Stream Processing for the Practitioner:

Blueprints for Common Stream Processing Use Cases with Apache Flink®

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dataArtisans

About Data Artisans

PLATFORM

Original creators of Apache Flink®

Open Source Apache Flink + dA Application Manager

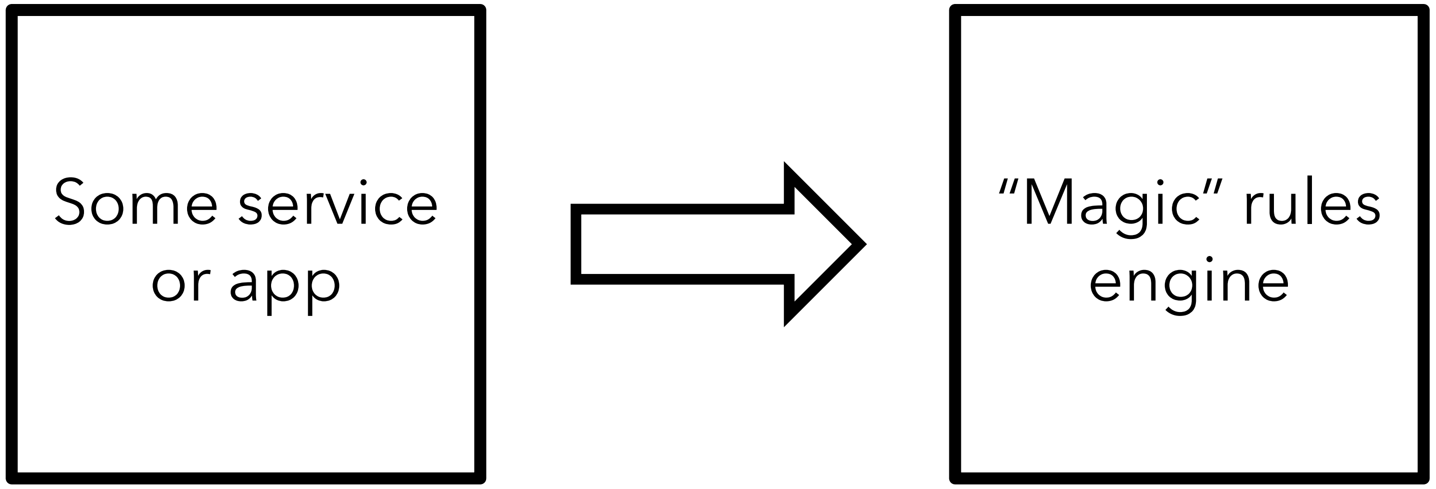
What is stream processing and why is it useful?

Use Case: "Suspicious Behaviour" Detection

Some service or app

- Dropbox, Google Suite, Box
  - Sharing, accessing, and modifying data produces events that we can/want to analyse
- Banking
  - We monitor all transactions, know the user data

Use Case: "Suspicious Behaviour" Detection



- Spits out alerts when suspicious stuff is happening
  - "More than 10 failed login attempts"
  - "Sharing more than 100 files within 1 Hour"
  - "Impossible Travel"/"Magic carpet travel"
  - "Continuously increasing withdrawal amounts"

