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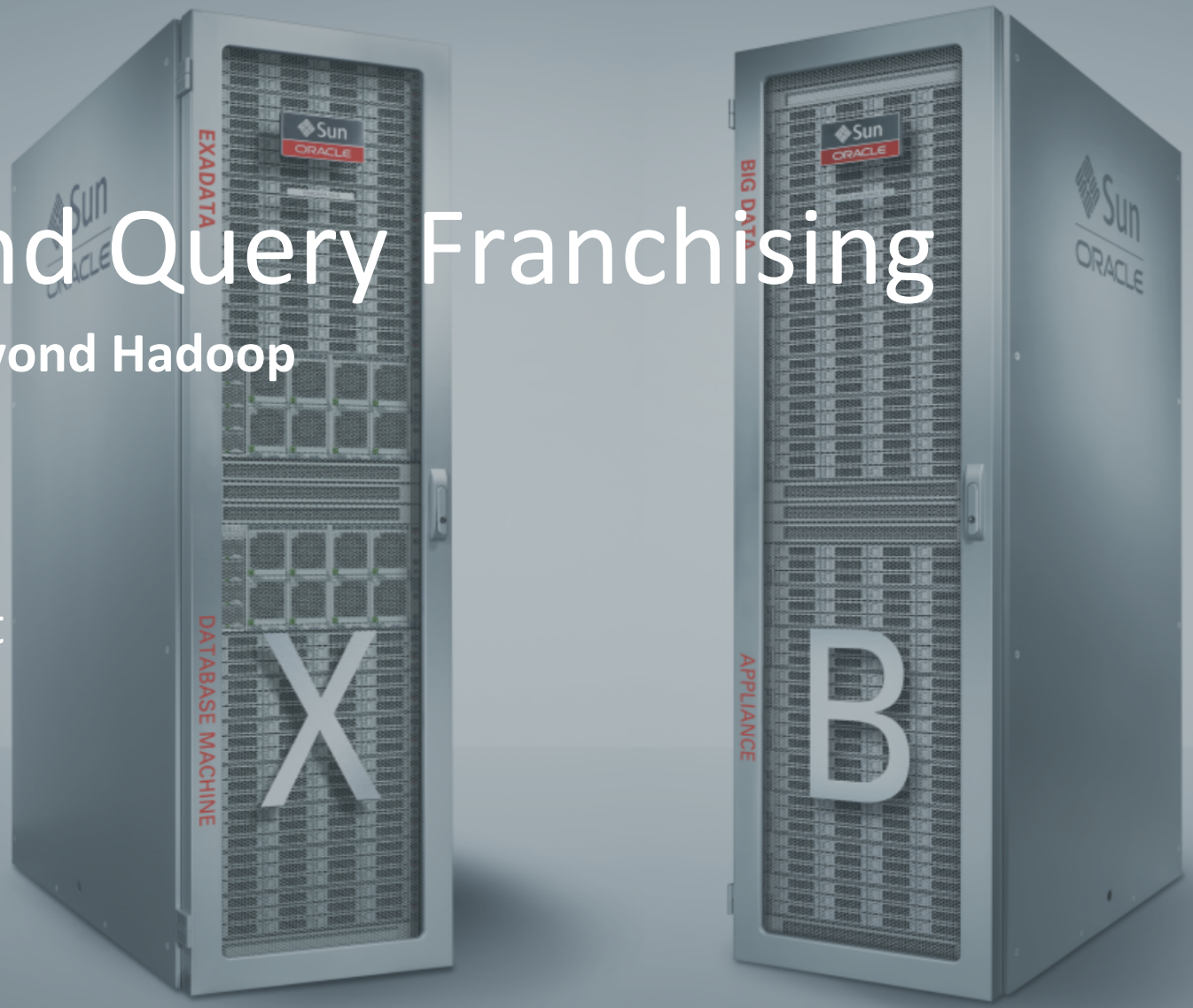
Big Data SQL and Query Franchising

An Architecture for Query Beyond Hadoop

Dan McClary, Ph.D.
Big Data Product Management
Oracle



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Agenda

1. Fixing the fashion problem
2. Why Unified Query Matters
3. Query Franchising: an architecture for unified query
4. Customer 360 Live!

“Oracle has a fashion problem”

Every industry analyst I’ve ever talked with.

We thought everything went with black.

Risk Removal, Not Empire Building

- Make the Big Data ecosystem easy to consume
  - Simplified operations
  - Databricks' certified Spark environment
  - Cloudera's Enterprise Data Hub
- Encourage and support the use of new technologies
  - We build on Hadoop!
  - You should build on Hadoop!
- De-risk new innovations with bridges to the business

hadoop @ Oracle Global Support Services

- Cloudera's Distribution captures HW failures
- Integrate with customer telemetry, configurations, service history, diagnostics
- **Predict failures, save money, and serve customer better**

