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DETAILED LECTURE NOTES

Characteristics of Cloud Computing -

- ① On-demand self-service
- ② Broad network access
- ③ Rapid elasticity
- ④ Resource pooling
- ⑤ Measured service

Issues in cloud computing

Cloud computing is internet based computing where shared resources, software and information are provided to computers and other devices on demand.

These are major issues in cloud computing - ^{Ethical}

- i) Privacy
- ii) Compliance
- iii) Security
- iv) Sustainability
- v) Abuse
- vi) Higher cost
- vii) Recovery of lost data (contingency)
- viii) Upkeep (management) of cloud
- ix) Lack of resources / skilled expertise
- x) Pay per use service charges.

Cloud computing definition - Cloud computing is an ~~an~~
on-demand service model for IT provision, often
based on virtualization and distributed computing
technologies. Cloud computing architectures have:

- highly abstracted ~~resource~~ resources.
- near instant scalability and flexibility
- near instantaneous provisioning
- shared resources (hardware, database,
memory etc.)
- Service on demand usually with a pay as
you go billing system.
- Programmatic management ~~Req.~~

~~Issues in cloud computing~~

Important Components of Cloud Architecture -

- ① Client Infrastructure
- ② Application
- ③ Service
- ④ Runtime cloud
- ⑤ Storage
- ⑥ Infrastructure
- ⑦ Management
- ⑧ Security
- ⑨ Internet



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Benefits of Cloud Computing Architecture -

- Significantly reduces IT operating costs.
- Offers good user accessibility
- It has a better disaster recovery.
- Provides high security
- Helps to enhance your data processing.



Cloud Migration:- A cloud migration is when a company moves some or all its data center capabilities into the cloud, usually to run on the cloud based infrastructure. Provided by a cloud service provider such as AWS, Google Cloud or Azure.

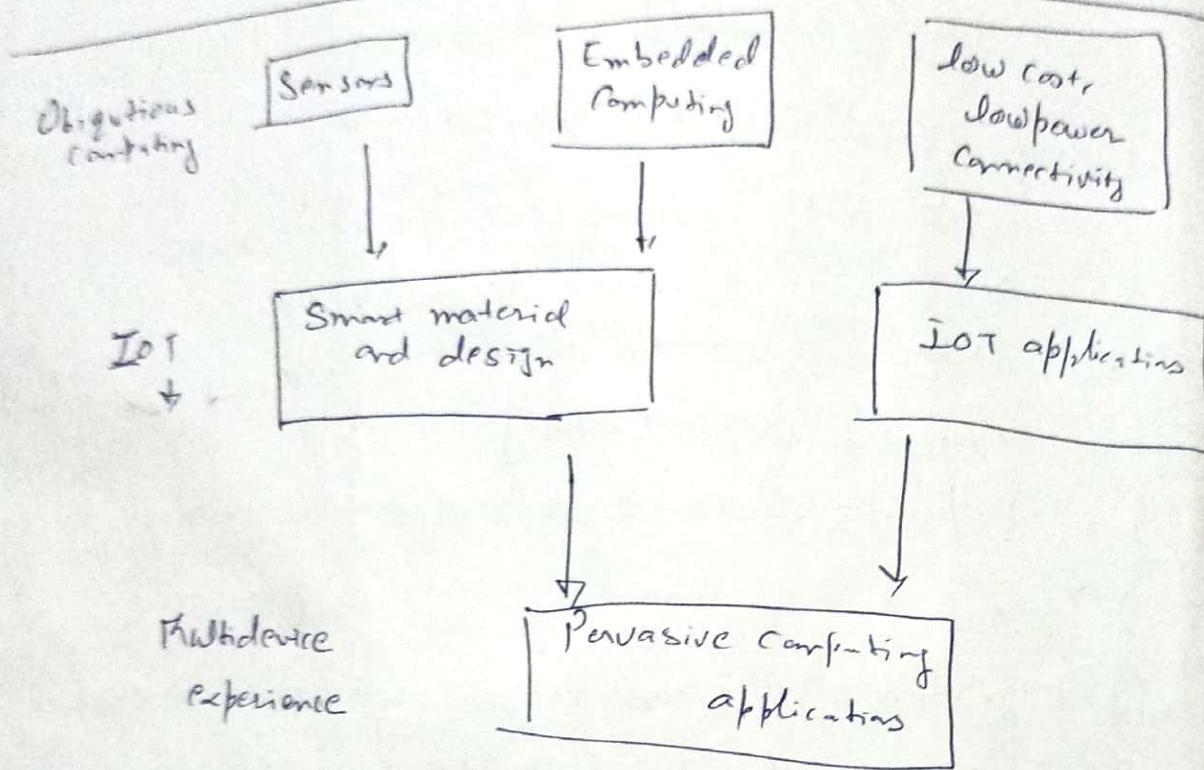
Benefits of Cloud migration of cloud -

- Scalability
- Cost
- Performance
- Digital Experience

Common Cloud Migration Challenges:-

- i) Lack of Strategy
 - ii) Cost Management
 - iii) Vendor lock-in
- iv) Data Security and Compliance.

- Cloud Service Providers -
- i) AWS ii) Microsoft Azure iii) Google Cloud
 - iv) Alibaba cloud v) Oracle cloud vi) IBM cloud
 - vii) Tencent cloud



Cloud Migration Process - Common elements of cloud migration

Strategy include the following -

- Evaluation of performance and security requirements.
- Selection of cloud provider.
- Calculation of costs.
- Any the organization deemed necessary.

