

ERP SYSTEM IN VIRTUALIZED PRODUCTION ENVIRONMENT

D. C. SPOIALĂ¹, H.M. SILAGHI¹, V. SPOIALĂ¹, A. CACUCI²

¹Department of Control Systems Engineering and Management, Faculty of Electrical and Technological Engineering, University of Oradea, 1 University Street, 410087, Oradea, Romania

²FaistLightMetals Ltd, 33i Borsului Street, Oradea, Romania

E-mail: dspoiala@uoradea.ro, hsilaghi@uoradea.ro, vspoiala@uoradea.ro, ao.cacuci@gmail.com

Abstract This paper presents one implementation of a ERP system using small computer systems interface (iSCSI) Network attached storage (NAS), and VMware technology, used in a company production environment. As a case ERP system is SAP.

Keywords: ERP, iSCSI, LUN, NAS, VMware, RDTs, SAP

1. INTRODUCTION

ERP (Enterprise Resource Planning) represents an information system based on IT technologies, computers and systems software performances, used for monitoring and control of main operations carried out by a company, like production, distribution, commerce, etc.

ERP operates in an organization like an instrument providing an efficiency optimization and maximum reducing of the achievement procedures for the services of that organization in a unified system [1].

The introduction of an ERP system for replacing two or more independent applications, eliminates the necessity of some external interfaces to ensure the good relationships of the applications. Beside this fundamental benefit, ERP systems offer some supplementary advantages, like reduced maintenance costs and increased and efficient report capacity. ERP systems contain also solutions for informatics security, being, in this way, protected for external attacks [2].

ERP systems are like a kind of modular programs (Figure 1), each area of activities being covered by one specific application. The ERP modules have integrated functions working independently or using a common database. Like examples of categories of modules that serve to manage the efficiency of an enterprise we can mention:

- production: production planning and supervising;
- financial administration: stocks, suppliers and cashing evidence;
- sales: sales, distribution and invoicing activities optimization;
- salaries: salaries calculation and staff information management;
- accountancy: accounting evidence;
- FRM (Finance Resource Management): financial evidence;
- records of fixed assets and depreciation calculation;
- HRM (Human Resource Management);
- CRM (Customer Relationship Management);

- SCM (Supply Chain Management);
- BI (Business Intelligence): reports, analysis, prognosis.

SAP ERP is an enterprise resource planning software developed by the German company SAP SE.

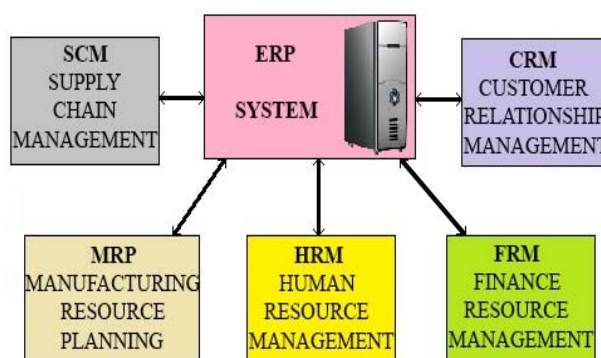


Figure 1. The main modules of a ERP system

SAP ERP incorporates the key business functions of an organization. Business Processes are included in SAP [3].

Network-Attached Storage (NAS) is a file-level computer data storage server connected to a computer network providing data access to a heterogeneous group of clients. NAS is specialized for serving files either by its hardware, software or configuration [4].

iSCSI is a protocol to facilitate SCSI-based storage commands to be sent over ubiquitous network structures, such as a LAN or VPN.

The iSCSI allows clients (called *initiators*) to send SCSI commands (*CDBs*) to SCSI storage devices (*targets*) on remote servers. It is a NAS protocol, allowing organizations to consolidate storage into data centre storage arrays while providing hosts (such as database and web servers) with the illusion of locally attached disks [6].

Virtualization is a method that allows the running of one or more "computers" on a single hardware platform, or otherwise, of several different operating systems on a single PC.

Virtualization enables efficient management of hardware resources on a server machine. It also allows multiple operating systems; each core server processor machine can be assigned to each virtual machine operating system

related. VMware vSphere (ESXi) is an enterprise-level virtualization product.

2. SPECIFIC IMPLEMENTATION

A datastore is an independent storage space for centralizing virtual machine's physical data. By using Synology NAS as the VMware datastore, we can consolidate and share storage space to maximize storage utilization and simplify management with better flexibility, Figure 2. VMware vSphere Hypervisor is a free bare-metal hypervisor that virtualizes servers.

