DTCC

2015中国数据库技术大会

DATABASE TECHNOLOGY CONFERENCE CHINA 2015

大数据技术探索和价值发现

HAWQ

MPP SQL for HDFS of Hadoop

基于Hadoop原生HDFS的大规模并行SQL

HAWQ Is The…

Enterprise platform that provides the fewest barriers, lowest risk, most cost effective and fastest way to enter in to big data analytics on HDFS of Hadoop

HAWQ 简述

- Multi-User Platform
  - Resource Queues
  - Concurrency
  - Data Encryption
  - Role-Based Security
- ANSI SQL 2003/2011 Support
- SQL Engine
  - Cost-Based Query Optimization
    - CPU
    - Mem
    - Disk
    - Users
  - Robust Query Optimizer
  - Complex Data Management
    - Sub-Partitioning
    - Distributions
    - Partitioning

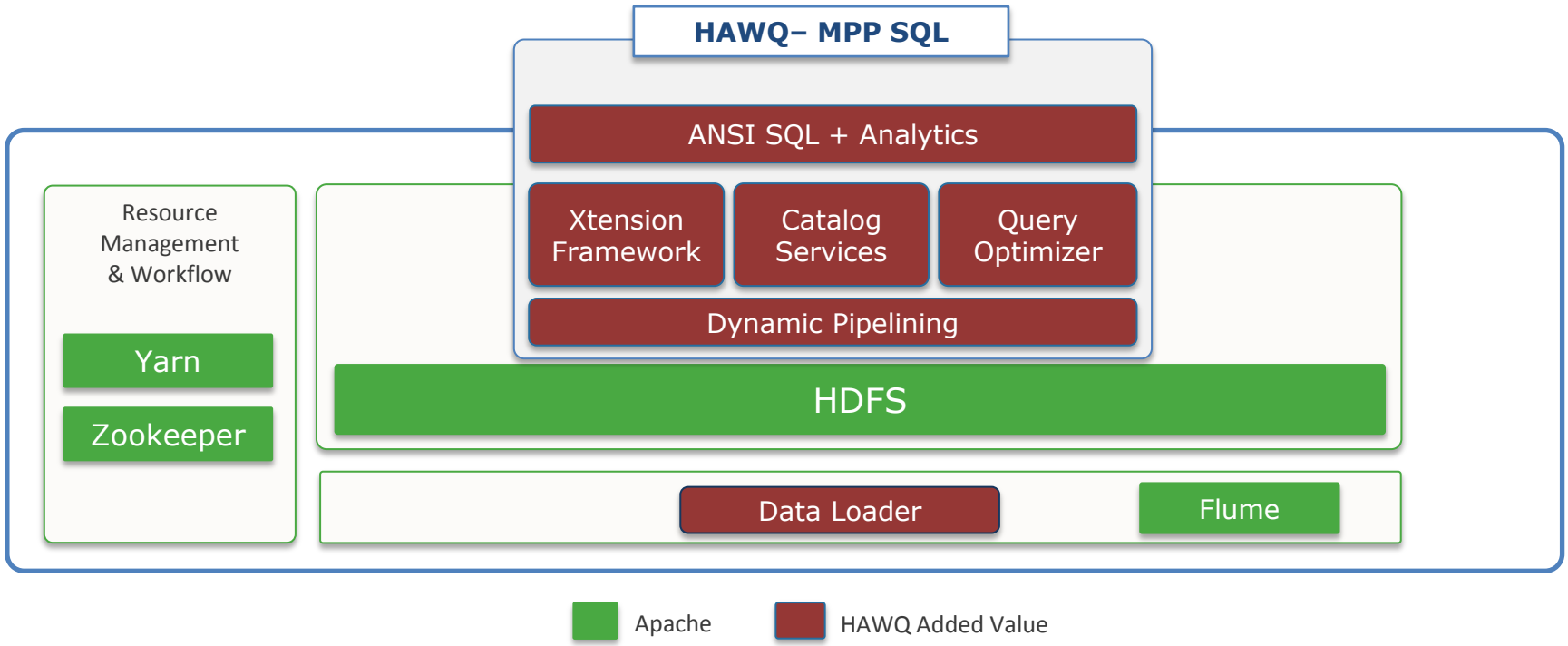
Greenplum database re-platformed on Hadoop/HDFS

- Accessibility
  - ODBC/JDBC Driver L3,4
  - Parallel Loading/Unloading
  - HDFS Native Formats
    - txt
    - Avro
    - Seq
    - HBase
    - Hive
  - Extendable…
- Storage Options
  - Polymorphic Storage
  - Row/Columnar Storage
  - Built-in Compression
  - HDFS Native Formats
  - MapReduce Integration

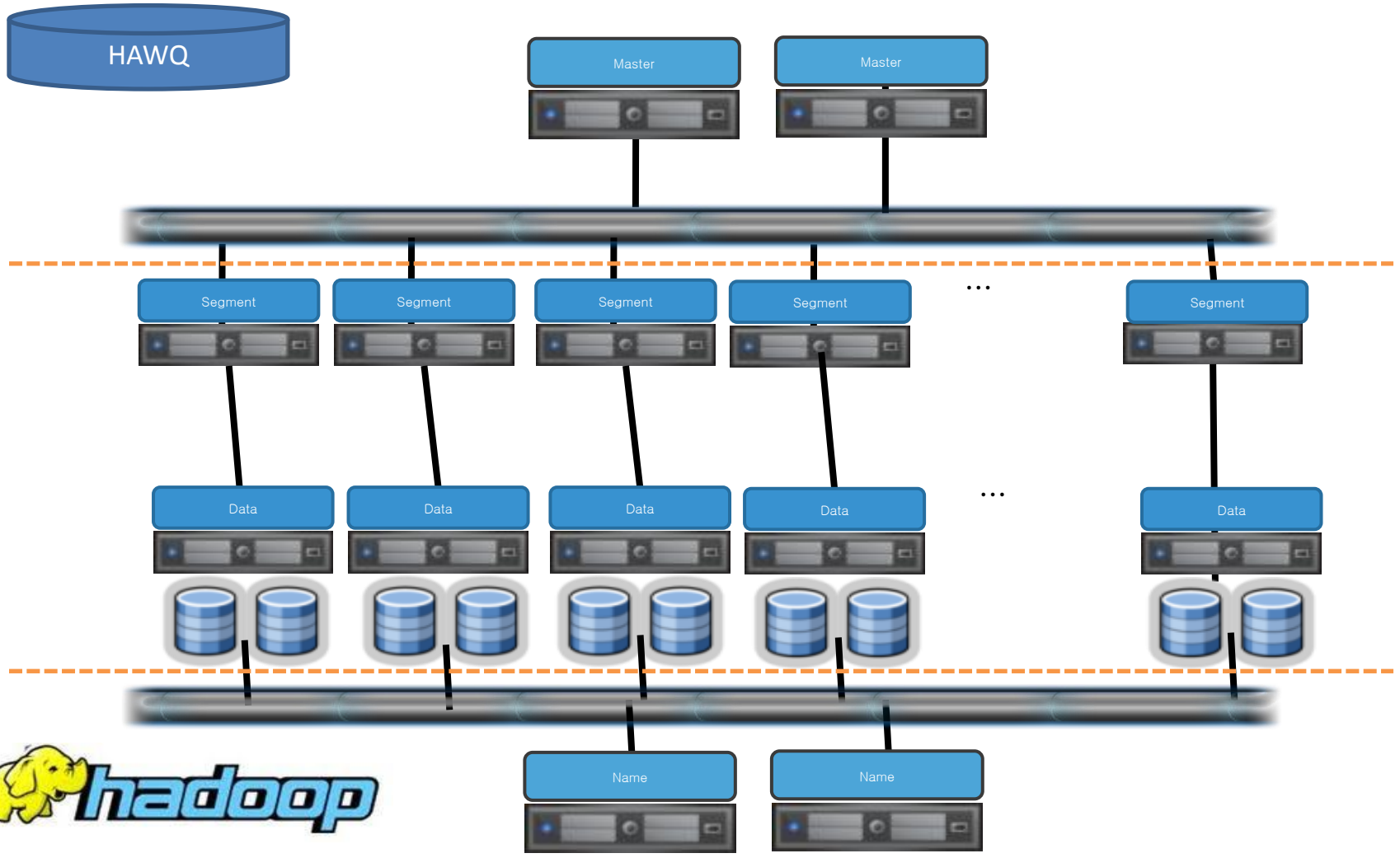
HAWQ的优点...

