

Flink七武器及应用实战

Flink killer feature in practice

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职位：技术专家

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Flink Forward China 2018

而在这个AI时代，每一个梦想都更有机会成为现实，每一位开发者的创新与现实仅有一步之遥。

In this AI era, every dream has a better chance to become a reality, and every developer's innovation and reality are only one step away.



个人简介 Profiles

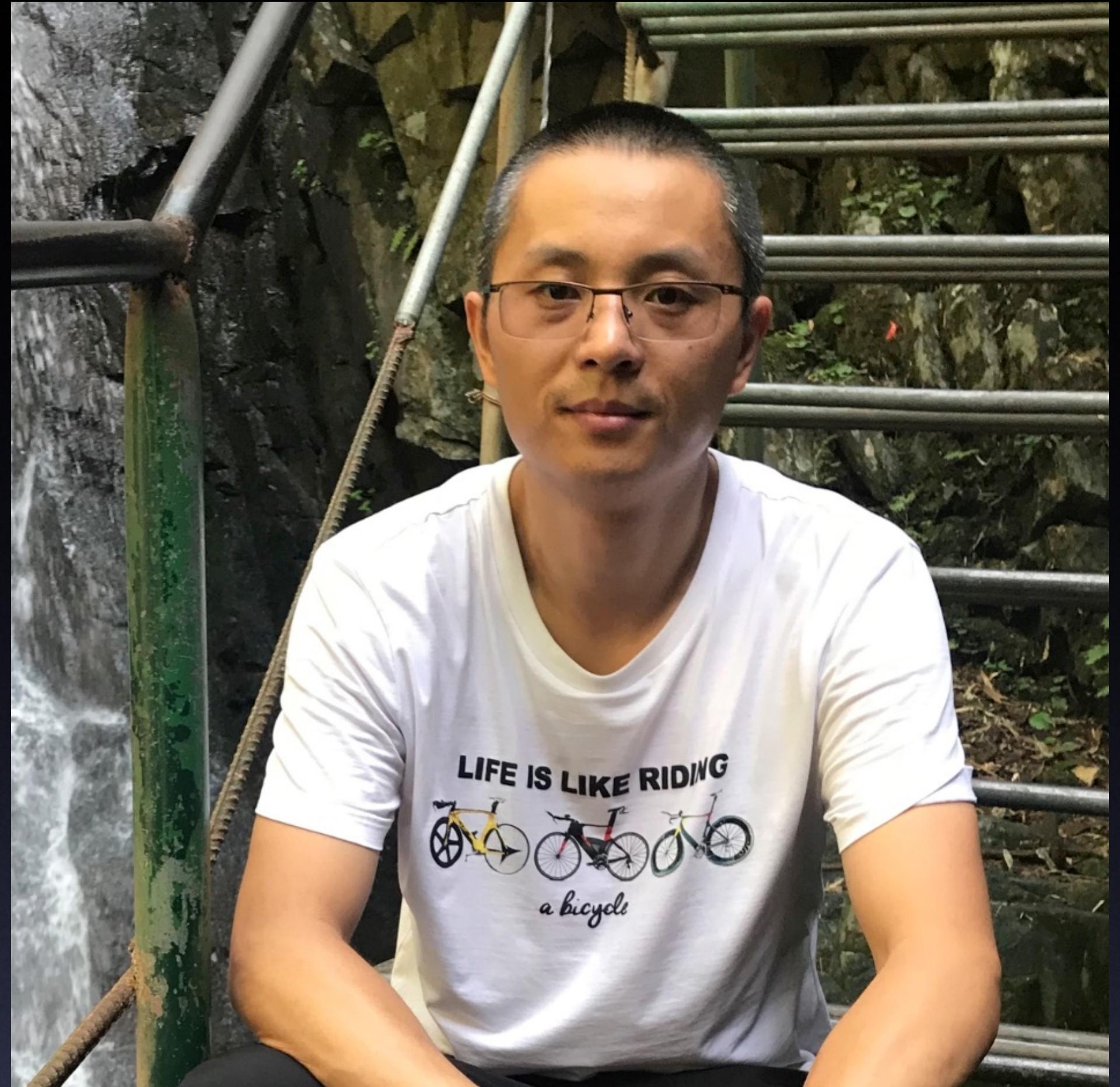
华为云高级技术专家，负责实时流计算服务、日志分析服务和车联网智能体，智慧城市架构师。

12年的开发经验，2012年开始研究Spark。多年来从事高性能计算和大数据方面的工作，曾参与国内互联网产品开发。近3年专注于Flink和Spark的研究和云产品开发。

Huawei Cloud Senior Technical expert, responsible for CloudStream services, log Analysis Services and Vehicle Intelligent Twins, smart city architect.

Have 12 years developing experience. 2012 began to study the spark, 2016 began to study the Flink. Over the years engaged in high-performance computing and big data work, has been involved in several Internet product development.

Nearly 3 years of research and cloud product development focused on Flink and spark.



内容提要 Agent

- Flink features
- Flink七武器 – Flink seven killer features
 1. StreamingML
 2. StreamingDL
 3. Time GeoSpatial
 4. CEP SQL
 5. Cost-based Optimizer
 6. Real-time visualization
 7. EdgeCompute: Flink-Lite
- Flink行业应用场景 - Flink Industry Use Case
- Flink SQL在线体验 - Online Flink SQL in practice

