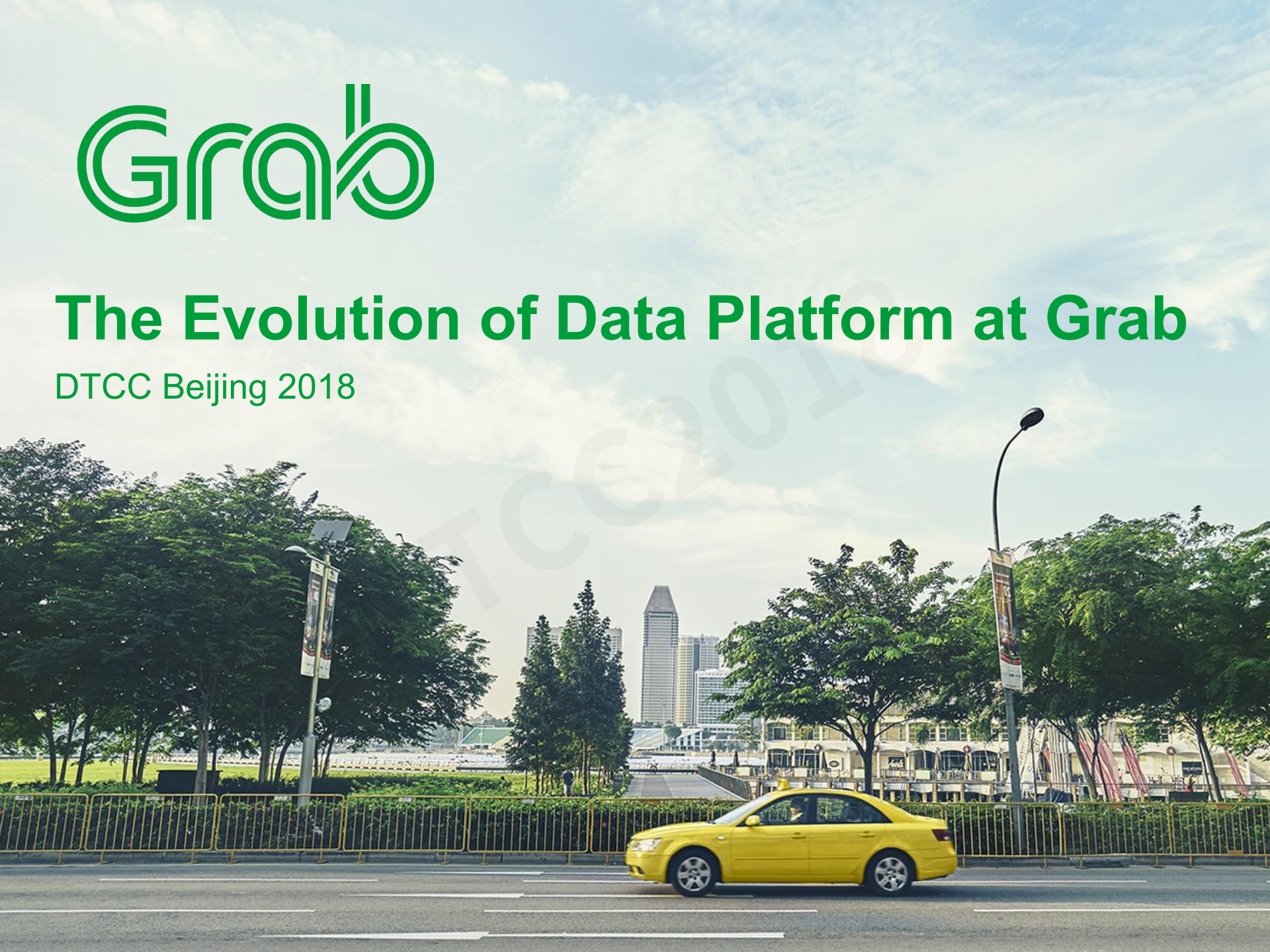
The Evolution of the Data Platform in Grab

Cheng Feng



The Evolution of Data Platform at Grab

DTCC Beijing 2018

#1 mobile app in SEA

1 Billion+
Rides annually

86 Million+
Downloads

2.6 Million+
Drivers in 191 cities

#1 transport app in SEA

Agenda

- **History, Data in Grab**
  - Data Analytics Platforms
  - Architecture review
- **Now, Why Presto, Lessons and Mistakes**
  - Decouple storage & compute
  - Stories and lessons learned
  - Data Gateway
- **Future, Serverless, Real-time platform**
  - Serverless data platform
  - Real-time platform

History, Data in Grab

Early Challenges

Architecture review

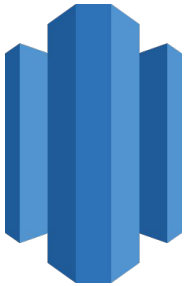
Early Challenges

- Hyper Local Strategy
  - Different markets track different metrics
  - Analytics is driven from the ground up
  - Hard to pre-process data due to these requirements

- Scaling to keep up with growth
  - Data Volume would double every 2 - 3 months
  - Number of reports, metrics and consumers growing.
  - Complexity of workloads also increase

Scalability and Concurrency Problems

- Simple stack, easy to manage for small team.



Data Warehouse Operational Reports Management Reports

- All workloads run on a massive Redshift Cluster
- Scalable but storage and compute are tightly coupled
- High concurrency and resource contention killed perf.

