

Tim Spann, Developer Advocate

안녕하세요

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# Pulsar Summit Asia 2021

Xin chào

November 20-21, 2021

Apache Pulsar with MQTT for Edge  
Computing

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**Tim Spann**  
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- <https://www.datainmotion.dev/>
- <https://github.com/tspannhw/SpeakerProfile>
- <https://dev.to/tspannhw>
- <https://sessionize.com/tspann/>



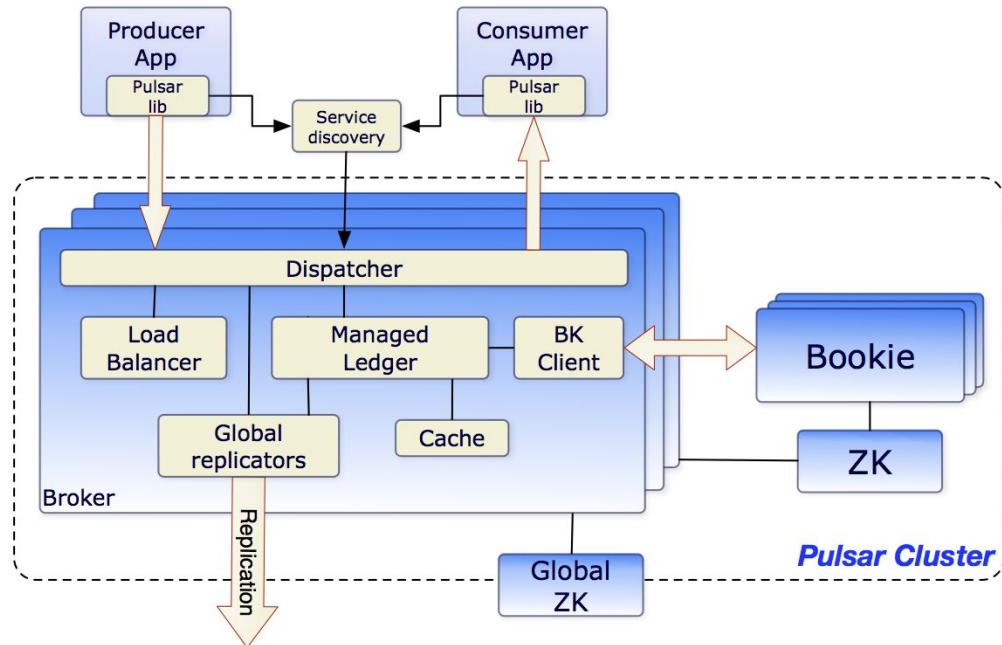
# A Unified Messaging Platform



# Apache Pulsar Overview

## 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
  - ...



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# Edge Computing Environments

*Characteristics, Challenges, &  
Opportunities*

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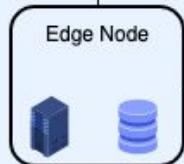
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CLOUD



