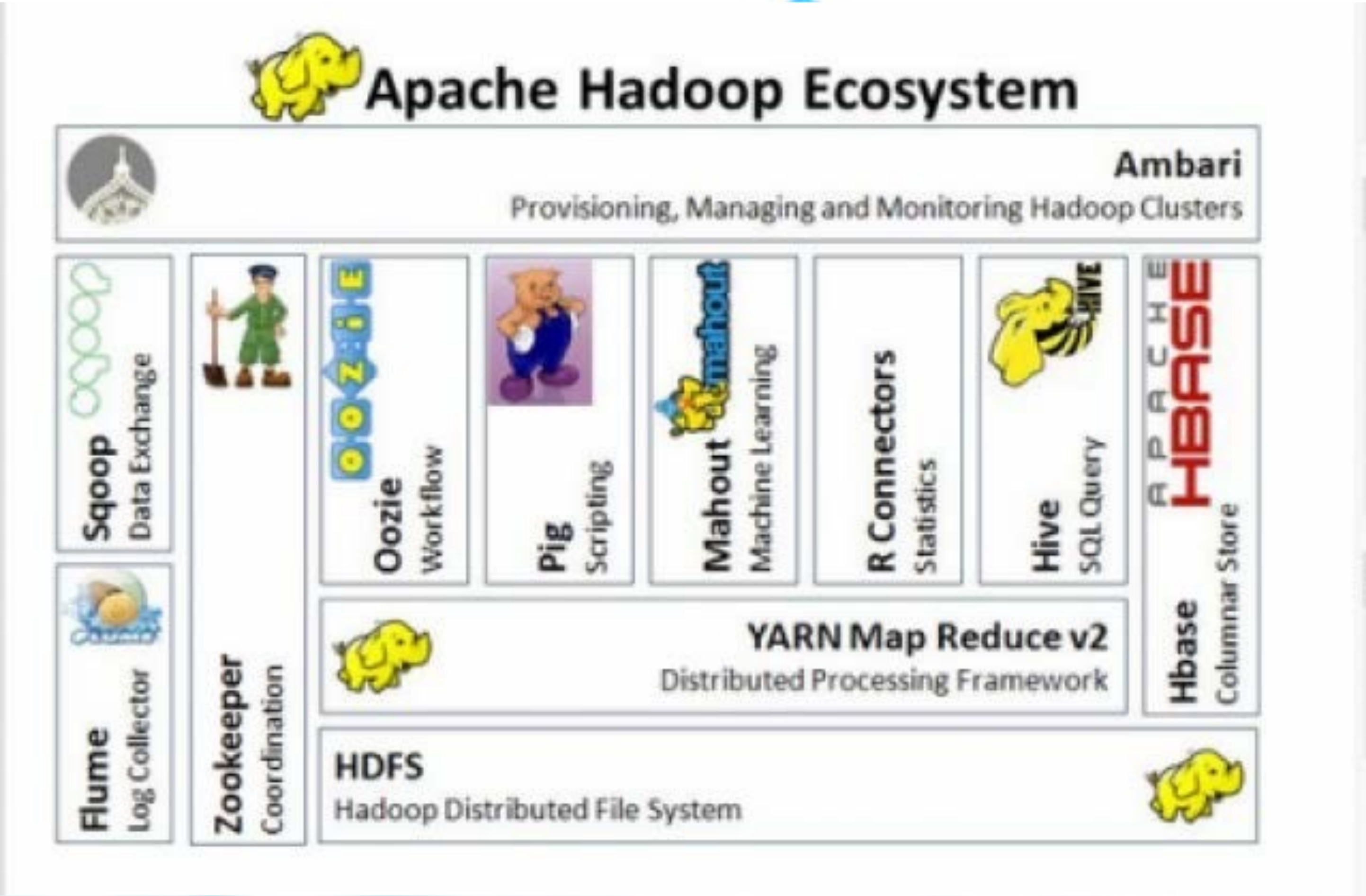
Introduction to Hive

Lecture 27


Apache Hadoop Ecosystem
Ambari
Provisioning, Managing and Monitoring Hadoop Clusters
Sqoop
Data Exchange
Flume
Log Collector
Zookeeper
Coordination
Oozie
Workflow
Pig
Scripting
Mahout
Machine Learning
R Connectors
Statistics
Hive
SQL Query
Hbase
Columnar Store
APACHE HBASE
YARN Map Reduce v2
Distributed Processing Framework
HDFS
Hadoop Distributed File System

What is Hive?

Data warehouse infrastructure build on top of Hadoop for querying and managing large data sets

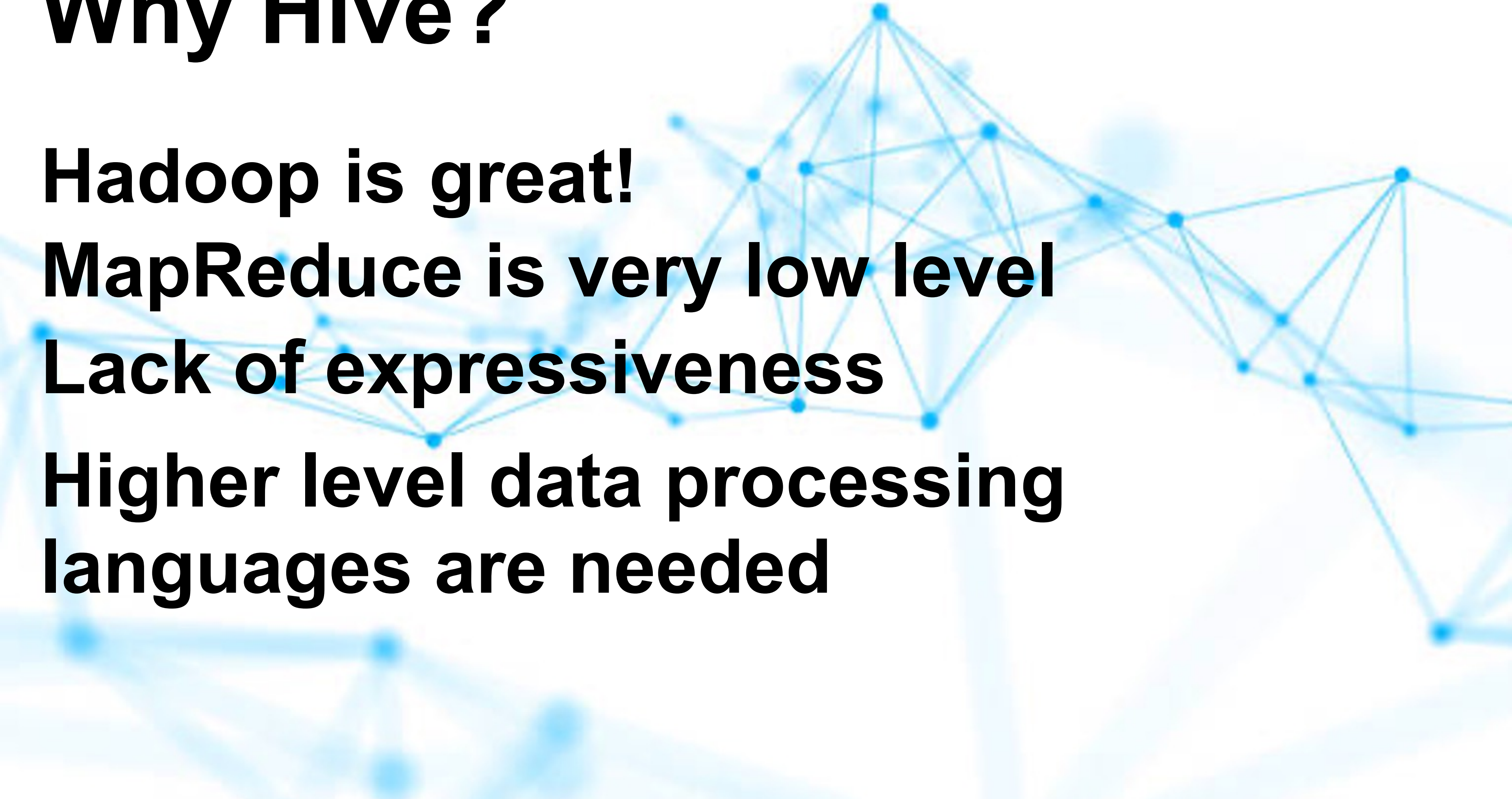
Why Hive?

