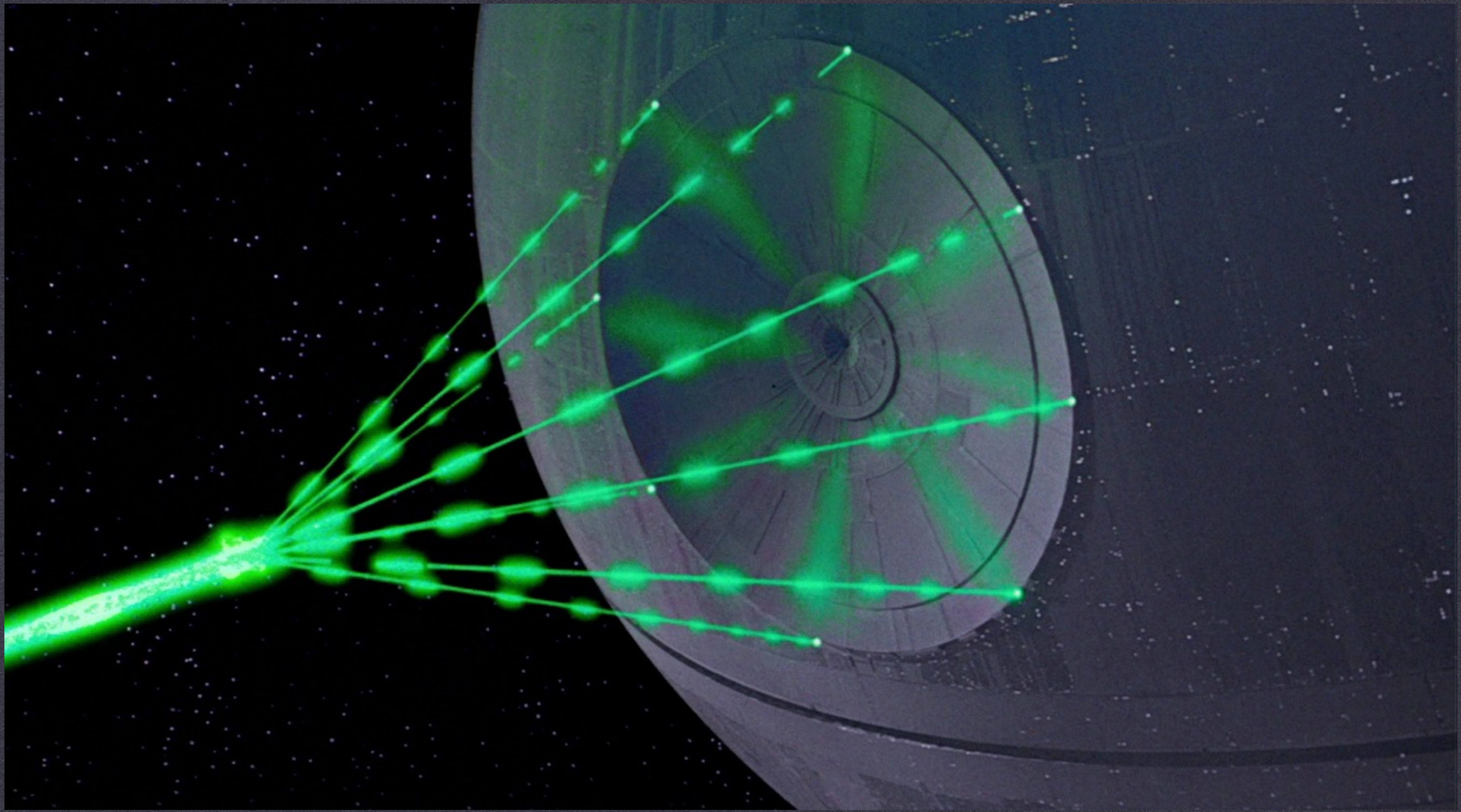

SerIoTics

Serialization metrics in an Internet of Things environment

SHAUN DONACHY

```
{“minType":"BATHROOM",
“majType”:"HUMANITARIAN,
“major_area_num”:19,
“minor_area_num":436,
“quantity”:3.7826,
“unique_id":1000,
“runtime":1443200834318,
“item_sensed”:"toilet",
“subject_measured”:"water",
“sensor_location_name”:"bathroom",
"ticks_since_turn_on":2}
```

