

Virtualization for Small and Medium Sized Enterprises

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Abstract — In order to improve their business and answer to the nowadays challenges, enterprises of all sizes, especially small and medium sized (SMEs) ones, reconsider possibilities of virtualization. In situation where business needs to run many applications on a server and use Internet services, having one or more virtual computers on a single machine can optimize the work. Furthermore, there are many benefits, such as: reducing equipment and energy costs, hardware independence, easy upgrade and managing of virtual machine, backup and disaster recover, etc. All of that enables SMEs to achieve strategic advantage too. This paper stresses the meaning and importance of virtualization for small and medium sized enterprises. Also, it presents virtualization solutions such as: VMware, Parallels, etc.

I. INTRODUCTION

Growth of Information Technology (IT) sector eased almost every aspect of people's life and business, and nowadays, in the phase of Green IT, this quality is even improved. The main focus of Green IT is on saving energy and decreasing wastes and one of its elements is certainly virtualization.

Among other, virtualization enables reducing the usage of physical resources. This means that instead of running one application on a server and using less than 20% of its capabilities, one server can be used for running many applications with full utilization. Furthermore, virtualization enables: cost savings from server consolidation, strategic benefits for companies, reducing energy costs, hardware independence, easy upgrade and managing of virtual machine, backup and disaster recover, etc.

Above mentioned is important to companies of all sizes, especially to small and medium sized ones. Those companies can use benefits of virtualization in order to optimize their work through increased efficiencies, flexibility and responsiveness.

For example, according to [1] businesses in nearly any industry can consolidate workstations for a variety of workers, including: Creative professionals using Macs and Microsoft Windows development tools, contract workers who use their own machine and a client machine, Unix users running Windows, production Design professionals running Linux and Windows.

Main reasons [2] for adopting virtualization at SMEs are: increasing the efficiency in managing the server environment, controlling hardware sprawl and spending and reducing the number of servers needed to run the production systems to repurpose hardware for other needs. Also, by adopting virtualization SMEs can see improvements in [3]: time spent on routine IT administrative tasks, backup and data protection,

application availability, ability to respond to changing business needs, business continuity preparedness, company profitability and growth rate.

This paper presents the characteristics of virtualization for small and medium sized enterprises, as well as the virtualization solutions.

II. ABOUT VIRTUALIZATION

The main characteristics of traditional computing environment are that one computer runs a single operating system and a single application. It is often that the capacity of server exceeds the requirements for any single application, which results below 20% hardware utilization rates in many data centers. On the other hand, virtualization is an approach which enables that several applications – sometimes running on different operating systems – run on the same computer, and, in that way creates multiple "Virtual" servers from a single computer. It seems that the several virtual servers on each host are isolated from one another, the same as on separate hardware.

Computer virtualization refers to the abstraction of computer resources, such as the process of running two or more logical computer systems on one set of physical hardware. The concept originated with the IBM mainframe operating systems of the 1960s (VM/370), but was commercialized for x86-compatible computers only in the 1990s. With virtualization, a system administrator could combine several physical systems into virtual machines on one single, powerful system, thereby unplugging the original hardware and reducing power and cooling consumption. A hypervisor is a virtualization platform that enables running multiple operating systems on a single physical computer called the host computer. Hypervisor provides isolated execution environments for each virtual machine and to manage access between the guest operating systems running in virtual machines and the hardware resources on the physical computer [4]. Virtualization can assist in distributing work so that servers are either busy, or put in a low power sleep state. In the beginning the virtualization was very popular, because of high hardware prices and low utilization of these systems. The decline of virtualization started with the growth of PC market and lower cost of computers. In 1988. The technology slowly regains its popularity with number of products, starting with company Connectix and its product Virtual PC [5]. Today, the virtualization makes one of the top IT technologies.

For small and medium businesses, though, the most important types are server and desktop virtualization [6,7]. Server virtualization presents partition of a single physical server into several virtual servers. Desktop virtualization

is when central server is divided up into multiple virtual desktop computers. Users remotely access those systems, like in the old mainframe model with “dumb” terminals.

III. VIRTUALIZATION SOLUTIONS

The virtualization technology market is very developed. There are number of commercial and open-source products available. In order to present this variety of product in the following section of the paper will be presented major and characteristic virtualization software product.

There are three major companies [6] that are leaders in development and distribution of virtualization tools. Their leading role is determined by their variety of product as well as the high level of its usage. According to the survey from December 2007 [3] VMware covers 70% of the market, followed by Microsoft (23%) and Citrix (3%). Other virtualization solutions have only 4%. Because this survey was released before promotion of Microsoft Hyper-V, the results may be different today in the sense of higher percentage for Microsoft and Citrix Hyper-V.

