Unit-1

The Evolution of Cloud Computing: Hardware Evolution. Internet Software Evolution. Establishing a Common Protocol for the Internet. Evolution of Ipv6. Finding a Common Method to Communicate Using the Internet Protocol. Building a Common Interface to the Internet.

Cloud Formations: From One Computer to a Grid of Many. Server virtualization. Parallel Processing. Vector processing. Symmetric Multi processing Systems. Massively Parallel Processing Systems

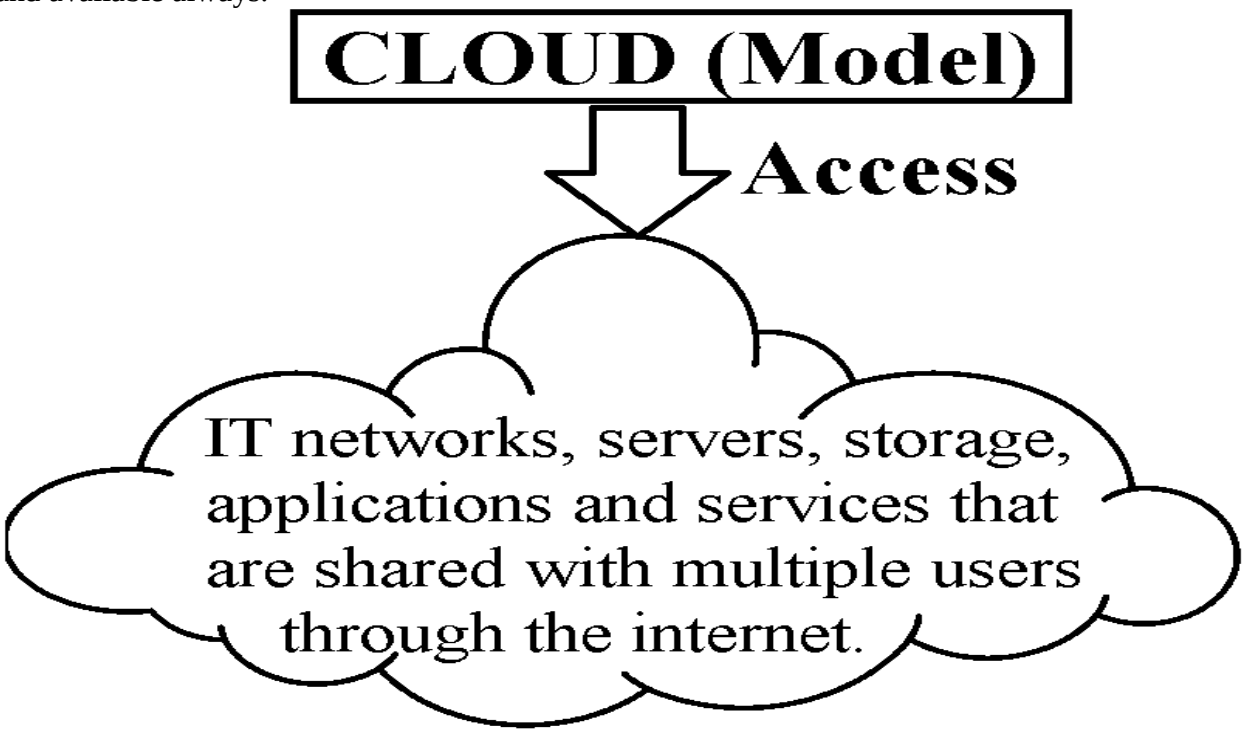
The Evolution of Cloud Computing
Evolution means the gradual development of something.

CLOUD COMPUTING
The practice of using a network of remote servers hosted on the Internet to store, manage, and process data, rather than a local server or a personal computer.

It is a model for accessing IT networks, servers, storage, applications and services that are shared with multiple users through the internet.

It delivers cost-efficient computer hardware, software and services as infinitely flexible and adaptable resources. Popular software like cloud CRM requires minimal IT personnel and management involvement from users.

