Migration from VMware to Oracle VM – A Case Study

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Oracle on Oracle Introduction

This paper is based on an Oracle Consulting project that was initiated following the acquisition of Micros Corporation by Oracle. One of the technical objectives resulting from that acquisition was to deliver the Micros Hospitality applications as a software as a solution (SaaS) via the Oracle Cloud.

The first phase of that SaaS effort involved building a Proof of Concept (PoC) environment, representative of the Oracle Cloud for Industries (OCI) hardware and software infrastructure, and migrating the Micros applications over to that infrastructure.

Micros had historically deployed their multi-tiered, highly distributed, Global Hospitality Cloud applications on infrastructures based on VMware 5 virtualization, and operating systems and hardware from Microsoft, HP, EMC, Cisco and HP-3Par. Micros also had all of the associated datacenter costs and issues including fragmented environments with various critical applications running on disparate operating systems and proprietary hardware from an array of vendors; all with their loosely integrated point product tools for infrastructure management.

The desired end state, as well as a Corporate mandate, was to have the core Oracle-Micros Hospitality Cloud applications running on Oracle hardware, i.e. Oracle on Oracle, while leveraging the OCI recommended framework and Maximum Availability Architecture (MAA) best practices for Oracle Virtual Machine 3 (OVM 3), Sun X-Series enterprise grade servers, and ZFS-SA storage provided over SAN and NAS topologies. This paper focuses specifically on the approach used to migrate Micros applications from VMware VM onto the Oracle VM using the PoC Oracle on Oracle platform.

VMware to OVM Migration – a Structured Approach

The VMware VM to OVM migration approach involved 3 primary phases outlined below.

» Discovery/Assessment Phase. The primary steps in this phase included reviewing the existing virtualization system architecture, discovery of the existing VMware foot prints at the Micros datacenters, and establishing a target architecture recommendation. During this process the existing compute, memory, network interfaces, network topologies and storage profiles were compiled for each ESXi server cluster in the environment using VMware Tools, vSphere Client or vCenter functionalities. In some cases other third party tools are used for this purpose. RVTools for example, is a third party product and is capable of generating an RV Report for the VMware VM infrastructure providing a detailed outline of the VM configurations.

» Target OVM Environment Build Phase. This phase entailed the process of constructing the new OVM Cloud PoC environment utilizing the newly acquired Oracle X4-2 servers, a Cisco network infrastructure, ZFS-SA storage appliances, and with OVM 3 virtualization technology; following the OCI recommended guidelines while building the PoC ecosystem.
**Automated Migration Phase.** This phase was comprised of the actual migration of VMware VM image (OVA) files to Oracle VM Assembly by executing custom scripts developed using Oracle VM APIs and CLI scripts. Automated migration process is illustrated at a high level in Figure 1.

**Discovery and Assessing the Source VMware Environment**

The process of assessing the existing VMware environment involved gaining a thorough understanding of the Micros VMware landscape by determining the number, sizes, and contents of the VMs that were to be migrated. Ultimately this process led to establishing the target OVM architecture and mapping of VMware VMs, from current state to OVM based future state. The steps followed were to:

- Collect vSphere Reports, by selecting the vSphere Client Virtual Machines Tab or using RV Tools
- Collect Compute, Storage and Network capacity statistics from Oracle Enterprise Manager, and other similar resource management platform used to monitor host, network and storage resources.
- Review provisioned Virtual Machine specifications for Memory, Network, CPU, and Storage; noting over-provisioning factors
- Translate above data to an equivalent Oracle VM target, OVS server cluster and overall VM design.

