

Impact of Server Virtualization on Real Business World

¹ Kapil Saxena

¹ Lecturer, School Of Computer Applications
Babu Banarsi Das University
Lucknow – U.P India

Abstract

Among the leading business challenges confronting CEO's and IT managers today are: cost-effective utilization of IT infrastructure; responsiveness in supporting new business initiatives and flexibility in adapting to organizational changes. Server virtualization has come just in time for IT departments caught between the pressure to cut costs in the face of a developing worldwide recession, steadily increasing energy costs and maxed-out data centers. Virtualization attacks the problem of the low utilization of single application servers. This paper describes the background behind Server Virtualization, its latest trends and different products used in server virtualization. This paper mainly focuses on server virtualization impacts on business in today's IT world.

Keywords: *Confronting – Tackling Utilization – Usage Virtualization-imaginable responsiveness-Interest Initiatives-drive*

1. Introduction

In the midst of IT adding and patching systems, global competition forced management to look for ways to reduce costs and complexity while maintaining or increasing service levels. Executives sought to make their businesses more nimble. They wanted to respond to fast changing global conditions. They sought to become more efficient to better compete with competitors, lower costs and improve shareholder value. A company's technology infrastructure costs slip out of control. Server virtualization can become a compelling approach to getting control over server infrastructures. Before describing the various approaches and benefits of Server virtualization we must have some idea about the basic meaning of virtualization.

1.1 Virtualization

The term virtualization broadly describes the separation of a resource or request for a service from the underlying physical delivery of that service. We can also describe Virtualization abstracts the underlying physical structure of various technologies. Virtualization, in computing is simple example of virtual memory in which Computer software gains access to more memory than is physically installed, via the background swapping of data to disk storage. Similarly, virtualization techniques can be applied to other IT infrastructure layers - including networks,

storage, laptop or server hardware, operating systems and applications.

1.2 Server Virtualization

Server virtualization, also known as hardware virtualization, enables multiple operating systems to run on a single physical machine in virtual machines. Server virtualization allows IT managers to use specific software to divide a single, physical server into multiple partitions or virtual servers and each acting as its own individual server. This blend of virtualization technologies or virtual infrastructure provides a layer of abstraction between computing, storage and networking hardware, and the applications running on it (see Figure 1). The deployment of virtual infrastructure is non-disruptive, since the user experiences are largely unchanged. However, virtual infrastructure gives administrators the advantage of managing pooled resources across the enterprise, allowing IT managers to be more responsive to dynamic Organizational needs and to better leverage infrastructure investments. Server virtualization helps maximize hardware use by aggregating more applications and services onto fewer pieces of hardware, while maintaining operating system separation. So server virtualization enables applications and services to safely coexist on the same server hardware, yet within multiple operating systems. We can easily make the comparison between traditional servers and virtualized servers with respect to intelx86 architecture in the **figure-1** and **figure-2**.

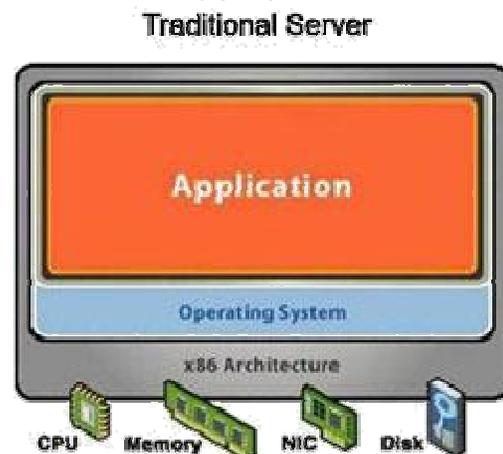


Figure: 1 Traditional Server

Before Virtualization:

- Single OS image per machine
- Software and hardware tightly coupled
- Running multiple applications on same machine Often creates conflict
- Underutilized resources
- Inflexible and costly infrastructure.

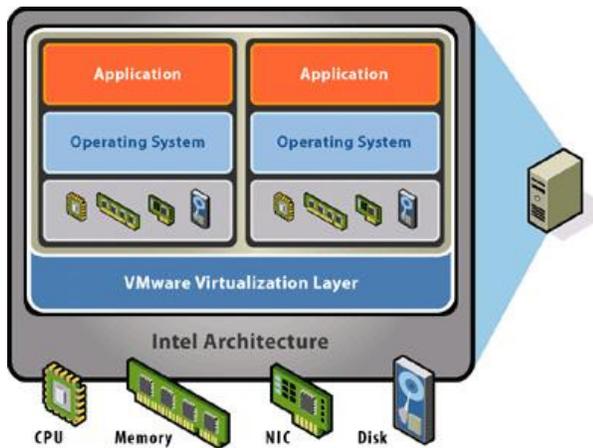


Figure: 2 Intel Architecture

After Virtualization:

- Hardware-independence of operating system and applications.
- Virtual machines can be provisioned to any System.
- Can manage OS and application as a single unit by encapsulating them into virtual machines.