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```

JSON message
~ 265 bytes

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```

JSON message
~ 265 bytes

ProtoBuf Byte Array
~ 69 bytes

Avro Byte Array
~ 58 bytes

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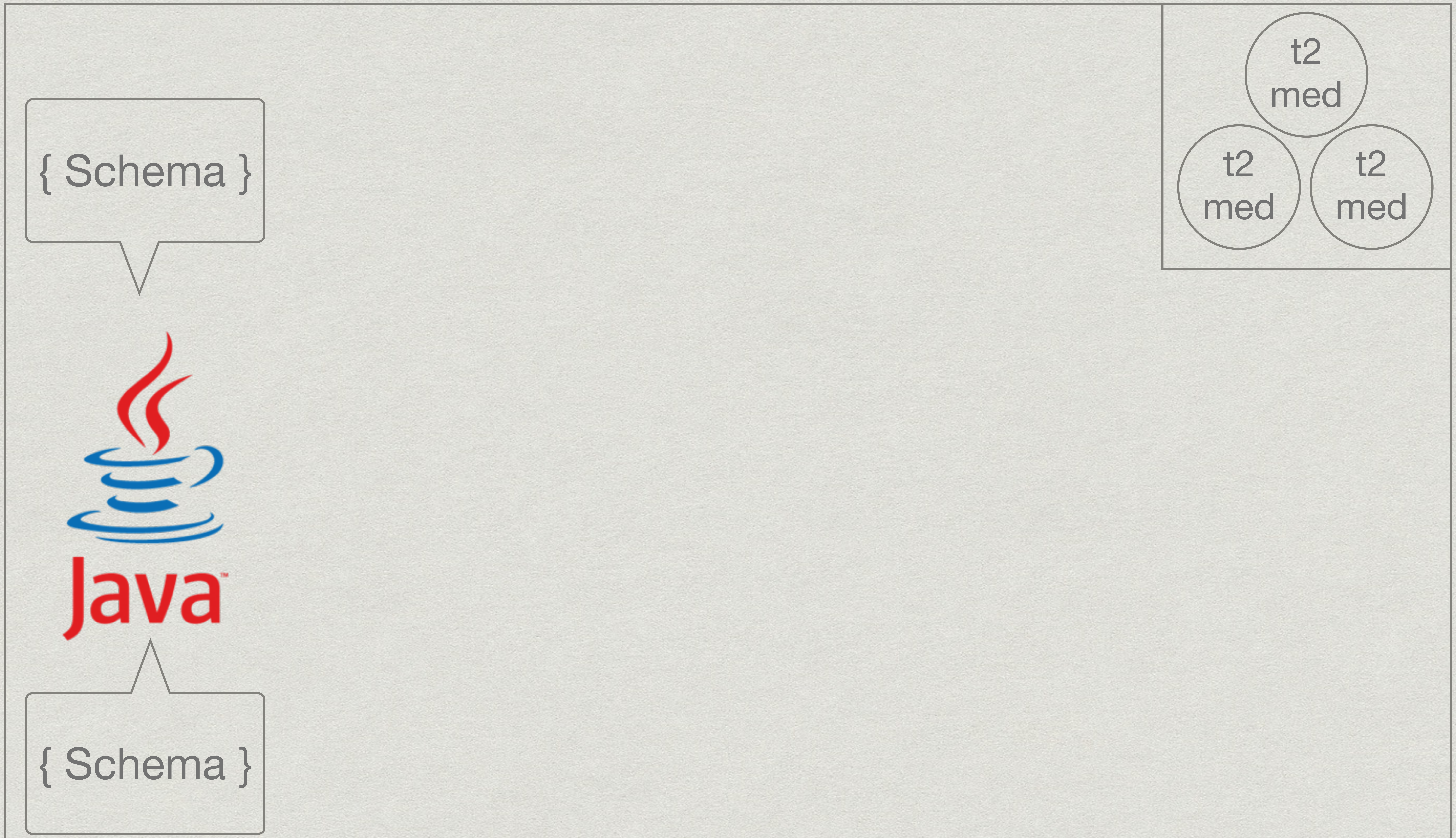
```