Decoupling Storage and Compute

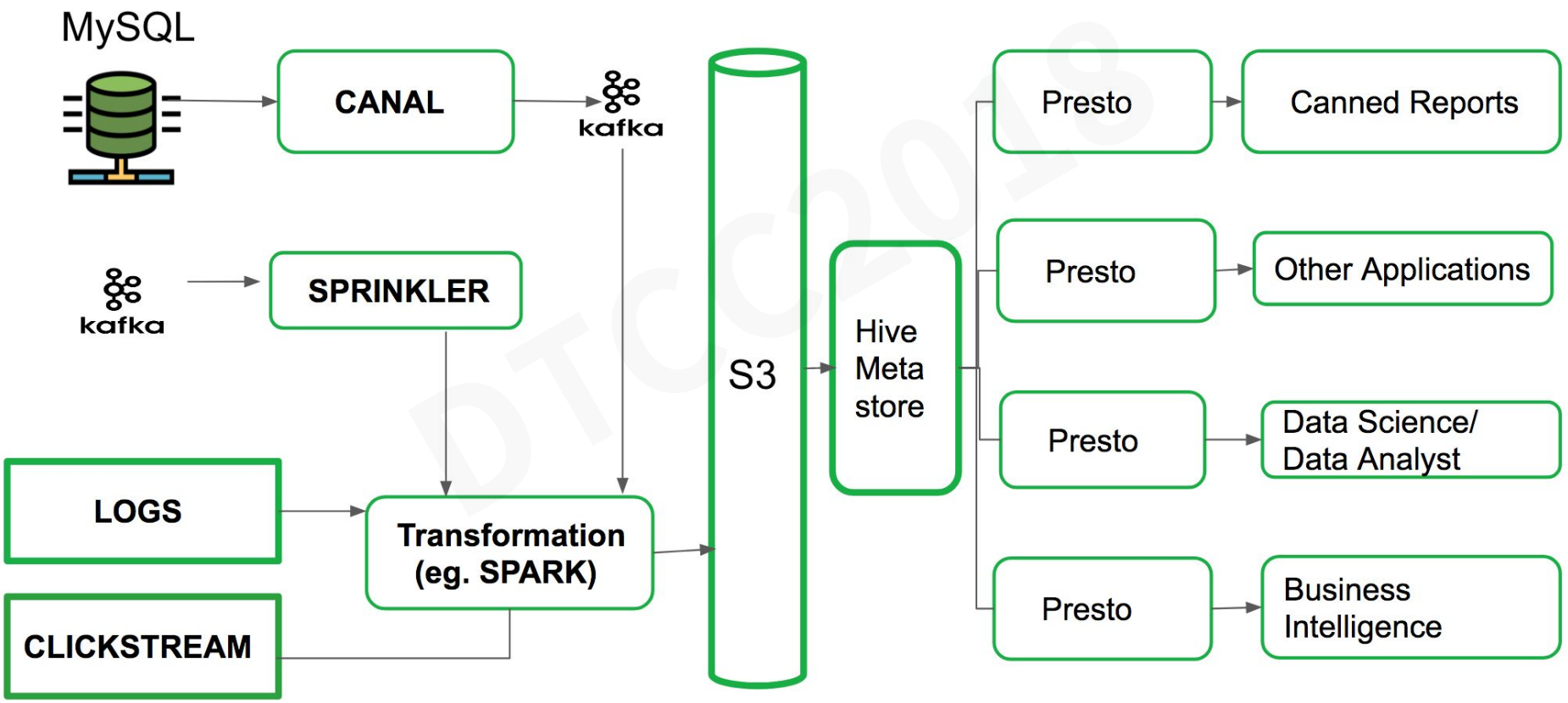
CLIENT

Data Gateway

COMPUTATION

STORAGE

Data Analytics Platforms



Key metrics

~2PB hot data
~15TB new daily

~20,000 jobs daily
~50,000 queries per day
in Presto

~20 clusters
~600 instances
~300 presto active users

Now, Why Presto, Lessons and Mistakes

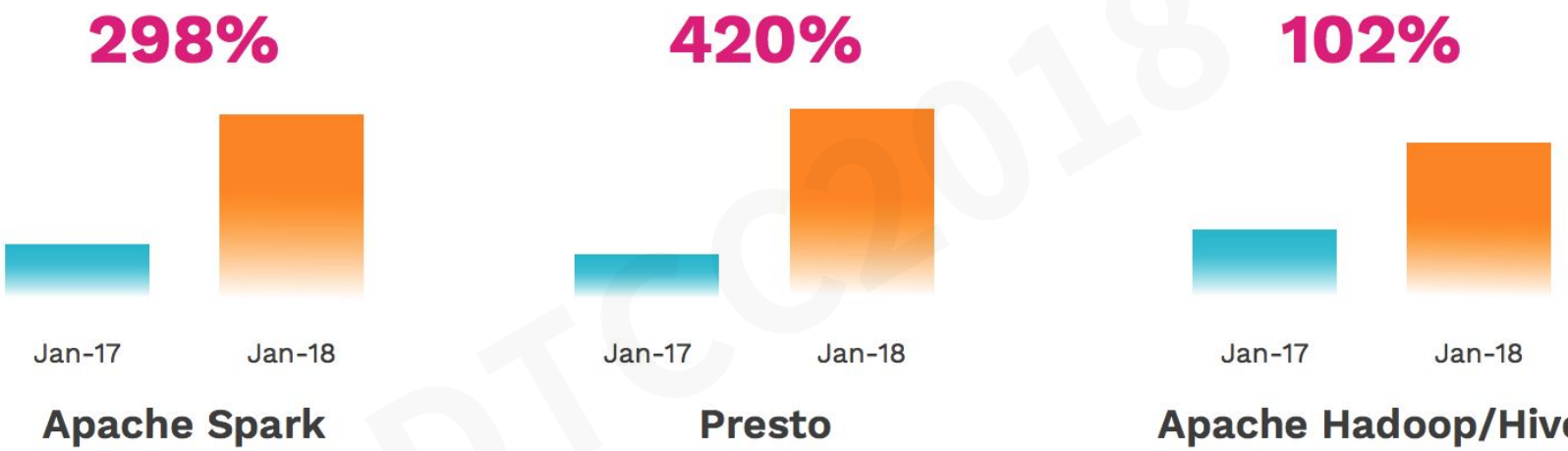
Decouple storage & compute

Presto, Stories and lessons learned

Data Gateway

BIG DATA ACTIVATION REPORT 2018

Total Engine Usage Globally by Compute Hours (YoY Change Jan '17–Jan '18)



