

# Apache Hive 2

## (대규모 고속 SQL)

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tchoi@apache.org



YAHOO!

Microsoft



Powerset



APACHE PHOENIX

APACHE HBASE



## 데이터의 시대

오픈소스는 표준이고,  
아파치는 그 중심에 있습니다.

THE APACHE<sup>®</sup>  
SOFTWARE FOUNDATION  
Founded: 1999

HORTONWORKS<sup>®</sup>  
POWERING THE FUTURE OF DATA<sup>™</sup>  
Founded: 2011  
IPO: 2014

LinkedIn



Berkeley  
UNIVERSITY OF CALIFORNIA

NFLABS

kafka



APACHE STORM<sup>™</sup>

Spark



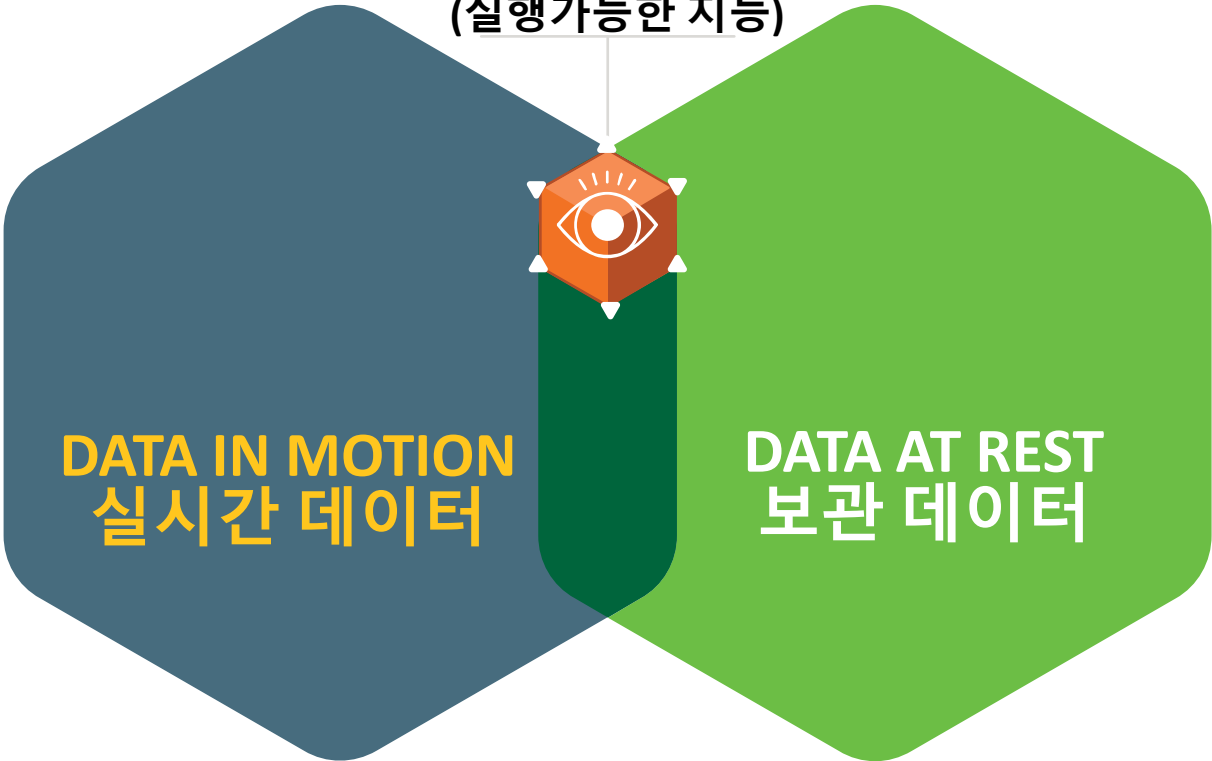
# 호튼웍스의 접근과 배포판(HDP, HDF)



Modern Data Applications  
(선구적인 데이터 어플리케이션)



ACTIONABLE INTELLIGENCE  
(실행가능한 지능)



Hortonworks  
DataFlow  
(Powered by Apache NIFI)

Hortonworks  
Data Platform  
(Powered by Apache Hadoop)





# 호튼웍스 회사 소개

ONLY **100** %

오픈소스

Apache Hadoop Data Platform

2011년 Yahoo! 에서  
하둡팀이 분사

**1** 번째 하둡 상장회사  
IPO 4Q14 (NASDAQ: HDP)  
유일한 흑자회사

**2,100+** 기술파트너  
전략 파트너  
파트너사 컨설턴트  
리셀러

US 포천 100대 기업의  
60%, Global 포천  
500대기업의 30%가  
구독고객

**1,100+**  
구독고객

**1,110+**  
직원

**19**  
개국

<sup>1</sup> Operating billings is an operating measure defined as the aggregate value of all invoices sent to our customers in a given period