Anticipate **Detect** **Predict** **Automate** **Delight**

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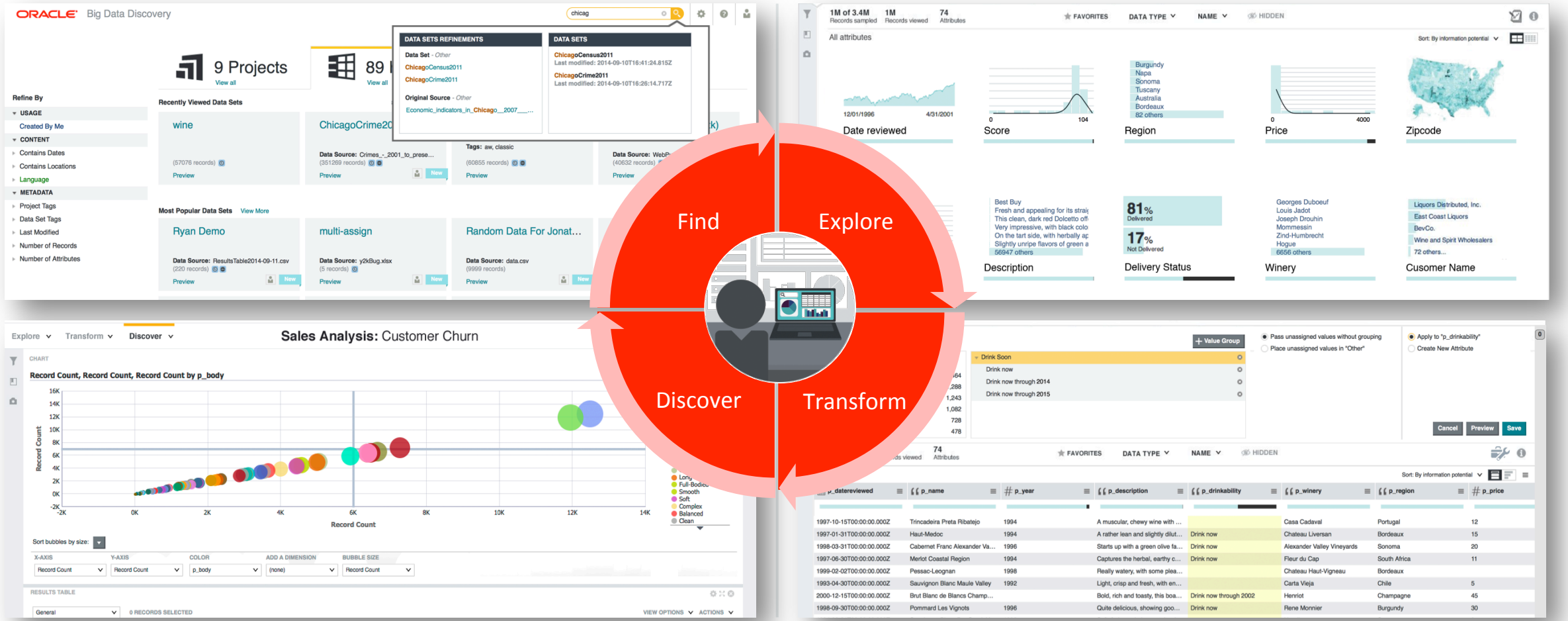
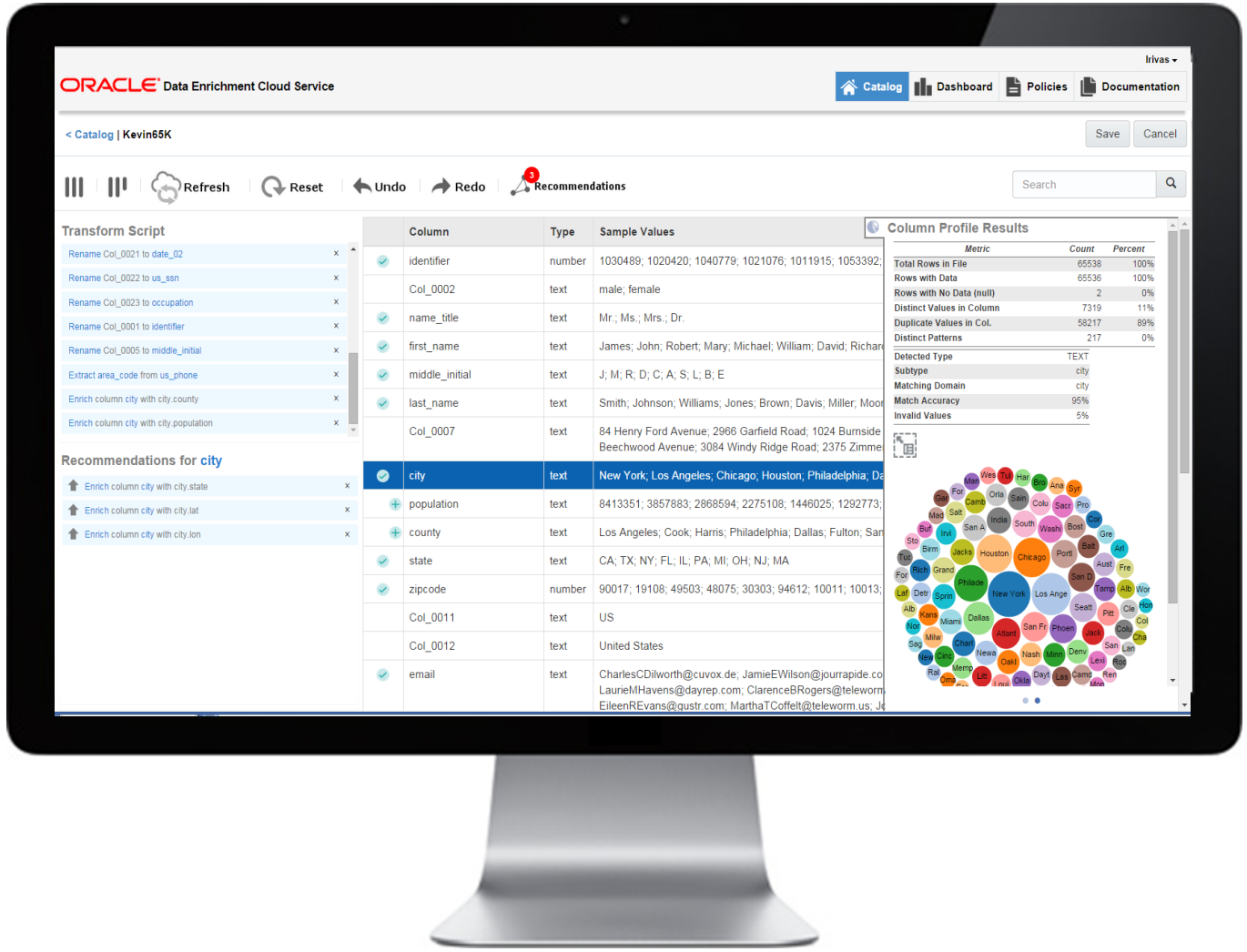
Oracle Big Data Discovery: Built on Spark