Hadoop is great!

MapReduce is very low level

Lack of expressiveness

Higher level data processing languages are needed



Hive Features

Designed for OLAP

On Line Analytical Processing

SQL type language for querying

HiveQL or HQL

It is familiar, fast, scalable, and extensible

Can plug in map/reduce scripts in language of choice

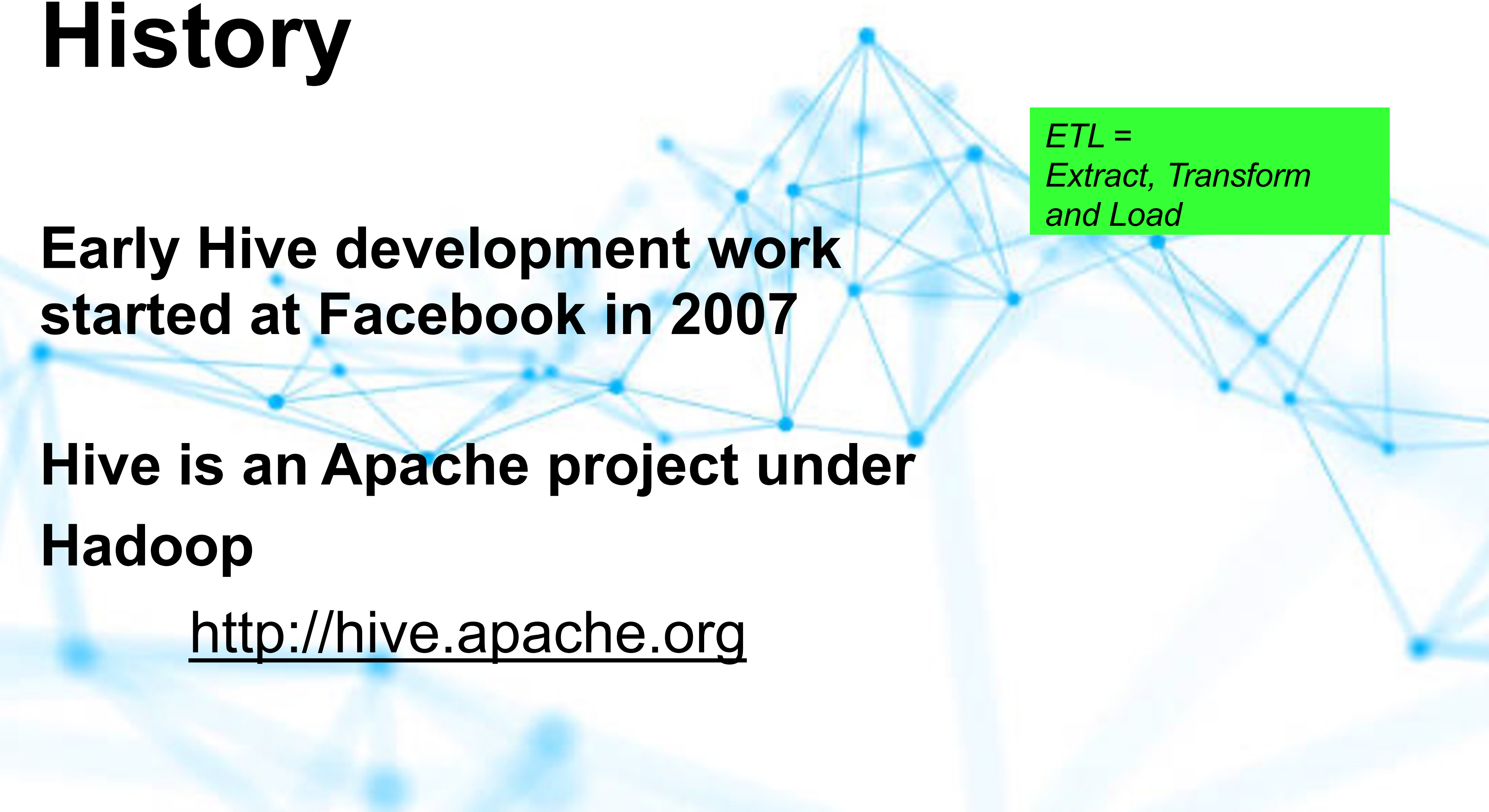
Hive is NOT

Relational database

Designed for Online Transaction Processing (OLTP)

*Online transaction processing, or **OLTP**, is a class of information systems that facilitate and manage transaction-oriented applications, typically for data entry and retrieval transaction processing (Wikipedia)*