# Agenda

## Scalable Data Warehousing on Hadoop

Overview



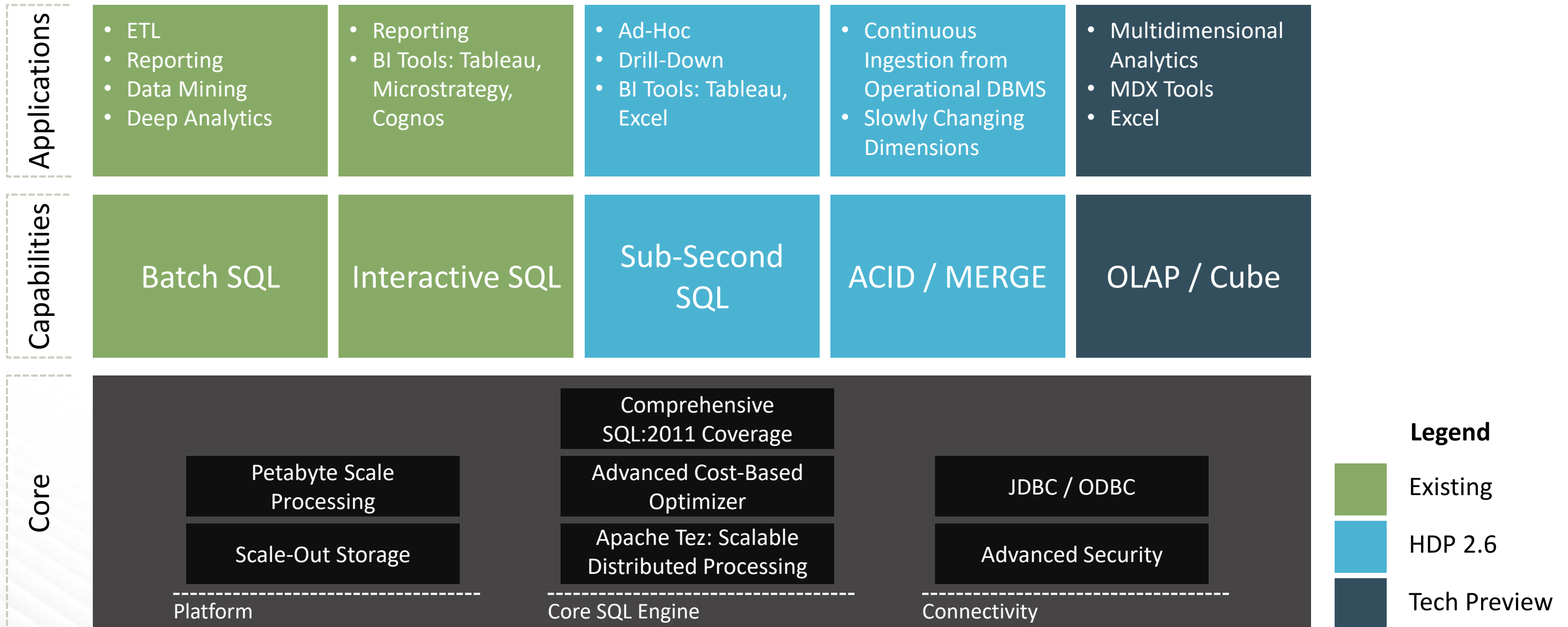
Solution Architecture

Customer Use Cases

What's New

Roadmap

# Scalable Data Warehousing on Hadoop





# Hive's Unique Advantages in HDP 2.6

## Why Hive:

- Comprehensive ANSI SQL including 99 TPC-DS Queries.
- The **only** Hadoop SQL with ACID MERGE for easy updates.
- In-Memory caching for MPP performance at Hadoop scale.
- Per-User dynamic row and column security.
- Replication and DR for critical workloads.
- Compatible with every major BI Tool.
- Proven at 300+ PB Scale.



# Apache Hive: Fast Facts

## Most Queries Per Hour

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**100,000 Queries Per Hour**  
(Yahoo Japan)

## Analytics Performance

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**100 Million rows/s Per Node**  
(with Hive LLAP)

## Largest Hive Warehouse

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**300+ PB Raw Storage**  
(Facebook)

## Largest Cluster

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**4,500+ Nodes**  
(Yahoo)



# Agenda

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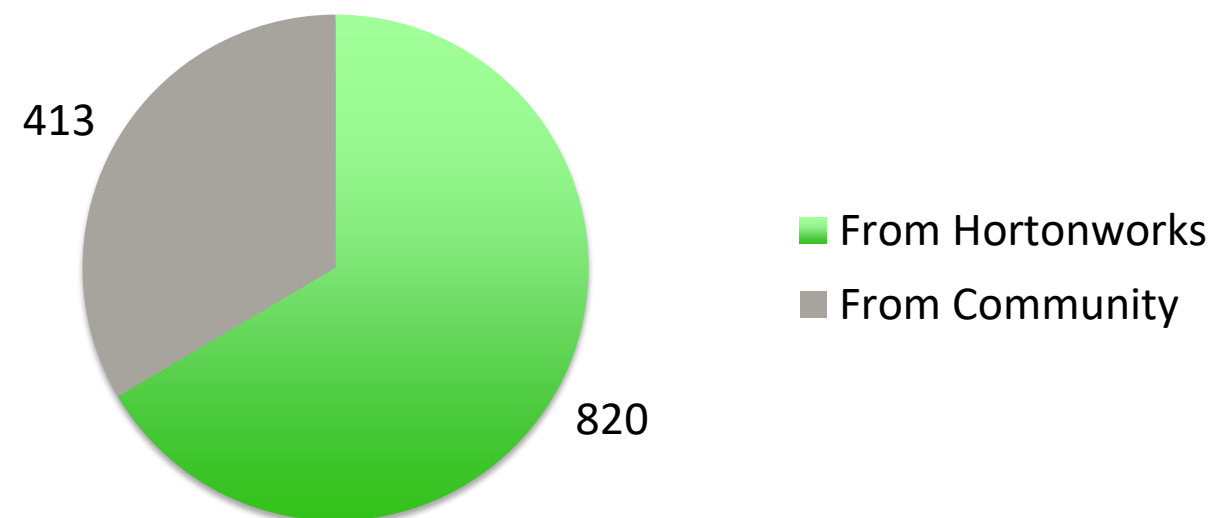
What's New

Roadmap

# HDP 2.6 Continues Strong Momentum for Hive

- ◆ At a High Level:
  - 1200+ features, improvements and bug fixes in Hive since HDP 2.5.
  - 400+ of these from outside of Hortonworks.
- ◆ Major Improvements:
  - Hive LLAP Now GA
  - ACID MERGE
  - SQL: All 99 TPC-DS out-of-the-box with only trivial rewrites
  - Hive View 2.0: Great Features for DBAs
  - Diagnostics: Tez UI Total Timeline View
  - Tech Preview: Hive OLAP Indexes powered by Druid