At the same time, be prepared to address several common challenges during a cloud migration:-

- Interoperability
- Data and application portability
- Data integrity and security
- Business continuity



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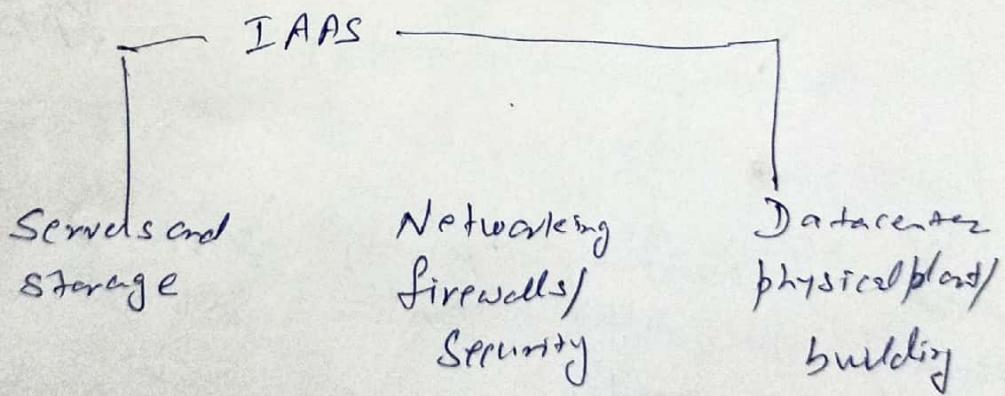
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Cloud Computing - The important characteristics of cloud computing is ability to deliver a variety of services which can be diverse from each other.

Types of Cloud Computing Reference Model - Cloud Service Models

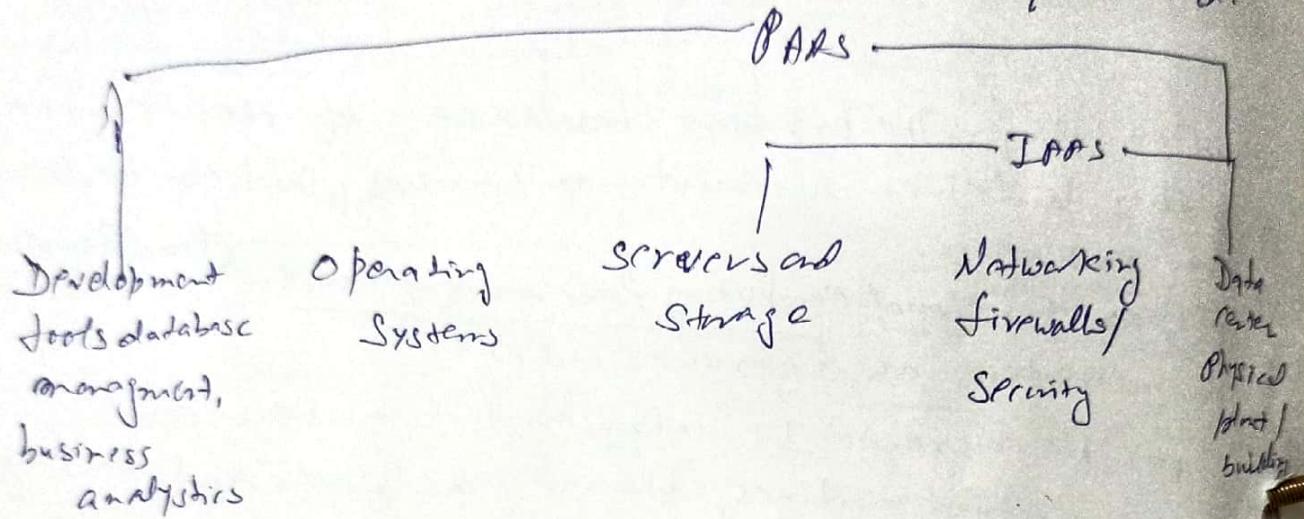
Infrastructure as a Service (IaaS)

i) We can rent IT infrastructure servers and virtual machines, storage, networks and operating system from cloud provider on a pay-as-you-go basis. It's an instant computing infrastructure provisioned and managed over the internet. Virtual hardware is provided on demand in the form of virtual machine instances.

