

Virtualization using Virtual Machines: for Improved Service Delivery, increased throughput, technical and financial resource optimization in e-Governance

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Abstract:

Server consolidation based on virtualization technology will simplify system administration, reduce the cost of power and physical infrastructure, and improve utilization in today's Internet-service-oriented enterprise data centers. The basic use of Virtualization is the optimization of technical resources, improved service delivery with valuable reduction of the cost. The benefits of virtualization are typically considered to be server consolidation, increased availability, isolation, ease of operating system deployment and simplified disaster recovery. As the size and complexity of modern computing systems keep increasing to meet the demanding requirements of Performance applications, manageability is becoming a important concern to achieve both performance and productivity computing. Here I am present analytical framework for utility analysis of Virtual Machines to achieve Testing and R & D, new effortless deployments, basic system administration, Adaptability scalability, new models of Service Delivery, Efficiency, Enhancement, User Convenience, Sustainability, and leverage of shared government infrastructure. However to deliver the maximum throughput requires careful attention toward system details for the minimal loss of CPU performance and I/O efficiency.

Keywords: Virtualization, Virtual Machine, Improved Service Delivery, financial and technical resource Optimization

1. Introduction

By day to day development, virtualization technology has rapidly attains popularity in computing. In fact, it is now proven to be a fundamental building block for today's computing. The virtualization technology can separate hardware and software management and provide useful features including performance isolation [1], server consolidation and live migration [2]. In addition, the virtual technology can also provide portable environments for the modern computing systems [3]. Therefore, the new computing theorem and model that the virtualization technology embodies has very widespread use.

For the casual user, though, probably the biggest use of virtualization is to run one operating system (OS) from within another. Run Windows from within Linux, Linux from within Windows, one Linux distro within another, and so on. This is the source of my interest in virtualization. [4]

In computer science, virtual machines recover the interests to researches as well as the industries and e-Governance. The main advantages of the virtual machines are that multiple guest operating systems can co-exist on the same computer and it is in strong isolation from each other. Another important benefit of the virtual machines is to provide an instruction set architecture (ISA) that could be different from that of the real machine. Applications of virtual machines arise widely in computer science, such as in embedded systems, which support a real-time operating system at the same time as a high-level OS. In virtual machines (VMs) environment, the software layer which provides the virtualization is called a *virtual machine monitor* (VMM). The guest OS do not have to be all the same, they could be different OS or different version of an OS on the same computer. These nature or type of virtual machines are very useful for the server consolidations.

Virtual Machine now seen as cost-effective techniques for organizing computer systems resources to provide extraordinary system flexibility and support for certain unique applications with optimum use of technical Hardware ,software, Network, human resources and time.

Virtual machines are a concept that is used quite often in the computing world to solve very important problems, but often these are transparent to you as the user because virtual machines are typically used within programs and operating systems that users use every day. Some of these problems include: sharing the same hardware among many programs by partitioning the hardware, allowing software to be "portable" between various operating systems, as well as running older software on a newer computer. All of these uses of virtual machines are very important to the way that we compute today.[5]

Virtual Machines are a great way to experiment with a new operating system, work safely on a new development project, test new software [6]

Basic concept of Virtual Machine is running multiple distinct Operating Systems (including client as well as server) at a time simultaneously on single Computer.

With the modularity of virtualization technology, VM (*Virtual Machine*) has the following properties, such as flexible, secure, reliable, and easy to manage and configure, which can greatly minimized the hardware cost. However, besides these benefits, it also increases the complexity of virtual computing

systems, and maximizes the performance of virtual computing systems. Furthermore, end user desktop will also receive the benefits of virtualization.

2. Virtual Machines

The original meaning of Virtual Machine, sometime called hardware Virtual Machine is that number of discrete identical execution of environments (instances) on a single computer, each of which runs an Operating System (OS). Basic use of Virtual Machine is running multiple Operating Systems at a time simultaneously on single computer System. [5]

Virtual Machine Logically divide the single Computer System and resources into several isolated different sizes same like the slices of the bread each of which works and feels as a separate computer System / Server of different client / server Operating System and simultaneously run different isolated processes. [5]

This way the single computer system is efficiently optimally used logically as multiple computer systems with various distinct operating systems in hand running simultaneously at any time as guest using Virtual Machine Technique using Virtual Machine software.

