GREENPLUM DATABASE

2020 POSTGRESQL CONFERENCE CHINA

# 第十届PostgreSQL中国技术大会

开源 自研 新机遇

## Greenplum中的多阶段聚集实现 - 李晓亮，陈金豹

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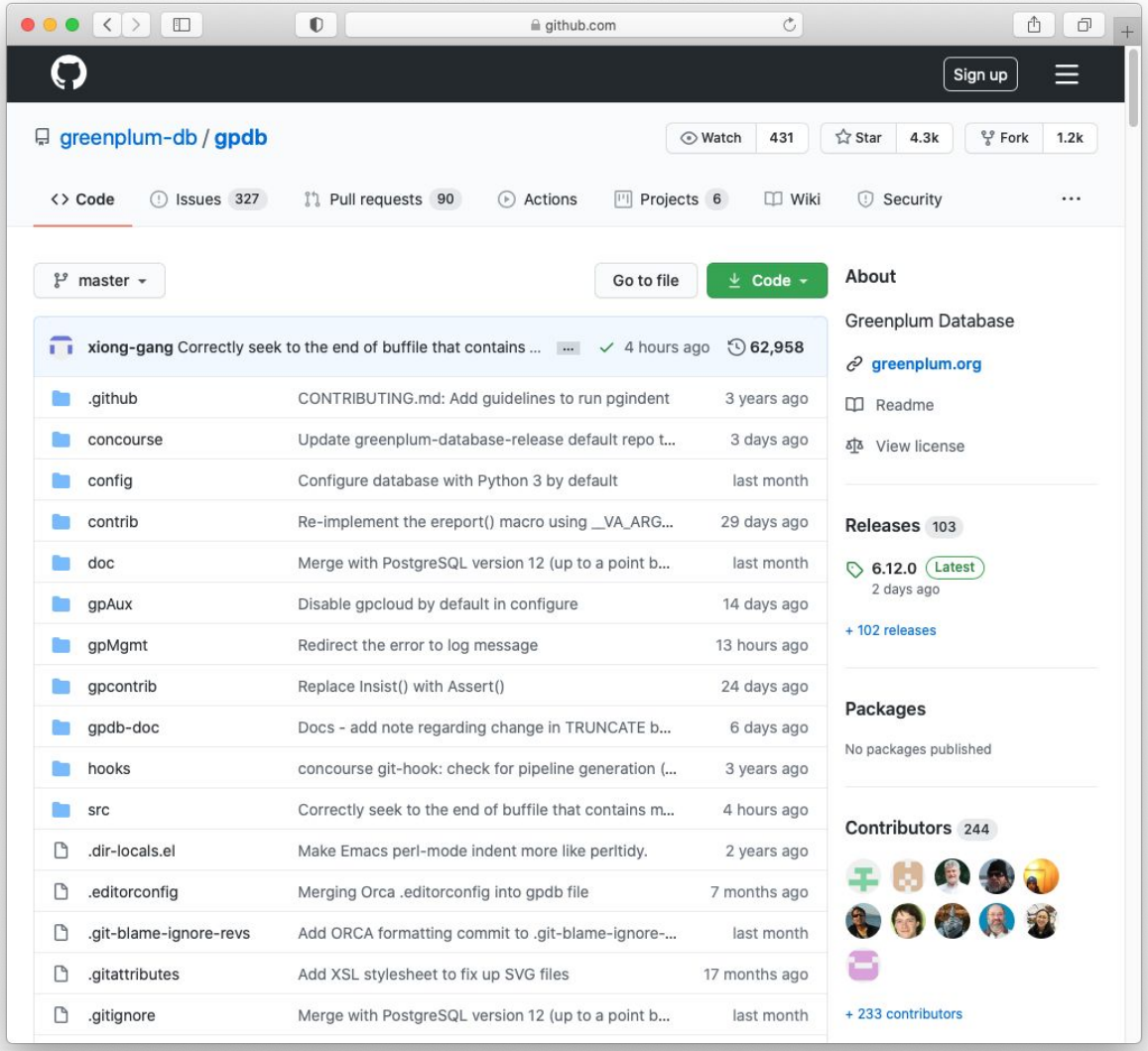
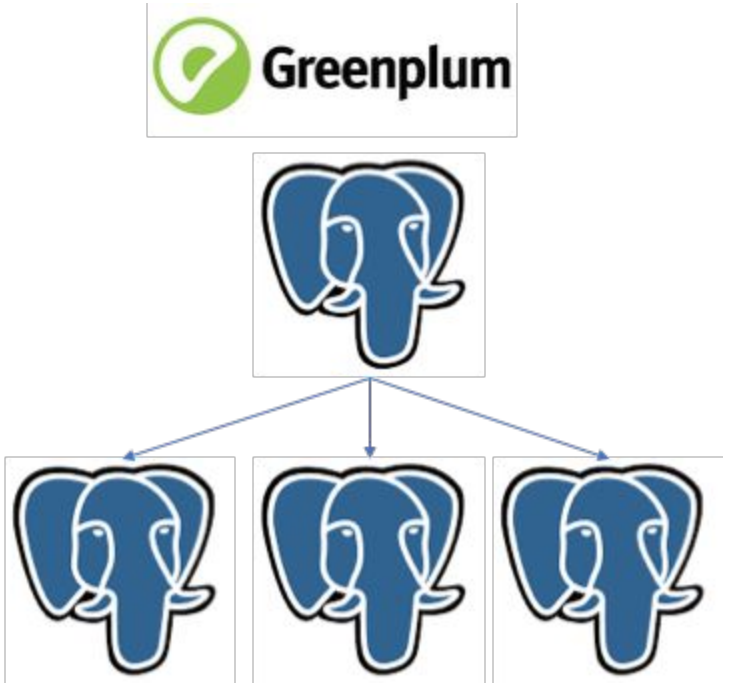
# 关于Greenplum

