

# Uber Business Metrics Generation and Management Through Apache Flink

## Uber 商业性能指标生成与管理

公司： Uber

职位： Engineer at Uber Marketplace

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## Uber Mission

We ignite opportunity by setting the world in motion.  
我们构建交通服务平台，为全球点燃机遇之火。

“运”动全球，燃亮机会。

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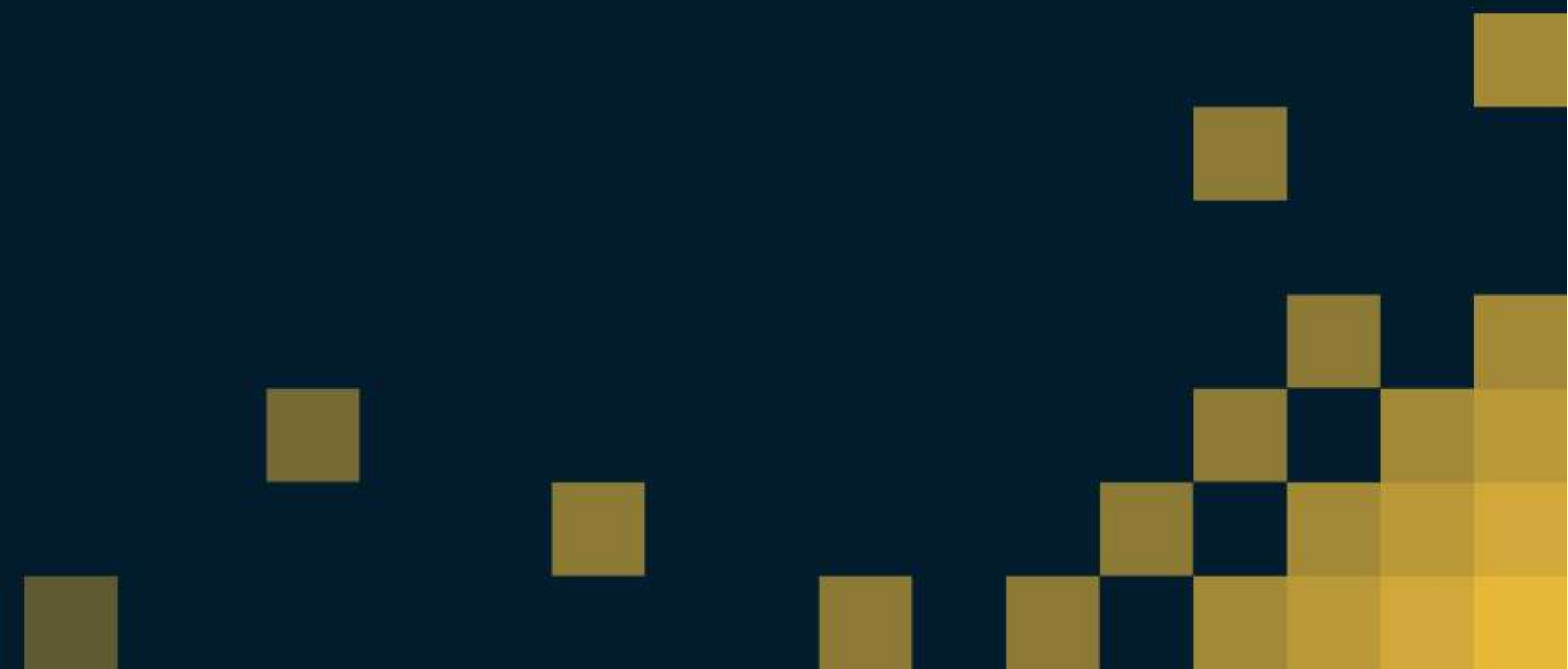


## Outline

- Marketplace
- Project background
- Architecture
- User case walkthrough
- Challenges
- Future work

