HADOOP DAEMONS

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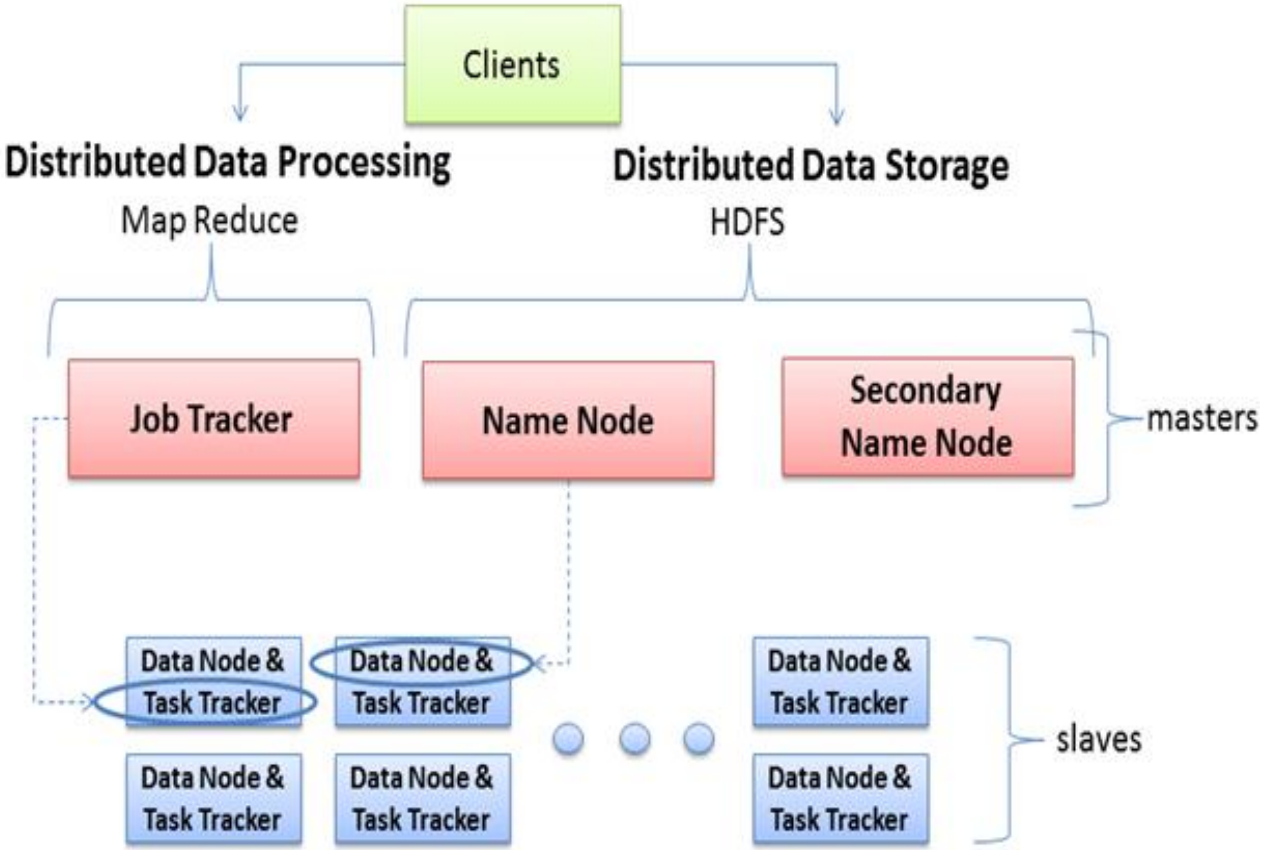
Hadoop Terminology

Terminology	Definition
Job	A full program – an execution of a Mapper and Reducer across data set
Task	An execution of a mapper or reducer on a slice of data.
Task Attempt	Particular instance of an attempt to execute a task on a machine
Daemon	Computer program that runs as a background process rather than being under the direct control of an interactive user (like Services in Windows)

Hadoop 1.0 Daemons

Daemons in Hadoop 1.0

- NameNode
- Secondary NameNode
- DataNode
- JobTracker
- TaskTracker



NameNode

- ✓ Centerpiece of HDFS.
- ✓ http://localhost:50070/
  - – web UI for HDFS name node(s)
- ✓ Maintains directory tree files in file system.
- ✓ Tracks file data in cluster.
  - – Does not store the data of these files itself.
- ✓ Client application talk to NameNode to locate a file.
- ✓ Responds to successful client requests.
- ✓ Returns list of relevant DataNodes where data lives.
- ✓ Use heartbeats to detect DataNode failure.
- ✓ Chooses new DataNodes for new replicas.
- ✓ Single point of failure for the HDFS Cluster.

