



Big Data Technologies

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Hadoop

Developed by Doug Cutting at Yahoo.

Open source Distributed framework
for Big Data
Apache (2006)

HDFS ← Distributed Storage
Map Reduce ←⁺ Distributed Computing

Hadoop 1.x
Daemons

Hadoop 2.x/3.x
Daemons

① NameNode

① NameNode

② Sec NameNode

② Sec NameNode/
Standby NameNode

③ DataNode

③ DataNode

④ Job Tracker

④ Resource Manager

⑤ Task Tracker

⑤ Node Manager⁺
= YARN

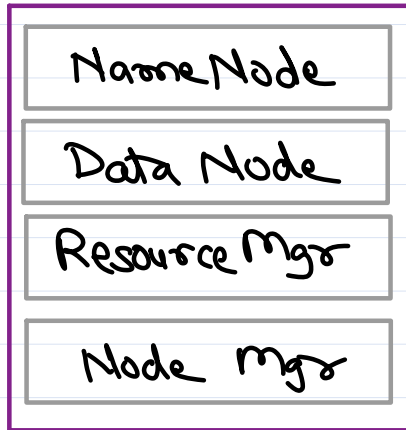
} Distributed
Storage

} Distributed
Computing

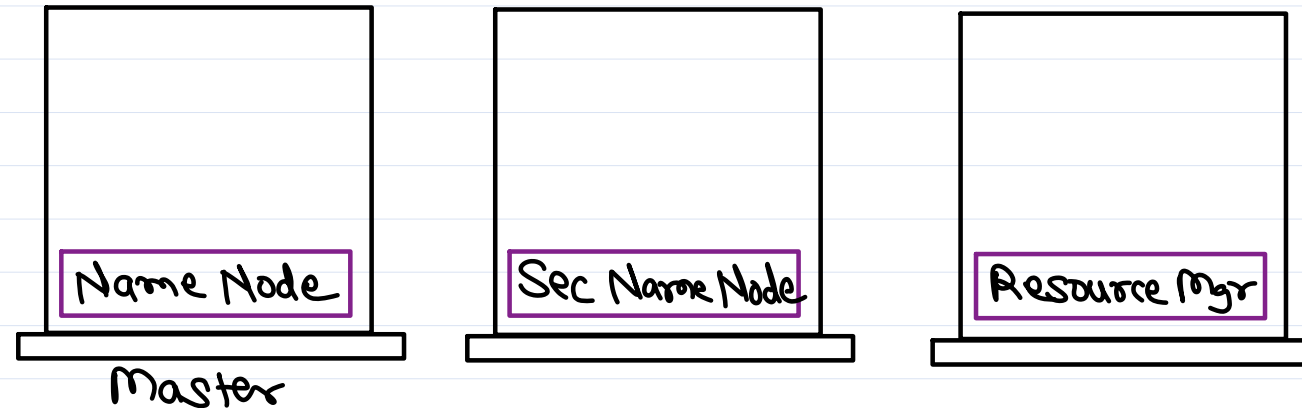


Hadoop Installation Modes

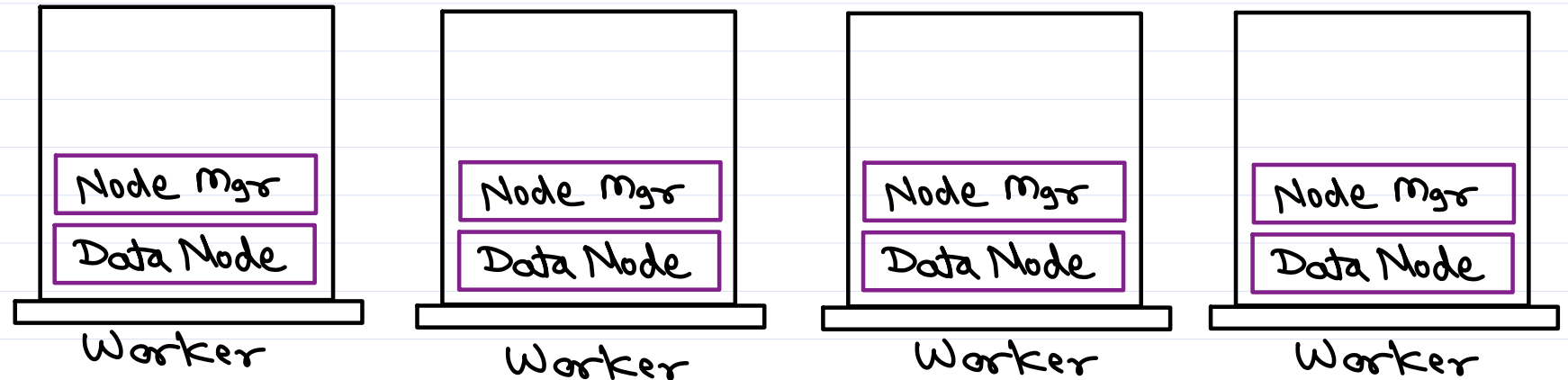
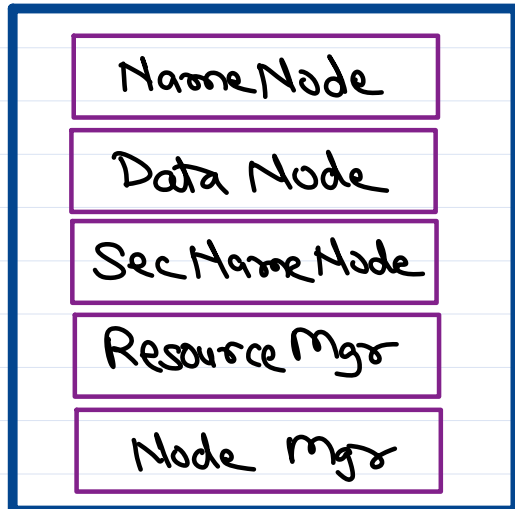
Local mode



