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Hadoop Ecosystem

Agenda for today's Session

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Hadoop Ecosystem

- HDFS -> Hadoop Distributed File System
- YARN -> Yet Another Resource Negotiator
- MapReduce -> Data processing using programming
- Spark -> In-memory Data Processing
- PIG, HIVE-> Data Processing Services using Query (SQL-like)
- HBase -> NoSQL Database
- Mahout, Spark MLlib -> Machine Learning
- Apache Drill -> SQL on Hadoop
- Zookeeper -> Managing Cluster
- Oozie -> Job Scheduling
- Flume, Sqoop -> Data Ingesting Services
- Solr & Lucene -> Searching & Indexing
- Ambari -> Provision, Monitor and Maintain cluster

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Hadoop Ecosystem

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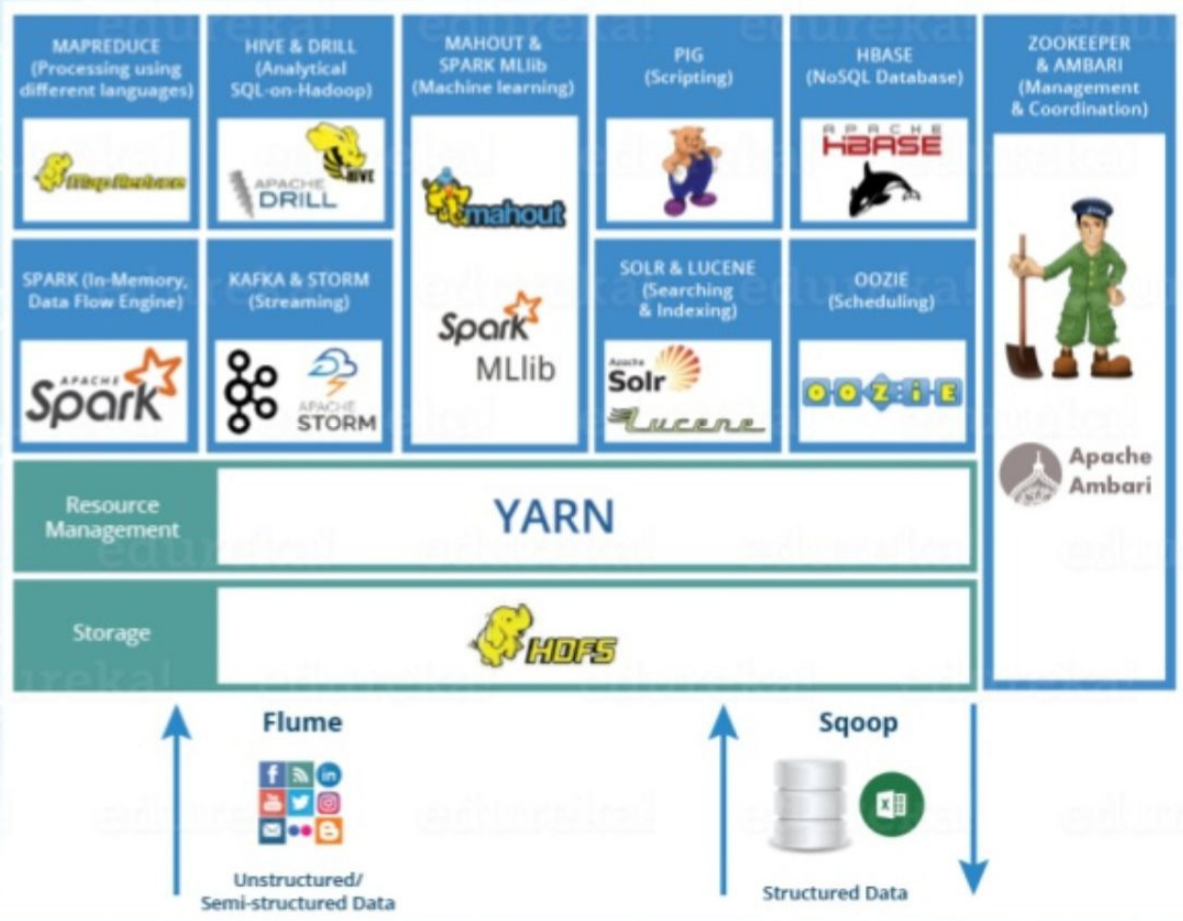

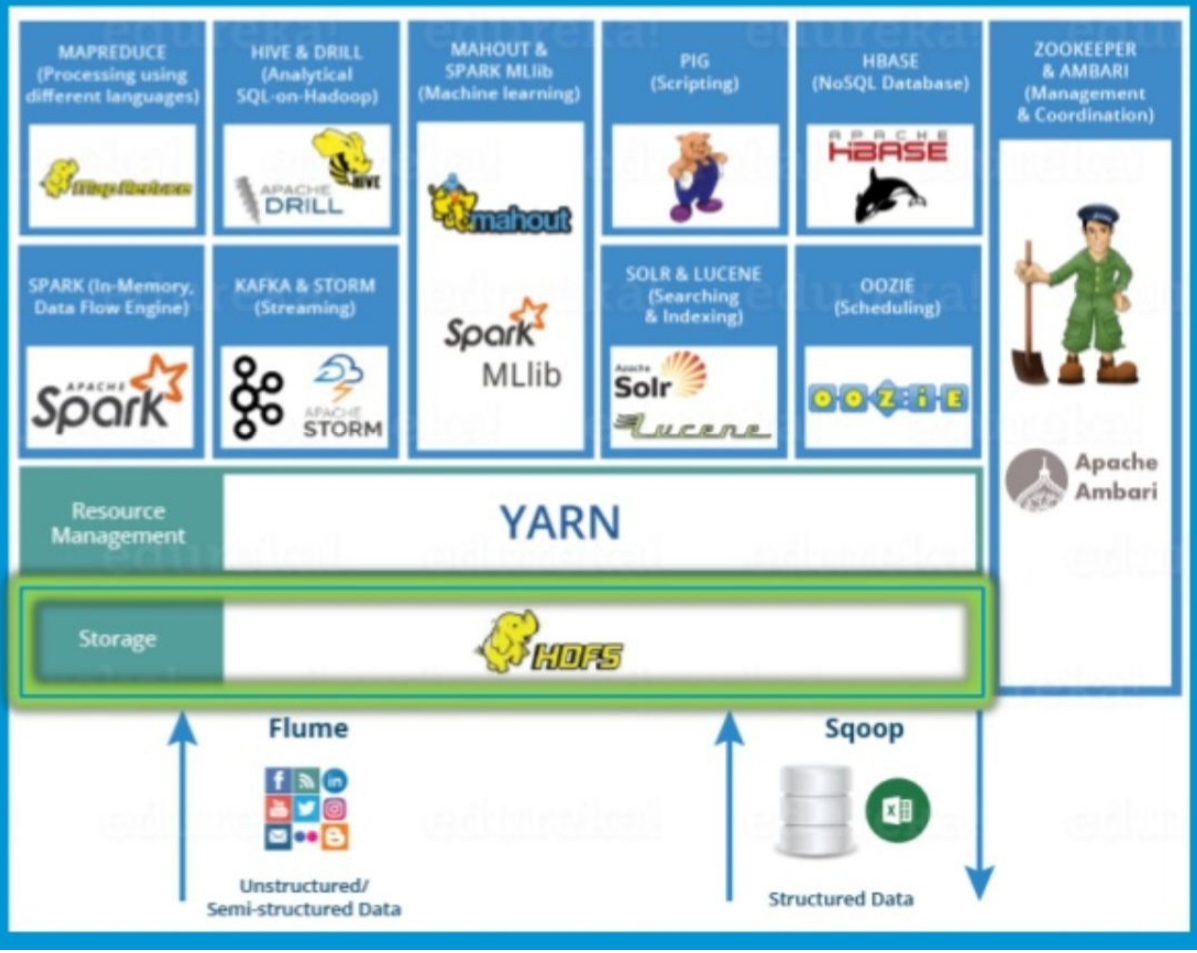
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HDFS (Hadoop Distributed File System) - Storage

