cloudera
Ask Bigger Questions

Hive in Enterprises

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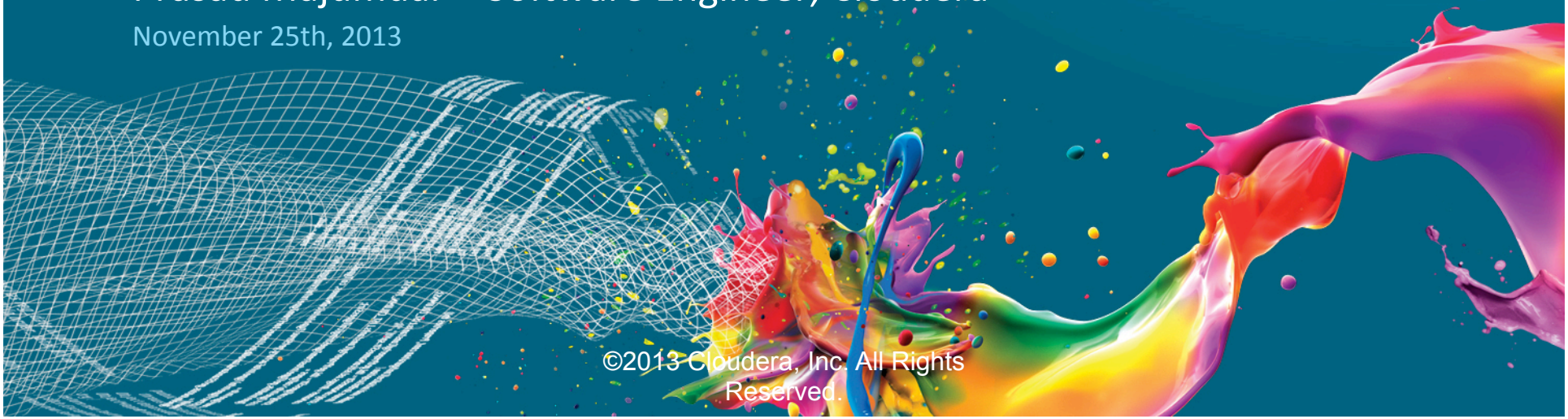


What we will be Talking About

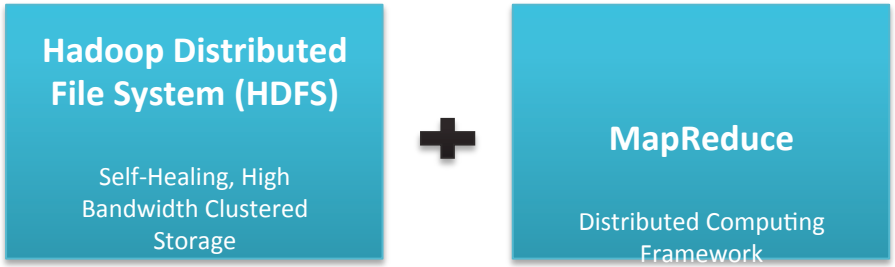
- Integration of Hive and Hadoop in enterprises
  - Current challenges
  - How is Hadoop being leveraged with existing data infrastructures?
- Other tools and features in and around Hive
  - Authentication and Authorization
  - BI Tools
  - User Interface

What is Apache Hadoop?

Apache Hadoop is an open source platform for data storage and processing that is…

- ✓ Scalable
- ✓ Fault tolerant
- ✓ Distributed

CORE HADOOP SYSTEM COMPONENTS



Has the Flexibility to Store and Mine Any Type of Data

- Ask questions across structured and unstructured data that were previously impossible to ask or solve
- Not bound by a single schema

Excels at Processing Complex Data

- Scale-out architecture divides workloads across multiple nodes
- Flexible file system eliminates ETL bottlenecks

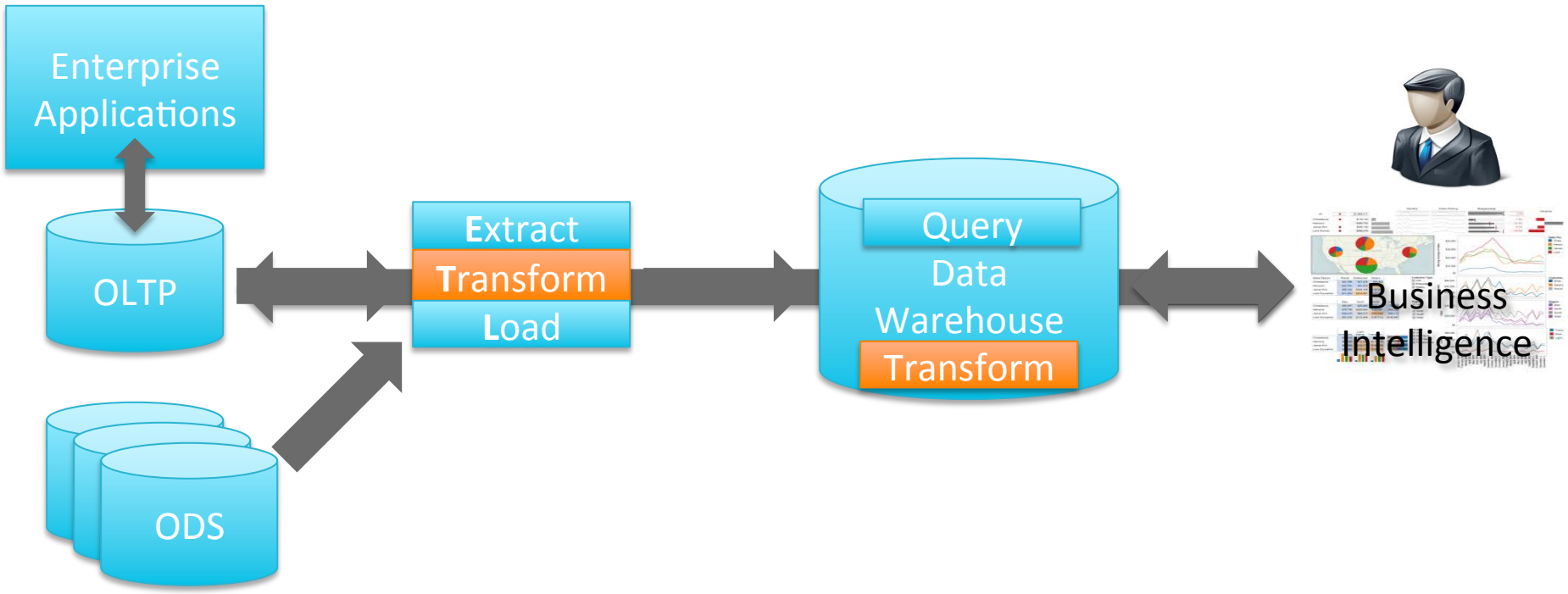
Scales Economically

- Can be deployed on commodity hardware
- Open source platform guards against vendor lock