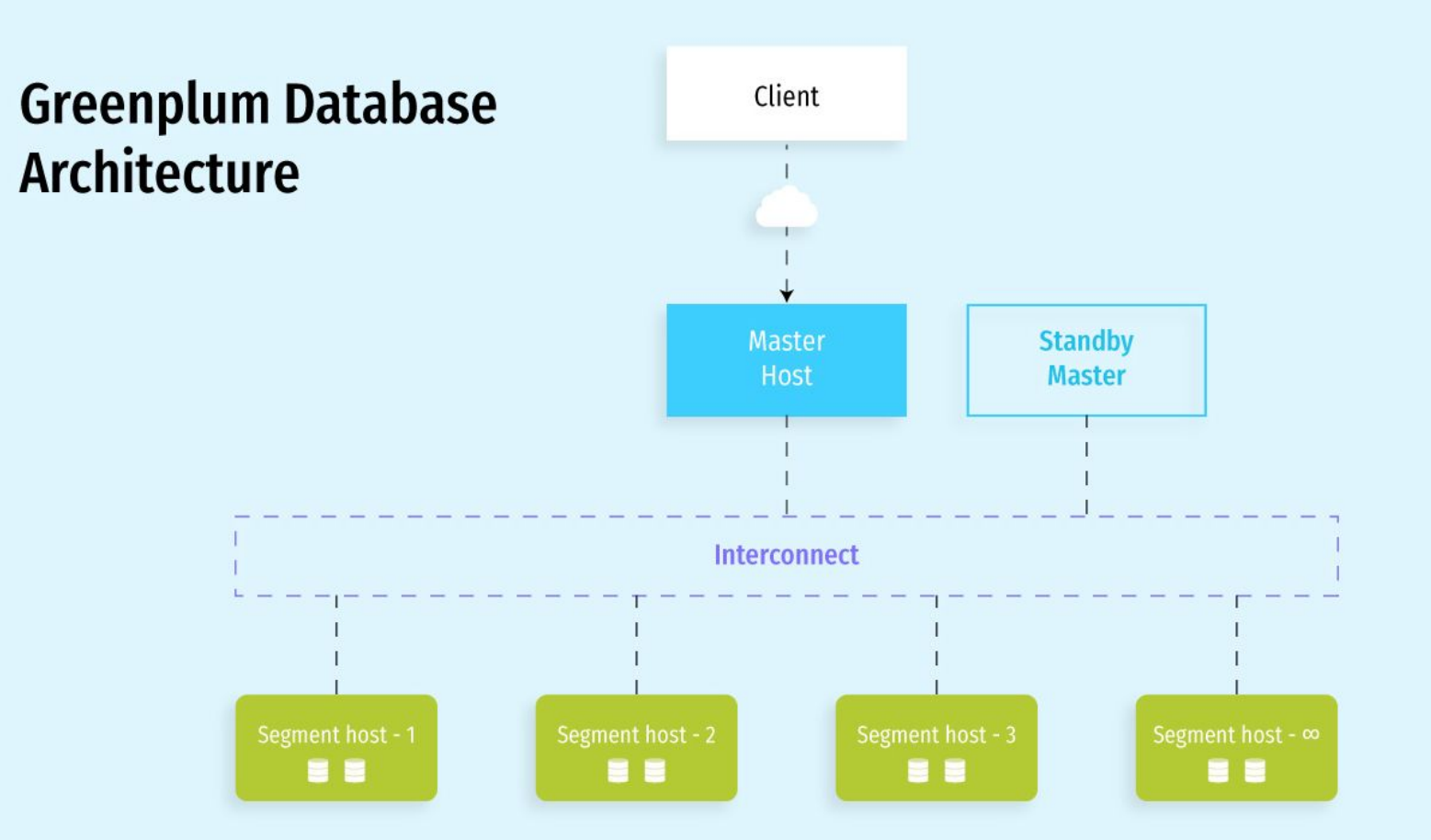
https://github.com/greenplum-db/gpdb



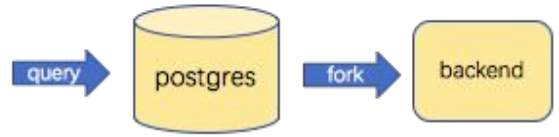
# 关于Greenplum

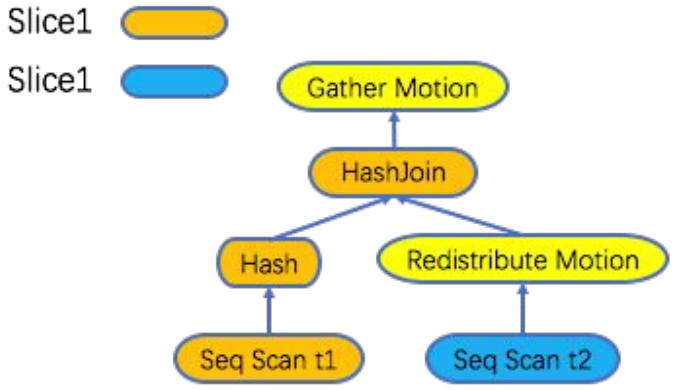



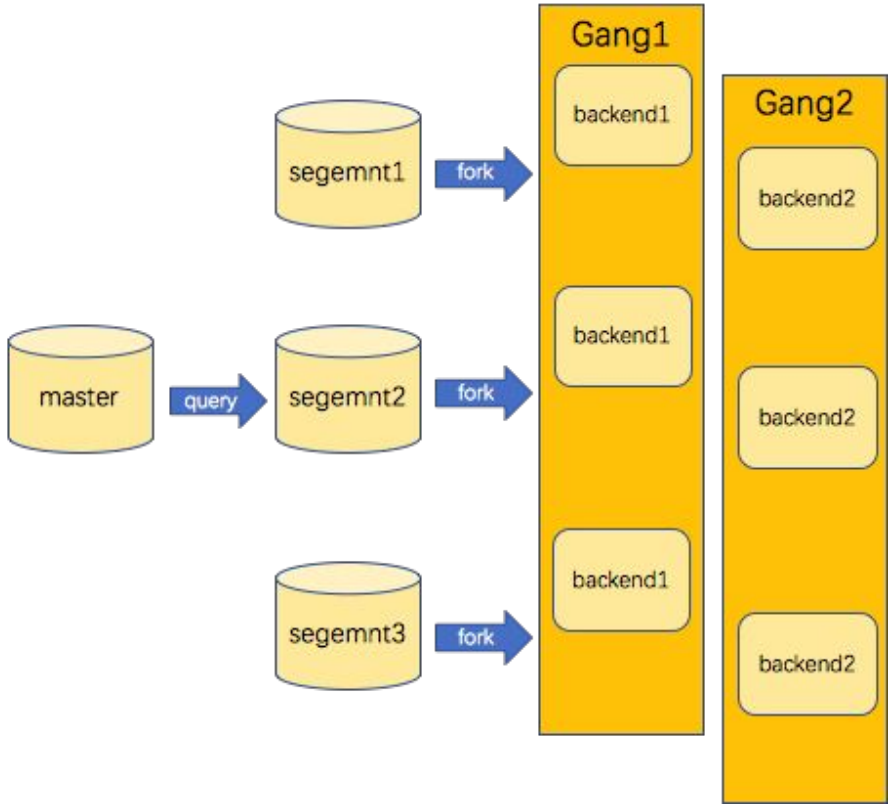
# 关于Greenplum



# 关于Greenplum



# 聚集在MPP架构中的问题

Aggregate functions perform calculations on a set of values and return a single value.

```
SELECT avg(t.b) FROM t GROUP
BY t.a;
```