History

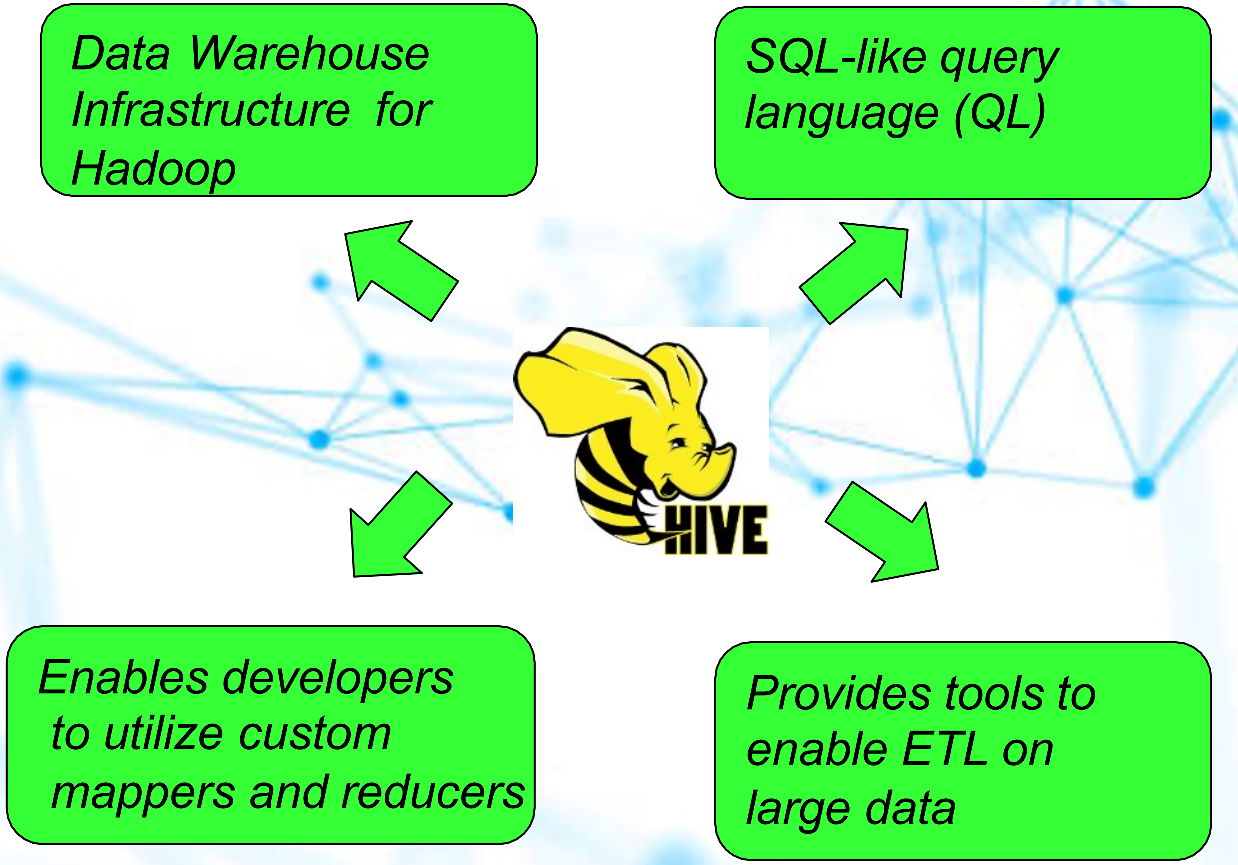


ETL =
Extract, Transform and Load

Early Hive development work started at Facebook in 2007

Hive is an Apache project under Hadoop

http://hive.apache.org



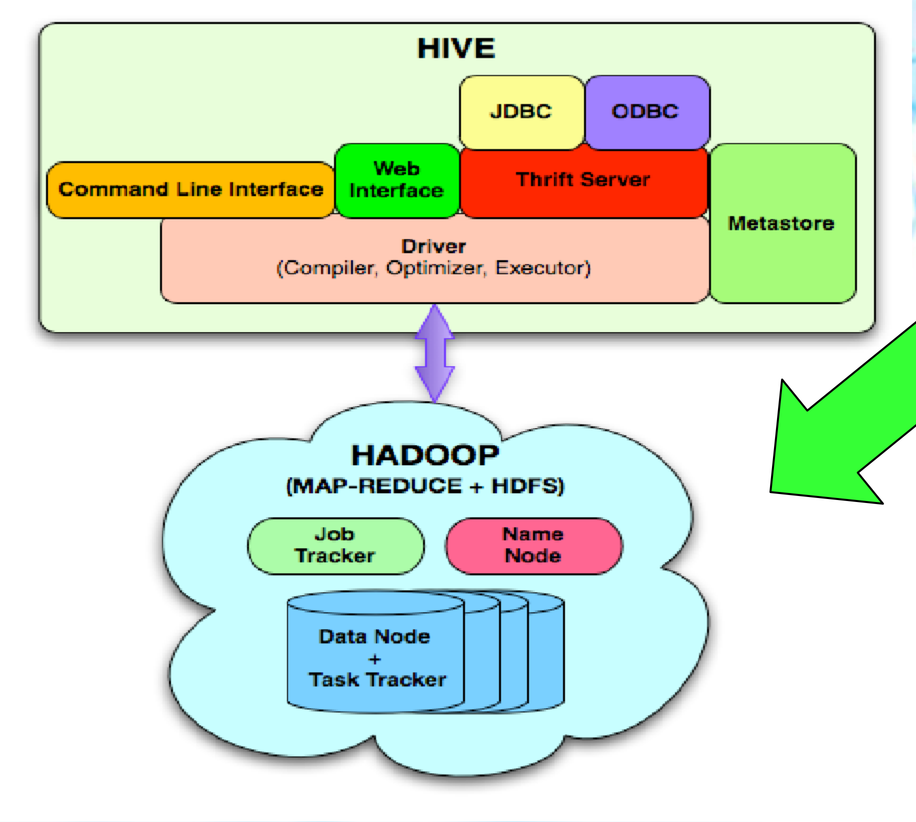
Data Warehouse Infrastructure for Hadoop

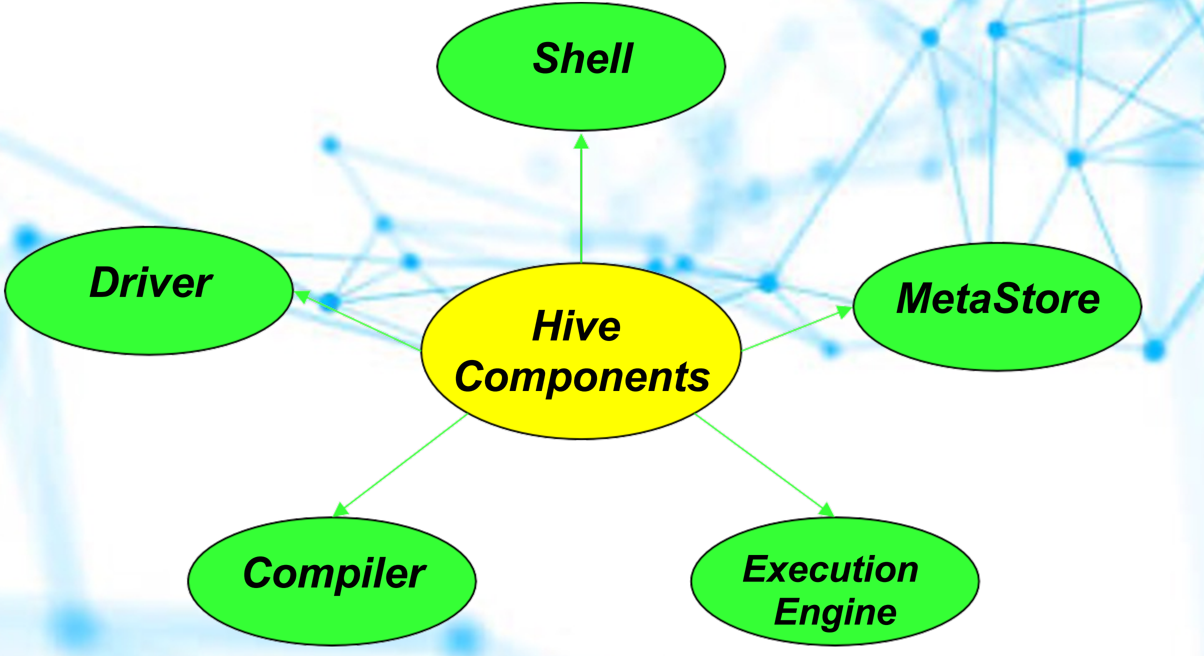
SQL-like query language (QL)

