Apache Kylin on HBase

Extreme OLAP Engine for Big Data

Shaofeng Shi | 史少锋

Apache Kylin Committer & PMC

August 17, 2018

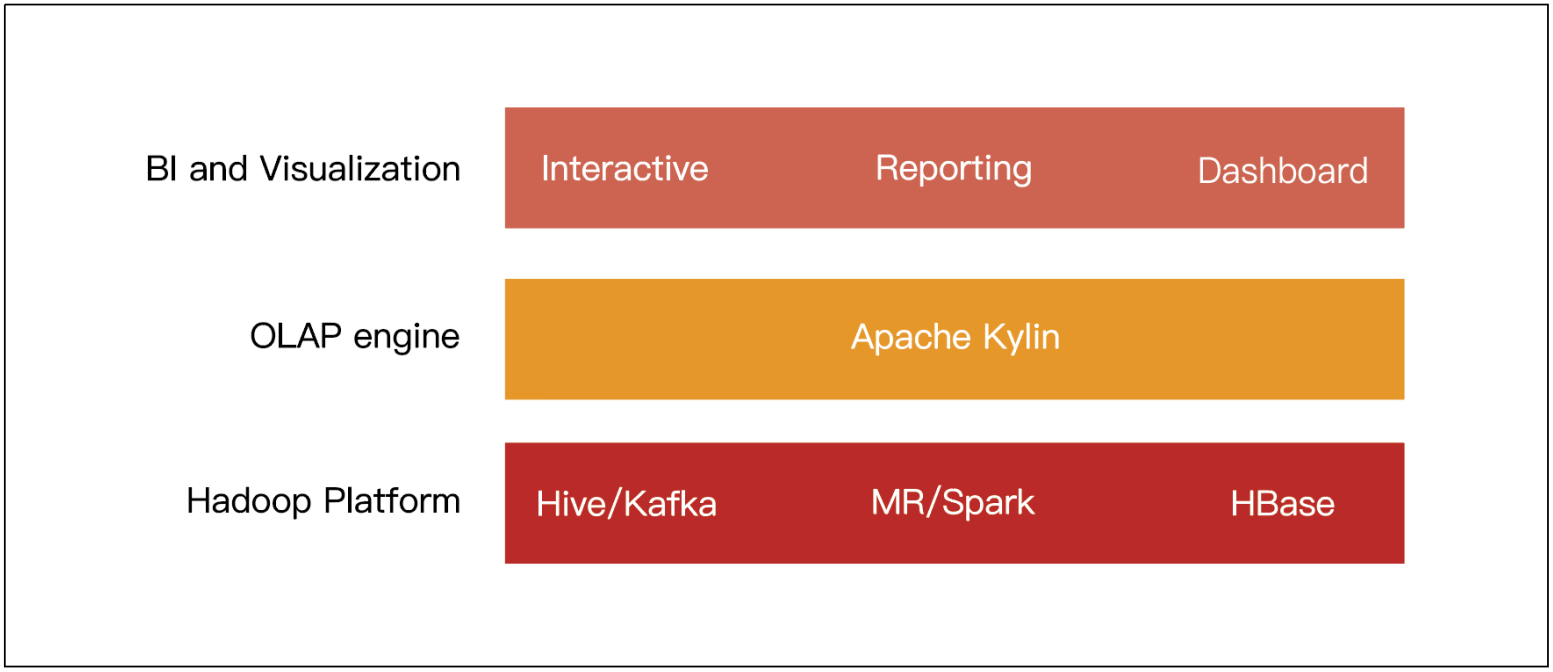
Content

01 What is Apache Kylin

What is Apache Kylin

OLAP engine for Big Data

Apache Kylin is an extreme fast OLAP engine for big data.



What is Apache Kylin

Key characters

Real Interactive

Trillion rows data, 99% queries < 1.3 seconds, from Meituan.com

ANSI-SQL

SQL on Hadoop, supports most ANSI SQL query functions

Hadoop Native

Compute and store data with MapReduce/Spark/HBase, fully scalable architecture;

Ease of Use

No programing; User-friendly Web GUI;

