Igniting Analytics

Apache Spark's Promise and Potential Perils

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Sponsor

Speakers

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Agenda

- What is Spark and why care?
  - *High performance engine*
  - *Analytic uses of Spark's libraries*
- Desirable characteristics of Spark
  - *High performance*
  - *Broad compatibility*
  - *Flexible deployment*
  - *One console for multiple functions*
  - *Native ANSI SQL*
- Real-world use cases for Spark
  - *Iterative queries for data exploration, etc.*
  - *SQL-based analytics*
  - *Multiple, diverse forms of analytics in one app*
- Conclusions

PLEASE TWEET --
@pRussom, @Teradata,
#TDWI, #Hadoop,
#Analytics, #BigData

DEFINITION

Apache Spark™

- Apache Spark is a parallel processing engine for big data that achieves high speed and low latency by leveraging in-memory computing and cyclic data flows.
- Spark today includes four libraries of functionality.
  All have direct applications in BI, DW, DI, & analytics.
  - *SQL, streaming data, machine learning, graph analytics*
- Spark's high performance and analytic functionality are distinct advantages over the current state of Hadoop MapReduce.

The Apache Spark Libraries

- Spark SQL
  - *ANSI standard; ODBC/JDBC; APIs for Python, Scala, Java*
  - *Hive's GUI & metastore can be a frontend for SQL queries*
- Spark Streaming
  - *Scalable fault-tolerant streaming apps; in Python, Scala, Java*
  - *Reuse batch jobs; join stream & historic data; query a stream state*
- MLib (machine learning)
  - *Contains many high-quality algorithms that leverage iteration*
- GraphX (API & parallel computation engine for graph analytics)
  - *Work with graphs and collections simultaneously*

Desirable Characteristics of Spark

- High performance
- Broad compatibility
- Flexible deployment
- One console for multiple functions
- Native support for standard SQL

- I'll dive into more detail for each of these.

High Performance

- Benchmarks show Spark to be up to one hundred times faster than Hadoop MapReduce with in-memory operations.
- Spark is ten times faster than MapReduce with disk-bound operations.
- Spark has the low latency required of new practices, like data exploration, discovery, and SQL-based analytics.

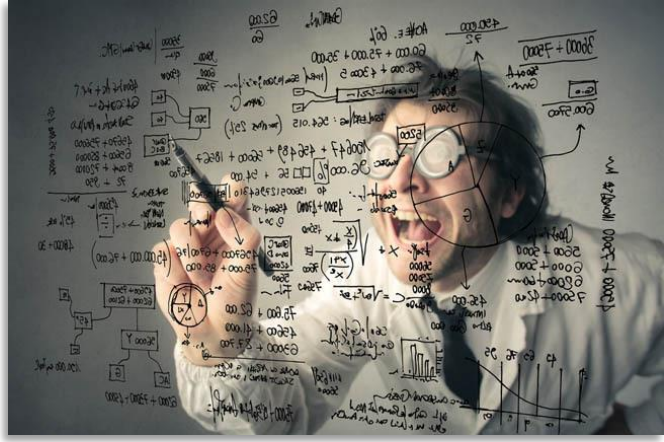
Broad Compatibility

- Spark SQL reuses the Hive front-end and metastore, to provide compatibility with existing Hive data, queries, UDFs.
- Spark SQL's server mode extends interoperability via industry-standard ODBC/JDBC.
- Spark can process data in S3, HDFS, HBase, Hive, Cassandra, and any Hadoop InputFormat.

Flexible Deployment

- Spark requires some kind of shared file system (NFS compliant), so its deployment options are diverse.
- Spark runs on its standalone cluster, Hadoop YARN, Apache Mesos, and Amazon EC2; on premises or cloud.
- Works with systems from Databricks, Paxata, IBM, etc…
- A single job, query, or stream processing can be deployed in either batch or interactive mode via Scala, Python, and R shells.

One console for multiple functions



- Apache Spark includes libraries for four high-level applications:
  - *SQL, streaming data, machine learning, and graph analytics*
- These are integrated tightly, so users can create applications that mix SQL queries and stream processing, alongside complex analytic algorithms.
- Hence, Spark fosters seamless development with diverse analytic functionality.