## HDP 2.6 Improvements



Hive LLAP GA

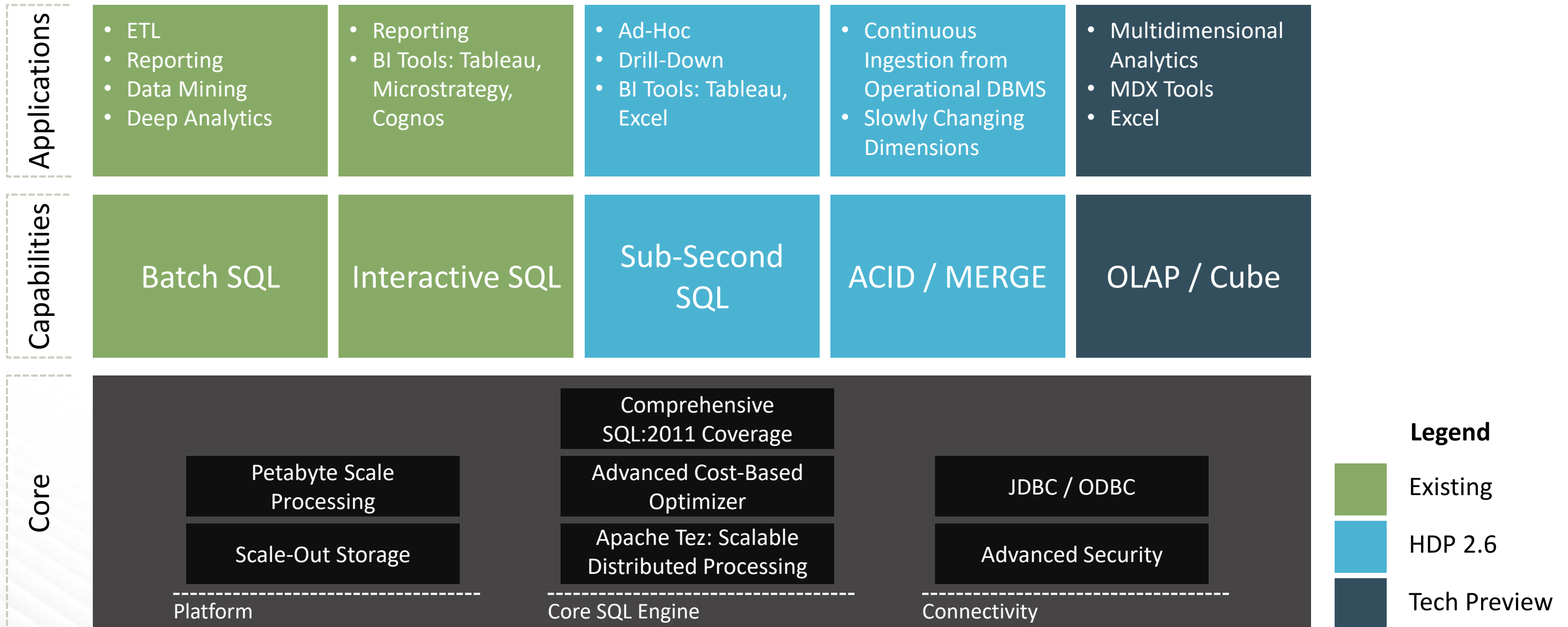


SQL MERGE

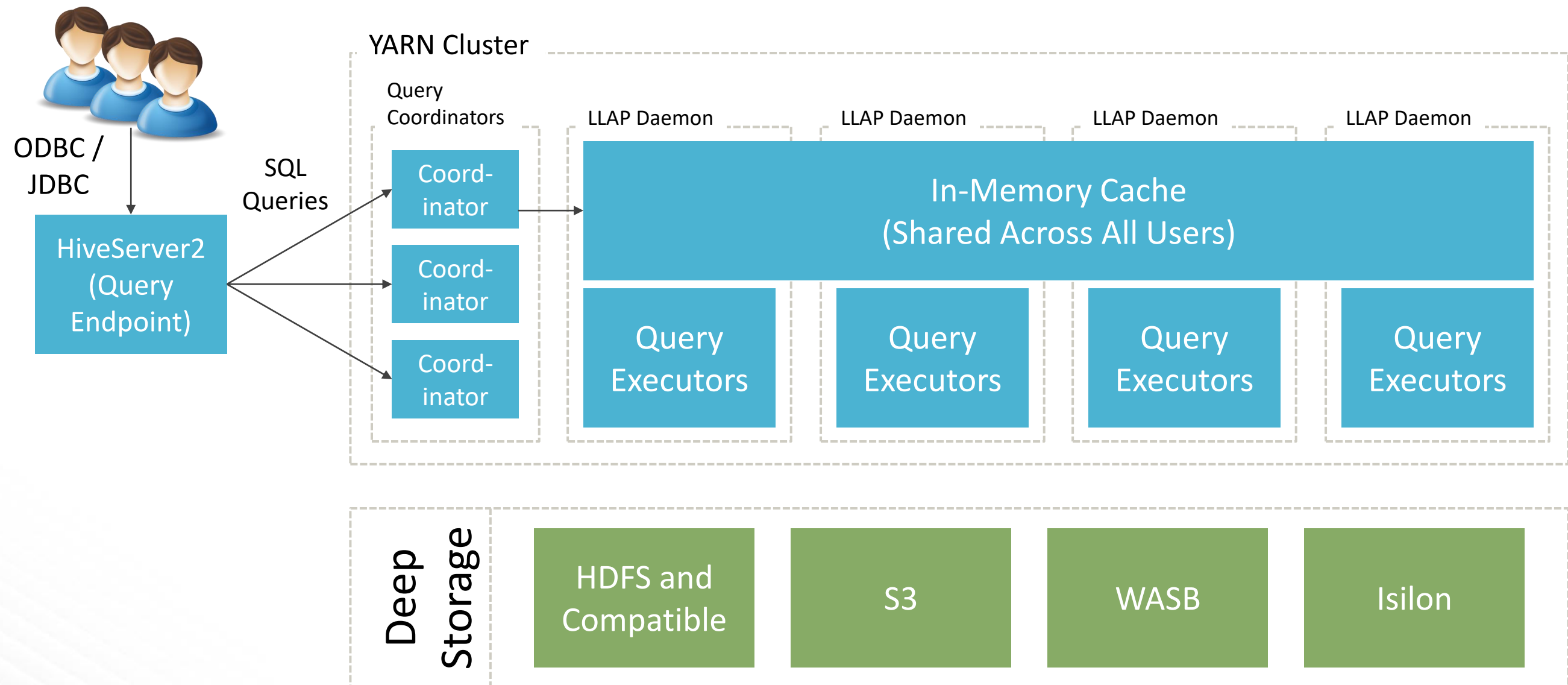


All TPC-DS Queries

# Scalable Data Warehousing on Hadoop



# Hive LLAP -- MPP Performance at Hadoop Scale





# Hive LLAP: One-Touch Provisioning

ambari4.example.com:8080/#/main/services/HIVE/configs

Actions ▾

V2 ✓ admin authored on Mon, Mar 13, 2017 12:30

Discard Save

### Security

Choose Authorization

None ▾

Run as end user instead of Hive user

True

HiveServer2 Authentication

None ▾

Use SSL

False

### Interactive Query

Enable Interactive Query (requires YARN pre-emption)