Oracle Data Enrichment Cloud Service: Uses Spark



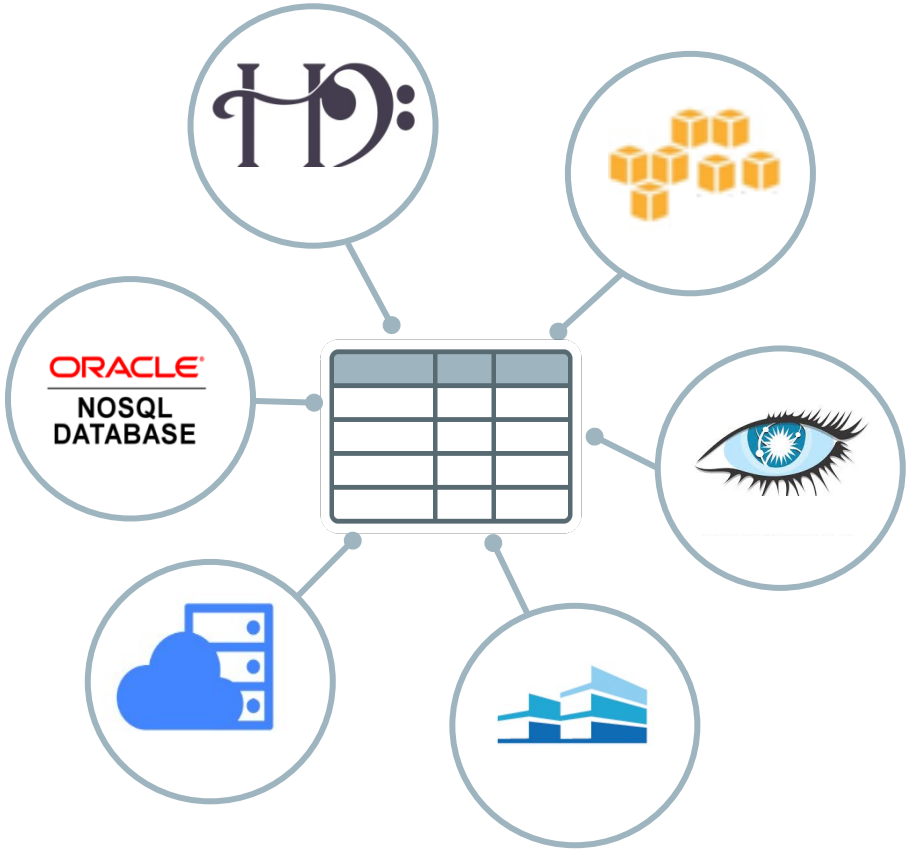
Scalable Machine Learning Pipeline
Natural Language Processing
Knowledge Graph-driven Repair and Blending

Interactive **Recommendations** and **Visual Profiling** to Transform Noisy Signal Into Refined Information Sets for Analytics

Data Analytics Challenge (2012)

Separate data access interfaces

Tables on NoSQL



SQL on Hadoop

HIVE

cloudera IMPALA

Hortonworks

presto

MAPR TECHNOLOGIES

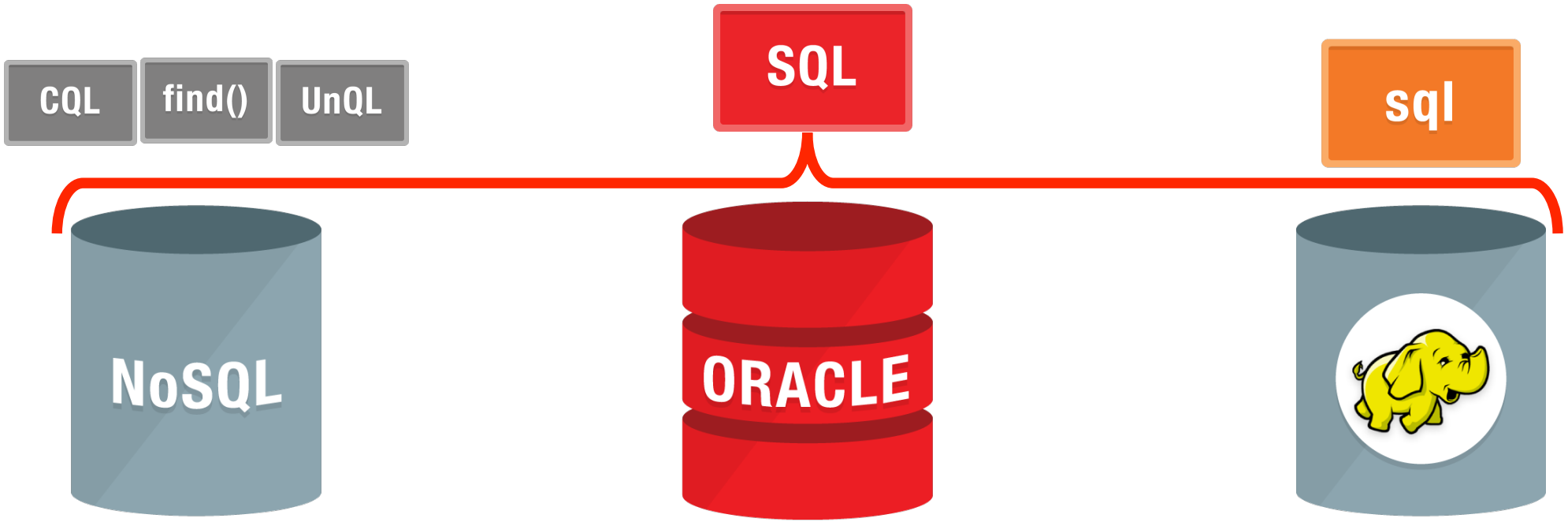
Google

Data Analytics Challenge: 2013

No comprehensive SQL interface across Oracle, Hadoop and NoSQL

Oracle Big Data Management System

Unified SQL access to all enterprise data



What Does Unified Query Mean for You?

