SK Big Data Course (2019)

빅데이터 아키텍처

SK Big Data Course (2019), 빅데이터 아키텍처

Designing Modern Streaming Data Applications

Me:

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- Hi-Tech DT 팀, Data Labs, ICT기술센터, SK 텔레콤

목차

- 개요
- 빅데이터 아키텍처
  - 스트리밍 데이터 응용을 위한 빅데이터 아키텍처
    - a.k.a, Fast data
    - a.k.a, Real-time data
- 스트리밍 데이터 플랫폼
  - Data Source
  - Event Hub / Message Broker
  - Data Ingestion / Data Integration
  - Data Storage
  - Stream Processing
  - Data Analytics / SQL / Search
- **Hands-on Labs**

개요

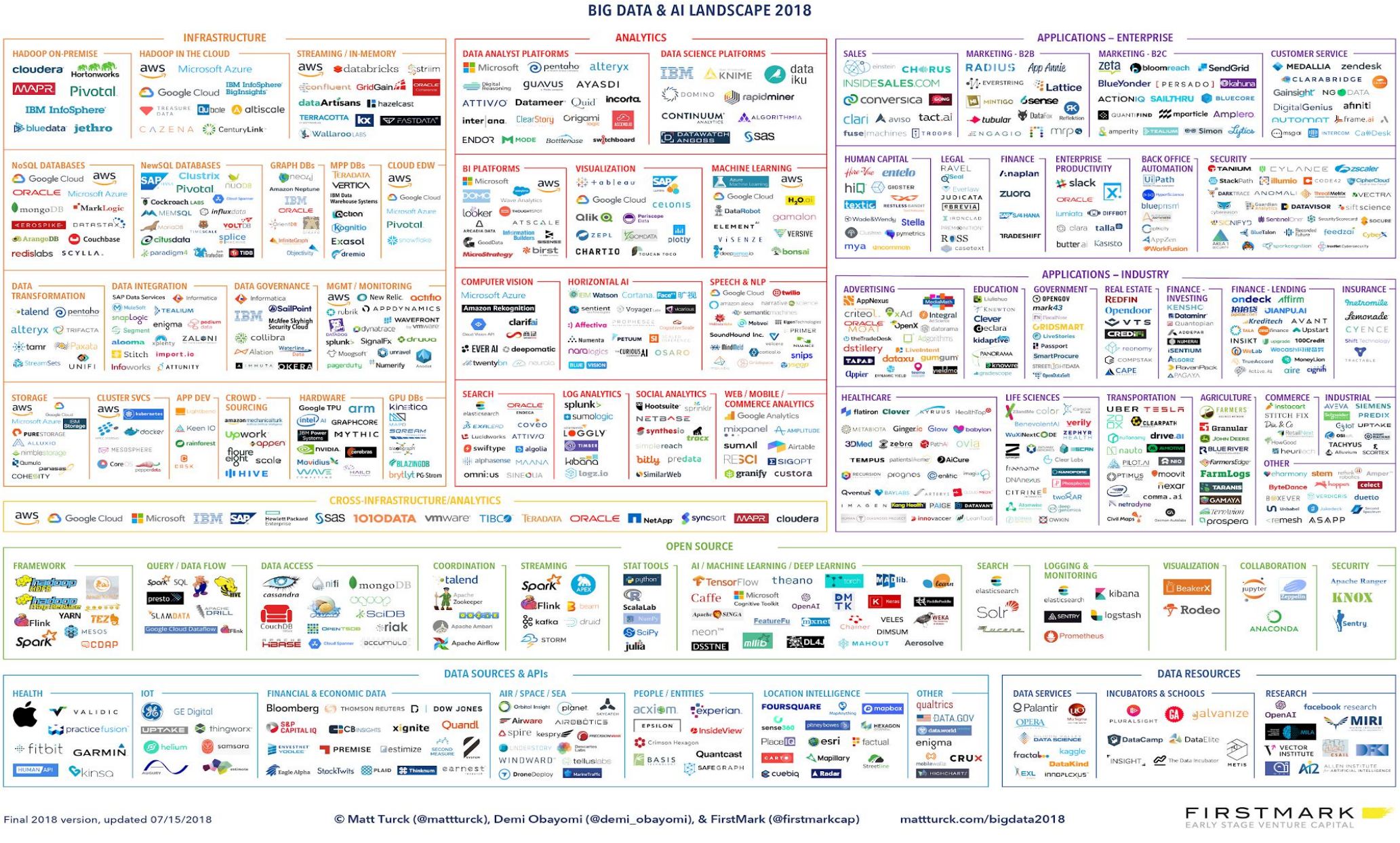
개요

- 스트리밍 데이터 처리 시스템을 구성하기 위해 필요한 구성 요소에 대하여 학습
- 실시간 데이터를 위한 오픈소스 프로젝트와 해당 프로젝트의 특징 학습
- 성공적인 데이터 응용 설계와 개발을 위한 고려사항
- 스트리밍 데이터 아키텍처 시나리오를 바탕으로 **e2e** 스트리밍 응용 개발 실습

빅데이터?

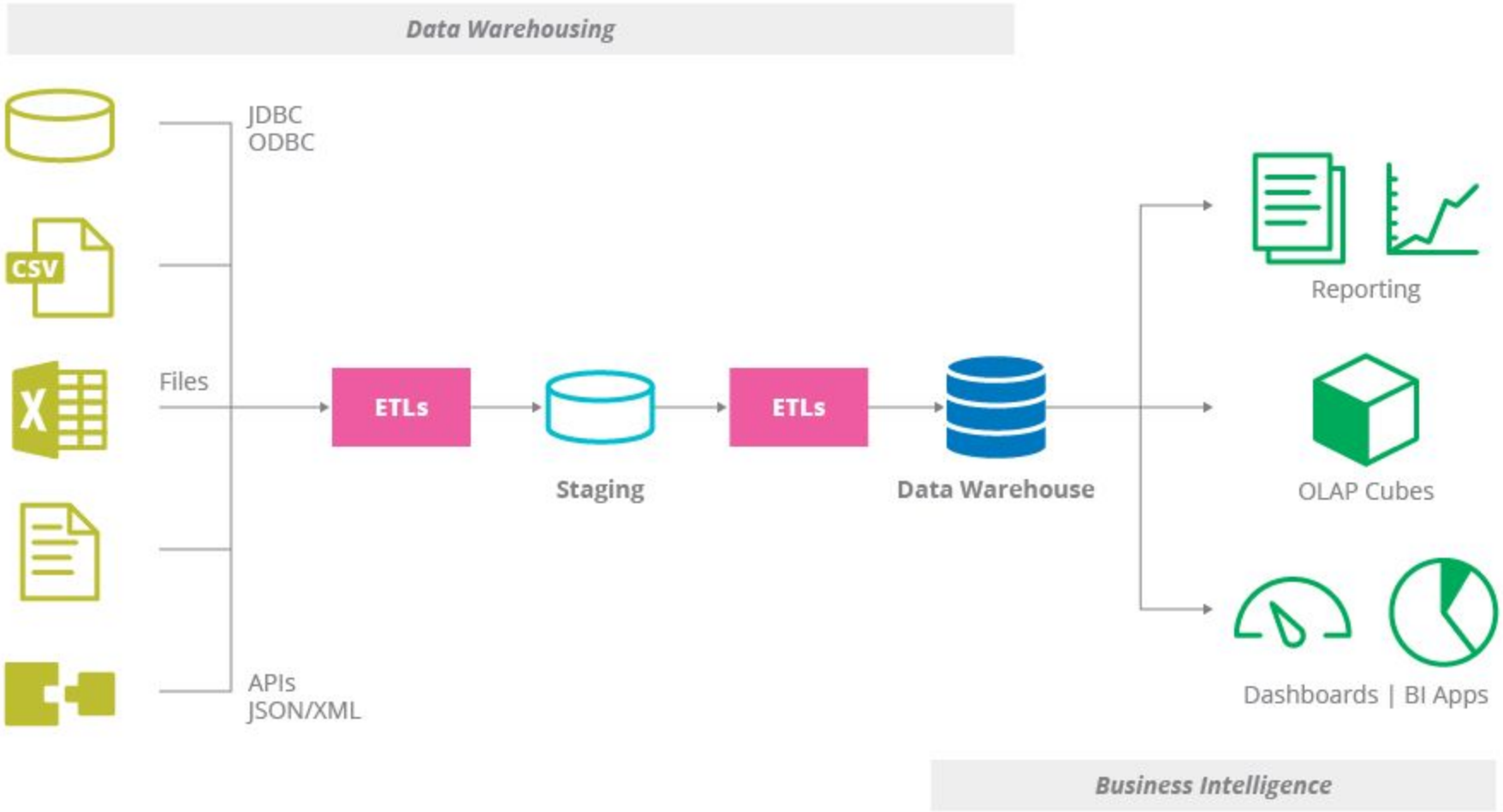
- **nVs**
  - 3Vs
  - 4Vs
  - 5Vs
  - 6Vs
  - 7Vs
  - ……
  - As of May 2019
    - 8Vs
    - 10Vs
    - ㅋㅋㅋ