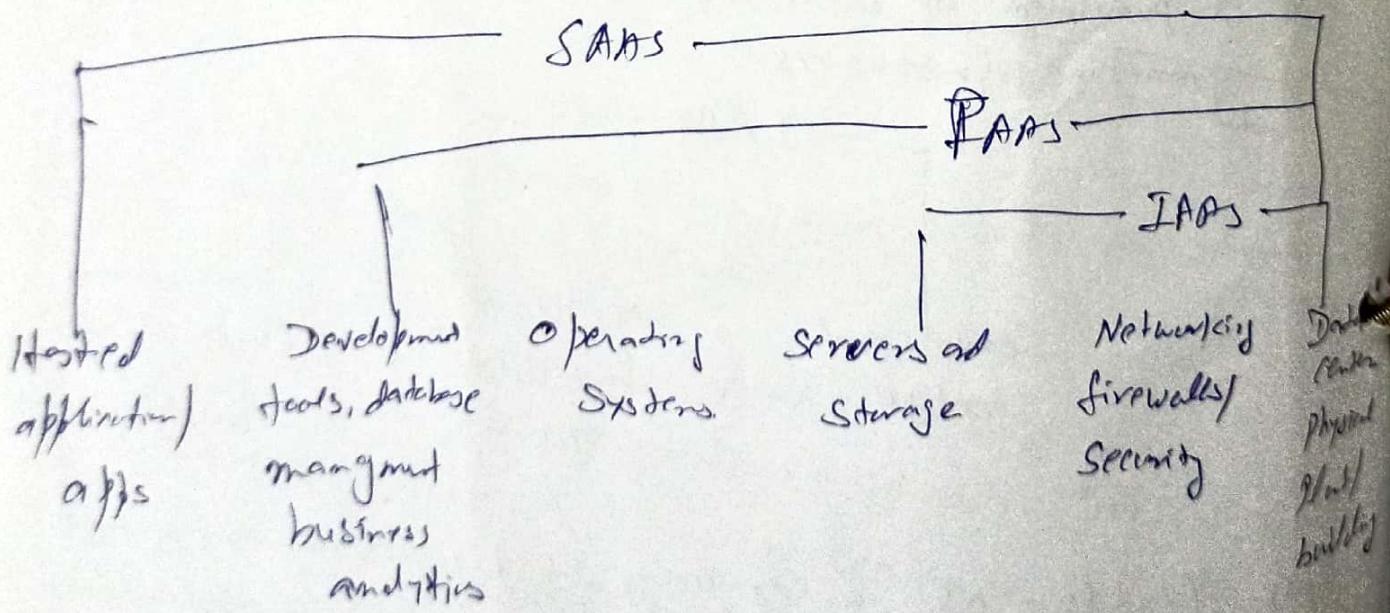


PaaS Platform as a service - It provides an environment for building, testing, and deploying software applications. The goal of PaaS is to help create an application as quickly as possible without having a focus on managing the underlying infrastructure.

SaaS models deliver scalable and elastic runtime environments on demand and host execution of applications. These services are backed by a core platform that is responsible for creating an abstract environment where applications are deployed/ executed.



SaaS - This is centrally hosted and managed for the end customer. Common examples email, calendars, and office tools.





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Cloud Migration Strategies -

- Rehost - Or "lift and shift" involves using infrastructure as a service. You simply redeploy your existing data and applications on the cloud server. It is also a good option for cases where it is difficult to modify the code, and you want to migrate your applications intact.
- Refactor - or lift, tinker and shift. is when you tweak and optimize your applications for the cloud. In this case PaaS model is ~~not~~ employed. The core architecture of the applications remain unchanged, but the adjustments are made to enable the better use of cloud based tools.
- Revise - Revision builds upon the previous strategies, requiring more significant changes to the architecture and code of the systems being moved to cloud. This is done to enable applications to take full advantage of the services available in the cloud which may require introducing major code changes. This strategy requires foreplanning and advanced knowledge.

• Rebuild:- Rebuild ~~involves~~ discarding the existing code base and replacing it with a new one. This process takes a lot of time and is only considered when companies decide that their existing solutions don't meet current business needs.

• Replace:- The company doesn't redevelop its own ~~or~~ native application from scratch. This involves migrating to a third party, prebuilt application & the data while every thing else about the system is new.

Cloud Migration Strategies -

① Refactor - or Rearchitect

Rearchitect with cloud native features.

Traditional
server

Database

Storage

Cost log-run

AWS Cloud

Amazon
Elastic
Container
Service

Amazon
Dynamo
DB

Amazon
RDS

S3 object
store

Amazon
S3 Glacier

② Replatform. Lift, reshape /inker & shift.

Traditional
server

Cost log-run

AWS Cloud

Amazon Elastic
Kubernetes
Service

③ Rehost - Lifting & Shift - Maintain logrun

Traditional
server

Amazon
EC2

④ Repurchase - BI Tools, Reporting Tools.

⑤ Retain - Revisit

⑥ Retire - Decommission the application.



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- For showing max. memory size for the current user.
ulimit -m
- For showing max. memory size limit
ulimit -v



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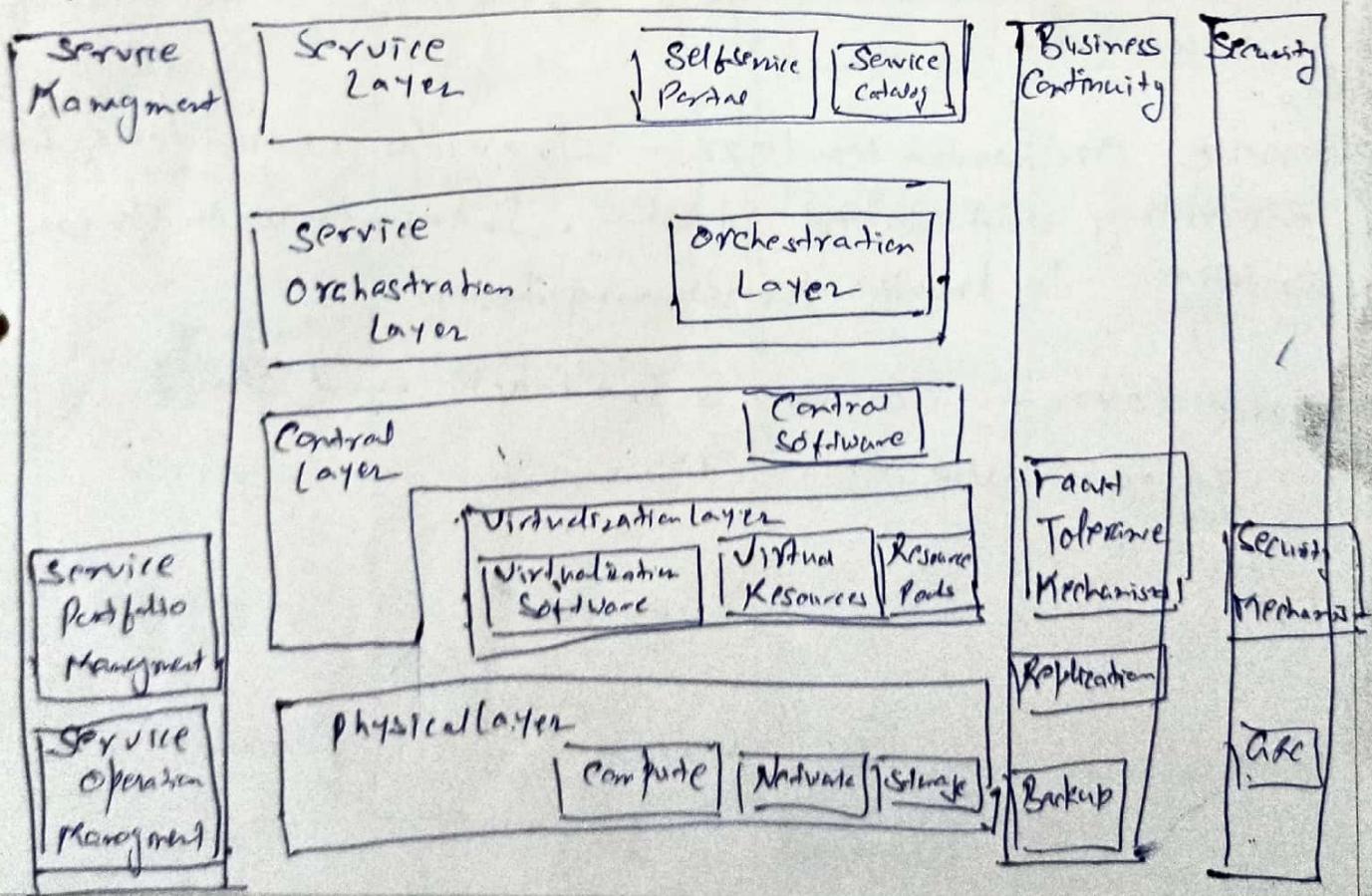
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Unit - 2