MOLAP Cube

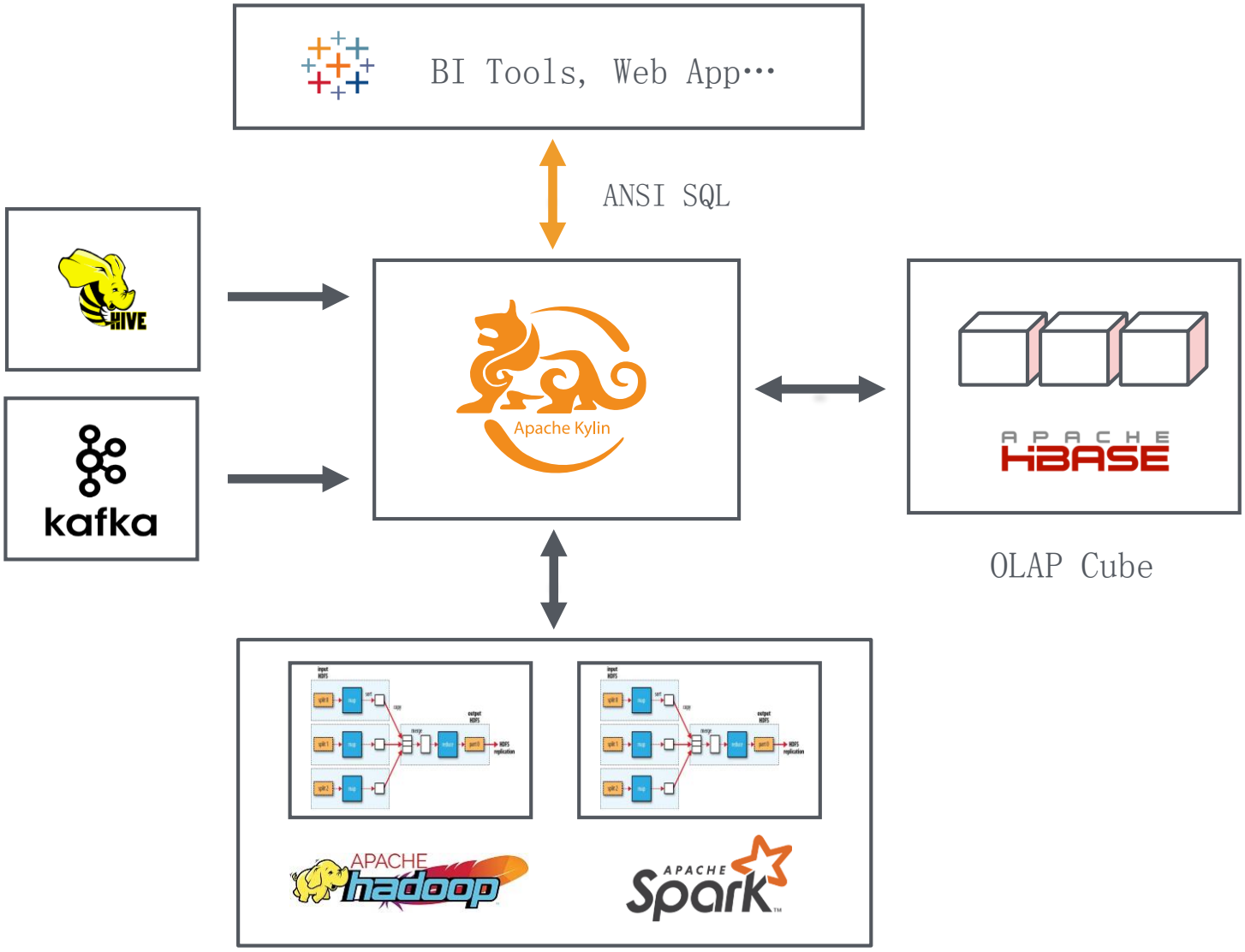
User can define a data model and pre-build in Kylin with more than 10+ billions of raw data records

Seamless BI Integration

JDBC/ODBC/REST API; Supports Tableau, MSTR, Qlik Sense, Power BI, Excel and others

