~~Cloud~~ INTRODUCTION

UNIT-1

① Historical Development -

Five core technologies that played an important role in the realization of cloud computing. These technologies are -

(1) Distributed System -

It is a collection of independent computers that appears to its users as a single coherent system. Various properties are heterogeneity, openness, scalability, transparency, concurrency, availability and independent failures.

*** Three major milestones have led to cloud computing that is mainframe computing, cluster computing and grid computing

(2) Virtualization -

It allows creation of different computing environments. These environments are called virtual because they simulate the interface that is expected by a user. Eg - Hardware virtualization, storage virtualization and network virtualization (VMWare, VCloud, RightScale)

(3) Web 2.0 -

The Web is transformed into a rich platform for application development which is known as Web 2.0. It brings interactivity and flexibility into Web pages, providing enhanced user experience using different technologies such as XML, Asynchronous Javascript, AJAX etc. Eg - Facebook, Youtube, Wikipedia etc.

(4) Service Oriented Computing -

It supports the development of rapid, low-cost, flexible, interoperable and evolvable applications and systems.

A service is supposed to be loosely coupled, reusable, programming language independent and location transparent.

Two important concepts of service-oriented computing are -

(i) Quality of service (QoS) identifies a set of functional & non functional attributes that can be used to evaluate the behaviour of a service from different prospectives.

(ii) Software as a Service (SaaS) is inherited from ASPs (application service providers).

(5) Utility-Oriented Computing –

It is a vision of computing that define a service-provisioning model for compute services in which resources such as storage, compute power, applications and infrastructure are packed and offered on a pay-per-use basis.

(2) Vision of cloud computing –

Cloud computing allow anyone with a credit card to provision virtual hardware, runtime environments and services.

The long term vision of cloud computing is that IT services are traded as utilities in an open market, without technological and legal barriers.

(National Institute of Standards and Technology)

(3) Characteristics of cloud computing as per NIST –

Five essential characteristics of cloud computing are –

(1) On-demand self service –

Compute services can be provided without requiring interaction with service provider.

(2) Broad Network Access –

Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms. Eg- mobile phones, tablets, laptops etc.

(3) Resource Pooling –

The providers computing resources are pooled together to serve multiple customers, with different physical and virtual resources dynamically assigned and reassigned according to the customers demand without control or knowledge over the exact location of provided services.

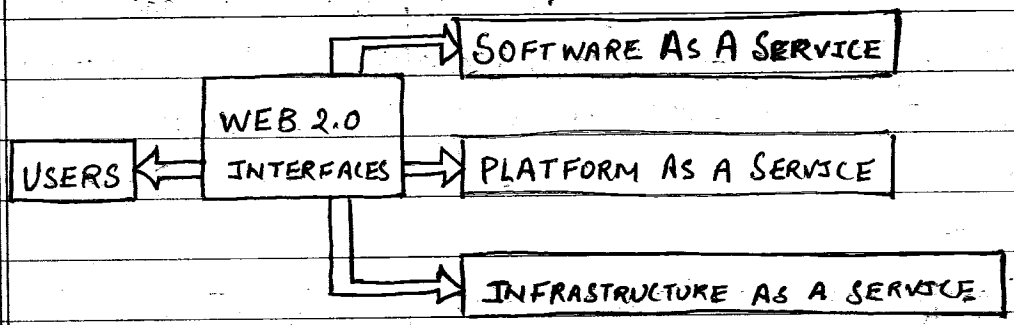
(4) Rapid Elasticity –

Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand.

(5) Measured Service -

Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service.

(4) Cloud computing reference model -



IaaS - It delivers infrastructure on demand in the form of virtual hardware, storage and networking. Eg - vCloud, S3.

PaaS - It delivers scalable and elastic runtime environment on demand and host the execution of applications. Eg. - Azure, Hadoop.

SaaS - It provides applications and services such as social networking, photo editing, office automation etc. Eg - Facebook, Salesforce.

