DataStax Enterprise Analytics

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Agenda

1	Introduction DSE Analytics
2	Lab 6: Hands-on DSE Analytics

DSE Analytics

Data extraction, transformation and load (ETL)

Cross-table operations, JOIN, UNION

Ad-Hoc queries

Complex analytics e.g. machine learning

Streaming processing

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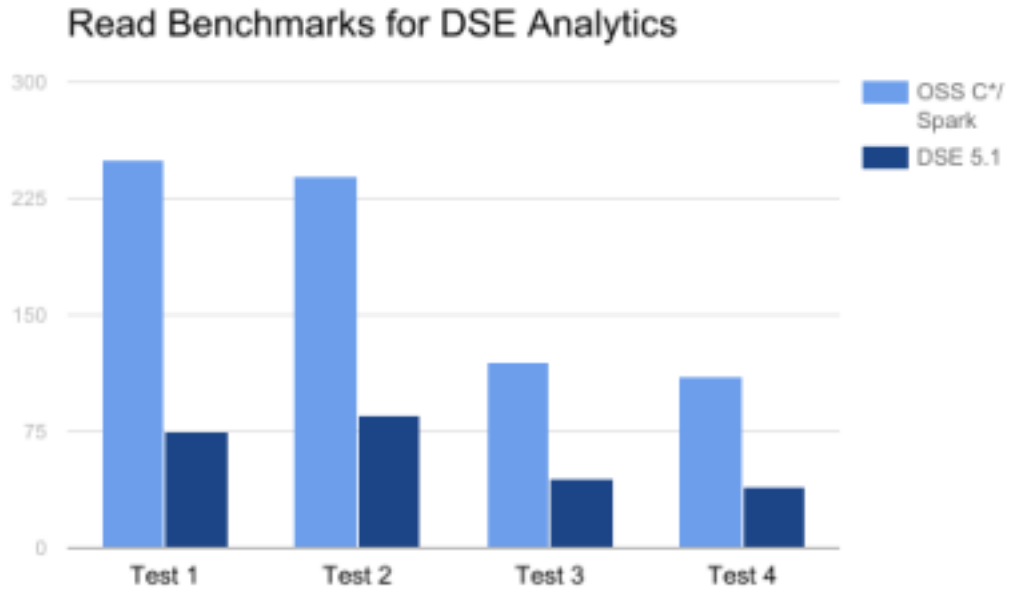
DSE Analytics

Only in DSE:

- Spark/Cassandra
  - 3x better performance
  - Custom join strategies
  - Implicit use of DSE Search
  - Structured Streaming to Cassandra
- AlwaysOn SQL for Spark
  - Supports BI/ETL/other tools
  - Unified Authentication with DSE
  - Security improvements via proxy execution
- Isolate workloads cost-effectively
  - DSE Analytics Solo



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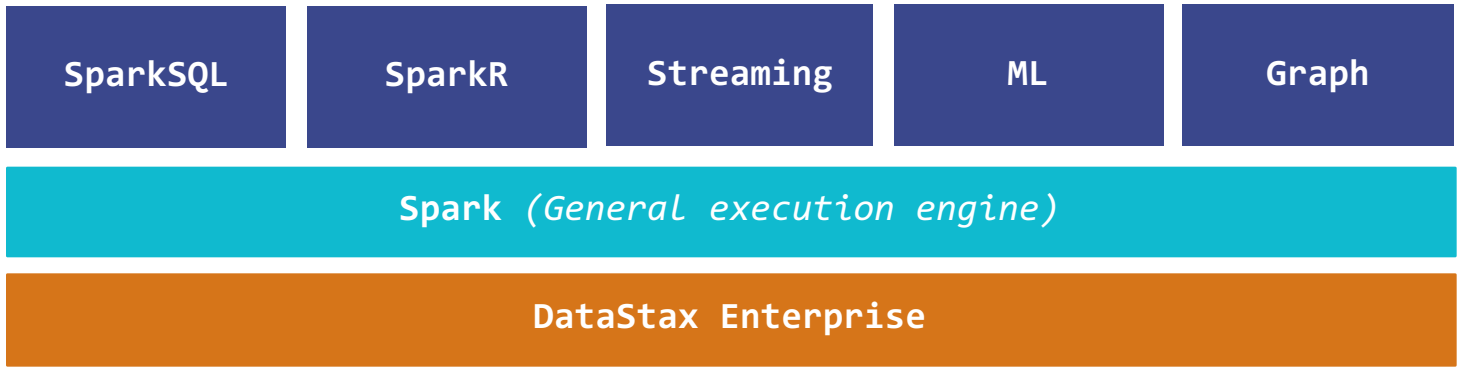
Leveraging Apache Spark through DSE Analytics