2. Background and Effects of Server Virtualization

Server virtualization technique is used to construct the multiple virtual servers on one physical server. Virtual machines can be built by dividing physical servers into hardware and software. There are two advantages associated with hardware and software virtualization. When the physical server is divided by hardware, server virtualization offers an advantage of dividing hardware error in one section does not affect other and when the physical layer is divided by hardware, server virtualization offers other advantages such as allowing CPU, I/O devices, memory and other hardware resources assign to virtual machines.

Given the recent background of significant increase in application system construction costs (in terms of expenses , time , location etc), there are great expectation for server virtualization technology. In other words we can say that its urgent need in changing business environment. In the last recent years the server populations of many

non-virtualized environments average about 20% utilization. The result is a huge waste of power, which is doubled since every kilowatt used has to be balanced with an equal amount of cooling to maintain the servers at optimal operating temperature. This also has grave implications for the lifespan of data centers as increasing numbers of facilities run short of power, cooling and, in some cases, floor space despite the move to blade servers over the last few years. Virtualization avoids this problem by automating the management issues of stacking multiple applications on a single server and sharing resources among them. This allows IT shops to increase their server utilization up to 80%.The impact of this on a large organization demonstrated by BT in the UK. It achieved a 15.1 consolidation of its 3000 Wintel servers and saves approximately 2 megawatt of power and \$2.4 million in annual energy cost. This helped to reduce server maintenance cost by 90%.

The ratio resource distributed to low-load jobs and standby system can also kept low as in usual operations, though the distribution rate may abruptly increase in case of a higher load or error occurrence. Thus server virtualization technology reduces the total cost of operations and makes rapid system configuration changes possible under changing use conditions.

3. Types of Virtualization and with their Market Trends

There are many different types of virtualization technologies that make up the virtualization market. Some are more popular than others due to the expected payback on the investment. Server virtualization targets the physical server machines in the data center. In general, between six and 10 virtual machines are used per physical server depending upon the role of the server. Storage virtualization maintains a middle layer between the host and the physical storage environment. The middle layer's role is to make different storage (SAN) devices look the same to the host. The benefit is better storage utilization, faster provisioning and non-disruptive data migration.

Application virtualization is a technique where a virtual environment is created on a local PC within which a software application runs without the need to utilize the supporting host resources. (i.e. file system, system registry, DLLs, etc.). The benefit to this method is that the underlying OS is untouched by the running applications thereby eliminating resource intensive configuration problems. An example of application virtualization would be Microsoft's Virtual PC 2007.

In the figure-3 we can easily understand the investments of the companies in different types of virtualization techniques.

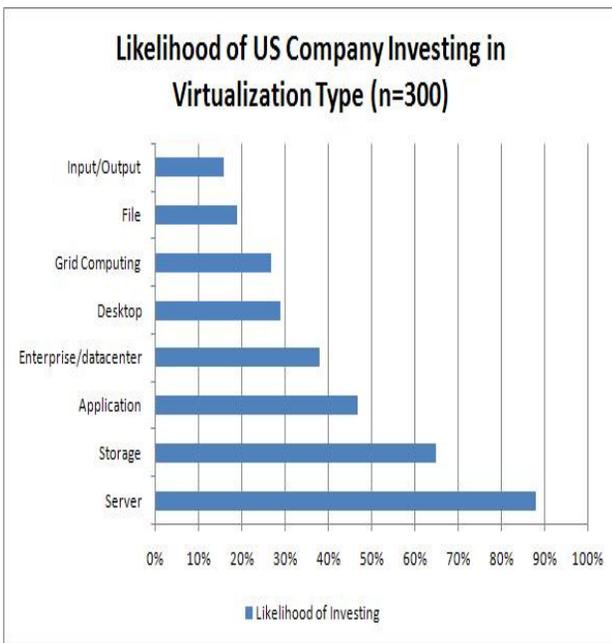


Figure 3. Likelihood Investing

The report rated the importance of each virtual technology to each company and by a large margin server virtualization was the most important. The research also indicated that the top four benefits of server virtualization was easier hardware provisioning and software deployment, more flexible development and testing environments, optimizing system performance (load balancing) and lower total cost of ownership.