Enables developers to utilize custom mappers and reducers

Provides tools to enable ETL on large data

Hive Architecture and Components





Hive Components

Shell

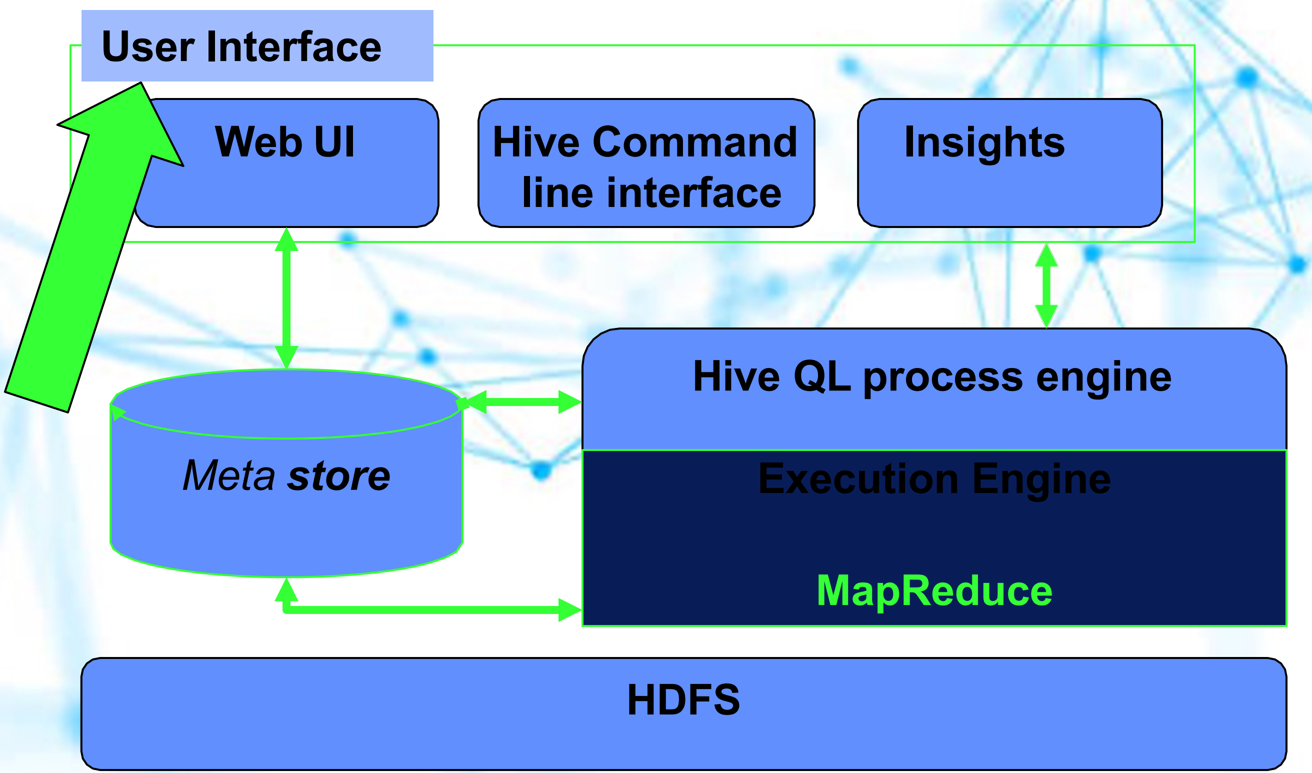
Driver

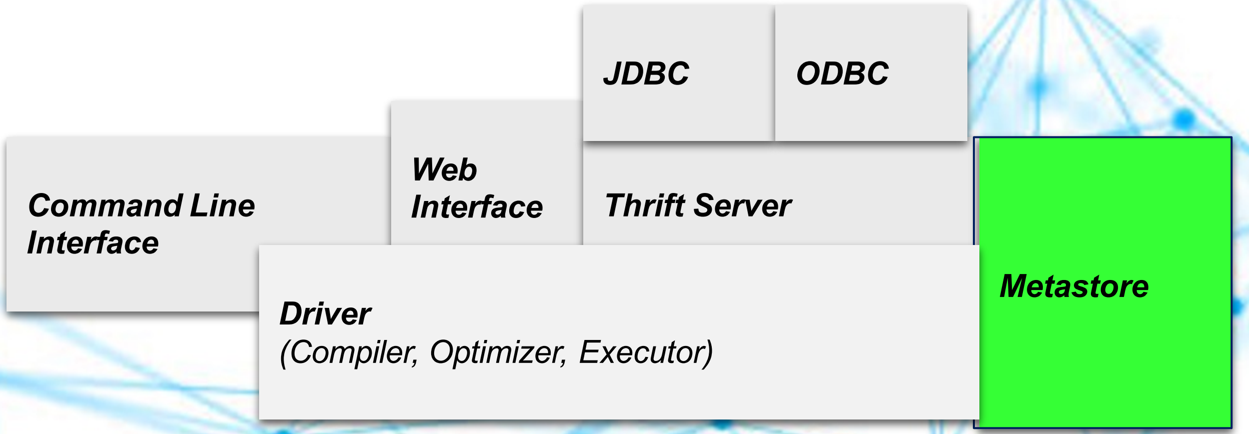
MetaStore

Compiler

Execution Engine

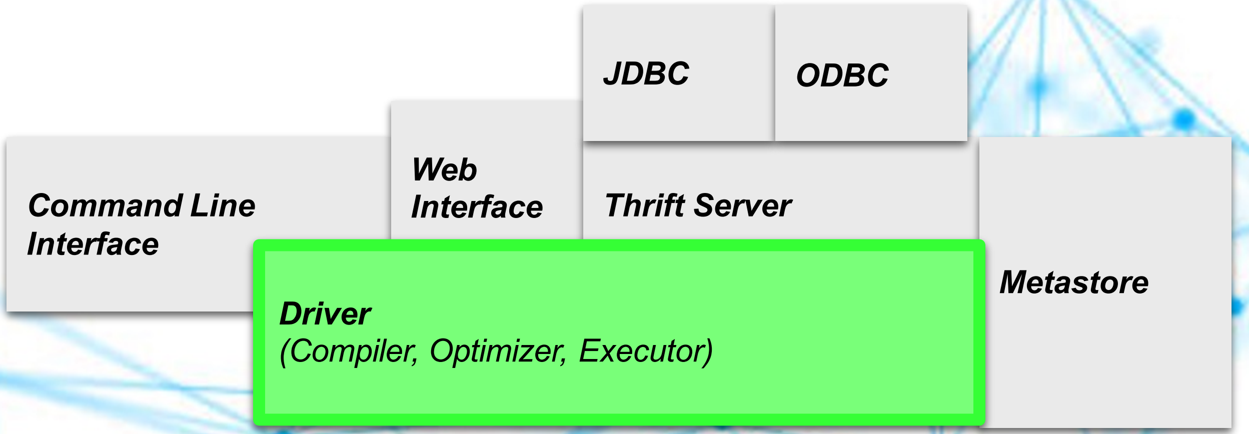
Hive Architecture





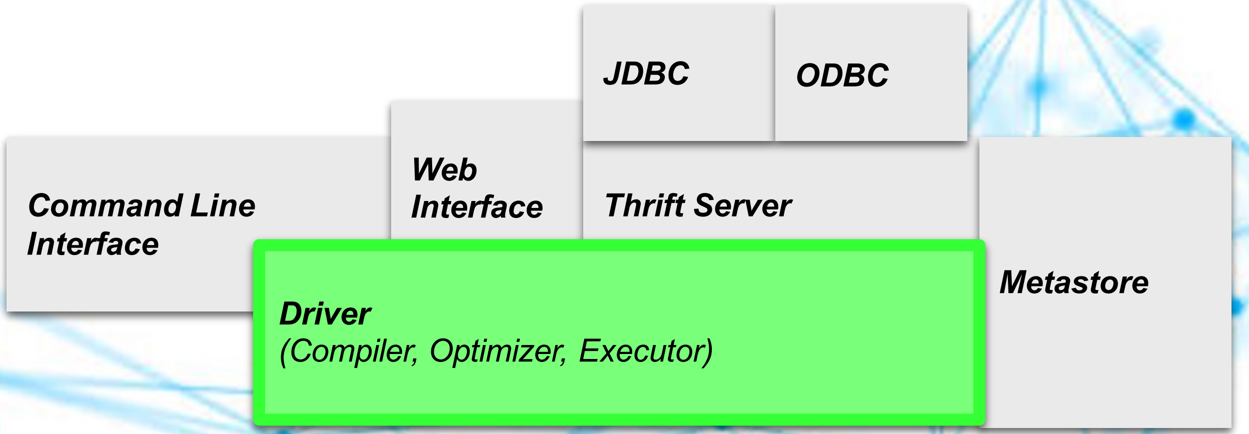
Metastore

Stores the system catalog and meta data about tables, columns, partitions etc.