Use Case: "Suspicious Behaviour" Detection

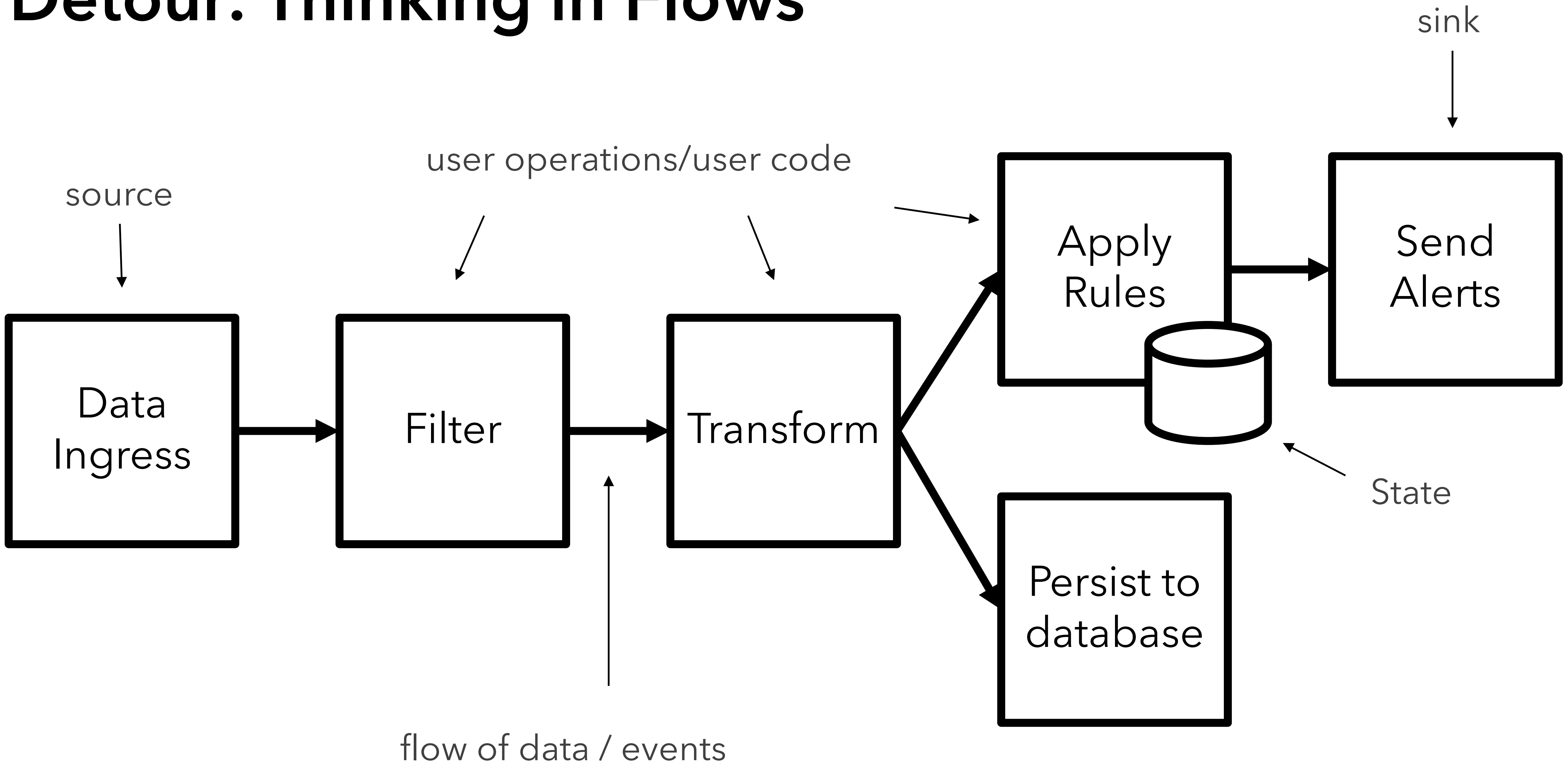
Ok, let me just use a single machine for this!

- What if the load becomes too high? → I'll use a distributed batch processor. (Hadoop MapReduce, Spark, and the like)

- This runs nightly? Isn't the latency very high then? I don't want to wait a day for my alerts 😳

I need alerts in real time → Apache Flink® is a real-time, distributed, stateful, and fault-tolerant stream processor

