Programming for Big Data

Apache Kafka and Flume

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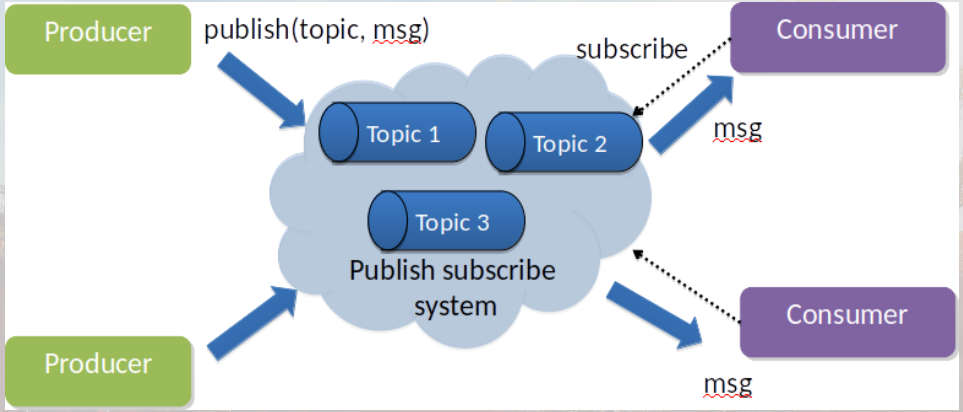
Outline


Producer
publish(topic, msg)
subscribe
Consumer
Topic 1
Topic 2
msg
Topic 3
Publish subscribe system
Producer
Consumer
msg

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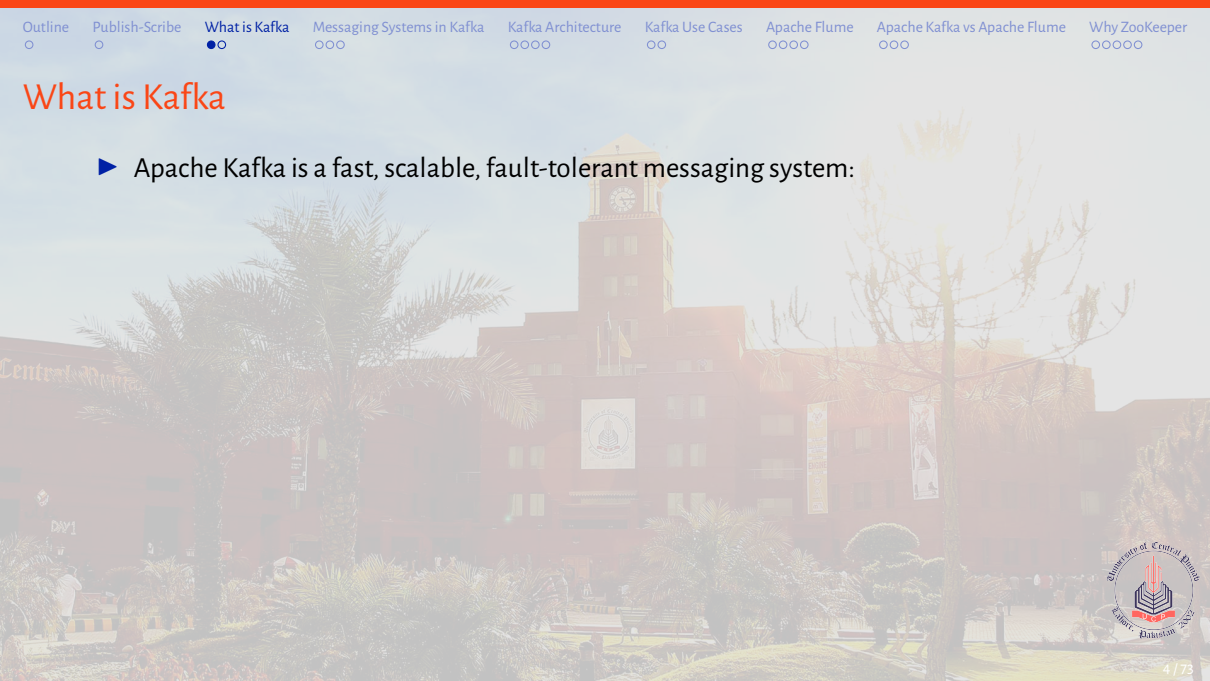

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- Kafka provides three main functions to its users:
  1. Publish and subscribe to streams of records.
  2. Effectively store streams of records in the order in which records were generated.
  3. Process streams of records in real time.