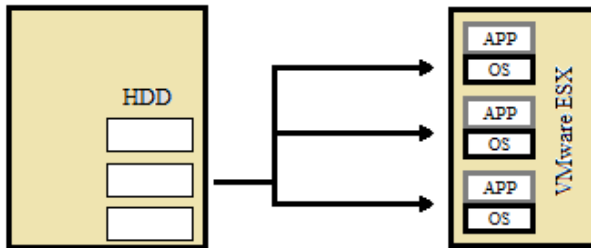


Figure 2. Synology NAS as VMware server datastore

Users can consolidate the applications on less hardware. VMware ESXi is an enterprise-class developed by VMware for deploying and serving virtual computers. ESXi is not a software application that one installs in an operating system, it includes OS components (kernel) [5].

Using the iSCSI Target service provides an illusion that a hard drive is locally attached to a computer and will be managed by a local computer operating system. In reality, the newly added disk is a virtual drive which exists on the Synology NAS. Because the hard drive is virtual, there is no need to add additional hardware to the computer, as the virtual drive is managed through a common network infrastructure.

A logical unit number (LUN) is a unique identifier for designating an individual or collection of physical or virtual storage devices that execute input/output (I/O) commands with a host computer, as defined by the Small System Computer Interface (SCSI) standard [5].

SCSI is a widely implemented I/O interconnect that commonly facilitates data exchange between servers and storage devices through transport protocols such as Internet SCSI (iSCSI) and Fibre Channel (FC). A SCSI initiator in the host originates the I/O command sequence that is transmitted to a SCSI target endpoint or recipient storage device. A logical unit is an entity within the SCSI target that responds to the SCSI I/O command [6].

The existing system is composed, as a study, on the hardware part:

- Synology RackStation RS3614 xs+, representing NAS;
- Supermicro X9DRW – as server machine;
- CISCO 2960X – as switch for pc-user's connections like: accountancy, production, logistic and acquisition departments;

On the software part we have:

- Microsoft 2008 server;
- Microsoft RDTs – Remote Desktop Terminal Services;
- Microsoft SQL Server;
- SAP.

Synology RackStation RS3614xs+ provides ultra-high performance network attached storage and reliable solution for large scale businesses, that requires an efficient way to centralize data protection, deploy virtualization solutions, simplify data management and rapidly expand storage capacity with minimal time spent on setup and maintenance. In internal storage there are 12 HDD – Seagate Enterprise NAS Edition - 4TB in RAID10. DSM 6.0.2 is the operating system of RS3614xs+. The backup capabilities are offered by *Cloud Station Backup* service that allows backup files from multiple client computers to a centralized Synology NAS. iSCSI LUN replication can be managed via *VMware vCenter Site Recovery Manager*.

When the need for more space arises, the volume could be easily expanded without any service disruption.

Built-in backup applications protect information assets by regularly backing up files and iSCSI LUNs locally and remotely.

Continuous data protection with snapshots of shared folders allows restoration of previous versions when the need arises.

Our hardware layout diagram is shown in Figure 3.

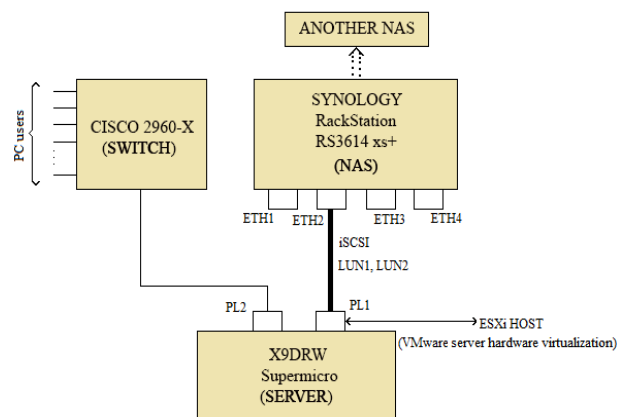


Figure 3. The hardware case of study

The PL1 network card of Supermicro X9DRW is direct plugged on ETH2 (10GB/s) of the same VLAN (22) of Synology RS3614 xs+ with restricted IP visibility (192.168.2.1) and the other PL2 network card with IP (192.168.20.16) with Host management destination is plugged into a CISCO 2960X switch in the user's network of the 3 Microsoft Windows Server operating systems.

Through VLAN 22 (192.168.2.1) the 2 - 1,5 TB LUN-s with 2 datastore R1 and R10 are injected in HOST via iSCSI initiator.

The server machine runs VMware host ESXi 6 software. The 2 datastore include the 3 virtual machines.

The main functional jobs of those 3 virtual machines are:

- Server access client RDTs to 40 clients;
- Server Local Domain;
- Server Microsoft SQL.