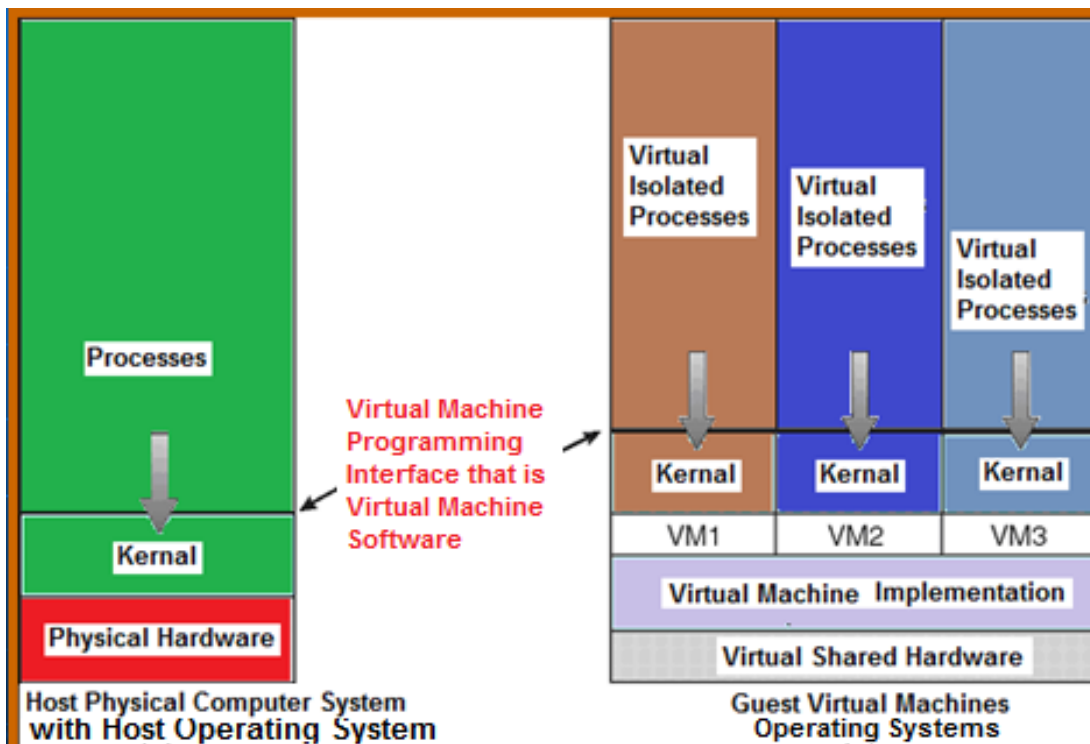


Figure 1: Logical Structure of Virtual Machine

The concept of virtualization can be applied not only to subsystems such as disks but to an entire machine. To implement a virtual machine, developers add a software layer to a real machine to support the desired architecture. By doing so, a VM can circumvent real machine compatibility and hardware resource constraints.

- More than one instance of that operating system run on the same hardware at the same time
- Another operating system can run in that simulated hardware
- More than one *different* operating system can share the same hardware at the same time
- Virtual Machine Operating System creates illusion of multiple processors
 - Each capable of executing independently
 - No sharing, except via network protocols
- *Host Operating System:*
 - The operating system actually running on the hardware
 - Together with *virtualization layer*, it simulates environment for ...
- *Guest Operating System:*
 - The operating system running in the simulated environment
- Virtual-machine concept provides complete protection of system resources
Each *virtual machine* is isolated from all other virtual machines. Isolation ensures that applications and services that run within a VM cannot interfere with the host OS or other VMs

Therefore its one use is for the isolation of processes with specific resources so that the processes should not collide and affect each other.

- The resources of the physical computer are shared to create the virtual machines under which
 - CPU scheduling can create the appearance that each user has own processor
 - Spooling and a file system provide
- virtual card readers, virtual line printers
 - Disk partitioned to provide virtual disks
 - A normal user time-sharing terminal serves as the virtual machine operator's console

By using the virtual machine Software we can install the new operating system as guest or we can configure and run the preexisting operating system in dual boot mode, as guest operating System.