Apache Kylin Architecture

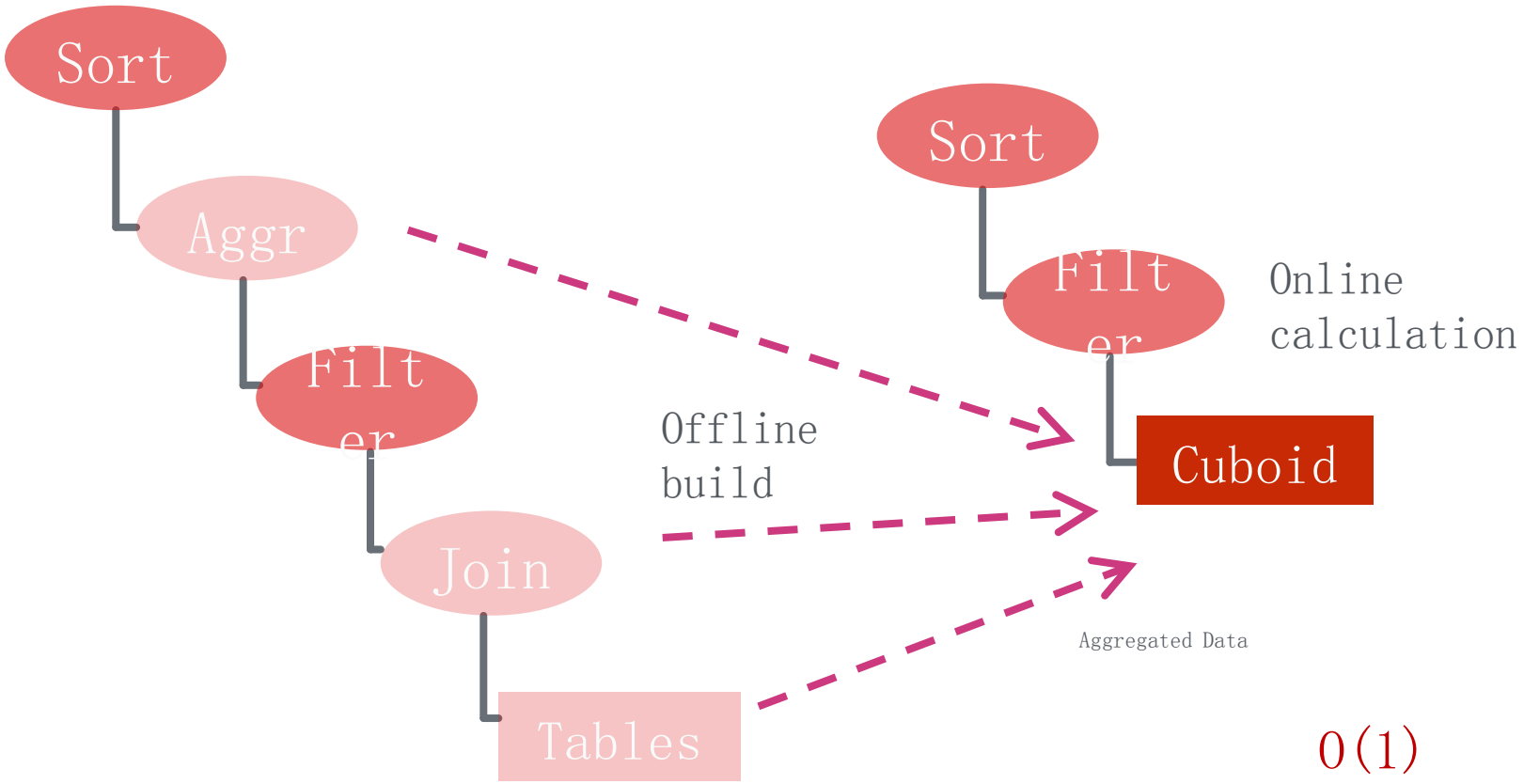
Native on Hadoop, Horizontal Scalable



Why Kylin is fast

Pre-calculation + Random access

- Join and aggregate data to Cube in offline
- No join at query time
- Convert SQL query to Cube visiting
- Filter with index and do online calculation within memory



02 Why Apache HBase

Criteria of the Storage engine for Kylin

Alibaba Group 阿里巴巴集团 APACHE HBASE

- Hadoop Native

- Low Latency

- High Capacity

- Wide Adoption

- Easy to use API

- Active User Community

Only HBase Can

Hadoop Native

HBase is built on Hadoop technologies; It Integrates well with HDFS, MapReduce and other components.

High Capacity

Supports very large data volume, TB to PB data in one table.

Easy to use API

Low Latency

Block cache and Bloom Filters for real-time queries.

Wide Adoption

Most Hadoop users are running HBase;

Active User Community

HBase has many active users, which provides many good articles and best practices.

HBase in Kylin

HBase acts four roles in Kylin

Massive Storage for Cube

Kylin persists OLAP Cube in HBase, for low latency access.

