Operational Tips for Deploying Apache® Spark™

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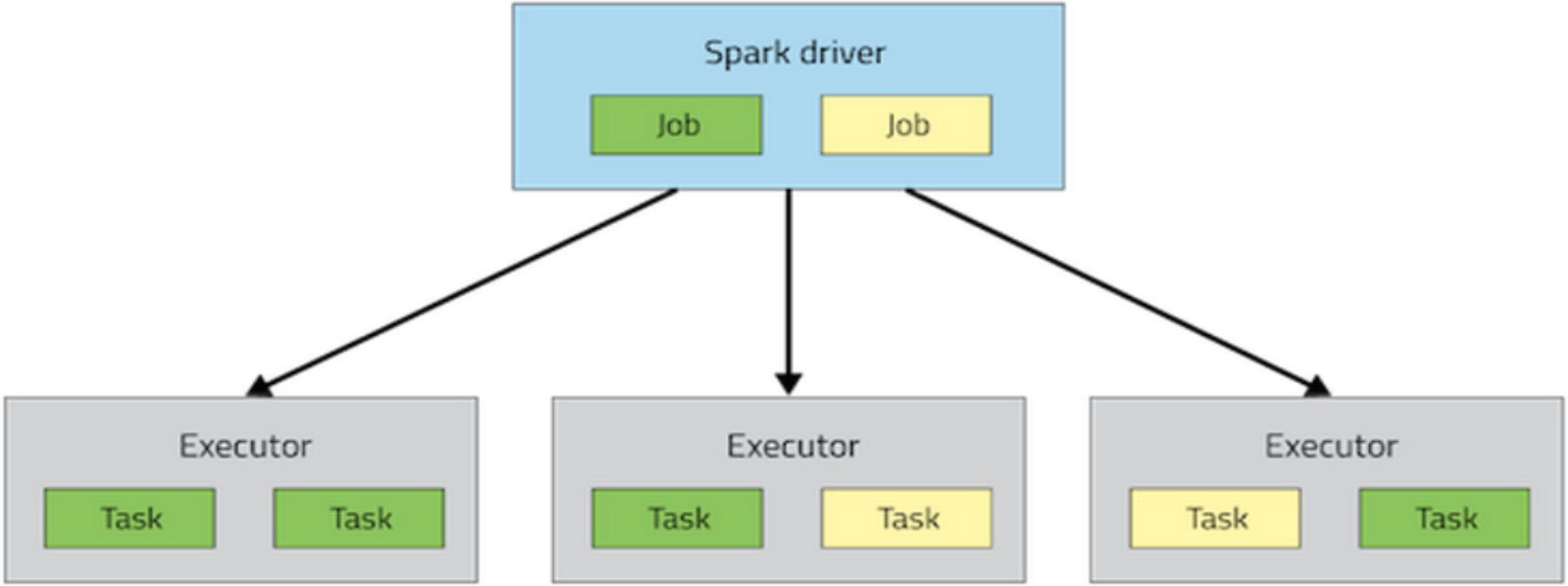
- Previously Systems Engineer @ Cloudera
- Deep Knowledge of Big Data Stack
- Apache Spark Expert
- Solutions Architect @ Databricks!

