Cloud Computing

Lecture 1

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- Distributed Computing
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- Cloud Computing
- Evolution of Cloud Computing
- Cluster Computing
- Grid Computing

Distributed Computing

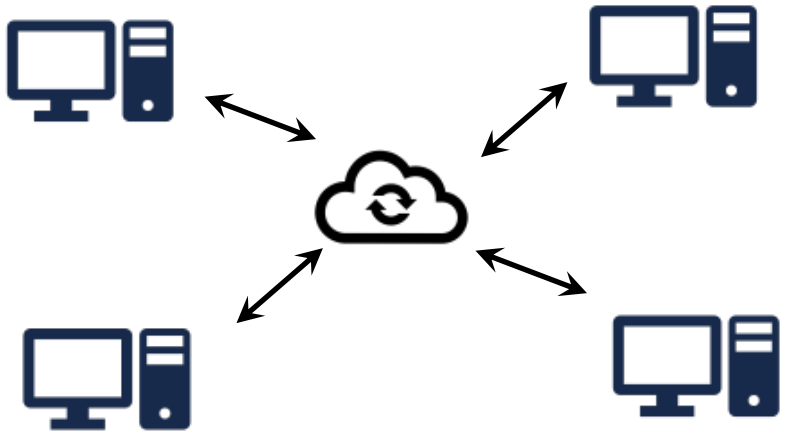
Centralized System

All calculations are done in one particular system

Fault tolerance – NA

Scalability (Capable of Single Machine)