EDGE

Service delivery  
Computing offload  
IoT management  
Storage & caching



Edge Node

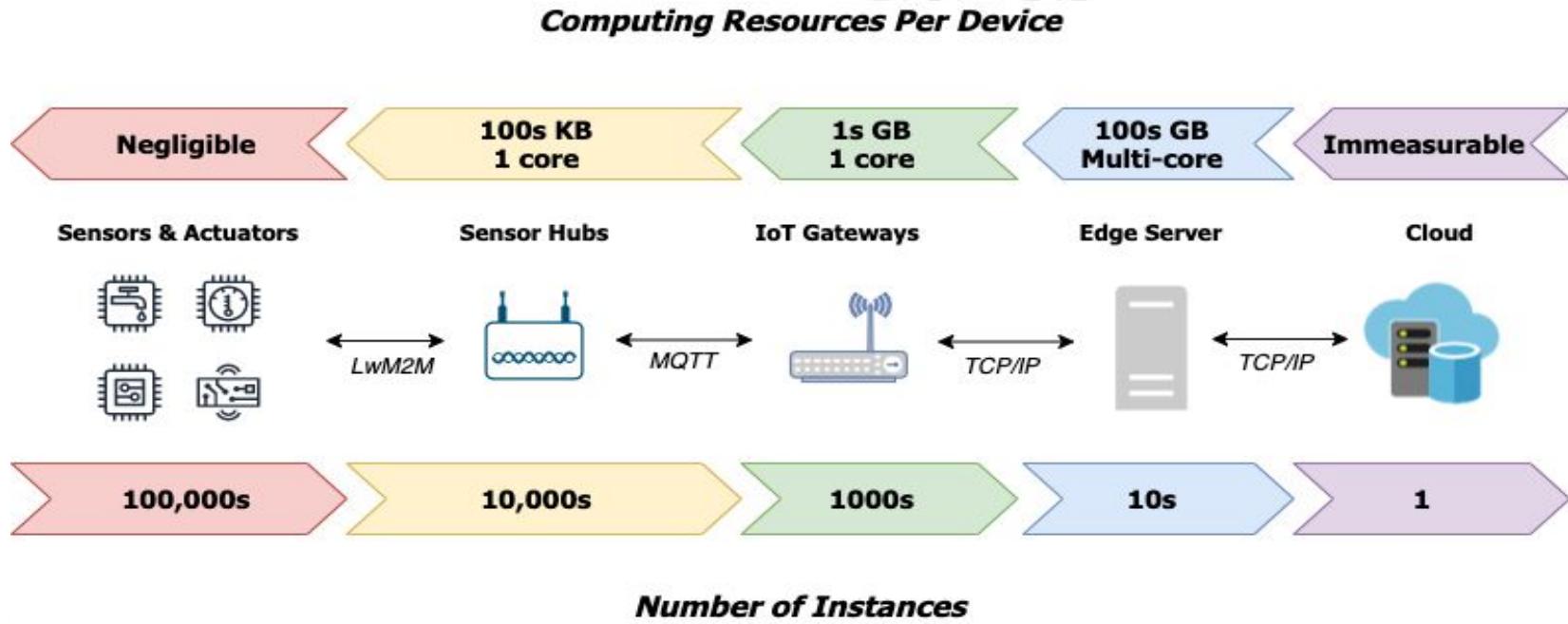
Edge Node



# Edge Computing

- Any computation happening outside the cloud at the edge of the network
  - Operates on real-time data generated by sensors or users
  - Improves response times in applications where real-time processing of data is required

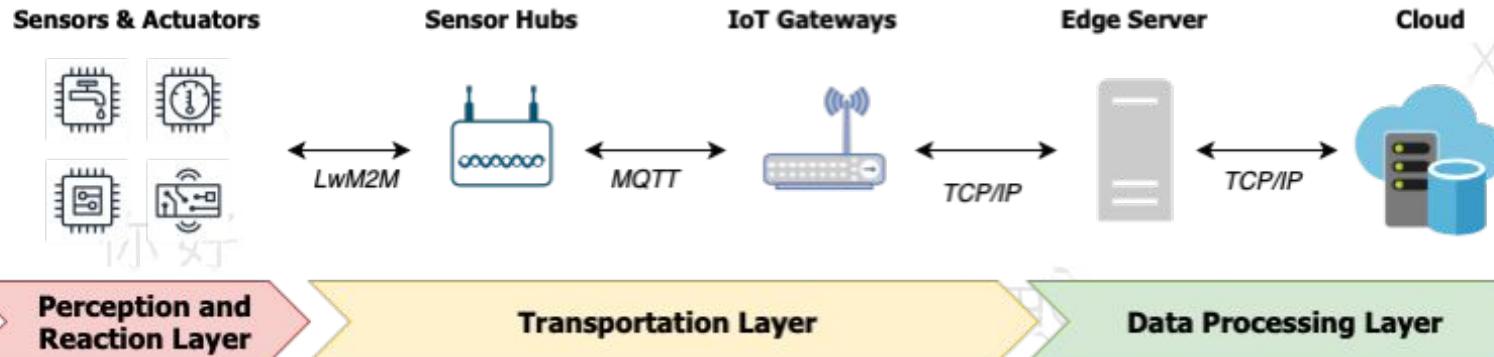
# Edge Computing Topology



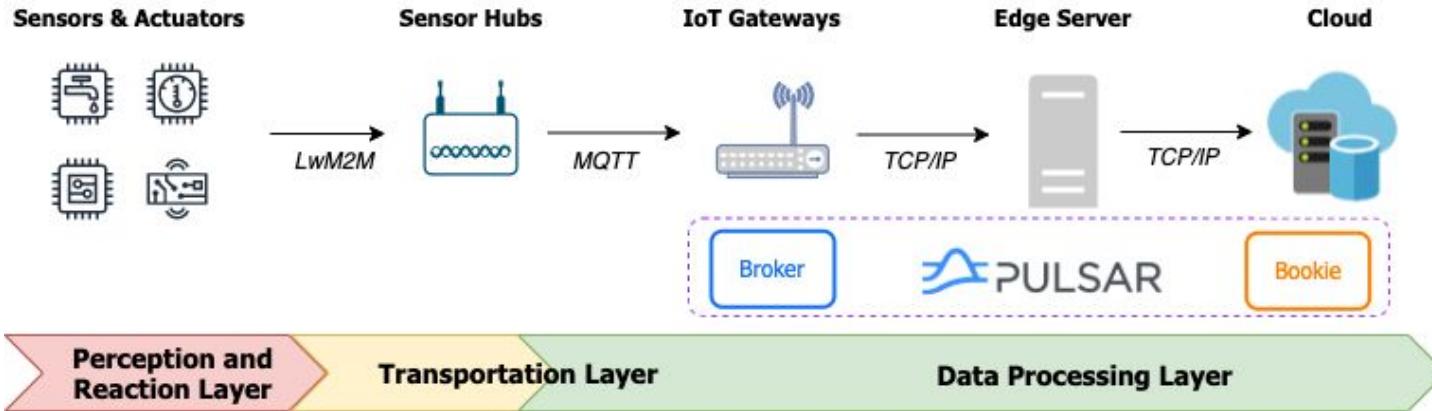
**Note:** There is an inverse relationship between computational resources and proximity to the data source.