The data in the cloud exists on servers which are mirrored onto other servers; this keeps it secure and available always.



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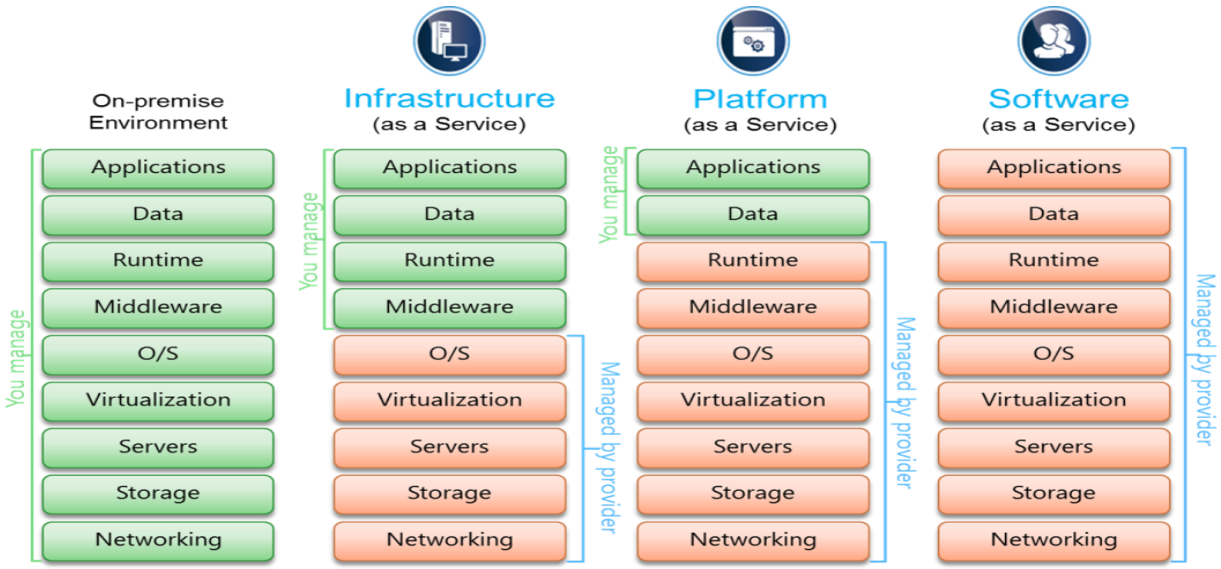
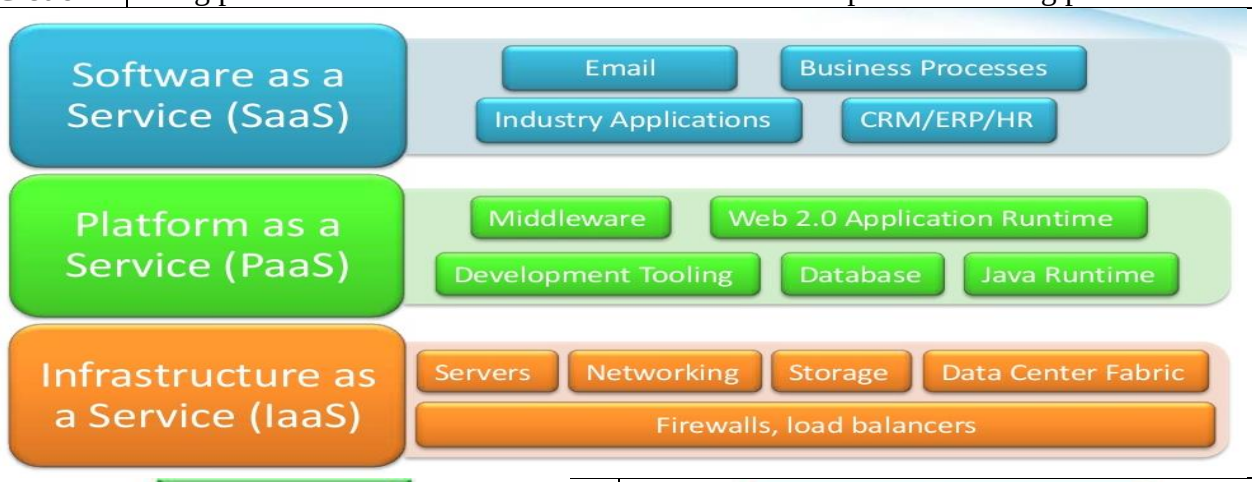
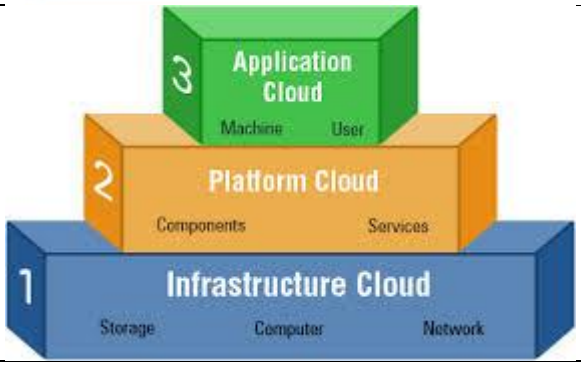
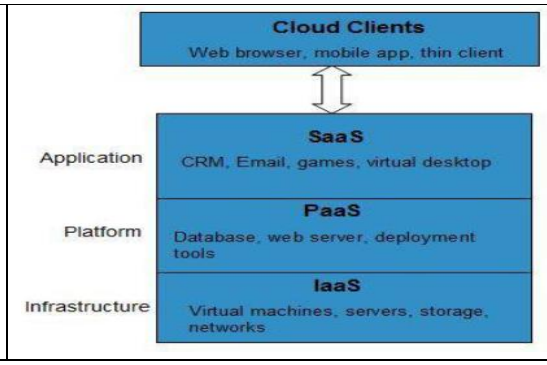