- 支持Apache Hadoop原生HDFS的SQL大规模并行引擎（MPP SQL）
- GPFX External Tables 接口，使用SQL透明访问Hadoop上各类数据
  - HDFS, HBase, Hive，Parquet格式等等
- 还支持SQL透明访问NFS，HTTP其他格式的数据（可自定义）
- Performance and Scalability
  - Parallel Everything
  - Dynamic Pipelining
  - High Speed Interconnect（基于UDP）
  - HDFS access with C++ libhdfs3
  - Co-Located Joins & Data Locality
  - Partition Elimination（支持静态动态表分区）
  - Higher Cluster Utilization
  - Concurrency Control（资源作业优先级调度）

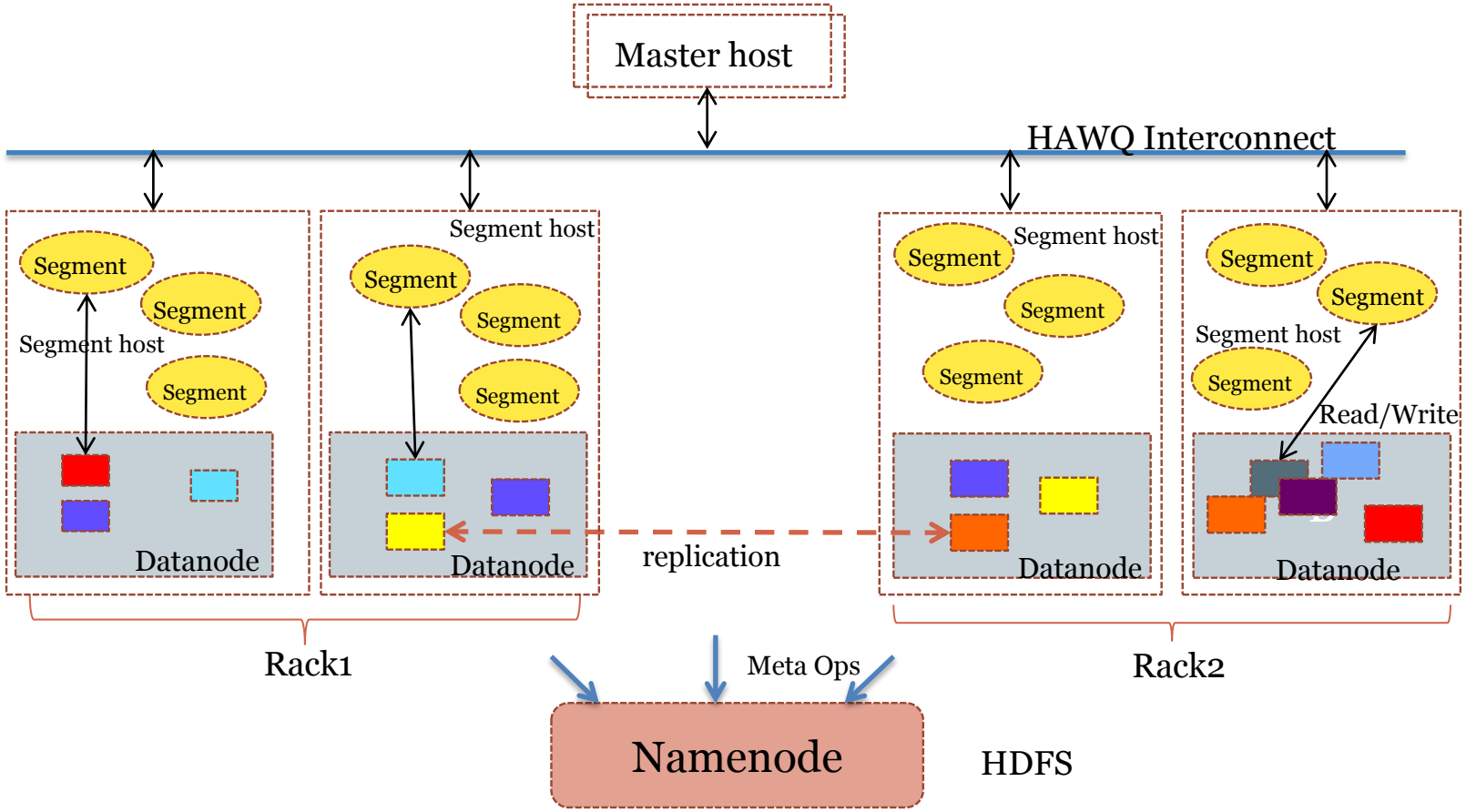
HAWQ 及Hadoop软件栈



HAWQ 与 Hadoop HDFS



HAWQ 与 Hadoop HDFS数据访问流

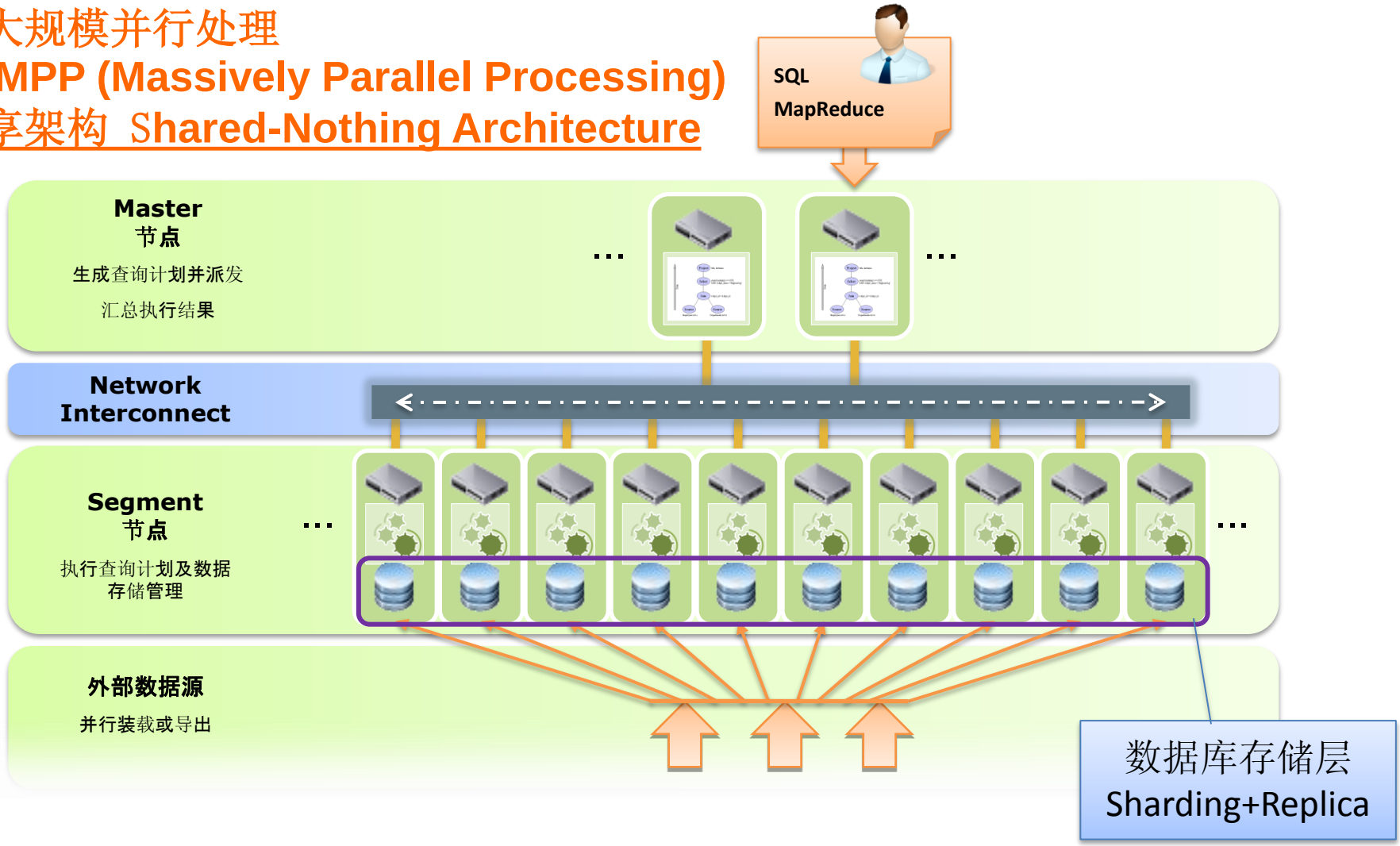


HAWQ 对比 Greenplum DB 基本架构

SQL 大规模并行处理

SQL MPP (Massively Parallel Processing)

