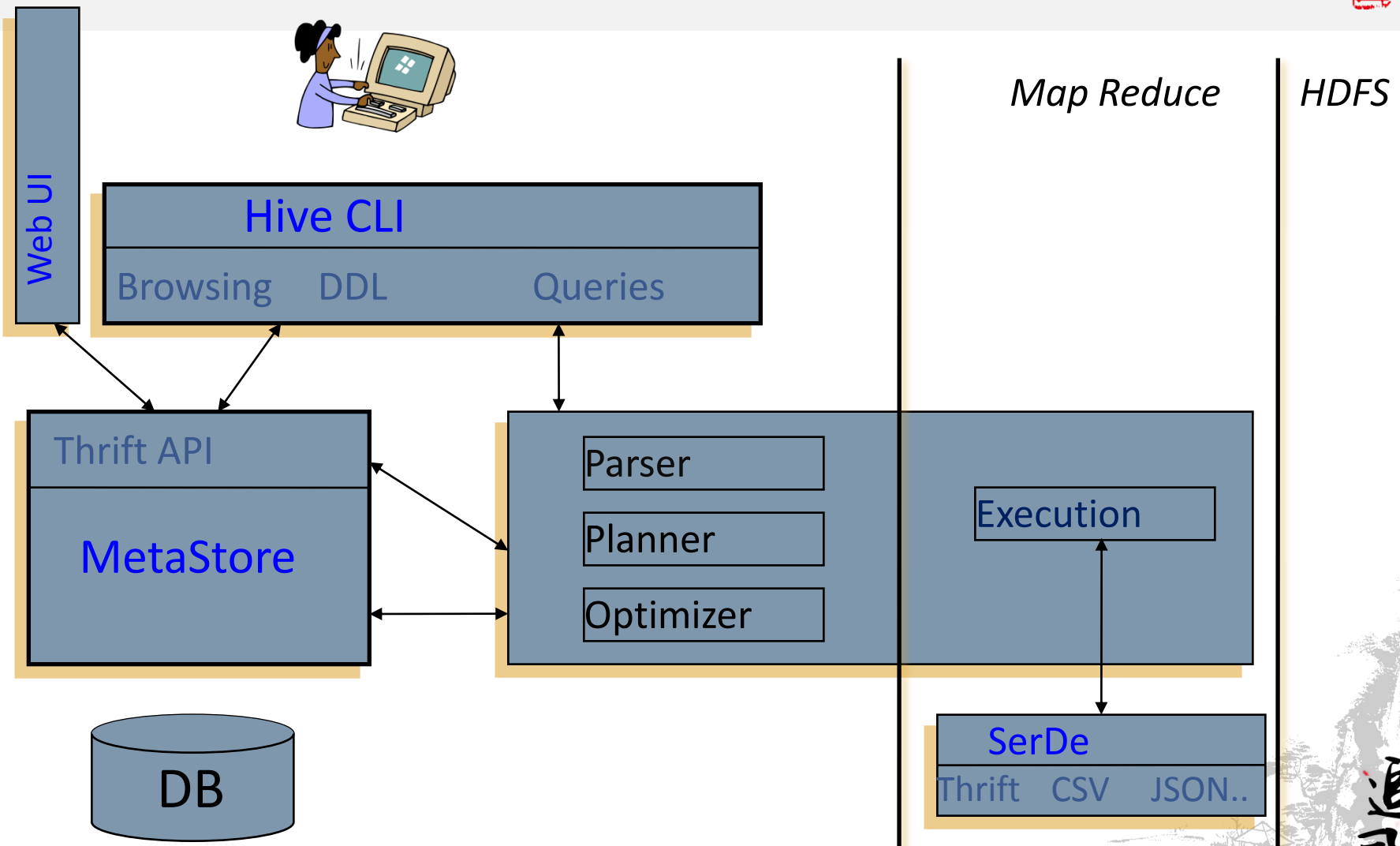
Hive高级编程

天照

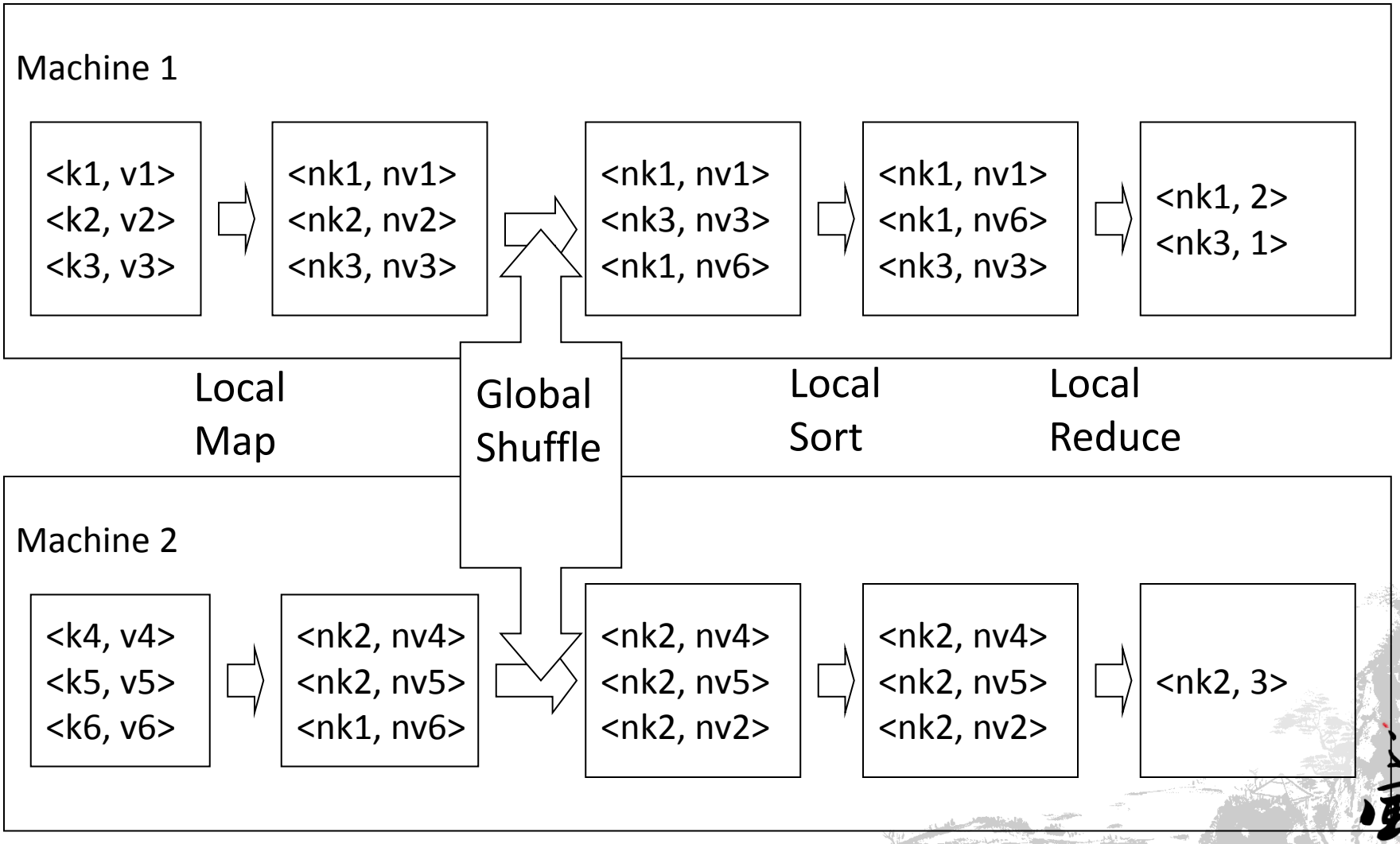
Agenda

- Hive Components
- MapReduce
- Hive QL
- Hive 优化
- SQL优化

HIVE: Components



(Simplified) Map Reduce Review



Hive QL – Join

page_view

pageid	**userid**	time
1	**111**	9:08:01
2	**111**	9:08:13
1	**222**	9:08:14

X

user

userid	age	gender
111	25	female
222	32	male

=

pv_users

pageid	age
1	25
2	25
1	32

- **SQL:**

```
INSERT INTO TABLE pv_users

SELECT pv.pageid, u.age

FROM page_view pv JOIN user u ON (pv.userid = u.userid);
```