Cloud Reference Model - The cloud computing reference model is an abstract model that characterizes and standardizes the functions of a cloud computing environment by ~~partitioning~~ partitioning it into abstraction layers and cross layer functions. This reference model groups the cloud computing functions and activities into five logical layers and three cross layer functions.



Physical Physical Layer - Exports requests generated by the virtualization and control layer.

Virtual Layer - Abstracts physical resources and makes them appear as virtual resources (Enables multi-tenant environment). Exports the requests generated by control layer.

Control layer - → Enable resource configuration.
→ Resource pool configuration
→ Resource provisioning.

- Exports requests generated by a service layer.
- Exposes resources to and support the service layer.
- Collaborates with the virtualization software enables resource planning and creating virtual resources, dynamic allocation and optimizing utilization of resources.

Q. Service Orchestration layer - Provides workflows for executing automated tasks. Interacts with various entities to invoke provisioning tasks.

Service Layer - Consumers interact and ^{consume} cloud resources via this layer.

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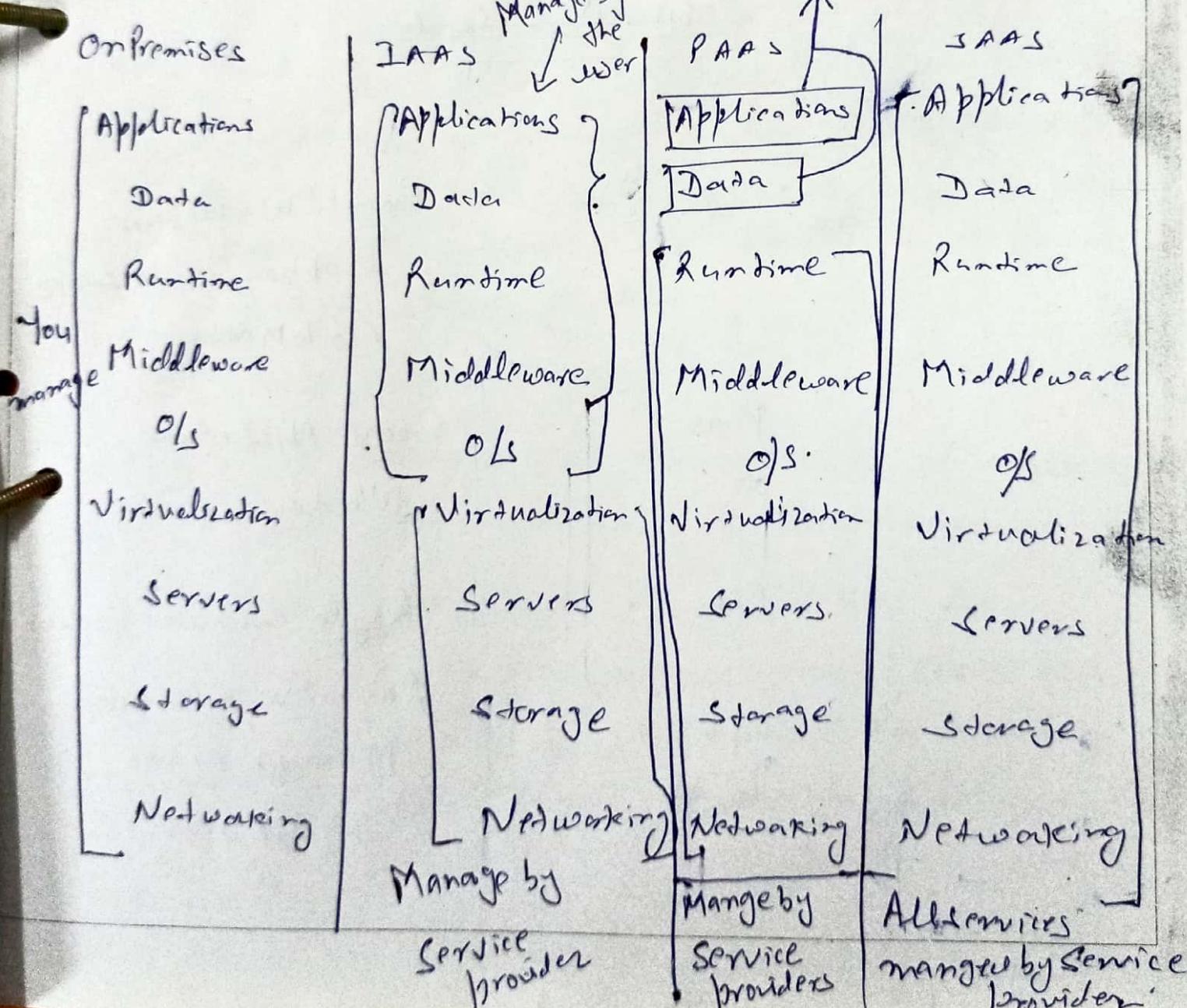
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Cloud Computing Services

- ① Software As a Service → Google Services (Apps)
- ② Platform As a service Azure AWS Manage by users
- ③ Infrastructure as a Service Manage by user Reespace, AWS S3



IaaS - Is on demand access to virtual servers, storage and networking for the backend IT infrastructure for running applications and workload in cloud.

