Real-Time Streaming in Any and All Clouds, Hybrid and Beyond

Timothy Spann
Developer Advocate

Stream Native

SCENIC CITY SUMMIT

www.sceniccitysummit.com

Tim Spann, Developer Advocate

DZone Zone Leader and Big Data MVB

https://github.com/tspannhw
https://www.datainmotion.dev/
https://github.com/tspannhw/SpeakerProfile
https://dev.to/tspannhw
https://sessionize.com/tspann/
https://www.slideshare.net/bunkertor

Stream Native

@PaasDev

AGENDA

Use Case - Fast Data Everywhere Always

Why Apache NiFi and Apache Pulsar?

Successful Architecture

Demo

USE CASE

IoT Ingestion: High-volume streaming sources, sensors, multiple message formats, diverse protocols and multi-vendor devices creates data ingestion challenges.

Other Sources: Transit data, news, twitter, status feeds, REST data, stock data and more.

KEY CHALLENGES

Data Ingestion: High-volume streaming sources, multiple message formats, diverse protocols and multi-vendor devices creates data ingestion challenges.

Real-time Insights: Analyzing continuous and rapid inflow (velocity) of streaming data at high volumes creates major challenges for gaining real-time insights.

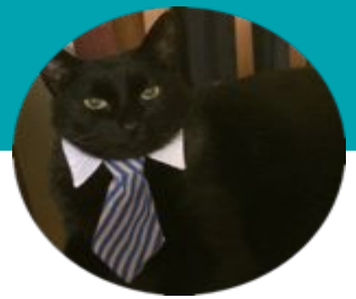
Visibility: Lack visibility of end-to-end streaming data flows, inability to troubleshoot bottlenecks, consumption patterns etc.

FLiP(N) Stack for Data Engineers - Events

Multiple users, protocols, frameworks, languages, clouds, data sources & clusters

CLOUD DATA ENGINEER

- Experience in ETL/ELT
- Coding skills in Python or Java
- Knowledge of database query languages such as SQL
- Experience with Streaming
- Knowledge of Cloud Tools



CAT

- Expert in ETL (Eating, Ties and Laziness)
- Edge Camera Interaction
- Typical User
- No Coding Skills
- Can use NiFi
- Questions your cloud spend

AI / Deep Learning / ML / DS

- Can run in Apache NiFi
- Can run in Apache Pulsar Functions
- Can run in Apache Flink
- Can run in Apache Flink SQL
- Can run in Apache Pulsar Clients
- Can run in Apache Pulsar Microservices
- Can run in Function Mesh

Function Mesh

https://functionmesh.io/

StreamNative Solution

APP Layer

Application Messaging

Micro Service

Payment

Notification

Data Pipelines

ETL

Real-time Contextual Analytics

Dashboard

Risk Control

Auditing

StreamNative Platform

Computing Layer

Storage Layer

Tiered Storage

IaaS Layer

kubernetes

Google Cloud Platform

Stream Native Platform

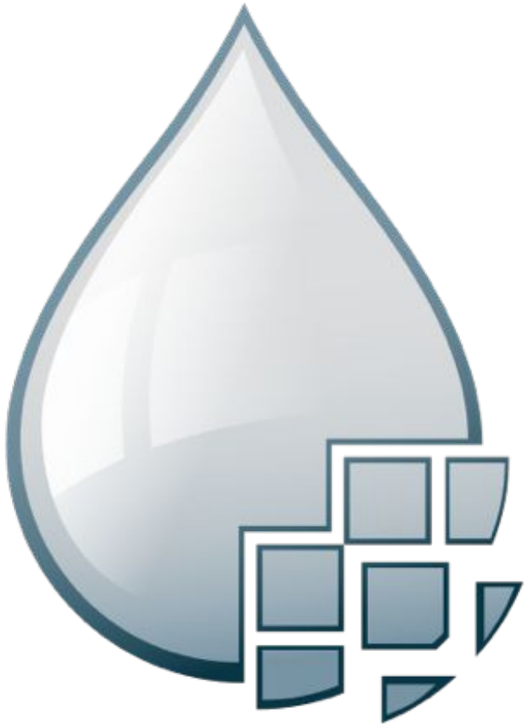
Stream Native Cloud

StreamNative

WHAT IS APACHE NIFI?

Apache NiFi is a scalable, real-time streaming data platform that collects, curates, and analyzes data so customers gain key insights for immediate actionable intelligence.

Why Apache NiFi?