Yes

Interactive Query Queue

llap ▾

Number of nodes used by Hive's LLAP

1

Maximum Total Concurrent Queries

1

### ACID Transactions

ACID Transactions

Off

Run Compactor

False

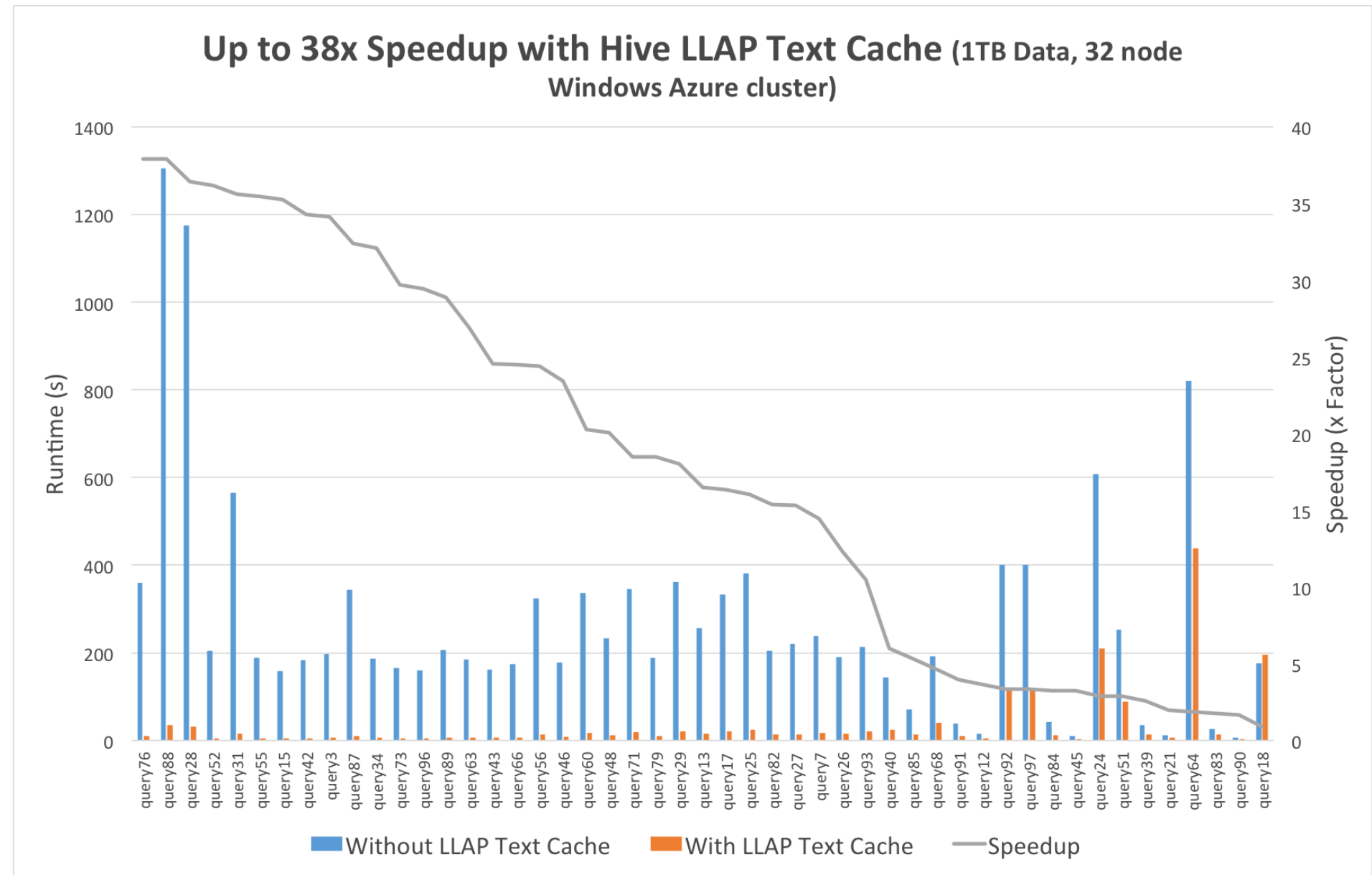
Number of threads used by Compactor

0

# Hive LLAP Text Cache Delivers Zero ETL Analytics

## Highlights

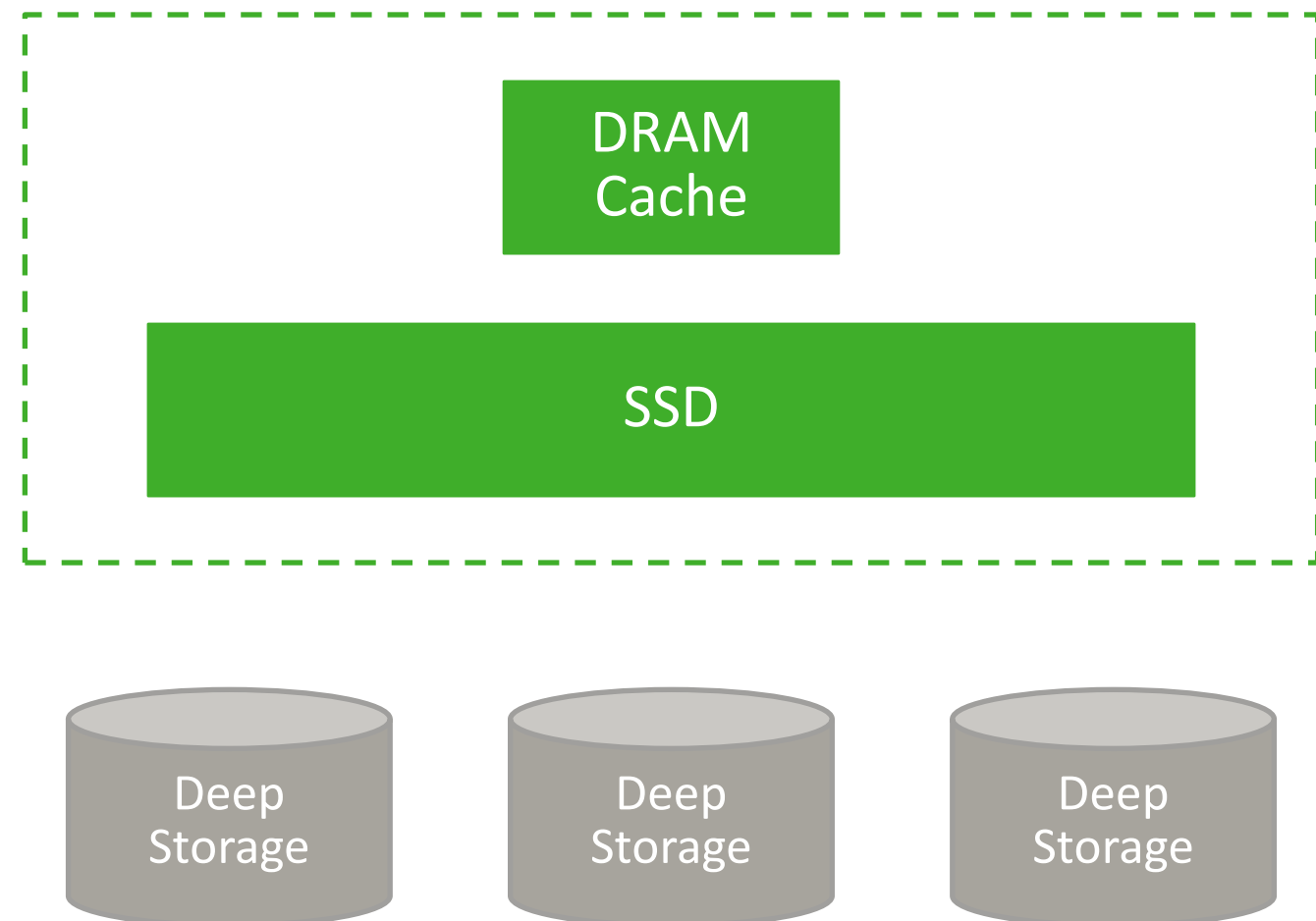
- Fast interactive analytics on CSV and JSON data.
- No ETL / conversion to ORCFile needed, just load and go.
- Once data is cached, analytics become dramatically faster.