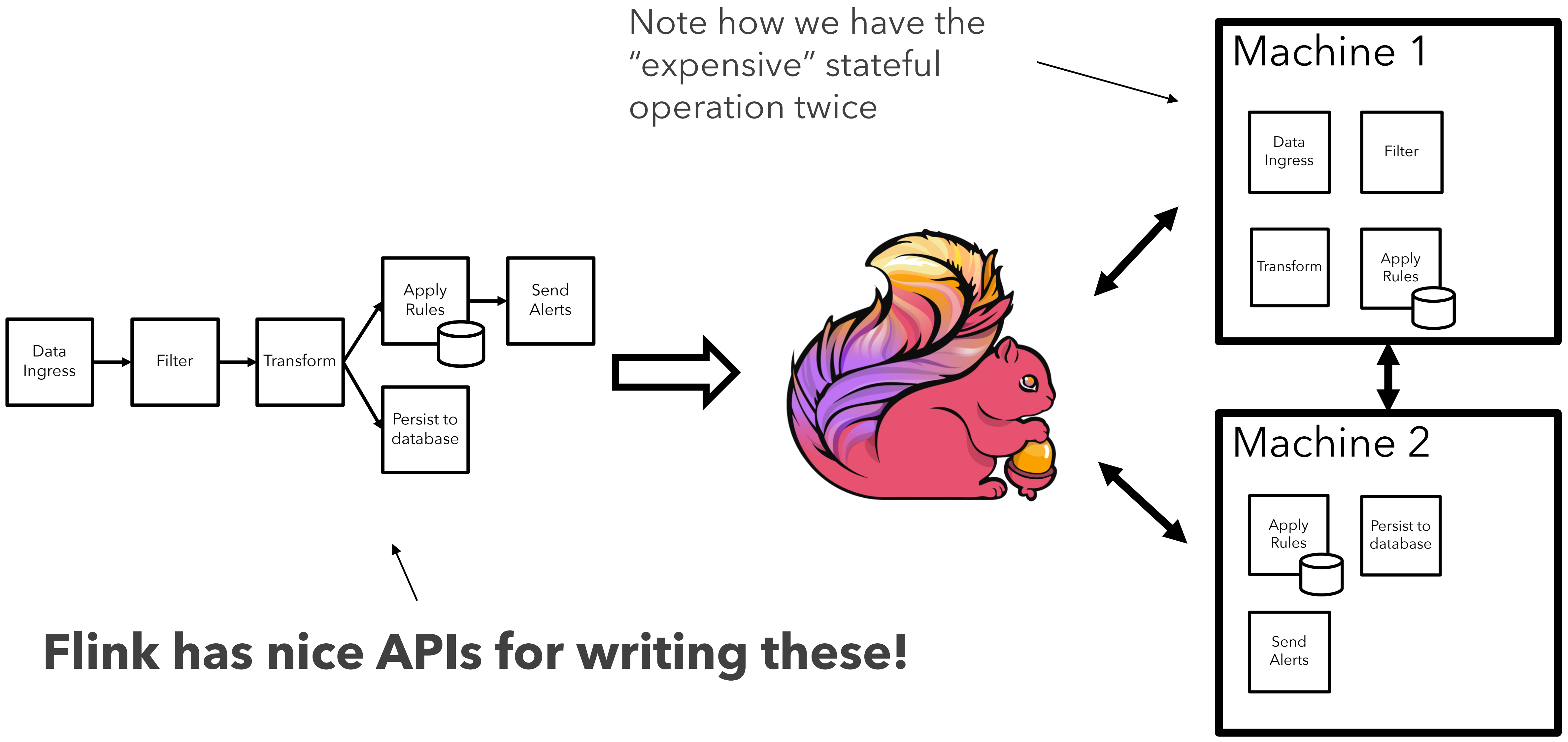
Detour: Thinking in Flows



Why flows and operations?

- This is how the physical world works
- Operations can be **composed** and are **reusable**
- Allows a system (Flink) to take these operations and execute them on different machines
- A system can execute the same operation multiple times on several machines to deal with high workloads

Apache Flink® distributed stateful stream processor



Flink has nice APIs for writing these!

Apache Flink® distributed stateful stream processor

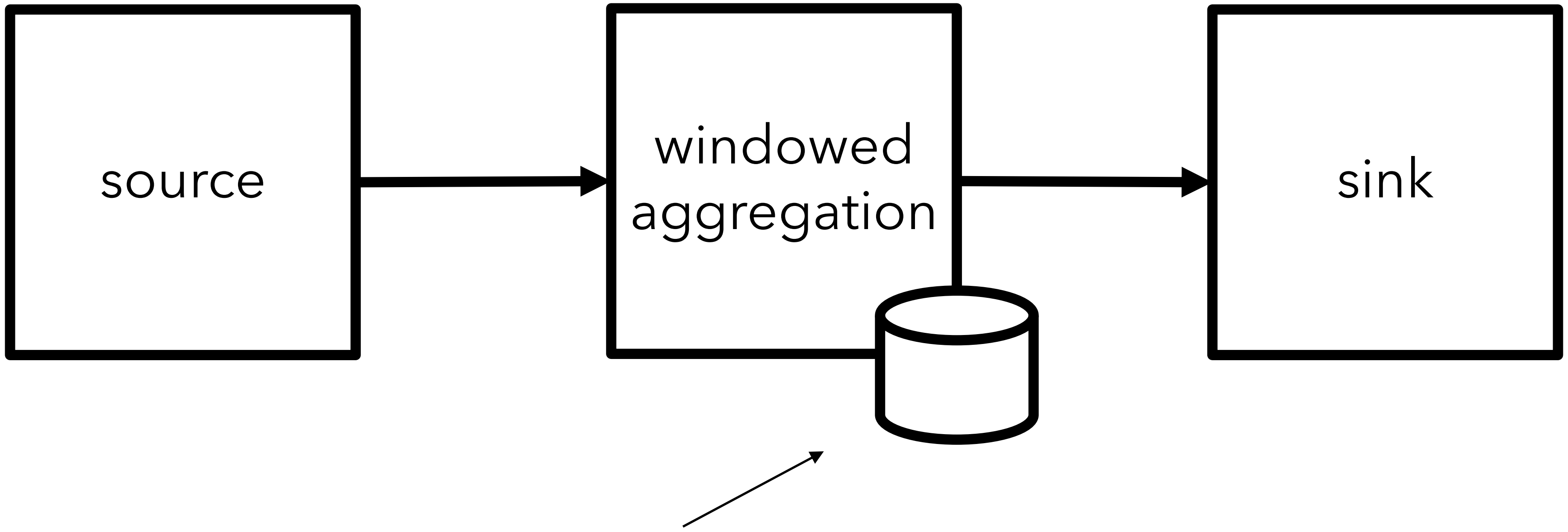
- Questions that a good stream processing system needs to have answers for:
  - What happens when machines fail or when user operations fail?
  - What happens if I move my stateful operations/flows/jobs?
  - What happens if I need to change the schema of the state that operations keep?
  - How can I update framework code while keeping my program state?
  - Same for user code?

Common stream processing blueprints

Blueprint: Aggregation of timestamped data

- Use cases
  - Give me the number of tweet impressions per tweet for every hour/day/…
  - Calculate the average temperature over 10 minute intervals for each sensor in my warehouse
  - Aggregate user interaction data for my website to display on my internal dashboards

Blueprint: Aggregation of timestamped data



state: contents of all the in-flight windows

Blueprint: Aggregation of timestamped data

Some things to look out for.