- Guaranteed delivery
- Data buffering
  - Backpressure
  - Pressure release
- Prioritized queuing
- Flow specific QoS
  - Latency vs. throughput
  - Loss tolerance
- Data provenance
- Supports push and pull models
- Hundreds of processors
- Visual command and control
- Over a sixty sources
- Flow templates
- Pluggable/multi-role security
- Designed for extension
- Clustering
- Version Control

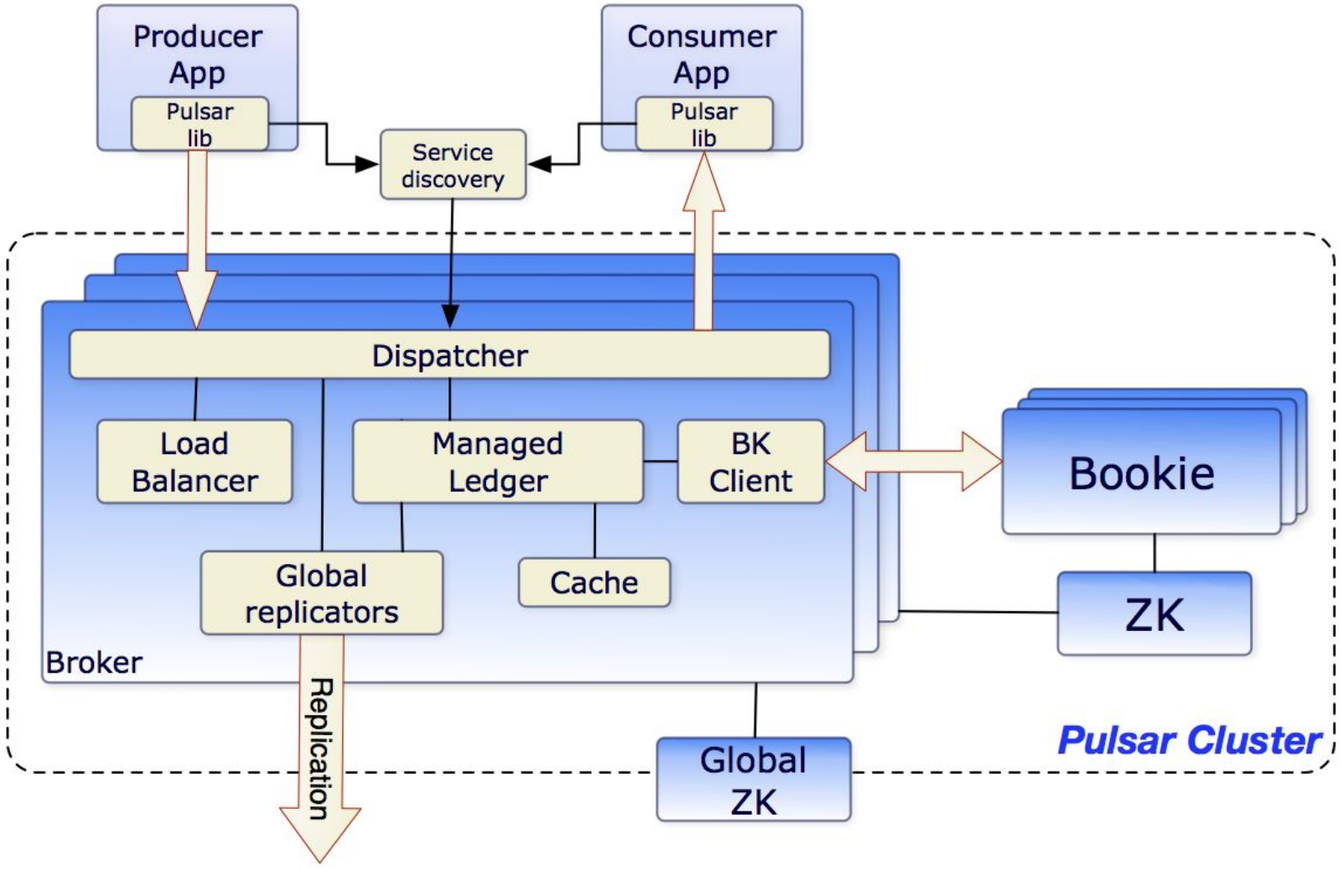
WHAT IS APACHE PULSAR?

Apache Pulsar is an open source, cloud-native distributed messaging and streaming platform.

APACHE PULSAR

Enable Geo-Replicated Messaging

- Pub-Sub
- Geo-Replication
- Pulsar Functions
- Horizontal Scalability
- Multi-tenancy
- Tiered Persistent Storage
- Pulsar Connectors
- REST API
- CLI
- Many clients available
- Four Different Subscription Types
- Multi-Protocol Support
  - **MQTT**
  - AMQP
  - JMS
  - **Kafka**
  - ...