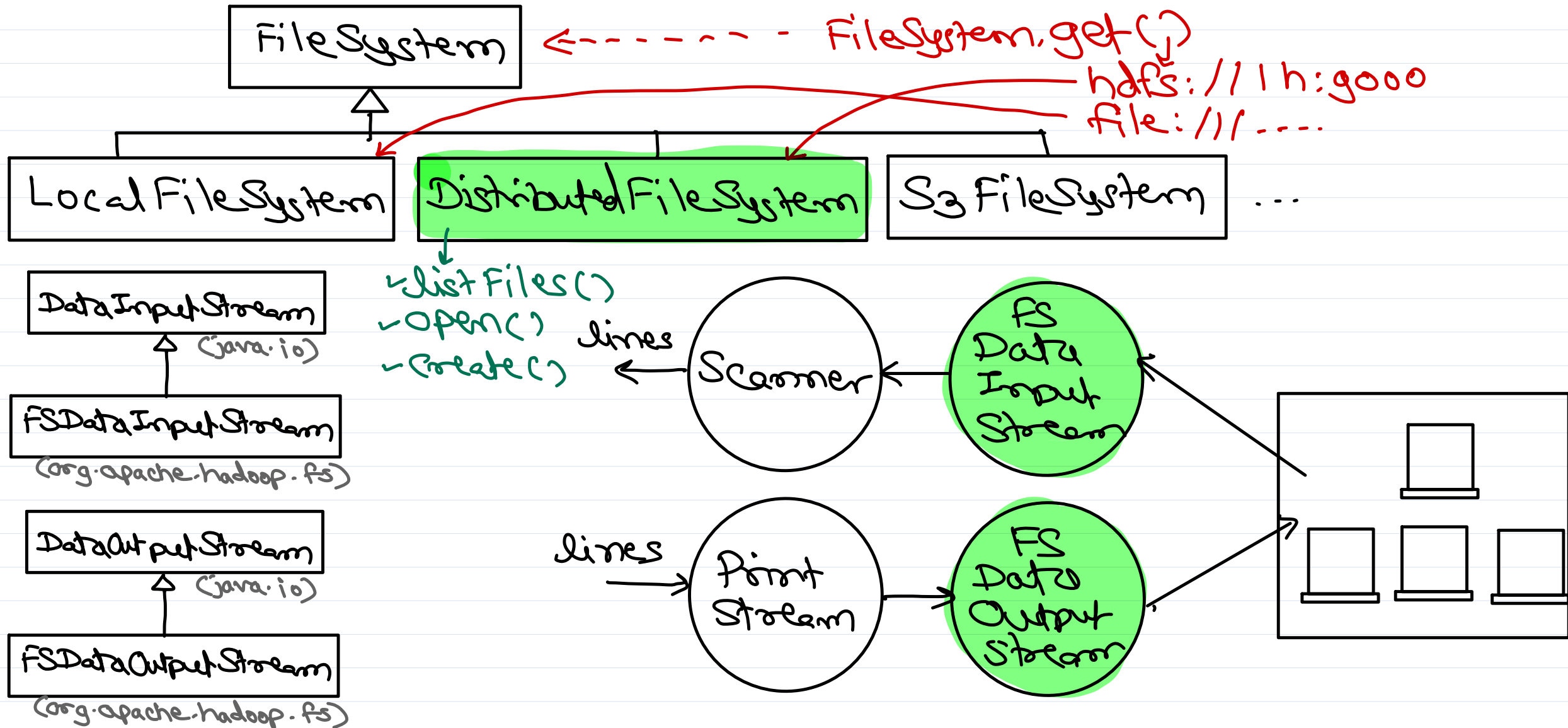
Multi-Node Cluster



Single Node Cluster

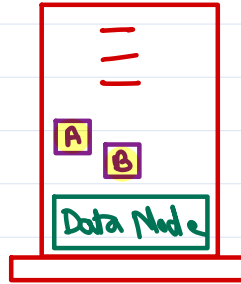
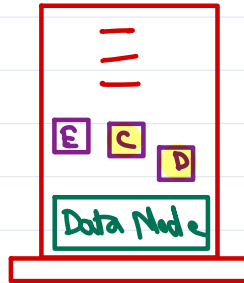
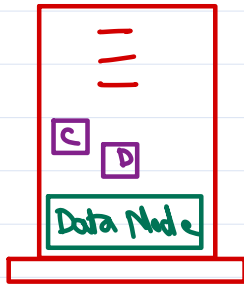
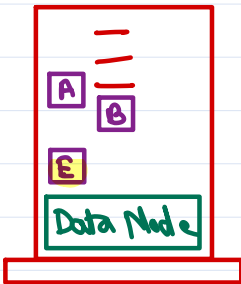
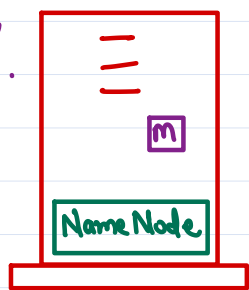


HDFS related classes



HDFS

In Hadoop 1.x,
NN is SPOF.



Name Node Failure → Sec. NameNode

- ✓ Each File metadata is copied periodically on a separate node → Sec NameNode. ↳ new changes after last backup may loose.
- ✓ If NameNode fails, the metadata can be recovered from Sec NN and HDFS can be restarted with new NameNode

Data block size

Hadoop 1.x = 64 MB

Hadoop 2.x = 128 MB

- ✓ Can be configured in hdfs-site.xml with dfs.blocksize property.

Data Node Failure → Replication (1.x-3.x)