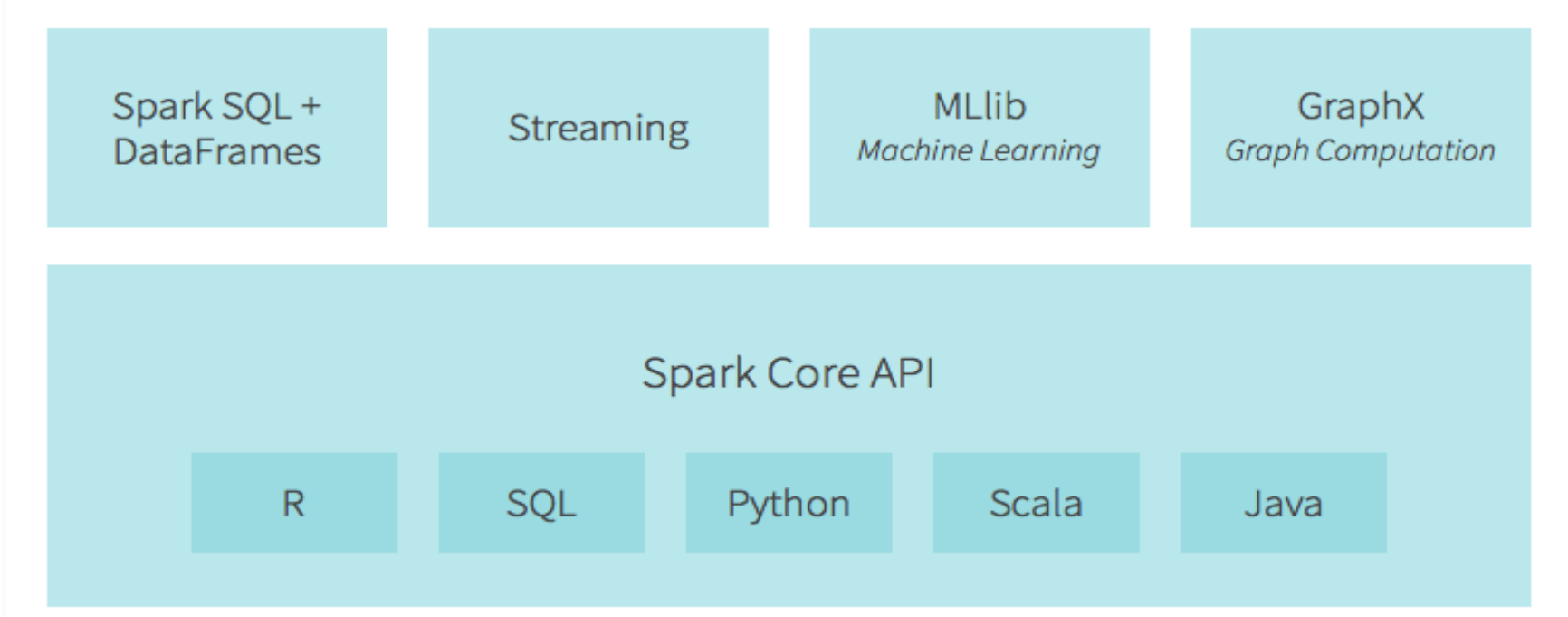
What Will I Learn?

- Quick Apache Spark Overview
- Configuration Systems
- Pipeline Design Best Practices
- Debugging Techniques

Apache Spark



Apache Spark Configuration



Apache Spark Core Configurations

- Command Line:
  `spark-defaults.conf`
  `spark-env.sh`
- Programmatically:
  `SparkConf()`
- Hadoop Configs:
  `core-site.xml`
  `hdfs-site.xml`

```
// Print SparkConfig
sc.getConf.toDebugString

// Print Hadoop Config
val hdConf =
sc.hadoopConfiguration.iterator()
while (hdConf.hasNext){
  println(hdConf.next().toString())
}
```

SparkSQL Configurations

- Set SQL Configs Through SQL Interface

```
SET key=value;
sqlContext.sql("SET spark.sql.shuffle.partitions=10;")
```

- Tools to see current configurations

```
// View SparkSQL Config Properties
val sqlConf = sqlContext.getAllConfs
sqlConf.foreach(x => println(x._1 +" : " + x._2))
```

Apache Spark Pipeline Design

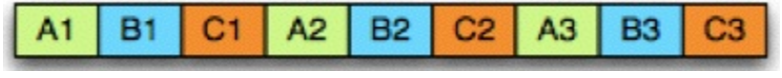
- File Formats
- Compression Codecs
- Apache Spark APIs
- Job Profiles

