**Assignment 2**

**Question 1: For NameNode, why it’s not necessary to store block locations persistently?**

Because of this information can be

* constructed by asking the DataNodes for their block lists when they join the cluster
* or dynamically built based on Block Report (which is periodically update to ensure NameNode’s block mapping is up to date).

**Question 2: Why is it important to make the NameNode resilient to failures?**

Because NN failure is the only SPOF in Hadoop system. When NN is crashed/down because of unexpected failure or scheduled maintenance, all machines of cluster is unusable.

**Question 3: What details are there in the FsImage file?**

FsImage (namespace image) file is the is a complete persistent checkpoint of the filesystem metadata (point in time snapshot). It contains file-related metadata such as permissions, replication factor, access times, block size, blocks of the file and so on.

**Question 4: What is the purpose of the secondary name-node?**

Secondary NameNode is a server which is used to merges the FsImage and the Edits Log file periodically (default hourly) and keeps edits log size within a limit.

**Question 5: Does the NameNode stay in the safe mode until all under-replicated files are fully replicated? Why or why not?**

No, NN will exit safe mode right after a configurable percentage of safely replicated blocks was checked. Then a list of blocks that needed to be replicated was recorded. After this point, when NN exited the safe mode and is working normally, the replication process is triggered.

Because in safe mode, NN still in failure state, meaning all cluster is down. Hence, to ensure that NN can work normally as soon as possible, the under-replicated files are replicated after NN quitted safe mode (because replication process usually takes very long time to finish).

**Question 6: What are the core changes in Hadoop 2.x compared to Hadoop 1.x? In other words, state the major differences between Hadoop 1 and Hadoop 2.**

* High Availability – Taking care of NameNode SPOF problem
* YARN - Taking care of JobTracker SPOF and added support for nonmapreduce type of processing (multitenancy) making MapReduce as a user library, or one of the applications residing in Hadoop.
* HDFS Federation - Added support for multiple namespaces with multiple NameNodes.
* High Cluster Utilization - Use of variable-sized Containers instead of fixed-size Slots mechanism
* Improved Scalability - Hadoop 2.x supports more than 10,000 nodes per cluster.
* MRv2 (simply MRv1 rewritten to run on top of YARN) – no need to rewrite existing MapReduce jobs.
* Beyond Java

**Question 7: What is the difference between MR1 in Hadoop 1.0 and MR2 in Hadoop2.0?**

In MapReduce 2.0, the JobTracker is divided into three services:

* ResourceManager: a persistent YARN service that manages resources in the cluster.
* JobHistoryServer: to provide information about completed jobs.
* ApplicationMaster: to manage life cycle of applications like MapReduce, Spark etc and is terminated when the job completes.

Also, the TaskTracker has been replaced with the NodeManager, a YARN service that manages resources and deployment on a node. NodeManager is responsible for launching containers that could either be a map or reduce task.

**Question 8: What is HDFS Federation? What advantage does it provide?**

HDFS Federation partitions the filesystem namespace over multiple separated NameNodes each of which manages a portion of the filesystem namespace.

Advantages of this concept:

* allows a cluster to scale by adding NameNodes.
* removes tight coupling of Block storage and Namespace.

**Question 9: What is NameNode High Availability and how is it achieved in Hadoop 2?**

The High Availability (HA) feature in Hadoop 2 fixes the NameNode’s SPOF problem by providing the option of running two redundant NameNodes at the same time by one cluster with a hot standby Active/Passive configuration.

In a typical HA cluster, two separate machines are configured as NameNodes. At any point in time, only one NameNodes is set in Active state, and the other is in a Standby (Passive) state. The Active NameNode is responsible for all client jobs in the cluster, while the Standby is simply maintaining enough state to provide a fast failover if necessary. In the case of the Active NameNode fails/crashes, the standby Passive NameNode will take over as the new active NameNode. This failover process can be configured to be automatic, without the need for human reaction. This allows a fast failover to overcome the NN’s SPOF.

**Question 10: What is the role of Application Master in YARN application execution?**

ApplicationMaster: It’s a framework specific library and is tasked with negotiating resources from the ResourceManager and working with the NodeManager(s) to execute and monitor/manage life cycle of applications like MapReduce, Spark etc and is terminated when the job completes.