**Building the Target VM Migration Environment**

There were three key design considerations when architecting and deploying the virtual machine environment using Oracle VM 3. For the PoC, Oracle Consulting followed the OCI recommended framework with slight modifications required to suit Micros’ requirements.
Oracle VM Management (OVMM) Design and Deploy

Oracle Virtual Server (OVS) is comprised of a lean, highly optimized, hypervisor component that runs on the physical server(s) and are typically clustered to provide VM High Availability (HA) functionality. OVS provides the compute, network, and storage resources to the guest VMS. A separate tightly integrated virtual infrastructure management platform component, Oracle Virtual Machine Manager (OVMM), runs on either a separate physical or virtual server, usually in an HA manner. These two major software components, OSV and OVMM, are collectively known as OVM. For the PoC OVM Manager was installed on a physical server, which is the preferred practice. OVM Manager was used to create, provision and manage one or more OVS physical server pools, manage and provision the various resources to the guest VMs running in the pools; resources such as SAN and NAS storage and the virtual networking utilized by the guest OSs and application stacks. There were some key design considerations for OVMM that were factored into the overall Oracle VM deployment architecture and these are:

» Location of OVMM – physical or virtual server; a physical server is preferred.
» Standalone or high availability configuration for OVMM – HA is preferred.
» Location and technology for OVMM data store – MySQL or Oracle DB – MySQL for PoC.

Oracle VM Manager stores its management data in a database, which could have either been installed locally on the Oracle VM Manager Server or remotely on another server. For the PoC, the default MySQL local database was sufficient; however for more enterprise production environment deployments Oracle Database 11gR2 Standard Edition could be used.

Oracle VM Shared Storage Design and Deploy

As with any IT ecosystem, the storage platforms chosen and how they are configured are critical to the overall performance of the environment. The following areas were considered during the PoC storage design and deployment:

» Planning and architecting for shared multi-tiered storage resources; in the PoC an Oracle ZFS Storage Appliance (SA) ZS3-4 array was used, composed of an Active-Active HA operating mode and utilizing 10K SAS HDD drives and write biased SSDs
» Provisioning of the shared storage to the OVM server pool repositories utilizing the ZFS-SA capabilities of providing a variety of block and file level access over: FC, iSCSI, NFS and CIFS, in order to provide performant and capacity oriented resources over various media types. For the PoC, performant NFS and iSCSI over 10GBE LACP and IPMP bonded links were used to provide 40Gb/s of network bandwidth from each ZFS-SA controller node
» Assuring that SLA dependent storage resources for performance, availability and capacity are provided when creating the repositories (i.e., storage resources) that align well to established application IO characterizations for Micros’ applications
» Presenting of the OVM repository based storage, if used, and Raw Device Mapped (RDM) storage to Oracle VM guests, in a manner that provides the most optimal storage performance aligned to the application IO characterizations. For the PoC, only repository based storage was used.

Oracle VM Network Design and Deploy

The following areas were considered carefully during the OVM network design and deployment, and are described in brief below. Generally speaking, six to eight network service types are deployed for a Maximum Availability Architecture (MAA) compliant OVM environment. For the PoC, certain functions that would otherwise be on dedicated networks were combined onto one VLAN. Specific network
service configurations utilized in the PoC are depicted and described below in Table 1. The various network types provide the virtualization servers and network infrastructure functional areas used in the PoC OVM ecosystem.

### Network Service Types

<table>
<thead>
<tr>
<th>Network</th>
<th>IP Network – Description</th>
<th>Type</th>
<th>Design &amp; Usage Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.0.1.0/24 Oracle Server VLAN</td>
<td>Routable</td>
<td>Sun X4-2 Server Client access: OVMM was installed on a Physical X4-2 server. This network was used for direct access to the X4-2 OVS Server Pools.</td>
</tr>
<tr>
<td>2</td>
<td>10.0.2.0/24 Application VLAN</td>
<td>Routable</td>
<td>Application Server Client Access: This network was used for Application server VMs. Application servers, Web-tier and Infrastructure servers all used this network.</td>
</tr>
<tr>
<td>3</td>
<td>10.0.3.0/24 Database VLAN</td>
<td>Routable</td>
<td>Database Server Client Access: This network is exclusively used for Database server VM machines.</td>
</tr>
<tr>
<td>4</td>
<td>192.168.4.0/24 OVM Management VLAN</td>
<td>Non-Routable</td>
<td>Server Management: OVM Manager communicates with agents on the physical OVS servers using this network. &lt;br&gt; Cluster Heartbeat: The Oracle Cluster File System heartbeat occurs over this typically dedicated network between the OVS servers within a physical server pool. This network is extremely latency sensitive and should not be shared with other traffic when possible. &lt;br&gt; Live Migrate: This network is used for OVM Live Migrations of running virtual machines from one OVS server to another within the OVM server pool. Normally a dedicated network is used for this purpose</td>
</tr>
<tr>
<td>5</td>
<td>192.168.5.0/24 ZFS Storage VLAN for NFS</td>
<td>Non-Routable</td>
<td>Storage Network: This network was used to provide a high performance storage network for the OVS servers. When possible this network should use TCP/IP ‘Jumbo’ frames, which uses a 9K frame vs. the standard 1.5K frames. In the PoC we used 1.5K frames</td>
</tr>
<tr>
<td>6</td>
<td>192.168.6.0/24 Database Heartbeat VLAN</td>
<td>Non-Routable</td>
<td>RAC Cluster Heartbeat: this network was used to provide a RAC cluster heartbeat between nodes and is latency sensitive; therefore it is a dedicated network.</td>
</tr>
</tbody>
</table>

