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Implementing Model Applied to a Virtualized Data Center based on Open Source Projects

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Abstract

This research aims to demonstrate that the proposed implementation model allows the deployment of a virtualized data center based on four open-source projects (identities, virtualization, storage, and platform) integrated at a very high level. The main contribution of the model is to simplify the process of implementation of the four projects that provide independent documentation of each other. The four components meet a checklist of requirements given by the industry, such as scalability, high availability, security, and manageability. A layered architecture complements the model, each layer implements key functionalities. The result is a data center deployed with less complexity, reducing implementation time and the cost to more than 40% by not incurring licensing costs but of renewable subscriptions annually. This deployment meets the requirements of organizations in the same way as proprietary solutions do. The model allows reusing servers and other components available in the organization to implement an open architecture, in addition to proposing the use of software-based and non-hardware technologies, giving way to future more specialized investigations of these software-based components.

Keywords: *virtualization, storage, data center, open source, software-based.*

INTRODUCTION

Data centers are the backbone of the area of technology in companies, since they host the IT services that support the applications that support business. According to Gartner[1] have many virtualized data center technologies for open architectures such x86. There are also several ways to implement the data center, in the present research will focus on virtualized data center hosted locally in the organization, that is, will not consider an outsourced data center or hosted at a remote site where it is not have control, do not consider the implementation of a public cloud, however a technological solution that supports a private or hybrid cloud will be implemented, in addition our focus will be on infrastructure as a service as defined by TechRadar[2] in his blog, which Consider the computer services that will call virtual machines.

Currently, virtualization market is led by VMware, according to Gartner[3] report in the year 2019, this reality is because vmware is the pioneer in virtualization technologies however vmware is not the only business solution , this research present a technological evaluation report that show why it is important to consider other alternatives, remember that many companies do not have the same requirements, so if a solution based on open source meets requirements of the organization then that is a viable alternative to evaluate, also if consider that this solution can be implemented at a lower cost, supports the migration decision.

Although virtualization data center is the core of the implementation, by itself it does not meet requirements of the industry, that is, virtualization lacks specialization in key functionalities such as identity management, platform management, assurance based in roles, etc. Therefore, the implementation model will be supported by 3 other

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solutions, so that the 4 proposed solutions will be integrated into an architecture based on layers, where each layer meets requirements of the industry.

Open source based solutions for server systems take advantage of the server's features and through a software layer and these deliver network, storage and computing resources that virtualization requires. At this point the technology allows to reuse and take advantage of these pre-existing resources and generate savings in acquisition costs of storage solutions and new software licenses.

This research is not an implementation manual of a virtualization solution and related components, it is success case where shows the benefits of technologies evaluated and results of the migration of the platform, neither Linux commands are shown because a virtualized data center management platform should be easy, Linux commands will be applied by support specialists in case of errors.

The model shows the implementation of four very specialized solutions that are integrated. The four projects are Red Hat Virtualization[3] as the core of the data center, to deliver software-based storage implements the Red Hat Gluster Storage[4], both projects together deliver the virtual machine platform based on open source, however for updates and operations management need RedHat Satellite[5] and for the assurance and management of accesses they need the RedHat IDM[6]. The 4 four projects integrate with each other and form the complete solution, all based on the Red Hat Enterprise Linux[7] operating system as shown in Figure 1.

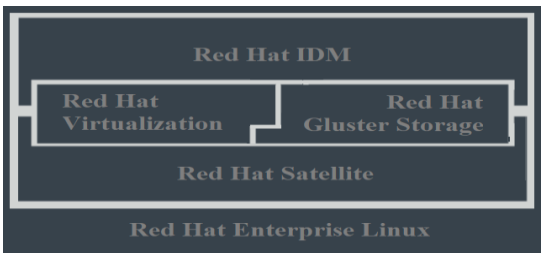

Figure 1. Open source projects

Therefore, this article aims to present a model of implementation or migration of proprietary solutions to open source as a technological alternative showing practical cases and highlighting their benefits.

II. VIRTUALIZED DATA CENTER ARCHITECTURE

Although virtualization technologies are being replaced by new technologies such as containers or cloud solutions, virtualization remains the technological basis of those solutions.

The proposed architecture can be deployed with the main virtualization providers such as VMware, Red Hat or oVirt. The main advantage of deploying under virtualization is to inherit the capabilities of virtualization equipment such as high availability, scalability, quality of service, redundancy of components, etc. towards virtualization guests or virtual machines.