# Logical Layers

- The perception layer is responsible for perceiving the physical conditions of the physical environment as sensed through numerous sensors.
- The transportation layer delivers the signals from the perception layer to the data processing layer and acts as a bridge between short-range and long-range communication protocols.
- The data processing layer performs the filtering, aggregation, and more complex analytical processing including **machine learning**.



# Edge Computing with Pulsar



- Apache Pulsar's two-tier architecture separates the compute and storage layers, and interact with one another over a TCP/IP connection. This allows us to run the computing layer (Broker) on either Edge servers or IoT Gateway devices.
- Pulsar's serverless computing framework, known as Pulsar Functions, can run inside the Broker as threads. Effectively “stretching” the data processing layer.

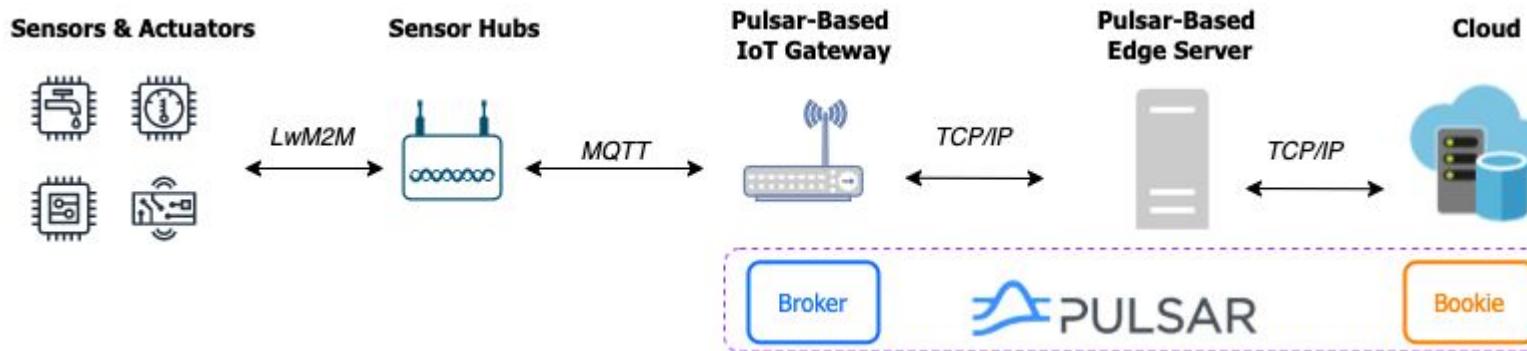
# Benefits of Running Pulsar Broker on the Edge