Qubole®

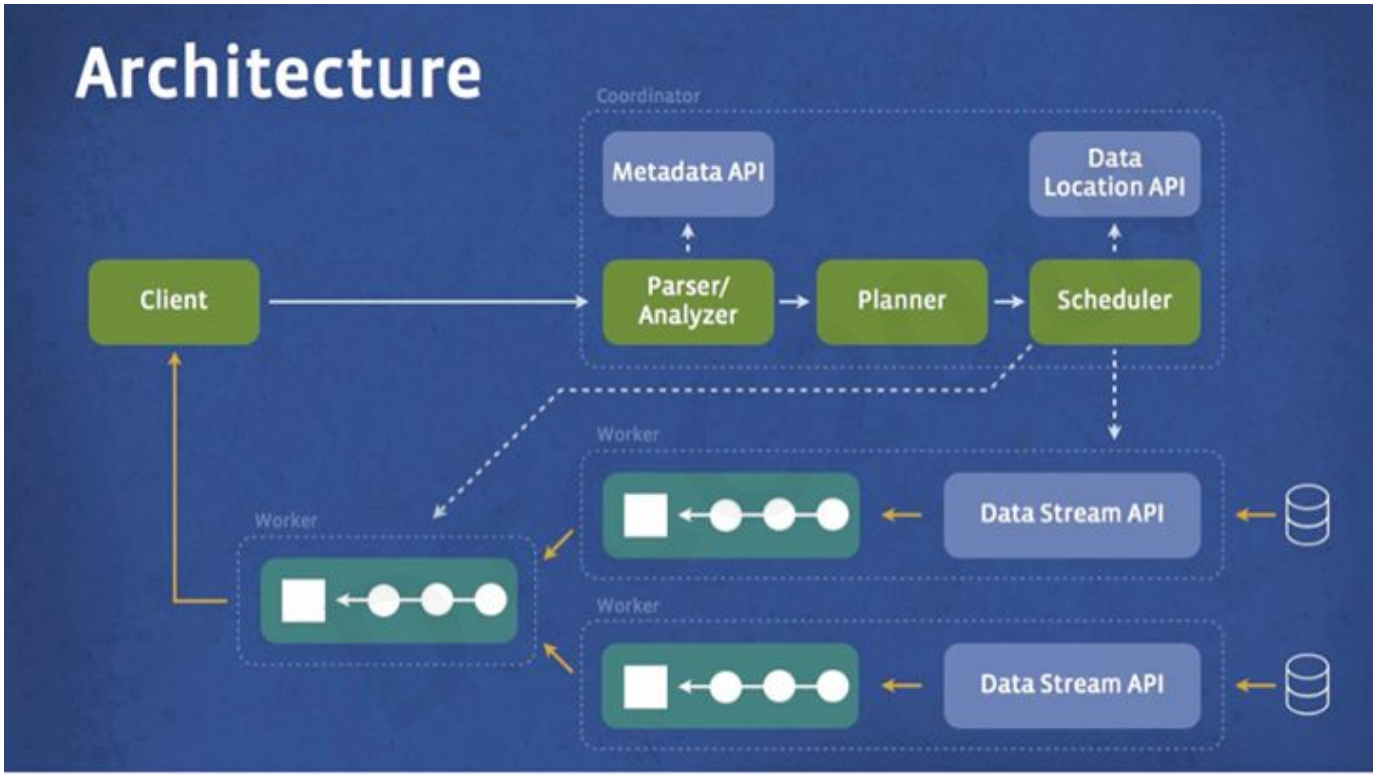
Presto

Understanding the memory management in presto to make trade-off between concurrency and memory Limit

Choosing the right EC2 Instance Type with correct configuration

Presto Performance Tuning

Presto Architecture



https://www.facebook.com/notes/facebook-engineering/presto-interacting-with-petabytes-of-data-at-facebook/10151786197628920/

Example

```
SELECT tab1.hour,
       tab1.pickup_geohash,
       Count(*) AS num
FROM   catalog.SCHEMA.bookings tab1
       INNER JOIN catalog.SCHEMA.cities tab2
               ON ( tab1.city_id = tab2.id )
WHERE  tab1.year = '2017'
       AND tab1.month = '11'
       AND tab1.day = '19'
       AND tab2.country_code = 'SG'
       ...
GROUP  BY 1, 2
HAVING Count(*) > 10000
```

PrestoCli

Presto JDBC Driver

Presto-cli

Data Gateway

Http

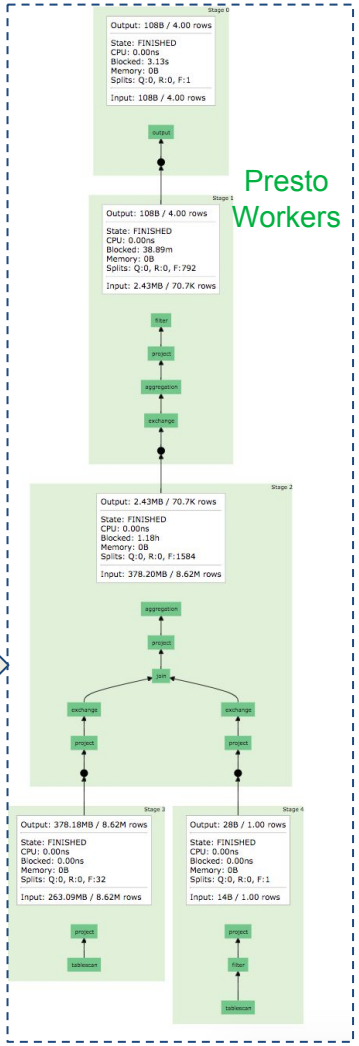
Query Results

PrestoCoodinator

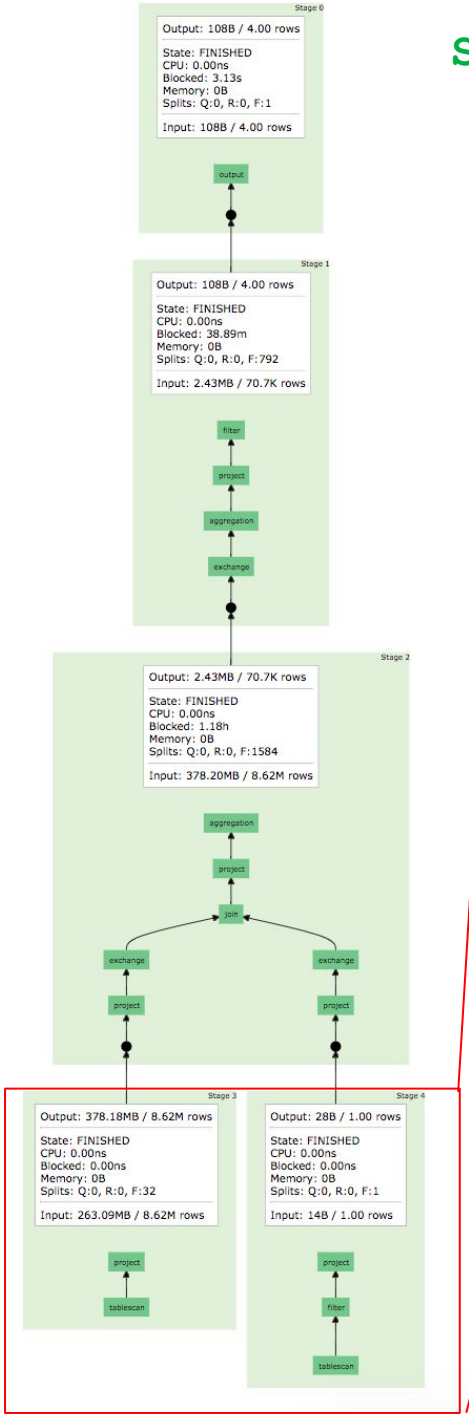
1. Parser the query and call metadata API