- Data model independent queries
- Cross-table operations (JOIN, UNION, etc.)
- Complex analytics (e.g. machine learning)
- Data transformation, aggregation, etc.
- Stream processing

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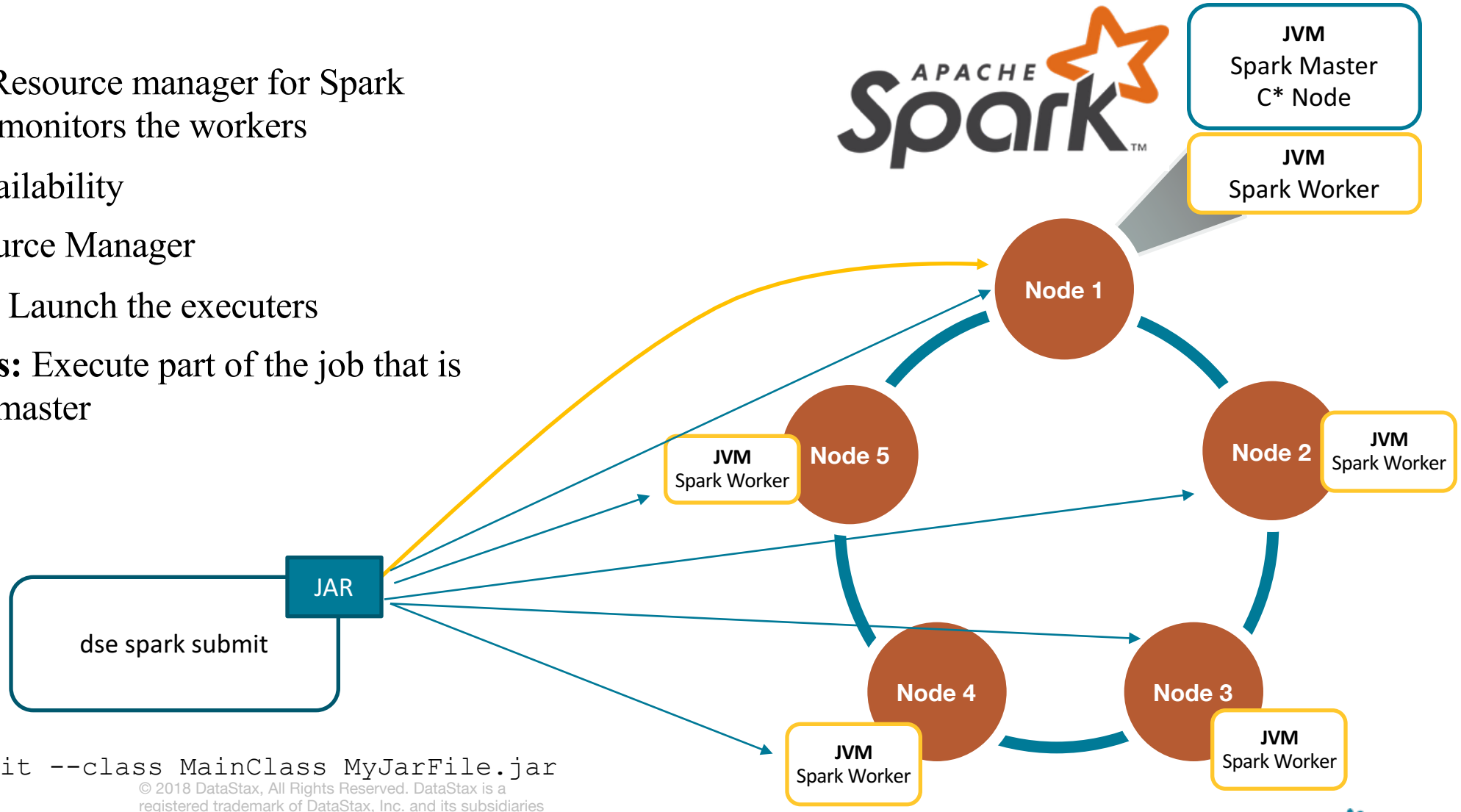
DSE Analytics Platform