We can form Network connections between Virtual Machines using single Network card. We can assign different IP addresses to Different Virtual Machine using a single Network Card.

The main disadvantages of VMs are:

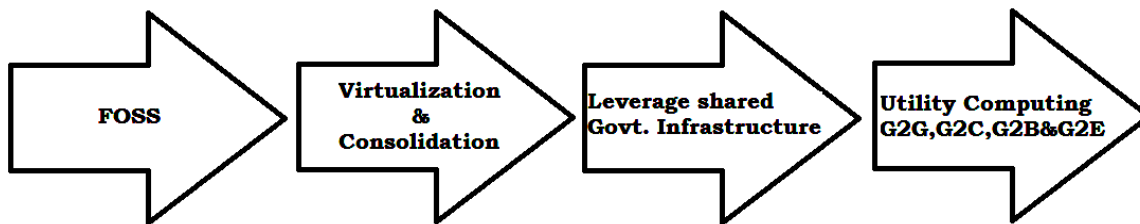
- a virtual machine is less efficient than a real machine when it accesses the hardware indirectly
- when multiple VMs are concurrently running on the same physical host, each VM may exhibit a varying and unstable performance (Speed of Execution, and not results), which highly depends on the workload imposed on the system by other VMs, unless proper techniques are used for temporal isolation among virtual machines. [7]

The Virtual Machine software handles the guest Operating System Virtual Machines as an instance/object like file for basic operations like creation, updating, removing, renaming, customizing , move, copy, backup and restore, sharing, Auto start, import/export etc. between the large number of Computer Systems between host servers with distinct old and new compatible/ incompatible software's and hardware's.

3. Framework

The proposed framework involves use of virtualization and server consolidation techniques, use of Free and Open Source Software (FOSS) ,utility computing leveraging shared infrastructure together for enhancing service delivery and reducing the expenditure incurred in facilitating e-services, and utility analysis. [8]

FOSS → Virtualization & Consolidation → Leverage of Shared Govt. Infrastructure → Utility Computing



Proposed Framework for effective e-Governance

3.1 Free and Open Source Software (FOSS)

A FOSS is abundantly licensed to the user and it also grants the rights associated with the software viz right to use, copy, study, change, and improve its design through the availability of its source code [9]. The use of FOSS reduces the total cost of ownership and vendor locking. The open source software needs to be standardized because of the involvement of national security. After standardization the open source software should be used nationwide for the development and deployment of e-governance applications [10]. Without adoption of FOSS, the government

is bound to obtain various types of software licenses as well as licenses for terminals from private vendors and India is spending an enormous amount for the same every year. The IT infrastructure cost is one of the major hurdles in successful implementation of e-governance in developing nations [11]. Therefore the use of FOSS must be encouraged and it must be standardized in such a way that it must have scalability and interoperability so that different applications can communicate with each other for reducing the redundancy of data.

3.2 Virtualization and Consolidation

Virtualization is a technique which provides a layer of abstraction between computing, storage and networking infrastructure and applications running on it whereas consolidation consolidates variety of servers together [12]. Consolidation reduces the data centers complexities, maintenance cost and energy consumptions. It enables efficient utilization of hardware resources in order to reduce total number of servers and server locations [13]. To deal with the aforesaid challenges in implementation of a Government Data Centre (GDC), virtualization can play a pivotal role at software as well as hardware level.

3.3 Utility computing leveraging shared Infrastructure

It is a way by which an IT service provider provides IT services in infrastructure, applications and business areas on need basis and charges the services on specific usages basis. It is also referred as cloud computing. The cloud computing can reduce the infrastructure cost to some extent because it imparts various types of services like Infrastructure as a Service (IaaS), Platform as aService (PaaS) and Software as a Service (SaaS) to enhance flexibility in network operations and data operations among network partners through service oriented architecture [14]. In India 72% of the populace is having cell phones [15], therefore to enhance the accessibility of e-services especially in remote areas cloud computing can be used as a pivot. It enables the recipients to access the services through cellular phones also. The government should design a G-Cloud (Government Cloud) for offering all kinds of e-services. It will overcome various challenges pertaining to accessibility of e-services in remote areas like connectivity, power and cooling infrastructure and IT infrastructure.