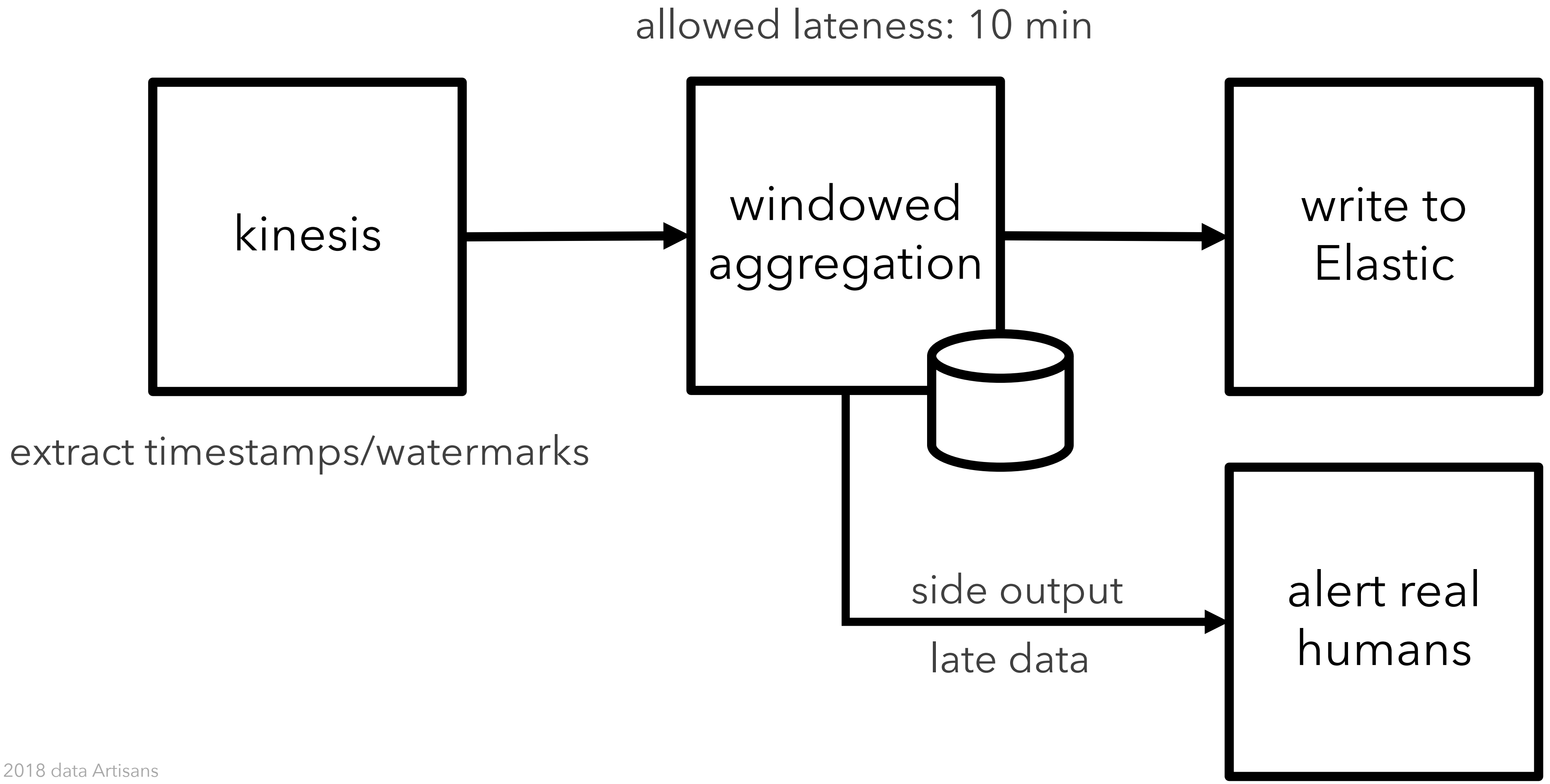
- Do I want to window by event-time or processing time?
- If using event-time, how do I know when my window is “done”?
- What happens if data arrives out of order with respect to their timestamp?
- If using event-time, when is data considered late?
- What should happen with late data?

Blueprint: Aggregation of timestamped data

Flink features to look at.

- Windowing API
- Timestamp assigners/watermark extractors for defining event-time and defining “readiness”
- *Allowed lateness* for defining when data is late
- Side output of late data as a special flow path