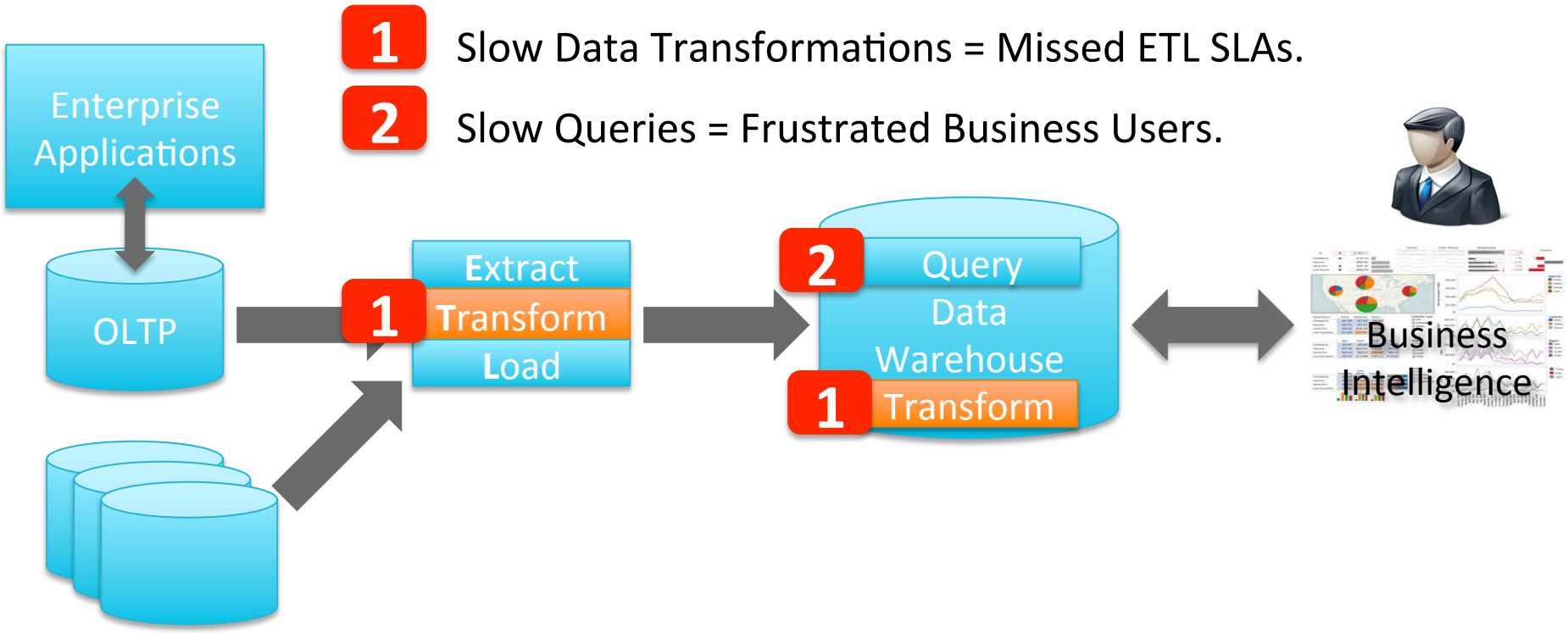
Current Challenges

Limitations of Existing Data Management Systems

The Transforming of Transformation

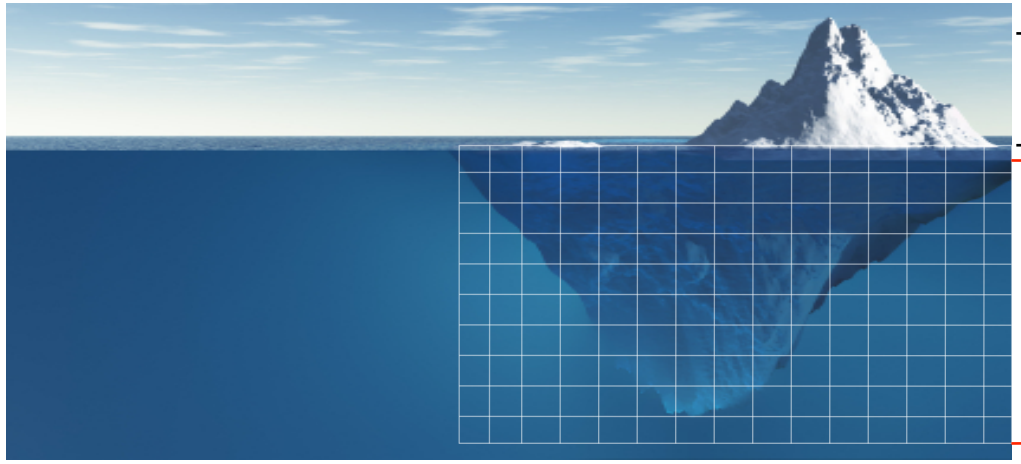


Volume, Velocity, Variety Cause Capacity Problems



Economics: Return on Byte

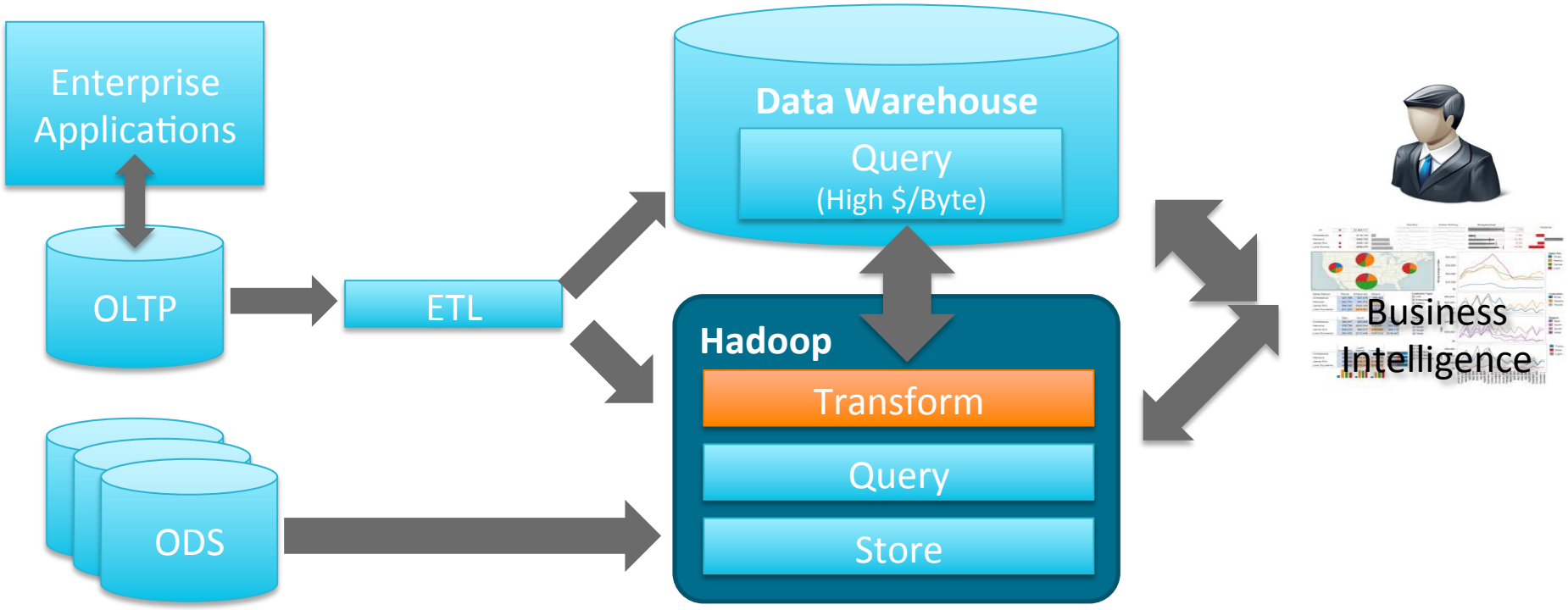
Return on Byte (ROB) = $\frac{\text{Value of Data}}{\text{Cost of Storing Data}}$



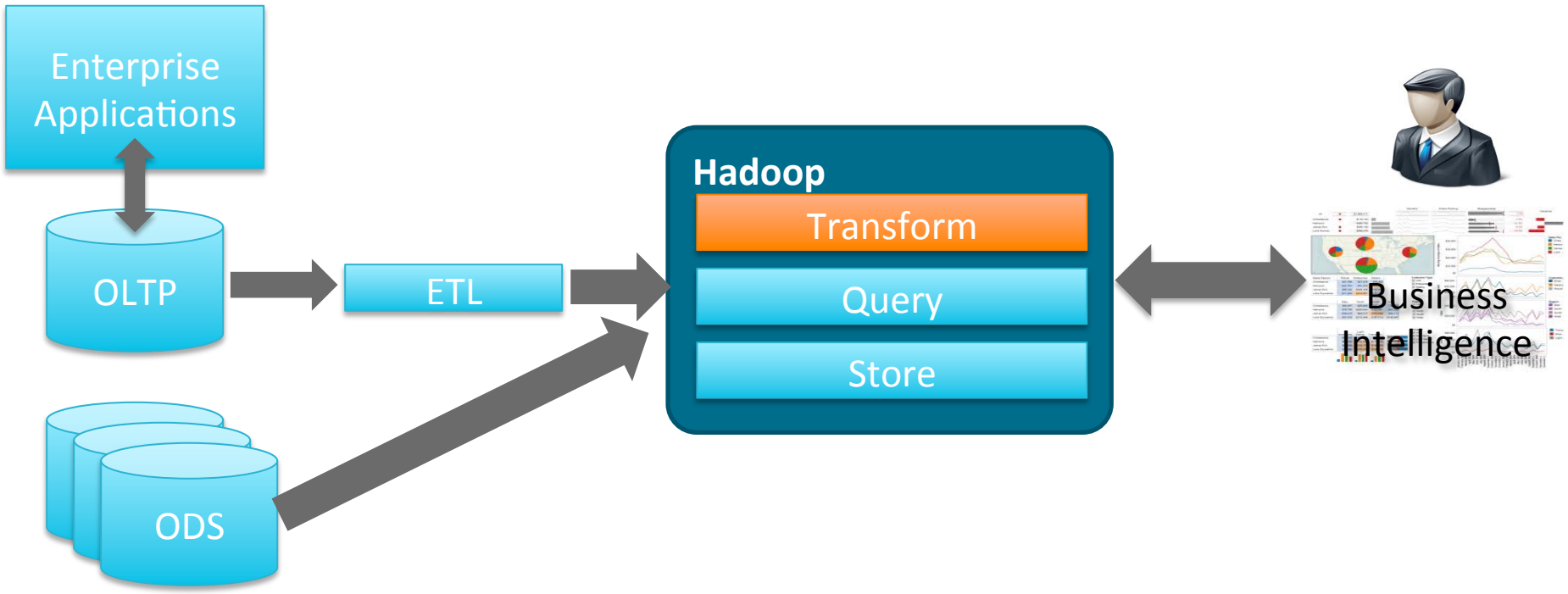
High ROB

Low ROB
(but still a ton of aggregate value)

Data Warehouse Optimization



Data Warehouse Optimization



The Key Benefit: Agility/Flexibility

Schema-on-Write (RDBMS):

- **Prescriptive Data Modeling:**
  - Create static DB schema
  - Transform data into RDBMS
  - Query data in RDBMS format
- New columns must be added explicitly before new data can propagate into the system.
- **Good for Known Unknowns (Repetition)**

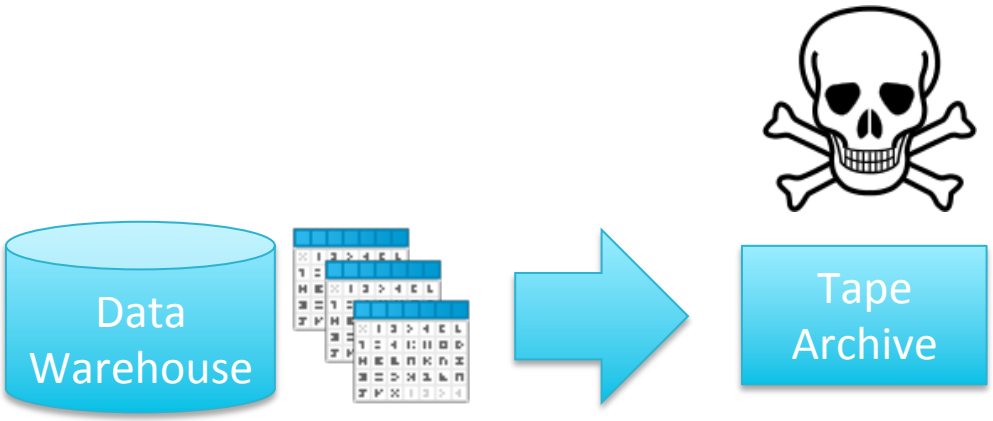
Schema-on-Read (Hadoop):

- **Descriptive Data Modeling:**
  - Copy data in its native format
  - Create schema + parser
  - Query Data in its native format
- New data can start flowing any time and will appear retroactively once the schema/parser properly describes it.
- **Good for Unknown Unknowns (Exploration)**