Cloud Deployment Model (Each on with its own set of customers it's targeting.)	
Public Cloud	It allows systems and services to be easily accessible to the general public. Public cloud may be less secure because of its openness, e.g., e-mail.
Private Cloud	It allows systems and services to be accessible within an organization. It offers increased security because of its private nature.
Hybrid Cloud	It is mixture of public and private cloud. However, the critical activities are performed using private cloud while the non-critical activities are performed using public cloud.







Cloud Computing Service Model Types

On-premise Environment	As you can see, for the first stack from left, you will need to take care of everything from networking all the way up to applications. This is typically what many of us are doing today.
IaaS (Infrastructure as a Service)	**IaaS** provides access to fundamental resources such as physical machines, virtual machines, virtual storage, etc. Example of IaaS market players: Amazon Web Service, Rackspace, and VMware vCloud.
PaaS (Platform as a Service)	**PaaS** provides the runtime environment for applications, development & deployment tools, etc. Example of PaaS market player: Google AppEngine, Windows Azure Platform, and force.com.
SaaS (Software as a Service)	**SaaS** model allows to use software applications as a service to end users. Example of SaaS market player: GMail, Office 365, and Google Docs.

Benefits of Cloud Computing

Customers can forgo capital expenditure and consume resources as a service by just paying for what they use.

This factor alone can

- reduce infrastructure costs significantly and
- Accelerate the speed of applications development.

One can access applications as utilities, over the Internet. Manipulate and configure the application online at any time.

It does not require to install a specific piece of software to access or manipulate cloud application.