2. Come up with a logic plan, then physical plan with a series of stages

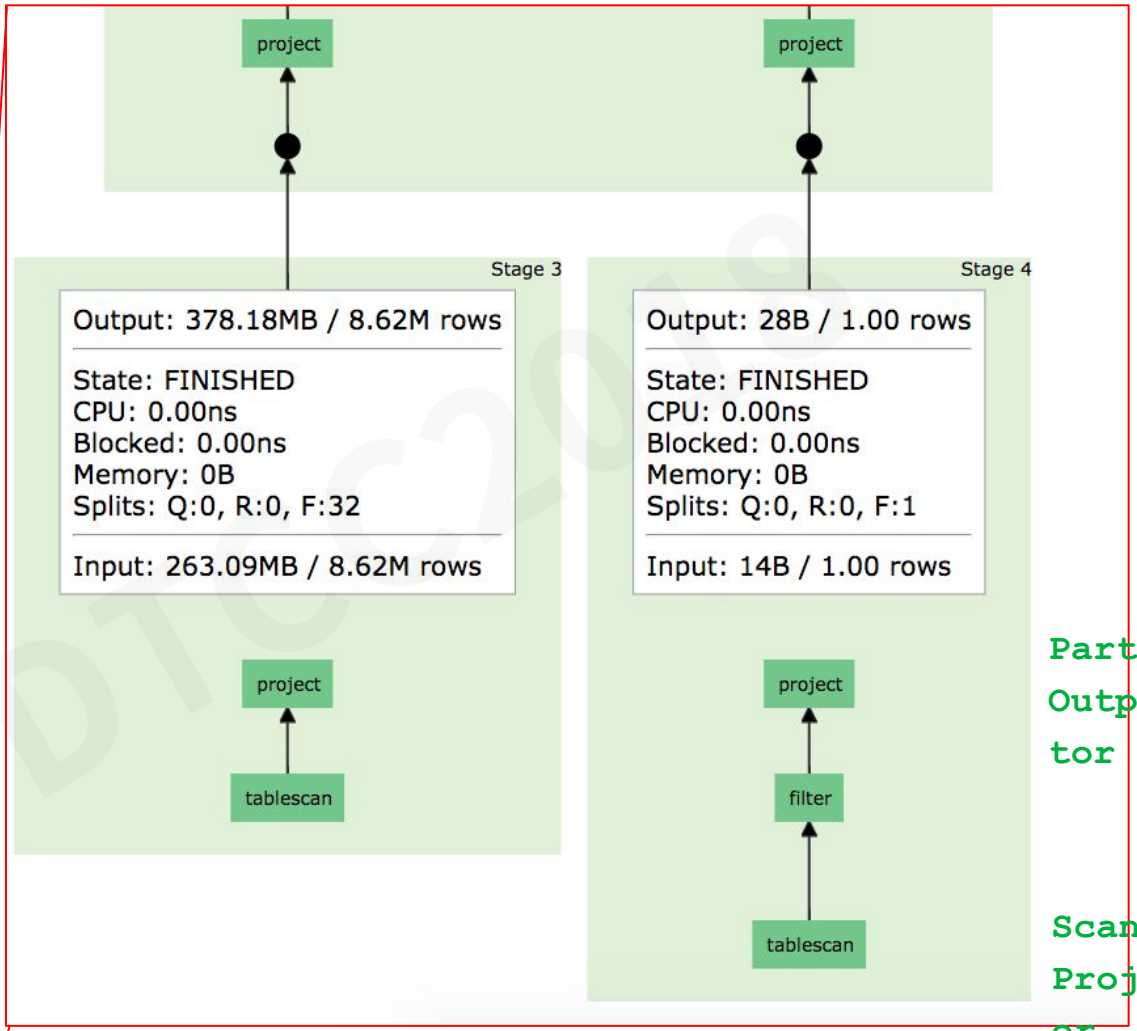
3. Stages will be translated into tasks running on a cluster of Presto workers



