Introduction to Stream Processing With Apache Flink

Marta Paes (@morsapaes)
Developer Advocate

ververica

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About Ververica

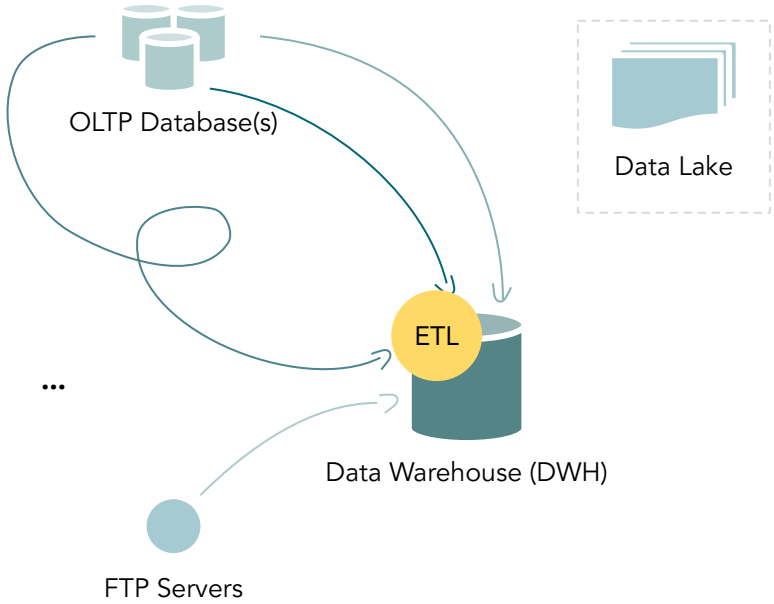
Original Creators of
Apache Flink®

Enterprise Stream Processing
With Ververica Platform

Part of
Alibaba Group

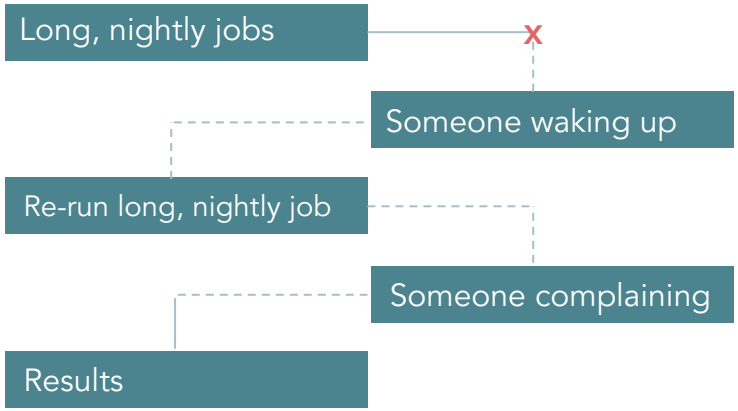
Try out Ververica Platform Community Edition (free forever!): https://www.ververica.com/platform

Analytics...Not that Long Ago



Analytics...Not that Long Ago

The quest for data...



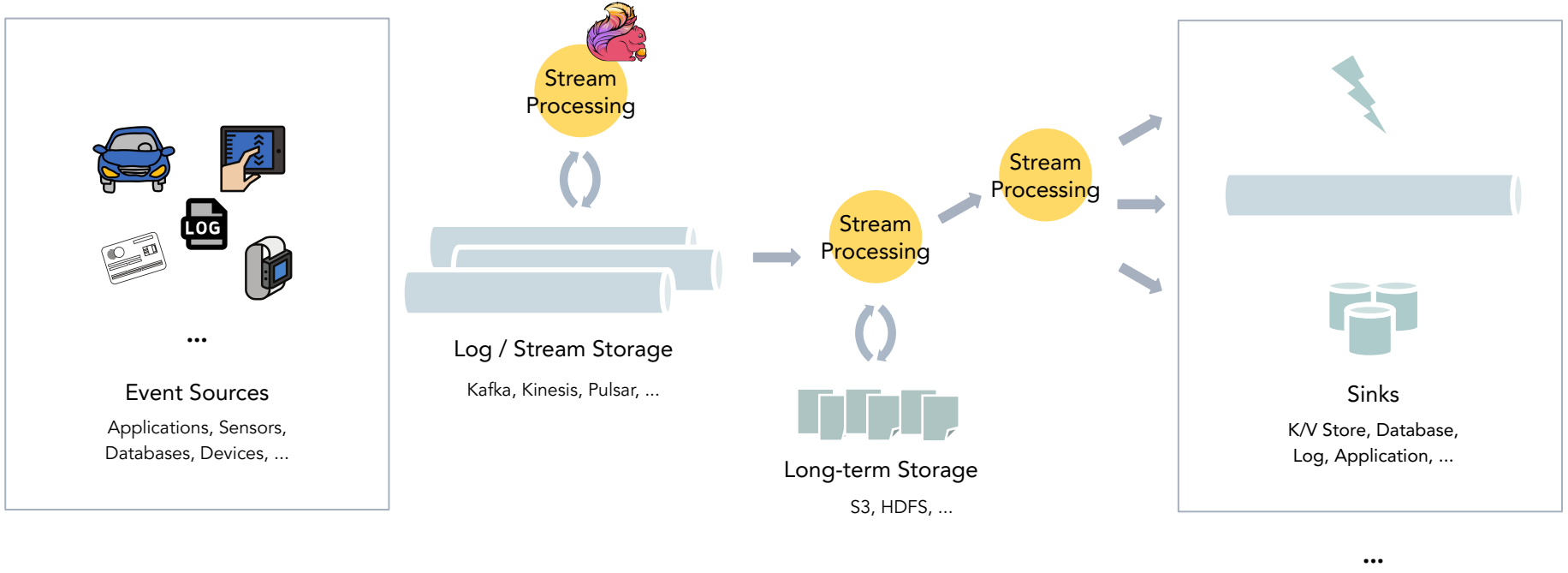
But in the end...

- Most source data is continuously produced
- Not everyone can wait for yesterday's data
- Most logic is not changing that frequently