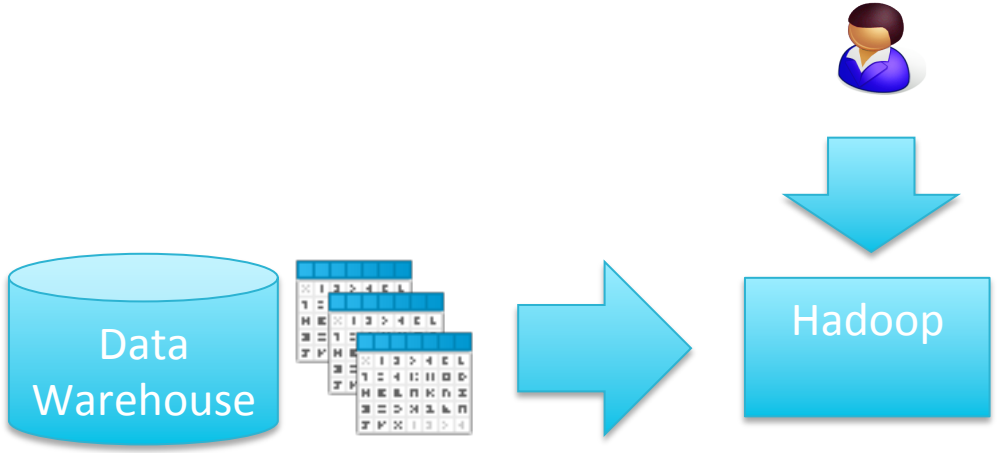
Not Just Transformation

Other Ways Hadoop is Being Leveraged

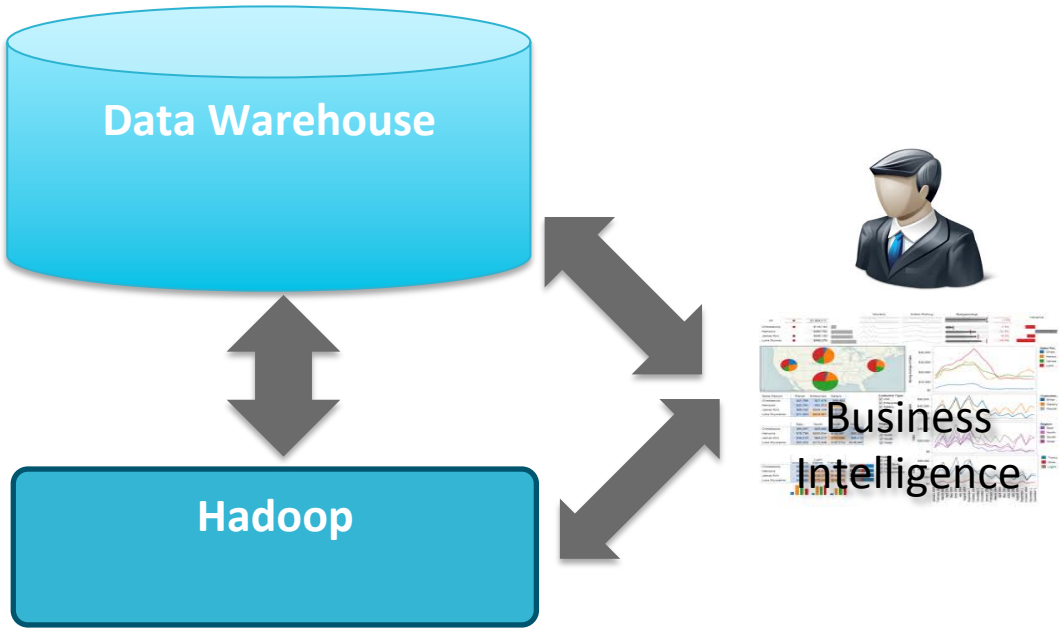
Data Archiving Before Hadoop



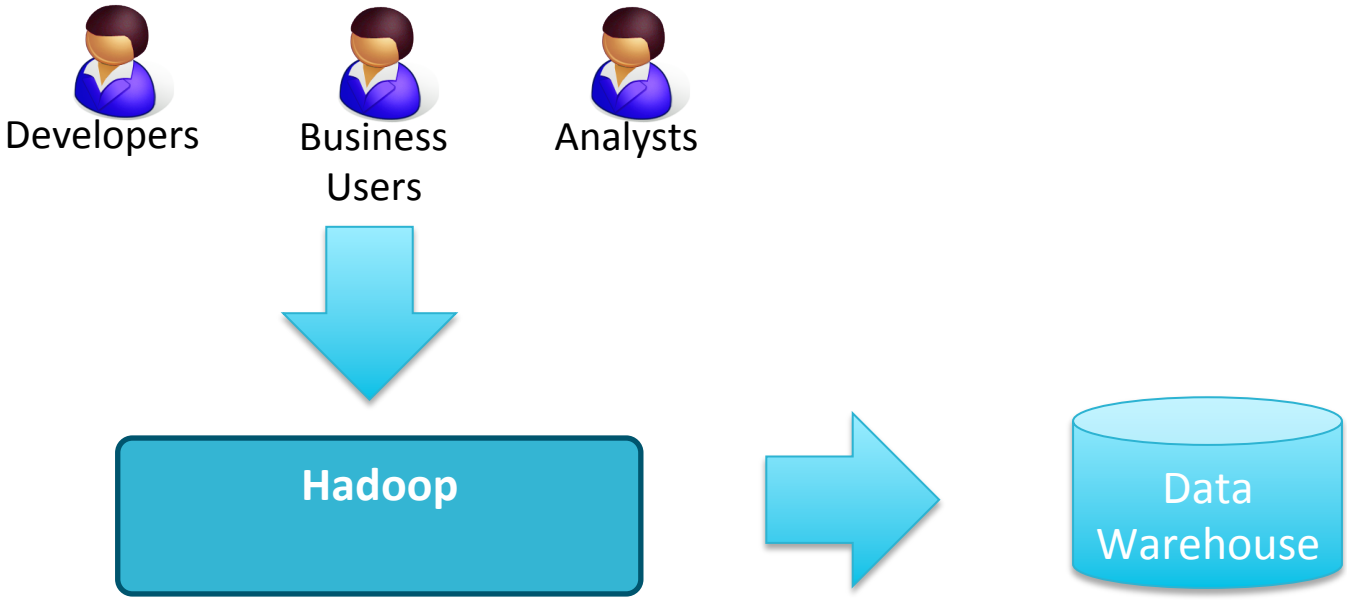
Active Archiving with Hadoop



Offloading Analysis



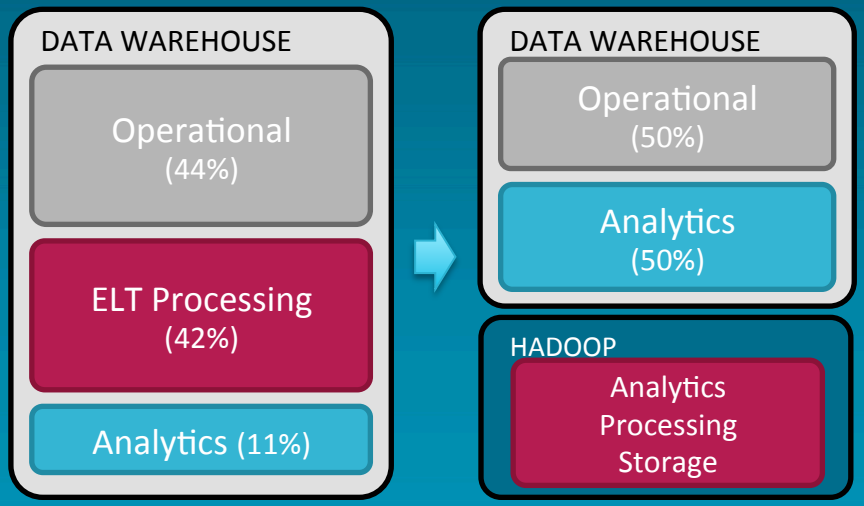
Exploratory Analysis



Use Case: A Major Financial Institution

The Challenge:

- Current EDW at capacity; cannot support growing data depth and width
- Performance issues in business critical apps; little room for innovation.

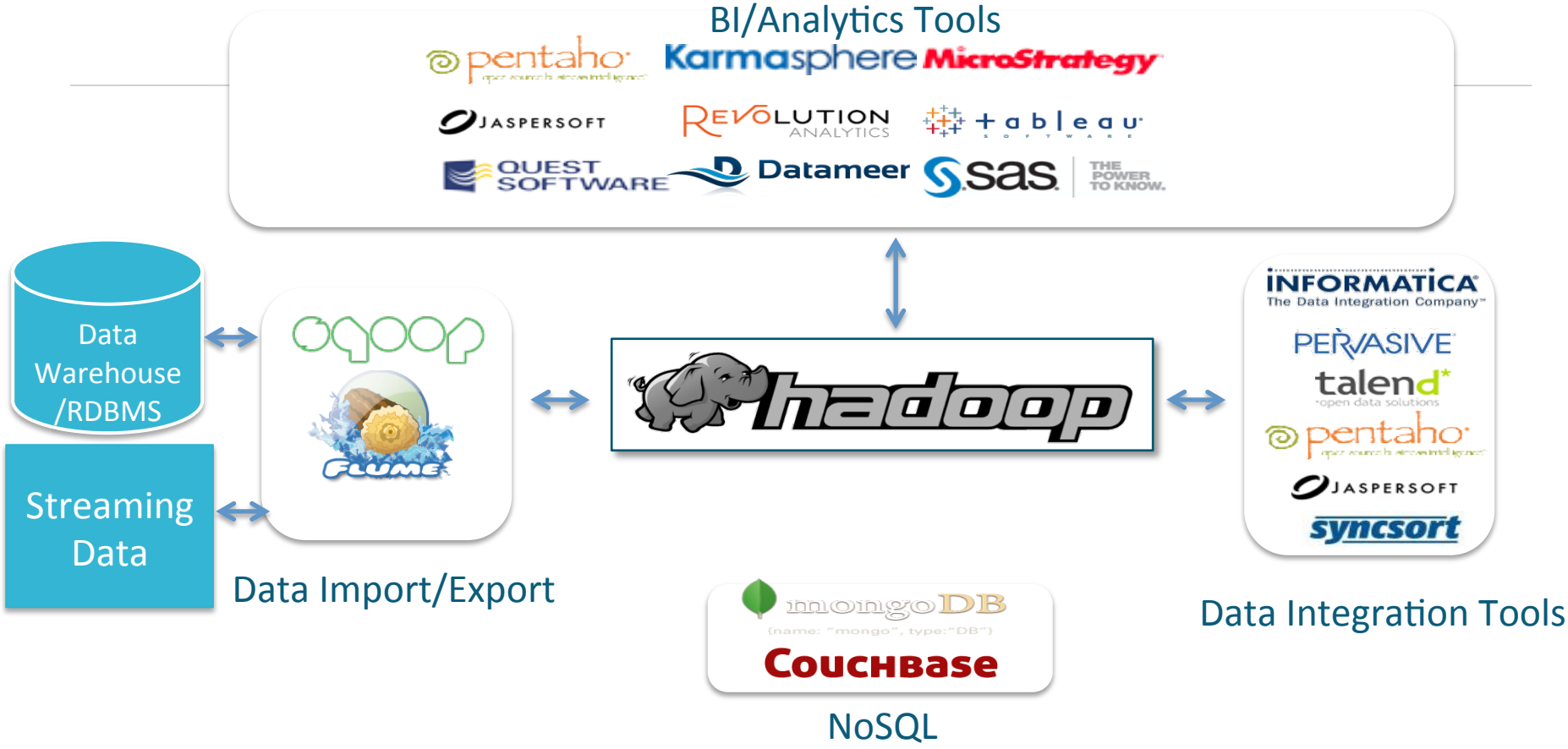


The Solution:

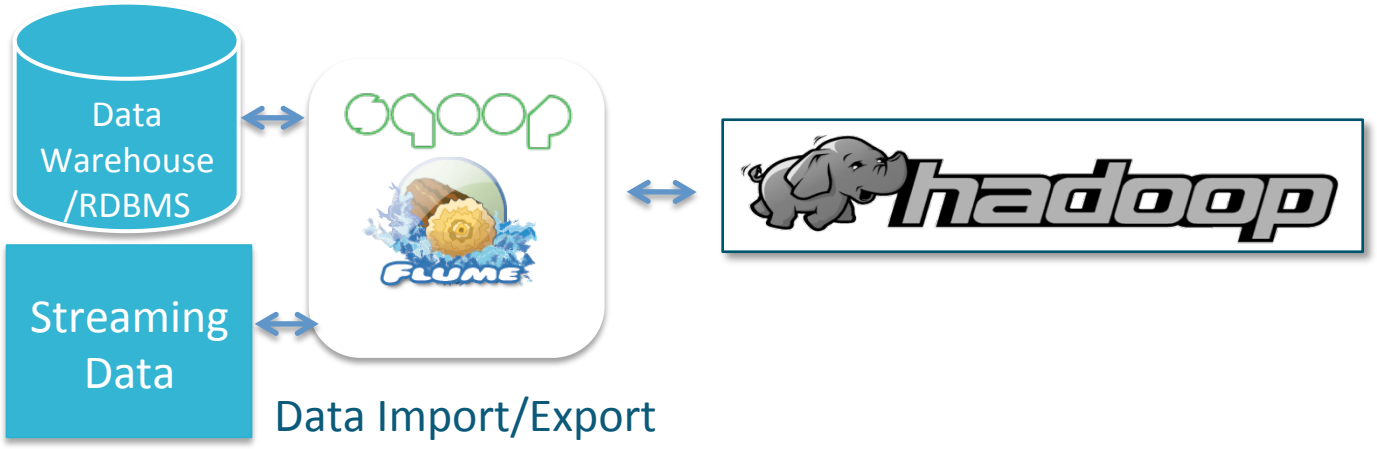
- Hadoop offloads data storage (S), processing (T) & some analytics (Q) from the EDW.
- EDW resources can now be focused on repeatable operational analytics.
- Month data scan in 4 secs vs. 4 hours