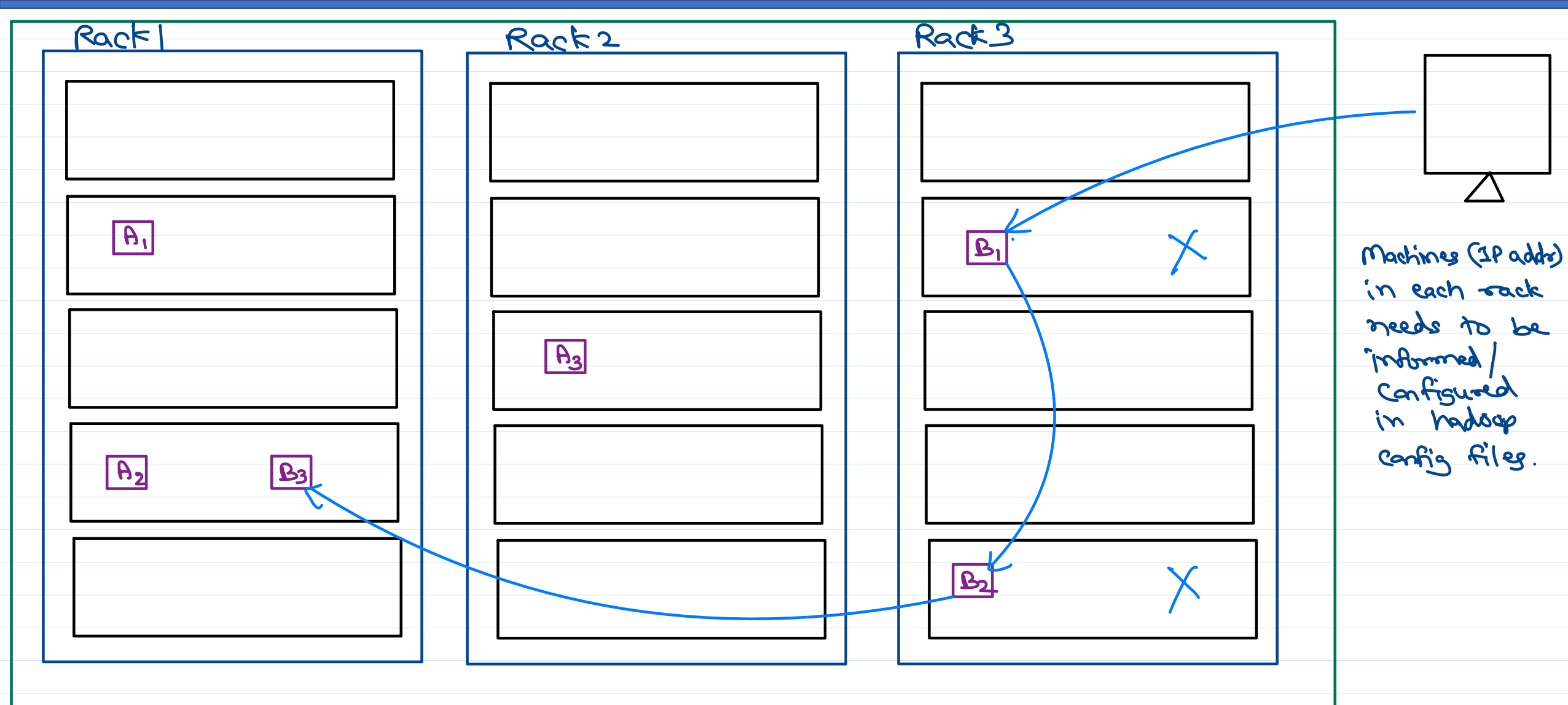
- ✓ Each data block is copied on other Data nodes.
- ✓ Default replication factor = 3
- ✓ Can be configured - dfs.replication
- ✓ Overheads = 200%. (repl factor = 3)

Data Node Failure → Erasure Coding (3.x)

- ✓ Stores parity for the blocks so that if any block is not readable, it can be recomputed.
- ✓ Overheads = 50% + CPU time for recomputation