At this point we will define a simple design without specifying hardware technologies as shown in Figure 2.

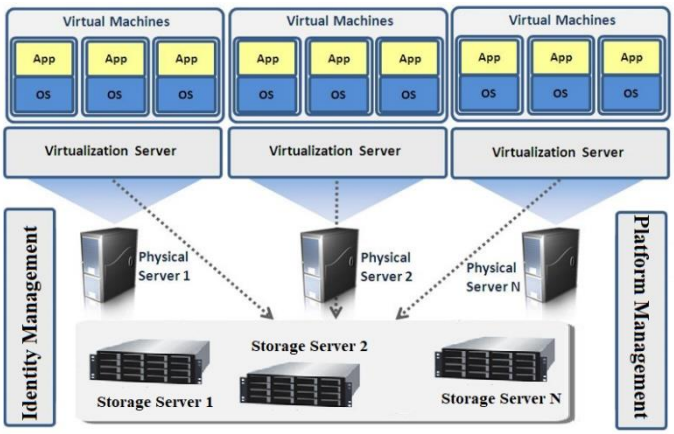

Figure 2. Virtualized Data Center architecture

Each component of the architecture contributes to the integral solution, complying with the requirements of the industry in some percentage as shown in Table 1

Table 1. Contribution of each component to the solution

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Project	HA	Scalability	Security	Manageability	System
RH Gluster Storage	45	45	5	10	server[01,02,03]
RH Virtualization	45	45	5	15	manager server[04,05,06]
RH IDM	5	5	70	15	idm
RH Satellite	5	5	20	60	satellite
Total	100	100	100	100	

Finally, when agree that Table 1 is implemented to comply with the architecture of Figure 1, the solution is designed with specific components of the opennova.pe domain as shown in Figure 3.

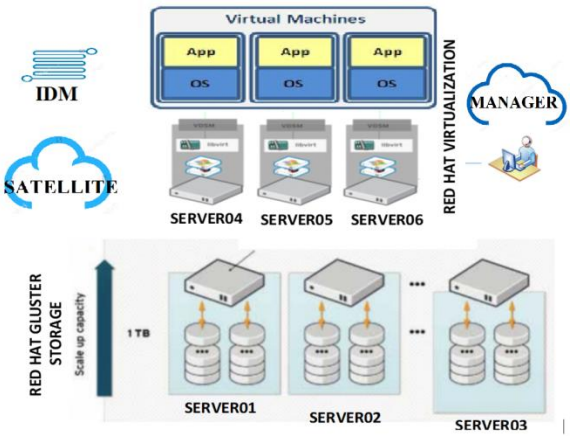

Figure 3. Specific components

III. PROJECTS IMPLEMENTATION OF THE PROPOSED MODEL

The first project to be implemented is the Red Hat IDM solution, it is important to consider that this solution allows centralized management of resources for allowed users in the another three components of the platform , this will allow the root/admin user not to be used and reserved only for very critical requests.

The specific functionalities that the IDM system brings to the implementation are the following:

- One-Time Password Authentication
- Identity Management CA Certificate
- Access Control Granularity
- DNS Service

The most common operation in this platform is the creation of the users of the organization and the assignment of permissions of these users through the creation of management groups, for example, the user Andy Reyes identified as the user andy.reyes@opennova.pe belongs to the storage management and virtualization management group as shown in Figure 4.

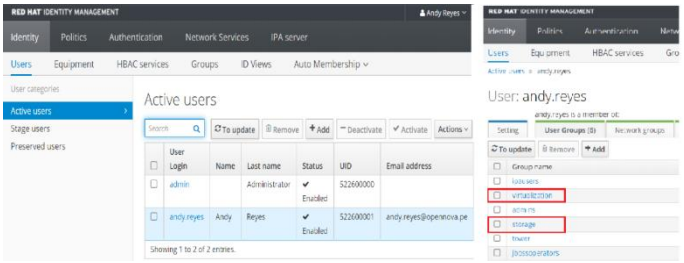

Figure 4. Identity Management

The second project allows managing the platform's operations, the most critical operation of this component is updates management. Red Hat Satellite consolidates the updates management by downloading all updates from the manufacturer's page to a local repository and allowing you to not expose the servers of entire platform to internet. As shown in Figure 5, access to Satellite is done with the IDM user and the platform is updating the RHEL repositories available for future virtual machines to be deployed in the next steps.