Hadoop Integration

The Big Picture



Data Import/Export Tools

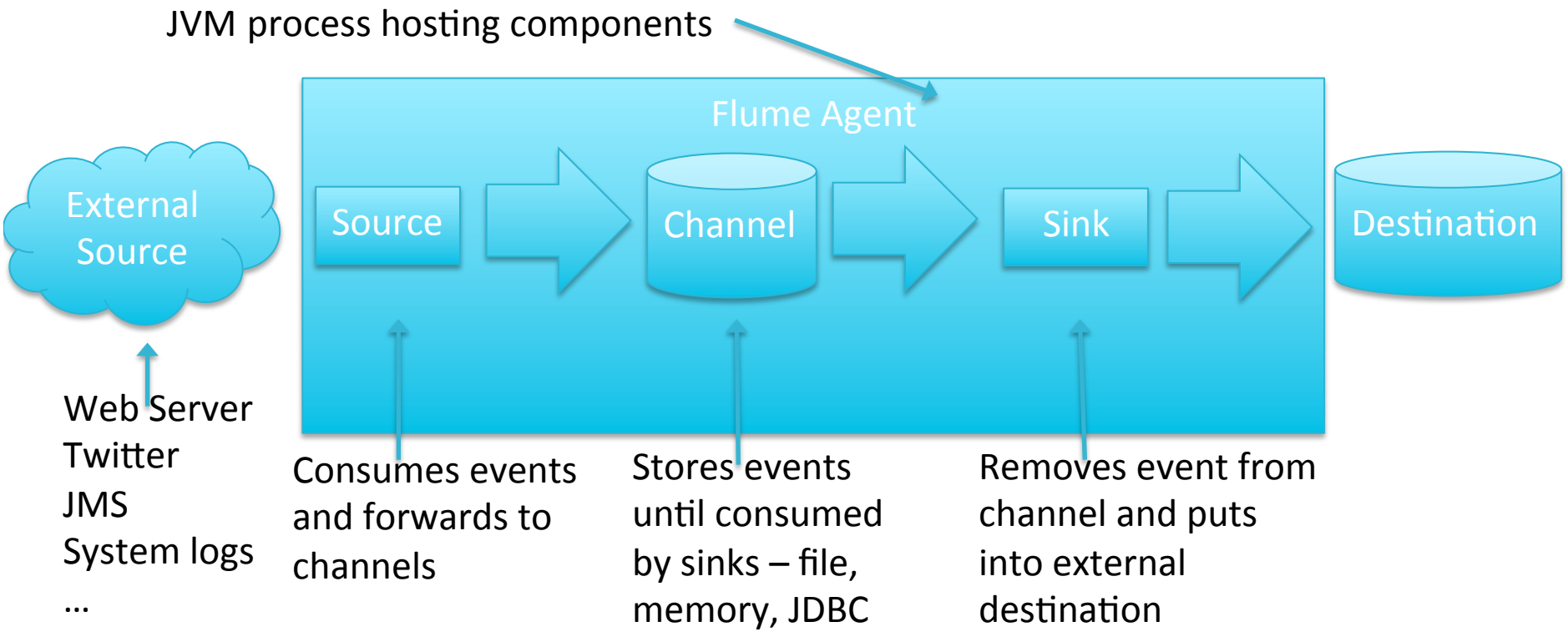


Flume in 2 Minutes

Or, why you shouldn't be using scripts for data movement.

- Reliable, distributed, and available system for efficient collection, aggregation and movement of streaming data, e.g. logs.
- Open-source, Apache project.

Flume in 2 Minutes



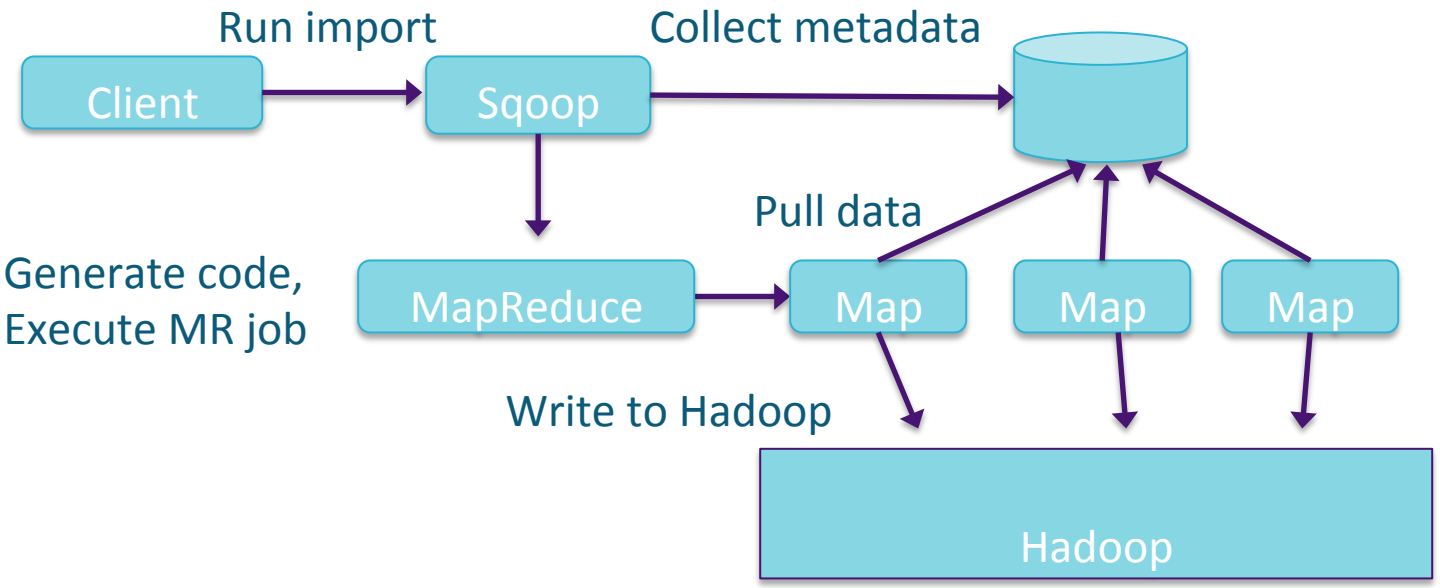
Sqoop Overview

- Apache project designed to ease import and export of data between Hadoop and relational databases.
- Provides functionality to do bulk imports and exports of data with HDFS, Hive and HBase.
- Java based. Leverages MapReduce to transfer data in parallel.

Sqoop Overview

- Uses a “connector” abstraction.
- Two types of connectors
  - Standard connectors are JDBC based.
  - Direct connectors use native database interfaces to improve performance.
- Direct connectors are available for many open-source and commercial databases – MySQL, PostgreSQL, Oracle, SQL Server, Teradata, etc.

Sqoop Import Flow



Transformation/Processing

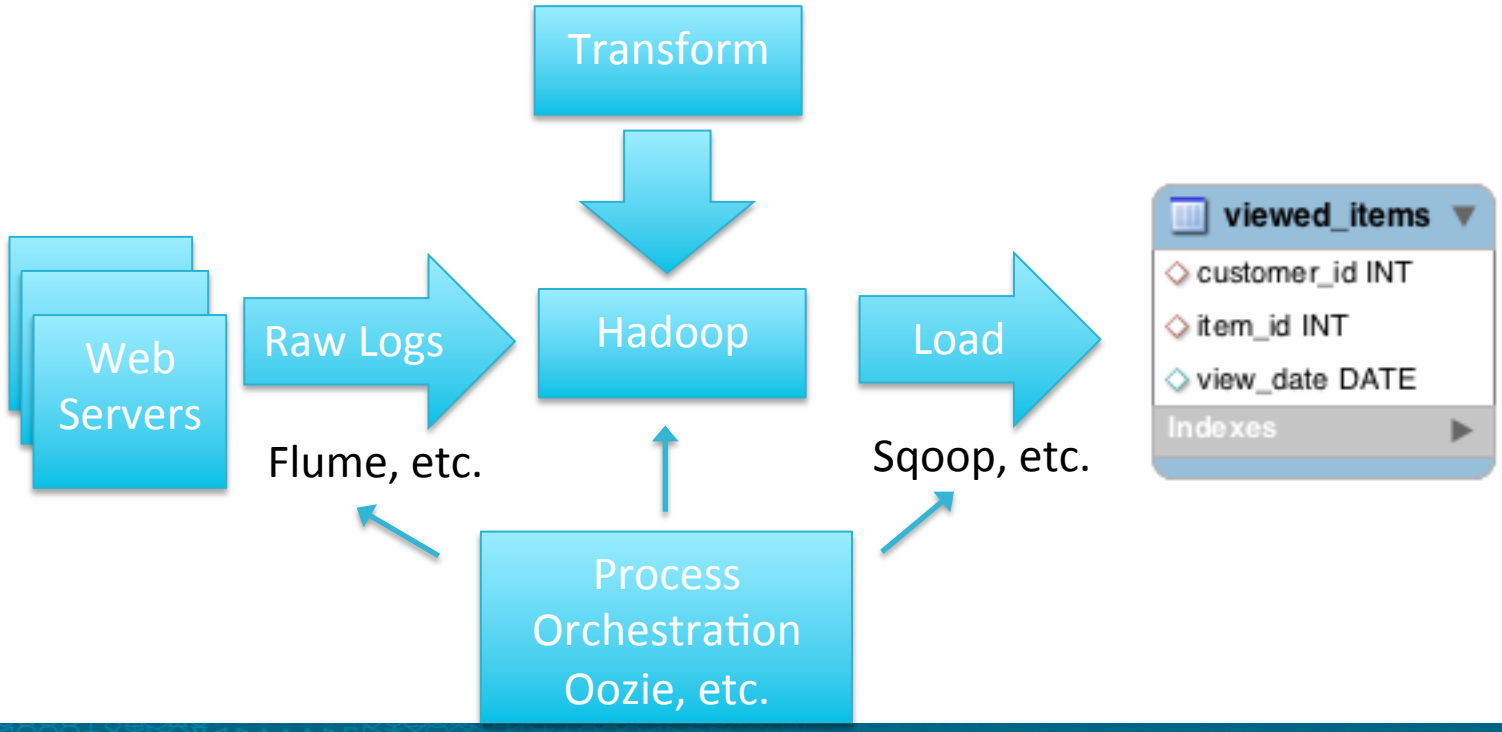
- Standard interface is Java MapReduce
- Higher-level interfaces are commonly used:
  - Apache Hive – provides an SQL like interface to data in Hadoop.
  - Apache Pig – declarative language providing functionality to declare a sequence of transformations.
  - Cloudera Impala – real-time SQL query engine on Hadoop
- Both Hive and Pig convert queries into MapReduce jobs and submit to Hadoop for execution.
- Impala has its own execution engine