Big Data & AI Landscape



FIRSTMARK
EARLY STAGE VENTURE CAPITAL

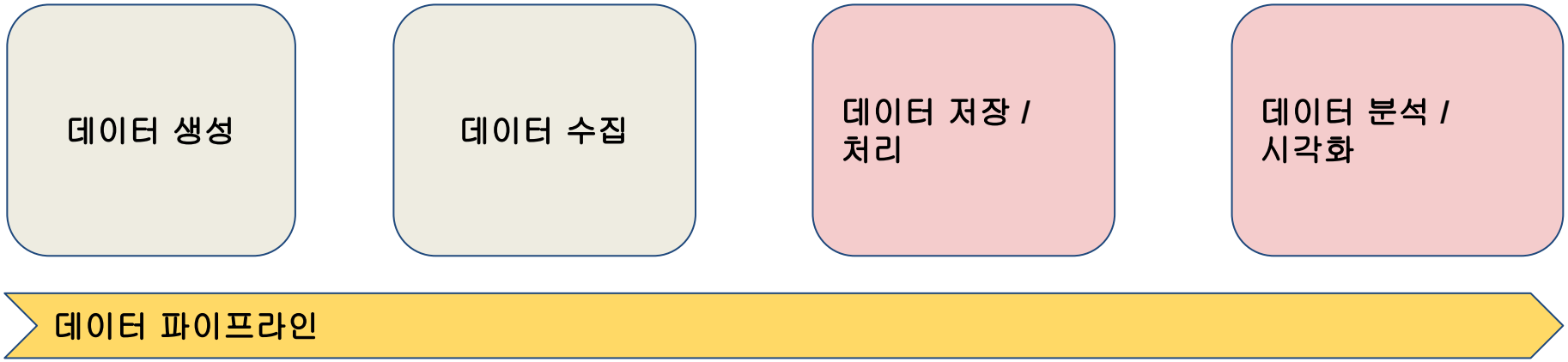
DW & BI (Data Warehousing & Business Intelligence)



1. https://www.thoughtworks.com/insights/blog/agile-data-warehousing-and-business-intelligence-action

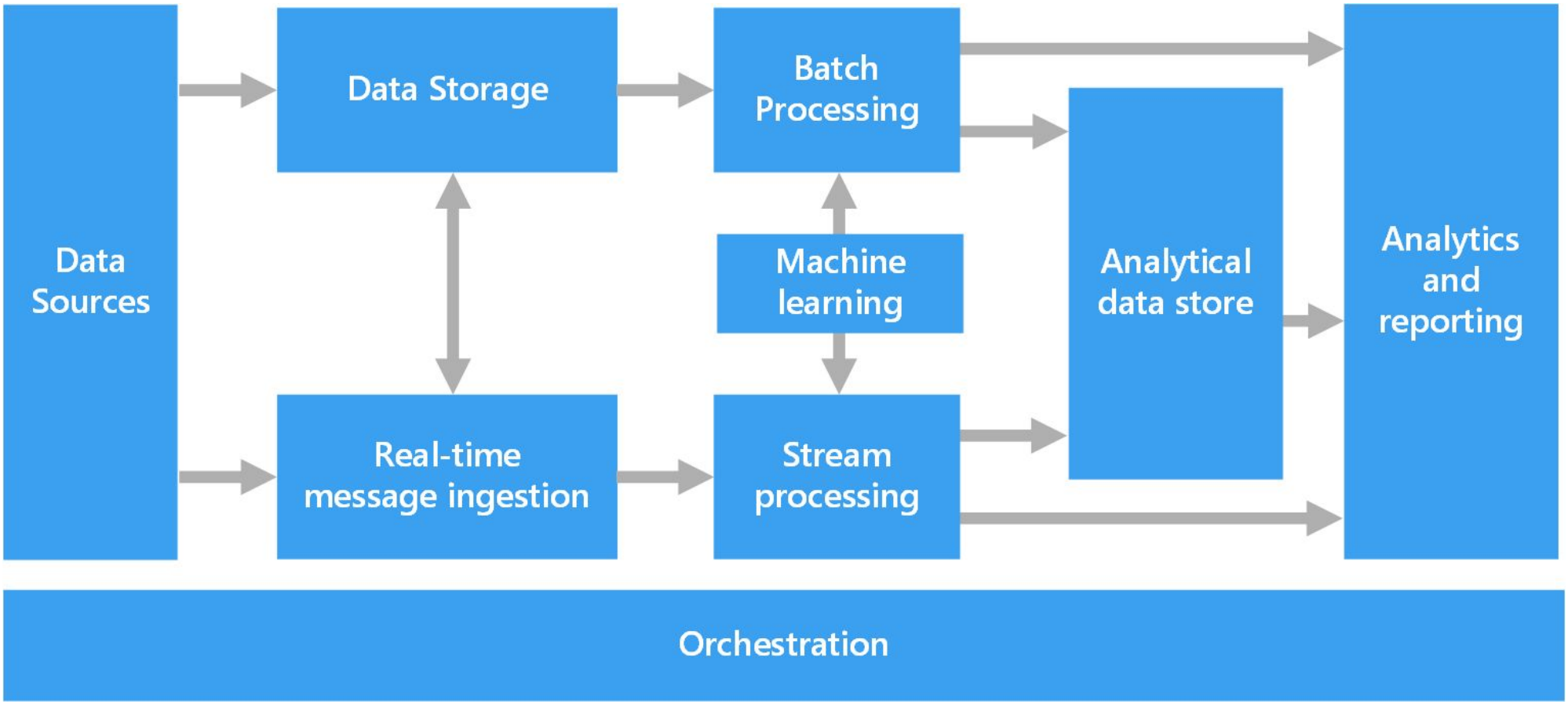
데이터 애플리케이션?

- **데이터 애플리케이션**
  - 데이터 수집
  - 데이터 저장
  - 데이터 처리
  - 데이터 분석 및 시각화
- **빅데이터 애플리케이션(시스템) 패턴**



빅데이터 아키텍처: 구성요소

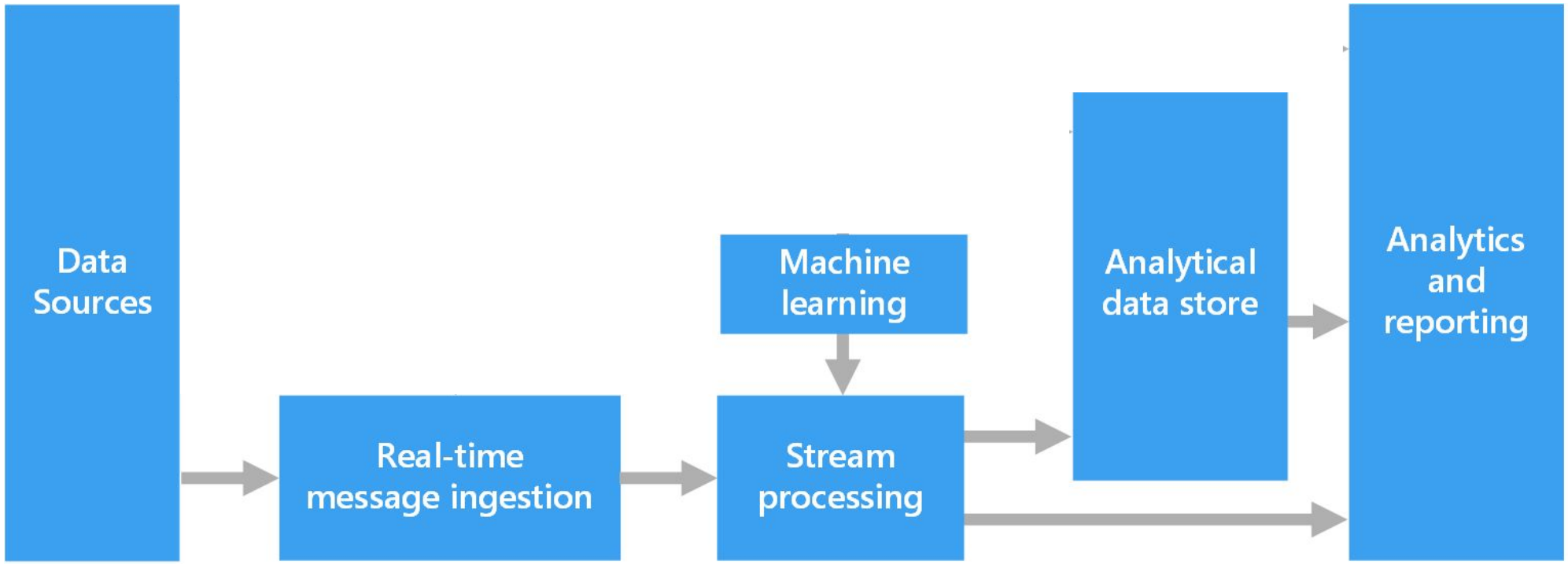
- **Components of a big data architecture [1]**



