Ohio Mutual Insurance Group's Deployment of WebSphere Application Server on VMware® ESX

April 2010

TECHNICAL CASE STUDY

vmware

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Executive Summary

This document describes the deployment of the IBM WebSphere Application Server (WAS) software in a set of virtual machines on VMware® ESX™ at the Ohio Mutual Insurance Group (OMIG). This deployment has been in place for more than two years and it serves the needs of 200 users within the larger company and 2400 outside users among its affiliates outside the company.

The performance of the virtualized WebSphere-based systems is seen to be very satisfactory for their users. The response times for the applications on the virtualized systems are better than those previously seen in the purely physical implementation. The company has seen a significant overall improvement in its failover and disaster recovery implementation as a result of virtualizing these systems as well as a significant cost reduction through consolidation of their hardware servers in the data center and the associated administrative tasks.

Company Overview

OMIG is a leading property and casualty insurer in the USA. The company has 200 internal staff using the virtualized applications located at its headquarters facility in Bucyrus, Ohio. The company also partners with over 300 independent insurance agencies (involving over 2400 individual agents) to distribute and service high quality property and casualty insurance products in the states of Ohio, Rhode Island, Connecticut and Indiana. The company uses virtualized computer systems supporting applications running on WAS for both its own staff and for outside independent agency staff. External partners use the OMIG systems through a custom-built web interface that also makes use of WAS and links to an internal policy management application.

Business Challenges

OMIG was faced with the challenge of providing access to business applications to a wide variety of users both inside and outside of the company's firewalls. It needed to do this while maintaining consistency and security of the customer data at all times. Since many of the application users are not company employees and some are located in different states, the levels of secure access and availability required careful consideration. The company also wanted to make use of more up-to-date technologies than it previously had in order to provide a basis for continuing use well into the future. Preserving access to some older tried-and-trusted applications on more mature systems is also very important. Some of the company's back-end systems run on IBM System i-series servers, for example.

OMIG had been using the VMware Infrastructure platform extensively for its applications development and testing activities since 2004. Between late 2005 and 2008, the company underwent an initiative to consolidate its original 40 physical servers down to seven systems with VMware Infrastructure. By late 2008, 99% of OMIG's IT environment had been moved to the VMware Infrastructure platform. Consolidation of its physical servers allowed the company to reduce equipment capital expenditure as well as power, cooling and recurring administrative costs.

The company also achieved increased application flexibility through using the virtual platform

- to move workloads around more easily between servers and
- to prioritize the allocation of computing resources to the most important work to be done.

A major reason to move to VMware Infrastructure was the capability for better failover and disaster recovery. Both the failover and disaster recovery strategies were initiated as result of moving to virtualization.

The company uses the virtualized WAS systems to support two main business applications:

- The Agent Access (AA) application enables the company's business partners to administer quotes and policies on the public internet. This is a home-grown application built on WebSphere. There are approximately 2400 users across 300 agencies in three states.

- The Policy Issuance (PI) System (called "**Point**") is a third-party application that manages the company's book of business. This application uses the WAS user interface building features and a Java Enterprise Edition communications bus that allows it to communicate back and forth with a legacy application that runs on a IBM System i-series server. This communication is achieved by means of standardized XML message transfer between the different systems. There are typically in the order of 300 concurrent users of this application, based internally.

The users of the AA application, typically independent insurance agents outside the company's firewalls, use the functionality of the PI system through a custom browser-based interface (built in-house using Java Server Faces and Servlet technology). The AA application is available to its web-based users from 5:30am till 11:00pm from Monday to Saturday. The peaks in usage come on Mondays and Fridays and are in the mid-morning and mid-afternoon typically. The user population does not currently span more than one time zone.

There is a rating engine that resides within the PI system and is relied upon by the Java based AA system to return rating results.