开源流计算框架

Open Source Stream Framework



Samza

Apache Flume™



Apache Gearpump
Latest Release v0.8.4

PULSAR

Flink关键特性

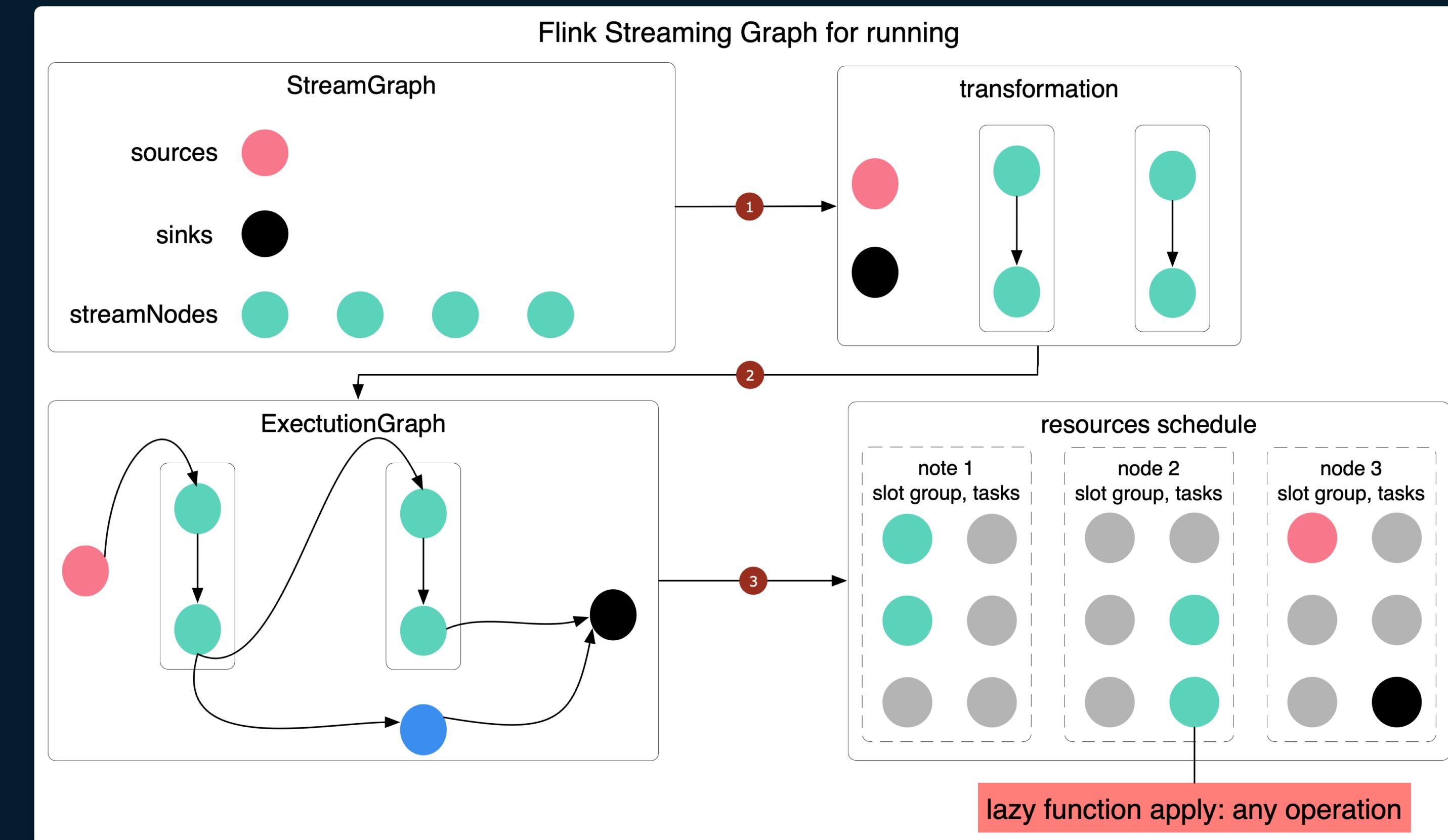
Flink key features



Flink关键特性：运行时流图

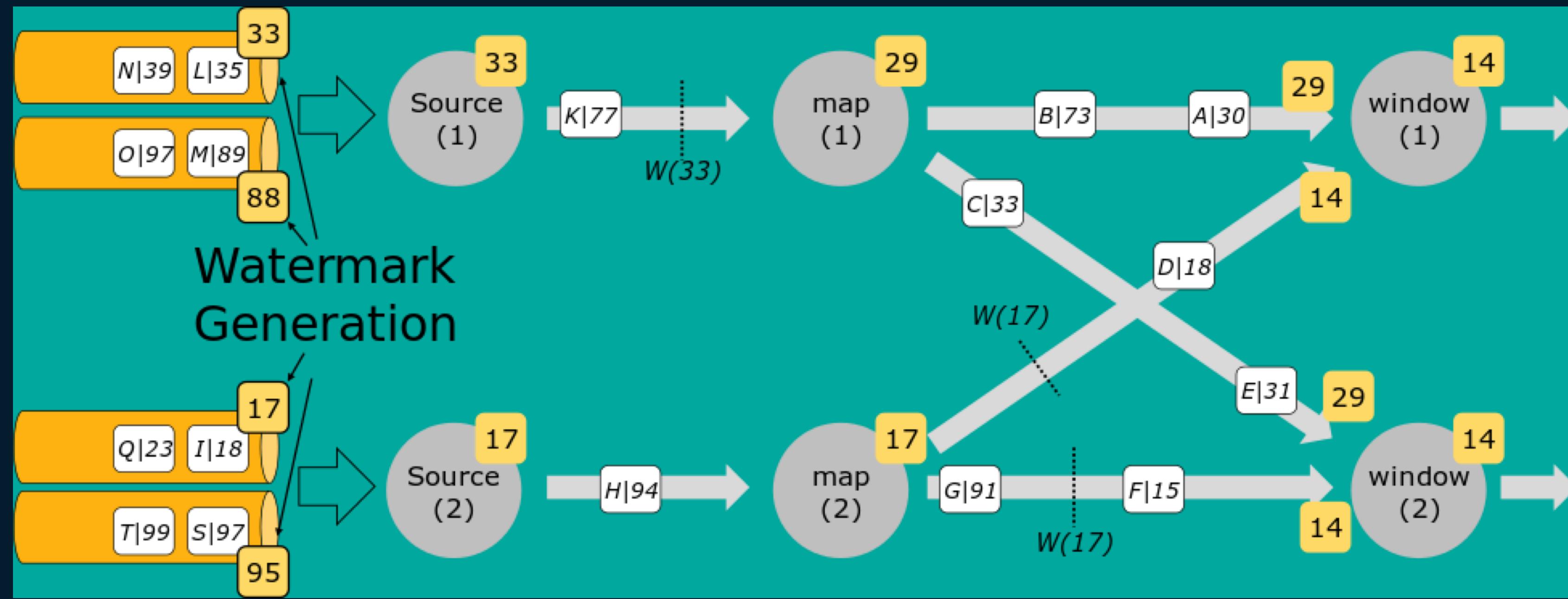
Flink key features: Runtime of Dataflow

- Build DAG
- Schedule resource
- Lazy apply function



Flink关键特性：支持解决乱序问题

Flink key features: resolve out-of-orderness problem



Picture from Apache Flink

Flink source generate Watermark , in parallel operators aligning the watermark flow(timestamp)

- Fixed latency time : `BoundedOutOfOrderTimestampExtractor(Time maxOutOfOrderness)`
- Allowed latency beside fixed latency configure : `allowedLateness`

Flink关键特性：三种窗口

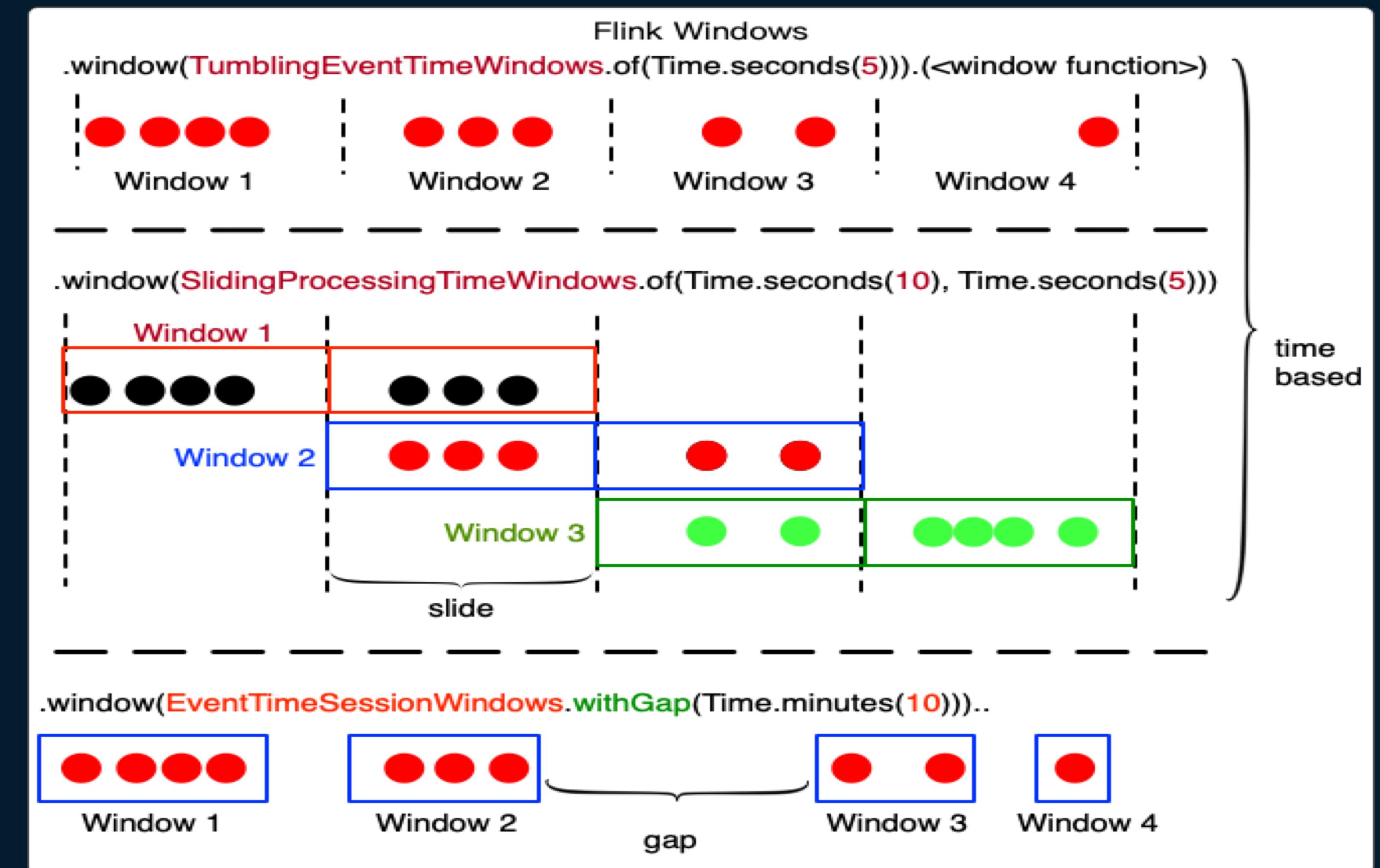
Flink key features: three windows

- Tumbling window
- Sliding window
- Session window

Sliding window will cost several times memory.

How to save memory as soon as possible?