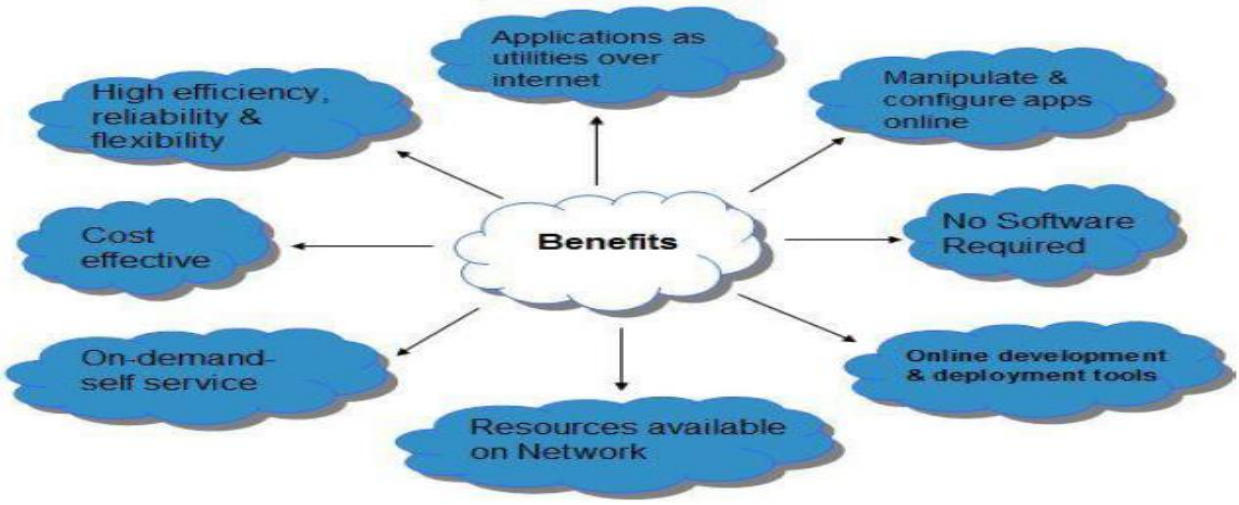
Cloud Computing offers online development and deployment tools, programming runtime environment through **Platform as a Service model**.

Cloud resources are available over the network in a manner that provides platform independent access to any type of clients.

Cloud Computing offers **on-demand self-service**. The resources can be used without interaction with cloud service provider.

Cloud Computing is highly cost effective because it operates at higher efficiencies with greater utilization. It just requires an Internet connection.

Cloud Computing offers load balancing that makes it more reliable.



What about Legal Issues When Using Cloud Models?

For example, the United States–European Union Safe Harbor Act allows most U.S. corporations to certify that they have joined a self-regulatory organization that adheres to the seven Safe Harbor Principles or has implemented its own privacy policies that conform with those principles.

The Seven Safe Harbor Principles

1. Notify individuals about the purposes for **which information is collected and used.**
2. Give individuals the choice of whether their **information can be disclosed to a third party.**
3. Ensure that if it **transfers personal information to a third party,** that third party also provides the same level of privacy protection.
4. **Allow individuals access** to **their personal information.**
5. Take reasonable **security precautions to protect collected data** from loss, misuse, or disclosure.
6. Take reasonable **steps to ensure the integrity of the data collected.**
7. Have in place an **adequate enforcement mechanism.**

Characteristics of Cloud Computing

On-demand	Resources should be always available when you need them, and you have control over turning them on or off to ensure there's no lack of resource or wastage happen.
Scalable	You should be able to scale (increase or decrease the resource) when necessary. The cloud providers should have sufficient capacity to meet customer's needs.
Multi-tenant	Sometimes you may be sharing the same resource (e.g. hardware) with another tenant. But of course, this is transparent to the customer. Cloud provider shall responsible the security aspect, ensuring that one tenant won't be able to access other's data.
Self-service computation and storage resource	Related processes including: billing, resource provisioning, and deployment should be self-service and automated, involving much less manual processing. If a machine where our service is hosted fails, the cloud provider should be able to failover our service immediately.
Reliability	Cloud provider should be able to provide customer reliability service, committing to uptimes of their service.
Utility-based subscription	You will pay the cloud provider as a utility based subscription, just like paying your electricity bill – without any upfront investment.