Technical Challenges

Before implementing the WAS Server on the VMware Infrastructure platform, the OMIG organization faced some significant technical challenges in maintaining reliable and scalable service to its end users. OMIG had been running WAS server on the System i for two years (2004-2005), then moved it to a physical Windows environment (2005-2008) before making the decision to move to the VMware platform. The most significant technical challenges that the company faced were:

- The need for a failover and disaster recovery solution
- The need for an infrastructure that could scale quickly to handle rapid business growth without adding new hardware
- The need to reduce the physical server count and consolidate the data center, thus reducing costs
- The need to test and deploy new functionality and features in a safe environment without affecting production systems

The VMware Infrastructure platform was the key enabler in resolving all of these challenges. The business applications ported across to the VMware Infrastructure platform from physical systems with ease. The WAS-based systems at OMIG are currently on VMware Infrastructure 3 (ESX 3.5).

No performance problems were seen once the business applications were brought up on WAS in the virtualized environment. The IBM Software Group that supports the performance of the WAS product has worked together with VMware on performance testing to ensure that applications like those used at OMIG work well on the WAS platform when executing on VMware. (Performance test data is available from IBM.)

WebSphere Application Server Overview

The WebSphere Application Server is a key component of the IBM WebSphere family of products that also includes the WebSphere Portal, WebSphere Integration and several other products. WAS provides support for the full 1.4 standard Java Enterprise Edition (Java EE). This includes support for Java Server Pages, Servlets, Enterprise Java Beans, Message-driven Beans and a host of other Java EE-defined capabilities. IBM's WAS is one of the most widely-deployed Java application servers on the market today with a large installed base, particularly in the financial services market segment. WAS is supported on many operating system platforms including several flavors of Linux and Windows on the x86 platform. There are several product tiers within the WAS suite itself, from the base deployment level, to WebSphere Network Deployment (ND), up to WebSphere Extended Deployment (XD). The WAS server ND suite has been in use at various parts of OMIG since 2005.

VMware Infrastructure Overview

VMware Infrastructure is the most widely deployed software suite for optimizing and managing IT environments through virtualization – from the desktop to the datacenter. VMware Infrastructure delivers results for more than 120,000 customers of all sizes. VMware Infrastructure is also used in a wide variety of environments and applications. The VMware Infrastructure suite is fully optimized, rigorously tested and certified for a wide range of hardware, operating systems and software applications. This enables enterprise-wide standardization independent of operating systems and hardware. VMware Infrastructure provides built-in management, resource optimization, application availability and operations automation capabilities that deliver cost savings as well as increased operational efficiency, flexibility and IT service levels.

VMware Infrastructure virtualizes and aggregates the underlying physical hardware resources (such as CPU bandwidth and RAM) across multiple physical systems and provides pools of computing resources to optimize datacenter management in the virtual environment. These resource pools can be shared in a variety of ways depending on the importance of the applications within the different virtual machines – and their relative “shares” of that pool’s resources.

In addition, VMware Infrastructure provides a set of distributed services that enables fine-grained, policy-driven resource allocation, high availability, and consolidated backup of the entire virtual datacenter. These distributed services enable an IT organization to establish and meet production service level agreements (SLAs) with its customers in a cost-effective manner.

The relationships between the various components of VMware Infrastructure are shown in Figure 1.