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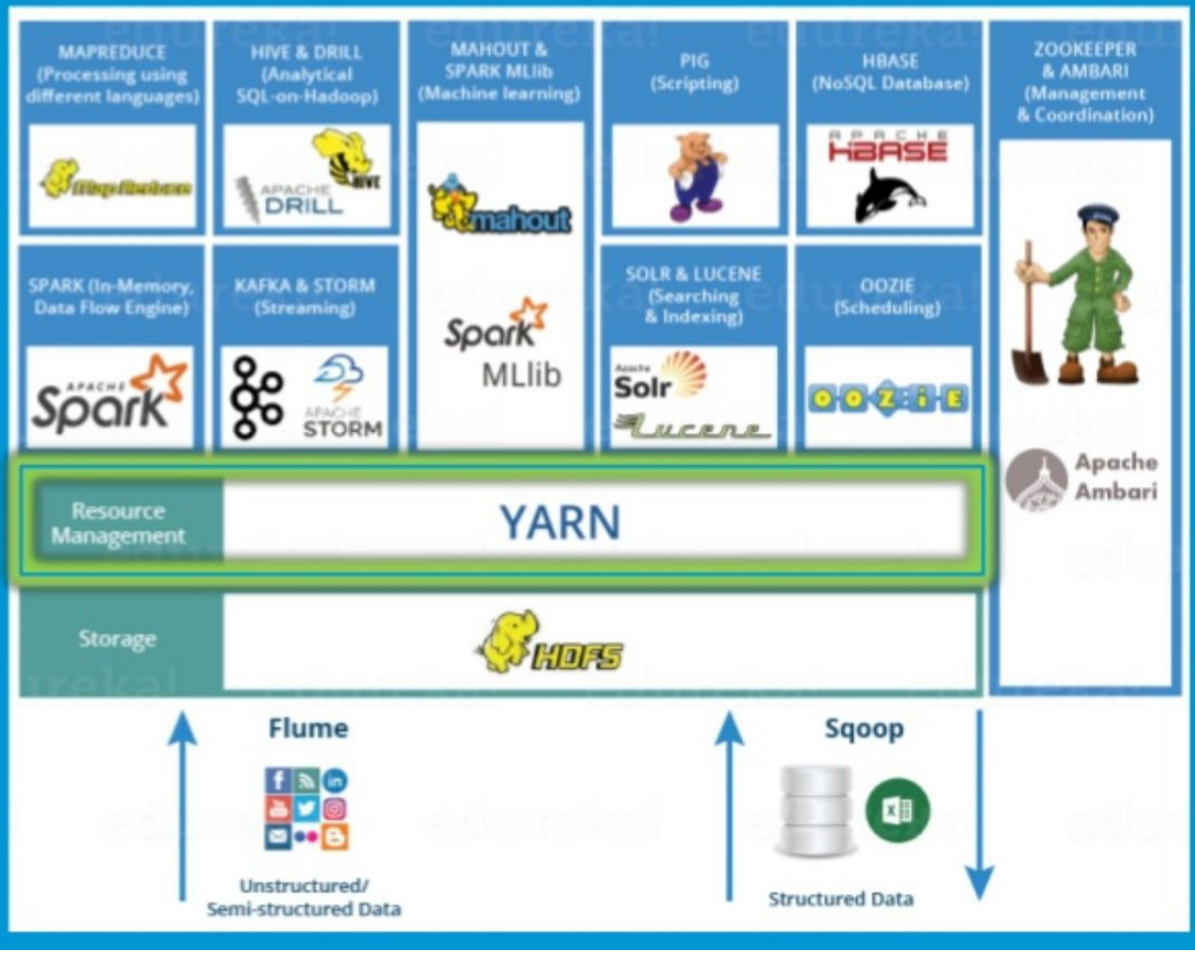
- Stores different types of large data sets (i.e. structured, unstructured and semi structured data)
- HDFS creates a level of abstraction over the resources, from where we can see the whole HDFS as a single unit
- Stores data across various nodes and maintains the log file about the stored data (metadata)
- HDFS has two core components, i.e. NameNode and DataNode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YARN (Yet Another Resource Negotiator)

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- Performs all your processing activities by allocating resources and scheduling tasks
- Two services: ResourceManager and NodeManager
- ResourceManager: Manages resources and schedule applications running on top of YARN
- NodeManager: Manages containers and monitors resource utilization in each container

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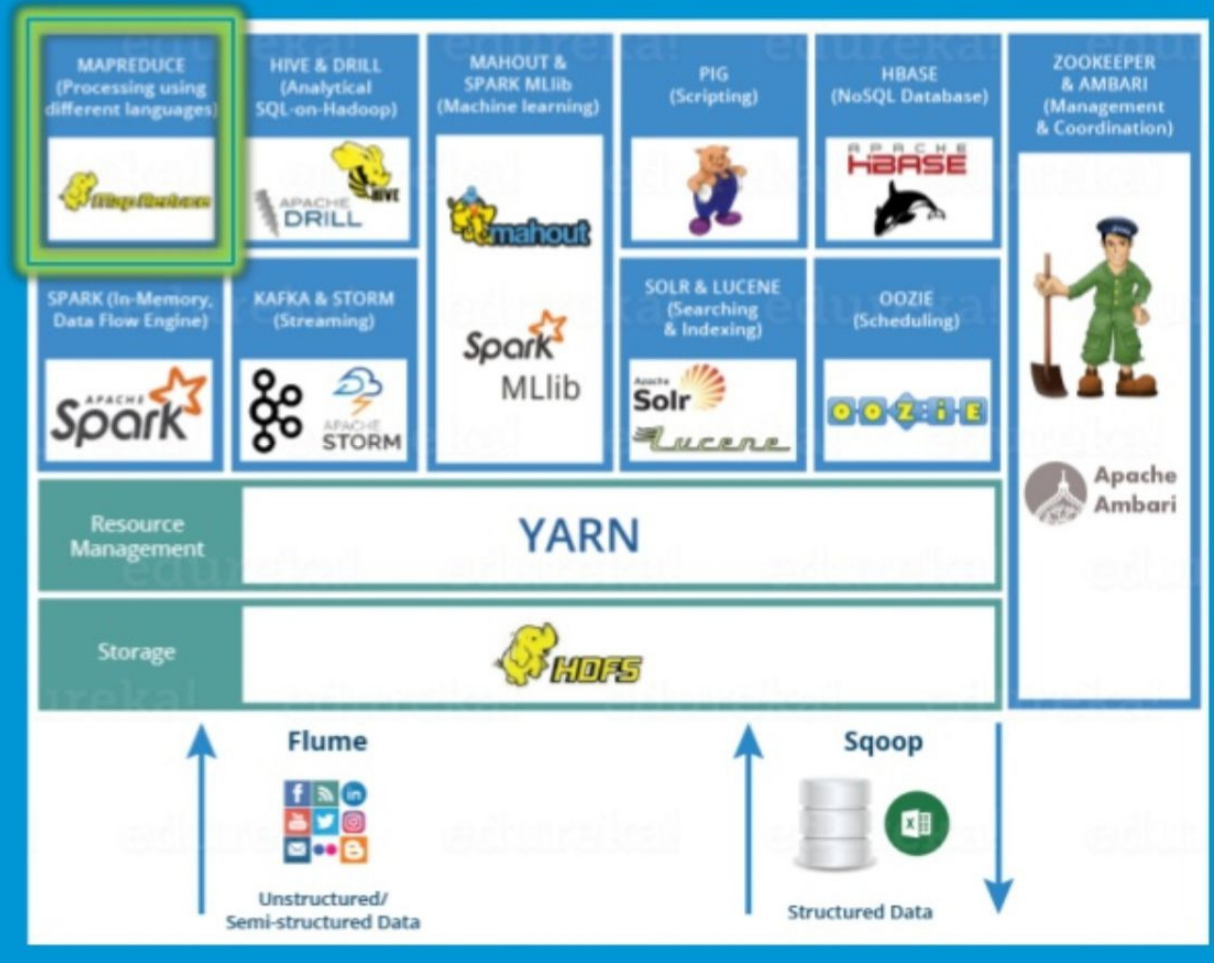
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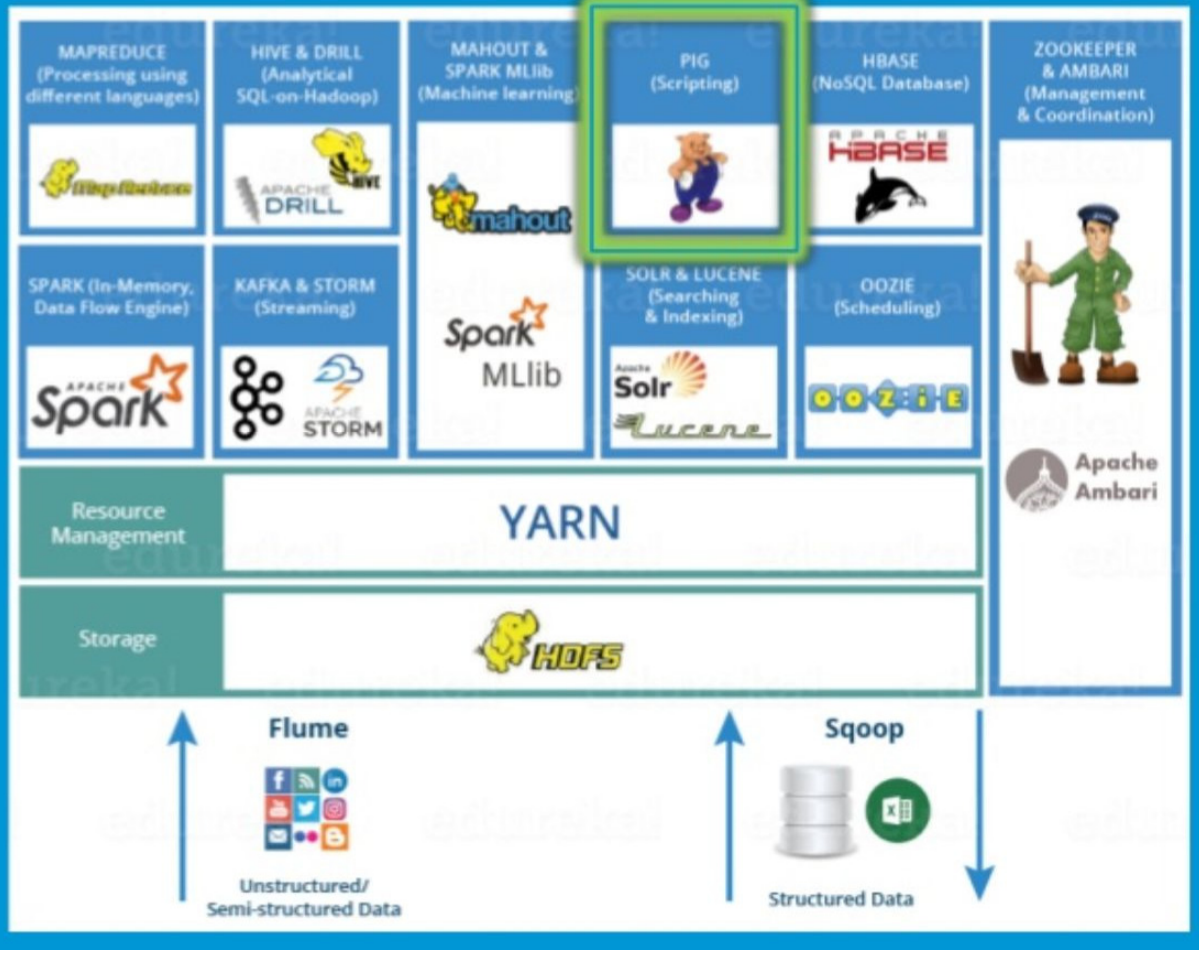
MapReduce: Data Processing Using Programming edureka!