Native support for standard SQL

- A modern enterprise wants to leverage pre-existing SQL skills and SQL-based tools that comply with ANSI & ISO.
- Furthermore, users want fast queries on Hadoop, to enable data exploration, analytics, and other interactive, data-driven practices.
- Spark and its SQL support promise to enable these, which in turn will spark big data analytics for end users.

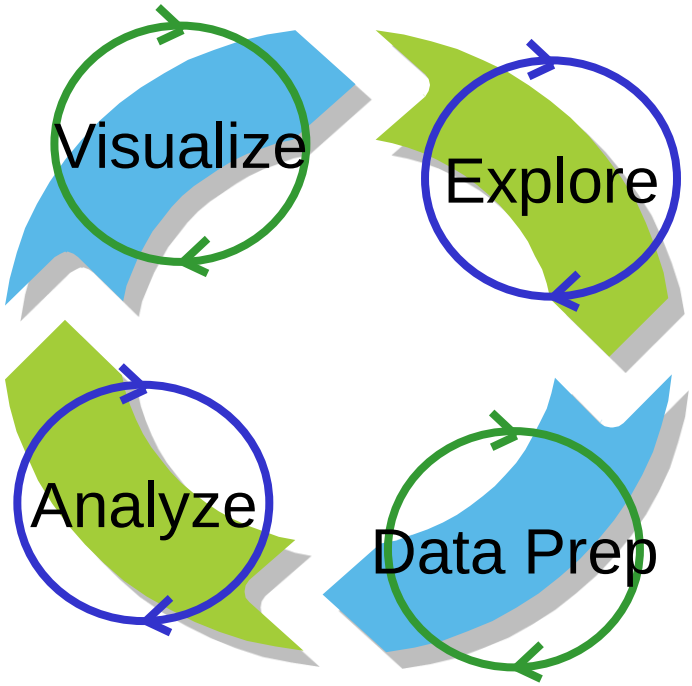
Real-World Use Cases for Spark

- Data exploration
  - *with fast iterative SQL queries*
- SQL-based analytics
  - *with more complex SQL than ever before*
- Miscellaneous analytic applications
  - *with mixtures of SQL, streams, graph, etc.*

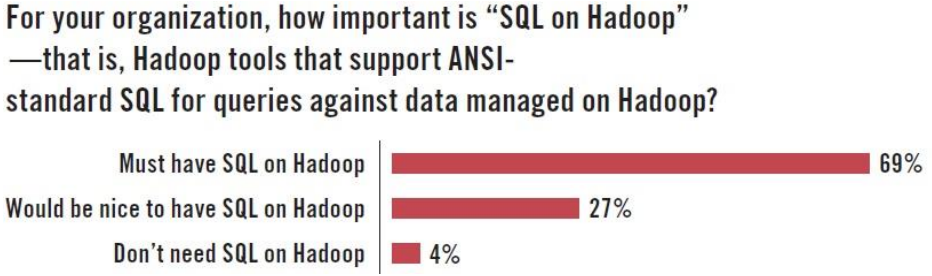
ITERATIVE, FOUR-STEP PROCESS FOR

Exploratory Analytics with Large and Diverse Data Sets

- Spark's libraries can all potentially contribute to capturing, exploring, preparing, and analyzing a wide range of data, both old and new.
- Spark promises to do that with speed, scale, and standard SQL.



SQL is More Important than Ever



- For example, consider the "SQL on Hadoop" versus "SQL off Hadoop" argument
  - *In recent TDWI survey, SQL on Hadoop is a "must have" (69%)*
    - Only 4% don't need SQL on Hadoop
    - (Source: TDWI survey run in late 2014. Based 99 respondents.)
  - *Users interviewed by TDWI want BOTH !*
    - In fact, the consensus is that BI/DW pros need solid SQL on all platforms.
    - Spark promises to help with that.