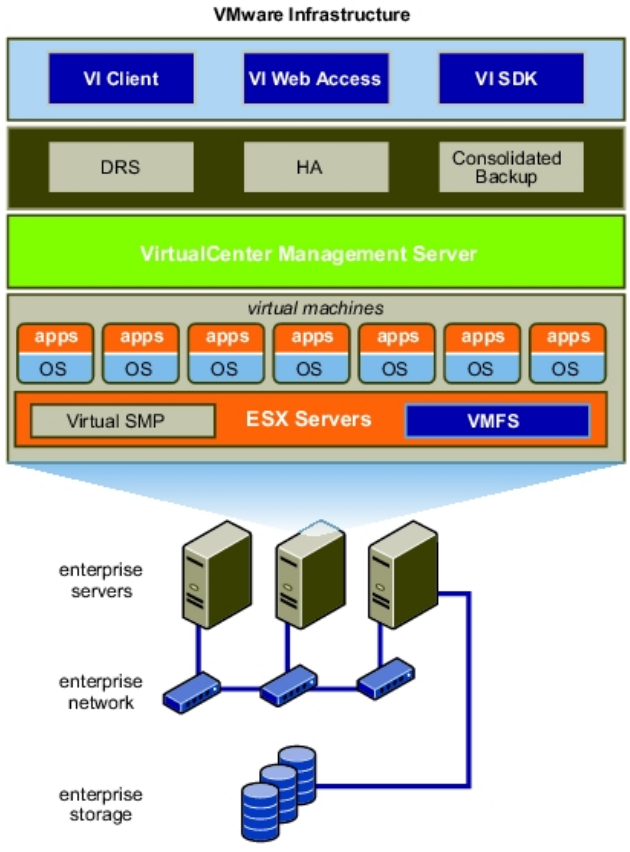

Figure 1. VMware Infrastructure high-level architecture

VMware Infrastructure includes the following components:

- **VMware ESX (ESX)**: A robust, production-proven virtualization layer, run on physical servers, that abstracts processor, memory, storage, and networking resources into multiple virtual machines.
- **VMware vCenter™ Management Server (vCenter)**: A central point for configuring, provisioning, and managing virtualized IT environments.
- **VMware Virtual Infrastructure Client (VI Client)**: A graphical interface that allows users to connect remotely to the VCenter Server or to individual ESX instances from any Windows PC.
- **VMware Virtual Infrastructure Web Access (VI Web Access)**: A web interface that allows virtual machine management and access to remote consoles.
- **VMware Virtual Machine File System (VMFS)**: A high-performance clustered file system for ESX virtual machines.
- **VMware Virtual Symmetric Multi-Processing (SMP)**: Allows a single virtual machine to use multiple physical processors simultaneously.
- **VMware vMotion (vMotion)**: Enables the live migration of running virtual machines from one physical server to another with zero down time, continuous service availability, and complete transaction integrity.
- **VMware High Availability (HA)**: Provides easy-to-use, cost-effective high availability for applications running in virtual machines. In the event of server failure, affected virtual machines are automatically restarted on other production servers that have spare capacity.
- **VMware Distributed Resource Scheduler (DRS)**: Allocates and balances computing capacity dynamically across collections of hardware resources for virtual machines.
- **VMware Consolidated Backup (Consolidated Backup)**: Provides a centralized facility for agent-free backup of virtual machines. It simplifies backup administration and reduces the load on the ESX host servers.
- **VMware Infrastructure SDK (SDK)**: supports a standard programming interface for VMware and third-party solutions that want to access the VMware Infrastructure.

A single Virtual Center Management Server typically manages multiple ESX server hosts, as shown in Figure 2 below. Administrators use the Virtual Infrastructure (VI) Client program to connect to the Virtual Center Server in order to create resource pools and clusters within which the virtual machines will reside. The VI client provides a management view on to the pool of ESX servers and resources that are used to host multiple virtual machines running concurrently.