Driver

- Manages the lifecycle of a HiveQL statement
- Maintains a session handle and any session statistics



Command Line Interface

Web Interface

JDBC

ODBC

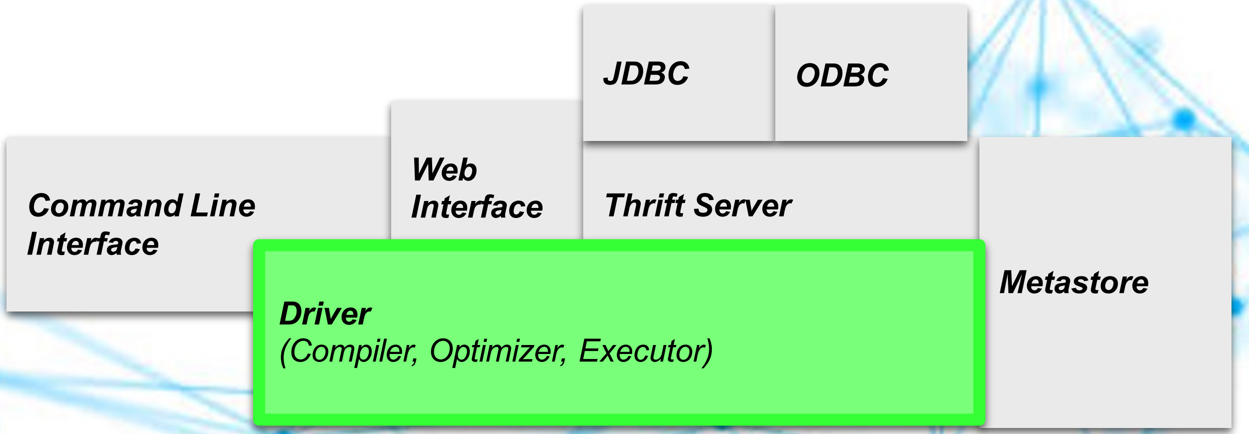
Thrift Server

Metastore

Driver
(Compiler, Optimizer, Executor)

Query Compiler

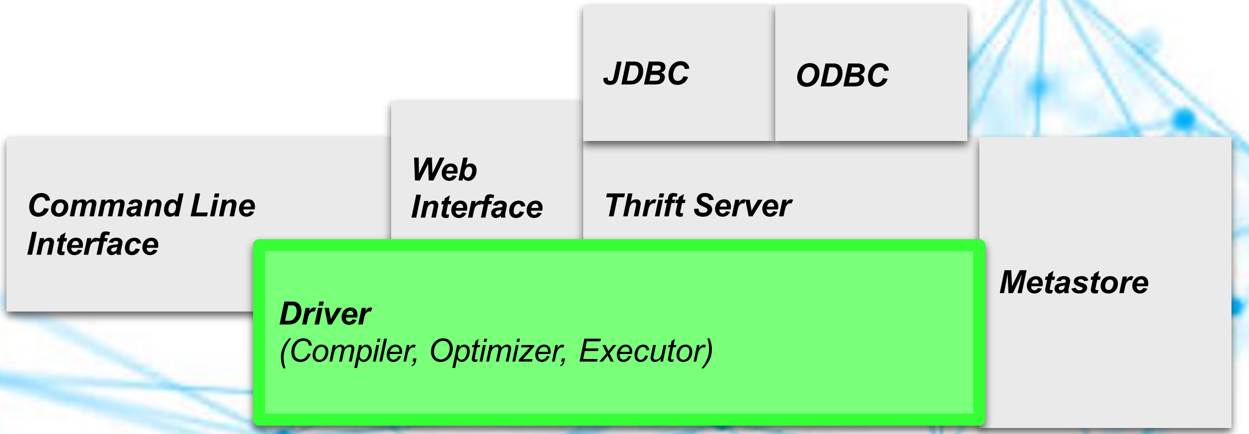
The component that compiles HiveQL into a directed acyclic graph of map/reduce tasks