Everything is a Stream

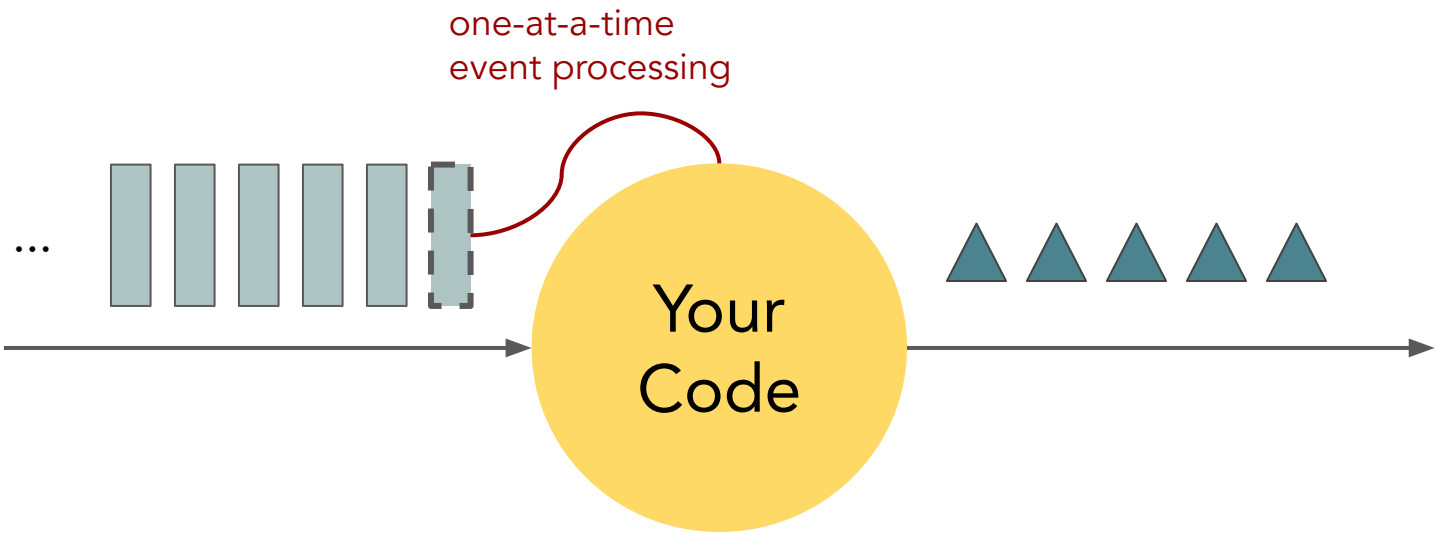
Everything is a Stream

Your static data records become **events** that are **continuously produced** and should be **continuously processed**.



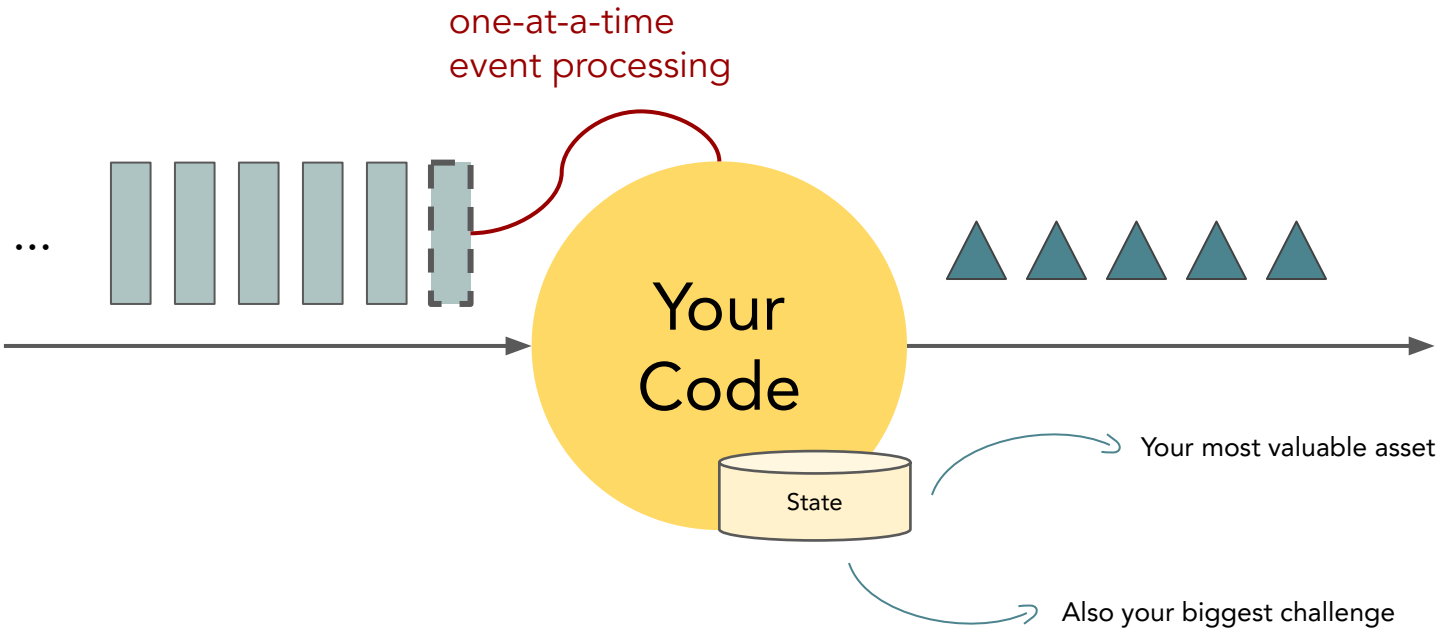
Stream Processing

Continuous processing of unbounded streams of events, one-at-a-time.



Stateful Stream Processing

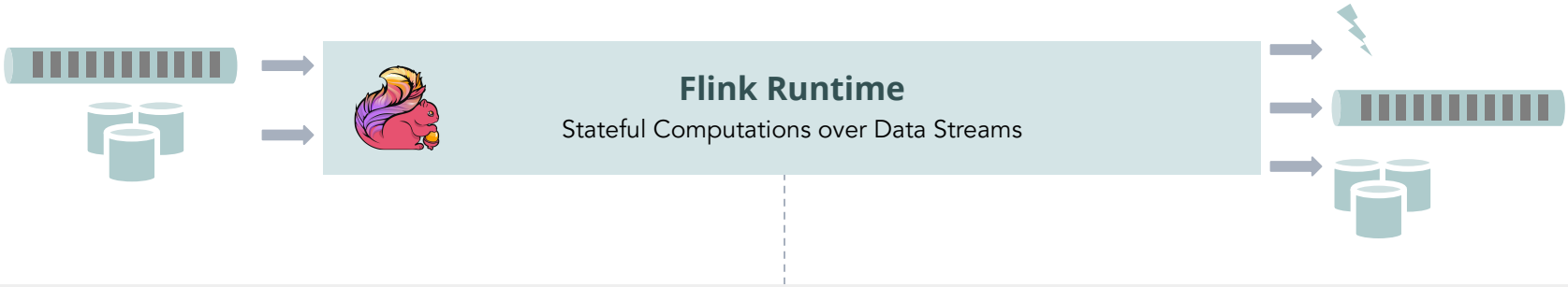
What if this simple model could “remember” events as they flow through?



So...what is Apache Flink?

What is Apache Flink?

Flink is an **open source** framework and distributed engine for **stateful stream processing**.



