CSG2132 Module 6 Notes

Virtualization

Virtualization involves creating entirely software-based instances of computing and IT assets such as applications, operating systems, servers, data storage and even networks. When they are created and operated in this form, they are said to be *virtualized*.

They operate just like the 'real thing' but are in fact abstract equivalents that exist purely if software form. Virtualization technology allows multiple, differing operating systems to be run on a single host, with each being referred to as a *Guest* or *Virtual Machine*. Each virtual machine has access to the host systems hardware resources such as physical memory, CPU, cache, HDD/SSD, input devices, etc.

A well-known example of software that allows you to set up and run virtual machines is VMware. You'll be using VMware to set up virtual machines that you will need to complete your main assignment in this unit.

Operating System Virtualization

Operating system virtualization refers to the use of software to allow system hardware to run multiple instances of different operating systems concurrently, allowing you to run different applications requiring different operating systems on one computer system. The operating systems do not interfere with each other or the various applications.

Hypervisors

Operating system virtualization requires the use of what is known as a **hypervisor**. A hypervisor is a software application that manages multiple operating systems, or multiple instances of the same operating system, on a single computer system. It is the role of the hypervisor to allocate the host system's processor, memory, storage and network access as required to each guest operating system it manages.

When a hypervisor is installed directly on the hardware of a physical machine, between the hardware and the operating system (OS), it is called a *bare metal hypervisor*. The term bare metal refers to the fact that there is no operating system between the virtualization software and the hardware. The virtualization software resides on the 'bare metal' or the hard disk of the hardware, where the operating system is usually installed.

Due to the fact that a bare metal hypervisor separates the OS from the underlying hardware, the software no longer relies on or is limited to specific hardware devices or drivers. This allows bare metal hypervisors to manage operating systems and their associated applications so that they can run on multiple hardware platforms.

Hypervisors also allow multiple OS and VM to reside on the same physical server. The VM independence this allows means they can move from machine to machine or platform to platform and dynamically allocate network, memory, storage, and processor resources across multiple servers as required. For example, when an application needs more processing power, it can easily access additional machines through the hypervisor. This results in greater cost and energy efficiency and better performance, using fewer physical machines.

Distributed Virtualization with VMware vSphere

VMware vSphere is a virtualization suite of software that allows datacenters to create a cloud computing infrastructure and IT organizations to deliver flexible and reliable IT services. VMware vSphere virtualizes and aggregates the underlying physical hardware resources across multiple systems and provides pools of virtual resources to the datacenter.

As a cloud operating system, VMware vSphere manages large collections of infrastructures such as CPUs, storage, and networking as a completely integrated and dynamic operating environment, managing all the complexities that this involves.

Thin Provisioning

Thin provisioning is a storage pre-allocation strategy. When a virtual disk is thin-provisioned virtual, it consumes only the space that it needs, not the maximum space it has been allocated. The difference between space 'actually used' and 'maximum space allocated' can then be used by other VMs, making much more efficient use of storage space shared amongst multiple VMs.

For example, if you create a new thin-provisioned 30GB virtual disk and copy 10 GB of files to it, the size of the resulting VMDK file will be 10 GB, whereas you would have a 30GB VMDK file if you had chosen to use a thick-provisioned disk.

CPU Overcommitment

CPU over commitment involves allocating more CPU resources to a cluster of VMs than exist on the physical hardware. A simple example of over commitment can be running 3 VM each with 4 GB RAM on an Esxi host which has only 8 GB RAM. In this case we have allocated 12 GB RAM to all VM's collectively but at physical level (ESXi host) we have only 8 GB RAM available. However, this approach assumes that not all VM will be using their maximum allocated CPU resources at all times, and as a result, at no time will the physical limit of 8Gb be exceeded.

Paravirtualization

Paravirtualization enables several different operating systems to run on one set of hardware by effectively using resources such as processors and memory. In paravirtualization, the OS is modified to work with a virtual machine. The intention behind the modification of the operating system is to minimize execution time required to perform operations.

Paravirtualization works differently from the full virtualization. It doesn't need to simulate the hardware for the virtual machines. The hypervisor is installed on a physical server and a guest OS is installed into the environment. Virtual guests aware that it has been virtualized, unlike the full virtualization where the guest doesn't know that it has been virtualized, to take advantage of the functions.