1. https://docs.microsoft.com/en-us/azure/architecture/data-guide/big-data/

빅데이터 아키텍처: 구성요소

- **Components of the “Streaming Data” architecture**



Streaming Data Platform

Streaming Data Platform

- Data Source
- Event Bus
  - a.k.a Message Broker
  - Transport Layer
  - Apache Kafka, Apache Pulsar, ActiveMQ, etc…
- Data Ingestion / Integration
- Data Storage
- Stream Processing
- Data Analytics / SQL / Dashboard

Streaming Data Platform: Data Source

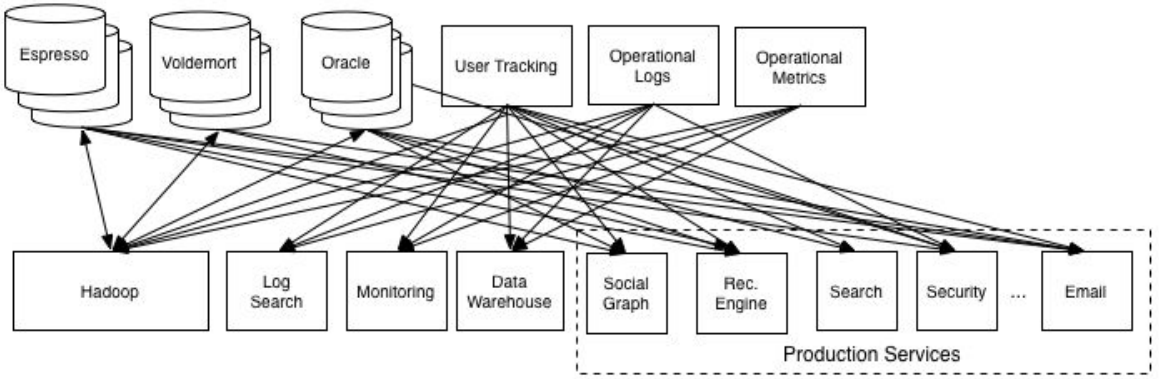
- **(Streaming) Data Source**
  - Log files
  - CDC (Transactions)
  - Events (Equipments, Sensors…)
  - APIs
  - Agents
  - Microservices
  - ……

- **Message Broker?, Why?**
  - A message broker is an architectural pattern for message validation, transformation, and routing. It mediates communication among applications, minimizing the mutual awareness that applications should have of each other in order to be able to exchange messages, effectively implementing decoupling. [1]
  - Event-driven Applications
  - Asynchronous Processing

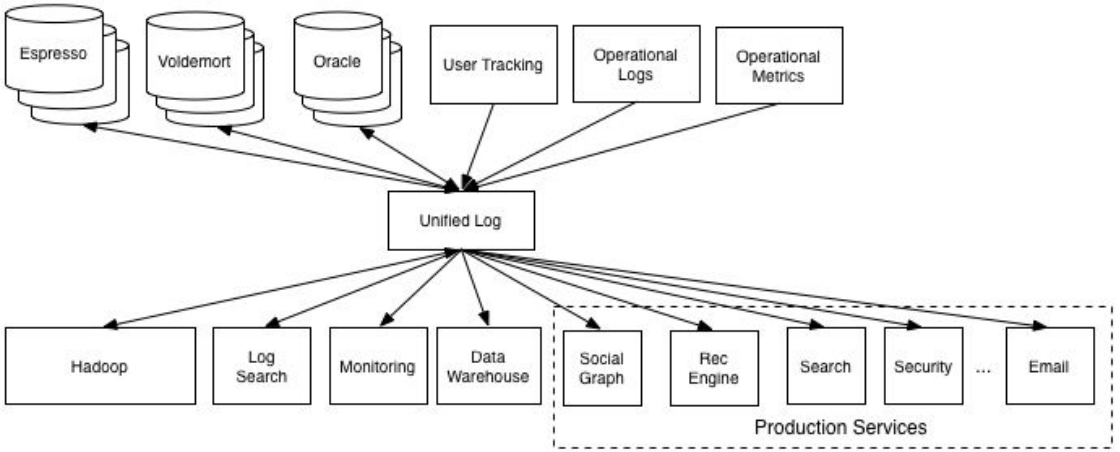
1. https://en.wikipedia.org/wiki/Message_broker

Streaming Data Platform

Bad



Good



1. https://engineering.linkedin.com/distributed-systems/log-what-every-software-engineer-should-know-about-real-time-datas-unifying

Streaming Data Platform

- **Message Broker**
  - a.k.a Enterprise Event Bus (Hub)
  - **Immutable append-only data store**
- **Goals for Enterprise Event Bus**
  - Buffering
  - Reliable Storage
  - Partitioning
  - Replay
  - High Throughput

Streaming Data Platform: 이벤트 버스 = 물류창고?

Streaming Data Platform

- **Key properties for Next-Generation Messaging**
  - High throughput
  - Low latency
  - Multi tenancy
  - Consistency
  - Ease of operations
  - Resiliency
  - Elasticity

Streaming Data Platform

- **Transmission**
  - Processing Guarantees (Messaging Semantics)
  - Duplication
  - Latency
  - Ordering

- **Messaging semantics (=message delivery semantics)**

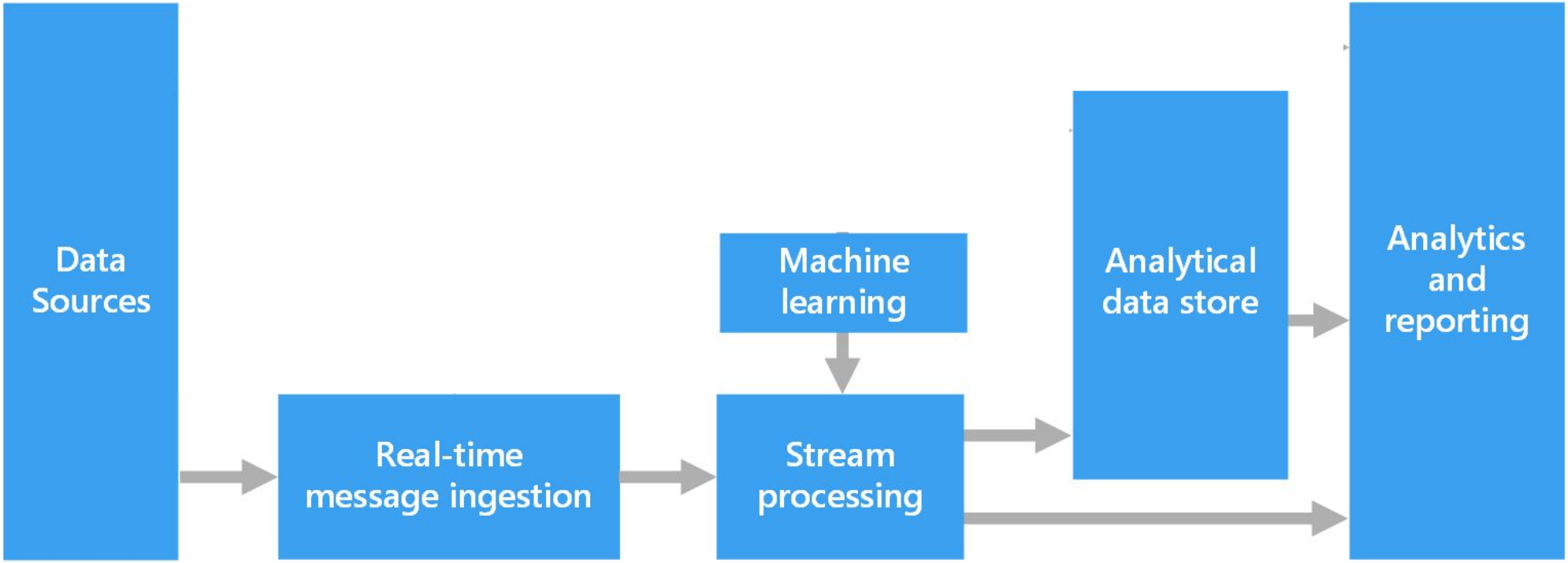
At most once	At least once	Exactly once
Message pulled once	Message pulled one or more times; processed each time	Message pulled one or more times; processed once
May or may not be received	Receipt guaranteed	Receipt guaranteed
No duplicates	Likely duplicates	No duplicates
Possible missing data	No missing data	No missing data

