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RECENT TRENDS IN IT - VIRTUALIZATION

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Abstract:

The term Information Technology usually puts a picture in our mind of society's application of the high end computing knowledge to solve the practical problems almost all the fields. Technological Innovation or the application of technology takes many forms across multiple industry verticals. The highly growing "IT Trend" Per se Virtualization is a concept has revolutionized the way the companies access their software applications, recent trends in this concept is allowing businesses to eliminate entire server farms and give a lot of way to the cost cutting of the company also making the IT infrastructure more economical and flexible, server virtualization has given root to use this tech for almost all the other IT initiatives. Usage of the term "Virtualization" will not restrict only for one particular field of Technology as in servers, the application in limitless.

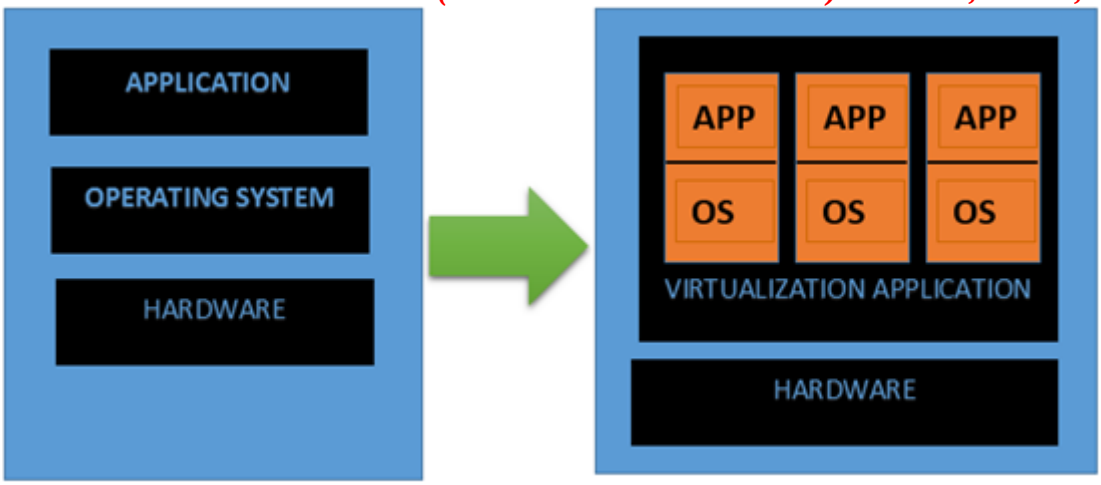
Index Terms: Virtualization, Technology & Server

1. Introduction:

The world of IT as we all know is the one which is changing or evolving in a very high pace. We are not realizing a fact that less than two decade ago, for communication, our top priority was a landline phone and owning a computer would make you a scientist. Now as we speak, we all have smart phones in our hands with processing and applicable limits more than our desktop which is a liable proof of rapid evolution of the IT industry. Keeping the facts aside people are becoming much more acknowledged about the hardware components of the daily devices. Normally you can hear a person mentioning about Processor, RAM, and Camera resolutions on phones and what not but missing the part where how resourcefully these can be used. Keeping the general factoids and the people apart can these resources be used of their full potential without reducing the performance. Let forget about the smaller devices let's think core devices. The servers, with the high end configuration can they be fully utilized. . ??? A server normally manages an entire network providing the required service. Let us acknowledge about the trending implication of the topic which I have chosen i.e. VIRTUALIZATION [1], [4] & [6] seen in almost all the IT Industries which is by far the trending development.

