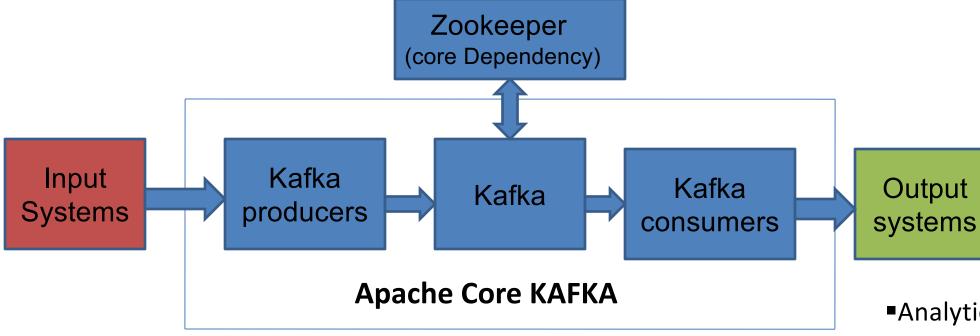
APACHE ZOOKEEPER

Apache Kafka - Core Kafka

- Kafka gets conflated with Kafka ecosystem
- Apache Core Kafka consists of Kafka Broker, start up scripts for Zoo Keeper, and client APIs for Kafka
- Apache Core Kafka does *not* include
 - Confluent Schema Registry (not an Apache project)
 - Kafka REST Proxy (not an Apache project)
 - Kafka Connect
 - Kafka Streams

Apache Kafka



- Log aggregation
- Metrics
- ■KPIs
- Batch imports
- Audit trial
- User activity logs
- ■Web logs

- Not part of core
- Scheme Registry
- Avro
- ■Kafka REST Proxy
- ■Kafka Connect
- ■Kafka Streams

- Apache Kafka Core
- Server Broker
- Scripts to start libs
- Script to start up
- Zookeeper
- •Utils to create topics
- •Utils to monitor stats

Analytics

Output

- Databases
- •Machine
- learning
- Dashboards
- Indexed for
- search
- Business Intelligene

Kafka needs Zookeeper

- Zookeeper helps with leadership election of Kafka Broker and Topic Partition pairs
- Zookeeper manages service discovery for Kafka Brokers that form the cluster
- Zookeeper sends changes to Kafka
 - New Broker join, Broker died, etc.
 - Topic removed, Topic added, etc.
- Zookeeper provides in-sync view of Kafka Cluster configure

Overview – What is ZooKeeper?

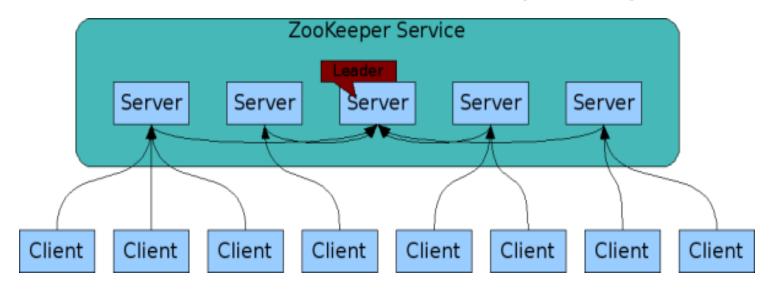
- An open source, high-performance coordination service for distributed application.
- Exposes common services in simple interface:
 - Naming
 - Configuration management
 - Locks & synchronization
 - Groups services
- Build your own on it for specific needs



Overview – ZooKeeper Use Cases

- Configuration Management
 - Cluster member nodes bootstrapping configuration from a centralized source in unattended way
- Distributed Cluster Management
 - Node join / leave
 - Node statuses in real time
- Naming service e.g. DNS
- Distributed synchronization locks, barriers, queues
- Leader election in a distributed system

The ZooKeeper Service (ZKS)



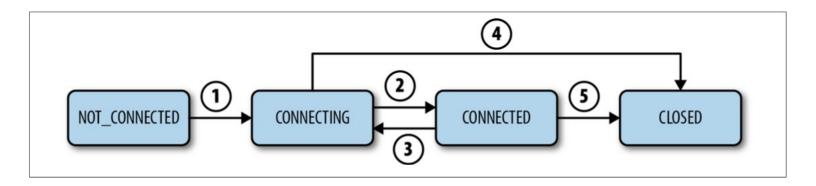
- ZooKeeper Service is replicated over a set of machines
- All machines store a copy of the data (in-memory)
- A leader is elected on service startup
- Clients only connect to a single ZooKeeper server and maintain a TCP connection