Dataflow Model:
<http://www.vldb.org/pvldb/vol8/p1792-Akida.pdf>

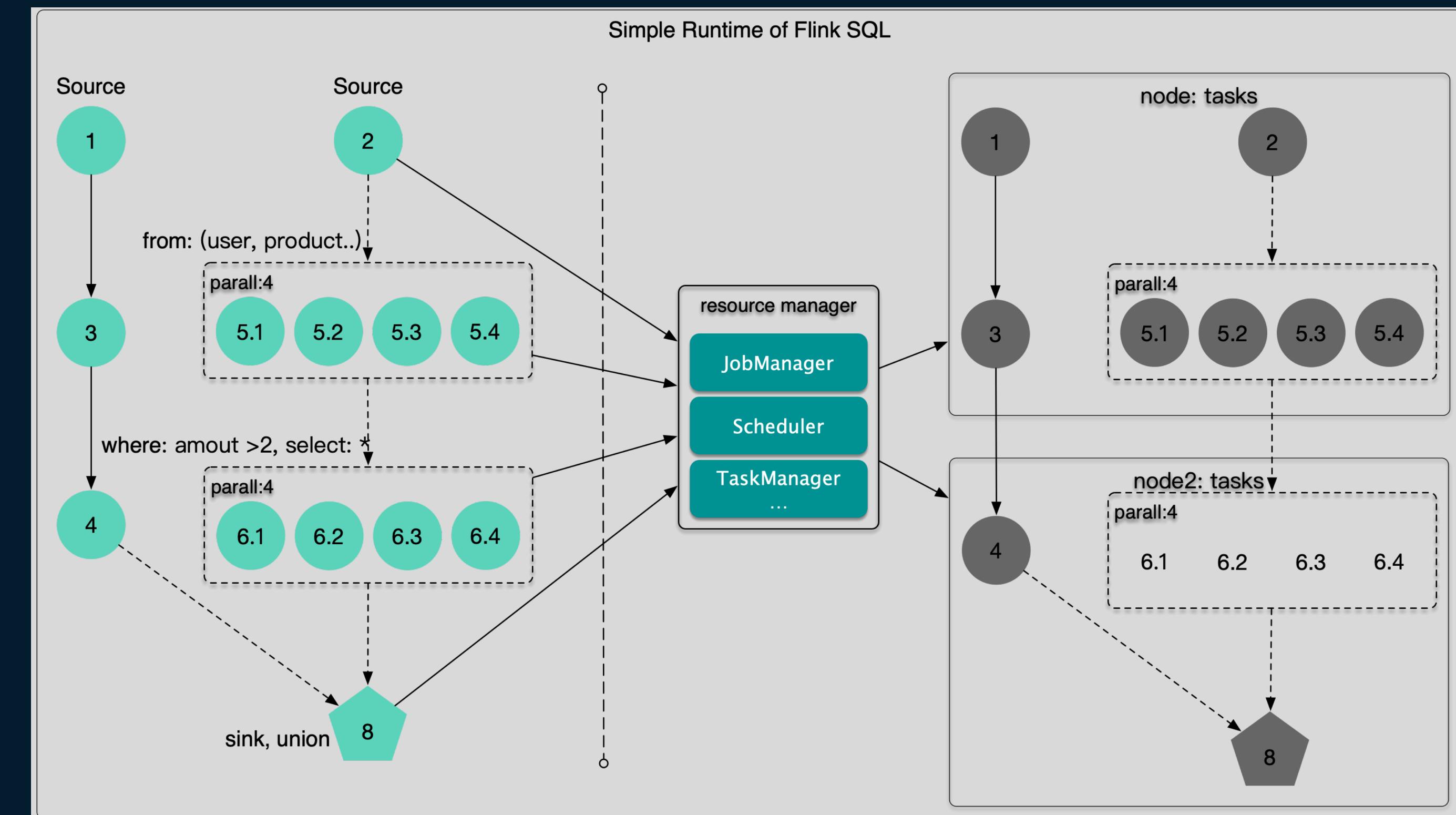


Flink关键特性：Stream SQL

Flink key features: Stream SQL

`select * from product from table1 where amount > 2 union (select * from table 2)`

逻辑图和物理图一致



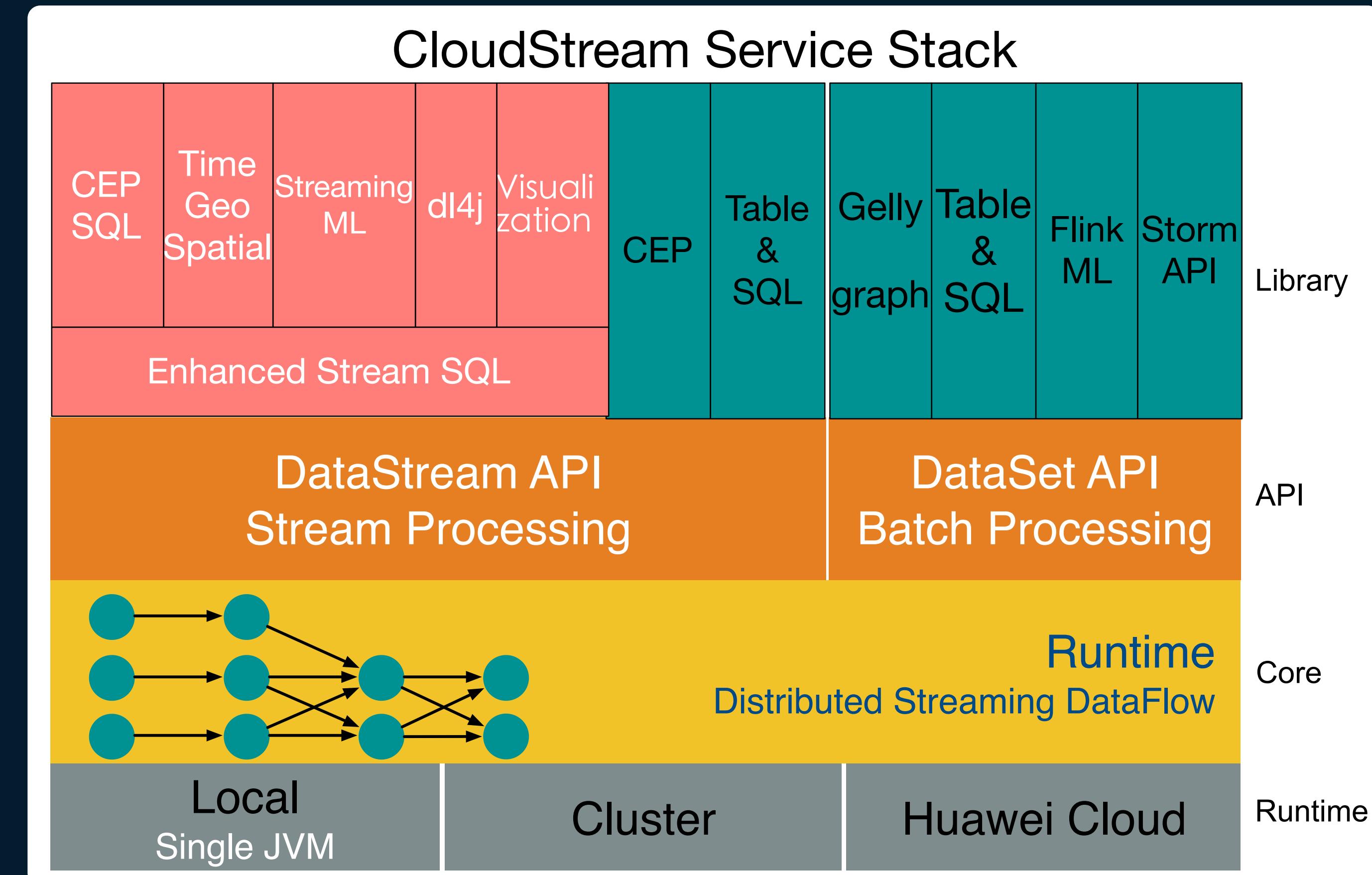
Flink关键特性：扩展的类库

Flink key features: extensible libraries

优雅的运行时框架，
AI支持不够。

Better Runtime,
weak libraries on AI

**How to enhance AI ability
based on Flink?**



Flink七武器

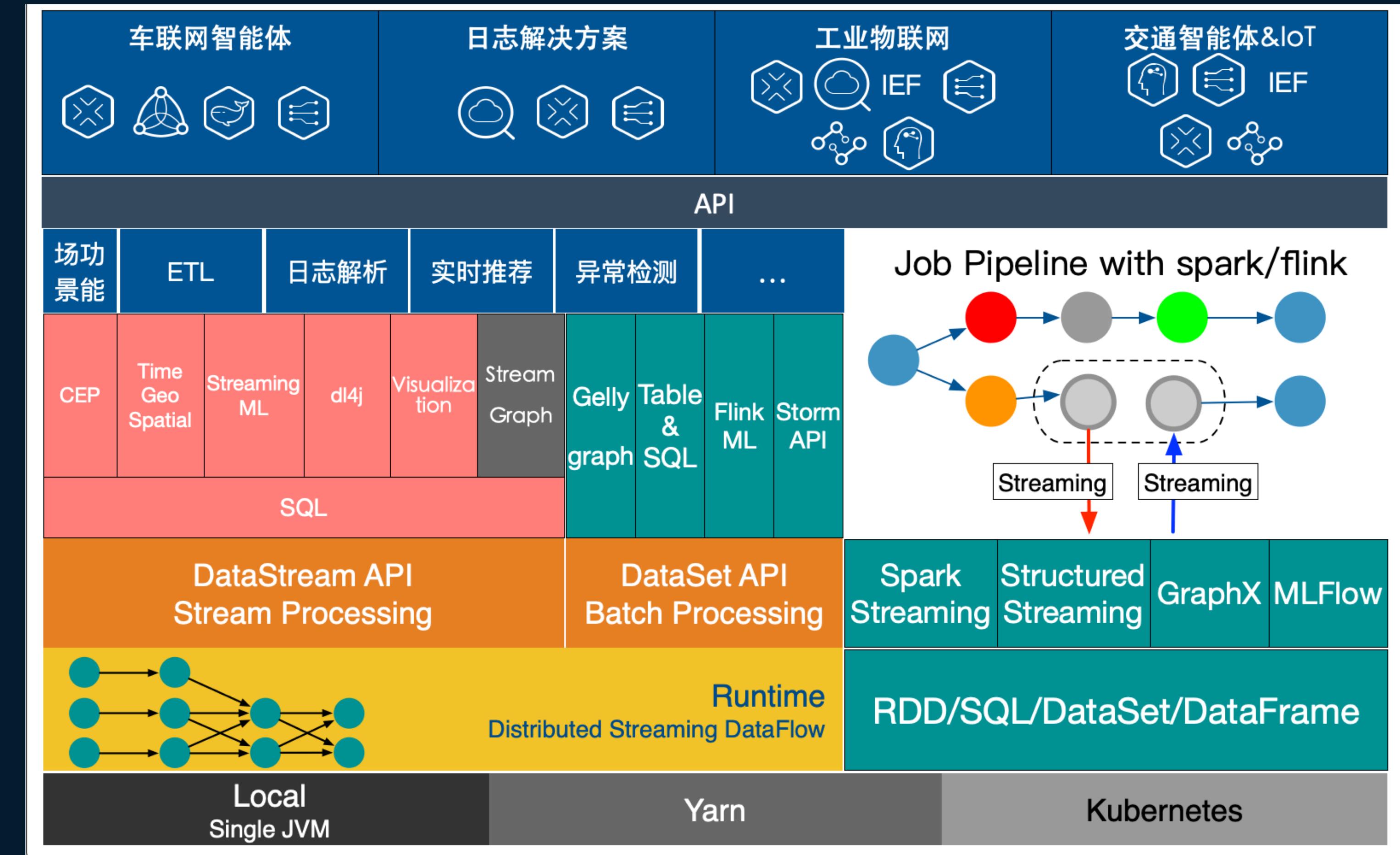
Flink killer features from Huawei

- 1. StreamingML
- 2. StreamingDL
- 3. Time GeoSpatial
- 4. CEP SQL
- 5. Cost-based Optimizer
- 6. Real-time visualization
- 7. Edge Compute: Flink-Lite



