Big Data

HDFS Enhancements

Hadoop

❖ Hadoop Enhancements

Feature	1.x	0.22	2.X
Secure authentication	Yes	No	Yes
Old configuration names	Yes		
New configuration names	No	Yes	Yes
Old MapReduce API	Yes	Yes	Yes
New MapReduce API	Yes (with some missing libraries)	Yes	Yes
MapReduce 1 runtime (Classic)	Yes	Yes	No
MapReduce 2 runtime (YARN)	No	No	Yes
HDFS Federation	No	No	Yes
HDFS HA (High Availability)	No	No	Yes

Hadoop

❖ Hadoop Release Series

- 2.x included several major new features
- Starting from MapReduce 2, the enhanced MapReduce runtime system called YARN was included
  - YARN (Yet Another Resource Negotiator)
  - General resource management system for running distributed applications

Hadoop

❖ Hadoop Release Series

- HDFS Federation partitions the HDFS namespace across multiple NameNodes
  - Enables improved support for clusters with very large numbers of files
- HDFS HA (High Availability) feature uses standby NameNodes for backup, and therefore, the NameNode is no longer a potential SPOF (Single Point of Failure)

HDFS

❖ NameNode Failure Backup

- Back up the NameNode files that form the persistent state of the filesystem's metadata
- Configure the NameNode to write its persistent state to multiple filesystems
  ➔ Synchronous and atomic backup
- Common backup configuration ➔ Copy to Local Disk and Remote FileSystem

HDFS

❖ Secondary NameNode

- Secondary NameNode does not act the same way as the NameNode
- Secondary NameNode periodically merges the namespace image with the edit log to prevent the edit log from becoming too large
- Secondary NameNode usually runs on a separate computer to perform the merge process because this requires significant processing capability and memory

HDFS

❖ HDFS Federation

- Allows a cluster to scale by adding NameNodes
- Each NameNode manages a *namespace volume* and a *block pool*
  - *Namespace volume* is made up of the metadata for the namespace
  - *Block pool* contains all the blocks for the files in the namespace

HDFS

❖ HDFS Federation

- Namespace volumes are all independent
  - NameNodes do not communicate with each other
  - Failure of a NameNode is also independent to other NameNodes
    - NameNode failure does not influence the availability of another NameNode's namespace

HDFS

❖ HDFS HA (High Availability)

- Pair of NameNodes (Primary & Standby) are set to be in Active-Standby configuration
- Secondary NameNode stores the latest edit log entries and an up-to-date block mapping
- When the primary NameNode fails, the standby NameNode takes over serving client requests

HDFS

❖ HDFS HA (High Availability)

- Although the active-standby NameNode can takeover operation quickly (e.g., few tens of seconds), to avoid unnecessary NameNode switching, standby NameNode activation will be executed after a sufficient observation period
  - For example, approximately a minute or a few minutes

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