# 聚集在MPP架构中的问题

```
CREATE TABLE sales
(
    id int NOT NULL,
    brand VARCHAR,
    type INT,
    quantity INT
);
```

```
INSERT INTO sales
(id, brand, type,
quantity) VALUES
(1, 'A', 1, 100),
(2, 'A', 2, 200),
(3, 'B', 1, 100),
(4, 'B', 2, 300);
```

# 聚集在MPP架构中的问题

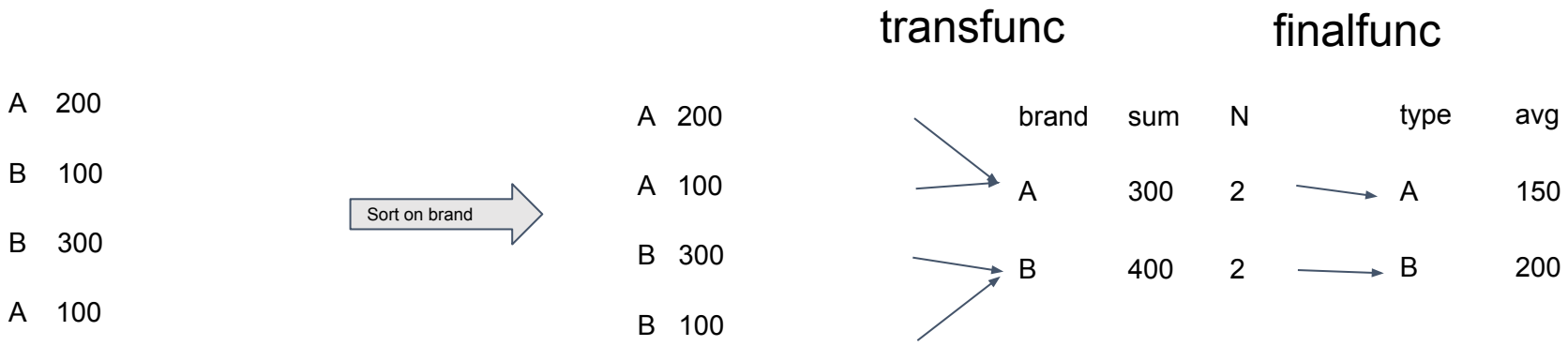
Postgres

```
demo=# explain (costs false) select avg(quantity) from sales;

        QUERY PLAN
-----------------------
 Aggregate
   ->  Seq Scan on sales
```

```
demo=# explain (costs false) select avg(quantity) from sales group by brand;

        QUERY PLAN
-----------------------
 HashAggregate
   Group Key: brand
   ->  Seq Scan on sales
```

# 聚集在MPP架构中的问题

Postgres



# Greenplum如何实现多阶段聚集

```
CREATE TABLE sales
(
    id int NOT NULL,
    brand VARCHAR,
    type INT,
    quantity INT
);
```

```
INSERT INTO sales (id,
brand, type, quantity)
VALUES
(1, 'A', 2, 100),
(2, 'A', 1, 200),
(3, 'B', 2, 100),
(4, 'B', 1, 300),
(5, 'A', 2, 200),
(6, 'A', 1, 400),
(7, 'B', 2, 100),
(8, 'B', 1, 400);
```