- Core component in a Hadoop Ecosystem for processing
- Helps in writing applications that processes large data sets using distributed and parallel algorithms
- In a MapReduce program, Map() and Reduce() are two functions
- Map function performs actions like filtering, grouping and sorting
- Reduce function aggregates and summarizes the result produced by map function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PIG: Data Processing Service using Query

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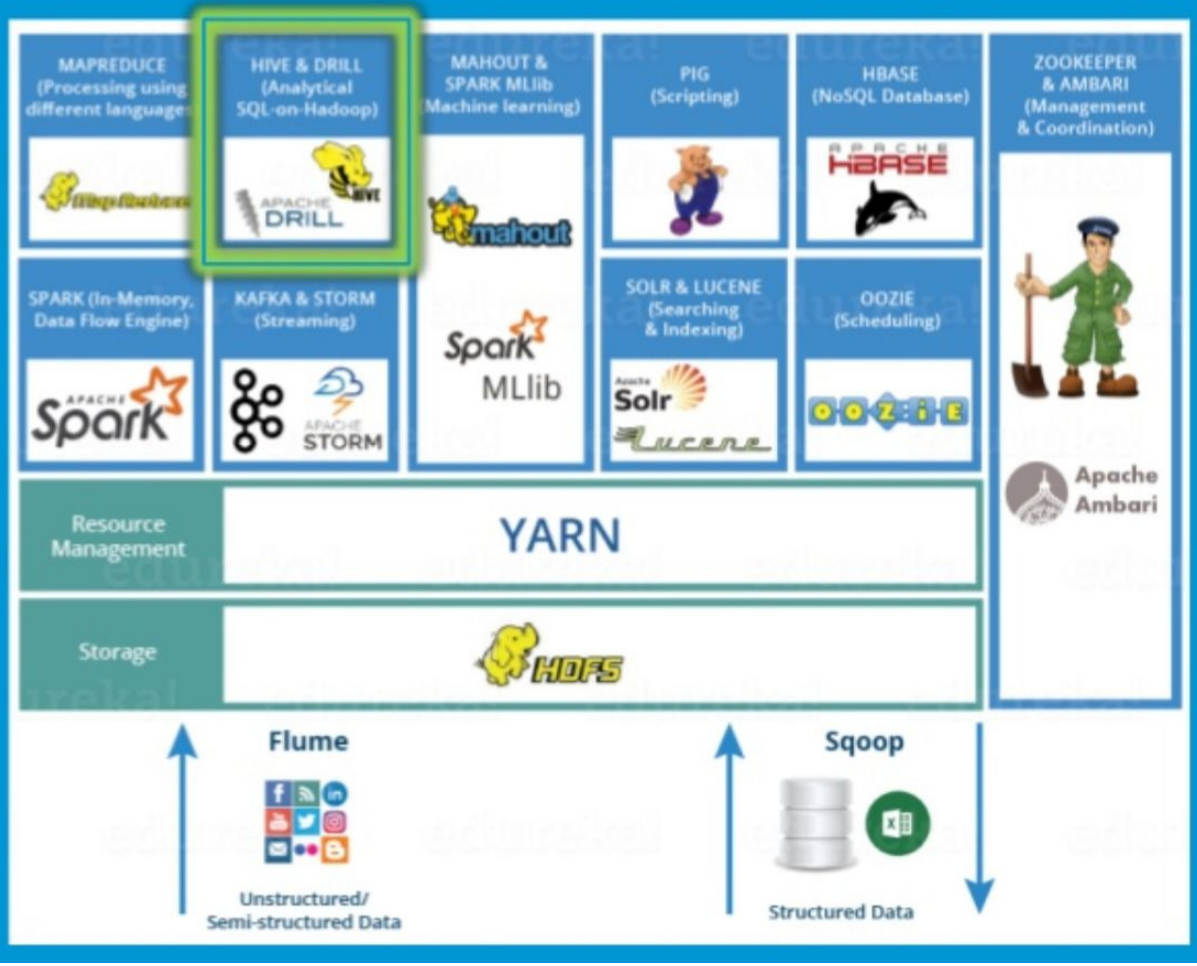
- PIG has two parts: Pig Latin, the language and the pig runtime, for the execution environment
- **1 line of pig latin = approx. 100 lines of Map-Reduce job**
- The compiler internally converts pig latin to MapReduce
- It gives you a platform for building data flow for ETL (Extract, Transform and Load)
- PIG first loads the data, then performs various functions like grouping, filtering, joining, sorting, etc. and finally dumps the data on the screen or stores in HDFS.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HIVE: Data Processing Service using Query

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- A data warehousing component which analyses data sets in a distributed environment using SQL-like interface
- The query language of Hive is called Hive Query Language(HQL)
- 2 basic components: Hive Command Line and JDBC/ODBC driver
- Supports user defined functions (UDF) to accomplish specific needs

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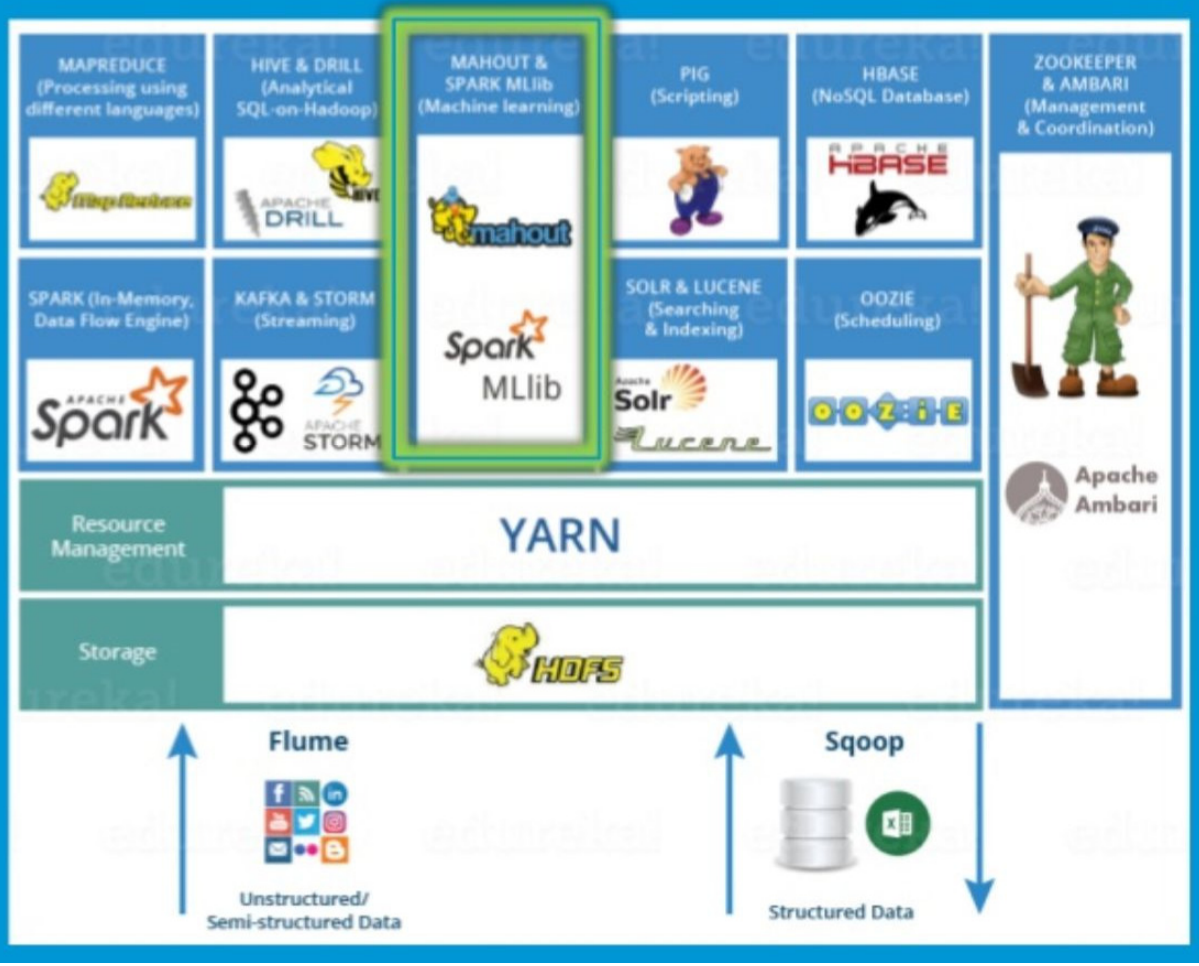
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Mahout: Machine Learning