Step 1

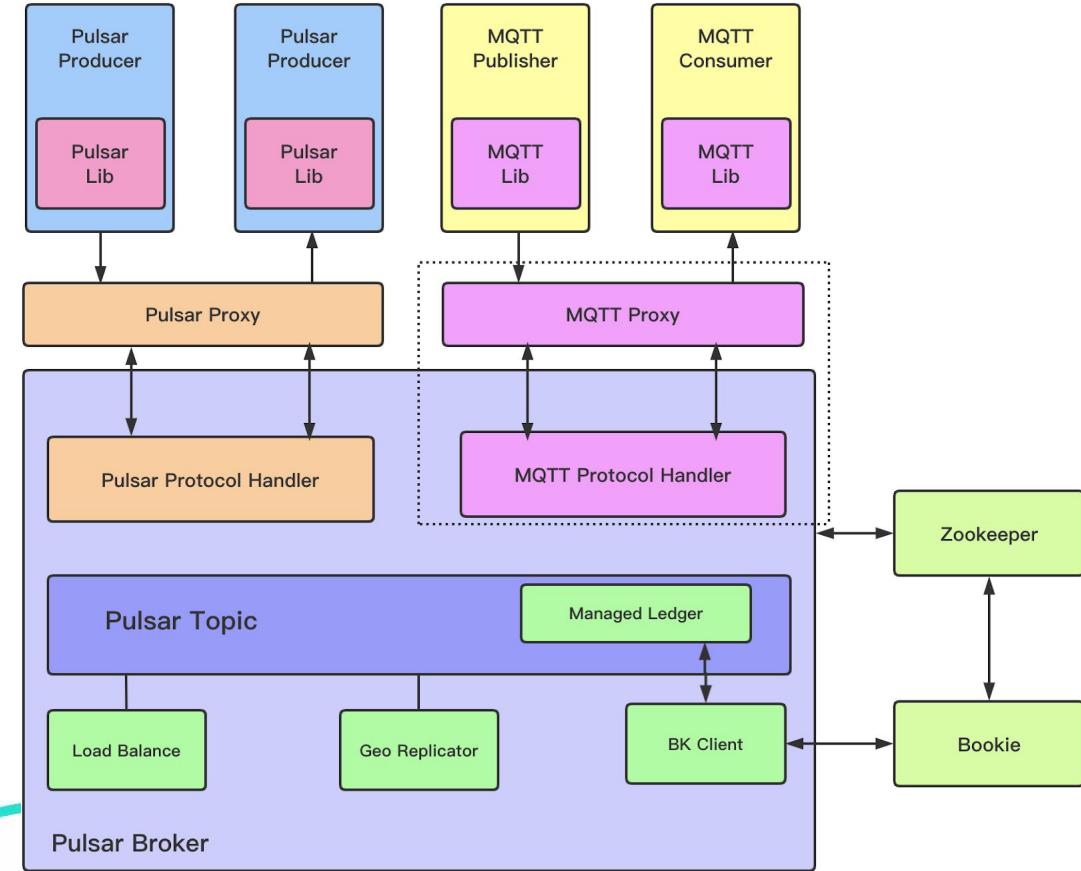
Pulsar's Serverless computing framework can run inside the Pulsar Broker as a thread pool. This framework can be used as the execution environment for ML models.

Step 2

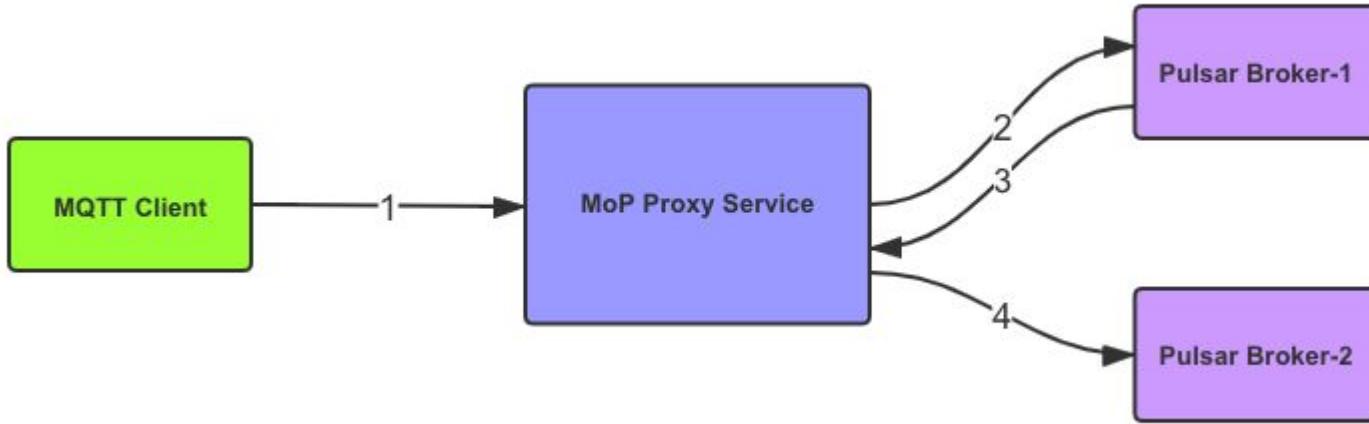
The Apache Pulsar Broker supports the MQTT protocol and therefore can directly receive incoming data from the sensor hubs and store it in a topic.



# MQTT on Pulsar (MoP)



# MQTT on Pulsar (MoP)



你好

<https://streamnative.io/blog/tech/2020-09-28-announcing-mqtt-on-pulsar/>

```
import paho.mqtt.client as mqtt

row = {}
row['gasKO'] = str(readings)
json_string = json.dumps(row)

client = mqtt.Client("rpi4-iot")
client.connect("pulsarcluster", 1883, 180)
client.publish("persistent://public/default/mqtt-2", payload=json_string, qos=0, retain=True)
```