MPP for online calculation

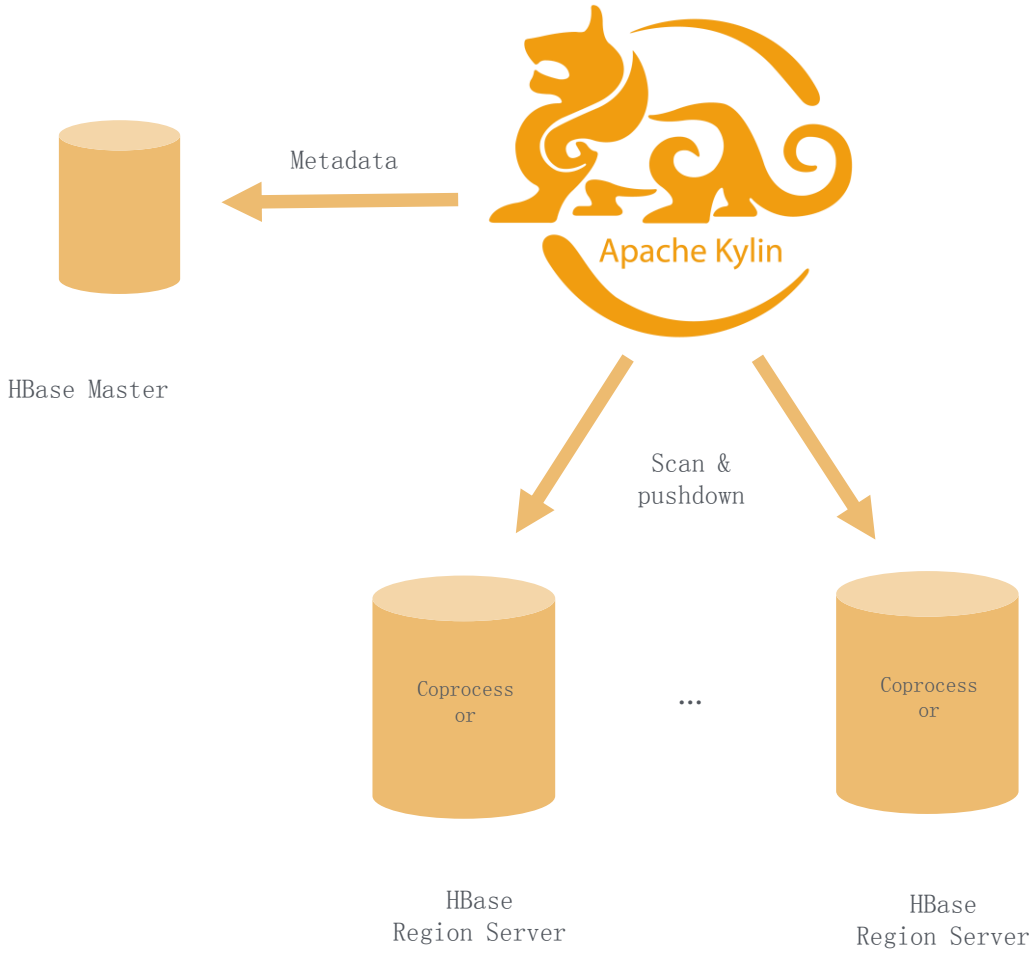
Kylin pushes down calculations to HBase region servers for parallel computing.

Meta Store

Kylin uses HBase to persist its metadata.

Cache

Kylin caches big lookup table in HBase.

