

Tackling The Challenges of Big Data

Big Data Storage

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Modern Databases: Three Years Later

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Organization of the Retrospective: Big Data!!!

Big Volume

- Business intelligence – simple (SQL) analytics
- Data Science -- complex (non-SQL) analytics

Big Velocity

- Drink from a fire hose

Big Variety

- Large number of diverse data sources to integrate
- Covered in the module on data integration

Big Volume - Little Analytics

Well addressed by the data warehouse crowd

Who have (almost universally) moved to multi-node column stores with sophisticated compression

Who are pretty good at SQL analytics on

- Hundreds of nodes
- Petabytes of data

Zynga example

But All Column Stores are not Created Equal...

Oracle is not multi-node and not a column store

- In spite of their marketing message

Performance among the products differs by a LOT

- At least one order of magnitude

Maturity among the products differs by a LOT

- Some on V8; some on V1

But All Column Stores are not Created Equal...

Some products are native column stores; some are converted row stores

- Expect lower performance from the conversions

Some products have a serious marketing problem

- I.e. good products that are invisible in the marketplace

Do not believe any marketing claims

- Kick the tires hard on anything you are interested in

Possible Storm Clouds

NVRAM

Networking no longer the “high pole in the tent”

All the money is at the high end

- Vertica is free for 3 nodes; 1 Tbyte

Modest disruption, at best....

- Warehouses are getting bigger faster than resources are getting cheaper

The Big Disruption

Solving yesterday's problem!!!!

- Data science will replace business intelligence
- As soon as we can train enough data scientists!
- And they will not be re-treaded BI folks

**After all, would you rather have a predictive model
or a big table of numbers?**

Data Science Template

Until (tired) {

- Data management;
 - Complex analytics (regression, clustering, bayesian analysis, ...);
- }**

**Data management is SQL,
complex analytics is (mostly) array-based**
– as noted earlier

How to Support Data Science (1st option)

Code in Map-Reduce (Hadoop) for HDFS (file system) data

- Drink the Google Koolaid

Map-Reduce

2008: The best thing since sliced bread

According to Google

2011: Quietly abandoned by Google

- On the application for which it was purpose-built
- In favor of BigTable
- Other stuff uses Dremmel, Big Query, F1,...

2015: Google officially abandons Map-Reduce

Map-Reduce

2013: It becomes clear that Map-Reduce is primarily a SQL (Hive) market

95+% of Facebook access is Hive

2013: Cloudera redefines Hadoop to be a three-level stack
SQL, Map-Reduce, HDFS

2014: Impala released; not based on Map-Reduce

- In effect, down to a 2-level stack (SQL, HDFS)
- Mike Olson privately admits there is little call for Map-Reduce

2014: But Impala is not even based on HDFS

- A slow, location-transparent file system gives DBMSs severe indigestion
- In effect, down to a one-level stack (SQL)

The Future of Hadoop

Map-Reduce is dead

The data warehouse market and Hadoop market are merging

- May the best parallel SQL column stores win!

HDFS is being marketed to support “data lakes”

- Hard to imagine big bucks for a file system
- More on this in the data integration module

How to Support Data Science (2nd option -- 2015)

For analytics, Map-Reduce is not flexible enough

And HDFS is too slow

**Move to a main-memory parallel execution
environment**

- Spark – the new best thing since sliced bread
- IBM (and others) are drinking the new koolaid

Spark

No persistence -- which must be supplied by a companion storage system

No sharing (no concept of a shared buffer pool)

70% of Spark is SparkSQL (according to Matei Zaheria)

- Which has no indexes

Moves the data (Tbytes) to the query (Kbytes)

- Which gives DBMS folks a serious case of heartburn

What is the future of Spark? (stay tuned)



How to Support Data Science (3rd option)

Move the query to the data!!!!

- Your favorite relational DBMS for persistence, sharing and SQL

But tighter coupling to analytics

- through user-defined functions (UDFs)
- Written in Spark or R or C++ ...

UDF support will have to improve (a lot!)

- To support parallelism, recovery, ...

How to Support Data Science (3rd option)

But.....

- Format conversion (table to array) is a killer
- On all but the largest problems, it will be the high pole in the tent
- Unless your arrays are really sparse



How to Support Data Science (4th option)

Use an array DBMS

With the same in-database analytics

No table-to-array conversion

Likely to be the most efficient long term solution

Check out SciDB; check out SciDB-R

The Future of Complex Analytics, Spark, R, and

Hold onto your seat belt

- 1st step; DBMSs as a persistence layer under Spark, push down predicates into the DBMS
- 2nd step; ????

“The wild west”

What will the Spark market look like in 2 years?

- My guess: substantially different than today

Big Velocity

Big pattern - little state (electronic trading)

- Find me a 'strawberry' followed within 100 msec by a 'banana'

Complex event processing (CEP) (Storm, Kafka, StreamBase ...) is focused on this problem

- Patterns in a firehose

Big Velocity – 2nd Approach

Big state - little pattern

- For every security, assemble my real-time global position
- And alert me if my exposure is greater than X

Looks like high performance OLTP

- NewSQL engines (VoltDB, NuoDB, MemSQL ...) address this market

In My Opinion....

Everybody wants HA (replicas, failover, failback)

Many people have complex pipelines (of several steps)

People with high-value messages often want “exactly once” semantics over the whole pipeline

Transactions with transactional replication do exactly this

My prediction: OLTP will prevail in the “important message” market!

Possible Storm Clouds

RDMA – new concurrency control mechanisms

Transactional wide-area replicas enabled by high speed networking (e.g. Spanner)

- But you have to control the end-to-end network
- To get latency down

Modest disruption, at best

I.e. the two approaches will “duke it out”

Summary

Hadoop and data warehouse market will merge

**Support for complex analytics at scale likely to be
“the wild west” for a while**

Two approaches to big velocity will duke it out

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THANK YOU