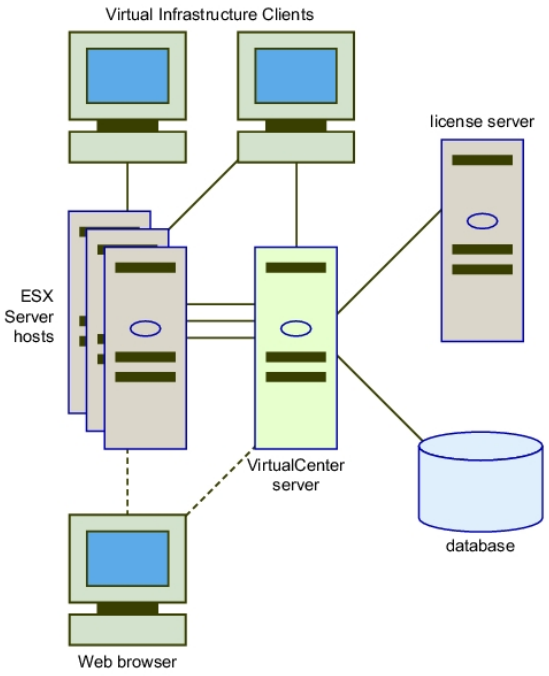

Figure 2. Virtual Center Server Outline architecture

The Technical Solution

Figure 3 shows the server layout for the production ESX systems and network switches at the main OMIG data center. There is a similar setup for the test environment that is described later in this document.

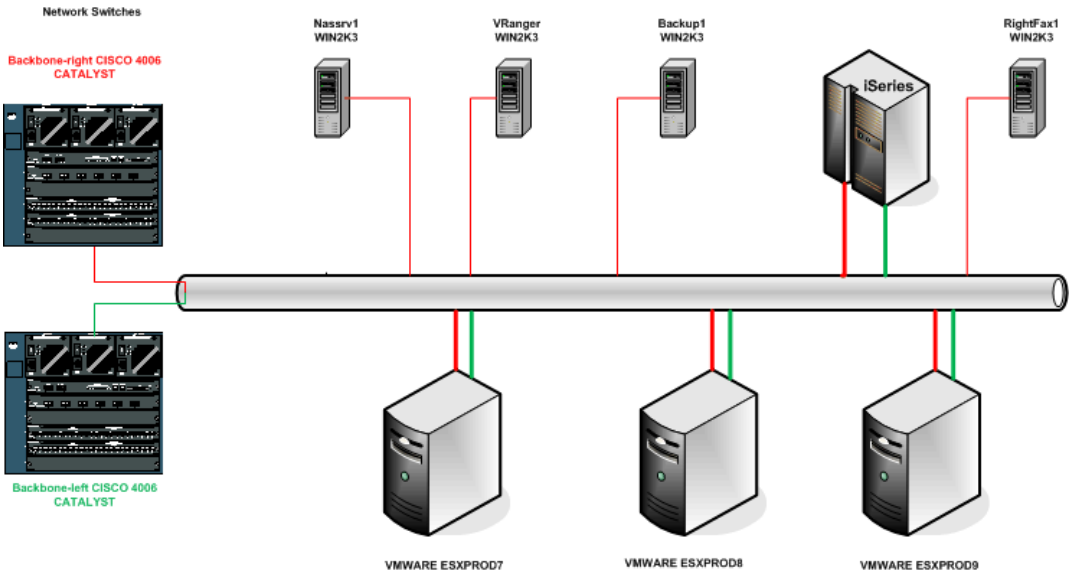

Figure 3. OMIG's Virtualized Hardware Layout

A second data center at OMIG contains a setup that is a mirror image of this one, including the storage configuration. The second data center is used for failover and disaster recovery. Details about this part of the OMIG system are also provided later this document.

Production WAS Server Virtual Machines

The core of the virtualized WAS system is made up of three production virtual machines, each running WAS, and identified as WAS "nodes" in the same way that a physical system running WAS can be a node. The three WAS nodes are in a network deployment configuration. One of the three nodes acts as a deployment manager, while the other two nodes support the production environment directly. There are nine logical servers spread out across the two production WAS nodes. The nine logical servers support a variety of business applications. The exact software specifications for the contents of the WAS Server virtual machines are detailed in the System Software Configurations section below.

System Software Configurations

This section describes the various software components that are installed and used in each virtual machine as well as configuration details of each WAS Server virtual machine. The VMware ESX version in use at the time of writing is ESX 3.5.0 build 143128.

