Virtual Infrastructure Approach for SADU Implementation

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Abstract: This paper proposes a new way of structuring the virtual infrastructure in terms of knowledge acquisition for SADU implementation. Through virtualization, the hardware infrastructure becomes a service, virtual machines become predominant within the infrastructure and their way of functioning can be affected by certain malfunctions. SADU supports human diagnostician in order to provide possible solutions to the raised issues. A virtualized IT infrastructure consists of layers that virtualized the used hardware components. Based on layers membership we propose a new approach to structuring the virtual infrastructure. This approach has fundamentally changed the architecture at the layer levels, increasing the security and availability of resources. Grouping layers depending on membership or type (hardware, virtual infrastructure, software) around the concept of stack led to a separation of intelligent agents' responsibility for knowledge acquisition and fault diagnosis, allowing a better understanding of the field, reflected by developing a new ontology.

Keywords: virtualization; DataCenter virtualization; structuring virtual infrastructure

JEL Classification: O10; O11

1. Introduction

Allowing the more efficient use of the available resources, which is stated and by the community of the IT specialists, the virtualization is one of the major benefits brought to an organization. Also, the continuous improvement of the DataCenter architecture has as main purpose to reduce the operating costs.

Today, many organizations have already in course of implementation or take into considerations the virtualization projects due to the immediate benefit represented by the reduction of capital costs and decreasing of costs related to real estates and power consumption.

The IT managers thus have the possibility of distributing the hardware resources, for the operating systems and applications based on timesharing, by using special products and services of virtualization. In this sense, can significantly increase the use and efficiency of servers, network equipments and storage devices, reducing the total number of physical devices required, the rack space necessary for their

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physical location and of course the requirement of physical equipment of management. Also, referring to saving the operational costs, the virtualization brings many benefits due to the unique management console, accessible from anywhere.

Like any transitions, a virtualization project is likely to have a major impact on the organizational structure and responsibilities of those involved.

The virtualization allows the implementation of software without modifying the operating system or the file system concomitantly with the significantly reduction of the conflicts between application, thus allowing the use of a single application on multiple versions of the operating system. In other words, according to VMware, the applications are more easily secured, implemented, updated and in the case of its non-functionality, to come back at the previous step of its modification (rollback).

2. Virtualization and Cloud Computing

The system virtualization and cloud computing are highly debated topics in the recent period which lead towards numerous strategies, quite different. The virtualization involves the transformation of a number of hardware components and network devices in software and it's uploading on a strong hardware platform, in other words, the services offered by a virtualized hardware component are abstracted from the physical component.

The virtualization is applied to servers, storage media, network and desktops so that most of the discussions concerning the virtualization and cloud highlight the unlimited access at the processing resources, storage and in the network at the network bandwidth. Concretely, the virtualization and cloud computing cannot exist without a DataCenter and the physical resources that it stores. The server consolidation is the next step in the restructuring of the architecture, achievable only through the virtualization of the available physical resources (see Figure 1).

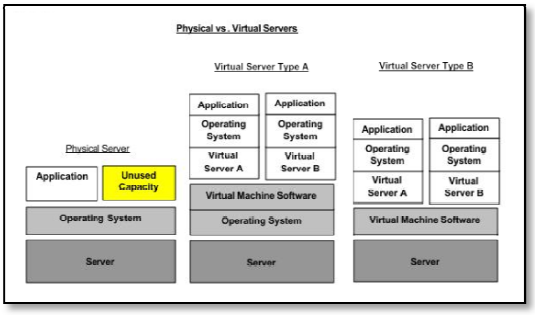

Figure 1. Types of server virtualization *(Postolache F. et al., 2010)*

In the case study concerning the virtualization of the informatics system subject to testing consists of three DataCenters, connected via a redundant fiber optic ring. In the main DataCenter we have an IBM Blade Center E, which consists of three IBM HS blade servers, each one equipped with two Xeon Quad Core and 32 G RAM. The data storage is made on a Storage Area Network IBMDS3400 redundant linked by Blade Center through optic fiber, which consists of five hard drives, three hard drives of 750 GB and two of 1 TB.