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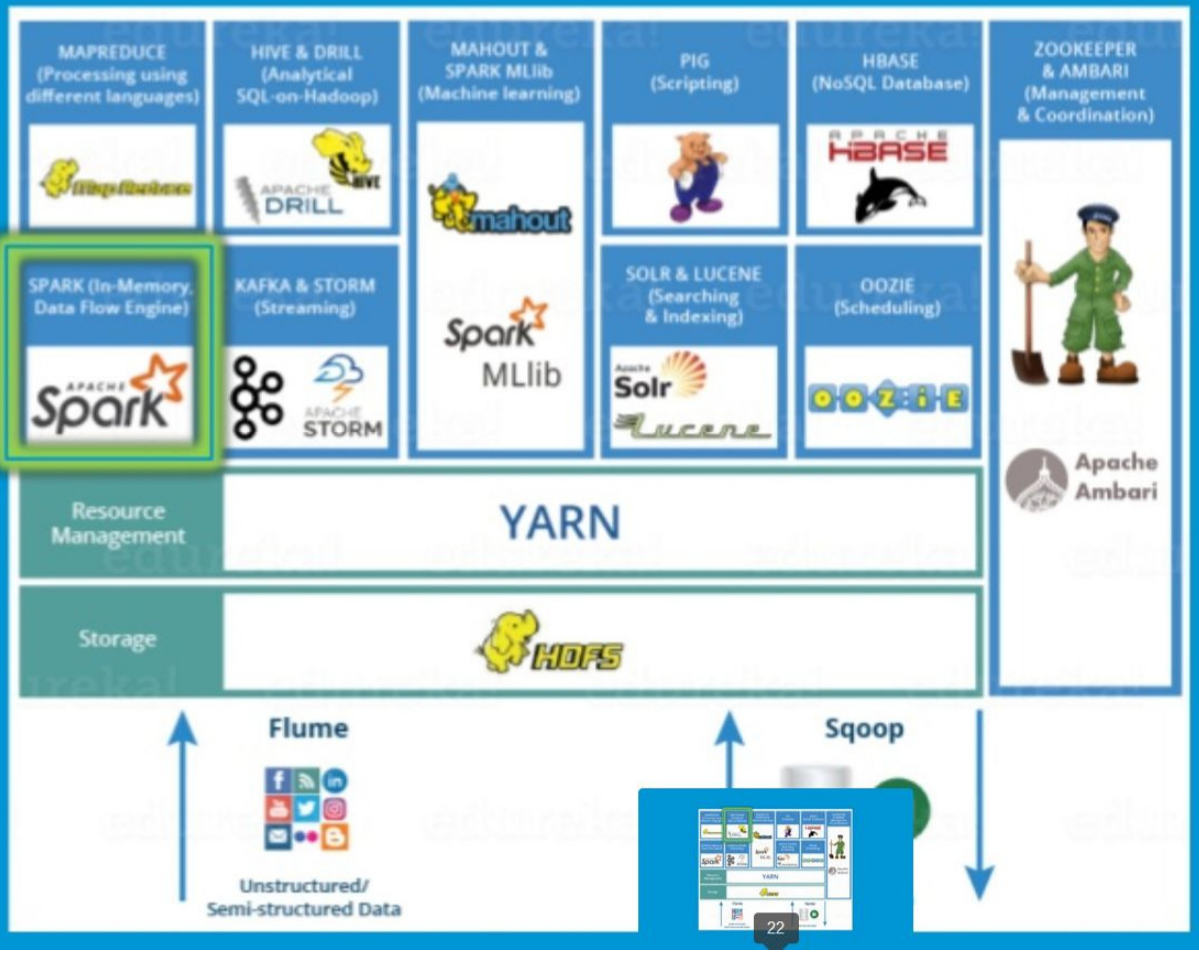
- Provides an environment for creating machine learning applications
- It performs collaborative filtering, clustering and classification
- Provides a command line to invoke various algorithms.
- It has a predefined set of library which already contains different inbuilt algorithms for different use cases.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Spark: In-memory Data Processing

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- A framework for real time data analytics in a distributed computing environment.
- Written in Scala and was originally developed at the University of California, Berkeley.
- It executes in-memory computations to increase speed of data processing over Map-Reduce.
- 100x faster than Hadoop for large scale data processing by exploiting in-memory computations

Spark: In-memory Data Processing

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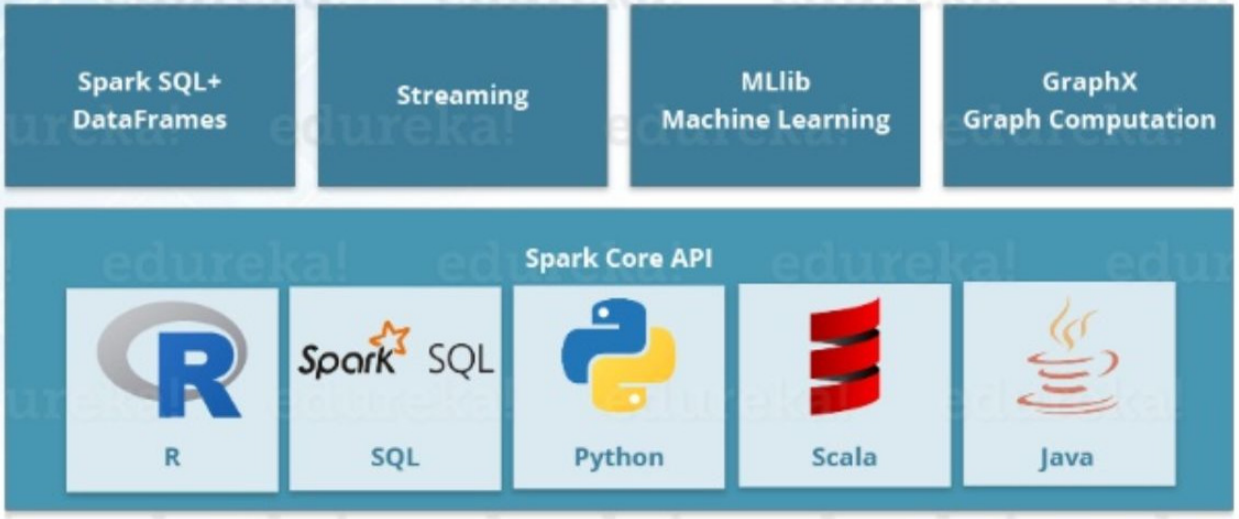
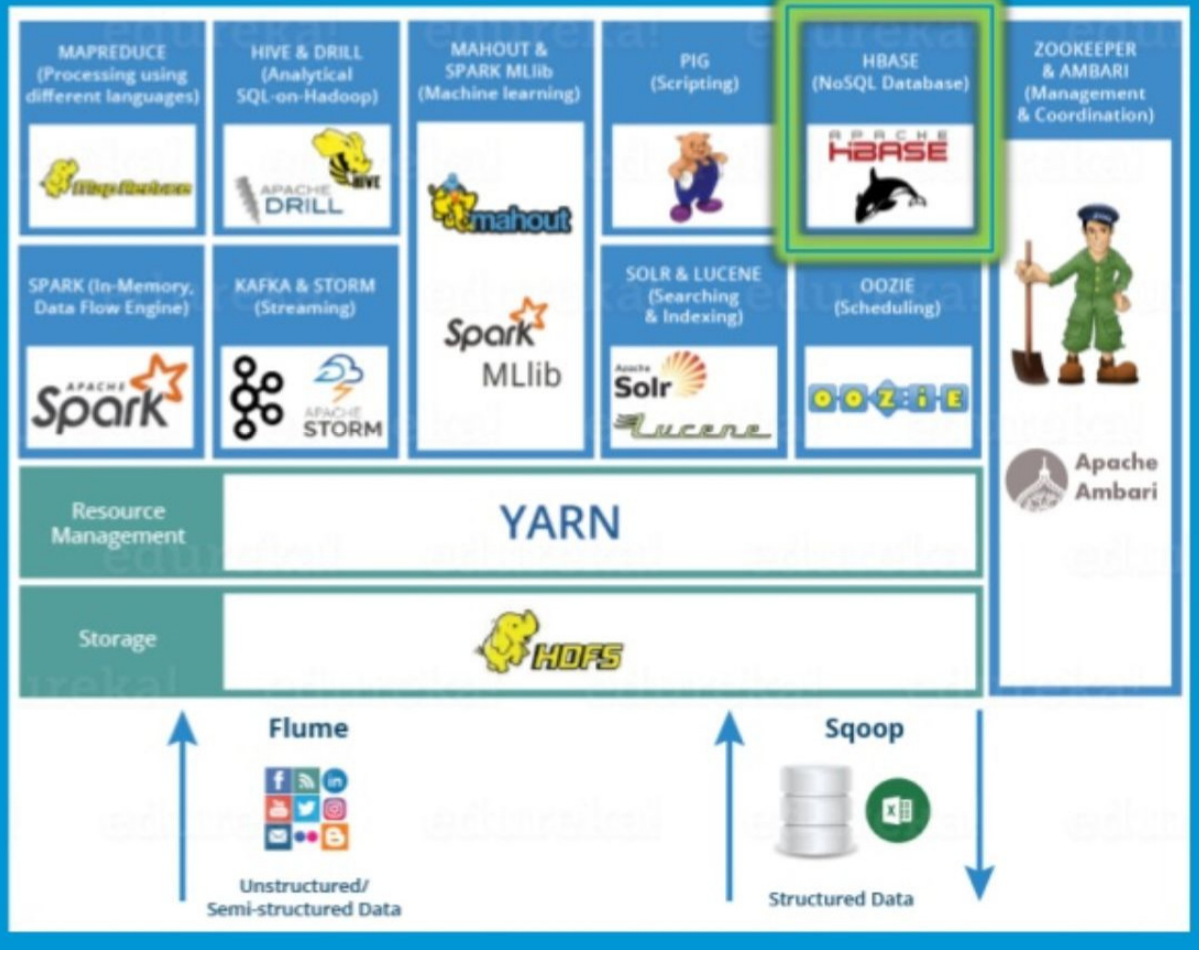
- Spark comes packed with high-level libraries
- Provides various services like MLlib, GraphX, SQL + Data Frames, Streaming services
- Supports various languages like R, SQL, Python, Scala, Java
- Seamlessly integrates in complex workflow