- **Spark Master:** Resource manager for Spark applications and monitors the workers
- Automatic high availability
- In-built DSE Resource Manager
- **Spark Workers**: Launch the executers
- **Spark Executors:** Execute part of the job that is submitted to the master




```
dse spark-submit --class MainClass MyJarFile.jar
```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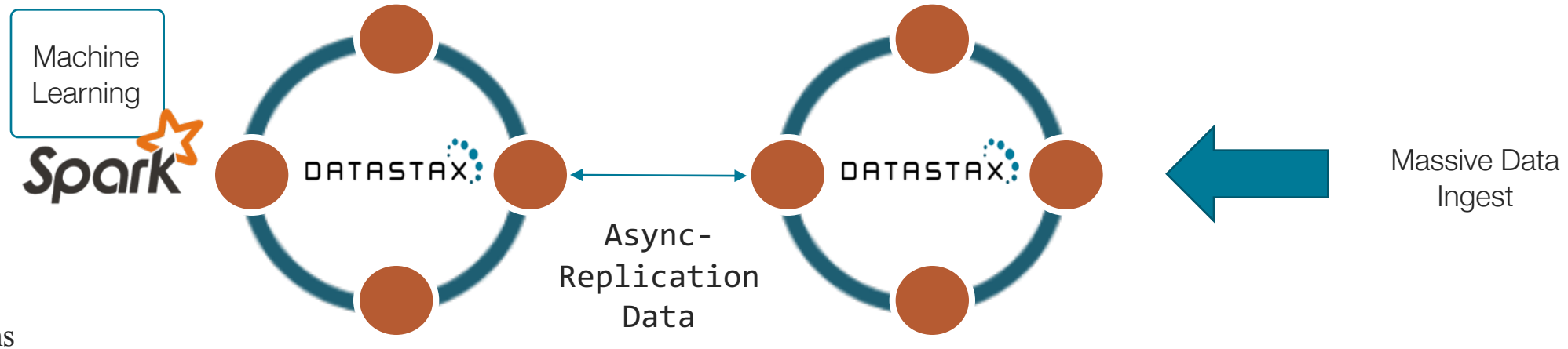
In-built Replication and Multi-Workload Separation



Sequential Scans
Data locality
Parallel and Distributed

```
CREATE KEYSPACE smart_meter WITH replication =
    {'class': 'NetworkTopologyStrategy', 'DC1': '3', 'DC2': '1'};
```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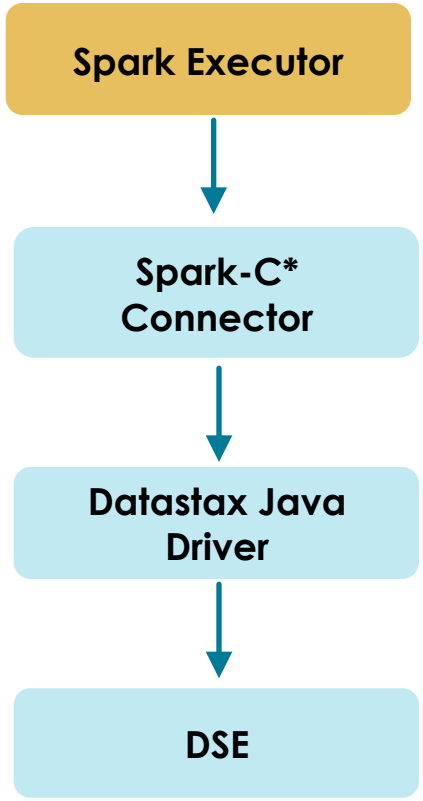
Database Access with DataStax Driver

- DataStax Cassandra Spark driver
  - Implemented mostly in Scala
  - Scala + Java APIs
  - Does automatic type conversions