JSON message
~ 265 bytes

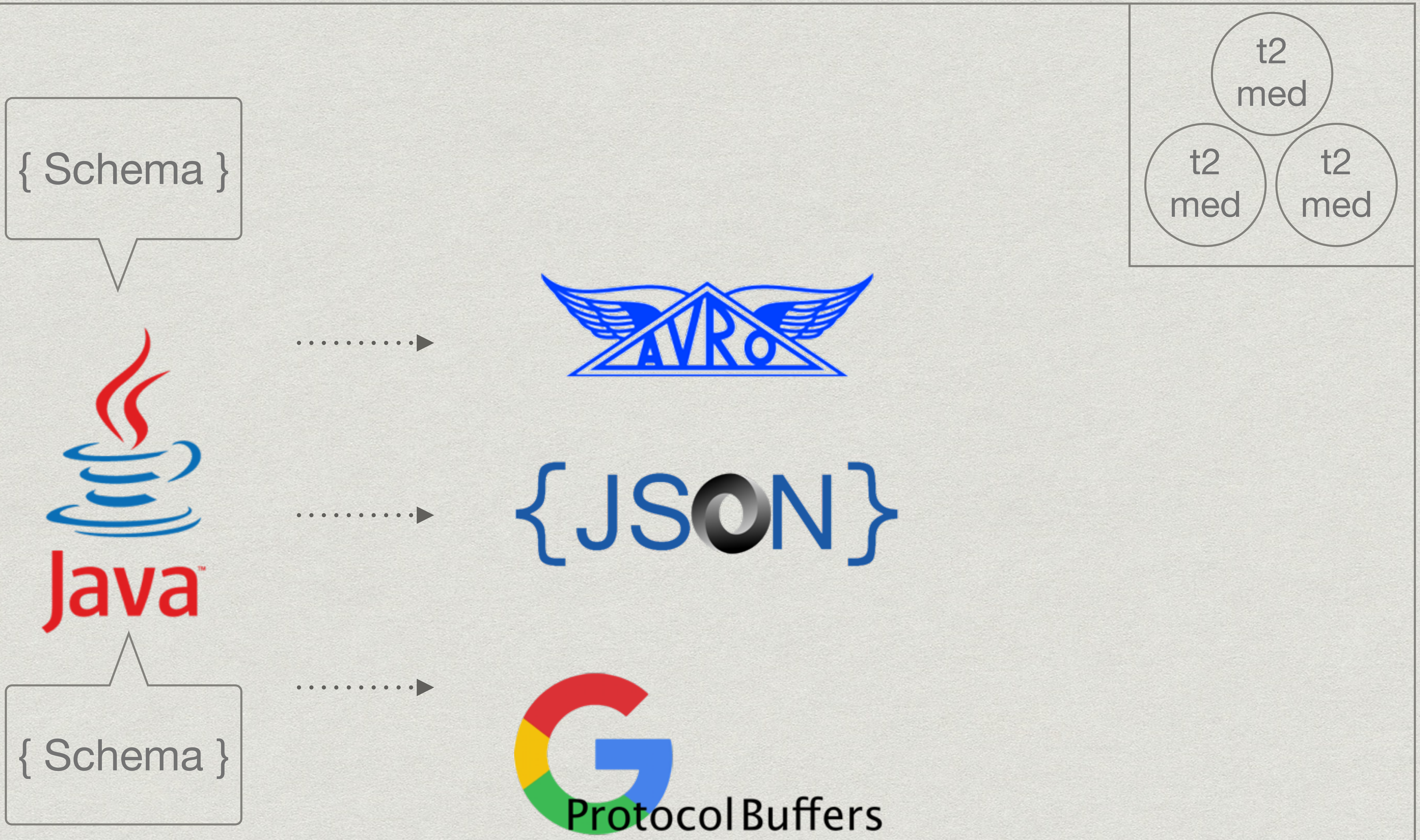
ProtoBuf Byte Array
~ 69 bytes

Avro Byte Array
~ 58 bytes

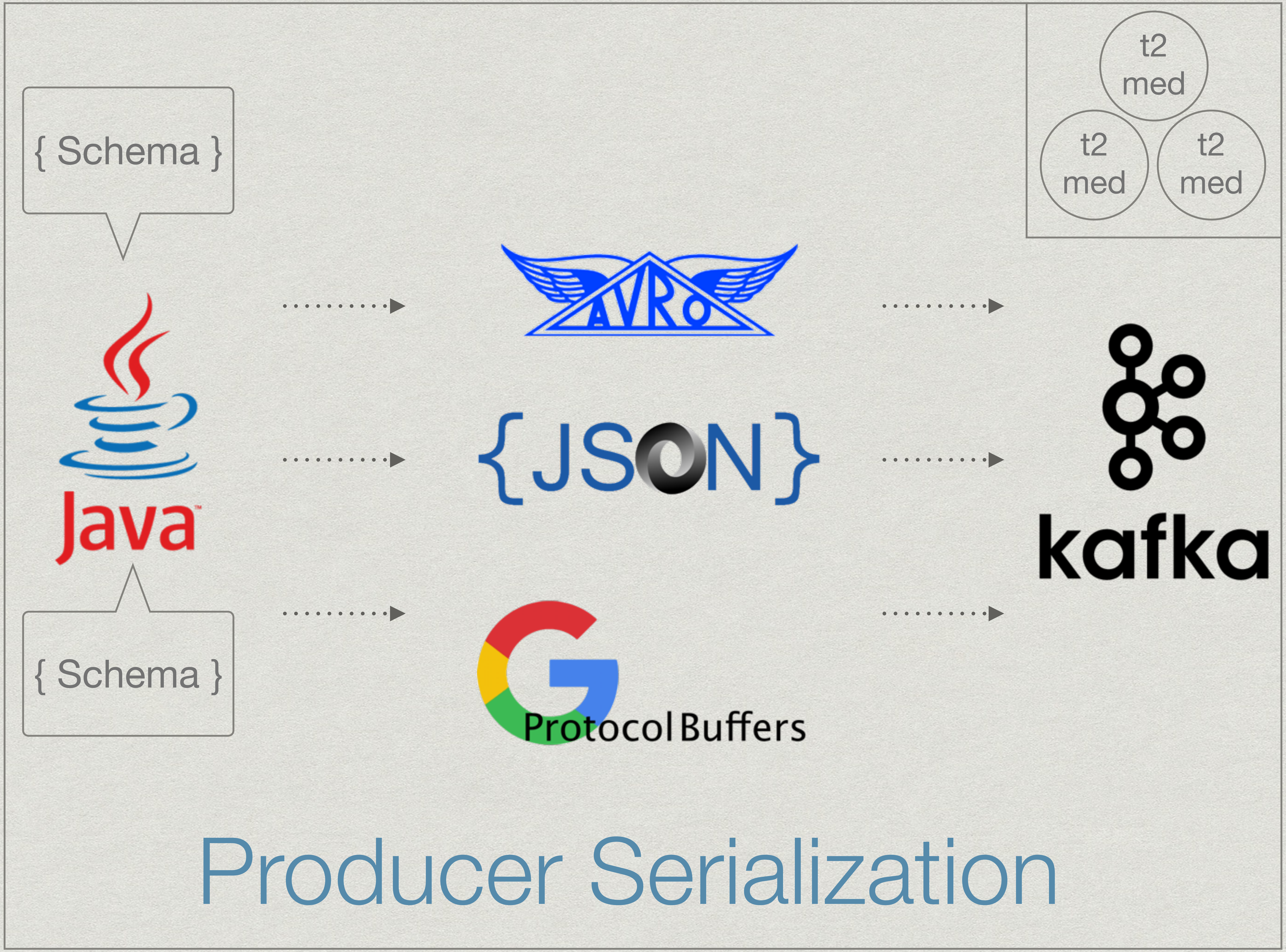