Distributed System



Calculate Concurrently

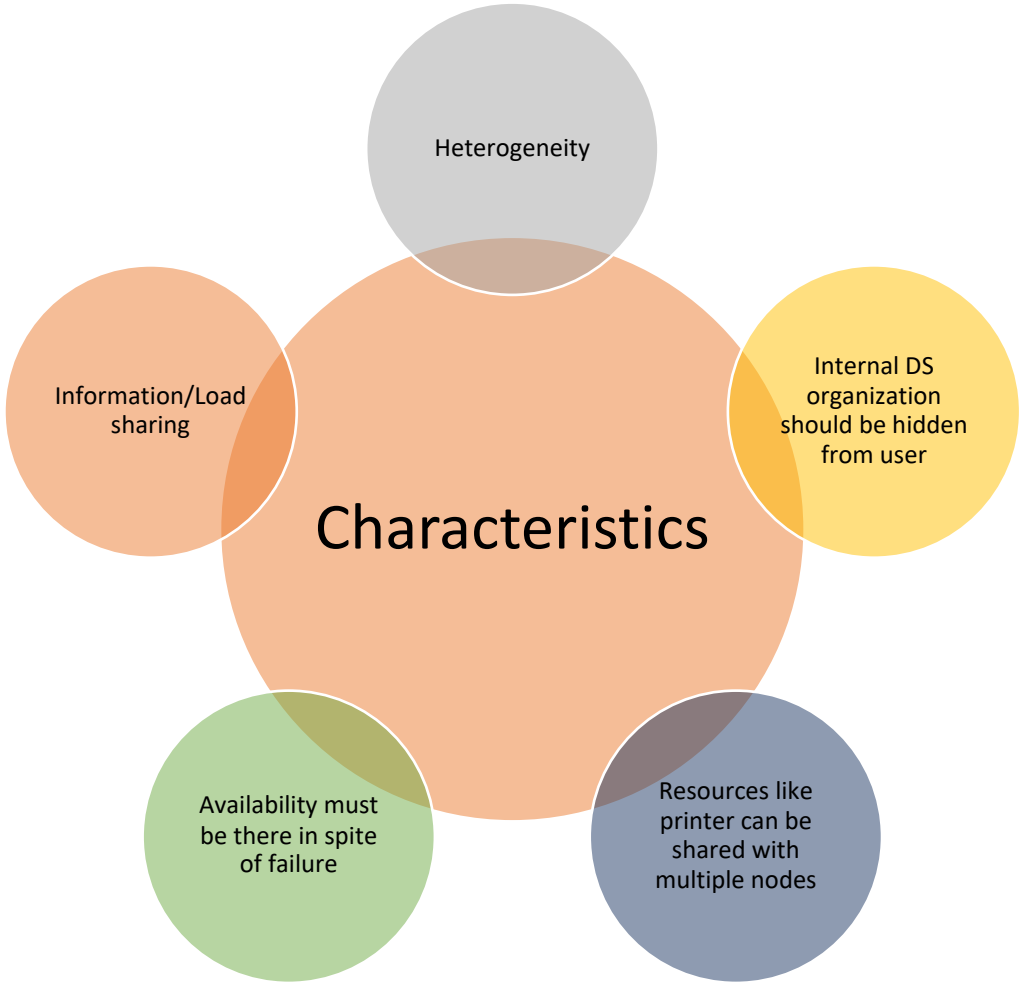
Fault tolerance – Available

Scalable

Distributed Computing

- Distributed computing refers to a system where processing and data storage is distributed across multiple devices or systems, rather than being handled by a single central device.
- In a distributed system, each device or system has its own processing capabilities and may also store and manage its own data.
- These devices or systems work together to perform tasks and share resources, with no single device serving as the central hub.

Distributed Computing



Distributed Computing

- There are several key components of a Distributed Computing System

  Devices or Systems: The devices or systems in a distributed system have their own processing capabilities and may also store and manage their own data.

  Network: The network connects the devices or systems in the distributed system, allowing them to communicate and exchange data.

  Resource Management: Distributed systems often have some type of resource management system in place to allocate and manage shared resources such as computing power, storage, and networking.

The architecture of a Distributed Computing System is typically a Peer-to-Peer Architecture, where devices or systems can act as both clients and servers and communicate directly with each other.