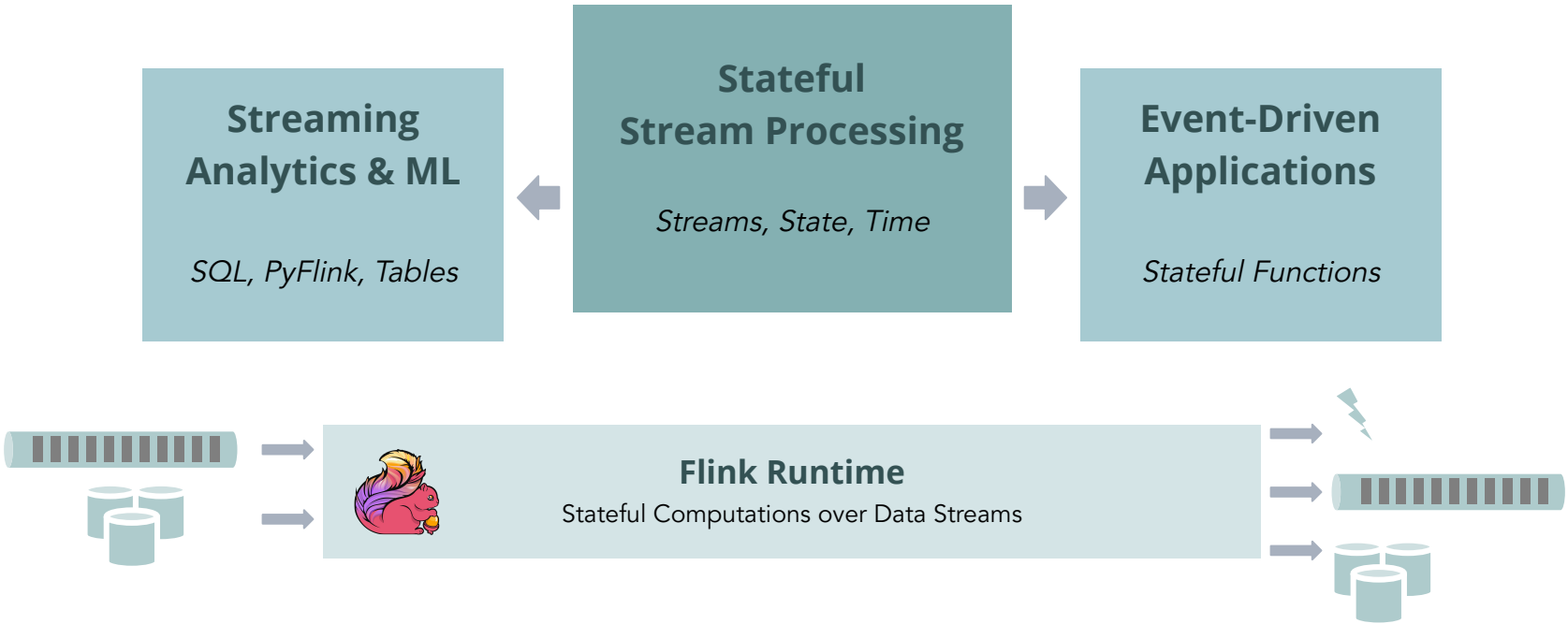
Stateful Computations over Data Streams

- State management is what makes Flink **powerful**.
- Consistent, one-at-a-time event processing is what makes Flink **flexible**.

Learn more: flink.apache.org

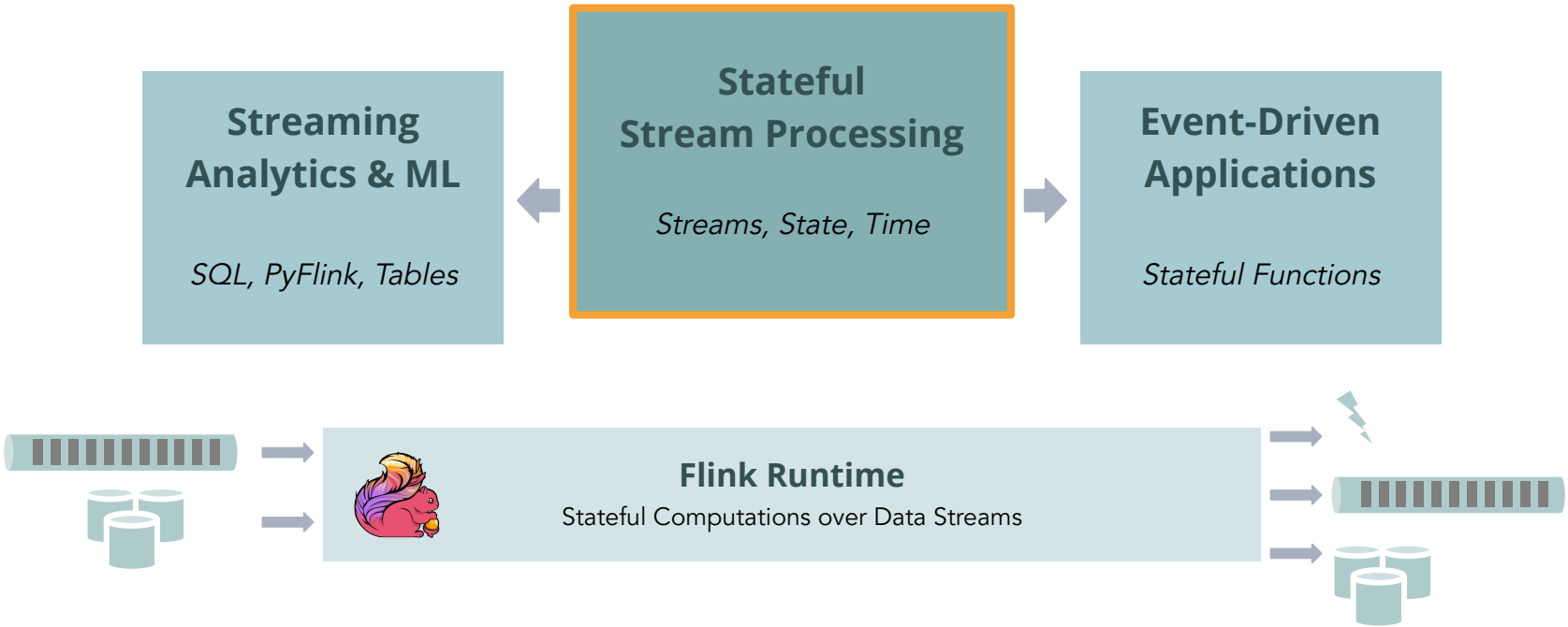
Stateful Computations over Data Streams

This gives you a robust foundation for a wide range of use cases:



Stateful Stream Processing

Classical, core stream processing use cases that build on the primitives of **streams**, **state** and **time**.



Stateful Stream Processing

Classical, core stream processing use cases that build on the primitives of **streams**, **state** and **time**.

- Explicit control over these primitives
- Complex computations and customization
- Maximize **performance** and **reliability**