WAS Server Virtual Machines

Each production WAS Server virtual machine has the following software installed:

- WAS ND Server version 6.1
- Windows Server 2003 Standard Edition R2 SP2

Virtual Machine configuration:

- 2 vCPUs and 4GB RAM per WAS Server virtual machine
- 1 x 20GB c:\ (VMFS) per virtual machine (OS and binaries)
- 1 x 40GB data store for application installations. WAS does not store any user data

The WAS Server virtual machines share a cluster of four physical ESX host servers that OMIG IT uses to host as many as 60 other non-WAS Server related workloads at any given time.

Application Configuration

The Policy Issuance (PI) application is implemented in two parts. The user-facing part is built using JSF and Servlet technology, both of which are hosted on the WAS servers. This front-end application communicates with the back-end database part of application using an enterprise message bus that is also Java EE-based and runs on the virtualized servers. The back-end database part of the application runs on IBM System i machine and is also partly implemented in COBOL. Home-grown protocols based on XML messages allow transactional data to flow back and forth between the Java-based applications and the back-end database on the System i machine. The Agent Access (AA) application used by external agents is also constructed in the same manner and uses similar Java EE technology.

Both main applications have a three-tiered architecture. The presentation tier is based on Java Server Pages (JSPs) on WAS. The middle tier is composed of business logic written in Java on WAS. The data tier is a mix of RDBMS access over JDBC and XML transactions with the enterprise policy processing system. DB2 on Windows and DB2/400 are both used for the database platforms.

Additional details:

- The AA and PI applications each run in a separate virtual machine.
- The virtual machine for the AA application has 4 virtual CPUs and 8GB of RAM.
- The virtual machine underlying the PI application has 2 virtual CPUs and 4 GB of RAM.

Physical Server Configurations

This section describes the physical servers, storage and network setup for the servers that host the virtual machines described above. All the WAS Server virtual machines run on a VMware ESX cluster that has VMware High Availability (HA) enabled.

- There are four IBM 3850 M2 rack-mounted servers for production and three others for development and testing support.
- There is 64 GB RAM configured in each server.
- There are 4 sockets in each server, with 4 cores per socket, using Intel processors operating at 2.4GHz.

The WAS virtual machines run on separate servers from each other, for safety reasons. VMware Distributed Resource Scheduler (DRS) is implemented in fully automated form in this cluster of machines. This makes use of anti-affinity rules to keep the virtual machines operating on separate ESX hosts.

The three WAS Server-based virtual machines co-exist with approximately 60 other non-WAS workloads in the cluster. These are virtual machines containing SQL Server, DB2, IIS, file and print servers as well as other applications. For example, there are several SQL Servers and DB2/Windows servers that provide data to the PI application.

Storage Configuration

The IBM N-series 3600 fiber channel storage array configuration for the WAS Server servers is shown in Figure 3. The disk storage is split into two main sections as follows. There is a 485GB LUN allocated to VMFS for each virtual machine. There 9 LUNs on the N-series giving a total of 6TB that are presented to VMware. The space on these LUNS is then allocated into VMFS partitions for each virtual machine. As stated previously, virtual machines have a standard 20 GB C: partition for the Windows OS and a second partition for application installation.

VMFS

Each WAS Server virtual machine has a 20 GB disk volume configured for the Guest Operating System and a smaller volume configured for application data. All the WAS Server virtual machines have their system drives (C:\) and user data areas on shared VMFS storage contained on the SAN. The SAN is implemented using an IBM N-series 3600 model disk array using fiber channel communication.

Operations Support

This section describes the use of various VMware Infrastructure facilities, such as HA, templates and management tools for the operational support of the system.

High Availability

The WAS Server environment relies on VMware HA for its high availability. A cluster of ESX host servers is constructed to provide a failover point for resident virtual machines. This setup is created in a straightforward manner in the vCenter user interface. In the VMware configuration, the WAS 1 and WAS 3 server virtual machines reside on server A and WAS 2 and WAS 4 reside on server B. Other virtual machines that do not belong to the WAS infrastructure also run on those servers. If one server were to fail unexpectedly, its resident virtual machines would be re-started automatically on the other server. To date, neither an ESX host server nor a WAS Server virtual machine failure has occurred.