Distributed Computing

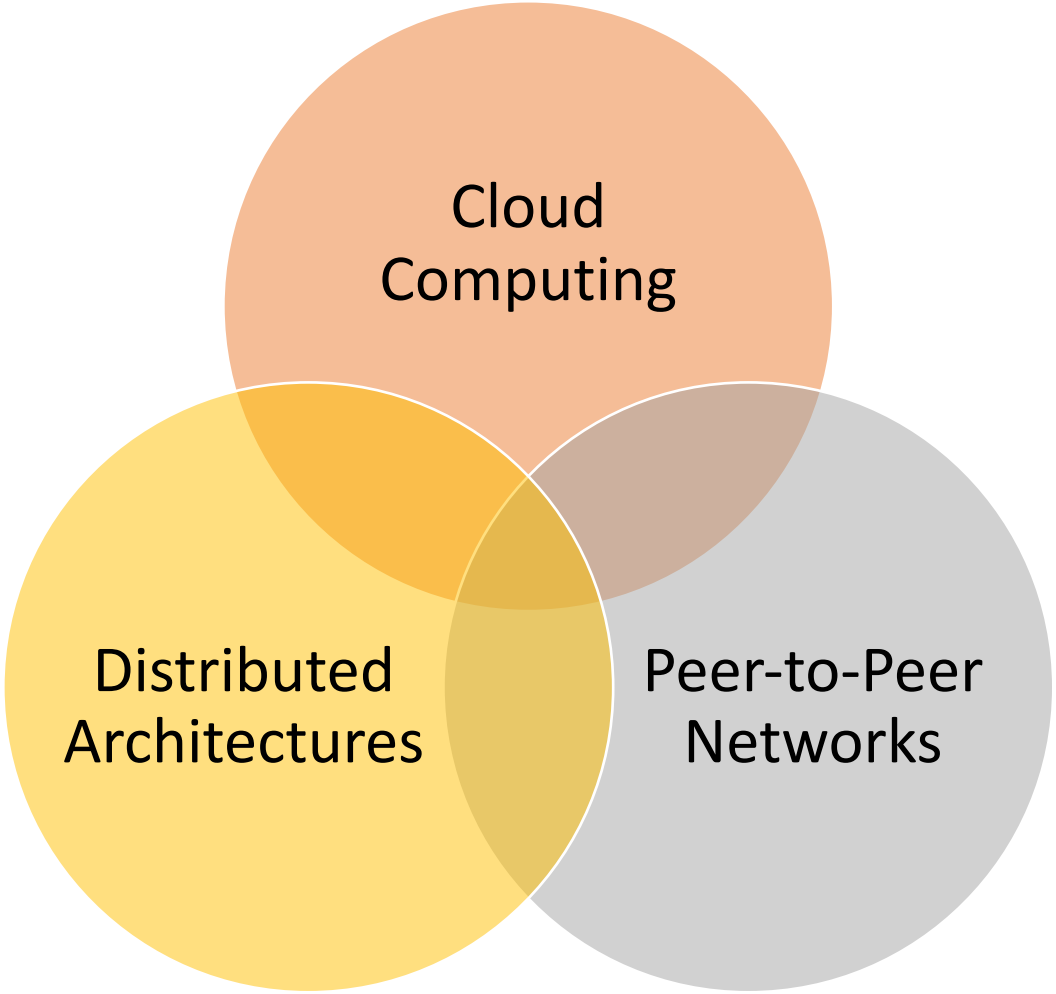
Advantages

- Scalability
- Reliability
- Flexibility

Disadvantages

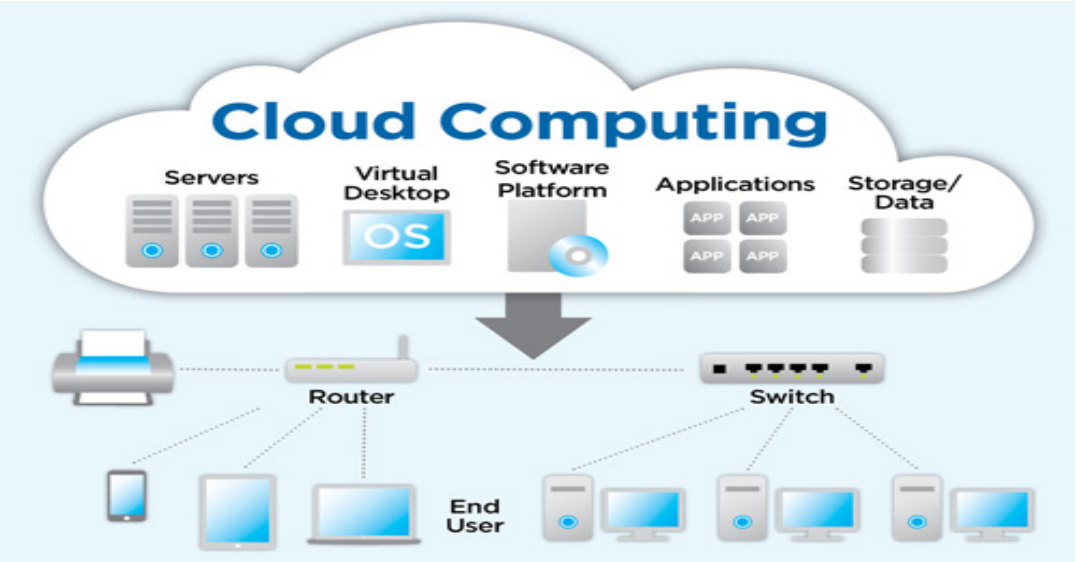
- Complexity
- Security
- Performance

Applications of DS



Cloud Computing

- The word “cloud” is used as a metaphor for “the Internet”.
- The phrase Cloud Computing means a type of Internet-based computing - including servers, storage and applications.



Cloud Computing

- Cloud computing allows anyone with a credit card to provision virtual hardware, runtime environments, and services. These are used for as long as needed, with no up-front commitments required.

- The entire stack of a computing system is transformed into a collection of utilities, which can be provisioned and composed together to deploy systems in hours rather than days and with virtually no maintenance costs.