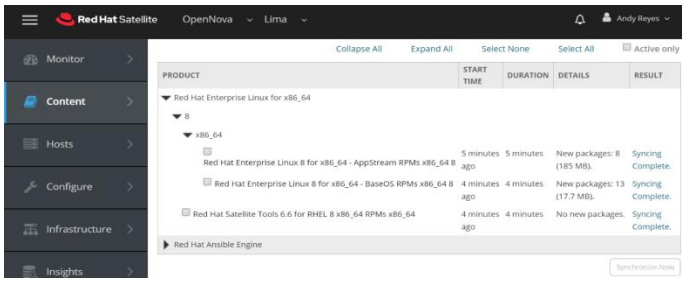

Figure 5. Updates Management

The third project implements software-based storage. The Red Hat Gluster Storage project

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recommend a base of 3 servers, in the present research it is implemented with server01, server02 and server03 from opennova.pe domain. The reason for using 3 servers is to comply with the requirement to maintain availability when a single server goes down, according to RedHat[8] a cluster of servers is considered reliable when half of +1 servers are active.

The storage cluster deploys 2 types of volumes[9], the replicated volume is a volume that has high cost but high levels of availability, the distributed volume is lower cost but low availability. In the proposed model, volumes are designed to assign replicated ones to VMs and distributed ones to backups and ISOs as shown in Table 2 where all volumes delivered have an effective size of X.

Table 2. Contribution of each component to the solution

Volume	Type	server01	server02	server03	Cost	Size
vol01	Replicated	A	X	X	2X	X
vol02	Replicated	X	A	X	2X	X
vol03	Replicated	X	X	A	2X	X
vol04	Replicated	X	X	X	3X	X
vol05	Distributed	X	-	-	X	X

Table 2 shows parts of the volume marked (X, A, -) where X represents a part of the server destined for data, A means arbiter that represents a minimum use of information approximate to 0, that is, it only contains file definitions but no data of the file, and finally the symbol - does represent that server adds nothing to the volume. These types and costs of volumes are the options available to create volumes with gluster commands that will managed by the virtualization platform in the next project.

The last project is Red Hat Virtualization which begins with the implementation of RHV Manager through the manager.opennova.pe system which is integrated to IDM to manage accesses on servers server01, server02 and server03.

The server manager.opennova.pe is the main system of the entire platform in terms of administration; it gives visibility of each component.

The server manager also manages virtualization servers server04, server05 and server06 through the IDM. Both virtualization and storage clusters are managed centrally as shown in Figure 6.

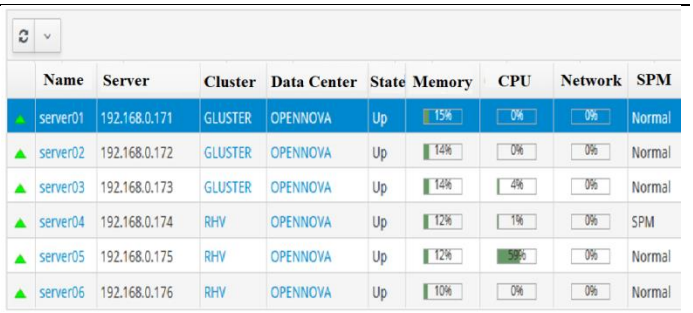

Figure 6. Data Center Management

IV. SCALABILITY AND HIGH AVAILABILITY

Storage and virtualization clusters are implemented to scale into additional nodes to expand their capabilities. This is possible because the functionalities are delivered by a software layer.. Include e-mail addresses if possible. Follow the author information by two blank lines before main text.

The high availability of components is critical, the storage cluster provides redundancy as shown in Table 2, the volume of cost X is less available, the cost 2X is medium availability and 3X cost is high availability. Similarly, the high availability of network interfaces on servers from server01 to server02 is important, with the use of redundant

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protocols, continuous access to services is guaranteed, which are inherited to all VMs in the infrastructure as shown in Figure 7.

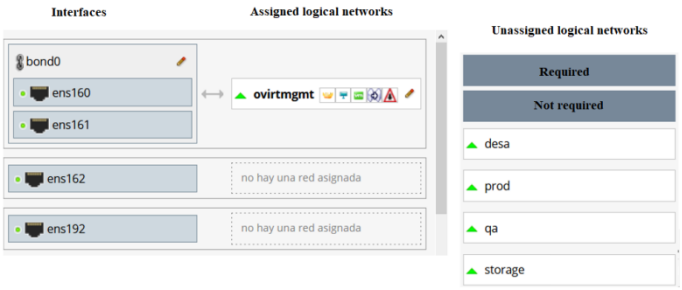

Figure 7. Network Interfaces HA

VI. SECURITY AND MANAGEABILITY

Security and manageability is delivered on the platform when managing the complete platform through the RHV Manager console integrated to the IDM as shown in Figure 8. It shows that user Andy Reyes is a platform administrator and the entire virtualization group it also has administration permissions.