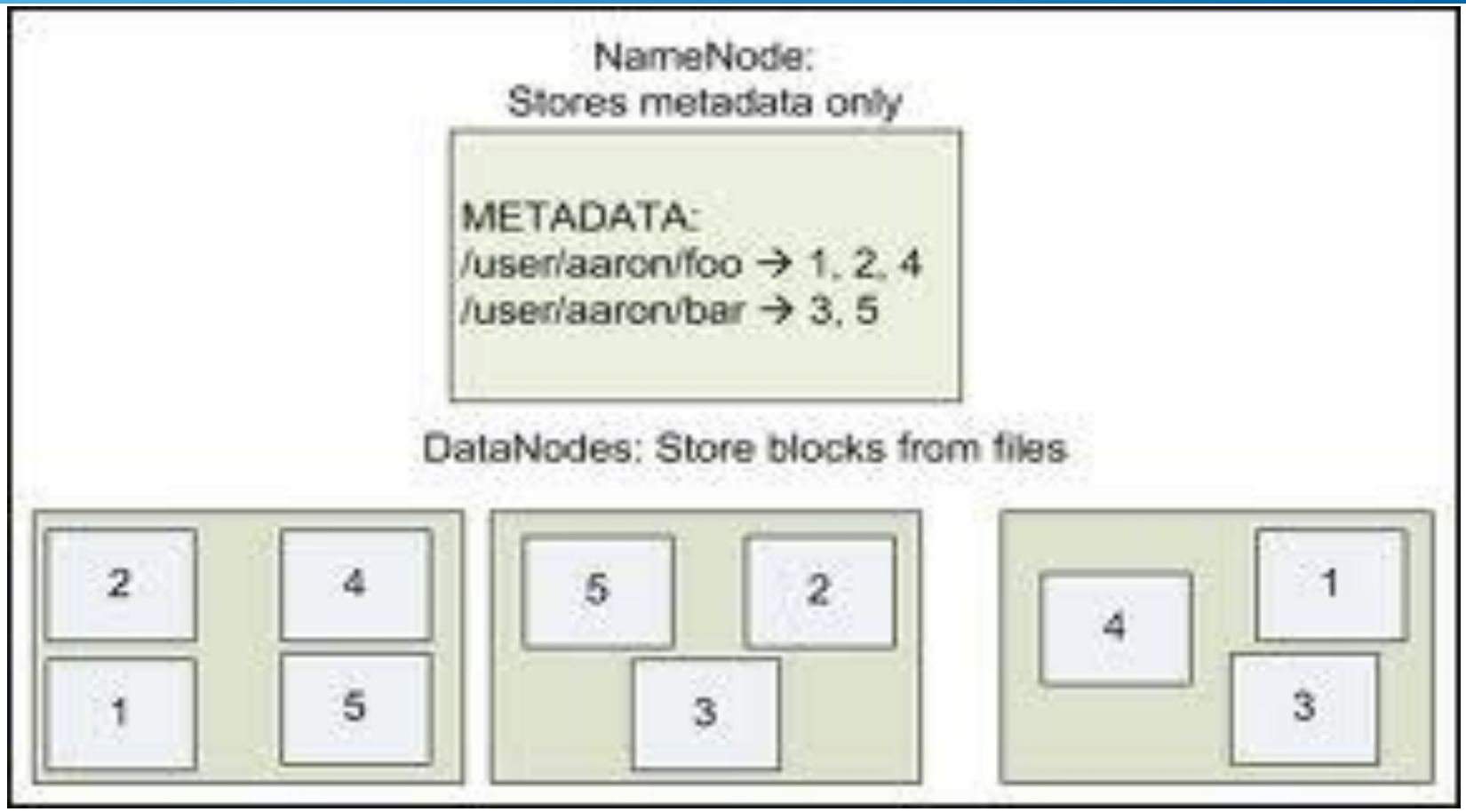
Secondary NameNode

- ✓ Assistant daemon for monitoring the state of HDFS.
- ✓ Each cluster has one SNN residing on its own machine.
- ✓ No other DataNode or TaskTracker runs on SNN.
- ✓ Doesn’t receive/record any real-time changes to HDFS.
- ✓ Allow NameNode to preserve file system's metadata to act as a backup.
- ✓ Communicates with NameNode.
- ✓ Take snapshots of metadata at intervals defined by the cluster configuration.
- ✓ Snapshots minimize the downtime and loss of data.

