**"Please detail how you will transition software systems (migrate data) from a variety of platforms into Oracle Cloud Infrastructure"**

When PwC migrates sensitive client data from On-Premise systems into Cloud hosted infrastructure we adopt a careful and considered approach to data security ensuring the privacy and integrity of the data remains intact at all phases of the migration (***Rest -> Transit -> Rest***). We consider the use of encryption utilities on all layers of the underlying technology stack, coupled with the enablement of native security features, bespoke to the underlying vendor(s), ensuring a robust migration approach aligned to the best practices of the vendor(s).

Typically, the technical approach to a migration is dictated by the accepted downtime window of the underlying system, leaving zero compromise on the level of data security. Therefore, PwC will consider the following technical approaches to be considered:

1. Oracle DataPump over secure DBLink.
2. Oracle Transportable Database.

**a. Oracle DataPump (Export / Import) over a secure DBLink:**

There are a number of advantages to using Oracle DataPump for a database migration into OCI.

1. ***Encrypted, network-based Export & Import process, with no flat files.***

With a direct, encrypted network path from Source Database to Target Database, the data in transit is secured with Transport Layer Security (TLS). In turn, this removes the requirement for file-system based dump files, streamlining the migration process.

1. ***No restriction on matching Endian format for Source and Target database.***

Oracle DataPump provides platform migration flexibility where an Endian format change between the Source and Target Database be required. For example, should the Source Database be hosted on a Solaris platform, and Target Database be on an Oracle Linux platform, Oracle DataPump will allow for a seamless Export / Import, taking care of the underlying Endian format conversion automatically.

1. ***Simultaneously migrate and upgrade, minimising the downtime window.***

Migrating and upgrading the underlying Database software simultaneously can significantly reduce downtime window and avoid having to repeat administration tasks. This approach allows for a secure end-state Database system, upgraded to the latest certified release (Major Release), and inclusive of the latest Critical Patch Updates (CPU).

**b. Full Transportable Database**

Assuming the Endian format of the Source and Target Database is to remain unchanged, Oracle Full Transportable Database provides much of the same benefits as the traditional Oracle DataPump utility, with the exception of being unable to facilitate the change of Endian-ness.

Transportable Database makes use of the underlying technology behind Transportable Tablespaces, and allows for a datafile based migration as opposed to a block by block transfer. This is typically the quickest route to migrate data between Databases, and is therefore especially useful during time limited downtime windows, even when migrating large volumes of data.

Furthermore, Full Transportable Database can be coupled with a secure Database Link to allow for a single action Export, Transmit, Import across a secure and encrypted network.

**Application Tier Migration**

Oracle Cloud Infrastructure (OCI) provides several options to move applications into the cloud. There are two approaches which we would use to move workloads into OCI.

**Lift and Shift:**

The Lift and shift approach moves existing on-premise workflows as-is into OCI with minimal changes.

If using VMWare and the Oracle Cloud VMware Service (OCVS) we can provision VMware Software-defined Data Centres (SDDCs) within OCI.

VMware virtual machines are Lifted and Shifted from on-premise into the newly created VMware SDDCs environment in OCI.

OCVS gives you complete control of the SDDC, including hypervisor management, as you would on-premise.

**Move & Optimise:**

Our preferred solution depends on the discovery process. We would look to optimise and improve the workloads using the automated Oracle Cloud Migration Service (OCM).

OCM automates the migration process via the use of agents installed on-premise. The agents perform a discovery of Virtual Machines and replicate the data into OCI object storage.   
The migration service reconfigures the virtual machines.   
OCI Native VM compute instances are deployed using the replicated data from the on-premise virtual machines.   
On-going management is simplified as OCI manages the hypervisor layer.

During the discovery phase, we will seek further opportunities to use Cloud Native and DevOps technologies such as containers, serverless & event streaming to refactor the existing applications. With OCI's OKE (Oracle Container Engine for Kubernetes), we can build scalable and resilient infrastructure using the current application code in conjunction with Oracle's Autonomous Database service to simplify the administration and ongoing management of workloads.

With this approach, we will look at the following areas:

* Application Development
* Platform-as-a-Service (PaaS) Integration
* DevSecOps Development & Pipeline Implementation
* Network & Core Infrastructure Modernization
* Database Migration (includes serverless)
* Microservices & Event-Driven Development (includes serverless)
* Container development & deployment
* Monitoring

**Case Study 1:**

A private sector client with a countrywide footprint and a number of On-Premise Oracle databases, E-Business suite applications to support their back office finance function that have been migrated to OCI which is spread across two OCI regions. PwC migrated its Oracle E-Business Suite solution from On-Premise into OCI, tailoring the approach to allow for a simultaneous upgrade of each of the underlying components within the technology stack, inclusive of the latest in security fixes in its resting end-state. At a high level, the OCI solution consisted of Oracle VM DB systems, with Load Balanced Application Tier Compute instances protected by TLS 1.2 encrypted end-point. Resilience was provided through both a multi-region tenancy, as well as an Oracle Data Guard implementation at a database level to allow for agility in the failover / switchover in a Disaster Recovery scenario.

All data was encrypted at Database level using Oracle’s Transparent Data Encryption (TDE). With speed of transfer being of importance in order to minimise a five day outage window, Oracle’s Cloud Manager was deployed to extract the Database and Application and facilitate the migration into OCI Object Storage over an IPSec connection.

**Case Study 2:**

A leading global financial services client with 8 databases, E-Business Applications & customer interfaces has migrated to the Azure cloud in two regions. PwC simultaneously carried out a platform migration and Oracle Database upgrade, migrating a Oracle Database 12c (Non-PDB) running on Microsoft Windows (On-Premise), into an Oracle Database 19c (PDB-Enabled) running in Microsoft Azure. This reduced technical debt and moved the customer onto the latest long term support version.

Traditional Oracle DataPump Export was used to extract the Database into flat dump files, before migrating via TLS1.2 into the Microsoft Azure storage ready for import. The Target Database instance was able to be created ahead of time and patched to include the latest Major Release and associated Critical Patch Updates (CPU). This allowed for a seamless Import process and a minimal downtime window. DBlink(s) were created to facilitate the Oracle Finance team to transfer data from a non-Oracle database to an Oracle database.