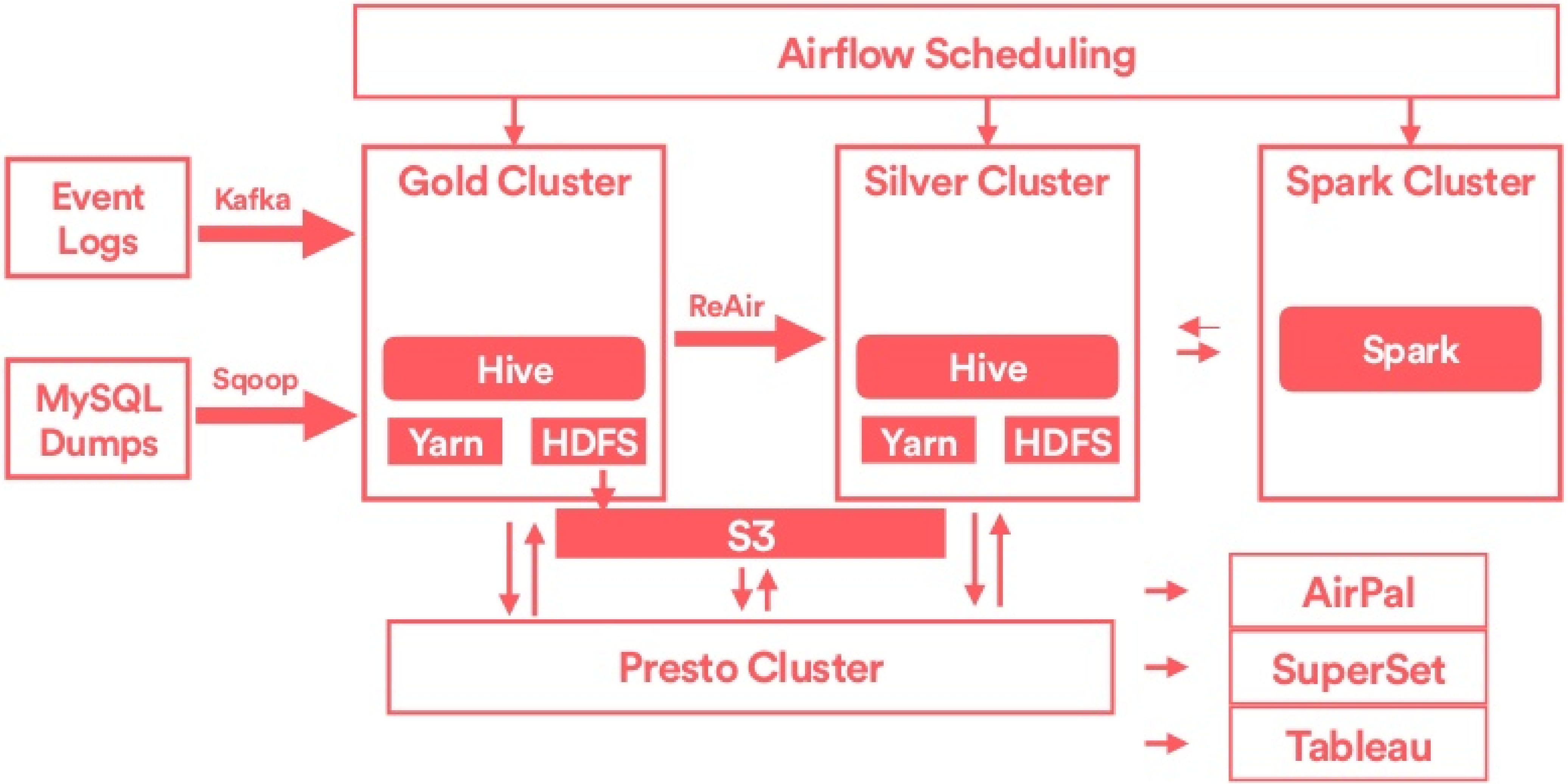
LIYIN TANG & JINGWEI LU

Building Data Products on Spark at Airbnb

airbnb

Data Infrastructure at Airbnb

Batch Infrastructure



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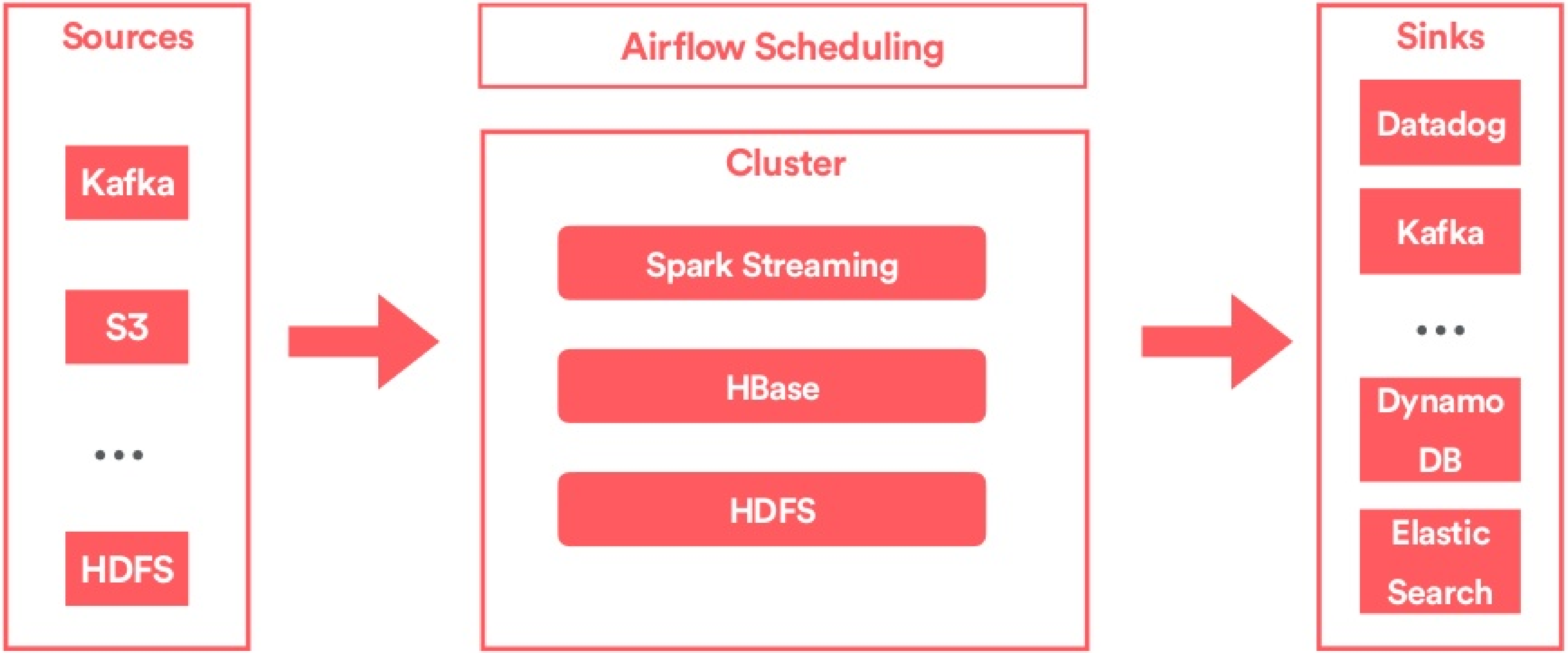
Streaming at Airbnb



Sources

Kafka

S3

• • •

HDFS

Airflow Scheduling

Cluster

Spark Streaming

HBase

HDFS

Sinks

Datadog

Kafka

• • •

Dynamo DB

Elastic Search

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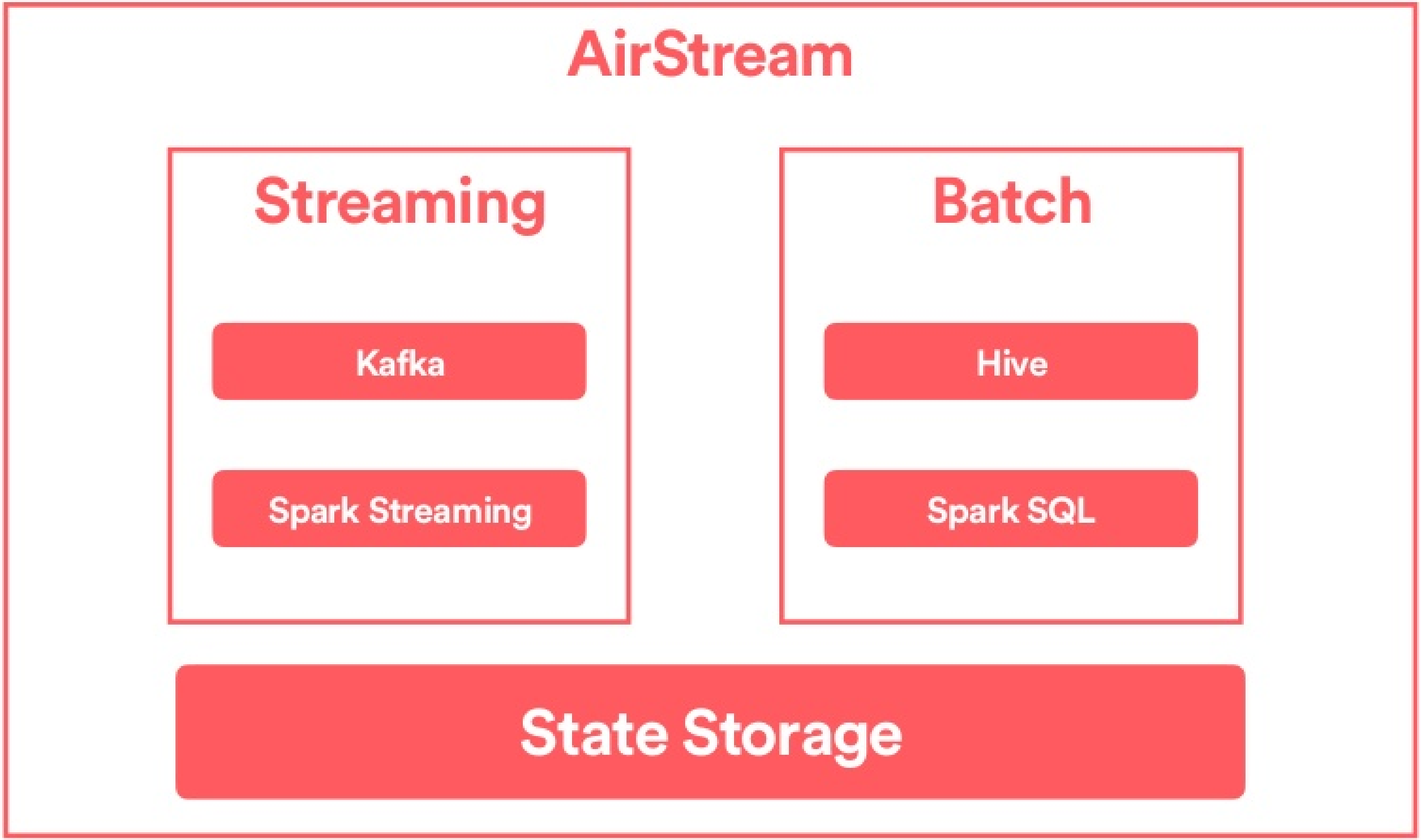
Lambda Architecture