Flink提供了坚实的基础，实际场景更复杂

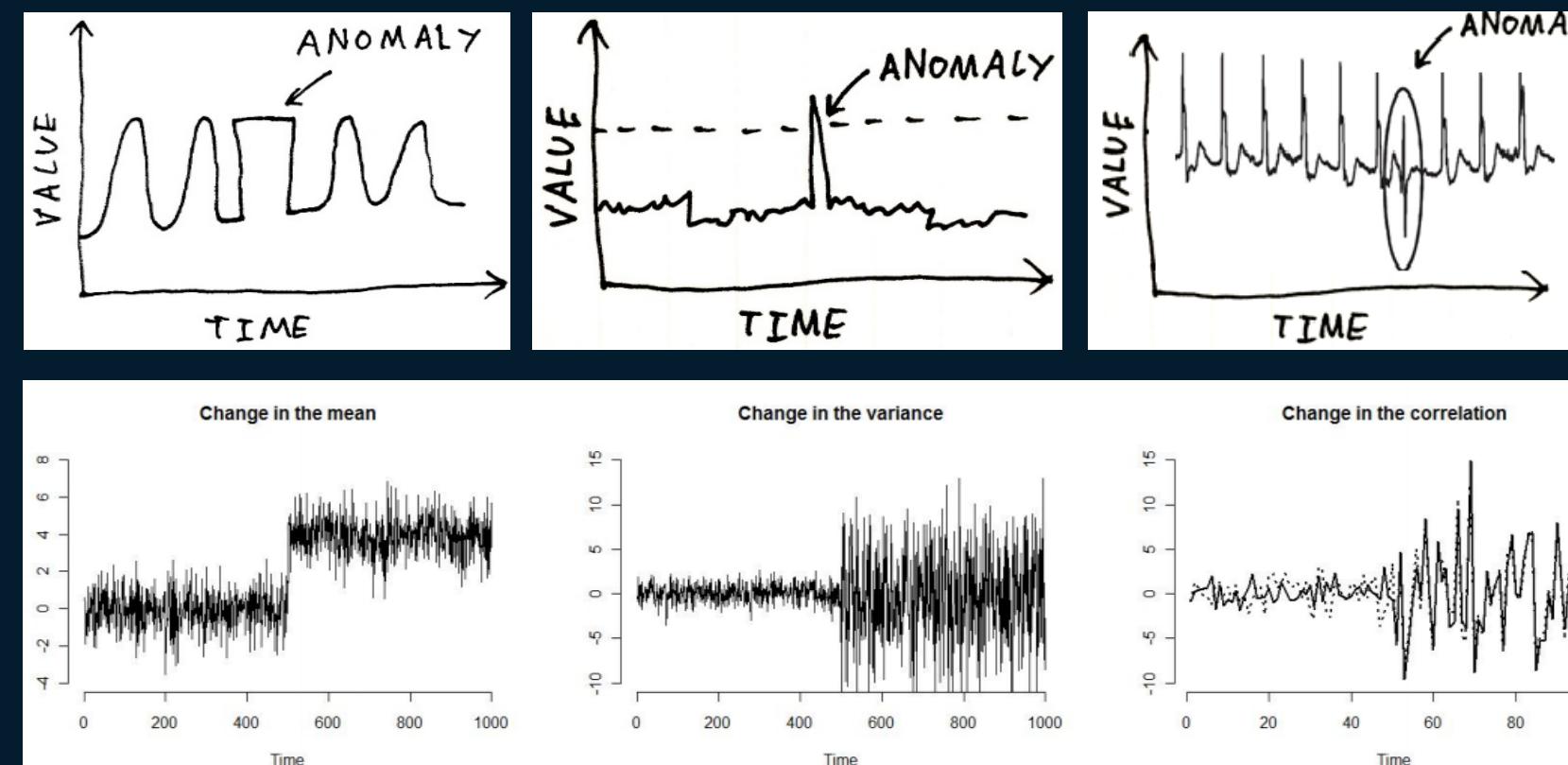
Flink provide solid runtime, scene is more complex



StreamingML

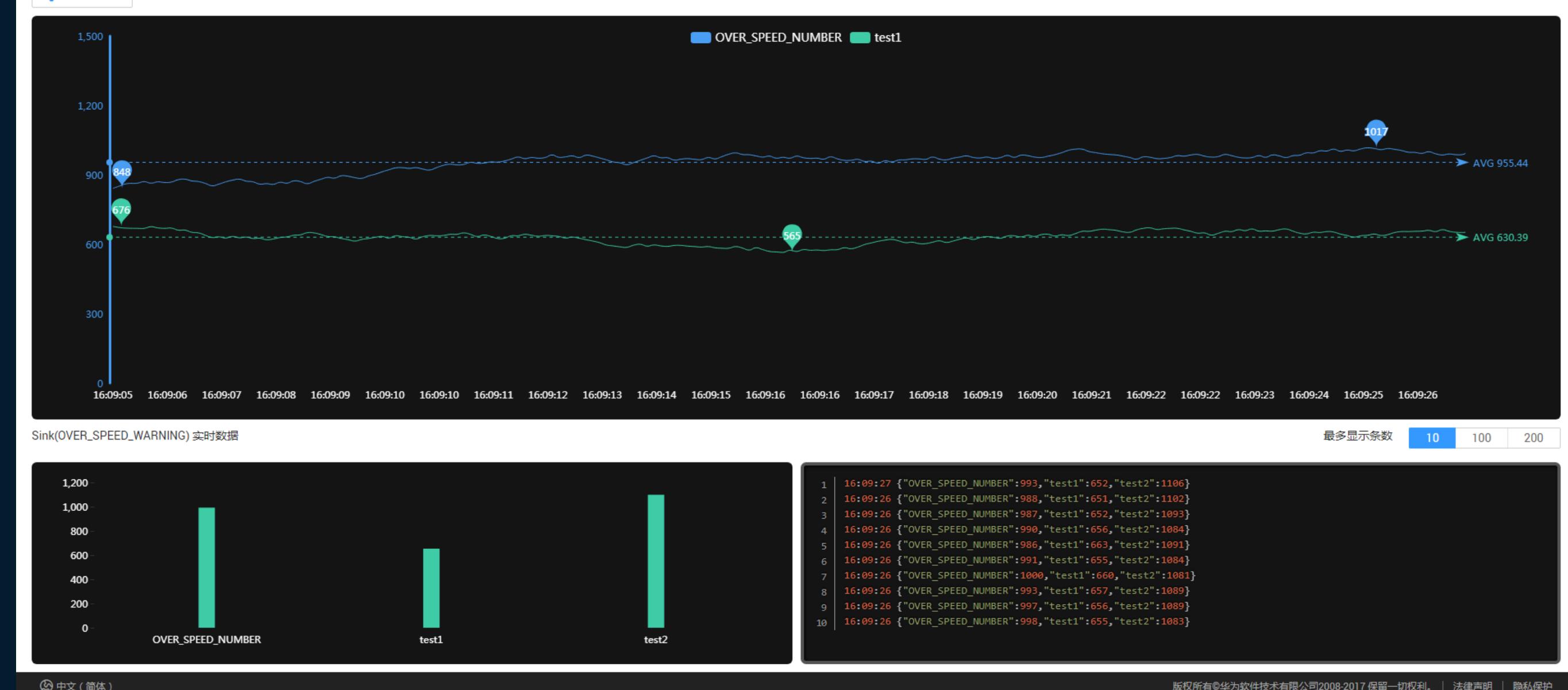
SRF: Stream Random Forest
Used in IoT or vehicle:
Abnormal detection

SRF_UNSUP : 无监督流式随机森林
SRF_SEMI_SUP : 半监督流式随机森林
SRF_SUP : 监督流式随机森林



```

SELECT c,
CASE WHEN SRF_UNSUP(ARRAY[c], "numTrees=15,seed=4010") OVER (ORDER BY proctime RANGE
BETWEEN INTERVAL '300' SECOND PRECEDING AND CURRENT ROW) > 0.8
THEN 'anomaly'
ELSE 'not anomaly'
END
FROM MyTable
  
```



https://support.huaweicloud.com/sqlreference-cs/cs_07_0028.html

Time GeoSpatial：实时时间地理位置分析

SQL Time Geospatial – 高级操作，在窗口中的GEO函数

1. AGG_DISTANCE(point) 计算窗口时间内覆盖的距离

示例：
`SELECT AGG_DISTANCE(ST_POINT(x,y)) OVER
 (ORDER BY proctime RANGE BETWEEN INTERVAL '10'
 MINUTE PRECEDING AND CURRENT ROW) FROM input`

2. AVG_SPEED 计算窗口时间内的速度

示例：
`SELECT AVG_SPEED(ST_POINT(x,y)) OVER
 (PARTITION BY user ORDER BY rowtime ROWS BETWEEN 10
 PRECEDING AND CURRENT ROW) FROM input`

上述函数支持窗口：

1. HOP/TUMBLE/OVER/SESSION windows
2. count/time windows
3. rowtime/proctime windows

DDL for Time Geospatial – 基本元素

1. `ST_Point(latitude, longitude)` 纬度和经度构成点
2. `ST_Line(array[point1...pointN])` 多点构成线
3. `ST_Polygon(array[point1...point1])` 多点构成多边形
4. `ST_Circle(point, radius)` 点和半径构成圆