# Greenplum如何实现多阶段聚集

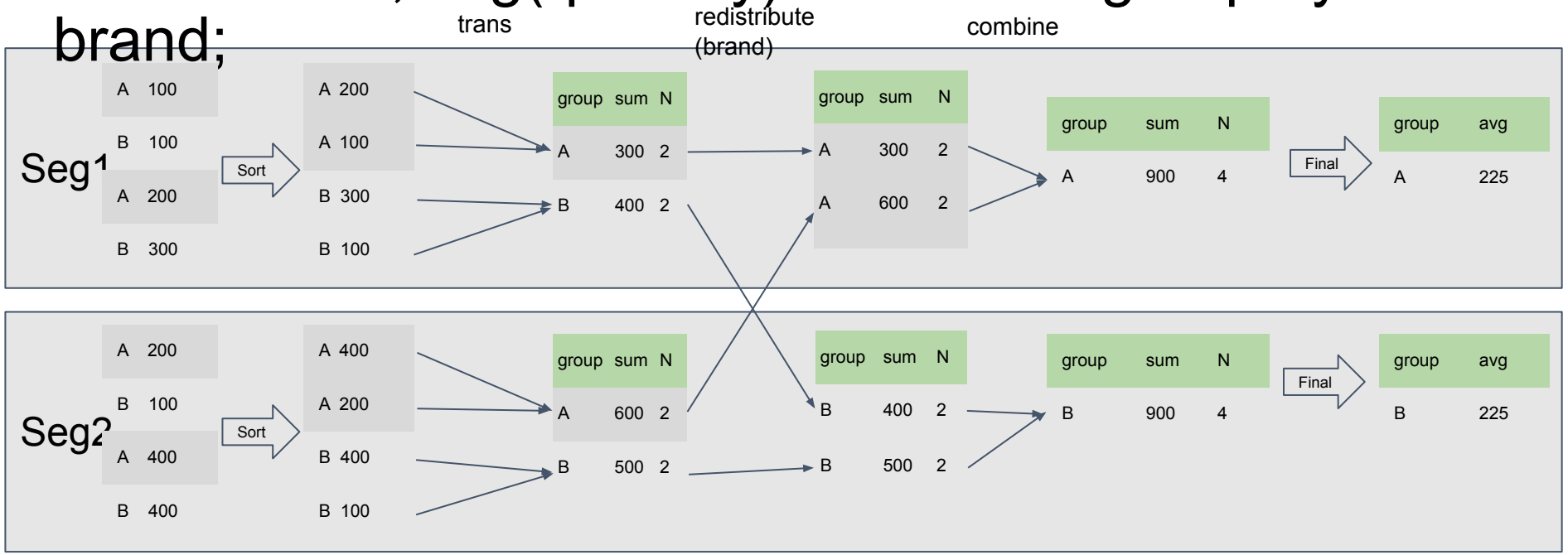
Greenplum

```
demo=# explain (costs false) select avg(quantity) from sales group by brand;

                        QUERY PLAN
-----------------------------------------------------------
 Gather Motion 3:1  (slice2; segments: 3)
   ->  GroupAggregate
         Group Key: sales.brand
         ->  Redistribute Motion 3:3  (slice1; segments: 3)
               Hash Key: sales.brand
               ->  GroupAggregate
                     Group Key: sales.brand
                     ->  Seq Scan on sales
```

# Greenplum如何实现多阶段聚集

Greenplum

select brand, avg(quantity) from sales group by brand;