MEMSQL

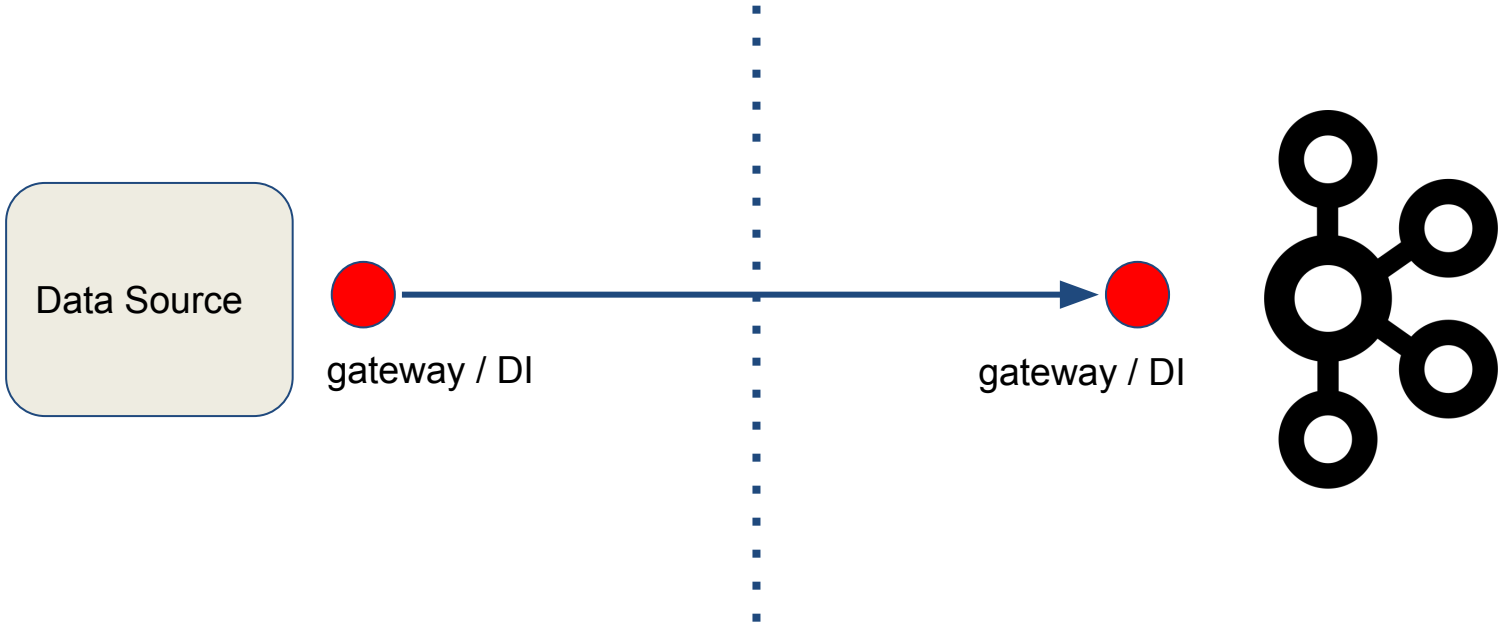
1. https://www.datanami.com/2017/02/09/exactly-big-deal-apache-kafka/

OSS for Streaming Data Platform

- **Components of a “Streaming Data” architecture (again!)**



- **Data Source & Data Acquisition**



OSS for SDP

- **Data Source & Data Acquisition**
  - Apache Flume
  - Apache Gobblin
  - Kafka Connect
  - DI tools...

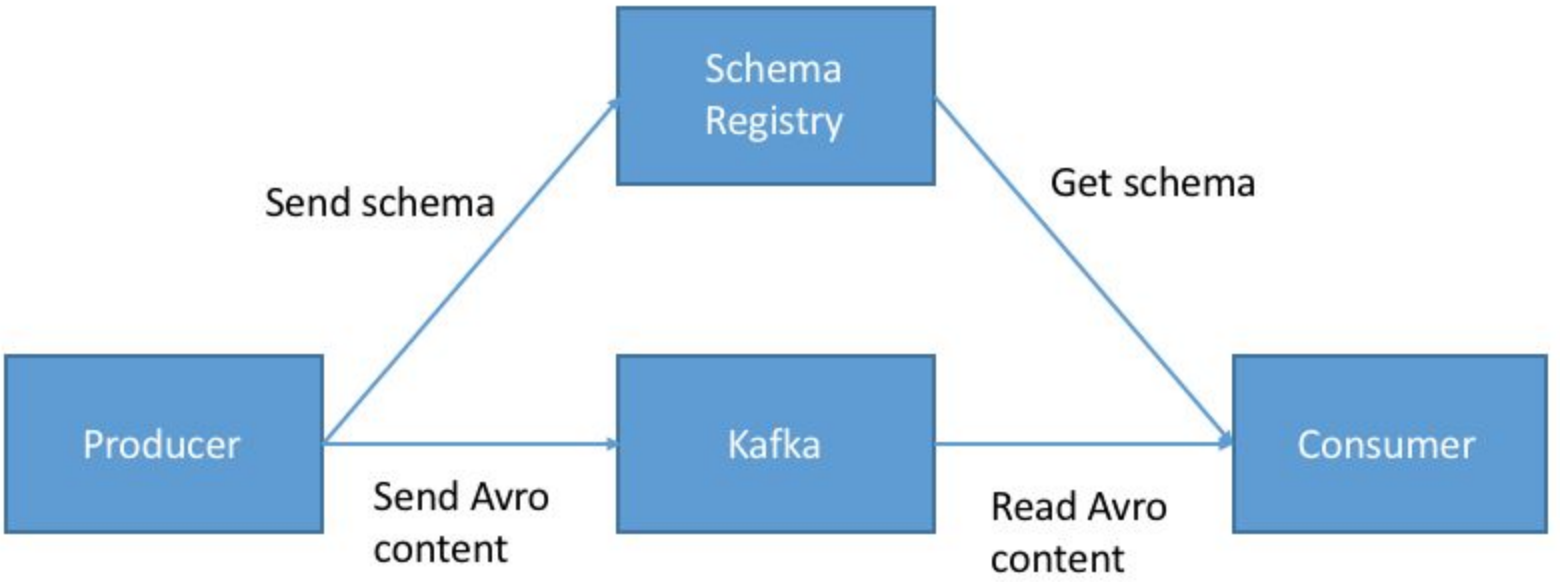
OSS for SDP

- **Message Broker / Enterprise Event Bus**
  - Apache Kafka
  - Apache Pulsar
  - RabbitMQ
  - Apache ActiveMQ
  - Apache Qpid
  - Apache RocketMQ
  - ZeroMQ
  - ……

Apache Kafka

- https://kafka.apache.org/
- **Kafka : High performance pub/sub messaging system**
  - Broker
  - Streams
  - Connect
- **Key terms:**
  - Message
  - Broker
  - Producer
  - Consumer
  - topic
  - topic partition
  - Consumer Group
- ***Apache Kafka vs. Confluent Platform***

- **Apache Kafka + Schema Registry [1][2]**
  - Why Avro For Kafka Data? [3]