Apache Pulsar: Key Features (1)

Multi-tenancy

- ✓ Data is stored in one system and shared by multiple organizations
- ✓ Apply access control policy to ensure data stay compliant

Geo-replication

- ✓ Pulsar supports multi-datacenter (n-mesh) replication with both asynchronous and synchronous replication for built-in disaster recovery

Tiered storage

- ✓ Enable historical data to be offloaded to cloud-native storage
- ✓ Effectively store event streams for indefinite periods of time

Cloud-Native Architecture

- ✓ Separate computing layer from storage layer
- ✓ Instant elasticity and scalability
- ✓ Rebalance-free to save labor cost
- ✓ Streamlined operations

Apache Pulsar: Key Features (2)

Converged Messaging

- ✓ Support both application messaging and data pipelines
- ✓ Store one copy of data
- ✓ Consume with different subscriptions

Serverless Streaming

- ✓ Pulsar Functions provides an easy-to-use stream processing framework to process streams in a serverless way

Pluggable Protocols

- ✓ Support popular messaging protocols: Kafka, AMQP, MQTT
- ✓ Provide full protocol compatibility
- ✓ Zero migration cost

Unified Batch and Stream Storage

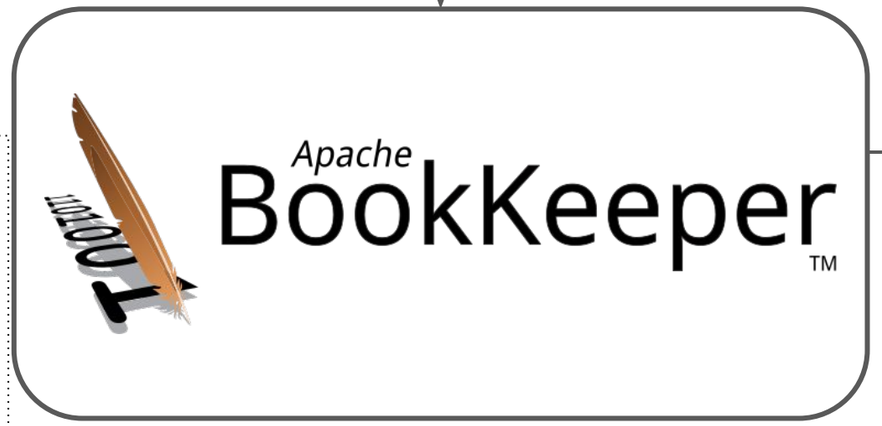
- ✓ Tiered storage enables Pulsar to store real-time data and historic data in one system
- ✓ Tightly integrated with Flink for unified batch and stream processing

Pulsar Cluster

- **“Brokers”**
- Handles message routing and connections
- Stateless, but with caches
- Automatic load-balancing
- Topics are composed of multiple segments