It was preceded to the virtualization of network, servers and of an informatics laboratory consisting of 32 computers, thus forming a Cloud. On the other hand, the cloud computing and server virtualization is mutual completing due to the following reasons:

- both require a robust physical infrastructure, relying heavily on the network and involving a rethinking of the traditional infrastructure
- cloud computing services are implemented after the Data Center is virtualized, in other words, only the virtualization layer supports the Cloud architecture.
- The cloud computing adds a new layer of virtualization between the final user and the entire IT infrastructure.

In our approach we emphasize especially the model of the virtualized infrastructure, the DataCenter server's consolidation and therefore on the virtual machines and the installed applications on them.

3. IT Infrastructure Virtualization

Allowing the more efficient use of the available resources, which is stated by the IT specialists' Community, the virtualization is one of the major benefits brought to an organization. Also, the continuous improvement of the DataCenter architecture has as main purpose to reduce the operating costs. The concerned hardware layers (Figure 2.) in a common virtualization design are: storage, servers and networks they serve.

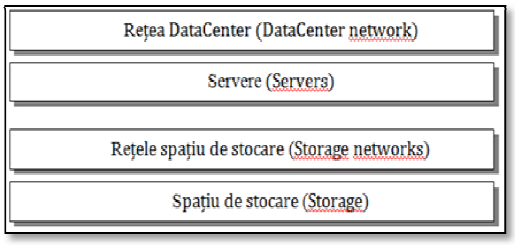

Figure 2. Infrastructure hardware layers

To succeed all these things that the virtualization promises, it is necessary to have an infrastructure that really can support the virtualization of each component and hence of the DataCenter (Figure 3).

Here we mention that not any application requires or benefits by the advantages of installing virtualized environments and that is why it is necessary that our infrastructure to provide some flexibility to support both the installation of the applications both on dedicated hardware and on virtualized hardware.

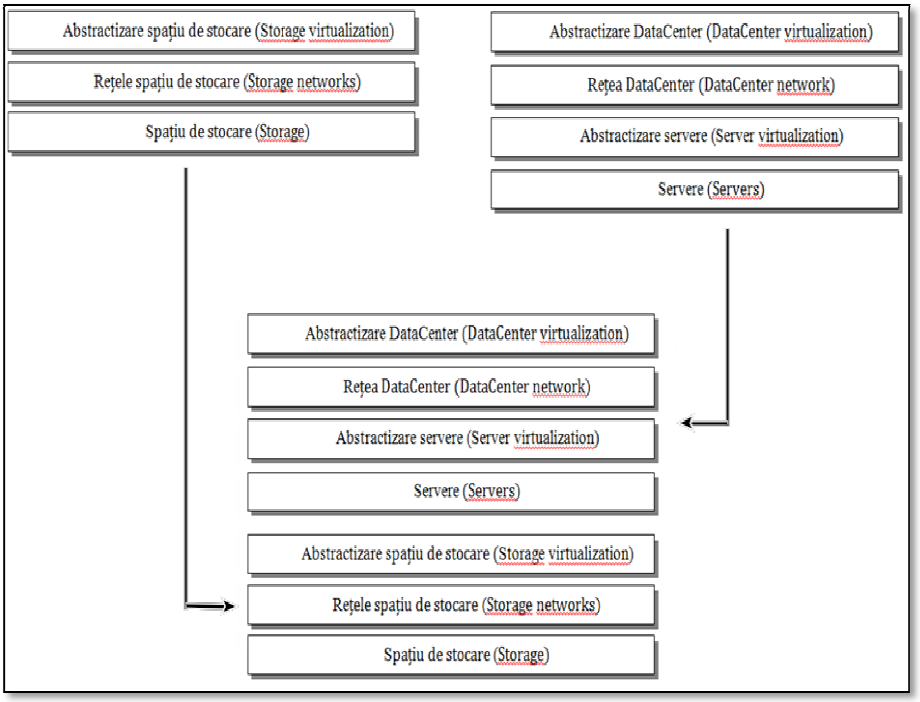

Figure 3. Layers virtualization

According to VMware, a virtualized IT infrastructure consists of layers which virtualize the used hardware components.