SQL-Based Analytics

- Most common form of analytics after OLAP
- Data Exploration = Ad-hoc queries on steroids
  - *Size, scope, complexity of query grows with each iteration*
- Complex SQL expresses many things
  - *Data access via many interfaces, near real time*
  - *Data models, even dimensional ones*
    - Data Prep = usually SQL-based
  - *Multi-way joins, but also complex transformations*
- KLOCs = Thousands of Lines of [SQL] Code
  - *Whether tool-generated, hand-written, or both*
- Growing number & diversity of users who need SQL
  - *Data analysts, data scientists, BI/DW pros, biz analysts*
- All the above demand a hefty tool environment
  - *SQL on Hadoop is key; Spark promises to help*

Miscellaneous Uses for Apache Spark

- SQL analytics & related set-based applications
  - *Customer-base segmentation, financial analyses, dimensional modeling and analysis, reporting*
- Stream capture and analysis
  - *Monitoring facilities (utilities, factories), tracking social sentiment, predictive machine maintenance, reroute traffic, manage mobile assets, any time-sensitive process*
- Graph analytics
  - *Anomaly detection for fraud or risk, behavioral analysis, entity clustering, patient outcome optimization*
- Mixtures of the above
  - *Trend: mix multiple analyses; each reveals different insight*
  - *Spark promises unified environ for such mixtures*

Conclusions

- Keep an eye on Apache Spark™
  - *It's too early to tell, but Spark has the potential to ignite analytics in multiple ways*
- Spark promises a lot for data management and analytics professionals
  - *Corrects a number of Hadoop weaknesses around SQL, speed, concurrency, analytic diversity, streams and real time*
  - *But Spark is not just for Hadoop*
  - *ANSI/ISO standard SQL with speed and scale*
  - *High performance for SQL and analytics*
  - *Analytic apps that mix multiple approaches*
- Spark has many real-world uses, including
  - *Low latency queries for data exploration*
  - *Analytics based on combinations of SQL, streams, machine learning, and graph*

Spark: Insights From Field Engagements

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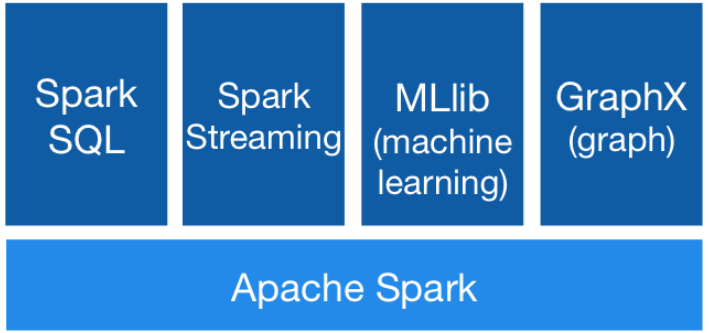
Sept. 24, 2015

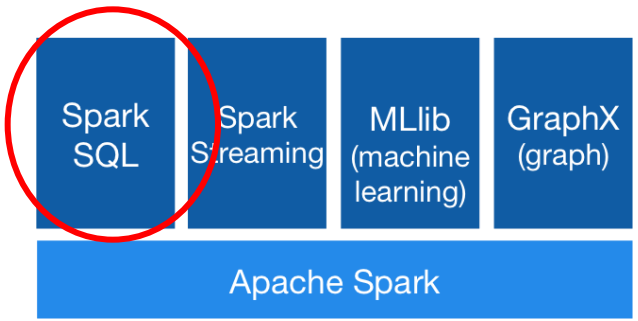
Where Does Spark Core Fit?

- Framework for parallel processing
- Hadoop competitor
  - MapReduce killer
  - Often built on the back of Hadoop
    - Cluster Resource Manager (Yarn)
    - Distributed File System (HDFS)
- Take input from some system, transform/analyze, write
  - Storage needed such as HBase, S3, Hive, database, etc.

