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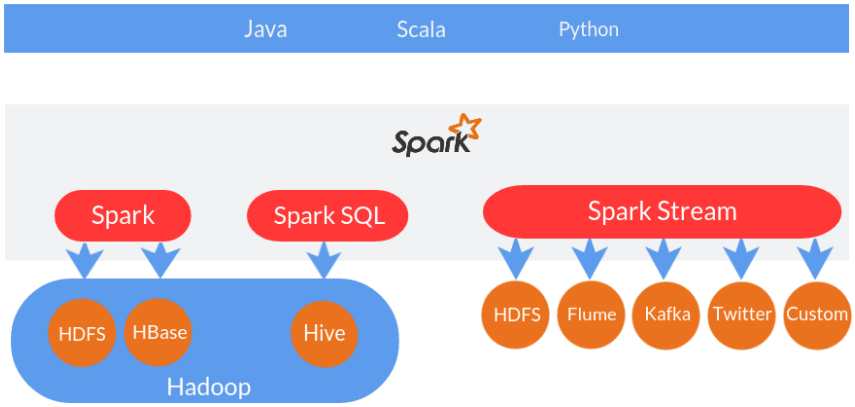
# *Introduction to Apache Spark*

It is a framework for performing general data analytics on distributed computing cluster like Hadoop.It provides in memory computations for increase speed and data process over mapreduce.It runs on top of existing hadoop cluster and access hadoop data store (HDFS), can also process structured data in Hive and Streaming data from HDFS,Flume,Kafka,Twitter




## Is Apache Spark going to replace Hadoop?

Hadoop is parallel data processing framework that has traditionally been used to run map/reduce jobs. These are long running jobs that take minutes or hours to complete. Spark has designed to run on top of Hadoop and it is an alternative to the traditional batch map/reduce model that can be used for real-time stream data processing and fast interactive queries that finish within seconds. So, Hadoop supports both traditional map/reduce and Spark.

We should look at Hadoop as a general purpose Framework that supports multiple models and We should look at Spark as an alternative to Hadoop MapReduce rather than a replacement to Hadoop.

## Hadoop MapReduce vs. Spark –Which One to Choose?

Spark uses more RAM instead of network and disk I/O its relatively fast as compared to hadoop. But as it uses large RAM it needs a dedicated high end physical machine for producing effective results

It all depends and the variables on which this decision depends keep on changing dynamically with time.

## Difference between Hadoop Mapreduce and Apache Spark

Spark stores data in-memory whereas Hadoop stores data on disk. Hadoop uses replication to achieve fault tolerance whereas Spark uses different data storage model, resilient distributed datasets (RDD), uses a clever way of guaranteeing fault tolerance that minimizes network I/O.

From the Spark academic paper: "RDDs achieve fault tolerance through a notion of lineage: if a partition of an RDD is lost, the RDD has enough information to rebuild just that partition." This removes the need for replication to achieve fault tolerance.

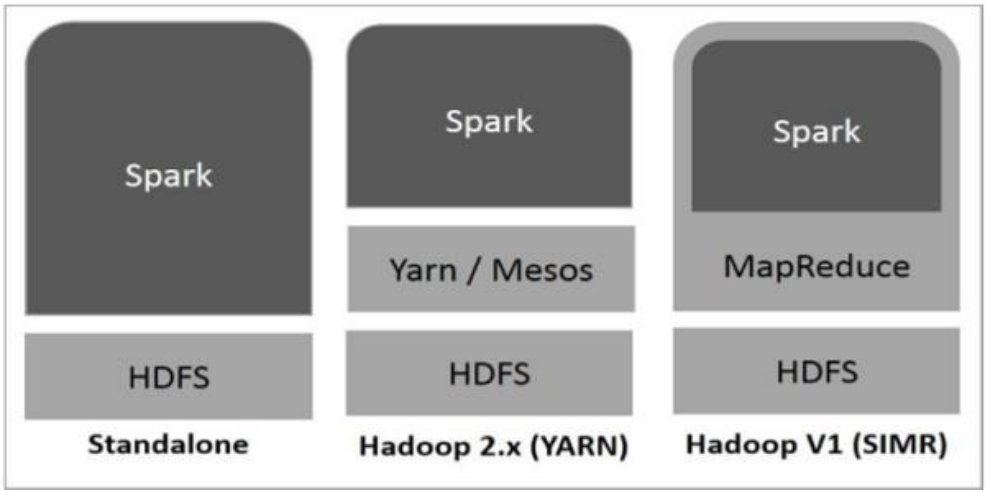
Spark enables applications in Hadoop clusters to run up to 100x faster in memory, and 10x faster even when running on disk. Spark makes it possible by reducing number of read/write to disc. It stores this intermediate processing data in-memory. It uses the concept of an Resilient Distributed Dataset (RDD), which allows it to transparently store data on memory and persist it to disc only it's needed. This helps to reduce most of the disc read and write – the main time consuming factors – of data processing

## Features of Apache Spark

- **Speed** – Spark helps to run an application in Hadoop cluster, up to 100 times faster in memory, and 10 times faster when running on disk. This is possible by reducing number of read/write operations to disk. It stores the intermediate processing data in memory.
- **Supports multiple languages** – Spark provides built-in APIs in Java, Scala, or Python. Therefore, you can write applications in different languages. Spark comes up with 80 high-level operators for interactive querying.
- **Advanced Analytics** – Spark not only supports 'Map' and 'reduce'. It also supports SQL queries, Streaming data, Machine learning (ML), and Graph algorithms.

