placed in the same region.

- 3. Determine target database tier location:** Database can be placed on Bare Metal, Database Cloud Service (DBCS) or Exadata Cloud Service. Here, the database is placed on IaaS + Exadata Cloud Service in the same location where the application is hosted.
- 4. Provision the application and database:** Based on the existing application load, one should allocate OCPU, memory and block storage.
- 5. Stage storage on-premises:** It is important to provision the storage area to handle application and database backup for migration to the cloud.
- 6. Set-up network security:** The secure network architecture must be established before migrating data to the cloud. The set-up can be a site-to-site VPN (gateway or endpoint) or a private, high bandwidth connection between the client's data center and Oracle Cloud using FastConnect.

- 7. Generate the SSH key pair:** Generate the Secure Shell (SSH) key to access the VM or DB server on the cloud. Using the SSH key, the server can be accessed from anywhere.
- 8. Create a stage area on the cloud as well as on-premises for application tier and database backup:** The staging area on cloud VM or DB server is used to store the backup when moving from on-premises to cloud and restore the backup on the cloud during the application migration.
- 9. Install the operating system:** Install/verify the pre-requisite Red Hat Package Manager (RPM) packages and Oracle-certified Linux Kernel parameter settings on the target instance.
- 10. Install EBS R12.1.x on Linux:** Use the EBS-only image from cloud and install the EBS technology stack on the cloud. The image from cloud market helps rapidly provision Oracle applications with pre-packaged templates on Oracle Cloud.



Cloud migration approaches

There are two different migration approaches based on the network speed and database sizes to move databases from on-premises to Oracle Cloud.

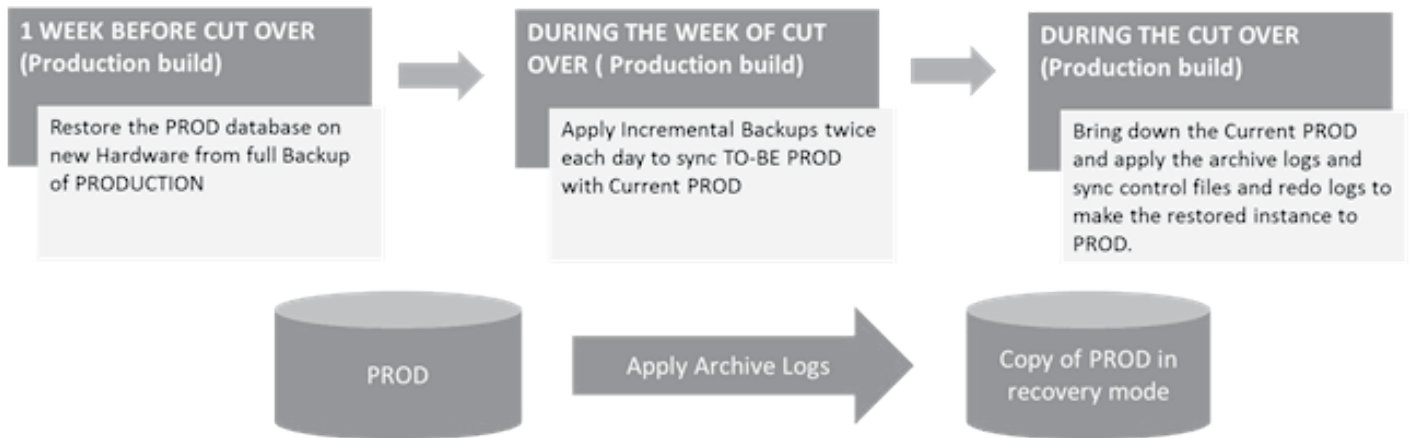


Fig 6: Migration approach during cutover weekend using database (Option A)