3.4 Analytical Framework for Utility Analysis

The Analytical Framework for identifying the utility of the Virtualization using Virtual Machines involves running and testing the working and usefulness of variant Virtual Machines on Variant physical host's hardware and software platforms in variant network environment.

The analytic queue network results are sometimes criticized for inaccurate evaluation and then it is invaluable during the development process[3]. However, without analytic results, it is too cost for the designers to test every new design proposal using all kinds of experiments. Furthermore, the designer cannot get the performance guarantees for any new design. Consequently, it is important for the designer to yield some analytic results though there is a gap between practice and theory. The virtualized system consists total n virtual machines above the VMM (or hypervisor). Each virtual machine has its own operating system. The detail of the framework is illustrated in Figure. 1.

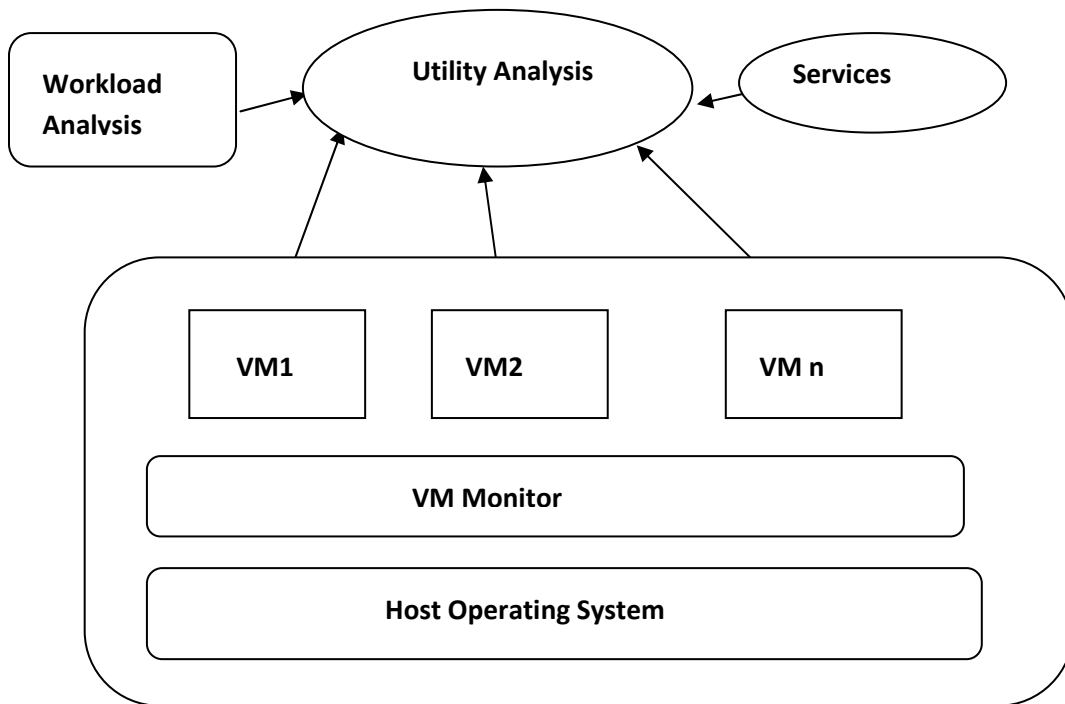


Figure 1: Analytic Framework

4. Features

The proposed framework can provide a cost effective solution for e-governance by using Free and Open Access Software for development and deployment of e-governance applications, virtualization and consolidation techniques for management of e-services and cloud computing

to deliver the maximum throughput enhancing the accessibility of services among remote locations. The major features of the proposed framework are depicted are under:

- It will help valuably to deliver maximum throughput
- It will help in reducing the cost of hardware incurred in facilitating e-governance services to citizens.
- It helps in reducing cooling requirements in establishment as well as maintenance of GDCs.
- It also reduces the total cost of ownership on e-governance projects by reducing the costs incurred on acquiring various types of hardware and software licenses from private vendors.
- It also gives solution to enhance the availability and accessibility of e-services in disadvantaged areas of country.
- It facilitates scalability of e-governance projects as the data volume in e-governance projects increases enormously.

