Lecture 14

What is Apache Spark?

What's in it for you?

1. History of Spark

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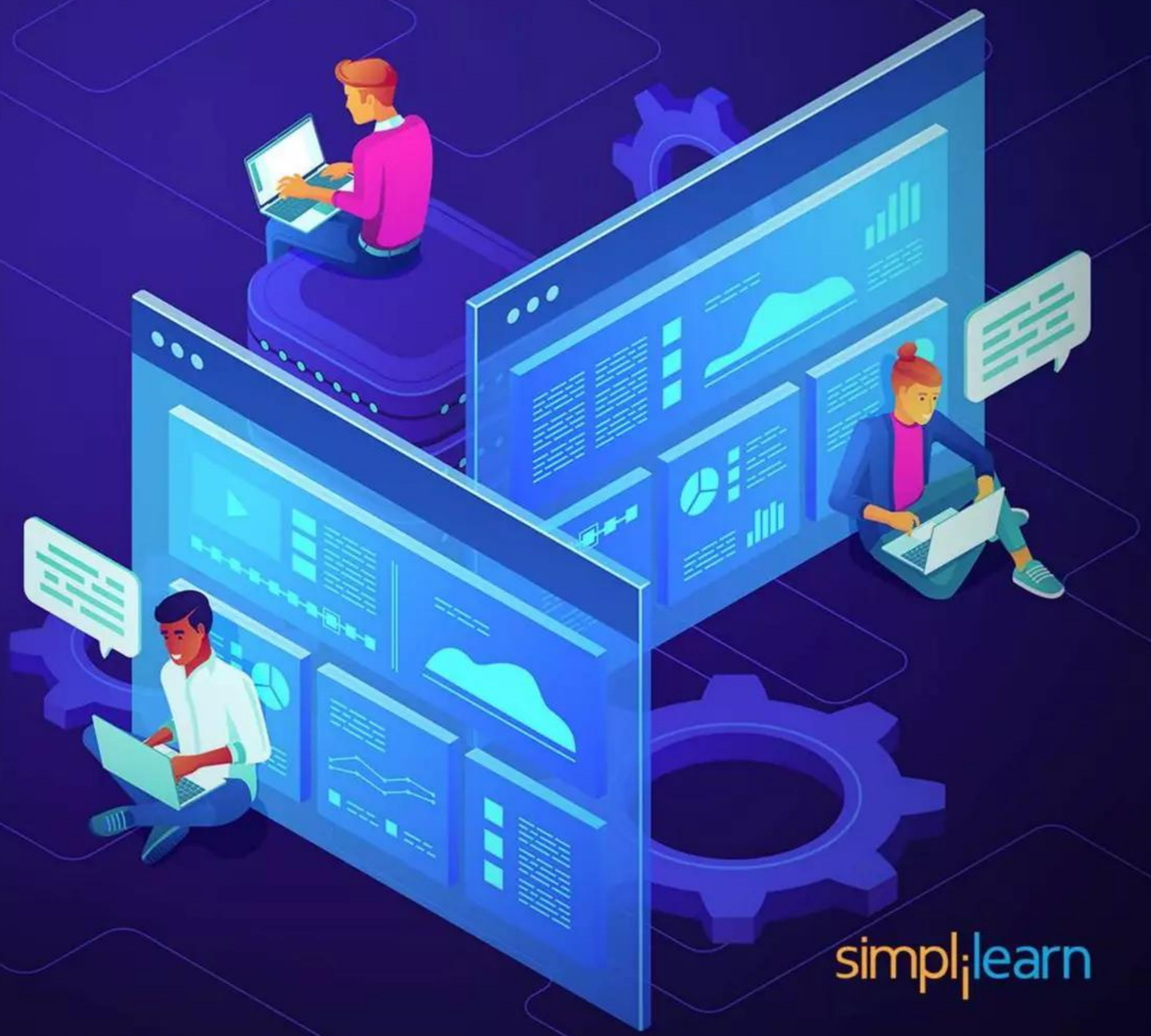
2. What is Spark?



What's in it for you?

1. History of Spark
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3. Hadoop vs Spark

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3. Hadoop vs Spark
4. Components of Apache Spark

Spark Core
Spark SQL
Spark Streaming
Spark MLlib
GraphX

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7. Spark Use Case

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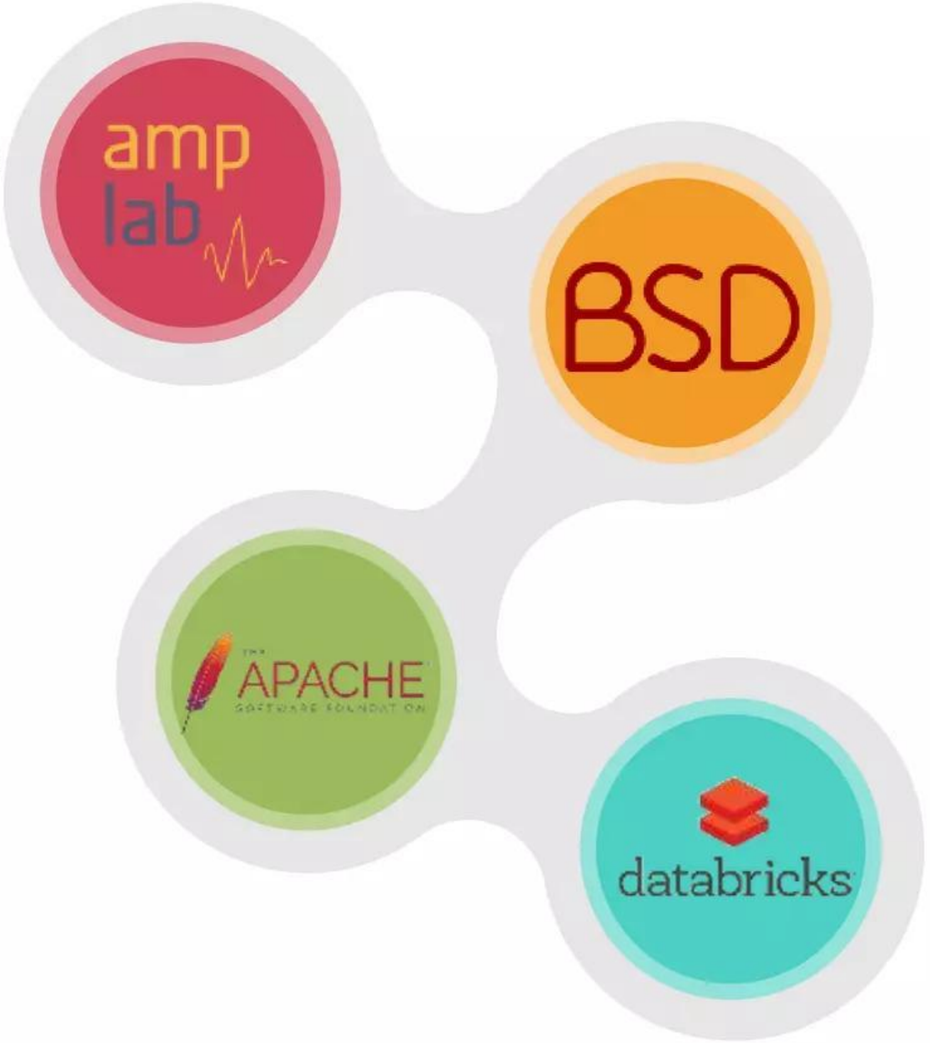
History of Apache Spark