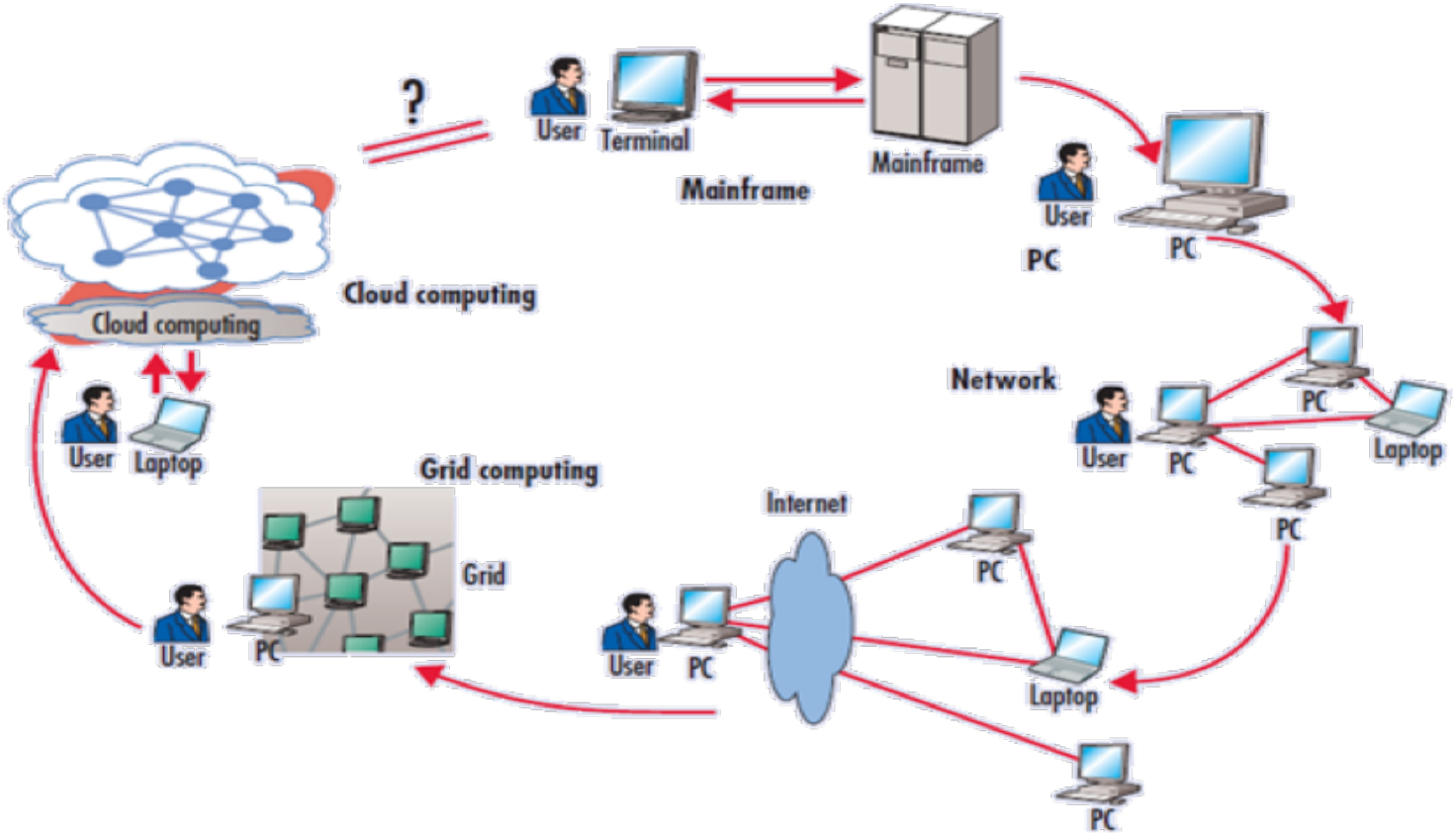
- The phrase Cloud Computing means a type of Internet-based computing - including servers, storage and applications.

Cloud Computing

Cloud Computing Features

- Helping enterprises, governments, public and private institutions, and research organizations shape more effective and **demand-driven computing** systems.
- Shared pool of **computing resources** e.g. servers, storage, application etc.
- Small enterprises and start-ups can afford to translate their ideas into business results more quickly, without excessive up-front costs.
- Minimal maintenance and operational **cost/efforts**.
- Simplified application acceleration and **Easy Scalability**: System developers can concentrate on the business logic rather than dealing with the complexity of infrastructure management and scalability.
- **High Availability**: End users can have their documents accessible from everywhere and any device.