Lambda Architecture



AirStream

Streaming

Kafka

Spark Streaming

Batch

Hive

Spark SQL

State Storage

Combine Streaming and Batch Processing

Sources

Streaming

```
source: [
 {
   name: source_example,
   type: kafka,
   config: {
     topic: "example_topic",
   }
 }
]
```

Batch

```
source: [
 {
   name: source_example,
   type: hive,
   sql: {
    select * from db.table where
ds='2017-06-05';
  }
 }
]
```

Computation

Streaming/Batch

```
process: [{
  name = process_example,
  type = sql,
  sql = """
   SELECT  listing_id, checkin_date, context.source as source
   FROM  source_example
   WHERE  user_id IS NOT NULL   """
 }]
```

Sinks

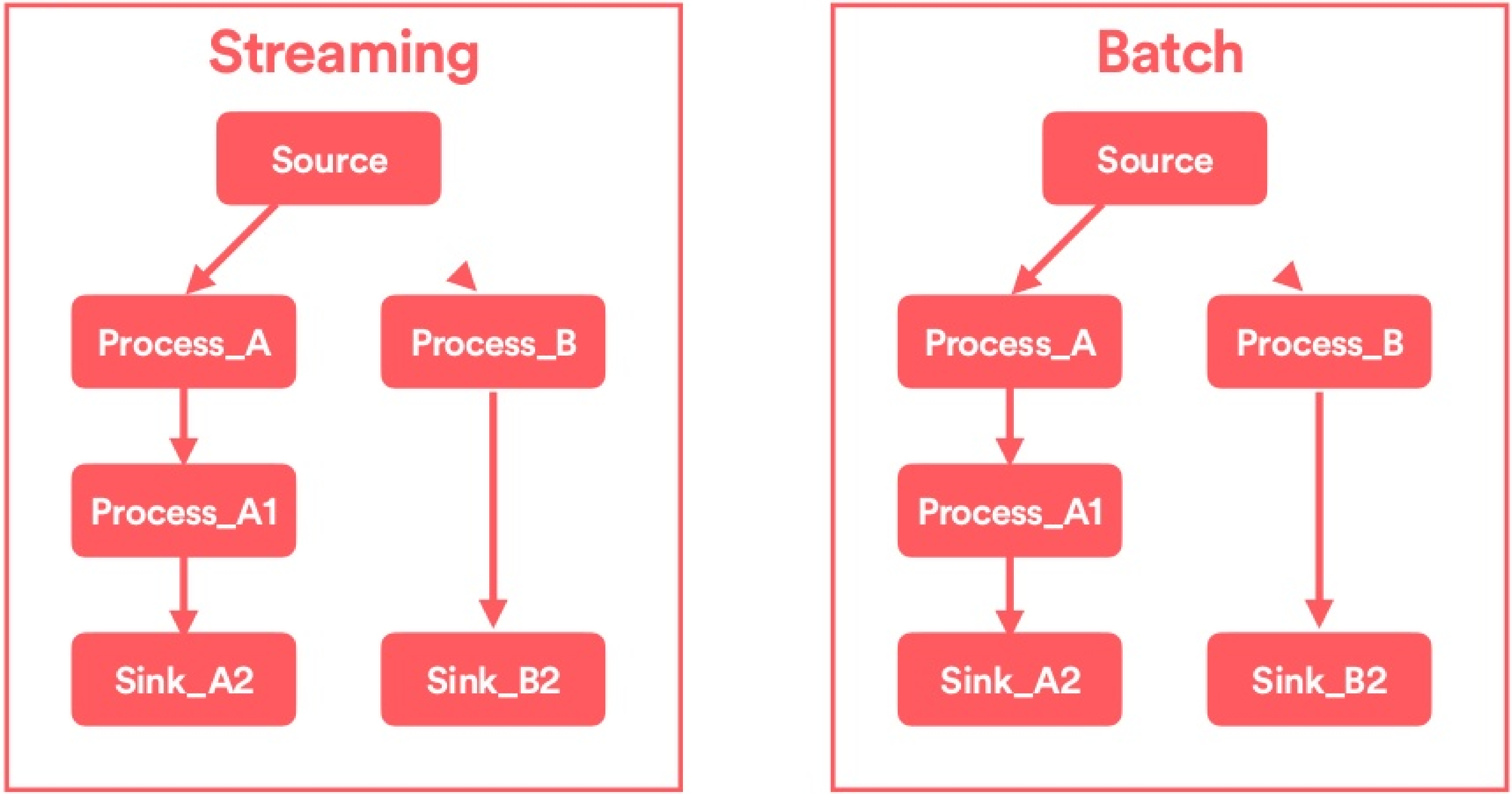
Streaming

```
sink: [
 {
  name = sink_example
  input = process_example
  type = hbase_update
  hbase_table_name = test_table
  bulk_upload = false
 }
]
```

Batch

```
sink: [
 {
  name = sink_example
  input = process_example
  type = hbase_update
  hbase_table_name = test_table
  bulk_upload = true
 }
]
```

Computation Flow



Streaming

Source

Process_A

Process_B

Process_A1

Sink_A2

Sink_B2

Batch

Source

Process_A

Process_B

Process_A1

Sink_A2

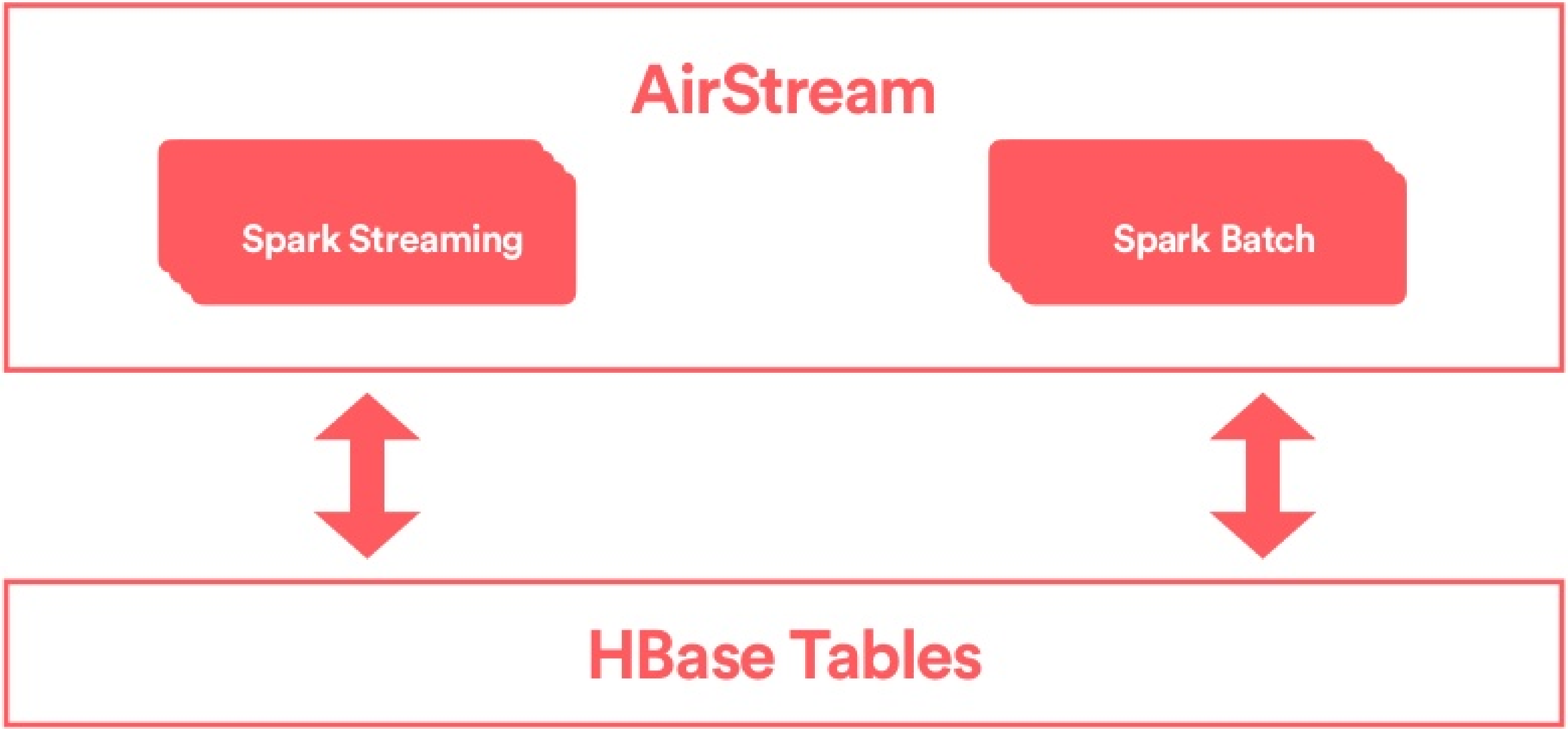
Sink_B2

Unified API through AirStream

- Declarative job configuration
- Streaming source vs static source
- Computation operator or sink can be shared by streaming and batch job.
- Computation flow is shared by streaming and batch
- Single driver executes in both streaming and batch mode job