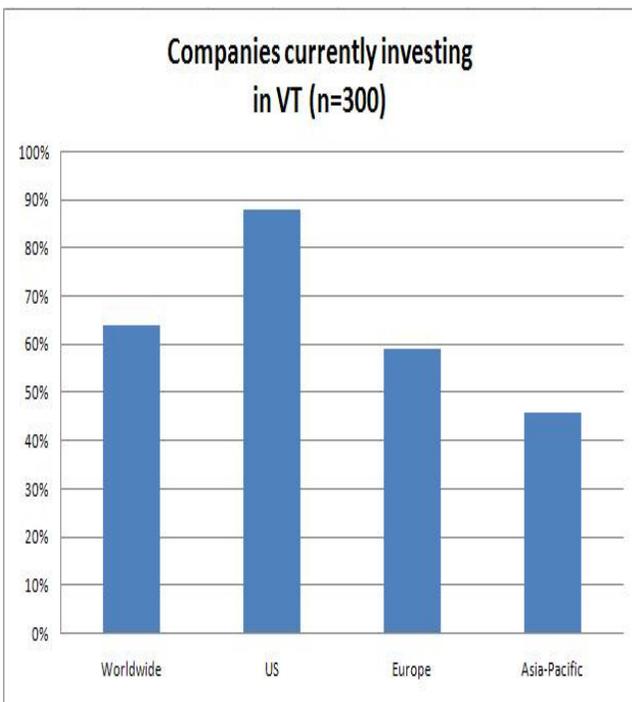


Figure 4. Investment of Companies

The maximum US companies investing on Server virtualization then on storage and application. These three are the major areas of investment.

3.1 Virtual Technology Market

Continued growth in the VT market, especially within the Server Virtual Machines (VMs) area, will continue its upward trend. In 2007 world-wide survey by Computer Associates shows that 88% (Figure-4) of the US companies interviewed are currently investing in virtualization technology and 12% are planning to invest. (Computer Associates, 2008). According to a recent AP press release the impact is already being felt in the server market where sales growth for x86 servers are declining (AP, 2008). The research firm IDC, a premier global provider of market intelligence for information technology, has noted that the global server virtualization market is forecast to expand at a compound annual growth rate of roughly 14 percent through

4. Impact of Server Virtualization on Business World

Small to midsize businesses are increasingly using virtualization to reduce capital expenses, improve business continuity and make their operations more responsive. High server performance and efficiency will continue to be major demands in the private sector, especially as the business landscape grows more competitive, forcing organizations to be as productive as possible for the least amount of money. By leveraging server virtualization technologies, companies of all sizes can meet these requirements and potentially gain an edge over rival firm.

In this difficult economic environment, the IT budgets of small to midsize businesses remain under pressure. The target for payback on IT investments seems to get higher and higher. However, some IT investments offer substantial opportunities for cost reduction, productivity improvements and enhanced business continuity. This can especially be the case with virtualization. And it's not simply a question of reduced expenses and resource requirements; virtualization can make your company more robust, agile and responsive to changing economic conditions and business opportunities. By utilizing technology properly, businesses can work to stay ahead of the competition and respond to the needs of their customers and partners. At the same time, the IT in department can become more responsive to business needs and begin to be seen as an innovator and driving new business initiatives instead of simply assisting the existing operations.

It is easy to say that the benefit of virtualization is high. By consolidation of fewer server business can:

- Lower hardware cost and the associated cooling and space cost.
- Improve productivity across organization and free up valuable IT time by simplifying IT infrastructure, which leaves additional time to focus on more strategic initiatives.
- Reduce costly downtime and streamline business contingency planning so data would be secure in a event of natural disaster or other calamity.

Here’s how your business can use virtualization to reduce costs and improve efficiencies:

4.1 Reduce Costs

Server virtualization reduces the cost and complexity of business continuity by encapsulating entire system files that can be replicated and restored onto any target server. Managing IT can be quite costly for some organizations, in time and resources. By virtualizing server infrastructure, it can help lessen the hardware and maintenance costs and lower company’s energy bill.