应用场景：

1. 偏航告警
2. 电子围栏
3. 区域检测
4. 超速检测
5. 危险驾驶行为分析

右图，车辆提前规划好路线：

1. 车辆实时平均车速
2. 车辆一旦偏离预定路线200米，实时告警



CEP SQL

CEP可用于：

Complex Event Process SQL used for:

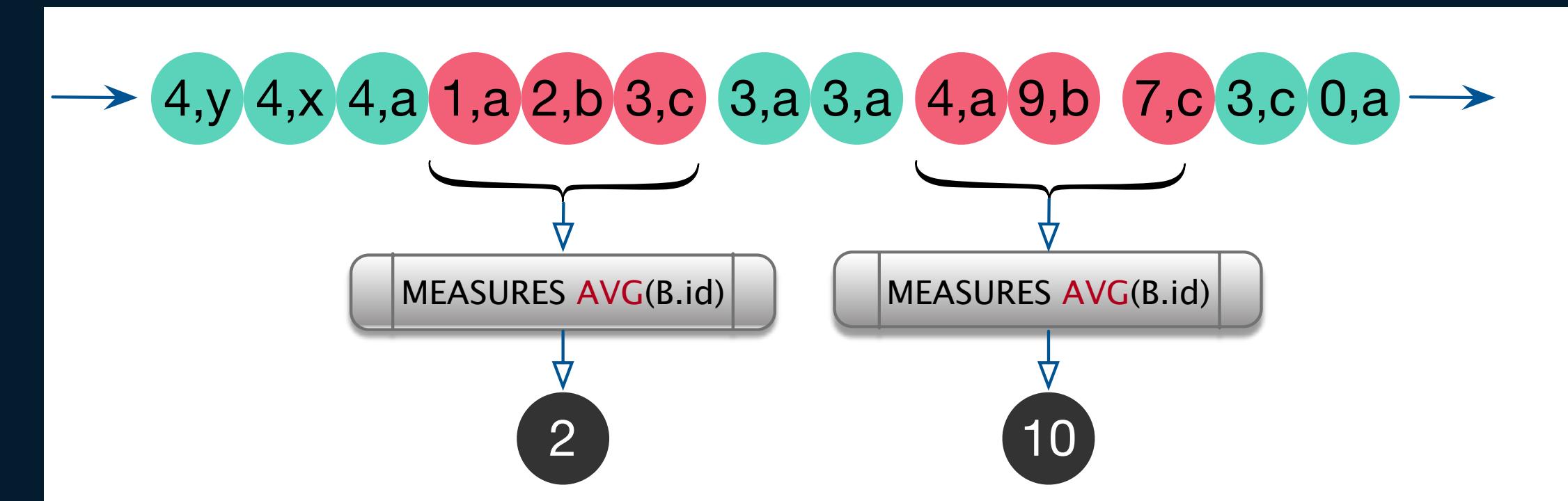
1. pattern matching 模式匹配
2. Fraud detection 反欺诈

- **MEASURES:**
对配后的结果运算
compute the matched result
- **PATTERN:**
定义匹配模式
define matching pattern
- **DEFINE:**
定义匹配模式所需的变量
define variable for pattern

```

1 SELECT * FROM MyTable MATCH_RECOGNIZE
2   (
3     MEASURES AVG(B.id) as Bid
4     ALL ROWS PER MATCH
5     PATTERN (A B C)
6     DEFINE
7       A AS A.name = 'a',
8       B AS B.name = 'b',
9       C as C.name = 'c'
10    ) MR

```



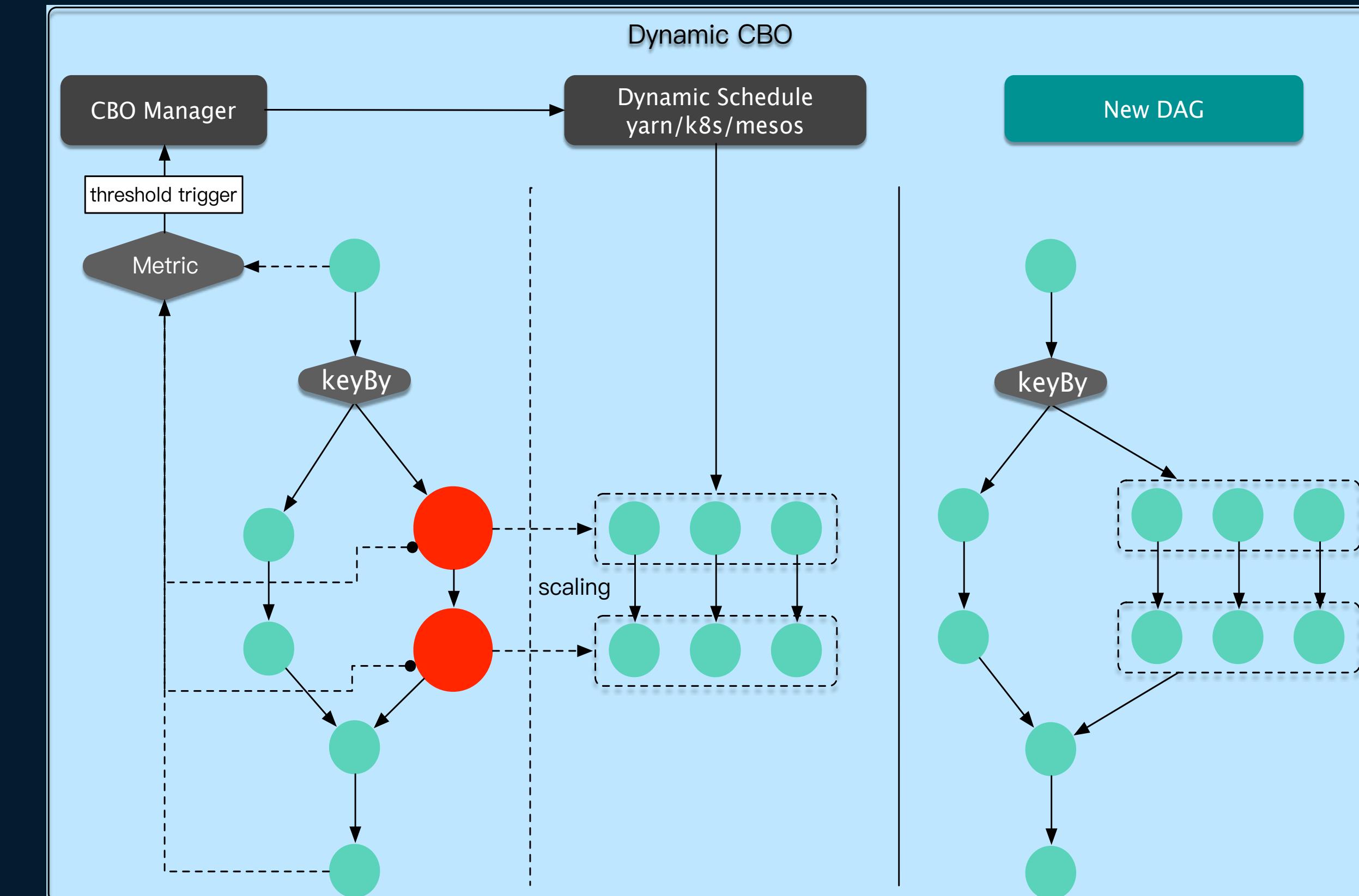
More info https://support.huaweicloud.com/sqlreference-cs/cs_07_0014.html

Dynamic Cost-based Optimizer

动态CBO要解决的问题：

Dynamic CBO resolve problems

- 数据倾斜引起作业崩溃
Data skew cause job shutdown
- 用于serverless的资源预估
Resource estimator for serverless
- 作业长时间运行的可靠性
Keep job long running reliably



实时可视化和作业即服务

Real-time visualization and job as a service

Job as a Service:

1. Every Job have a unique Stream API for subscribe
2. Source and Sink data sampling
3. Combine jobs as a “Big Screen”
4. Integrate jobs to your own system