To share data within the Intranet, we completed the following tasks (Figure 4 – Figure 7):

- Set up Synology NAS;
- Installed Synology DiskStation Manager (DSM, web-based operating system of Synology NAS);
- Created iSCSI LUN and Target;
- Setup a VMware ESXi host;
- Installed VMware vSphere Client;
- Install Datastore within ESXi Host;
- Install nested VM's;
- Install ERP SAP.

In Figure 4 we present the window with 2 LUN-s of 1,5 TB. Synology Advanced LUN support extremely improves the efficiency on massive data transfer and migration.

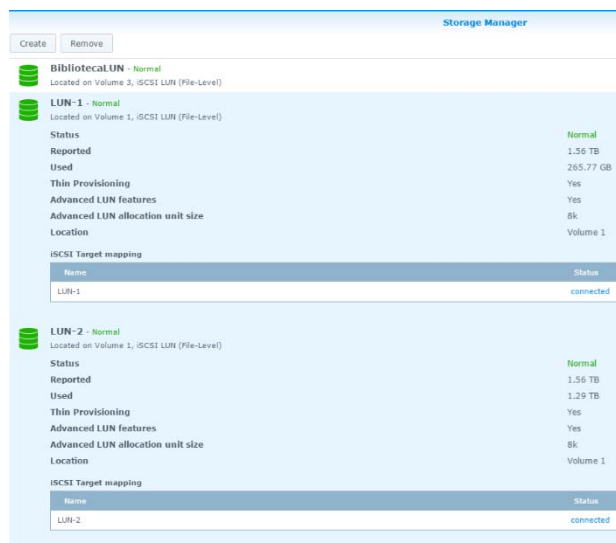


Figure 4. Creation of 2 LUN of 1.5 TB

The iSCSI initiators send SCSI commands to targets. LUN1 and LUN2 are presented in Figure 5.

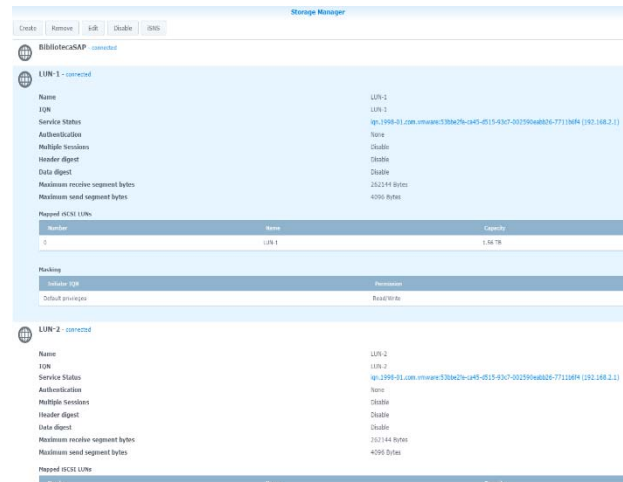


Figure 5. 2 iSCSI target corresponding to LUN1 and LUN2

Figure 6 presents the Supermicro X9DRW server ESXi Host. After installation of Datastore within ESXi Host the network assignment and configuration of ESXi Host are presented in Figure 7.

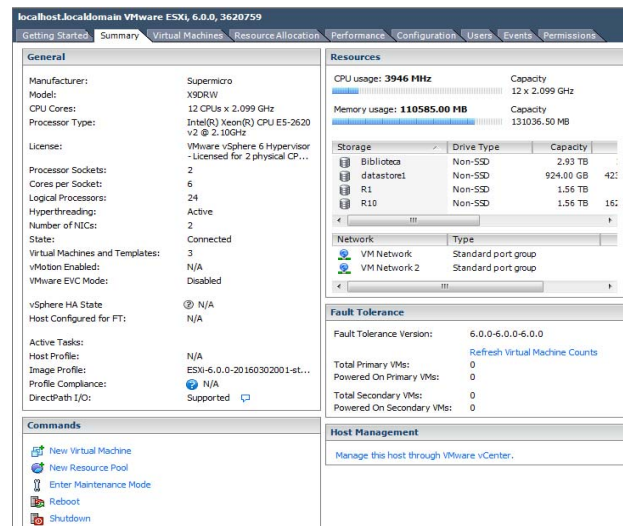


Figure 6. The Supermicro X9DRW server ESXi Host

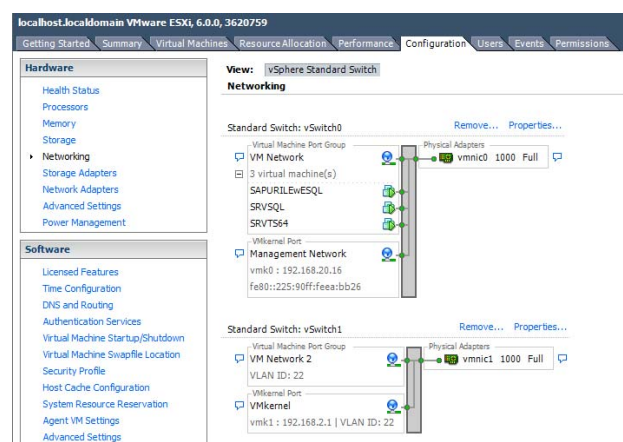


Figure 7. Network assignment and configuration of ESXi Host

Figures 8, 9, 10 and 11 present the performances of the implemented solution.



