AWS Solution Architect Associate Certification Training – Module 3

3. Basics of Virtualization

Virtualization and Virtualization terminologies:

Virtualization is the process of creating virtual format of resources like hardware, software, etc. In computing, it is termed as creation of virtual hardware resources, operating systems or network resources. Virtualization is nothing but a software layer in between OS and host machine. It has a greater importance in cloud computing.

By means of virtualization, Cloud Service providers are able to create virtual machines in cloud computing. The applications are deployed in virtual machines so that it can be accessed from anywhere in the world in its virtualized form. The VM image is created, and when a user sends request for accessing a particular resource, the VM instance is created and access is provided. Users are allowed to access only the VM's that contains their applications or resources. Virtual machines are end point software layers and need to be protected in an efficient manner. This software layer divides the resources of the host machine among all the guest OS.

The advantage of virtualization is that the CPU is shared among different OS. Multiplexing hardware resources to many OS is done by Virtualization Layer. Every OS would think that they are controlling the hardware but switching behind scenes is done by virtualization layer so that system can host many OS.

What is Hypervisor

With the help of Hypervisor, virtual machines are created and managed. Hypervisor is placed on top 8 of hardware which in turn will run multiple OS and applications in virtualized environment.

During virtualization, it is like single OS image per machine, even when there are Multiple OS running on machine. Due to the virtualization process the user will get a feeling he is working on single operating system. But actually a guest operating system will be running on the hypervisor by utilizing the underlying hardware resources of host operating system.

Different approaches to Virtualization

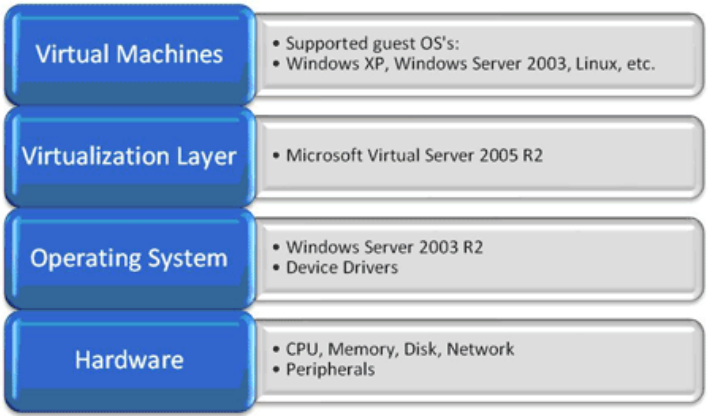
There are many approaches to virtualization. Some of them are

- Software virtualization
- Data virtualization
- Desktop virtualization
- Datacenter virtualization
- Network virtualization
- Server virtualization
- Hardware virtualization
- Application virtualization

Different type of Virtualization

Server-level virtualization:

The best known and most readily useful virtualization products are those that operate at the server level. VMware GSX Server and Microsoft Virtual Server 2005 are good examples. These products are installed within a host operating system (such as a supported Linux distribution or the Windows Server platform). In this approach, virtual machines run within a service or application that then communicates with hardware by using the host operating system's device drivers.



Server-level virtualization brings ease of administration (since standard management features of the host OS can be used), increased hardware compatibility (through the use of host OS device drivers) and integration with directory services and network security. Whether you're running on a desktop or a server OS, you can be up and running with these platforms within a matter of minutes.

One drawback is that the need for a host OS causes additional overhead. The amount of memory, CPU, disk, network, and other resources used by the host must be subtracted from what would otherwise be available for use by VMs. Generally, the host OS also requires an operating system license. Finally, server-level virtualization solutions are often not as efficient as that of hardware-based virtualization platforms.

Hardware-level virtualization and hypervisors:

We'll start the bottom of the stack, which is at the hardware level. Theoretically, virtualization platforms that run directly on the base hardware should provide the best performance by minimizing overhead. An example is VMware's ESX Server. ESX Server installs directly on a supported hardware platform and includes a minimal operating system. Administration is performed through a Web-based application that can be accessed remotely using a Web browser.

A hypervisor is a thin layer that runs directly between operating systems and the hardware itself. Again, the goal here is to avoid the overhead related to having a "host" operating system. Microsoft and other vendors will be moving to a hypervisor-based model in future versions of their virtualization platforms.

Although the low-level approach might seem ideal, it has some drawbacks. First and foremost is the problem of device compatibility. In order for the platform to work at all, it must support all of the

devices that are connected to the main computer. Currently, products such as ESX Server are limited to running only on approved hardware platforms. Although many popular server platforms are supported, this clearly is not as compatible as other solutions.

Another issue is manageability. The dedicated virtualization layers must provide some methods for managing virtualization services. There are various approaches, including operating system "hooks" and Web-based administration, but they tend to be more complicated than in other virtualization options.