DataNode

- ✓ Individual machines in a cluster are referred to as DataNodes.
- ✓ In HDFS files are broken into blocks of fixed size.
- ✓ These blocks are stored in DataNodes
- ✓ DataNode communicate with other DataNodes to replicate data blocks for redundancy.
- ✓ DataNode connects to NameNode to establish service.
- ✓ Responds to requests from the NameNode.
- ✓ DataNodes send heartbeat to the NameNode.

How Data is stored in HDFS ?



DataNodes holding multiple file blocks with a replication factor of 2
NameNode maps the filenames into the block ids

Default Replication factor is **3**

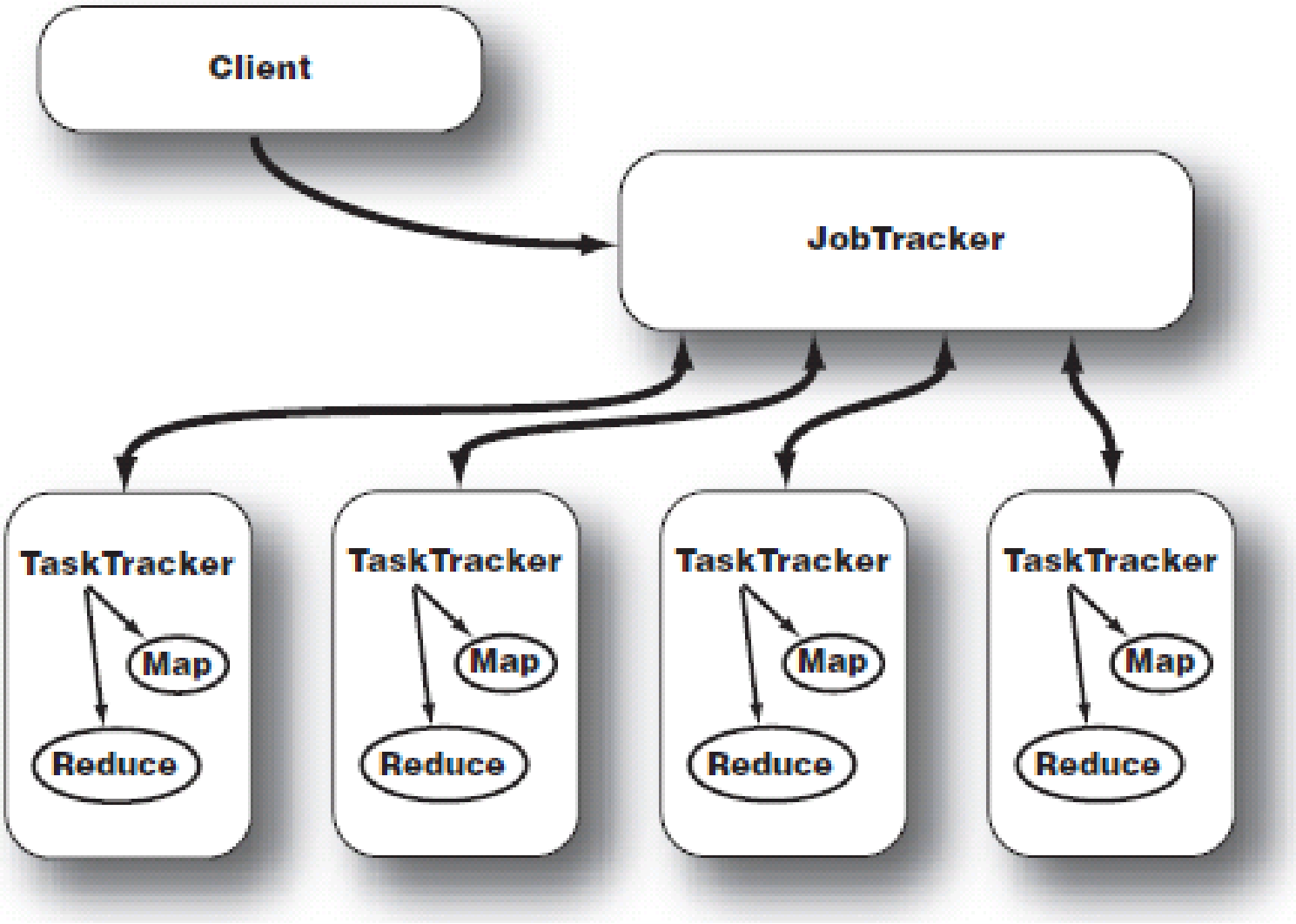
JobTracker

- ✓ Interface between application and Hadoop
- ✓ Run on a server as master node of the cluster.
- ✓ Determines the execution plan for file processing.
- ✓ Assigns nodes to different tasks and monitors them.
- ✓ If a task fails, re-launches the task on a different node.
- ✓ Only one JobTracker per cluster.
- ✓ http://localhost:50030/
  - web UI for MapReduce JobTracker(s)