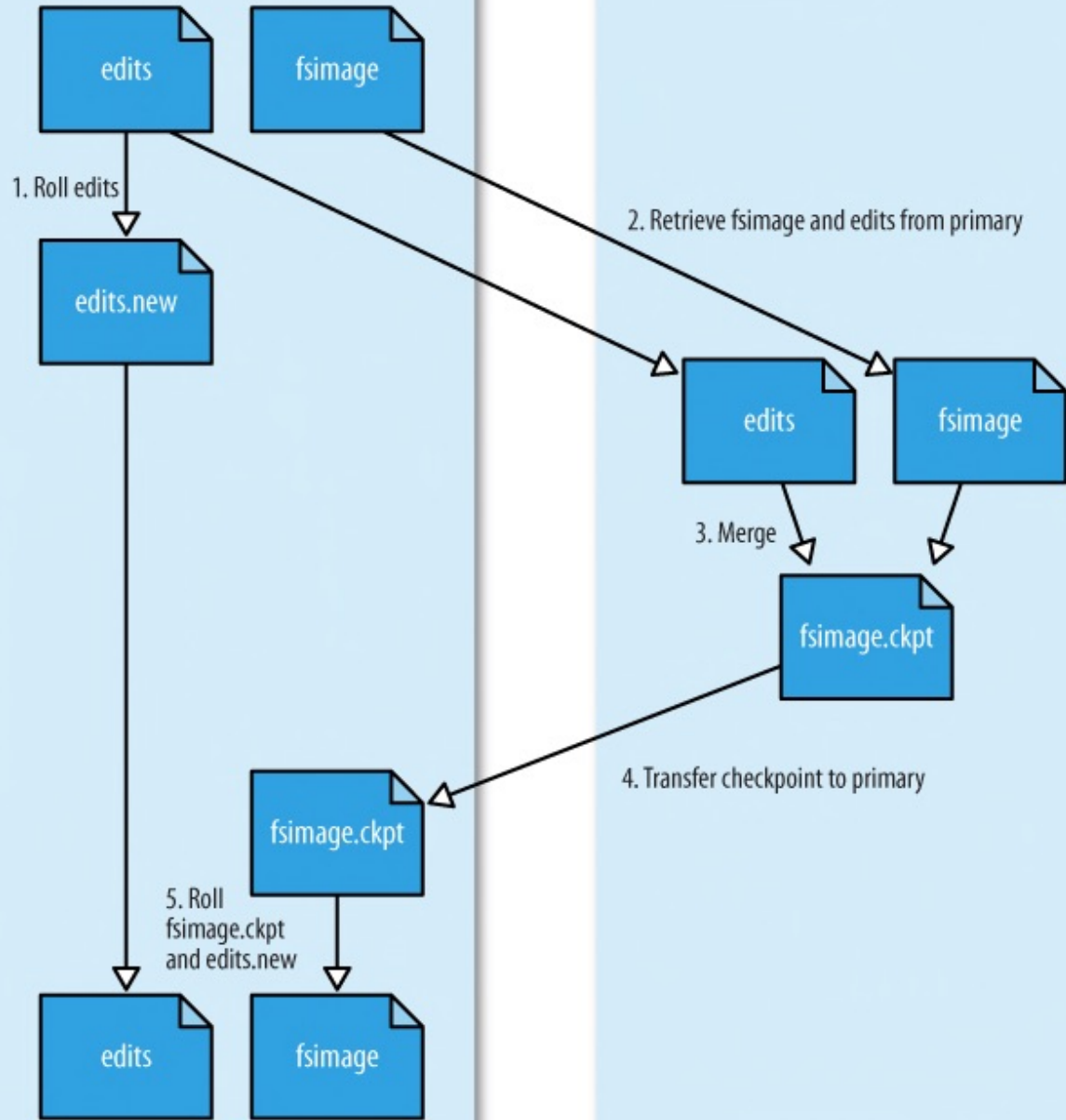


Rack aware Hadoop installation

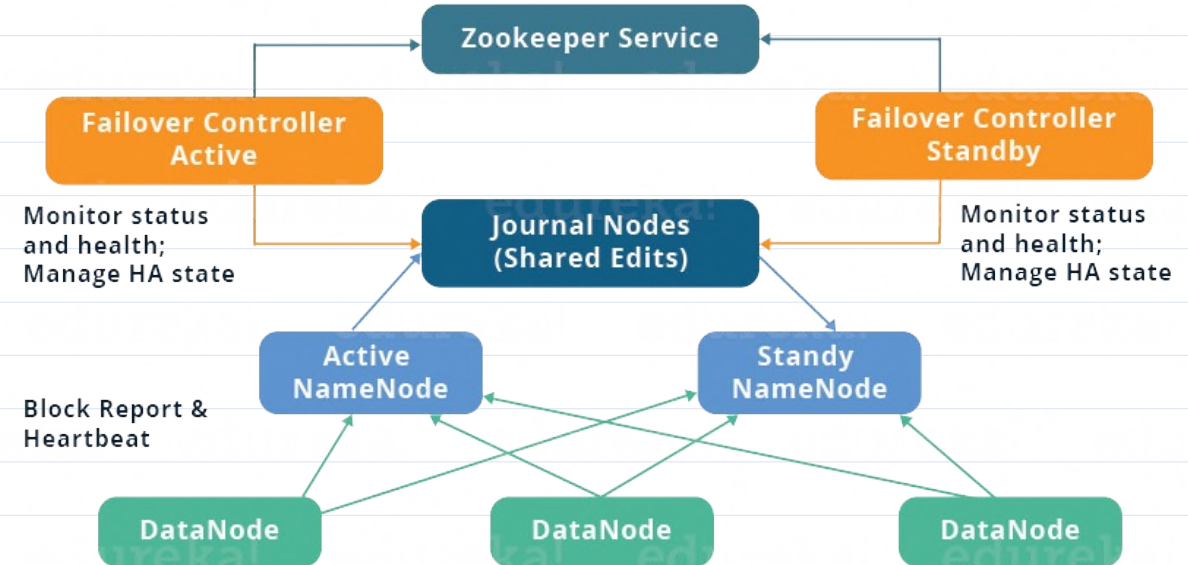


Primary Namenode