<https://github.com/streamnative/mop>

<https://github.com/tspannhw/FLiP-InfluxDB>

# MQTT on Pulsar (MoP) Configuration

```
messagingProtocols= mqtt
```

```
# directory  
protocolHandlerDirectory=./protocols
```

```
#mqtt 3.1.1 - port / ip  
mqttListeners=mqtt://127.0.0.1:1883  
advertisedAddress=127.0.0.1
```

# Ingesting IoT Data via Java Pulsar

```
UUID uuidKey = UUID.randomUUID();
String pulsarKey = uuidKey.toString();
String OS = System.getProperty("os.name").toLowerCase();
String message = "" + jct.message;
IoTMessage iotMessage = parseMessage("" + jct.message);
String topic = DEFAULT_TOPIC;
if ( jct.topic != null && jct.topic.trim().length()>0 ) {
    topic = jct.topic.trim();
}
ProducerBuilder<IoTMessage> producerBuilder = client.newProducer(JSONSchema.of(IoTMessage.class))
    .topic(topic)
    .producerName("jetson")
    .sendTimeout(5, TimeUnit.SECONDS);

Producer<IoTMessage> producer = producerBuilder.create();

MessageId msgID = producer.newMessage()
    .key(iotMessage.getUuid())
    .value(iotMessage)
    .send();
```

<https://github.com/tspannhw/StreamingAnalyticsUsingFlinkSQL/>

# Query Your Topics with Pulsar SQL (Trino)

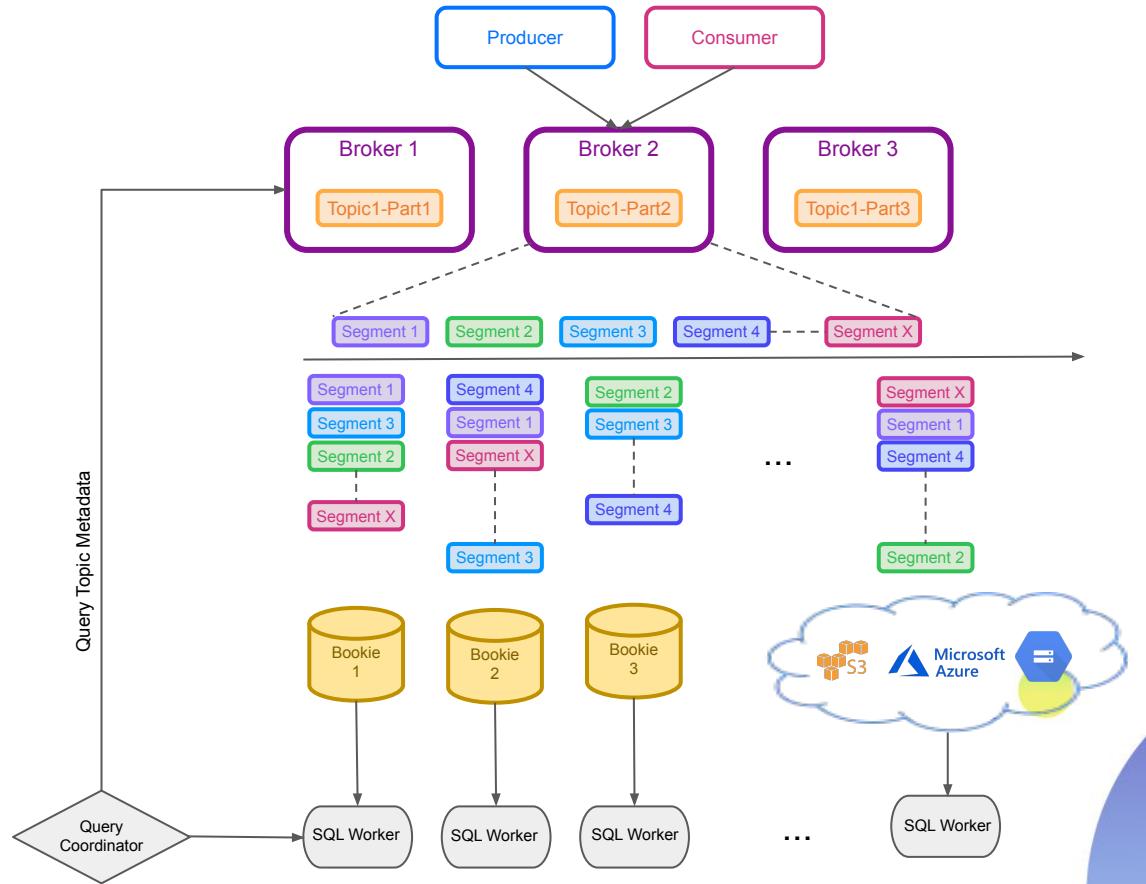
```
presto> select camera, cpu, cputempf, gputempf, memory, top1, top1pct, uuid, __publish_time__, __message_id__, __key__ from pulsar."public/default".iotjetsonjson;
      camera |   cpu | cputempf | gputempf |   memory |      top1 |    top1pct |        uuid | __publish_time__ | __message_id__ | __key__
-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
/dev/video0 |  8.7 |   82 |  82 |  33.5 | microphone, mike | 18.85986328125 | xav_uuid_video0_lgl_20211001183019 | 2021-10-01 14:30:30.657 | (564,3,0) |
/dev/video0 |  8.7 |   82 |  82 |  33.6 | microphone, mike | 19.22607421875 | xav_uuid_video0_kpt_20211001183033 | 2021-10-01 14:30:44.380 | (564,4,0) |
/dev/video0 | 12.0 |   80 |  81 |  33.5 | microphone, mike | 12.53662109375 | xav_uuid_video0_gzd_20211001182930 | 2021-10-01 14:29:48.756 | (564,0,0) |
/dev/video0 |  8.5 |   82 |  82 |  33.6 | microphone, mike |          14.0625 | xav_uuid_video0_wlw_20211001182951 | 2021-10-01 14:30:02.919 | (564,1,0) |
/dev/video0 |  8.5 |   82 |  82 |  33.5 | microphone, mike |       29.8828125 | xav_uuid_video0_ulq_20211001183005 | 2021-10-01 14:30:16.787 | (564,2,0) |
5 rows)
[END]
```

```
presto> show tables in pulsar."public/default";
      Table
-----
generator_test
iotjetsonjson
mqtt-2
(3 rows)
```

```
Query 20211001_054538_00008_s8x23, FINISHED, 1 node
Splits: 19 total, 19 done (100.00%)
0:00 [3 rows, 105B] [14 rows/s, 493B/s]
```