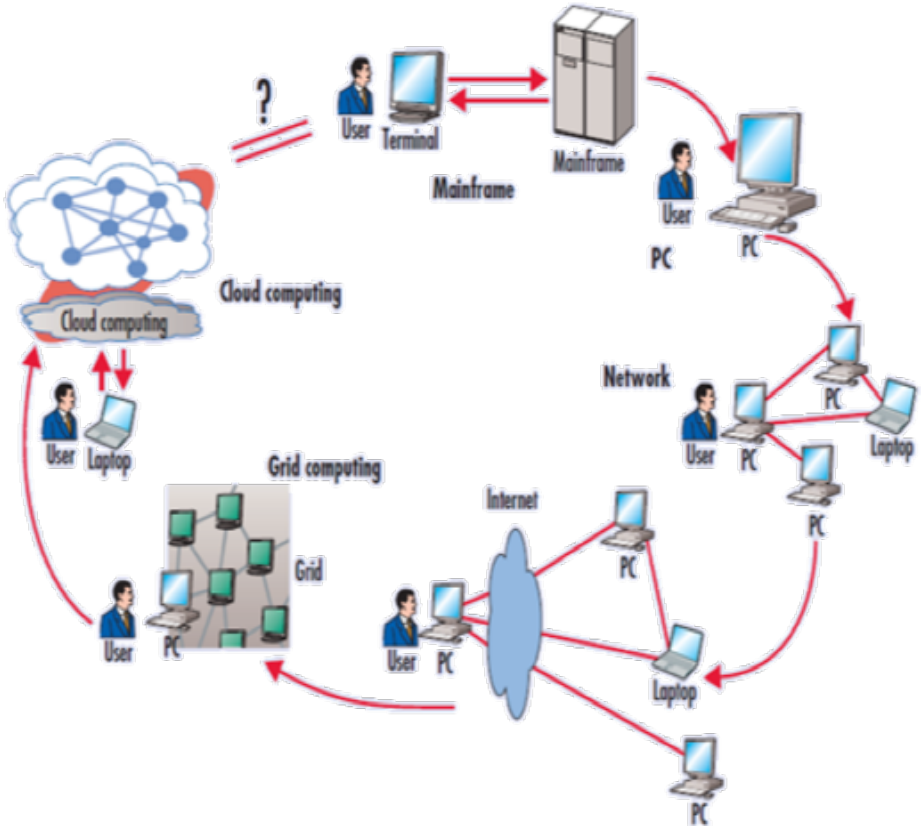
Evolution of Cloud Computing



Evolution of Cloud Computing

Mainframes

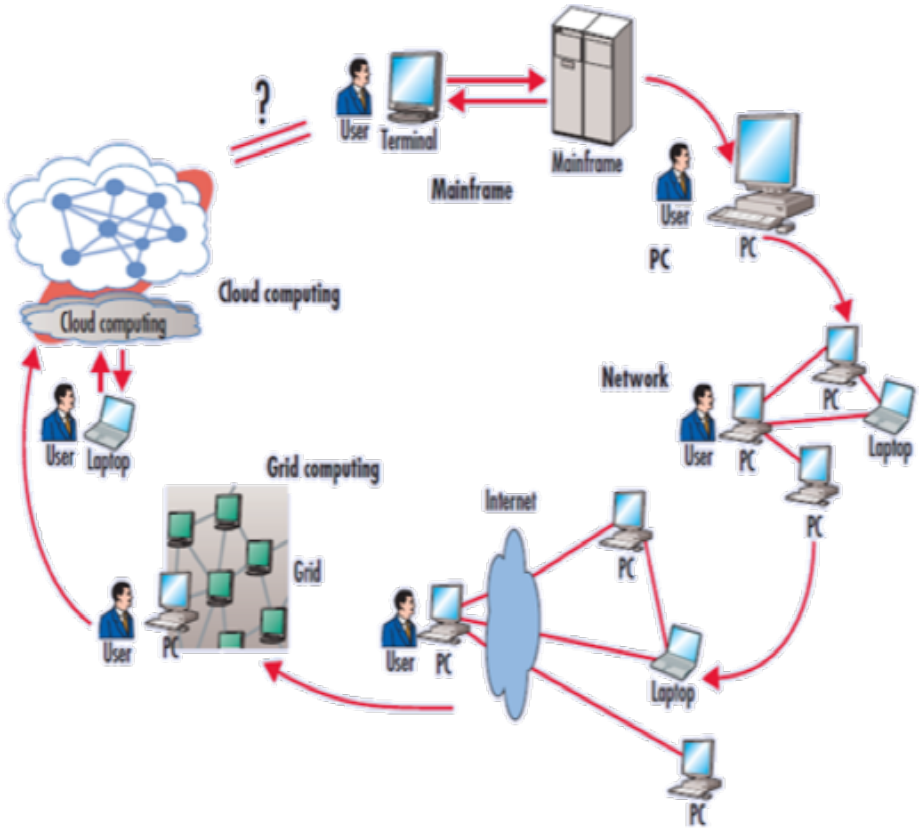
- These were the **first examples of large computational facilities** leveraging multiple processing units.
- **Powerful, highly reliable** *(no shut down required)* computers specialized for large data movement and massive input/output (I/O) operations.
- **Not Distributed**, offered large computational power by using multiple processors, which were presented as a single entity to users.