Shared State Storage

Shared Global State Store



Why HBase

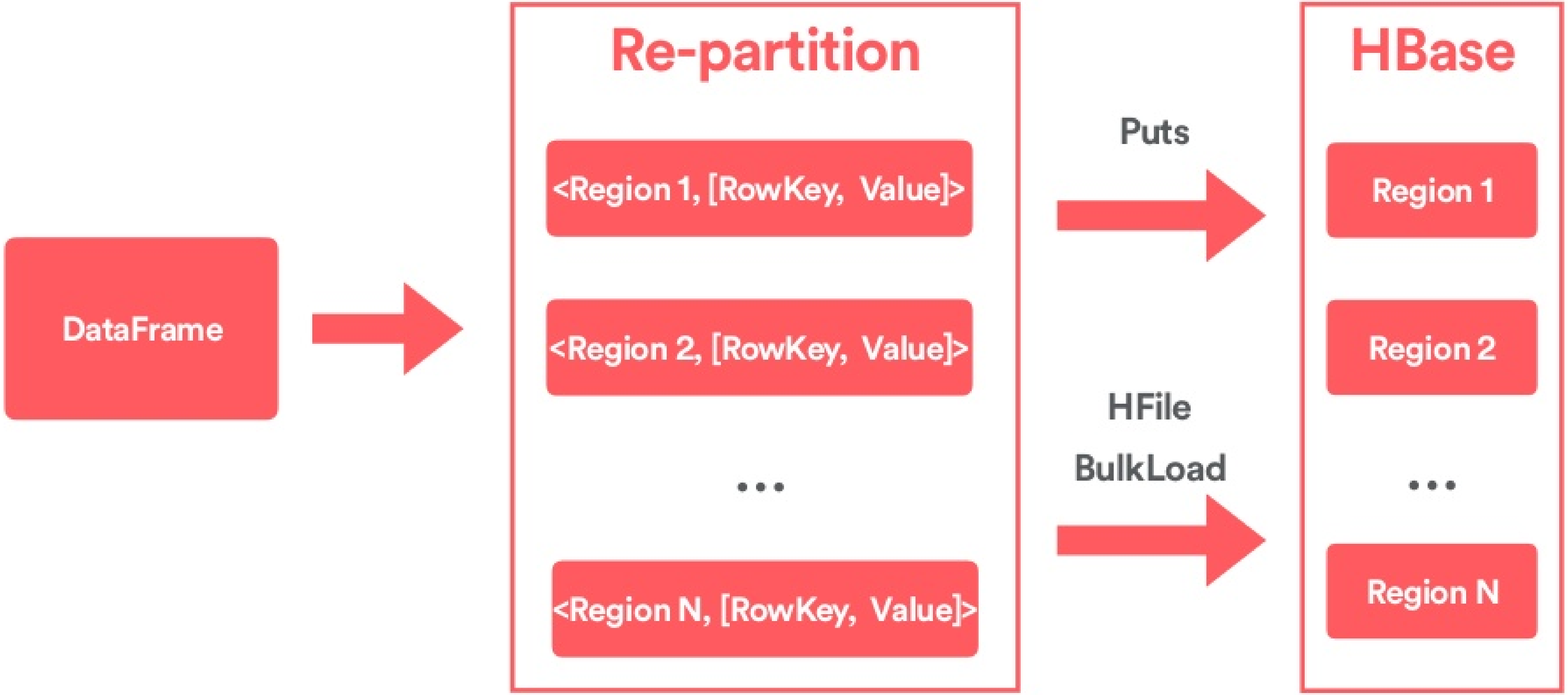
- Well integrated with Hadoop eco system

- Efficient API for streaming writes and bulk uploads

- Rich API for sequential scan and point-lookups

- Merged view based on version

Unified Write API



DataFrame

Re-partition

<Region 1, [RowKey, Value]>

<Region 2, [RowKey, Value]>

...

<Region N, [RowKey, Value]>

Puts

HFile BulkLoad

HBase

Region 1

Region 2

...

Region N

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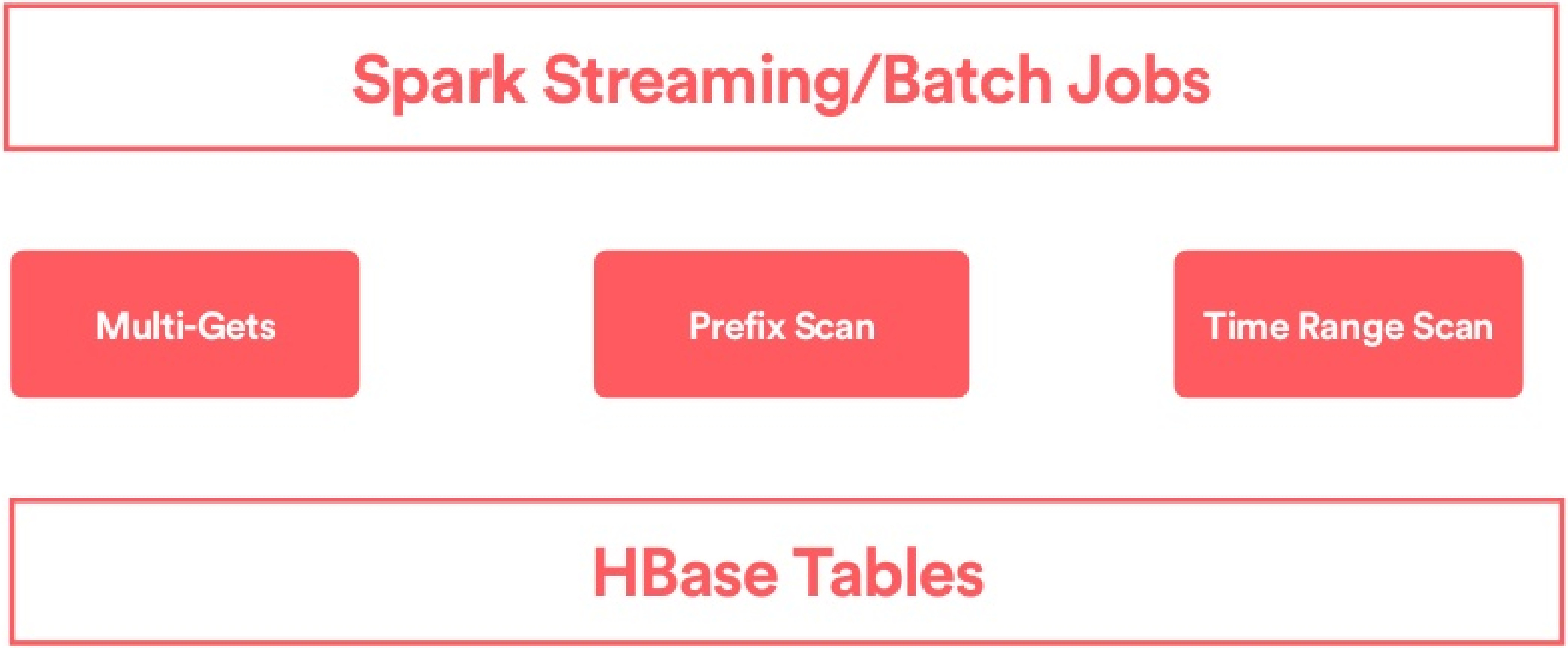
Rich Read API