PaaS - Is on-demand access to complete, ready to use, cloud hosted platform for developing, running, maintaining and managing applications.

SaaS - Is on demand access to ready to use cloud hosted application software.

Types of Clouds

Examples

~~for~~

SaaS

Google Workspace,
Dropbox, Salesforce,
GoToMeeting

PaaS

Google App Engine,
Windows Azure

IaaS

Google Compute Engine
Amazon Web Service
Microsoft Azure,
Digital Ocean



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Types of cloud

- ① Public cloud
- ② Private cloud
- ③ Hybrid cloud
- ④ Community cloud

Public cloud -

- ① Public clouds are managed by third parties which provide cloud services over the internet to the public, these services are available as pay as you go billing models.
- ② Those deploy Globally.
- ③ The fundamental characteristics of a ~~cloud~~ public clouds are multitenancy.
- ④ A public cloud offer solutions for minimizing IT infrastructure costs and became a good option for handling local clouds on the local infrastructure.

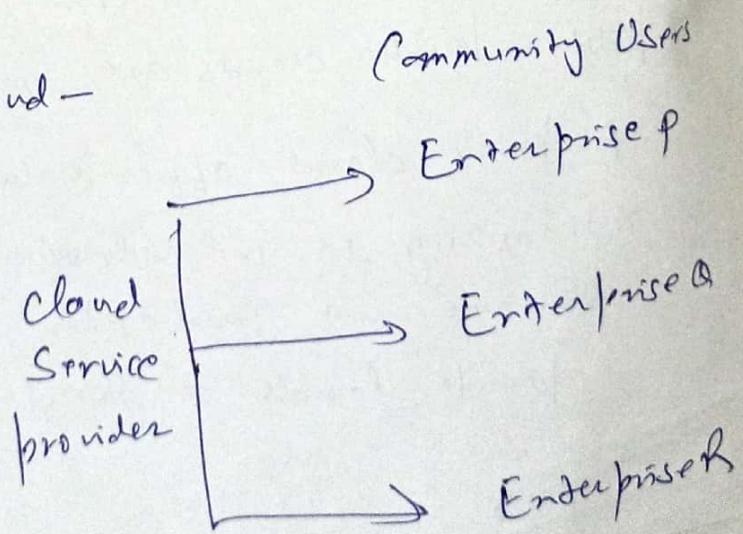
Private cloud - These deploy locally.

- ① Private clouds are distributed systems that work on private infrastructure and provide the users with dynamic provisioning of computing resources.
- ② Instead of a pay-as-you-go model in private clouds, there could be other schemes that manage the usage of the cloud and proportionally billing of the different departments or sections of an enterprise.

Hybrid cloud - Combination of public and private cloud. It is a heterogeneous distributed system formed by combining facilities of public cloud and private clouds.

Hybrid cloud took advantage of public and private cloud.

Community Cloud -



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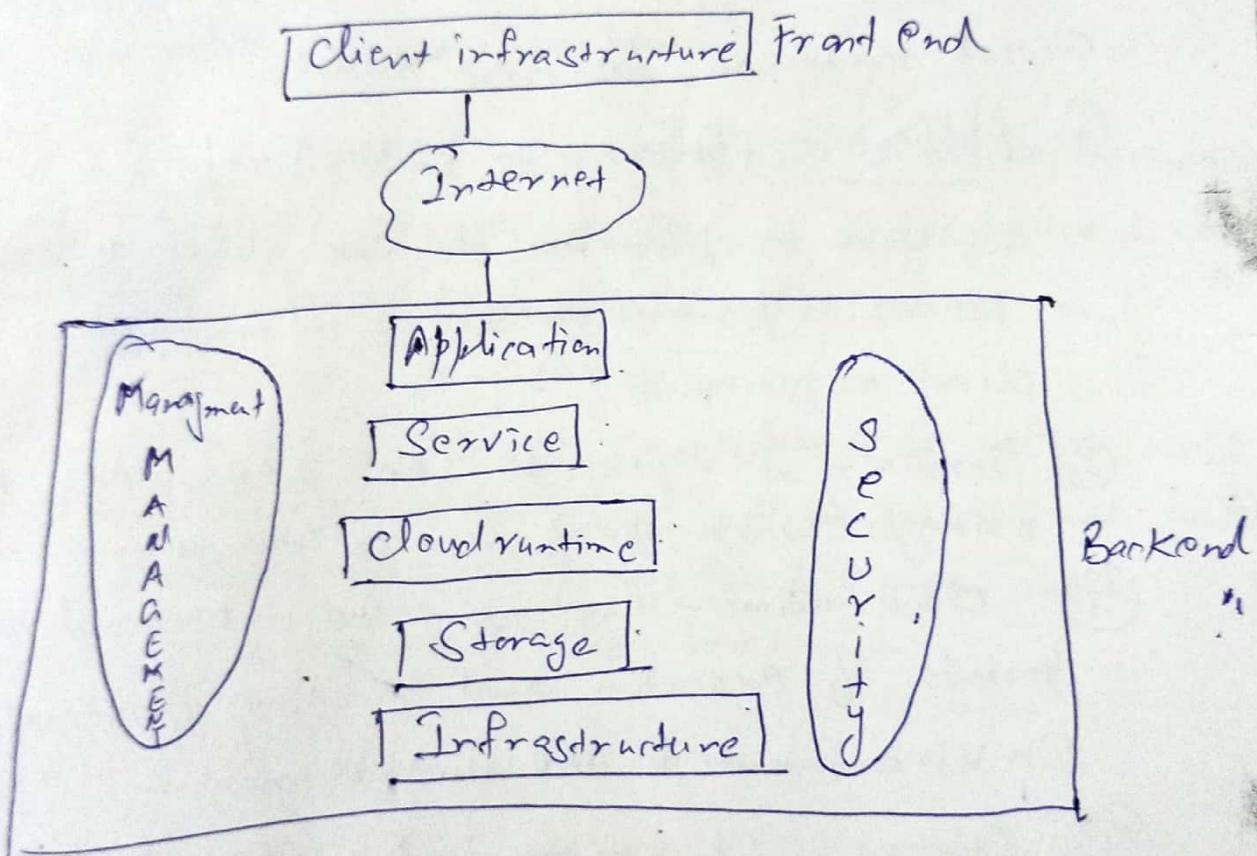
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Cloud Computing Architecture - Unit - 2