- Before moving deep into the Kafka, you must aware of the main terminologies:

Message: In Kafka often we consider data as a set of messages. A message is a simple array of bytes, e.g. csv file.

Producer: Producer is an application that sends messages. It does not send messages directly to the recipient. It send messages only to the Kafka server.

Consumer: It is an application that reads messages from the Kafka server. (i.e. consumers are the recipients.) Consumers should have the permission to read the messages.

Broker: The broker is a Kafka server. One can say that all Kafka does is act as a message broker between producer and consumer, because producer and consumer do not connect directly.

Cluster: Kafka is a distributed system, it act as a cluster. That is, a group of computers sharing workload for common purpose. Each instance contains a Kafka broker.

Topics: A stream of messages belonging to a particular category is called a topic. Data is stored in topics.

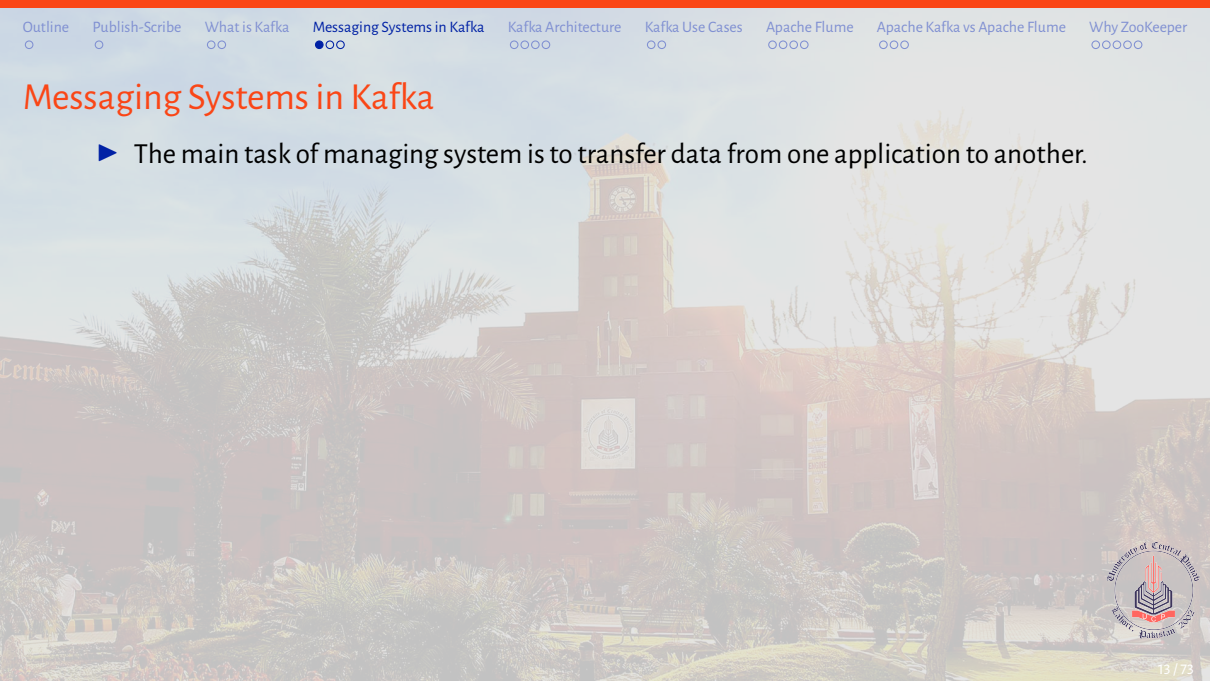
Partitions: Kafka Brokers will store messages for a topic. But the capacity of data can be enormous and it may not be possible to store in a single computer.

Offsets: Offset is a sequence of ids given to messages as the arrive at a partition. Once the offset is assigned it will never be changed.

Zookeeper: Zookeeper serves as the coordination interface between the Kafka brokers and consumers.

Messaging Systems in Kafka

- The main task of managing system is to transfer data from one application to another.