Optimizer

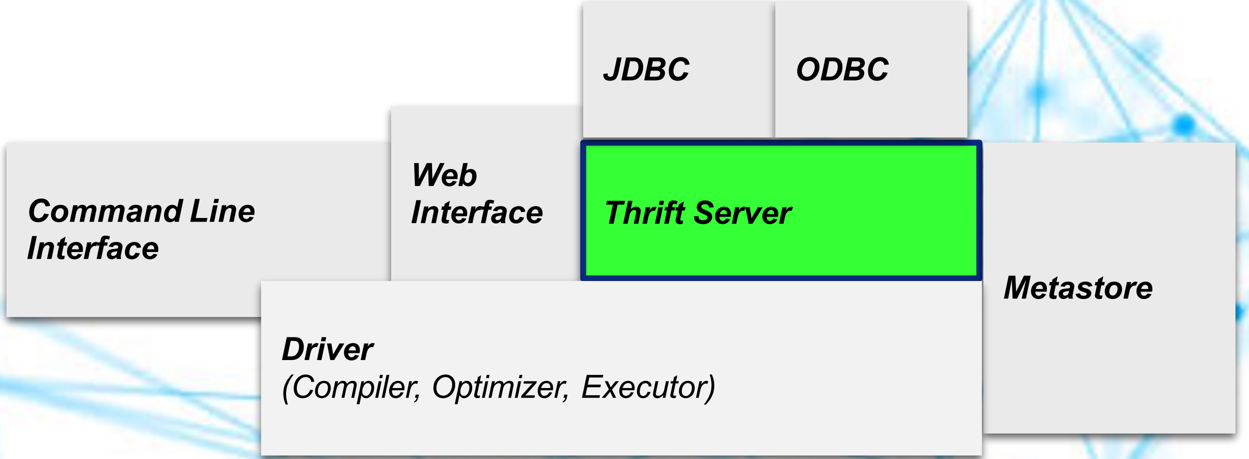
Consists of a chain of transformations

Performs Column Pruning , Partition Pruning, Repartitioning of Data



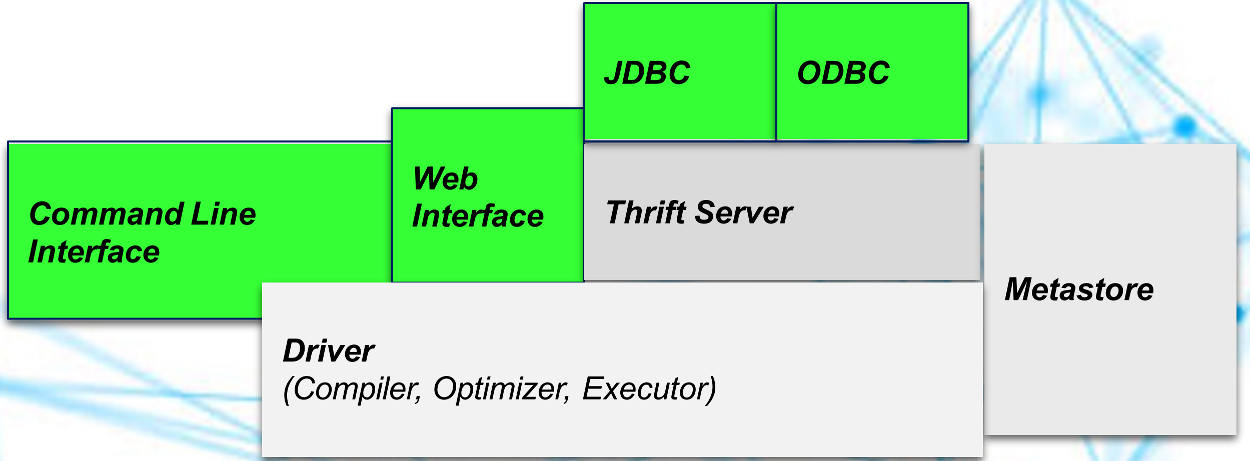
Execution Engine

- Executes the tasks produced by the compiler in proper dependency order
- Interacts with the underlying Hadoop instance



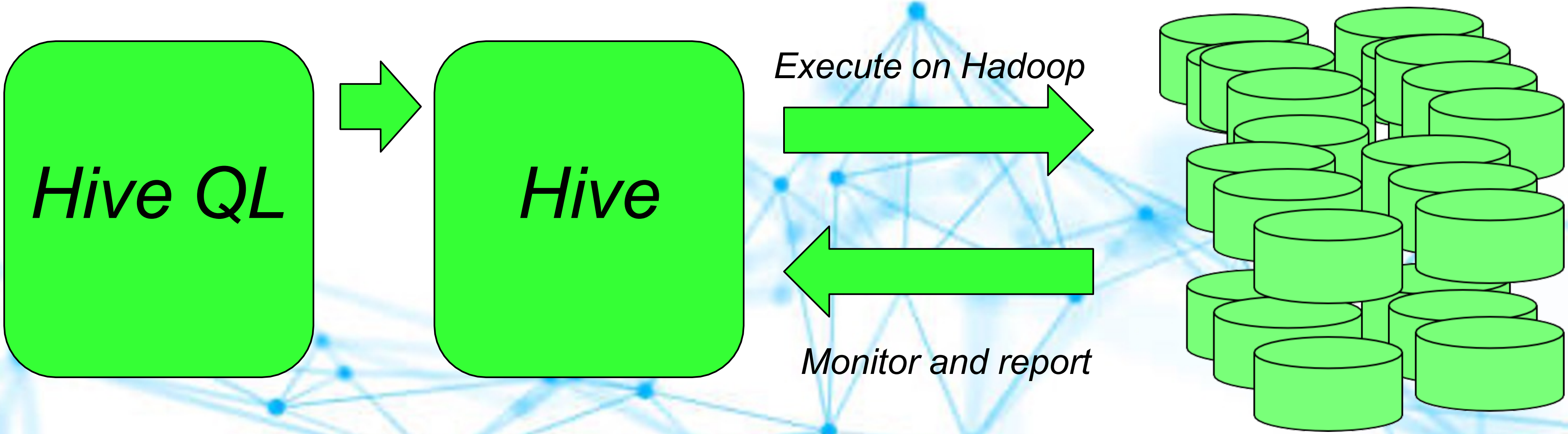
HiveServer

Provides a Thrift interface and a JDBC/ODBC server Enables Hive integration with other applications



Client Components

- Command Line Interface(CLI)
- Web UI
- JDBC/ODBC driver

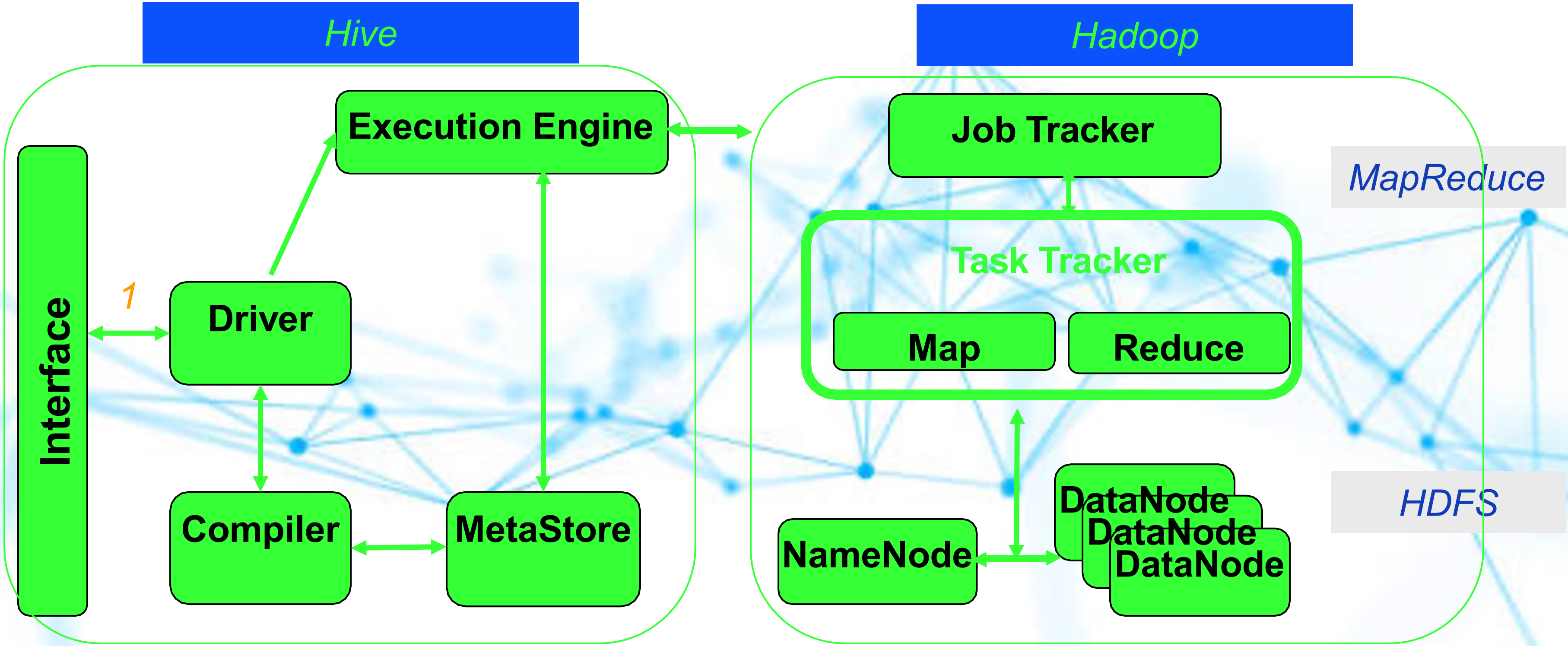


Hive QL

Hive

Execute on Hadoop

Monitor and report


Hive
Hadoop
Execution Engine
Job Tracker
MapReduce
Interface
1
Driver
Task Tracker
Map
Reduce
Compiler
MetaStore
DataNode
DataNode
DataNode
NameNode
HDFS