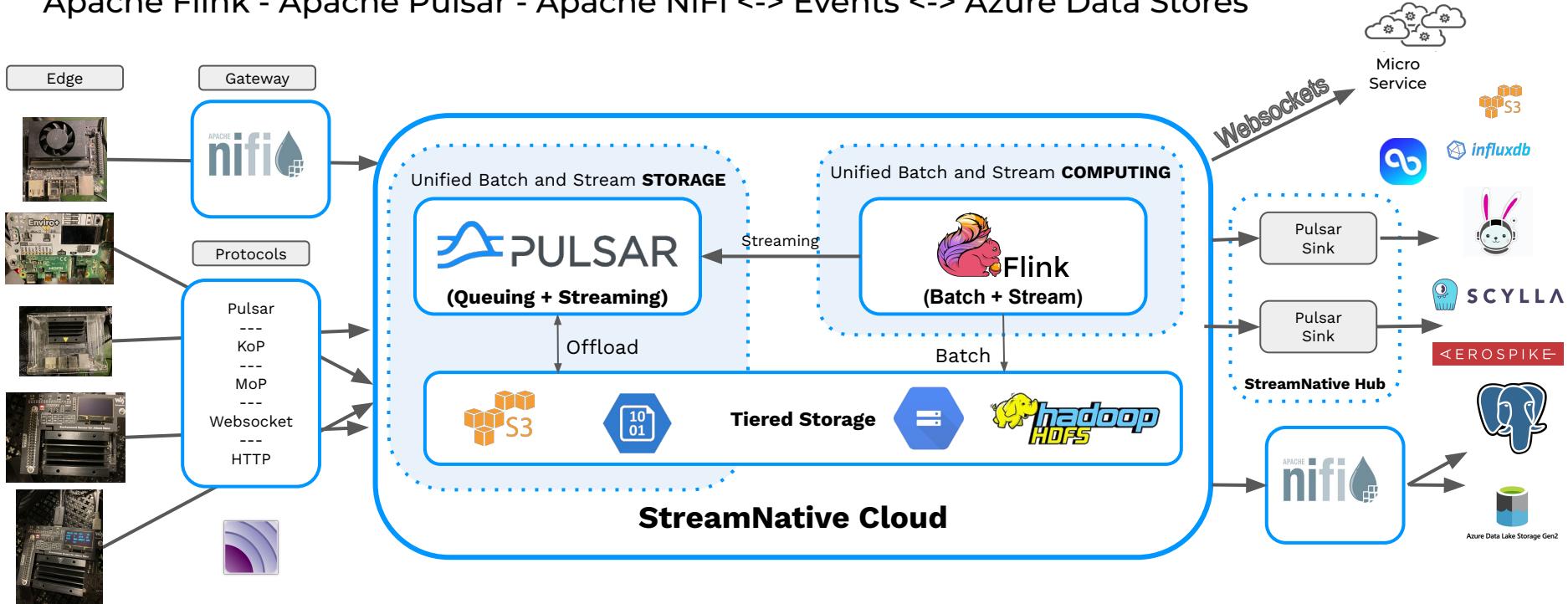
# Pulsar SQL

Presto/Trino workers can read segments directly from bookies (or offloaded storage) in parallel.