Spark Streaming/Batch Jobs

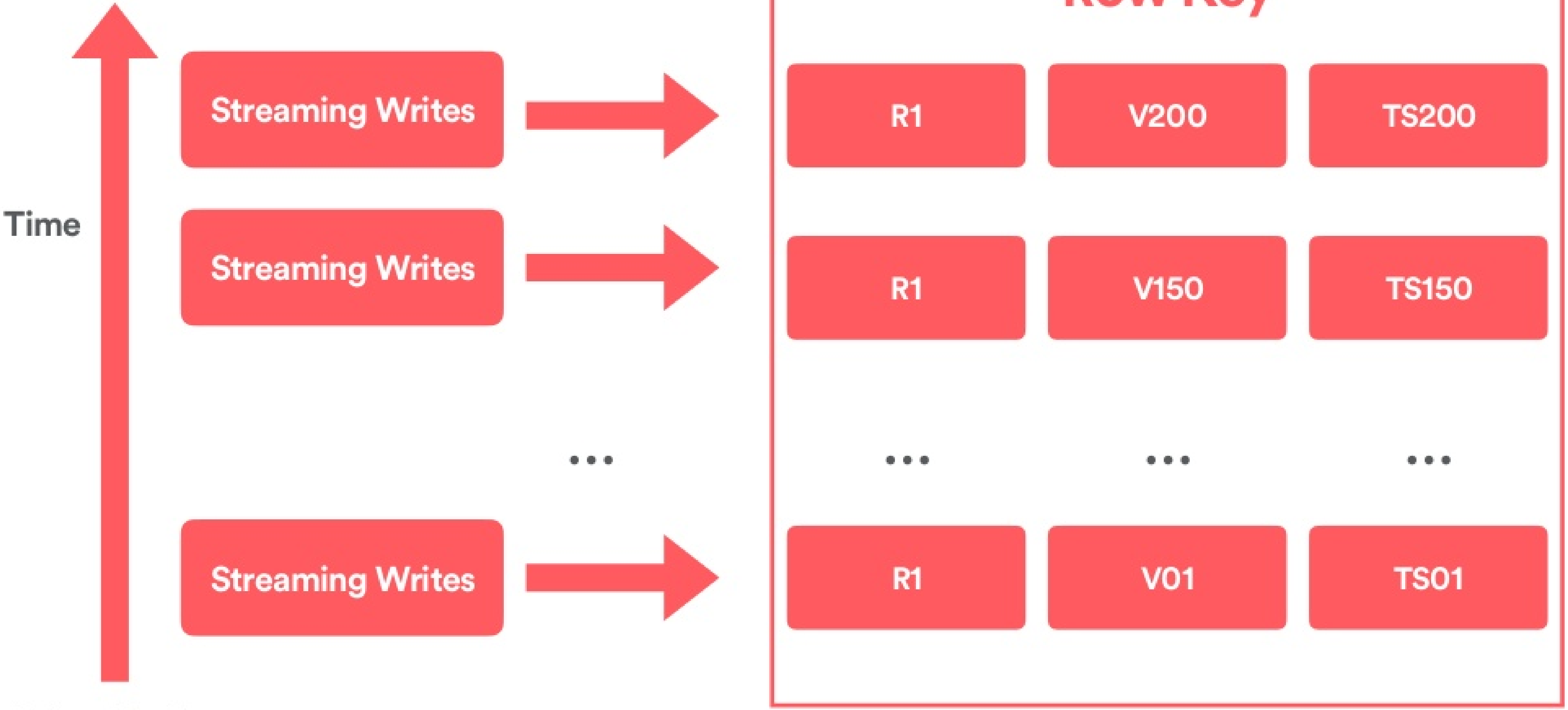
Multi-Gets

Prefix Scan

Time Range Scan

HBase Tables

Merged Views



Time

Streaming Writes

Streaming Writes

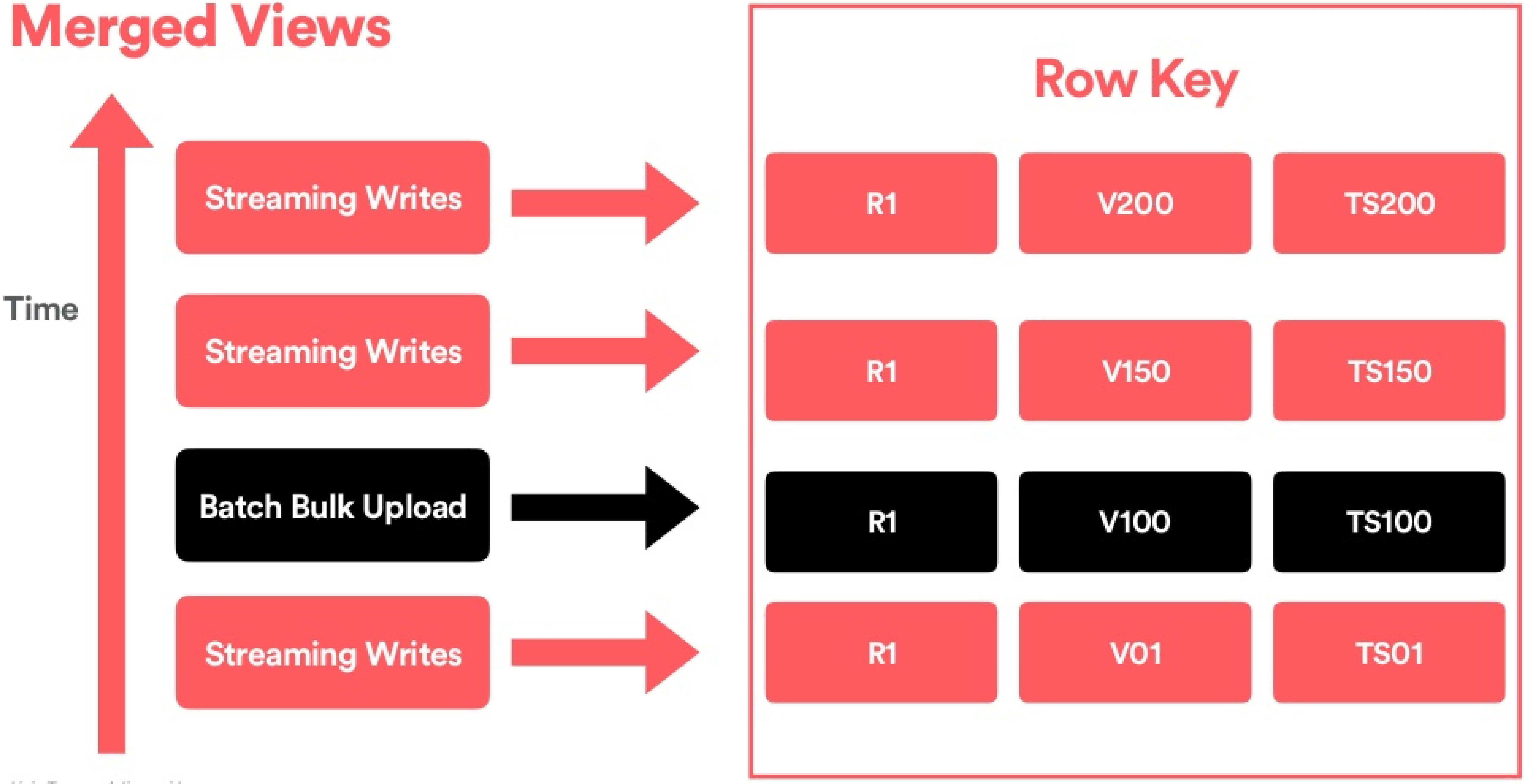
…

Streaming Writes

Row Key

R1	V200	TS200
R1	V150	TS150
…	…	…
R1	V01	TS01

Merged Views



Row Key

R1	V200	TS200
R1	V150	TS150
R1	V100	TS100
R1	V01	TS01

Our Foundations

- Unify streaming with batch process
- Shared global state store

Use Cases

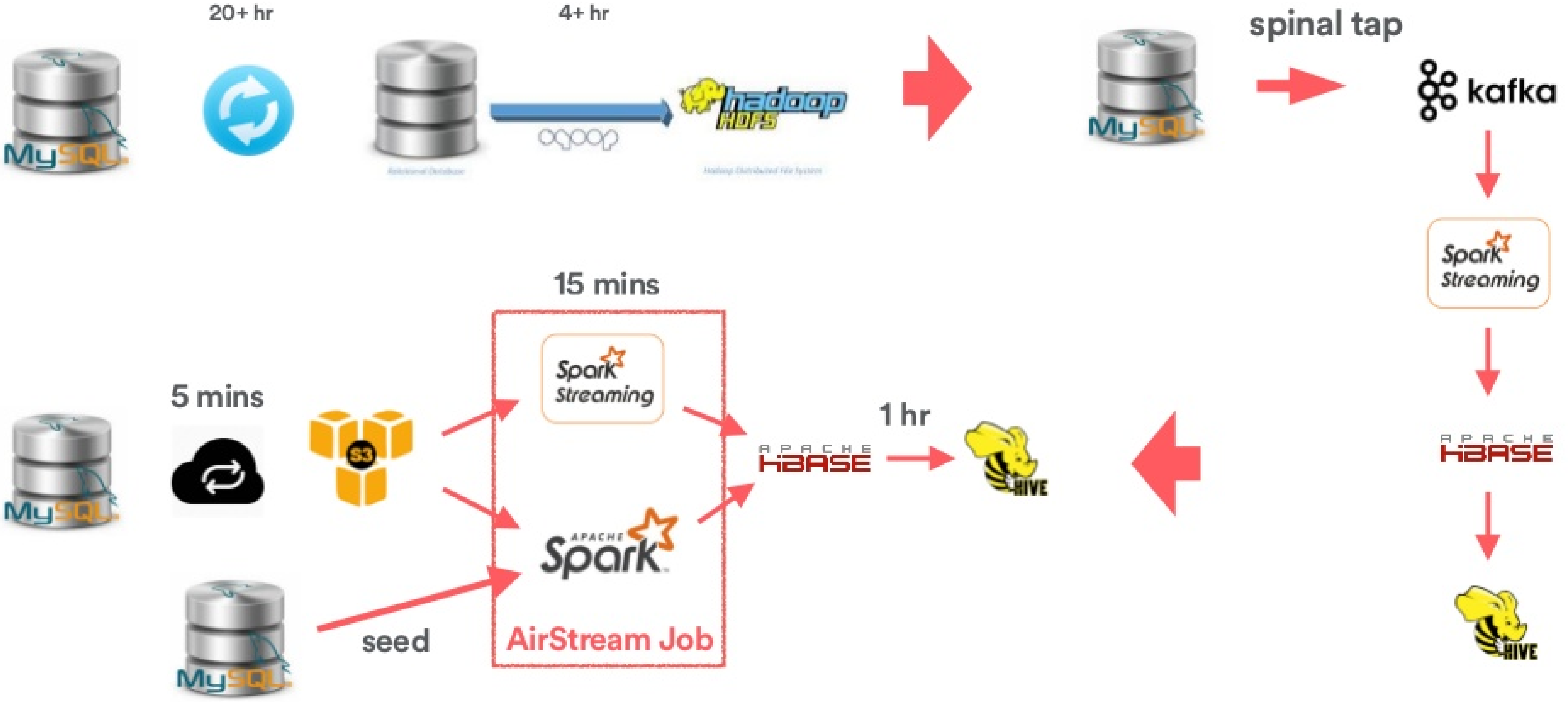
MySQL DB Snapshot Using Binlog Replay

Move Elephant

Database Snapshot

- **Large amount of data:** Multiple large mysql DBs
- **Realtime-ness:** minutes delay/ hours delay
- **Transaction :** Need to keep transaction across different tables
- **Schema change:** Table schema evolves