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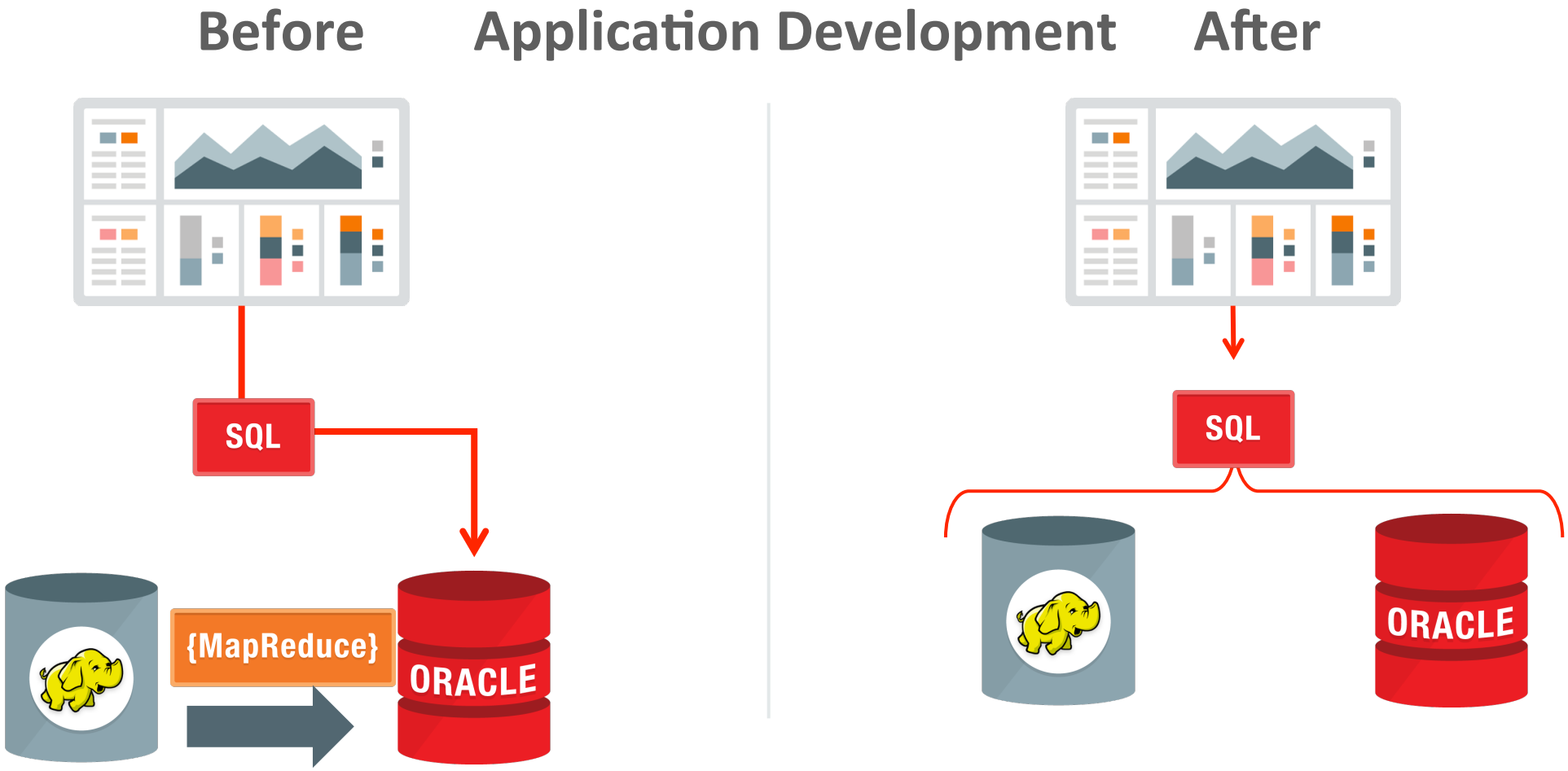


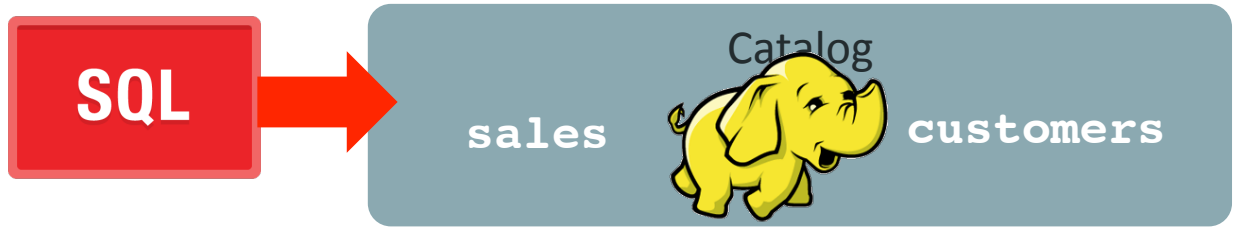
How Does Unified Query Work?

- Unify Metadata
  - Catalog data sources
  - Translate queries into plans
- Distribute Execution
  - Distribute the plan
  - Do work
  - Return answer

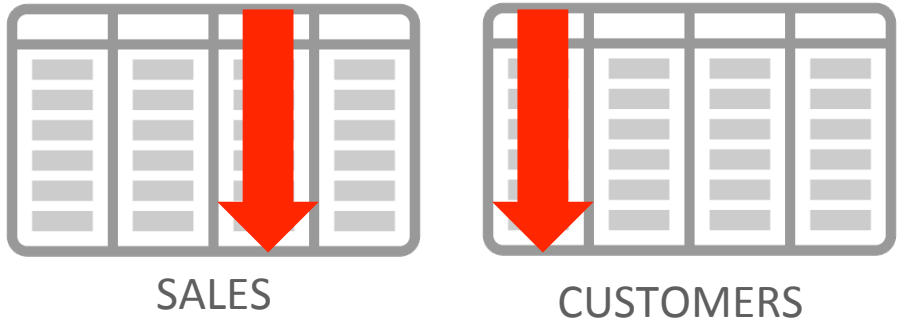
Unifying Metadata

Why Unify Metadata?