File Formats

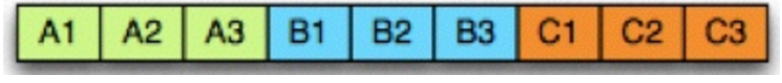
- Text File Formats
  - CSV
  - JSON

A	B	C
A1	B1	C1
A2	B2	C2
A3	B3	C3

- Avro Row Format



- Parquet Columnar Format



User Story:
260GB CSV Data Converted to 23GB Parquet

Compression

- Choose and Analyze Compression Codecs
  - Snappy, Gzip, LZO

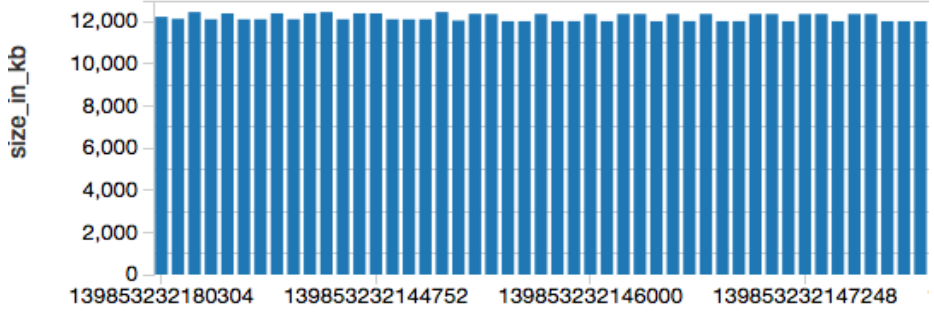
- Configuration Parameters
  - `io.compression.codecs`
  - `spark.sql.parquet.compression.codec`

Small Files Problem

- Small files problem still exists
- Metadata loading
- Use `coalesce()`

```
display(df)
```

▸ (2) Spark Jobs

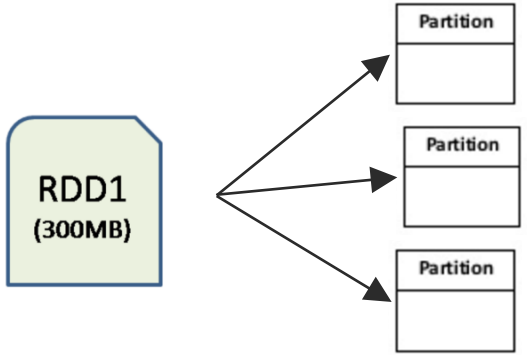


Ref:

http://spark.apache.org/docs/latest/api/python/pyspark.sql.html#pyspark.sql.DataFrame

What are Partitions?

- 2 Types of Partitioning
  - Spark
  - Table Level




```
# Get Number of Spark
> df.rdd.getNumPartitions()
40
```

Partition Controls

- Apache Spark APIs
  - `repartition()`
  - `coalesce()`

```
# Re-partition  a DataFrame
> df_10 = df.repartition(10)
```

```
df = sqlContext.read.\
      jdbc(url=jdbcUrl,  \
               table='employees',\
               column='emp_no',\
               lowerBound=1,\
               upperBound=100000,  \
               numPartitions=100)

df.repartition(20).write.\
    parquet('/mnt/mwc/jdbc_part/')
```

Table Partitions

- Partition by a column value within the table

```
> df.write.\
    partitionBy("colName").\
    saveAsTable("tableName")
```

```
ls -l /dbfs/user/hive/warehouse/tablename/

total 0
-rw-r--r-- 1 root root 0 Jan  1  1970 _SUCCESS
drwxr-xr-x 1 root root 0 Jan  1  1970 year=2014
drwxr-xr-x 1 root root 0 Jan  1  1970 year=2015

Command took 0.38s
```

