

Cloud Computing Fundamentals.

Assignment - 1

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Cloud Computing

- It refers to delivery of different services such as data and programs through internet and different servers.
- It takes place on third party servers that is hosted by third-party hosting companies.
- It is ability to access data anyone and anywhere by the user.
- More cost effective.
- User user friendly.
- It requires fast, reliable and stable internet connection.
- It provides more storage space and servers.

Traditional computing

- It refers to delivery of different services on local servers.
- It takes place on physical hard drives and website servers.
- User can access data only on system in which data is stored.
- Less cost effective.
- Less user friendly.
- It does not require any internet connection.
- It provides less storage as compared to cloud computing.

(2)

Virtualization is a collection of an alternative to actual machine or something:

- virtual memory
- virtual disk
- virtual hardware, desktop, disk, appliances, sensors.
- virtual worlds.

for our context it is realizing one or more complete computer systems as guests on the base machine / operating system.

Virtualization is way to run multiple operating systems as guests on the host machine / operating system and user applications on the same hardware.

e.g. Many users run windows and linux on the same laptop.

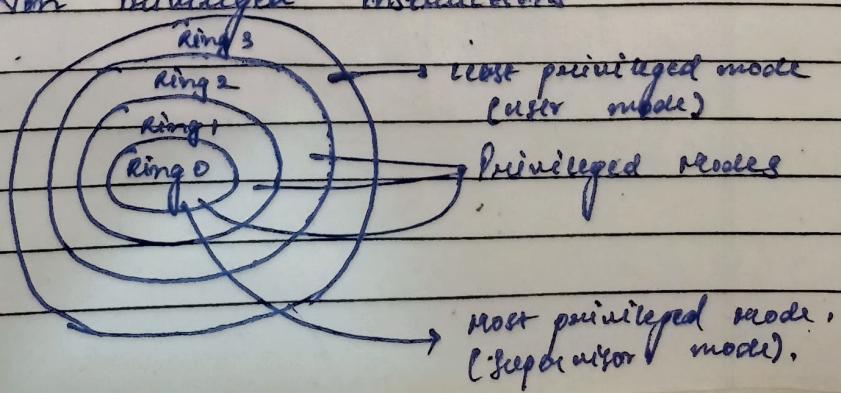
- Sharing - Virtualization allows the creation of a separate computing environment around the same host.
- Aggregation - It is possible to share physical resources among several guest but virtualization also allows aggregation, which is the opposite process.
- Emulation - guest programs are executed within an environment that is controlled by the virtualization layer, which ultimately is a program.

- Isolation - Virtualization allows providing guests with their own operating systems, applications run on other entities with completely separate environment, in which they are executed.

(3) Machine Reference Model -

- Virtualization technique actually replace one of the layers and intercept the calls that are directed towards it.
- therefore, a clear separation between layers simplify their implementation, which only requires the emulation of the interfaces and a proper interaction with the underlying layer.
- This layered approach simplifies the development and implementation of computing systems and simplify the implementation of multitasking and the coexistence of multiple executing environments.

The instruction set exposed by the hardware has been divided into different security classes that define who can operate with them.
Privileged or Non Privileged instructions



- API (Application Programming Interface) -
It is a set of rules and protocols that allows different software applications to communicate with each other. It defines the methods and data formats that applications can use to request and exchange information.
- ABI (Application Binary Interface) -
It defines how binary objects interact with each other at the machine code level. It includes details like calling conventions, data type size, and layout conventions in memory.
- ISA (Instruction Set Architecture) -
It is a set of instructions that a particular CPU architecture understands and can execute. It includes details such as the available instructions, register set, memory addressing modes and data types.

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Hypervisors are a fundamental element of hardware virtualization or a. It is also called virtual machine manager (VMM). It recreates a hardware environment in which guest operating systems are installed.

There are 2 major types of hypervisors -

- Type I -

- They run directly on top of the hardware.
- Therefore, they take the place of the operating systems and interact directly with the ISA interface exposed by the underlying hardware, and they emulate this interface in order to allow the management of guest operating systems.
- This type of hypervisor is also called a Native Virtual Machine / Bare metal since it runs natively on hardware.

- Type II -

- Hypervisors require the support of an OS to provide virtualization services.
- This means they are programs managed by the operating system, which interact with it through the ABI and emulate the ^{ISA of} hardware.
- This type of hypervisor is also called a hosted VM.

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Execution level virtualization are of two types process level and system level.

- Full / Native Virtualization - It refers to the ability to run a program, most likely an operating system, directly on top of a virtual machine and without any modification, as though it were run on the raw hardware.
- Para-Virtualization - There is no hardware simulation / emulation done by the virtual machine. The virtual machine uses hypercall-API to communicate with the hypervisor for instruction dispatch and other purpose. The guest OS must be modified to work with the hypercall.
- Partial Virtualization provides a partial emulation of the underlying hardware, thus not allowing the complete execution of the guest operating system in complete isolation. Partial virtualization allows many applications to run transparently, but not all the features of the operating system can be supported, as happens with full virtualization.

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Cloud computing is a utility-oriented and Internet-centric way of delivering IT services on demand. These services cover the entire computing stack: from the hardware infrastructure packaged as a set of virtual machines to software services such as development platforms and distributed applications.

- Cloud computing supports any IT service that can be consumed as a utility and delivered through a network, most likely the Internet. Such characterization includes quite different aspects: infrastructure, development platforms, applications and services.
- Infrastructure as a service - customers are provided with virtualized hardware and storage on top of which they can build their infrastructure.
- Software as a Service - customers are provided with applications that are accessible anytime and from anywhere.
- Platform as a service - customers are provided with a platform for developing applications hosted in the cloud.

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Storage virtualization is a system administration practice that allows decoupling the physical organization of the hardware from its logical representation. Using this technique, users do not need to be worried about the specific location of their data, which can be identified using a logical path. Storage virtualization allows us to harness a wide range of storage facilities and represent them under a single logical file system. There are different techniques for storage virtualization, one of the most popular being network-based virtualization by means of storage area networks (SANs). SANs use a network-accessible device through a large bandwidth connection to provide storage facilities.

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Without a hypervisor, there is less overhead since there's no additional layer between the hardware and the operating system. However, it also means that all containers share the same operating system kernel, which can limit compatibility with different OS versions or kernel configurations.