Example Use Cases

NETFLIX

FUJITSU

aws

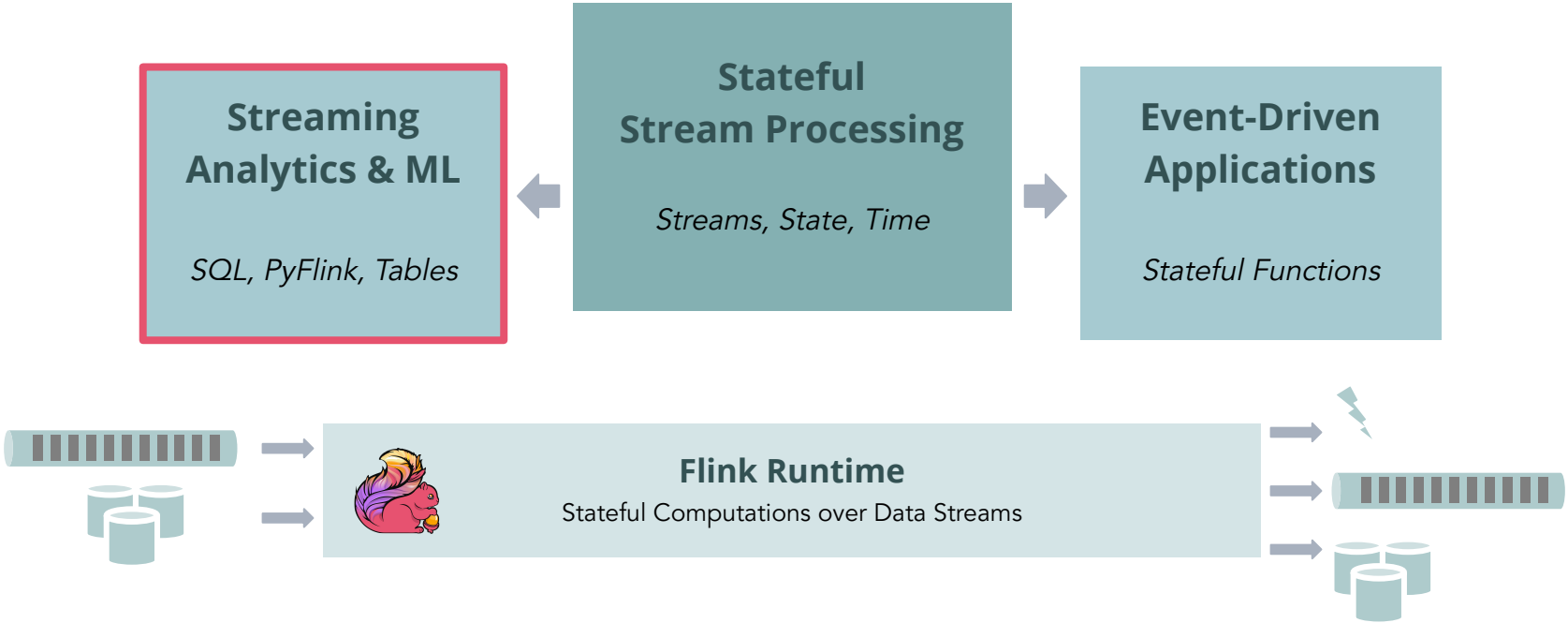
Large-scale Data Pipelines

Real-time IoT Data Platform

Service Monitoring & Anomaly Detection

Streaming Analytics & ML

More high-level or domain-specific use cases that can be modeled with SQL/Python and dynamic tables.



Streaming Analytics & ML

More high-level or domain-specific use cases that can be modeled with SQL/Python and dynamic tables.

- Focus on logic, not implementation
- Mixed workloads (batch and streaming)
- Maximize **developer speed** and **autonomy**

Example Use Cases

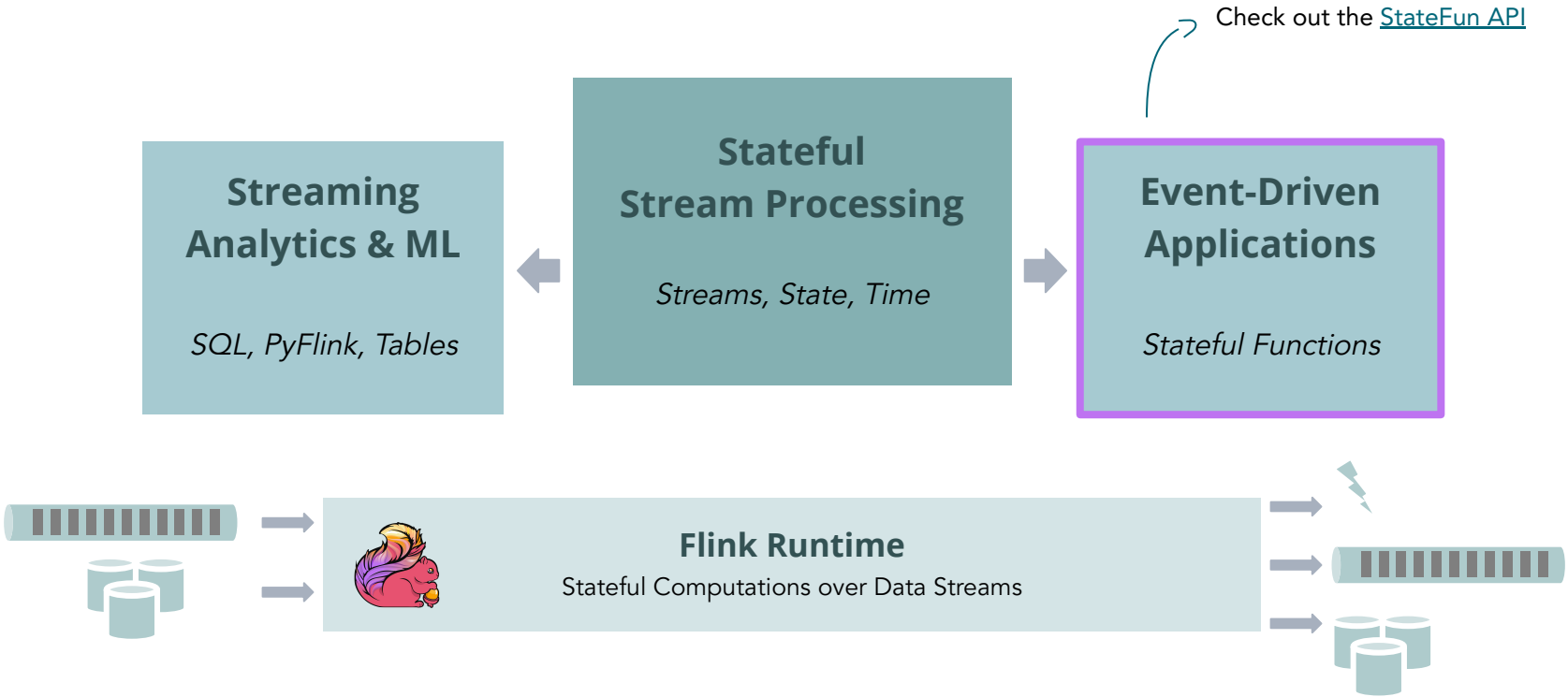
Uber

criteo

Unified Online/Offline Model Training	E2E Streaming Analytics Pipelines	ML Feature Generation

Event-Driven Applications

Use cases that extend stream processing to stateful serverless applications.



Learn more: Hands-On Stateful Serverless Applications w/ Kubernetes and Stateful Functions

More Apache Flink Users

Learn More: Powered by Flink, Speakers – Flink Forward San Francisco 2019, Speakers – Flink Forward Europe 2019

How big can you go?

Flink at Alibaba scale

Double 11 / Singles Day

Alibaba Group

incl. sub-second updates to the GMV dashboard

Real-time Data Applications

Search | Recomm. | Ads | BI | Security

Data Size

1.7EB

Throughput (Peak)

4B events/sec

State Size (Biggest)

100TB

Latency

Sub-sec

Learn more: Alibaba Cloud Unveils 'Magic' Behind the World's Largest Online Shopping Festival

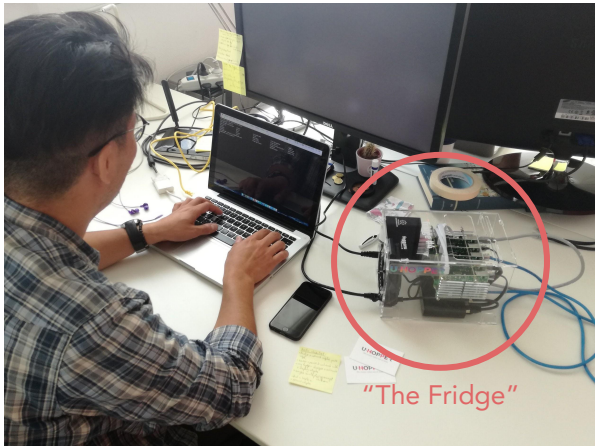
...but you can also go small...