# Greenplum如何实现DQA

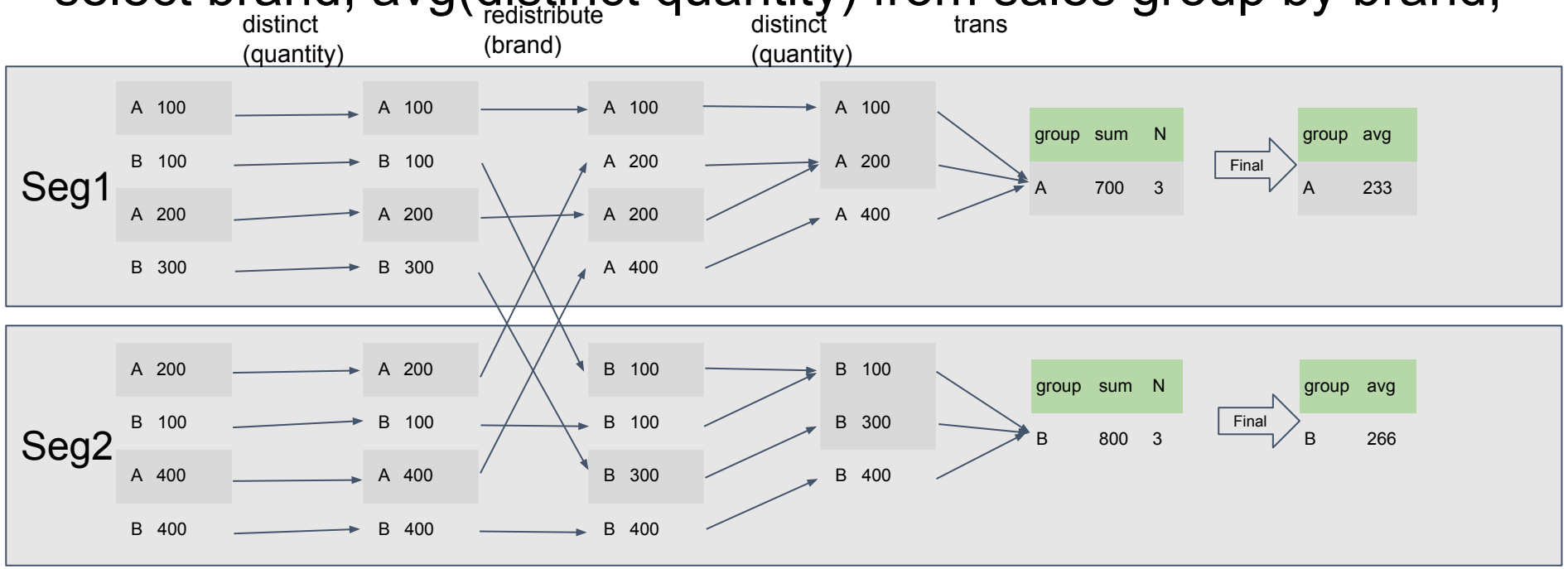
Greenplum

```
demo=# explain (costs false, verbose) select brand, avg(distinct quantity) from sales group by brand;
                          QUERY PLAN
---------------------------------------------------------------
 Gather Motion 3:1  (slice2; segments: 3)
   Output: sales.brand, (avg(sales.quantity))
   ->  HashAggregate
         Group Key: sales.brand
         ->  HashAggregate
               Group Key: sales.brand, sales.quantity
               ->  Redistribute Motion 3:3  (slice1; segments: 3)
                     Hash Key: sales.brand
                     ->  HashAggregate
                           Group Key: sales.brand, sales.quantity
                           ->  Seq Scan on public.sales
```

# Greenplum如何实现DQA

Greenplum

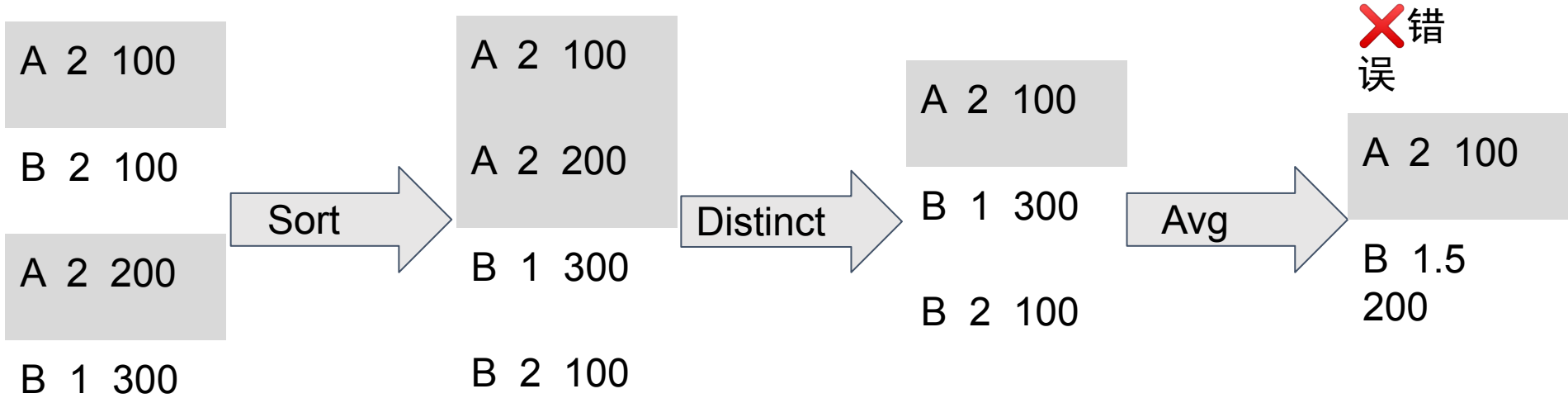
select brand, avg(distinct quantity) from sales group by brand;



