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DBS Bank builds private cloud with Oracle Linux and Virtualization

Moving the business forward with IT innovation

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Public

Purpose statement

This document provides an overview of a successful implantation of a private cloud built using Oracle technologies.

Introduction

Many companies move from expensive proprietary hardware to cheaper commodity systems to lower operational costs and enable a more flexible infrastructure.

Financial institutions considering this switch face additional concerns however, as they handle sensitive data that is tightly regulated and must meet strict compliance standards.

This paper explores how DBS Bank successfully made this transition by building a new private cloud infrastructure using Oracle technologies. You will learn implementation details, and how this project fit into DBS Bank's greater strategic IT shift to embracing a corporate open source strategy.

"Building our private cloud using commodity hardware with Oracle Linux and Virtualization has enabled us to scale and keep up with our growth, and improve our security and operational efficiency while reducing our cost."

KOH Jit Soon
Executive Director
Cloud Engineering & Services
DBS Bank

About DBS

DBS Bank Ltd is a leading financial services group in Asia with a presence in 18 markets. Headquartered in Singapore, DBS is in the three key Asian axes of growth: Greater China, Southeast Asia, and South Asia. The bank's "AA-" and "Aa1" credit ratings are among the highest in the world.

Recognized for its global leadership, DBS has been named “World’s Best Bank” by Euromoney, “Global Bank of the Year” by The Banker, and “Best Bank in the World” by Global Finance. . In addition, DBS has been accorded the “Safest Bank in Asia” award by Global Finance for 12 consecutive years from 2009 to 2020. The bank is at the forefront of leveraging digital technology to shape the future of banking.

A few years back, DBS started to receive recognition as a technology leader. This was after they successfully embarked on a journey to transform their IT landscape from legacy platforms towards newer technologies such as cloud computing models and open source software.
Motivating these changes was a desire to re-architect the bank’s technology infrastructure, software, and processes to help drive the bank’s broader digital transformation efforts.

DBS’s IT challenge

The DBS Technology Team needed a more scalable and cost-effective architecture to support 30+ core financial applications running on Oracle middleware and database tiers. These applications were housed on a physically localized technology infrastructure built using proprietary Unix servers and related technologies. While there are several advantages for using these robust legacy systems, there were also many downsides. For one, the systems were very expensive to purchase and maintain. Furthermore, it was not easy to add additional compute capacity. This was especially challenging to do across different data center locations. For these reasons, the team wanted to consider alternative technology models.

Any new infrastructure plans were required to ensure the chosen technologies’ performance, reliability, security and uptime would meet the requirements of a financial institution such as DBS, that are tightly regulated and need to adhere to strict compliance mandates. Additionally, DBS could not compromise on the availability of its business operations. Consequently, any new architecture would have to either meet or improve application performance.

Building a Private Cloud

After carefully evaluating the options, the DBS Technology Team decided to replace its legacy environment with a virtualized private cloud built using x86 commodity servers and software solutions. This new model offered greater scalability and could more easily accommodate future growth.

Much of the design for this new private cloud architecture focused on Oracle Database, which powers the performance of the 30+ applications. With Oracle Database as a core component, it made sense for the DBS Technology Team to evaluate Oracle Linux and Virtualization solutions. Both offered licensing and performance advantages when compared to competitive offerings. Adopting

these solutions would also complement DBS's commitment to open source software.

While many people do not typically associate Oracle with the open source community, Oracle actually offers many open source technologies. These include Oracle Linux, Oracle Virtualization, MySQL, Java, and more. Established in 2006, in response to customer demand, Oracle Linux was launched and is one of the first distributions designed for enterprise workloads. Oracle is also a founding, platinum member of the Linux Foundation. As part of this endeavor, Oracle engineers work with other contributors in the global open source community and regularly contribute millions of lines of code towards mainline kernel development.

The DBS Technology Team realized that Oracle Linux offered many technical benefits, such as easier set-up and administration, when used in conjunction with the Oracle Database. When using Oracle Linux, customers can choose between two kernel options, the Red Hat Compatible Kernel (RHCK) and the Unbreakable Enterprise Kernel (UEK). RHCK is identical to the kernel shipped with Red Hat Enterprise Linux, whereas UEK is based on the mainline Linux kernel versions that offer newer capabilities.

UEK is also designed to optimize Oracle Database performance. For example, there have been significant enhancements in UEK for OLTP, InfiniBand, SSD disk access, NUMA-optimizations, Reliable Datagram Sockets (RDS), async I/O, OCFS2, and networking. UEK also provides extensive performance and scalability improvements to the process scheduler, memory management, file systems, and the networking stack. For these combined reasons, the Technology Team decided to use Oracle Linux with UEK.

Oracle Linux also offered a valuable security feature with Ksplice. This is a live-patching tool that helps ensure system security without downtime. Ksplice patches the Oracle Linux operating system kernel and select user space libraries while the system is running, without a reboot or any service interruptions. This unique capability enables the DBS Technology Team to stay current with important Linux patches and updates while keeping operations smooth and reliable.

Further enhancing IT security, Ksplice can detect attempts to exploit kernel vulnerabilities that have been patched in memory. If there is an attempt to execute code on a compromised server, Ksplice proactively alerts IT administrators so they can quickly act.