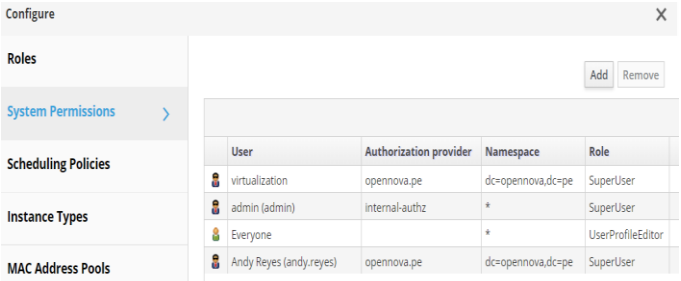

Figure 8. System permissions based roles

The most important feature in the platform is updates management, this functionality obtained from the integration of RHV Manager with Saellite allows to know in a centralized GUI whichs VMs are exposed to the reported vulnerabilities. Entering the errata section knows the vulnerability mitigation updates for each VM as shown in Figure 9 for rhel system.

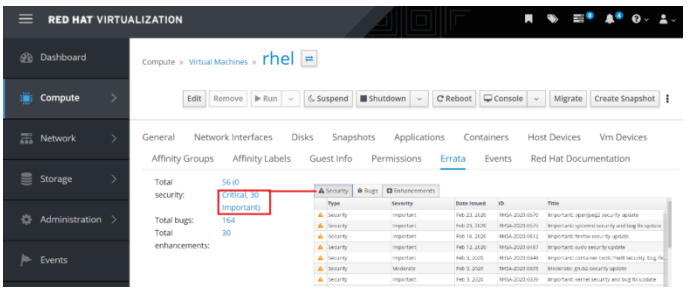

Figure 9. VM Security Updates

VII. RESULTS

Implementing the virtualized data center alternative on open source, the organization's IT services could be continued at a lower cost, maintaining the required functionalities, then a case is presented in Table 3 with the subscription prices of licenses and / or subscriptions for the scenario presented compared to the virtualization leader VMware with integration to Microsoft.

Table 3. Price comparison

Product	Units	Price	Total
VMware vSphere Enterprise Plus (includes vSan)	6	4500	27000
Windows Server Standard(ADDS+WSUS)	2	1000	2000
		Total	**29000**
Red Hat Enterprise Virtualization	3	1500	4500
Red Hat Gluster Storage (3 nodes)	1	10000	10000
RHEL Standard(IDM+Satellite+Manager)	3	1000	3000
		Total	**17500**

The result of the comparison of prices of table 3 shows a saving in license and subscriptions of 39.66% adding to this value of the saving in hardware renovation by encouraging the reuse of hardware in the organization.

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VIII. DISCUSSION

The present research is very similar to the hyperconvergence of servers[10], being another viable alternative since it proposes a very similar procedure, however, in this research additional integration considerations must be taken and the hardware support becomes even more critical, in addition to The sizing has additional practices and the tuning and tuning functionalities are more specialized.

The level of specialization required to manage open source solutions is very similar to the owner because both have very simplified procedures, however, it is clarified that continuous administration is not equal to the solution of specific errors, in this case the expertise is required of Linux operating system.

It is recommended investigating solutions based on open source from different manufacturers such as Oracle Virtual Machine, Citrix Xen Server, Proxmox, even KVM which is the core of many similar solutions and software-based components.

IX. CONCLUSIONS

Evaluation of technological alternatives is very important because the regulations of the public companies of many countries specify that, given similar functionalities, the financial factor is the decisive factor for the acquisition process.

No matter which guest operating system hosts the platform, this is a separate layer so a Linux virtualization platform can host Windows virtual servers without any difficulty for the administrator and it is recommended to evaluate it even for Microsoft solution specialists.

The research process determined that specialized local support[11] in technology is very critical. A learning period of at least 1 year is considered necessary, being this period where specialized personnel becomes more critical.

The implementation model allows savings costs of at least 40% in the purchase of licenses and even more savings if available hardware is re-used in the organization.

ACKNOWLEDGEMENTS

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