Challenges for the Cloud

1. Secure data storage

a. Data that is oriented around user **privacy, identity, and application specific preferences in centralized locations raises many concerns about data protection.**

b. These concerns, in turn, give rise to questions regarding the legal framework that should be implemented for a cloud-oriented environment. (Research Question)

2. High-speed access to the Internet: Google announced publicly in October 2008 that the 99.9% service level agreement offered to their Premier Edition customers using Gmail would be extended to Google Calendar, Google Docs, Google Sites, and Google Talk.

3. Standardization

It is a crucial factor in gaining widespread adoption of the cloud computing model.

1. Chapter Over View	**Advancements in** 1. Hardware (1st to 4th Generation) 2. Software (IPV4 to IPV6). The first step along the evolutionary path of computers occurred in 1930 1. binary arithmetic was developed 2. became the foundation of computer processing technology, terminology And programming languages. Calculating devices date back to at least as early as 1642 In 1939, the Berry brothers invented an electronic computer capable of operating digitally.

2. Hardware Evolution

2.1 First-Generation Computers. 2.2 Second-Generation Computers

2.3 Third-Generation Computers 2.4 Fourth-Generation Computers

First-Generation Computers

- The Mark I(Built at Harvard University.) and Colossus computers(Built at Britain) in 1943.
- It was a general-purpose electromechanical programmable computer.
- Colossus was the world's first programmable, digital, electronic, computing device and was built in Britain.
- First-generation computers were built using hard-wired circuits and vacuum tubes (thermionic valves).
- Data was stored using **paper punch cards.**

Second-Generation Computers

ENIAC (Electronic Numerical Integrator and Computer) in 1946 in USA.

- Could solve a full range of computing problems.
- contained 18,000 thermionic valves,
- weighed over 60,000 pounds,
- Consumed 25 kilowatts of electrical power per hour.

Within a year after its completion, the invention of the transistor.

Replaced the inefficient thermionic valves with smaller, more reliable components.

Transistorized computers marked the advent of

<table>
<tr>
<td> 
</td>
<td>second-generation computers.
These computers were still bulky and expensive.</td>
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<tr>
<td>Third-Generation Computers
• The integrated circuit was produced in September 1958
• Was used in computers in1963.
• The integrated circuit or microchip was developed by Jack St. Claire Kilby, an achievement for which he received the Nobel Prize in Physics in 2000.
• In November 1971, Intel released the world’s first commercial microprocessor, the Intel 4004.
The Intel 4004
  </td>
<td>Fourth-Generation Computers
• They utilized a microprocessor that put the Computer’s processing capabilities on a single integrated circuit chip.
• By combining random access memory (RAM), developed by Intel, fourth generation computers were faster than ever before.
• The first commercially available personal computer was the MITS Altair 8800, released at the end of 1974.
• The PC era had begun in earnest by the mid-1980s.
• Even though micro processing power, memory and data storage capacities have increased by many orders of magnitude since the invention of the 4004 processor, the technology for large-scale integration (LSI) or very-large-scale integration (VLSI) microchips has not changed all that much.
• For this reason, most of today’s computers still fall into the category of fourth generation computers.</td>
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3. Internet Software Evolution
3.1 Establishing a Common Protocol for the Internet
3.2 Evolution of Ipv6
3.3 Finding a Common Method to Communicate
Using the Internet Protocol
3.4 Building a Common Interface to the Internet
3.5 The Appearance of Cloud Formations
—From One Computer to a Grid of Many

3. Internet Software Evolution

1. The Internet is named after the Internet Protocol.
2. Used by every computer on the Internet.
3. **Vannevar Bush** wrote a visionary description of the potential uses for information technology with his description of an automated library system named MEMEX.
4. The second individual to have a profound effect in **shaping the Internet Was Norbert Wiener.**
5. Influenced by Wiener, Marshall McLuhan put forth the idea of a global village that was interconnected by an electronic nervous system as part of our popular culture.
6. In 1957, U.S. President Dwight Eisenhower created the Advanced Research Projects Agency (ARPA) agency to regain technological edge Against the Soviet Union.