# Cache 4x More Data with Hive LLAP SSD Cache

## Highlights

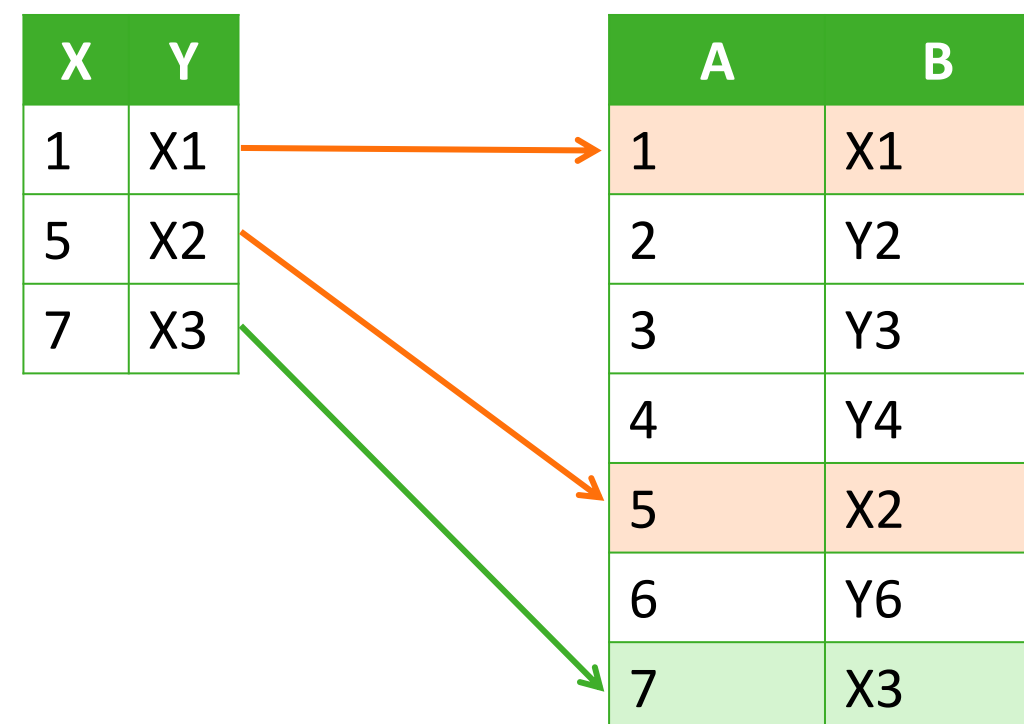
- ◆ Use the combination of DRAM and SSD to dynamically cache data.
- ◆ Cache 4x more data than using DRAM alone.
- ◆ Deliver fast analytics on larger datasets with higher concurrency.



# Hive ACID MERGE Makes Data Maintenance Simple

## Highlights

- ◆ SQL Standard ACID MERGE now available in Hive.
- ◆ Efficiently perform record-level inserts, updates and deletes.
- ◆ Delivers real Data Management in Hadoop, massively simplifying updates, data restatements and change data capture.





# Comprehensive SQL in Hive Including All 99 TPC-DS Queries

## Highlights

- ◆ Multiple and Scalar Subqueries
- ◆ INTERSECT and EXCEPT
- ◆ Standard syntax for ROLLUP / GROUPING
- ◆ Syntax improvements for GROUP BY and ORDER BY
- ◆ In HDP 2.6+ Hive runs all 99 TPC-DS with only trivial re-writes.



# Hive View 2.0: Visual Explain Plan Makes Debugging Easier

**Visual Explain Plan**  
See how your query is run  
and the cost of each step.

**Worksheet1** +

**DATABASE**  
Select or search database/schema  
× foodmart

```
1 select
2   time_by_day.the_year as c0, customer.gender as c1,
3   sum(sales_fact_1997.unit_sales) as m0, count(*) as m1
4 from
5   time_by_day as time_by_day, sales_fact_1997 as sales_fact_1997, customer as customer
6 where
7   sales_fact_1997.time_id = time_by_day.time_id and time_by_day.the_year = 1997
8   and sales_fact_1997.customer_id = customer.customer_id group by time_by_day.the_year, customer.gender ;
```

✓ Execute

Save As

Insert UDF ▾

Visual Explain

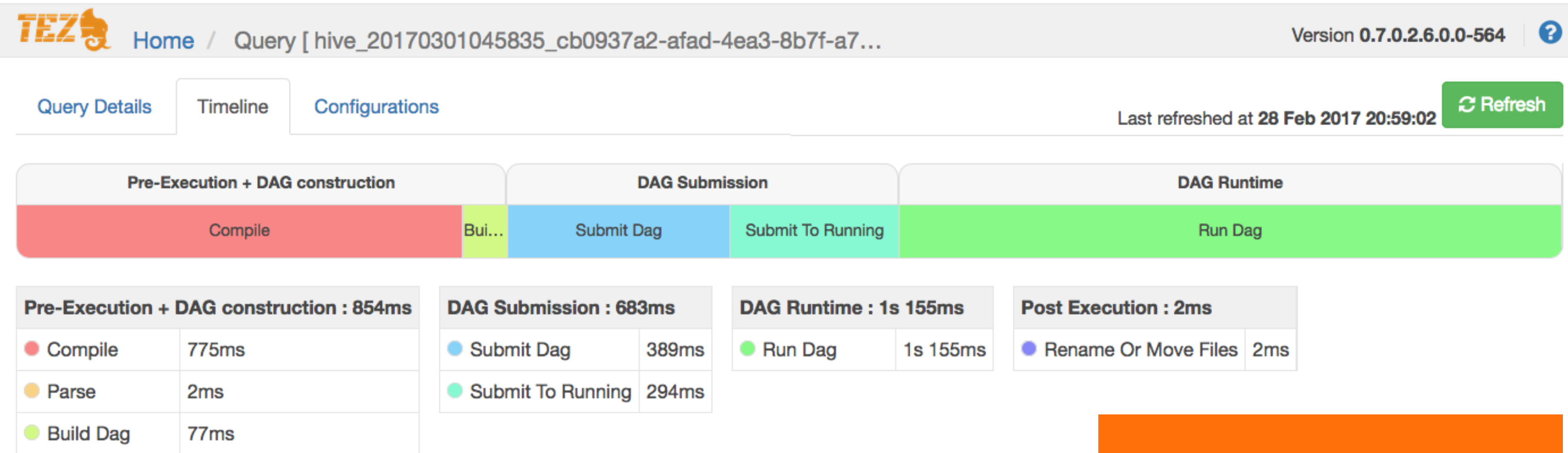
RESULTS

LOG

**VISUAL EXPLAIN**

TEZ UI

# Tez Total Timeline View Show Exactly Where Time Goes



**Total Timeline View**  
See exactly where query time is spent, from compilation to execution.

# Dynamic Tag-based Access Policies with Apache Atlas

- **Basic Tag policy** – PII example. Access and entitlements must be tag based ABAC and scalable in implementation.
- **Geo-based policy** – Policy based on IP address, proxy IP substitution maybe required. The rule enforcement but be geo aware.
- **Time-based policy** – Timer for data access, decoupled from deletion of data.
- **Prohibitions** – Prevention of combination of Hive tables that may pose a risk together.