Orchestration

Schedulers for Hadoop jobs

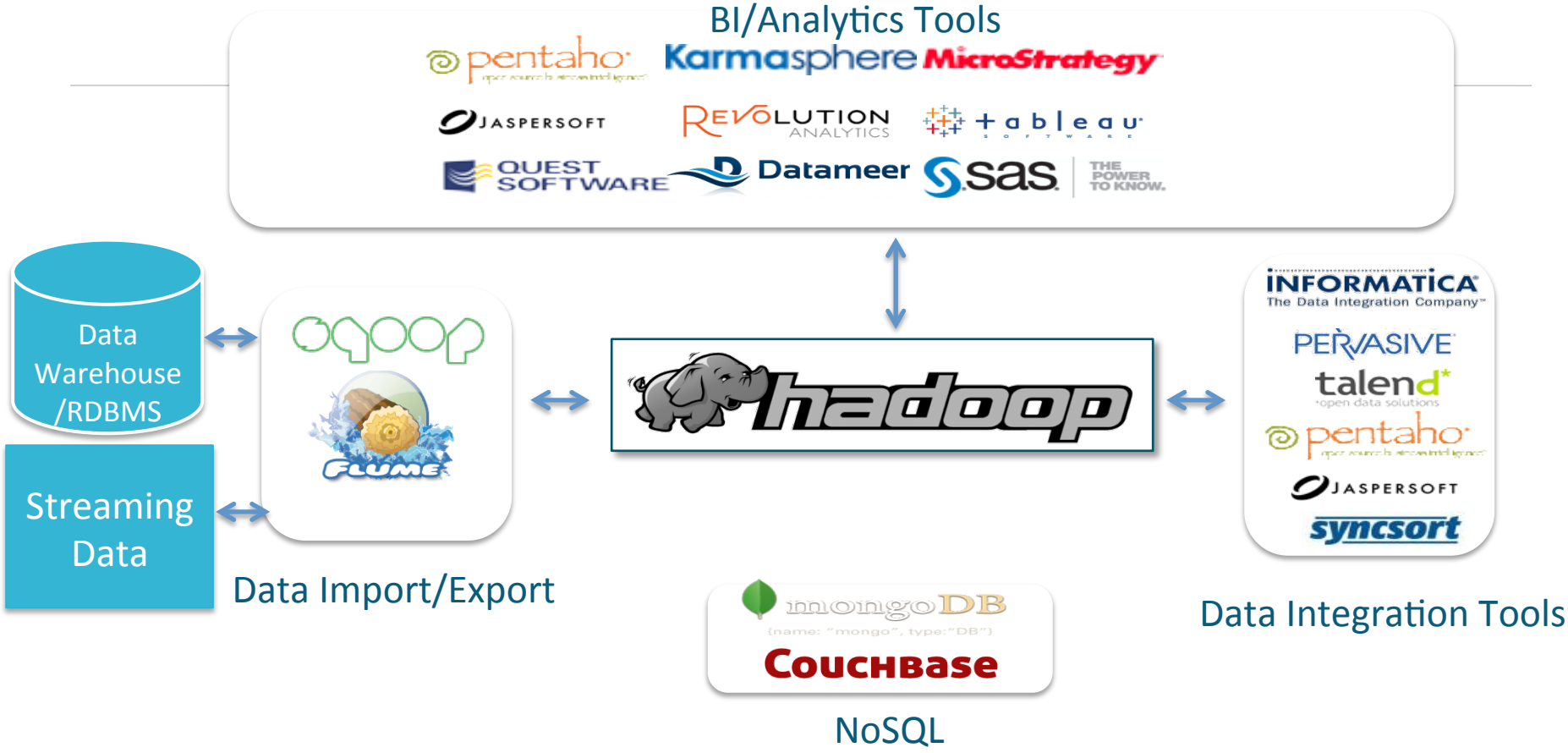
- Oozie
- Azkaban

Data Flow with OSS Tools

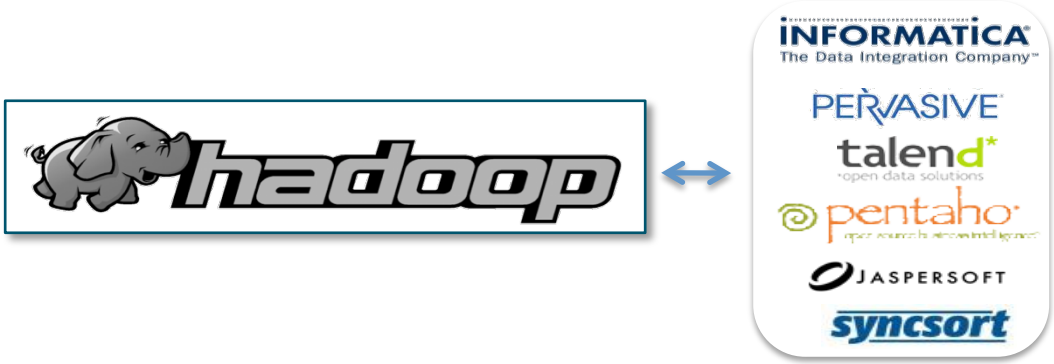


Hadoop Integration

Data Integration Tools



Data Integration Tools



Pentaho

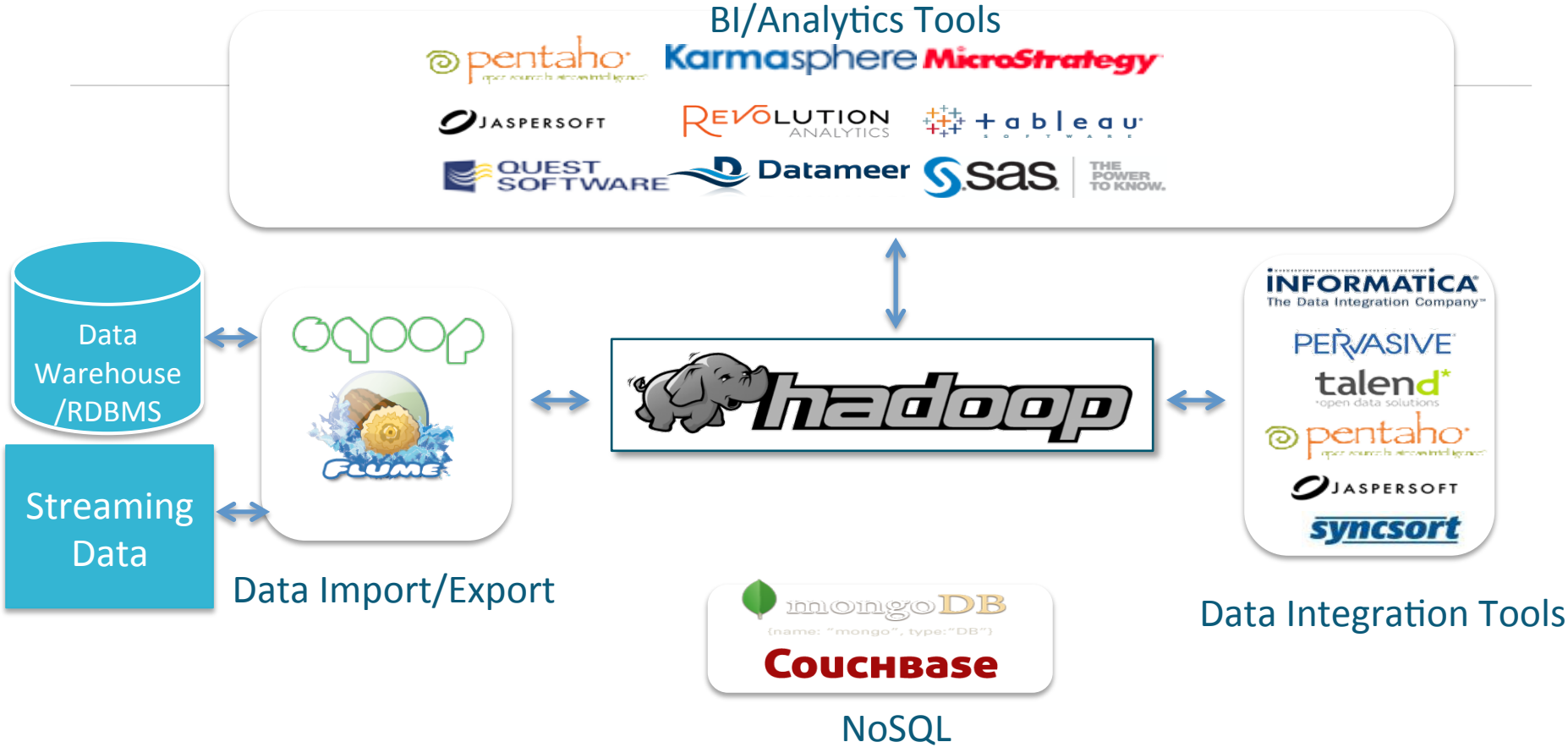
- Existing BI tools extended to support Hadoop.
- Provides data import/export, transformation, job orchestration, reporting, and analysis functionality.
- Supports integration with HDFS, Hive and HBase.
- Community and Enterprise Editions offered.

Informatica

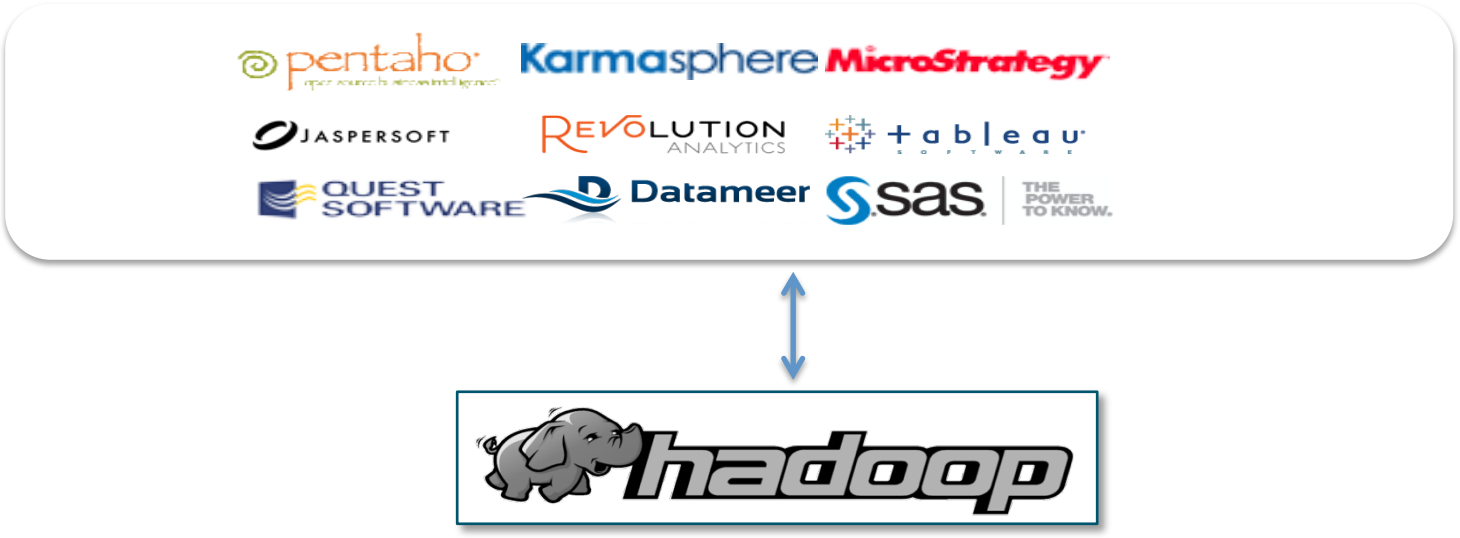
- Informatica
  - Data import/export
  - Metadata services
  - Data lineage
  - Transformation
  - …

Hadoop Integration

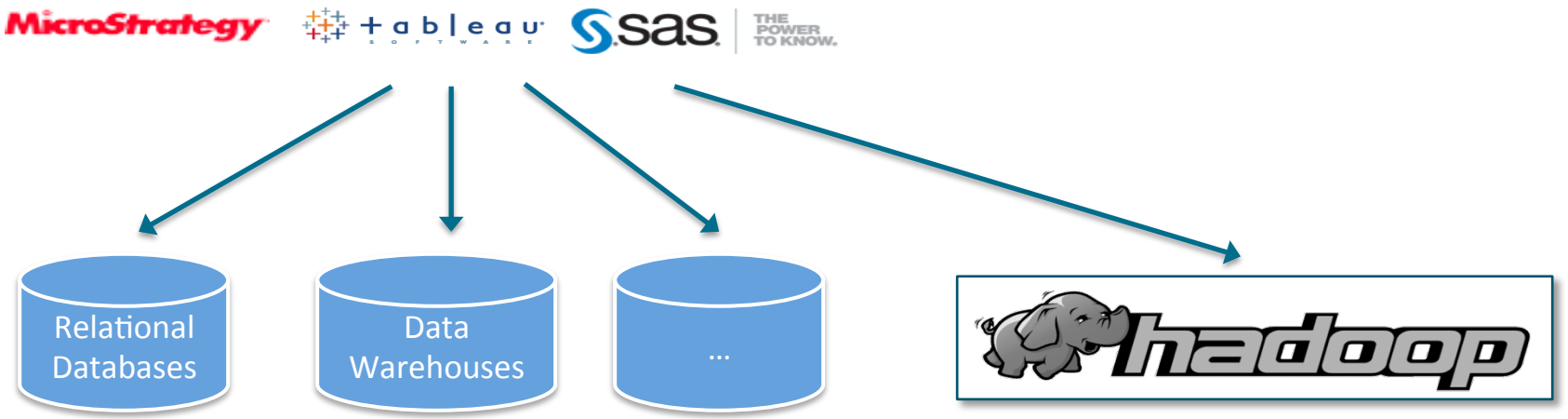
Business Intelligence/Analytic Tools



Business Intelligence/Analytics Tools

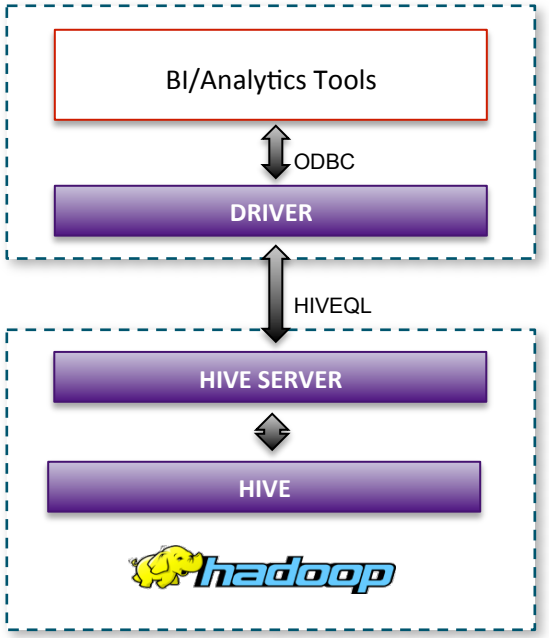


Business Intelligence/Analytics Tools



ODBC Driver

- Most of these tools use the ODBC standard.
- Since Hive is an SQL-like system it's a good fit for ODBC.
- Several vendors, including Cloudera, make ODBC drivers available for Hadoop.
- JDBC is also used by some products for Hive Integration

