

Virtualization: A Sustainable Resource Management Strategy in Computing Practices

Olaitan O. Afolabi¹, Ibrahim K. Ogundoyin²

¹(College of Information and Communication Technology, Salem University, Nigeria)

²(Faculty of Basic and Applied Sciences, Osun State University, Nigeria)

Abstract: Many computing practitioners are challenged with resource inefficiencies and insufficiencies emanating from poor management strategy. In order to reduce complexity and risk while improving productivity, practitioners need to virtualize their resources. Virtualization of devices allows fast installation of applications and reduces cost of procuring equipments and time spent on placing orders, delivery and set-up. The socio-political ramifications of global warming requiring good corporate citizens to meet greenhouse gas reduction targets, creates an added incentive for virtualization. This paper unleashes the many potentials of virtualization technology and explores how it promises to address much of the problems confronting computing practices. The results of the analysis of survey obtained from the industry-leading virtualization software company (VMware) ascertained virtualization as a solution for sufficiency and efficiency in computing practices as the main objectives of this paper.

Keywords: Computing, Efficiency, Sufficiency, Technology, Virtualization

I. Introduction

A good number of organizations experience the challenge of scarce resources due to poor state of economy in many continents of the world today. To boost productivity and organizational growth, employers need to bear the cost of travel to meetings and conferences by their employees. By so doing, risks attached to travelling by means of aircraft, motor vehicles and other forms of transportation are inevitable. As such, corporations need to adopt sophisticated technologies that provide an opportunity for geographically distributed colleagues to interact in real time. This has led to the growing awareness of the advantages provided by virtualization technology. Virtualization is a combination of software and hardware engineering that creates Virtual Machines (VMs) - an abstraction of the computer hardware that allows a single machine to act as if it were many machines. Virtualization reduces power consumption and air conditioning needs as well as the building space and land requirements that have always been associated with volume of computing infrastructures. Virtualization also provides high availability for critical applications, and streamlines application deployment and migrations. Virtualization can simplify IT operations and allow IT organizations to respond faster to changing business demands [1]. Section II of this paper details how virtualization works and the various categories of virtual services, section III discusses applications areas of virtualization and how it benefits the users. In Section IV we discussed the result of a survey report as obtained from testimonials of customers of a reputable VM application producing organization. Section V concludes on the many advantages of virtualization, the mitigating factors and recommendations that can encourage the adoption of the technology.

II. How Virtualization Works

Virtualization separates traditional IT resources into more easily managed and centralized solutions in a way that often increases scalability, improves resource utilization, and reduces administrative resources. It facilitates efficient use of computing resources for collaboration that reduces travel time and cost, increases organizational efficiency, and addresses environmental concerns [3]. In a virtualized system two or more logical computer systems runs on one set of hardware. Through the practice of virtualization; organizations lowers power and cooling consumption, by reducing the number of machines and servers it needs. Organizations often run only one application on a single server due to the fear of possibility of one application crash that can affect the other if two or more runs on the same machine. Estimates indicate that most x86 servers are running at an average of only 10 to 15 percent of total capacity [4]. Through virtualization, a single purpose server can be a multi-tasked, and multiple servers can be turned into a computing pool that can adapt more flexibly to changing workloads. Virtualization also reduces the number of physical devices, which consequently means a reduction in the amount spent on energy required to power and cool many devices. Aside the benefit of lesser investment on computing infrastructures, a lot of time is saved with fewer devices when performing manual tasks for maintenance. New trends in virtualization technology include video conferencing with increased integration and portability. Smaller devices, such as smartphones (e.g., the iPhone™ and Blackberry Storm™) and digital tablets (e.g., the iPad™ and HP TouchPad™) can be loaded with video conferencing software with minimum

power consumption. This facilitates student learning, employee training, project management, and the broadcasting of organizational events [5].