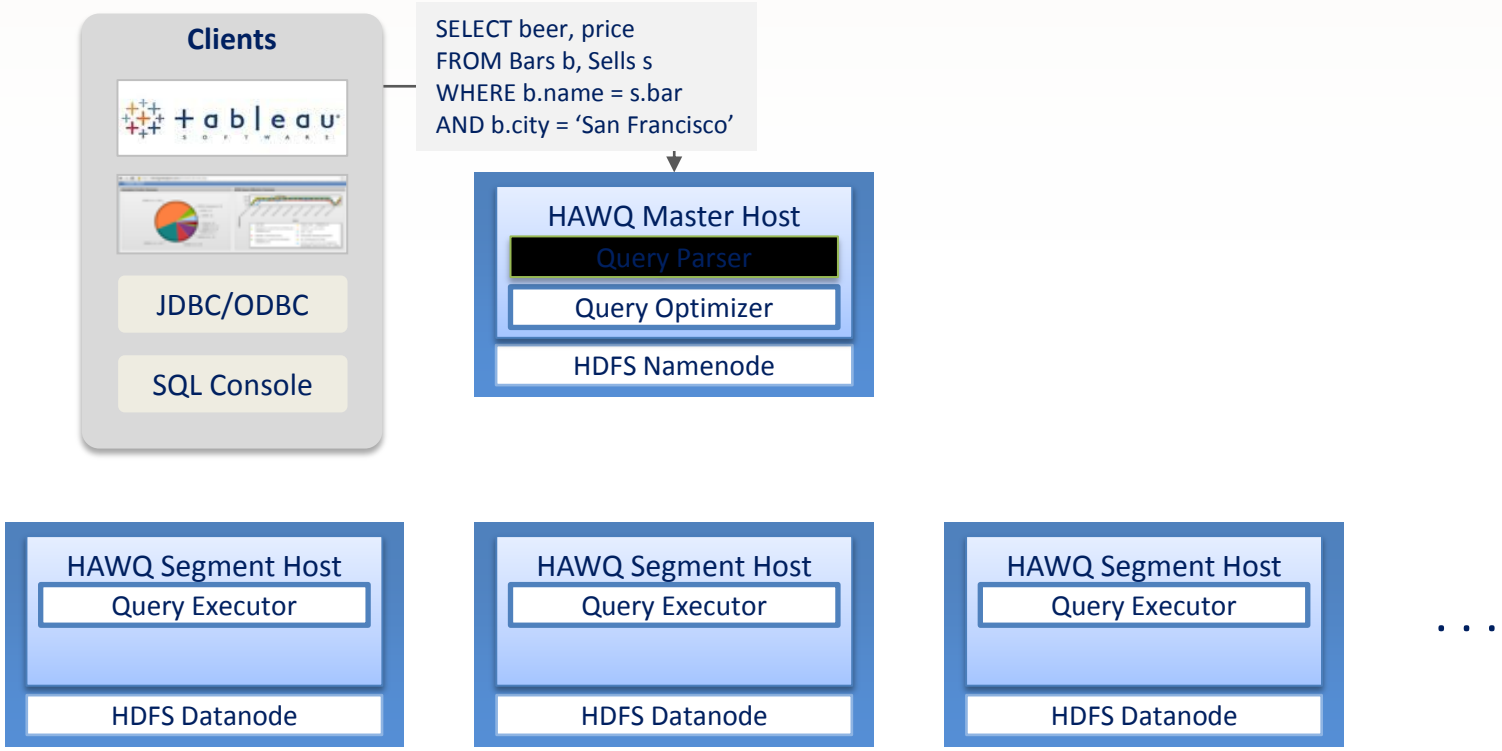
无共享架构 Shared-Nothing Architecture



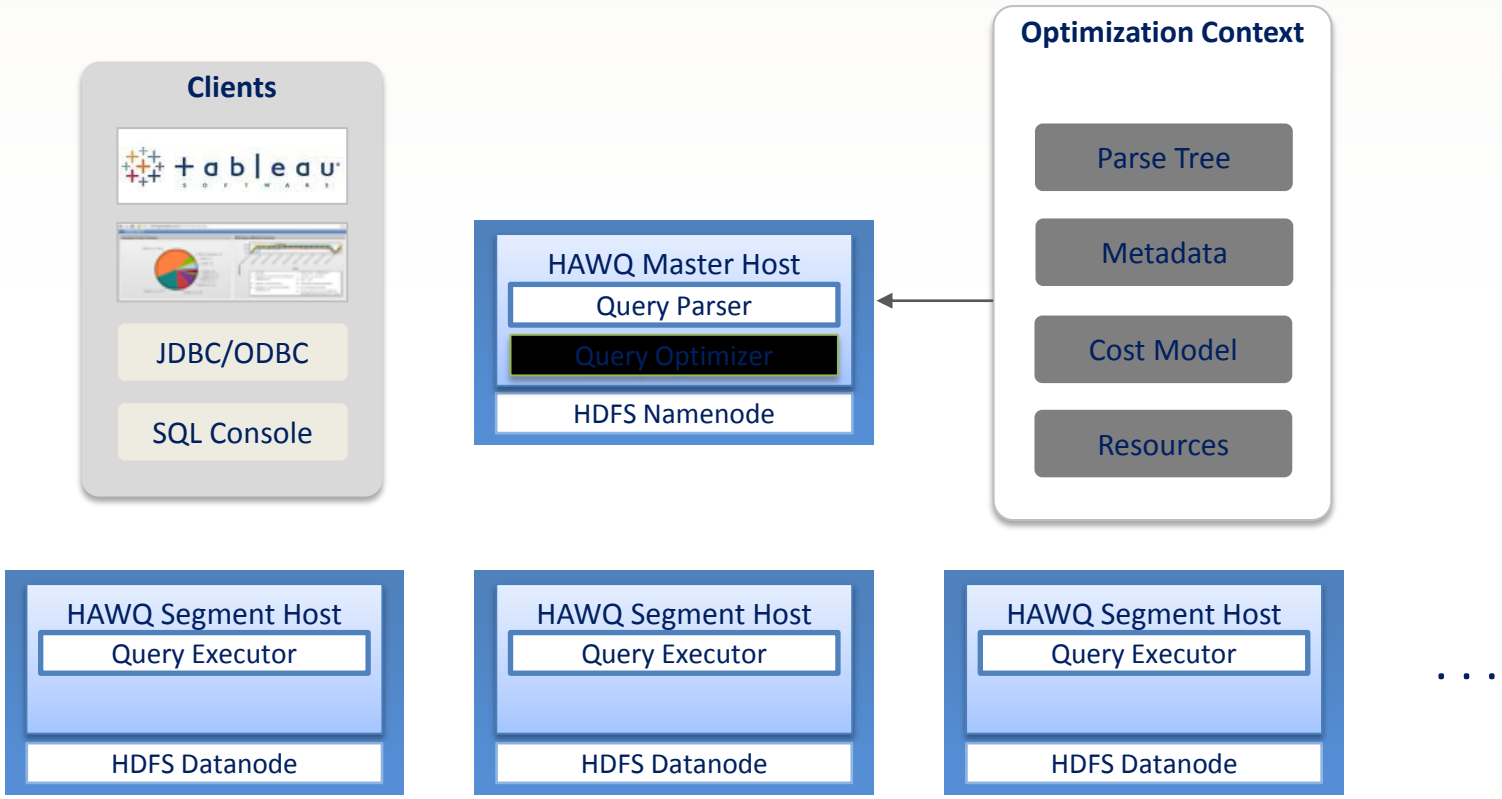
运行SQL，支持SQL2008及OLAP选项

```
-- Top 10 products for each category for all time
SELECT lineitems.product_id
,      products_dim.product_name
,      product_category_id
,      category_name
,      product_count
,      category_rank
FROM (SELECT product_id, product_category_id
      ,      SUM(item_quantity) AS product_count
      ,      row_number() OVER (PARTITION BY product_category_id ORDER BY SUM(item_quantity) DESC) AS category_rank
      FROM   retail_demo.order_lineitems
      GROUP BY product_id, product_category_id
     ) AS lineitems
INNER JOIN retail_demo.categories_dim on product_category_id = category_id
INNER JOIN retail_demo.products_dim on lineitems.product_id = products_dim.product_id
WHERE category_rank <= 10
ORDER BY product_category_id, category_rank
limit 100;
```

