



Virtualization, A case for Business Payoff

VoloFi®

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1) Introduction:

Computer virtualization is becoming more and more popular in current IT world. According to Gartner *“4 million virtual machines expected by 2009, 611 million virtualized PCs by 2011 and the IT infrastructure and operations deeply impacted by virtualization by 2012”*. Lower TCO, better manageability and higher security are some of the factors that are driving this extraordinary interest in this emerging technology. Corporations as well as home users can greatly benefit from virtualization technologies.

Virtualization is a term with broad set of meanings, it is used in different capacities in computing world. In this white paper, we will be using term virtualization specifically for *“Platform Virtualization”*, meaning emulation of a virtual computer by using combination of software and hardware.

The core idea behind virtualization is to make efficient use of hardware resources, such as CPU, memory and disk. In any computing environment its highly unlikely that hardware resources are being used to their full capacity. For example a typical desktop does not use more than 10% of its hardware resources under normal operational conditions.

By using hardware virtualization, we can more effectively distribute our hardware resources among multiple virtual instances of operating systems according to that particular environment computing needs. Virtualization provides a mean to dynamically allocate hardware resources when needed and essentially unbinding software from hardware. Thus bringing down the overall requirements for hardware, which ultimately result in lesser hardware costs.

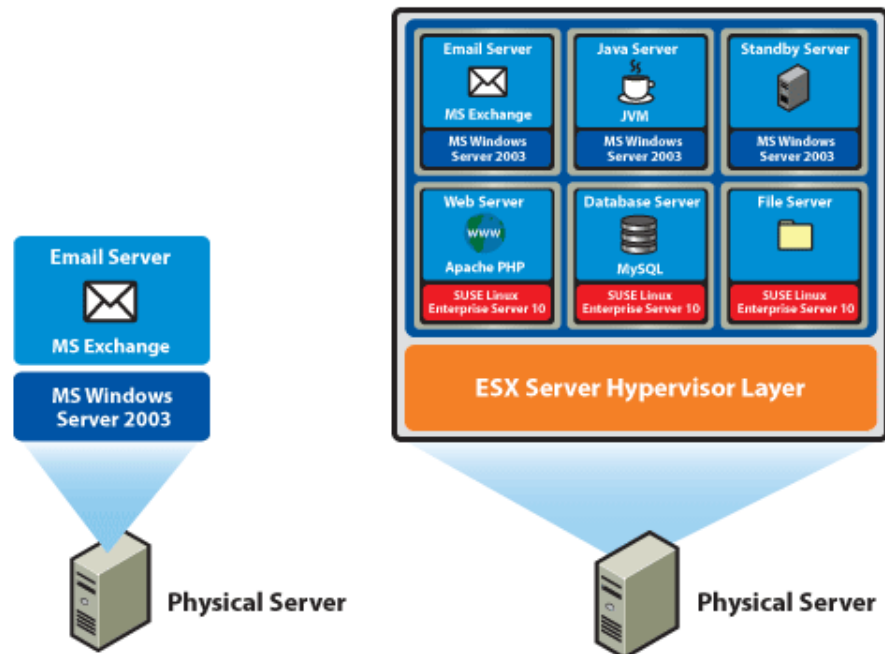


Fig 1.1

Figure 1.1 shows how virtualization allows multiple operating systems to run simultaneously and allow sharing of hardware resources.

2.1) Virtualization Technical Architecture:

Technically speaking, virtualization is done by presenting simulated hardware resources to guest operating systems using an abstraction layer, generally known as hypervisor layer. Virtualization software uses hypervisor layer to bridge between operating system and physical hardware resources.

Hypervisor allows physical hardware to be efficiently divided into multiple simulated virtual computers, each running their own instances of operating system along with dedicated memory, processor and storage resources for that particular virtual computing environment. Hypervisor layer is operating system agnostic and can support

variety of operating systems such Microsoft Windows and Linux running simultaneously on the same physical hardware.

