APACHE SPARK INTRODUCTION

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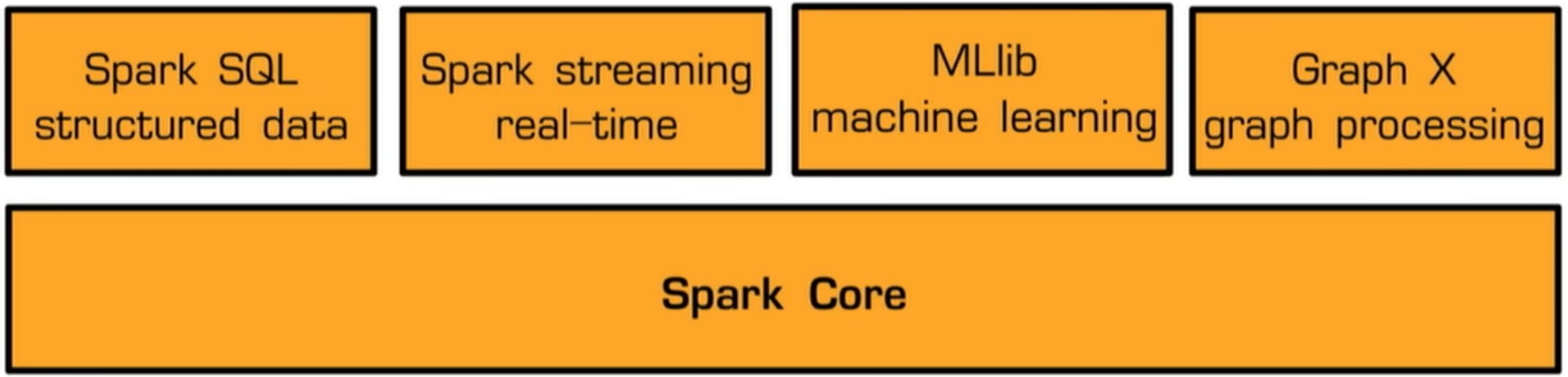
APACHE SPARK

Fast and general engine for large-scale data processing and cloud computing

APACHE SPARK ECOSYSTEM



DISTRIBUTED COMPUTE

Fast and general engine for large-scale data processing

RESILIENT DISTRIBUTED DATASET (RDD)

Collection of elements partitioned across the nodes of the cluster that can be operated on in parallel

RDD FEATURES

- **Distributed collection**
- **Immutable**
- **Fault tolerance**
- **Lazy evaluations**
- **Functional transformations**
- **Data processing formats**
- **RDD API is available in Java, Scala, Python and R**
- **Spark.mllib class is built on top of RDD**

RDD LIMITATIONS

- **No inbuilt optimization engine**
- **Handling structured data**

Quora: Difference between DataSet API and DataFrame API

RESILIENT DISTRIBUTED DATASET (RDD)

Immutable distributed collection of data that data is organized into a table with named columns