Metadata & Service Discovery

Store Messages

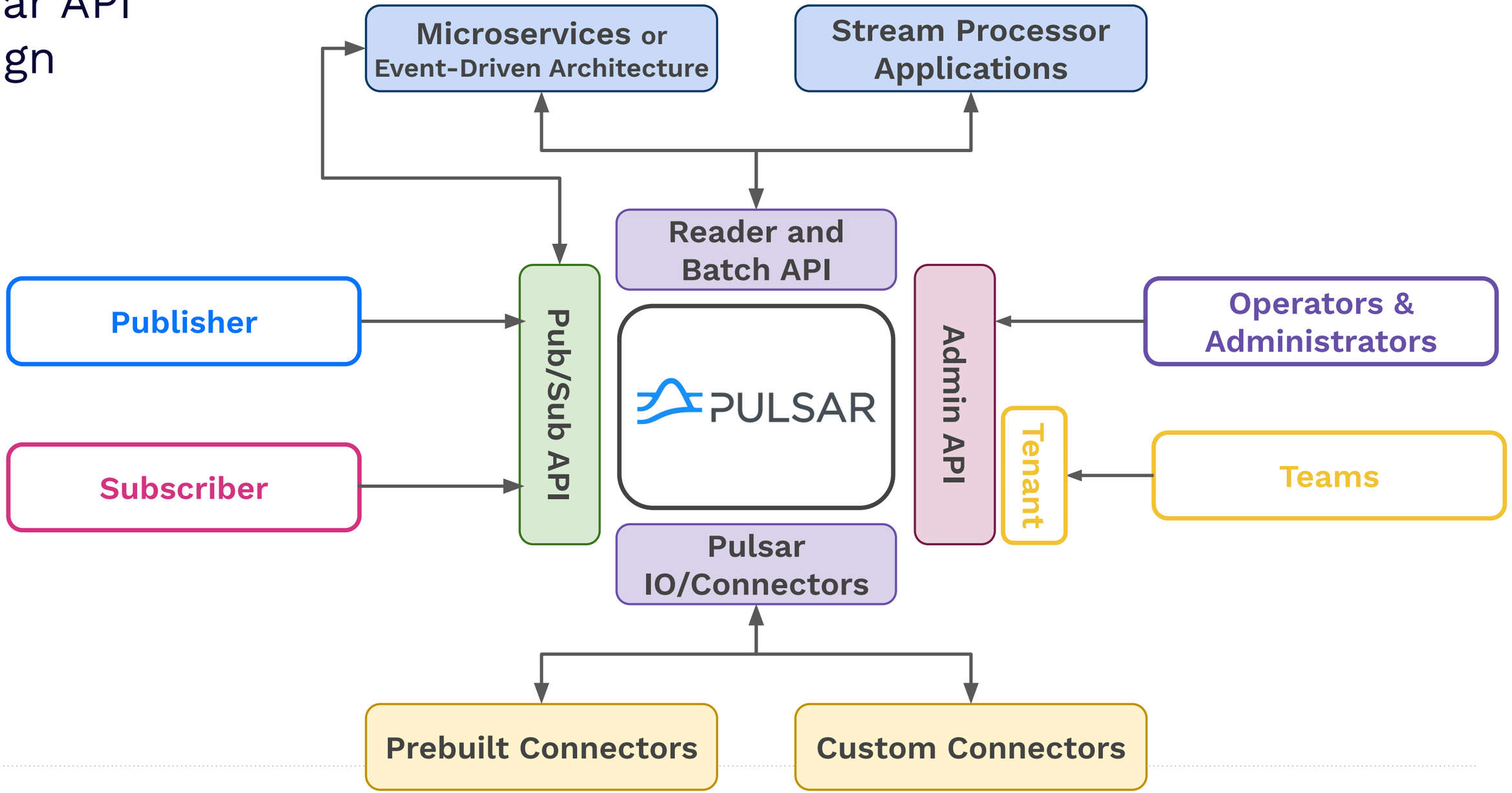


Metadata & Service Discovery

- Stores metadata for both Pulsar and BookKeeper
- Service discovery

- **“Bookies”**
- Stores messages and cursors
- Messages are grouped in segments/ledgers
- A group of bookies form an “ensemble” to store a ledger