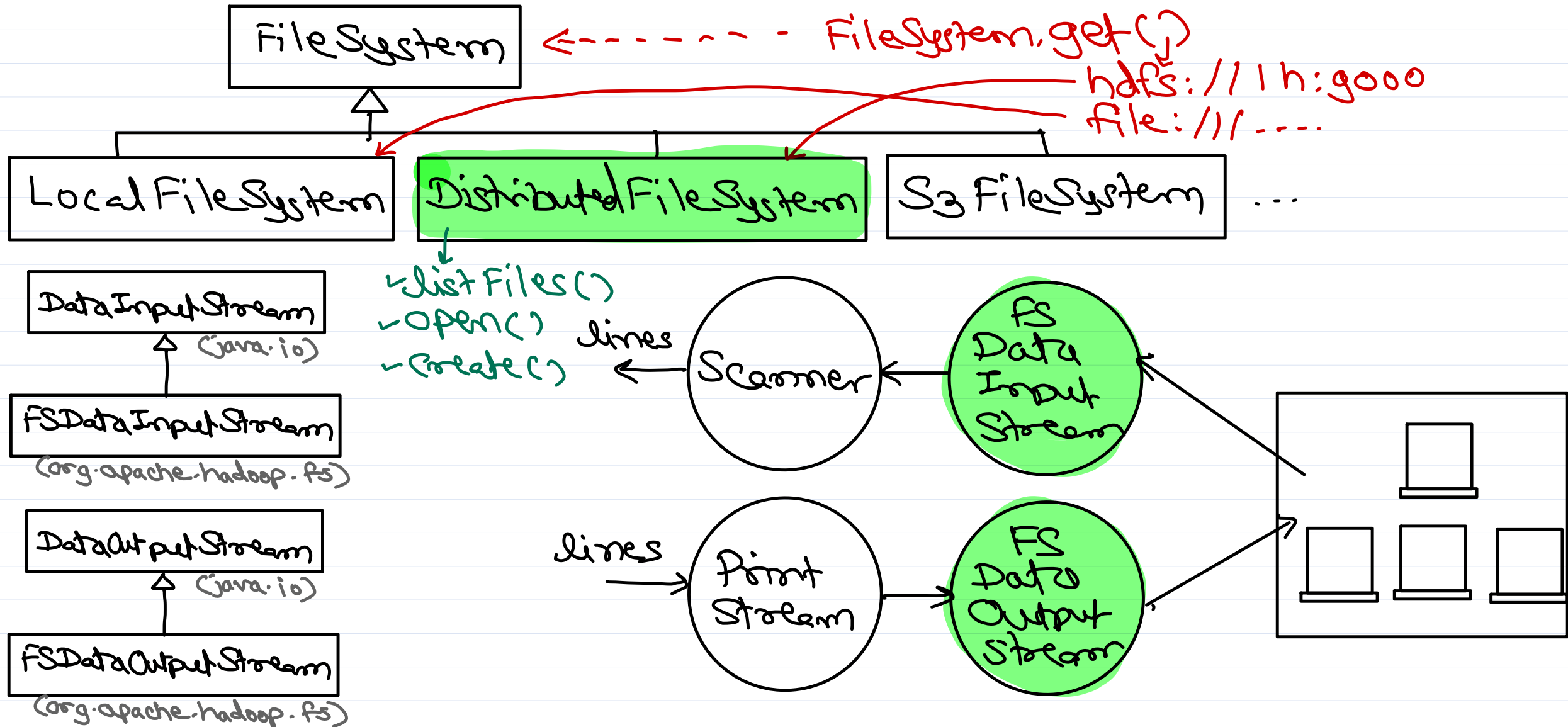
Secondary Namenode



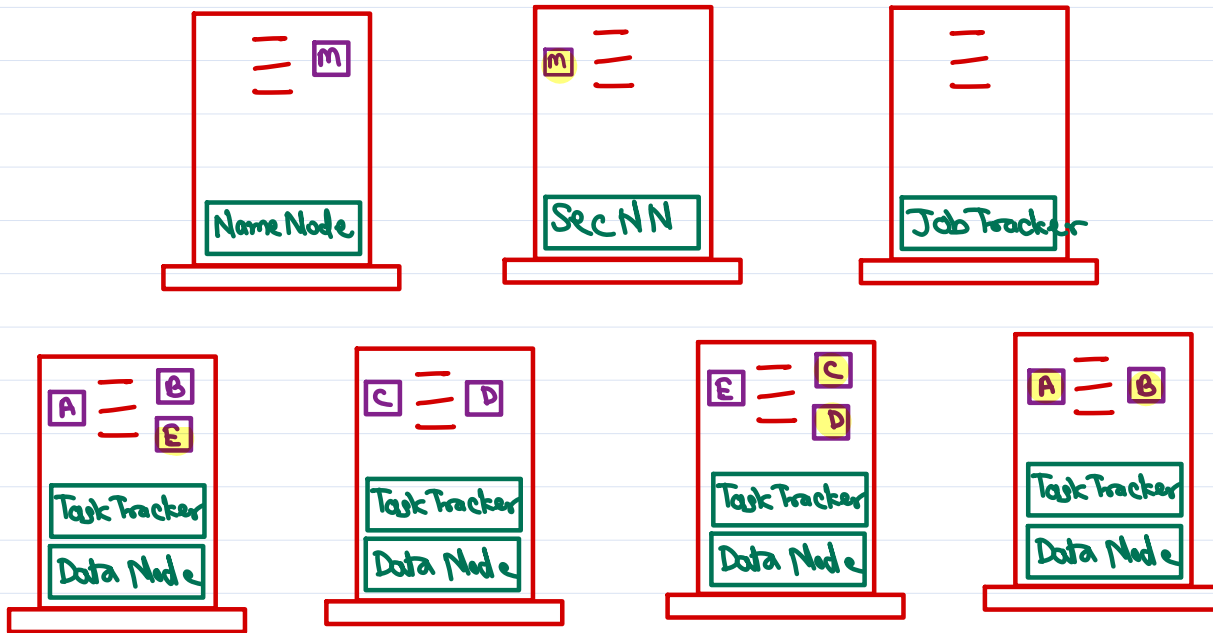
HDFS High Availability Architecture