The ZKS - Sessions

- Before executing any request, client must establish a session with service
- All operations client summits to service are associated to a session
- Client initially connects to any server in ensemble, and only to single server.
- Session offer order guarantees requests in session are executed in FIFO order

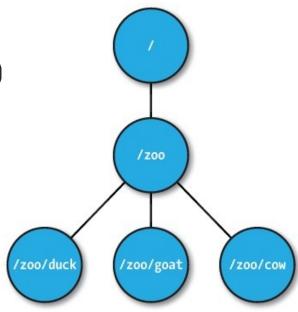
The ZKS – Session States and Lifetime

 Main possible states: CONNECTING, CONNECTED, CLOSED, NOT_CONNECTED



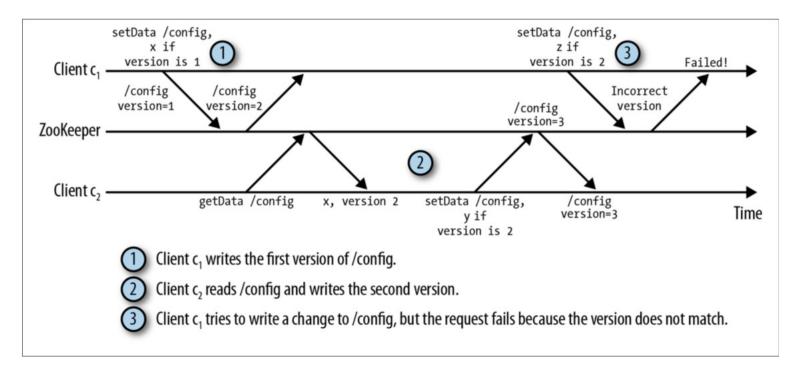
The ZooKeeper Data Model (ZDM)

- Hierarchal name space
- Each node is called as a ZNode
- Every ZNode has data (given as byte[]) and can optionally have children
- ZNode paths:
 - Canonical, absolute, slash-separated
 - No relative references
 - Names can have Unicode characters
- ZNode maintain stat structure

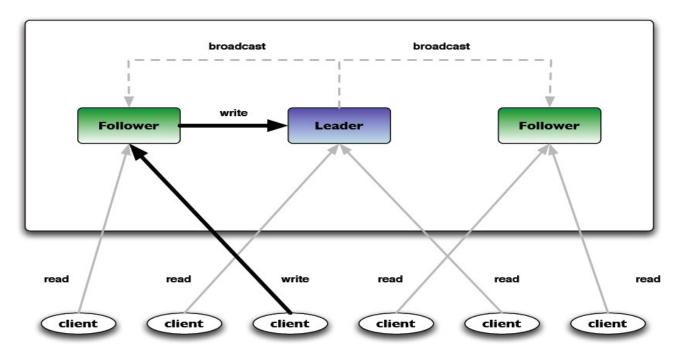


ZDM - Versions

- Eash Znode has version number, is incremented every time its data changes
- setData and delete take version as input, operation succeeds only if client's version is equal to server's one



ZDM – Znode – Reads & Writes



- Read requests are processed locally at the ZooKeeper server to which client is currently connected
- Write requests are forwarded to leader and go through majority consensus before a response is generated