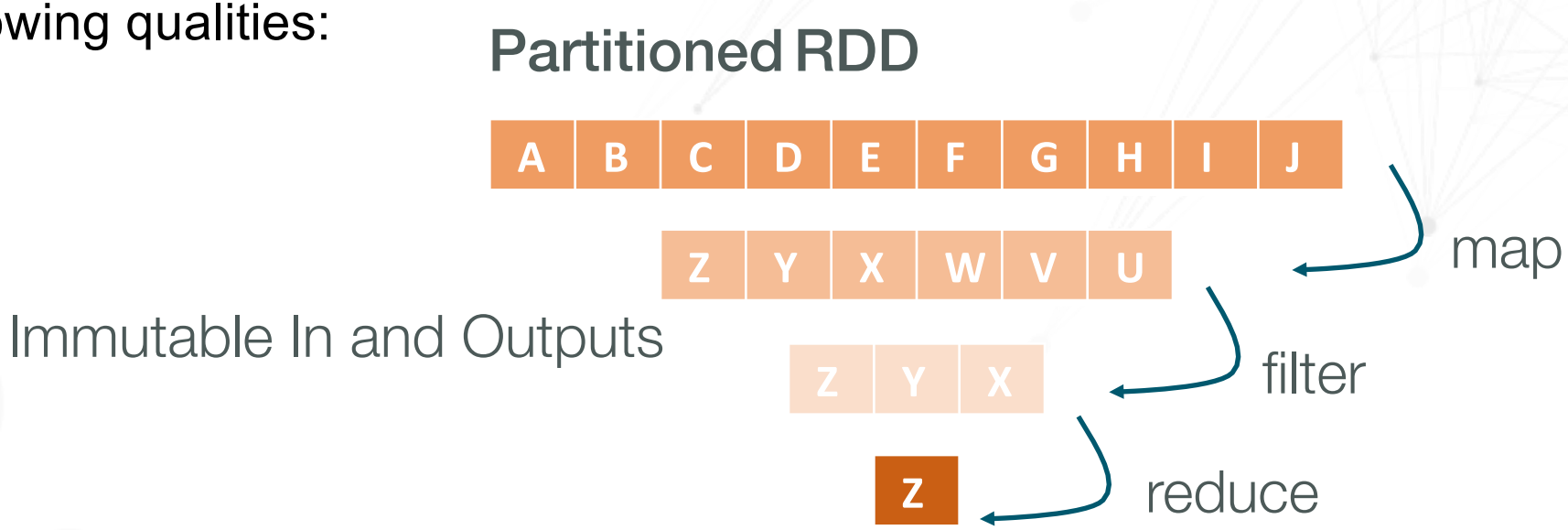

```
// Spark connection options
val conf = new SparkConf(true)
     .set("spark.cassandra.connection.host", "127.0.0.1")
     .set("spark.cassandra.auth.username", "cassandra")
     .set("spark.cassandra.auth.password", "cassandra")
val sc = new SparkContext("spark://127.0.0.1:7077", "myapp", conf)


// Read from DSE and add partitioner with primary key
val rdd = sc.cassandraTable("my_keyspace", "my_table").byKey("pk","cc")


// Save to DSE
rdd.saveToCassandra("my_keyspace", "my_table", SomeColumns("key", "value"))
```

Spark data model RDD

- RDD = Resilient Distributed Dataset
- A collection with following qualities:
- immutable
- iterable
- serializable
- distributed
- parallel
- lazy



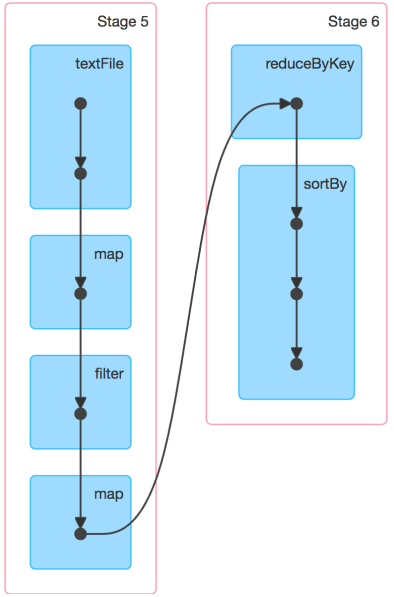
Transformations are state less

RDD – Resilient Distributed Dataset

- Sparks RDD is the Data abstraction layer for the distributed data processing
- RDDs are stateless , immutable and partitioned data collections, which are distributed across many machines (cluster)