- 部门介绍
- 项目背景
- 系统架构
- 案例分析
- 挑战
- 展望

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# Marketplace Team

Marketplace Platform

市场平台组



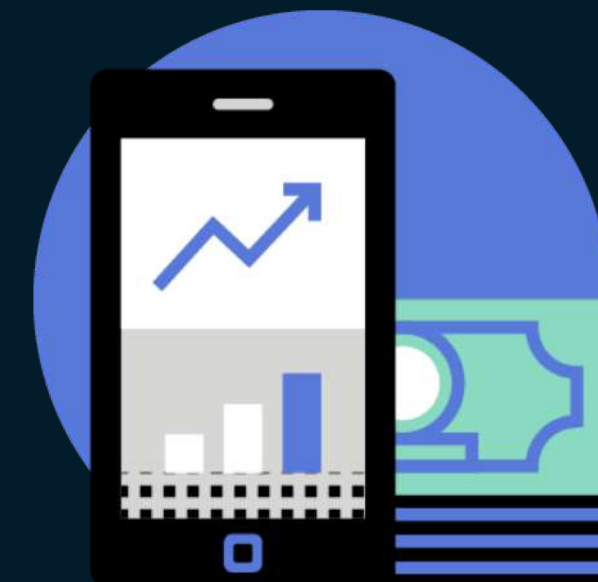
Marketplace Dynamics

市场动态组



Marketplace Data

市场数据组



Marketplace Fare

市场费用组



## Marketplace Data

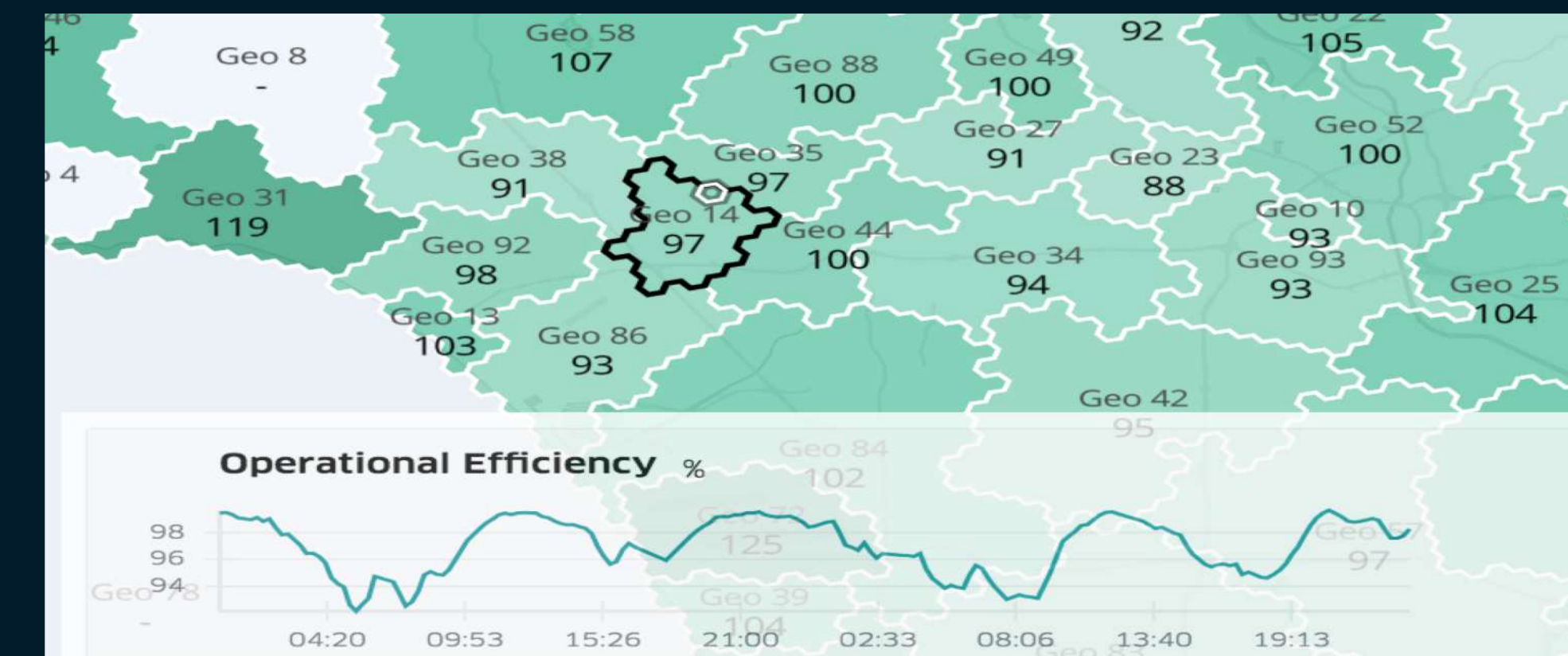
- Mission: Empower teams throughout Uber to understand and improve the efficiency of the marketplace by providing real time data for our Marketplace levers, modeling and analysis  
使命：为Uber各组提供实时数据来对市场进行建模和分析，从而更好地理解和改进市场运作效率
- Data sources: trip lifecycle, matching, rider, driver, fare, mobile across 100+ Apache Kafka topics  
数据来源：乘车过程，匹配，乘客，司机，费用，移动设备等100多种Kafka主题
- **24 Elasticsearch clusters, 1000T data, 300+ million queries / week , 30+ customer services**  
数据复杂度和规模：如上