(5) Cloud computing Environments -

It encompasses both the development of applications and systems that leverage cloud computing solutions and the creation of frameworks, platform and infrastructures delivering cloud computing services.

Application development -

Cloud computing benefit from its capability to dynamically scale on demand. Various application are web applications, enterprise applications, resource-intensive application and scientific applications.

Infrastructure and System development -

Core technologies are distributed computing, virtualization, service orientation and Web 2.0.

Computing platforms and Technologies -

(1) Amazon Web Services (AWS) - provides IaaS services. AWS is mostly known for its compute and storage-on-demand services such as - Elastic Compute Clould (EC2) provides users with customizable virtual hardware that can be used as the base infrastructure for deploying computing systems on the cloud.
Simple Storage Service (S3) delivers persistent storage on demand.

(2) Google AppEngine - It is a scalable runtime environment mostly devoted to executing Web applications. It services include in-memory caching, scalable ~~and bigt~~ data store, job queues, mailing and cron tasks.

(3) Microsoft Azure - It is a cloud operating system and a platform for developing applications in the cloud. It provides web role, worker role and virtual machine role.

(4) Hadoop - Apache Hadoop is an open source framework that is suited for processing large data sets on commodity hardware. It provides runtime environment, and developers need only provide the input data and specify the map and reduce functions that need to be executed.

(5) Force.com and Salesforce.com -

Force.com is a cloud computing platform for developing social enterprise applications. The platform is the basis for Salesforce.com, a SaaS solution for customer relationship management.

(6) Manjrasoft Aneka - It is cloud application platform for rapid creation of scalable applications and their deployment on various types of clouds in a seamless and elastic manner.

(6) Cloud Services Requirements -

A proven service management system to provide visibility, control and automation across services to help accelerate standardization, rapid client payback on investment.

Various IT service management are knowledgement management, service request, asset lifecycle manager, self service portal, Policy & compliance, service level management, responsibility and dashboard, process manager, change and release, incident and problem, service catalogue, configuration management and event management.

⑦ Cloud and Dynamic Infrastructure –

Cloud computing is dynamic in nature. It allows client to access standardized IT resources to deploy new applications, services or computing resources rapidly without reengineering their entire infrastructure, thus making it dynamic.

Cloud Dynamic Infrastructure provides the following features –

(1) Service Management - that is IaaS, PaaS, SaaS which manages IT services which includes visibility, automation and control to delivering the first class IT services.

(2) Asset Management - The assets or the property which is involved in providing the cloud services are getting managed in such a way so that their value will got maximized.

(3) Virtualization and Consolidation - Resources are getting utilized more and more efficiently and also the operating cost of the systems is getting down.

(4) Information Infrastructure – It helps the business organizations to achieve information compliance, availability of resources retention and security objectives.

(5) Energy-Efficiency – IT infrastructure or organization is sustainable. It means it is not likely to damage or effect any other thing.

(6) Security - This cloud infrastructure is responsible for the risk management and customizing the governance (administration).

(7) Resilience - Infrastructure is safe from all side. The IT operations will not be easily get affected.

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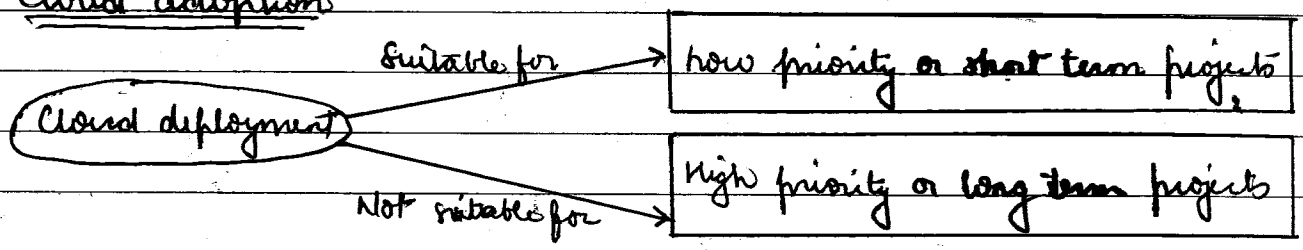
(8) Cloud adoption -