It promotes interoperability in the e-governance applications for reducing data redundancy and hence increases consistency of data.

5. Utility Analysis

In the general virtualization environment, each virtual machine runs several classes of jobs, our task is to estimate the utility in each virtual machine. A base line study is carried out and a case study has been conducted by developing distinct Virtual Machines and the working and usefulness of variant Virtual Machines on Variant physical host's hardware and software platforms in variant network environment. and tested with implementation and utility analysis of Virtual Machine for the client server based various applications of Land Record Computerization to deliver maximum throughput, in the state of Maharashtra, where the cloud of Distinct Virtual Machines are developed and hosted over NICNET wide WAN leveraging shared govt. network and downloaded by the Distinct Districts for the utility of Virtual Machines.

6. Analysis results.

Based on these observations and analysis , we can conclude that

- a. The Overall basic scope for the service is the running distinct isolated multiples Operating Systems at a time on the single physical computer system. The single computer system is logically as multiple computer systems with various distinct operating systems running isolated to each other at a time simultaneously, using Virtual Machines:

- b. This is practically very useful when we have to do the processing /data entry on client and server Environment at large number of distinct locations and where the server is just required as a background service. Under such situation we can install the client and server on single system and process the work and this way save the cost of the server hardware per every location.
- c. Virtual Machines are very useful to Optimize the Technical efforts and exercises, under the situation where a typical complex sophisticated application software is to be used at large number of Distinct locations., to achieve the output target within less time with optimal use of the Hardware / software and resources.
- d. The Virtual Machine software handles the guest Operating System Virtual Machines as an instance for basic operations like creation, updating, removing, renaming, customizing , move, copy, backup and restore, sharing, Auto start, import/export etc. between the large number of Computer Systems between host servers with distinct old and new compatible/ incompatible software's and hardware's.
- e. It is very useful to run the Application on the Computer System which contains the non supporting host Operating System. Under this situation we can get the same application running and operational by installing the supporting guest Operating Installed using the Virtual Machine.
- f. Virtual Machines can also be easily moved, copied, and reassigned between host servers to optimize hardware resource utilization. Also we can customize the shared Hardware configuration settings allotted to the Virtual Machine as per the need and requirements. and availability of Hardware, Software and Network Resources.
- g. Virtual Machines are very useful to Optimize the Technical efforts and exercises, under the situation where a typical complex sophisticated application software is to be used at large number of Distinct locations., to achieve the output target within less time with optimal use of the Hardware / software and resources.
- h. **Faster Booting and processing:** Another advantage is that booting and restarting a virtual machine can be much faster than with physical machine, since it may be possible to skip tasks such as hardware initialization.

- i. Imagination to Guest VM as a Physical Server Hardware: Typically, guest operating systems and programs are not aware that they are running on a virtual platform and, as long as the VM's virtual platform is supported, this software can be installed in the same way it would be deployed to physical server hardware
- j. Virtual Machines Used for Backups and Disaster Recovery:
- k. Useful for Testing and R & Purposes under Client Server Environment :
- l. Import and Export Virtual Machine: We can Import / Export Virtual Machines between the various virtual machine
- m. It is very useful to run the Application on the Computer System which contains the non supporting host Operating System. Under this situation we can get the same application running and operational by installing the supporting guest Operating Installed using the Virtual Machine.

7. Conclusion

This work suggests a deigned framework to deliver the maximum throughput using technical resource optimization with improved and cost effective e-governance services. The involvement of technologies like virtualization, consolidation and cloud computing and adoption of free and open source software in designing and deploying e-governance will lead towards maximum throughput using resource optimization with reduction in total cost associated with both hardware as well as software. Therefore it reduces the financial burden abide by the state and central governments. For ensuring the successfulness of e-governance projects the delivery mechanism needs to be reengineered. The success of any e-governance project depends upon its utilization by the intended group and hence there accessibility needs to be enhanced drastically.

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