

WHITE PAPER

SAP Solutions on VMware® Infrastructure 3: Customer Implementation - Technical Case Study



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Introduction

This document describes the technical architecture of a live deployment of SAP solutions on VMware® Infrastructure at a pharmaceutical company. With the help of VMware certified partner AddOn, the customer migrated its existing SAP implementation from a non-industry standard platform to the HP ProLiant platform running VMware Infrastructure 3. Virtualization on VMware Infrastructure brought numerous benefits to the customer including:

- Server consolidation
- Reduced new server deployment time from eight hours to 30 minutes
- Reduced time and complexity of process for certifying new servers against pharmaceutical industry regulatory requirements
- Expected cost savings of more than €1M over three years

SAP Solutions-Based Landscape

Table 1 identifies the SAP products deployed on VMware Infrastructure 3.

Table 1. SAP Products

SAP Product	# of Active Users	Database	Guest OS
SAP 4.7 ERP 2004 (NetWeaver 6.40)	200	Oracle 10.2 64 bit	Windows Server 2003 Enterprise SP2 - 64 bit
SAP HR (NetWeaver 6.40)	30	Oracle 10.2 64 bit	Windows Server 2003 Enterprise SP2 - 64 bit

The SAP landscape includes development, quality assurance/test and production systems for each SAP product as shown in Figure 1. The arrows depict the typical SAP promote to production path for development changes.

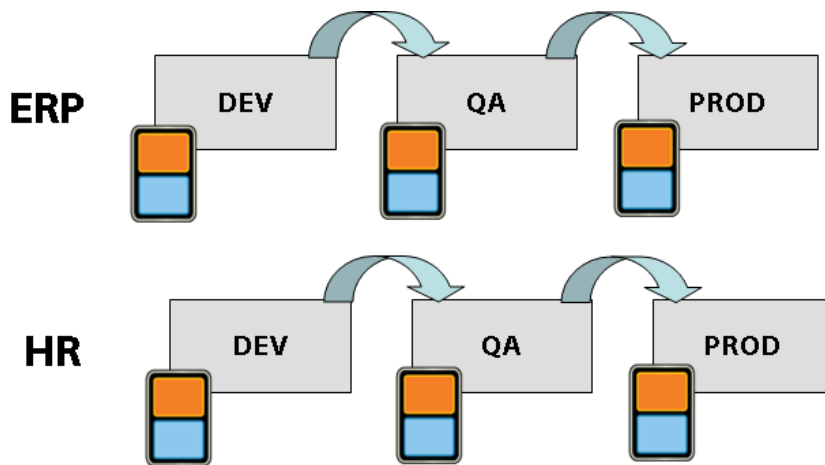


Figure 1. SAP Landscape

The SAP software is deployed on the following infrastructure:

- VMware Infrastructure 3:
 - VMware® ESX 3.0.2
 - VMware® VirtualCenter 2.0.2
- HP DL580 ProLiant Servers
- EMC CLARiiON CX500 Storage Array

Logical Architecture

Figure 2 depicts the logical architecture of the deployment, which is implemented across two datacenters, 300 meters apart.