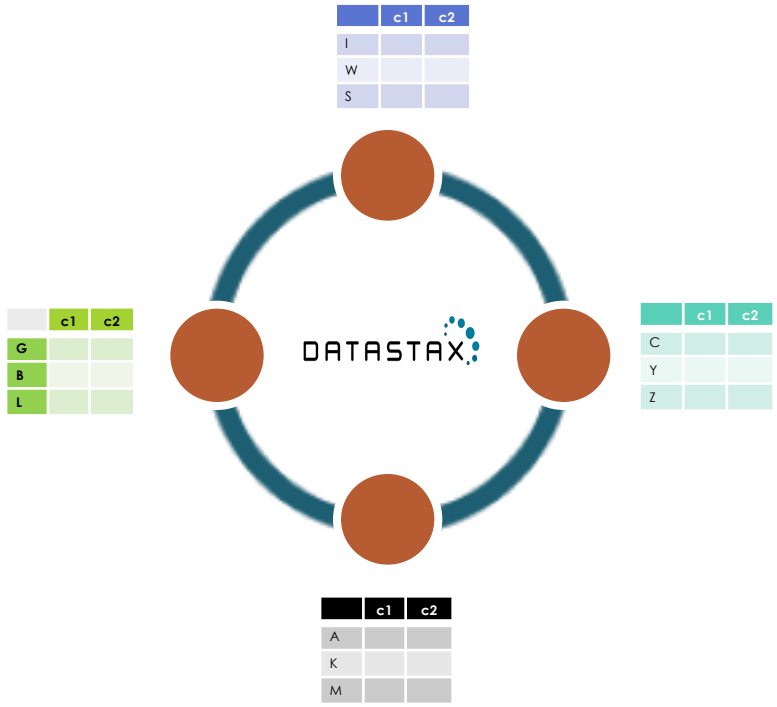
```
myRDD.filter(_._3 == "Hessen")
     .map(record => (record._5,1)).
     .reduceByKey( (a,b) => (a + b)).
     .sortBy(-_._2).
     .take(10)
```

Directed Acyclic Graph (DAG)



- Resilience : Spark's RDDs dependencies address fault tolerance by using a lineage graph
- Lazy Evaluation: transformations performed on RDDs without actually spending compute time on them
- RDD functions and data structure are opaque to Spark => general-purpose compute engine

Data Locality

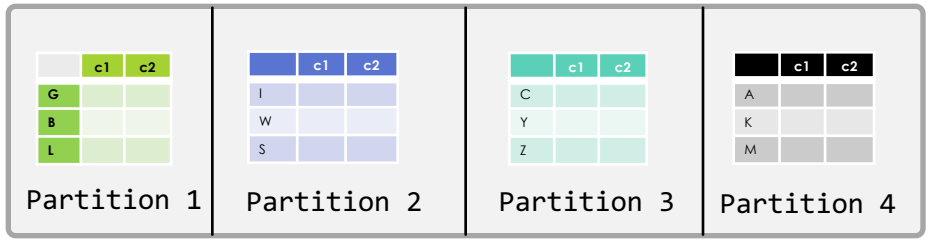


Every Spark task uses a CQL-like query to fetch data for a given token range:

```
SELECT "key", "value"FROM "keyspace"."table“
    WHERE
         token("key") >  384023840238403 AND
         token("key") <= 38402992849280
ALLOW FILTERING
```

- DSE Analytics respects data locality
- No need for ETL between separated clusters
- Spark Master HA

In Memory: Distributed on all available nodes



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Pushdown Predicate and Integration with DSE Search

- SearchAnalytics mode allow you to create analytics queries that use DSE Search indexes
- Improves performance by reducing the amount of data that is processed

Push Down Predicate with DSE Search solr query

```
val table = sc.cassandraTable("states_statistics","de_zip_code")
val result = table.select("zip","city")
.where("solr_query='cite:He*'")
.take(10)
```

Push Down Predicate with DataFrames

```
val table1 = spark.read.cassandraFormat("department","hr"))
.load()
```


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DataFrames and Datasets

- Higher Level API of structured distributed data
- DataSets are structured, typesafe objects
- DataFrames equivalent to tables in relational DBs
- Uses Query optimizations and predicate pushdown
- Enables better optimizations through Spark
- Faster serialization and less memory consuming

Scala query

```
spark.table("zip").
    filter("state = 'Hessen'").
    groupBy("city").
    count().
    orderBy(desc("count")).
    limit(10).show()
```

SQL Query

```
spark.sql("select count(zip) z, city c
          FROM zip
          WHERE State = 'Hessen'
          GROUP BY city
          ORDER BY z desc
          LIMIT 10").show()
```

Apache Spark @Scale: A 60 TB+ production use case

https://code.facebook.com/posts/1671373793181703/apache-spark-scale-a-60-tb-production-use-case/

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DSE Analytics Features

- Easy setup and config
  - No need to setup a separate Apache Spark™ cluster
  - No need to tweak classpaths or config files
- High availability of DSE Analytics Master
- Enterprise security
  - Password / Kerberos / LDAP authentication
  - SSL for all DSE Analytics to DSE C* connections

Lab 6 : Hands-on DSE Analytics

Thank You!