Templates

The Windows 2003 Server software is installed and configured in a VMware ESX template along with the most current Windows patches and then sealed with Sysprep. The IT department can deploy a new virtual machine from this template and install and configure the WAS Server software in less than an hour. The application deployment files are then loaded into WAS in order to run those applications. The template allows the IT team to deploy a new virtual machine quickly for load-balancing purposes or in case of an issue with an existing virtual machine.

Operations and Performance Monitoring

A combination of tools is used to monitor guest operating system health, virtual machine disk usage and response times to end users. These include:

- VMware VirtualCenter 2.5 for virtual machine and ESX host management and performance monitoring.
- The Vizioncore VFoglight and VMware Virtual Center suite for systems management.
- GFi's LANGuard is used to manage OS updates.
- Advent Net (now Zoho) Application Manager is used to collect performance as well as availability statistics. Tivoli Performance Viewer is used to monitor the WebSphere portion of the application; Performance Navigator and PM/400 are used to monitor the System i portion of the application.

Application Manager is a web-based tool that can be used to monitor various aspects of the Windows environment. For example, it is used to monitor the availability and average response times of the AA and PI applications.

Tivoli Performance Viewer (or TPV) is a monitoring tool that is included with the WebSphere software. It is accessed using the WebSphere Administrative Console. Basic statistics gathering is always turned on in the environment, and TPV can be used to graphically display information about the WebSphere environment.

PM/400 is a performance monitoring tool that is part of the OS/400 operating system on the System i server. It is configured to gather basic statistics about the performance of the server. PM/400 can also be used to gather detailed statistics about system performance, allowing for additional analysis of a problem.

Performance Navigator is a Java-based GUI tool that runs in the Windows environment. It connects to the System i server and interfaces with PM/400. Performance Navigator can be used to graphically display the PM/400 data. Various charts and reports can also be created. In addition, Performance Navigator allows you to perform "what if" analysis.

Disaster Recovery (DR)

This is implemented using a combination of VMware's Site Recovery Management (SRM) product and the NetApp SnapMirror facility for disk replication. The recovery site, located in Wisconsin, is a mirror image of the main site in Ohio. The current DR plans include the creation of new WAS Server virtual machine deployments from templates at a DR facility should a disaster occur in the primary datacenter. The recovery time has been established at 15 minutes after a series of test runs have been executed through the SRM recovery plan. Aside from these tests, the entire system has been failed over a number of times to ensure that it behaves correctly. The RPO figure is 15 minutes and RTO is approximately 2 hours.

System Backup Strategy

The WAS Server is backed up on a nightly/weekly basis. All Windows servers are backed up nightly via CA's Arcserve product. Daily backups are incremental, weekly and monthly backups are full backups.

Benefits Achieved

This deployment was one of the easiest virtualized rollouts the OMIG IS department has done. By carrying out this virtualization of WAS work, the company achieved the following benefits:

- Reduced physical server count
- Increased high availability
- Reduced provisioning times
- Reduced planned downtime with vMotion
- Dynamic load balancing with VMware DRS

Conclusions

The virtualization of the WebSphere-based applications at OMIG is successful from both a business and technical perspective. The WAS virtualized servers, along with other associated servers, are now serving the needs of over 200 concurrent users in the company. The deployment was achieved without adding to the number of physical servers in the IT department. The virtualized environment provides a 24/7 level of service for the company and is considered one of the most reliable and easiest to manage IT services provided by OMIG to its internal customers in several states in the US.

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VMware, Inc. 3401 Hillview Avenue Palo Alto CA 94304 USA Tel 877-486-9273 Fax 650-427-5001 www.vmware.com