11 – Spark SQL

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Remember the Spark stack …

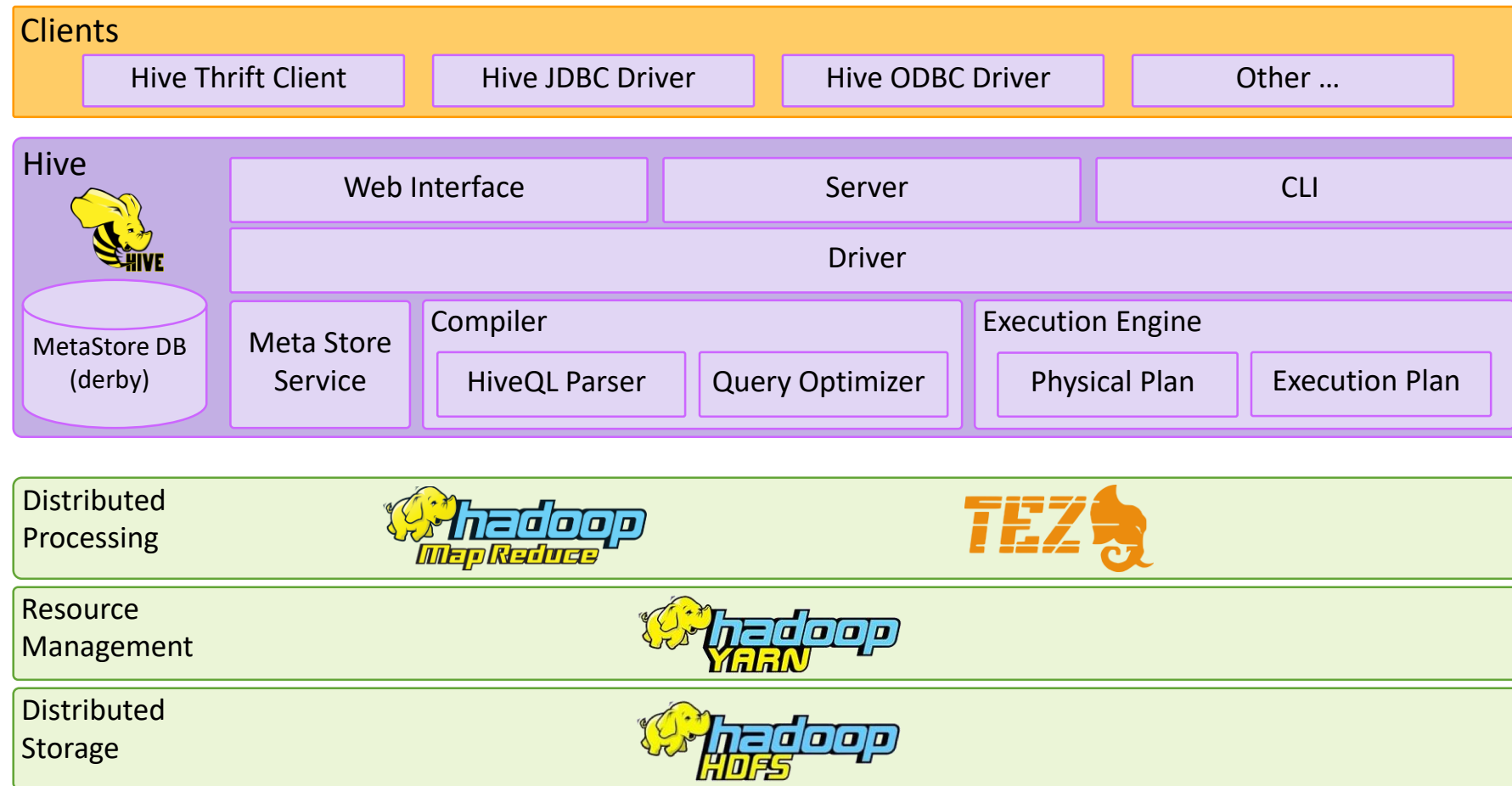Logos: https://www.apache.org/logos
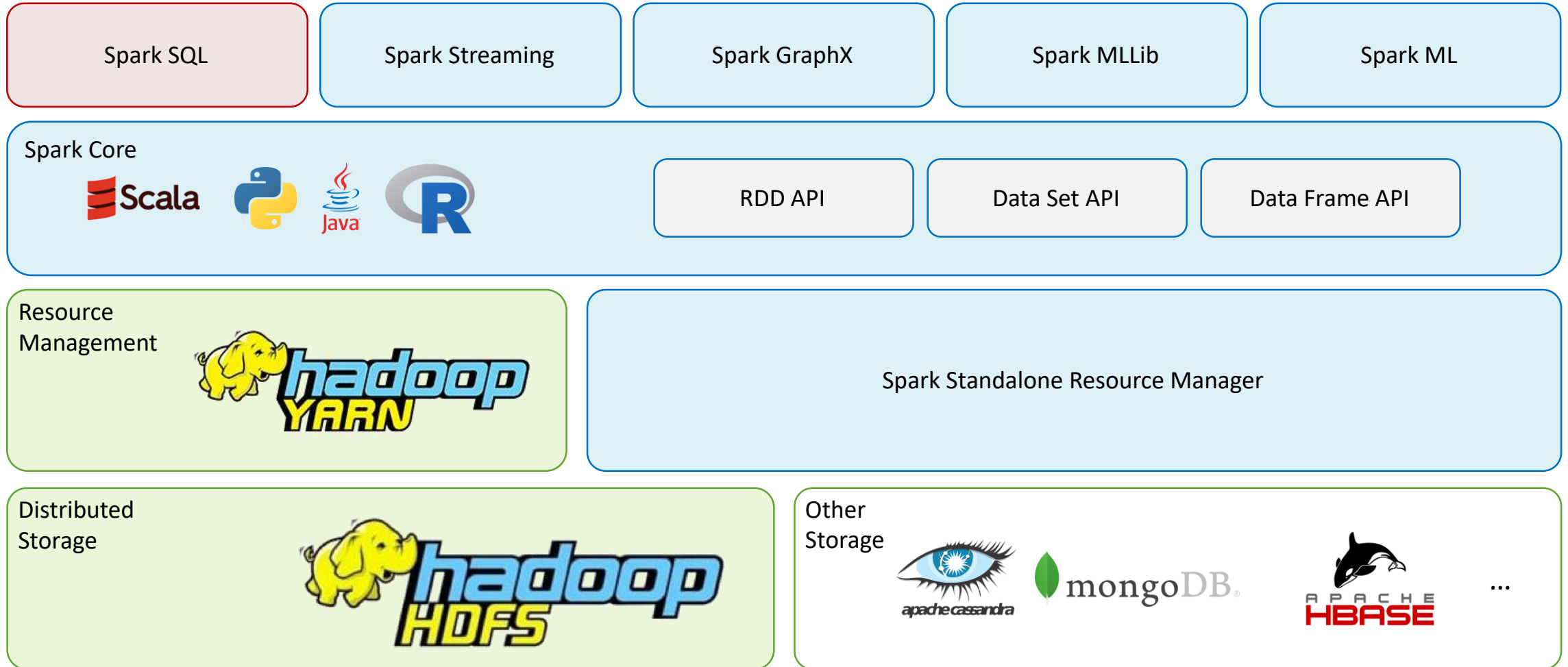
Some History