There are many forms of virtualization commonly used in enterprise environments [6]: Hardware Virtualization uses software called a hypervisor (commonly VMware ESXi, Microsoft Hyper-V, or Citrix XenServer) to abstract the physical characteristics of a server. This permits multiple guest operating systems to run virtually on a single physical server. The guest virtual machines are not aware that they are sharing physical hardware. In addition, the resources of the physical server are better utilized. Software or Application Virtualization streams a remotely installed application from a server to a client (commonly Citrix XenApp or Microsoft App-V) or packages up an application to run in a standalone sandbox without requiring local installation (commonly VMware ThinApp). Because the applications are no longer installed on client desktops, administrators can easily administer and distribute applications and their patches from a single networked location. Desktop Virtualization is similar to hardware virtualization in the sense that it separates a personal computer desktop environment from a physical machine by either remotely streaming the desktop (commonly VMware View or Citrix XenDesktop). In some cases the entire desktop may be cached locally, but most solutions simply provide a remote keyboard, video, and mouse (KVM) interface via a locally installed application (commonly Citrix Receiver or Microsoft Remote Desktop Connection). The desktops run on high performing servers that are centrally managed and easily deployed by IT. Storage Virtualization abstracts logical storage from physical storage. Large pools of disks are divided into smaller logical units that are presented as a single volume but may actually span across many physical disks. This improves performance, increases drive space utilization, and provides redundancy. Network Virtualization either separate physically attached networks into different virtual networks or combine many separate virtual networks to share the same segments of a large physical network. By creating virtual networks, administrators are able to logically group machines and their traffic while better utilizing the physical networking infrastructure.

III. Virtualization as a Resource Management Strategy

The advent of virtualization technology has aided organizational productivity in diverse industries spanning through arts, legal, health and academia. BT Conferencing; a prominent vendor of videoconferencing technology reported a number of case studies of clients who had benefited from their audio, video, web, and streaming collaboration services [7]. BT Conferencing has wide expertise in video conferencing and offers an extensive product portfolio; ranging from sophisticated TelePresence suites to desktop solutions and hosted services. According to Stuart Babiy; the Information & Audit Lead of Greater Midlands Cancer Network. In a bid to bring in clinical inputs from other areas and set up specialist multidisciplinary teams. The organization chose to commission BT video conferencing who recommended a solution tagged “the Polycom HDX 8000 video conferencing system”. The system enables specialists to see and share scans, X-rays, and medical images as well as discussing things face to face without leaving their workplaces. In addition, cancer specialists can now make decisions faster and get more done with minimum time and cost. In the same vein, BT video conferencing services have helped law firms in extending the scope of their client services especially to safeguard the security of vulnerable witnesses during court proceedings [8]. In cases involving difficult situations such as domestic violence, clients sometimes fear for their personal safety and are reluctant to attend court in person, virtualized courtroom attendance has proffered solution to this limitation.



Figure 1. Application of virtualization technology in business with videoconferencing

To foster Sustainable learning and development on a global scale BT Conferencing as a firm found conferencing as a cost effective way to invest in the professional skill of its people. The team developed a distance-learning program using Web 2.0 technology [9]. The service has enabled professional to interact and provide briefings on best practice in virtual collaboration. Aside from reduced ineffective time and the sustainability benefits of travel avoidance, there is a significant reduction in direct costs. The firm recorded an average saving of over 40 percent; meaning more than US\$500 per delegate was saved compared to traditional

face-to-face media. This amount saved can also provide learning opportunities for twice the number of people for the same investment, without loss in quality of delivery. On the part of art industry, Southbank Sinfonia recruits artists around the world using TelePresence audition from BT. The solution has helped the firm to recruit people from around the world, thereby saving thousands of pounds, 20 tonnes of carbon and the roguer of flying 55,000 miles [10].

IV. Return On Investment (ROI) From Virtualization Technology Adoption

In this section, we showcase reports of quantitative research that measures the business and operational impact of virtualization by VMware; an industry-leading virtualization software company based in USA [11]. Table 1 and Table 2 respectively show the statistics of operational efficiency and sufficiency acquired by VMware customers who have virtualized their “x86 sever”.