Cloud adoption is suitable for -

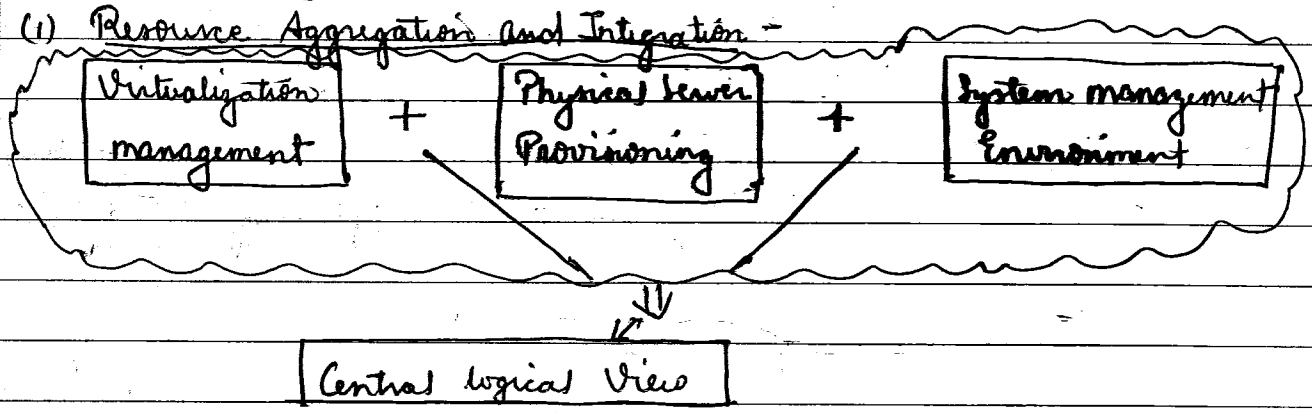
(1) low availability requirement and short life spans
(2) ~~to~~ recovery management, backup recovery based implementations
(3) modular and loosely coupled applications.
(4) Research and development projects

Cloud adoption is not suitable for -

(1) Goal-critical applications.
(2) Core business applications
(3) Data sensitive applications

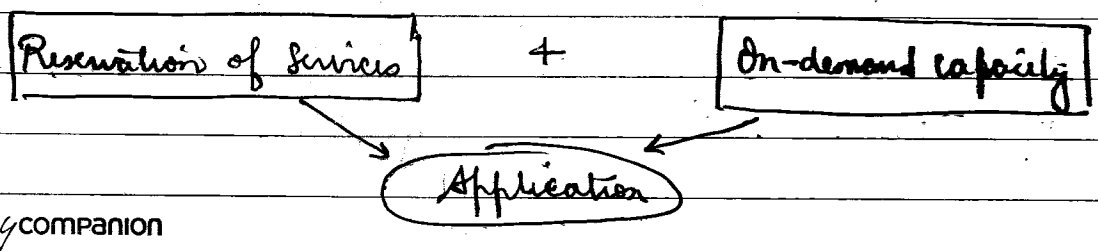
(9) Cloud Rudiments - (essential)

(1) Resource Aggregation and Integration -



Cloud solution integrates or aggregates the information of these 3 resources and after that the integrated information will be sent into a central logical view.

(2) Application services -



→ The application instances represents the agreement between service provider and the consumer to use services on On-Demand basis.

→ Reservation of resources means that it is guaranteed that at a given point of time the resources or the services will surely available for consumer.

(3) Self-service portal -

Users can request machine or entire multi-machine environments and monitor and control them using a web-based self-service portal.

(4) Allocation Engine -

The Dynamic Resource Management (DRM) provides the automated allocation and reallocation of resources.

DRM maximize the efficiency of IaaS.

(5) Reporting and Accounting -

The actual resource allocation and the actual cloud usage will be get recorded or collected in an accounting database.