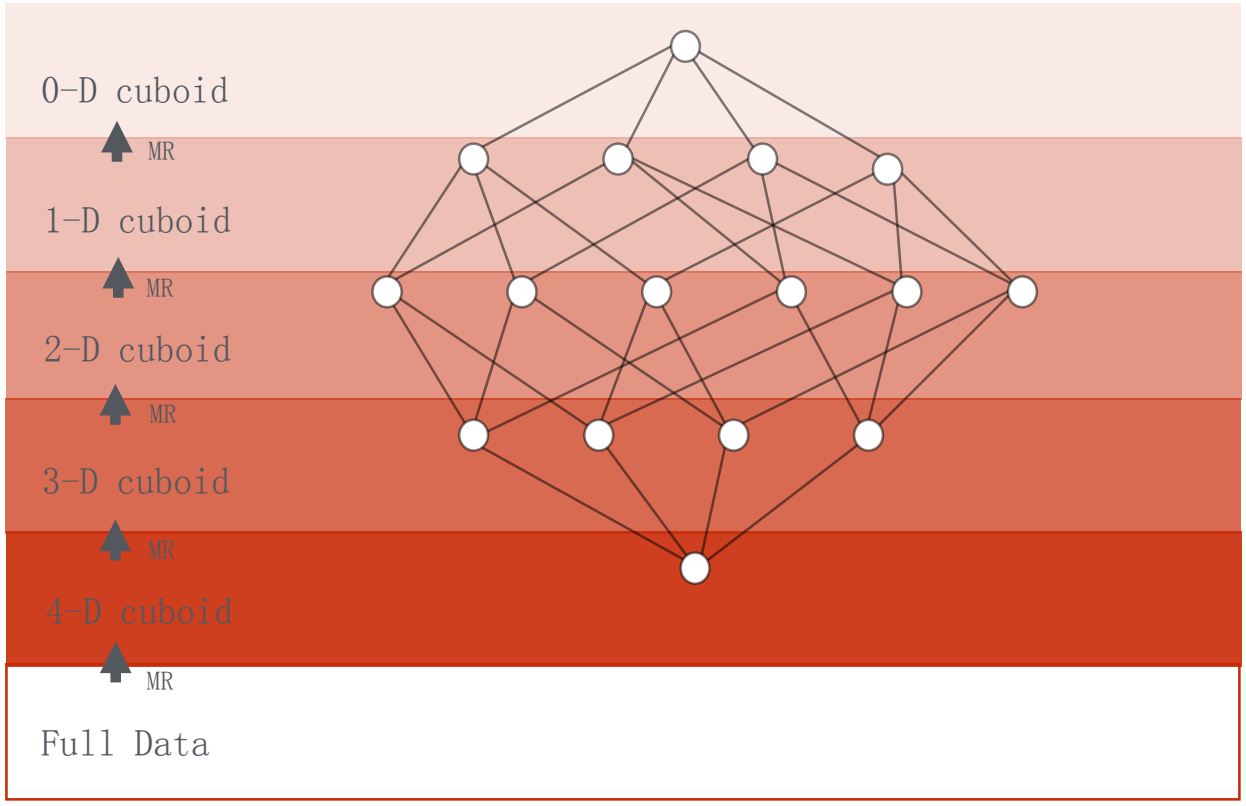


03 How to use HBase in OLAP

How Cube be Built

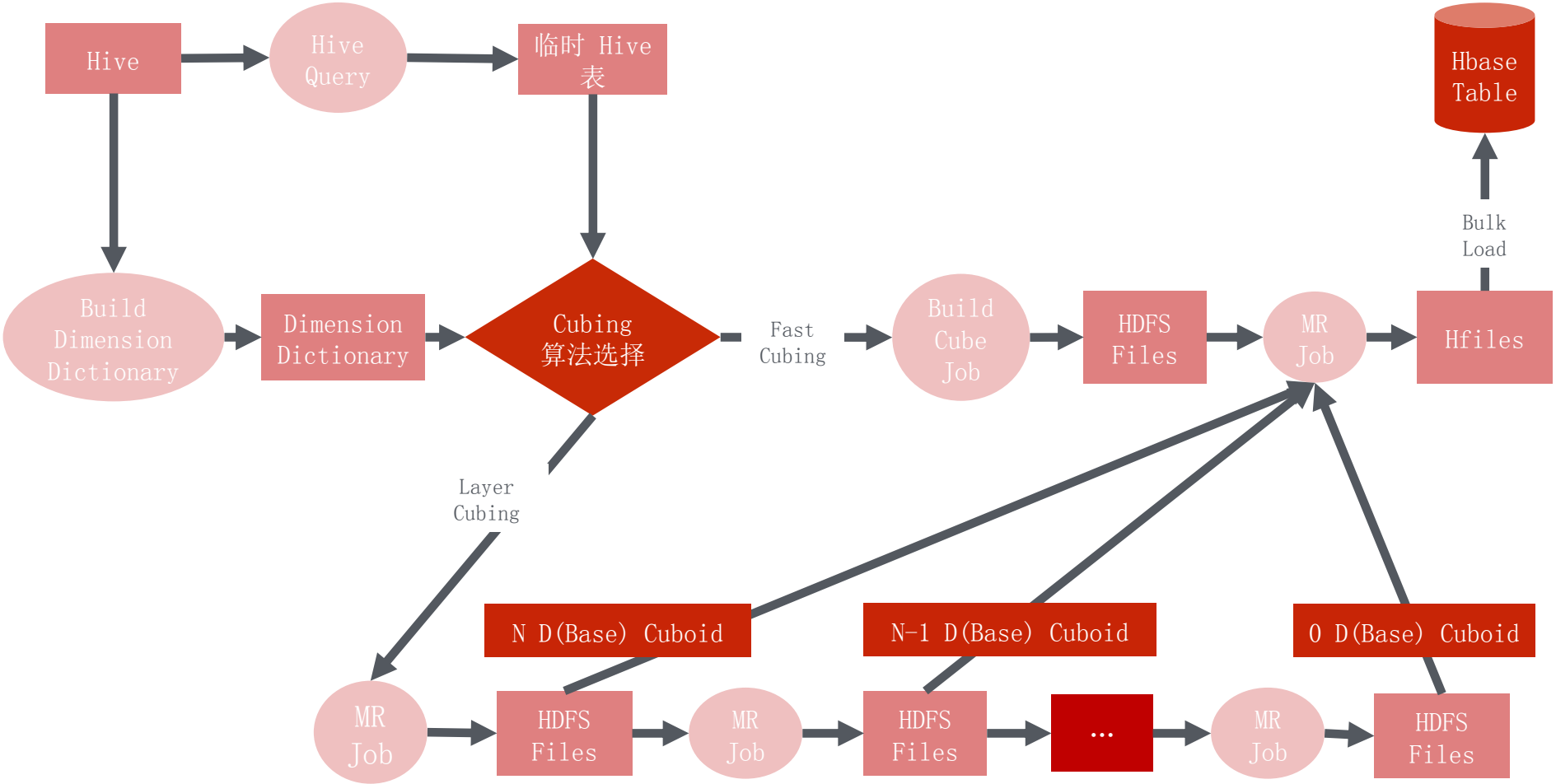
Cube building process

- Kylin uses MR or Spark to aggregate source data into Cube;
- The typical algorithm is by-layer cubing;
- Calculate N-Dimension cuboid first, and then calculate N-1.