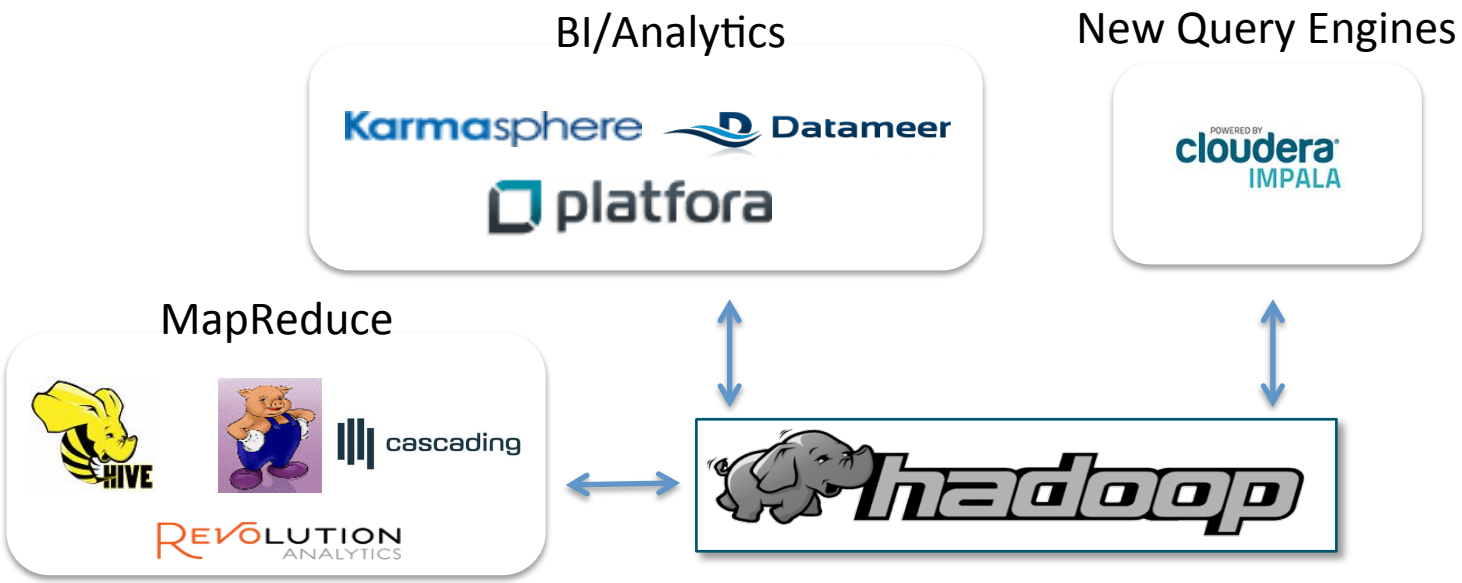


Hadoop Integration

Next Generation BI/Analytics Tools

New "Hadoop Native" Tools

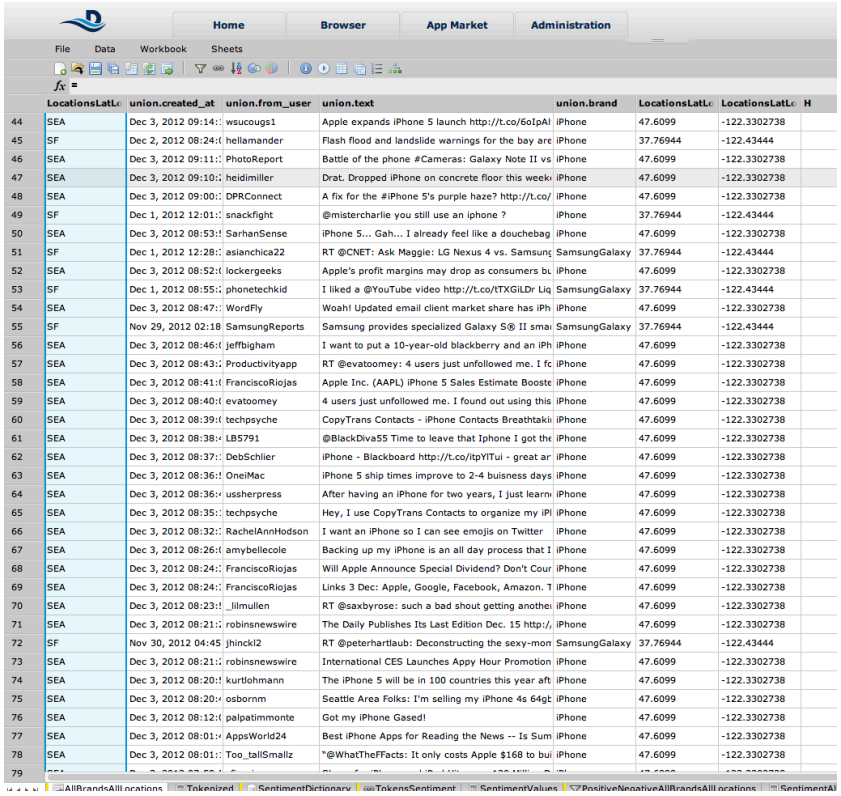
You can think of Hadoop as becoming a shared execution environment supporting new data analysis tools…



Hadoop Native Tools – Advantages

- New data analysis tools:
  - Designed and optimized for working with Hadoop data and large data sets.
  - Remove reliance on Hive for accessing data – can work with any data in Hadoop.
- New query engines:
  - Provide ability to do low latency queries against Hadoop data.
  - Make it possible to do ad-hoc, exploratory analysis of data in Hadoop.

Datameer



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45	SF	Dec 2, 2012 08:24:(	hellamander	Flash flood and landslide warnings for the bay are	iPhone	37.76944	-122.43444	
46	SEA	Dec 3, 2012 09:11::	PhotoReport	Battle of the phone #Cameras: Galaxy Note II vs	iPhone	47.6099	-122.3302738	
47	SEA	Dec 3, 2012 09:10::	heidimiller	Drat. Dropped iPhone on concrete floor this week	iPhone	47.6099	-122.3302738	
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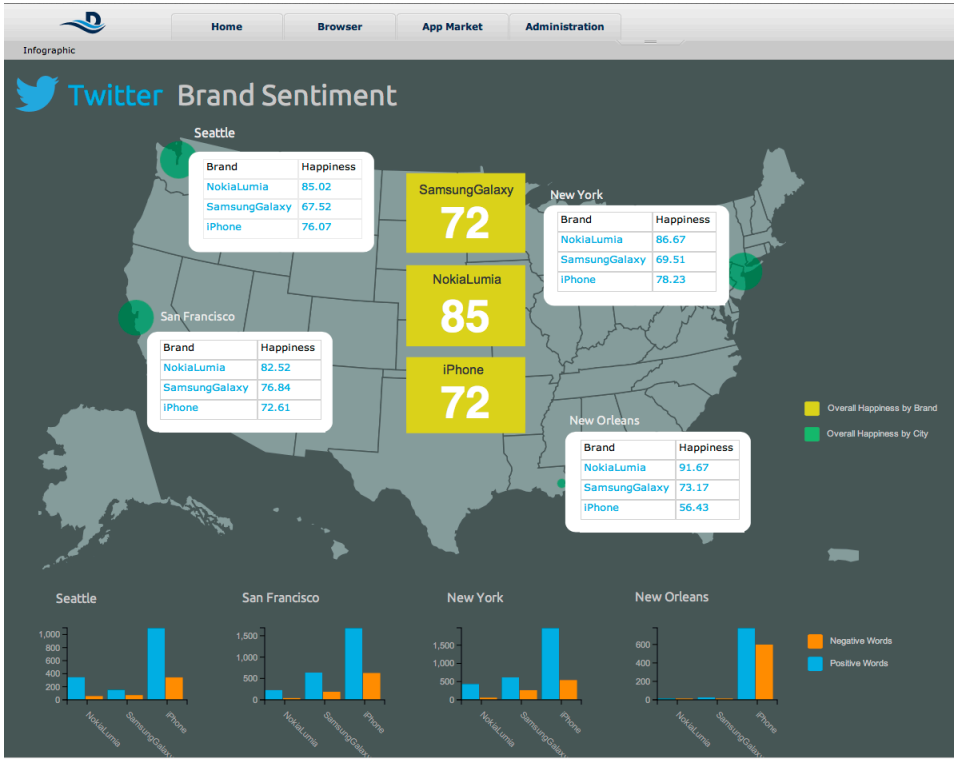
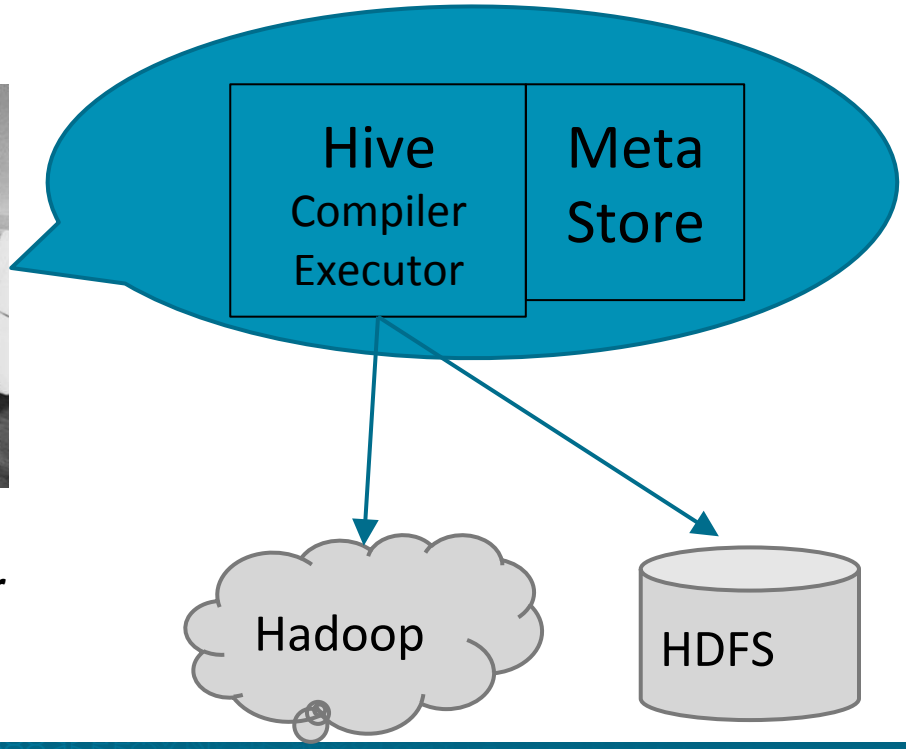
79								