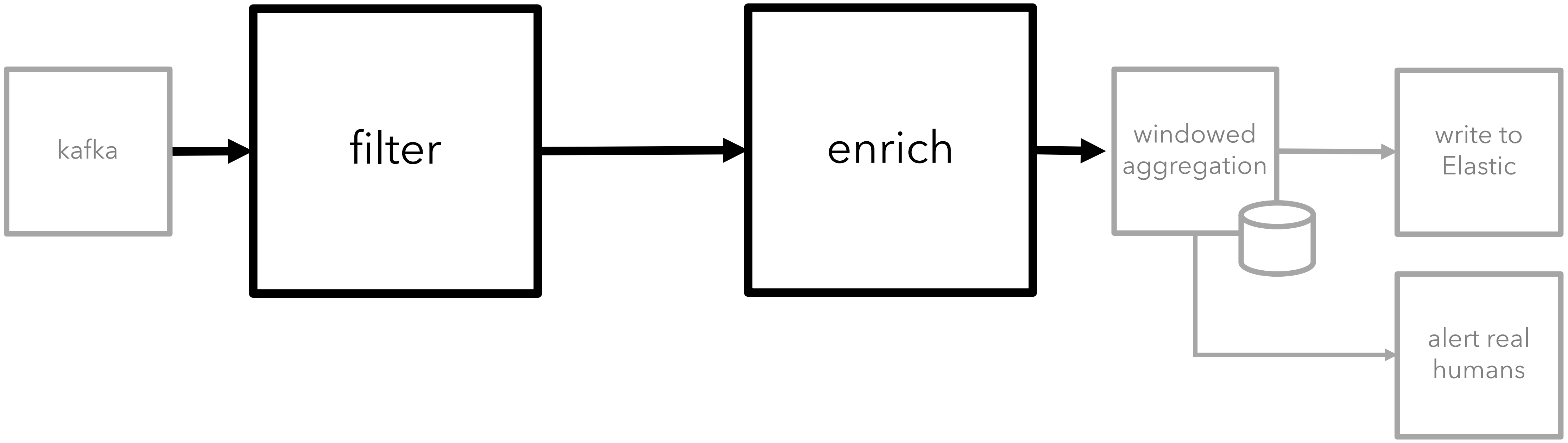
Blueprint: Aggregation of timestamped data



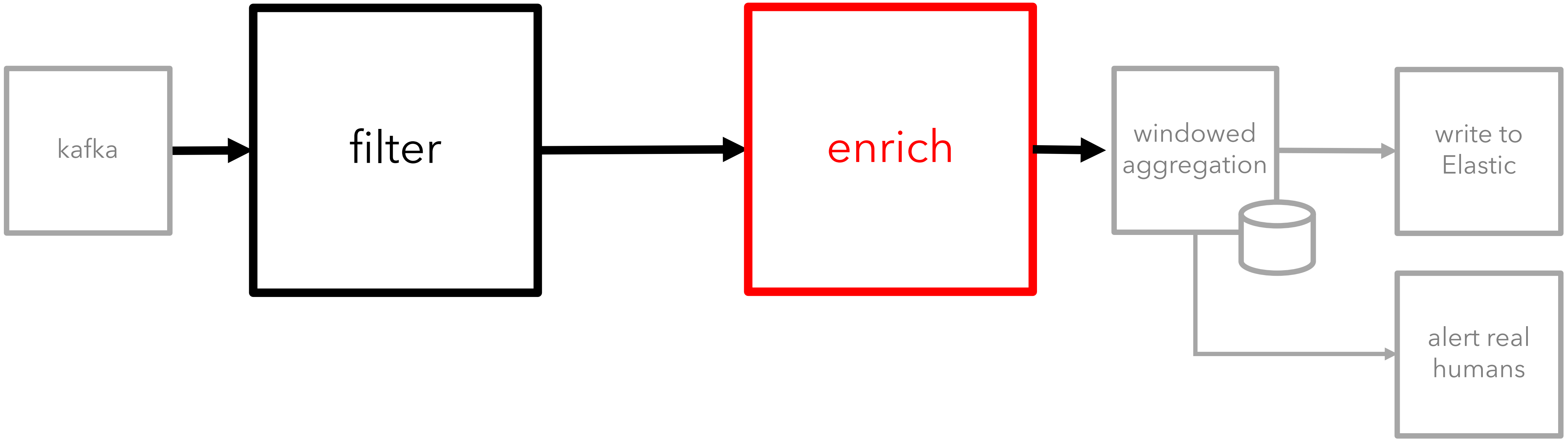
Blueprint: Enriching data with “side input”

- Use cases
  - Enrich user events with known user data
  - Add geolocation information to geotagged events

Blueprint: Enriching data with “side input”