Binlog Replay on Spark



20+ hr

4+ hr

spinal tap

15 mins

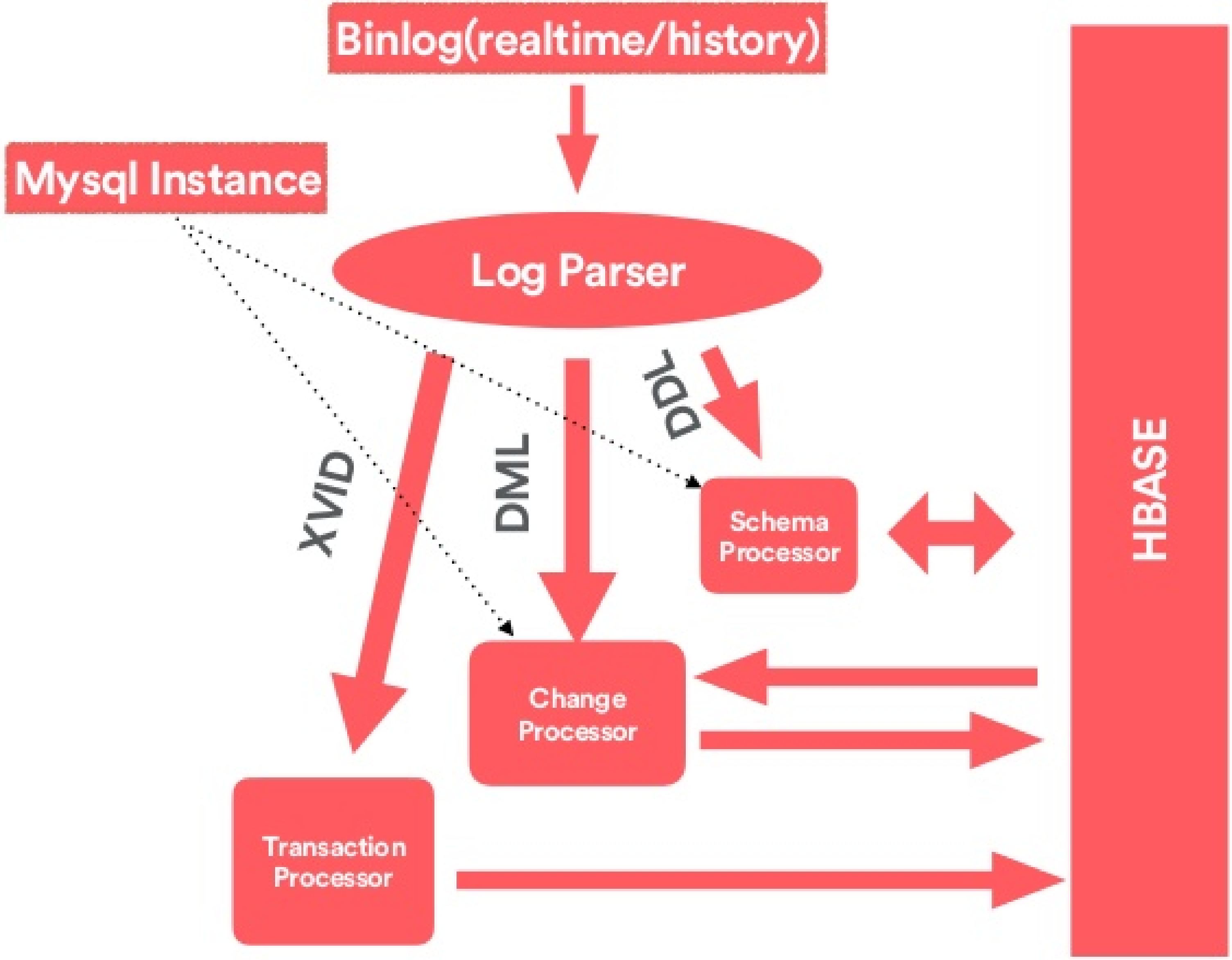
5 mins

1 hr

seed

AirStream Job

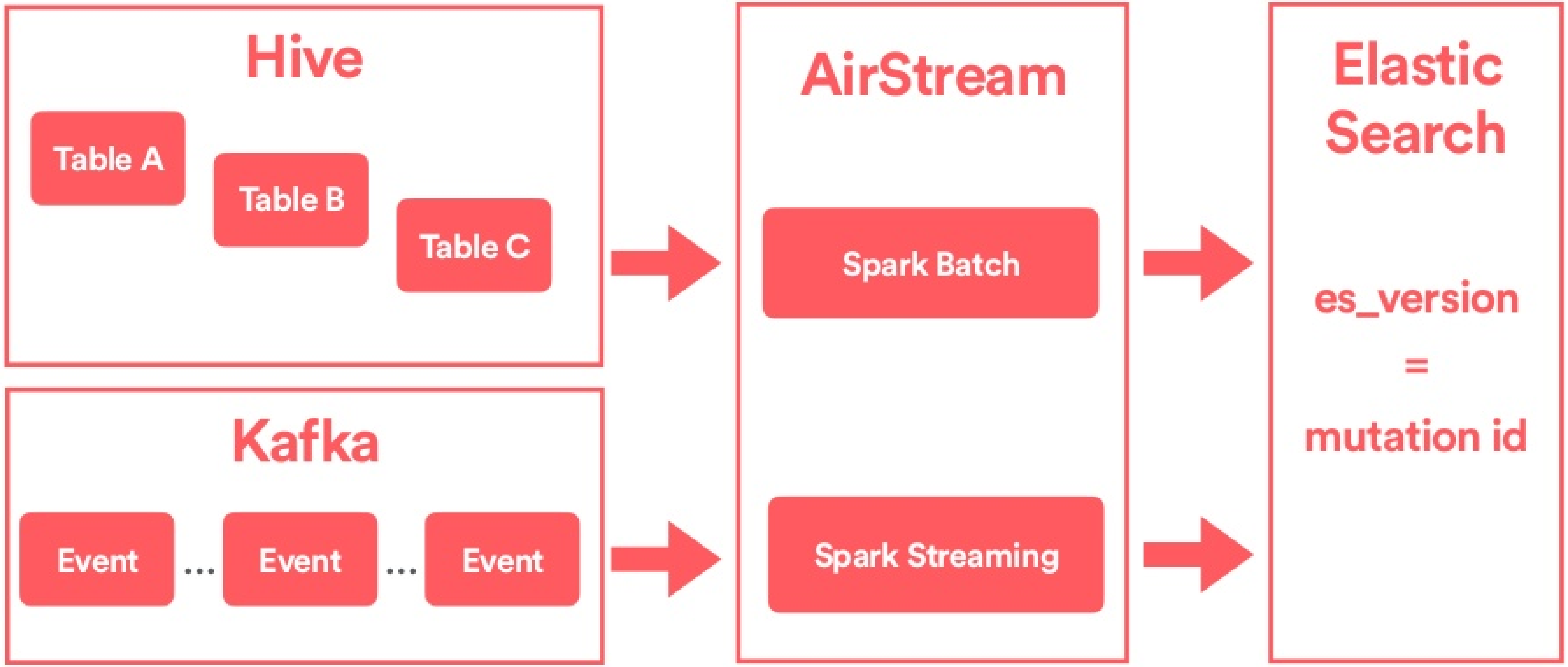
Lambda Architecture



- **Streaming and Batch shares Logic:** Binlog file reader, DDL processor, transaction processor, DML processor.
- **Merged by binlog position:** <filenum, offset>
- **Idempotent:** Log can be replayed multiple times.
- **Schema changes:** Full schema change history.

Realtime Indexing

Realtime Indexing



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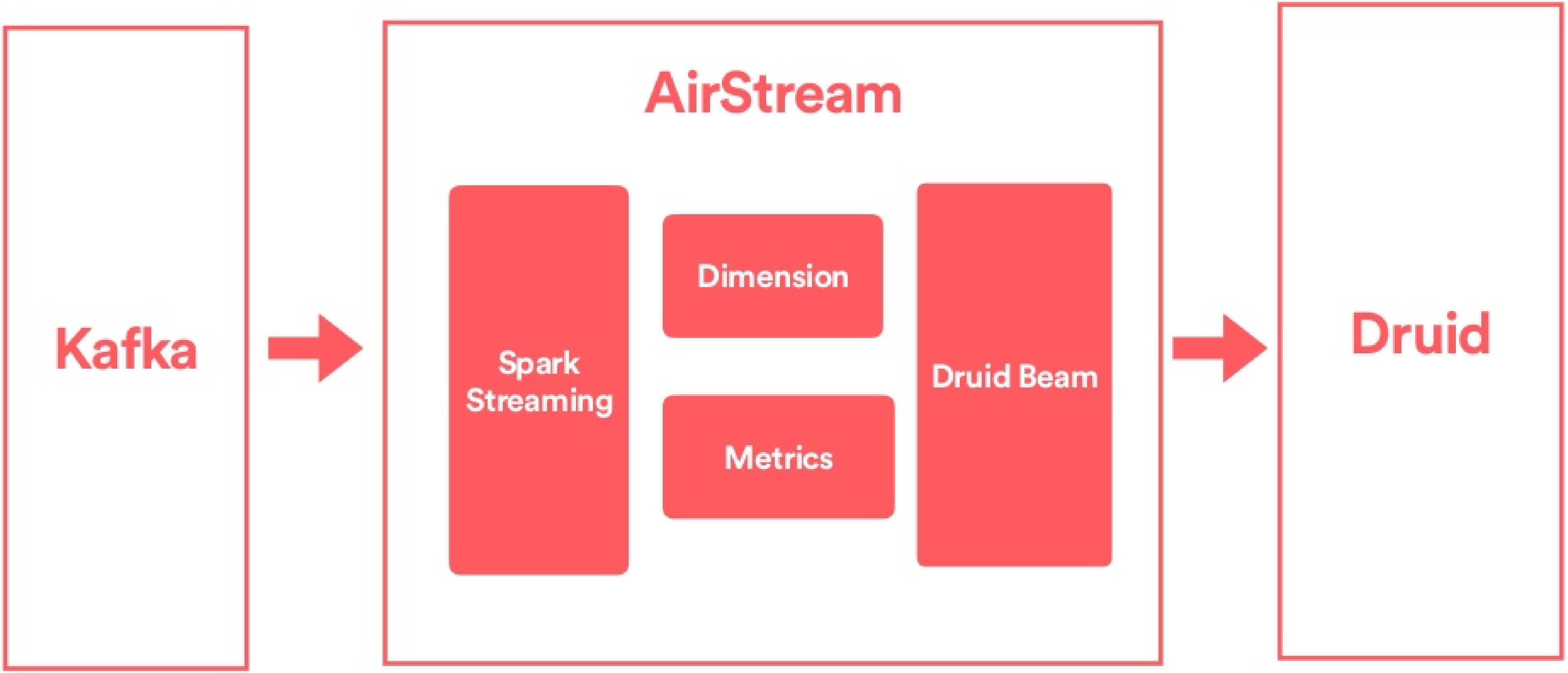
Realtime OLAP with Druid