Pulsar API Design



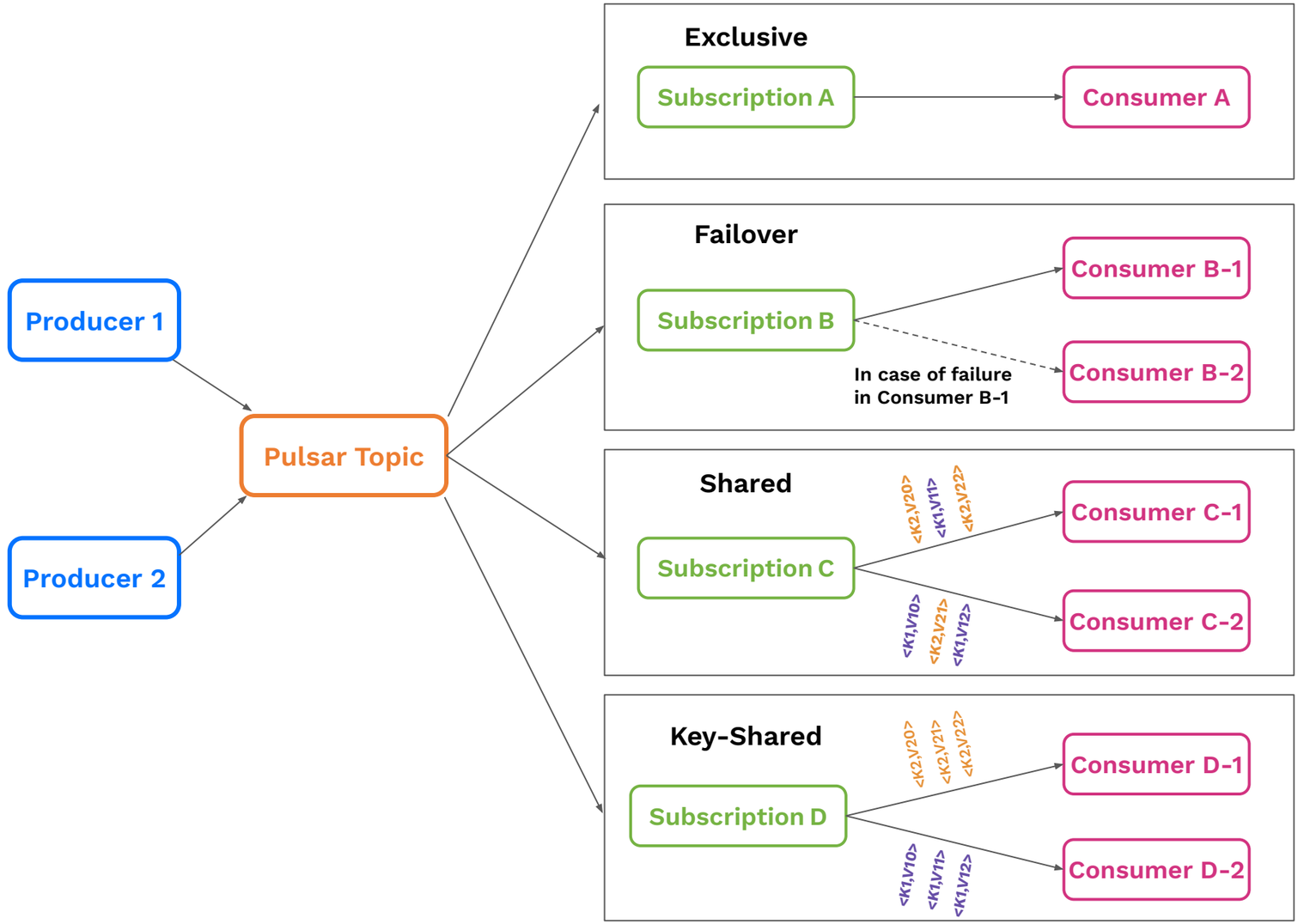
Subscription Modes

Different subscription modes have different semantics:

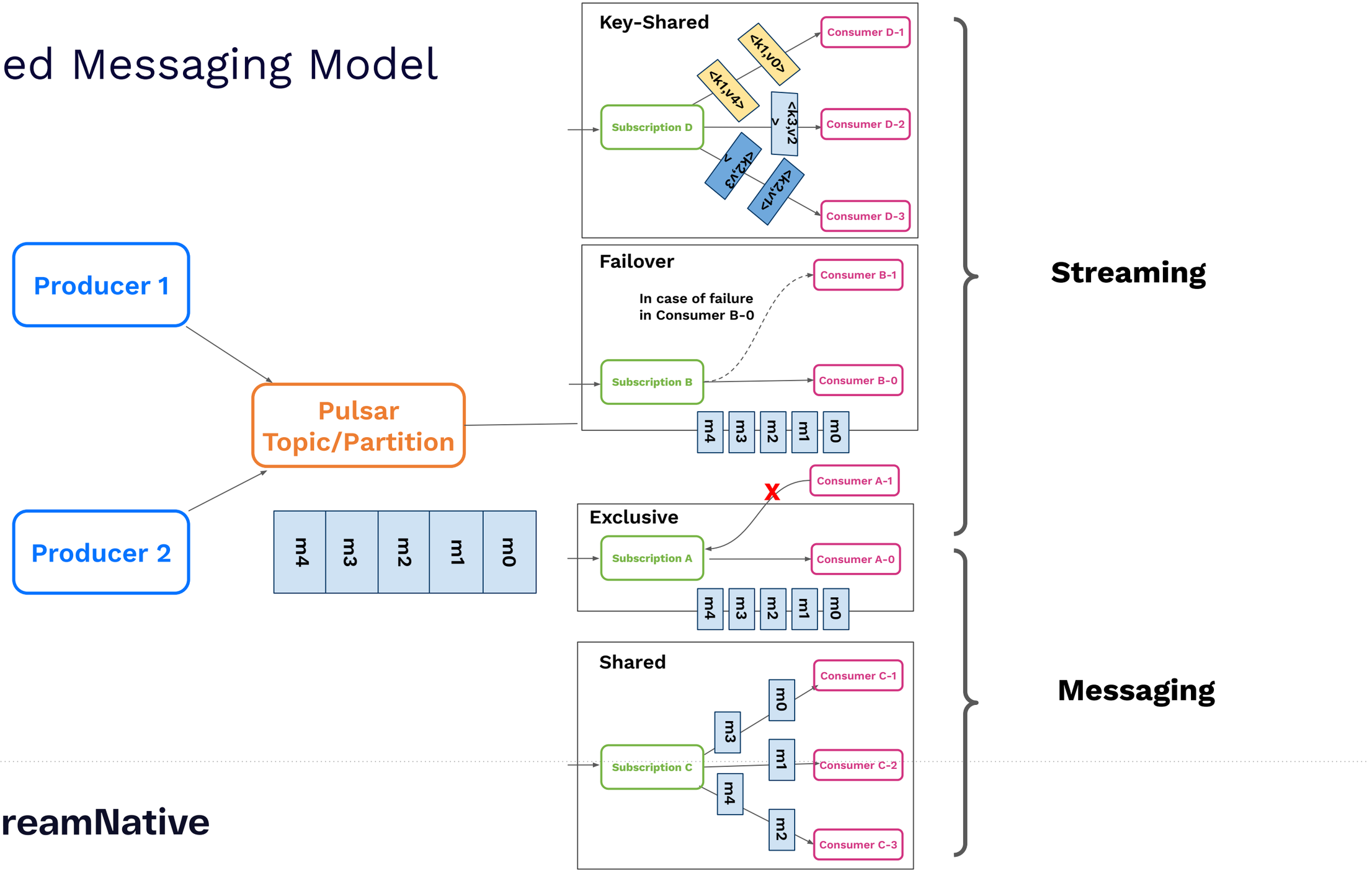
Exclusive/Failover - guaranteed order, single active consumer