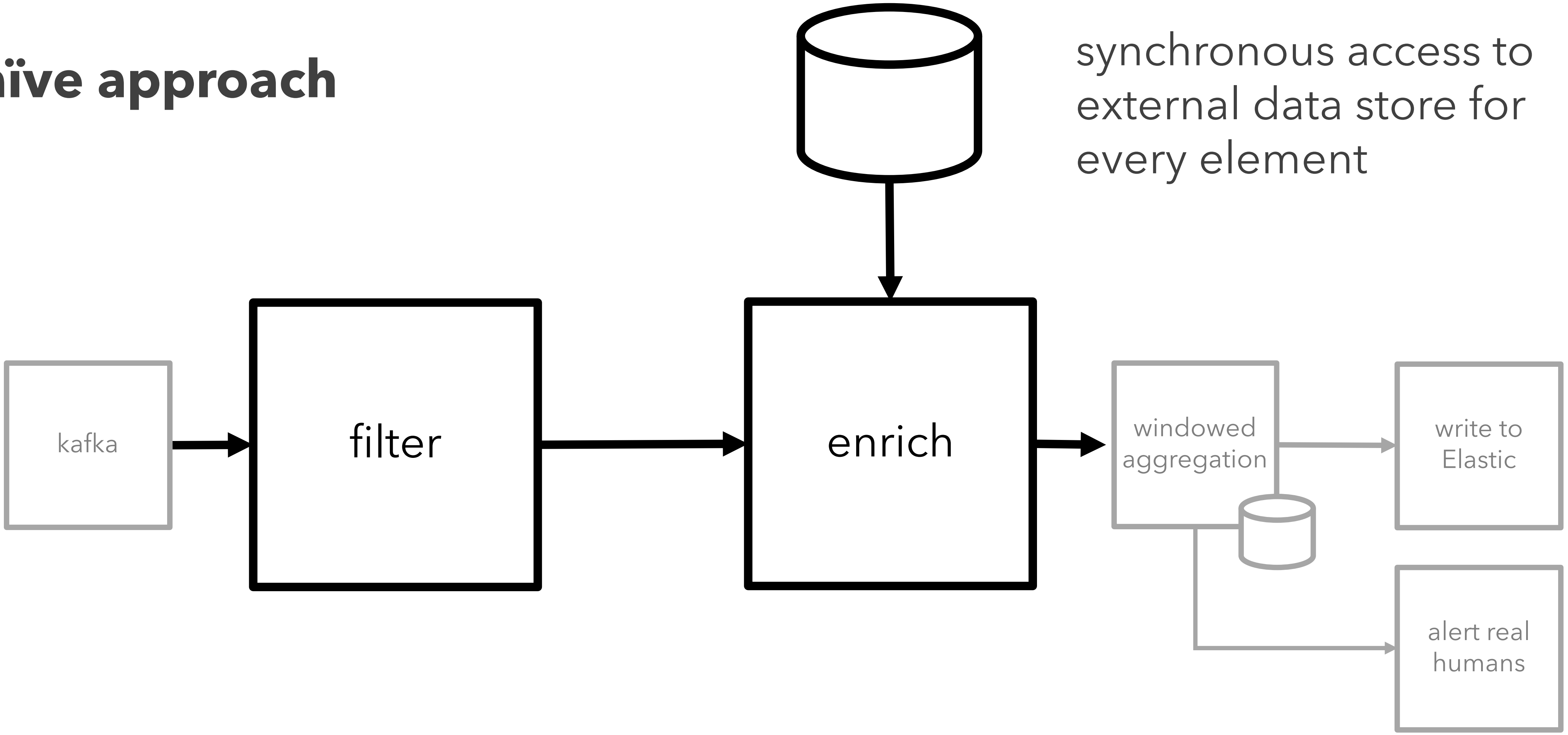
Blueprint: Enriching data with “side input”



Blueprint: Enriching data with “side input”

Naïve approach

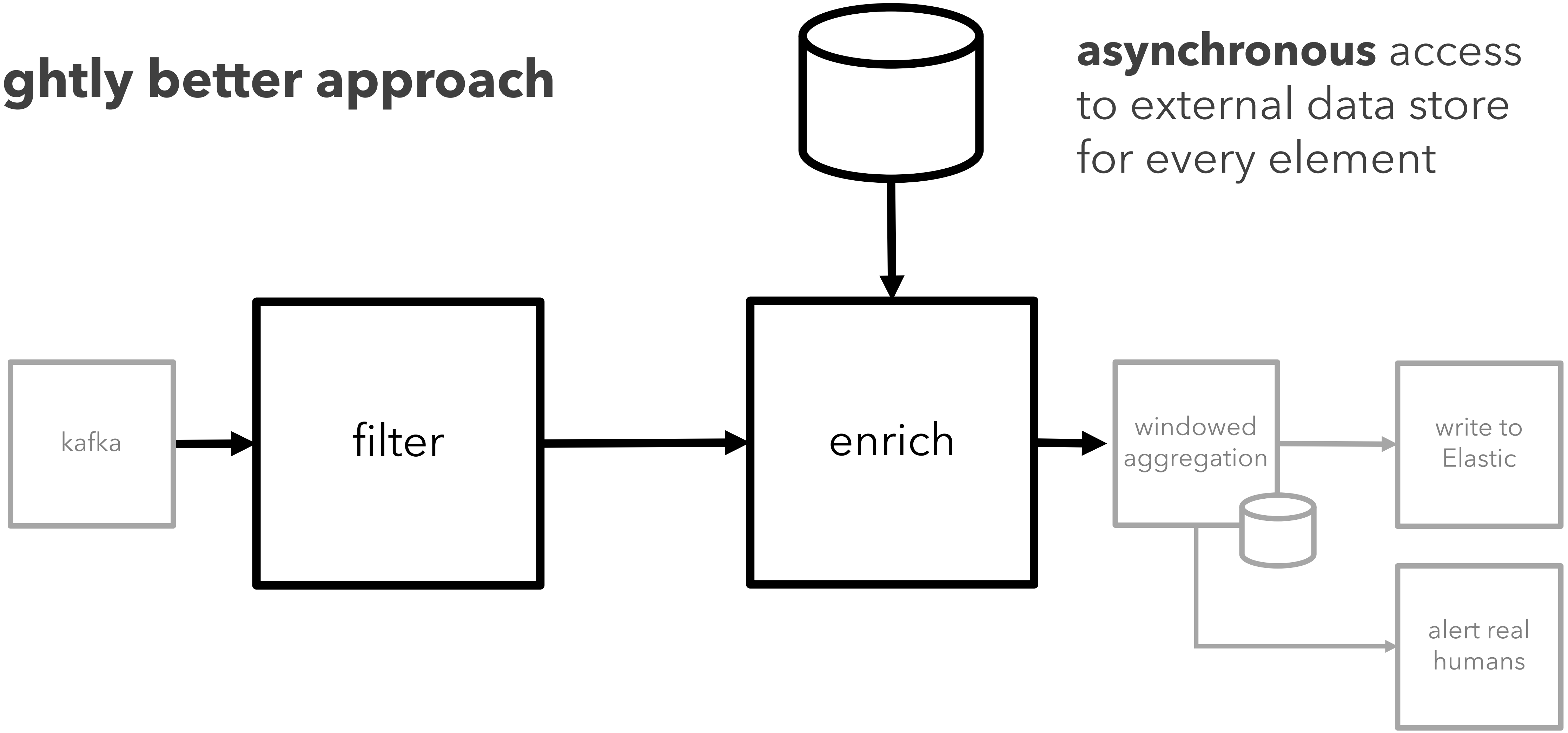
synchronous access to external data store for every element