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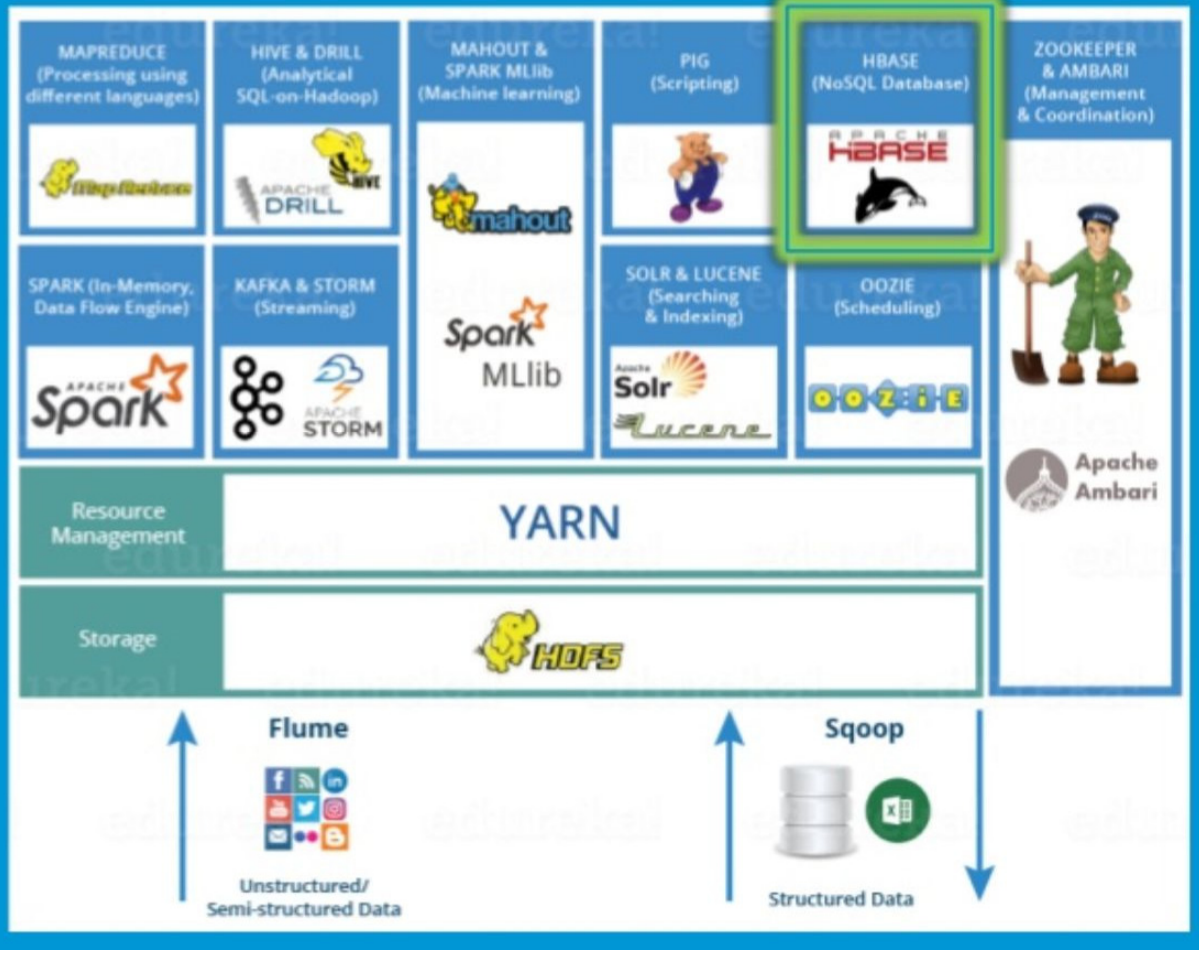
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Hbase: NoSQL Database

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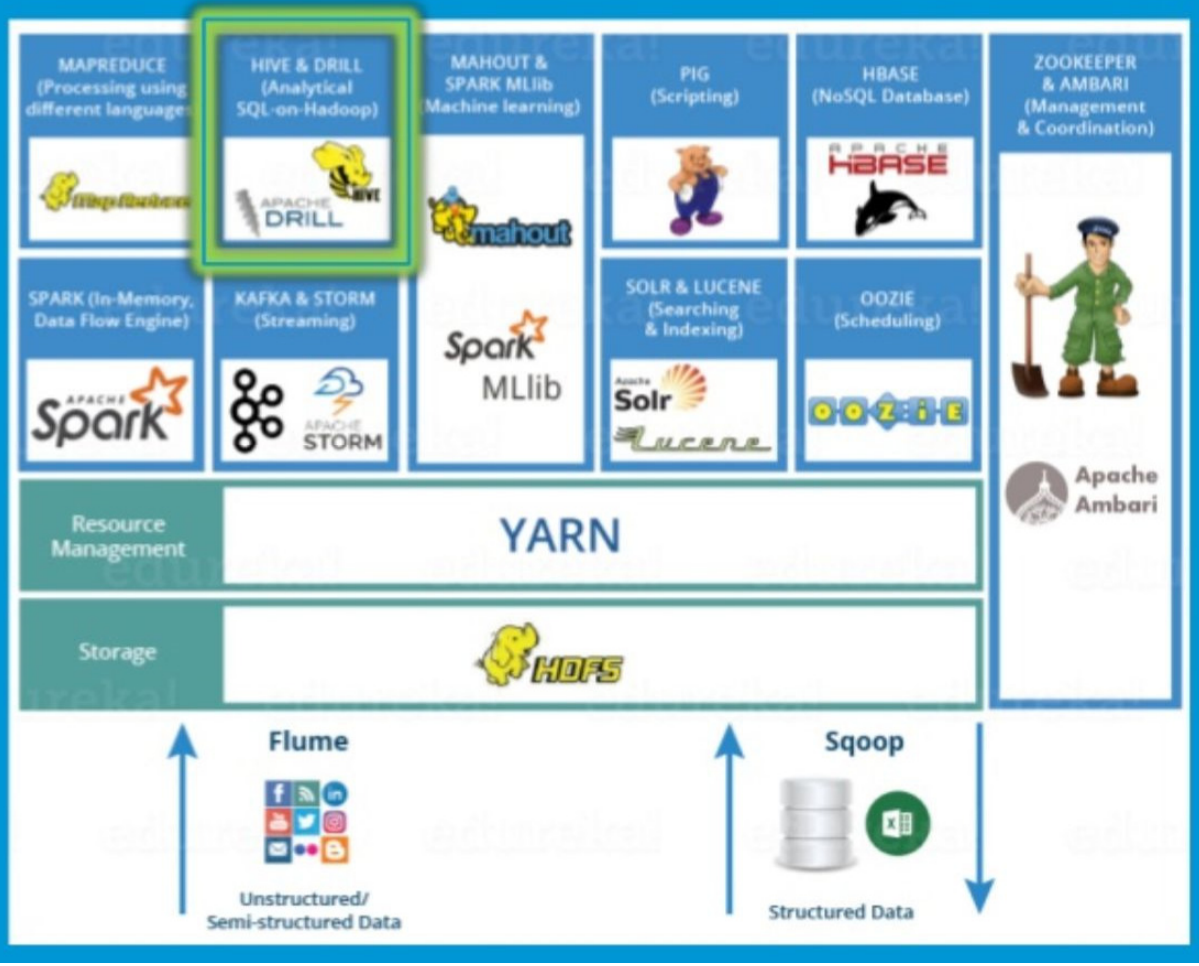
- An open source, non-relational distributed database - a **NoSQL** database
- Supports all types of data and that is why, it's capable of handling anything and everything
- It is modelled after Google's BigTable
- It gives us a fault tolerant way of storing sparse data
- It is written in Java, and HBase applications can be written in REST, Avro and Thrift APIs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Apache Drill: SQL on Hadoop