Shared - multiple active consumers, no order

Key_Shared - multiple active consumers, order for given key

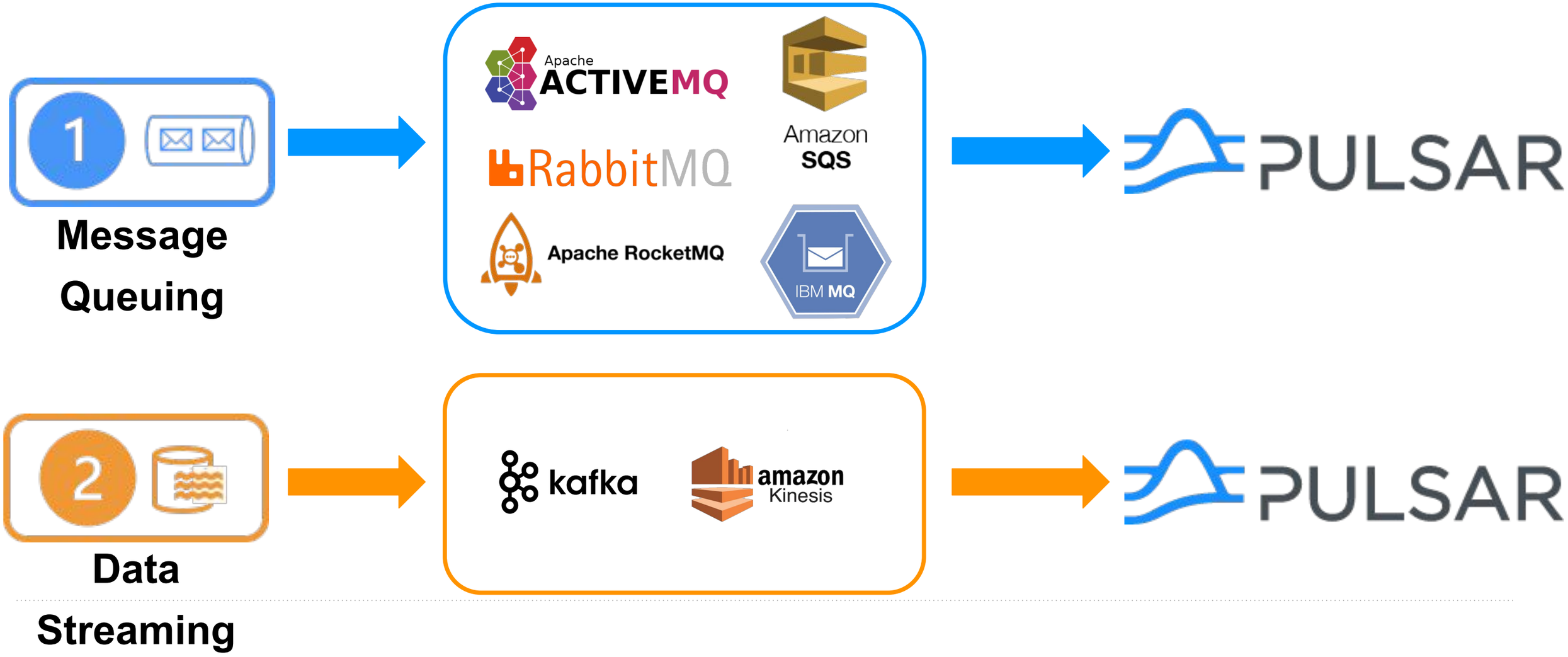


Unified Messaging Model



StreamNative

A Unified Messaging Platform



Stream Native Cloud

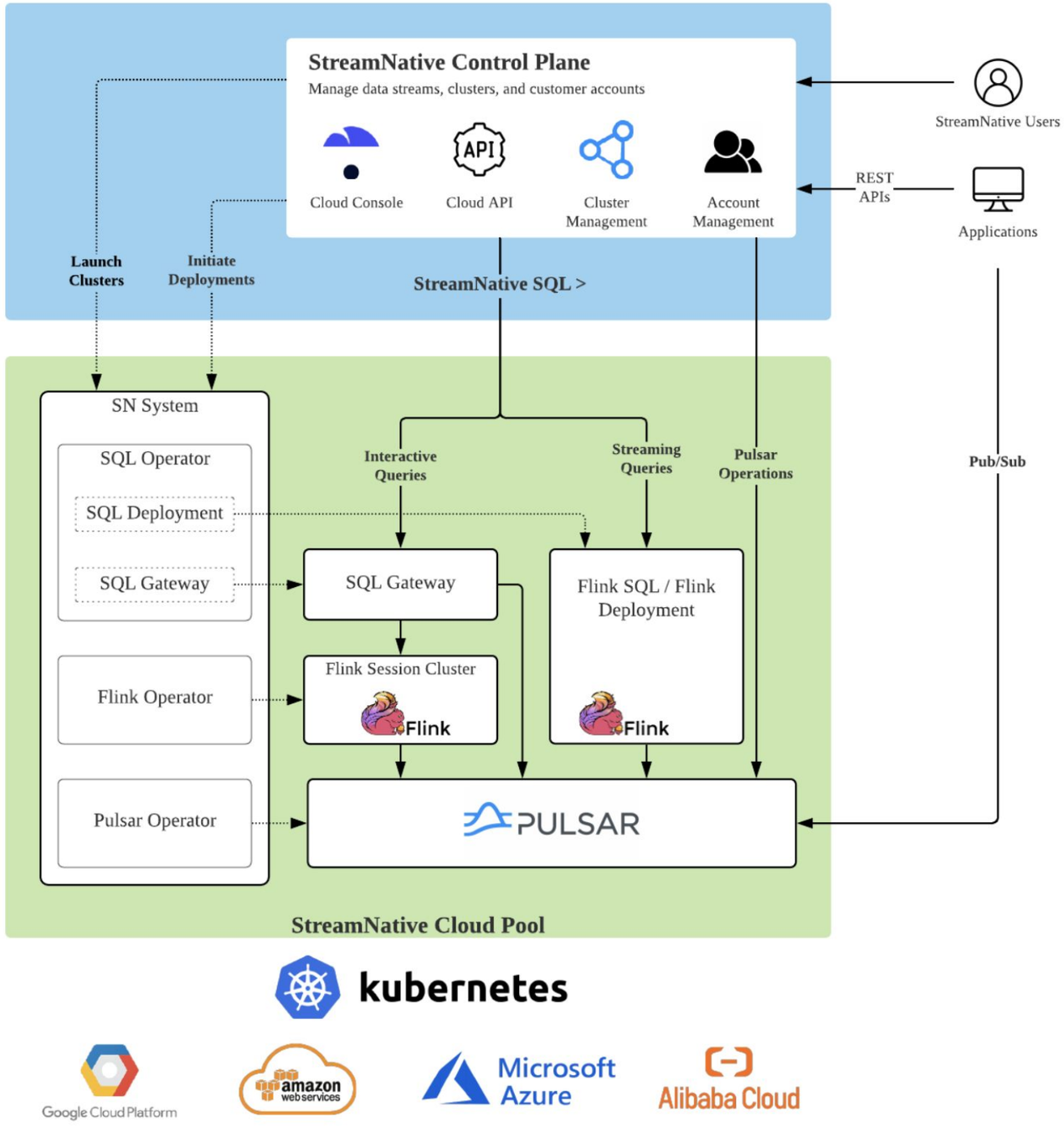
A cloud-native, real-time messaging and streaming platform to support multi-cloud and hybrid cloud strategies.

Powered by Pulsar

Built for Containers

Cloud Native

Flink SQL



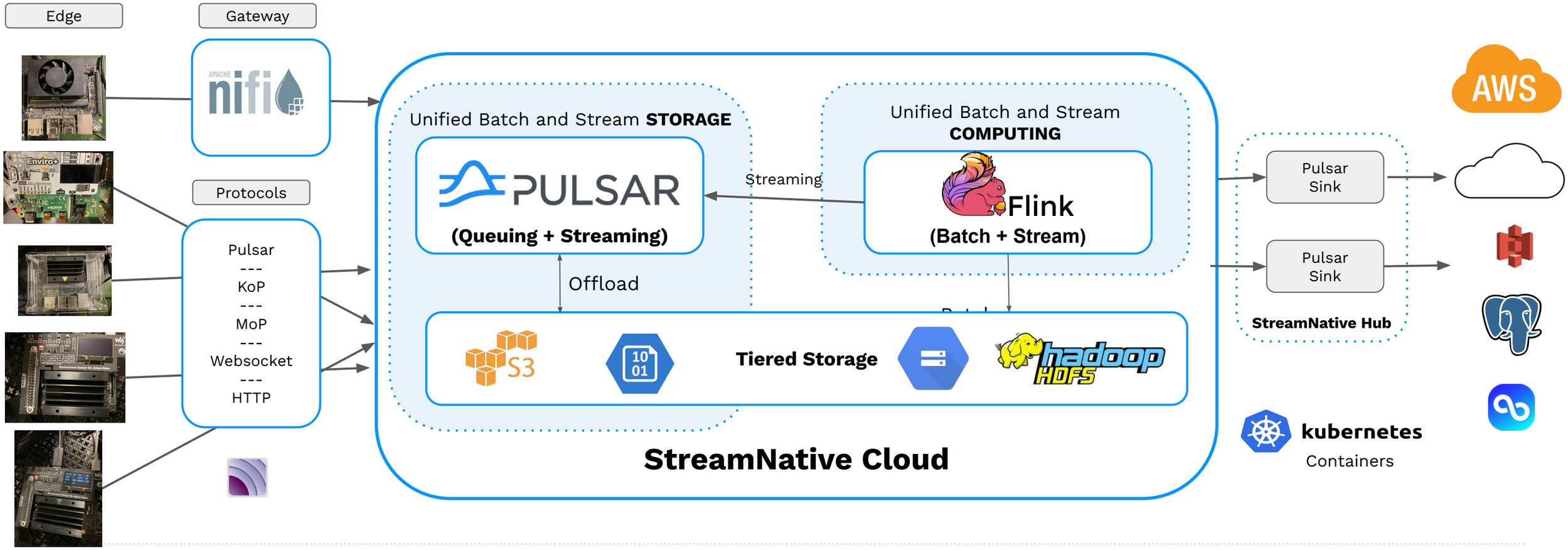

```
|    mqtt-python |
|       mqtt-rp4 |
|       my-topic |
| nvidia-kafka-1 |
|    rp4-kafka-1 |
|           rwar |
|          scada |
|         stocks |
|         stonks |
|        stonkss |
|  topic82547611 |
+----------------+
28 rows in set

Flink SQL> use catalog default_catalog;
[INFO] Execute statement succeed.

Flink SQL> show tables;
+------------+
| table name |
+------------+
|     scada2 |
|     stocks |
+------------+
2 rows in set

Flink SQL> exit;
[INFO] Exiting Flink SQL CLI Client...
```