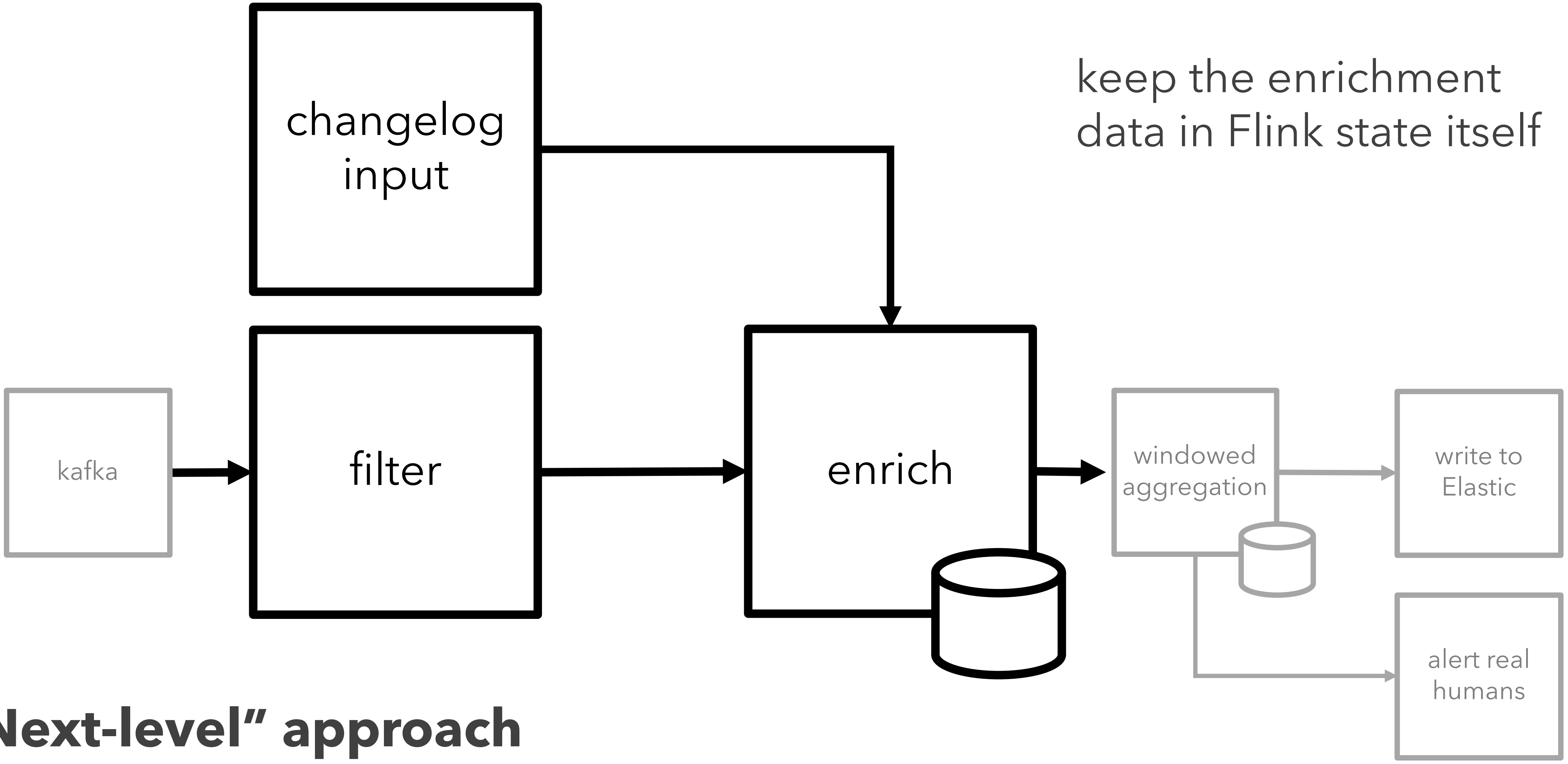
Blueprint: Enriching data with "side input"