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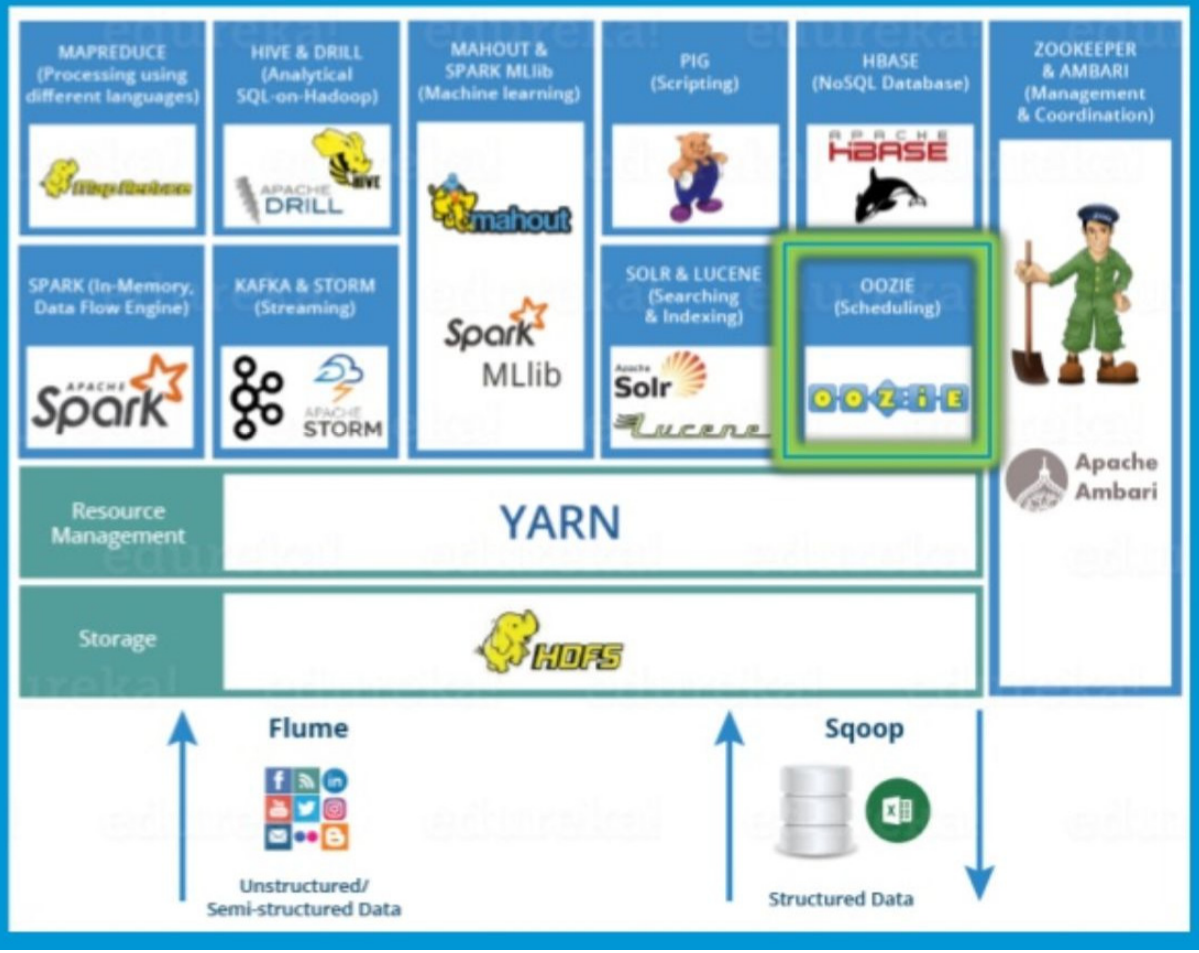
- An open source application which works with distributed environment to analyze large data sets
- Follows the ANSI SQL
- Supports different kinds NoSQL databases and file systems
- For example: Azure Blob Storage, Google Cloud Storage, HBase, MongoDB, MapR-DB HDFS, MapR-FS, Amazon S3, Swift, NAS and local files
- Combines a variety of data stores just by using a single query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Oozie: Job Scheduler

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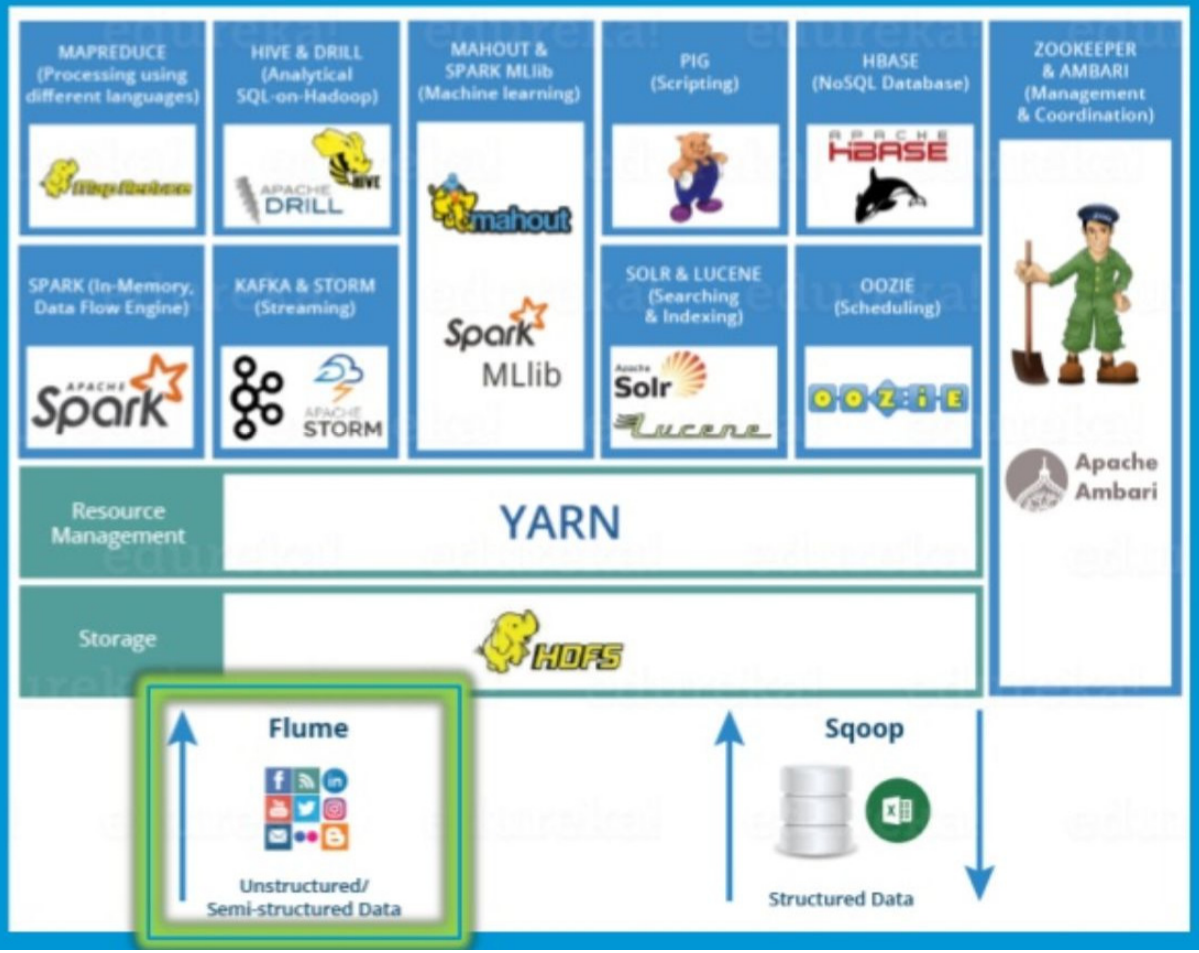
- Oozie is a job scheduler in Hadoop ecosystem
- Two kinds of Oozie jobs: Oozie workflow and Oozie Coordinator
- **Oozie workflow**: Sequential set of actions to be executed
- **Oozie Coordinator**: Oozie jobs which are triggered when the data is made available to it or even triggered based on time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Apache Flume: Data Ingesting Service

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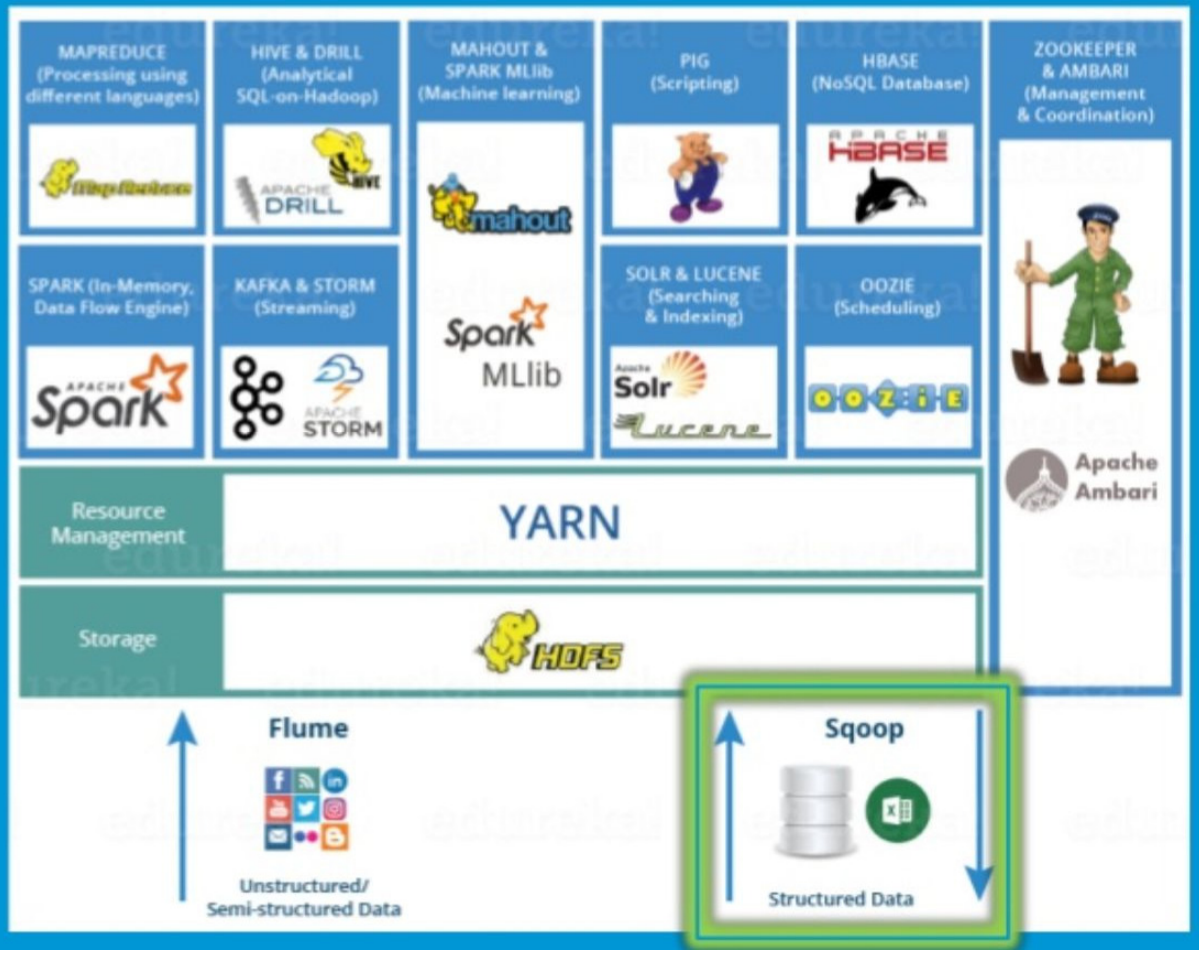
- Ingests unstructured and semi-structured data into HDFS.
- It helps us in collecting, aggregating and moving large amount of data sets.
- It helps us to ingest online streaming data from various sources like network traffic, social media, email messages, log files etc. in HDFS.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Apache Sqoop: Data Ingesting Service