Druid Ingestion



Kafka

AirStream

Spark Streaming

Dimension

Metrics

Druid Beam

Druid

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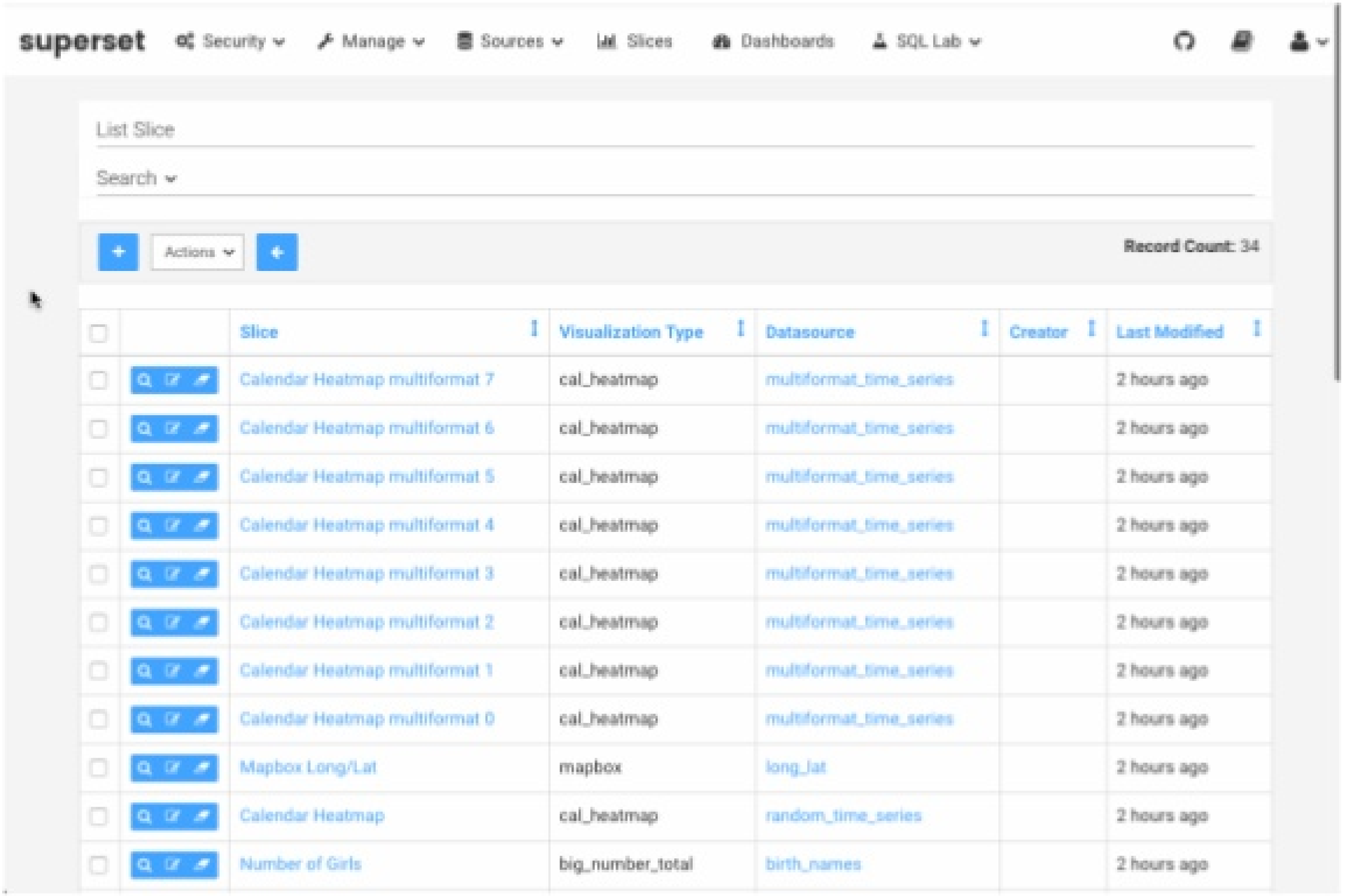
Superset Powered by Druid



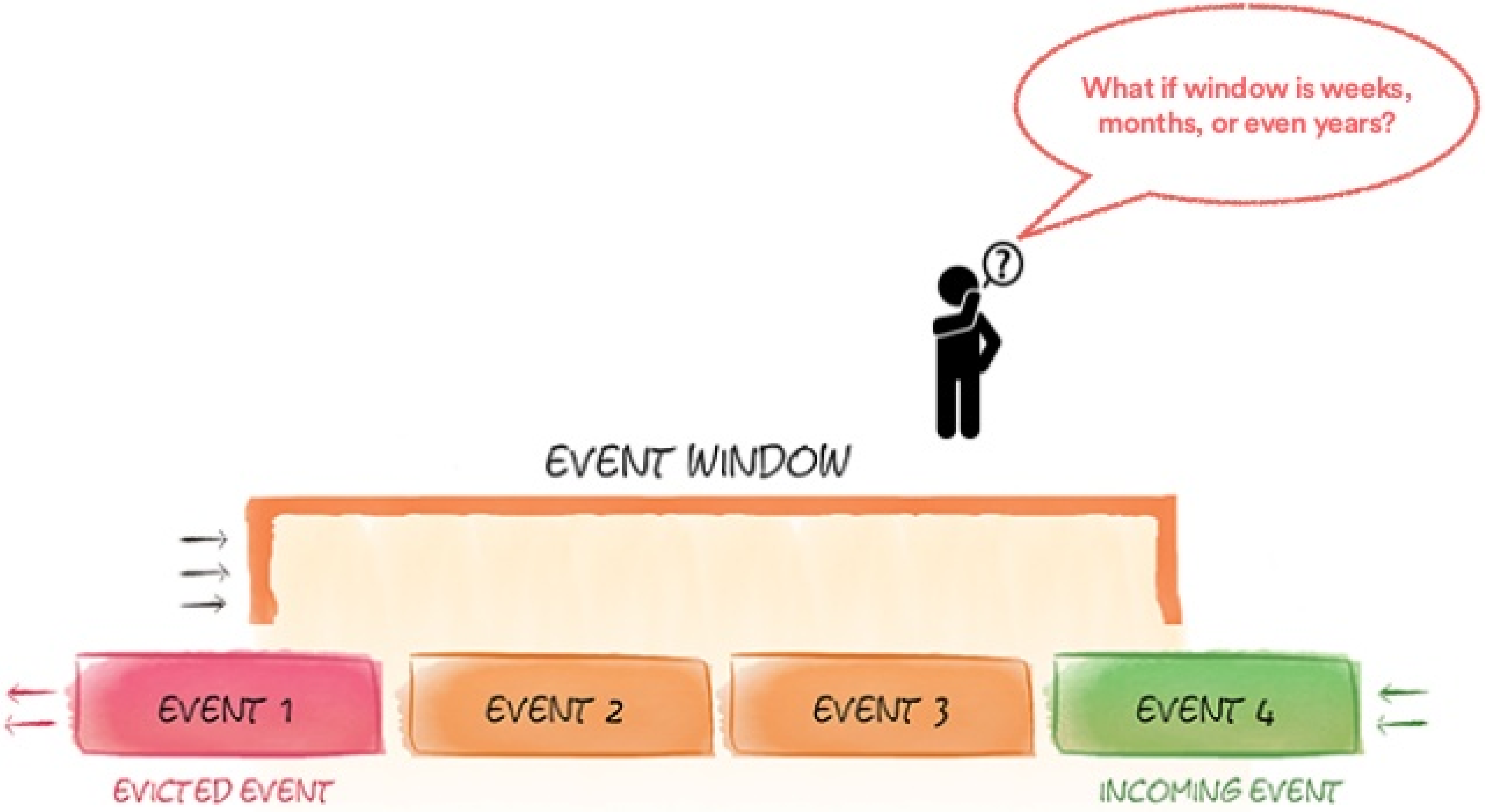
Record Count: 34

□		Slice	Visualization Type	Datasource	Creator	Last Modified
□		Calendar Heatmap multiformat 7	cal_heatmap	multiformat_time_series		2 hours ago
□		Calendar Heatmap multiformat 6	cal_heatmap	multiformat_time_series		2 hours ago
□		Calendar Heatmap multiformat 5	cal_heatmap	multiformat_time_series		2 hours ago
□		Calendar Heatmap multiformat 4	cal_heatmap	multiformat_time_series		2 hours ago
□		Calendar Heatmap multiformat 3	cal_heatmap	multiformat_time_series		2 hours ago
□		Calendar Heatmap multiformat 2	cal_heatmap	multiformat_time_series		2 hours ago
□		Calendar Heatmap multiformat 1	cal_heatmap	multiformat_time_series		2 hours ago
□		Calendar Heatmap multiformat 0	cal_heatmap	multiformat_time_series		2 hours ago
□		Mapbox Long/Lat	mapbox	long_lat		2 hours ago
□		Calendar Heatmap	cal_heatmap	random_time_series		2 hours ago
□		Number of Girls	big_number_total	birth_names		2 hours ago