Datameer

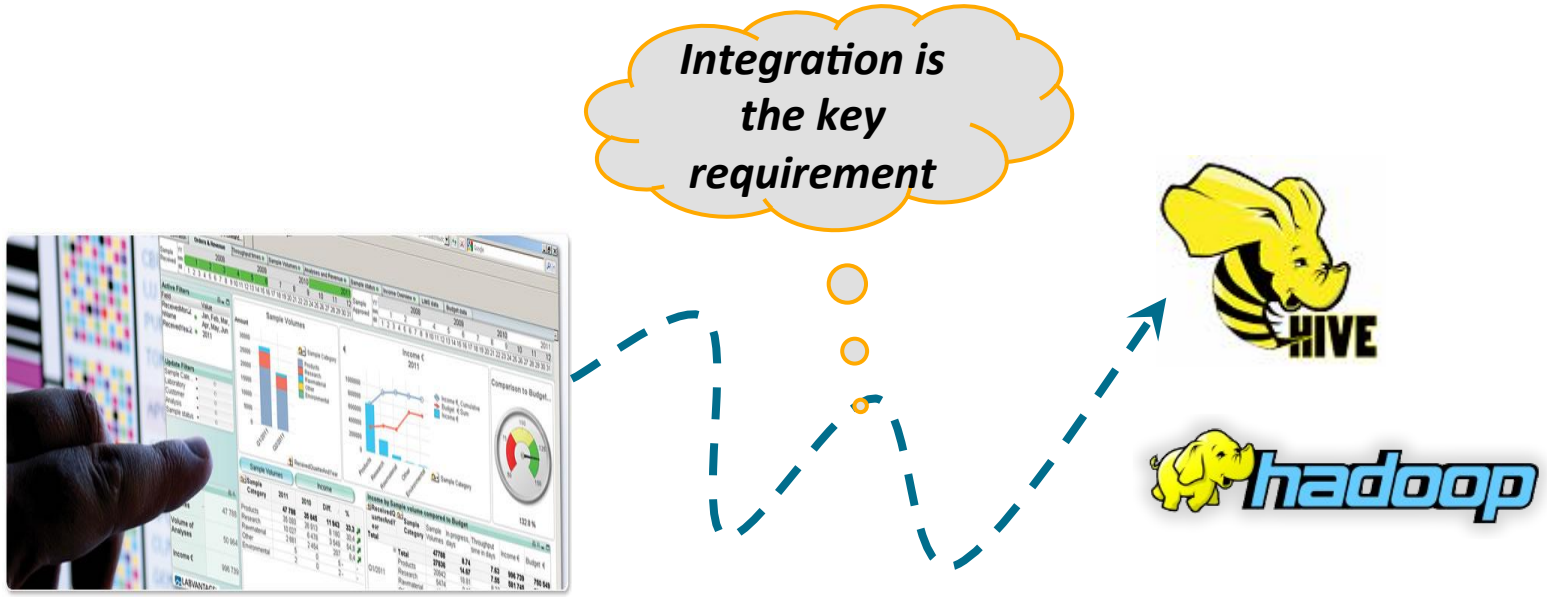


What Hive community expected?

Embedded Hive engine for batch or ad-hoc queries ..



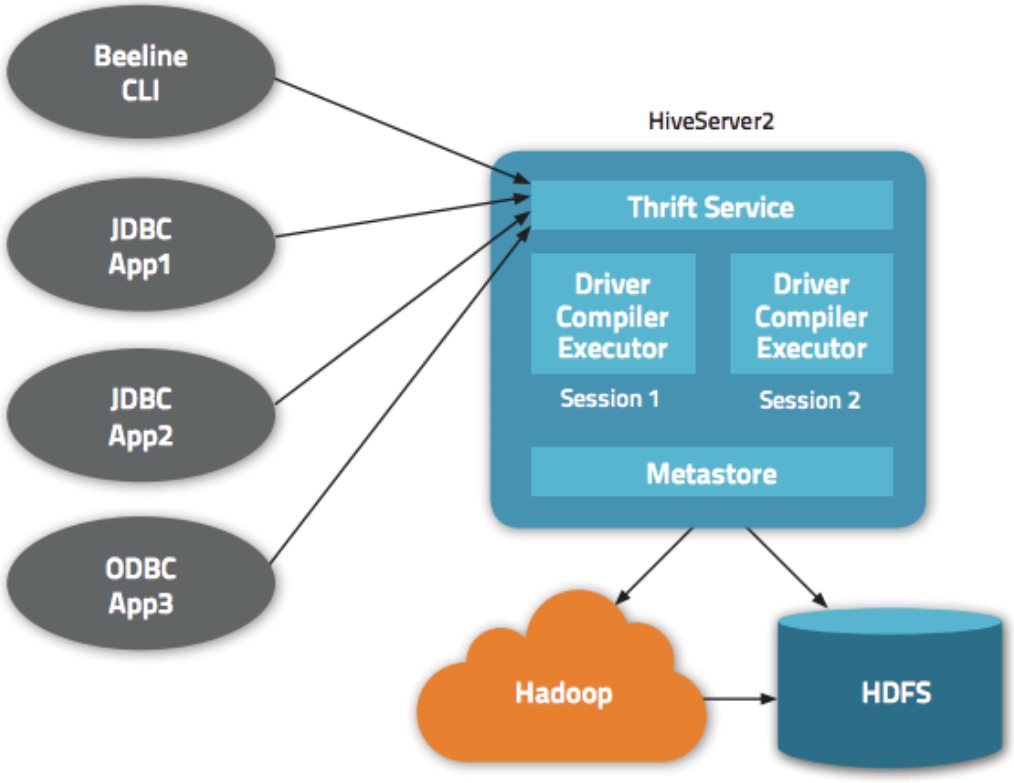
What industry users expect ...



Need server proxy access

- Facilitate remote client
  - Server process to support concurrent clients
- Standard compliant connectors
  - JDBC, ODBC
- Security, Auditing

Hive Server2



Hive Integration

HiveServer1

- No support for concurrent queries. Requires running multiple HiveServers for multiple users
- No support for security.
- The Thrift API in the Hive Server doesn't support common JDBC/ODBC calls.

HiveServer2

- Adds support for concurrent queries. Can support multiple users.
- Adds security support with Kerberos.
- Better support for JDBC and ODBC.

Protecting Hadoop data and services

- Kerberos based authentication
- Posix style file permissions
- Access control for job submission
- Encryption over wire

Securing Hive access

- Restrict access to service
- Supports Kerberos and LDAP authentication
- Encryption over wire

Need for authorization

- Secure authorization
  - Enforce policy control access to data for authenticated user
- Fine grain authorization
  - Ability to control subset of data
- Role based authorization
  - Ability to associate privileges with roles

Current state of authorization

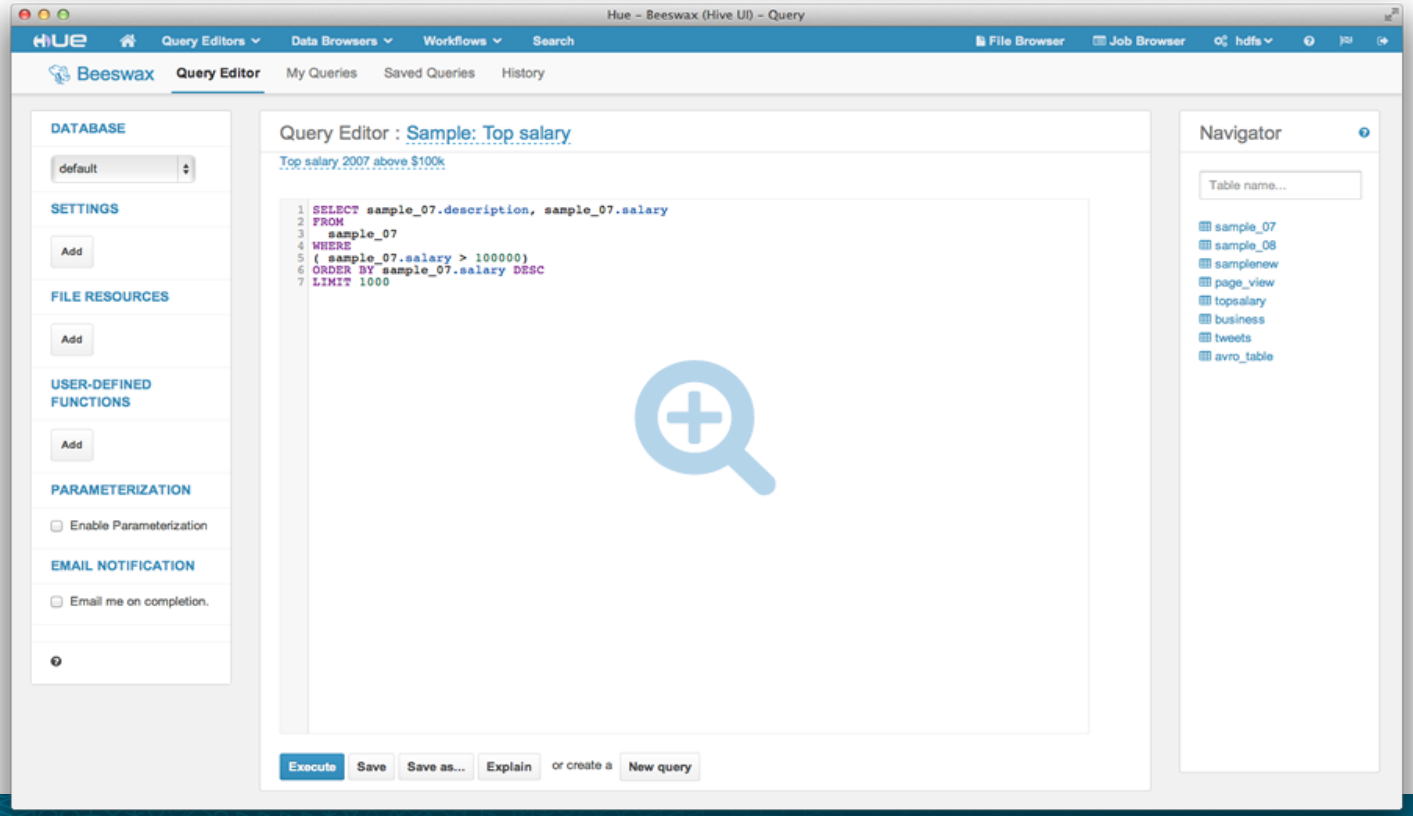
- File based authorization
  - Control at file level
  - Insufficient for collaboration
  - No fine grain access control

- Sub-optimal built-in authorization
  - Intended for preventing accidental changes
  - Not for preventing malicious users for hacking ..