## Key Benefits:

New scalable metadata based security paradigm

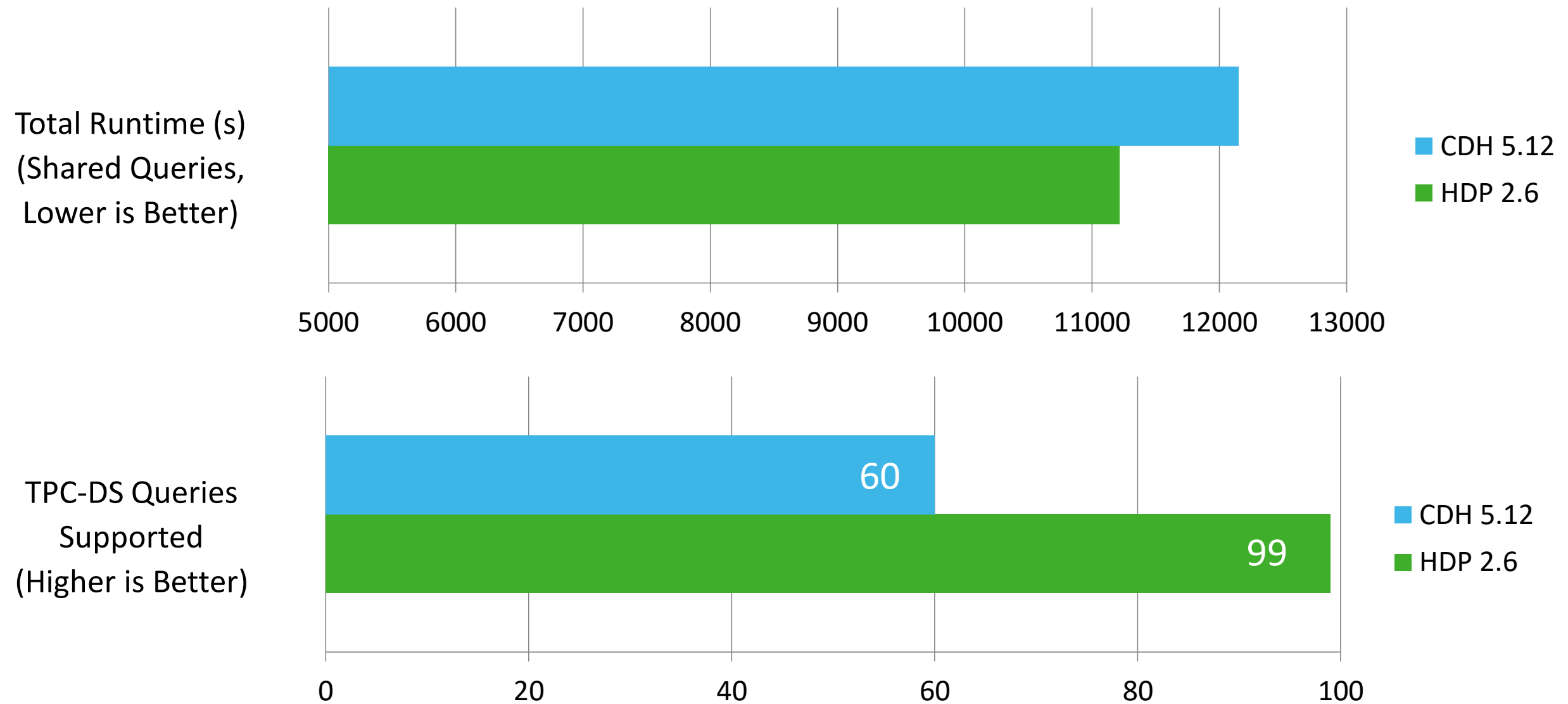
Dynamic, real-time policy

Active protection – fast updates to changes

Centralized and simple to manage policy



# Head to Head: TPC-DS Hive versus Impala

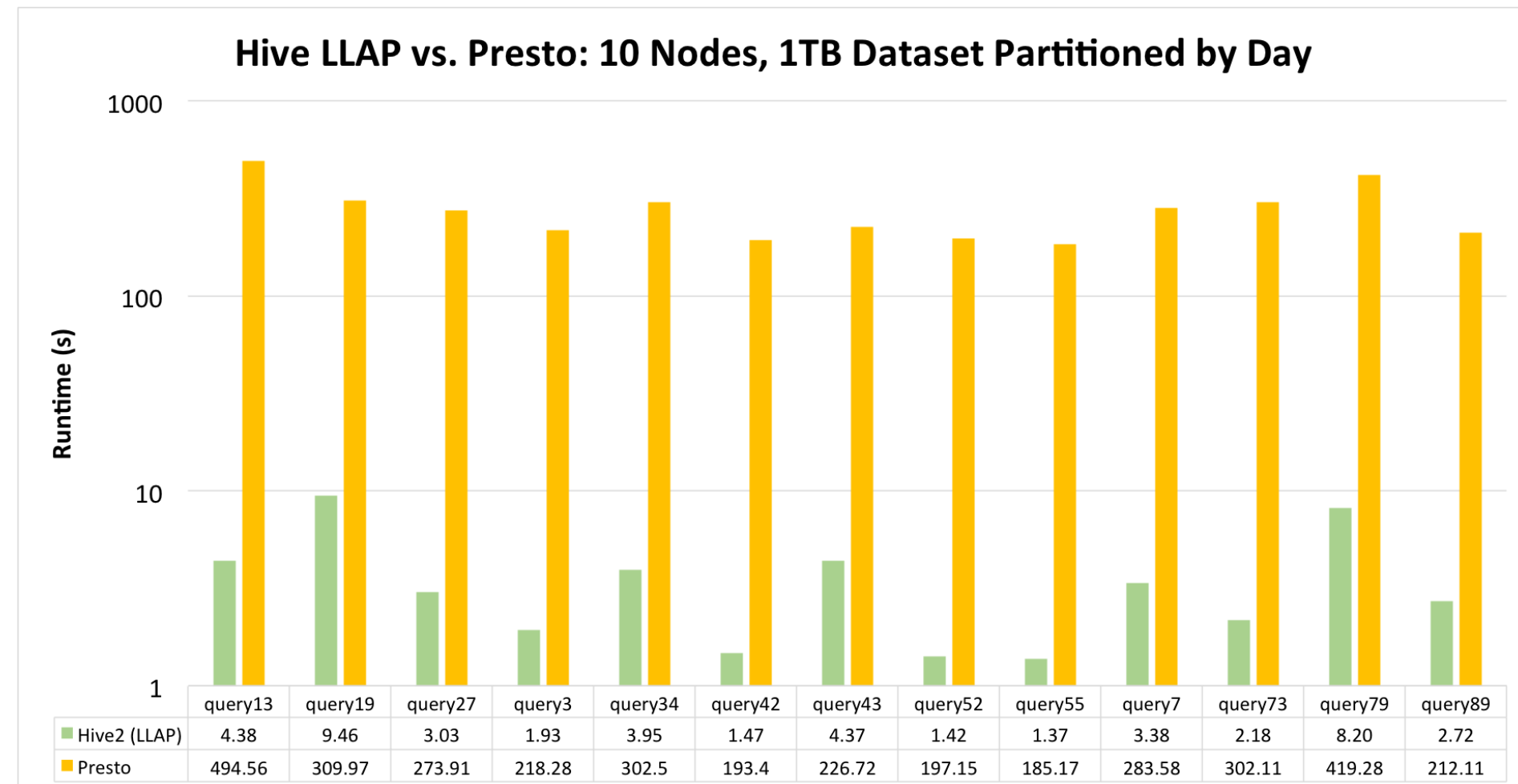


TPC-DS; Scale 10,000; 9 Nodes; Identical, Trivially Modified SQL Queries

# Performance: Apache Hive vs. Presto on a partitioned 1TB dataset.

## Highlights

- Presto lacks basic performance optimizations like dynamic partition pruning.
- On a real dataset / workload Presto perform poorly without full re-writes.
- Example: Query 55 without re-writes = 185.17s, with re-writes = 16s. LLAP = 1.37s.