2. What is Virtualization?

Definitively virtualization as the name says is the virtual creation of the actual something is an operating system, a network device, a server or storage device. Virtualization is capable software technology which makes the possibility of utilizing the resources to their 100% with the stable performance level, run multiple operating systems and their applications on a single server at the same time. It's a break through which is moved the IT industry to a whole new level in terms of usability or utilization of the resources. For a better understanding lets us consider a simple example of our hard disk in a laptop it's a single storage device where in partitioning us gives different disk. This is just a logical division but in effect we can see two separate drives. On a high end - Operating system virtualization is running multiple operating system images with a help of application.[2][3][5]



Traditional Architecture **Virtual Architecture**

Virtualization Types:

The concept was basically started in order to avoid the wastage of expensive processing power of the high end computing machines like main frames. Once the application was seen in operating systems it was also implemented for the other resources so we can see it being classified into 3 types:[6][9]

Network Virtualization: The concept of virtualization is the process of combining hardware and software network resources and network functionality into a single entity. In this concept the network hardware by splitting up the available bandwidth into channels, each of which is independent of others, each of which can be assigned or reassigned to a particular server or device in real time. The idea is that virtualization disguises the true complexity of the network by separating it into manageable parts, much like your partitioned hard drive makes it easier to manage your files.[6][11]

Storage virtualization: Is the grouping of physical storage from multiple network storage devices into a single storage device that is managed from a central console. Storage virtualization is commonly used in storage area networks (SANs). Storage virtualization helps the storage administrator perform the tasks of backup, archiving, and recovery more easily and in less time by hiding the actual complexity of a storage area network (SAN). Administrators can implement virtualization with software applications or by using hardware and software hybrid appliances. [10][13][15]

Server Virtualization: The masking of all the server hardware components (Individual physical servers, processors and operating systems). The idea is to make the user easily manage the complicated details of the server components like increase resources sharing, utilization and maintaining the capacity of the component for future use. The server administrator uses a software application to divide one physical server into multiple isolated virtual environments. The virtual environments are sometimes called virtual private servers, but they are also known as guests, instances, containers or emulations. Server virtualization can be viewed as part of an overall virtualization trend in enterprise IT that includes storage virtualization, network virtualization, and workload management. This trend is one component in the development of autonomic computing, in which the server environment will be able to manage itself based on perceived activity. 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.[7][10][11]

3. Device I/O Virtualization:

The requirement beyond CPU and memory visualization is the I/O virtualization. The concept is similar to that other techniques basically here management and routing of the I/O requests between the virtual and the shared physical devices. Software based virtualization helps us to expand our reach of the usability of all the features for networking like Virtual NICs and switches. The key to effective I/O virtualization is to preserve these virtualization benefits while keeping the added CPU utilization to a minimum. [12][13]

4. Factors Affecting Virtualization in Organizations:

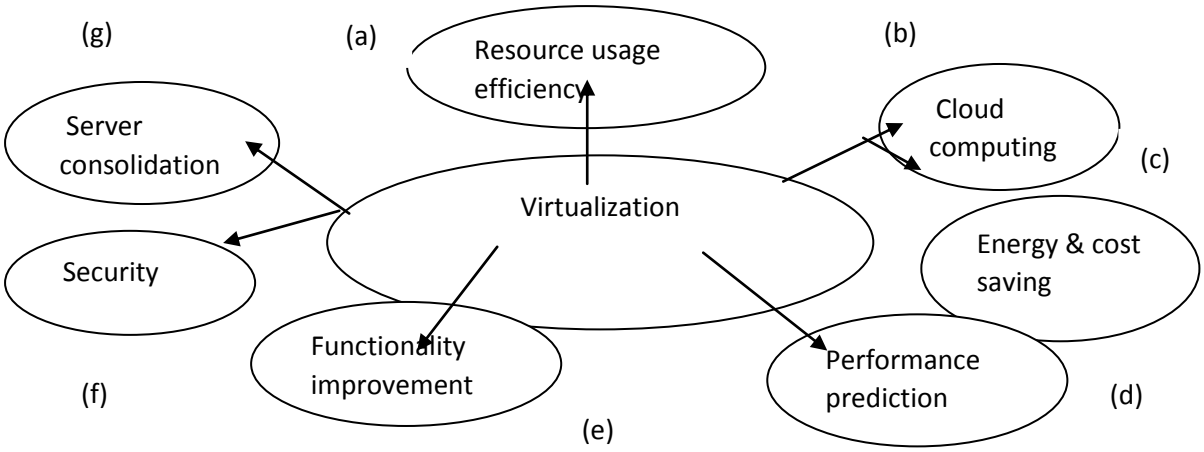


Figure 1: Depicts in each block the factors affecting virtualization [15] & [16]

The factors affecting virtualization are discussed below and they are

Resource Usage Efficiency [Figure 1: Block (a)]: Virtualization is capable software technology which makes the possibility of utilizing the resources to their 100% with the stable performance level, run multiple operating systems and their applications on a single server at the same time.[17][19]

Cloud Computing [Figure 1: Block (b)]: Is the practice of using a network of remote server hosted on the internet to store, manage and process data was influenced by virtualization.