U-Hopper: FogGuru

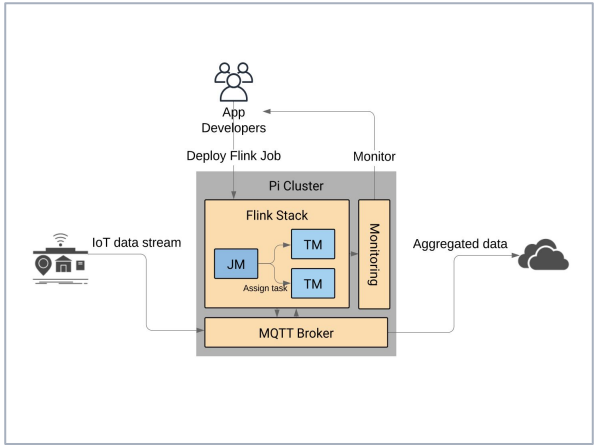
FogGuru is a platform for developing and deploying fog applications in **resource-constrained devices**.

Demo

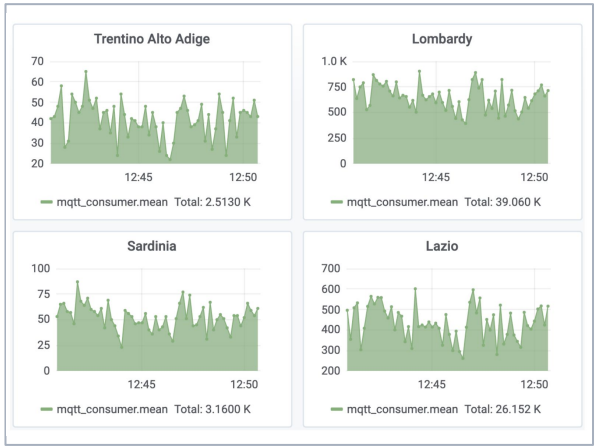
Cluster of 5 Raspberry Pi 3b+



Docker Swarm + Flink + Mosquitto



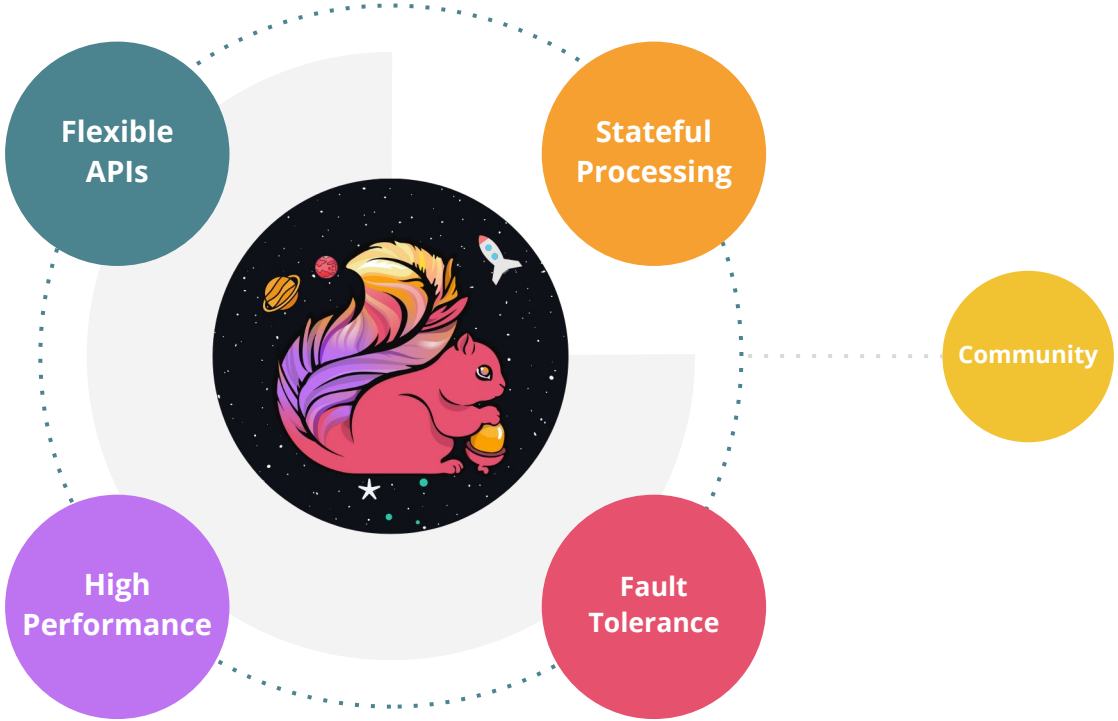
Data volume: 800 events/sec



Learn more: FogGuru: a Fog Computing Platform Based on Apache Flink

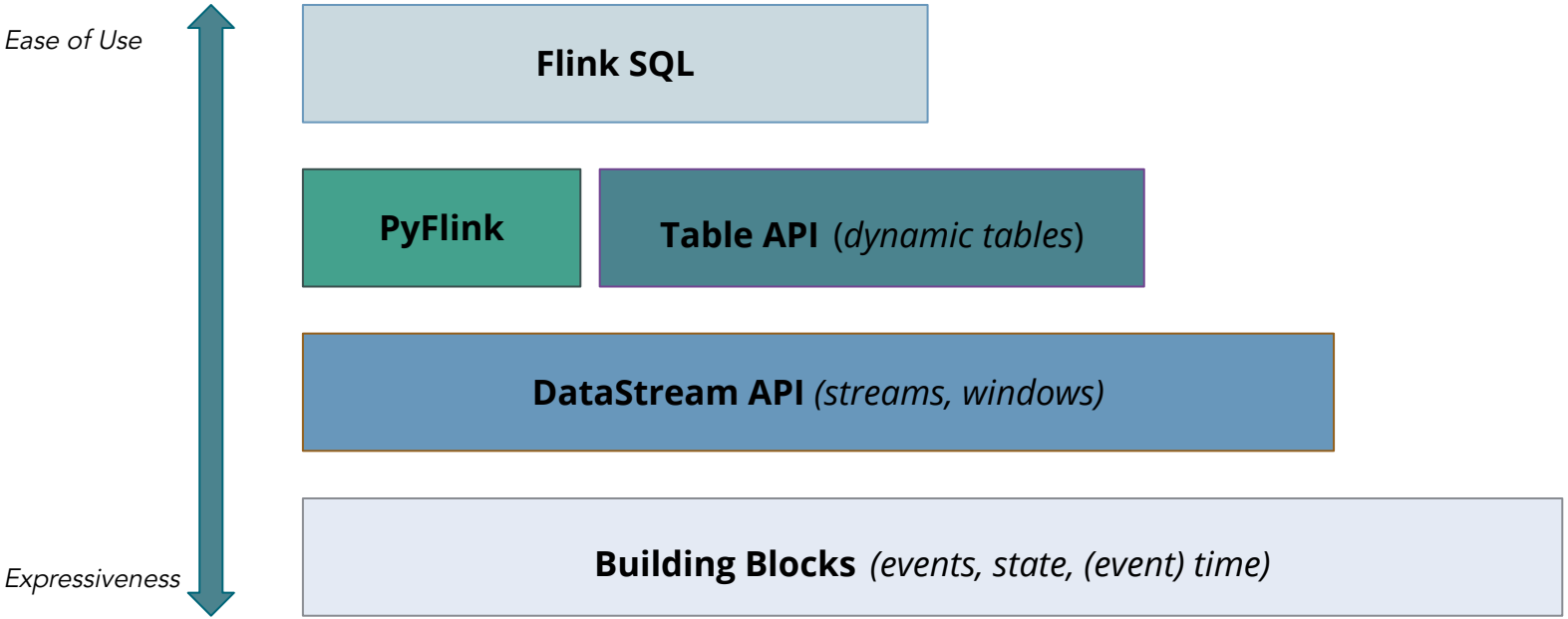
...or just use your laptop + an IDE.