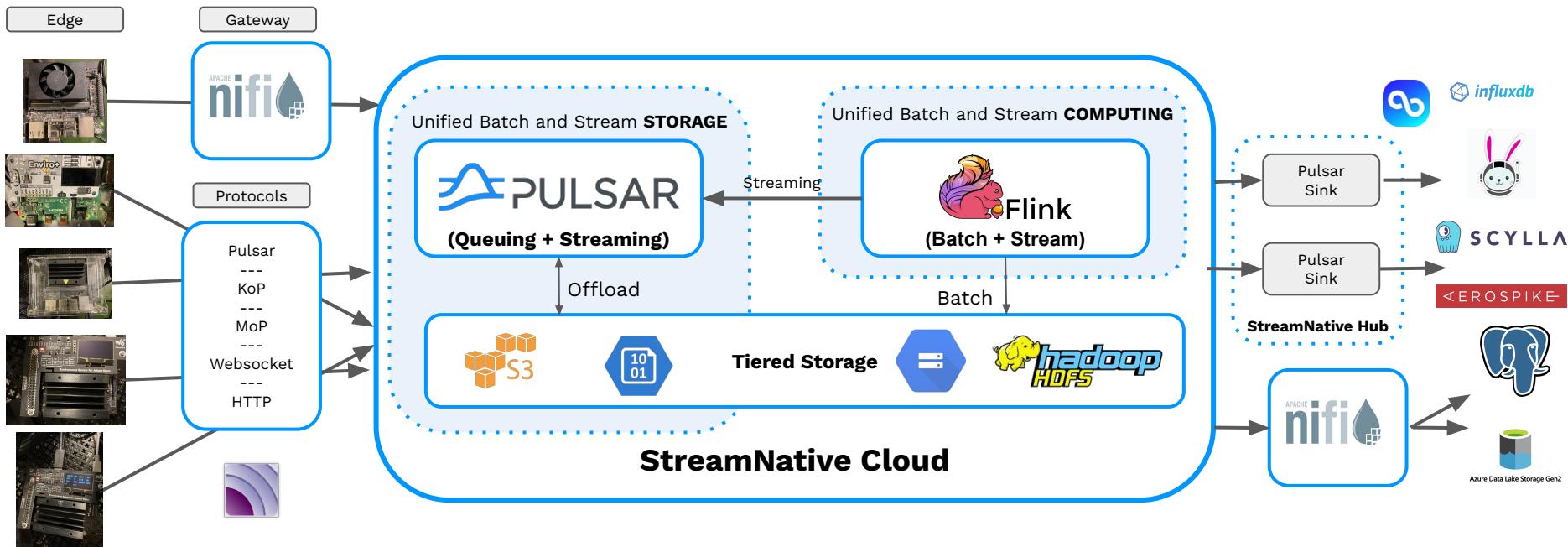
# End-to-End Streaming FLiP(N) Apps

Apache Flink - Apache Pulsar - Apache NiFi <-> Events <-> Azure Data Stores



# End-to-End Streaming FLiP(N) IoT Apps

Apache Pulsar - Apache NiFi - MiNiFi <-> Events/Messages <-> Data Stores



# Using NVIDIA Jetson Devices With Pulsar

<https://dev.to/tspannhw/unboxing-the-most-amazing-edge-ai-device-part-1-of-3-nvidia-jetson-xavier-nx-595k>

<https://github.com/tspannhw/minifi-xaviernx/>

<https://github.com/tspannhw/minifi-jetson-nano>

<https://github.com/tspannhw/Flip-iot>

<https://www.datainmotion.dev/2020/10/flank-streaming-edgeai-on-new-nvidia.html>

<https://github.com/tspannhw/FLiP-Mobile/blob/30bcc1ec98fc31e039b51a06180d98545c1e0542/python3/enviro.py>