作业即服务：

1. 每个作业都有唯一的可订阅的流式API
2. 输入流和输出流采样，检查数据质量
3. 联合多个作业组成监控大屏
4. 云上作业集成到线下业务系统



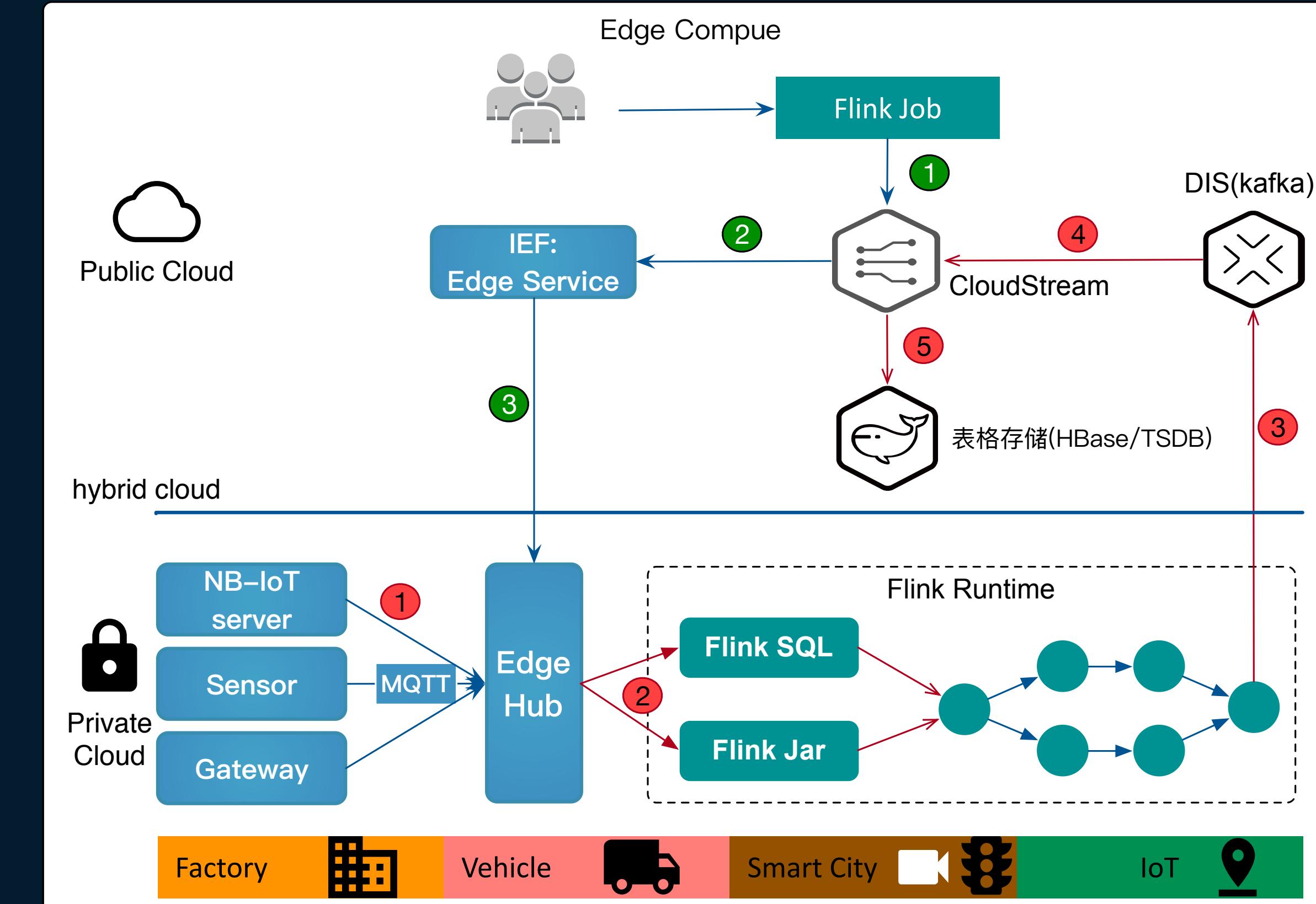
Edge Compute: Flink-Lite

Why does Edge choose stream framework?

1. Personal privacy 个人隐私数据
2. Industrial Formulators 工业核心配方机密
3. Data too huge 数据太大
4. Low latency of ms 毫秒级低延迟

混合云模式 Hybrid cloud :

- 公有云开发应用并推送到私有云
Public cloud for develop app and deploy
- 私有云接收应用和执行应用
Private cloud receive app and apply
- 私有云反馈安全脱敏结果数据到公有云
Feedback to cloud if security rules allow



全生态连接 Open Source and Cloud platform

连接：

1. 开源框架 Open Source framework
2. 存储类云服务 Storage Service
3. AI：机器学习/图计算/深度学习/模型推理

全连接覆盖最常用场景 Cover most case

计算存储分离，连接更丰富的存储

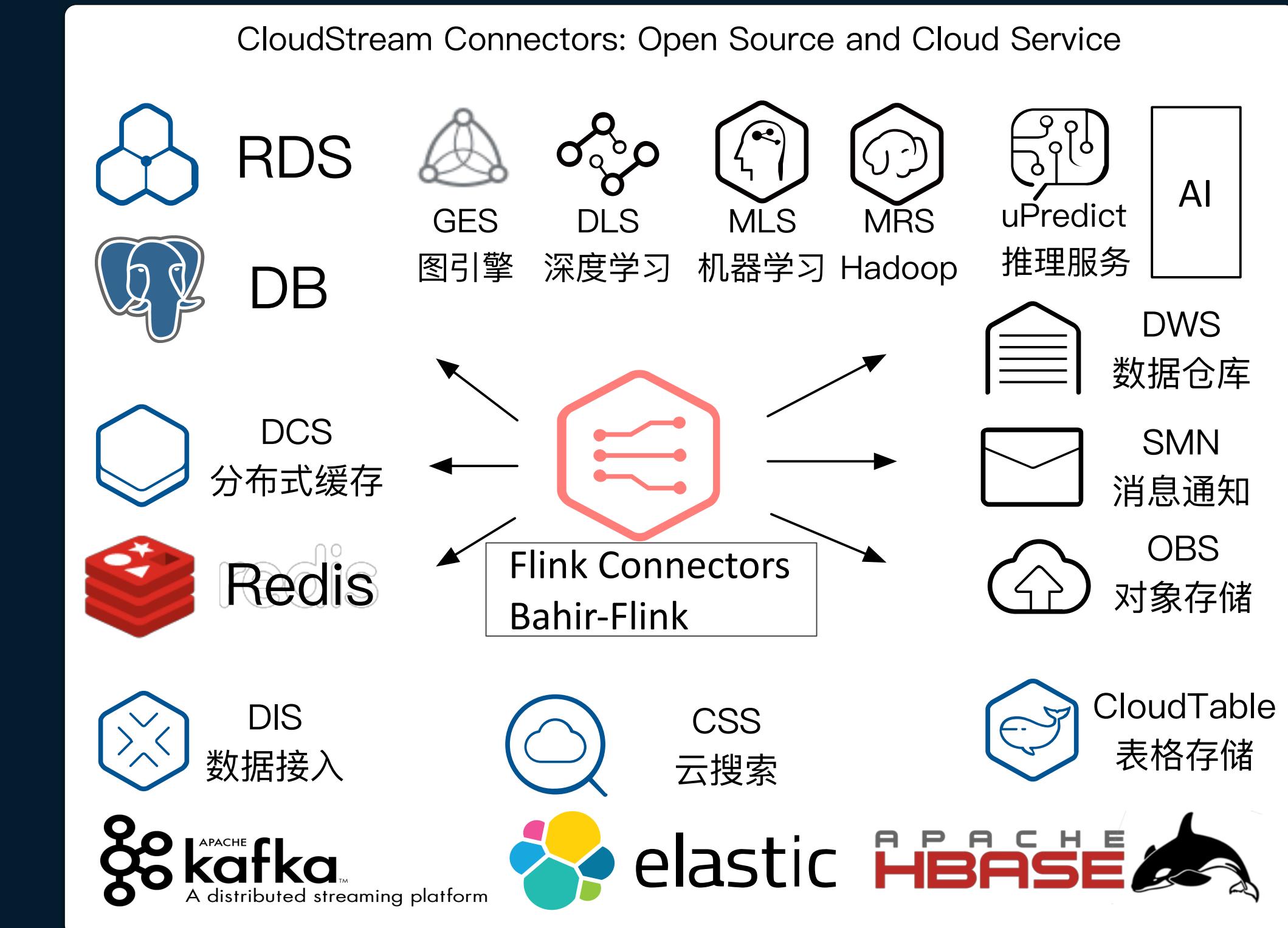
Connect more external storage system

连接不同的系统，会有不同的吞吐

Different external system, different throughput

如何保证source输入流的可靠性？

How guarantee source stream data reliability?



隔离和安全：共享模式和独享集群 isolation & exclusive cluster

独享集群特点 Characteristics of exclusive cluster :