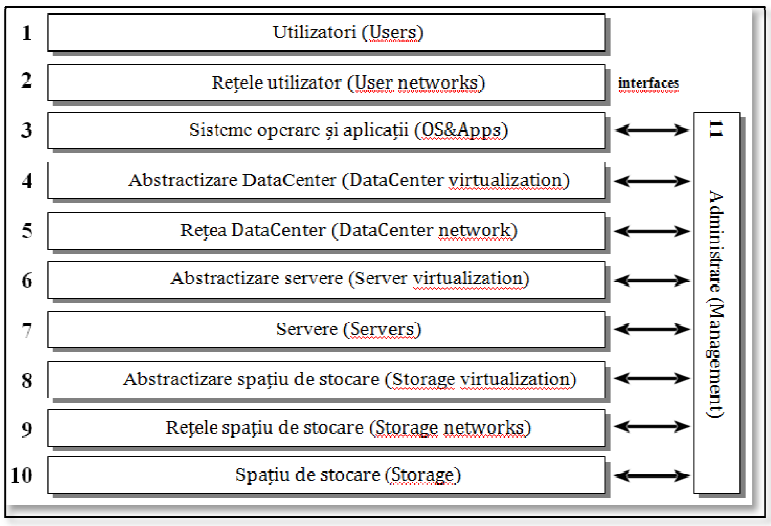

Figure 4. IT infrastructure virtualization(VMware)

Initially, the IT infrastructure was structured according to Figure 4, having the following layers:

- **Users**. The DataCenter supplies applications to the users connected with the help of any fixed or mobile devices that allow this (notebooks, traditional or virtual desktops, tablet PCs, smart phones, PDSs, etc.)
- **User networks**. This generally, is optimized to reduce the cost at the expense of performance, therefore, the connection at DataCenter through the network it must be made regardless of the client type and of the instrument used to connect.
- **Operating system and applications** (OS& Apps). At the level of the operating system the accent is directed towards the management of resources allocated to the application, the transfer rate towards HDD, on the number of processes that are in the background and the number of clients connected simultaneously. At this level, the functionality of the application is the most important objective that must be pursued carefully.
- **DataCenter virtualization**. It is mainly made to benefit as much as possible of the maximum capacity of the available resources but, and of the advantages offered by the layer of virtualization in the relation between clients and DataCenter.

- **DataCenter Network**. Require a secure and powerful network to support the mobility of applications between them, provided by speed connectivity within the network.
- **Server virtualization**. It is the software layer installed on the hardware platform, which is necessary to provide services that ensure the management of physical resources and of servers that goes into the compound of the virtualized infrastructure or of the cloud computing.
- **The servers**. Hosting on physical platforms, powerful of the virtual servers is a condition imposed because the servers' consolidation is not justified if we have few virtual machines per platform.
- **Storage virtualization**. It is necessary when the operations mustn't be interrupted by an upgrade or a replacement of a storage device.
- **Storage network**. To support the mobility of the virtual machine any server must have shared the storage space and to have a redundant connection with SAN. The redundancy requires that every DataCenter to have at least two physical SAN's separated.
- **Storage**. It is vital that the storage system to be capable to support any type of application due to the fact that each manager follows its own strategy.
- **Administration**. It requires the coordination of the behaviour from LAN and SAN whether the traffic is intersecting.

The management of the available layers' resources, whether there are hardware or software, are made with a separate interfaces (Figure 4) which, from a single console, allow the management, monitoring and configuration of resources easily available.

4. Implementation of Proposed Model

In the conducted study, we propose a new vision of the traditional model based on the experience of debugging / using virtual systems in order to ensure a resource and knowledge management for effective fault diagnosis. The virtualized IT infrastructure, structured according to the proposed approach also allows us to deepen know and understand the virtualization domain, its components and their relationships.

Compared to the virtualized model suggested by the developer, within the existent infrastructure we have made a combination of the layers that virtualizes the physical components (it does not mean that we combine the software with the hardware components) and a unification of the layers concerning the networks from DataCenter (the storage and physical network for the IP traffic), with the

observation that we did not combine the network services (Figure 5). We mention that the new model of virtualized infrastructure not exclude any layers from the previous model.