The cloud architecture is divided into 2 parts -

1. Frontend 2. Backend



Architecture of cloud computing is the combination of both Service oriented Architecture and EDA Event driven Architecture.

1. Frontend - Front end of the cloud architecture refers to the client side of cloud computing system. It contains all the user interfaces and applications which are used by the client to access the cloud computing services / clouds. For example use of web browser to access the cloud platform.
2. Backend - It is a cloud which is used by service provider. It contains the resources as well as manages the resources and provides security mechanisms. Along with this it includes huge storage, virtual applications, traffic control mechanisms, deployment models.

- ① Application - Application in backend refers to a software or platform to which client accesses means it provides the service in backend as per client requirement.
- ② Service - It refers to SaaS, IaaS, PaaS. Also manages which type of service the user accesses.
- ③ Cloud runtime - Runtime cloud in backend refers provide of execution and runtime platform environment to the virtual machine.
- ④ Storage - It refers to provide flexible and scalable storage service and management of stored data.
- ⑤ Infrastructure - Cloud infrastructure in backend refers to the hardware and software components like it includes servers, storage devices, network devices, virtualization software etc.



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6. Management - Management in backend refers to the management of backend components like application, Service, ~~runtime~~, cloud, storage, infrastructure and other security mechanism.
7. Security - Security in backend refers to implementation of different security mechanisms in the backend for secure cloud resources, systems, files and infrastructure to end users.
8. Internet - Internet connection acts as the medium or a bridge between frontend and backend and establishes the interaction and communication between frontend and backend.



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Parallel Computing - In parallel computing multiple processors performs multiple tasks assigned to them simultaneously.

Memory in parallel systems can be either shared or distributed, Parallel computing provides concurrency and saves time and money.

Distributed Computing - In distributed computing we have multiple autonomous computers which seems to the user as single system. In distributed systems there is no shared memory and computers communicate with each other through message passing. In distributed computing a single task is divided among different computers.

Difference between Parallel Computing and Distributed computing

Parallel Computing

- ① Many operations are performed simultaneously
- ② It ~~have~~ may have shared or distributed memory.

Distributed Computing

- System components are located at different locations.
- It have only distributed memory.

- Parallel Computing
- ③ Multiple ~~processes~~ processors perform multiple operations.
- ④ Processors communicate with each other through bus
- ⑤ Improves the system performance

multiple computers performing multiple operations.

Computers communicate with each other through message passing.

Improves system scalability, fault tolerance and resource sharing capabilities.

What is Hadoop?