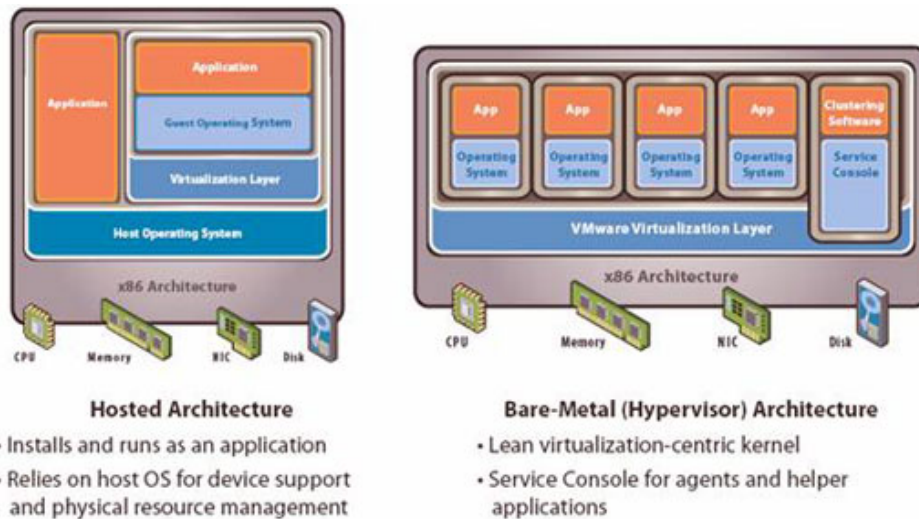


Fig 2.1

Virtual computers do not have direct control or access to the physical hardware. Virtual computers can only access physical hardware via hypervisor layer. This isolation allows hypervisor layer to have complete control over physical hardware resources, allowing more efficient scheduling of hardware resources and provide better security thorough isolation.

Users access these simulated virtual computers by different remote access means. Remote desktop protocol (RDP) can be used to access windows based virtual computers while Linux based virtual computer can be accessed via ssh or xwindows. Hypervisor also provides a way to have console access to these virtualized guest operating systems. Console access is normally slow speed and mainly used for administration purposes only.



2.2) Major Players in the market:

Among companies who have major market share in virtualization industry are vmware, Sun Micro System, IBM and Intel corporation. Even though Vmware is a more recent entry in virtualization market, but they currently own major share of PC based virtualization industry.

On the other hand IBM has been in virtualization technology for a very long time. IBM has offered virtualization solutions from 1960's, with their LPAR(logical partitions) based solution IBM was able to offer its customers a way to run multiple instances of Linux and AIX on same hardware. Sun offered its first virtualization solution in 1996 with its E10 servers which allowed creation of multiple partitions, also known as domains. This was hardware based solution for vitalization from sun, in 2002 sun offered a more software based solution known as containers with its Solaris 10 operating system. More recently sun has announced another virtualization solution based on hardware and software called Ldoms (Logical Domains). Sun is also offering an open source based solution for PC virtualization known as Sun Virtual Box.

With almost same underlying concepts some of these products are more optimized for particular needs. For example VMware ESX product is designed for Server Virtualization while VMware VDI is tailored for Desktop Virtualization. Solaris containers is a virtualization solution for servers running Solaris operating system.

2.3) Benefits of Virtualization

There are numerous benefits that can be achieved from virtualization, we will discuss few of them in this white paper, these does not include business payoff benefits such as lower TCO etc, these business related benefits are discussed in next section of this white paper.

Partitioning	Multiple applications and operating systems can be supported within a single physical platform.
Consolidation	Servers can be consolidated into virtual machines on either a scale-up or scale-out architecture
Resource Management	Computing resources are treated as a uniform pool to be allocated to virtual machines in a controlled manner
Isolation/Security	Virtual machines are completely isolated from the host machine and other virtual machines. If a virtual machine crashes, all others are unaffected Data does not leak across virtual machines and applications can only communicate over configured network connections
Portability	Virtual machine environment is a piece of software and saved as an image file; easy to back up, move and copy. Standardized virtualized hardware is presented to the application - guaranteeing compatibility and portability.
Dynamic-Resource Allocation	Resources can be allocated dynamically to accommodate computing needs of virtual machines on the fly.

Table 2.3 Virtualization Benefits

3.1) Business justification for virtualization:

Two major factors that provide business justification for virtualization are cost savings and improved business continuity.

Virtualization is well known for its cost savings, in fact cost saving was the primary reason that triggered rapid popularity of virtualization solutions in recent years. Cost saving is achieved by reducing the number of physical computers that are needed to support business applications by means of consolidation. Multiple physical servers consolidated into one physical server result in saving hardware resources and management overhead. This also helps in reducing energy costs for datacenters. With energy cost going up so rapidly this can be the most substantial cost saving in present and in future.

Business Continuity is another very important benefit that is achieved by using virtualization solutions. Higher business continuity requires higher data protection, high availability and faster disaster recovery. In virtual computers, operating system instances are completely independent of underlying physical hardware. This makes virtual computers extremely portable resulting in higher data protection, high availability and faster disaster recovery. This is probably by far the greatest benefit business achieved from virtualization.