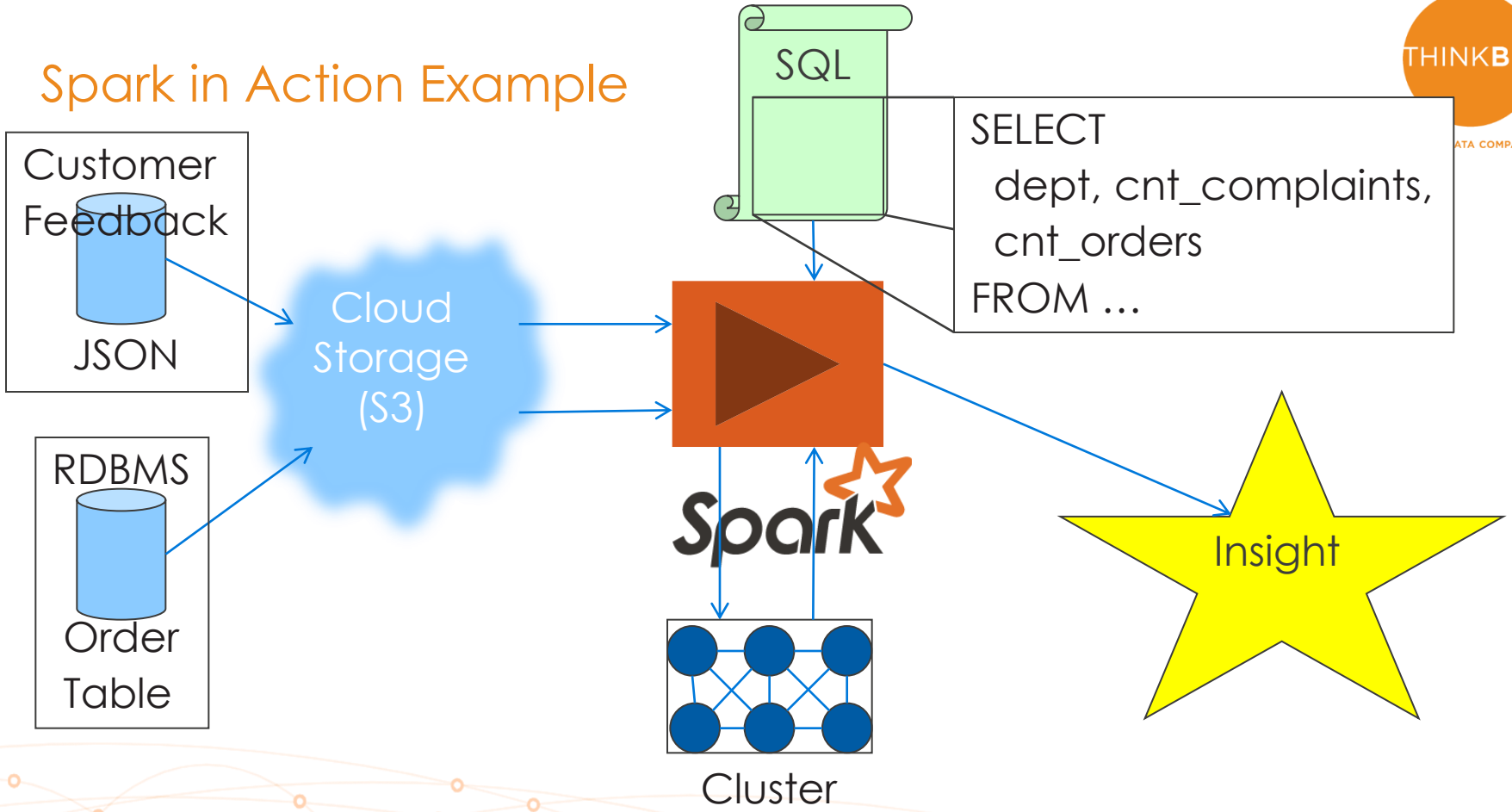


Spark SQL: What is it?

