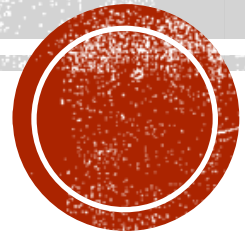
Distributed Streaming SQL

For Fast Data Management



Milinda Pathirage & Beth Plale

School of Informatics and Computing, Indiana University

AGENDA

- Introduction
- Motivation
- Requirements
- SamzaSQL
- Future Work

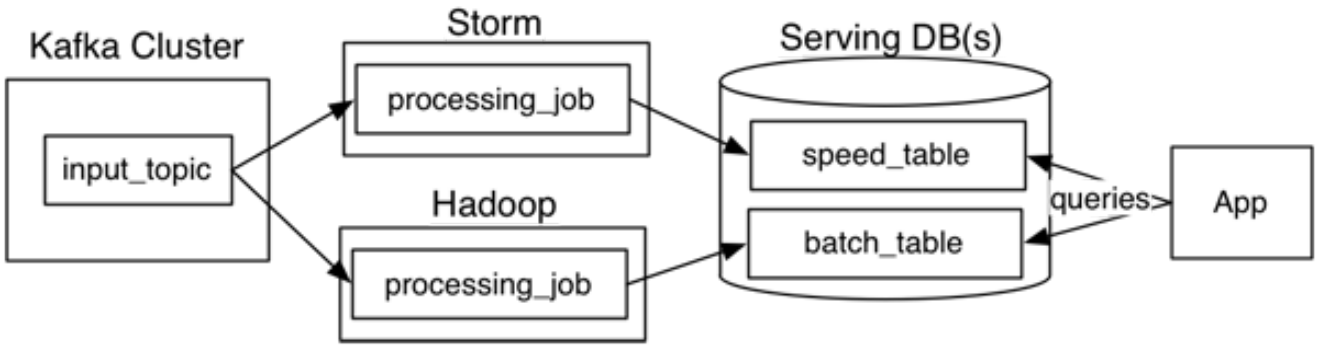
INTRODUCITON

- SamzaSQL: Streaming SQL implementation on top of Apache Kafka and Apache Samza
- Utilizes Apache Calcite for query planning
- Extension of standard SQL
- Streams and Relations are first class citizens of both language and runtime
- Nearline applications

MOTIVATION

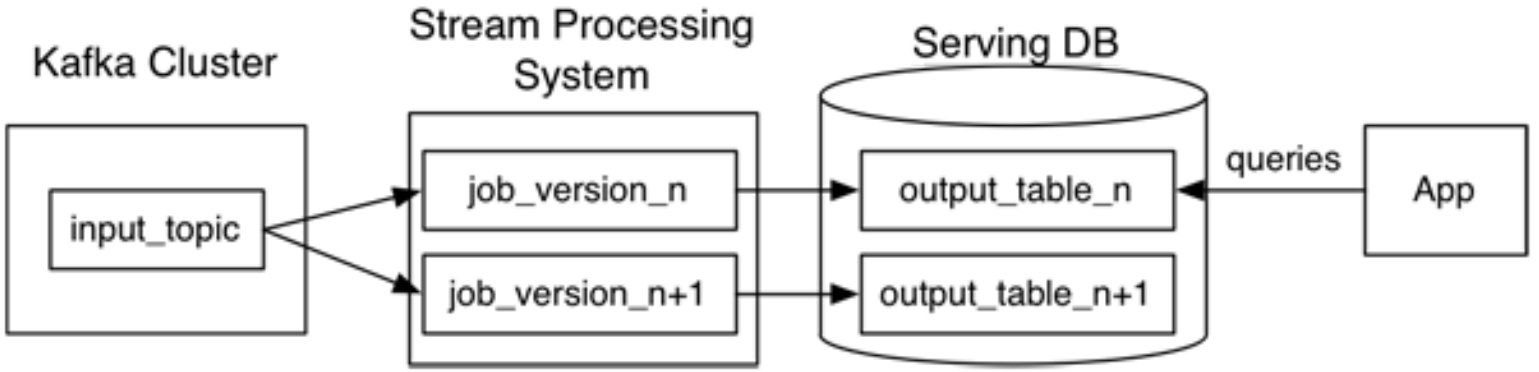
- The sources of information over which real time processing can be done is significantly multiplied and varied
- Lambda Architecture[5]
- Kappa Architecture[6]
- Current distributed stream processing systems require developers to use programming APIs in high-level languages
- Wide adoption of SQL based Big Data management solutions like Hive, Drill and Presto
- Often real-time or near real-time processing applications are backed by computed summaries or modeled information generated by traditional batch-oriented processing systems
- *LinkedIn's stream analytics use cases*[3,4]

LAMBDA ARCHITECTURE



Jay Kreps; http://radar.oreilly.com/2014/07/questioning-the-lambda-architecture.html

KAPPA ARCHITECTURE



Jay Kreps; http://radar.oreilly.com/2014/07/questioning-the-lambda-architecture.html