Hive’s Data Units

- Databases
- Tables
- Partitions
- Buckets (or clusters)

Very similar to SQL and Relational DBs

3-Levels: Tables → Partitions → Buckets

Data Model

Table maps to a HDFS directory

Partition maps to sub-directories under the table

Bucket maps to files under each partition

Tables

Similar to tables in relational DBs

Each table has corresponding directory in HDFS

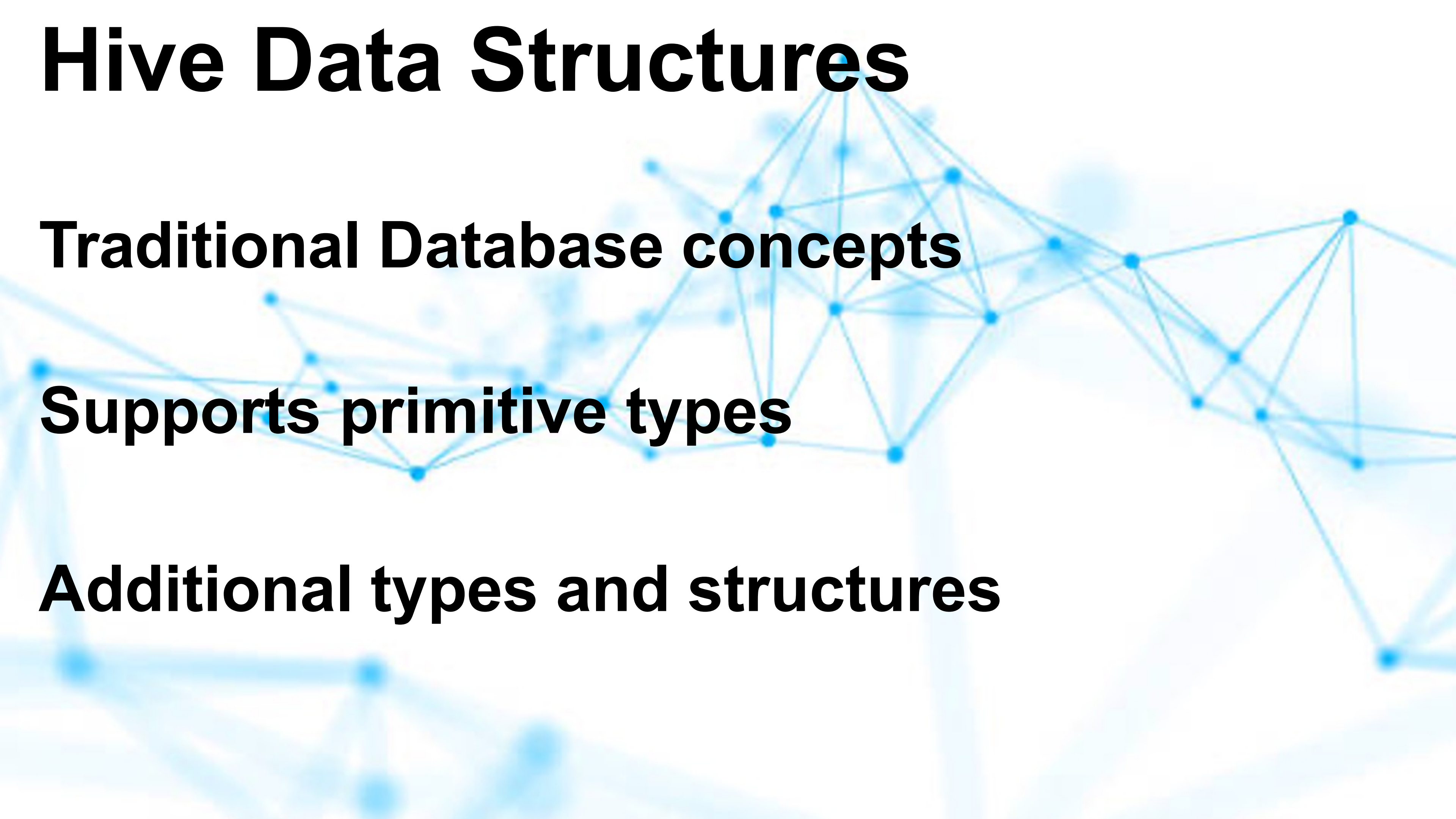
Partitions

Analogous to dense indexes on partition columns

Nested sub-directories in HDFS for each combination of partition column values

Allows users to efficiently retrieve rows

Hive Data Structures

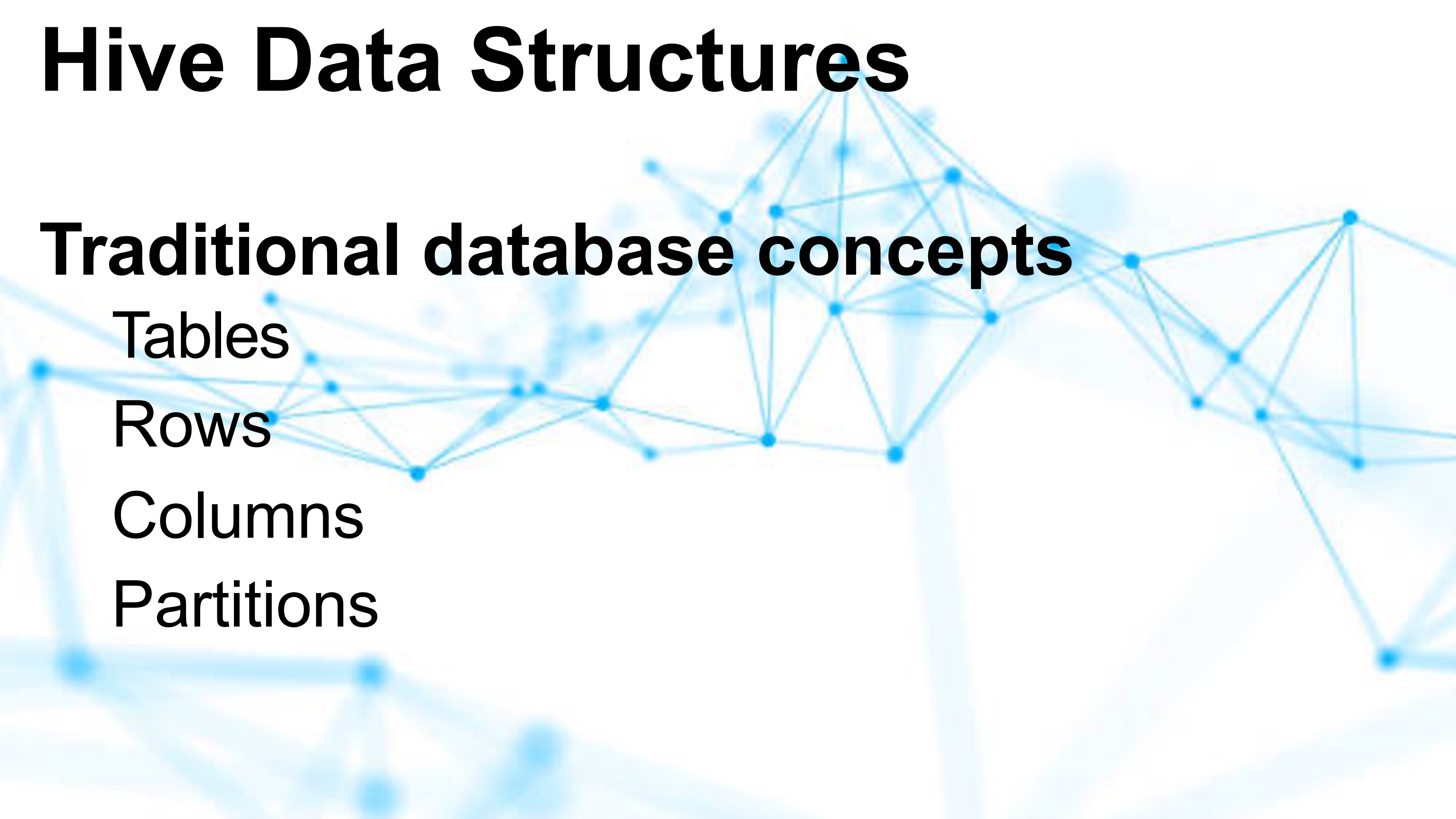


Traditional Database concepts

Supports primitive types

Additional types and structures

Hive Data Structures



Traditional database concepts

- Tables
- Rows
- Columns
- Partitions

Hive Data Structures

Basic types

- Integers
- Floats
- Doubles
- Strings

Hive File Formats

Hive enables users store different file formats

Performance improvements