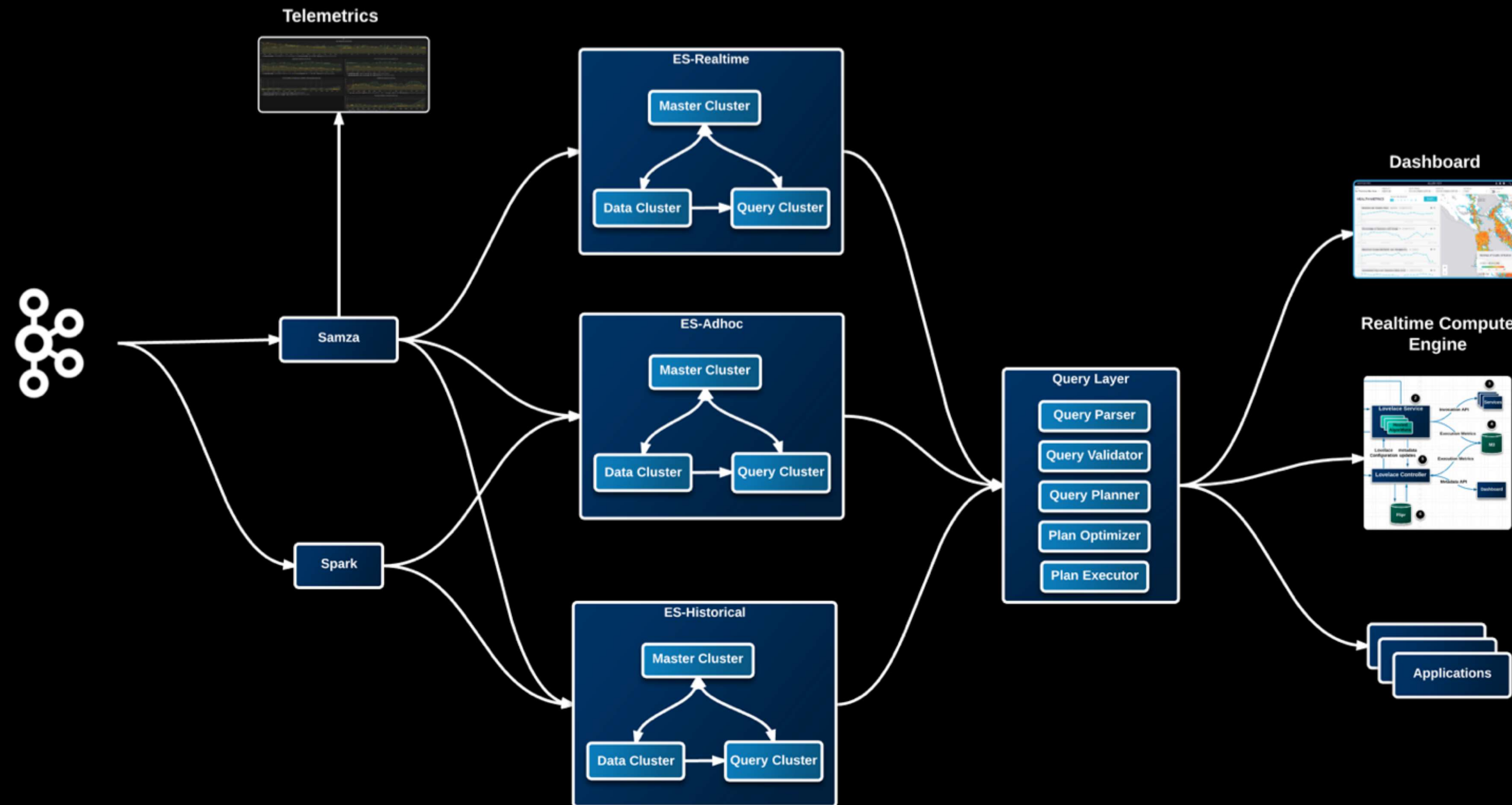
## Human Consumption – Incentives 激励



## Human Consumption - Regional Metrics 区域指标

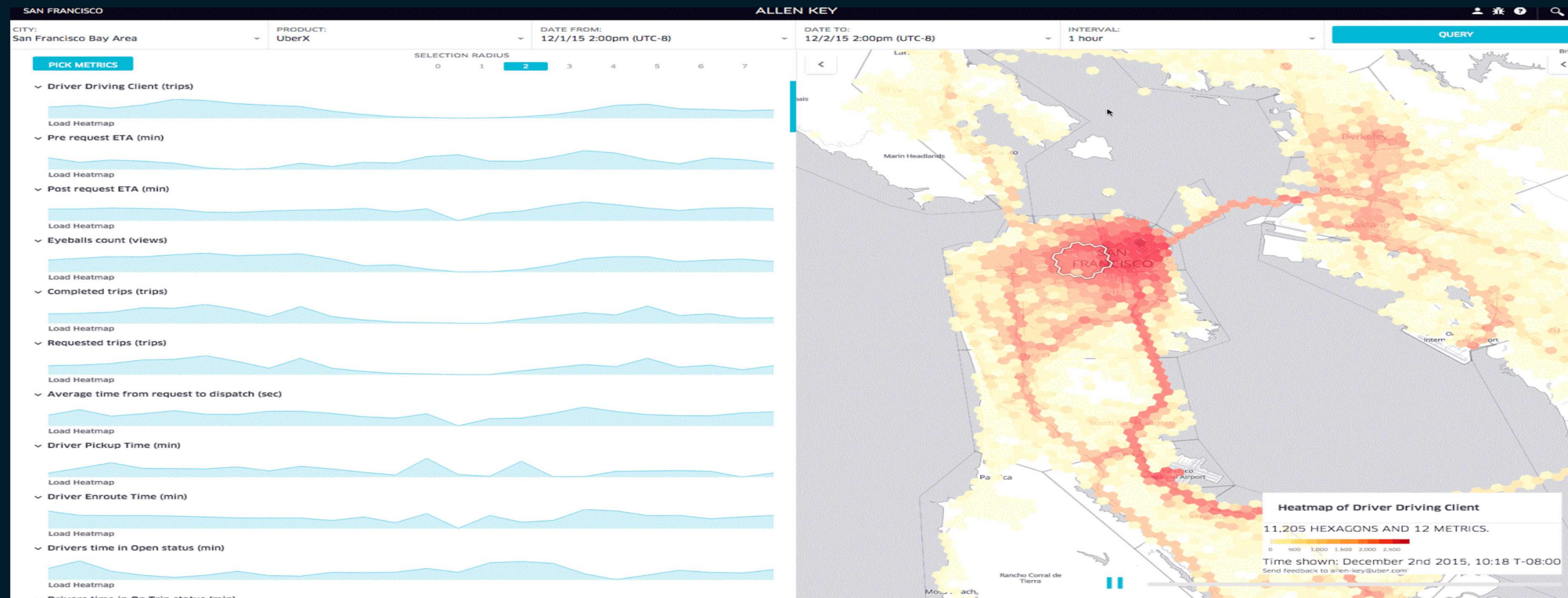