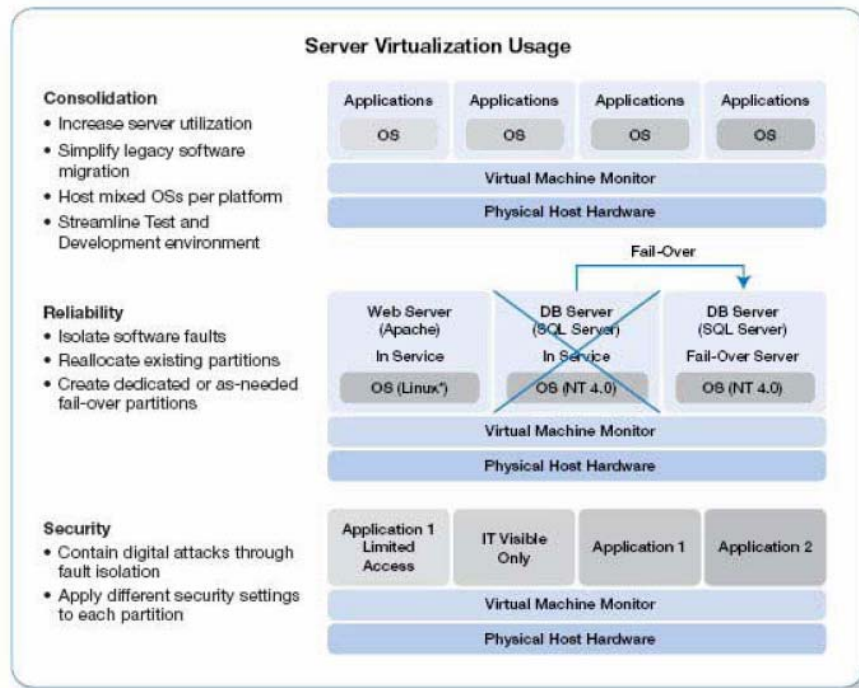


Fig 3.1

3.2) Business Payoff, Reduced Total Cost of Ownership:

Reduce Hardware Cost: First virtualization payoff is in reduced number of physical servers which result lower IT budget for servers hardware. In an average environment, servers can be consolidated in ratio of 10:1. This not only saves the cost of purchasing hardware but also saves the cost of supporting those extra servers.

Reduce Cost for disaster recovery: Most disaster recovery plans require building an exact duplicate of production data centers, requiring the purchase and maintenance of a large number of servers that are mostly idle. Virtual machines are hardware independent and can be consolidated onto fewer physical servers.

Reducing Downtime Costs: Hardware independence enables having lesser planned and unplanned downtime for servers.

Reducing Business Administration: By reducing the number of servers needed, organizations can reduce the frequency of server purchases and thus the frequency of time-consuming approval and procurement processes. Because virtual machines are hardware-independent, virtual infrastructure also makes it possible to standardize server purchases on a smaller set of hardware and thus simplify the purchasing process.

According to a study done by VMware[4] for three different industries, we can clearly see the trend in lower TCO achieved by virtualization.

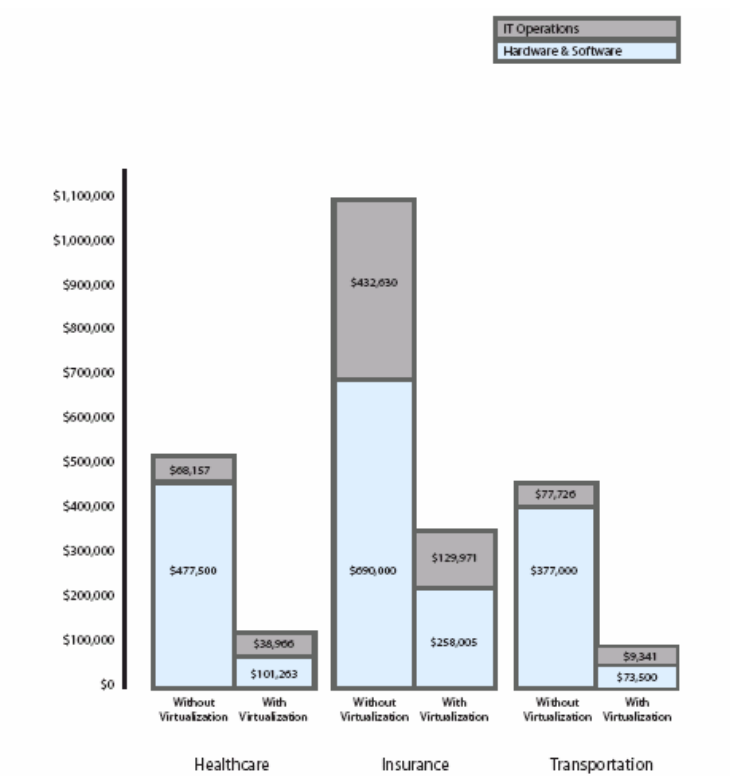


Fig 3.2

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