Hive QL – Join in Map Reduce

page_view

pageid	**userid**	time
1	**111**	9:08:01
2	**111**	9:08:13
1	**222**	9:08:14

user

userid	age	gender
111	25	female
222	32	male

Map

key	value
111	<**1**,1>
111	<**1**,2>
222	<**1**,1>

key	value
111	<**2**,25>
222	<**2**,32>

Shuffle
Sort

key	value
111	<**1**,1>
111	<**1**,2>
111	<**2**,25>

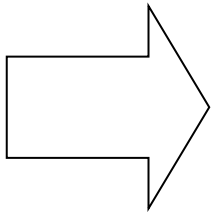
key	value
222	<**1**,1>
222	<**2**,32>

Reduce

Hive QL – Group By

pv_users

pageid	age
1	25
2	25
1	32
2	25

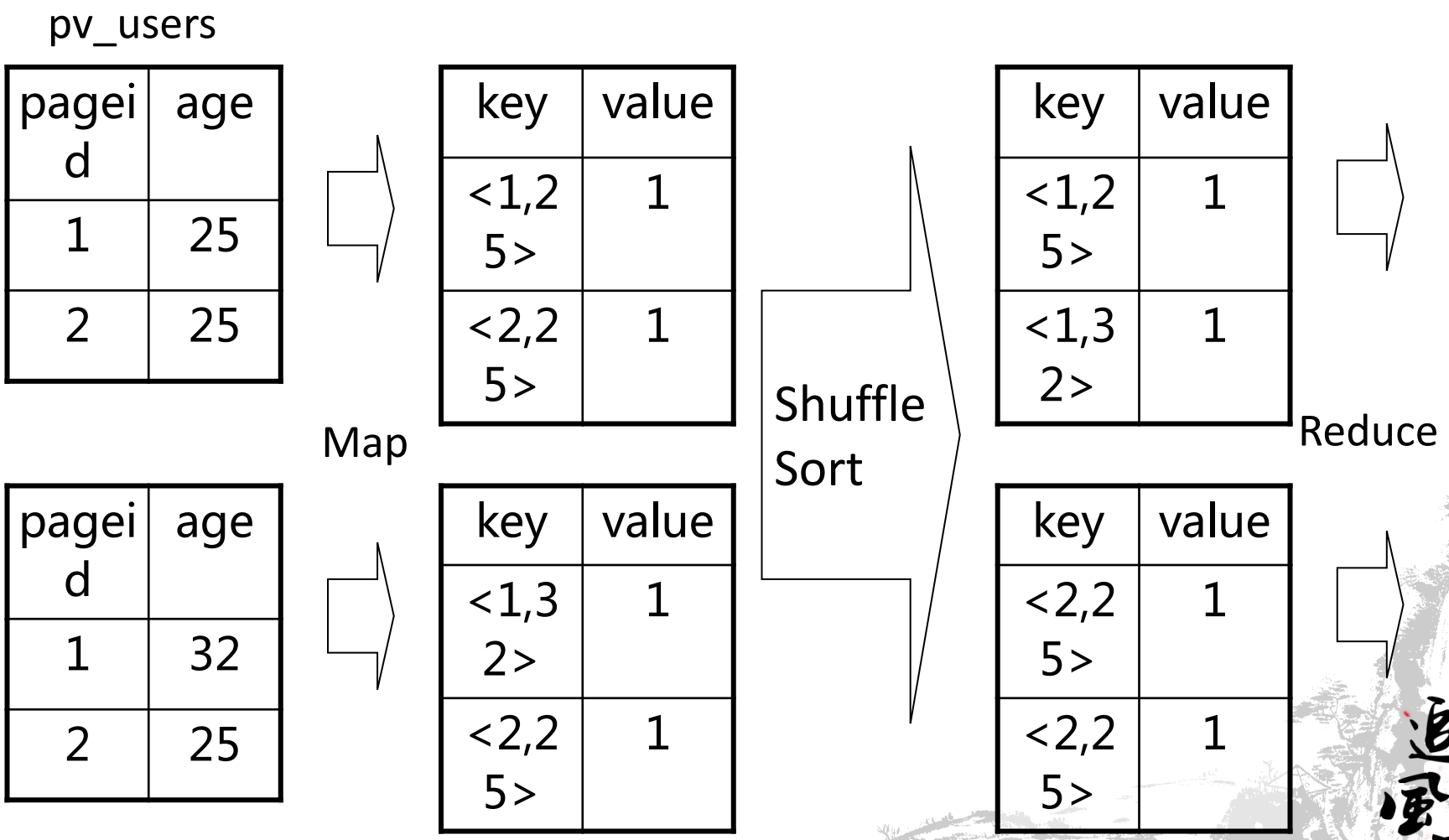


pageid_age_sum

pageid	age	Count
1	25	1
2	25	2
1	32	1

- **SQL:**
  - INSERT INTO TABLE pageid_age_sum
  - SELECT pageid, age, count(1)
  - FROM pv_users
  - GROUP BY pageid, age;