2009

Started as a project at UC Berkley AMPLab



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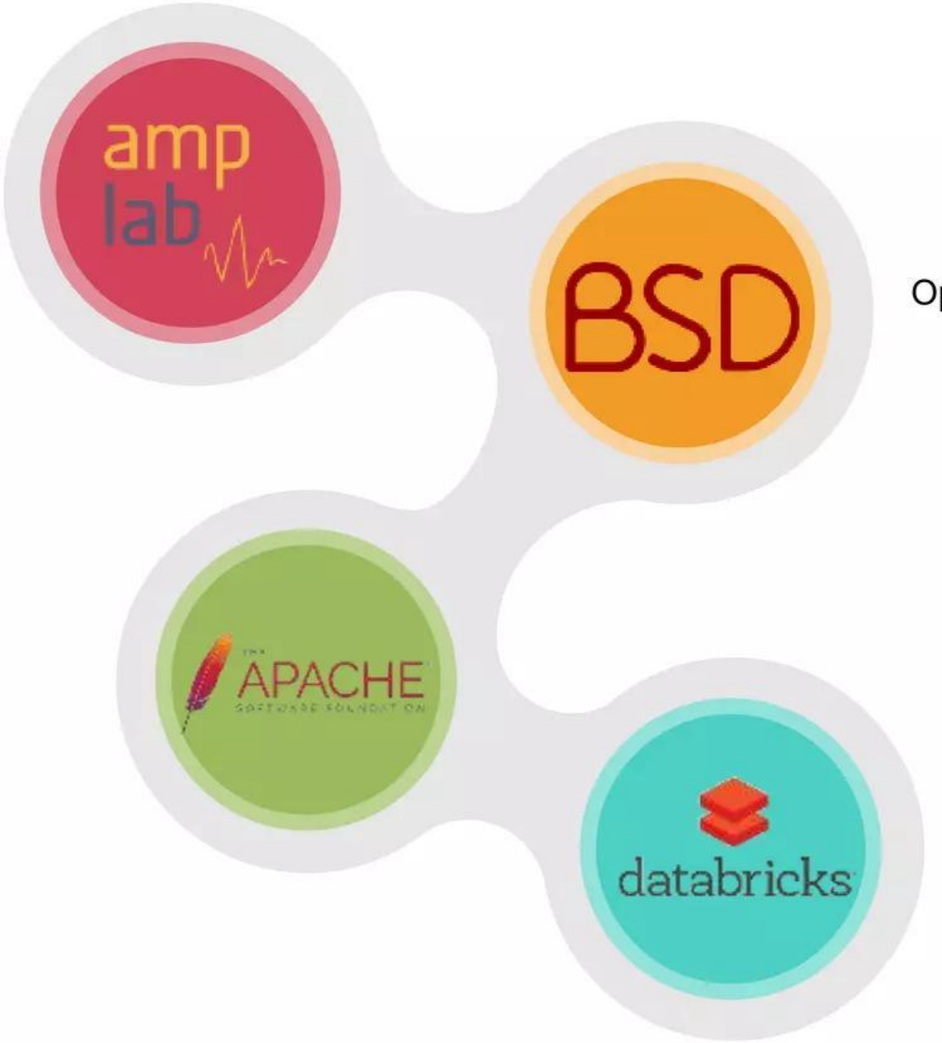