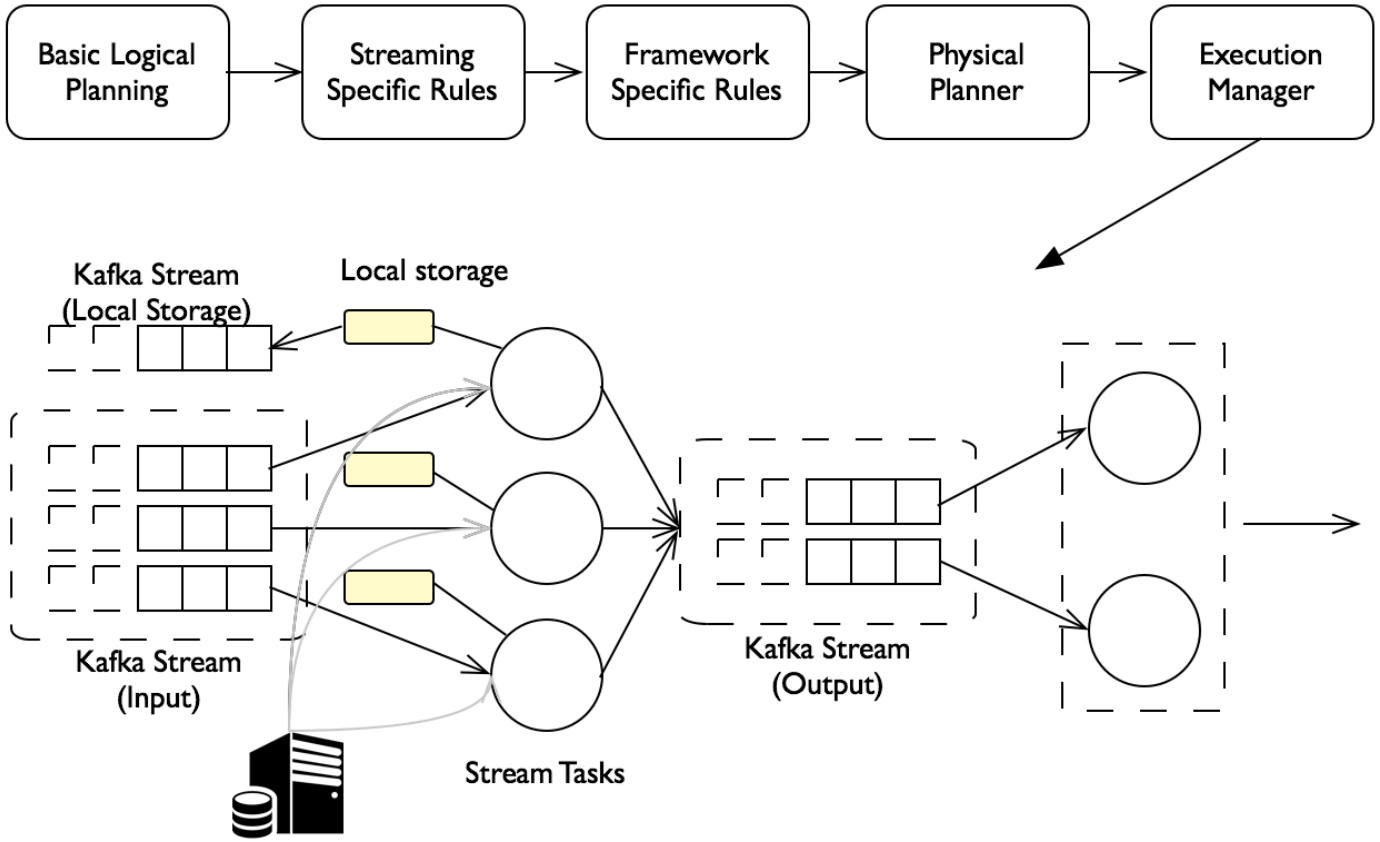
LANGUAGE REQUIREMENTS

- Extension to ***standard SQL***
- ***Streams*** and ***relations*** as first class entities in both language and runtime
- ***Produce same results on a stream as if the same data were in a table***
- Rich set of window constructs for streaming aggregates and joins
  - `SELECT STREAM START(rowtime), COUNT(*) FROM Orders GROUP BY TUMBLE(rowtime, INTERVAL '1' HOUR)`
  - `SELECT STREAM START(rowtime), COUNT(*) FROM Orders GROUP BY HOP(rowtime, INTERVAL '1' HOUR, INTERVAL '1' HOUR)`
- Session windows

ARCHITECTURAL REQUIREMENTS

- Scaling across thousands of stream partitions[4]
- Fault tolerance and ability to recover by replaying local storage change stream
- Out of order event handling
- Incremental processing and early results
- Support for multiple stream processing back-ends.

SAMZASQL


Basic Logical Planning
Streaming Specific Rules
Framework Specific Rules
Physical Planner
Execution Manager
Kafka Stream (Local Storage)
Local storage
Kafka Stream (Input)
Stream Tasks
Kafka Stream (Output)

SAMZASQL

- Uses Samza as stream processing back-end
- Uses Apache Calcite for query planning
- One or more partitions are mapped to a stream task
- Local storage is checkpointed to a stream
- In case of a failure tasks will be rescheduled in a different container and bootstrapped from local storage change stream

FUTURE WORK

- Performance evaluation
- Session windows in SQL
- How to handle stragglers
- Streaming specific cost model for enabling more optimizations
- SQL to Lambda Architecture style query plans
- Backend independent implementation
- Integrating with Big Data frameworks like HBase, Apache Phoenix

ACKNOWLEDGEMENTS

- Julian Hyde; Apache Calcite and Hortonworks
- Chris Riccomini; Apache Samza, WePay (Previously LinkedIn Data Infrastructure Team)
- Yi Pan; Apache Samza and LinkedIn Data Infrastructure Team
- Apache Samza Community
- Members of LinkedIn Data Infrastructure Team

REFERENCES

1. Apache Samza
2. Apache Calcite
3. Moving faster with data streams: The rise of Samza at LinkedIn
4. Real time insights into LinkedIn's performance using Apache Samza
5. Lambda Architecture
6. Kappa Architecture
7. Summingbird: A Framework for Integrating Batch and Online MapReduce Computations
8. https://issues.apache.org/jira/browse/SAMZA-390

Questions?