The data will be available centrally to create reports of usage.

Cloud Features →

- Dynamic Workload Management -

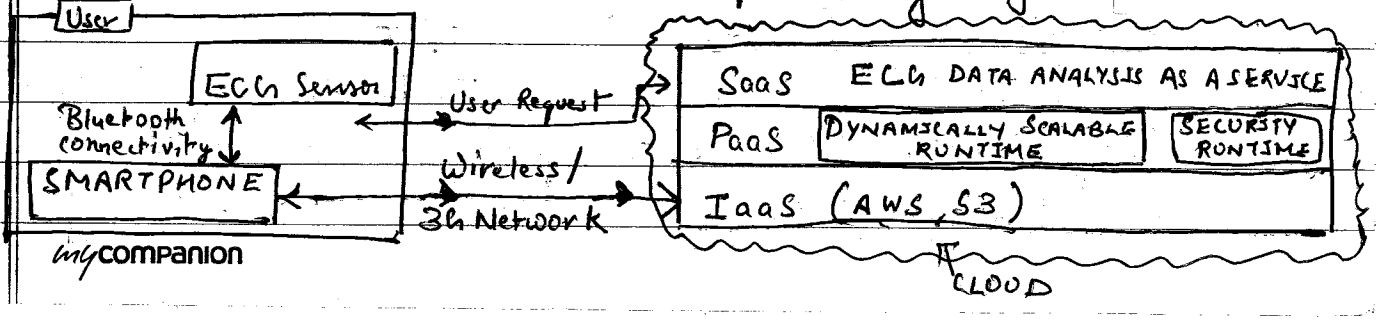
Cloud virtual machines are enabled with automated softwares that control the workflow request and also enabled with a lifecycle that increase the effective utilization of resources.

Overview of Cloud Application -

(1) ECG analysis in the cloud (Healthcare) -

The remote monitoring of a patient's heartbeat data, data analysis in minimal time, and the notification of first-aid personnel and doctors should these data reveal potentially dangerous conditions.

eg -



Orchestrator is a workflow management software for the data center.

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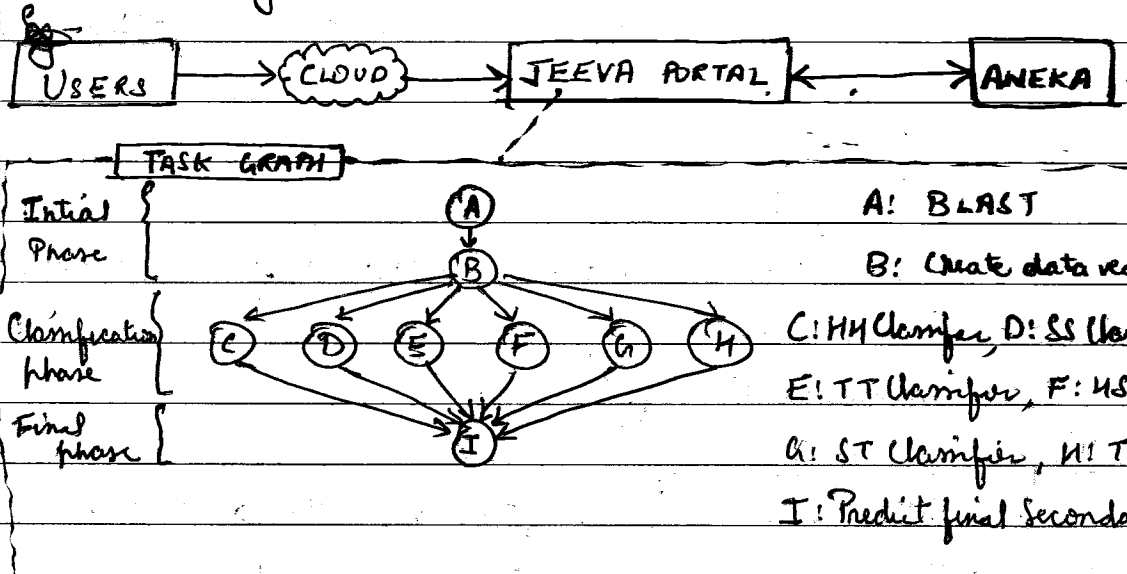
② Protein Structure Prediction (Biology) -