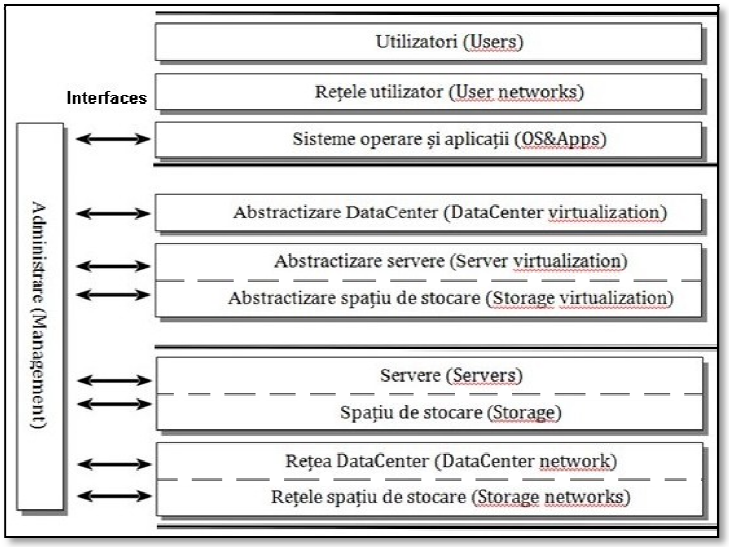

Figure 5. Virtualized IT infrastructure approach

This new approach, where some layers are combined, presents of course separated interfaces of administration for management, monitoring and configuration of services (LAN and SAN). Similarly, the interfaces for storage and servers remain independent.

Initially implemented in 2008, May, this approach has fundamentally changed the architecture at LAN and SAN level, materialized through the increase of security and availability of resources, and of economically, by reducing costs.

Tested IT system consists of three DataCenters, connected via a redundant optical fiber ring. The main DataCenter (B) have an IBM Blade Center E, which consists of three IBM HS blade servers, each equipped with two Quad Core Xeon processors and 32 G RAM. Storage of data is performed on an IBM DS3400 SAN (having three hard drives of 750GB) with a redundant fiber connection. DataCenter (C) has two IBM HS servers and one IBM DS3400 SAN with two 1TB HDD. We virtualized the physical networks, servers and storage from DataCenters and also an IT laboratory consisting of 32 computers, forming a Cloud (Figure 6).

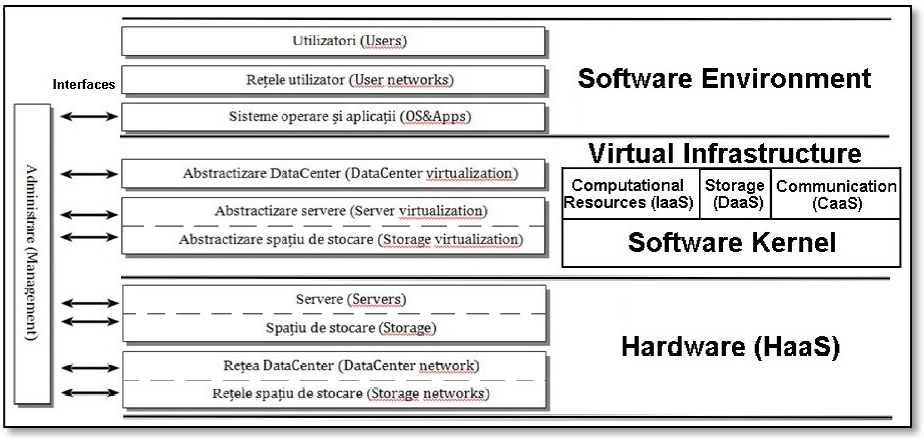

Figure 6. Implemented Model

The proposed model requires in exchange the removal of the separation layer between SAN's and involves the combination of what were once two independent physical networks of storage into one network.

Involving a rethinking of traditional infrastructure, cloud computing and server virtualization complement each other because both require a robust physical infrastructure, heavily based on network.

In conclusion, the assumed approach in terms of layers membership or type (hardware, software, etc.) based on stack concept led to a separation of responsibility of the intelligent agents during knowledge acquisition process for fault diagnosis and allowed a better understanding of virtualization field.

5. Model Characterization

The model signalized possible problems, which we can meet if we do not provide redundancy at the level of layers. During the three years since the implementation, the model confirmed certain advantages highlighting in exchange and the risks at which it may be subjected.

Advantages

- **Cost**. Regardless of the economic condition of the infrastructure owner, we have the certain advantage of a low cost because of that on a "single cable" we will have all traffic. Because the equipments used by LAN and SAN become common, the management if equipments is more convenient, leading to an easier monitoring of the traffic.