Apache Sentry

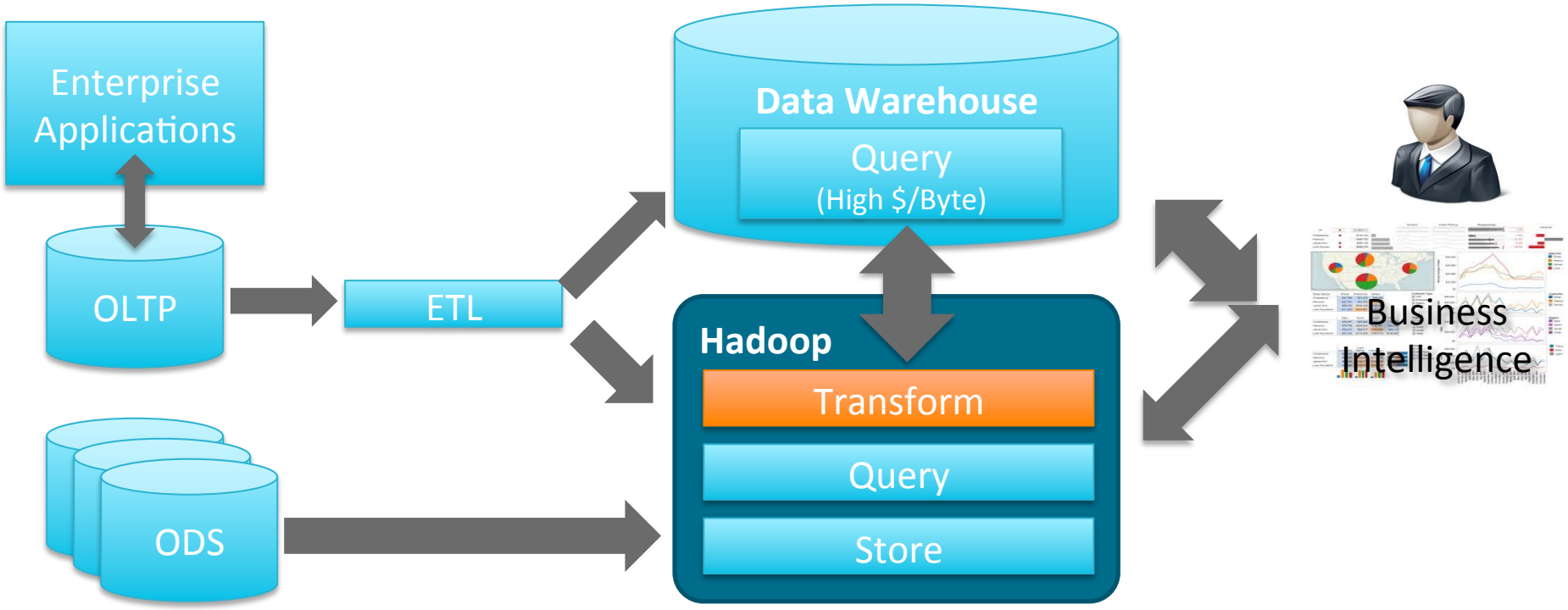
- Policy Engine for authorization
- Fine-grain, role based
- Pluggable modules for Hadoop components
  - Works with out of the box with Hive

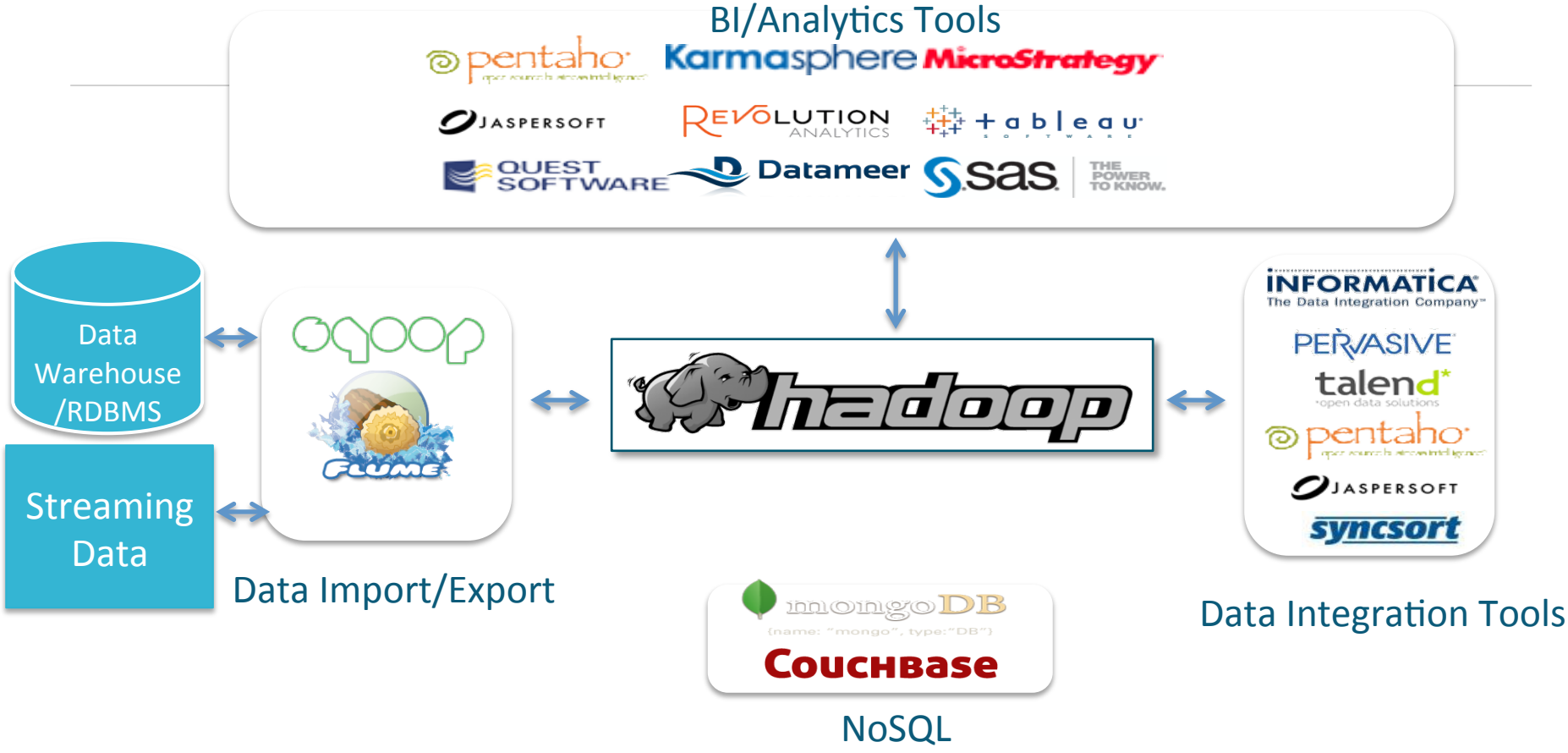
Hue - Hadoop User Experience



Recap

Data Warehouse Optimization





Questions?

- Slides at github.com/markgrover/hive-sjsu

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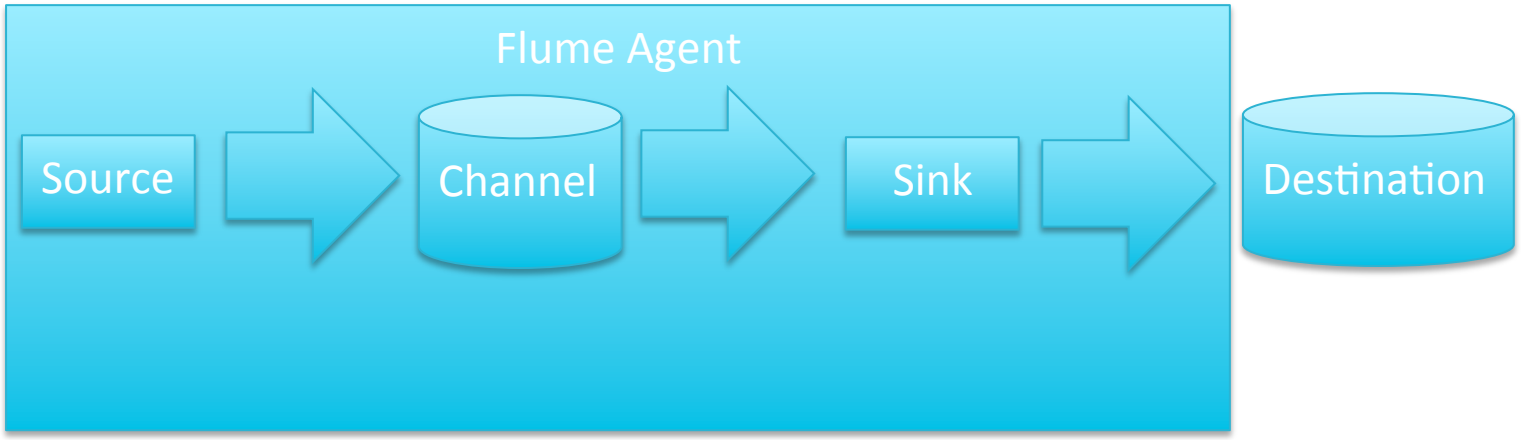
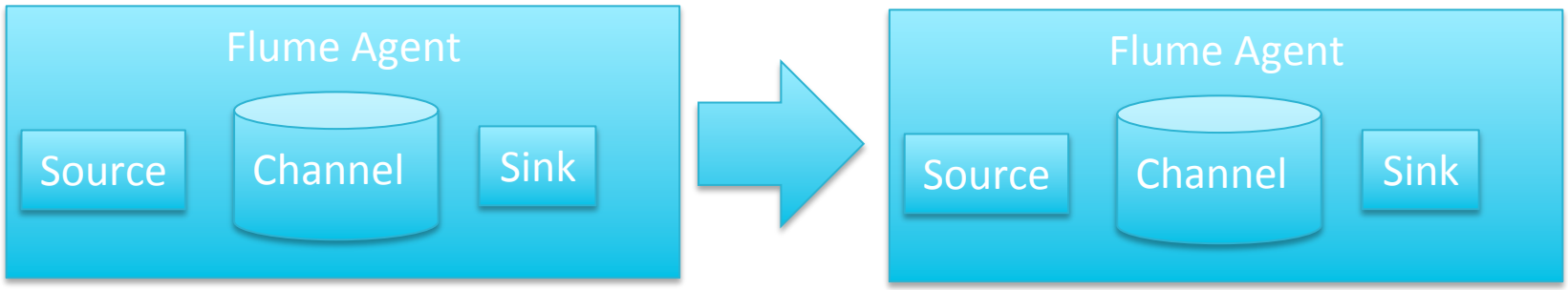
Flume in 2 Minutes

- Reliable – events are stored in channel until delivered to next stage.
- Recoverable – events can be persisted to disk and recovered in the event of failure.



Flume in 2 Minutes

- Supports multi-hop flows for more complex processing.
- Also fan-out, fan-in.



Flume in 2 Minutes

- Declarative
  - No coding required.
  - Configuration specifies how components are wired together.

```
# example.conf: A single-node Flume configuration

# Name the components on this agent
a1.sources = r1
a1.sinks = k1
a1.channels = c1

# Describe/configure the source
a1.sources.r1.type = netcat
a1.sources.r1.bind = localhost
a1.sources.r1.port = 44444

# Describe the sink
a1.sinks.k1.type = logger

# Use a channel which buffers events in memory
a1.channels.c1.type = memory
a1.channels.c1.capacity = 1000
a1.channels.c1.transactionCapacity = 100

# Bind the source and sink to the channel
a1.sources.r1.channels = c1
a1.sinks.k1.channel = c1
```

Flume in 2 Minutes

- Similar systems:
  - Scribe
  - Chukwa

Sqoop Limitations

Sqoop has some limitations, including:

- Poor support for security.

```
$ sqoop import –username scott –password tiger…
```

  - Sqoop can read command line options from an option file, but this still has holes.
- Error prone syntax.
- Tight coupling to JDBC model – not a good fit for non-RDBMS systems.

Fortunately…

Sqoop 2 (incubating) will address many of these limitations:

- Adds a web-based GUI.
- Centralized configuration.
- More flexible model.
- Improved security model.

New Query Engines – Impala

- Fast, interactive queries on data stored in Hadoop (HDFS and HBase).
  - But also designed to support long running queries.
- Uses familiar Hive Query Language and shares metastore.
- Tight integration with Hadoop.
  - Reads common Hadoop file formats.
  - Runs on Hadoop DataNodes.
- High Performance
  - C++, not Java.
  - Runtime code generation.
  - Entirely re-designed execution engine bypasses MapReduce.

Impala Architecture