Energy & Cost Saving [Figure 1: Block (c)]: Deploying several virtual environments guarantees the good practices of high availability, redundancy and failover since workloads can go where they are more efficient. Thus, virtualization focuses not only effectiveness (doing the right things) but also efficiency (doing things in a faster, cheaper and more reliable way).

Performance prediction [Figure 1: Block (d)]: Technology allows some virtualized environments to be provisioned as needed and on the fly, thus facilitating automation of business processes and eliminating the need to continually resource and manage portions of the technical environment that support sporadic business needs. Some virtualization technology facilitates the automatic allocation of a process for its optimal performance within a pool of virtualized environments.

Functionality Improvement [Figure 1: Block (e)]: The relatively easy creation or preparation of the right environment for the right application enables enterprises to provide flexibility to the infrastructure, not only in the test or preproduction phases but also in the Production area. When a new procedure or technical/business requirement arises, virtualization's ability to enable rapid creation of the environment allows the business to test the environment without having to wait for the regular provisioning process to be executed and delivered.

Security [Figure 1: Block (f)]: There are two primary types of attacks on virtualization infrastructure: Hyper jacking and virtual machine (VM) jumping (or guest-hopping). Hyper jacking is a method of injecting a rogue hypervisor (also called virtual machine monitor [VMM]) under the legitimate infrastructure (VMM or OS) with control over all interactions between the target system and the hardware. Some examples of hyper jacking-style threats include Blue Pill,1 SubVirt2 and Vitriol.3 These proofs of concept and their associated documentation illustrate various ways of attacking a system to inject rogue hypervisors under existing OSs or virtualization systems. Regular security measures are ineffective against these threats because the OS, running above the rogue hypervisor, is unaware that the machine has been compromised. To date, hyper jacking is still only a theoretical attack scenario, but it has garnered considerable press attention due to the potential damage it could cause.

Server Consolidation [Figure 1: Block (g)]: Server consolidation saves space in the data center and facilitates scalability since many servers exist within one server.

5. Possible Applications of Virtualization in Various Fields:

5.1 Educational Institutes: Educational institutes can engage one of the virtualizations concept i.e. desktop virtualization. This is a software technology that separates the desktop environment and its associated application software from the physical client (The actual hardware component) that is used to access it. A Third party application like "virtual Box" can be used for the purpose on practically generalizing the concept to the young generation.

5.2 Military: The evolution of computing capabilities to allow the mobilization of data has made its way for the transformation of tactical vehicles into rolling data centers. These impressive machines have provided invaluable resources for warfighters to dominate the battlefield. Unfortunately, despite the obvious benefits to packing a Humvee or tank with real-time intelligence computing equipment, these capabilities come at a not-so-obvious price: a sacrifice of precious power, cooling capabilities, and logistical space to accommodate the new equipment. To address these challenges, data center managers have turned to virtualization to perform physical to virtual server consolidation, regularly achieving a 10 to 1 optimization or better.

5.3 Production/Business Enhancement:

Research papers listed the top business benefits provided by virtualization as follows:

- ✓ Reduction in operating expenses – it is very obvious intention of every concept is the reduction of the costs by optimizing the server farm a huge cost can saved.
- ✓ Improved business continuity – for having multiple servers it's a huge investment. Virtualizing the servers can increase the productivity of the servers and also increase the lifespan of the existing hardware also the reduced energy cost can be seen.
- ✓ Better response by IT to requests for new services - The focus of the application usage can be given to new line which the company wishes to adapt.