DATAFRAME/DATASET FEATURES

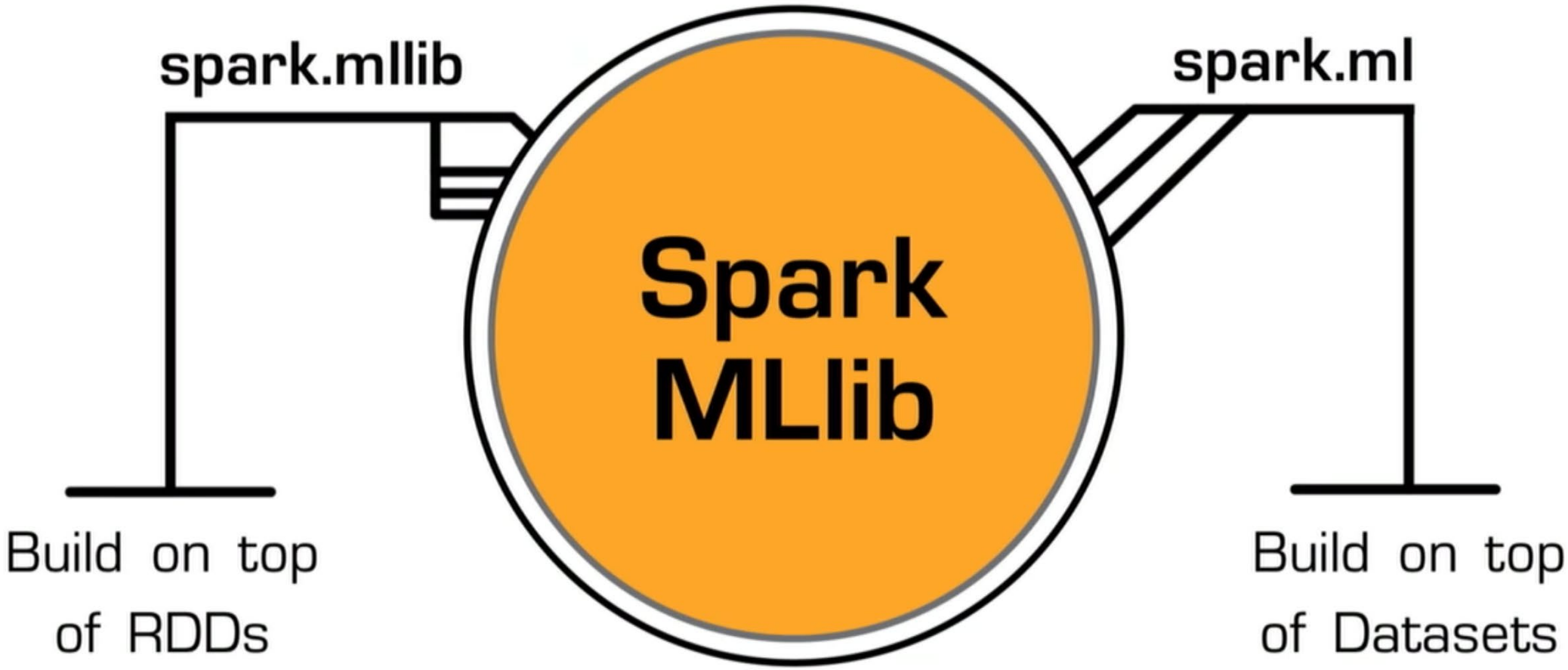
- **Distributed collection of Row Object**
- **Data Processing**
- **Optimization using catalyst optimizer**
- **Hive Compatibility**
- **Tungsten**
- **Dataframe API is available in Java, Scala, Python and R**
- **More modern spark.ml class**

DATAFRAME/DATASET LIMITATIONS

- **Compile-time type safety**
- **Cannot operate on domain Object (lost domain object)**

Quora: Difference between DataSet API and DataFrame API

Databricks - A Tale of Three Apache Spark APIs: RDDs, DataFrames, and Datasets



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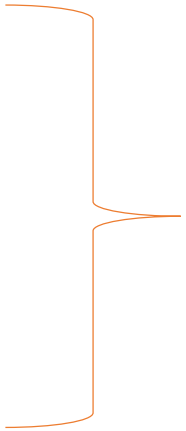
SPARK.MLLIB FEATURES

- **Utilities: linear algebra, statistics, etc.**
- **Feature extraction, features transformations, etc.**
- **Regression**
- **Classification**
- **Clustering**