Slightly better approach

asynchronous access to external data store for every element



Blueprint: Enriching data with "side input"



keep the enrichment data in Flink state itself

"Next-level" approach

Blueprint: Enriching data with “side input”

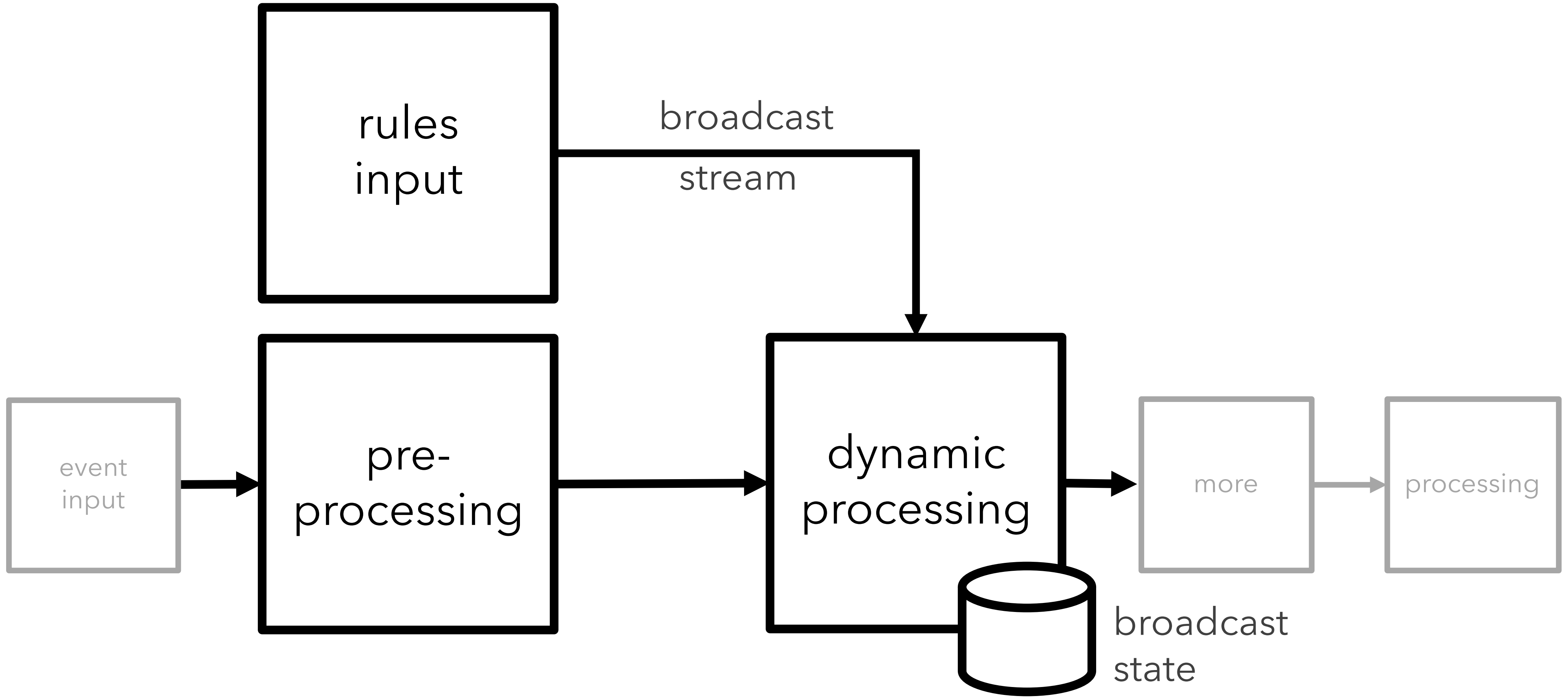
Flink features to look at.

- Regular user functions/operations
- Async I/O operation for more efficient data store accesses
- Two-input operations and stateful operations

Blueprint: Dynamic processing

- Use cases
  - Update of processing rules via DSL, think dynamic fraud-detection rules/policies
  - Live-update of machine learning models

Blueprint: Dynamic processing



Blueprint: Dynamic processing

Flink features to look at.

- ProcessFunction
- Broadcast streams and broadcast state

Closing

Learnings

- For immediate results you probably need a stream processor
- Start thinking in terms of data flows and reusable operations
- Getting state fault-tolerance, and event-time right is tough, check what your stream processor has as answers for those questions
- Flink has your use cases covered

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billions messages per day
A lot of Stream SQL

NETFLIX

Streaming Platform as a Service
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1400+ nodes, 22k+ cores, 100s of jobs,
3 trillion events / day, 20 TB state

Alibaba Group

1000s jobs, 100.000s cores,
10 TBs state, metrics, analytics,
real time ML,
Streaming SQL as a platform

ING

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Streaming Analytics Platform

Powered by Apache Flink

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