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Subject: Cloud Computing

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Q1) d)

→ Cloud computing :- It is the delivery of computing services over the internet. Cloud services allows individuals and businesses to use software and hardware that are managed by third parties at remote locations.

Characteristics of cloud computing are as follows :-

These are five essential characteristics of cloud computing :-

1) On demand self service -

cloud computing resources can be provisioned on-demand by the users, without requiring interactions with the cloud service provider. The process of provisioning resources is automated.

2) Broad network access -

Cloud computing resources can be accessed over the network using standard

access mechanisms that provide platform independent access through the use of heterogeneous client platforms such as workstations, laptops, tablets and smartphones.

3) Resource Pooling :-

The computing and storage resources provided by cloud service providers are pooled to serve multiple users, multi-tenancy.

Multi-tenant ^{using} aspects of cloud allow multiple users to be served by same physical hardware. Users are assigned virtual resources that run on top of the physical resources.

4) Rapid Elasticity :-

Cloud computing resources can be provisioned rapidly and elastically. cloud resources can be rapidly scaled up or down based on demand. Two types of scaling options exist :

- Horizontal Scaling - (scaling out)
Horizontal scaling or scaling-out

involves ~~the~~ launching ~~and~~ provisioning additional server resources.

- Vertical Scaling (Scaling up) :-
Vertical Scaling or scaling up involves changing the computing capacity to the server resources while keeping the no. of server resources constant.

5) Measured Service :-

Cloud computing resources are provided to users on a pay-per-use model. The usage of the cloud resources is measured and the user is charged based on some specific metric. Metrics such as amount of CPU cycles used, amount of stored space used, no. of network I/O requests, etc. are used to calculate the usage charges for cloud resources.

6) Performance :- Cloud computing provides improved performance for applications since the resources available to the applications can be scaled up or down based on the dynamic application workloads.

7) Reliability :- Applications deployed in cloud computing environments generally have higher reliability since the underlying IT infrastructure is professionally managed by the cloud service. Cloud service providers specify and guarantee the reliability and availability levels for their cloud resources in the form of SLAs.

Q1] b) Legal Issues in cloud computing

→ ① Significant issues regarding privacy of data and data security exist, specifically as they relate to protecting personally identifiable information of individuals, but also as they relate to protection of sensitive and potentially confidential business information.

② There are multiple contracting models under which cloud services may be offered to customers (eg. licensing, service agreements, on-line agreements, etc) >

③ Data to reside in disparate or multiple geographies. What country's law might govern in the event of a data breach or intrusion into cloud systems.

④ Commercial and business considerations require some attention. What happens to customer information, applications and data when a cloud provider is acquired? What are implications for the same set of information when a cloud provider files bankruptcy or ceases to do business? All these issues will be explored.

(Q4) a) Role of network in cloud?

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- ① Due to network only various services can be provided to clients.
 - ② Allows resource pooling.
 - ③ Virtualization is possible.
 - ④ Scaling is possible.
 - ⑤ Due to network any one can access cloud from any mobile devices.
 - ⑥ Physical workload is tied to particular server but virtual workload can exist anywhere on any server.

Q4] b) Cloud Computing Architecture :-

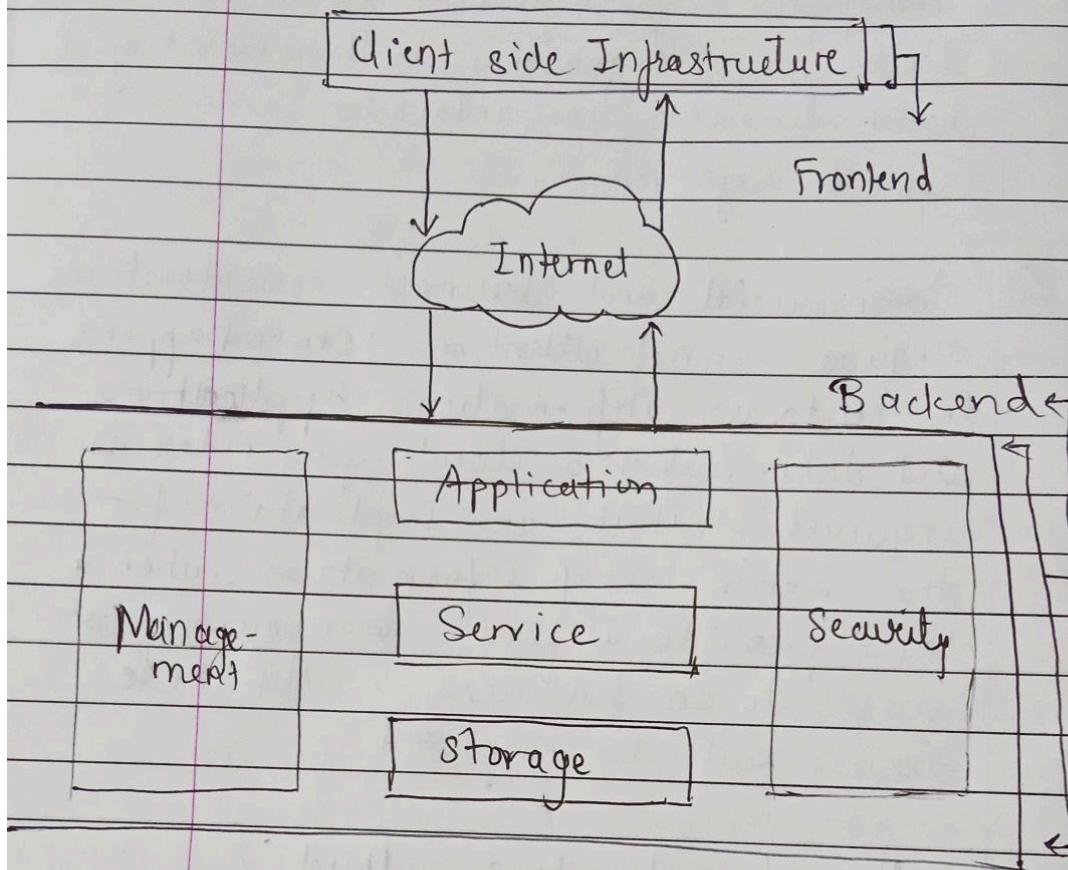


Fig:- Architecture of Cloud Computing.

Cloud Computing Architecture comprises of many cloud components, which are loosely coupled. We can broadly divide the cloud architecture into two parts :

- 1] Front End
- 2] Back End

Front End :- 1] The front end refers to the client side part of cloud computing system.

2] It consists of interfaces and applications that are required to access the cloud computing platforms, Example:- web browser.

3] The interaction is done through middleware or via web-browser or virtual sessions.

Back End :-

1] The back end refers to cloud itself.

2] It consists of all the resources to provide cloud computing services.

3] It comprises of huge data storage, virtual machines, security mechanisms, services, deployment models, servers, etc.

4] It is the responsibility of the backend to provide the security of data for cloud users along with the traffic control mechanisms. The server also

the middleware which helps to connect devices and communicate with each other.

Components of cloud computing architecture are Hypervisor, deployment software, server of cloud, storage of cloud, management software and Route of connectivity, etc.