- **Shark** (not SparkSQL) was initially started as a Apache Spark subproject

- Project timelines

  - started in 2011 (Spark was started in 2009)

  - alpha version available in April 2012

- The intent was to port Apache Hive capabilities to Apache Spark

  - Often referred as "Hive on Spark"

- **Shark was deprecated and replaced by SparkSQL** (July 2014)

- **Hive on Spark** was added in 2015 to Hive to complement the MapReduce/Tez engines
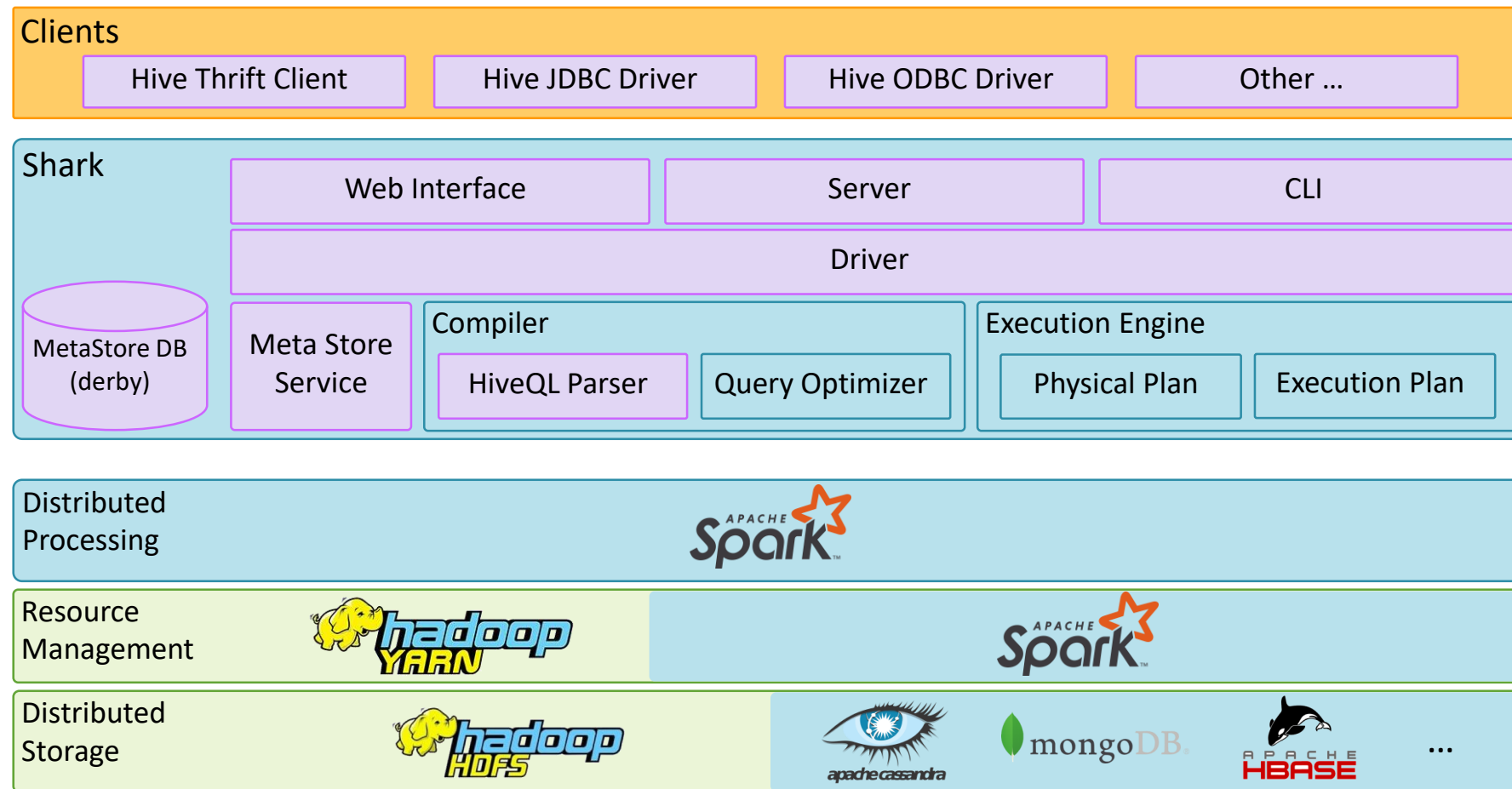
From Hive to Shark to Spark SQL

- In a few words, Shark reimplemented most of the Hive execution engine on Spark instead of MapReduce / Tez

- However, Shark inherited the Hive codebase (large & complicated, hard to optimize and maintain)

- SparkSQL was designed from ground-up to leverage the power of Spark based on the lesson learned while building Shark and maintaining performances and compatibility with Shark/Hive (Hive on Spark)

Remember the Hive architecture…

Clients

| Hive Thrift Client | Hive JDBC Driver | Hive ODBC Driver | Other … |

Hive

| Web Interface | Server | CLI |

Driver

MetaStore DB (derby)

| Meta Store Service | Compiler | | Execution Engine | |
| | HiveQL Parser | Query Optimizer | Physical Plan | Execution Plan |

Distributed Processing

 hadoop Map Reduce   TEZ

Resource Management

 hadoop YARN

Distributed Storage

 hadoop HDFS

Logos: https://www.apache.org/logos

Then the Shark architecture …

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Shark

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MetaStore DB (derby)