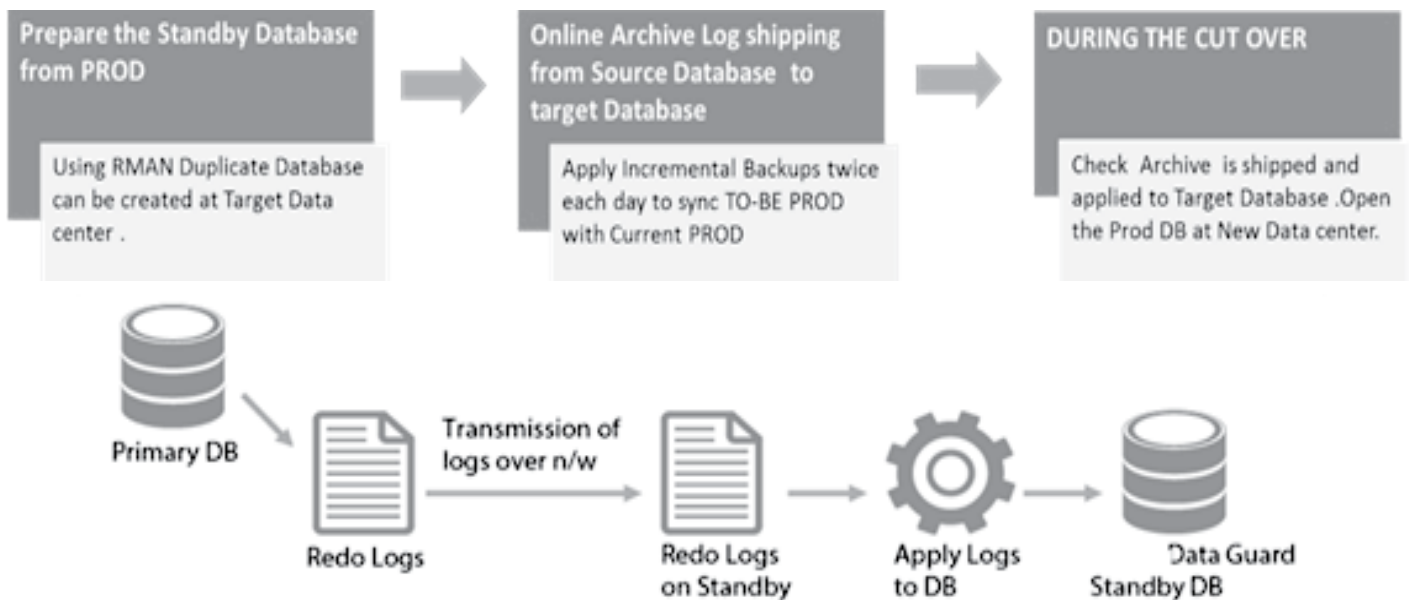
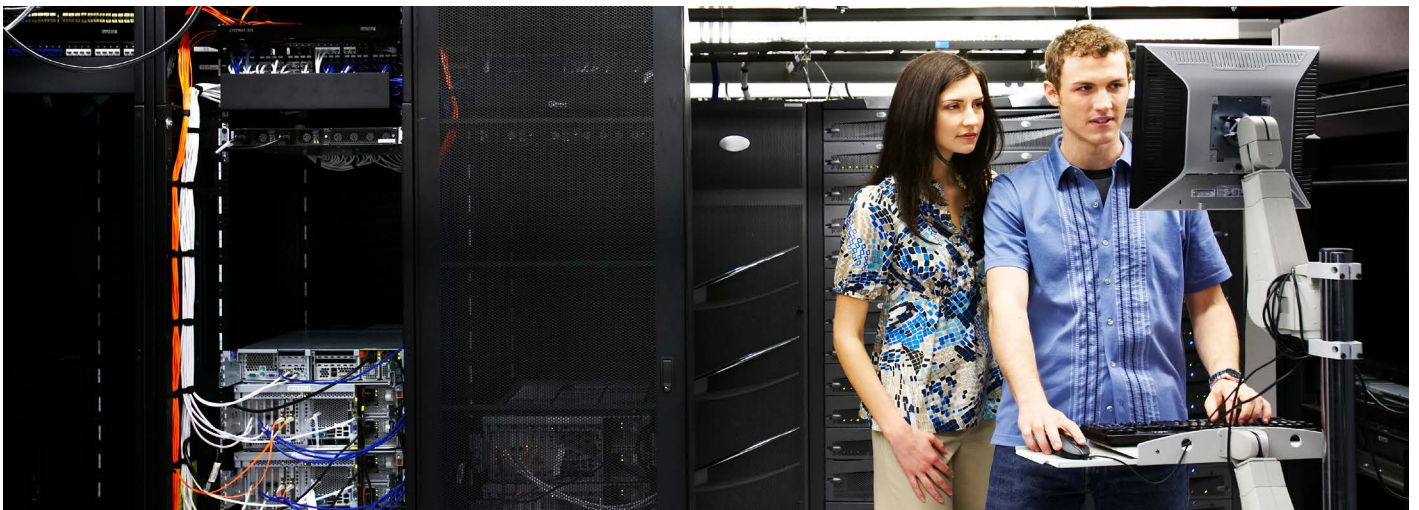
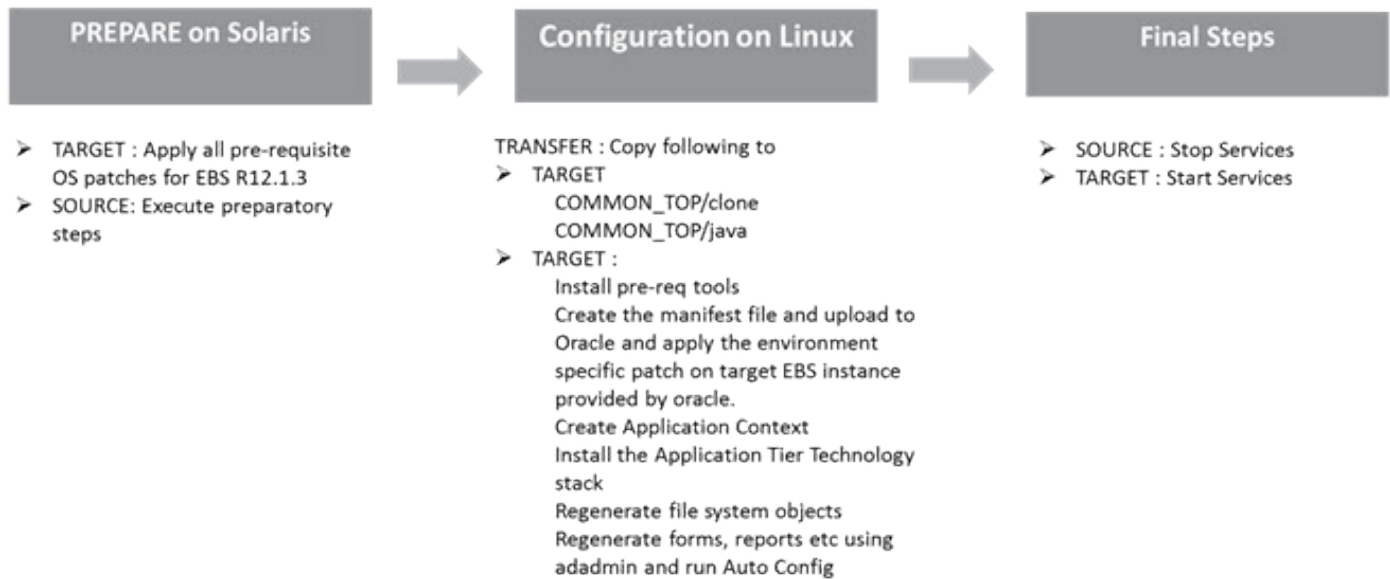