Those Other Partitions

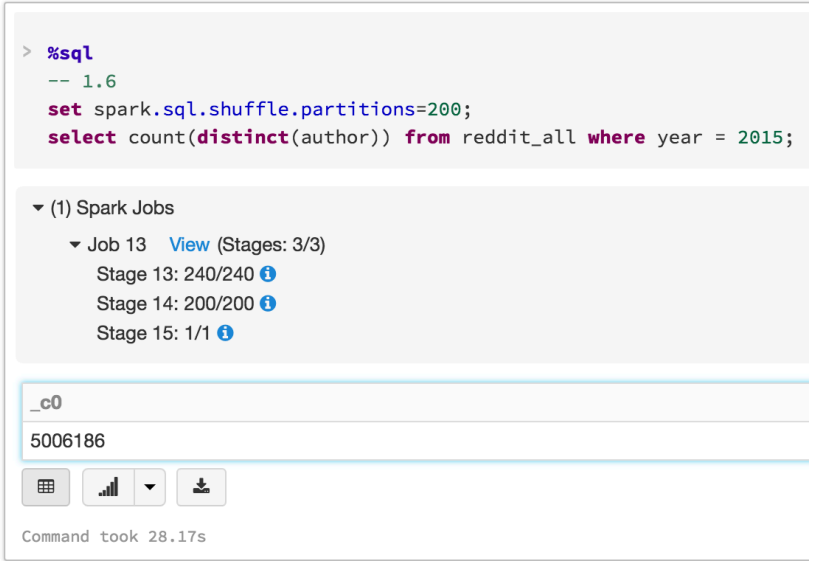
- SparkSQL Shuffle Partitions
  `spark.sql.shuffle.partitions`

```
sqlCtx.sql("set spark.sql.shuffle.partitions=600”)
sqlCtx.sql("select a1.name, a2.name from adult a1 \
   join adult a2 \
   where a1.age = a2.age")

sqlCtx.sql("select count(distinct(name)) from adult")
```

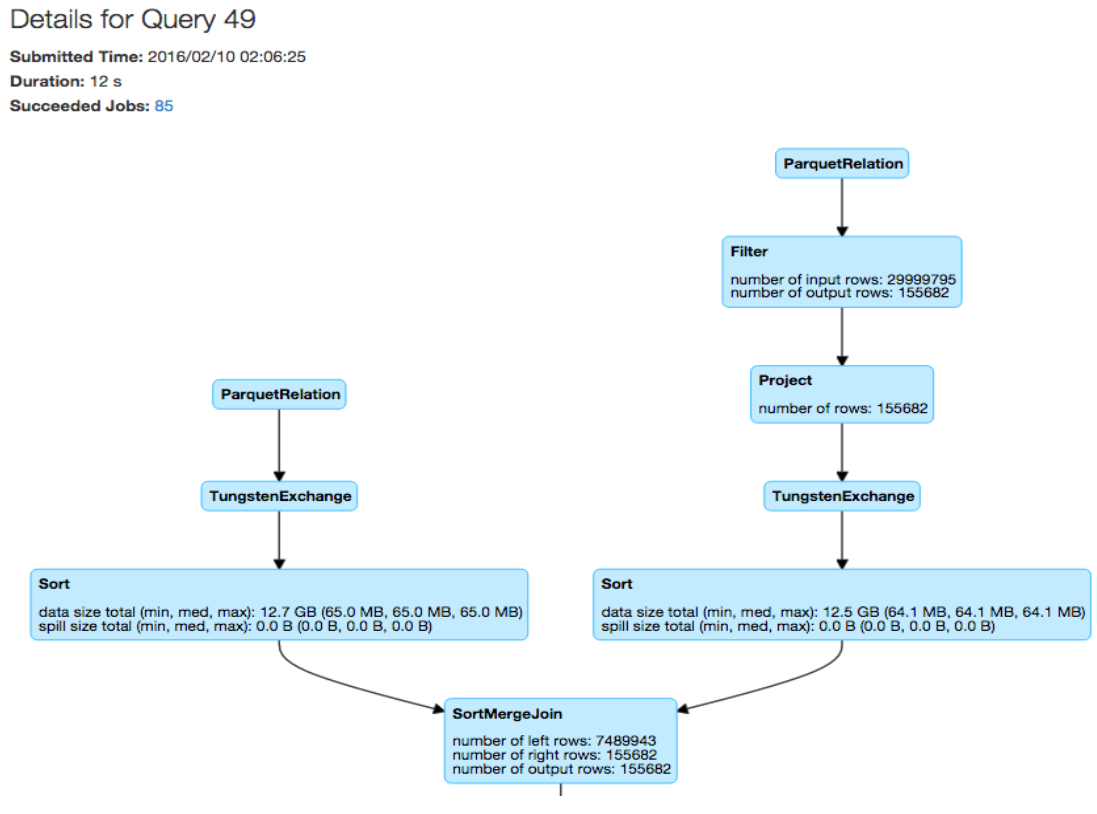
How Does This Help?

- Q: Will increasing my cluster size help with my job?
- A: It depends.