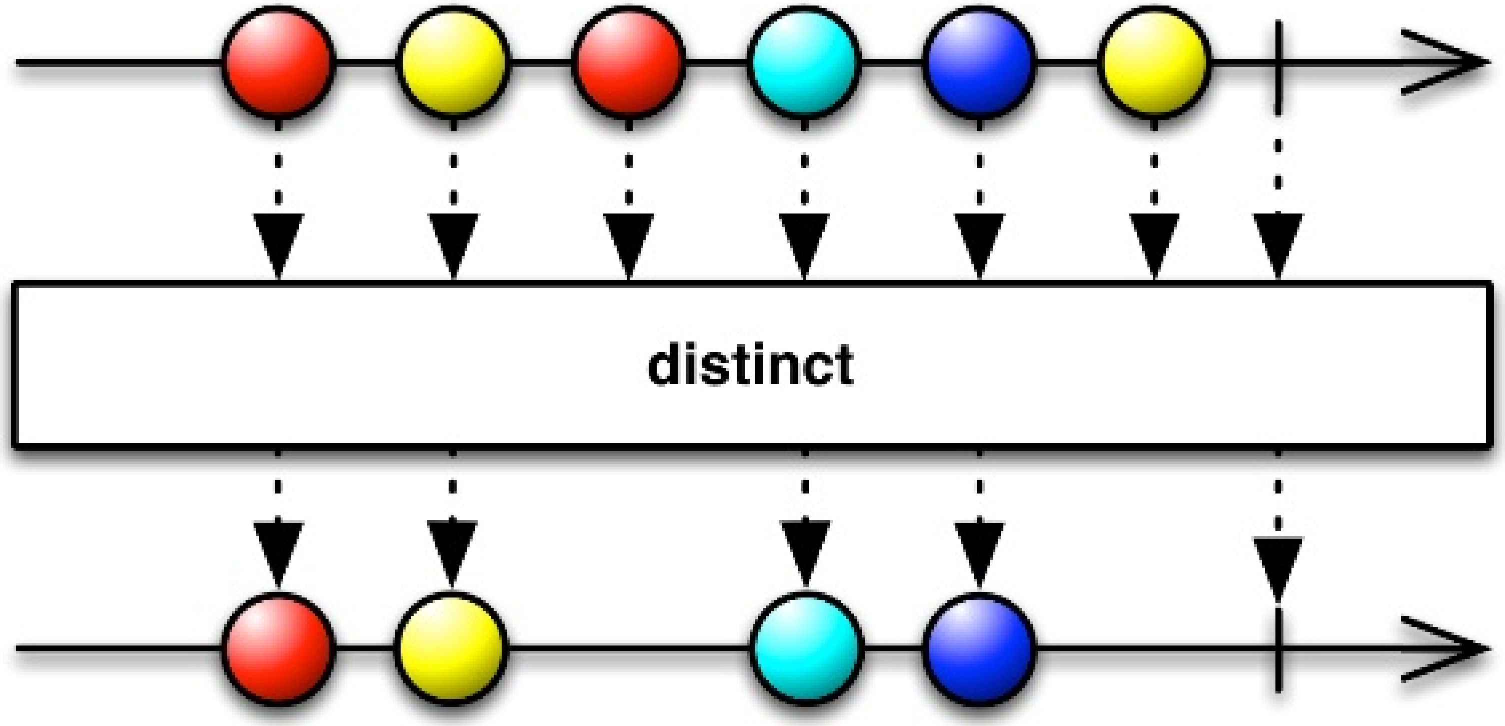
Tips

Moving Window Computation

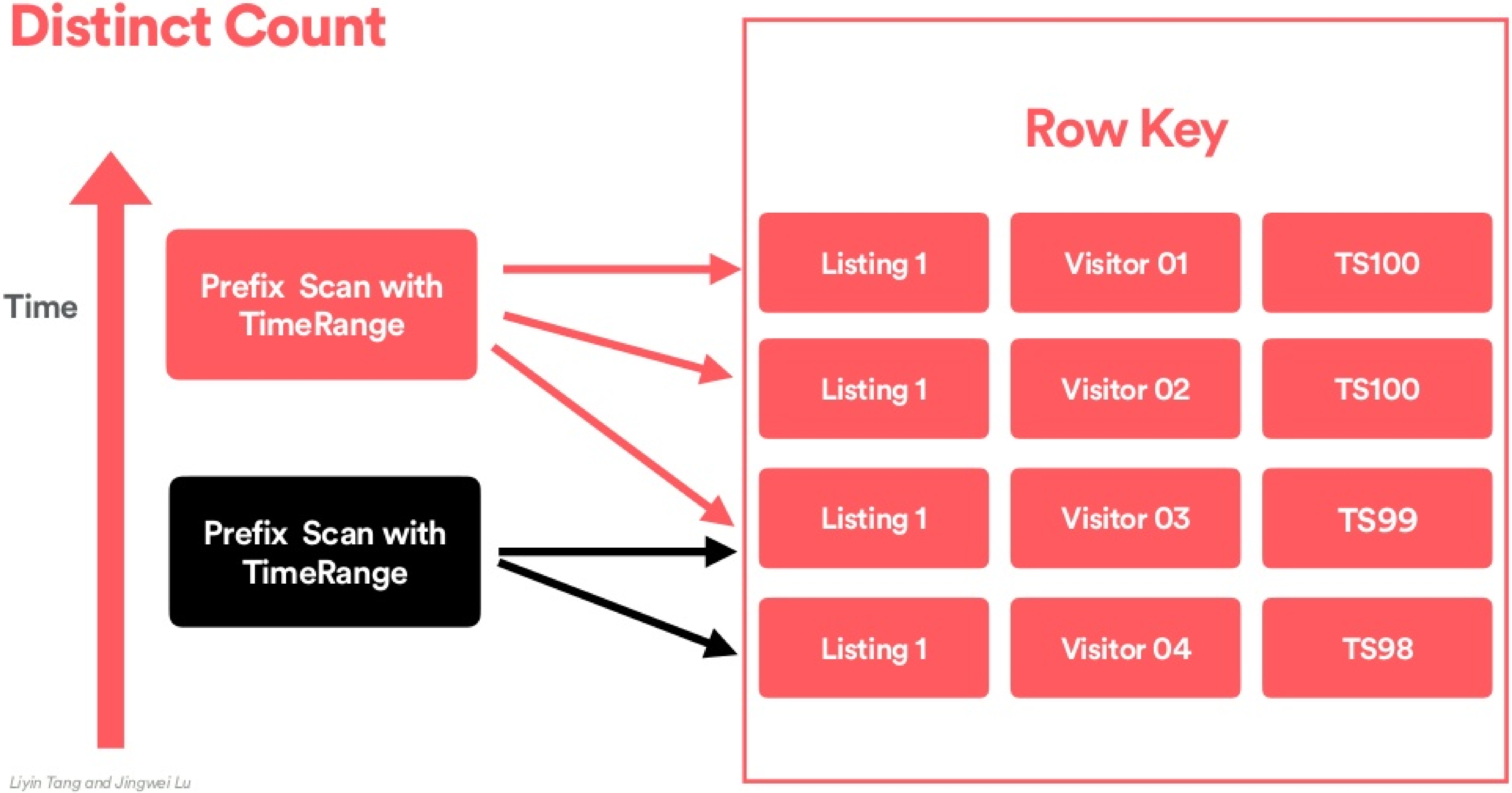
Long Window Computation



Distinct in a Large Window

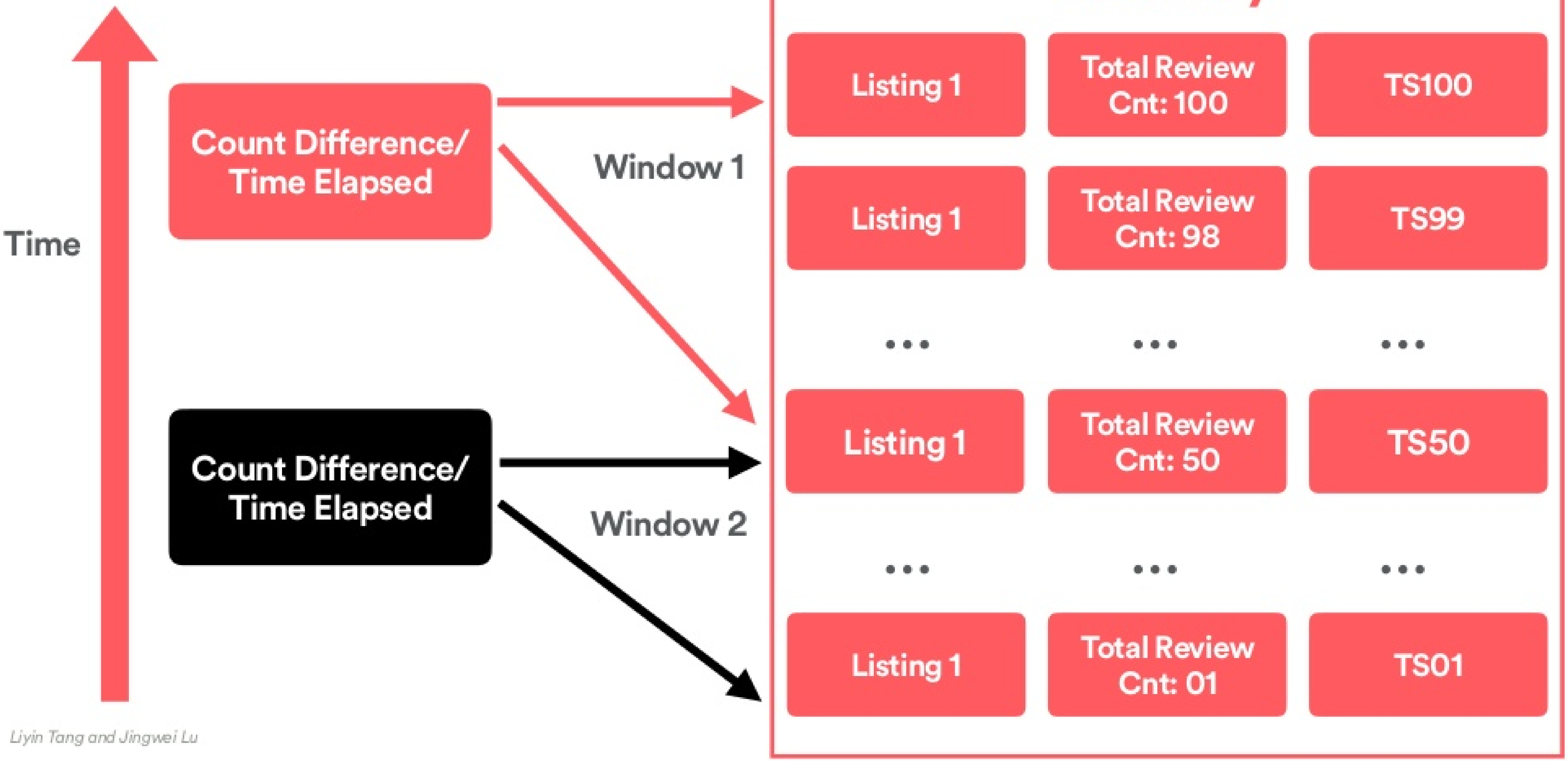


Distinct Count



Listing 1	Visitor 01	TS100
Listing 1	Visitor 02	TS100
Listing 1	Visitor 03	TS99
Listing 1	Visitor 04	TS98