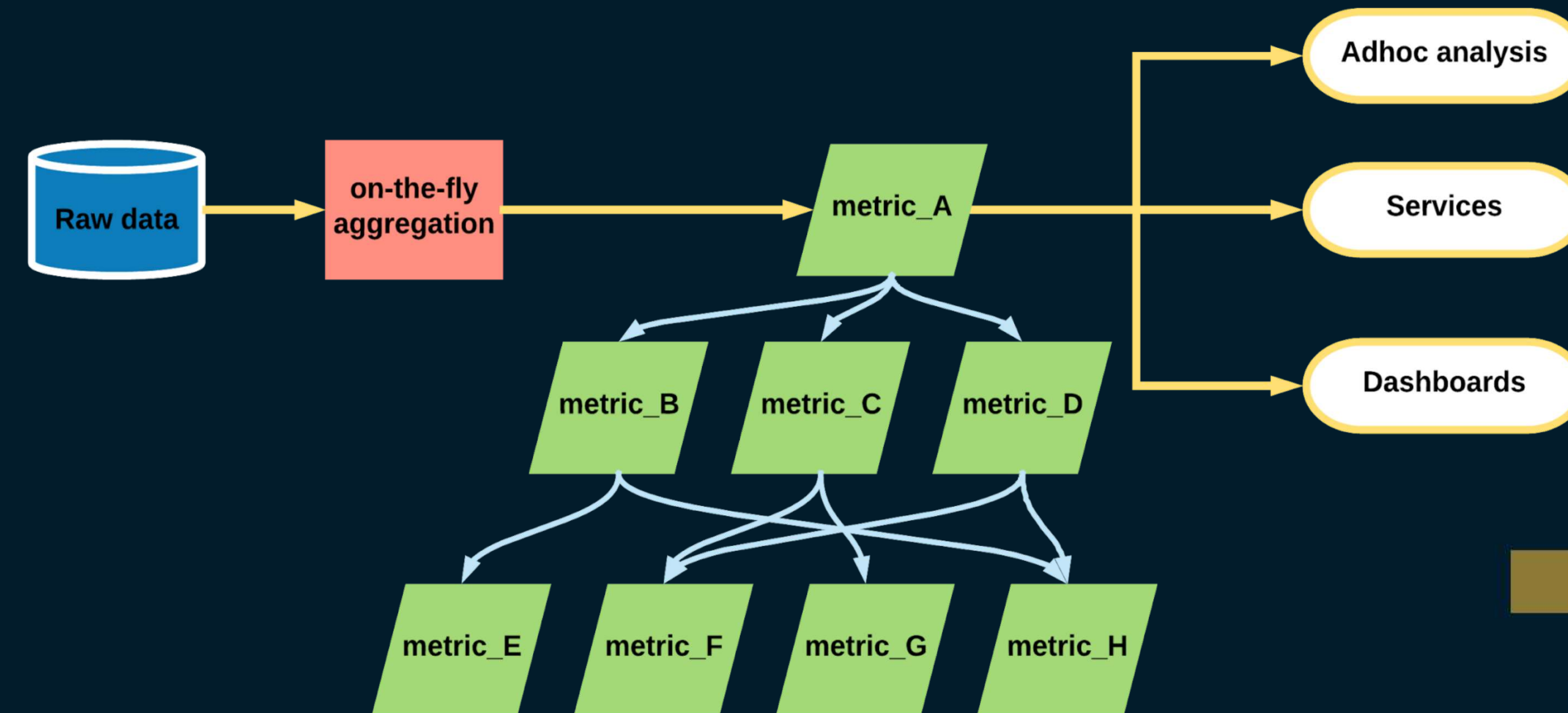
# Real-Time Analytics





## Project Background

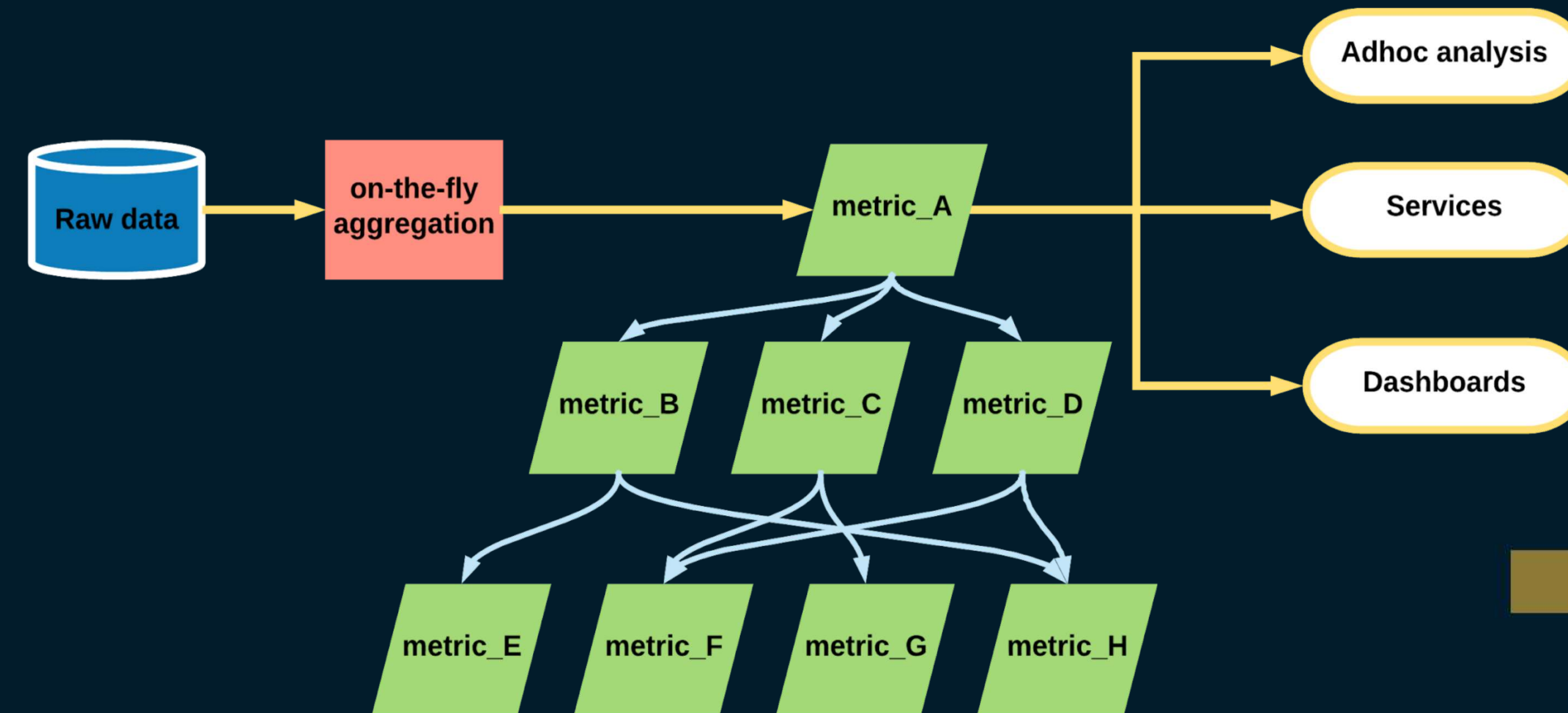
- Usage pattern 使用模式
- Issues 问题
- Solution 方案