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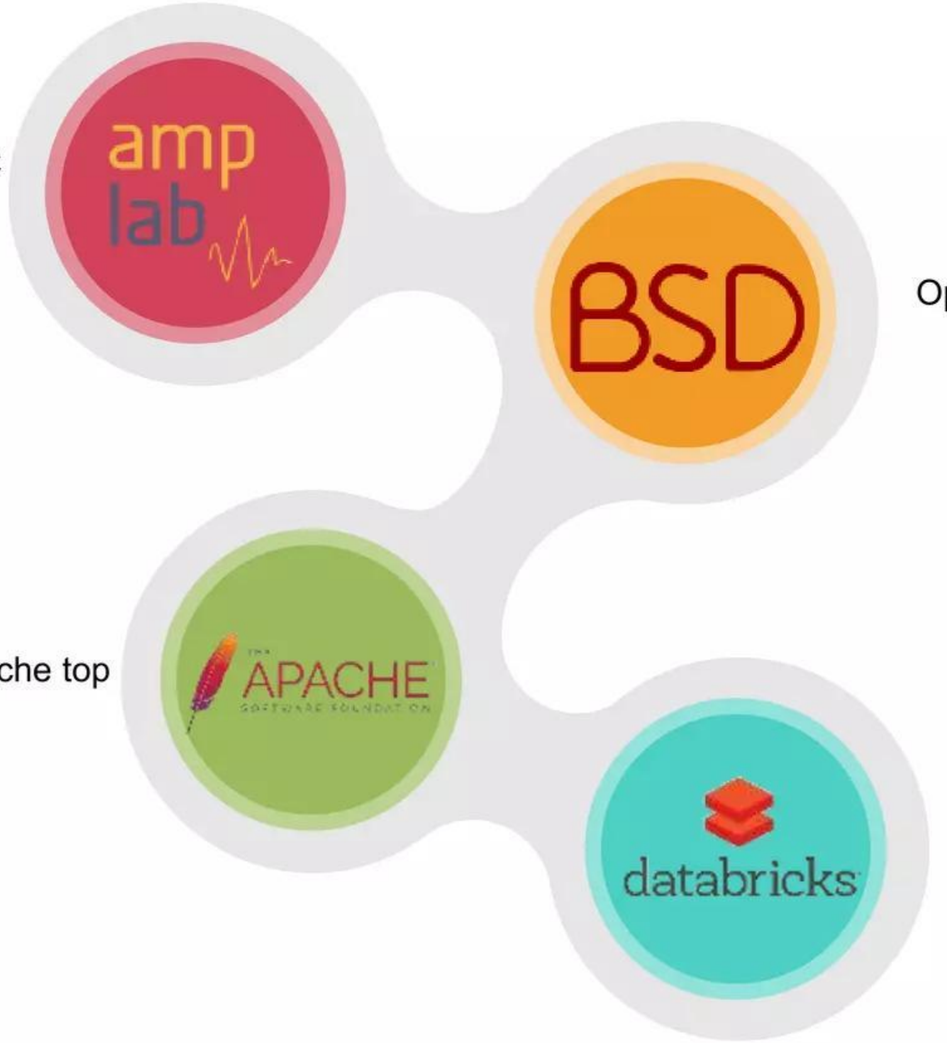

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Spark became an Apache top level project

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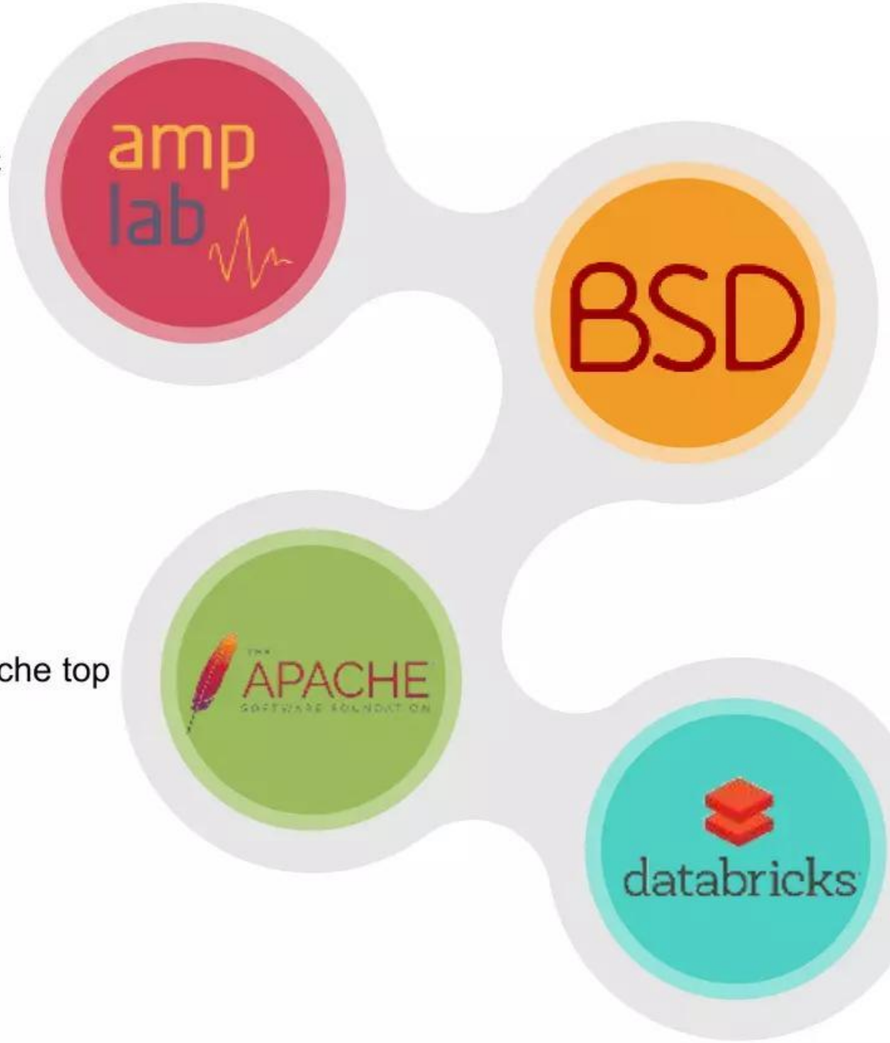