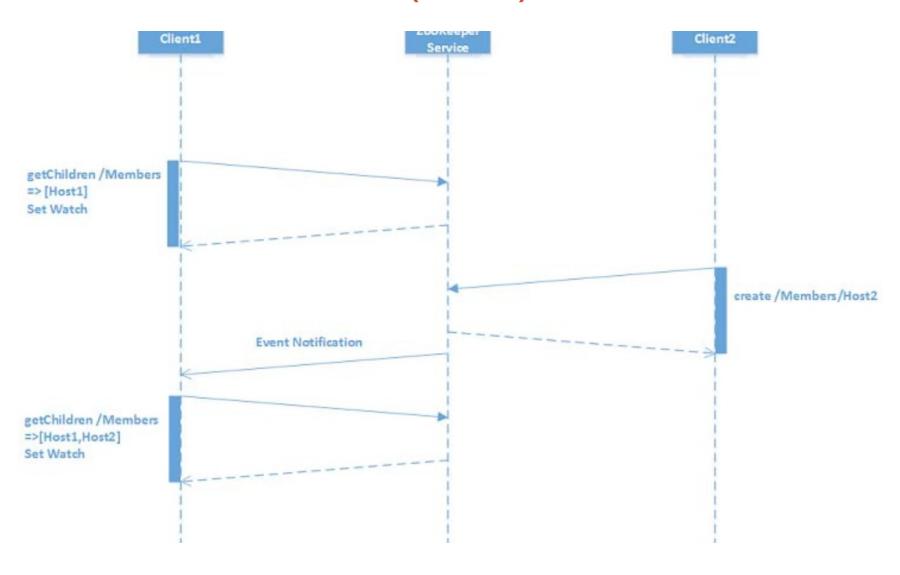
ZDM – Consistency Guarantees

- Sequential Consistency
- Atomicity
- Single System Image
- Reliability
- Timeliness (Eventual Consistency)

ZDM - Watches

- A watch event is one-time trigger, sent to client that set watch, which occurs when data for which watch was set changes.
- Watches allow clients to get notifications when a znode changes in any way (NodeChildrenChanged, NodeCreated, NodeDataChanged,NodeDeleted)
- All of read operations getData(), getChildren(), exists()
 have option of setting watch
- ZooKeeper Guarantees about Watches:
 - Watches are ordered, order of watch events corresponds to the order of the updates
 - A client will see a watch event for znode it is watching before seeing the new data that corresponds to that znode

ZDM – Watches (cont)



Leader Election – SID-ZXID(epoch+count)

2020-08-31 21:24:35,972 [myid:2] - INFO

[QuorumPeer[myid=2](plain=[0:0:0:0:0:0:0:0:0]:2182)(secure=disabled):QuorumPeer@1371] - LOOKING

2020-08-31 21:24:35,975 [myid:2] - INFO

[QuorumPeer[myid=2](plain=[0:0:0:0:0:0:0:0:0):2182)(secure=disabled):FastLeaderElection@944] - New election. My id = 2, proposed zxid=0x0

<u>2020-08-31 21:24:35,999 [myid:2]</u> - INFO [WorkerReceiver[myid=2]:FastLeaderElection\$Messenger\$WorkerReceiver@389] - Notification: my state:LOOKING; n.sid:2, n.state:LOOKING, n.leader:2, n.round:0x1, n.peerEpoch:0x0, n.zxid:0x0, message format version:0x2, n.config version:0x0

<u>2020-08-31 21:24:36,004 [myid:2] - INFO [QuorumConnectionThread-[myid=2]-2:QuorumCnxManager@513] - Have smaller server identifier, so dropping the connection: (myld:2 --> sid:3)</u>

<u>2020-08-31 21:24:36,009 [myid:2]</u> - INFO [WorkerReceiver[myid=2]:FastLeaderElection\$Messenger\$WorkerReceiver@389] - Notification: my state:LOOKING; n.sid:3, n.state:LOOKING, n.leader:3, n.round:0x1, n.peerEpoch:0x0, n.zxid:0x0, message format version:0x2, n.config version:0x0

<u>2020-08-31 21:24:36,017 [myid:2]</u> - INFO [WorkerReceiver[myid=2]:FastLeaderElection\$Messenger\$WorkerReceiver@389] - Notification: my state:LOOKING; n.sid:1, n.state:FOLLOWING, n.leader:3, n.round:0x1, n.peerEpoch:0x1, n.zxid:0x0, message format version:0x2, n.config version:0x0

2020-08-31 21:24:36,018 [myid:2] - INFO

[QuorumPeer[myid=2](plain=[0:0:0:0:0:0:0:0):2182)(secure=disabled):QuorumPeer@857] - Peer state changed: following 2020-08-31 21:24:36,018 [myid:2] - INFO

[QuorumPeer[myid=2](plain=[0:0:0:0:0:0:0:0:0):2182)(secure=disabled):QuorumPeer@1453] - FOLLOWING

Lab: Zookeeper