Meta Store Service

Compiler
HiveQL Parser | Query Optimizer

Execution Engine
Physical Plan | Execution Plan

Distributed Processing

Resource Management

Distributed Storage

…

Logos: https://www.apache.org/logos

And finally, the SparkSQL architecture …

Logos: https://www.apache.org/logos
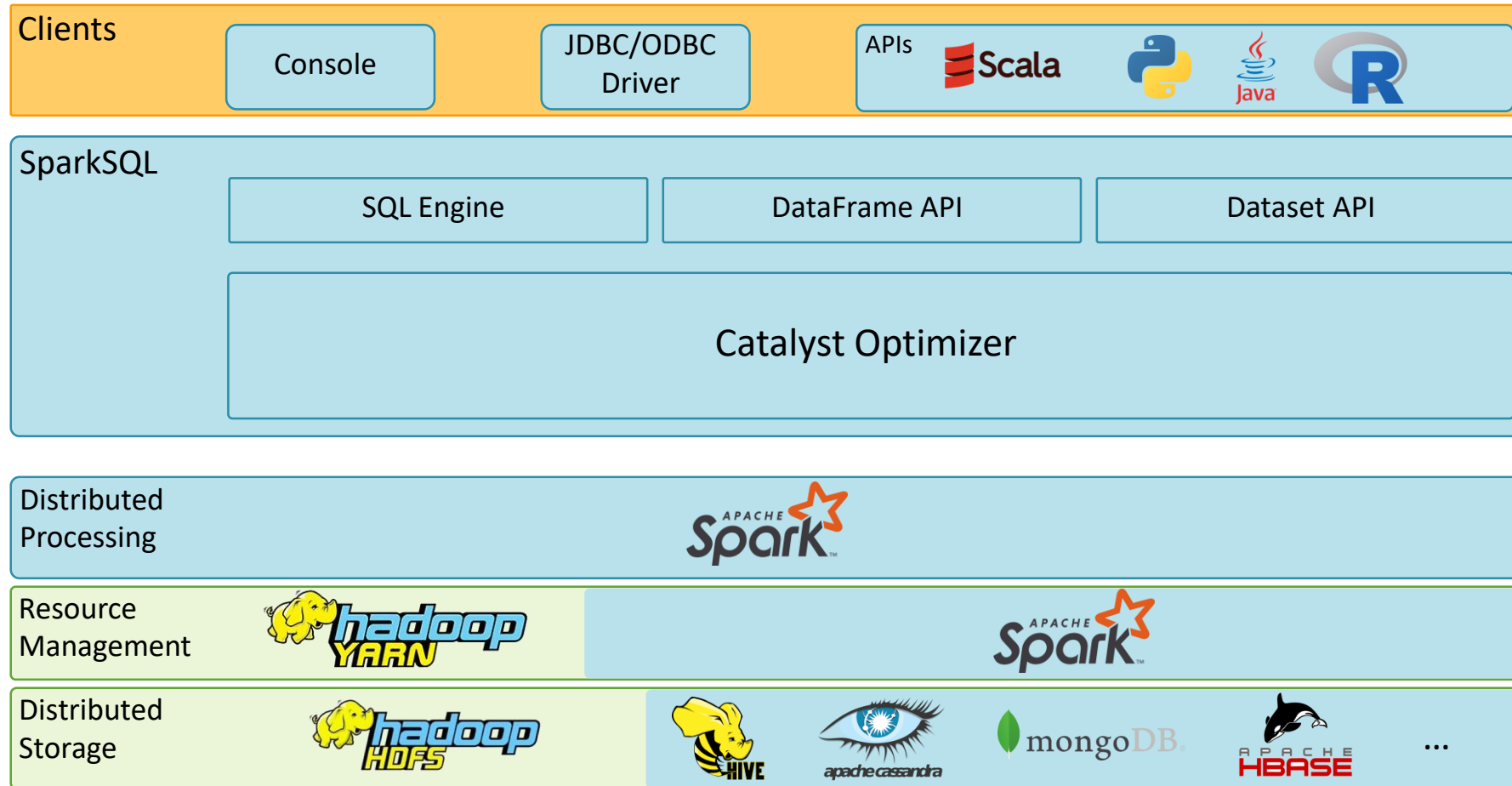
But also the "Hive on Spark" architecture…

Clients

Hive Thrift Client	Hive JDBC Driver	Hive ODBC Driver	Other …

Hive

Web Interface	Server	CLI

Driver

MetaStore DB (derby)	Meta Store Service	**Compiler**	**Execution Engine**
		HiveQL Parser / Query Optimizer	Physical Plan / Execution Plan

Distributed Processing — Hadoop Map Reduce, TEZ, Apache Spark

Resource Management — Hadoop YARN, Apache Spark

Distributed Storage — Hadoop HDFS

More info: https://cwiki.apache.org/confluence/display/Hive/Hive+on+Spark

Logos: https://www.apache.org/logos

Why Spark SQL?