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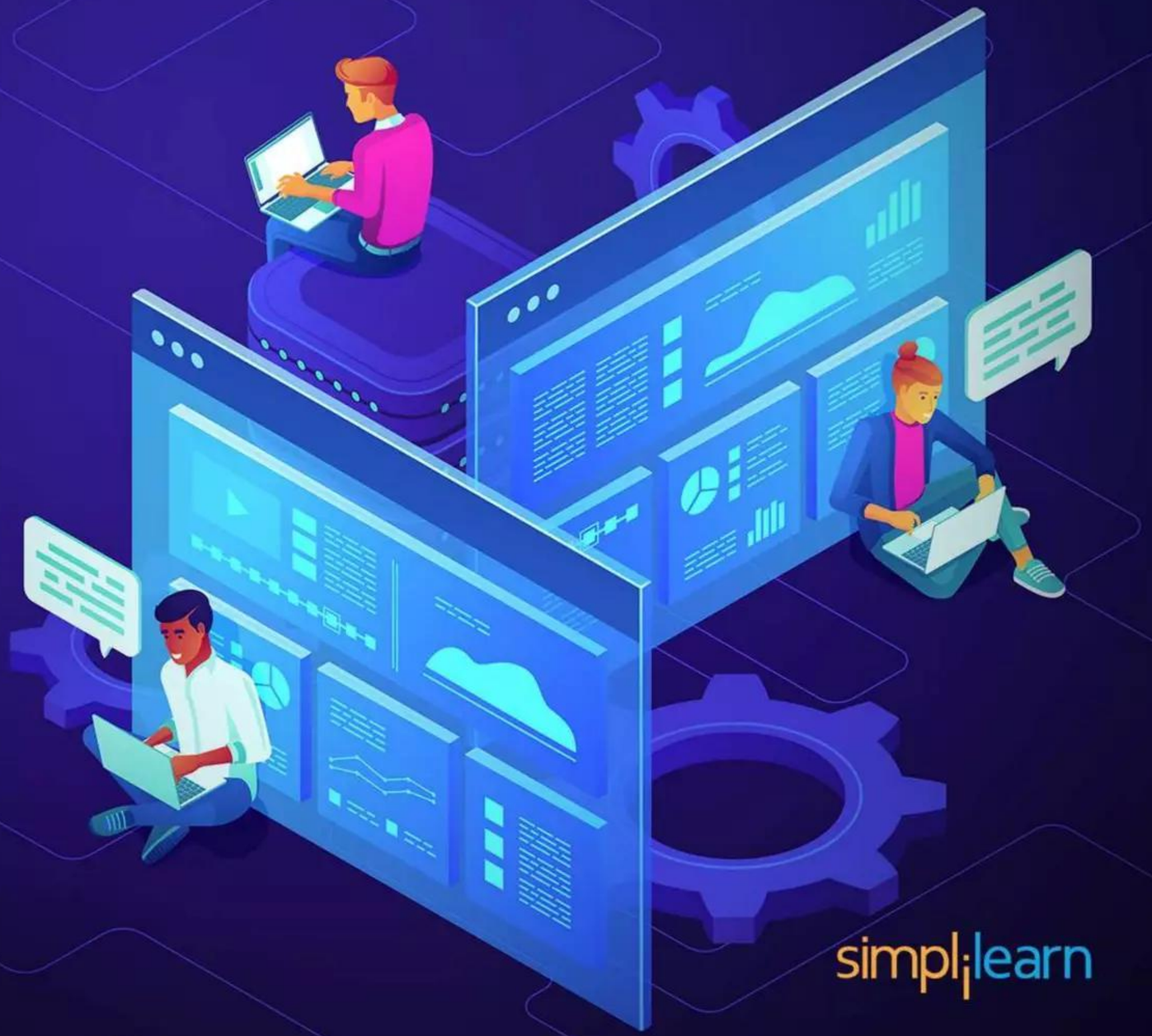
2013

Spark became an Apache top level project

2014

Used by Databricks to sort large-scale datasets and set a new world record

What is Apache Spark?



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What is Apache Spark?

Apache Spark is an open-source data processing engine to store and process data in real-time across various clusters of computers using simple programming constructs

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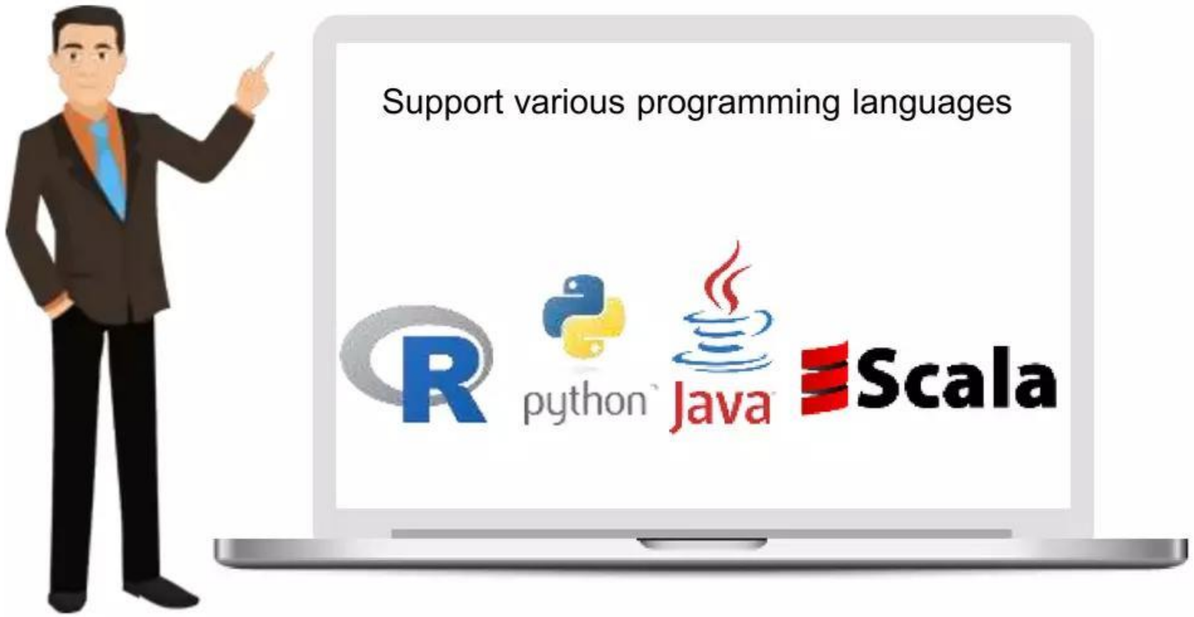

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Hadoop vs Spark

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Hadoop vs Spark

Processing data using MapReduce in Hadoop is slow

Spark processes data 100 times faster than MapReduce as it is done in-memory

Hadoop vs Spark

Hadoop	Spark
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Performs batch processing of data	Performs both batch processing and real-time processing of data

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Hadoop supports Kerberos authentication, which is difficult to manage	Spark supports authentication via a shared secret. It can also run on YARN leveraging the capability of Kerberos

Spark Features

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Spark Features

Fast processing

Spark contains Resilient Distributed Datasets (RDD) which saves time taken in reading, and writing operations and hence, it runs almost ten to hundred times faster than Hadoop

Spark Features

Fast processing

In-memory computing

In Spark, data is stored in the RAM, so it can access the data quickly and accelerate the speed of analytics

Spark Features

Fast processing

In-memory computing

Flexible

Spark supports multiple languages and allows the developers to write applications in Java, Scala, R, or Python