# Greenplum如何实现Multi DQA

Greenplum

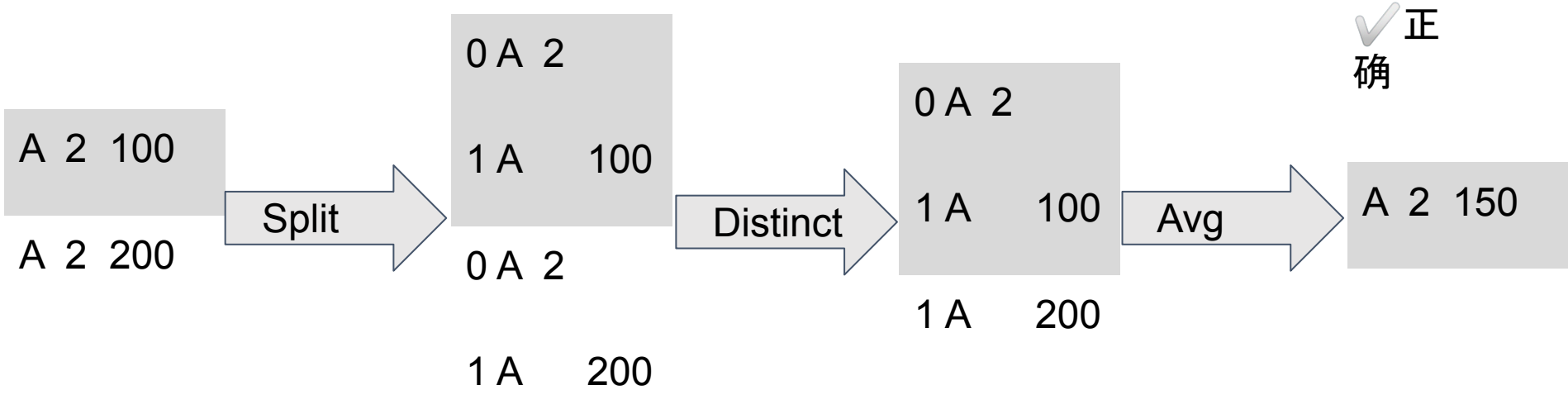
demo=# explain (costs false, verbose) select brand, avg(distinct type), avg(distinct quantity) from sales group by brand;



# Greenplum如何实现Multi DQA

Greenplum

demo=# explain (costs false, verbose) select brand, avg(distinct type), avg(distinct quantity) from sales group by brand;



# Greenplum如何实现Rollup

```
select
      brand, type,
avg(quantity)
from
      sales
group by
      grouping sets (
      (brand, type),
      (brand),
      (type),
       ()
);
```

```
select
      brand, type, avg(quantity)
from
      sales
group by
      brand, type
union all
select
      brand, NULL,
avg(quantity)
from
      sales
group by
      brand
union all
...
```

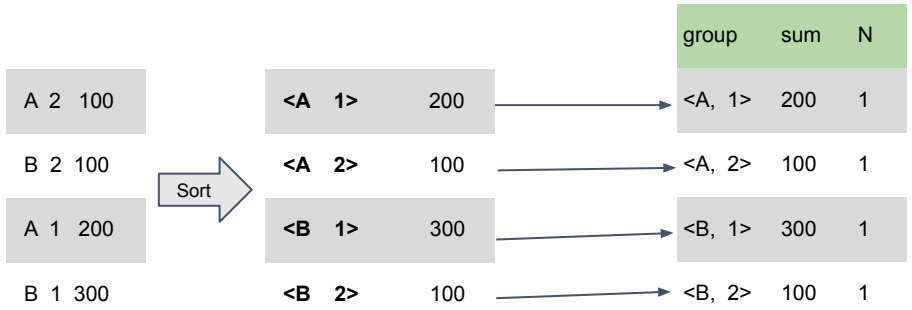
Greenplum

```
select
      brand, type, avg(quantity) from
      sales
group by
      rollup (brand, type);
```

# Greenplum如何实现Rollup

Greenplum

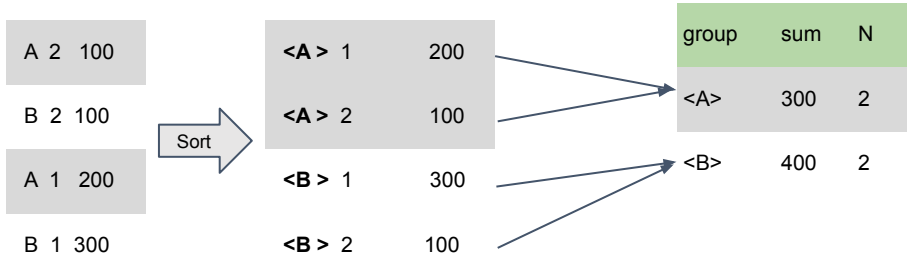
select brand, type, avg(quantity) from sales group by rollup (brand, type);