- **Infrastructure administration**. Using the unique administrative console met in the case of the traditional architecture (multiple interfaces of administration, travel time, ensuring the functionality and conflict resolution, etc.)
- **Server Consolidation**. There is an increased utilization of existing hardware resources along with a significant decrease in the number of physical servers.
- **Availability of resource**. It is the strength of the approach because we can always have a certain resource which is initially allocated to another virtual machine. Here we refer to all the generalized physical resources (disk, network, memory, processor, etc) of which we have within the infrastructure.
- **Testing new solutions**. Due to limited time and the ease of creating new servers, premises quickly creates an enabling environment for testing new software, updates, patches, etc.
- **Security**. The techniques and instruments of hackers are mainly designed for IP or intranet because of that they do not work and in the case of Fiber Chanel San. The existence of a layer of separation between SAN and the sources of threat from the IP networks make the attack techniques useless. Physically it is impossible to separate this networks, in exchange their administration it can be done separately.
- **Green infrastructure**. According to VMware, for each virtualized server saves the equivalent of about 7KW/h or 4 tons of carbon dioxide/year.

Disadvantages

- **I/O constraints**. This is an impediment in terms of information transport because a small number of I / O devices serving an increasing number of virtual machines.
- **LAN or SAN configuration**. A possible disadvantage it could be, in the proposed model, the moment of intervention in the LAN or SAN configurations. Due to merging the blocks, if we intervene in LAN, there implicitly occurring changes and in SAN and vice versa. Due to the fact that physical it is impossible to separate these networks, they can be administered separately and it is possible that this thing to affect the operational and maintenance procedures of the infrastructure.
- **Application Functionality**. Another reason that it is possible to meet is that not all the applications will work in the proposed model. Possible delays may occur in the process of installation and accessing the operating system implicitly of the applications supported by it.

For example, we met some difficulties in the moment of installing Microsoft Windows Server 2003, Standard Edition (32 – bit) on the virtual machine

win2003srv. These were small but were manifested by an increase of the response time to requests and delays in the feedback of applications.

Here, too, may intervene and the limitations at which are subjected the complex virtualized systems, starting from the I/O constraints, storage capacity, their management and spreading but continuing with the economic ones, fear of new, institutional resistance and continuous technologic development.

6. Conclusion

Due to the current economic circumstances but, and of the problems imposed by the security of the informatics systems, the companies have now started to use virtualization technologies to better protect their most valuable assets: data stored. Reducing the costs involved by the investments in hardware, software and by granting the licenses as well as and reducing the utility bills, minimizing the downtime of non-functionality of equipments and of simplification and rationalization of the management processes are objectives of which we can benefit through virtualization. This technology changes the way in which a DataCenter operates, is managed and administered. For example, before implementing the virtualization, it was known at all times which are the most used applications, on what physical machines are installed, how much of the machine's resources are used, which are the moments of maximum loading, etc.

Thanks to virtualization, this traditional connection between hardware and software is broken, and this creates a better perspective concerning the functionality and solving conflicts. Due to the cyclical profile of applications, the administrators have a global overview on the system, knowing the way of operation of it and which are the applications and moments that slowdown the performance of the system. The strength is the management of the entire virtual informatics system using a single console.

The IT departments involved in projects of servers' consolidation are aware by the possibilities of reducing the number and types of servers that support different applications, which ultimately leads to significant savings of the companies' costs.

Once with the growth and development of the company, are increasing and the necessities. Of course, we always hit with new problems and obstacles, therefore we must take into account that it is possible than an application that we today virtualized it may have to be moved back on a physical environment, as a result of the necessity of more computing power or due to some priority processes. We must analyze in detail with what instruments we operate for migrating the machines and applications at a virtual environment, ensuring that the selection was correct in the case in which we go back on a physical server or migrate the application on different virtual machines installed on different hardware machines. Also, the

security strategy of the DataCenter must take into account both the physical devices and of the virtual devices.

The virtualization also has an impact on physical infrastructure due to the computing power necessary to the physical devices that support multiple virtual machines, and some capacity of the network to satisfy the transfer requests between the virtual and physical machines.

The main contribution that results from this paper is related on how grouping layers around the stack concept in order to composing the virtualized infrastructure.

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