Vannevar Bush's MEMEX.

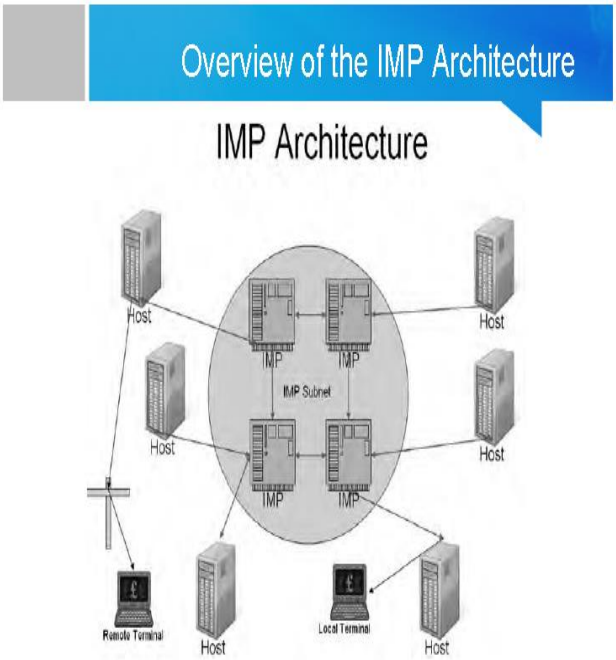
SAGE (Semi-Automatic Ground Environment) was the most ambitious computer project ever undertaken at that time, it required over 800 programmers and technical resources of some of America's largest corporations.

SAGE was started in the 1950s and became operational by 1963.

It remained in continuous operation for over 20 years, until 1983.

The SAGE system.

The network implemented for DARPA was ARPANET.

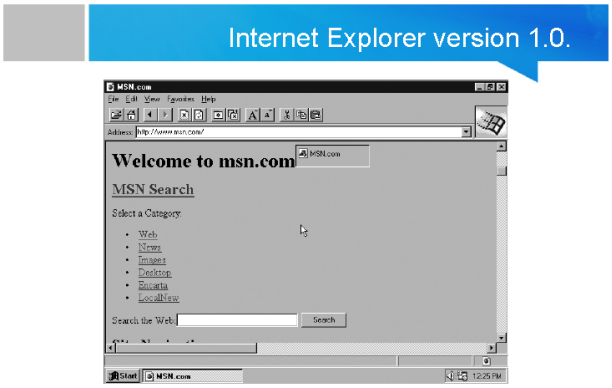
	The **first networking protocol** that was used on the **ARPANET** was the Network Control Program (NCP). The NCP managed the connections and flow control. An application layer, built on top of the NCP, provided services such as email and file transfer. A minicomputer was created specifically to realize the design of the Interface Message Processor. 
1.3.1 Establishing a Common Protocol for the Internet On 1/1/1983 known as Flag Day, NCP was rendered obsolete. **ARPANET changed its core networking protocols from NCP to TCP/IP** **Versions of TCP/IP** a. TCP v1. b. TCP v2 c. a split into TCP v3 and IP v3 d. TCP v4 and IPv4.	**1.3.2 Evolution of Ipv6** IPv4 was never designed to scale to global levels. This resulted in a longer IP address and that caused problems for existing hardware and software. The Internet Engineering Task Force (IETF) settled on IPv6, which was released in January 1995 as RFC 1752. Ipv6 is sometimes called the Next Generation Internet Protocol (IPNG) or TCP/IP v6. By 2004, IPv6 was widely available from industry as an integrated TCP/IP Protocol.

1.3.3 Finding a Common Method to Communicate Using the Internet Protocol

- The word hypertext was coined by Ted Nelson.
- Nelson popularized the hypertext concept, but it was Douglas Engelbart who developed the first working hypertext systems.
- Developed the first working hypertext system, named NLS (derived from oNLine System)
- Engelbart's NLS system was chosen as the second node on the ARPANET, giving him a role in the invention of the Internet as well as the World Wide Web.
- The National Center for Supercomputer Applications (NCSA), a research institute at the University of Illinois, developed the Mosaic and Netscape browsers.