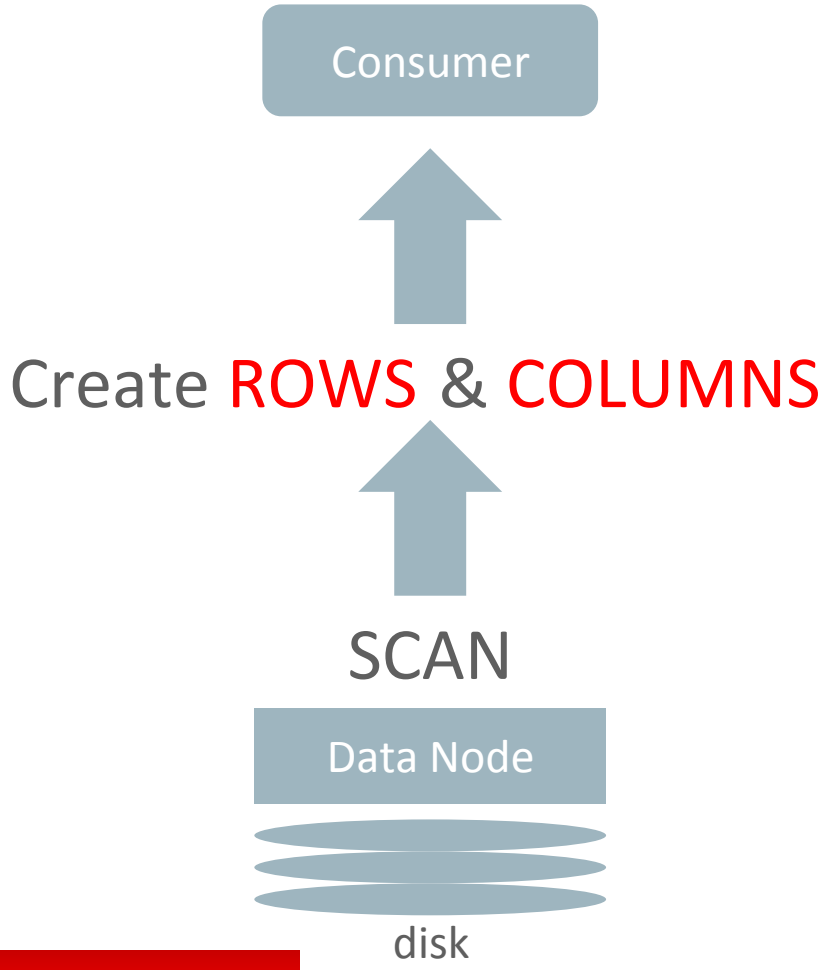
```
CREATE TABLE customers…

SELECT name FROM customers

CREATE TABLE orders…

SELECT customers.name, sales.amount
```



Query across sources → Integrate new metadata



Metadata: InputFormats and SerDes

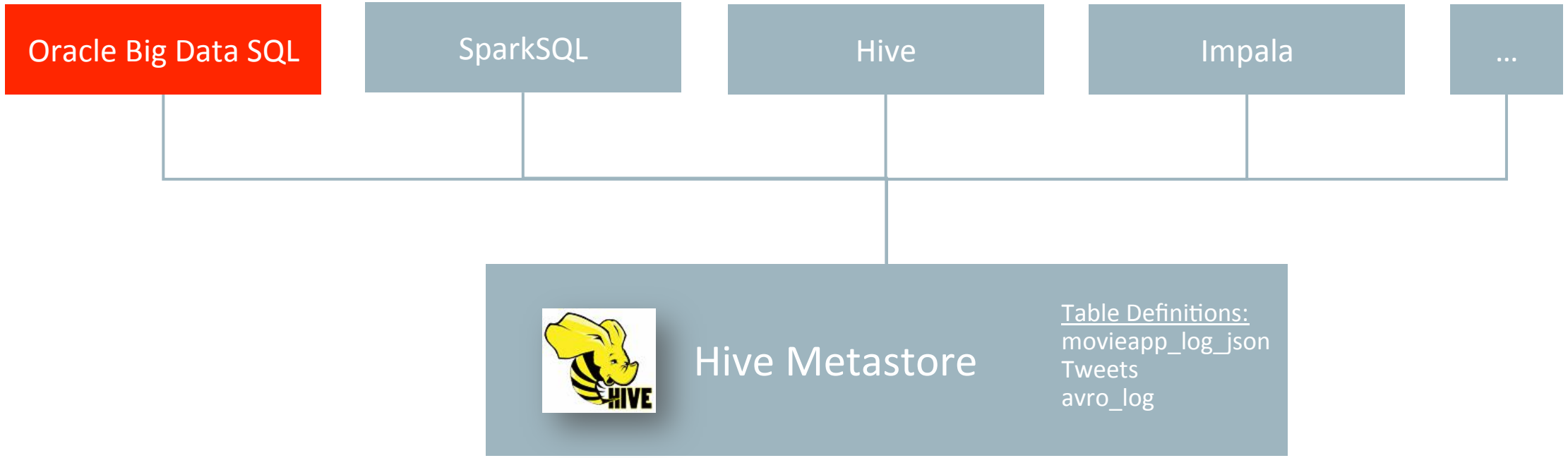


- Scan and row creation needs to be able to work on “any” data format
- Data definitions and column deserializations are needed to provide a table

RecordReader => Scans data (keys and values)
InputFormat => Defines parallelism
SerDe => Makes columns
Metastore => Maps DDL to Java access classes

SQL-on-Hadoop Engines Share Metadata, not MapReduce

Hive Metastore



Metastore maps DDL to Java access classes

Extend Oracle External Tables

```
CREATE TABLE movielog (
  click VARCHAR2(4000))
ORGANIZATION EXTERNAL (
  TYPE ORACLE_HIVE
  DEFAULT DIRECTORY DEFAULT_DIR
  ACCESS PARAMETERS
  (
com.oracle.bigdata.tablename logs
com.oracle.bigdata.cluster mycluster
  ))
REJECT LIMIT UNLIMITED;
```

- New types of external tables
  - ORACLE_HIVE (inherit metadata)
  - ORACLE_HDFS (specify metadata)
- Access parameters for Big Data
  - Hadoop cluster
  - Remote Hive database/table
    - DBMS_HADOOP Package for automatic import

Enhance Oracle External Tables

```
CREATE TABLE ORDER (
  cust_num VARCHAR2(10),
 order_num VARCHAR2(20),
 order_total NUMBER(8,2))
ORGANIZATION EXTERNAL (
  TYPE ORACLE_HIVE
  DEFAULT DIRECTORY DEFAULT_DIR
)
PARALLEL 20
REJECT LIMIT UNLIMITED;
```

- Transparent schema-for-read
  - Use fast C-based readers when possible
  - Use native Hadoop classes otherwise
- Engineered to understand parallelism
  - Map external units of parallelism to Oracle
- Architected for extensibility
  - StorageHandler capability enables future support for other data sources
  - Examples: MongoDB, HBase, Oracle NoSQL DB

That just makes a good **client.**

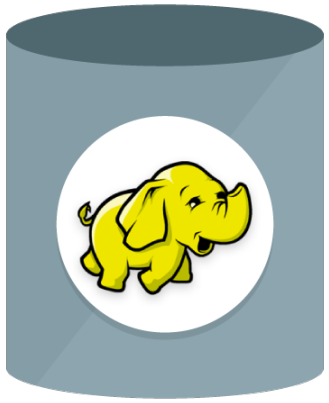
Distribute Execution

But how?