# Greenplum如何实现Rollup

Greenplum

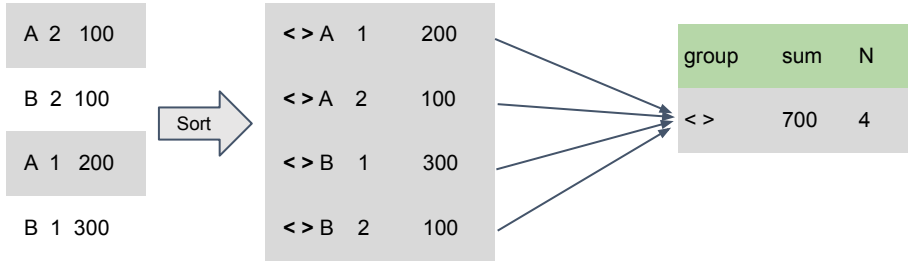
select brand, type, avg(quantity) from sales group by rollup (brand, type);



# Greenplum如何实现Rollup

Greenplum

select brand, type, avg(quantity) from sales group by rollup (brand, type);



# Greenplum如何实现Rollup

Greenplum

| | | |
|---|---|---|
| A | 1 | 200 |
| A | 2 | 100 |
| B | 1 | 300 |
| B | 2 | 100 |

| | | |
|---|---|---|
| A | 1 | 400 |
| A | 2 | 200 |
| B | 1 | 400 |
| B | 2 | 100 |

| group | sum | N |
|---|---|---|
| <A, 1> | 200 | 1 |
| <A, 2> | 100 | 1 |
| <B, 1> | 300 | 1 |
| <B, 2> | 100 | 1 |
| <A> | 300 | 2 |
| <B> | 400 | 2 |
| < > | 700 | 4 |

| group | sum | N |
|---|---|---|
| <A, 1> | 400 | 1 |
| <A, 2> | 200 | 1 |
| <B, 1> | 400 | 1 |
| <B, 2> | 100 | 1 |
| <A> | 600 | 2 |
| <B> | 500 | 2 |
| < > | 1100 | 4 |

combine

| group | sum | N |
|---|---|---|
| <A, 1> | 600 | 2 |
| <A, 2> | 300 | 2 |
| <B, 1> | 700 | 2 |
| <B, 2> | 200 | 2 |
| <A> | 900 | 4 |
| <B> | 900 | 4 |
| < > | 1800 | 8 |

Final

| group | avg |
|---|---|
| <A, 1> | 300 |
| <A, 2> | 150 |
| <B, 1> | 350 |
| <B, 2> | 100 |
| <A> | 225 |
| <B> | 225 |
| < > | 225 |

# Greenplum如何实现Rollup

```
explain (costs off) select brand, type, avg(quantity) from sales group by rollup (brand, type);
                                                    QUERY PLAN
-------------------------------------------------------------------------------------------------------------------------------------------
 Gather Motion 3:1  (slice2; segments: 3)
   ->  HashAggregate
         Group Key: partial_aggregation.brand, partial_aggregation.type, partial_aggregation."grouping",
partial_aggregation."group_id"
         ->  Subquery Scan on partial_aggregation
               ->  Redistribute Motion 3:3  (slice1; segments: 3)
                     Hash Key: "rollup".brand, "rollup".type
                     ->  GroupAggregate
                           Group Key: "rollup"."grouping", "rollup"."group_id", "rollup".brand, "rollup".type
                           ->  Subquery Scan on "rollup"
                                 ->  GroupAggregate
                                       Group Key: rollup_1.brand, rollup_1."grouping", rollup_1."group_id", rollup_1.type
                                       ->  Subquery Scan on rollup_1
                                             ->  GroupAggregate
                                                   Group Key: sales.brand, sales.type
                                                   ->  Sort
                                                         Sort Key: sales.brand, sales.type
                                                         ->  Seq Scan on sales
```

Greenplum

# GREENPLUM DATABASE®

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# THANKS

## 谢谢观看