5.4 Challenges and Opportunities of Virtualization:

The use of isolation and segmentation will also greatly reduce the risks. It is effective to use physical, network and virtualization-based separation to segment VMs and systems, and to couple the separation with leveraging policy or security levels to cluster like VMs/applications together such that a low-value (and, therefore, less scrutinized) application cannot have a negative impact on high-value VMs/applications. VM segmentation can be implemented through the virtualization management infrastructure or can be accomplished manually, depending on the tools and Products

used. Segmentation is also an important tool in dealing with the networking risks associated with virtualization. As noted previously, separating VMs of differing security postures reduces the risk for the higher-value VMs. Additionally, the use of transport encryption is recommended for securing VM migration. Virtual private network (VPN) tunnels can be deployed system to system or, in some cases, it is possible to leverage features available from Virtualization vendors or security software solutions that provide for encrypted VM migration. Solving the management and compliance challenges requires implementing virtualization-aware management products and services, as well as virtualization-aware security products. This enables the existing management infrastructure to recognize and track VMs just as it does systems and applications in the data center. There are products specifically developed for virtualization security management, and add-ons or upgrades to existing infrastructure products that provide virtualization awareness and the necessary compliance and management features. [7][9][10]

6. ABCD Analysis:

ABCD listing and ABCD framework are two models of qualitative [15-20] and quantitative ABCD analysis [21-28] respectively. In this section we have used ABCD analysis for qualitative listing of advantages, benefits, constraints and disadvantages from business service providers and customer's point of view.

6.1 Advantages Virtualization:

Cost Cutting: For startup companies which are likely to have a 1000 employees, up to 40% companies IT budget is spent for the hardware, for having multiple servers it's a huge investment. Virtualizing the servers can increase the productivity of the servers and also increase the lifespan of the existing hardware also the reduced energy cost can be seen.

Easier Backup and Disaster Recovery: Any kind of disaster are un predictable be it natural or intentional. Virtualization makes recovery much swifter and accurate, with less man power and a fraction of the equipment – it is all virtual.

Enable Centralized Management: Mostly for the SANs all the resources can be combined and used as central managing device increases efficiency.

6.2 Benefits of Virtualization:

Deliver High Application Availability: More application can be accessed operating in different operating systems within a single server.

Eliminate or Minimize Downtime: Server downtime or any resource for that matter can be reduced.

Increase IT Productivity, Efficiency, Agility and Responsiveness: Imagine a machine where you expect 1 and you get 5 times more productivity is definitely increased.

Speed and Simplify Application and Resource Provisioning: Mapping of the resources accordingly as per the application requirement.

Build True Software Defined Data Center: A proper planning of data center with adapting this concept will ensures the capital reduction and productivity of the data center in a huge volume**.** [6][9][14]

6.3 Constraints of virtualization:

- ✓ Not all hardware equipment's are specifically designed to be virtualization friendly.
- ✓ Since date is very important to your business it is essential that only you choose virtualization options that offer adequate data protection. Not owning your own servers can put your data at risk which is not ideal.[15][21][26]

6.4 Disadvantages of Virtualization:

- ✓ Performance may be down depending on the source used to virtualize without proper planning it is not possible to achieve the maximum hardware performance.
- ✓ As this concept is just started to boom in the IT industry some of the core applications including few database applications are not ready to get virtualize yet. [1][8][24]

7. Conclusion:

Virtualization can help to reduce the physical server foot print. The datacenters will be performing to their core capacity in floor space as well as in energy consumption. More to be concerned about the size of the server, smaller the size more the performance, more the heat will increase the need for extension of the cooling equipment, limiting the floor space even further. Virtualization will overcome all this circle of limitations. A server normally will be consuming 100% of the energy but will using 10% of its capacity, the 100% server utilization can be achieved by virtualization. The Concept will be realized or is being spread over a variety of devices like smart phones over laptop to routers. Using virtual machine on the smart phone could be used for private and business purposes. Well the applications of the concept does not have boundary. The chief technology officer at VMware quotes "It is clear that virtualization is here to stay" [19].[21][28]

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