What Makes Flink...Flink?



The Flink API Stack

Flink has layered APIs with different tradeoffs for **expressiveness** and **ease of use**. You can mix and match all the APIs!



Learn more: Rethinking Flink's APIs for a Unified Data Processing Framework

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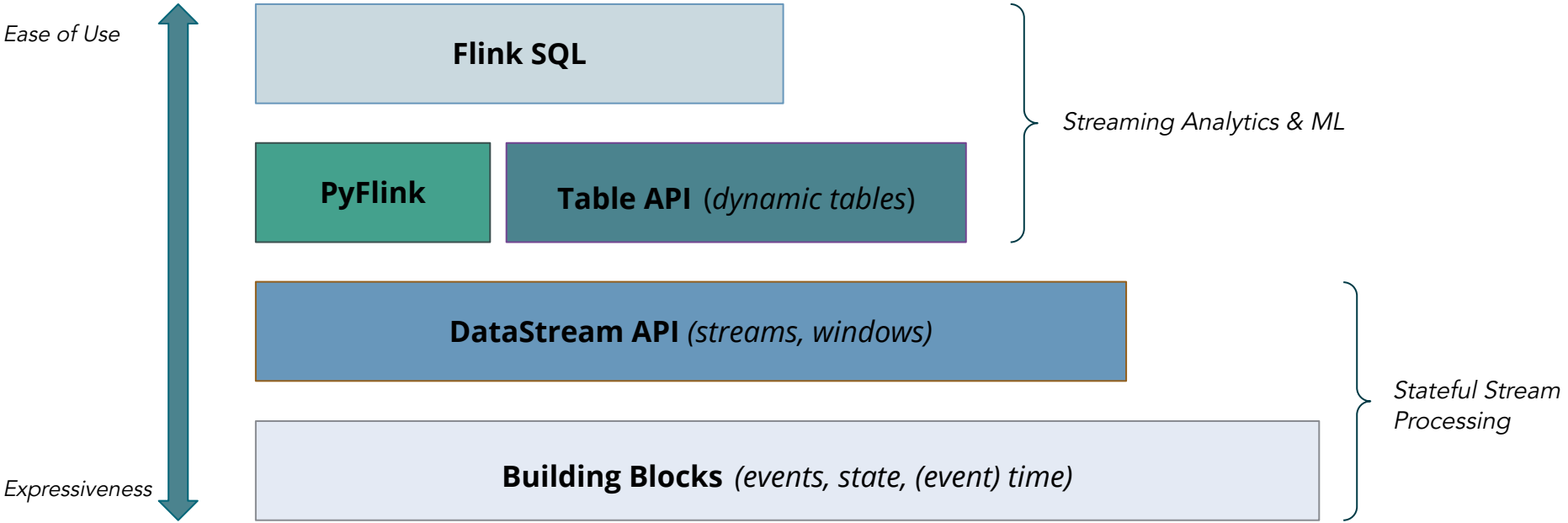

Learn more: Rethinking Flink's APIs for a Unified Data Processing Framework

At the Core: Streaming Dataflows

```
DataStream<SensorReading> sensorData = env.addSource(new FlinkKafkaConsumer(...));
```

Source

```
DataStream<SensorReading> avgTemp = sensorData
    .map(r -> new SensorReading(r.id, r.timestamp, (r.temperature-32) * (5.0/9.0)))
    .keyBy(r -> r.id)
    .timeWindow(Time.seconds(5))
    .apply(new TemperatureAverager());
```

Transformations

```
avgTemp.addSink(new ElasticSearchSink(...));
```

Sink

At the Core: Streaming Dataflows

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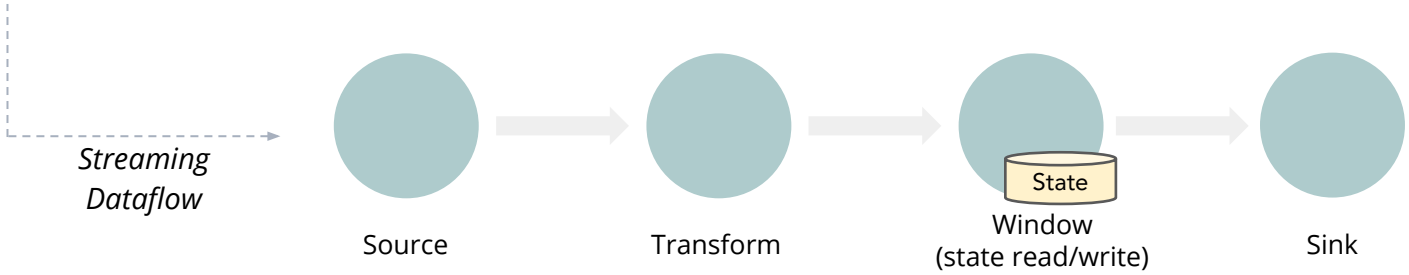
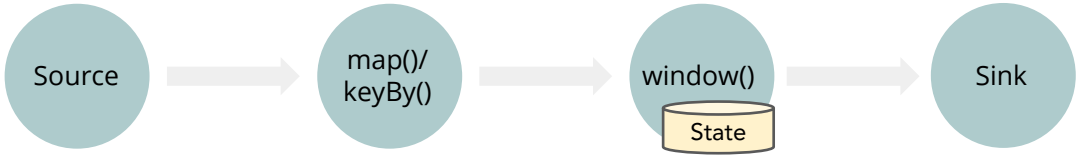


At the Core: Streaming Dataflows

Flink takes care of transforming your topology into a parallel dataflow that can run **distributed** on multiple machines.