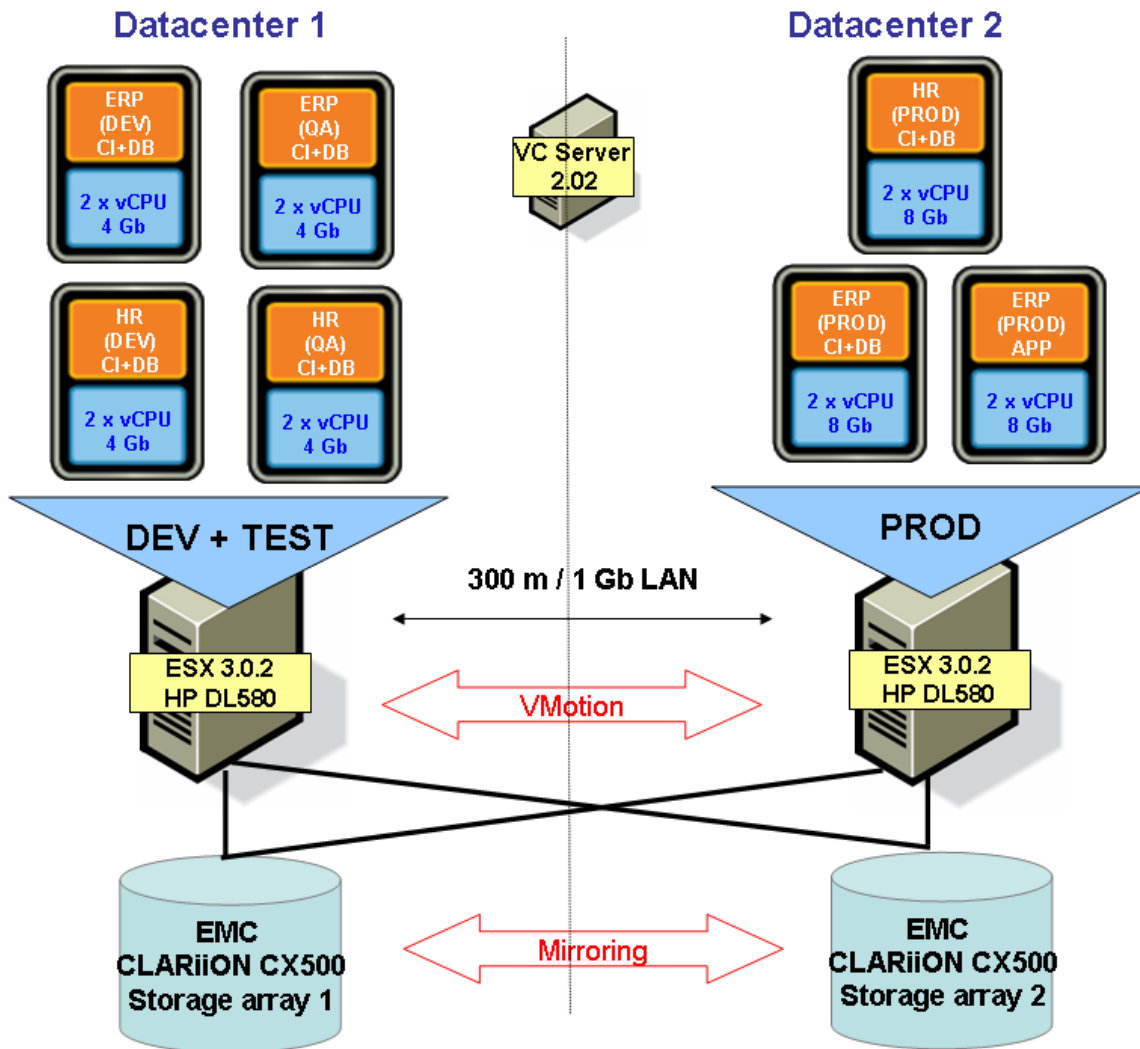


Figure 2. Logical Architecture

Figure 2. Architecture Overview

- Production and non-production systems virtual machines are separated onto two separate ESX host servers (one for production, the other for non-production). Each ESX host server is located in a separate datacenter, as shown in Figure 2 above. The two datacenters are located on the same campus and connected by way of a 1 GB LAN.
- Virtual machine configuration:
 - Non-production virtual machines are configured with two vCPUs and 4GB RAM.
 - Production virtual machines are configured with two vCPUs and 8GB RAM.
 - Only production ERP is configured as 3-tier with one application server virtual machine; all remaining SAP systems are 2-tier setups.
- For normal operation there is no memory over-commit, which is in accordance with best practices for SAP solutions on VMware ESX (see SAP note 1056052 - VMware ESX Server Configuration Guideline).

Storage Configuration

SAP virtual machines are stored on EMC shared storage (CX 500) as follows.

- Two separate storage arrays exist in each datacenter:
 - Every ESX host server is connected to both arrays.
 - EMC MirrorView mirrors the SAP virtual machines so they exist on each array for disaster protection.
- The virtual machines are stored either as VMFS volumes or using VMware raw device mapping (RDM) :
 - VMFS is used for the operating system, Windows pagefile and application executables.
 - RDM is used for the database data files and log files.
- The mixed use of VMFS and RDM combines the flexibility of using VMware templates and cloning (supported by VMFS) with the EMC storage array functions and tools that require use of RDM.
- A maximum of three VMFS-based virtual machines (running the operating system) are allocated per LUN.