Apache

Open Source Framework

Java

Distributed Storage

Distributed processing

Big data

HDFS

Map Reduce

Simple Programming Model

Parallel Processing

Local file system



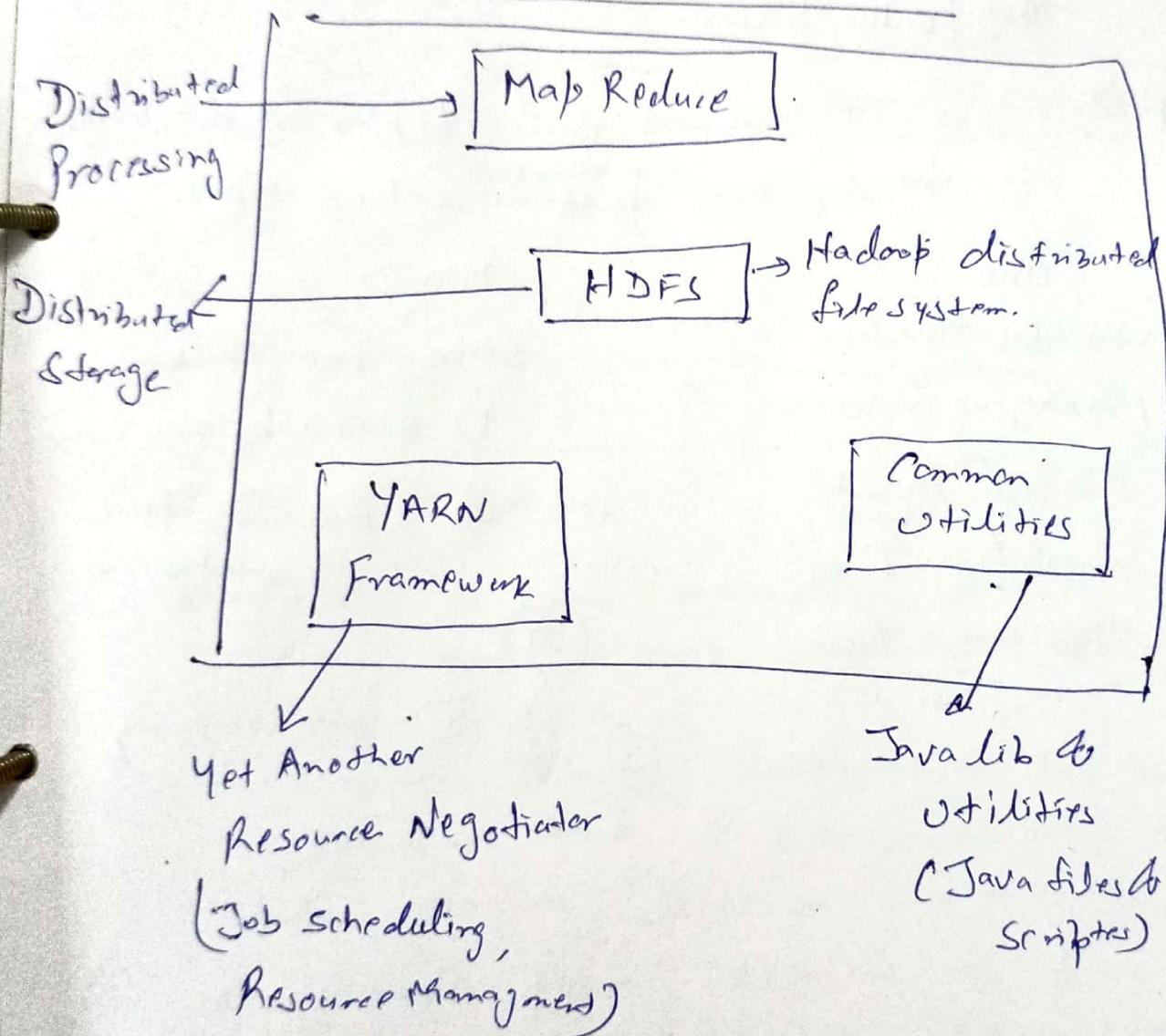
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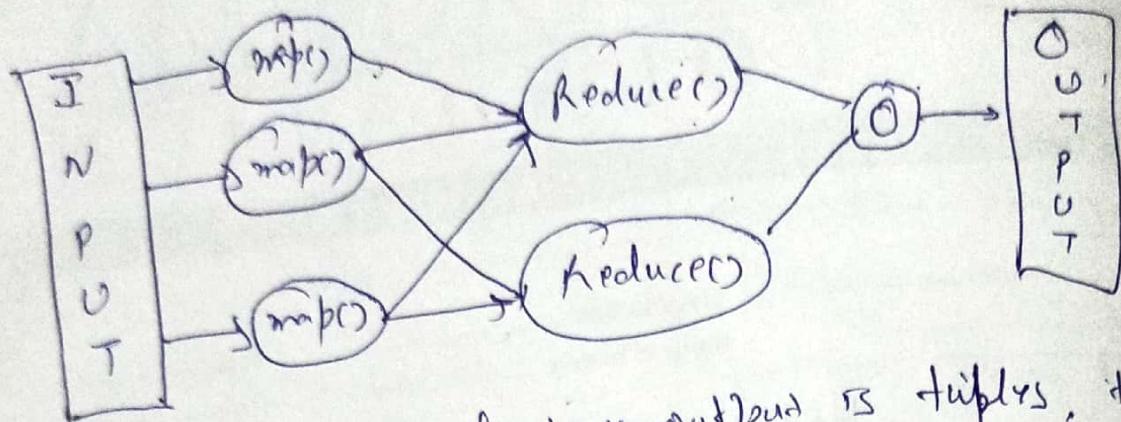
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Hadoop Architecture



Map Reduce



`map()` → This function's output is tuples, these are key | value pairs.

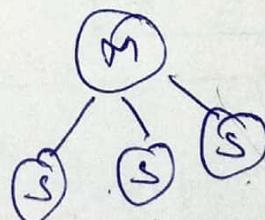
`reduce()` → It combines various tuples on the basis of keys, and ~~performs~~ ^{Combine} set of tuples.

Master Job Tracker
One

- ① Managing Resources
- ② Resource Mgmt
- ③ Scheduling Task
- ④ Monitoring Task

Many
Slave Task Tracker

- 1) Executes the task
- 2) Provide Task status.