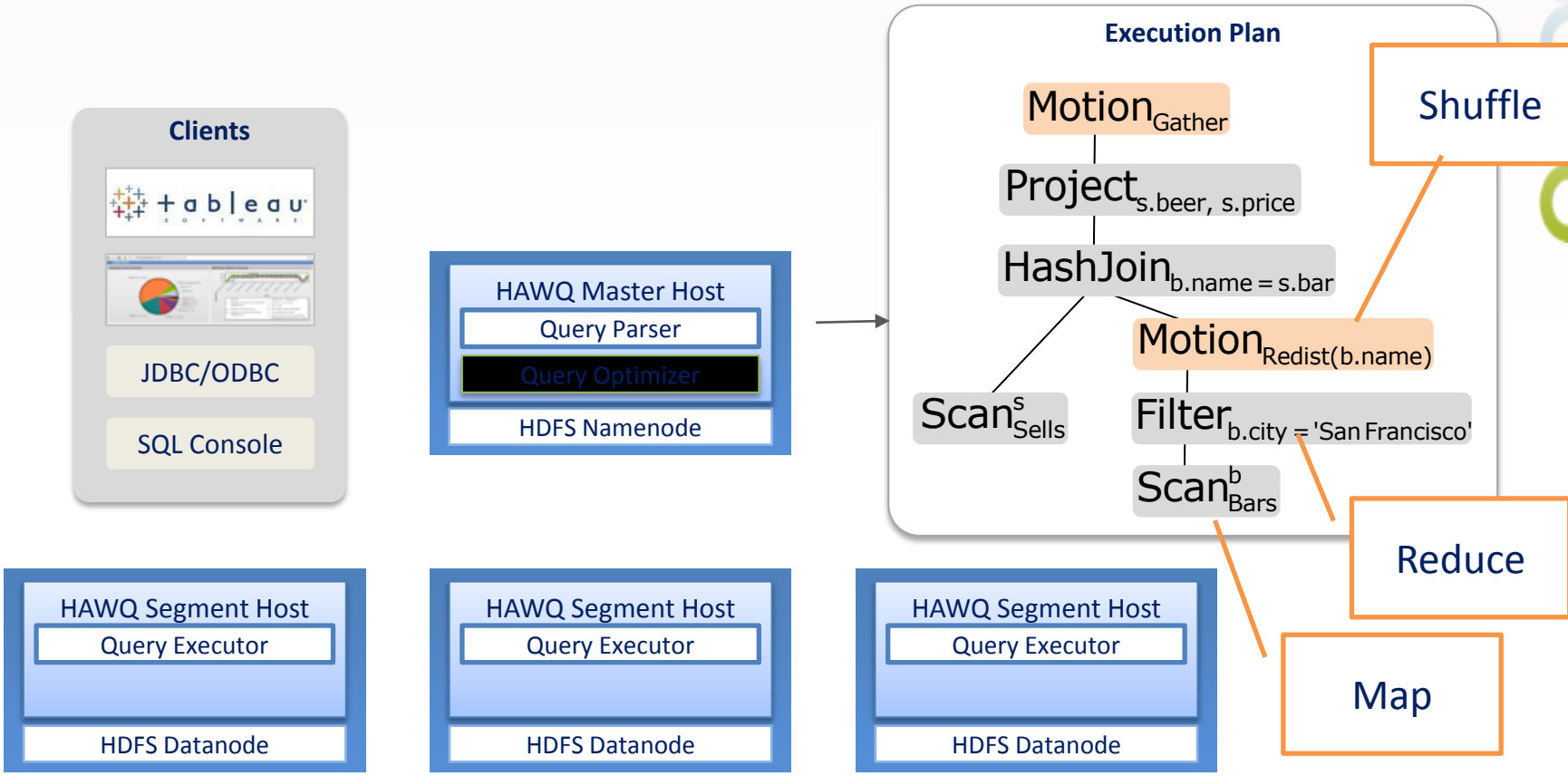
HAWQ（SQL MPP）机制-1



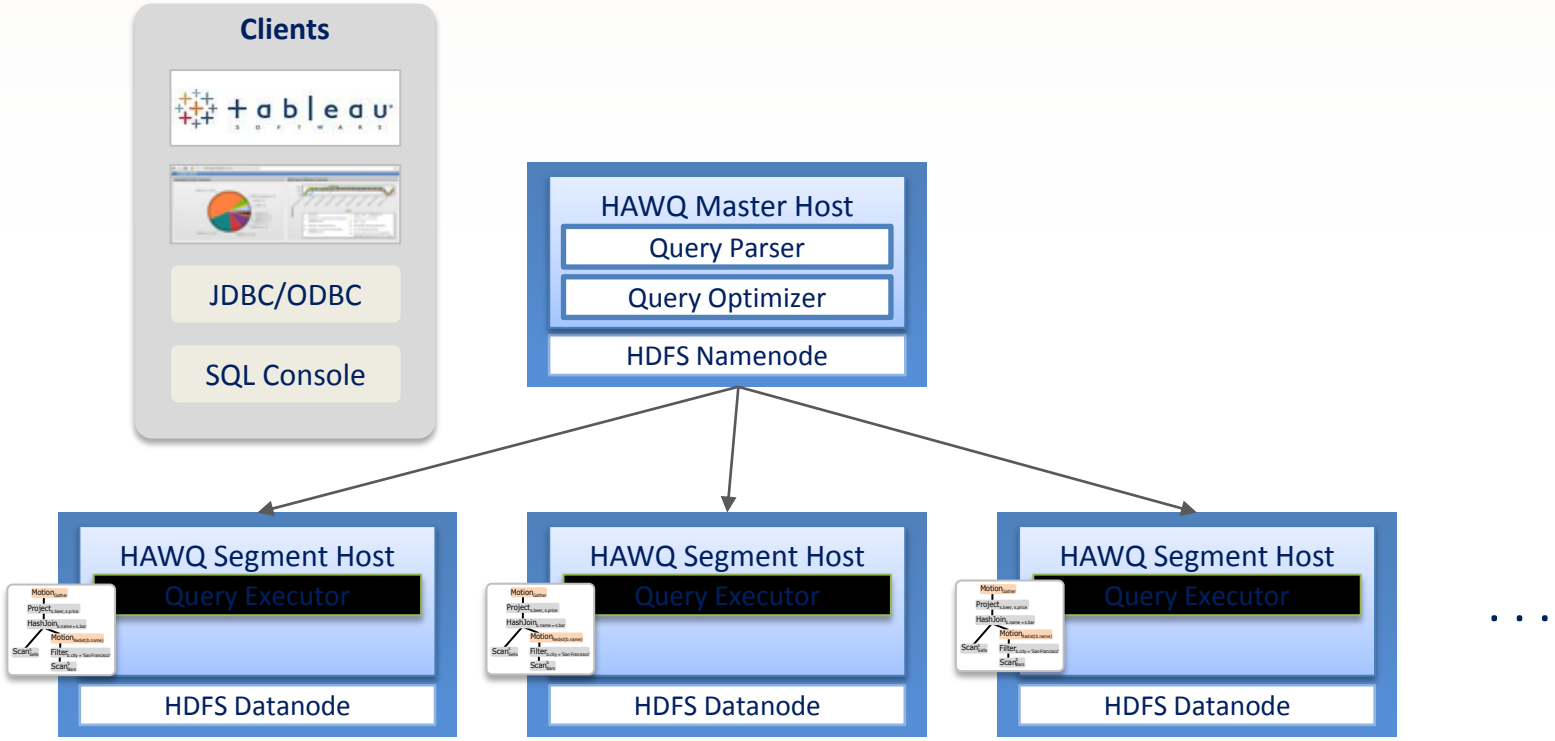
HAWQ（SQL MPP）机制-2



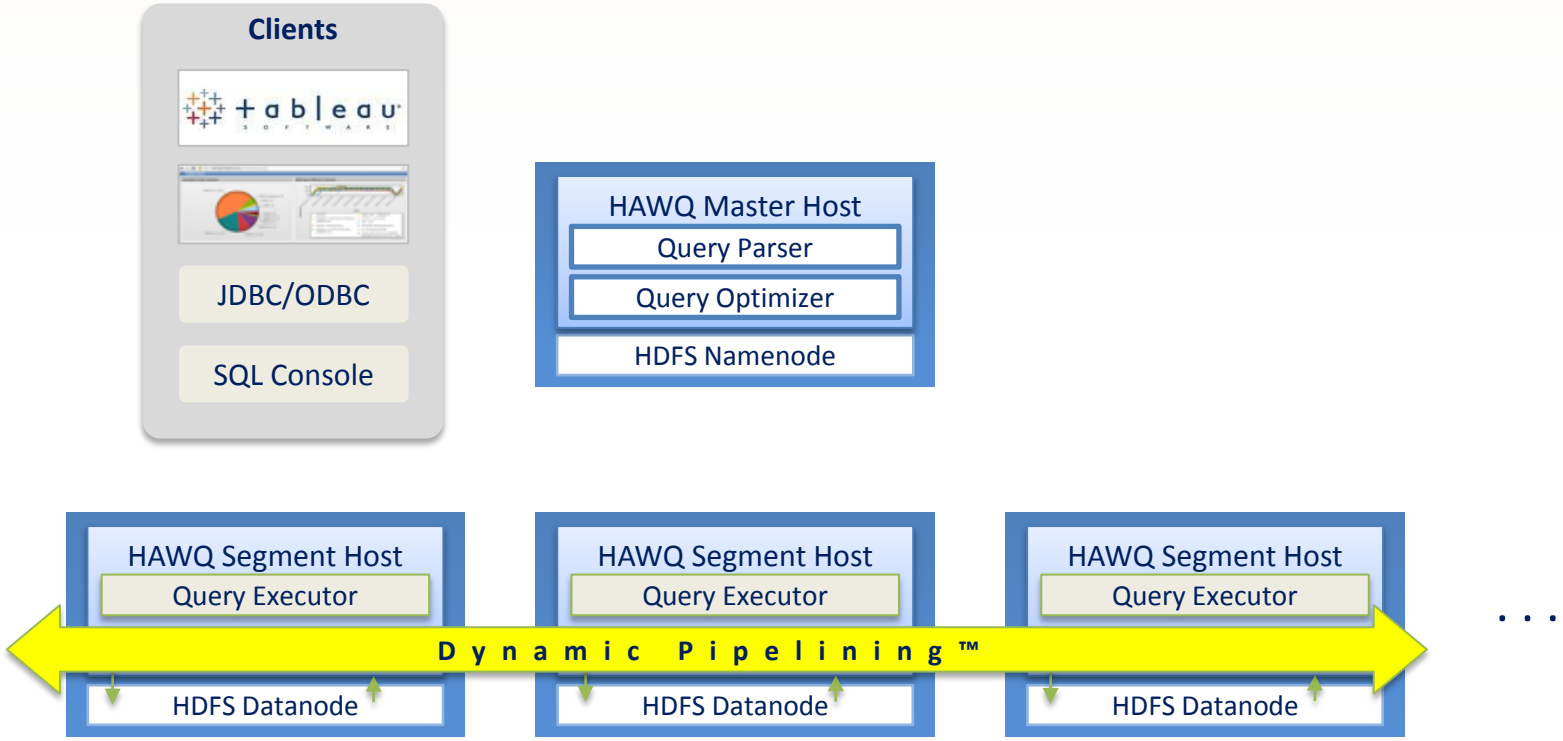
HAWQ（SQL MPP）机制-3



