

Virtualization

- Virtualization simulates the interface to a physical object by any one of four means:

1. Multiplexing. Create multiple virtual objects from one instance of a physical object.

For example, a processor is multiplexed among a number of processes or threads.

2. Aggregation. Create one virtual object from multiple physical objects.

For example, a number of physical disks are aggregated into a RAID disk.

3. Emulation. Construct a virtual object from a different type of physical object.

For example, a physical disk emulates a random access memory.

4. Multiplexing and emulation.

Examples: Virtual memory with paging multiplexes real memory and disk, and a Virtual address emulates a real address;

TCP emulates a reliable bit pipe and multiplexes a physical communication channel and a processor.

- Virtualization abstracts the underlying resources and simplifies their use, isolates users from one another, and supports replication, which, in turn, increases the elasticity of the system.
- Virtualization is a critical aspect of cloud computing, equally important to the providers and consumers of cloud services, and plays an important role in:
 - **System security** because it allows isolation of services running on the same hardware.
 - **Performance and reliability** because it allows applications to migrate from one platform to another.
 - The development and management of services offered by a provider.
 - **Performance isolation**

Virtual Machine monitor

- A virtual machine monitor (VMM), also called a hypervisor, is the software that securely partitions the resources of a computer system into one or more virtual machines.
- A guest operating system is an operating system that runs under the control of a VMM rather than directly on the hardware.
- **The VMM runs in kernel mode, whereas a guest OS runs in user mode.**

Virtual Machines

- A virtual machine (VM) is an isolated environment that appears to be a whole computer but actually only has access to a portion of the computer resources.
- Each VM appears to be running on the bare hardware, giving the appearance of multiple instances of the same computer, though all are supported by a single physical system.
- Virtual machines have been around since the early 1970s, when IBM released its VM/370 operating system.

Two types of VM: process and system VMs

- **A process VM is a virtual platform created for an individual process and destroyed once the process terminates.**
- **Virtually all operating systems provide a process VM for each one of the applications running, but the more interesting process VMs are those that support binaries compiled on a different instruction set.**