The Art of a Smooth Migration

Ensuring Painless Technology Transitions

"To help address our concerns from moving from an Oracle Engineered Solution (Exadata) to Oracle running on VMware, we partnered with Viscosity to help mitigate that risk. Viscosity was able to bring to the table resources with intimate expertise related to setup, configuration, tuning and monitoring of Oracle running on VMware. Without their guidance and commitment to succeed, PHH would not have been successful in our migration from Oracle Exadata to VMware."

PHH

GOALS AND OBJECTIVE

- Minimize the dependency the Exadata system and enable a platform for streamlined migration to the cloud

CHALLENGE

- Analytic applications heavily relied on the Exadata core feature functionalities

PHH Overview

PHH, based in Mount Laurel, New Jersey, provides outsourced mortgage banking services to a range of clients, including financial institutions and real estate brokers throughout the United States, and is focused on originating, selling, servicing and subservicing residential mortgage loans. The company operates through two segments: Mortgage Servicing and Mortgage Production.

Introduction

PHH purchased an Oracle Exadata X2 Database Machine (Exadata) to support their mission-critical and business analytic systems. At the time of purchase, the Exadata provided a perfect platform for their highly demanding Oracle reporting and transactional workload. Also, to maintain a high return on investment in their Exadata, PHH consolidated many Oracle database systems into the Exadata. For eight years, their business analytics heavily leveraged the capabilities and key attributes of Exadata, such as Smart Scans, Predicate Pushdown and Storage Index. Viscosity supported and maintained this Exadata over the past several years, and routinely reviewed AWR reports to validate and verify performance.

However, due to a number of factors, including reduction in volume of transactions in the systems (which directly correlates to the reduced use of business analytics), overall support cost of the Exadata and the high cost of talent acquisition required to support Exadata, PHH made a strategic change in direction for their database platform.

PHH decided that a cloud platform was the long-term strategic direction. Note, the cloud platform and vendor was not determined at the time of this writing. Thus, until the cloud platform was properly evaluated, the mid-term direction was to migrate these applications to an on-premise VMware platform. This was a natural selection, as VMware was already the platform of choice for most of PHH's middleware, SQL Server and Microsoft back office products (SharePoint, Exchange, etc.). Moreover, a migration to VMware also provided an opportunity to move to traditional cloud services.

Although there was a reduction in transactional activity on the system, the importance of the business analytics and other systems was still extremely vital. Thus, the appropriate VMware configuration was of the utmost importance.

Goals and Objective

The key objective of this migration to VMware was to minimize the dependency the Exadata system and enable a platform for streamlined migration to the cloud. However, the challenge was with the analytic applications, such as Commander, which heavily relied on the Exadata core feature functionalities. To mollify the application performance, there was a concentrated effort to remove the reliance of these features. This required database infrastructure change (hardware and Oracle stack software), database structural change (adding indexes, object partitioning, pre-sorting columns, etc.) and a SQL re-write in some cases.

The PHH Exadata was a ¼ rack system (two compute nodes and three storage cells). To mimic this configuration, staff decided that the database architecture would implement Oracle Real Application Clusters (RAC) for scalability and high availability. Viscosity-PHH deployed a three-node VMware cluster to support a three-node RAC cluster, based on Cisco UCS M5 blades.

FINAL PHH VMWARE CONFIGURATION	
COMPONENT	VERSION/DETAILS
VMware	• VMware 6.0 — 3 node vSphere cluster
Server Hardware	• Cisco UCS B200 M5 • 1.5TB memory Intel Xeon E5-2600 v3/v4 processors
Oracle Grid Infrastructure	• 11.2.0.4 • 3 node cluster

Oracle Database (RAC)	• 11.2.0.4
	• 3 node cluster
	• Options:
	  • Real Application Clusters (RAC)
	  • Partitioning Option
	  • Real Application Testing (RAT)
	  • Diagnostics Pack

FIGURE 1: PHH VMware Configuration: This database architecture implements Oracle Real Application Clusters (RAC) for scalability and high availability.