Evolution of Cloud Computing

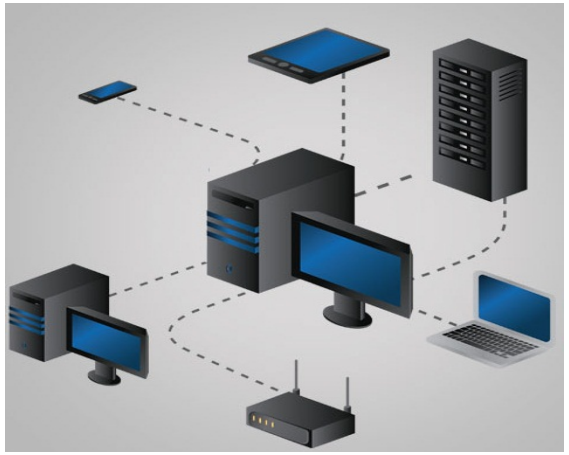
Cluster Computing

- Starting in the **1980s**, clusters become the standard technology for parallel and high-performance computing.
- **Technology advancements** created cheap commodity machines.
- Machines could then be **connected** by a **high-bandwidth network** and controlled by specific software tools that manage them as a single system.



Cluster Computing

- A cluster is a type of parallel and distributed system
- It consists of a collection of inter-connected stand-alone computers.



A Node

A single or multiprocessor system with memory, I/O facilities, & OS

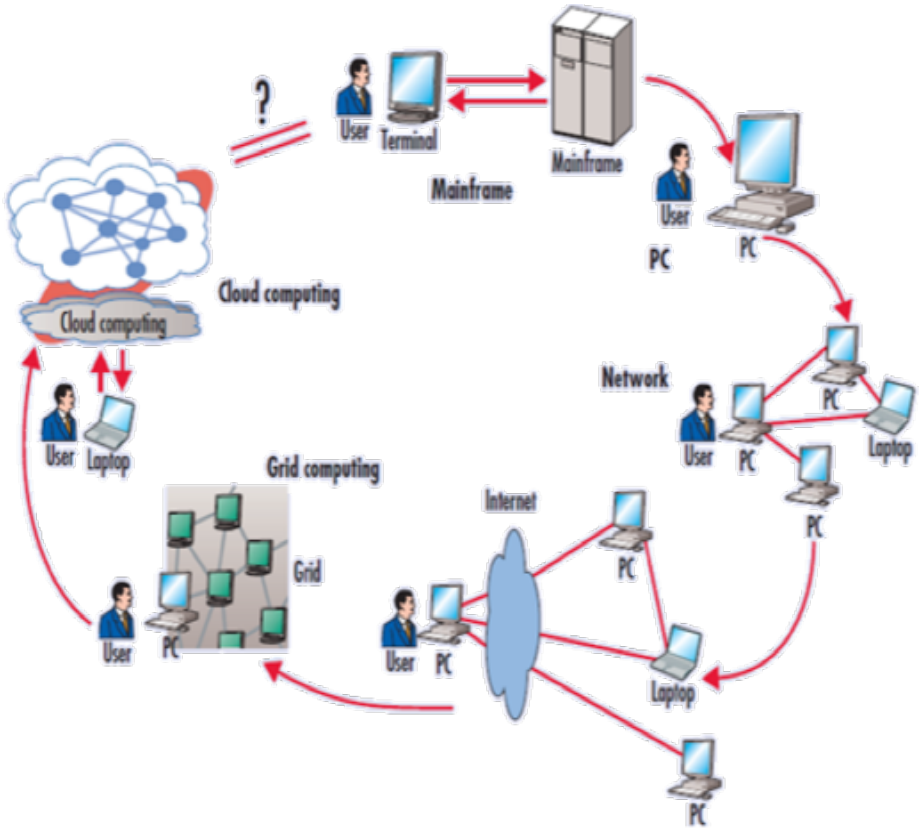
A Cluster

- Generally two or more computers (nodes) connected together
- In a single cabinet, or physically separated & connected via a LAN
- Appear as a single system to users and applications
- Provide a cost-effective way to gain features and benefits

Evolution of Cloud Computing

Grid Computing

- Appeared in the early **1990s** as an evolution of cluster computing.
- Grids initially developed as **aggregations** of geographically dispersed clusters by means of Internet connections.
- These **clusters** belonged to **different organizations,** and arrangements were made among them to **share the computational power.**