### PoC Network Topology of Oracle Sun X4-2 Servers and ZFS Storage

Figure 2 below illustrates the physical network topology used for the OVM based Hospitality Cloud PoC infrastructure, and depicts the network types and usage described above in Table 1. The PoC had (1) X4-2 for the OVM Manager, OVM Tools and a local MySQL database. The array of (15) X4-2 Servers formed the compute node pool(s). An Active-Active ZFS-SA cluster provided the highly performant, highly available NFS and iSCSI based storage environment used to define the OVM Storage Repositories.
OVM Network Topology - A Logical View

Figure 3 below illustrates the logical network topology used for the OVM based Hospitality Cloud PoC infrastructure, and depicts the network types and usage described above in Table 1. The PoC had (1) X4-2 for the OVM Manager, OVM Tools and a local MySQL database. An array of (15) X4-2 Servers formed the compute node OVS cluster pool(s). An Active-Active ZFS-SATA cluster provided highly performant, highly available NFS and iSCSI based storage resources used to define the OVM Storage Repositories.
Figure 4, shown below, illustrates the PoC network topology used in the OVS server pool created for the migration effort. There are four physical 1/10 Gigabit Ethernet (GBE) link ports on the Sun X4-2 PoC servers that were used (eth0 - eth3) on each OVS server to provide the various network connectivity and services required, as described in Table 1 earlier. The 4 GBE link ports were used to first create Virtual Interfaces (VIF) on each physical interface, the VIFs were then associated with unique VLANs to create the two bonded network interfaces (bond0, bond1). VLAN groups were then assigned as described earlier using the bonded interfaces. As shown below Net0 and Net1 forms bond0 for the OVM Management network and for the storage network; VLANs 900 and 902 respectively. Net2 and Net3 formed bond1 providing Client Access over VLAN 901 for the X4-2 OVM server client access network, VLAN 903 for client application access to the guest VM network, VLAN 904 was used for the guest VM Database server client access network, and VLAN 905 was utilized for the RAC Database VM machines Cluster heartbeat network.
OVM Migration and Automation

While there are limited opportunities for automation in the discovery and assessment, and target build phases; the actual migration process of converting the VMware image files offers the best opportunity for automation. To facilitate a VMware to Oracle VM migration effort, Oracle Consulting has built and packaged a number of scripts to perform the following migration tasks:

» Migrate OVA images to Assembly
» Convert Assembly to Template
» Generate VM Machines from the Template
» Template from Open Cloud repository
» Convert Open Cloud template to VM Machines
Figure 5 above illustrates the actions that create VMware OVA images as inputs to the OVM Assemblies, and subsequently used to create OVM VM Templates used to create the Oracle Linux and Windows VMs utilized by the OPERA and SIMPHONY applications.

Conclusion

The Micros re-platforming project proved the viability of a structured and repeatable process for migrating the Oracle-Micros Hospitality core application sets, from a VMware 5 Enterprise grade environment of all non-Oracle hardware, to an Oracle Virtual Machine environment running on Oracle hardware. The additional effort invested in automating key components of the overall migration process resulted in the ability to scale the migration process, with a cost efficiency that accommodates the migration of large enterprise landscapes of VMware infrastructures.