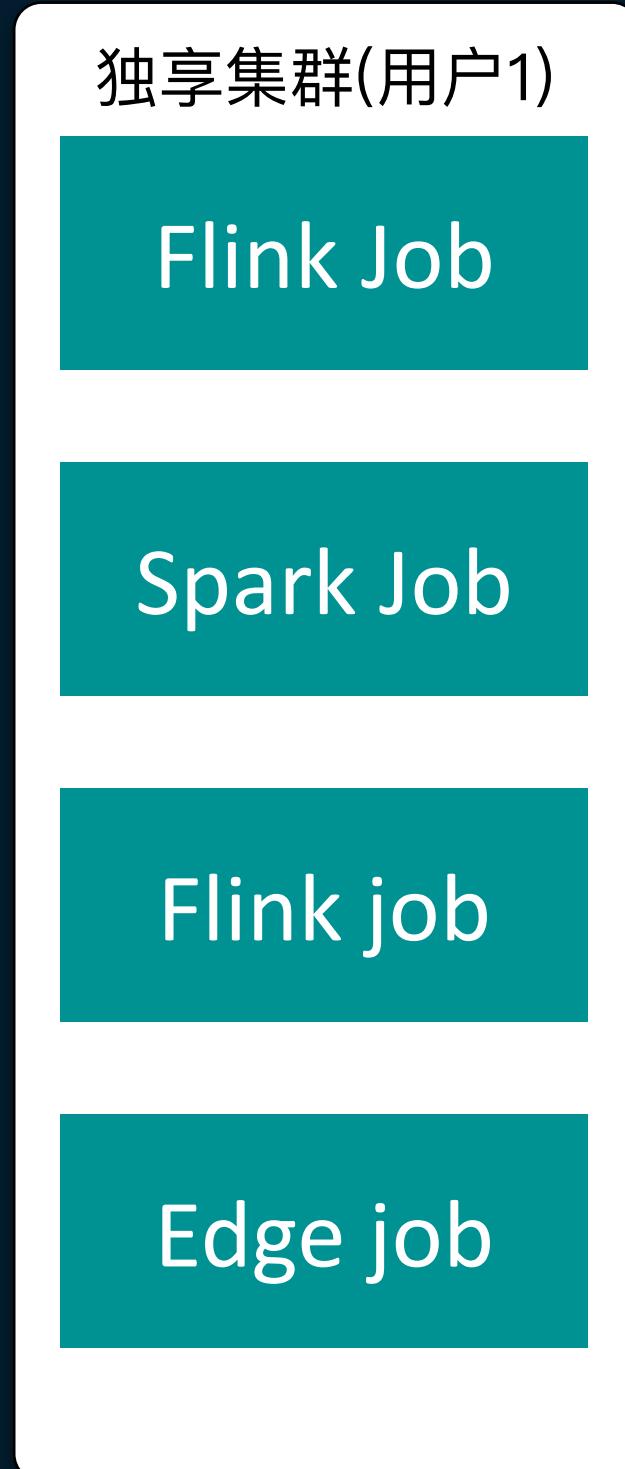
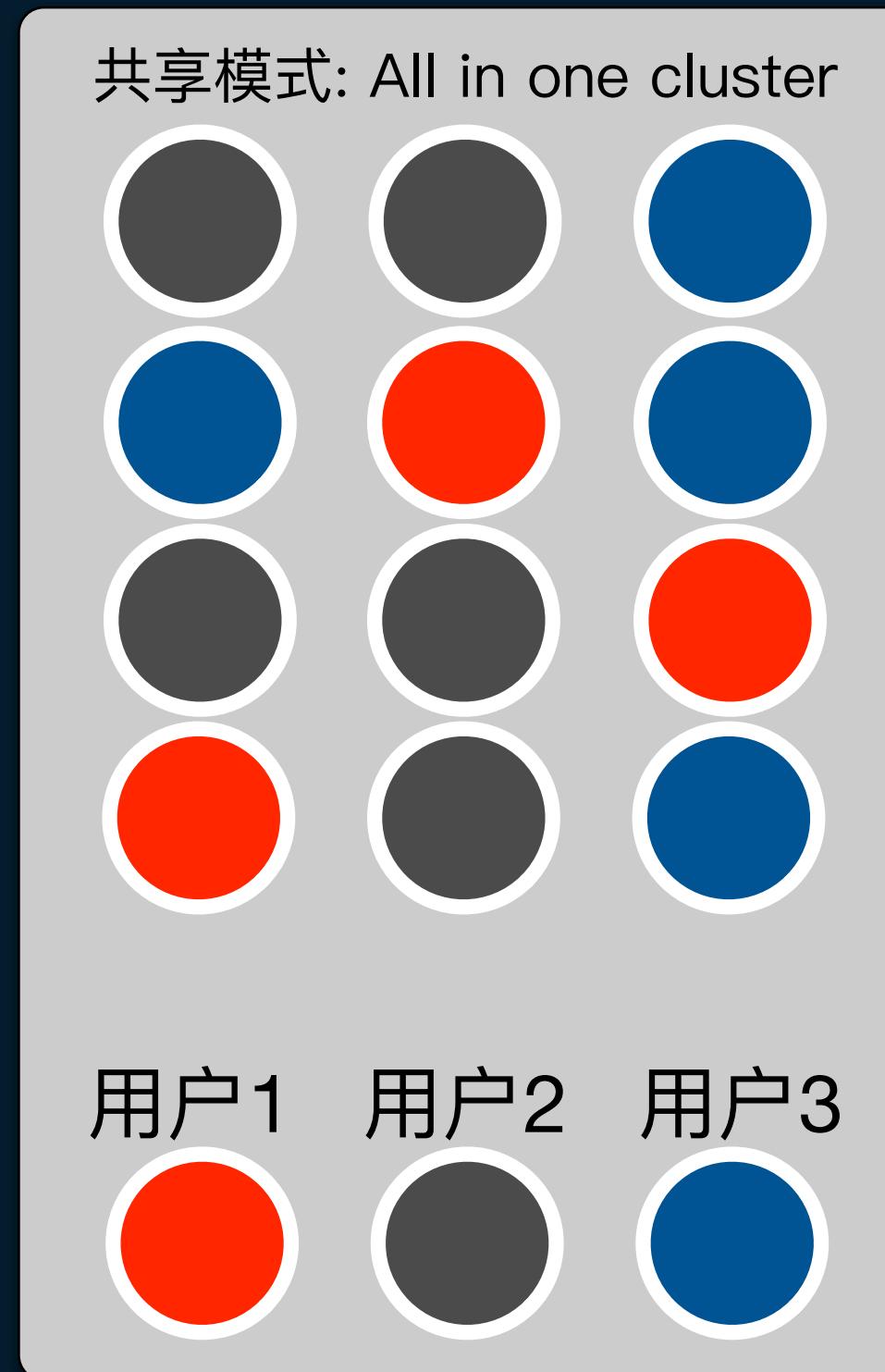
- 资源隔离 Resource isolation
- 专用集群，无多用户交叉. Exclusive cluster just for one tenant
- 业务隔离 Business scene isolation

如消防IoT设备在同一个集群中管理连接、数据和计算，无干扰

For example a group of IoT sensors data analyze are isolated in exclusive cluster.

沙箱问题 Sand box problem

- 沙箱无法解决所有安全问题，矛盾。Language sandbox can't resolve security exhaustive
- 通过硬件和VM隔离。粗暴有效。Hardware and VMs are isolated, which solves security problems.



Severless:

弹性伸缩 Auto scaling

按需收费，作业用多少算多少. Pay-per-use billing mode. You only need to pay for the resources you use.