HDFS related classes



Hadoop 1.x - Map Reduce



Hadoop MR program has mappers and reducers.

Job Tracker

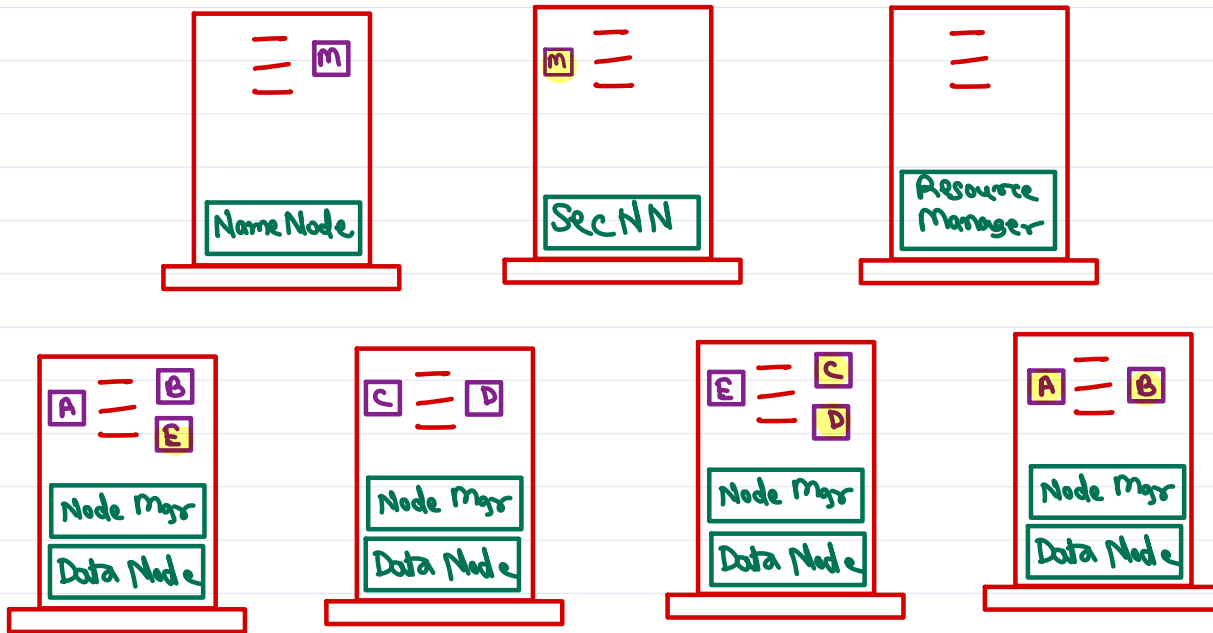
- ✓ allocate resources (CPU, RAM - node) - cluster mgmt
- ✓ track progress of individual jobs.

