Effective use of Virtualization in Computer Laboratory Management

Mrs. Anshu Thakral
Department of Computer Science
Bharati Vidyapeeth University Pune, India
anshu.thakral@gmail.com

Dr. Sachin A. Kadam
Professor, Department of Management and
Entrepreneurship Development
Bharati Vidyapeeth University
Pune, India

Abstract - Virtualization is a framework of dividing the resources of a computer into multiple execution environments, by applying one or more technologies. The laboratories at colleges are widely used by students and teaching staff. Colleges and universities today are facing several challenges with current technologies for example; in case of machine failure a new machine needs to be setup that leads to increase in cost, before every exam the laboratory machines need to be reinstalled which is very tedious and time consuming task, the laboratories are set up as per subject requirements and there is no separate laboratory for individual subjects , every machine is installed with multiple heavy applications this whole process is headache for laboratory assistance[1]. The increasing demand for connecting a wide variety of brings your own device (BYOD) places strain on understaffed IT resources. In addition, many campuses also have needs for increased security, as well as a lower energy footprint [2]. Deploying virtualization within college campus in computer laboratory management can be said as a new approach to solution for all the problems mentioned above.

This paper presents an overview of virtualization, types of virtualization, challenges involved in computer laboratory management, virtualization solutions in computer laboratory management and significance of virtualization which would help to manage the computer laboratory in an efficient way.

Keywords - Virtualization, Computer Laboratory Management, Virtual Machine, Challenges, Types of Virtualization

I. INTRODUCTION

Virtualization has become one of the most talked about technologies in recent years. Virtualization is a process in which software creates virtual machines including a virtual machine monitor called 'hypervisor' that allocates hardware resources dynamically and transparently so that multiple operating systems called 'guest operating systems' can run concurrently on a single physical computer without even knowing it [3]. It can be seen as abstraction and creation of multiple logical systems on a single physical platform. It is called virtualization because it creates a virtual version of computing resources rather than actual. Virtualization allows for the maximizing of hardware through the sharing of resources.

II. TYPES OF VIRTUALIZATION

Virtualization is the creation of a virtual version of something, such as an operating system, a server, a storage device or network resources. Various types of virtualization are:

Server Virtualization:

Server virtualization is the partition of a physical server into smaller virtual servers to help maximize server resources. In server virtualization the resources of the server itself are hidden from users and software is used to divide the physical server into multiple virtual environments called virtual or private servers.

Benefits:

Server virtualization can be used to eliminate server sprawl, to make more efficient use of server resources, to improve server availability, to assist in disaster recovery, testing and development, and to centralize server administration.

Desktop Virtualization:

Desktop virtualization is used to separate a computer desktop environment from the physical computer. Desktop virtualization is considered a type of client-server computing model because the "virtualized" desktop is stored on a centralized server.

Benefits:

To virtualizing the desktop reduce maintenance costs, increase security, easy deployment, reduce energy costs and centralized management.

Storage Virtualization:

Storage virtualization is the process of grouping the physical storage from multiple network storage devices so that it looks like a single storage device.

Benefits:

Storage virtualization helps the storage administrator perform the tasks of backup, archiving, and recovery more

easily and in less time. It allows for the reduction in duplicated data and attempts to maximize the efficiency.

Network Virtualization:

By virtualizing a network, multiple networks can be combined into a single network, or a single network can be separated logically into multiple parts. Network virtualization treats all servers and services in the network as a single pool of resources that can be accessed without regard for its physical components.

Benefits:

Network virtualization is intended to optimize network speed, reliability, flexibility, scalability, and security.

III. CHALLENGES INVOLVED IN COMPUTER LABORATORY MANAGEMENT

Computer laboratories are a necessary tool in a student's learning process. In universities a great amount of time is needed to manage and operate lab course IT infrastructures. The traditional brick and mortar computer laboratory is no longer enough when the entire student body needs access to different applications for each class in every semester. Managing a large number of individual computers can be a costly and error-prone activity. The traditional physical computer laboratory places extreme demands on the limited resources, ties up valuable space and limits the way students now choose to work. Day to day performed activities in traditional computer laboratories become challenges for them like [4]:

- **Mobility:** Installing on alternate machines to support mobility increases licensing costs and reduces desktop performance.
- **Low reliability:** Laboratory use is prone to errors; machines are often rendered unusable for extended periods of time until administrators restore functionality.
- **Difficult to backup:** There are numerous desktops to be covered during backups; it is often the case that many of them are inadvertently left out.
- **Multiple machines per student:** It would be expensive to provide students with more than one machine to run experiments, and therefore experiments involving networking and heterogeneous environments are often avoided.
- **Difficult to maintain:** Many users share a machine; it becomes very difficult to maintain the software configuration on it, especially when USB drives are regularly used to upload updates to the system.
- **Tedious to prepare for an examination:** Before every exam, the laboratory machines need to be reinstalled to ensure a pristine environment during the test. This process is extremely tedious and time consuming and therefore laboratories that have been prepared for an exam are often quarantined before and during examinations.