Spark Features

Fast processing

In-memory computing

Flexible

Fault tolerance

Spark contains Resilient Distributed Datasets (RDD) that are designed to handle the failure of any worker node in the cluster. Thus, it ensures that the loss of data reduces to zero

Spark Features

Fast processing

In-memory computing

Flexible

Fault tolerance

Better analytics

Spark has a rich set of SQL queries, machine learning algorithms, complex analytics, etc. With all these functionalities, analytics can be performed better

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Components of Spark

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Components of Apache Spark

Components of Apache Spark

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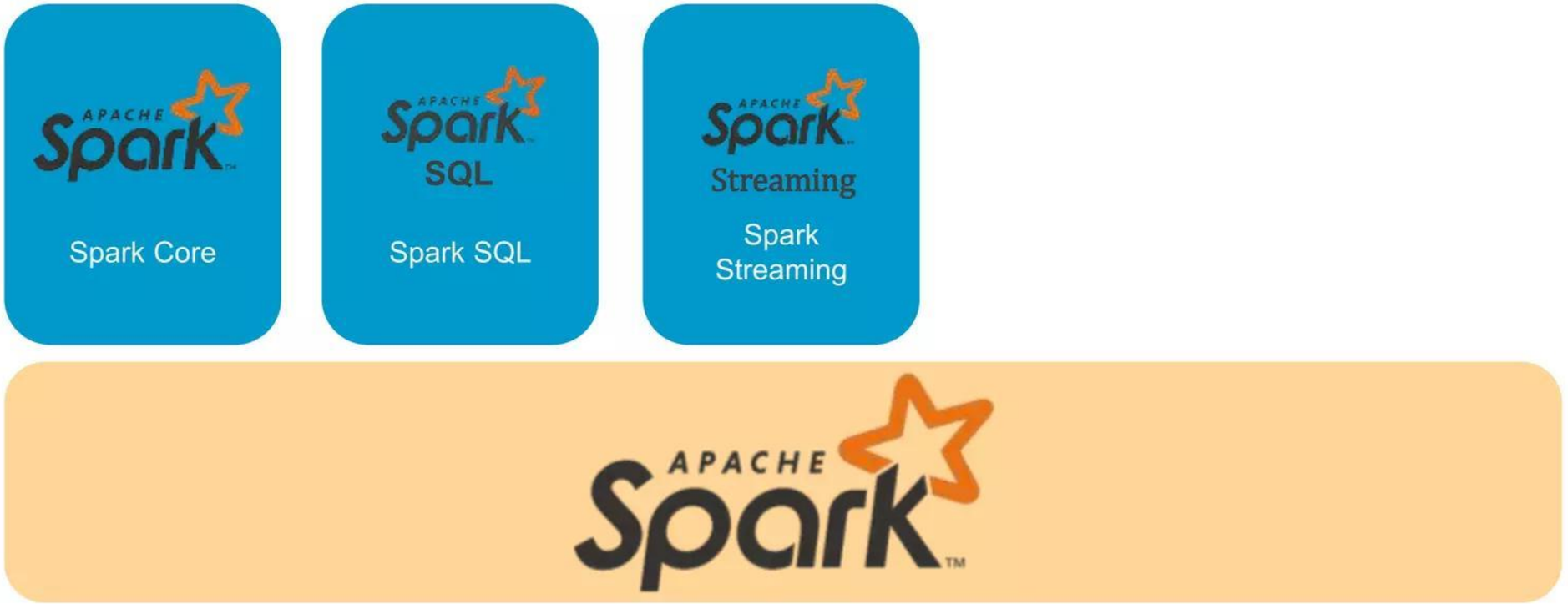

Components of Apache Spark

Components of Apache Spark

Components of Spark – Spark Core

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Spark Core

Spark Core is the base engine for large-scale parallel and distributed data processing

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Spark Core

Spark Core is the base engine for large-scale parallel and distributed data processing

Spark Core

It is responsible for:

memory management

fault recovery

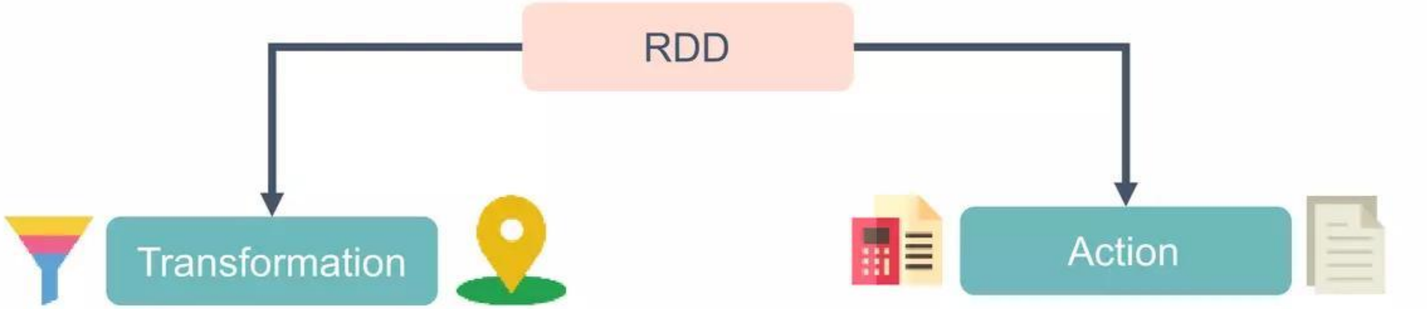
scheduling, distributing and monitoring jobs on a cluster

interacting with storage systems

Resilient Distributed Dataset

Spark Core is embedded with **RDDs** (Resilient Distributed Datasets), an immutable fault-tolerant, distributed collection of objects that can be operated on in parallel

Spark Core



These are operations (such as map, filter, join, union) that are performed on an RDD that yields a new RDD containing the result

These are operations (such as reduce, first, count) that return a value after running a computation on an RDD

Components of Spark – Spark SQL

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Spark SQL

Spark SQL framework component is used for structured and semi-structured data processing