Task Tracker

- ✓ execute individual tasks
- ✓ Report status to job tracker



Hadoop 2.x - Map Reduce



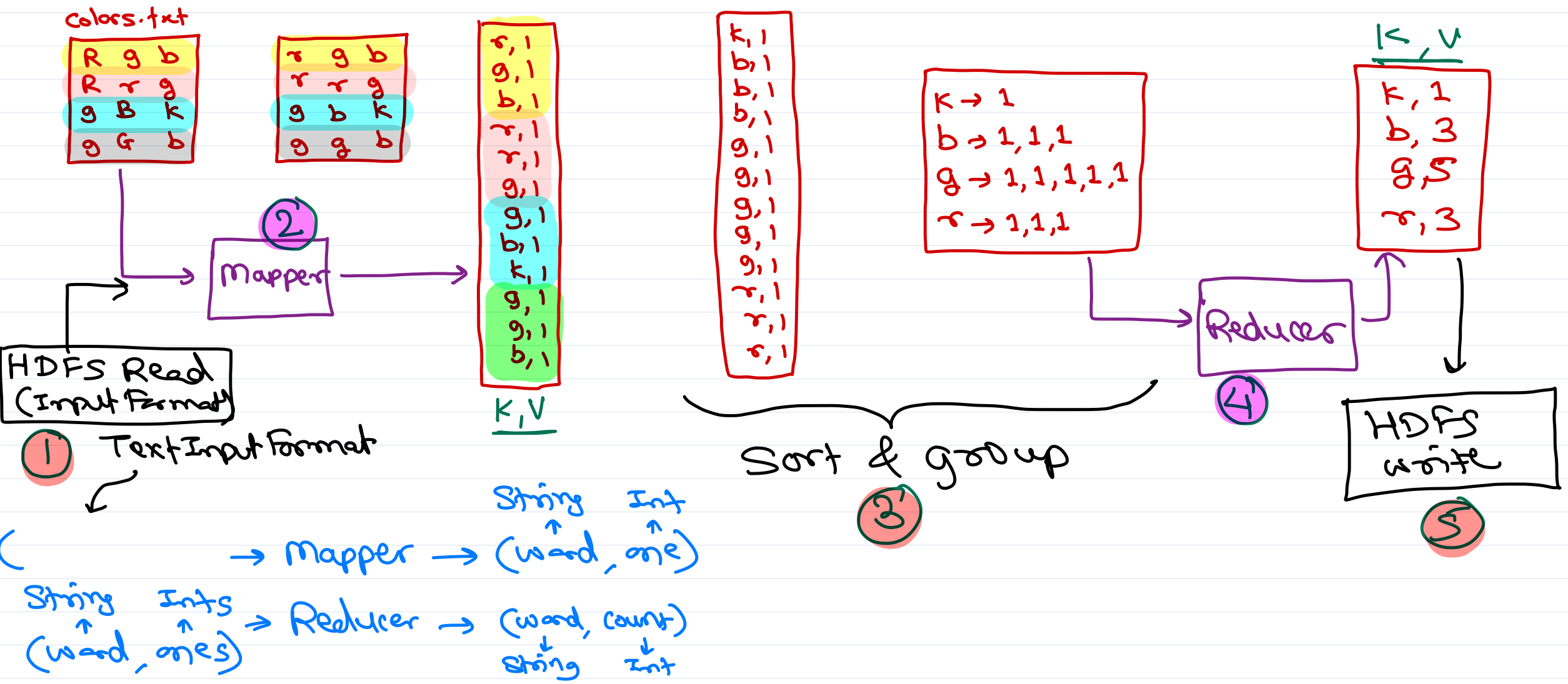
Hadoop MR program has mappers and reducers.

YARN = RM + NMs

- ✓ allocate resources (CPU, RAM - node) - cluster mgmt
- ✓ Job scheduler.
 - FIFO
 - Fair
 - Capacity
- ✓ Creates new processes (containers/ yarn childs) to execute MR job.



Word Count- MR job





Thank you!

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