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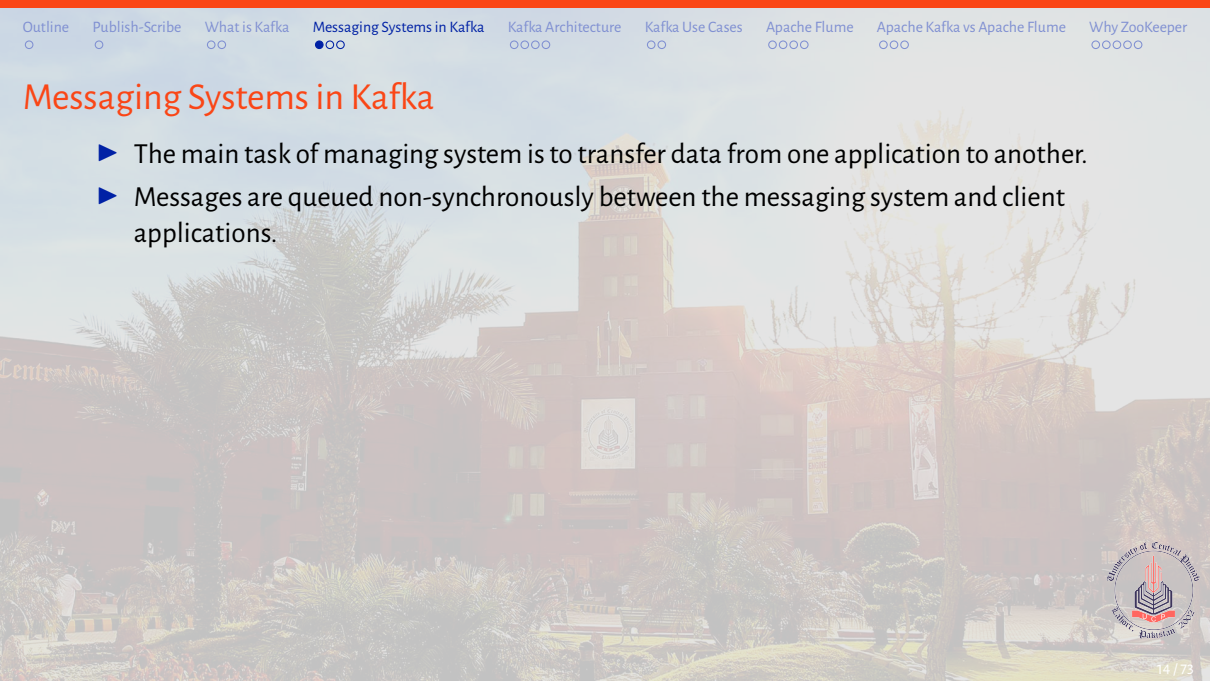

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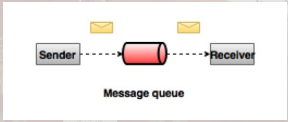
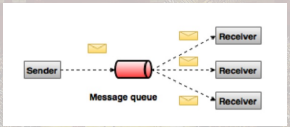
- There are two types of messaging patterns available:
  1. Point to point messaging system.



  2. Publish-subscribe messaging system



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- **The PTP messaging model can be further categorized into two types:**
  1. Fire-and-forget model
  2. Request/reply model

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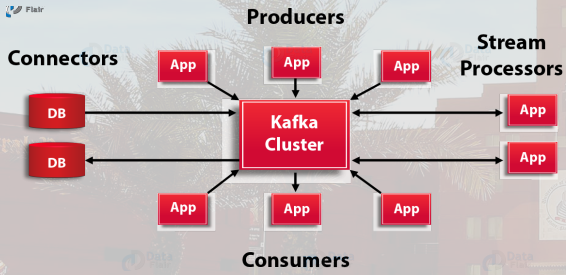
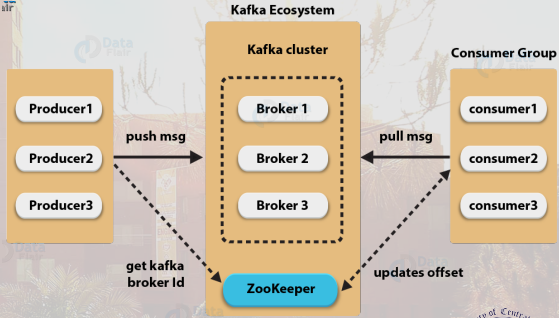
- The Publisher generally does not know and is not aware of which subscribers are receiving the topic messages.

Kafka Architecture





Kafka Architecture

- Apache Kafka Architecture has four core APIs, Producer, Consumer, Streams, and Connector API.

Producer: In order to publish a stream of records to one or more Kafka topics, the Producer API allows an application.

Consumer: This API permits an application to subscribe to one or more topics.

Streams: It consuming an input stream from one or more topics and producing an output stream to one or more output topics.

Connector: While it comes to building and running reusable producers or consumers that connect Kafka topics to existing applications or data systems, we use the Connector API.