Oracle Database LUN Layout

The Oracle database is spread over multiple LUNs to maximize I/O performance. Figure 3 depicts the LUN layout of a single database system across VMFS and RDM LUNs.

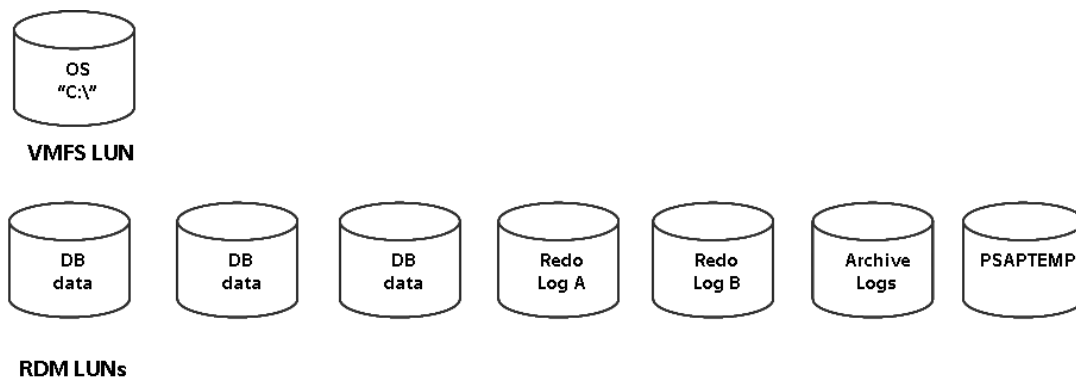


Figure 3. Oracle Database LUN Layout

The VMFS LUN in addition to the OS also contains the configuration files for the virtual machine, virtual machine swapspace file and the pointers for each of the RDM (Raw Device Mapping) disks.

Operations

VMware® Distributed Resource Scheduler (DRS) is configured in manual mode, which means that VirtualCenter recommends migrations but a human operator is required to initiate a live migration.

VMware® High Availability (HA) is used in case of ESX host server failure. In the event of production ESX host server failure, non-production SAP systems are taken off line to maintain uptime and performance of production systems. In case of a datacenter outage, EMC storage-based replication enables manual recovery of production virtual machines in the other datacenter.

Physical Architecture

Figure 4 below shows the physical architecture.