## Usage Pattern

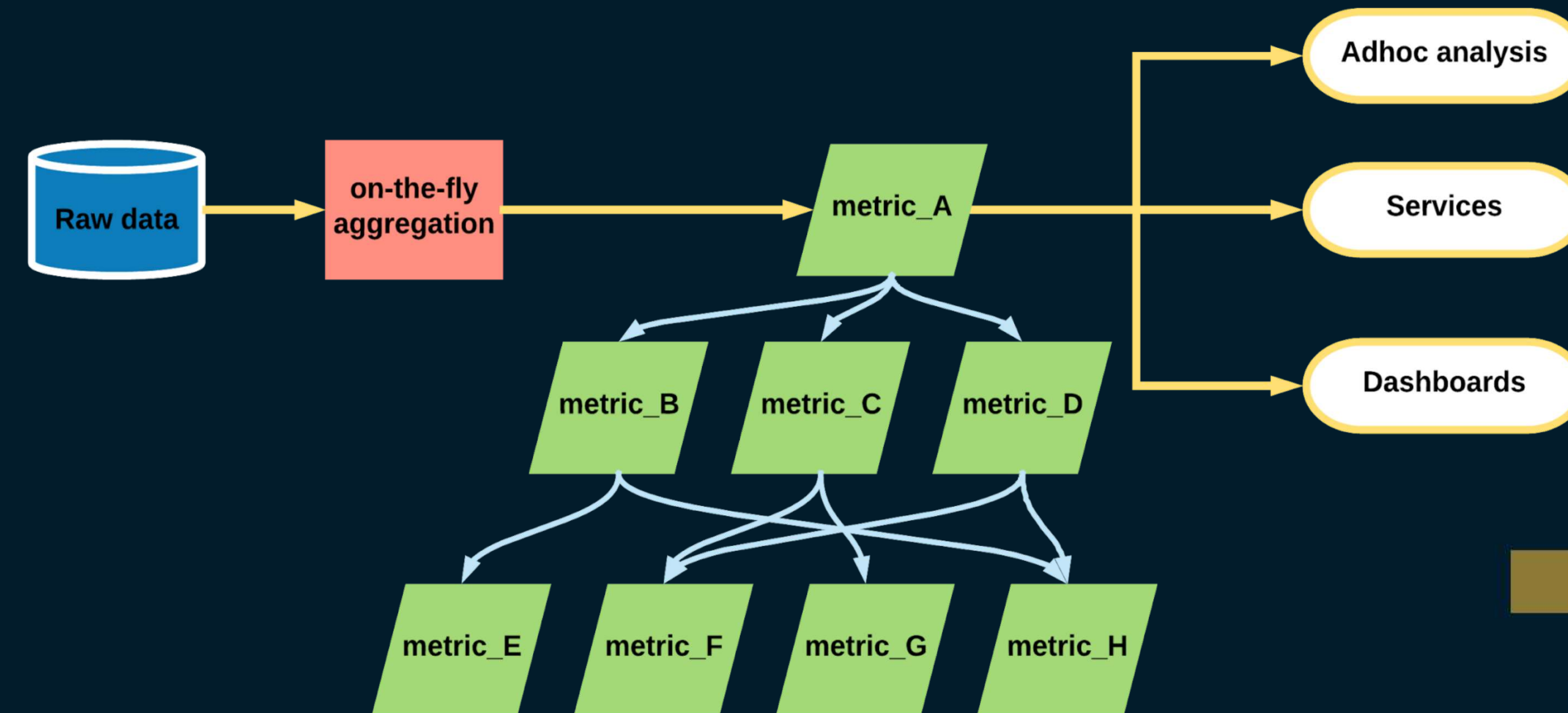
- Metrics are aggregated on the fly from raw data.  
指标都是在当前需要的时候，直接从原始数据现场计算
- Metric definitions have a DAG structure.  
指标定义有一个固定的DAG结构
- Metrics are usually aggregated with fixed pattern upon a limited set of dimensions, e.g., time, geo  
指标通常都是有固定的模式基于一些有限的方面来统计计算的





## Issues

- Resource waste 资源浪费
- Bad performance 低性能
- Inconsistency 不一致
- ...