Moving Average



Time

Count Difference/ Time Elapsed

Window 1

Count Difference/ Time Elapsed

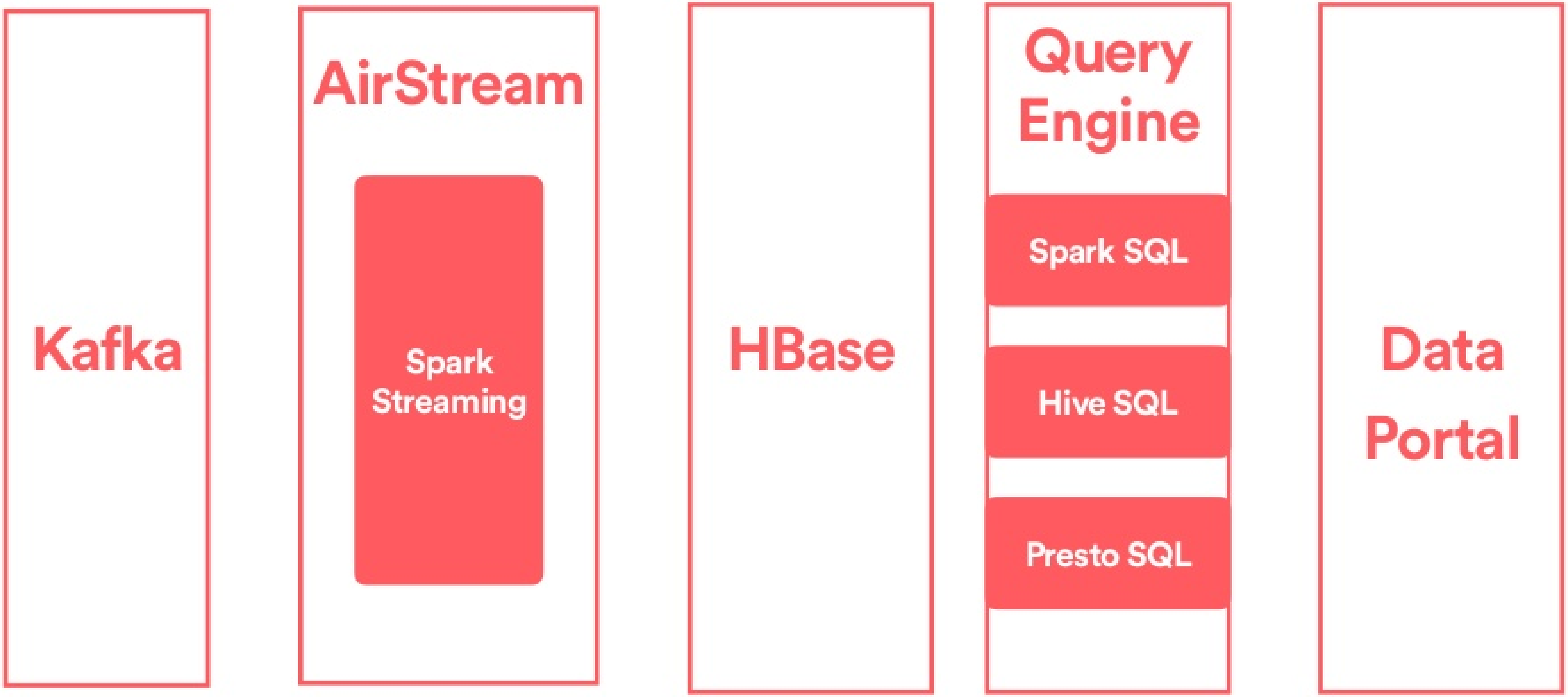
Window 2

Row Key

Listing 1	Total Review Cnt: 100	TS100
Listing 1	Total Review Cnt: 98	TS99
...	...	...
Listing 1	Total Review Cnt: 50	TS50
...	...	...
Listing 1	Total Review Cnt: 01	TS01

Streaming Ingestion & Realtime Interactive Query

Realtime Ingestion and Interactive Query



Kafka

AirStream

Spark Streaming

HBase

Query Engine

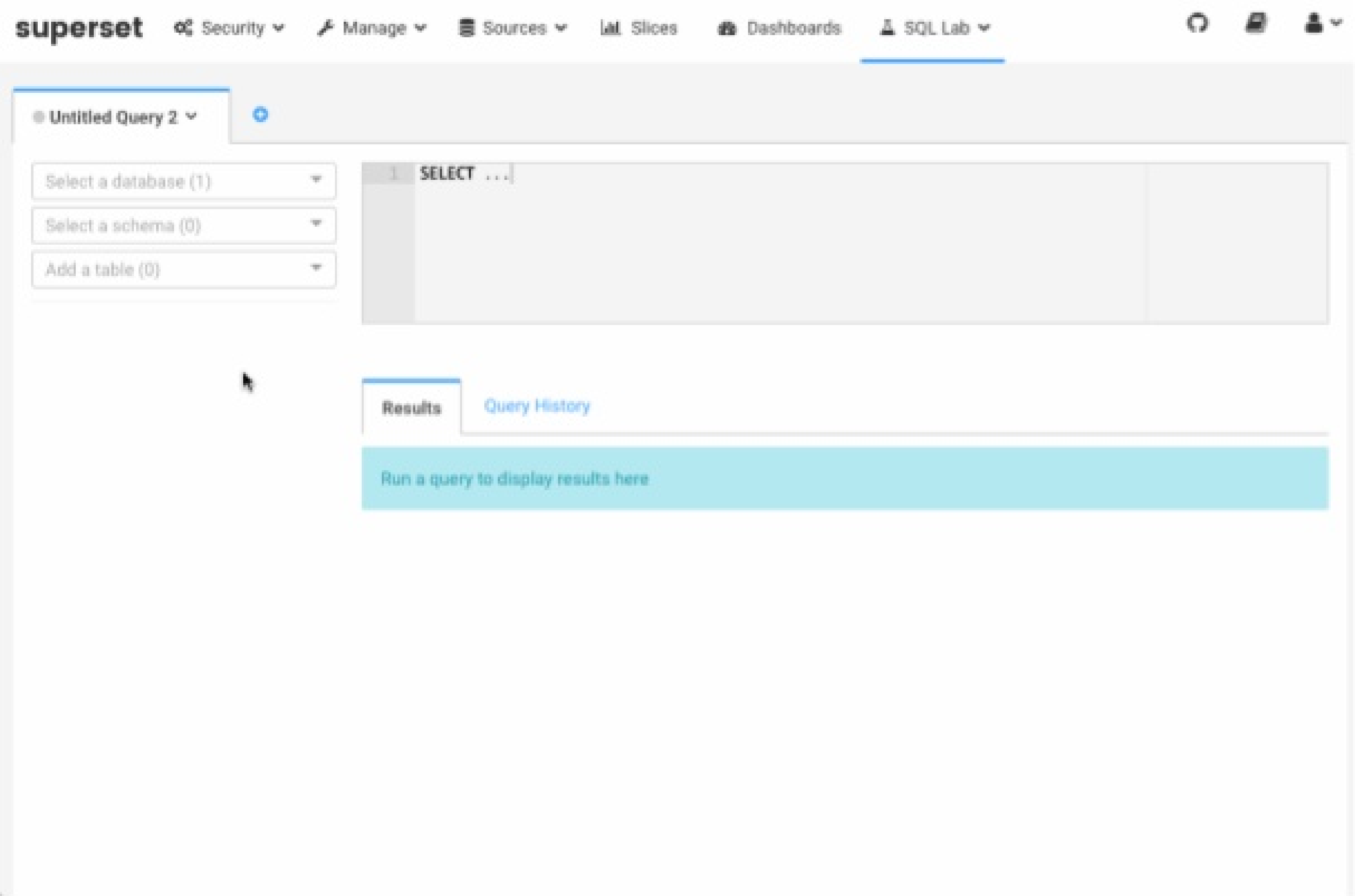
Spark SQL

Hive SQL

Presto SQL

Data Portal

Interactive Query in SqlLab

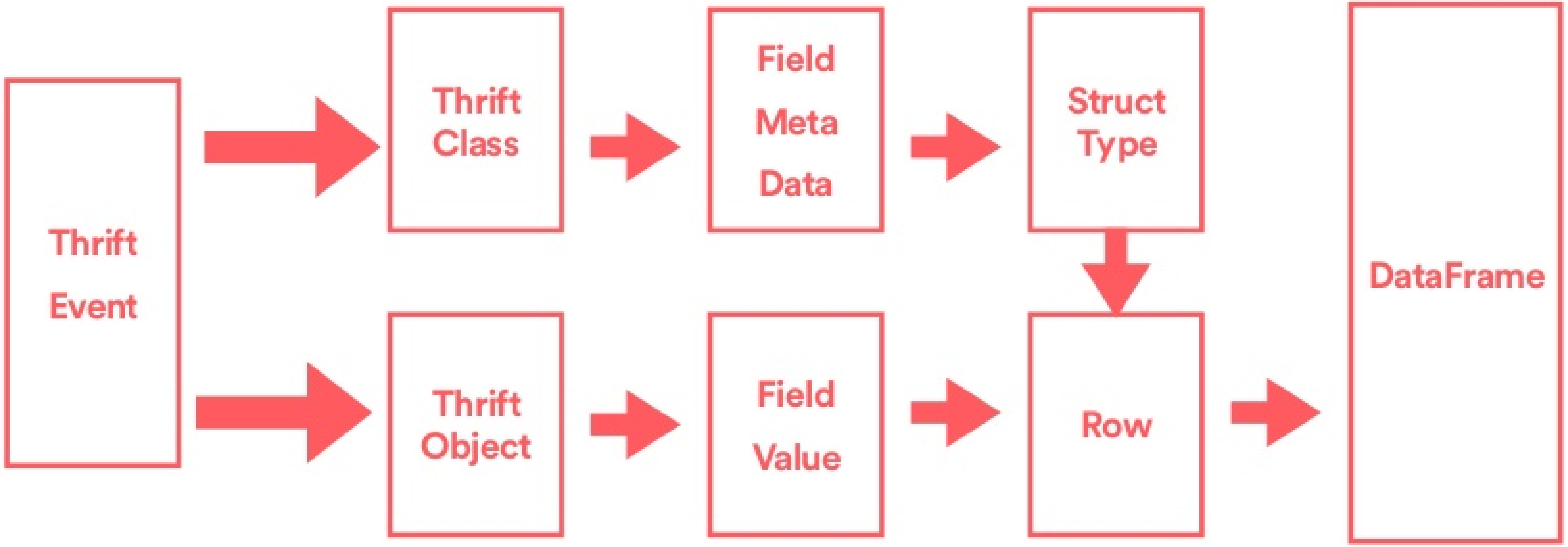


```
SELECT ...
```

Run a query to display results here

Schema Enforcement
Streaming Events

Thrift -> DataFrame



https://github.com/airbnb/airbnb-spark-thrift

Summary

Unify Batch and Streaming Computation

Global State Store Using HBase

airbnb

We are hiring

Happy Hour:
6pm, B Restaurant & Bar, 720 Howard St, SF