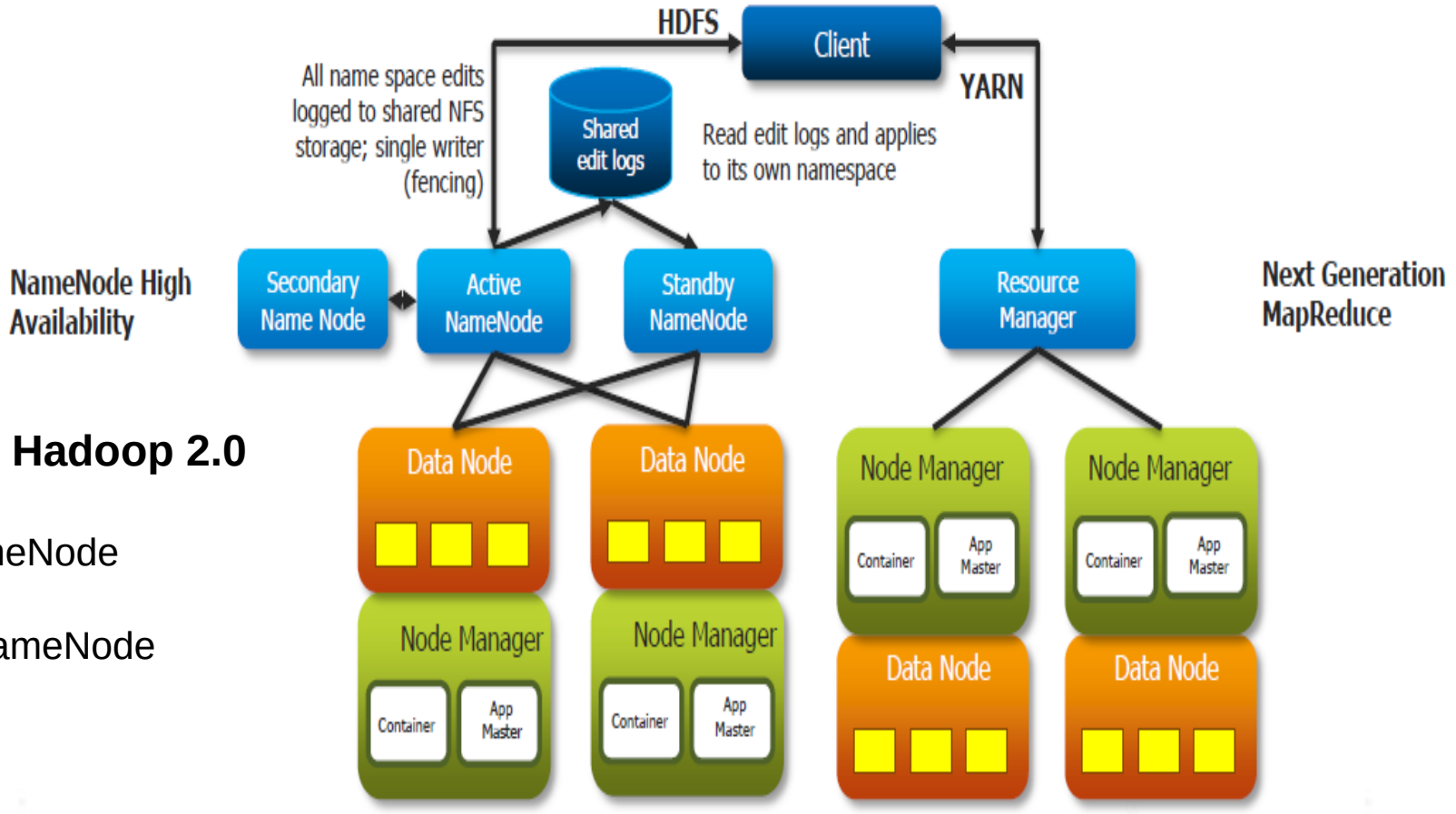
TaskTracker

- ✓ Manage the execution of individual tasks on each slave node.
- ✓ Single TaskTracker per slave node.
- ✓ Can handle many map or reduce tasks in parallel.
- ✓ Constantly communicates with JobTracker.
- ✓ In case of failure of heartbeat reception from tasktracker
  - JobTracker assumes TaskTracker has crashed.
  - Resubmit corresponding tasks to another.
- ✓ http://localhost:50060/
  – web UI for task tracker(s)

JobTracker and TaskTracker Interaction



Hadoop 2.0 Daemons



Daemons in Hadoop 2.0

- Active NameNode
- Standby NameNode
- DataNode
- Resource Manager
- Node Manager