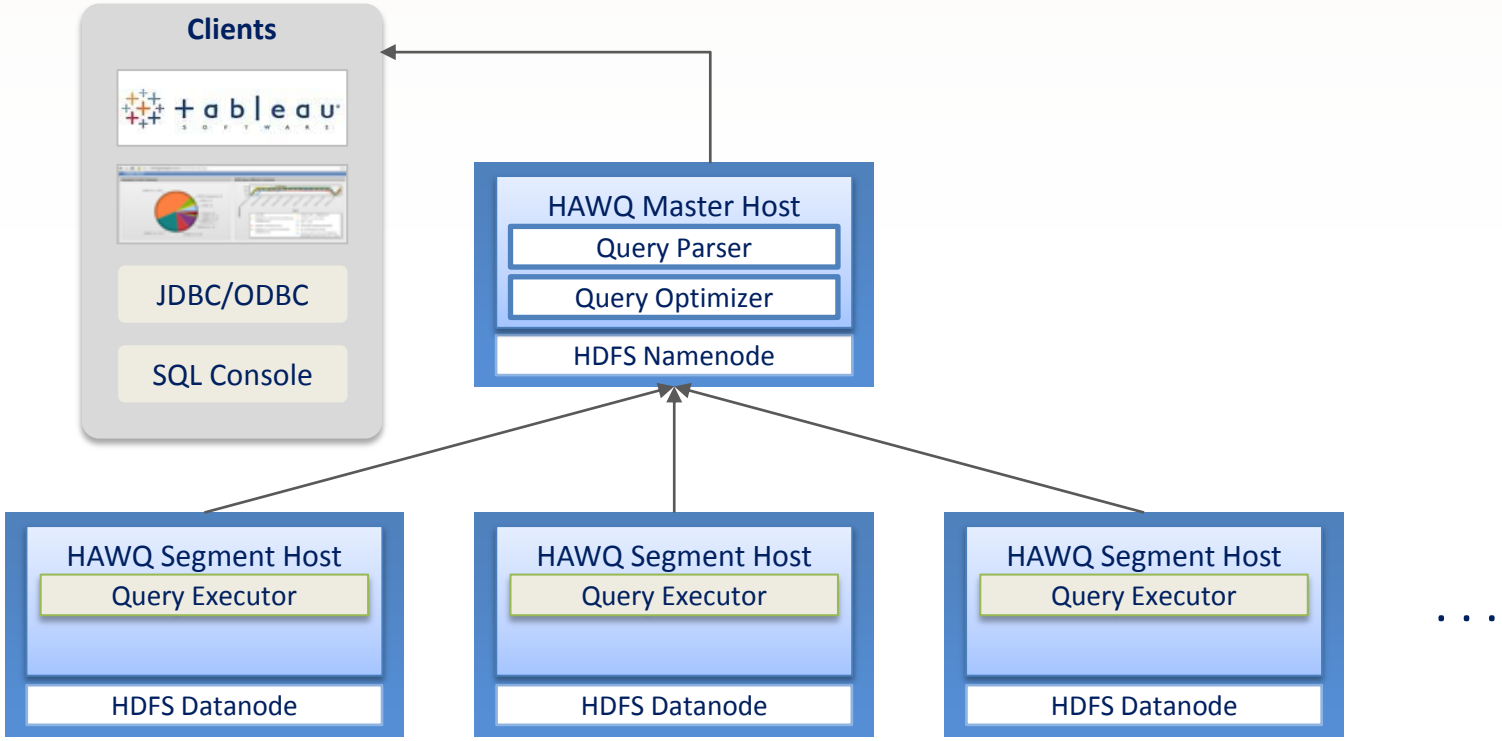
HAWQ（SQL MPP）机制-4



HAWQ（SQL MPP）机制-5



HAWQ（SQL MPP）机制-6

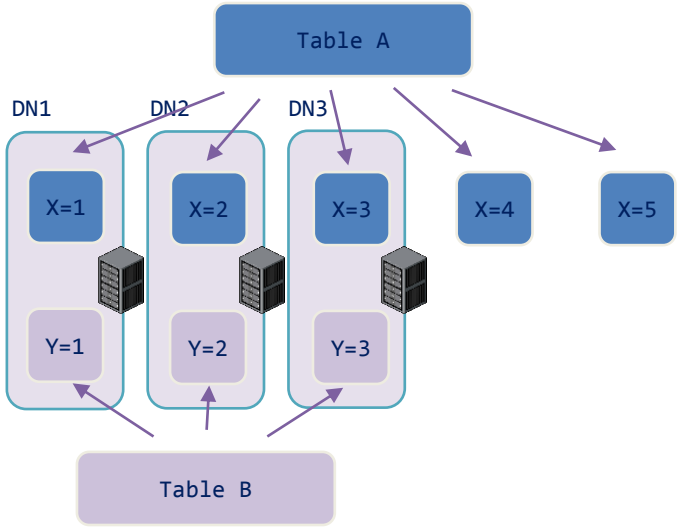


数据分布方式(Data Distribution)