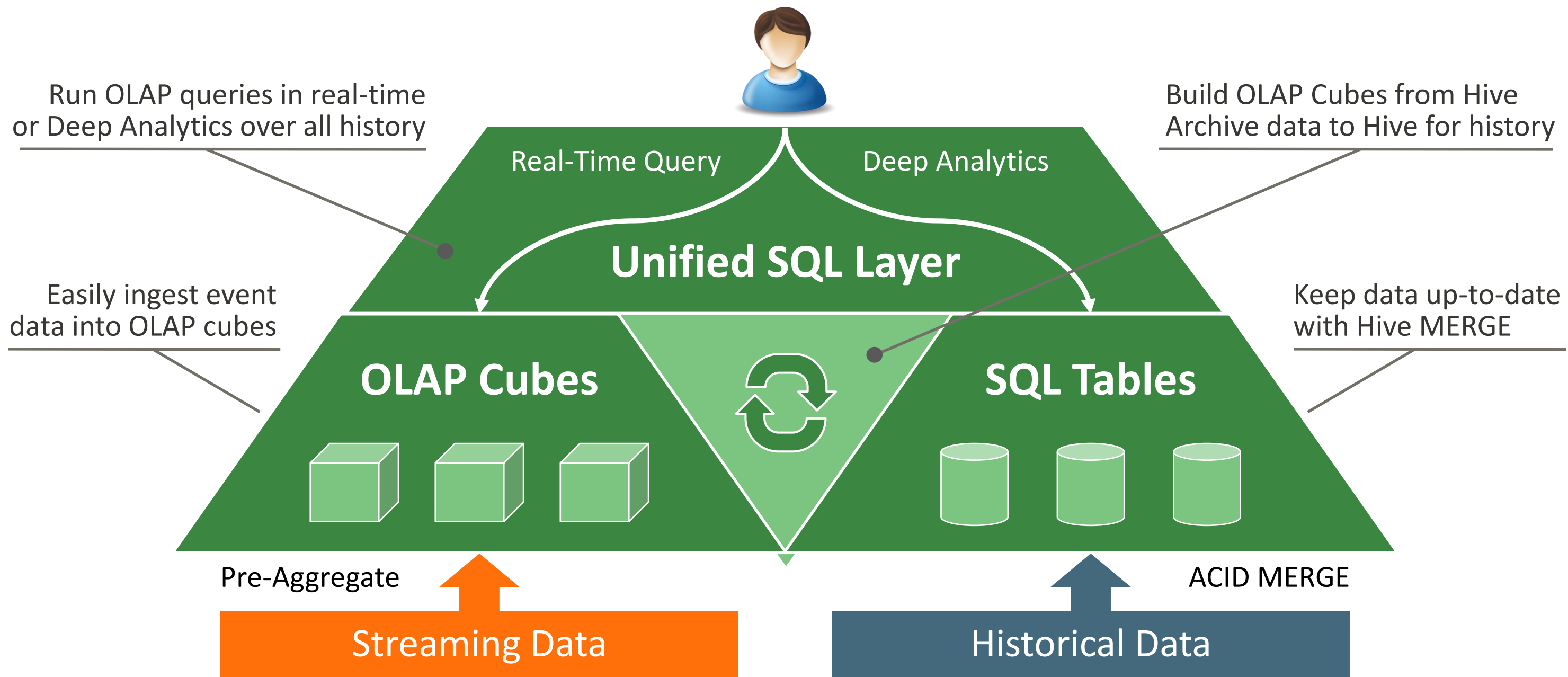


# Announcing: Druid is Now GA in HDP 2.6.3

- ✓ Analyze Streaming and Historical Data with SQL
- ✓ Powerful Visualization
- ✓ Simple management and monitoring with Ambari
- ✓ Fine-grained security
- ✓ Integrates with Hortonworks SAM for simple development.

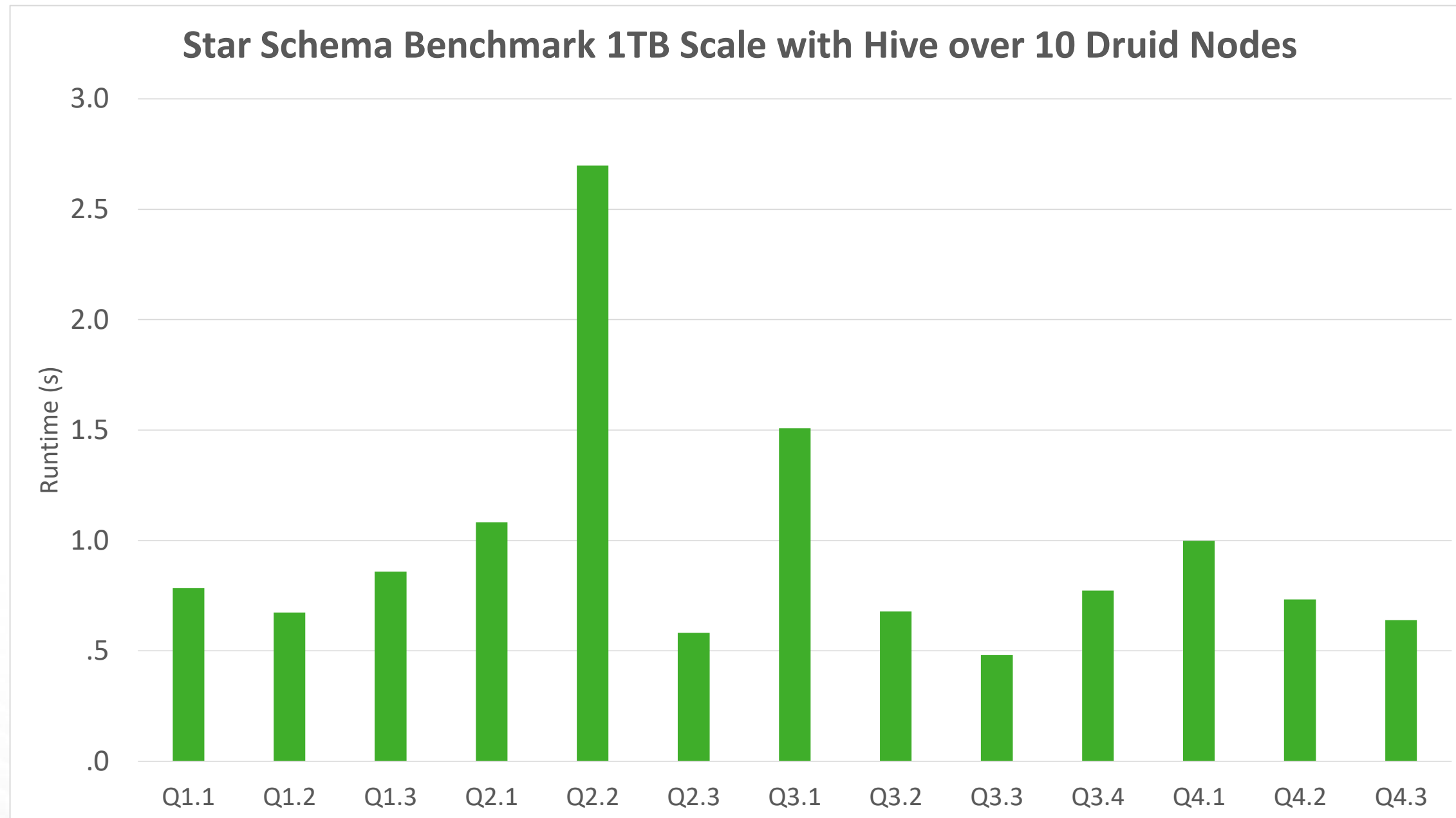
Note: Superset remains in Technical Preview in HDP 2.6.3