Apache Spark Job Profiles

- Leverage Spark UI
  - SQL
  - Streaming



Apache Spark Job Profiles

Aggregated Metrics by Executor

Executor ID ▲	Address	Task Time	Total Tasks	Failed Tasks	Succeeded Tasks	Input Size / Records	Shuffle Write Size / Records
0	ip-10-0-197-52.us-west-2.compute.internal:45222	39 min	291	0	291	10.0 GB / 82423	11.9 KB / 291
1	ip-10-0-238-218.us-west-2.compute.internal:41578	39 min	292	0	292	10.0 GB / 82795	12.0 KB / 292
2	ip-10-0-229-111.us-west-2.compute.internal:43837	39 min	294	0	294	10.1 GB / 82721	12.1 KB / 294
3	ip-10-0-176-36.us-west-2.compute.internal:47072	39 min	294	0	294	10.2 GB / 84025	12.1 KB / 294
4	ip-10-0-207-37.us-west-2.compute.internal:41034	39 min	293	0	293	10.1 GB / 82656	12.0 KB / 293
5	ip-10-0-156-34.us-west-2.compute.internal:44449	39 min	298	0	298	10.2 GB / 83917	12.2 KB / 298
6	ip-10-0-156-35.us-west-2.compute.internal:58803	39 min	298	0	298	10.2 GB / 84277	12.2 KB / 298
7	ip-10-0-232-3.us-west-2.compute.internal:55489	39 min	297	0	297	10.3 GB / 84628	12.2 KB / 297
8	ip-10-0-232-2.us-west-2.compute.internal:38085	39 min	296	0	296	10.2 GB / 83582	12.1 KB / 296
9	ip-10-0-207-36.us-west-2.compute.internal:55661	39 min	288	0	288	9.9 GB / 81804	11.8 KB / 288
10	ip-10-0-178-163.us-west-2.compute.internal:59616	39 min	294	0	294	10.1 GB / 83350	12.1 KB / 294
11	ip-10-0-178-162.us-west-2.compute.internal:41800	39 min	295	0	295	10.2 GB / 83822	12.1 KB / 295