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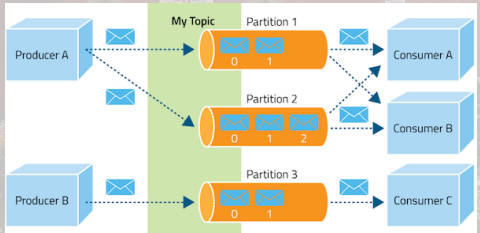
  6. We can not change or update data, as soon as it gets published.



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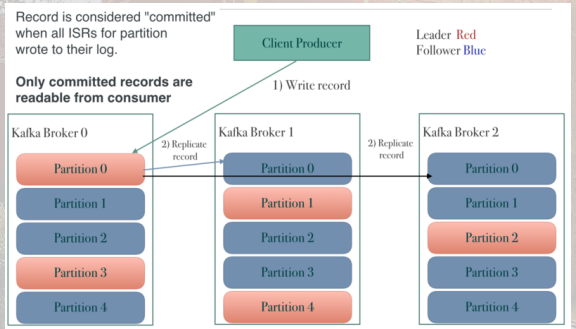
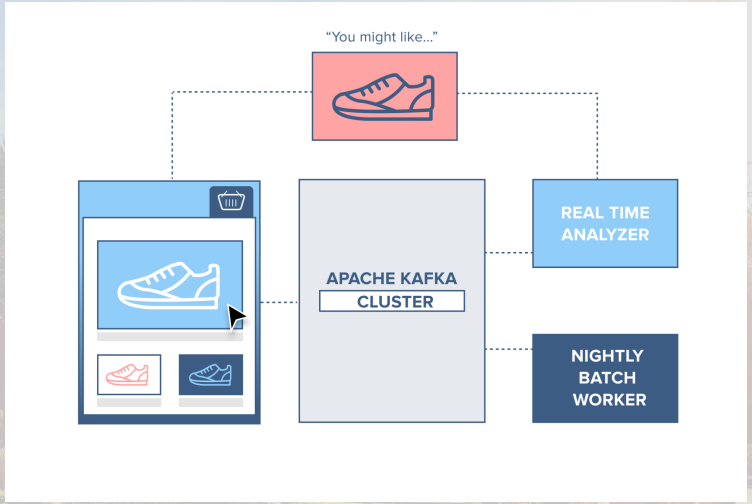
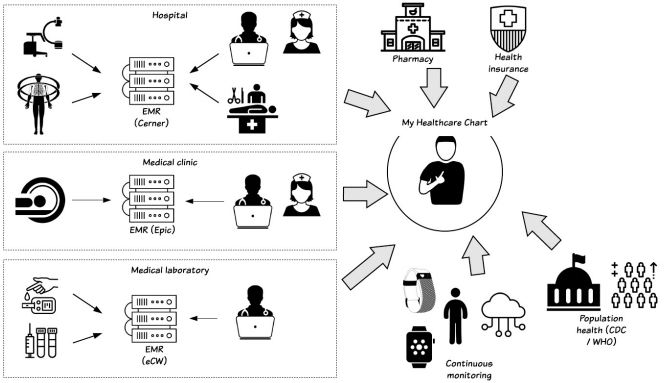


Kafka Use Cases – eshop



Kafka Use Cases – Healthy AI



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  3. Apache Flume is used to collect log data present in log files from web servers and aggregating it into HDFS for analysis.

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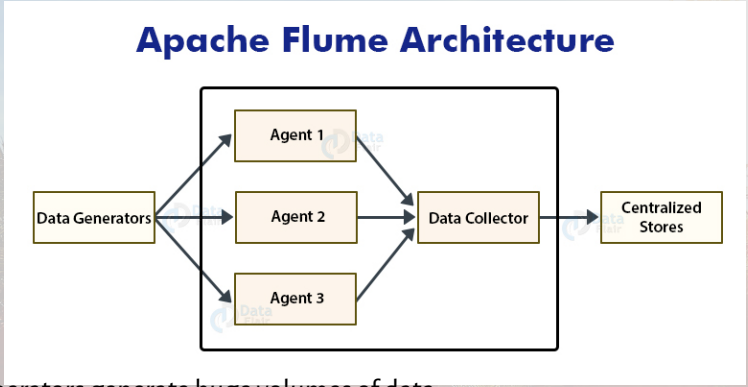