It's more concise, simpler & faster

Spark SQL:

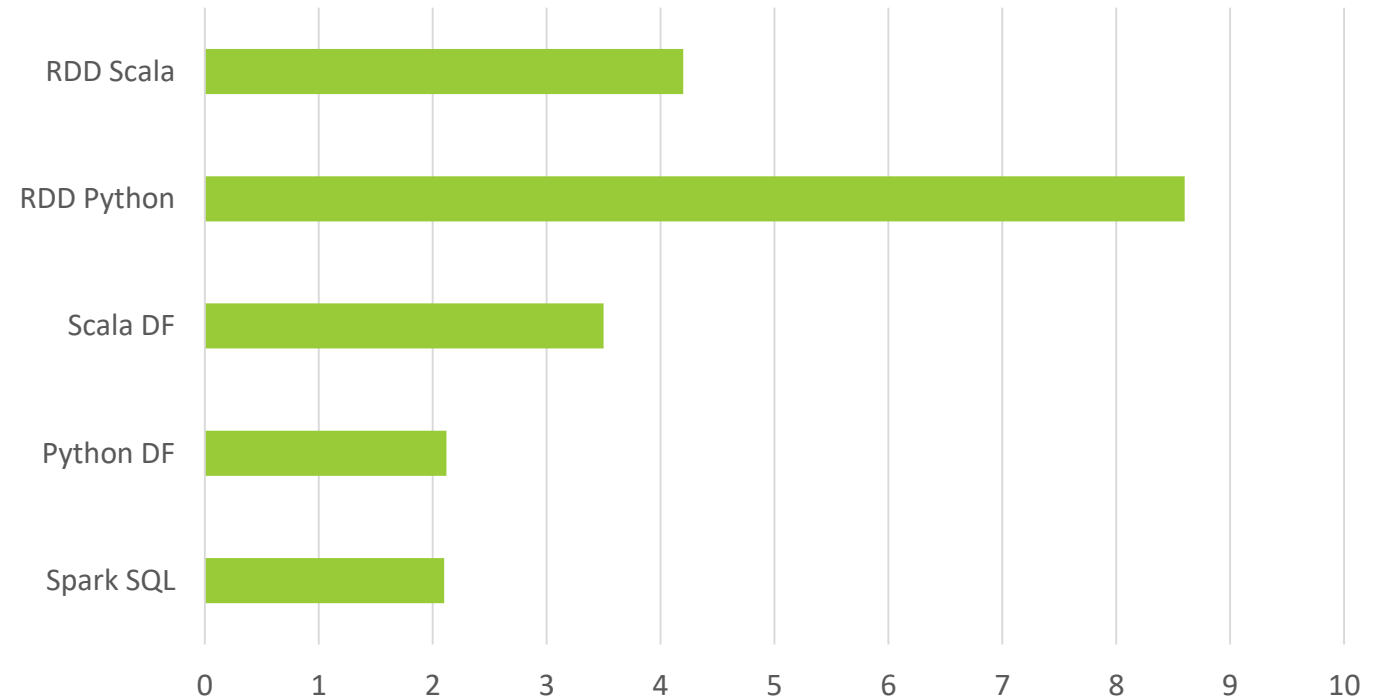   select dept, avg(age) from data group by dept

DataFrame:

    data.groupBy("dept").avg("age")

Scala RDD:

```
data.map {

    case (dept, age) => dpt -> (age, 1)

}.reduceByKey {

    case ((a1, c1), (a2, c2)) => ( a1 +a2, c1 + c2)

}.map {

    case (dept, (age, c)) => dpt -> age / c

}
```

Runtime Performance of aggregating 10 million int pairs (secs)

More info: https://databricks.com/blog/2015/02/17/introducing-dataframes-in-spark-for-large-scale-data-science.html

Spark SQL - For **SQL users**

- Provides state-of-the-art SQL performance

- Maintains compatibility with Shark/Hive.

- Spark SQL supports existing

  - Hive data formats

  - user-defined functions (UDF)

  - Hive meta store.

- With features that will be introduced since Apache Spark 1.1.0, Spark SQL beats Shark in TPC-DS performance!

  More info: https://databricks.com/blog/2014/07/01/shark-spark-sql-hive-on-spark-and-the-future-of-sql-on-spark.html

Spark SQL - For **Spark users**

- Enable ingestion of data from heterogeneous schema-full/less sources

  such as JSON, Parquet, Hive, or EDWs

- Ease the manipulation of (semi-) structured data

- Unifies SQL and sophisticated analysis

- Allow users to mix and match SQL and Spark APIs for advanced analytics

More info: https://databricks.com/blog/2014/07/01/shark-spark-sql-hive-on-spark-and-the-future-of-sql-on-spark.html

Spark SQL - For **open source developers**

- Proposes a novel, elegant way of building query planners

- Ease to add new optimizations under this framework

- Strong support and enthusiasm from the open source community, largely

  thanks to this new design.

- After only three months, over 40 authors have contributed code to it

More info: https://databricks.com/blog/2014/07/01/shark-spark-sql-hive-on-spark-and-the-future-of-sql-on-spark.html