Process

Project Planning and Assessment

- Detail out the project specifications for the migration.
- Assess current Exadata database and system workload, configuration, evaluate and document system capacity.
- Define appropriate VM sizing for database environment.
- Review and assess database migration strategy options — Datapump or RMAN with GoldenGate.

Dev Database Migration (for each database)

- Install Oracle software and apply patches to current Oracle Software Home.
- GoldenGate migrate database from source Exadata to target VMware VM.
- Validate database.
- Perform volume and unit testing using RAT (Real Application Testing) and SPA (SQL Performance Analyzer).
- Post-migration support.

Prod environment migration

- Install Oracle software and apply patches to current Oracle Software Home.
- Instantiate GoldenGate replication for Commander database to achieve nearly zero-downtime migration.
- Upgrade/migrate database from source Exadata to target VMware VM.
- Implement Tuning recommendations from UAT testing.
- Validate database.
- Set up GoldenGate reverse replication to provide a backout strategy.
- Configure OEM for monitoring.
- Post-migration support.

A component of the migration to VMware included a database upgrade and patching to 11.2.0.4. To provide zero-downtime migration, Viscosity decided to leverage GoldenGate for the Exadata-to-VMware migration. This database migration strategy was chosen depending on the state, size, version and criticality of the Oracle database. Furthermore, this migration method was used for all the key databases.

The Viscosity-PHH Team built a UAT environment to test and rollback the Exadata features. Viscosity-PHH spent the largest portion of the engagement in this UAT phase, as this defined how well-behaved the application would be without the Exadata features as well as the impact of the hypervisor.

The following key Exadata metrics were used to evaluate overall potential impact:

- Cell physical IO Bytes eligible for predicate offload
- Cell physical IO bytes saved by storage index
- Cell physical IO interconnect bytes return by smart scan

In an Exadata environment, administrators would expect high values for these metrics to showcase database scalability and efficiency. However, for non-Exadata these need to be converted to non-Exadata calls.

This UAT validation leveraged the Oracle Real Application Testing and SQL Performance Analyzer Database features to capture various Exadata workloads from a variety of timeframes. This captured workload was replayed on the VMware configuration. AWR as well as system reports were evaluated for performance impact and reviewed for further tuning. In addition, esxtop was collected to evaluate hypervisor performance.

Over 100 queries were candidates for evaluation across multiple databases, of which 40 queries required some form of re-work.

Key changes made through the RAT evaluation included the following:

- Addition of indexes to counter the effect of full tables that leveraged Smart Scans
- Modified predicate filters to minimize row
- Modified Database Initialization Parameters
- Implemented 30 percent larger buffer cache and SGA
- Deployed minimal number of VMs per ESXi hosts

Key VMware best practices were implemented to minimize hypervisor overhead included the following:

- Adherence to NUMA CPU/memory boundaries. Each RAC VM was 16 vCPUs and 96GB.
- Implemented Linux hugepages (70 percentof total allocated memory)
- Use of paravirtualized drivers (PVSCSI)
- Multiple SCSI controllers. Datafile traffic was separated from Redo log traffic.

After each query was tuned, a list of implementation details were "canned." These canned changes would need to be implemented for the Production rollout.

Overall Benefits and Conclusion

PHH reached the point where an investment was required to address PHH's Oracle Exadata X2 supportability. When evaluating performance and feature requirements, along with in-house resource skillsets, it was determined that utilizing commodity hardware configuration running VMware was a more cost-effective solution. Although exact cost savings cannot be easily identified, significant operating expense reduction would be realized with a move to cloud with and cloud automation.

It should be noted that the migration off of an engineered system, such as Exadata is not a simple and straightforward exercise — especially when the application is heavily dependent on the engineered system's feature functionality. The project to migrate onto VMware took many man-months, creativity and deep skillsets across the tech stack.

For more information on cloud computing and VMware vCloud Powered services, please visit **vmware.com/solutions/cloud-computing.html** or contact your VMware representative.