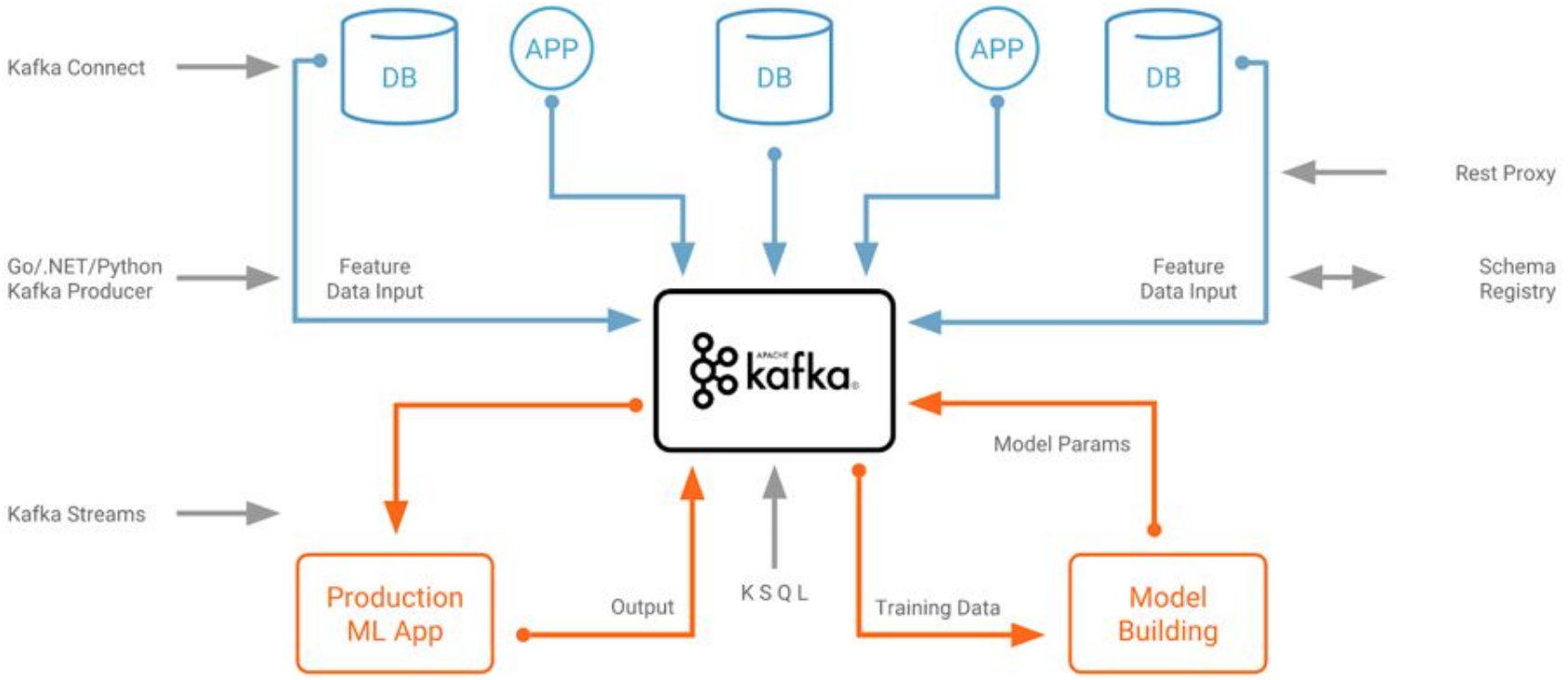


1. https://github.com/confluentinc/schema-registry
2. https://medium.com/@stephane.maarek/introduction-to-schemas-in-apache-kafka-with-the-confluent-schema-registry-3bf55e401321
3. https://www.confluent.io/blog/avro-kafka-data/

레퍼런스 아키텍처: Apache Kafka

- **Binary format for event data (Avro, Protobuf)**
  - Fast serialization / deserialization
  - more compact messages
  - have a schema of the data
  - schema evolution
  - ……
  - **Meta data and Data Discovery**

레퍼런스 아키텍처: Apache Kafka (for ML)

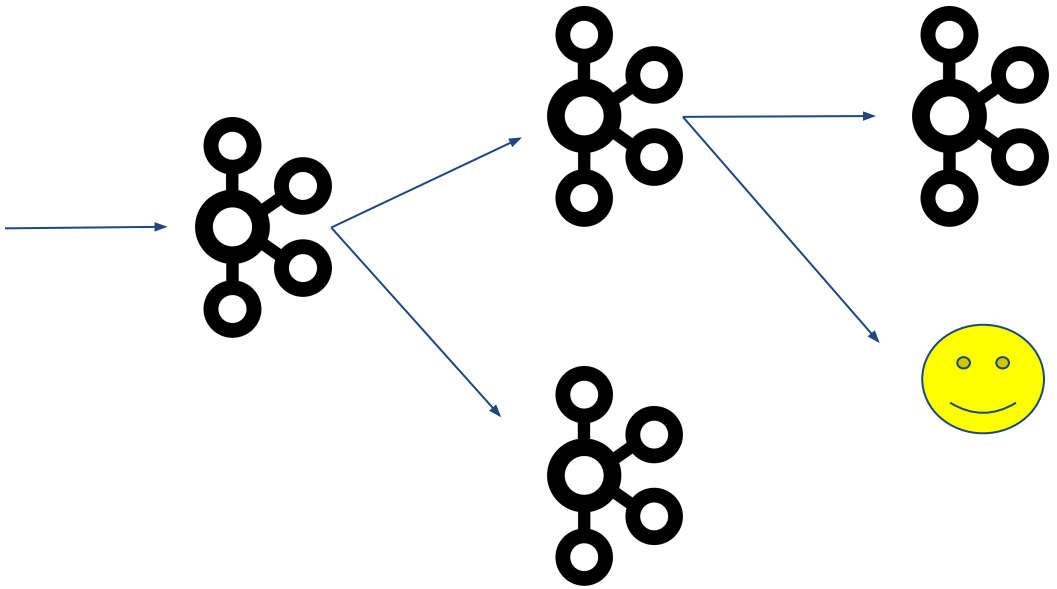


1. https://www.confluent.io/blog/using-apache-kafka-drive-cutting-edge-machine-learning

Scaling Apache Kafka

- **Tuning Kafka Broker, Producer and Consumer**
  - Async producer, acks, partitions, compression, Disk I/O…