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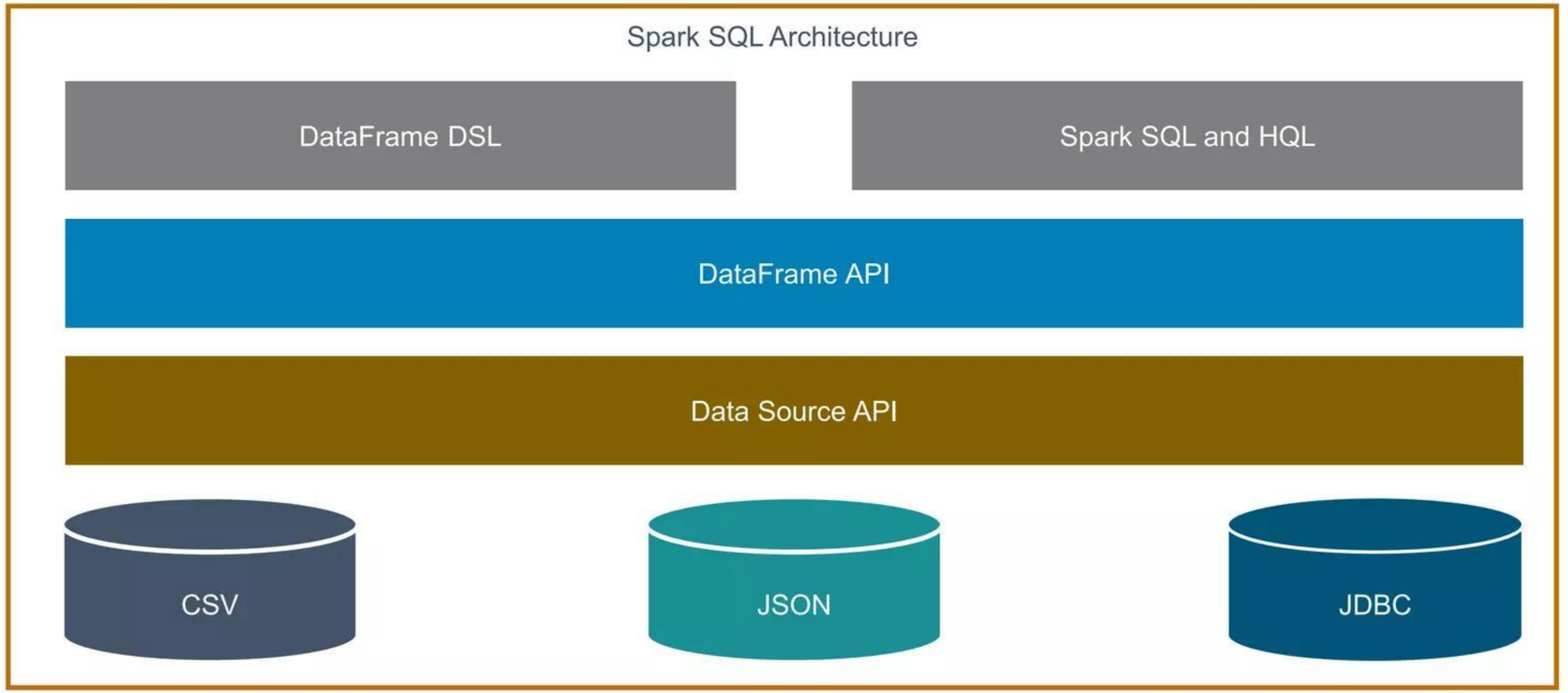

Spark SQL

Components of Spark – Spark Streaming

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Spark Streaming

Spark Streaming is a lightweight API that allows developers to perform batch processing and real-time streaming of data with ease

Provides secure, reliable, and fast processing of live data streams

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Components of Spark – Spark MLlib

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Spark MLlib

MLlib is a low-level machine learning library that is simple to use, is scalable, and compatible with various programming languages

MLlib eases the deployment and development of scalable machine learning algorithms

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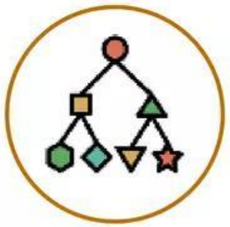
Spark MLlib

MLlib is a low-level machine learning library that is simple to use, is scalable, and compatible with various programming languages

MLlib eases the deployment and development of scalable machine learning algorithms

It contains machine learning libraries that have an implementation of various machine learning algorithms

Clustering



Classification

Collaborative Filtering

MLlib

Components of Spark – GraphX

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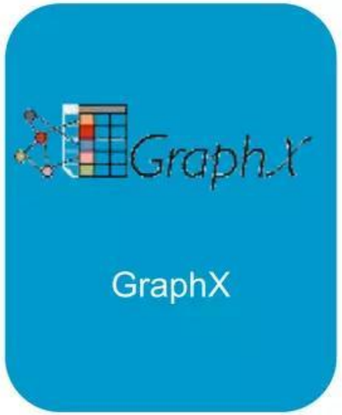
GraphX