- TEXTFILE
- SEQUENCEFILE
- ORC
- RCFILE

Optimized Row Columnar (ORC)

Record Columnar File - RCFILE

Hive Commands

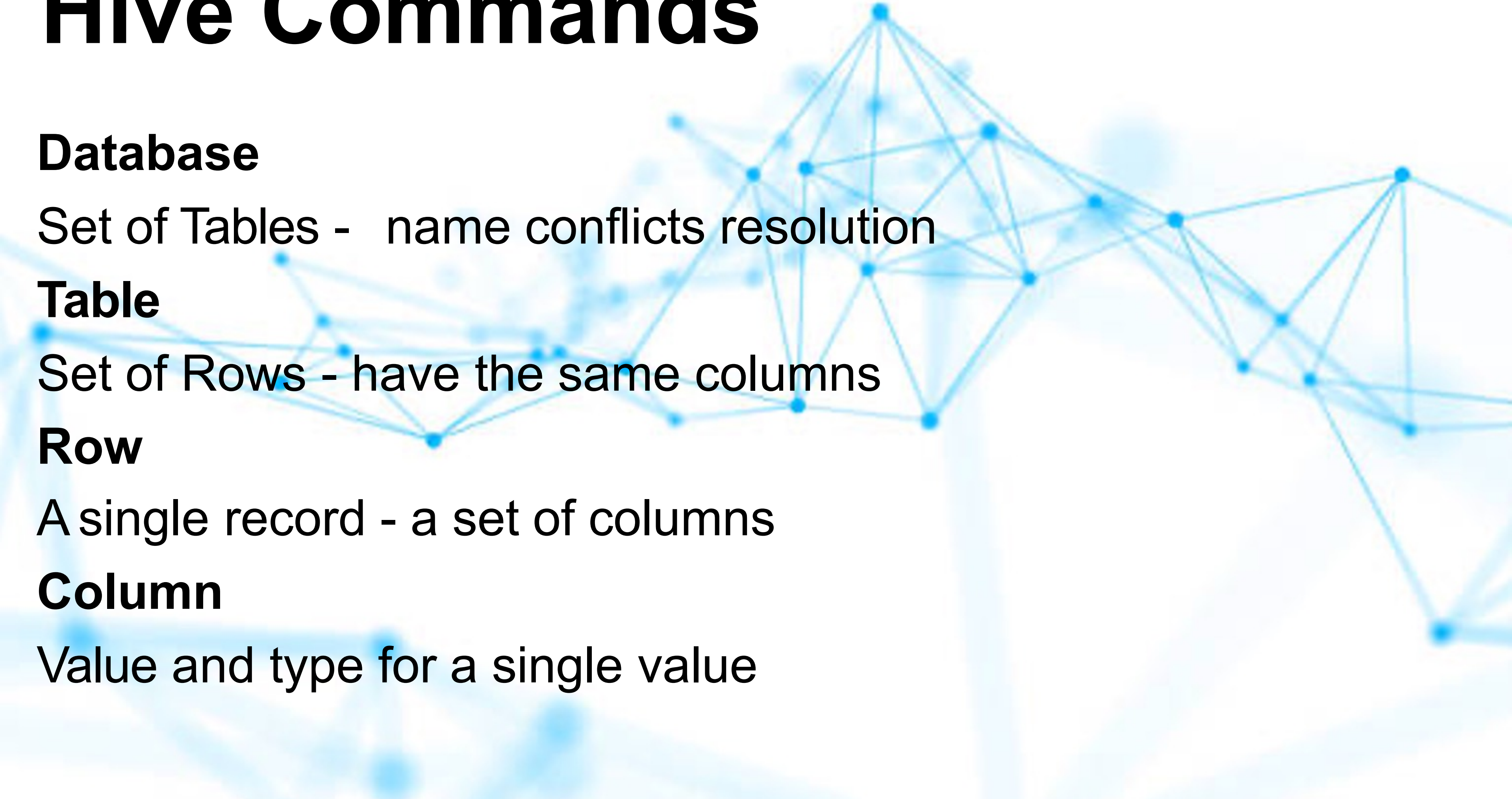
Hive Interface

Command Line interface

Web interface or Hue

Java Database connectivity

Hive Commands



Database

Set of Tables -   name conflicts resolution

Table

Set of Rows - have the same columns

Row

A single record - a set of columns

Column

Value and type for a single value

Tables Commands

- SHOW TABLES
- CREATE TABLE
- ALTER TABLE
- DROP TABLE

Hive Commands

```
CREATE TABLE mytable (myint INT, bar STRING)
PARTITIONED BY (ds STRING);

SHOW TABLES '.*my';

ALTER TABLE mytable ADD COLUMNS (new_col
INT);

DROP TABLE mytable;
```

A table in Hive is an HDFS directory in Hadoop

Hive Commands

Schema is known at creation time (like DB schema)

Partitioned tables have “sub-directories”, one for each partition

```
CREATE TABLE mypeople (
id                      int,
name                    string
)
partitioned by (date string)
```