- **Tiered Kafka Cluster (=Multi-tier Architecture) [1][2]**

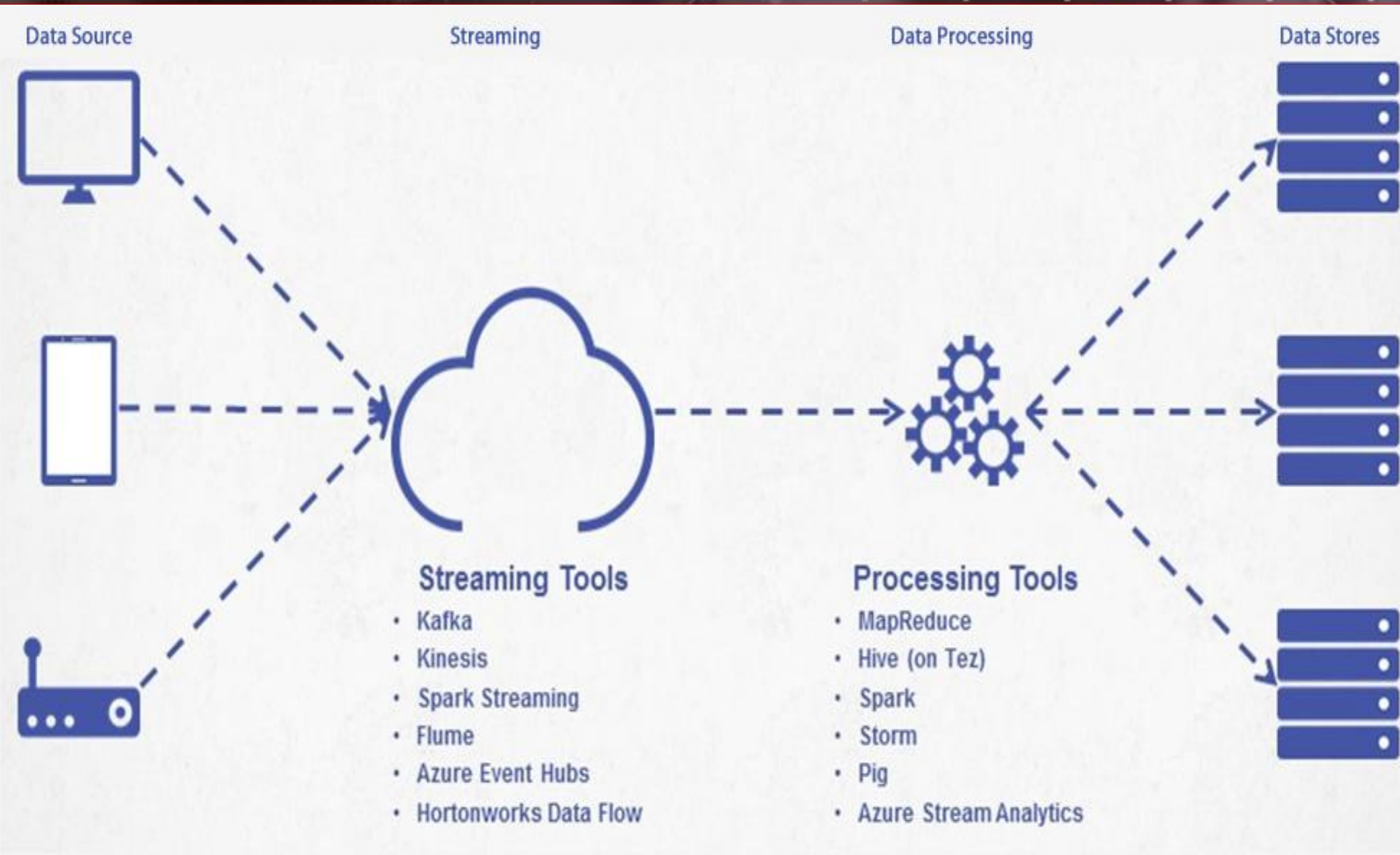


1. Kafka at Scale
2. Building Scalable and Extendable Data Pipeline for Call of Duty Games: Lessons Learned

Streaming Data Platform: Stream Processing

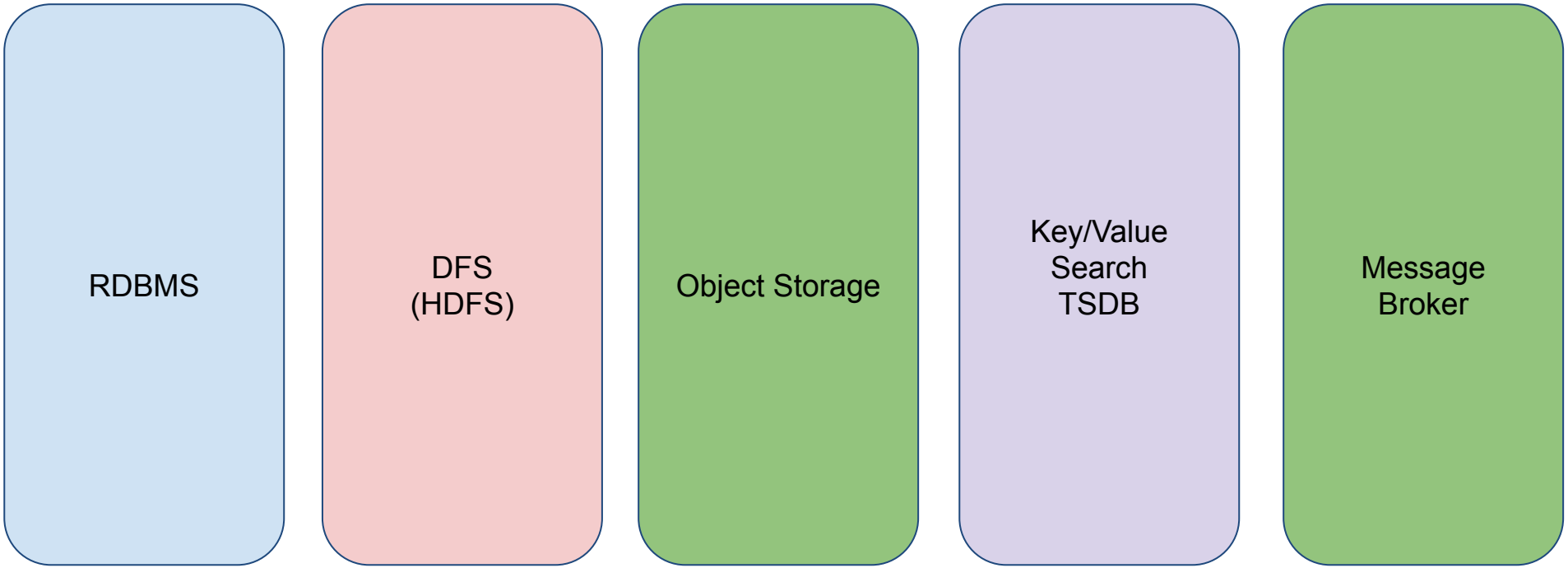
- **Kafka client for Java, Scala, Python, Go, etc...**
- **Apache Spark**
- **Apache Flink**
- **Apache Samza**
- **Apache Storm**
- **Apache Heron**
- **Apache Samza**
- **Apache Beam**
- **……**

Streaming Data Platform: Data Store



Streaming Data Platform: Data Store

- **One size fits all?**



Streaming Data Platform: Data Store

- **RDBMS**
- **Distributed File System**
  - Hadoop HDFS
- **Object Storage**
  - S3
  - Minio
  - Ceph
- **KV Store**
  - Apache HBase
  - Apache Cassandra
  - Redis
- **Search**
  - Apache Solr
  - ElasticSearch
- **Message Broker**
  - Apache Kafka, Apache Pulsar or MQs...

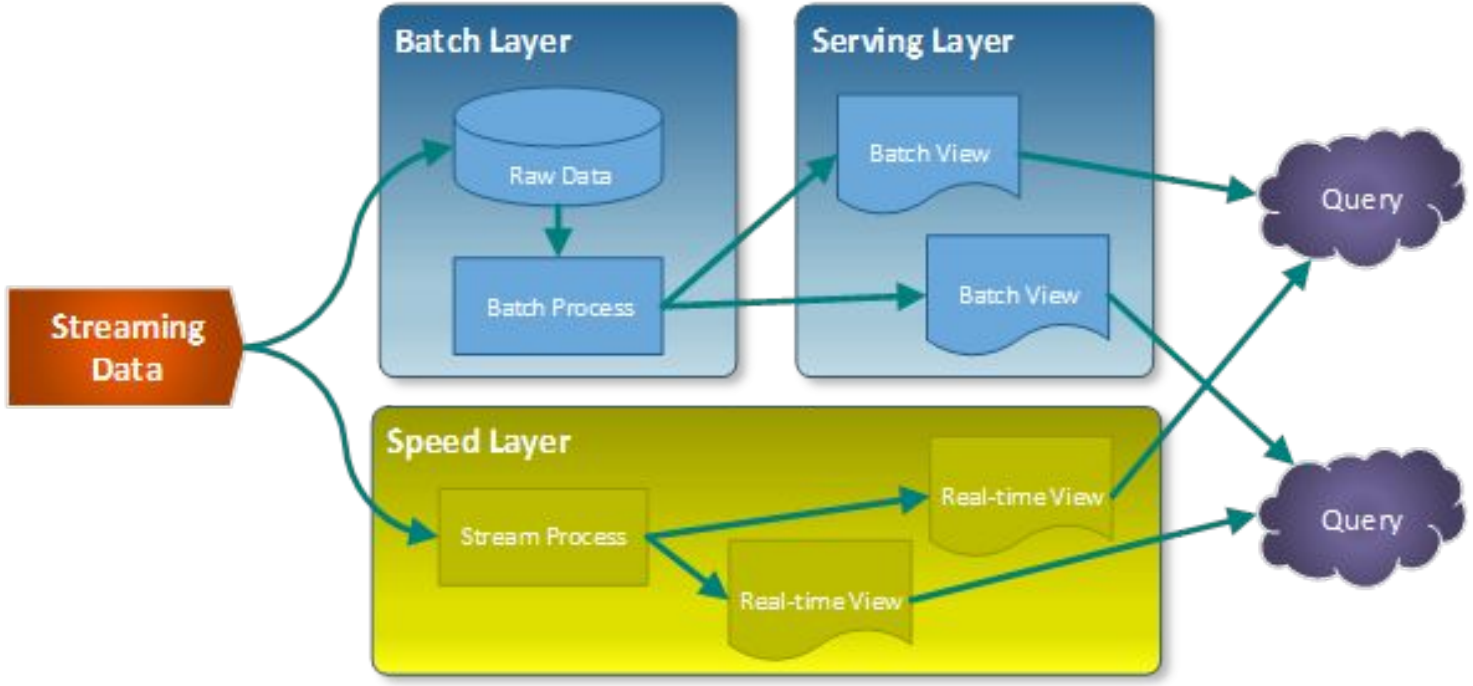
Streaming Data Platform: File Format

- **File format for Data Store**
  - Distributed File System. -- HDFS, QFS, & etc…
  - Object Storage -- S3 or S3 compatible data store
- **Big Data File Formats**
  - Text (CSV, JSON)
  - Apache Avro
  - Apache ORC**
  - Apache Parquet**

**** Columnar storage > immutable data and analytics queries**

레퍼런스 아키텍처: Lambda Arch. vs Kappa Arch.