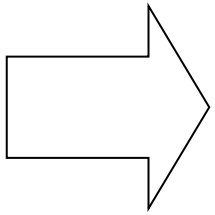
Hive QL – Group By in Map Reduce



Hive QL – Group By with Distinct

page_view

pageid	userid	time
1	111	9:08:01
2	111	9:08:13
1	222	9:08:14
2	111	9:08:20



result

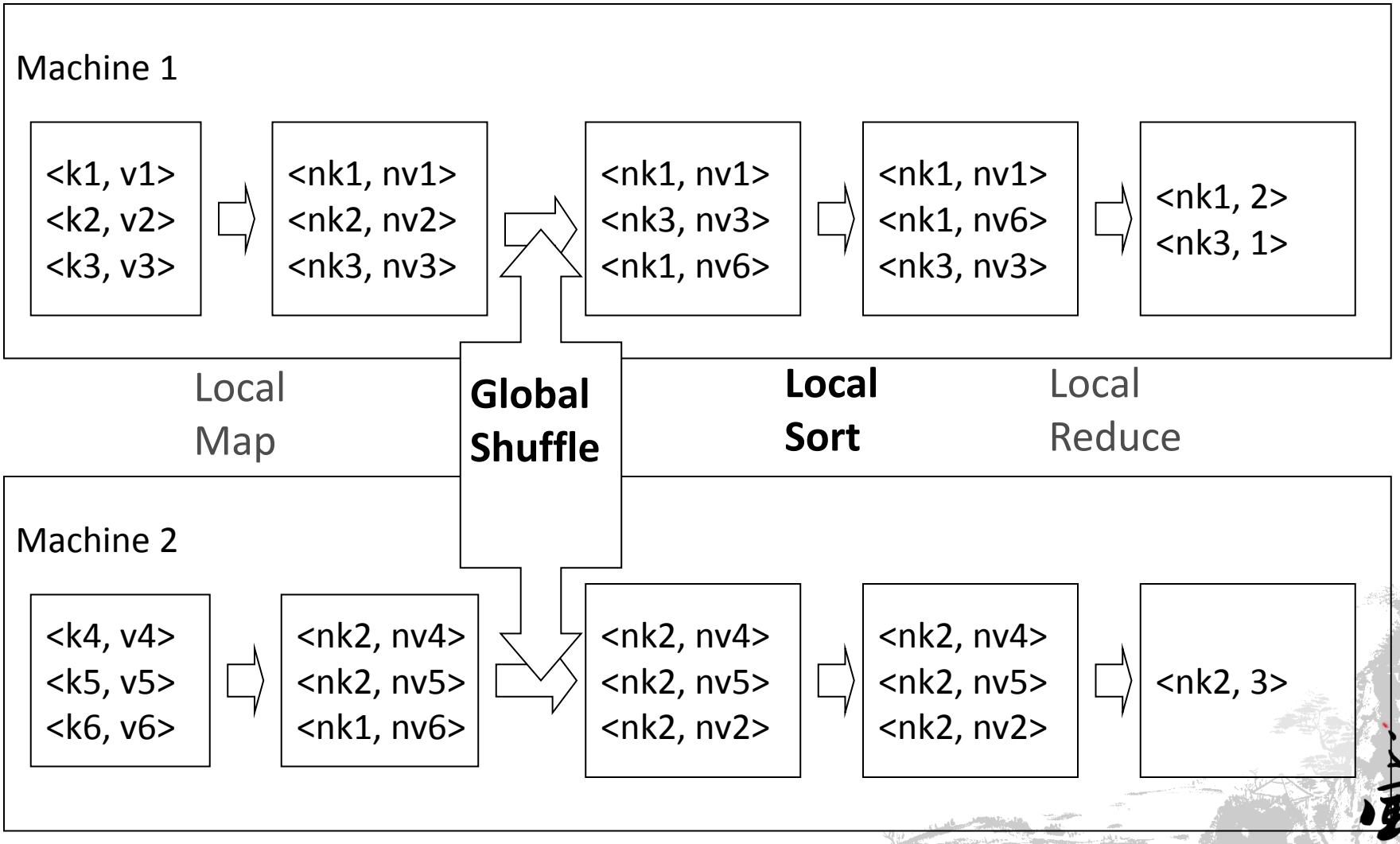
pageid	count_distinct_userid
1	2
2	1

- **SQL**
  - SELECT pageid, COUNT(DISTINCT userid)
  - FROM page_view GROUP BY pageid