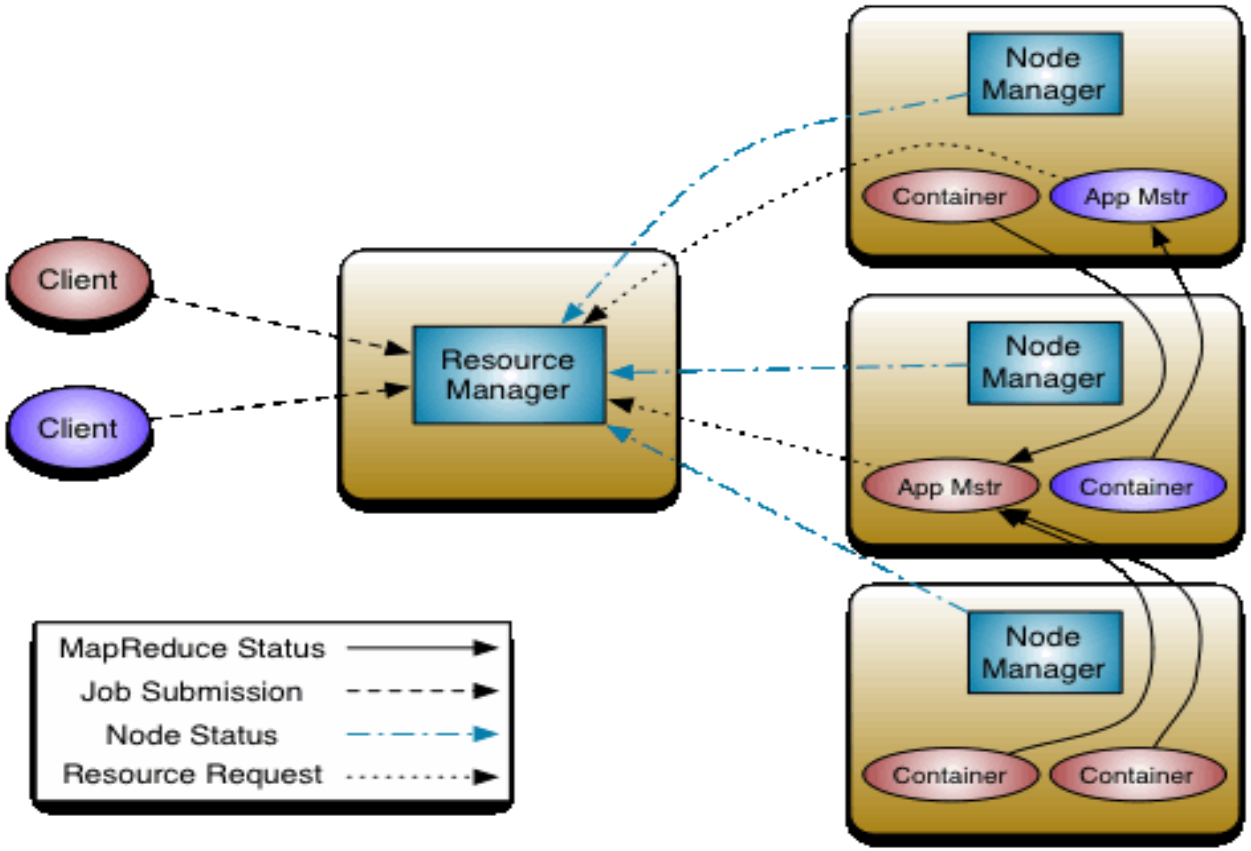
Hadoop 2.0 Daemons

- ✓ NameNode was a single point of failure (SPOF) in an Hadoop 1.0 cluster
- ✓ Each cluster had a single NameNode, and if that machine or process became unavailable, the cluster as a whole would be unavailable until the NameNode was either restarted or brought up on a separate machine
- ✓ In Hadoop 2.0, we have two redundant NameNodes in the same cluster in an Active/Passive configuration with a hot standby
- ✓ Exactly one of the NameNodes is in an Active state, and the other is in a Standby state
- ✓ The Active NameNode is responsible for all client operations in the cluster, while the Standby is simply acting as a slave, maintaining enough state to provide a fast failover if necessary

Hadoop 2.0 Daemons

- ✓ An Application is either a single job in the classical sense of Map-Reduce jobs or a DAG of jobs
- ✓ The ResourceManager and NodeManager (NM), form the data-computation framework