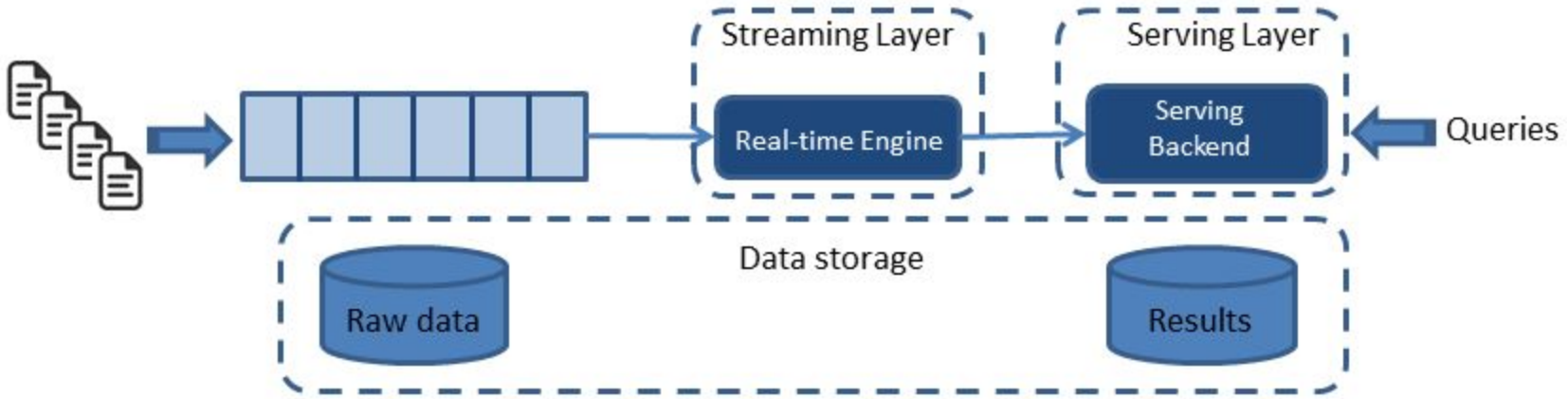
- **Lambda Architecture**



https://www.talend.com/blog/2017/08/28/lambda-kappa-real-time-big-data-architectures/

레퍼런스 아키텍처: Lambda Arch. vs Kappa Arch.

- **Kappa Architecture**



1. https://www.oreilly.com/ideas/applying-the-kappa-architecture-in-the-telco-industry

Streaming Data Platform: DI

- **Real-time Data Ingestion / Integration**
  - Apache Flume
  - Apache Gobblin
  - Kafka Connect
  - StreamSets
  - ……

Streaming Data Platform: Data Apps (Analytics / SQL / Dashboard)

- **Data Applications**
  - API
- **Querying Data**
  - SQL
- **Jupyter notebooks**
- **Data Discovery**
  - metatron discovery
- **ML / DL**
- **Search**
- **Dashboard**

Stream analytics @ Public Cloud

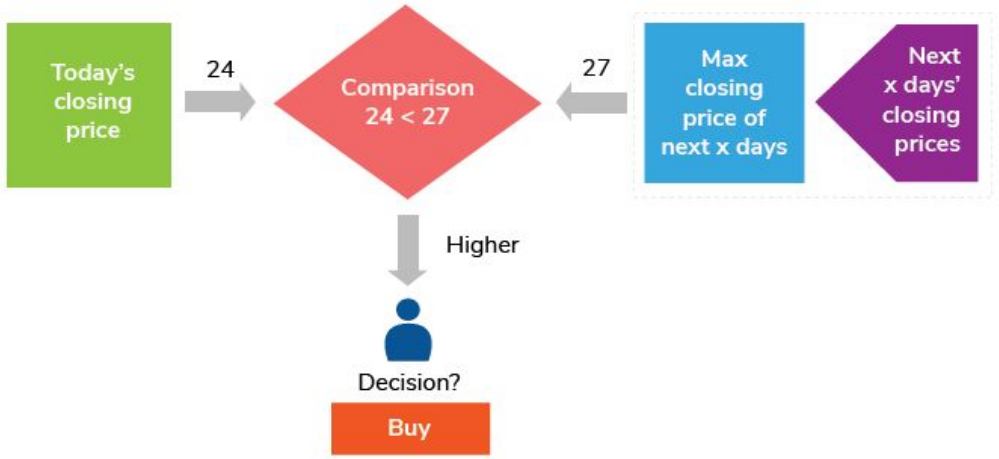
- **AWS**
  - https://aws.amazon.com/ko/streaming-data/
- **MS Azure**
  - https://azure.microsoft.com/en-in/services/stream-analytics/
- **GCP**
  - https://cloud.google.com/solutions/big-data/stream-analytics/

Hands-on Labs

- **Stock Trading(Quote) API**를 이용한 실시간 데이터 수집 및 분석
  - Data Sources
    - Dataset
    - API
  - Real-time message ingestion
    - Stream Ingestion
      - ➢ Kafka Clients
    - Event Bus
      - ➢ Apache Kafka

Hands-on Labs

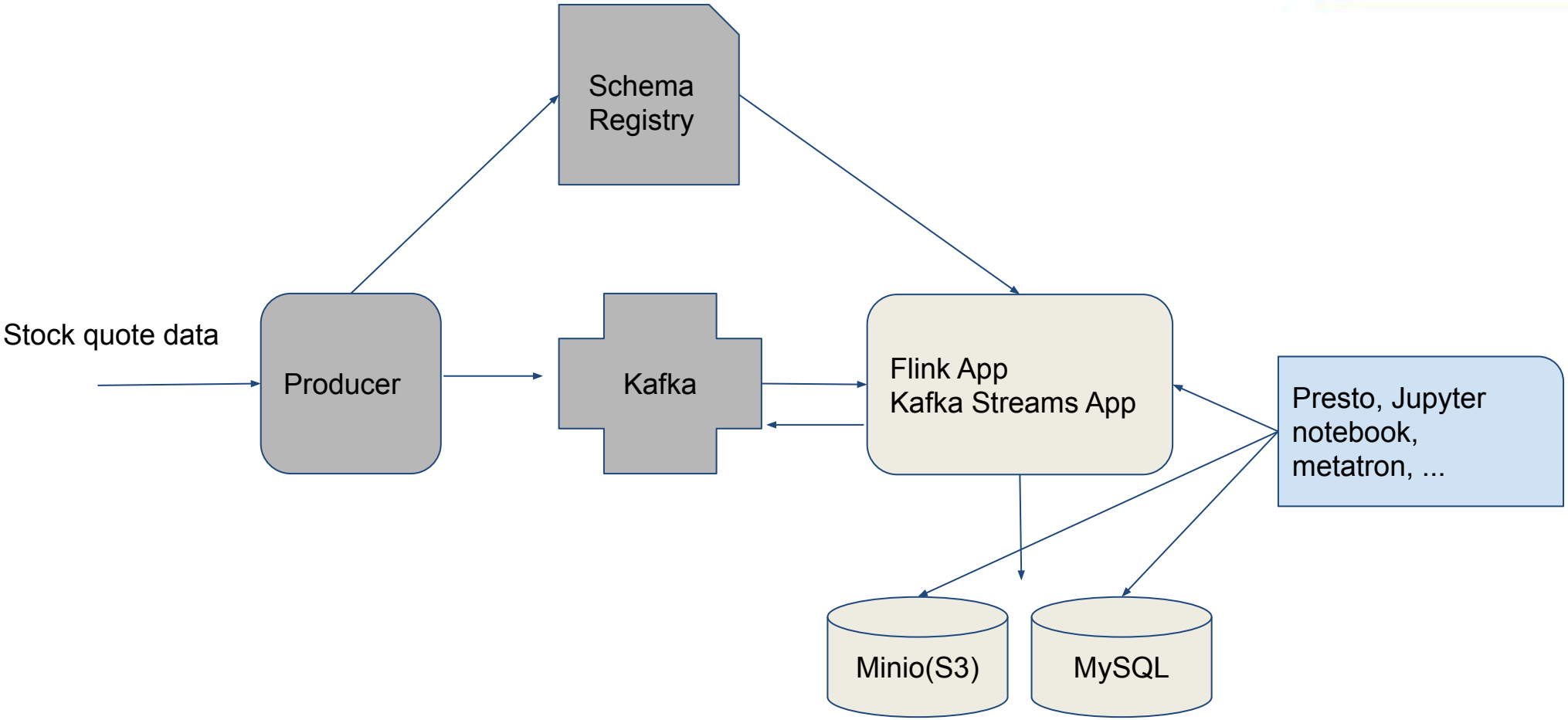
- **Stock Trading**
  - Stream processing
    - Kafka Streams, Apache Spark, Apache Flink
  - Data Store
    - RDBMS, Object Storage, RDBMS
  - Data Analytics
    - SQL
    - Python