<https://github.com/tspannhw/StreamingAnalyticsUsingFlinkSQL>



# NVIDIA Device

	Domain	Pro
	persistent	

### New Topic

Domain

Persistent  Non-persistent

\* Topic Name

\* Partitions

**Confirm** **Cancel**

# Example IoT App

```
#!/bin/bash

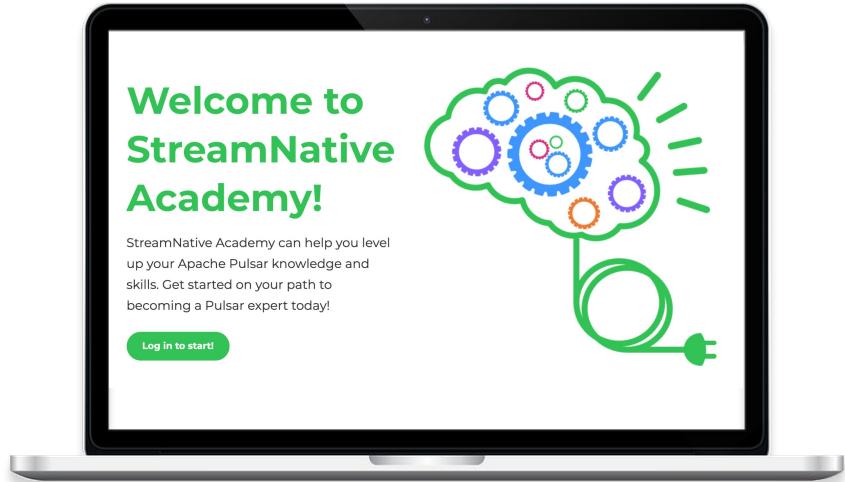
while :
do
    DATE=$(date +"%Y-%m-%d_%H%M")
    python3 -W ignore demo.py --camera /dev/video0 --network
        googlenet images/$DATE.jpg 2>/dev/null

done
```



# Now Available On-Demand Pulsar Training

[Academy.StreamNative.io](https://Academy.StreamNative.io)



Platform Engineer [Remote]

San Francisco

Platform Engineer (Flink/Spark) [Remote]

San Francisco

Product Engineer - Cloud [Remote]

San Francisco

Platform Engineer (Flink/Spark) [Remote]

San Francisco

Product Engineer - Cloud [Remote]

San Francisco

Sr. Product Manager [Remote]

San Francisco

# We're Hiring

[streamnative.io/careers/](https://streamnative.io/careers/)



StreamNative

# Connect with the Community & Stay Up-To-Date

- Join the Pulsar Slack channel - [Apache-Pulsar.slack.com](https://Apache-Pulsar.slack.com)
- Follow [@streamnativeio](https://twitter.com/streamnativeio) and [@apache\\_pulsar](https://twitter.com/apache_pulsar) on Twitter
- [Subscribe](#) to Monthly Pulsar Newsletter for major news, events, project updates, and resources in the Pulsar community

# Interested In Learning More?



## Resources

[Flink SQL Cookbook](#)

[The Github Source for Flink SQL Demo](#)

[The GitHub Source for Demo](#)



## Free eBooks

[Manning's Apache Pulsar in Action](#)

[O'Reilly Book](#)



## Upcoming Events

- [Pulsar Summit North America](#)
- [Pulsar Summit Europe](#)
- [Pulsar Summit Asia](#)



StreamNative

# Let's Keep in Touch!



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Developer Advocate



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<https://www.linkedin.com/in/timothyspann>



<https://github.com/tspannhw>



<https://bit.ly/32dAJft>



# FLIP Stack Weekly

This week in Apache Flink, Apache Pulsar, Apache NiFi, Apache Spark and open source friends.

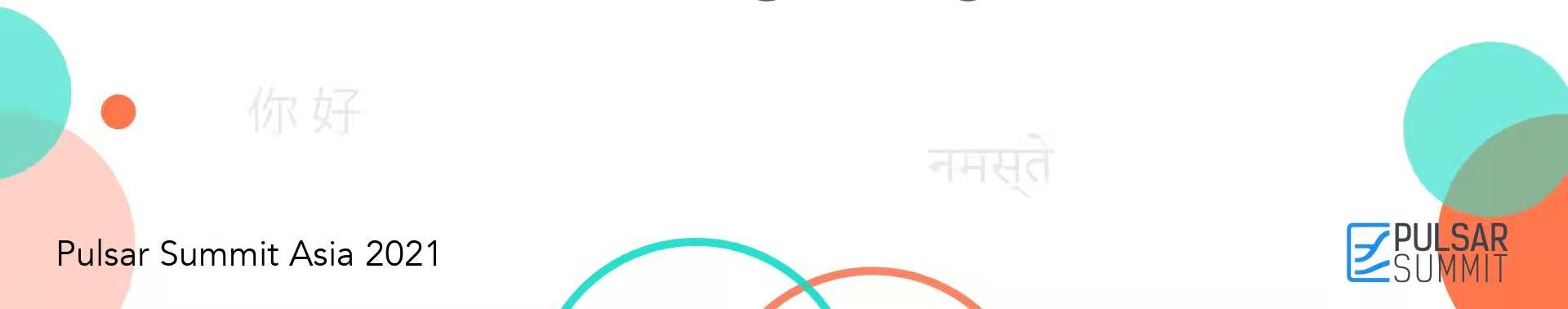
<https://bit.ly/32dAJft>



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THANK YOU FOR  
WATCHING



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Pulsar Summit Asia 2021

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SUMMIT