Table 1. Significant Operational Findings of Benchmark Study Research
Source: VMware

Operational Benefits of Virtualization	Overall
Number of new projects increased by	21%
Application time to market improved by	22%
Rework and testing improved by	26%
Server incidents reduced by	27%
System downtime reduced by	26%

Table 2. Significant Financial Findings of Benchmark Study Research

Financial Benefits of Virtualization	Overall	
	Importance Today	Future Importance
Reduced hardware costs	72%	52%
Server provisioning time reductions	62%	43%
Disaster recovery improvements	39%	49%
Upgrade / maintenance expenses reduced	25%	31%
Applications released faster	14%	22%

Fig. 2 represents the graph of business and operational benefits delivered by virtualization currently, and in comparison with the future trend. Reduced hardware spend was listed as the top contributor to ROI both now and in the future. However, the contribution of reduced hardware spend is expected to go down in the future with factors such as improved disaster recovery and improved upgrade/maintenance time increasing in importance. To better understand if and how virtualization influences business results, VMware took a rating of the importance of business benefits that can be delivered by VMware virtualization from organizations. The most important benefits are expenses reduction, improvement of business continuity, and increase in business agility. These benefits accrue directly to the business and are in addition to the operational efficiencies available to information technology. As shown in Fig. 3, the average rating from organizations when asked if VMware virtualization delivered on these benefits on a scale of 5 is 4.1. This suggests that customers are experiencing business benefits based on the deployment of VMware virtualization software.