Citrix XenExpress Edition is free edition that is a production ready virtualization platform and supports dual socket servers with up to 4GB of RAM. XenExpress can host up to four virtual machines on each system and can be upgraded to Standard or Enterprise Edition. Citrix XenServer Standard Edition is a virtualization platform for Windows and Linux guest operating systems, and is a native 64-bit Xen hypervisor. The version with extended features beside Standard Edition is Citrix XenServer Enterprise Edition or OEM and Citrix XenServer Platinum Edition.

Besides Server editions Citrix offers desktop version of their software called Citrix XenDesktop which comes in three sub variants (Standard, Advanced, Enterprise and Platinum). This product is targeted for desktop virtualization.

The second vendor, Microsoft offers Virtual Server 2005 R2 SP1 and Virtual PC 2007, which are both free products. Its enterprise-class hypervisor product types, Microsoft offers Hyper-V as a part of the Windows Server 2008 OS in version for only 64-bit platforms. Microsoft Virtual Server is a free tool available in both 32-bit and 64-bit versions. It only supports and runs 32-bit virtual machines. Virtual PC 2007 is a free virtualization software package for usage in small environments. It represents good solutions for hosting few virtual machines on a Windows XP Workstation or Windows 2003 Server.

VMware also offers variety of virtualization tools. That products can be divided in two categories. The desktop software has two representatives: VMware Workstation developed for PC x86 and x86-64 platforms and VMware Fusion designed for Macintosh platforms. VMware Workstation is first released in 1999. and current version is 7. It runs on Windows and Linux platform and supports variety of guest operating systems like Windows, Linux, BSD etc. The second version of the software is VMware Fusion designed for Macintosh platform with Intel processors. It runs on MAC OS and supports variety of guest operating systems such as Windows, Linux, Solaris etc. On the other hand, the server software has three variants: VMware Server, ESX and ESXi hypervisor products.

VMware Server is free package targeted for use in small environments, testing, or for individuals. It has memory limitations for VMs and low disk performance. It supports 64-bit machines as hosts and guests. VMware ESX/VMware ESXi are hypervisor product developed for large environments. They have 64-bit architecture. ESXi is successor of ESX and available for free.

Besides presented market leader product, there is also variety of other commercial and free solutions as well [8]. User-mode Linux (UML) is Linux kernel modification that uses root file system to create a virtual machine. UML is included with all 2.6.x kernels. It supports only Linux platforms as guest operating systems.

Bochs is a free, open source, Intel architecture x86 emulator that runs on UNIX and Linux, Windows, and Mac OS X, but only supports x86-based operating systems (Windows, Linux, BSD etc.). QEMU is also free, open source emulation program. It runs on variety of platforms, such as: x86, x86_64, and PowerPC. The available guest operating systems are also supported well (x86, x86_64, ARM, Sparc, PowerPC, MIPS, and m68k). Linux KVM (Kernel Virtual Machine) is a modified QEMU. KVM supports Windows, Linux, and FreeBSD. It uses the Linux kernel as a hypervisor and runs as a kernel loadable module. Other products are Sun xVM (earlier VirtualBox), Solaris Containers (Zones) and OpenVZ. VirtualBox is best suited for small networks and individuals for the same reasons as VMware Server.

IV. RESEARCH COMSERNING THE USAGE IN SMEs

There is a question about willingness of small and medium enterprises to implement the virtualization technology. Another important question about this issue is the main reasons for that implementation. One research commissioned by VMware Inc. and Intel Corp. in May/June 2007. The survey was conducted with IT professionals of small and midsize. The goal of the survey was to better understand the usage of virtualization technology at small and midsize businesses. Total number of 104 IT experts familiar with virtualization technology participated in the survey. They are employed at organizations with 100 to 1,000 [2].

The results showed that 84% of participants responded that their companies currently using or think about usage of the virtualization technology. The percentage of companies that already implemented technology is 49%. Other 35% companies plan to implement technology in the near future.

This research also showed that small and medium enterprises run average of virtual machines (VM) in each physical machine.

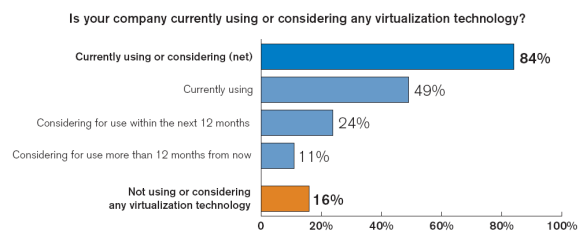


Figure 1. The results about plans for introduction and usage of virtualization of technology [2]

Top reasons for implementing virtualization at SMEs are:

- Increase of efficiency in managing the server environment (66%),
- Hardware sprawl and spending control (58%),
- Reduction of number of servers needed to run the production systems to repurpose hardware for other needs (46%),
- Increasing the productivity of the IT staff (39%),
- Move to a fully scalable disaster recovery system (35%).