Hands-on Labs

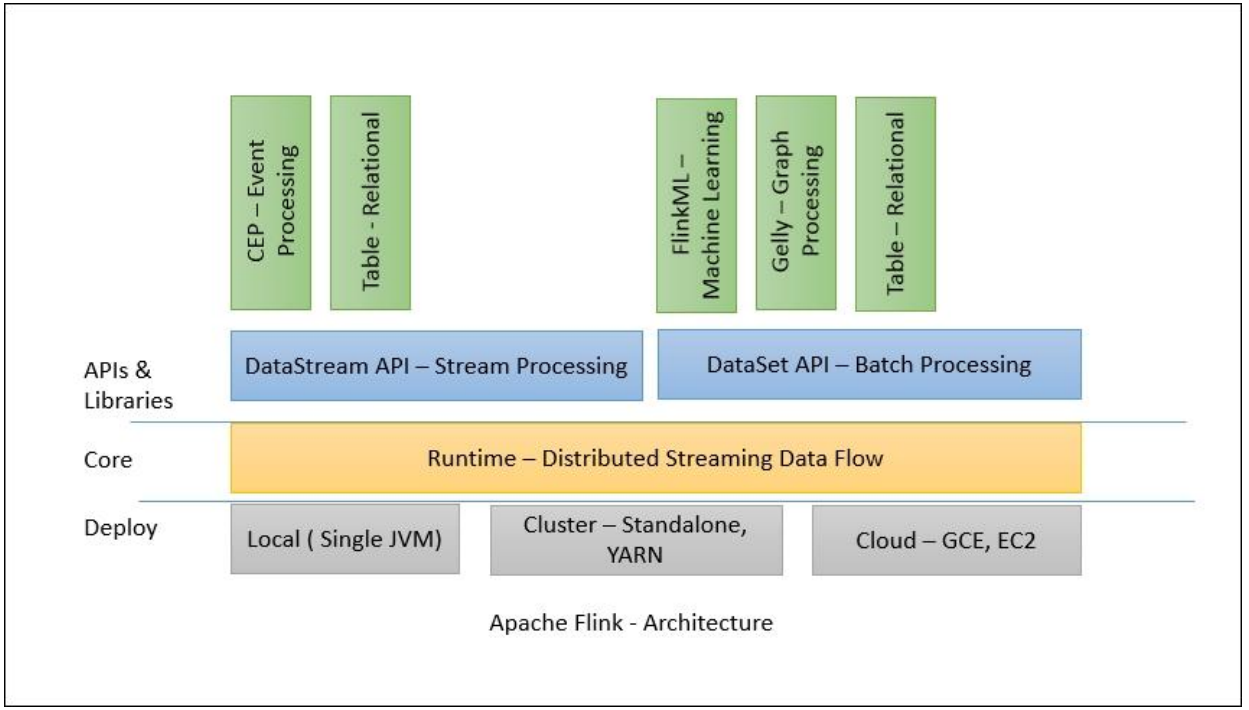
- https://github.com/youngwookim/skbdc-bda-2019
  - $ cd /path/to/workspace
  - $ git checkout https://github.com/youngwookim/skbdc-bda-2019.git

Hands-on Labs: Data flow



Apache Flink

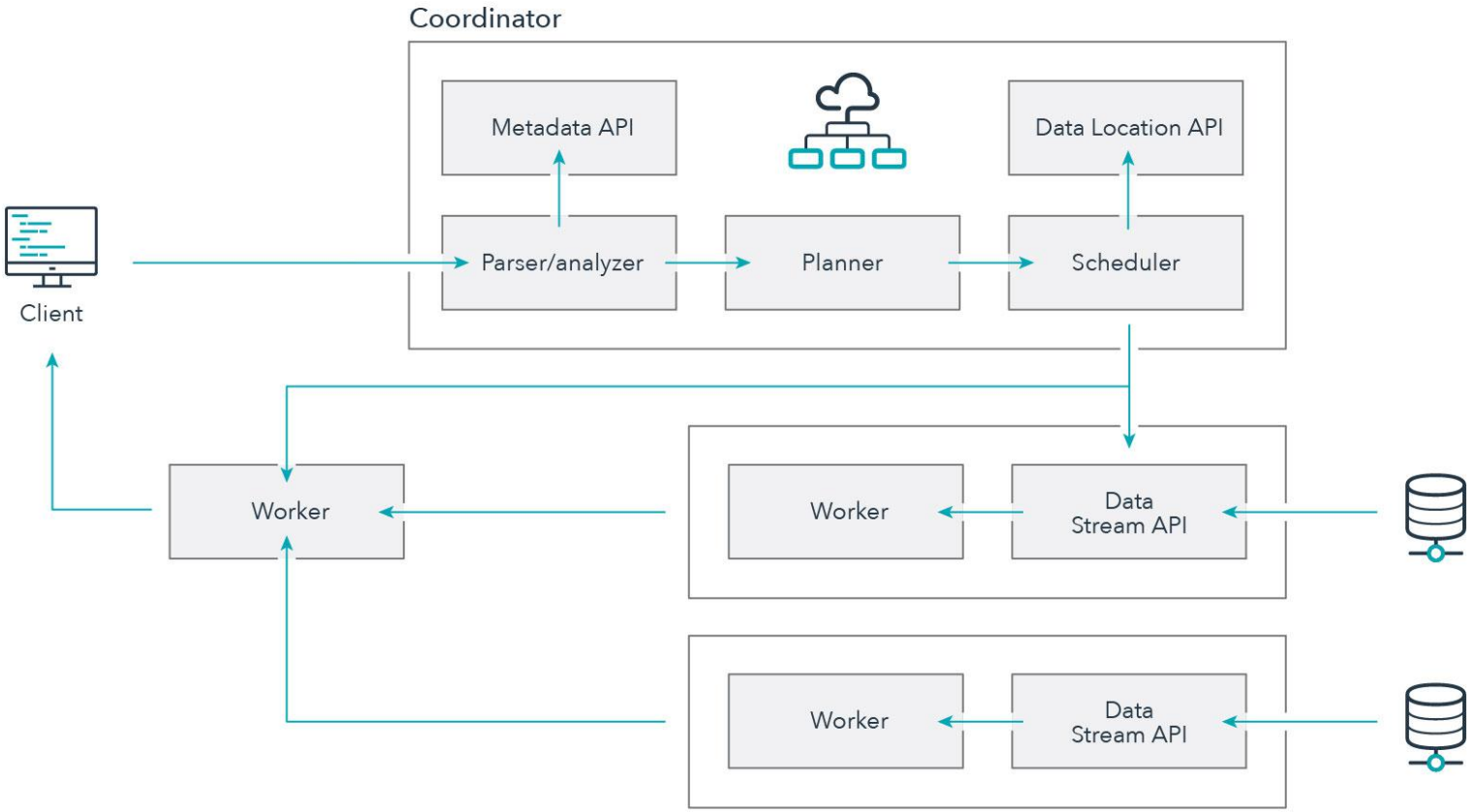
- https://flink.apache.org/
  - vs. Apache Spark
  - vs. Apache Samza
  - vs. Apache Storm
  - vs. Apache Heron



Apache Flink - Architecture

Presto

- **a.k.a PrestoSQL**
  - http://prestosql.io



Metatron Discovery

- **metatron discovery**
  - https://www.youtube.com/channel/UC5IdHK8qBiN9zVgD7SvO41g

Refs.

1. Big data architectures
2. Architecting a next-generation data platform
3. Designing modern streaming data applications
4. Kafka Best Practices
5. Kafka Best Practices
6. I Heart Logs
7. https://engineering.linkedin.com/distributed-systems/log-what-every-software-engineer-should-know-about-real-time-datas-unifying
8. Architectural considerations for Hadoop Applications

Image Credits

1. http://insight360.com/big-data/data-stores/
2. https://en.wikipedia.org/wiki/Apache_Kafka
3. https://www.talend.com/blog/2017/08/28/lambda-kappa-real-time-big-data-architectures
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5. https://www.starburstdata.com/learn-presto/reference-architectures/