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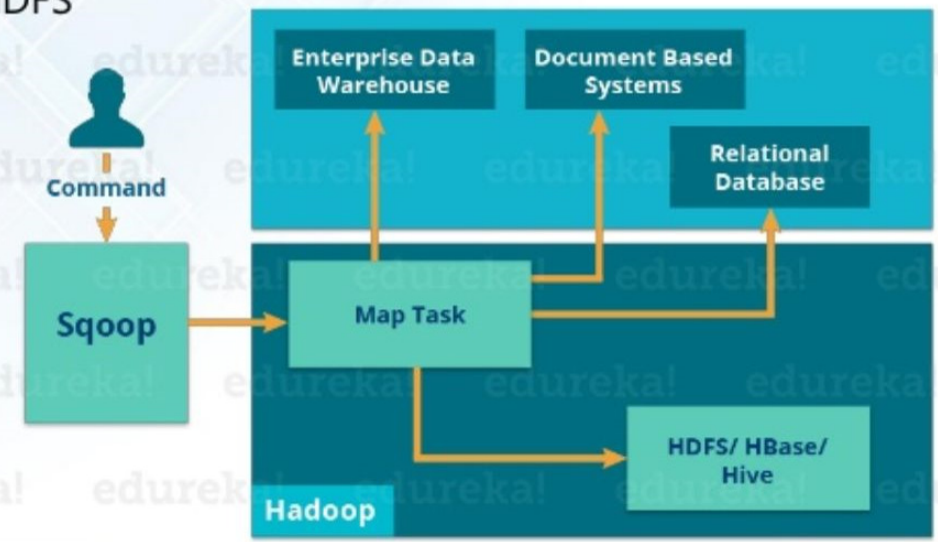
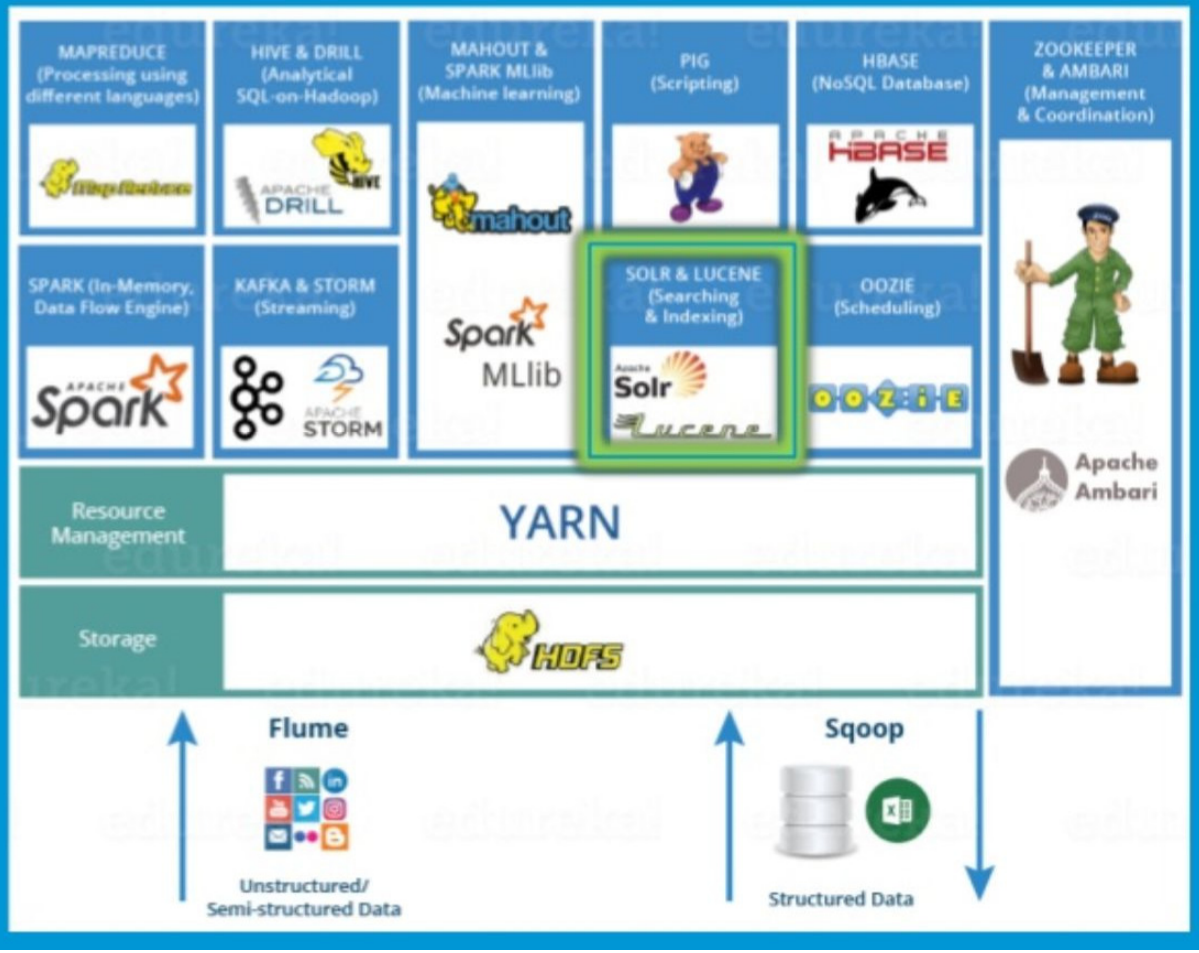
- Another data ingesting service
- Sqoop can import as well as export structured data from RDBMS
- Flume only ingests unstructured data or semi-structured data into HDFS

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Apache Solr and Lucene

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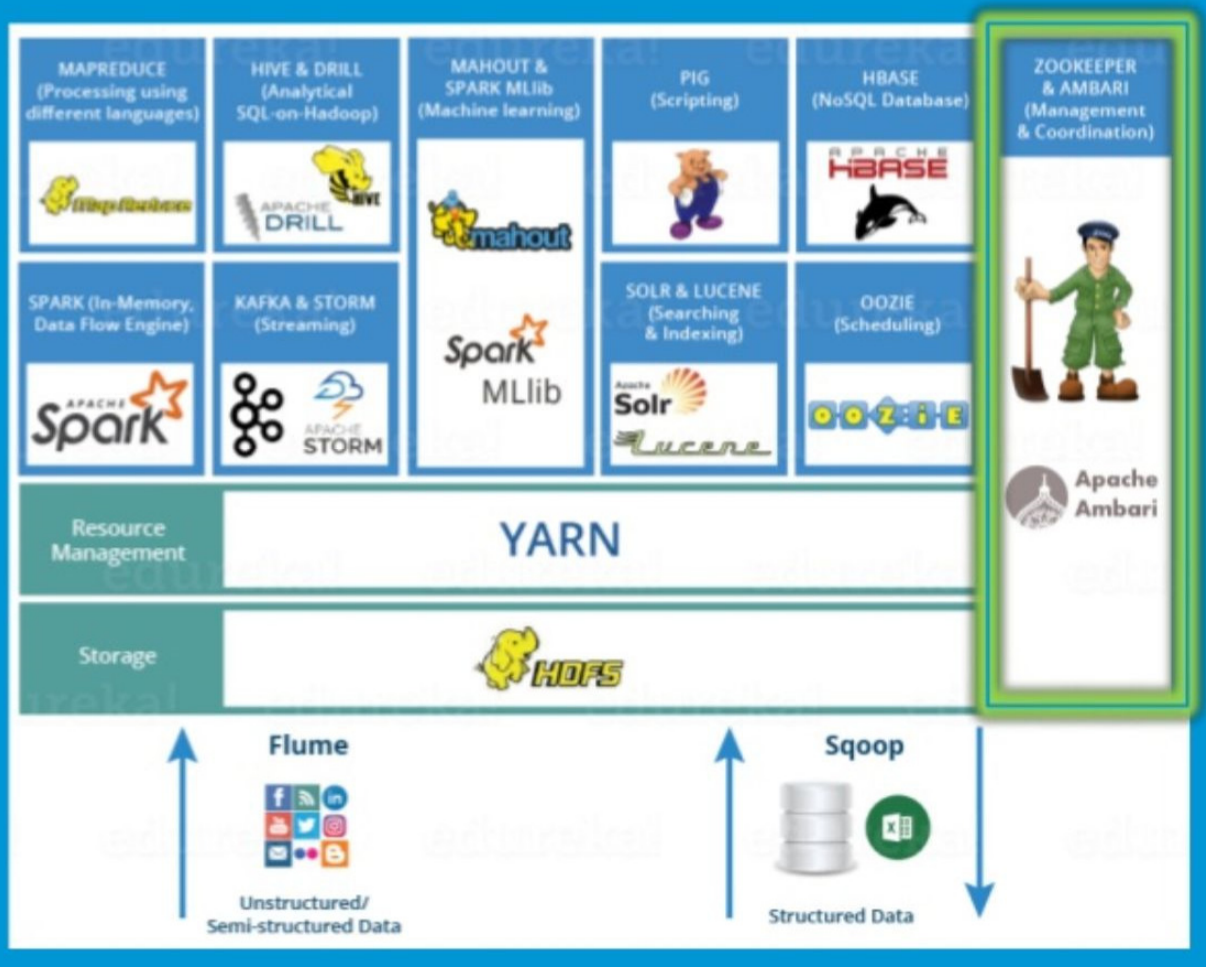
- Two services which are used for searching and indexing in Hadoop Ecosystem
- Apache Lucene is based on Java, which also helps in spell checking
- Apache Lucene is the engine, Apache Solr is a complete application built around Lucene
- Solr uses Apcahe Lucene Java search library for searching and indexing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ZooKeeper: Coordinator