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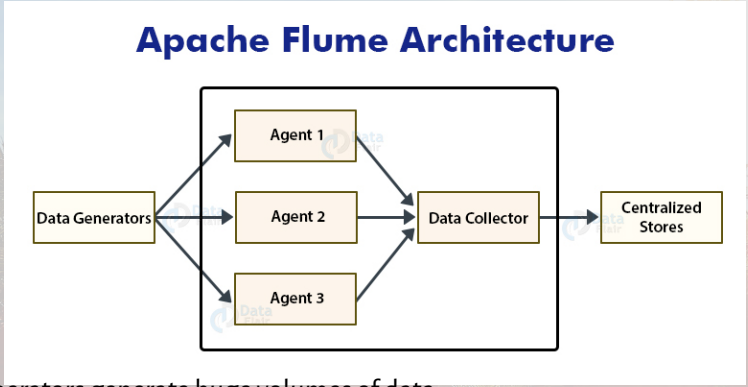

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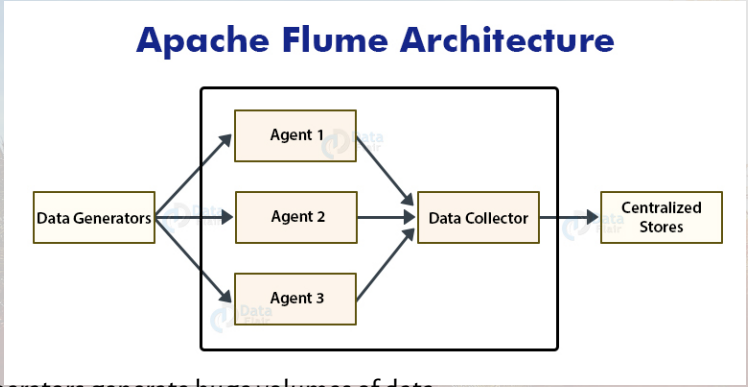

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- Data collector collects data from the agents, aggregates them, and pushes them into a centralized repository such as HBase or HDFS.

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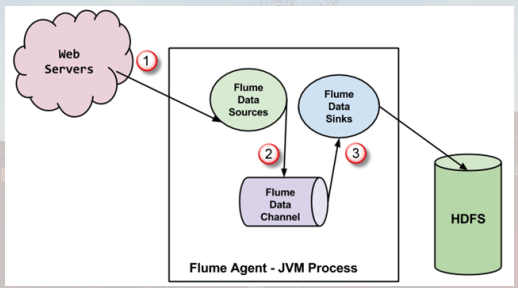

- The events generated by external source (WebServer) are consumed by Flume Data Source.
- Flume Source receives an event and stores it into one or more channels. The channel acts as a store which keeps the event until it is consumed by the flume sink.
- Flume sink removes the event from a channel and stores it into an external repository like e.g., HDFS.

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- An efficient, fault-tolerant and scalable messaging system
- **Flume** is a service or tool for gathering data into Hadoop

Assignment 4:

Setup Flume library and Load&stream data from twitter using Flume.

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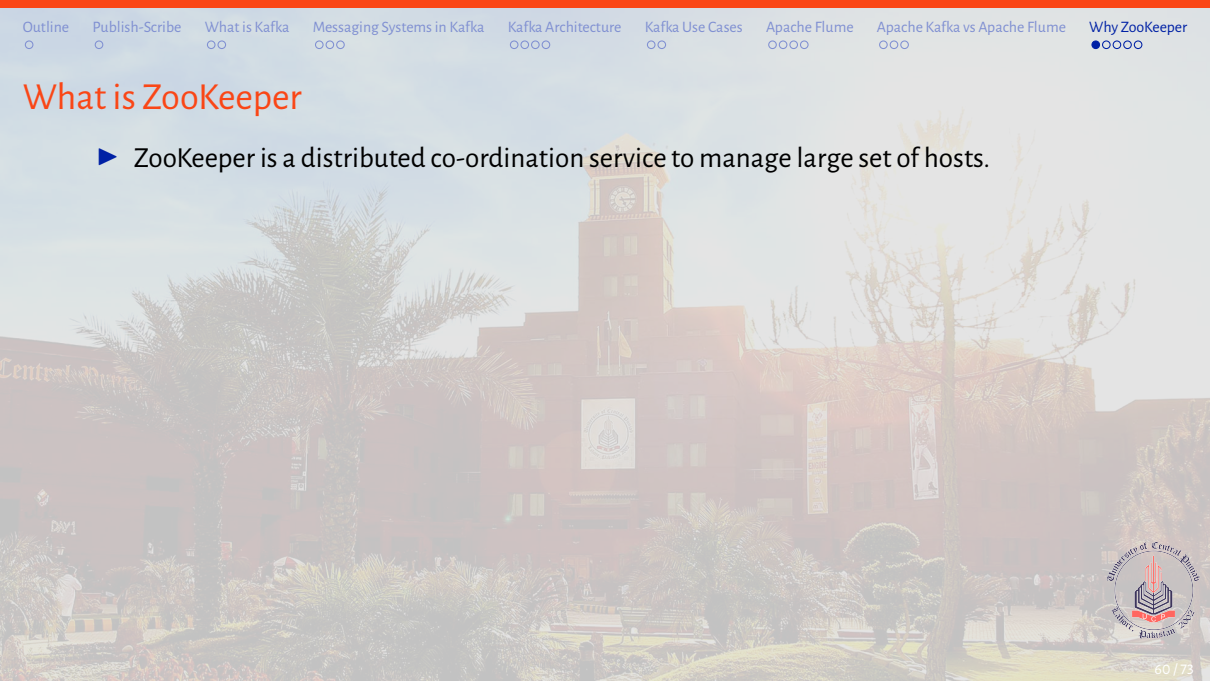