Fig 7: Migration approach during cutover weekend using standby database (Option B)



Platform migration of EBS R12.1.x application from Solaris/on-premises to Linux/cloud

Oracle uses a standard and certified approach to move an existing Oracle application tier from Solaris to Linux. The migration utility retains the exact Oracle E-Business Suite patch level so that no APPL_TOP/database synchronization is needed. This allows organizations to retain several customizations.



Cloud Platform migration Approach

Post migration tasks: The post-migration tasks that need to be completed after migrating application configurations to the cloud are:

1. Review and re-configure all integration check points such as inbound/outbound, file transfer protocol (FTP) directory, etc.
2. Ensure seamless change management of Secure Sockets Layer (SSL), if used, due to host change.
3. Apply the necessary technology stack patches after migrating the application from Solaris to Linux.
4. Verify and, if needed, re-create all database and symbolic links for the custom program at the application level.
5. Migrate custom code using DevOps.

Conclusion

Migrating workloads from on-premises to cloud helps organizations reduce IT costs. Besides this, cloud also improves data center resilience and offers high physical, logical and network security. However, organizations are often unaware which option – public, private or hybrid cloud – is suited to their business. Further, each migration strategy is governed by client-specific factors such as budget, security, compliance, failover control, and SLA management. Oracle Cloud Services helps organizations migrate Oracle applications by using a structured and phase-wise migration approach that includes assessment, proof-of-concept, testing, and a database cutover plan. By ensuring that the right compute, storage and network requirements are met, this approach helps organizations leverage best practices for successful workload migration.



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References

http://www.Oracle.com/webfolder/technetwork/tutorials/obe/Cloud/compute-iaas/migrate_ebiz_dbcs_ccs/05dbcs.html

<https://docs.oracle.com/en/cloud/get-started/subscriptions-cloud/ofcug/using-oracle-network-cloud-service-fastconnect-partner-edition.pdf>

https://cloud.oracle.com/opc/iaas/whitepapers/Oracle_Cloud_Security_Whitepaper.pdf

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