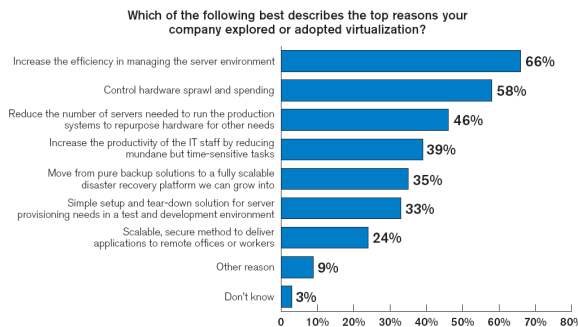


Figure 2. The key reasons for implementation of virtualization [2]

Types of applications currently being virtualized at SMEs are:

- Web services (48%),
- Active Directory (40%),
- E-commerce (28%),
- Industry-specific applications such as banking/financial applications, ERP and document management applications (24%) and
- Supply chain (13%).

The VMware Inc. conducted survey for senior business and IT managers at companies with 20 to 1,000 employees. This survey has total number of 309 participants from United States and Canada companies. The survey conducted in November 2009 [3]. The survey results are presented in the figure below.

The key benefits and impact of virtualization on cost, security and applications are [3]:

- Time spent on routine IT administrative tasks,
- Application availability,
- Ability to respond to changing business needs,
- Backup and data protection,
- Business continuity preparedness,
- Company profitability and growth rate, etc.

Factors, according to the same survey that inhibits penetration of virtualization are: lack of available budget,

uncertain about the business benefits and which solution is right for company, lack of resources and skills to deploy and absence of identification the right stakeholders or approvers.



Figure 3. Impact of Virtualization on Costs, Security and Applications [3]

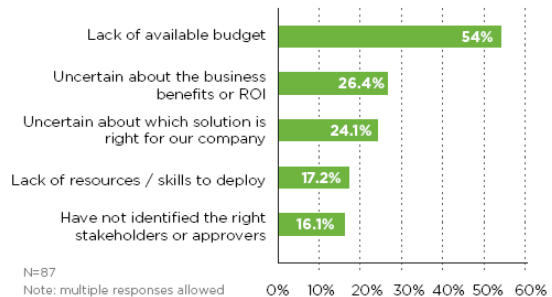


Figure 4. Factors That Inhibit Adoption of Virtualization [3]

Another important question is in what environments and cases virtualization makes sense for SMEs. According to [7] these cases are:

- In environments with less than 20 servers, let alone the more typical small business environment with perhaps 1 to 6 servers,
- If a company is starting a network from scratch, but in most cases there's an existing network in the company.

According to the same source [7] the benefits of virtualization for small businesses are:

- Better and cheaper disaster recovery,
- Scalability - because more servers can be added without extra hardware costs,

- Flexibility - servers can be added and removed for reconfiguration and testing, and servers can restore their older configuration if something is going wrong with the new one.

V. CONCLUSION AND FURTHER WORK

The potential economic benefit or cost changes after implementation of virtualization technology is outlined in this section. Hardware cost will be the same or lower. Virtualization affects lower costs because fewer computers needed for company. Cost can be raised again, due to need for utilization of more powerful computers in order to run several servers on the same platform. The costs needed for licenses will be same because the virtual computer, as well as physical, uses the same operating systems and applications. All virtualization software needs to be purchased. The software costs will be at least the same, except in the cases where the virtualization software will be purchased; in that cases the cost for licensing will be increased.

The IT support costs are going to be much lower than before utilization of virtualization technology. Furthermore, virtualization simplifies the maintenance of the systems. All virtual computers and servers, their configuration and software are placed into one single image file for each virtual machine. These files can be frequently backed up, which makes the whole process of maintenance much easier. The disaster recovery will be simplified as well, because in the case of system crash, whole virtual machine can be easily recovered by simple replacement of the image file. In the case of reconfigurations and software upgrade, as well in testing the new software solutions, effective roll-backs are available if something is going wrong.

The last cost changes are connected with infrastructural issues. Setting up the one virtualization server as a central point of company infrastructure creates also the single point of failure. In such scenarios, majority of users connect through network infrastructure on this central point. This approach requires efficient and stable network links with higher bandwidth. Environment like that requires implementation of new technologies and that affects on increasing the costs and investment in the infrastructure.

The last, but not the least, cost changes concerning computer center space and bills. Putting all servers on one or few physical servers with virtualization software, decrease the need for data center space. The power consumption for machines, and for air-condition and ventilation devices also decreases as well.

At the end, it is important to say that this paper presents the review of the situation in the field of utilization of virtualization technology in small and medium enterprises in the world. The similar research can be conducted in Serbia. The main significance of that research will be introduction of these technologies to SMEs sector and encouragement for SMEs to utilize this useful technology in order to improve their efficiency and incomes.

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