1 Nosql Databases :

A NoSQL DBMS (Not only SQL database management system) is system software designed to create and manage NoSQL databases. The DBMS provides users and programmers with a systematic way to create, retrieve, update and manage data.

* Types of Nosql Databases

Type Examples of this type

Data-Structures Server Redis

Tuple Store Apache River, Coord, GigaSpaces

Object Database DB4O, Objectivity/DB, Perst, Shoal, ZopeDB

Document Store ArangoDB, Clusterpoint, Couchbase, CouchDB, DocumentDB, IBM Domino, MarkLogic, MongoDB, Qizx, RethinkDB, XML-databases

* CAP Theorem

CAP stands for :

Consistency : Every read receives the most recent write or an error

Availability: Every request receives a (non-error) response – without guarantee that it contains the most recent write

Partition Tolerance : The system continues to operate despite an arbitrary number of messages being dropped (or delayed) by the network between nodes.

No distributed system is safe from network failures, thus network partitioning generally has to be tolerated. In the presence of a partition, one is then left with two options: consistency or availability. When choosing consistency over availability, the system will return an error or a time-out if particular information cannot be guaranteed to be up to date due to network partitioning. When choosing availability over consistency, the system will always process the query and try to return the most recent available version of the information, even if it cannot guarantee it is up to date due to network partitioning.

* HBase Architecture

HBase provides low-latency random reads and writes on top of HDFS. In HBase, tables are dynamically distributed by the system whenever they become too large to handle (Auto Sharding). The simplest and foundational unit of horizontal scalability in HBase is a Region. A continuous, sorted set of rows that are stored together is referred to as a region (subset of table data). HBase architecture has a single HBase master node (HMaster) and several slaves i.e. region servers. Each region server (slave) serves a set of regions, and a region can be served only by a single region server. Whenever a client sends a write request, HMaster receives the request and forwards it to the corresponding region server.

Components of Apache HBase Architecture

HBase architecture has 3 important components- HMaster, Region Server and ZooKeeper.

HMaster

HBase HMaster is a lightweight process that assigns regions to region servers in the Hadoop cluster for load balancing. Responsibilities of HMaster –

Manages and Monitors the Hadoop Cluster

Performs Administration (Interface for creating, updating and deleting tables.)

Controlling the failover

DDL operations are handled by the HMaster

Region Server

These are the worker nodes which handle read, write, update, and delete requests from clients. Region Server process, runs on every node in the hadoop cluster. Region Server runs on HDFS DataNode and consists of the following components –

Block Cache – This is the read cache. Most frequently read data is stored in the read cache and whenever the block cache is full, recently used data is evicted.

MemStore- This is the write cache and stores new data that is not yet written to the disk. Every column family in a region has a MemStore.

Write Ahead Log (WAL) is a file that stores new data that is not persisted to permanent storage.

HFile is the actual storage file that stores the rows as sorted key values on a disk.

Zookeeper

HBase uses ZooKeeper as a distributed coordination service for region assignments and to recover any region server crashes by loading them onto other region servers that are functioning. ZooKeeper is a centralized monitoring server that maintains configuration information and provides distributed synchronization. Whenever a client wants to communicate with regions, they have to approach Zookeeper first. HMaster and Region servers are registered with ZooKeeper service, client needs to access ZooKeeper quorum in order to connect with region servers and HMaster. In case of node failure within an HBase cluster, ZKquoram will trigger error messages and start repairing failed nodes.

ZooKeeper service keeps track of all the region servers that are there in an HBase cluster- tracking information about how many region servers are there and which region servers are holding which DataNode. HMaster contacts ZooKeeper to get the details of region servers. Various services that Zookeeper provides include –

Establishing client communication with region servers.

Tracking server failure and network partitions.

Maintain Configuration Information

Provides ephemeral nodes, which represent different region servers.

* HBase vs RDBMS

Schema/Database in RDBMS can be compared to namespace in Hbase.

A table in RDBMS can be compared to column family in Hbase.

A record (after table joins) in RDBMS can be compared to a record in Hbase.

A collection of tables in RDBMS can be compared to a table in Hbase..