- ✓ The ResourceManager is the ultimate authority that arbitrates resources among all the applications in the system
- ✓ The NodeManager is the per-machine framework agent who is responsible for containers, monitoring their resource usage (CPU, memory, disk, network) and reporting the same to the ResourceManager/Scheduler
- ✓ The ApplicationMaster is a framework specific library and is tasked with negotiating resources from the ResourceManager and working with the NodeManager(s) to execute and monitor the tasks
- ✓ The MapReduce job history server allow the user to get status on finished applications

ResourceManager & NodeManager Interaction



References

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- Yahoo Hadoop Tutorials.
- Introduction to HDFS, Developer Works, IBM.
- Hadoop In Action

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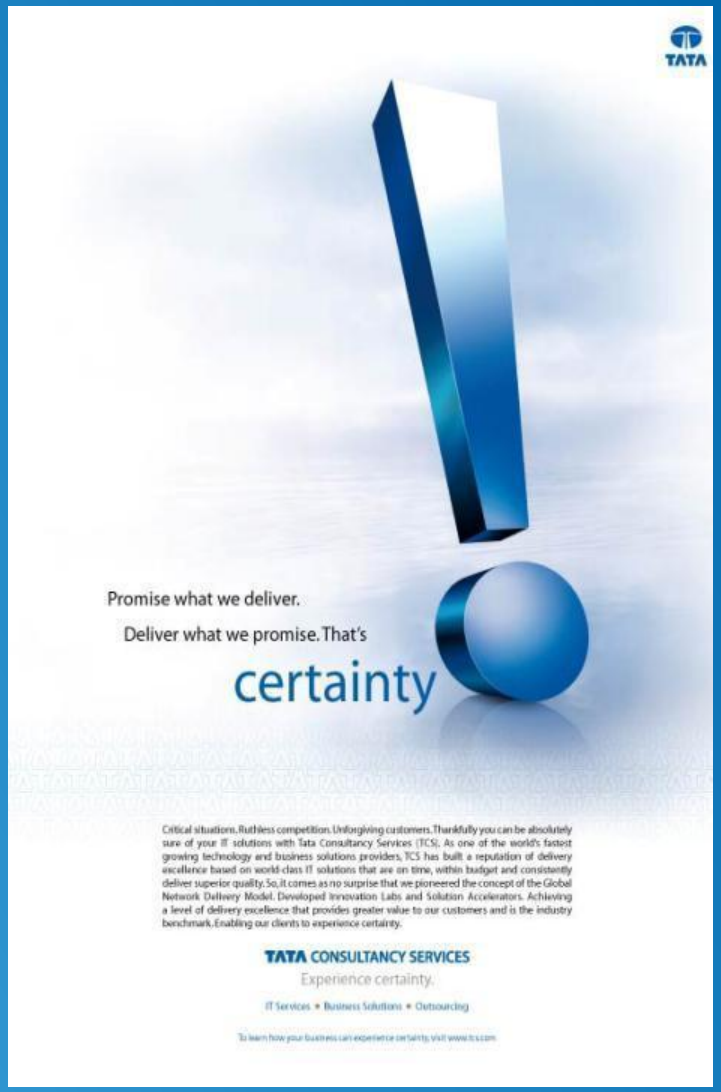
Thank You



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