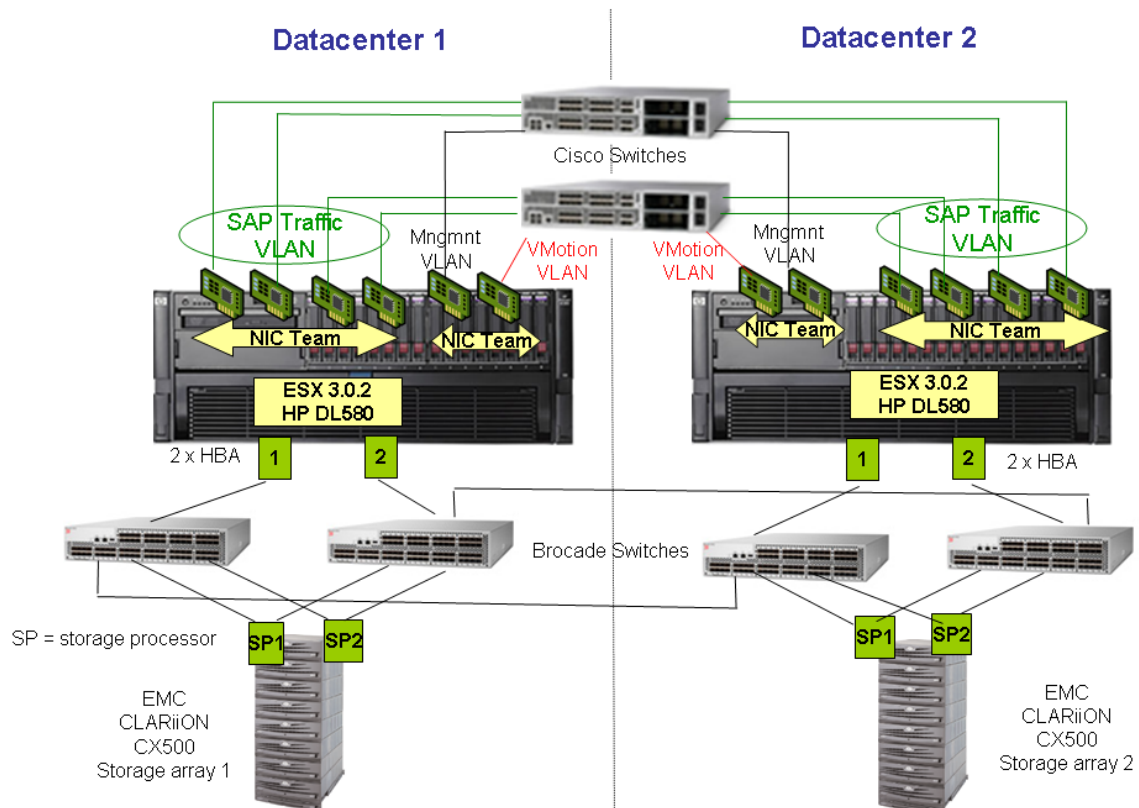


Figure 4. Physical Architecture

There are three types of network traffic, each configured with redundancy for high availability:

- SAP traffic
- VMotion migrations traffic
- Management traffic: this network also includes the heartbeat for VMware HA so network switch redundancy is employed as a best practice.

The NICs are attached to separate Cisco switches for redundancy. NIC teaming is incorporated into the architecture shown in Figure 4. NIC Teaming in the VMware context refers to the configuration of redundant ESX NIC cards in order to minimize the chance of losing network connectivity because of a PCI card failure. VMware vSwitches support VLAN tagging. A preferred option is to configure the vSwitch to mark traffic from the virtual machines with a VLAN TAG and to establish an 802.1q trunk with the Cisco switch connected to the ESX NICs. VMware calls this method Virtual Switch Tagging. The VLANS that carry management and VMotion traffic are configured into a single vSwitch port group connected to two physical NICs in a NIC team and set to active/standby mode. In the event of a network failure on any one of these connections (VMotion or management), the other will take over.

The Fibre Channel (FC) storage fabric design consists of an active/passive disk array. In an active/passive disk array, one SP is actively servicing a given volume. The other SP acts as backup for the volume and may be actively servicing other volumes.

ESX supports multipathing to maintain a constant connection between the server machine and the storage device in case of the failure of an HBA, switch, SP, or FC cable. To support path switching, each server has two available HBAs from which the CLARiiON storage array can be reached using one or more switches. In Figure 4, multiple paths connect each server with the storage device. For example, if HBA1 or the link between HBA1 and the FC switch fails, HBA2 takes over and provides the connection between the server and the switch. Similarly, if SP1 fails or the links between SP1 and the switches breaks, SP2 takes over and provides the connection between the switch and the storage device.

Summary

This document describes the technical architecture of a live production deployment of SAP solutions on VMware infrastructure 3 in a pharmaceutical company. The customer gained considerable benefits from the virtualized deployment that translated into expected cost savings of more than €1M over three years. The key benefits realized by the customer include:

- Consolidated virtual machines to maximize server CPU utilization.
- Used VMware DRS to monitor utilization of resource pools and allocate available resources among the virtual machines based on pre-defined rules that reflect business needs and changing priorities.
- Used VMware VMotion to move running virtual machines from one physical server to another with no impact to end users, providing flexibility and availability to meet the increasing demands of SAP business and end users.
- Gained cost-effective high availability for SAP applications running in a virtual machine without the cost or complexity of traditional clustering solutions with VMware HA.

- Increased operational flexibility and efficiency with rapid deployment of new SAP application layers using VMware templates.

For more information, refer to the VMware-SAP alliance page here:

<http://www.vmware.com/piances/technology/sap.html>.

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