Language-level Federation Fails

Been there, done that.

Hadoop Part



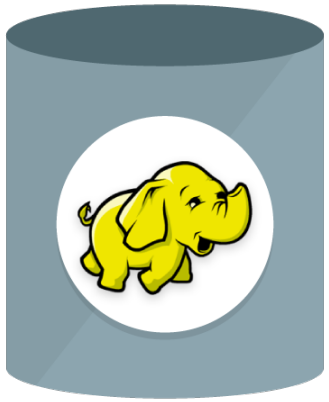
```
with sites as
(
 select s.custid as cust_id,
listagg(s.site, ',')
    within group (order by
s.custid) site_list
  from shortcodes s
  group by custid
),
select c.first_name,
c.last_name, c.AGE,
c.state_province, s.site_list
from customers c, sites s;
```

Database Part

Language-level Federation Fails

Been there, done that.

```
select s.custid as cust_id,
 listagg(s.site, ',')
    within group (order by
 s.custid) site_list
  from shortcodes s
    group by custid
```



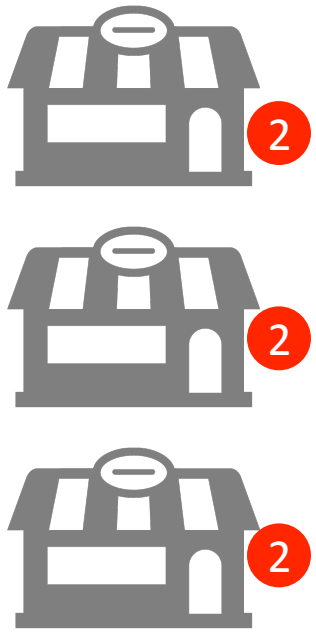
- Operators exist in both places?
- Is their behavior consistent?
- How do you negotiate resources?

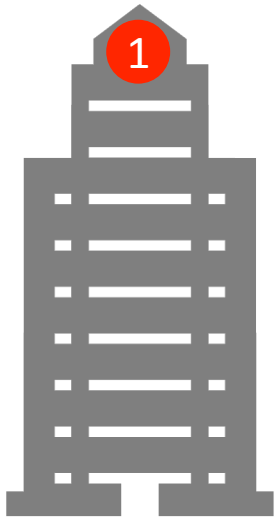
We have to do **better**

Query Franchising – *dispatch of query processing to self-similar compute agents on disparate systems without loss of operational fidelity*

What does **that** mean?

Query Franchising: Uniform Behavior, Disparate Location



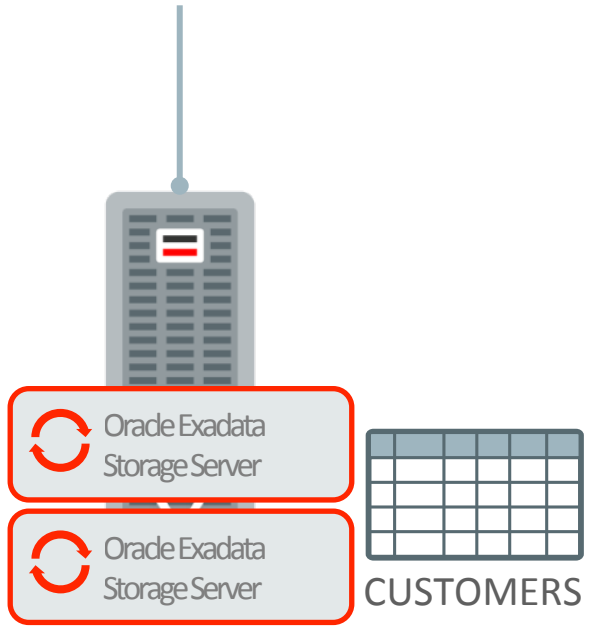


1. Top-level plan created
   - Holistic plan plan for all work
   - Distribute to franchises based by location
2. Franchisees carry out local work
   - Franchises secure and utilize resources
   - All franchises speak the internal language
3. Global operations optimized
   - Adapts to local variation
   - Nothing “lost in translation”

What Can Big Data Learn from Exadata?