Presto Workers

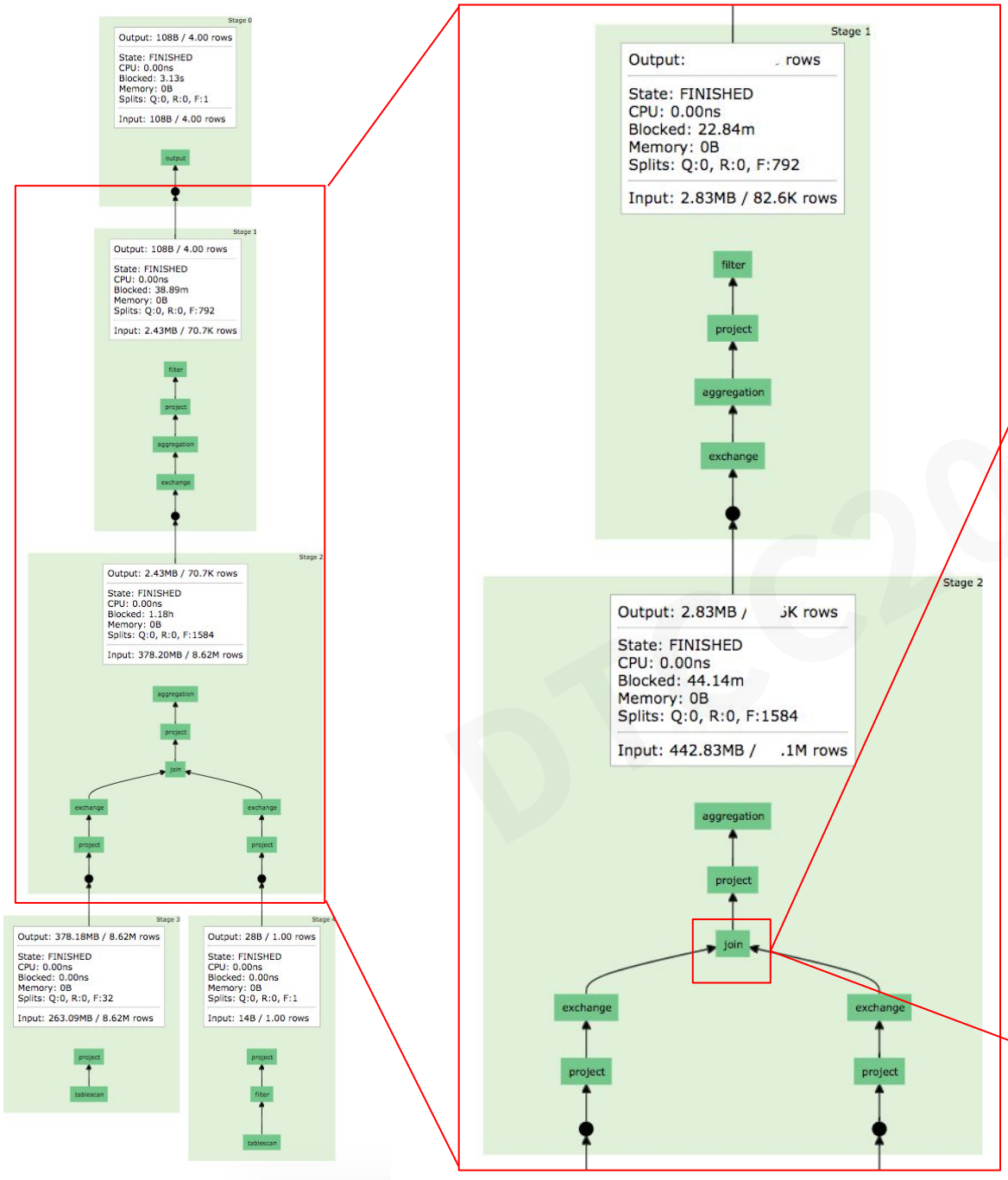


SOURCE stage



PartitionedOutputOperator

ScanFilterAndProjectOperator



HASH stage

Tasks operate on splits; Split is part of table/dataset;

Tasks contain one or more parallel drivers Drivers act a set of operators in memory

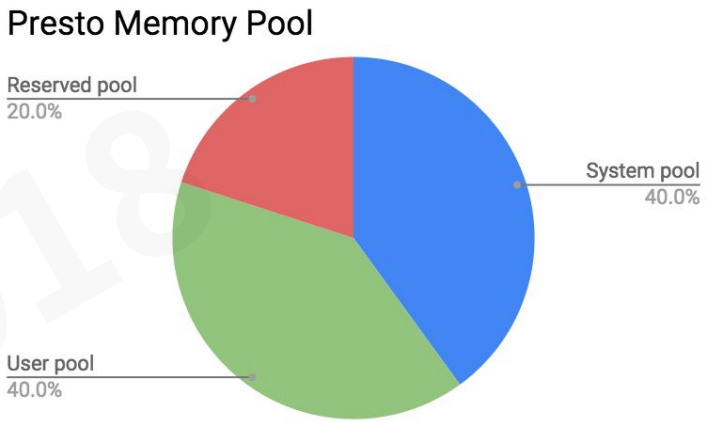
For example, A Join has HashBuilderOperator LookupJoinOperator

Error #1

Query exceeded max memory size of 30GB

Concurrency VS Memory Limit

- Presto Memory Pool
  - General pool(user+system)
    - Initially submitted to General Memory Pool
  - Reserved pool
    - Used only 1 time if GP exhausted
    - query.max-memory-per-node (Limit for per query per node)



Notes:

More Reserved Memory, support bigger query; (0% or 60%)

More General Memory (maxHeap-Reserved), support more concurrent Jobs.

Spilling memory to disk to avoid exceeding memory limits for the query.

https://github.com/prestodb/presto/issues/2624

https://github.com/prestodb/presto/issues/8638

Example

Case 1:

maxHeap=10GB,General pool=9GB; Reserved pool=1GB

If you have 8 queries need 1GB for each, and one need 6GB. The query(6GB) will fail, and we can have **8** queries running in general pool.

Case 2:

maxHeap=10GB,General pool=4GB; Reserved pool=6GB

If you have 8 queries need 1GB for each, and one need 6GB. The query need 6GB will be move to reserved pool, but in general pool, we can only run **4** queries parallely, and the other 4 queries will queuing until some queries finish execution.

Error #2

Encountered too many errors talking to a worker node. The node may have crashed or be under too much load.

Page Transport Timeout

- Infrastructure
  - Outbound network spikes hitting caps
  - Coordinator sending plan was costly
  - Workers saturating NICs
  - No fault tolerance

- Configuration
  - JVM size
  - GC type(Correlated GC pauses with errors => G1GC collector)
  - Tuned timeouts

Lesson #3

Presto Performance Tuning

Presto Optimization

- Choosing the Right Storage Plan
  - Partition the data along natural query boundaries;
  - Use columnar data store;
  - Optimize file sizes (File Size, Compression).

- Query optimization
  - Simple rule-based optimizer;
  - Reordering the join, for example: large tables first in join clause;
  - The cardinality within GROUP BY, for example: paxid,country;
  - Distributed join or broadcast join.