# Hive + Druid = Insight When You Need It





# OLAP Analytics in Milliseconds with Hive over Druid



# OLAP Analytics in Milliseconds with Hive over Druid

The screenshot displays the Domo interface for analyzing 'tpcds\_store\_sales\_sold...' data. The interface is divided into several sections:

- Left Sidebar:** Contains 'Dimensions' (Time, C City, C Nation, C Region, D Weeknuminyear, D Year, D Yearmonth, D Yearmonthnum, Lo Discount, Lo Quantity, P Brand1, P Category, P Mfgr, S City, S Nation, S Region, Measure Names) and 'Measures' (Discounted Price, Lo Revenue, Net Revenue, Latitude (generated), Longitude (generated), Number of Records, Measure Values).
- Columns:** Set to 'P Mfgr'.
- Rows:** Set to 'C City'.
- Table (Sheet 1):** Displays a grid of data with columns for C City, MFGR#1, MFGR#2, MFGR#3, MFGR#4, and MFGR#5. The data is grouped by C City (ALGERIA, ARGENTINA, BRAZIL).
- Right Sidebar:** Contains visualization options (Map, Bar, Line, Pie, etc.) and a section for 'symbol maps' with buttons for 'Dimension' and 'Measures'.

C City	MFGR#1	MFGR#2	MFGR#3	MFGR#4	MFGR#5
ALGERIA 0	36,582,330,368	35,935,735,808	37,442,236,416	36,759,834,624	36,060,016,640
ALGERIA 1	33,839,779,840	34,384,187,392	34,775,113,728	34,427,187,200	33,830,017,024
ALGERIA 2	36,029,472,768	36,345,294,848	35,936,518,144	35,789,303,808	35,417,128,960
ALGERIA 3	34,535,223,296	34,594,828,288	34,973,024,256	35,293,192,192	34,622,537,728
ALGERIA 4	33,262,698,496	33,173,129,216	33,924,915,200	33,239,597,056	33,496,127,488
ALGERIA 5	32,829,038,592	32,228,409,344	32,524,138,496	32,729,792,512	33,192,769,536
ALGERIA 6	32,138,606,592	31,944,652,800	31,794,976,768	31,183,060,992	31,971,774,464
ALGERIA 7	35,090,792,448	33,816,387,584	34,121,072,640	34,004,860,928	33,969,782,784
ALGERIA 8	34,651,770,880	34,413,797,376	34,026,190,848	34,351,736,832	34,856,583,168
ALGERIA 9	29,360,269,312	29,304,784,896	30,068,733,952	30,241,349,632	29,570,742,272
ARGENTINA0	33,948,067,840	34,220,302,336	34,167,302,144	33,589,409,792	33,530,499,072
ARGENTINA1	36,901,027,840	36,472,401,920	36,875,743,232	36,027,920,384	36,226,199,552
ARGENTINA2	33,853,542,400	34,201,411,584	33,838,196,736	33,884,393,472	33,490,642,944
ARGENTINA3	38,191,456,256	36,744,028,160	36,683,890,688	36,984,586,240	37,373,526,016
ARGENTINA4	36,311,388,160	36,588,908,544	36,961,607,680	36,513,943,552	35,523,317,760
ARGENTINA5	33,817,057,280	33,803,808,768	34,018,498,560	34,224,609,280	34,087,006,208
ARGENTINA6	35,652,763,648	34,920,136,704	35,401,211,904	35,209,965,568	36,025,733,120
ARGENTINA7	33,352,011,776	33,400,088,576	32,841,275,392	33,466,871,808	33,348,249,600
ARGENTINA8	29,275,078,656	28,464,879,616	29,054,812,160	28,754,841,600	29,358,651,392
ARGENTINA9	35,483,631,616	34,779,795,456	35,026,505,728	34,487,418,880	34,443,239,424
BRAZIL 0	26,796,023,808	27,104,827,392	26,745,077,760	26,858,899,456	26,519,859,200
BRAZIL 1	33,607,491,584	33,929,889,792	33,355,728,896	33,627,047,936	33,187,532,800
BRAZIL 2	34,217,852,928	34,114,772,992	34,083,676,160	34,675,277,824	35,114,680,320
BRAZIL 3	33,295,640,576	33,318,260,736	33,309,433,856	34,293,899,264	32,656,254,976
BRAZIL 4	33,354,082,304	33,622,761,472	33,115,633,664	33,102,680,064	33,670,782,976
BRAZIL 5	40,675,901,440	40,123,490,304	40,554,377,216	40,640,143,360	40,690,765,824
BRAZIL 6	31,602,323,456	31,849,109,504	32,463,755,264	31,463,909,376	31,919,474,688
BRAZIL 7	31,123,267,584	30,999,287,808	31,139,454,976	30,689,056,768	30,584,436,736
BRAZIL 8	34,284,582,912	34,622,738,432	34,555,355,136	34,276,005,888	34,850,725,888

# Agenda

## Scalable Data Warehousing on Hadoop

Overview

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Customer Use Cases

What's New



Roadmap

# Roadmap At A Glance

<div>Current</div> Scalable DW in Hadoop			
	HDP 2.6 (Current)	HDP 3.0 (Future)	Beyond HDP 3.0
Fast BI	<ul style="list-style-type: none"> <li>LLAP GA</li> <li>Vectorized Decimal</li> <li>SSD Cache</li> <li>Text / JSON Cache LLAP</li> <li>Tech Preview: Hive / Druid</li> </ul>	<ul style="list-style-type: none"> <li>Fine-grained Resource Management Policies</li> <li>View navigation for Druid tables</li> <li>Transparent Parquet cache</li> <li>Intermediate Results Spooling</li> </ul>	<ul style="list-style-type: none"> <li>Query Cache</li> <li>Admission Controls</li> </ul>
SQL / EDW	<ul style="list-style-type: none"> <li>ACID MERGE</li> <li>SQL: Cross Product, Multi Subquery, TPC-DS Complete</li> </ul>	<ul style="list-style-type: none"> <li>Tables default to ACID capable</li> <li>Column NOT NULL / Defaults</li> <li>Surrogate Key Generation</li> <li>Better Unicode support</li> </ul>	<ul style="list-style-type: none"> <li>Multi-Statement Transactions</li> <li>Improved HPL/SQL</li> </ul>
Cloud	<ul style="list-style-type: none"> <li>LLAP Template for Hortonworks Data Cloud</li> </ul>	<ul style="list-style-type: none"> <li>Replication / DR</li> </ul>	<ul style="list-style-type: none"> <li>Full ACID support for S3 / WASB</li> </ul>
Operations	<ul style="list-style-type: none"> <li>Hive View 2.0: Tools for DBAs</li> <li>Tez UI: Hive Power Tools</li> </ul>	<ul style="list-style-type: none"> <li>Hive Studio: Single pane of glass for Hive development and debugging</li> </ul>	<ul style="list-style-type: none"> <li>Usage Reports</li> <li>Schema Recommendations</li> </ul>

Note: Roadmap is forward-looking and subject to change without notice.