How Cube be Built

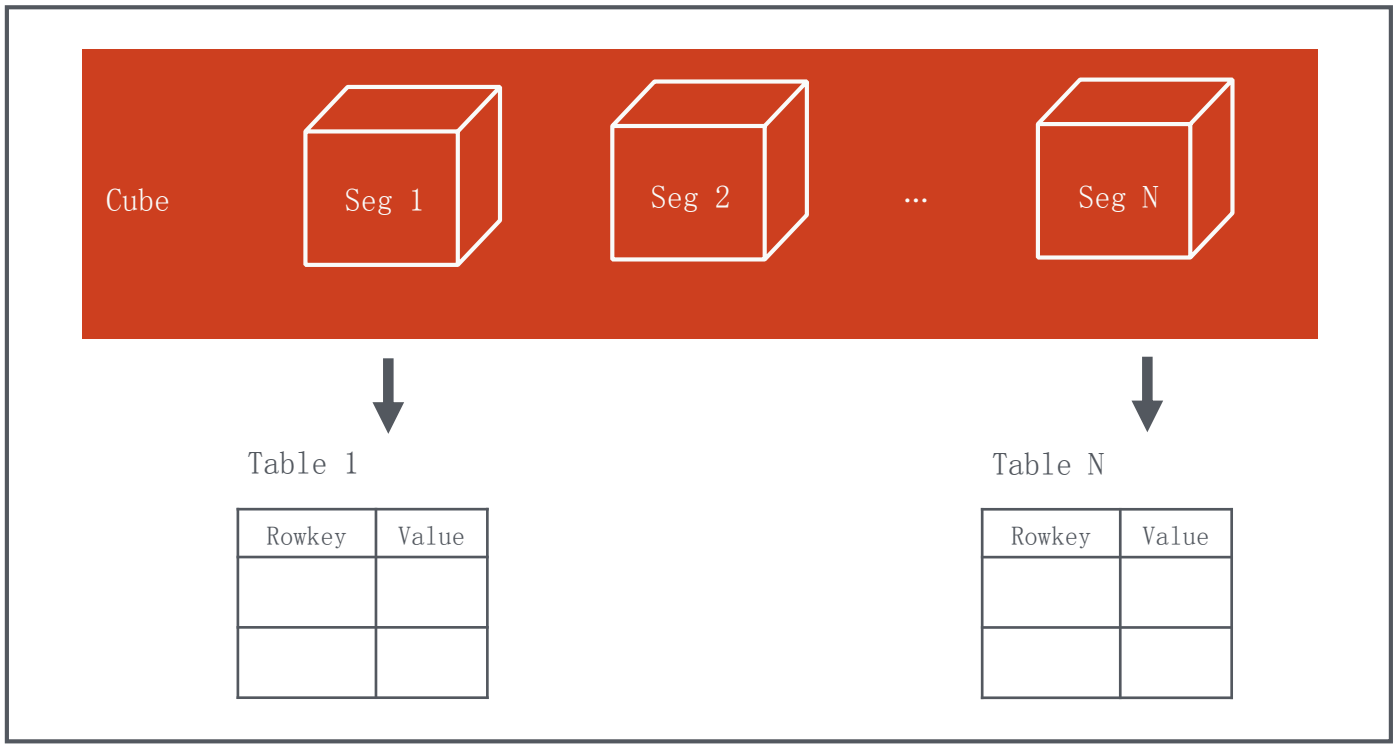
The whole Cube building process



Cube in HBase

Cube Structure

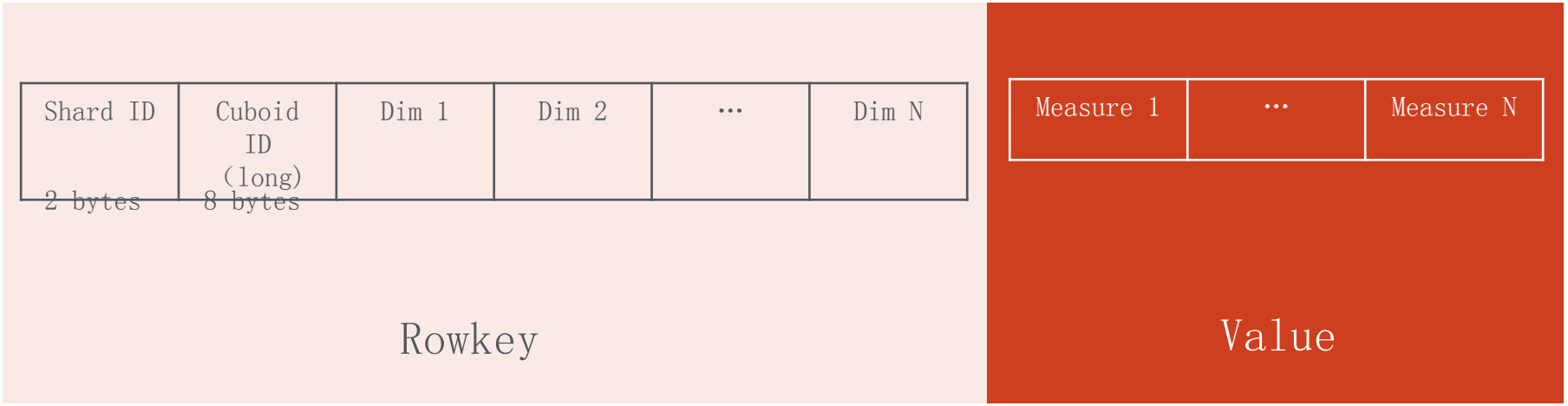
- Cube is partitioned into multiple segments by time range
- Each segment is a HBase Table
- Table is pre-split into multiple regions
- Cube is converted into HFile in batch job, and then bulk load to HBase



HBase Table Format

Rowkey + Value

- Dimension values are encoded to bytes (via dictionary or others)
- Measures are serialized into bytes
- HBase Rowkey format: Shard ID (2 bytes) + Cuboid ID (8 bytes) + Dimensions
- HBase Value: measures serialized bytes
- Table is split into regions by Shard ID
- User can group measures into 1 or multiple column families



How Cube be Persisted in HBase

Example: a Tiny Cube

- 2 dimensions and 1 measure; total 4 cuboids: 00, 01, 10, 11
- Please note the Shard ID is not appeared here

Source Table

year	city	price
1993	bejing	10
1993	bejing	30
1994	shanghai	20
1994	bejing	40

Dictionary Encoding

Dimension Value	Encoded Value
1993	0
1994	1
beijing	0
shanghai	1

Aggregated Table (Cube)

year	city	sum(price)
1993	bejing	40
1994	shanghai	20
1994	bejing	40
1993	*	40
1994	*	60
*	bejing	80
*	shanghai	50
*	*	100

HBase KV Format

Rowkey	Value
00000000	100
00000001+0	80
00000001+1	50
00000010+0	40
00000010+1	60
00000011+00	40
00000011+10	40
00000011+11	20