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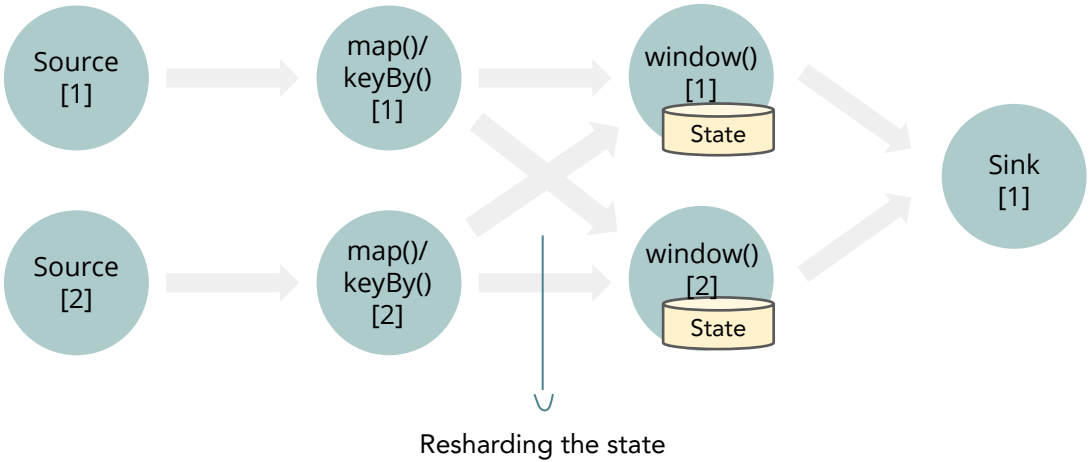
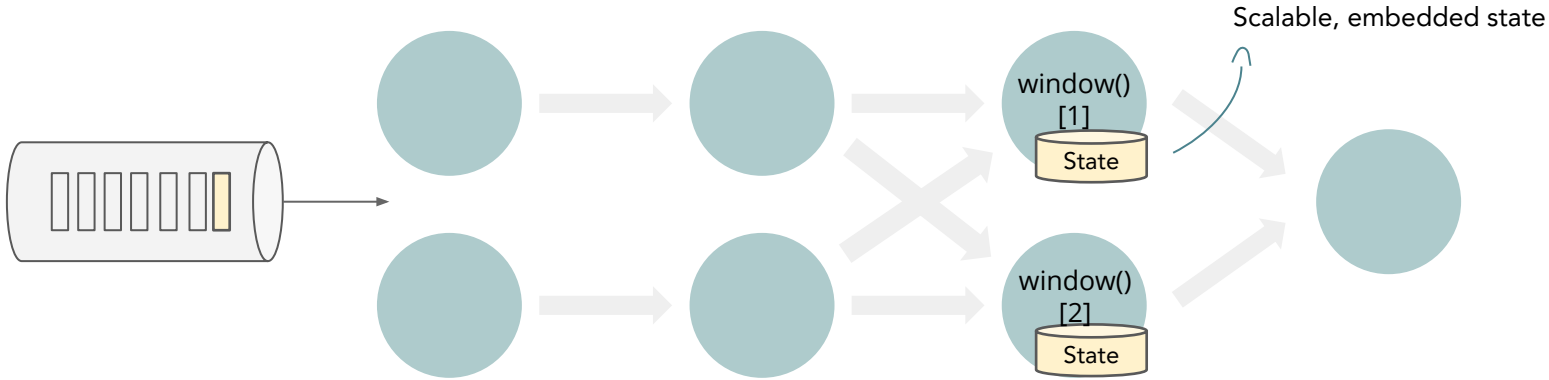


- State is re-scaled automatically with parallel operators

Learn more: A Deep-Dive into Flink's Network Stack

At the Core: State

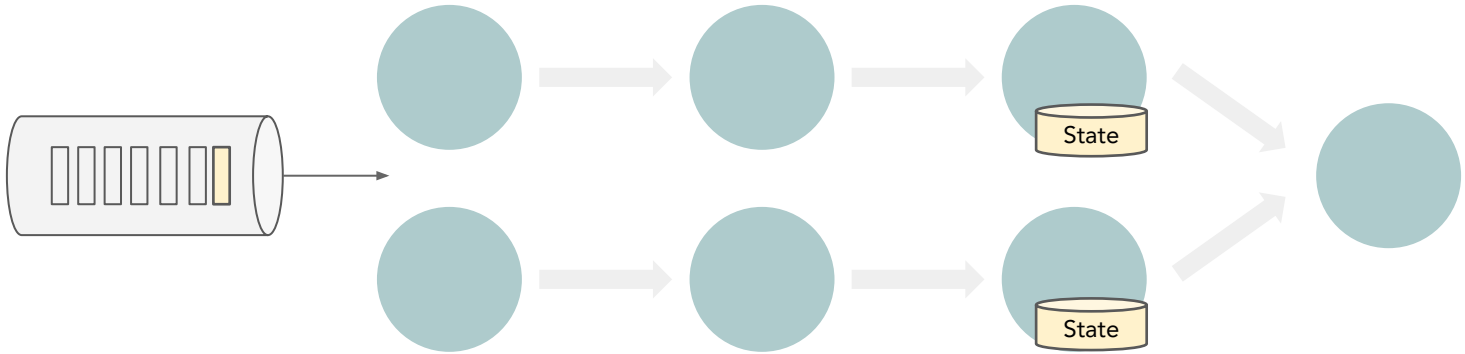
Flink stores your state **locally** in-memory (on the JVM heap) or on disk (RocksDB).



- State access at memory/disk speed
- The amount of state you can keep is only limited by heap/disk size

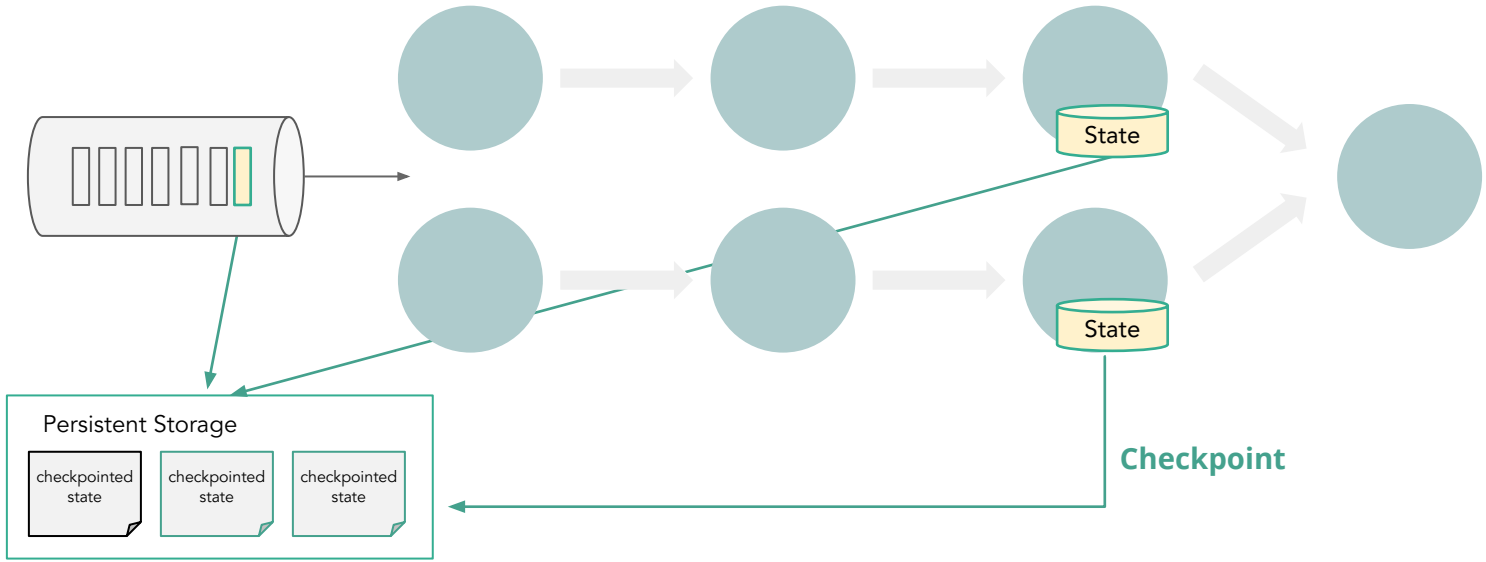
Fault Tolerance

What happens when something goes wrong? How does Flink guarantee that this state is **fault tolerant**?