Case study

```
SELECT vertical,
       date_local,
       AVG(distance) AS avg_distance,
       COUNT(event) AS event_count,
       ...
FROM passenger_check_price tab1
  LEFT JOIN test_bookings tab2
        ON (tab1.bookingcode = tab2.code)
  LEFT JOIN taxi_types tab3
       ON (tab1.vehicletypeid = tab3.id
        AND tab1.streamtime >= tab3.start_at
        AND tab1.streamtime < tab3.end_at)
WHERE  concat(year,'-',month,'-',day,' ',hour,':00:00')
    >= date_format(now() -INTERVAL '30' day,'%Y-%m-%d')
AND tab2.code IS NULL
...
GROUP BY 1,
         2;
```

```
SELECT vertical,
       date_local,
       AVG(distance) AS avg_distance,
       COUNT(event) AS event_count,
       ...
FROM passenger_check_price tab1
  LEFT JOIN test_bookings tab2
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       ON (tab1.vehicletypeid = tab3.id )
WHERE tab2.code IS NULL
AND tab1.streamtime >= tab3.start_at
AND tab1.streamtime < tab3.end_at
AND  concat(year,'-',month,'-',day,' ',hour,':00:00')
    >= date_format(now() -INTERVAL '30' day,'%Y-%m-%d')
...
GROUP BY 1,
         2;
```
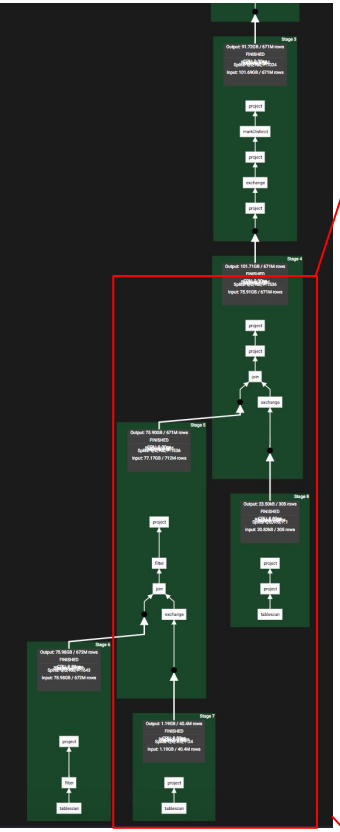
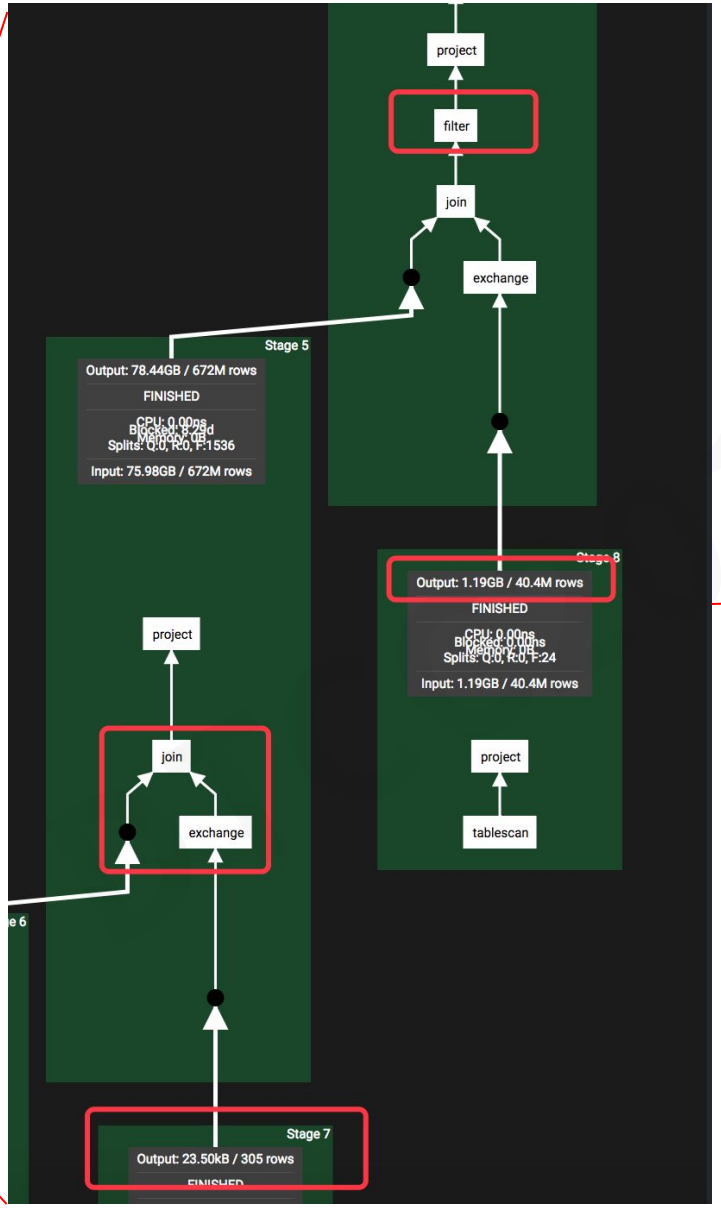
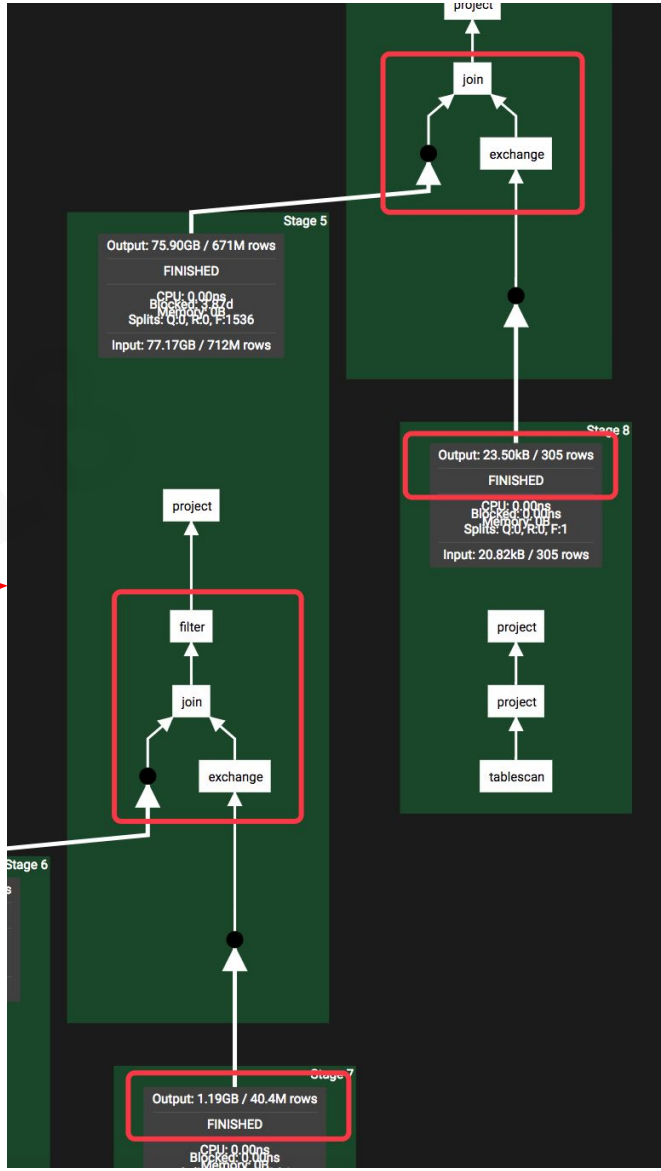