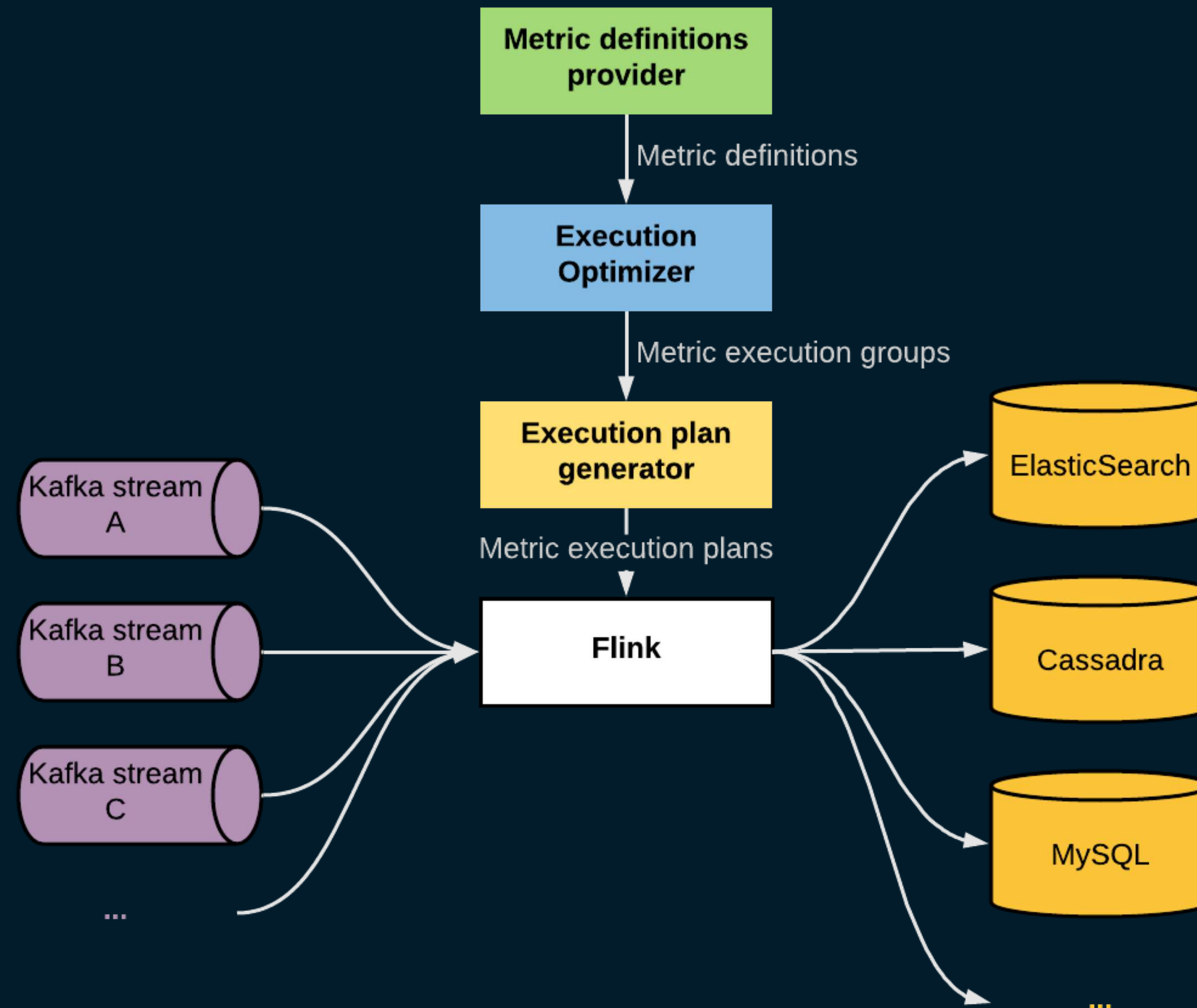




## Solution

- An E2E platform 一个端到端的平台
  - Defines metrics with a unified DSL for multiple datasources like Kafka, Elastic Search etc.  
基于统一的DSL来定义指标，并且允许多种输入数据类型
  - Optimizes execution plan based on objectives including performance, isolation, and etc.  
根据不同的目标（性能，隔离等）来优化执行计划
  - Generates final metrics, instead of generating an intermediate raw dataset  
生成最终用户使用的指标，而不是生成中间原数据让用户进一步计算







## Metric Definition

- Formula: a DSL describing an aggregation or arithmetic operation over aggregation

公式：定义如何计算指标

*$metric\_A + metric\_B * metric\_C - avg((table\_A \text{ where } (exists(column\_A) \text{ AND } (column\_B \neq 0))).column\_C)$*

- Dimensions: over which this metric will be aggregated

维度：定义指标是具体在那些特定的维度来计算

Time, geo, product type, and ...

- Sinks: physical storage of this metric

接受池：定义指标的物理存储器

Elastic search, Cassandra, MySQL, and ...



## Execution Optimizer

1. Parse all metric definitions

解析所有的指标定义

2. Build a DAG to link all metrics based on data operations

构建一个DAG来通过数据操作连接所有的指标计算

3. Optimize the DAG to remove duplication, promote isolation and improve performance

对指标进行分组，优化DAG从而去除重复，提升隔离以及改进性能

4. Generate metric group config files and feed them into execution plan generator

生成指标分组配置文件，提供给执行计划生成器



## Execution Plan Generator

1. Parse metric group config files

解析指标分组配置文件

2. Given configs, build a DAG of stream operators. Within each stream operator, there could be also a DAG of event operators

构建流操作 DAG，其中每一个 DAG 节点中是基于事件的 DAG 来表达公式计算。

3. Applied pre-defined operator templates and generate the final Flink execution graph

应用提前定义的 Flink 模板来生成 Flink 执行图



## Additional Functionalities

- Given a specific set of metrics, export SQL for it.  
选定一组指标，可以导出对应的 SQL
- Convert the adhoc query to leverage existing data in platform  
将临时用户提交的查询进行转换，从而可以利用已经计算好的指标库
- Auto debugging to find root cause of data abnormality  
自动寻找产生不正常数据的根本原因
- Metric discovery  
指标探索
- ....



## Benefits

- Avoid inconsistency and duplicate effort
  - Avoid cluster resource waste
  - Improve the metrics definition
  - Decouple metrics definition and generation techniques
  - Decouple platform from storage
- 避免不一致性以及重复的工作
  - 避免资源浪费
  - 改进指标定义
  - 分离指标定义和运算
  - 平台与存储的松耦合