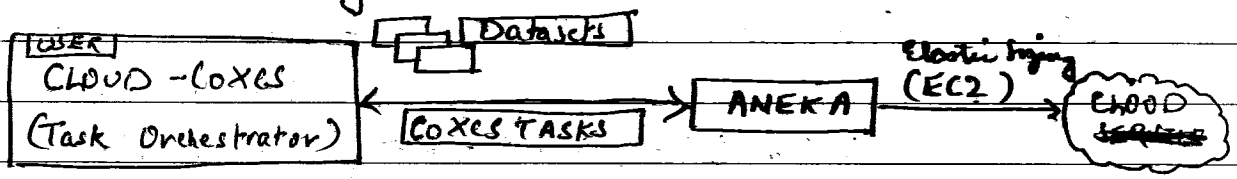
It is computationally intensive task that is fundamental to different types of research in the life sciences. This task requires the investigation of a space with a massive number of states, consequently creating a large number of computations for each of these states. Eg - Jeeva Portal.



③ Gene Expression Data analysis for cancer diagnosis (Biology) -

It is used to understand the biological processes that are triggered by medical treatment at a cellular level.

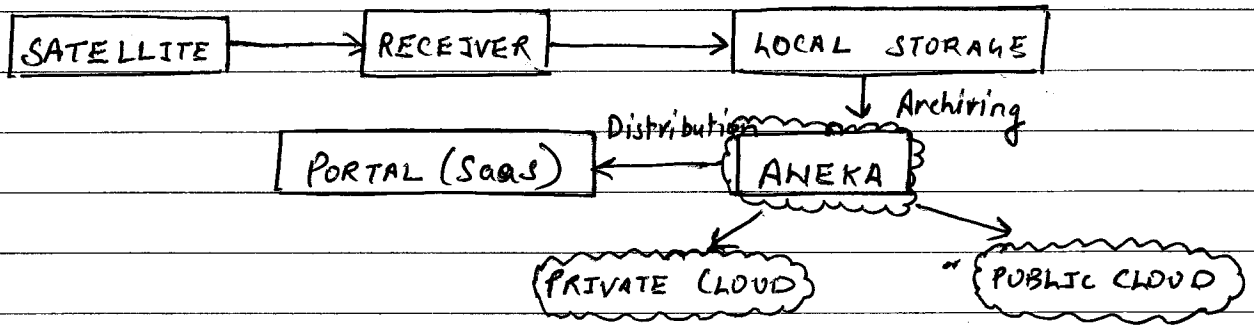
Extended Classifier System (XCS) has been successfully utilized for classifying large data sets in the bioinformatics and computer science domains. Eg - Cloud-CoXCS.



④ Satellite Image Processing (Geoscience) -

Satellite remote sensing generates hundreds of gigabytes of raw images that need to be further processed to become the base of several different Geographic Information System (GIS) products.

Eg -



(5) CRM and ERP -

CRM → Customer Relationship Management

ERP → Enterprise Resource Planning

Cloud CRM applications consitute a great opportunity for small enterprises and start-ups to have a fully functional CRM software without large up front cost & by paying subscriptions.

ERP integrates several aspects of an enterprise - finance and accounting, human resources, manufacturing, supply chain management, project management and CRM.

CRM examples - Salesforce.com, Microsoft Dynamics CRM, Netsuite Global CRM+

ERP example - Netsuite Global ERP

(6) Social Networking -

TO sustain their traffic and serve millions of users seamlessly, services such as Twitter and Facebook have leveraged cloud computing technologies. The possibility of continuously adding capacity while systems are running is the most attractive feature for social networks, which constantly increase their user base.