Real-Time Streaming Application



StreamNative

Apache Pulsar - Cloud Storage Sink

- Ensure exactly-once delivery. Records, which are exported using a deterministic partitioner, are delivered with exactly-once semantics regardless of the eventual consistency of cloud storage.
- Support data formats with or without a Schema. The Cloud Storage sink connector supports writing data to objects in cloud storage in either Avro, JSON, or Parquet format. Generally, the Cloud Storage sink connector may accept any data format that provides an implementation of the Format interface.
- Support time-based partitioner. The Cloud Storage sink connector supports the TimeBasedPartitioner class based on the publishTime timestamp of Pulsar messages. Time-based partitioning options are daily or hourly.
- Support more kinds of object storage. The Cloud Storage sink connector uses jclouds as an implementation of cloud storage. You can use the JAR package of the jclouds object storage to connect to more types of object storage. If you need to customize credentials, you can register ‘org.apache.pulsar.io.jcloud.credential.JcloudsCredential` via the Service Provider Interface (SPI).

https://hub.streamnative.io/connectors/cloud-storage-sink/2.5.1/

Apache Pulsar - Other Sinks

- mongoDB 
- AWS Lambda 
- redis 
- AWS S3 
- GCS 

https://hub.streamnative.io/connectors/cloud-storage-sink/2.5.1/

SHOW ME THE DATA


```
{"ir": "252.0", "id": "20210914001822_5e4882ee-22d9-432c-9074-19f12be62006", "end":
"1631578962.03", "uuid": "nano_uuid_koo_20210914001822", "lux": "0", "gputemp": "26.0",
"cputemp": "25.5", "te": "259.676094055", "systemtime": "09/13/2021 20:22:42", "hum":
"52.31", "memory": 20.1, "gas": "29671.0", "pressure": "1013.62", "host":
"nano2gb-desktop", "diskusage": "33312.5 MB", "ipaddress": "192.168.1.170", "macaddress":
"1c:bf:ce:1a:7f:a0", "temp": "22.92", "uv": "0.01", "gputempf": "79.0", "host_name":
"nano2gb-desktop", "runtime": "260.0", "cpu": 3.8, "cputempf": "78.0"}
```

SHOW ME SOME DATA

DEEPER CONTENT

- https://github.com/tspannhw/FLiP-CloudIngest
- https://github.com/tspannhw/EverythingApacheNiFi
- https://github.com/tspannhw/CloudDemo2021
- https://github.com/tspannhw/StreamingSQLExamples
- https://www.linkedin.com/pulse/2021-schedule-tim-spann/
- https://www.pulsardeveloper.com/
- https://github.com/tspannhw/SpeakerProfile

Connect with the Community & Stay Up-To-Date

- Join the Pulsar Slack channel - *Apache-Pulsar.slack.com*
- Follow @streamnativeio and @apache_pulsar on Twitter
- Subscribe to Monthly Pulsar Newsletter for major news, events, project updates, and resources in the Pulsar community

PULSAR SUMMIT

Pulsar Summit Europe

October 6, 2021

Pulsar Summit Asia

November 20-21, 2021

Contact us at partners@pulsar-summit.org to become a sponsor or partner

Q&A