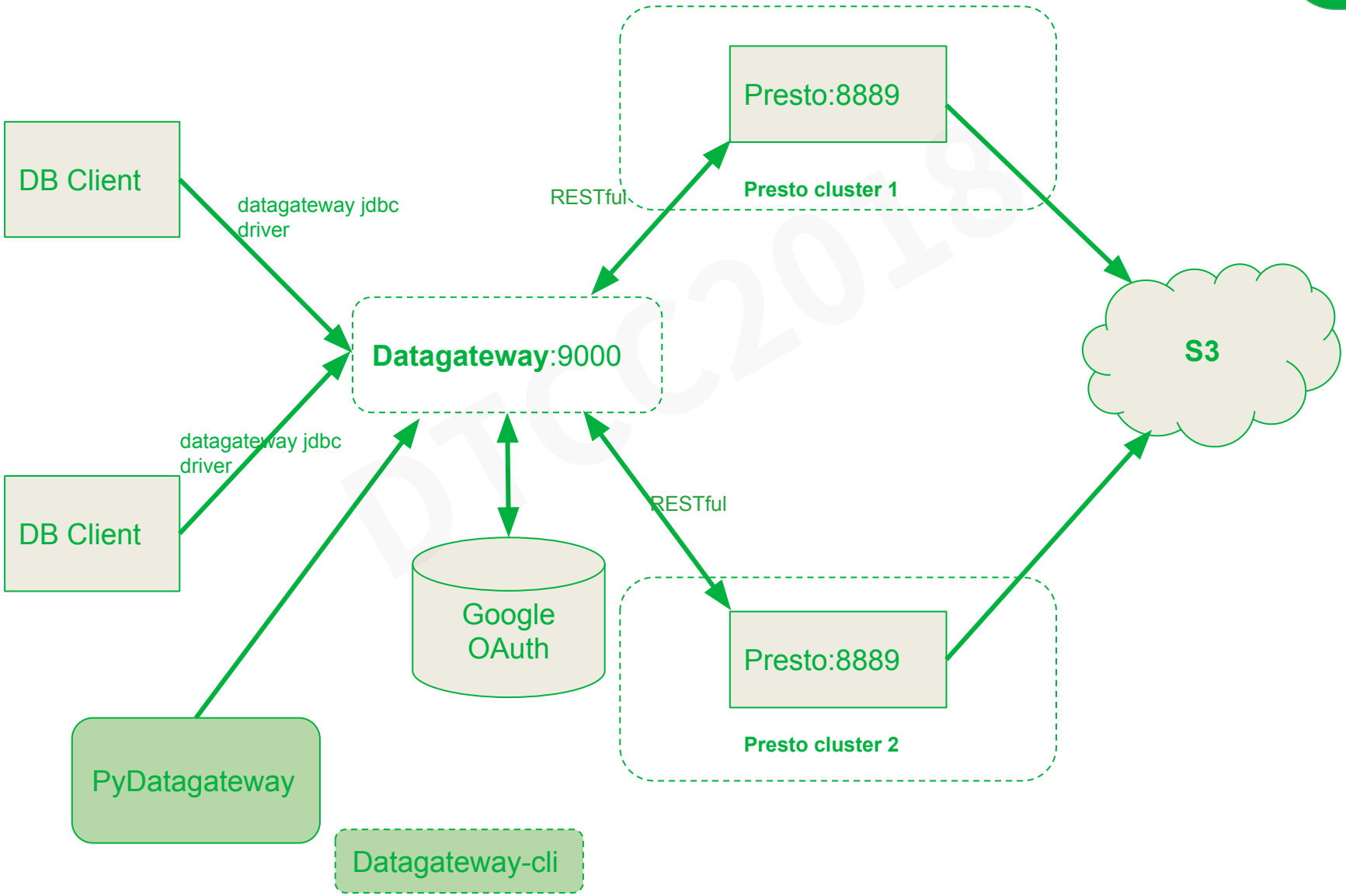




Before 13.79m

After 6.76m

Datagateway Design



Future, Serverless, Real-time platform

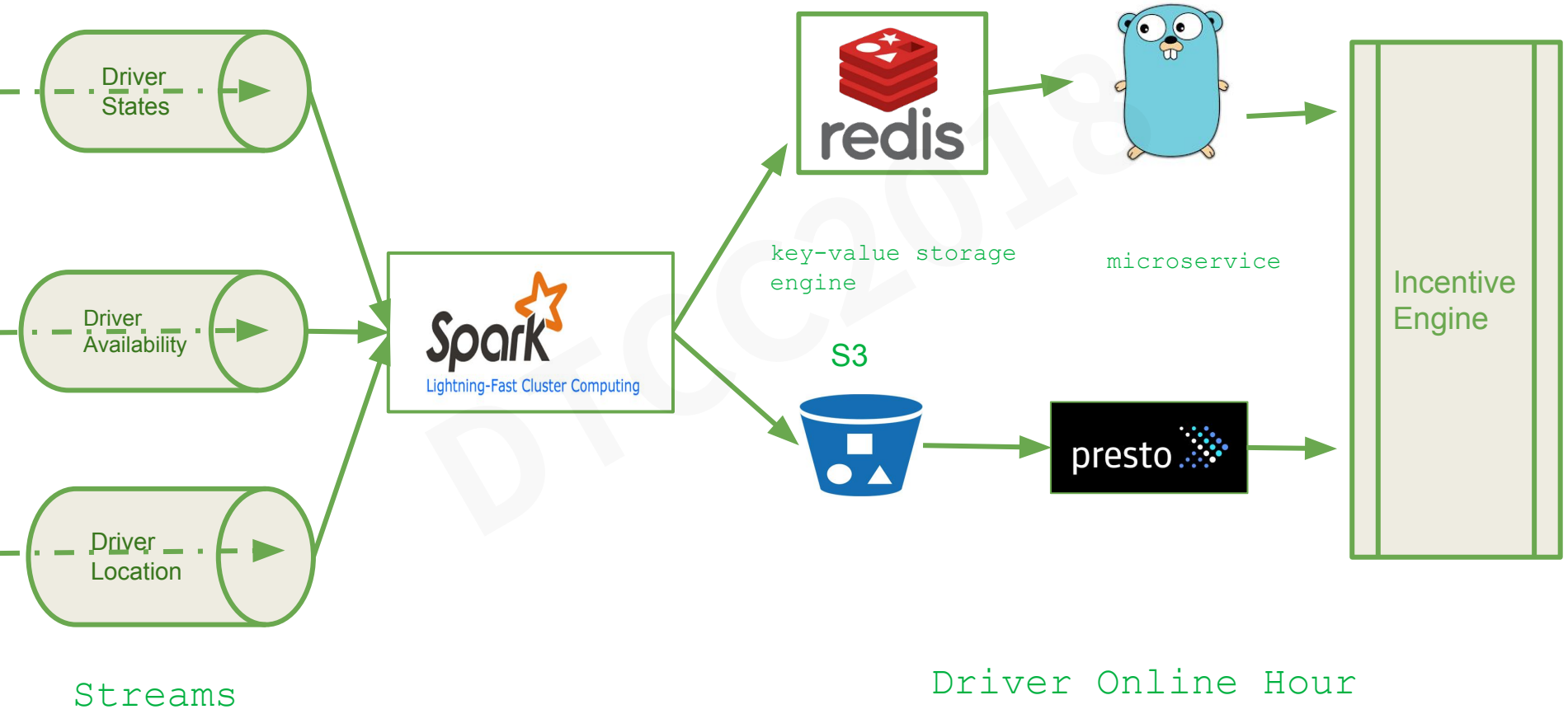
Serverless data platform

Real-time platform

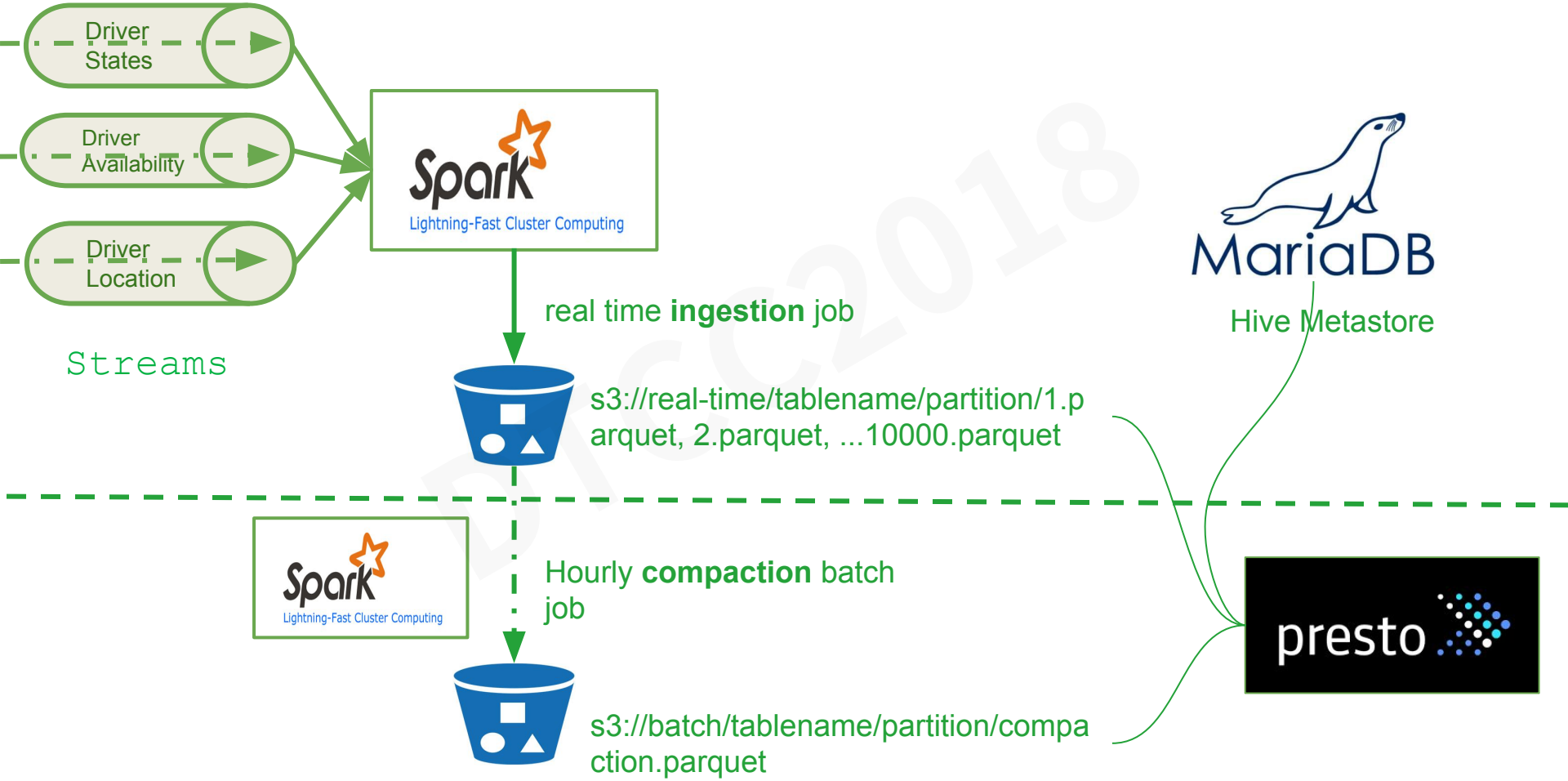
Moving to serverless data platform

- Athena
  - Serverless Presto compatible query engine;
  - No code changes migration, Cost saving (bill based on data volume scaned);
  -
- Glue
  - Serveless Spark compatible ETL service;
  - Automatically generates the code(billed by DPU)

Processing Data in real-time



Making Data available in real-time



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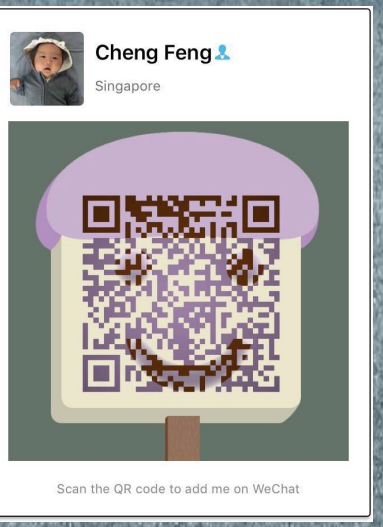

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