To manage the operating system environment, the DBS team uses Oracle Linux Manager, a management tool based on the open source Spacewalk project. This tool includes all the features previously available in Oracle's earlier management offering as well as incremental enhancements. Oracle Linux Manager filters the listed errata and package upgrades to only those relevant to the module.

In addition to the performance and security gains by using Oracle Linux, the DBS Technology Team also lowered its costs. Oracle Linux can be downloaded, used, and distributed free of charge and all updates and errata are freely available. Customers decide which of their systems require a support subscription. This

makes Oracle Linux an ideal choice for development, testing, and production systems, since support coverage can be optimized for each individual system, while keeping all systems up to date and secure.

The DBS Technology Team decided to use Oracle Virtualization hard partitioning with Oracle Database in a true active-active VM setup. The Technology team was also able to use Oracle VM Templates for the Oracle Database VMs. Templates are self-contained and pre-configured virtual machines of key Oracle technologies. Each Oracle VM template is packaged using Oracle best practices, which eliminates installation and configuration costs, reduces risk, and dramatically shortens deployment time. These templates also help ensure that all VMs are deployed consistently and reliably. Using Oracle Virtualization also offered a financial upside, given the favorable support licensing model is based on allocated VM cores. This helped to further lower overall IT costs without compromising performance.

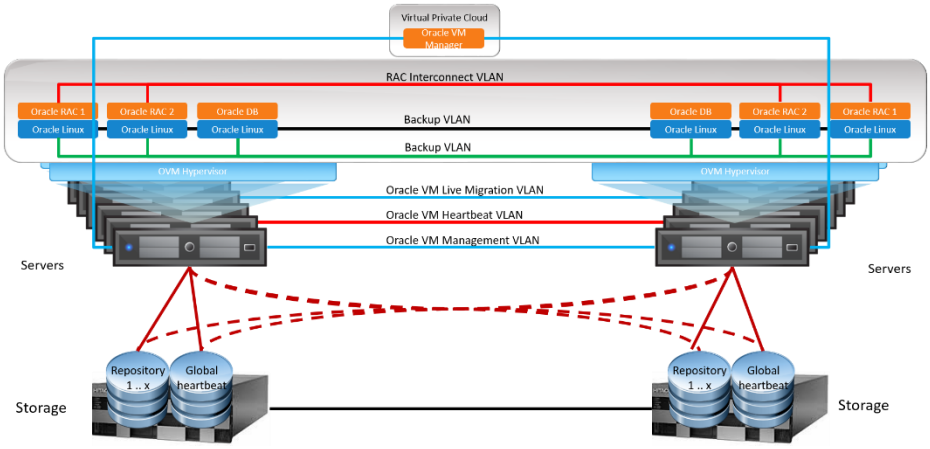

Figure 1.1 Diagram of the private cloud architecture

The details

Below are the architectural highlights and results, including high-level configuration approaches that were successful for the DBS Technology Team.

Capacity/Performance

- The private cloud uses a dedicated storage frame and all flash disks to speed up I/O database performance. Typically, I/O performance is the slowest part of any database transaction. Thus, improving the I/O improves the overall database performance.
- An Oracle VM repository is dedicated per application. This minimizes any competing I/O access for other applications, which can impact performance.

Reliability

- Oracle Database VMs are deployed using Oracle Database Real Application Cluster (RAC) template(s). This helps ensure that all VMs are deployed consistently and reliably.

High Availability & Disaster Recovery

- Disaster recovery drills were virtually eliminated as the same Oracle Database VM can be flipped and run from an alternate site.
- The flip can also be done in isolation at an application level, instead of across the board.
- VMs are configured with High Availability. This way, in case of a frame failure, the VM can be more easily restarted.

OPEX Costs

- OPEX cost was lowered by 40% by using Oracle Linux and Oracle Virtualization.

Moving forward

The DBS Technology Team is currently onboarding some of Oracle's newest virtualization offerings. These include Oracle Linux Virtualization Manager and Oracle Linux KVM, which are components of the Oracle Linux operating environment, already used to power its private cloud. Oracle Linux Virtualization Manager is a server virtualization management platform that can be easily deployed to configure, monitor, and manage an Oracle Linux Kernel-based Virtual Machine (KVM) environment.

There will be many advantages for implementing the new offering. This includes support license consolidation for further OPEX savings since the same license can cover both the operating system and virtual machines. Moving to Oracle Linux Virtualization Manager and Oracle Linux KVM also provides advanced features not available in Oracle VM. These features include snapshots which allow administrators to make copies while the VMs are running for backup and archival purposes. This will be another valuable tool for the Technology Team to meet their compliance and disaster recovery requirements.

Another new feature is Role-Based Access Control (RBAC) for granular user level control. This can further enhance private cloud security since IT administrator access can be specifically segmented. This means that an administrator cannot accidentally reconfigure the wrong environment or see some data that they are not supposed to see. There is also an auditing capability with log files showing who accessed which parts of the system.

Conclusion

While any technology migration is challenging, moving to a new platform and redesigning an entire solution stack is a massive endeavor. The DBS Bank deployment showcases a business that successfully migrated from its legacy systems and embraced newer technologies to improve infrastructure performance, increase security, and still adhere to strict compliance standards. The DBS Technology Team did this by building a private cloud using x86 severs, Oracle Linux, and Oracle Virtualization solutions.

Additional Resources

To learn more about the benefit from using Oracle Linux and Oracle Virtualization, please visit

- oracle.com/linux
- oracle.com/virtualization