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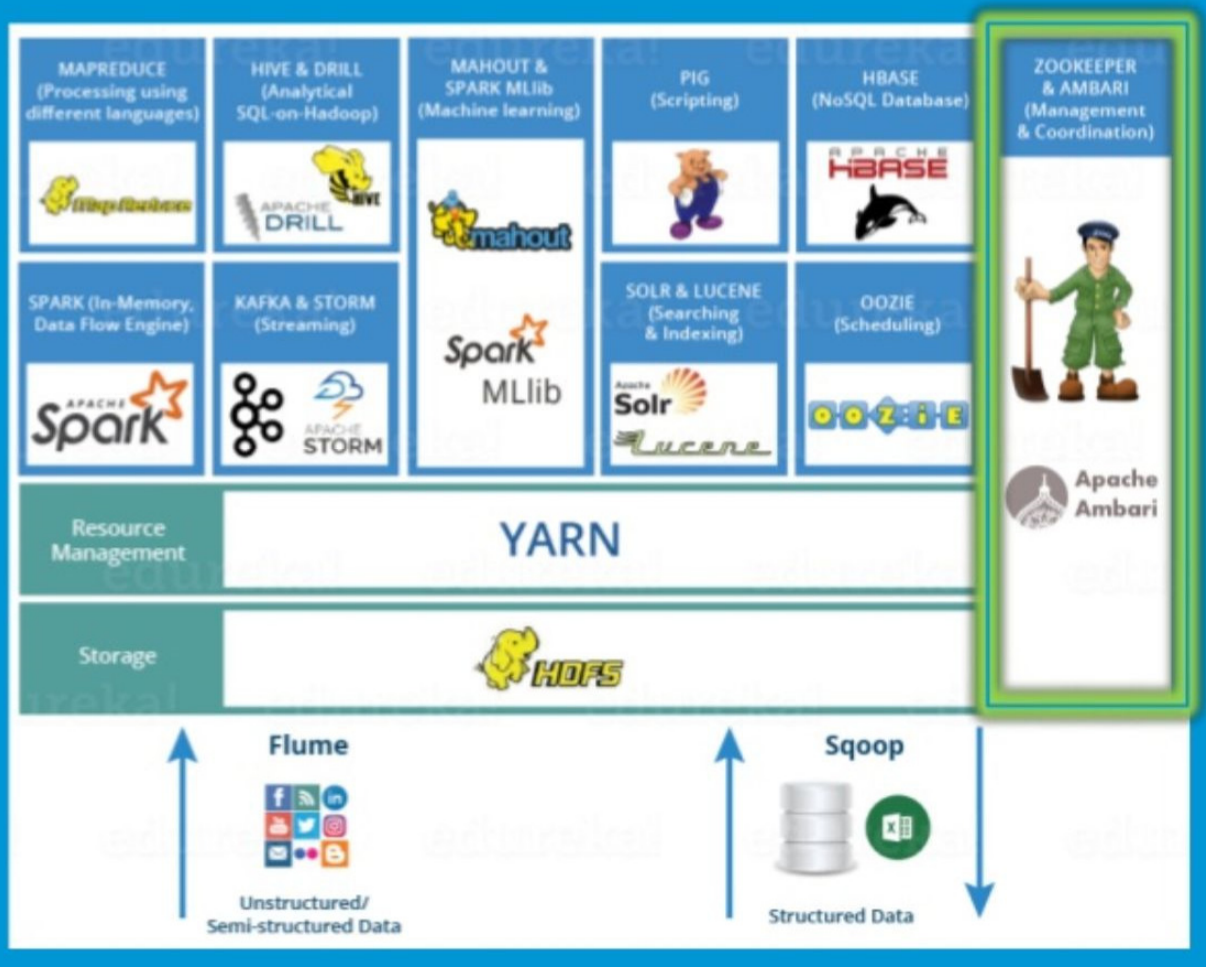
- An open-source server which enables highly reliable distributed coordination
- Apache Zookeeper coordinates with various Hadoop services in a distributed environment
- Performs synchronization, configuration maintenance, grouping and naming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Apache Ambari: Cluster Manager

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- Software for provisioning, managing and monitoring Apache Hadoop clusters
- Gives us step by step process for installing Hadoop services
- Handles configuration of Hadoop services
- Provides a central management service for starting, stopping and re-configuring Hadoop services
- Monitors health and status of the Hadoop cluster

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Learning Resources

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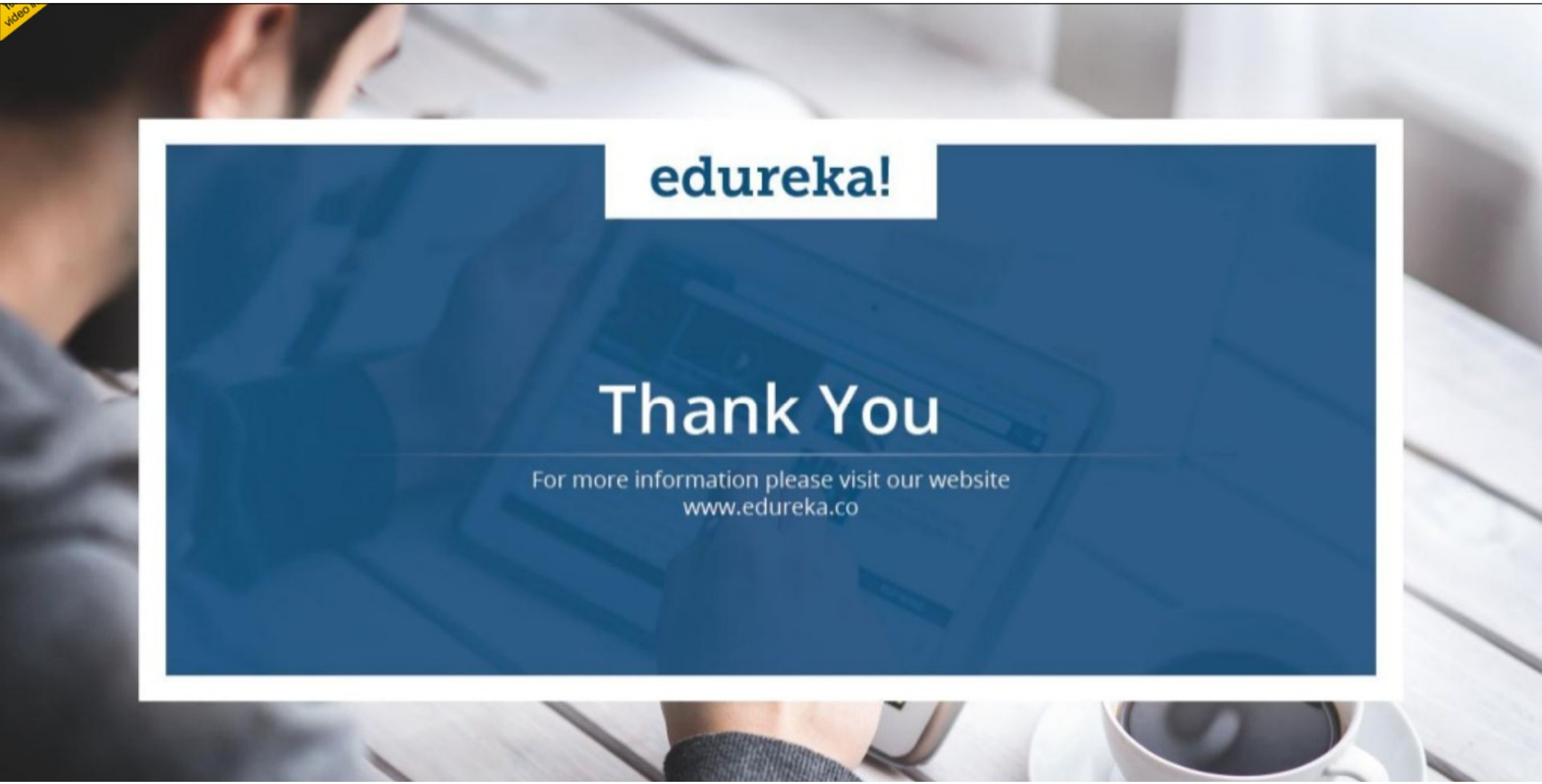
- Hadoop Tutorial: www.edureka.co/blog/hadoop-tutorial
- HDFS Ecosystem: www.edureka.co/blog/hadoop-ecosystem


edureka!
Thank You
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