Flink行业应用场景：车联网

Flink Industry Use Case : Intelligent Vehicle

车联网行业，基础设施已成熟

实时数据：基于位置、CAN数据、语音、视

频数据的实时分析

改善体验：

人机交互

智能座舱

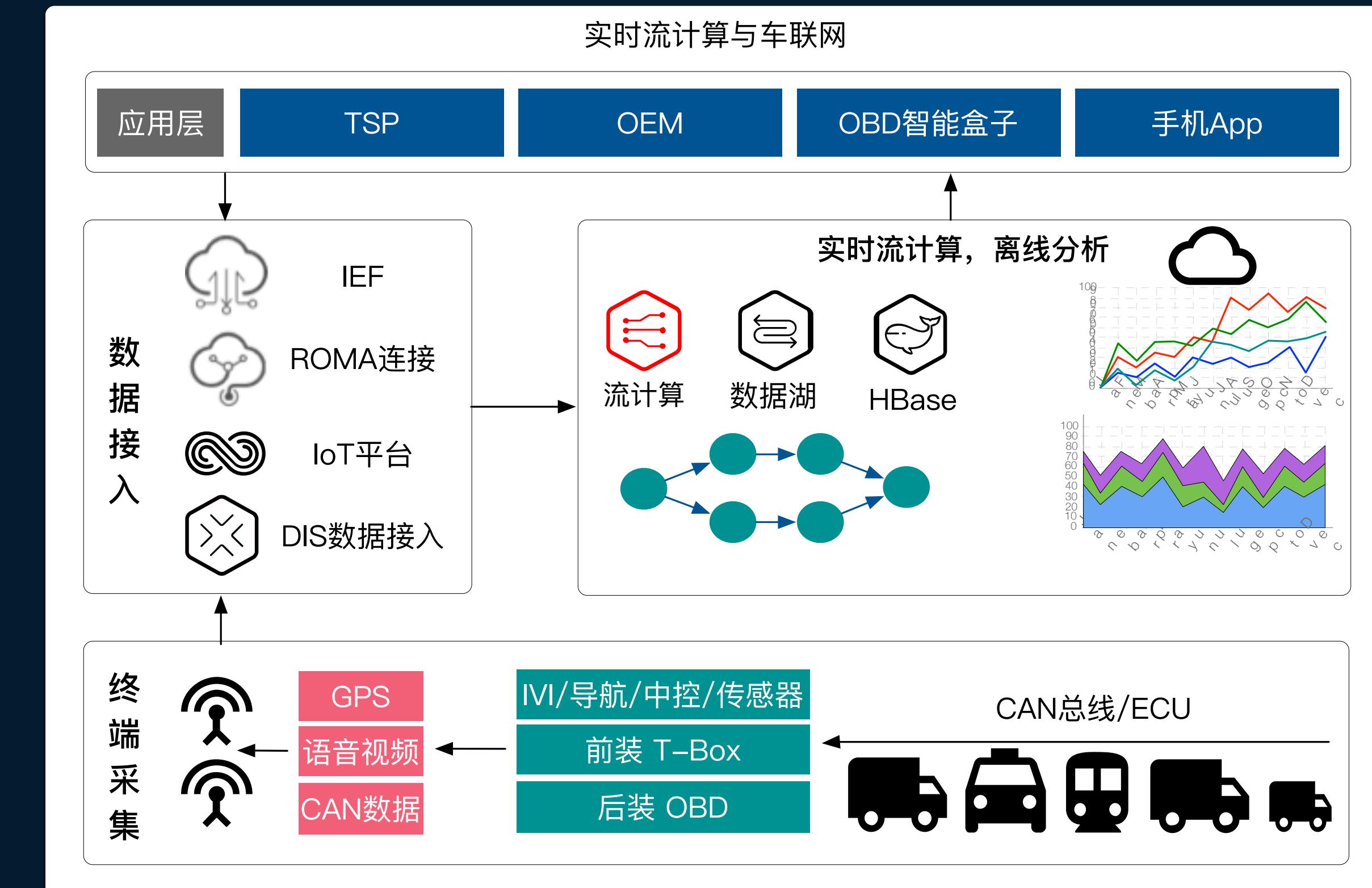
OTA在线升级

新能源

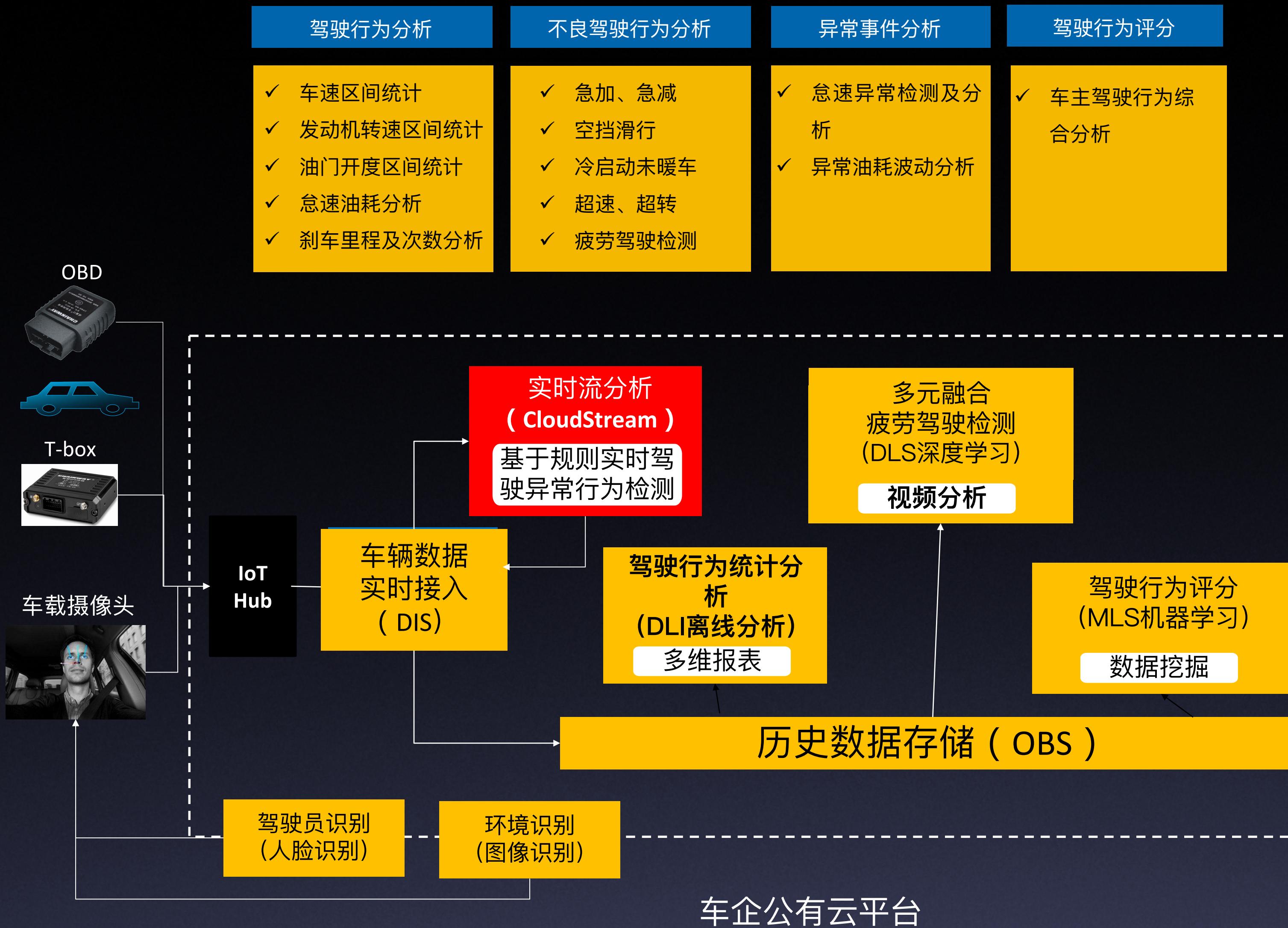
共享：车、单车、电动车

... ...

大数据AI使能



典型场景：驾驶行为管理解决方案 Driving behavior analysis



客户价值

深入了解驾驶员的驾驶行为有助于制定更为合理的交通法规并设计更加有效地智能驾驶系统，从而达到减少交通事故、提高交通效率的目的。

关键技术

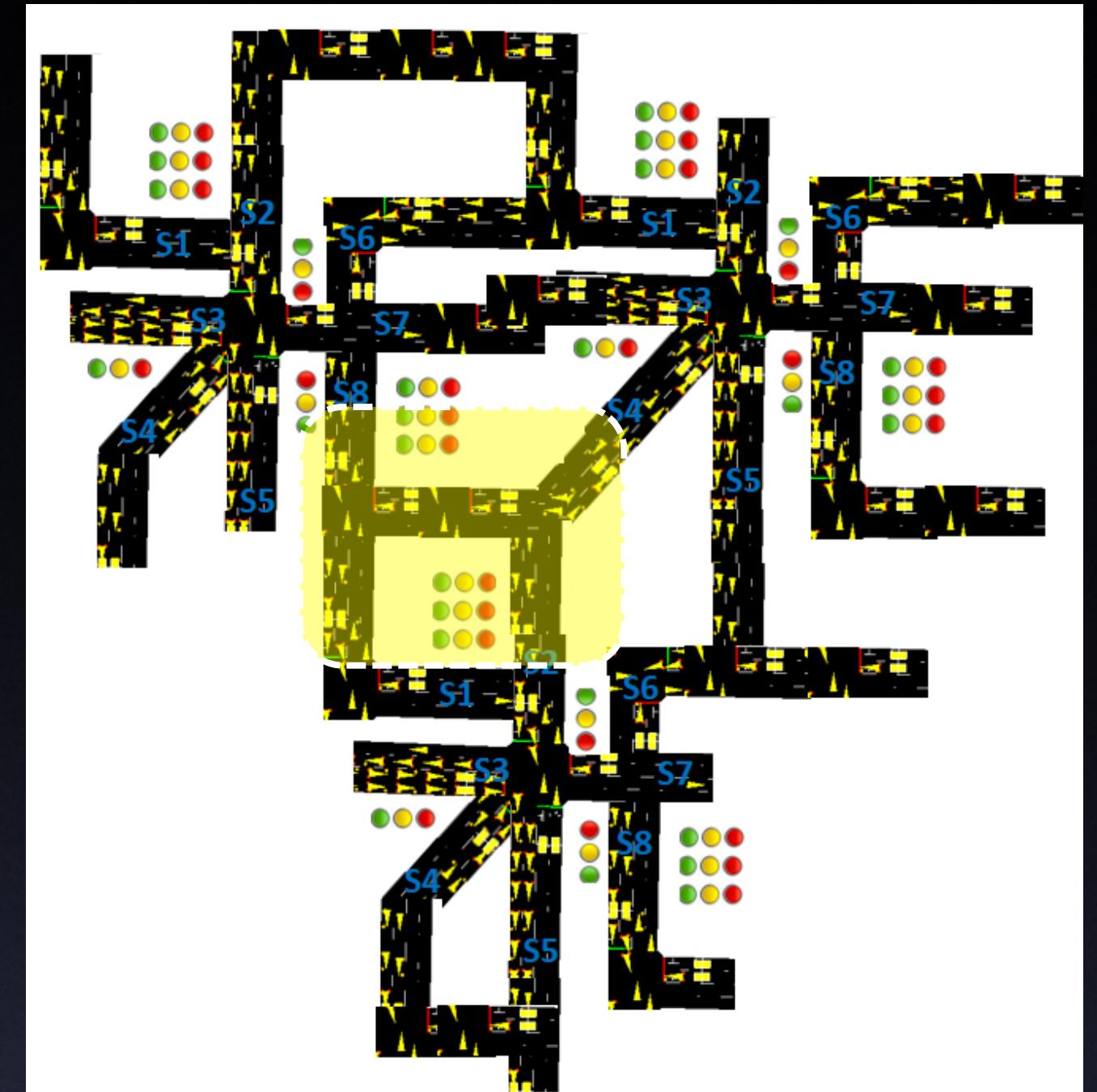
1. 实时流复杂事件处理能力：CloudStream提供CEP on SQL的能力，提供基于规则的异常行为检测。
2. 计算查询优化：业界先进的CarbonData存储技术，结合分区表，缓存加速，索引下压等技术加速查询性能，并提供基于OBS的SparkSQL计算引擎。
3. 人脸识别能力：快速检测多达74个人脸关键点，识别效果更精准，在背景复杂的图像中依然拥有良好表现。并提供RESTful API接口及SDK，方便客户使用与集成。
4. 图像识别能力：有效识别多达23000个标签，识别更精准。单张图像识别速度小于0.1秒。
5. 丰富的驾驶行为评分基础算法：基于workflow提供回归类性能深度优化算法，随机森林，GBDT等。
6. 基于GPU的深度学习引擎：提供物体检测、视频分析等几十种CNN/RNN神经网络算法模型；提供大量基于开源数据集训练好的模型，方便用户加快模型训练；方便客户基于T-BOX、OBD及车载摄像头完成深度数据挖掘。

典型场景：城市智能体 Smart City

1. 自动回归学习
2. 在线机器学习算法
3. 自动选择最优算法
4. 在线训练模型



Extension to cities



Flink SQL在线体验

Online Flink SQL in practice

See the StreamingML demo

Demo step by step:

https://github.com/huaweicloud/huaweicloud-cs-sdk/blob/master/huaweicloud-cs-examples/StreamingML_abnormal_detection_example.md

THANKS