Application-level virtualization:

In some cases, running multiple independent operating systems is overkill. If you want only to create isolate environments that allow multiple users to concurrently run instances of a few applications, there's no need to create a separate VM for each concurrent user. That's where application-level virtualization comes in.

Application-level virtualization products run on top of a host operating system and place standard applications (such as those included with Microsoft Office) in isolated environments. Each user that accesses the computer gets what appears to be his or her own unique installation of the products. Behind the scenes, file system modifications, registry settings and other details are performed in isolated sandbox environments and appear to be independent for each user. Softricity and SWSoft are two vendors that provide application-level virtualization solutions.

The main benefits of this approach are greatly reduced overhead (since only one full operating system is required) and improved scalability (many users can run applications concurrently on the same server). Generally, only one OS license is required (for the host OS). The drawbacks are that only software settings will be independent. If a user wants to change hardware settings (such as memory or network details) or operating system versions (through patches or updates), those changes will be made for all users on the system.

Datacenter virtualization

Data center virtualization is the process of designing, developing and deploying a data center on virtualization and cloud computing technologies.

It primarily enables virtualizing physical servers in a data center facility along with storage, networking and other infrastructure devices and equipment. Data center virtualization usually produces a virtualized, cloud and collocated virtual/cloud data center.

Data center virtualization encompasses a broad range of tools, technologies and processes that enable a data center to operate and provide services on top of virtualization layer/technology. Using data center virtualization, an existing or a standard data center facility can be used to provide/host multiple virtualized data centers on the same physical infrastructure, which can simultaneously be used by separate applications and/or organizations. This not only helps in optimal IT infrastructure/resource utilization, but also in reducing data center capital and operational costs.

Network Virtualization

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When applied to a network, virtualization creates a logical software-based view of the hardware and software networking resources (switches, routers, etc.). The physical networking devices are simply responsible for the forwarding of packets, while the virtual network (software) provides an intelligent abstraction that makes it easy to deploy and manage network services and underlying network resources. As a result, NV can align the network to better support virtualized environments.

Desktop Virtualization

Desktop virtualization, often called client virtualization, is a virtualization technology used to separate a computer desktop environment from the physical computer. Desktop virtualization is considered a type of client-server computing model because the "virtualized" desktop is stored on a centralized, or remote, server and not the physical machine being virtualized.

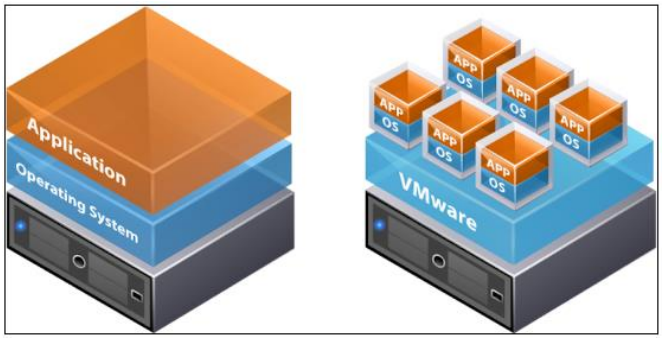
Desktop virtualization "virtualizes desktop computers" and these virtual desktop environments are "served" to users on the network. You interact with a virtual desktop in the same way you would use a physical desktop. Another benefit of desktop virtualization is that is lets you remotely log in to access your desktop from any location.

VDI (Virtual Desktop Infrastructure -- or Interface) is a popular method of desktop virtualization. This type of desktop virtualization uses the server computing model, as the desktop virtualization in this scenario is enabled through hardware and software. VDI hosts the desktop environment in a virtual machine (VM) that runs on a centralized or remote server.

Virtual Machine Concepts

A virtual machine is a software computer that, like a physical computer, runs an operating system and applications. The virtual machine is comprised of a set of specification and configuration files and is backed by the physical resources of a host. Every virtual machine has virtual devices that provide the same functionality as physical hardware and have additional benefits in terms of portability, manageability, and security.

A virtual machine consists of several types of files that you store on a supported storage device.



Benefits of Virtualization:

Virtualization can increase IT agility, flexibility and scalability while creating significant cost savings. Greater workload mobility, increased performance and availability of resources, automated operations – they're all benefits of virtualization that make IT simpler to manage and less costly to own and operate. Additional benefits include:

- Reduced capital and operating costs.
- Minimized or eliminated downtime.
- Increased IT productivity, efficiency, agility and responsiveness.Faster provisioning of applications and resources.
- Greater business continuity and disaster recovery.
- Simplified data center management.

Disadvantages of virtualization are almost negligible when compared to the multiple advantages it offers.

- Software licensing costs.
- Necessity to train IT staff in virtualization.