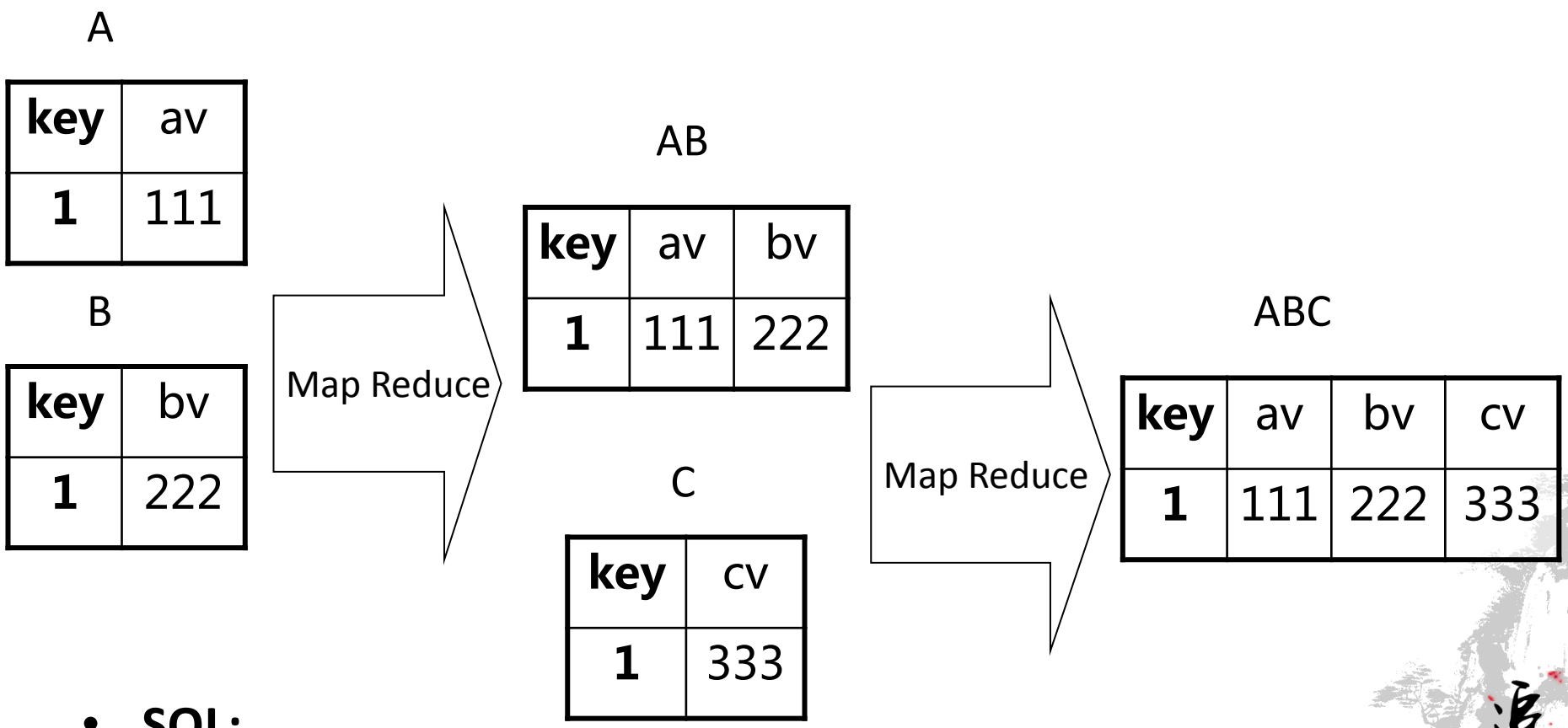
Hive Optimizations

Efficient execution of SQL on Map Reduce

(Simplified) Map Reduce Revisit

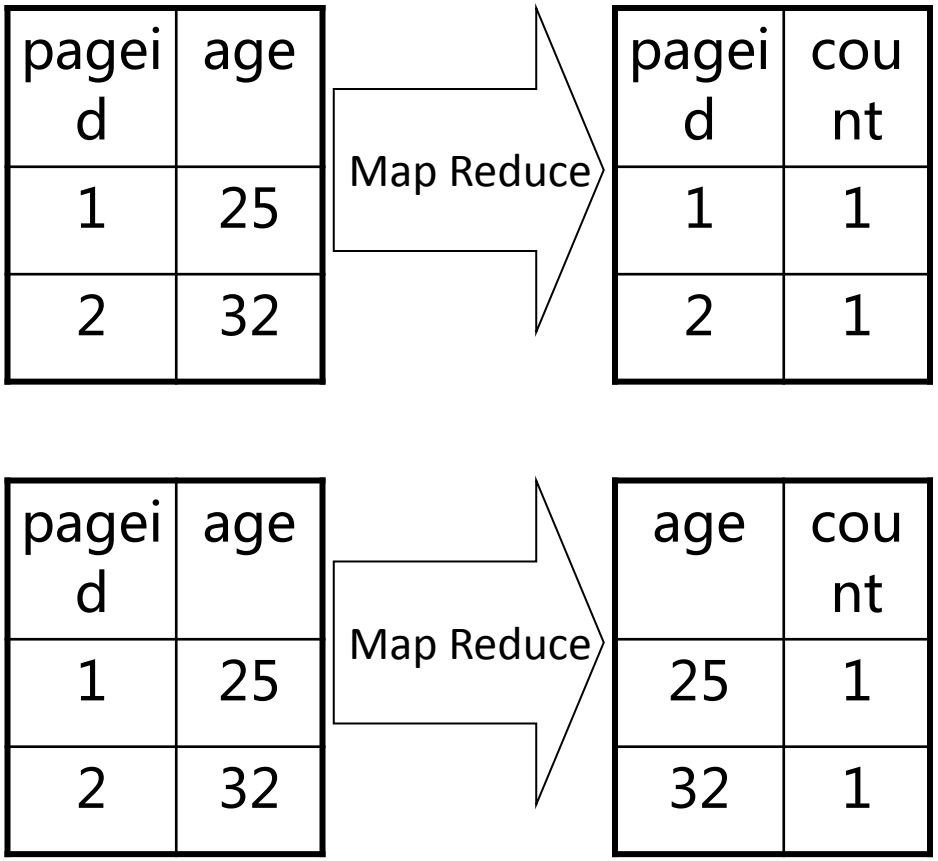


Hive Optimizations – Merge Sequential Map Reduce Jobs



- **SQL:**
  - FROM (a join b on a.key = b.key) join c on a.key = c.key SELECT …

Hive Optimizations – Share Common Read Operations



- **Extended SQL**
  - **FROM pv_users**
  - **INSERT** INTO TABLE pv_pageid_sum
    - SELECT pageid, count(1)
    - GROUP BY pageid
  - **INSERT** INTO TABLE pv_age_sum
    - SELECT age, count(1)
    - GROUP BY age;

Hive Optimizations –Map Join

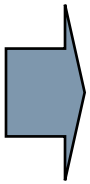
- **Map Joins**
  - User specified small tables stored in hash tables on the mapper backed by jdbm
  - No reducer needed

```
INSERT INTO TABLE pv_users
SELECT /*+ MAPJOIN(pv) */ pv.pageid, u.age
FROM page_view pv JOIN user u
ON (pv.userid = u.userid);
```