4.1.1. Reduce Expenses

The biggest benefit of virtualization is lower server infrastructure costs. With virtualization, you can consolidate excess server and desktop hardware, increasing utilization rates for x86 servers from 5 percent to 15 percent up to 60 percent to 80 percent. With energy costs and global warming concerns rising, power consumption is another issue for many businesses. Virtualization can help lower energy costs and lessen a company’s CO2 emissions.

Power Cost as Percentage of Total Cost	
Non-virtualized Server	4.36%
Virtualized OS	1.68%

Figure-5 Power Cost

Savings from Virtualized Guests	
Hardware Annual	\$ 2,560.62
Maintenance Annual	\$ 467.54
Power Annual	\$ 302.40
HVAC Annual	\$ 102.82
Admin Annual	\$ 1,434.38
Network Annual	\$ 560.15
Data Center Allocation	\$ 305.04
Enterprise Management	\$ -
Storage	\$ (1,330.59)
Backup / Archive	\$ -
OS & Virtualization Licensing	\$ 632.49
Cost Savings Per Instance	\$ 5,034.84

Figure-6 Virtualized Guest

Conserving energy becomes increasingly essential in the future. In fact, as many as half the data centers in the world will soon face a shortage of cooling needs and energy capacity to deal with the newest, high-density computer equipment.

4.1.2. Server Consolidation

Enterprises are now looking for ways to improve the average utilization of servers, reduce maintenance cost and also retain the QoS (Quality of Services). If your business currently uses one server per application, you can save on expensive floor space and help eliminate server sprawl by bringing together multiple applications onto a single server. This can reduce hardware and maintenance costs by as much as 50 percent. Virtualization technology can enable workload consolidation by providing all the required level of isolation with minimal loss in performance.

4.1.3. Test and Development Optimization

Rapidly provisioning test and development servers by reusing pre-configured systems, enhancing developer collaboration and standardizing development environments.

4.2. Increase Efficiency and Business Continuity

In addition to cost savings, virtualization has other benefits, including improving staff productivity, business continuity and disaster recovery. It also enables your IT team to focus on more strategic projects that can help speed time to market for critical products or services your business is developing to remain competitive.

Reducing the cost and complexity of business continuity (high availability and disaster recovery solutions) by encapsulating entire systems into single files that can be replicated and restored on any target server, thus minimizing downtime.

4.2.1. Improve Productivity

Because IT employees won’t have to order and set up a new server for every new application, you will be able to get applications up and runner sooner.

With fewer technical issues to manage, they can focus on strategic projects, such as improving customer service or developing new offerings. 73 percent of small to midsize businesses that have implemented virtualization reported seeing significant improvements on time spent on routine administrative tasks.

4.2.2 Protection of Business from Downtime and Disaster

Natural disasters, malicious attacks, and even simple configuration problems like software conflicts can cripple services and applications until administrators resolve the problems and restore any backed up data.

AMD's Enhanced Virus Protection helps protect against certain viruses, worms, and other malicious attacks. Windows Server 2008 Hyper-V provides support for disaster recovery within IT environments and across datacenters using geographical dispersed clustering capabilities. Traditional business continuity solutions are expensive and complex to deploy, putting them out of reach for many smaller organizations. Virtualization helps companies achieve faster and easier backup and recovery of key application workloads and data. It also enables you to more cost-effectively switch to a secondary IT site and restore critical business operations.

4.2.3. Improve Business Responsiveness

Managing a virtual infrastructure allows IT professionals to quickly connect and manage resources to meet ever-changing business needs, providing them with more flexibility in systems.

4.2.4. Resource Provisioning and Securing Assets

Live Migration in conjunction with dynamic resource provisioning feature available in virtualization software can open up lots of possibilities that make an enterprise data center better able to handle varying transaction volumes. Application can be moved around along with the virtual machine using live migration to bigger servers if they are found to be choking under high load or more resources can be committed to suffering applications by shrinking the resources level of other virtual machines hosted on the same physical servers. Secure company assets. Rather than securing hardware, businesses are securing data, no matter where it resides on the network. Virtualization can enhance a company's ability to increase security because the IT staff is able to apply security patches and move applications between virtual machines to avoid downtime. Since virtual machines reduce your server count, it also leaves your business less vulnerable to security attacks.