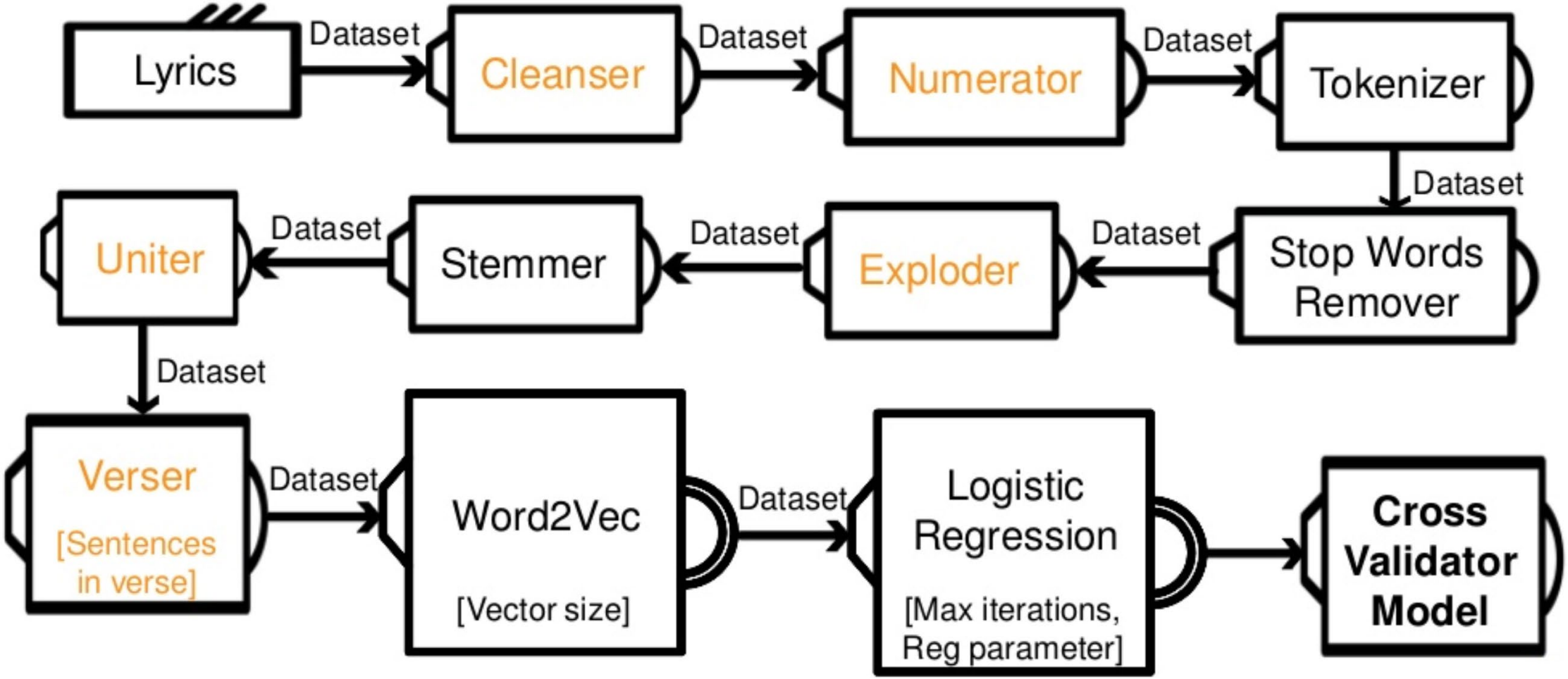
SPARK.ML FEATURES

- Utilities: linear algebra, statistics, etc.
- Feature extraction, features transformations, etc.
- Regression
- Classification
- Clustering
- **Pipelines with persistence**
- **Model Selection and tuning**
  - **Train/validate/split**
  - **K-fold cross validation**



Inspired by Python's SKLearn

EXAMPLE SPARK ML PIPELINE



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SPARK ML PIPELINE EXAMPLE

```
// Create model.
Word2Vec word2Vec = new Word2Vec().setInputCol(VERSE.getName()).setOutputCol("features").setMinCount(0);

LogisticRegression logisticRegression = new LogisticRegression();

Pipeline pipeline = new Pipeline().setStages(
        new PipelineStage[]{
                cleanser,
                numerator,
                tokenizer,
                stopWordsRemover,
                exploder,
                stemmer,
                uniter,
                verser,
                word2Vec,
                logisticRegression});

// Use a ParamGridBuilder to construct a grid of parameters to search over.
ParamMap[] paramGrid = new ParamGridBuilder()
        .addGrid(verser.sentencesInVerse(), new int[]{4, 8, 16})
        .addGrid(word2Vec.vectorSize(), new int[] {100, 200, 300})
        .addGrid(logisticRegression.regParam(), new double[] {0.01D})
        .addGrid(logisticRegression.maxIter(), new int[] {100, 200})
        .build();
```

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PYTHON SKLEARN PIPELINE EXAMPLE

```
lm = Lemmatizer()
tfidf = TfidfVectorizer(max_features=max_features)
lr = LogisticRegression()
nb = NBFeaturer(1)
p = Pipeline([
    ('lm', lm),
    ('tfidf', tfidf),
    ('nb', nb),
    ('lr', lr)
])

cross_val_score(estimator=p, X=x, y=y, scoring=scoring, cv=cv, n_jobs=n_jobs)
```

Kaggle SKLearn Pipeline Tutorial

SUMMARY

Why Move to Apache Spark?

- **Swift Processing**
- **Dynamic in Nature**
- **In-Memory Computation**
- **Re-Usability**
- **Fault Tolerance**

Why Admire from Afar?

- **Expensive**
- **Latency**
- **Manual Optimization**
- **No File Management**
- **Problem With Small Files**

Quora: What are the pros and cons of Apache Spark?

INTRODUCTORY SPARK USES CASES

- Link 1: HealthCare Use Case With Apache Spark
- Link 2: Introduction to Spark RDD and Basic Operations in RDD
- Link 3: Analyzing New York Crime Data Using SparkSQL
- Link 4: Spark Use Case – Travel Data Analysis
- Link 5: Spark Use Case – Uber Data Analysis
- Link 6: Spark Use Case – Analyzing MovieLens Dataset
- Link 7: Spark Use Case – Social Media Analysis