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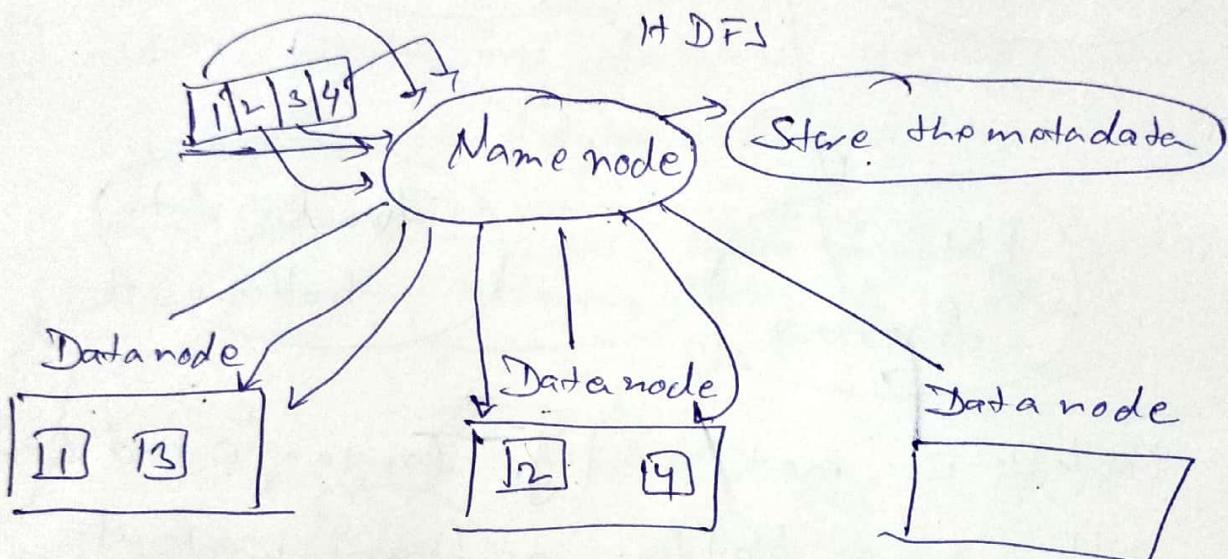
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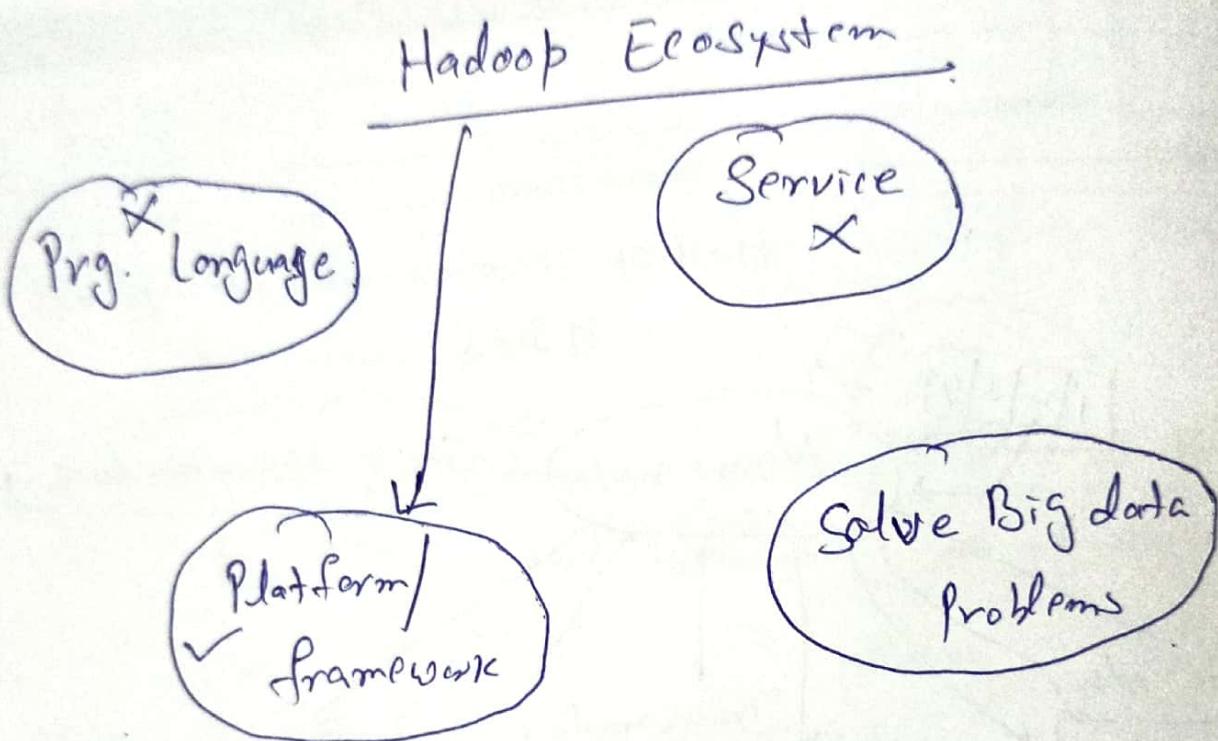
Hadoop Distributed File System



64MB → Default Size

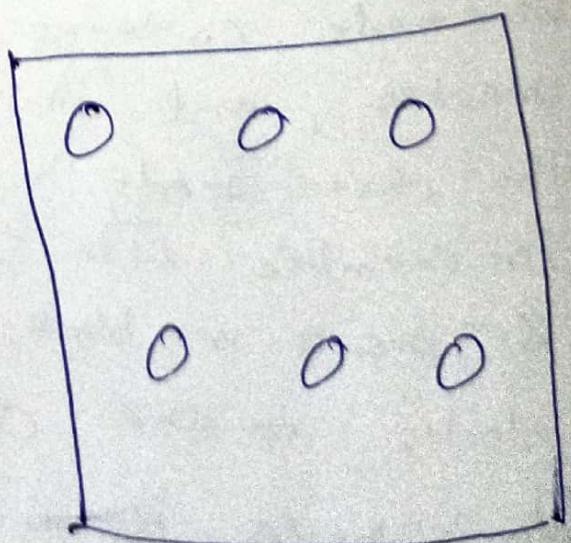
- ① Name node contains metadata. It acts as a master, and it maps the file's block to the data node.
- ② For example file is divided into 1, 2, 3, 4 segments or block. • Name node maps the blocks to the different data nodes.
- ③ Name node ~~is~~ sends instructions to data node to make replica of the file's segment, and it also suggests the data node that if file segment is not very useful in the particular time instant delete that file's segment.

④ so opening the file segment, make replica of file segment, deleting the file segment all are maintained by name node.



Hadoop is not a prg. language and Service
It is a platform or framework to
Solve big data problems.

- HDFS
 - YARN
 - MapReduce
- Apache Pig
→ Apache Hive
→ Mahout





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HBase → Is a database

① It is distributed database, no SQL based system. It stores data in form of columns and rows in a table.