Hive QL – Map Join

page_view

pageid	**userid**	time
1	**111**	9:08:01
2	**111**	9:08:13
1	**222**	9:08:14



Hash table

key	value
111	<1,2>
222	<2>

user

userid	age	gender
111	25	female
222	32	male

pv_users

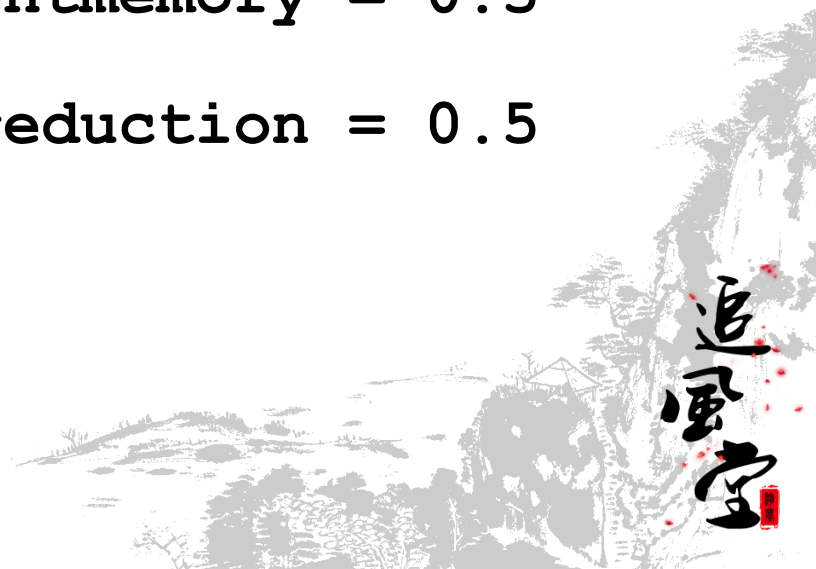
Pageid	age
1	25
2	25
1	32

Group by Optimizations

- **Map side partial aggregations**
  - Hash-based aggregates
  - Serialized key/values in hash tables
  - 90% speed improvement on Query
    - `SELECT count(1) FROM t;`

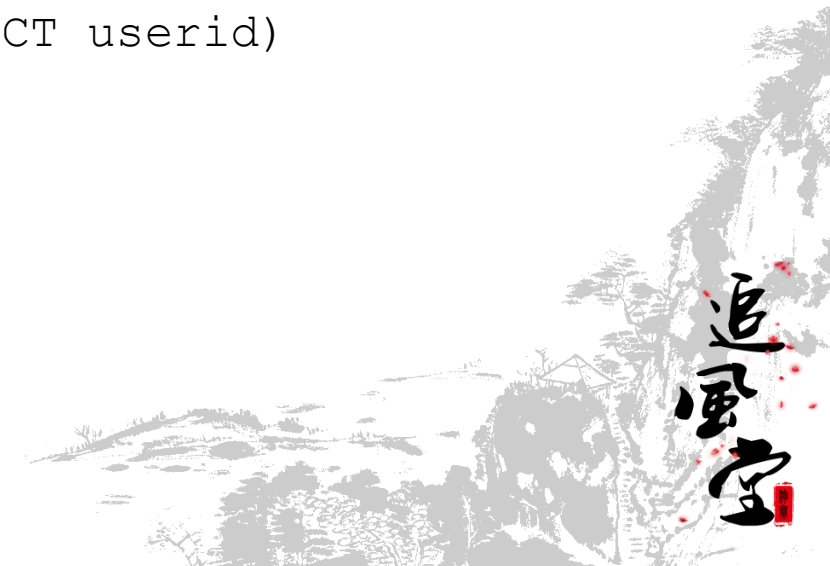
Parameters

- `hive.map.aggr = true`
- `hive.groupby.skewindata = false`
- `hive.groupby.mapaggr.checkinterval = 100000`
- `hive.map.aggr.hash.percentmemory = 0.5`
- `hive.map.aggr.hash.min.reduction = 0.5`



Multi GroupBy

```
FROM pv_users
  INSERT OVERWRITE TABLE pv_gender_sum
    SELECT gender, count(DISTINCT userid),
      count(userid)
      GROUP BY gender
  INSERT OVERWRITE TABLE pv_age_sum
    SELECT age, count(DISTINCT userid)
      GROUP BY age
```