Fault Tolerance: Checkpointing

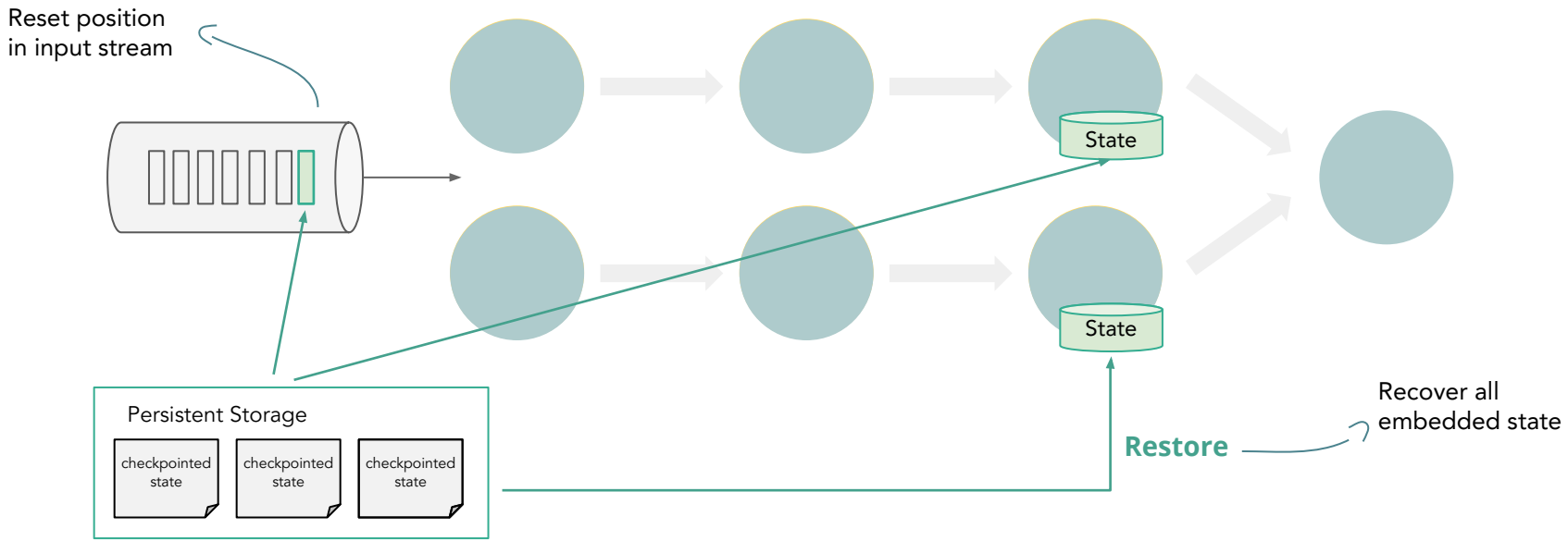
Flink takes **periodic snapshots** (i.e. checkpoints) of your application state to guarantee state consistency in case of failures.




State
State

Fault Tolerance: Recovery

Flink recovers all embedded state and positions in the input streams, giving you **failure-free execution** semantics with **exactly-once** consistency guarantees.



Beyond Fault Tolerance

You can also explicitly trigger these snapshots (i.e. savepoints) for planned, manual backup.

- Upgrades and Rollbacks
- Cross Datacenter Failover
- State Archiving
- Blue / Green Deployments
- Schema Evolution

Learn more: "State Unlocked", Flink Forward Virtual Conference

At the Core: Time

STAR WARS

Event Time

When the events in the movies *really* happened

When the movies were released

Processing Time

At the Core: Time

Event Time

Time embedded in the records when they are produced

- Deterministic results
- Handle out-of-order or late events
- Trade-off result completeness/correctness and latency

At the Core: Time

- Non-deterministic results
- Best performance and lowest latency
- Speed > completeness/correctness

System time of the processing machine

Processing Time

What Makes Flink...Flink?

- Ease of use/Expressiveness
- Wide Range of Use Cases

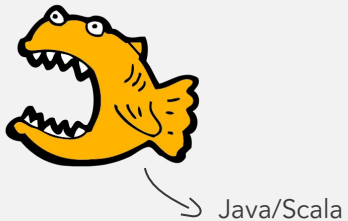
- State = First-class Citizen
- Event-time Support

- Local State Access
- High Throughput/Low Latency

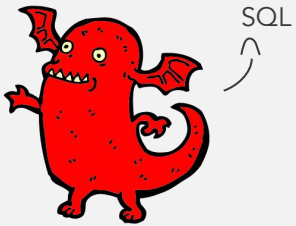
- Distributed State Snapshots
- Exactly-once Guarantees

How to Get Started?

There are many ways to get started with Flink — and you don't have to know Java/Scala.



Self-paced Training Course



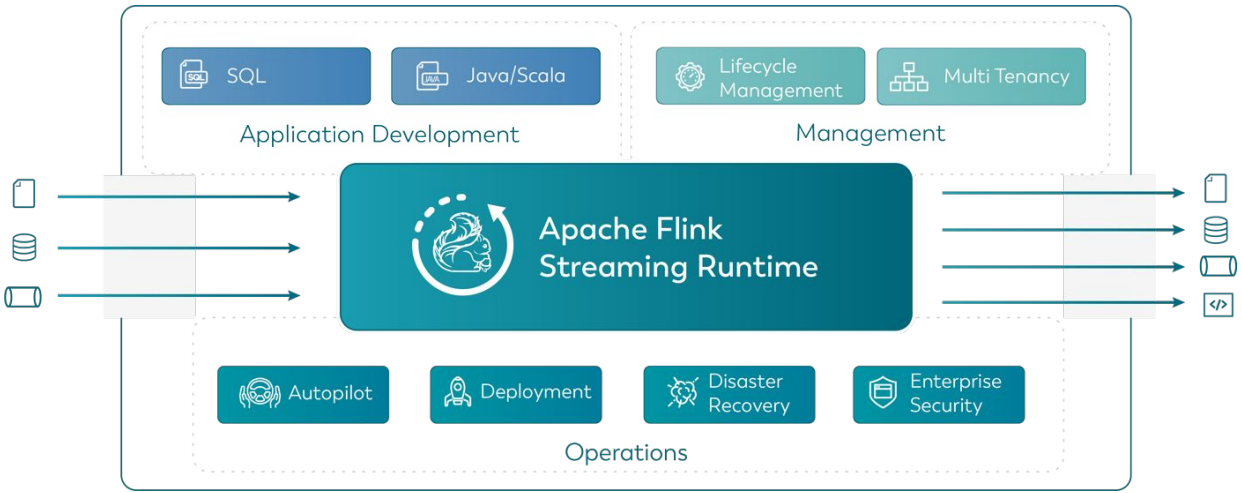
Flink SQL Walkthrough

PyFlink Walkthrough + Notebooks

- Visit flink.apache.org
- Subscribe to the User Mailing List (for help!) or use the `apache-flink` tag on SO
- Follow @ApacheFlink

How to Get Started?

Get up and running with Flink on Kubernetes with Ververica Platform Community Edition!



- Permanently free
- Unlimited application size
- Support for Flink SQL

Download

Learn more: Announcing Ververica Platform Community Edition

ありがとう!

Marta Paes (@morsapaes)
Developer Advocate

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