## Spark Built on Hadoop

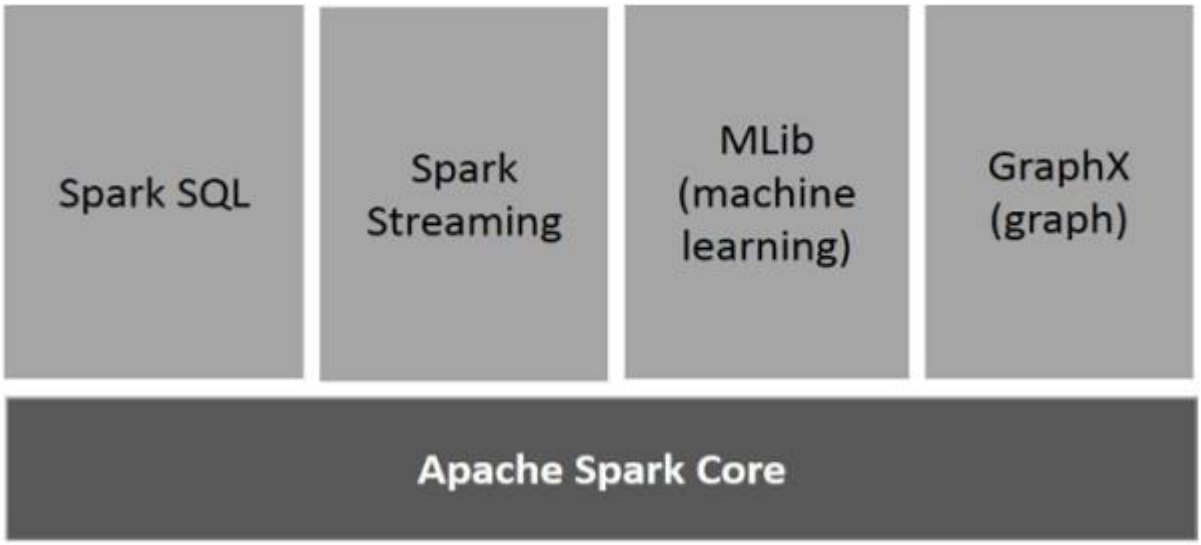
The following diagram shows three ways of how Spark can be built with Hadoop components.




## Spark's major use cases over Hadoop

- Iterative Algorithms in Machine Learning
- Interactive Data Mining and Data Processing
- Spark is a fully Apache Hive-compatible data warehousing system that can run 100x faster than Hive.
- Stream processing: Log processing and Fraud detection in live streams for alerts, aggregates and analysis
- Sensor data processing: Where data is fetched and joined from multiple sources, in-memory dataset really helpful as they are easy and fast to process.

## Components of Spark




### *Apache Spark Core*

Spark Core is the underlying general execution engine for spark platform that all other functionality is built upon. It provides In-Memory computing and referencing datasets in external storage systems.

### *Spark SQL*

Spark SQL is a component on top of Spark Core that introduces a new data abstraction called SchemaRDD, which provides support for structured and semi-structured data.

### *Spark Streaming*

Spark Streaming leverages Spark Core's fast scheduling capability to perform streaming analytics. It ingests data in mini-batches and performs RDD (Resilient Distributed Datasets) transformations on those mini-batches of data.

### *MLlib (Machine Learning Library)*

MLlib is a distributed machine learning framework above Spark because of the distributed memory-based Spark architecture. It is, according to benchmarks, done by the MLlib developers against the Alternating Least Squares (ALS) implementations. Spark MLlib is

nine times as fast as the Hadoop disk-based version of Apache Mahout (before Mahout gained a Spark interface).

### *GraphX*

GraphX is a distributed graph-processing framework on top of Spark. It provides an API for expressing graph computation that can model the user-defined graphs by using Pregel abstraction API. It also provides an optimized runtime for this abstraction.

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# *Resilient Distributed Dataset (RDD)*

At the core of Spark is the notion of a Resilient Distributed Dataset (RDD), which is an immutable collection of objects that is partitioned and distributed across multiple physical nodes of a YARN cluster and that can be operated in parallel.

There are two ways to create RDDs: *parallelizing* an existing collection in your driver program, or referencing a dataset in an external storage system, such as a shared filesystem, HDFS, HBase, or any data source offering a Hadoop InputFormat.

Once an RDD is instantiated, you can apply a series of operations. All operations fall into one of two types: transformations or actions. Transformation operations, as the name suggests, create new datasets from an existing RDD and build out the processing Directed Acyclic Graph (DAG) that can then be applied on the partitioned dataset across the YARN cluster. An Action operation, on the other hand, executes DAG and returns a value.