GraphX is Spark's own Graph Computation Engine and data store



GraphX

GraphX is Spark's own Graph Computation Engine and data store

GraphX

Provides a uniform tool for ETL

Exploratory data analysis

Interactive graph computations

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Spark Architecture

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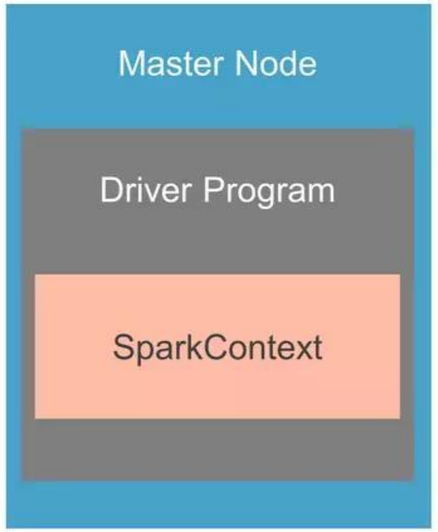
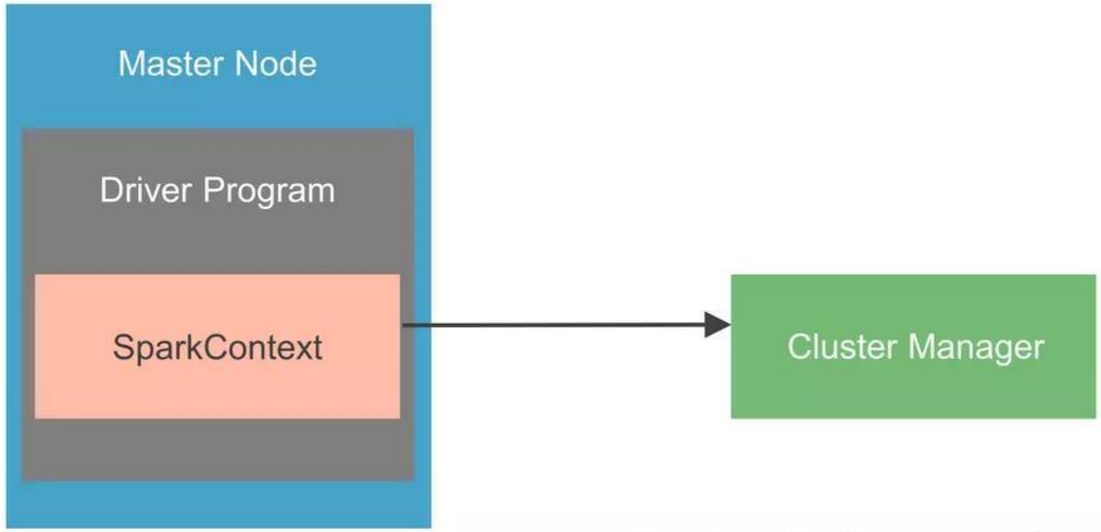
Spark Architecture

Apache Spark uses a master-slave architecture that consists of a driver, that runs on a master node, and multiple executors which run across the worker nodes in the cluster



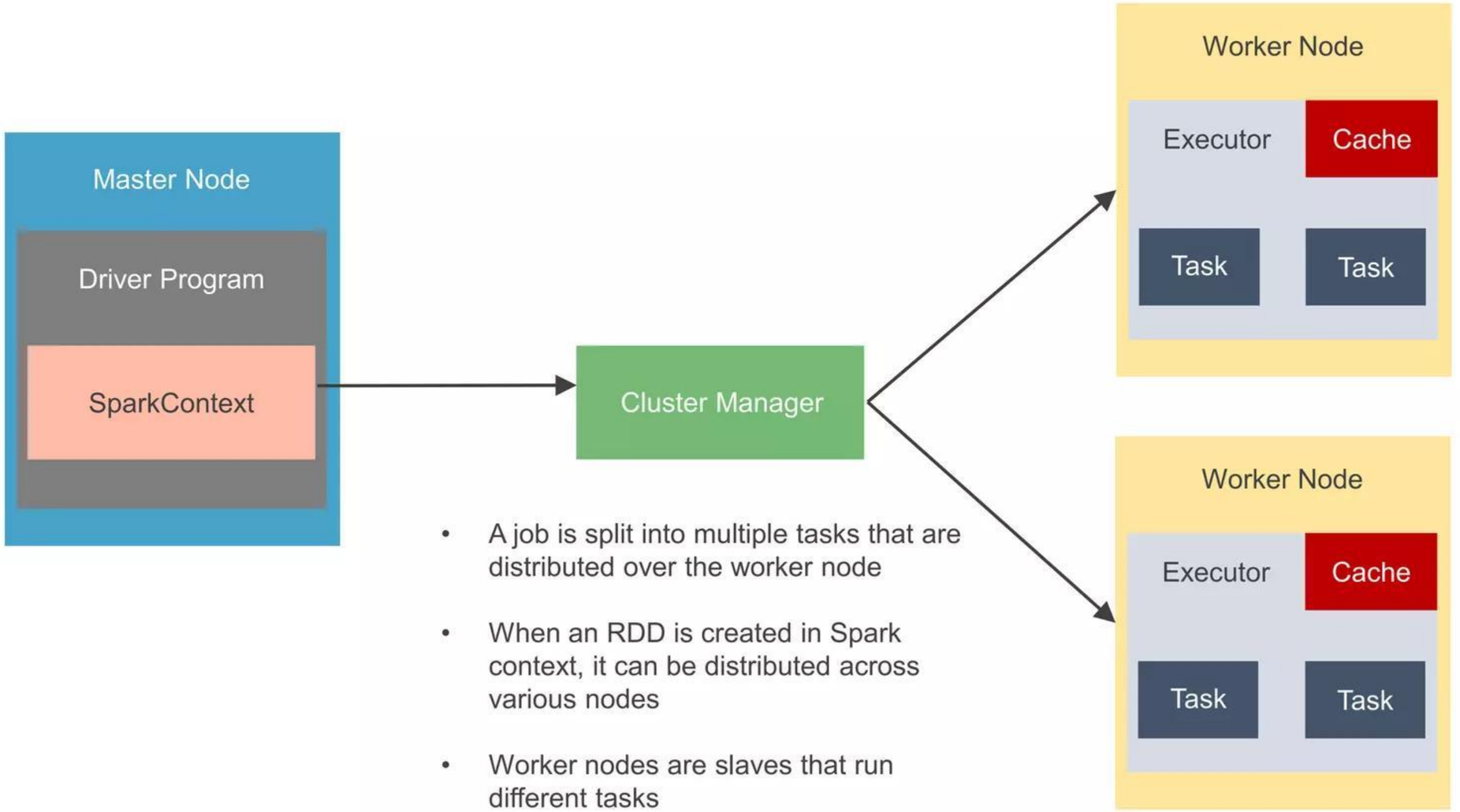
- Master Node has a Driver Program
- The Spark code behaves as a driver program and creates a SparkContext, which is a gateway to all the Spark functionalities