5. Server Virtualization Products

The key is to ensure that the virtualization software meets your corporate security policies and ensures regulatory compliance. Perhaps the most important factor to consider in virtualization purchase decision is the vendor you select. More small to midsize businesses have chosen

software on the factor of its reliability, ease of implementation and management, ability to deliver high-performance for applications, market leadership and lower operating costs. Some of the products are as follows:

5.1. VMware

VMware has a suite of virtualization product that aid in server consolidation .It has released virtualization solutions namely the VMware Workstation, VMware ESX Server, VMware GSX Server and the VMware Virtual Center. VMware supports both windows and Linux as guest operating system. VMware enjoys many of the advantages of having pioneered the market and owning a dominant market share. For years, it was virtually the only game in town and thus benefits from the support of the broadest range of third-party software programs and systems for functions such as disaster recovery, lifecycle management and capacity planning. VMware also has the benefit of being generally regarded as the technology leader and pacesetter. In having the largest installed base, it has an inherent advantage of already being in place when companies are looking to expand their use of virtualization: VMware, in its 2010 corporate brochure, says its solutions are used by more than 97 percent of Fortune 1000 companies and 94 percent of Global 500 companies. There are many applications that are using VMware as virtualization. The application percentage using VMware is provided in the given **figure -7**

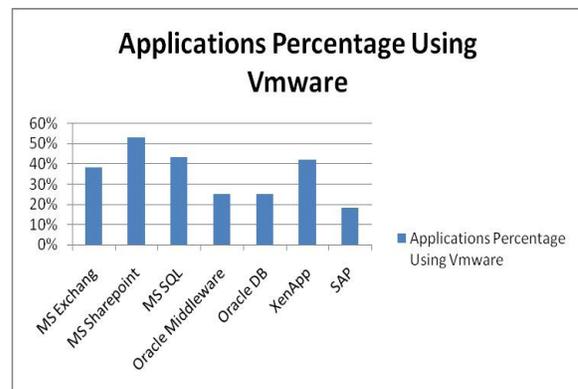


Figure-7 VMware

5.2. Microsoft

Customers that are new to virtualization and coming from Windows environments tend to view Hyper-V as a natural virtualization platform. Microsoft benefits from its ability to deliver familiar administrative tools and setup options. As a company coming in against an established market leader, Microsoft has taken an aggressive pricing approach by simply making Hyper-V R2 an available option within the setup of Windows Server 2008 R2. Since Windows Server virtual rights licensing is the same across any

vendor’s hypervisor, this results in Hyper-V being a generally less expensive solution to implement than VMware, at least for the up-front initial investment. However, the Microsoft solution includes more than just the integrated features in Windows Server. Management tools, which are branded under Microsoft System Center, provide management at all four layers of the IT infrastructure, from the physical hardware all the way to the application and services inside the virtual environments, in any easy-to-license suite. This provides a cost-effective way to build a virtual environment without losing control and insight. There is definitely an advantage for some customers in purchasing solutions from a single vendor. For example, as part of Windows Server 2008 R2, Hyper-V R2 offers the same driver support for attached devices. The Enterprise and Datacenter editions of Windows Server 2008 R2 provide advanced features and functionalities for Hyper-V virtualization beyond the Standard edition. These include increased memory support, application failover, host clustering and dynamic data center. There are also different virtualization licensing benefits associated with the Enterprise and Datacenter editions, which is an area where an expert partner can provide guidance as to the overall costs and ROI of your Microsoft virtualization deployment. Now we can make the comparison between VMware and MS Hyper-V in terms of total virtualization coast per host (**Figure-8**).

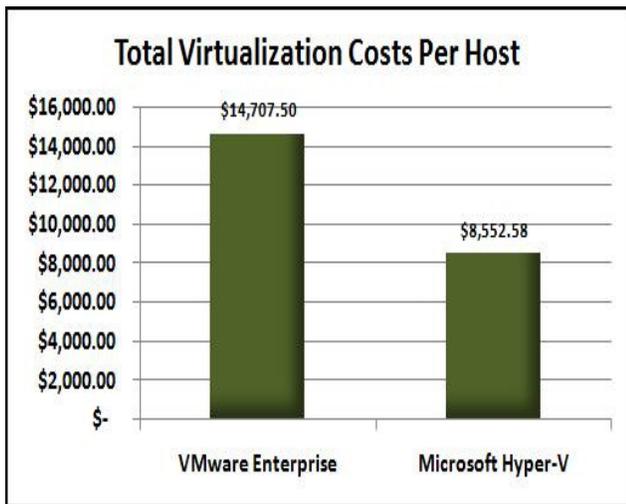


Figure 8. Virtualization Cost

5.3. Citrix

Citrix benefits by having a solution that comes from the open source world. Its Xen hypervisor has an active community of software developers, ensuring many options, particularly those that organizations can build into their own virtualization solutions. Like Microsoft, Citrix positions itself as a far-less-costly alternative to VMware. XenServer 5.6 provides customers with the most robust and competitive free virtualization suite, compared with