Figure 8. First Windows Server SQL virtualized machine data performances

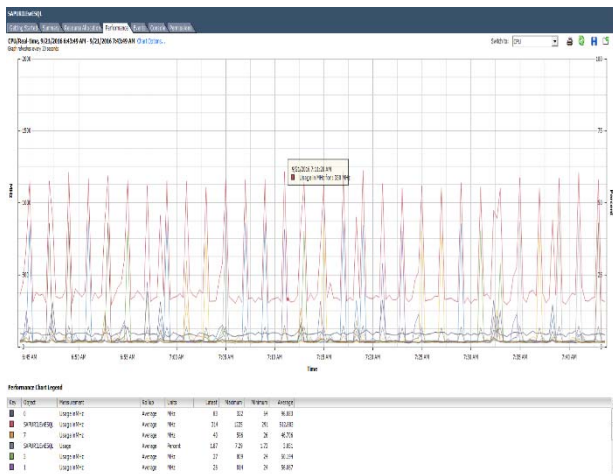


Figure 9. Local domain performances

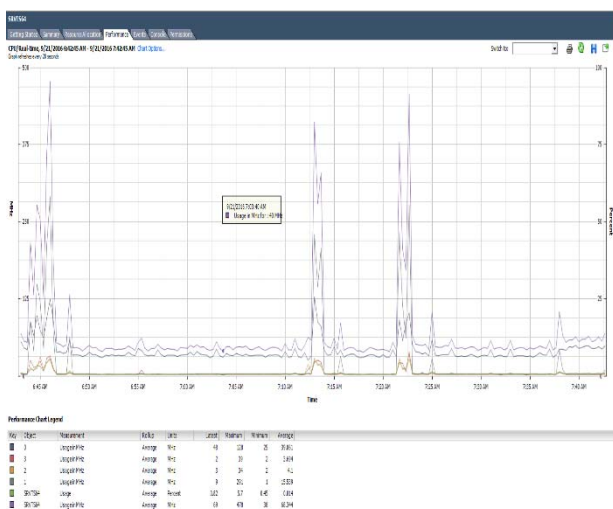


Figure 10. RDTP access performances



Figure 11. Overall NAS performances

As it shown in Figure 8 the CPU real-time SQL server average usage was 314 MHz

In Figure 9 we present the local domain performance (SAP) where the CPU real-time average usage was 330 MHz

Figure 10 shows the CPU real-time average of Remote Terminal Desktop Services at 40 MHz

In Figure 11 we present overall NAS performance where the average network speed and iSCSI throughput speed in capture moment was 26,5 kB/s, respectively 29.3 kB/s. Also we can observe the small utilization of CPU, memory, disk and volume.

3. CONCLUSIONS

If not long time ago, in the implementation of an application, only the specific hardware architecture counted (processor – frequency, number of cores, cache memory, bandwidth and RAM memory), in the last years it emerged a new concept IOPS (input/output operations per second) which ensures local capacity data transport over network measurement.

IOPS is frequently referenced by storage vendors to characterize performance in solid-state drives (SSD), hard disk drives (HDD) and storage area networks.

Enterprise Resource Planning - ERP represents an information system based on IT technologies, computers and systems software performances. It is used for monitoring and control of main operations carried out by a company, like production, distribution, commerce, etc.

The implemented solution presented in this paper provides scalability, operational efficiency demonstrated versatility and ease of implementation. In our case the ERP system is SAP.

SAP Business One was designed with the idea that smaller companies need ERP software to help manage

their business, but not the kind of ERP that large and complex organizations need.

SAP Business One expands on its ERP chops by adding enhancements in the areas of inventory, production management and material requirements planning.

It also provides hardware resources developed management and automated backup solution via iSCSI. Advanced security is offered by the server domain and user management.

It is a centralized solution for resources access.

NAS offers secure hardware encryption, scalability from 128 TB till 200 TB on the fly with VMware Citrics certification.

VMware ESxi Host virtualizes the server hardware.

The operating systems are virtual machines included in NAS.

The used VMware virtualization solution ensures efficient use of hardware resources of the server.

LUN resizing can be easily done without hardware-level intervention.

Of course NAS can serve multiple servers.

Backups are done on another identical NAS in real time. We recommend this ERP implementation for every environment development.

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