1.3.4 Building a Common Interface to the Internet

- In the fall of 1990, Berners-Lee developed the first web browser.
- Later added support for the FTP protocol.
- Berners-Lee managed to get CERN to provide a certification on April 30, 1993, that the web technology and program code was in the public domain
- Mosaic was the first widely popular web browser available to the general public.
- Mosaic provided support for graphics, sound, and video clips.
- In October 1994, Netscape released Mozilla 1.0, the very first commercial web browser.
- Microsoft realized that the WWW was the future and focused vast resources to begin developing a product to compete with Netscape and thus created the Microsoft Internet Explorer.



- In July 1995, Microsoft released the Windows 95 operating system, with support for dial-up networking and TCP/IP.
- It also included an add-on to the operating system called Internet Explorer 1.0
- Mozilla Firefox, released in November 2004, became very popular almost immediately.

1.3.5 The Appearance of Cloud Formations

From One Computer to a Grid of Many

- Initially computers were clustered together to form a single larger computer in order to simulate a supercomputer and harness greater processing power.
- The purpose was to balance the computational load across several machines.
- A key to efficient cluster management was engineering where the data was to be held.

In the early 1990s, Ian Foster and Carl Kessel man presented their concept of "The Grid."

One of the most well known of the new cloud service providers is Amazon's S3 (Simple Storage Service) thirdparty storage solution.

Cluster Computing -> Grid Computing -> Cloud Computing.

4. Server Virtualization

4.1 Parallel Processing

4.2 Vector Processing.

4.3 Symmetric Multiprocessing Systems.

4.4 Massively Parallel Processing Systems.

4 Server Virtualization

Virtualization is a method of running multiple independent virtual operating systems on a single physical computer.

The creation and management of virtual machines has often been called platform virtualization.

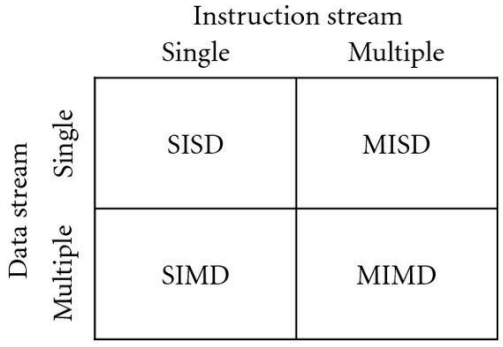
Virtualization technology is a way of reducing the majority of hardware acquisition and maintenance costs, which can result in significant savings for any company.

4.1 Parallel Processing(Flynn's Classification)

It contains 4 types. They were

a. SISD. b. MISD.

c. SIMD. d. MIMD.