## Use Case Walkthrough

Driver status summary of one minute: 基于1分钟的司机状态统计

1.Driver utilization per hexagon on 1 minute

单独 hexagon 每分钟的司机占用情况

2.Driver utilization per city on 1 minute

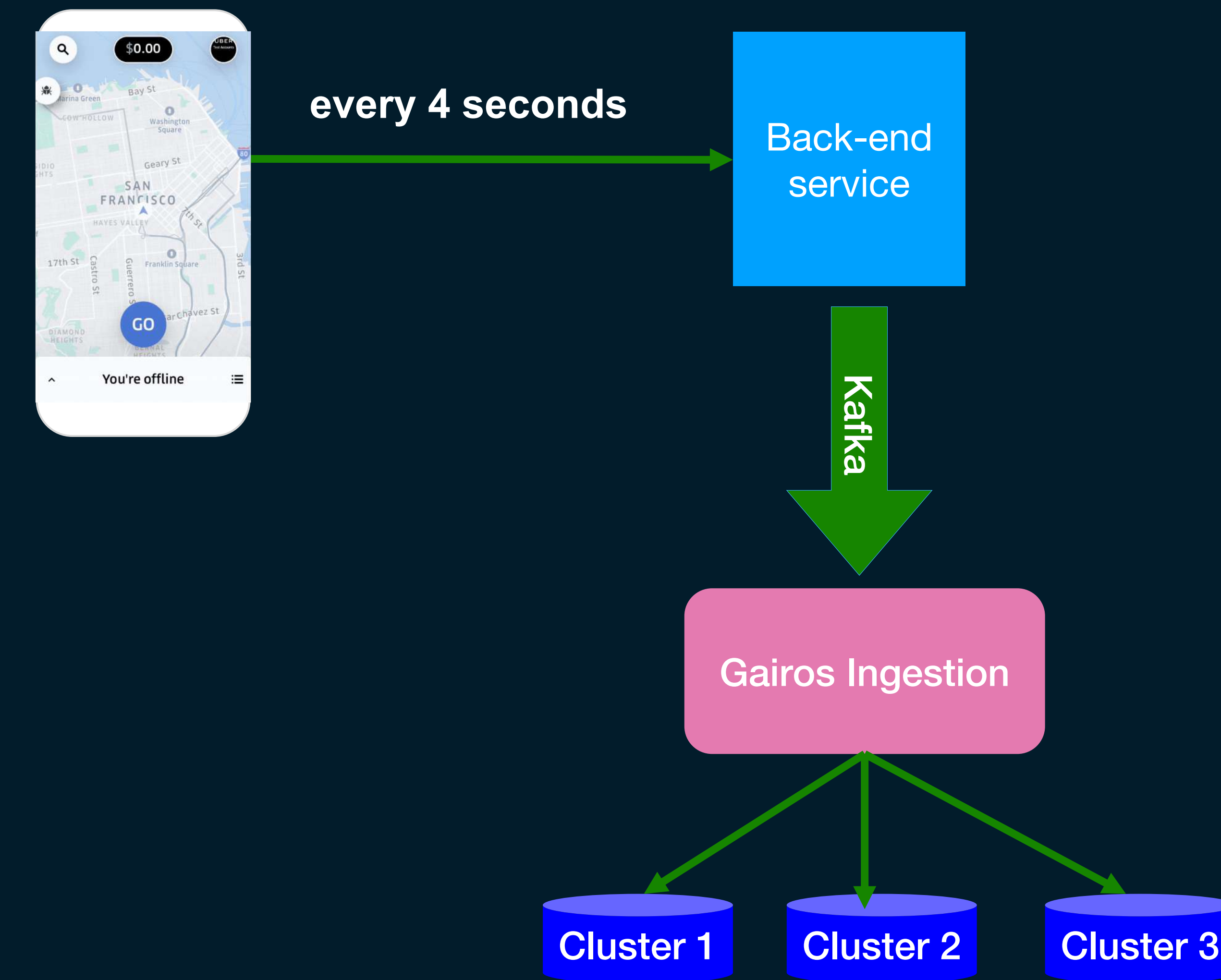
单个城市每分钟司机占用情况

3.Driver total worked minutes per hour

单个司机每小时工作时间

4.Open cars of each hexagon at 1PM in San Francisco

旧金山市每个 hexagon 上空车司机





## Use Case Walkthrough

There are two solutions that support these three use cases:

我们公司之前存在两种解决方案

1. Aggregate 1 minute summary into Elasticsearch and query on-the-fly

基于一分钟来统计司机的状态并存储到 Elasticsearch 里面，然后用户根据不同需求来查询

2. Each team calculate the exact data needed through streaming job

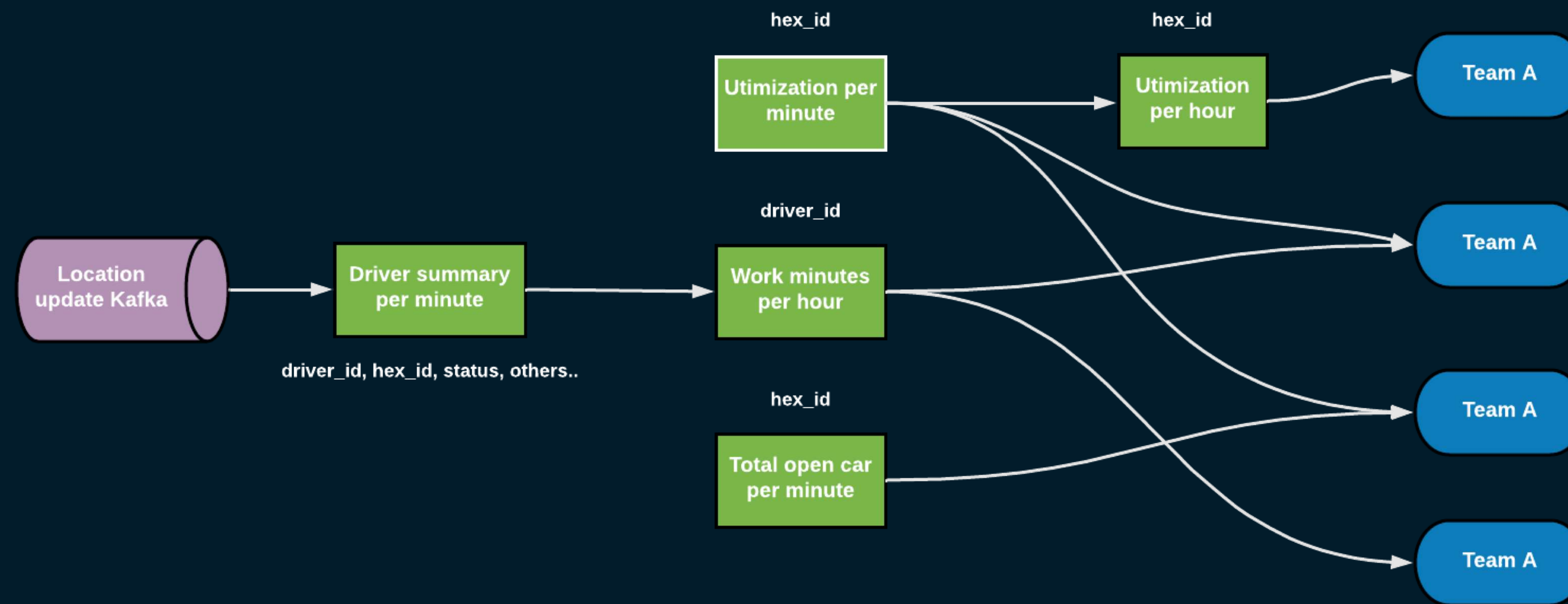
每个组使用流处理来计算需要的数据

Dimension	Value
Hexagon id	Hex_1
Driver id	Driver_1
Status	Driving_client
Others..	..

## Use Case Walkthrough

Our new framework supports all these use cases but without any duplication or inconsistency.

我们新的平台可以支持上面所有的需求并且可以避免重复以及不一致性





## Challenges

### Complex topology

复杂的拓扑逻辑

- Hundreds of metrics

成百上千的指标

- Cluster the tasks and split them into separate jobs connected via Apache Kafka.

将所有的流任务进行聚类，然后部署成不同的流工作，彼此之间通过 Kafka 来连接

## Challenges

### Unstable sinks

不稳定的数据接受池

- Metrics stored in different storages maintained by different teams with different SLAs  
指标会存储到不同的物理存储器，并且会被不同的组以不同的 SLA 来维护
- It's desirable to separate the sink from the processor  
我们需要把数据处理和数据存储的过程分开



## Challenges

### Metrics evolution

指标演化

- Add new metrics and update the existing metric  
增加或者修改指标
- Distinguish the golden sets from ad-hoc cases  
区分核心数据集以及临时使用数据



## Challenges

### Onboarding

让用户使用新数据

- 15 teams and 20+ services query the existing platform  
我们有15个以上的组以及20个以上的系统在使用已有的平台
- Auto conversion through the query gateway  
在查询入口处进行自动转换

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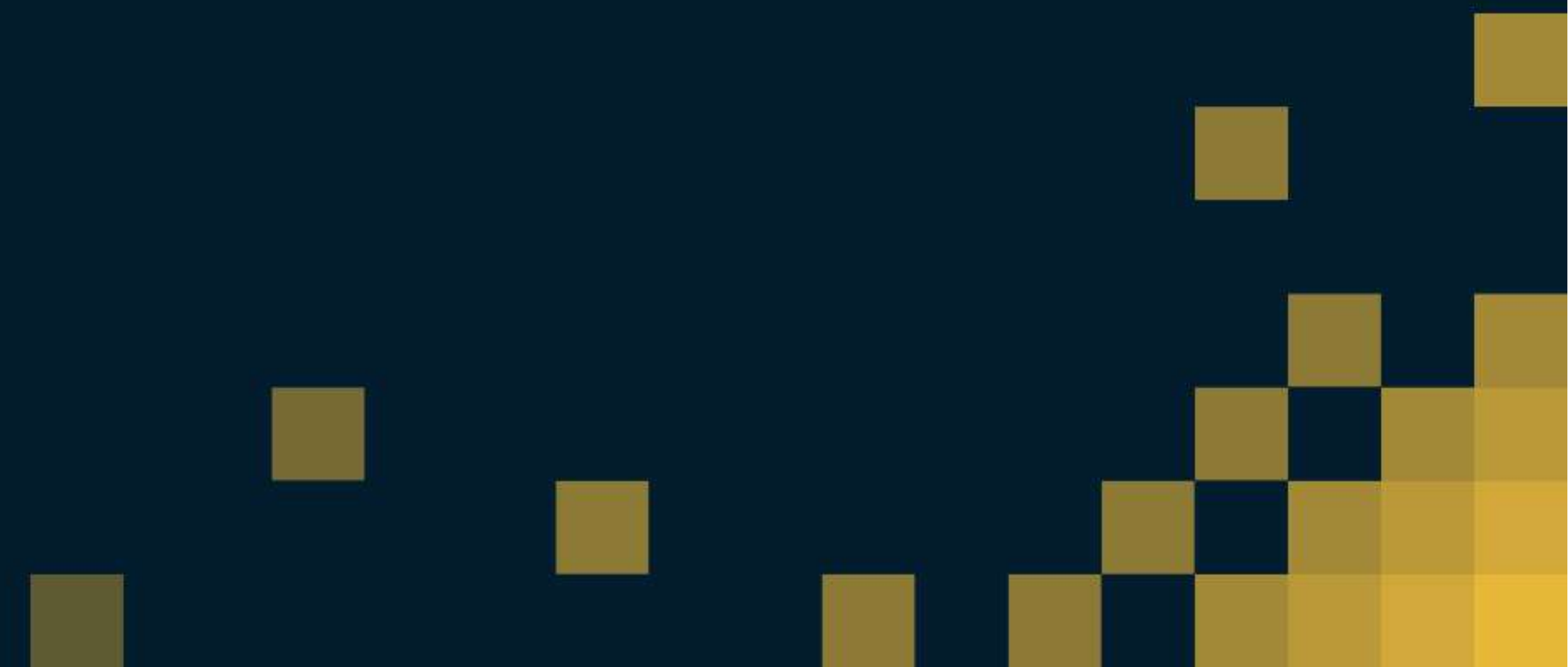




## Future Work

- Improve execution optimizer  
改善我们的执行计划优化器
- Improve tooling  
改善我们的工具

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THANKS





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