- Data can be distributed based on a column or a composite of columns
- Tables distributed similarly are co-located
- Distribution scheme modifiable thru alter table

Advantages:

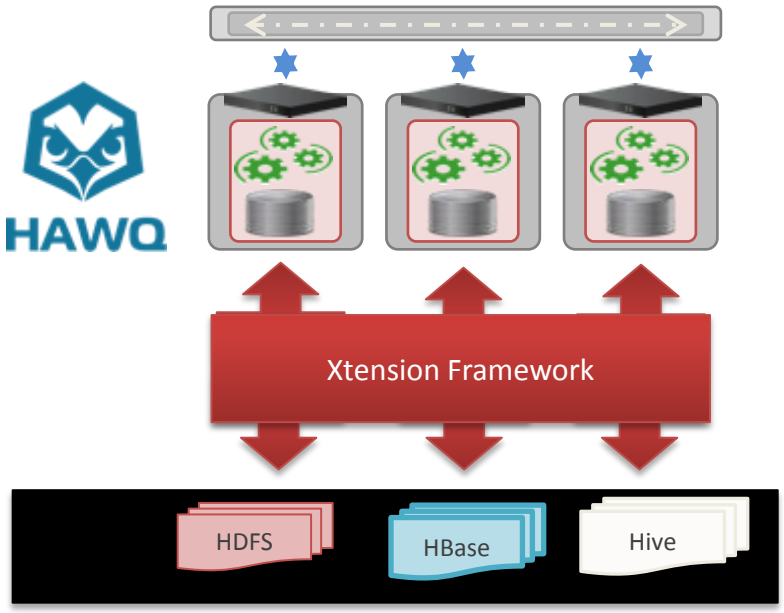
- Co-located joins
- No data movement on joins or aggregates
- Improved performance on complex queries
- Query engine optimization




```
SELECT X FROM A,B WHERE A.X = B.Y

SELECT SUM(X) FROM A GROUP BY A.X
```

数据互联框架(Xtension Framework)



- An advanced version of Greenplum DB external tables
- Enables combining HAWQ data and Hadoop data in single query
- Supports connectors for HDFS, Hbase and Hive
- Provides extensible framework API to enable custom connector development for other data sources

数据导入导出(Loading/Unloading Data)

gpload, gpfdist, External Tables

- Flat Files, CSV, Delimited, …
- Existing RDBMS Systems
- Web Tables, JSON, XML, HTML, …
- Executing Scripts, …

PXF {Native Hadoop Files}

- HDFS Flat Files, CSV, Delimited, …
- Hive
- HBase {w. predicate push-down}
- Avro, RCFile, SeqFile
- Open extendable API
- Available on Github: Accumulo, JSON,…

Spring XD

- Java Development Framework

DataLoader

- File Farms
- Streaming || Batch Mode
- Flume, … integration
- Throttling, Compression, … features

Traditional Tools

- Postgres insert, copy, …
- ODBC + JDBC drivers
- Pivotal Data Dispatch {PDD}
- Integration with ETL tools…