Query Federation for Oracle Database

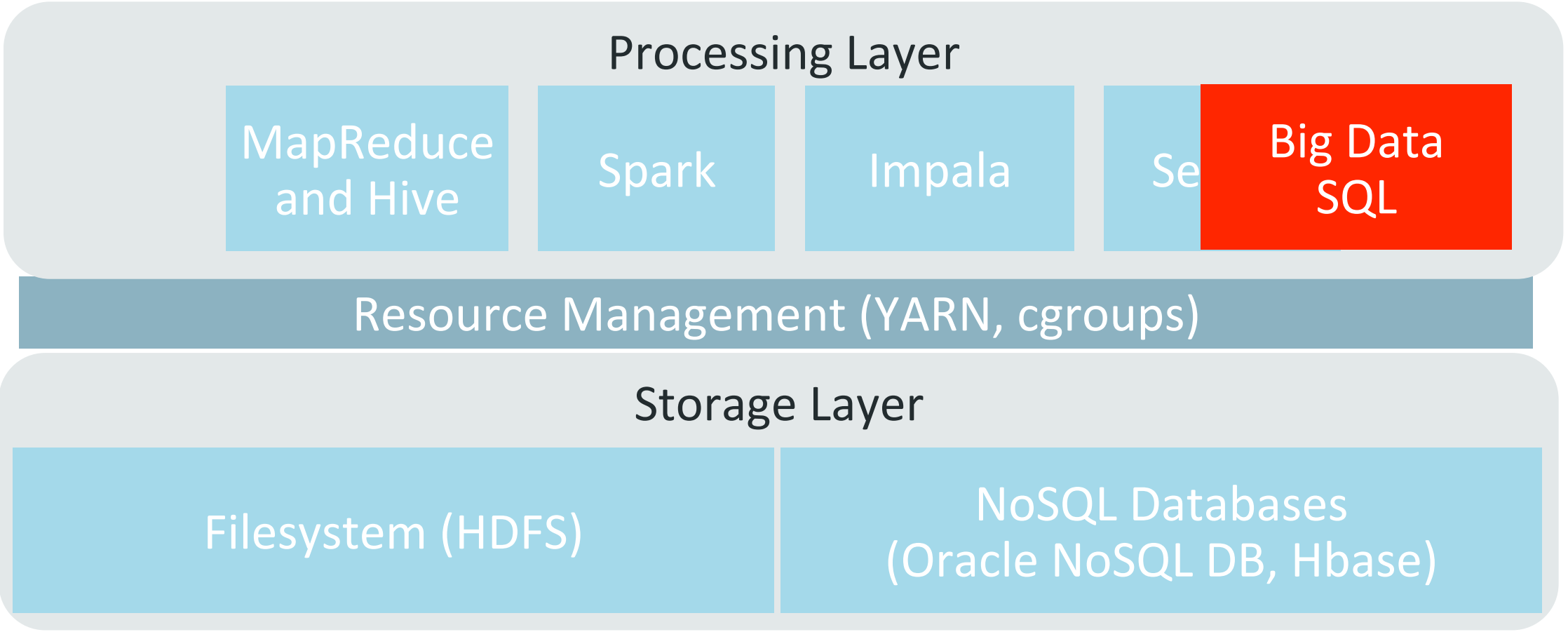
```
SELECT name, SUM(purchase)
  FROM customers
  GROUP BY name;
```



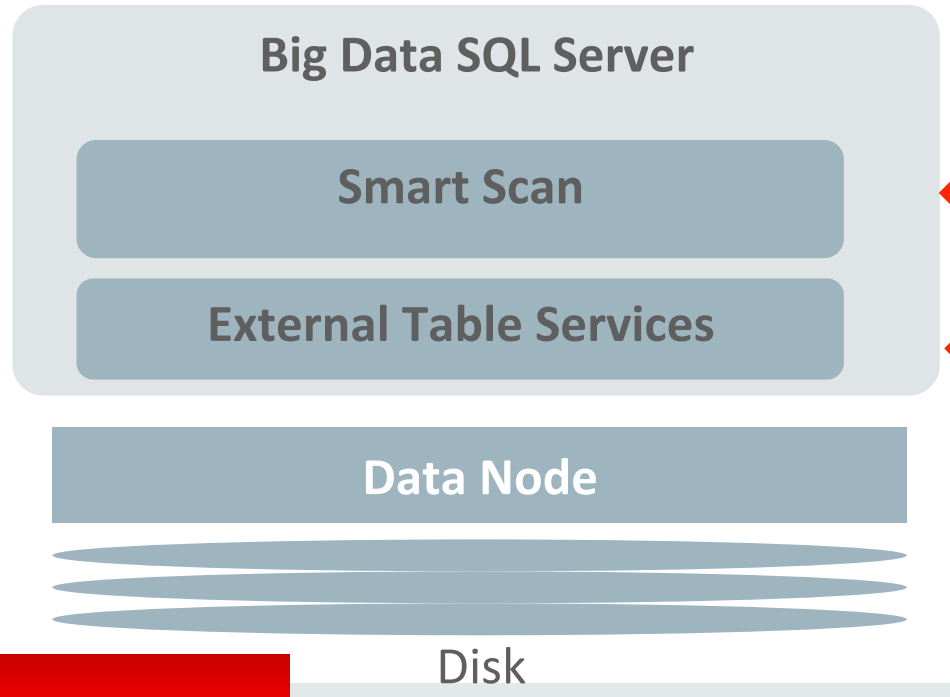
1. Oracle SQL query issued
   - Plan constructed
   - Query executed

2. Smart Scan Works on Storage
   - Filter out unneeded rows
   - Project only queried columns
   - Score data models
   - Bloom filters to speed up joins

Big Data SQL Server: A New Hadoop Processing Engine



Smart Scan for Hadoop: Optimizing Performance



"Oracle on top"

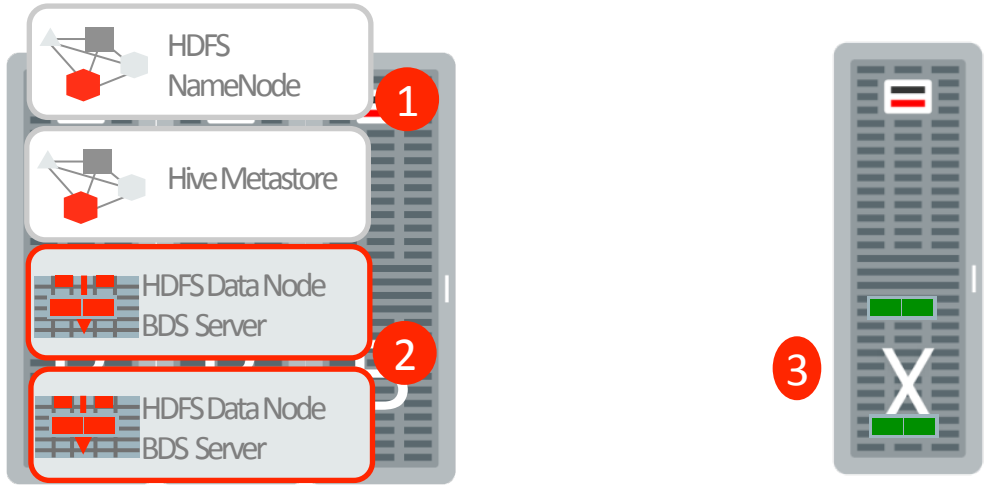
- Apply filter predicates
- Project columns
- Parse semi-structured data

"Hadoop on the bottom"

- Work close to the data
- Schema-on-read with Hadoop classes
- Transformation into Oracle data stream