- **Licensing:** While for mobility, it would be useful to have all software installed on all desktops that would increase licensing costs. If one could install and reinstall application software at will, one could contain the licensing costs to cover exactly what one uses.
- **Difficulties in monitoring:** It would be nice if teachers could access student desktop from their desks and keep an eye on the laboratory class. With the current setup this is not possible and physically monitoring each student is close to impossible.
- **Managing power consumption:** From the economic perspective, it would have been nice to control/reduce the power consumption of computer laboratories.
- **Restriction on location of access:** A user doing laboratory work now has to be physically present in the laboratory to access his/her work or has to carry his/her work data to a different machine with replicated configuration. If laboratory session s could be accessed from anywhere on the campus, the flexibility afforded would be nice.
- **Storing state information:** If work done partially or assignments submitted, can be preserved for a later date, it would greatly improve the utility of a computer laboratory. Today's laboratory only allows to save data but don't save the machine status.
- **Management:** Time consuming maintenance and support for laboratory desktops and applications.
- **Security:** Assurance of data, application and device security.
- **Semester provisioning:** Timely updates required for each new semester's application and data.
- **Access:** optimal students access to data and applications.
- **Cost:** The need to work within the limits of decreasing budgets.

IV. VIRTUALIZATION SOLUTIONS IN COMPUTER LABORATORY MANAGEMENT

As we saw many problems occurred in computer laboratories due to traditional set up. So with the help of virtualization we can reduce above mentioned challenges in computer laboratories. Virtualization can have large impact on education technology. For college or universities virtualization is an efficient way to deliver data and applications to students anytime, anywhere without exceeding current staffing and financial resources [5]. Virtualization solutions optimize the computer laboratory and create a virtual laboratory that reaches any student, anywhere and anytime. Virtual environment allows laboratories to progress in a secure and portable manner. Various types of virtualization solutions can help to manage the computer laboratory in an efficient manner like:

Desktop Virtualization:

A single desktop image, including installation and maintenance of software, upgrades and patches is maintained at server level and then securely delivered to the student's end device over the network. With desktop virtualization tools, IT staff can enable central provisioning of computers and

applications for better security, reliability, and standardization, while also helping to save time and labor.

- **Application Virtualization:**

    Software and hardware components work together to create an infrastructure that allows the college or university to virtualize application resources, manage them centrally, accelerate their performance and ensure their security.

    - **Server Virtualization:** Multiple physical and virtual servers run on a single server box without impacting one another, increasing server flexibility and cutting costs through the consolidation of the physical infrastructure.
    - Optimize computer laboratories to improve delivery of applications while reducing the strain on IT resources.
    - Centralize administration and reduce IT cost to bring technology initiatives within reach of available resources.
    - Give colleges and universities the ability to securely deliver data and applications to any student with an internet.
    - Reduce cost by eliminating the need to maintain the physical laboratory and upgrade equipment.
    - Free IT personnel to work on other projects.

V. WHY VIRTUALIZATION IS SIGNIFICANT FOR COMPUTER LABORATORY MANAGEMENT

Survey done by different companies and researchers shows how virtualization is greatly helpful for computer laboratories to overcome some of the challenges:

- According to Citrix survey's result virtual computer laboratory will provide easy delivery of semester based instructional applications and resources (67%), reduce costs by eliminating the need to maintain the physical laboratory (62%), free IT personnel to work on other projects (58%) [6].
- According to Weinmans it turned out that virtual laboratories are able to provide a more than 25 times cost advantage compared to classical dedicated approaches [7].
- Dell's virtualization solution creates a virtual environment in which client machines have no hard drive, which reduces virus maintenance, extends service life and decrease power consumption [8].
- According to Microsoft's virtualization solution; the computer laboratory has no desktops but only monitors, keyboards and mice on its desks. So it appears to be laboratory without noise and heat [9].