Hive QL – Group By in Map Reduce

pv_users

gender	age	userid
M	25	1
M	25	2
M	25	1
M	24	1
F	24	2
F	24	1

Key: userid
Value: gender, age

gender	dist	count
M	1	3
F	1	1

age	dist
25	1
24	1

gender	dist	count
M	1	1
F	1	1

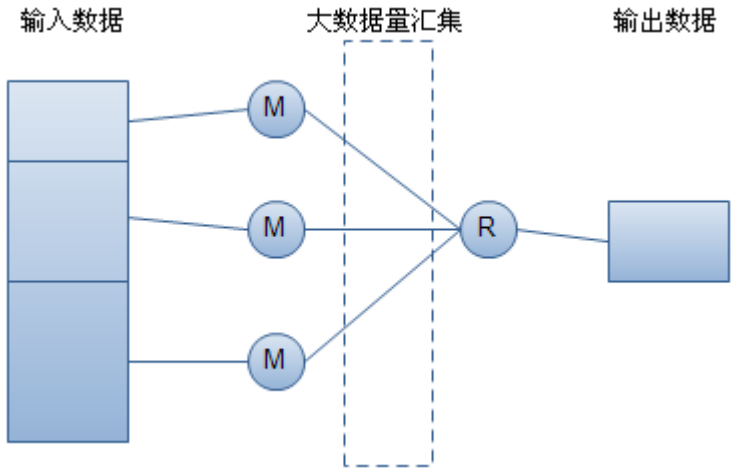
age	dist
25	1
24	1

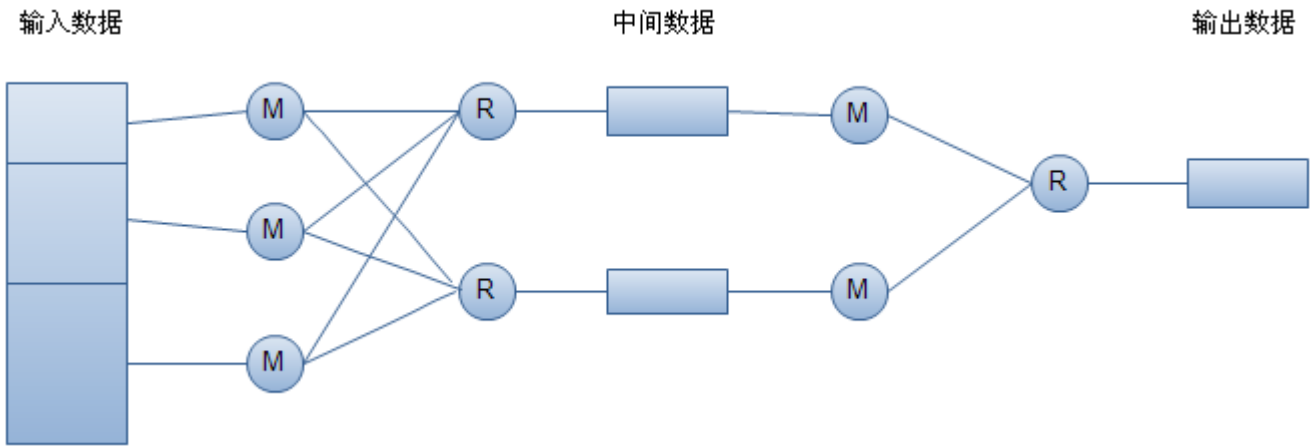
gender	dist	count
M	2	4
F	2	2

age	dist
24	1
25	1

Load balancing for data skew

- **GroupBy数据倾斜**
  - skewindata优化
  - 用法
    - set hive.groupby.skewindata=true





Hive Optimizations – Load Balance Problem

pv_users

pageid	age
1	25
1	25
1	25
2	32
1	25

Map-Reduce

pageid_age_partial_sum

pageid	age	count
1	25	2
2	32	1
1	25	2

SQL优化

- 数据倾斜
- Join顺序
- Map only

Skew

- **数据倾斜**
  - 倾斜的原因？
    - group by/distinct
    - join

Join 顺序

- **内存优化**
  - 驱动表
    - 使用大表做驱动表，避免内存溢出
    - Join中最右边的表是驱动表
    - MapJoin无视Join顺序，使用大表做驱动表
    - STREAMTABLE

Map Only

- **Map only**
  - 特征
    - 没有Join、 GroupBy、 Order by、 Sortby等，导致无Reduce
    - 每个Map有一个输出文件，输入数据量大，Map数很多导致输出文件很多
  - 缺点
    - 依赖此job输出的下一个job，map数很大
    - Fetch 结果很慢

课程回顾、总结页

- Hive Components
- MapReduce
- Hive QL
- Hive 优化
- SQL优化

谢 谢 ！