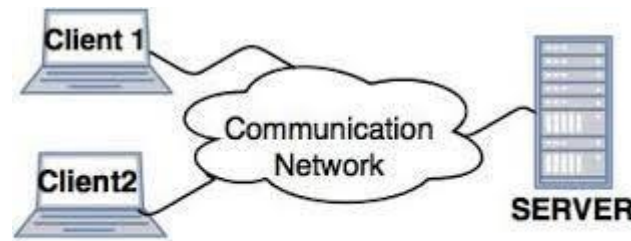


1.1 From Client-Server and collaborative computing to Cloud computing,,Defining cloud Computing, Essential characteristics of cloud computing.

a) Explain Client-Server and collaborative computing to Cloud computing.

Ans.: Client-Server and collaborative computing to Cloud computing:

- (i) Client server architecture/model is a distributed application structure (practical application of distributed system architecture), that divides/partitions the tasks/workload between the providers of service/resource i.e, Server and the service receivers — Clients.
- (ii) It is basically a client-server interaction involving a computing process.
- (iii) Figure illustrates Client-Server Architecture.



Client-server architecture

(iv) **Types of Computing:** In the field of computer science, exchange of data, sharing of resources, operations on the data and its storage are important aspects to look into. The term ‘Computing’ is given to all these activities together inside or outside i.e, within a computer or between the computers.

(v) Computing can resource-provisioning mainly classified as:

(a) **Parallel Computing**

(b) **Distributed Computing**

(vi) In **parallel computing**, all processors may have access to a **shared memory** to exchange information between processors.

(vii) In **T computing**, each processor has its own **private memory** (*distributed memory*). Information is exchanged by passing messages between the processors.

(viii) **The Client-Server Architecture is based on the concept of distributed computing.** It is now understood that Client-Server Architecture involves distributed systems. So, the Clients & Servers are those distributed systems which coordinate, communicate and interact to perform a particular function.

(ix) The client/server architecture significantly decreased network traffic by providing a query response rather than total file transfer.

(x) Clients and servers exchange messages in a request-response-messaging pattern..The Client sends a request to the server and the server returns a response.

(xi) The client requests the server for any particular resource/service, this service is an abstraction of computer processes and the clients have no concern with how the service is provided or fulfilled by the server.

(xii) **Collaborative computing** focuses on group rather than individual problem solving and decision-making tasks necessary to accomplish business and scientific objectives. It provides an environment in which people can share information without the constraints of space and time.

(xiii) **Cloud Computing:** Simply put, cloud computing is the delivery of computing services — servers, storage, databases, networking, software, analytics, intelligence and more — over the Internet (“the cloud”) to offer faster innovation, flexible resources and economies of scale. You typically pay only for cloud services you use, helping lower your operating costs, run your infrastructure more efficiently and scale as your business needs change.

(b) Define Cloud Computing. Enlist Essential characteristics of cloud computing.

Ans.: Definition of Cloud Computing:

- i) The definition given by Armbrust is that Cloud computing refers to both the applications delivered as services over the Internet and the hardware and system software in the data centers that provide those services.
- ii) National Institute of Standards and Technology (NIST) has defined, Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.
- iii) Buyya et al. [2] have defined it as follows: “Cloud is a parallel and distributed computing system consisting of a collection of inter-connected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service-level agreements (SLA) established through negotiation between the service provider and consumers.
- iv) Vaquero et al. [3] have stated “clouds are a large pool of easily usable and accessible virtualized resources (such as hardware, development platforms and/or services). These resources can be dynamically reconfigured to adjust to a variable load (scale), allowing also for an optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the Infrastructure Provider by means of customized Service Level Agreements.”

Essential characteristics of cloud computing:

- In-demand self-service,
- Broad network access,
- Resource pooling,
- Rapid elasticity,
- Measured service.
- No up-front commitments
- On-demand access
- Simplified application acceleration and scalability
- Efficient resource allocation
- Energy efficiency
- Seamless creation and use of third-party services

(c) Explain Essential characteristics of cloud computing.

Ans.: Essential characteristics of cloud computing:

Following are five main characteristics that cloud computing offers businesses today.

(i) In-demand self-service:

- A business will secure cloud-hosting services through a cloud host provider which could be your usual software vendor. You can add or delete users and change storage networks and software as needed.
- Typically, you are billed with a monthly subscription or a pay-for-what-you-use scenario. Terms of subscriptions and payments will vary with each software provider.

(ii) Broad network access:

- Your team can access business management solutions using their smartphones, tablets, laptops, and office computers. They can use these devices wherever they are located with a simple online access point.
- Broad network access includes private clouds that operate within a company’s firewall, public clouds, or a hybrid deployment.

(iii) Resource pooling:

- The cloud enables your employees to enter and use data within the business management software hosted in the cloud at the same time, from any location, and at any time.
- This is an attractive feature for multiple business offices and field service or sales teams that are usually outside the office.
- Resources that are abstracted or virtualized.

(iv) **Rapid elasticity:**

- If anything, the cloud is flexible and scalable to suit your immediate business needs.
- You can quickly and easily add or remove users, software features, and other resources.
- Capacity and the illusion of infinite resources.

(v) **Measured service:**

- Going back to the affordable nature of the cloud, you only pay for what you use.
- You and your cloud provider can measure storage levels, processing, bandwidth, and the number of user accounts and you are billed appropriately.

(vi) **Pay-per-use model:**

- Cloud computing focuses on delivering services with a given pricing model, in most cases a “pay-per-use” strategy.
- It makes it possible to access online storage, rent virtual hardware, or use development platforms and pay only for their effective usage, with no or minimal up-front costs.
- All these operations can be performed and billed simply by entering the credit card details and accessing the exposed services through a Web browser.
- This helps us provide a different and more practical characterization of cloud computing.

(vii) **On-demand access:**

- On-demand access create new opportunities for composing systems and applications with a flexibility not possible before cloud computing.
- New service offerings can be created by aggregating together existing services and concentrating on added value. Since it is possible to provision on demand any component of the computing stack, it is easier to turn ideas into products with limited costs and by concentrating technical efforts on what matters: the added value.