Grid

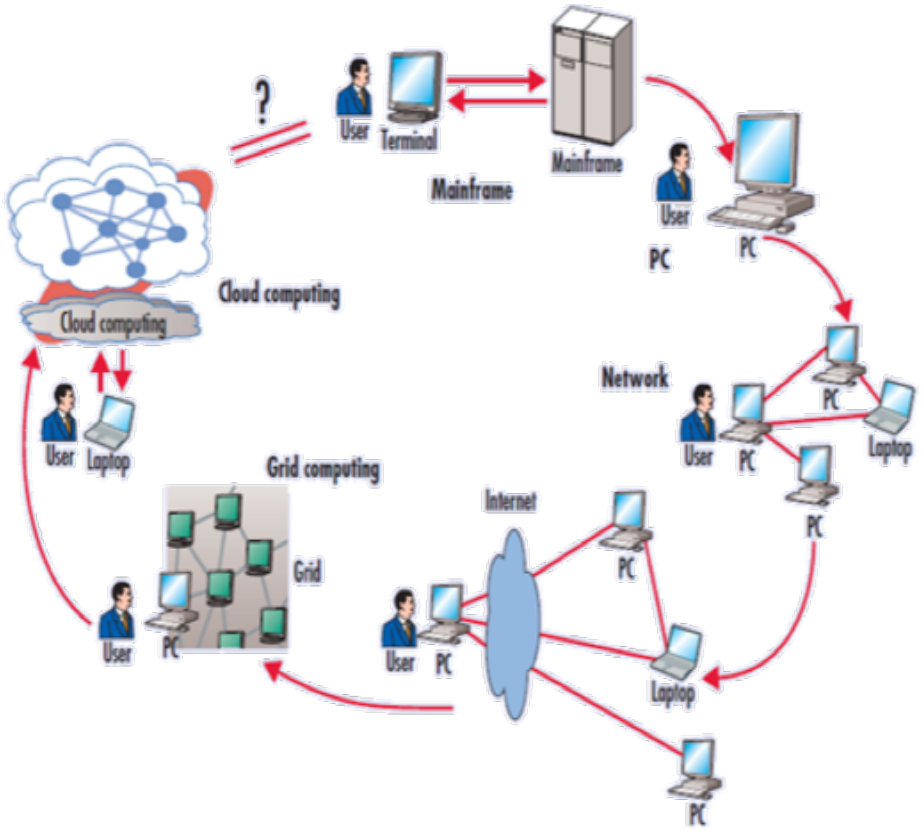
In **future** people will -

- Plugging into a computer grid will be as simple as plugging **into electric grid.**
- Alike electric grid, users will **plug and use as** much as computing power.
- User **need not to know** where the power is coming from.

Evolution of Cloud Computing

Several developments made possible the diffusion of computing grids:

- Clusters became quite **common resources**.
- Clusters were often **underutilized.**
- **New problems were requiring computational power** that went beyond the capability of single clusters.
- **Improvement in internet technology,** long-distance, high-bandwidth connectivity



Cluster vs Grid Computing

Key	Cluster Computing	Grid Computing
Computer Type	Nodes or computers has to be of same type.	Nodes or computers can be of same or different types.
Task	Computers of Cluster Computing are dedicated to single task.	Computers of Grid Computing can leverage the unused computing resources to do other tasks.
Location	Computers of Cluster computing are co-located.	Computers of Grid Computing can be present at different locations.
Topology	Centralized network topology.	De-centralized network topology.
Autonomy	In Cluster computing network, whole system works as a unit.	In Grid computing network, each node is independent.
Task Scheduling	A centralized server controls the scheduling of tasks in cluster computing.	In Grid Computing, multiple servers can exist.
Resource Manager	Cluster Computing network has a dedicated centralized resource manager.	In Grid Computing, each node is independently managing each own resources.

Utility Computing

Def

"*The packaging of computing resources (Computation, storage etc.) as a metered service similar to a traditional public utility*".

Observation

Not a new concept

"If computers of the kind I have advocated become the computers of future, then computing may someday be organized as a public utility just as the telephone system is a public utility… The computer utility could become the basis of a new and important industry" – *John McCarthy, MIT Centennial in 1961*

Questions

Is cloud computing?

Grid computing + utility computing??

Green Computing??

Difference between Grid and Utility Computing?

Thank You