How Cube be Queried

- Kylin parses SQL to get the dimension and measures;
- Identify the Model and Cube;
- Identify the Cuboid to scan;
- Identify the Cube segments;
- Leverage filter condition to narrow down scan range;
- Send aggregation logic to HBase coprocessor, do storage-side filtering and aggregation;
- On each HBase RS returned, de-code and do final processing in Calcite

```
select city ,
sum(price) from table
where year= 1993 group
by year
```

```
Dimension: city, year
Cuboid ID: 00000011
Filter: year=1993 (encoded value:
0)

Scan start: 00000011|0
Scan end: 00000011|1
```

Good and not-good of HBase for OLAP

HBase is a little complicated for OLAP scenario; HBase supports both massive write + read; while OLAP is read-only.

- ✓ Native on Hadoop.
- ✓ Great performance
  (when search pattern matches row key design)
- ✓ High concurrency

- ■ Not a columnar storage
- ■ No secondary index
- ■ Downtime for upgrade
  (update coprocessor need to disable table first)

04 Use Cases

1000+ Global Users

Alibaba Group 阿里巴巴集团 APACHE HBASE

Internet

- eBay
- Yahoo! Japan
- Baidu 百度
- Meituan 美团
- NetEase 网易
- Expedia
- JD 京东
- VIP 唯品会
- 360
- TOUTIAO 头条
- …

FSI

- CCB 建设银行
- CMB 招商银行
- SPDB 浦发银行
- CPIC 太平洋保险
- CITIC BANK 中信银行
- UnionPay 中国银联
- HuaTai 华泰证券
- GuoTaiJunAn 国泰君安证券
- …

Telecom

- China Mobile
- China Telecom
- China Unicom
- AT & T
- …

Manufacturing

- SAIC 上汽集团
- Huawei 华为
- Lenovo 联想
- OPPO
- XiaoMi 小米
- VIVO
- MeiZu 魅族
- …

Others

- MachineZone
- Glispa
- Inovex
- Adobe
- iFLY TEK科大讯飞
- …

Use Case - OLAP on Hadoop

Meituan: Top O2O company in China

Challenge

- Slow performance with previous MySQL option Heavy development efforts with Hive solution
- Huge resources for Hive job
- Analysts can't access directly for data on Hadoop

Solution

- Apache Kylin as core OLAP on Hadoop solution
- SQL interface for internal users
- Active participate in open source Kylin community

973 Cubes, 8.9+ trillion rows, Cube size 971 TB

3,800,000 queries/day, TP90 < 1.2 second

(Data in 2018/08)

Supporting all Meituan business lines

Use Case - Shopping Reporting

Yahoo! Japan: the most visited website in Japan

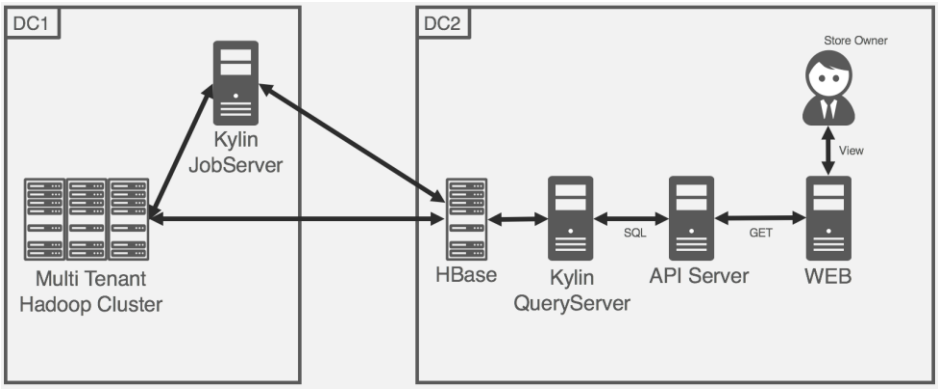
- We provide a reporting system that show statistics for store owners.

  e. g. impressions, clicks and sales.

- Our reporting system used Impala as a backend database previously. It took a long time (about 60 sec) to show Web UI.

- In order to lower the latency, we moved to Apache Kylin.

  Average latency < 1sec for most cases



Thanks to low latency with Kylin, we become possible to focus on adding functions for users.

We Are Hiring

WeChat: Kyligence

WeChat: Apache Kylin

Thanks