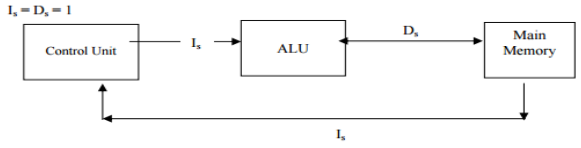


Figure 4: SISD Organisation

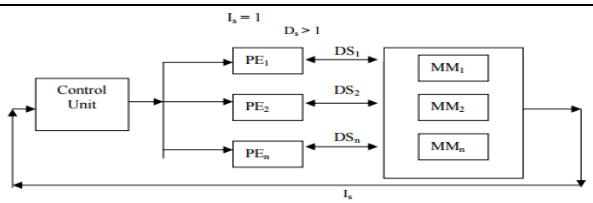


Figure 5: SIMD Organisation

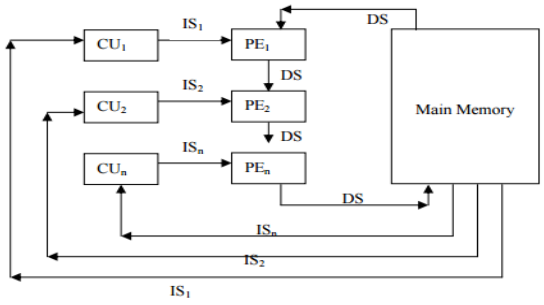


Figure 6: MISD Organisation

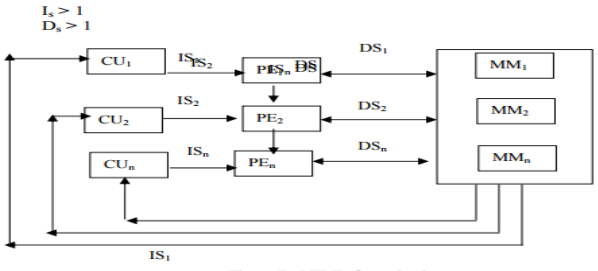
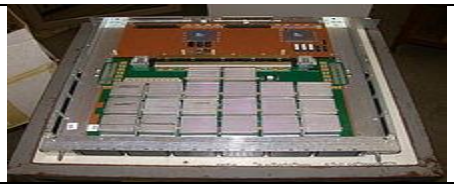
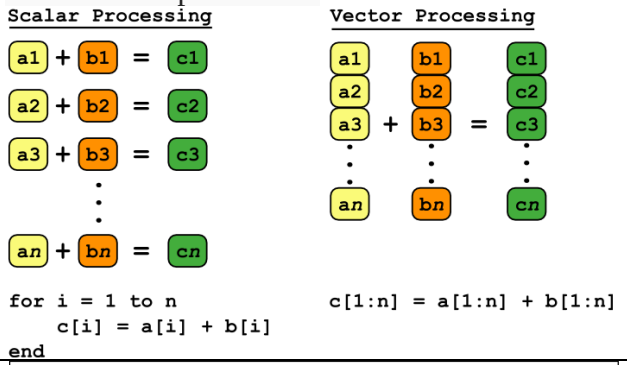
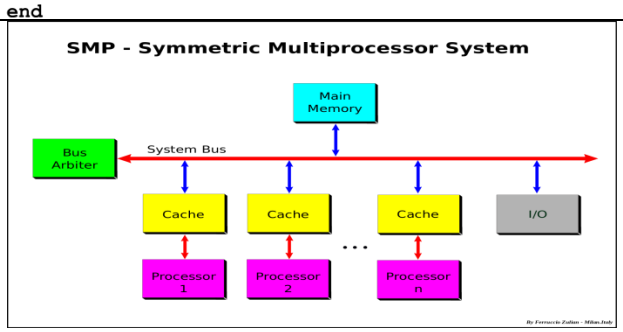


Figure 7: MIMD Organisation

4.2 Vector Processing.

In computing, a **vector** processor or array processor is a central **processing** unit (CPU) that implements an instruction set containing



instructions that operate on one-dimensional arrays of data called **vectors**, compared to scalar processors, whose instructions operate on single data items.	Cray J90 processor module with four scalar/vector processors. 
4.3 Symmetric Multiprocessing System (SMP). It is a **multiprocessor system** with centralized shared memory called main memory (MM) operating under a single operating **system** with two or more homogeneous processors—i.e., it is not a heterogeneous computing **system**.	
4.4 Massively Parallel Processing Systems. It (MPP) is the coordinated processing of a program by multiple processor s that work on different parts of the program, with each processor using its own operating system and memory . Typically, MPP processors communicate using some messaging interface. In some implementations, up to 200 or more processors can work on the same application.	An "interconnect" arrangement of data paths allows messages to be sent between processors. Typically, the setup for MPP is more complicated, requiring thought about how to partition a common database among processors and how to assign work among the processors. An MPP system is also known as a "loosely coupled" or "shared nothing" system. An MPP system is considered better than a symmetrically parallel system (SMP) for applications that allow a number of databases to be searched in parallel. These include decision support system and data warehouse applications.
5. Chapter Summary	