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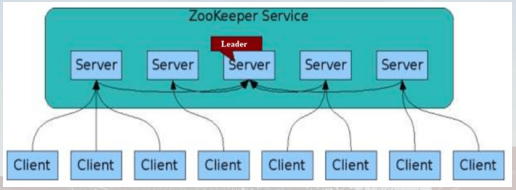
  5. **Locking and synchronization service** Locking the data while modifying it. This mechanism helps you in automatic fail recovery while connecting other distributed applications like Apache HBase.

ZooKeeper Architecture

Before going deep into the working of ZooKeeper, let us take a look at the fundamental concepts of ZooKeeper.

- Architecture
- Hierarchical namespace
- Session
- Watches

ZooKeeper Architecture



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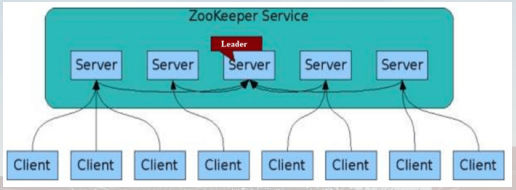

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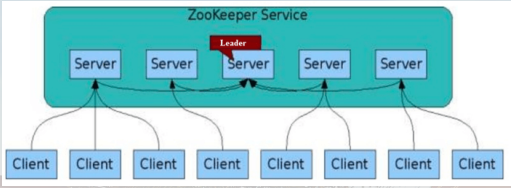

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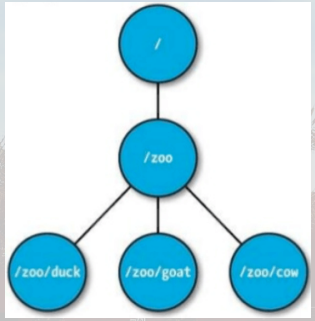
- **Ensemble:** Group of ZooKeeper servers. The minimum number of nodes that is required to form an ensemble is 3.
- **Server**, one of the nodes in our ZooKeeper ensemble, provides all the services to clients. Gives acknowledgement to client to inform that the server is alive.
- **Leader:** Server node which performs automatic recovery if any of the connected node failed. Leaders are elected on service startup.
- **Follower:** Server node which follows leader instruction.

Zookeeper Data Model



- The zookeeper data model follows a Hierarchal namespace where each node is called a ZNode (**Persistence, Ephemeral and Sequential**). A node is a system where the cluster runs.

- Every znode in the ZooKeeper data model maintains a stat structure. It consists of **Version number**, **Action control list (ACL)**, **Timestamp**, and **Data length**.

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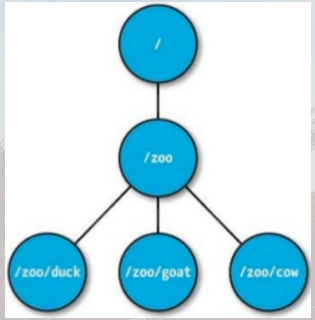

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- Every znode in the ZooKeeper data model maintains a stat structure. It consists of **Version number**, **Action control list (ACL)**, **Timestamp**, and **Data length**.
- **Sessions:** Requests in a session are executed in FIFO order. Once a client connects to a server, the session will be established and a session id is assigned to the client.
- **Watches:** are a simple mechanism for the client to get notifications about the changes in the ZooKeeper ensemble.

Thank You