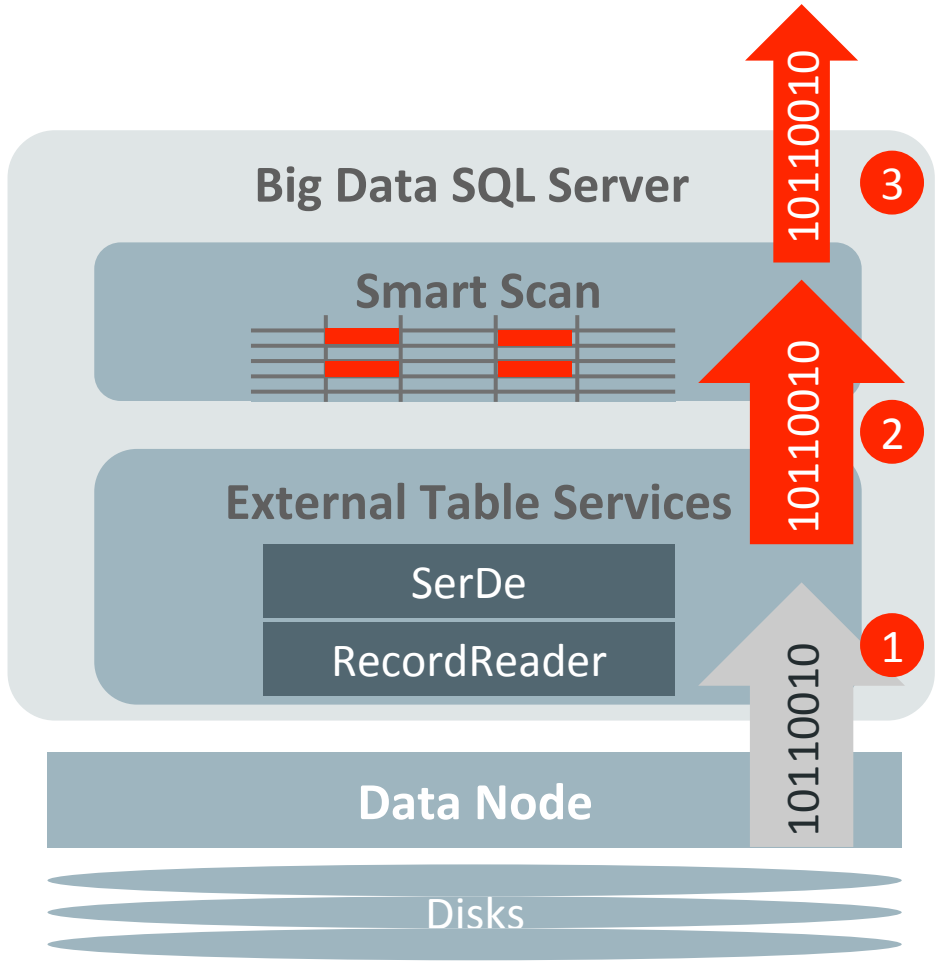
Big Data SQL Query Execution

How do we query Hadoop?



1. Query compilation determines:
   - Data locations
   - Data structure
   - Parallelism
2. Fast reads using Big Data SQL Server
   - Schema-for-read using Hadoop classes
   - Smart Scan selects only relevant data
3. Process filtered result
   - Move relevant data to database
   - Join with database tables
   - Apply database security policies

Big Data SQL Dataflow

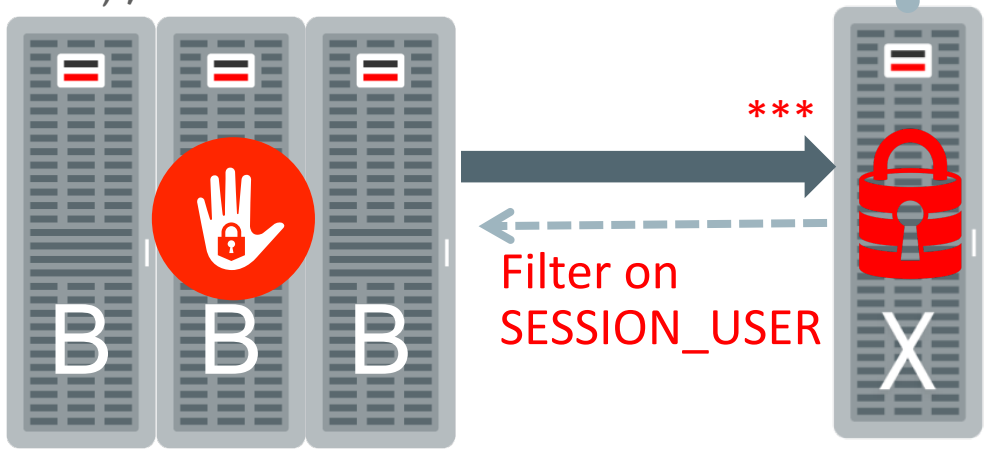


1. Read data from HDFS Data Node
   - Direct-path reads
   - C-based readers when possible
   - Use native Hadoop classes otherwise
2. Translate bytes to Oracle
3. Apply Smart Scan to Oracle bytes
   - Apply filters
   - Project Columns
   - Parse JSON/XML
   - Score models

But How Does Security Work?

```
DBMS_REDACT.ADD_POLICY(
   object_schema => 'MCLICK',
   object_name => 'TWEET_V',
   column_name => 'USERNAME',
   policy_name => 'tweet_redaction',
   function_type => DBMS_REDACT.PARTIAL,
   function_parameters =>
'VVVVVVVVVVVVVVVVVVVVVVVVV,*,3,25',
   expression => '1=1'
   );
```

```
SELECT * FROM my_bigdata_table
 WHERE SALES_REP_ID =
SYS_CONTEXT('USERENV','SESSION_USER');
```



1. Database security for query access
   - Virtual Private Databases
   - Redaction
   - Audit Vault and Database Firewall
2. Hadoop security for Hadoop jobs
   - Kerberos Authentication
   - Apache Sentry (RBAC)
   - Audit Vault
3. System-specific encryption
   - Database tablespace encryption
   - BDA On-disk Encryption

Customer 360, **Live!**

Unified Query Means **Less** Lock-in

- Unified Query means
  - More innovation
  - Less risk
- Use the right tools for your job
  - Hadoop, NoSQL, and whatever's next
  - We'll query all of it
- Explore and adopt new technologies
  - Focus on creating value using your data
  - We'll build bridges back to the business

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Engineered to Work Together


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