HAWQ 里数据导入导出仍是全并行

HAWQ External Tables

gpload, gpfdist, External Tables

Flat Files, CSV, Delimited, …

Existing RDBMS Systems

Web Tables, JSON, XML, HTML, …

Executing Scripts, …

HAWQ and Hadoop Native File Formats

PXF {Pivotal eXtention Framework}

HDFS Flat Files, CSV, Delimited, …

Hive

HBase {predicate push-down}

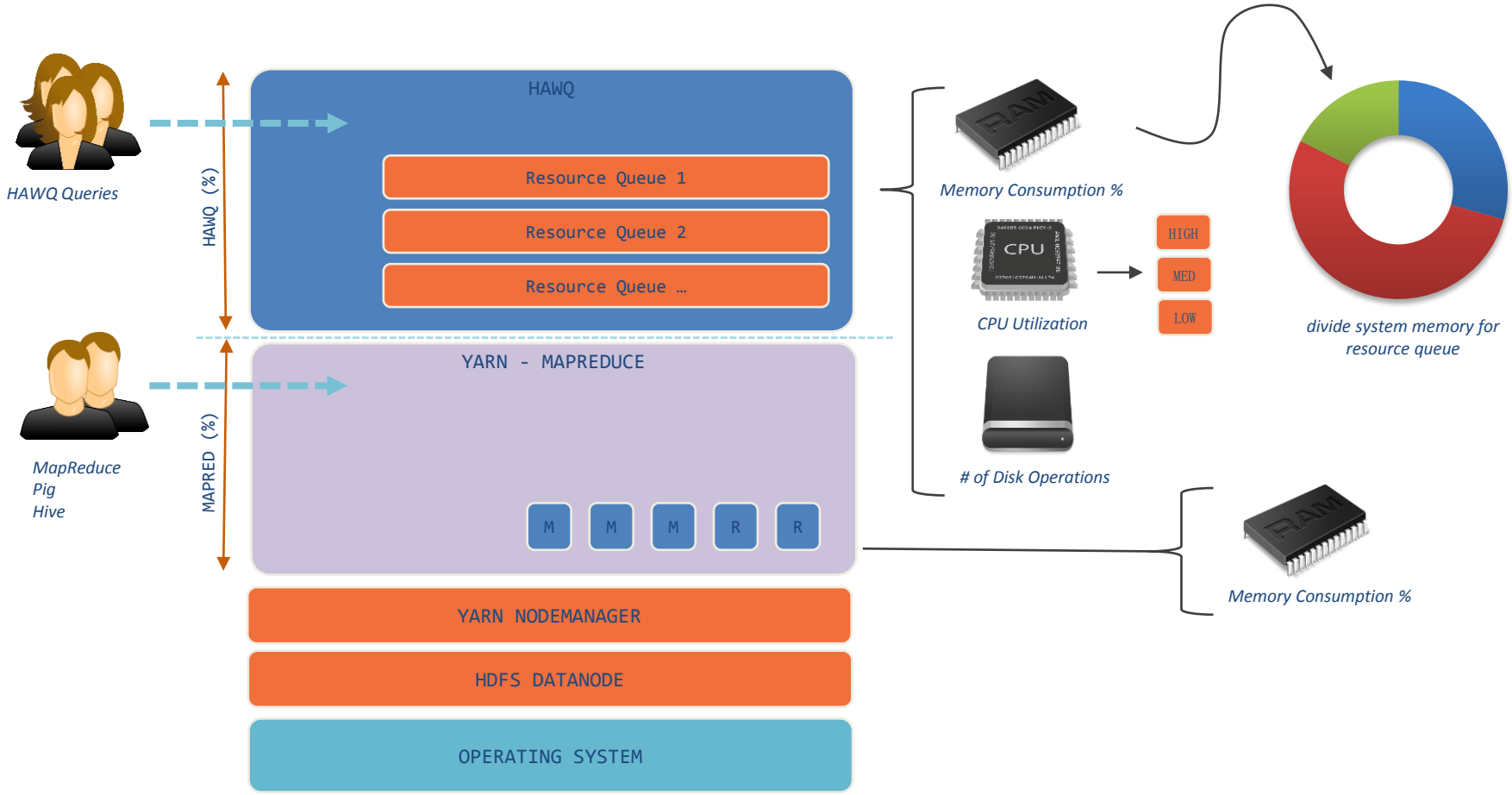
Avro, RCFile, SeqFile

Open extendable API

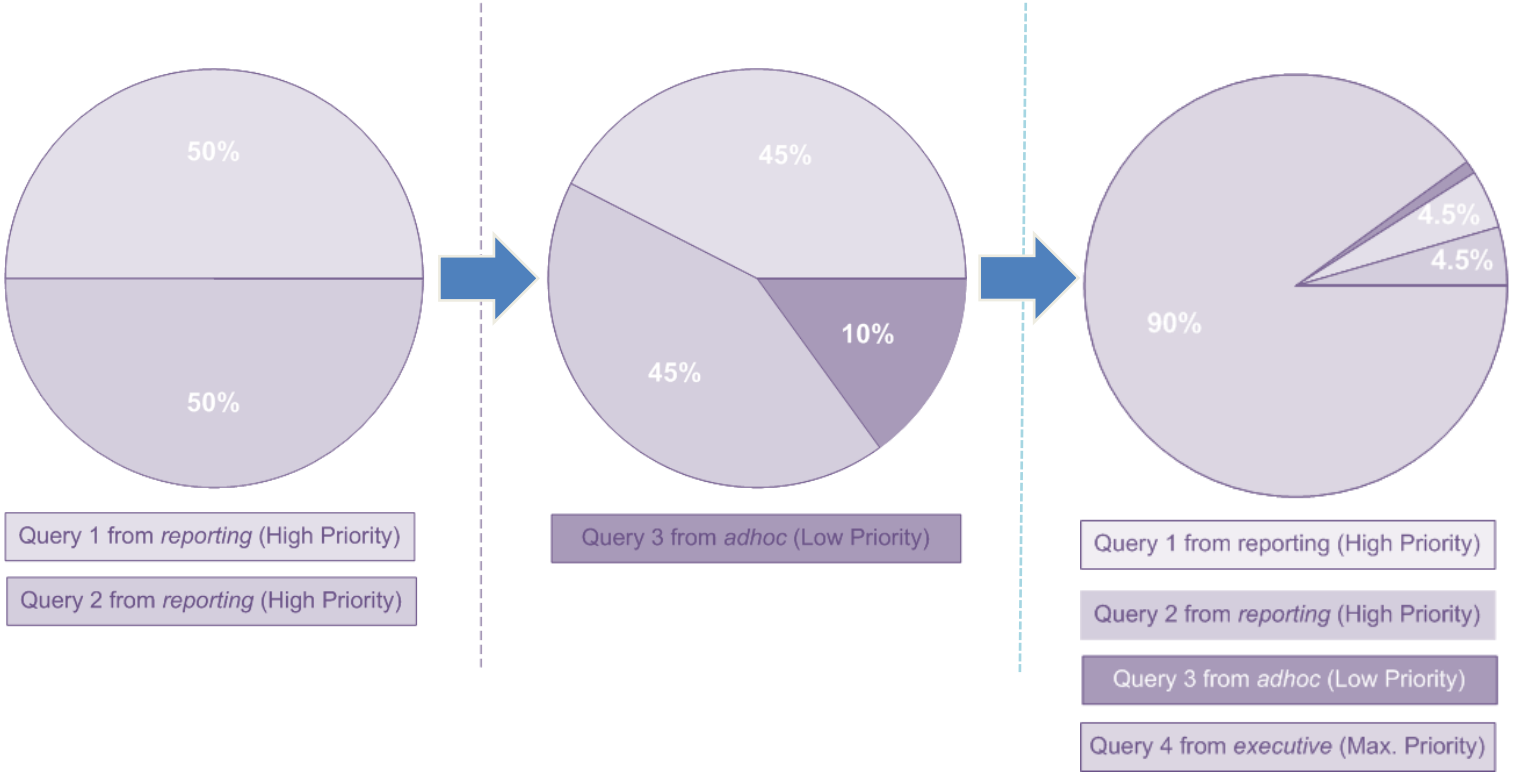
Available on Github: Accumulo, JSON,…

Read/Write

更强大的资源管理器,兼容YARN



运行时资源可控
(Dynamic Resources Allocation)



SQL for Hadoop功能对比

Feature	Hive	Impala	HAWQ
Work with HDFS native file formats	✓	✓	✓
Polymorphic Storage	✓	✓	✓
Advance SQL (ANSI SQL2008 & OLAP support)	✖	✖	✓
Partitions and compression	✓	✓	✓
Data Locality	✓	✓	✓
Distributions, Join, Aggregate Locality	✖	✖	✓
Join Optimization	✖	✖	✓
Spill to disk (query must fit in memory)	✓	✖	✓
Fault tolerance during large query execution	✓	✖	✖
Granular Security and authentication	✖	✓	✓
Extendable (Serdes)	✓	✖	✓
Resource Management	✖	✖	✓
Open-source code	✓	✓	✓

HAWQ 性能对比-1

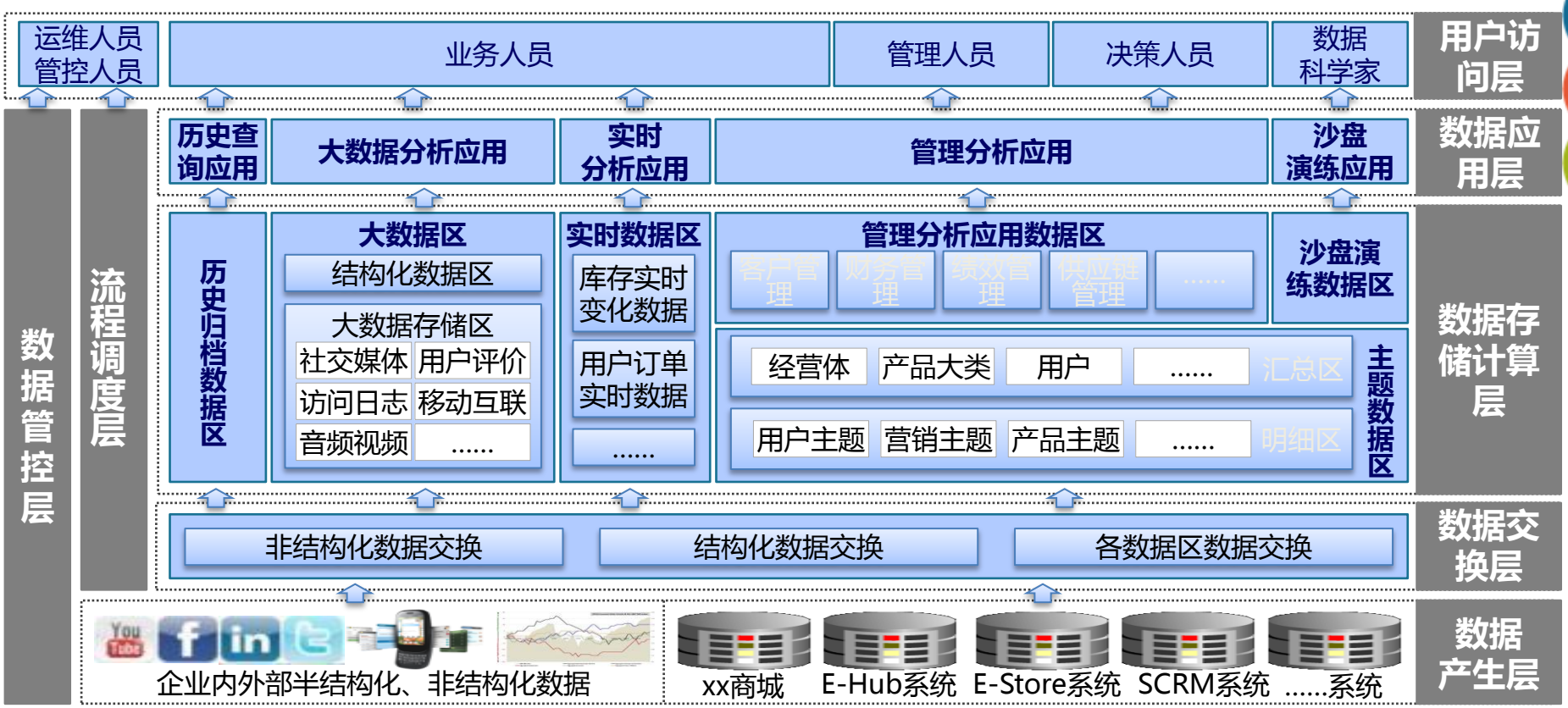
	HAWQ	POWERED BY cloudera IMPALA	
User intelligence	4.2	37	9X
Sales analysis	8.7	596	69X
Click analysis	2.0	50	25X
Data exploration	2.7	55	20X
BI drill down	2.8	59	21X