Spark Architecture



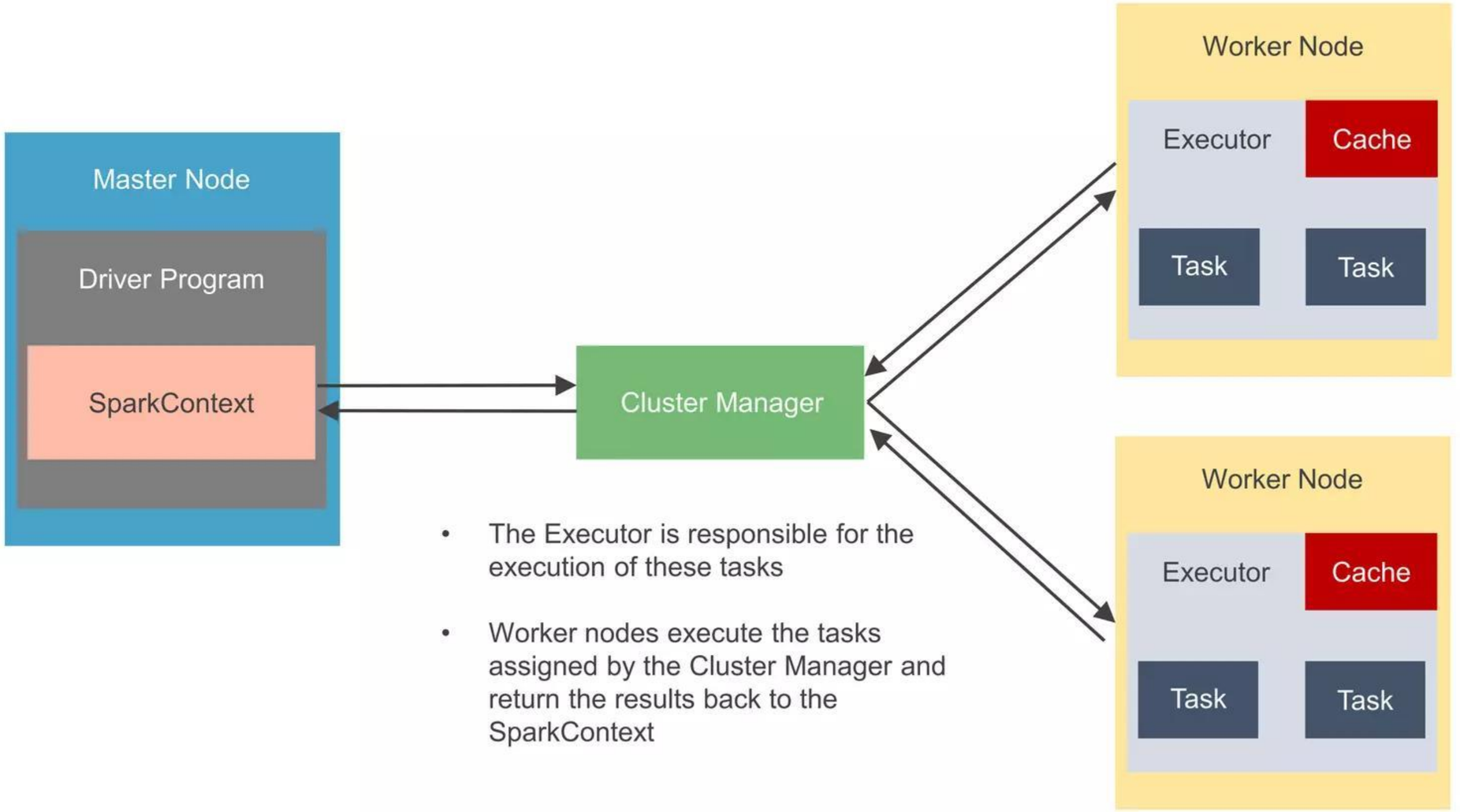
- Spark applications run as independent sets of processes on a cluster
- The driver program & Spark context takes care of the job execution within the cluster

Spark Architecture



- A job is split into multiple tasks that are distributed over the worker node
- When an RDD is created in Spark context, it can be distributed across various nodes
- Worker nodes are slaves that run different tasks

Spark Architecture



- The Executor is responsible for the execution of these tasks
- Worker nodes execute the tasks assigned by the Cluster Manager and return the results back to the SparkContext

Spark Cluster Managers

Standalone mode

1

By default, applications submitted to the standalone mode cluster will run in FIFO order, and each application will try to use all available nodes

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Apache Mesos is an open-source project to manage computer clusters, and can also run Hadoop applications

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Spark Cluster Managers

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Apache YARN is the cluster resource manager of Hadoop 2. Spark can be run on YARN

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Kubernetes is an open-source system for automating deployment, scaling, and management of containerized applications

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Applications of Spark

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Applications of Spark

JPMorgan Chase & Co.

JPMorgan uses Spark to detect fraudulent transactions, analyze the business spends of an individual to suggest offers, and identify patterns to decide how much to invest and where to invest

Banking

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Alibaba Group

Alibaba uses Spark to analyze large sets of data such as real-time transaction details, browsing history, etc. in the form of Spark jobs and provides recommendations to its users

E-Commerce

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IQVIA is a leading healthcare company that uses Spark to analyze patient's data, identify possible health issues, and diagnose it based on their medical history

Healthcare

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Healthcare

NETFLIX

RIOT GAMES

Entertainment and gaming companies like Netflix and Riot games use Apache Spark to showcase relevant advertisements to their users based on the videos that they watch, share, and like

Entertainment

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Spark Use Case

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Spark Use Case

Conviva is one of the world's leading video streaming companies

Spark Use Case

conviva

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Video streaming is a challenge, especially with increasing demand for high-quality streaming experiences

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Spark Use Case

conviva®

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Conviva collects data about video streaming quality to give their customers visibility into the end-user experience they are delivering

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Spark Use Case

conviva®

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APACHE Spark™

Using Apache Spark, Conviva delivers a better quality of service to its customers by removing the screen buffering and learning in detail about the network conditions in real-time

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Spark Use Case

conviva

Conviva is one of the world's leading video streaming companies

Using Apache Spark, Conviva delivers a better quality of service to its customers by removing the screen buffering and learning in detail about the network conditions in real-time

This information is stored in the video player to manage live video traffic coming from 4 billion video feeds every month, to ensure maximum retention

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Spark Use Case

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Reduces waiting time before the video starts

Avoids buffering and recovers the video from a technical error

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Avoids buffering and recovers the video from a technical error

Goal is to maximize the viewer engagement

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