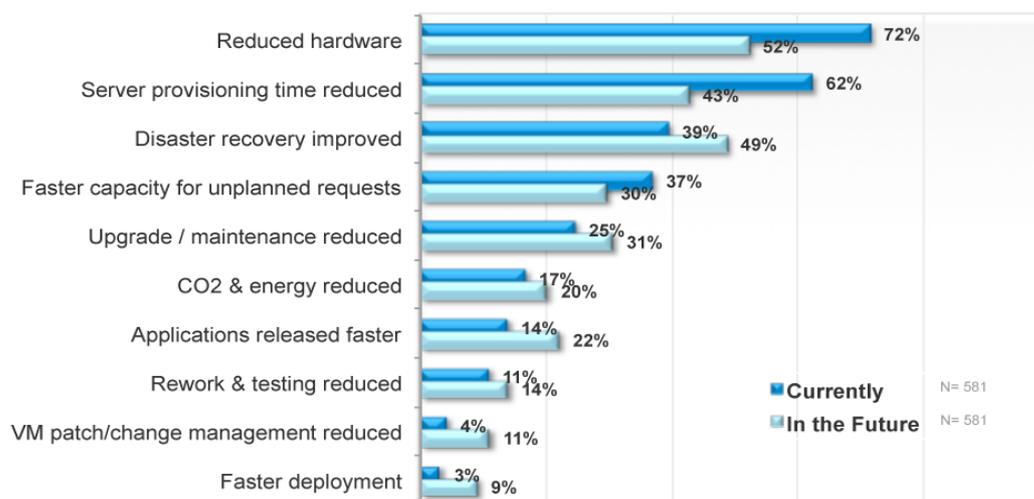


Figure 2. A comparison of the current and future trends in ROI

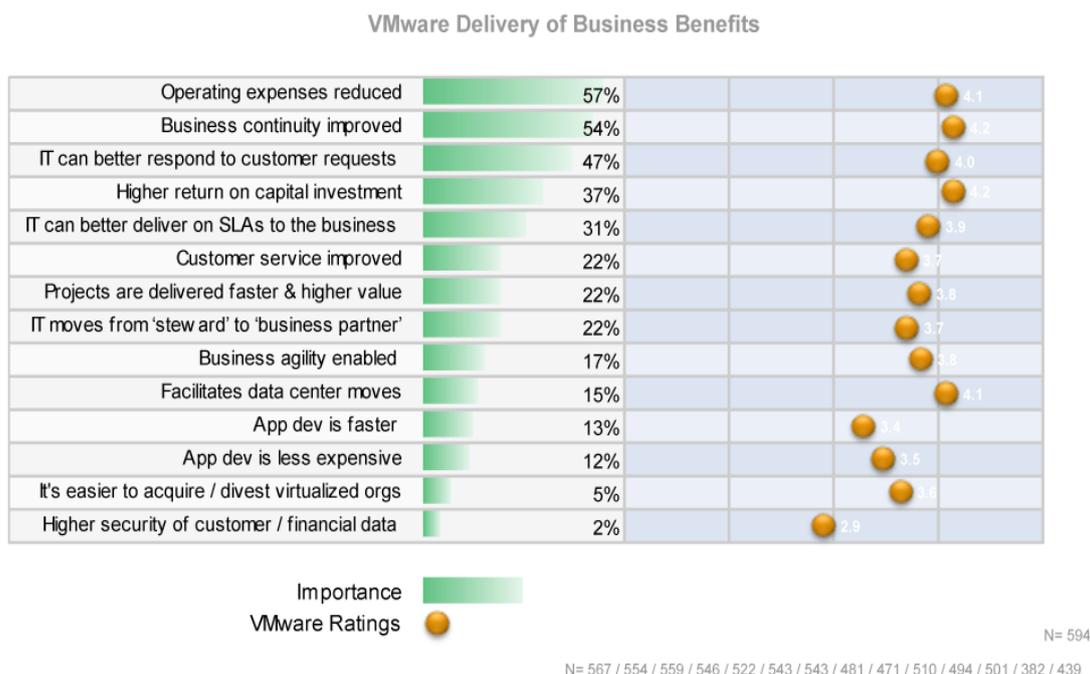


Figure 3. Business benefits delivered by VMware virtualization

V. Conclusion

The results of the study show a general trend away from capital expense savings as the primary motivator for virtualization, and toward business agility and operational efficiency. In general, virtualization is a new trend in resource management strategy that organizations may wish to adopt for the benefits of consolidation, energy efficiency, resource utilization, management, provisioning, load balancing, disaster recovery and automation. Part of the survey result obtained from our data source also reveals that cost, perception/knowledge, technical and process issues are the four major barriers mitigating the adoption of virtualization technology. Wrong perception of users on the workability of this method may be tackled through awareness programmes by major vendors of the technology to enlighten chief executives of organizations on many advantages of virtualization. More so, the streams of ROI reported in this paper serve as a signification prove that virtualization technology is a core solution for resource management strategy for organizational and computing practitioners.

References

- [1]. T. Burger, Mar. 2012, "The advantages of using virtualization technology in the enterprise", <https://software.intel.com/en-us/articles/the-advantages-of-using-virtualization-technology-in-the-enterprise>
- [2]. A. Murphy, Dec. 2007, "Virtualization defined eight different ways", <https://f5.com/resources/white-papers/virtualization-defined-eight-different-ways>
- [3]. O. Afolabi, J. Uhomoibhi, Studies of energy use, green IT practices and the role of entrepreneurship in higher engineering education in Nigeria, Proc. ICEER2014 –McMaster Conf, Hamilton, Ontario, Canada, 2014, 208-209
- [4]. L. McCabe, May 2009, "What is Virtualization, and Why Should You Care?", <http://www.smallbusinesscomputing.com/testdrive/article.php/3819231/What-is-Virtualization-and-Why-Should-You-Care.htm>
- [5]. T. Toperczer, 2011, "Video Conferencing 2.0", <http://pubs.royle.com/publication/?i=73978&p=12>
- [6]. J. Pearce, Dec. 2010, "How does virtualization work?", <http://www.quora.com/How-does-virtualization-work>
- [7]. BT Conferencing, 2014, "Putting cancer specialists in the picture", <http://www.btconferencing.com/case-studies>
- [8]. BT Conferencing, 2014, "Video conferencing serves justice", <http://www.btconferencing.com/case-studies>
- [9]. BT Conferencing, 2014, "Sustainable learning and development on a global scale", <http://www.btconferencing.com/case-studies>
- [10]. BT Conferencing, 2014, "Global players in virtual auditions", <http://www.btconferencing.com/case-studies>
- [11]. VMware, 2011, "Business and financial benefits of virtualization", <https://www.vmware.com/.../VMware-Business-Financial-Benefits-Virtualization-Whitepaper.pdf> Adobe Reader.