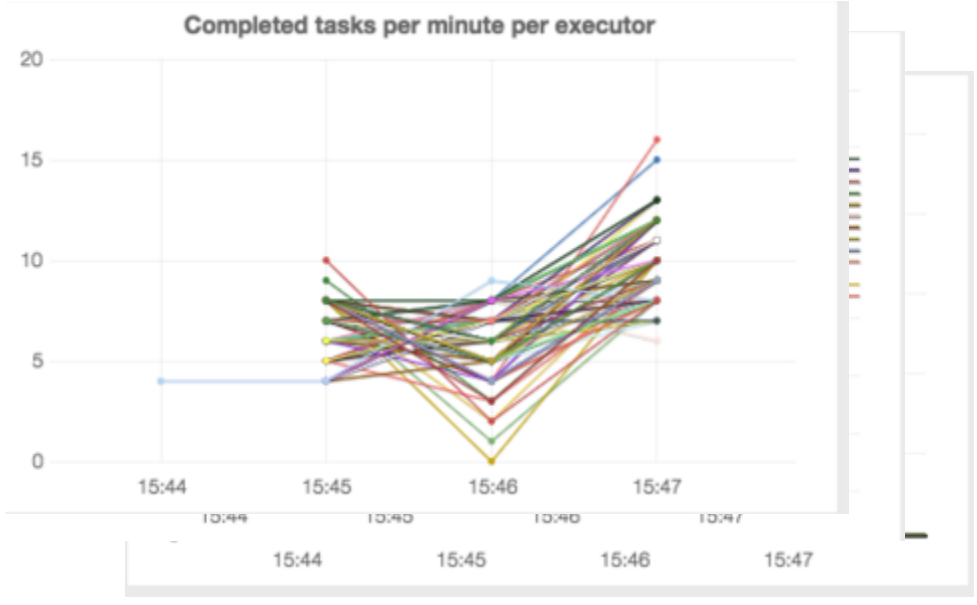
Apache Spark Job Profiles

Tasks

Index ▲	ID	Attempt	Status	Locality Level	Executor ID / Host	Launch Time	Duration	GC Time	Input Size / Records	Errors
0	16607	0	SUCCESS	PROCESS_LOCAL	18 / ip-10-0-171-33.us-west-2.compute.internal	2016/02/09 19:12:40	24 s	0.2 s	46.8 MB (hadoop) / 614400	
1	16608	0	SUCCESS	PROCESS_LOCAL	19 / ip-10-0-214-114.us-west-2.compute.internal	2016/02/09 19:12:40	23 s		46.8 MB (hadoop) / 614400	
2	16609	0	SUCCESS	PROCESS_LOCAL	18 / ip-10-0-171-33.us-west-2.compute.internal	2016/02/09 19:12:40	4 s		6.5 MB (hadoop) / 85355	
3	16610	0	SUCCESS	PROCESS_LOCAL	19 / ip-10-0-214-114.us-west-2.compute.internal	2016/02/09 19:12:40	23 s		46.8 MB (hadoop) / 614400	
4	16611	0	SUCCESS	PROCESS_LOCAL	18 / ip-10-0-171-33.us-west-2.compute.internal	2016/02/09 19:12:40	24 s	0.2 s	46.8 MB (hadoop) / 614400	

Apache Spark Job Profile: Metrics

- Monitoring & Metrics
  - Spark
  - Servers
- Toolset
  - Ganglia
  - Graphite



Ref:
http://www.hammerlab.org/2015/02/27/monitoring-spark-with-graphite-and-grafana/

Debugging Apache Spark

- Analyze the Driver's stacktrace.
- Analyze the executors stacktraces
  - Find the initial executor's failure.
- Review metrics
  - Memory
  - Disk
  - Networking

Debugging Apache Spark

- Know your tools: JDBC vs ODBC. How to test? What can I test?
  - RedShift / Mysql / Tableau to Apache Spark ,etc.

- Json SparkSQL for corrupt records

```
sqlCtx.read.json("/jsonFiles/").registerTempTable("jsonTable")
sqlCtx.sql("SELECT _corrupt_record \
        FROM jsonTable \
        WHERE _corrupt_record IS NOT NULL")
```

- Steps to debug SQL issues
  - Where's the data, what's the DDL?

Top Support Issues

- OutOfMemoryErrors
  - Driver
  - Executors
- Out of Disk Space Issues
- Long GC Pauses
- API Usage

Top Support Issues

- Use builtin functions instead of custom UDFs
  - `import pyspark.sql.functions`
  - `import org.apache.spark.sql.functions`

- Examples:
  - `to_date()`
  - `get_json_object()`
  - `monotonically_increasing_id()`
  - `hour() / minute()`

Ref: http://spark.apache.org/docs/latest/api/python/pyspark.sql.html#module-pyspark.sql.functions

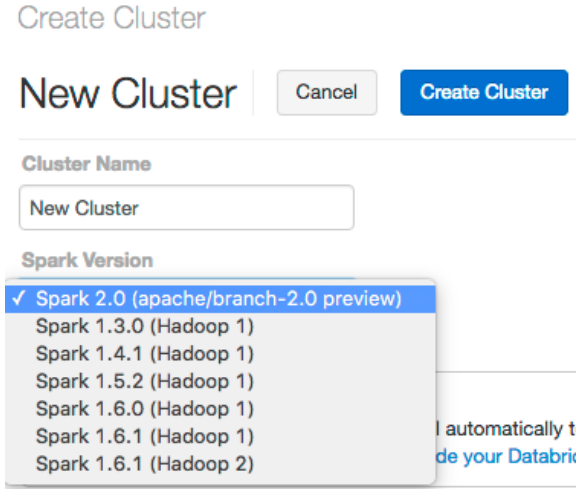
Top Support Issues

- SQL query not returning new data
  - `REFRESH TABLE <table_name>`
- Exported Parquet from External Systems
  - `spark.sql.parquet.binaryAsString`
- Tune number of Shuffle Partitions
  - `spark.sql.shuffle.partitions`

Try Apache Spark with Databricks

- Download notebook for this talk at: dbricks.co/xyz
- Try latest version of Apache Spark and preview of Spark 2.0

http://databricks.com/try



Thank you.

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