VI. CONCLUSION

Virtualization is the next big wave in computing. Virtualization paradigm is a new approach to produce a solution for old problems for computer laboratories. Deployment of this paradigm in computer laboratories have many benefits like collections of inefficient servers can be replaced with fewer machines; software can be tested while isolated in harmless virtual partitions; better data security, students can access resources from various devices, Provision of better and faster disaster recovery and satisfy the diverse needs of students, faculties and researchers to create an ideal environment for higher education learning needs.

Virtualization technology can be implemented in computer laboratories using one of the virtualization softwares like Microsoft Virtual PC, Virtual Box, VMLite Workstation, VMWare server, VMWare Player, VMware Workstation and many other approaches depends upon its remote side implementation or its own desktop implementation.

VII. REFERENCES

1. Mrs. Bharati Ainapure, Mrs. Sukhada Bhingarkar, Prof. Deven N. Shah, International journal of Advances in Computing and Information Researchs, "Design of Private Cloud for Educational Sector using Eucalyptus", volume 1 No. 1, January 2012.
2. Mike Holstein, "Virtualizing Desktops for Higher Education:A ViewSonic Case Study", 2013.
3. Joseph M. Kizza, International Journal of Computing and ICT Research, "Africa Can Greatly Benefit from Virtualization Technology – Part 1" Vol. 6, Issue 1, pp 6-10 June 2012.
4. Practical Experience, "Coriolis Technologies", Worked on virtualization software Pune, April 2013.
5. By Citrix, White Paper, "Virtualization: Meeting the Higher Education IT Challenge", Oct 30, 2009.
6. Margaret Rouse, "Server Virtualization", 29 June 2009.
7. Microsoft, "Get More out of Your Education IT Infrastructure", Year: 2012.
8. Jong – Hwan Jeong, Computing and Information Center of University of Incheon, Microsoft System Center Customer Solution Case Study, "Using a Computer Lab as the Starting Point for Students' Cloud Computing Experience".
9. Bradley Morgan, Research Paper, "Virtualization", 24 Jan, 2013
10. Jimmy Daly, Article, "What is Virtualization", 8 October 2012.
11. Richard Scroggins, Global journal of Computer Science and Technology Interdisciplinary, "Virtualization Technology Literature Review", volume 13 Issue 1 Version 1.0 year 2013.
12. Keith Walton, DELL, "Virtualization Solutions: Centralize computing and applications to enhance access and reduce costs", July 26, 2010.
13. Nane Kratzke, Department of Electrical Engineering and Computer Science, "Virtual Labs in Higher Education of Computer Science, Why they are Valuable? How to Realize? How much will It Cost?" 2012.
14. Marianne C. Murphy, Educause Review, "Instructional Benefits of Remote desktop Virtualization", June 24, 2010.
15. Nils gentschen Felde, Tobias Lindinger, Helmut Reiser, Leibniz Computing Centre, "Virtualizing an IT Lab for Higher Education Teaching", 12 Feb, 2008.

16. Harry Bulbrook, Durham Technical Community College, 2.1"Using Virtual Machines to provide a secure Teaching Lab environment".

17. Thomas Vater and Andreas Rynes, TechNet Magazine, 2.1"Virtualization: Build an IT Lab for Virtual Machines", September 2011.

18. Susanta Nanda, Tzi-cker Chiueh, Department of Computer Science, 2.1"A Survey on Virtualization Technologies", Year 2005.

19. Virtualization: "Virtualization Best Practices", 2 May 2008.

20. Miguel Santos Ribeiro, "Thoughts on Information Technology", November 10, 2009.

21. Wikipedia, the free encyclopedia, "Hardware virtualization", 3 May 2013.

22. David Burford, "Virtualization Is It Right for You?", LAD Enterprizes, Inc., August 2008.

23. Bill Hill, "Intro to Virtualization: Hardware, Software, Memory, Storage, Data and Network Virtualization Defined", Petri IT Knowledgebase, March 12, 2012.

24. Dedoimedo, "Best Free Virtualization Solutions", An article: Gizmo's freeware, 15 June 2012

25. Usman Khurshid, "4 Free Virtualization Software Solutions For Windows", Make Tech Easier, 8th Apr 2012.

26. INetU, "7 Great Uses for Virtualization", March 31st, 2009.

27. Kevin Lo (Lead Technology Analyst), "Turn one computer into several using virtualization software", An article: TechSoup, January 19, 2011.

28. Dan Kusnetzky, "Virtualization: A Manager's Guide (Book)", O'Reilly Media, Inc., ISBN-13: 978-1-4493-0645-8, June 28, 2011.