HAW性能对比-2

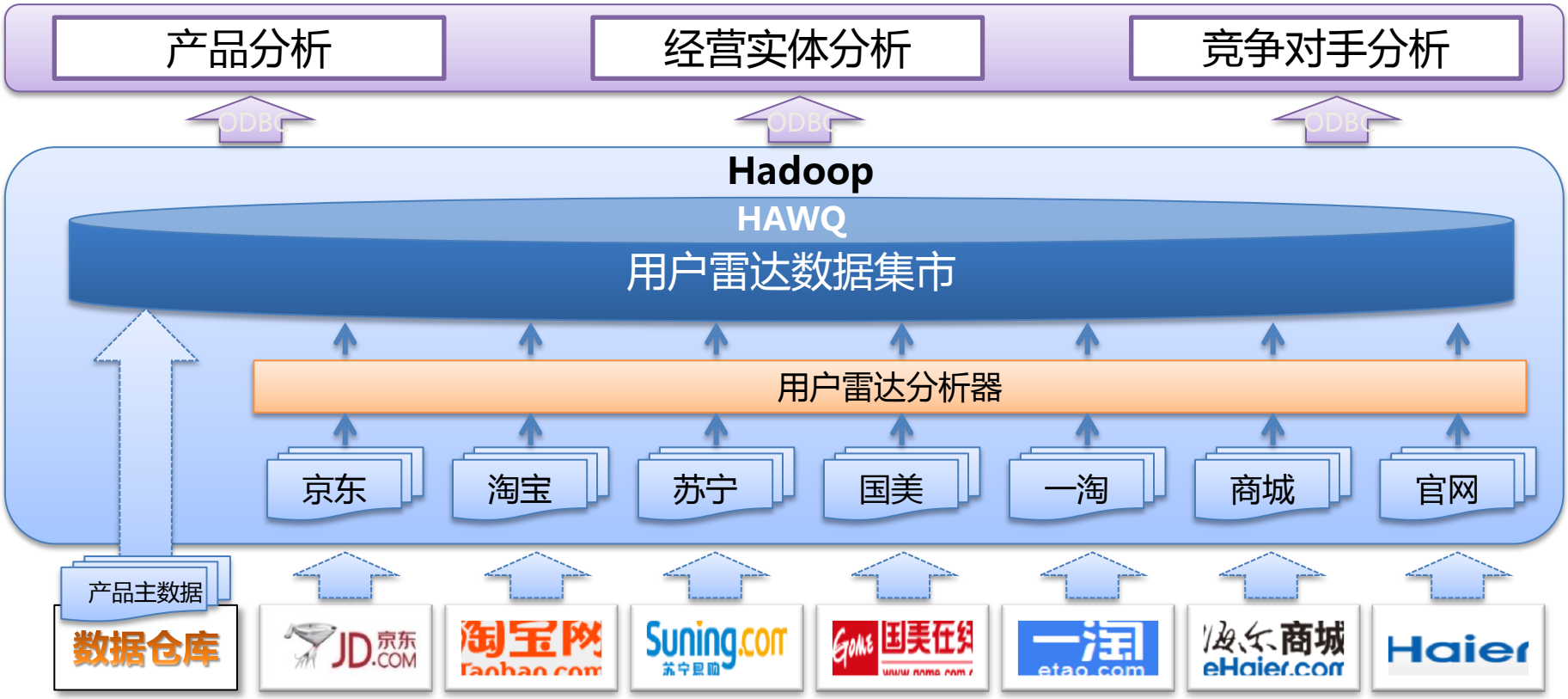
	HAWQ	HIVE	
User intelligence	4.2	198	47X
Sales analysis	8.7	161	19X
Click analysis	2.0	415	208X
Data exploration	2.7	1,285	476X
BI drill down	2.8	1,815	648X

部分应用案例

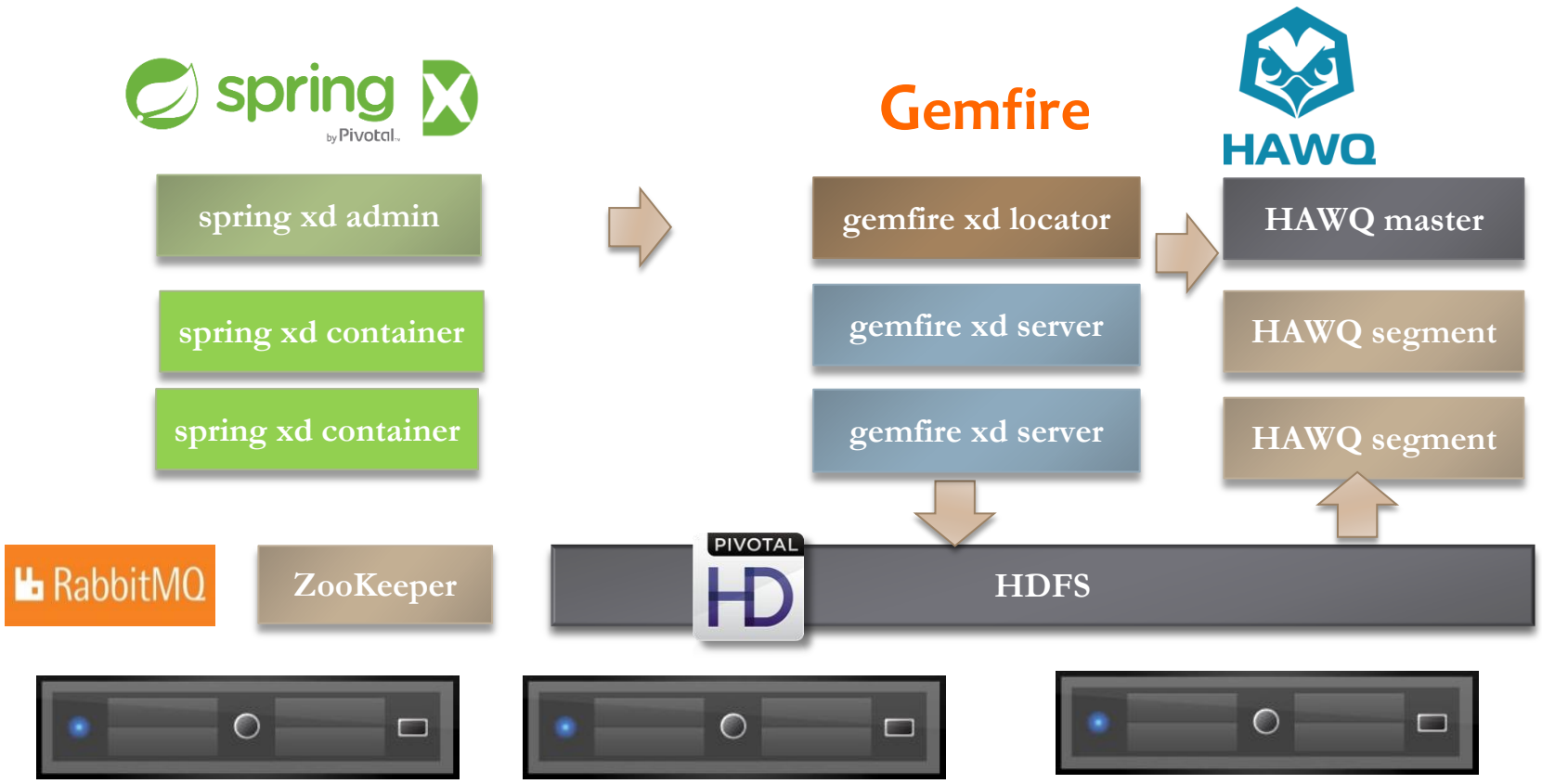
某企业解决方案


运维人员
管控人员
业务人员
管理人员
决策人员
数据
科学家
用户访问层
数据管控层
流程调度层
历史查询应用
大数据分析应用
实时分析应用
管理分析应用
沙盘演练应用
数据应用层
历史归档数据区
大数据区
结构化数据区
大数据存储区
社交媒体
用户评价
访问日志
移动互联
音频视频
.....
实时数据区
库存实时变化数据
用户订单实时数据
.....
管理分析应用数据区
客户管理
财务管理
绩效管理
供应链管理
.....
沙盘演练数据区
经营体
产品大类
用户
.....
汇总区
用户主题
营销主题
产品主题
.....
明细区
主题数据区
数据存储计算层
非结构化数据交换
结构化数据交换
各数据区数据交换
数据交换层
企业内外部半结构化、非结构化数据
xx商城
E-Hub系统
E-Store系统
SCRM系统
.....系统
数据产生层

大数据分析应用：用户雷达



方案架构图


spring
by Pivotal
spring xd admin
spring xd container
spring xd container
Gemfire
gemfire xd locator
gemfire xd server
gemfire xd server
HAWQ
HAWQ master
HAWQ segment
HAWQ segment
RabbitMQ
ZooKeeper
PIVOTAL
HD
HDFS

ChinaUnix
ITPUB
THANKS