Using Hadoop to Expand Data Warehousing

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Why do this?

Transforming to an Information and Analytics Company

We needed to capture ALL the data

We had to do this and strive to keep the effective cost of a TB under $250

We decided to commit to Open Source
**The Original Business Case**

100 TB of INCREMENTAL Data Storage

3 Year Cost

Millions US $

- **Hadoop Big Data**: $0.2
- **Netezza**: $6.3
- **Teradata**: $9.6
- **Oracle**: $9.6
Big Data Warehouse

Challenges
- Cost to store unstructured data
- Poor response time to changing BI needs
- Data Warehouse access for departments

Goals
- Integrate unstructured data with EDW
- Predictive analytics based on data science
- Data Governance in place to manage access
Technology Evolution Goals

» New data platforms unlock innovation
» Not just package implementation
» More open source technology
» Rethink assumptions
» Increase technology skills
» Focus data teams
Working Together – You need partners to succeed

» Thought Leaders in how
» Teach not just do
» Work at the executive level

» Expertise in Technologies
» Trusted partner
» Collaborative Teams

» Open source leader
» Invested in client success
» Price/performance
QFS – Our most recent addition

» Benefits to QFS
  » HDFS best practice is 3X replication
  » QFS give equivalent protection from Data Loss with a 1.5X replication factor.
    » Neustar nearly doubled the retention period of our largest data source (from 1 year to 2 years) with limited integration effort and no incremental Hardware Cost
  » QFS has provided a 30% improvement in Write performance and ~ 10% improvement in Read performance over HDFS
  » QFS was based on the Kosmos File System (KFS)
  » Uses “Reed- Salomon encoding” which is effectively Software Raid
  » QFS creates 9 stripes and can reconstruct the data from any 6 stripes
  » Been using QFS under Hadoop since early December 2012. It has been very stable

» Some trade offs
  » Need to implement with 10Gbit switching since QFS moves away from HDFS’s “localization” of Data
  » Group permissions work significantly different than HDFS
Our Architecture

Source Data Layer
- Product 1
- Product 2
- Product 3
- Product 4
- Product 5
- External Data

Transform / Integration Layer
- Collect
- Transform
- Integrate
- Load

Storage / Processing Layer
- Higher Latency
  - Hadoop EcoSystem
  - Use both HDFS and CFS
  - "Batch" Processing
  - Load Latency: 2 minutes to 1 day
  - Response times: 30 sec to hours depending on range of data
  - Size: 1.3 PB usable (3 PB raw)
  - Scalable: 10s to 100s of PB
  - 100% capture
  - Data Retention:
    - Detailed Transactions - 1-2 years
    - Aggregates - many years as required

- Low Latency
  - Parallelize Processing
  - Load Latency: 10 seconds to 1 day
  - Response times: less than 5 seconds (often sub second)
  - Size: 50 TB usable
  - Scalable: 200 TB
  - 1% Sampling and Aggregated data
  - Data Retention:
    - Detailed Transactions - 90 days
    - Aggregates - 15-24 months

- "Real Time / Near Real Time"
  - GreenPlum (2 socket - free version)
  - Load Latency: 2 seconds
  - Response times: usually sub second
  - Size: 3.5 TB
  - 1% Sampling and Aggregated data
  - Data Retention:
    - Detailed Transactions - 21 days

Access Layer
- SQL
- Hive
- Pig
- Mahout
- MapReduce
- Visualization (Tableau)
- Restful API (Templeton)
- Revolution R
- Talend

Data Consumers
- Customer – Extend Product
- New Data Products
- Neustar Applications
- Data Scientists
- Business Analyst
- Operations
Hadoop Cluster Q4 2012

Configuration:
» 128 Data Nodes (SuperMicro Fat Twin) + Primary and Backup Name Node
» Hortonworks Hadoop Distribution
» Will utilize both HDFS and QFS (Quantcast File System)
  » QFS based on Open Source KFS (Kosmos File System)
  » QFS used initially for the largest data source (DNS queries)

Each Data node:
» OS: centOS 6.3
» 2 sockets / 8 cores per socket
  » 2080 total cores
» 64 GB memory
  » 8.3 TB total memory
» 8 - 3TB SATA drives / node
  » 3 PB of raw storage
  » 1.5 PB of “usable” storage
» 10 Gbit Ethernet
Postgres Cluster Q4 2012

Configuration:
» 9 Database servers (SuperMicro)
» Customized Stato / Postgres (forked Postgres 9.0.3)

Database nodes:
» OS: centOS 6.3
» 2 sockets / 8 core per socket
  » 144 total cores
» 128 GB memory / Node
  » 1 TB total memory
» 16 - 3TB SATA drives per server
  » Raid 6
  » Total usable storage in cluster is 345 TB
» LSI Cachecade controller for database acceleration
  » 2 - 500 MB SSD
  » IO improvement cut server count in half
» 10Gbit Ethernet
Open Source Successes

Created a +1 Data Capture Platform with Hadoop
  » Initial investment of 500K

Committed to the Hortonworks Suite
  » Staying true to open source

Migrated Netezza Data Warehouse to Postgres
  » Eliminated $400K of annual support cost and $3 MM for a “Tech Refresh”

Migrated Oracle Data Warehouse to Postgres
  » Eliminated 48 Oracle Licenses and associated support

Bulk of ETL Migration was performed with Impetus (off-shore partner)
  » 7 years worth of code was migrated in 9 months
  » 10 Impetus resources
System Scale

» Query volume is ramping
  » 10,000 Map Reduce processes/day
» Ingesting over 40B rows a day
  » 1.5TB with 7x compression
» Storage utilization at 60%
» Core utilization spikes when processing Machine Learning Algorithms
» 100% capture of multiple large product data sets
By the Numbers – over last 2 years

Total Cost of Ownership

Cost Savings: 3 to 4 MM

Thousands

2012 2013 2014 2015

Open Source DB Hadoop Traditional
Challenges and Lessons

» Open Source is a commitment to your technologist
» DevOps is fuzzy in practice
» Commodity components break and aren’t supported
» Storage still isn’t free
» It takes more time to change attitudes than technology
» It is ok to try some scary things (like QFS)
» Data Science
» All that said, we are having a lot of fun