free products offered by VMware and Microsoft. Another advantage for Citrix is its strong position in the desktop virtualization market: Some customers will prefer using the same vendor for both server and client virtualization. According to Citrix, with core management features such as multiserver management, virtual machine templates, snapshots, shared storage support, resource pools and live migration. In addition, Citrix offers advanced management capabilities in Citrix Essentials for the XenServer product line. Customers can obtain XenServer for free, although they do need a license, and with the free version, they get access to features such as live migration, centralized management, VM template functionality and infrastructure update management as well as physical-server-to-virtual-machine conversions. Additional features are available for a fee in the Advanced, Enterprise and Platinum editions of XenServer. XenServer automatically restarts virtual machines if a failure occurs at the virtual machine, hypervisor or server level. The auto-restart capability allows administrators to protect all virtualized applications. Workload balancing is a feature of XenServer that captures data such as CPU, memory, disk I/O and network I/O on the hosts and virtual machines to guide the initial and ongoing host location for virtual machines.

XenCenter is Citrix’s product for centralized virtualization management. The XenCenter management console distributes management data across servers in a resource pool to ensure there is no single point of management failure. If a management server fails, any other server in the pool can take over the management role. Performance monitoring, reporting and alerting dashboards enable administrators to see both real-time and historical views of virtual machines and physical host performance. High server performance and efficiency will continue to be major demands in the private sector, especially as the business landscape grows more competitive, forcing organizations to be as productive as possible for the least amount of money. By leveraging server virtualization technologies, companies of all sizes can meet these requirements and potentially gain an edge over rival firms.

5.4. Comparison between VMware Windows Server 2012 with Hyper-V (beta) and Citrix XenServer 6

Attributes	VMware	Hyper-V (beta)	Citrix XenServer 6
Small Disk Footprint	144 MB disk footprint	>5GB with Server Core	>1GB

		installation	
OS Independence	No reliance on general purpose	Relies on Windows 2012 in	Relies on Linux in Dom0 management
Advanced Storage Management	VMware vStorage VMFS	Lacks an integrated cluster file system	Lacks an integrated cluster file system, storage features
Advanced CPU Management	Tuned to support Intel SMT hyper-threading; Supports 3D graphics accelerators	No reliable performance advantage when using hyper-threading	No reliable performance advantage when using hyper-threading
Flexible Resource Allocation	Hot add VM vCPUs and memory, VMFS volume grow, hot extend virtual disks, hot add virtual disks	Nothing comparable	Nothing comparable

6. Conclusion

One of the biggest technologies to hit the market over the last few years has been virtualization. From a server perspective, virtualization breaks the bond between the operating system (OS) and the underlying hardware. Using virtual servers to act as redundant backup servers in replication-based high availability environments makes the deployment of this technology less burdensome from a financial perspective. Virtualized service technologies allow businesses of nearly any size to consolidate data and applications onto fewer servers, doing so in less space, consuming less power, and usually for less money long term. Virtualization greatly simplifies how your company manages IT infrastructure; saving IT management time and increasing productivity through streamline and automation. The result is improved services to your company and clients, all while reducing operating cost and capital expenditures.

References

- [1] "An Analysis of Server Virtualization Utility Incentives" Corban Lester, Lockheed Marteen http://www.thegreengrid.org/~media/WhitePapers/Server%20Virtualization%20for%20Utilities_final.pdf?lang=en.
- [2] "Introduction to Virtualization" Morty Eisen http://www.ieee.li/pdf/viewgraphs/introduction_to_virtualization.pdf.
- [3] "Server Virtualization Technologies: Uses, Comparisons, and Implications". David Sweetman Windows Enterprise Systems Admin Administrative Information Services University of Michigan. www.windowshied.org/Conf2005/UMich_Virtualization_Testing.ppt.
- [4] "Making the Business Case for Virtualization" <http://www.vmware.com/files/pdf/solutions/VMware-Business-Case-Virtualization-EN-WP.pdf>.
- [5] "Windows Server Virtualization Configuration" WilliamPanik http://search.4shared.com/postDownload/7GltJuZa/0470449306_Server_Virtualizati.html.
- [6] "Virtualization Technology ppt" Alex Landau Alex Landau (alex@il.ibm.com) IBM Haifa Research Lab.