- One of a variety of languages to create parallel jobs
  - In place of Scala, Python, Java and now R
  - Replacement for Hive, Pig
- Similar to Hive
  - In fact uses the Hive library
  - Can read from and write to Hive, processing done in Spark engine
  - Hive scripts with minor modifications could in many cases be run through Spark
- Limited documentation from apache.spark.org
  - Details of supported SQL missing



Spark in Action Example

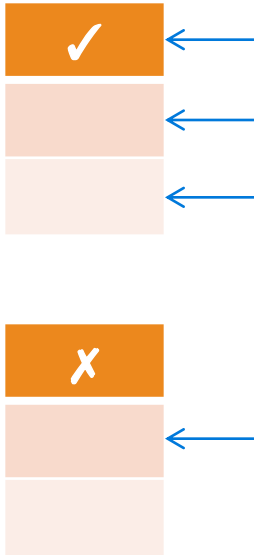


Spark Streaming

- Near real-time
  - Keep up to minute counts
  - React to data events
- Versus Storm
  - Storm meant for real-time
  - Spark is higher level
  - Spark great for windowed aggregation (sum last 10 minutes)
  - Spark can use SQL

Spark Realities

- Where Spark shines
  - Transform whole data set at once
  - Ad-hoc analysis
  - One-off find needle in haystack
- Where Spark may not be first choice
  - Data set fits in memory on single machine
    - Unnecessary overhead
  - Frequent single data point access or update
    - Each update creates new RDD
  - Storage engine
    - Not a database replacement

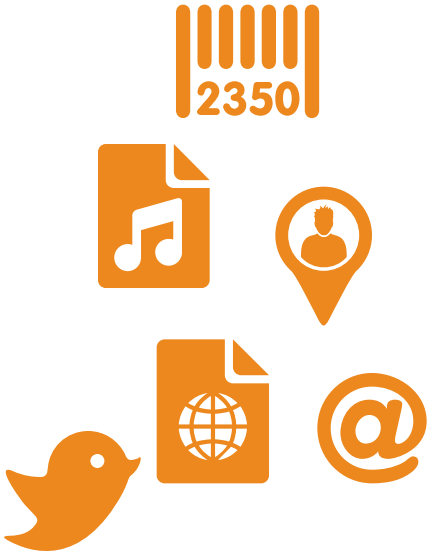


Ad Hoc Spark

- Original need for Hive and Pig
  - Hadoop code large to accomplish simple aggregations
  - Not interactive
- Spark Core
  - Many scripting options just as simple as Pig and Hive
  - Much larger support out of the box
    - Deploy any Python library to cluster
    - Parse Excel documents with Java library
  - Directly perform statistics and machine learning on the cluster

Data Sets and Spark

- Size:
  - Big enough to necessitate cluster (at least a few gigabytes)
  - Small enough to fit in memory of affordable cluster (smaller than a terabyte)
- Type:
  - Tables may or may not gain performance boost
  - Any text format
  - Custom processing with standard Java/Scala/Python library
    - JSON
    - Images
    - Graph (using GraphX module)



Production Pitfall: Spark Memory

- Estimate memory requirements
  - Need at least double main memory in cluster
- Usually first challenge of production code
  - Forget to remove previous states from memory
  - "Hydrated" version of data bigger than original bytes
  - Map and reduce operations require some open memory to work with
  - Track memory usage with GUI

Production Pitfall: Data Assumptions

- Data is too large to view
  - Impossible to review every possible scenario
- Make bad assumptions
  - Always have a create date
  - Names can be used to join tables
    - First name part of last name, etc.
  - Never have cycles in graph (loops)

Photo credit: John Drake. Courtesy of Flickr. Creative Commons.

Future of Spark

- Recent releases have emphasized Data Science
  - Integrated with R
  - Expansion of machine learning algorithms in MLLib
  - Data Frames similar to R and Pandas (commonly used in Data Science in Python)
- Spark is gaining momentum and critical mass
  - With YARN or standalone cluster
  - Cloud deployments gaining traction

Who is Think Big?

- Founded in 2010 with over 100 engagements across 70 clients
- Specialize in creating business value from big data
- Proven vendor-neutral open source expertise
- Dedicated Think Big Academy for change management and organizational development
- On-shore Solution Center and off-shore delivery model for cost effective big data deployments
- Data engineering solutions for data lake, analytics, data science

Summary

- Parallel processing framework
  - Great for combining and analyzing data
- SQL is a job creation language
- Streaming when timing is everything
- Pitfalls of production: memory and data assumptions
- If Spark is a good fit, embrace the speed of in cluster memory analytics!

Questions?

Contact Information

If you have further questions or comments:

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