CSC 504

Semester Assignment

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Cloud Services Promoted By IBM Cloud Computing Technology

# 1.0 Introduction

IBM cloud like every other cloud computing providers their services according to several fundamental models: infrastructure as a service (IaaS), software as a service (SaaS) and platform as a service (PaaS) offered through public, private and hybrid cloud delivery models, in addition to the components that make up those clouds.

IaaS is the most basic and each higher model abstracts from the details of the lower models. Other key components in anything as a service (XaaS) are described in a comprehensive taxonomy model published in 2009, such as Strategy-as-a-Service, Collaboration-as-a-Service, Business Process-as-a-Service, Database-as-a-Service, etc. In 2012, network as a service (NaaS) and communication as a service (CaaS) were officially included by ITU (International Telecommunication Union) as part of the basic cloud computing models, recognized service categories of a telecommunication-centric cloud ecosystem

# 1.1 Infrastructure as a Service (IaaS)

From IBM, the definition of infrastructure as a service (IaaS) is pretty simple. You rent cloud infrastructure - servers, storage and networking- over the internet on demand, in a pay-as-you-go model.

The IaaS model provides just the cloud infrastructure: hardware and network; the customer installs or develops its own operating systems, software and applications.

Compute servers, storage, and networking hardware delivered as a service. This infrastructure hardware is often virtualized, so virtualization, management and operating system software are also part of IaaS as well.

# 1.2 Software as a Service (SaaS)

Applications delivered as a service to end-users typically through a Web browser. There are hundreds of SaaS service offerings available today, ranging from horizontal enterprise applications to specialized applications for specific industries, and also consumer applications such as Web-based email.

SaaS has become a common delivery model for many business applications, including office & messaging software, DBMS software, management software, CAD software, Development software, [gamification](http://en.wikipedia.org/wiki/Gamification), [virtualization](http://en.wikipedia.org/wiki/Virtualization_software_licensing), [accounting](http://en.wikipedia.org/wiki/Accounting_software),[collaboration](http://en.wikipedia.org/wiki/Collaborative_software), [customer relationship management](http://en.wikipedia.org/wiki/Customer_relationship_management) (CRM), management information systems (MIS), enterprise resource planning (ERP), invoicing, human resource management(HRM), content management (CM) and service desk management.

# 1.3 Platform as a Service (PaaS)

An application development and deployment platform delivered as a service to developers who use the platform to build, deploy and manage SaaS applications. The platform typically includes databases, middleware and development tools, all delivered as a service via the Internet. PaaS offerings are often specific to a programming language or APIs, such as Java or Python. A virtualized and clustered grid computing architecture is often the basis for PaaS offerings, because grid provides the necessary elastic scalability and resource pooling.

Measures of Graceful Degradation Provided in Linux and Windows OS

# 2.0 Introduction

Increased reliability of a computer system is crucial in many applications. The ability of a system to fall back to a reduced level of service when a fault occurs and to revert to normal operations when the fault is rectified is called **Graceful Degradation**. This is also known as fault tolerance.

The OS must also be capable of providing system reconfiguration schemes to support graceful degradation. The OS uses both hardware and software duplication to ensure continued operation despite faults.

# 2.1 Graceful Degradation in Windows

Windows Operating System uses the following fault tolerance mechanisms:

## 2.1.1 Redundant Array of Inexpensive disks (RAID)

RAID is a fault tolerant method of storing data, meaning that a failure can occur and the system will still function. When RAID is hardware supported, the RAID hardware will perform parity calculations, thus freeing the system. The various RAID categories supported by windows are:

* Disk mirroring (RAID1) - One disk is a mirror copy of the other. This is geared for reliablilty, not speed. The boot and system partition may be mirrored. Mirrored volumes must be of the same size. Mirroring is done by clicking on the volume to be mirrored while holding the CTRL key down, then clicking on some free space of equal or greater size while the CTRL key is held down. Then click "Fault Tolerance", "mirror", and "establish mirror". To break a mirror, click on the mirror, and break.
* Disk Striping (RAID0) - Data is split into sections with part of the data being written to each disk in parallel. Can use 2 to 32 disks. This provides speed but not reliability unless disk striping with parity is used. Each partition in a stripe set must be the same size. The boot or system partition may not be part of a stripe set. Data is stored in 64K blocks. Must drives be of the same type to be part of a stripe set? (I don't think so.)
* Disk striping with parity (RAID2/3/4/5) - The same as disk striping except an additional disk that stores parity information is used. Can use 3 to 32 disks. The parity information may be used to recreate the contents of a failed drive. At least three disks are required to create a stripe set with parity. To make a stripe set from Disk Administrator, click on three areas of free space on three drives. From the fault tolerance menu choose "create stripe set with parity". Select the "Partition" menu, "commit changes". Reboot, then format the stripe set by highlighting the stripe set and selecting "tools", and "format".

## 2.1.2 Disk duplexing

Each disk gets its own controller so one controller failure can't bring both disks down. Without redundant controllers, this is the same as disk mirroring.

## 2.1.3 Replication

In Windows Server, one server is a complete copy of another in case one server fails. One is used as a primary server and the other is a backup server.

# 2.2 Graceful Degradation in Linux

## 2.2.1 RAID Options

Three versions of RAID are associated with LINUX: RAID 0, RAID 1, RAID 5

The various RAID categories are:

0 - Disk striping - Data is written across multiple drives in parallel. Different parts of the data is written at the same time to more than one drive. If there are two drives, half the data is written to one drive, while the rest of the data is written to the other drive. All partitions on striped drives must be the same size. No fault tolerance is provided with RAID-0.

1 - Disk mirroring - All the data is written to two drives so each drive has a complete of all stored data. If one drive fails, the other can be used to get a copy of the data. To be more fault tolerant, more than one controller card may be used to control the mirrored hard drives. This is called disk duplexing and will allow the system to keep functioning if one controller card fails.

5 - Disk striping with blocks with parity information stored using multiple drives. Uses five disks with one fifth of each one to store parity information.

OS Issues (Security) Peculiar to Linux and Windows OS

# 3. 0 File Management

## **File System**

### **Windows**:

* Windows supports a variety of file systems, including the legacy FAT/FAT32 file systems from DOS/Windows and formats common to CDs and DVDs.
* The most common file system used in Windows is **NTFS**, which has many advanced features related to security, encryption, compression, journalling, change notifications, and indexing built in.

### Linux

* Linux supports a variety of file systems, including Microsoft file systems, for compatibility and inter-operation.
* The most common file systems are **Ext2,Ext3,and IBM’s JFS** journaling file system

## File System Implementation

### Windows

Windows file systems are implemented as device drivers, and can be stacked in layers, as with other device drivers, due to the object-oriented implementation of Windows I/O.

Typically NTFS is sandwiched between 3rd party filter drivers, which implement functions like anti-virus, and the volume management drivers, which implement RAID

### Linux

Linux file systems are implemented using the Virtual File System (VFS) technique developed by Sun Microsystems. File systems are plug-ins in the VFS model, which is similar to the general object-oriented model used for block and character devices.

## File Permission

**Windows**

**Discretionary access control (DAC):** Controls access based on the identity of the requestor and on access rules (authorizations) stating what requestors are (or are not) allowed to do. This policy is termed discretionary because an entity might have access rights that permit the entity, by its own volition, to enable another entity to access some resource.

### Linux

Role-based access control (RBAC): Controls access based on the roles that users have within the system and on rules stating what accesses are allowed to users in given roles.

Each UNIX user is assigned a unique user identification number (user ID).A user is also a member of a primary group, and possibly a number of other groups, each identified by a group ID.When a file is created, it is designated as owned by a particular user and marked with that user’s ID.It also belongs to a specific group, which initially is either its creator’s primary group, or the group of its parent directory if that directory has SetGID permission set