Avro Byte Array with schema header
~ 540 bytes



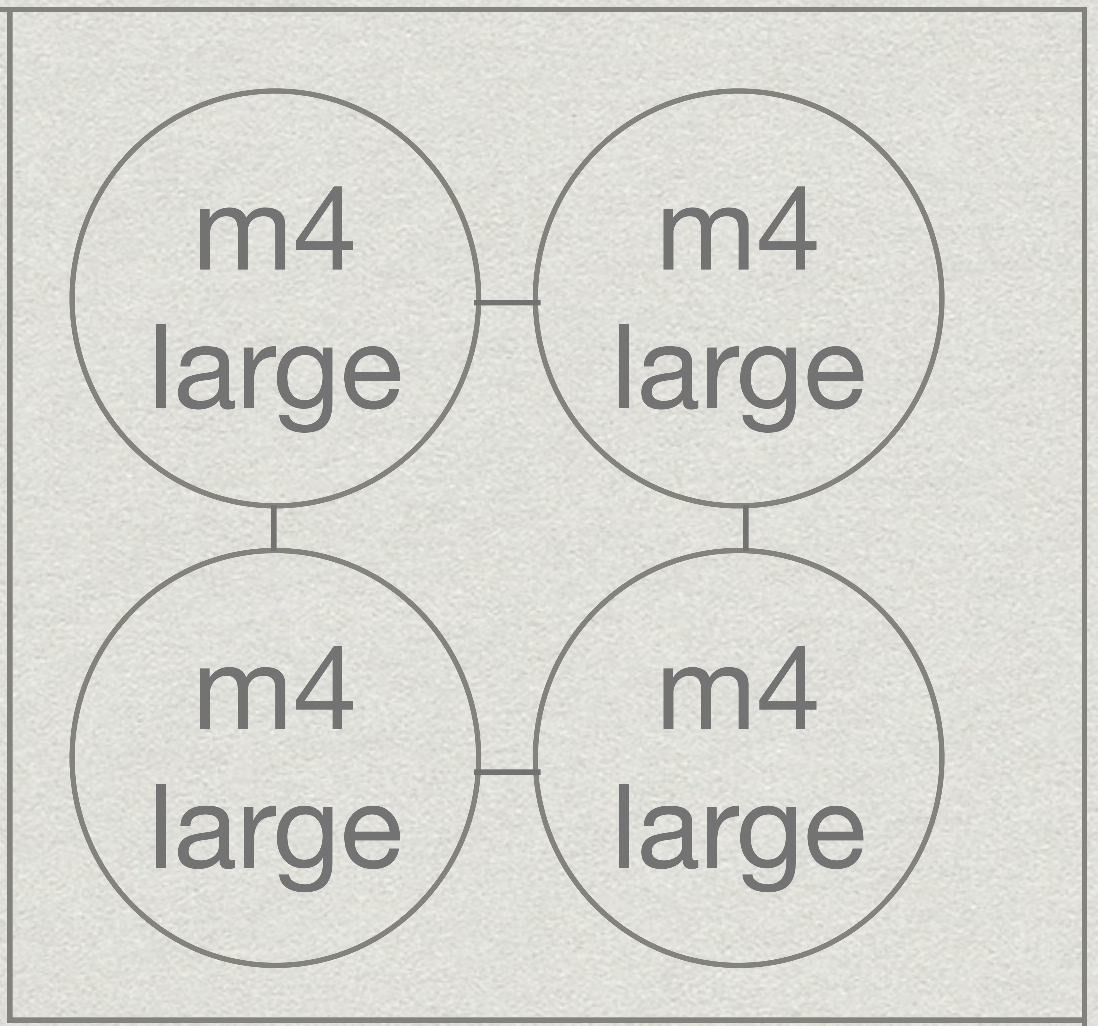
Producer Serialization



Producer Serialization



Producer Serialization

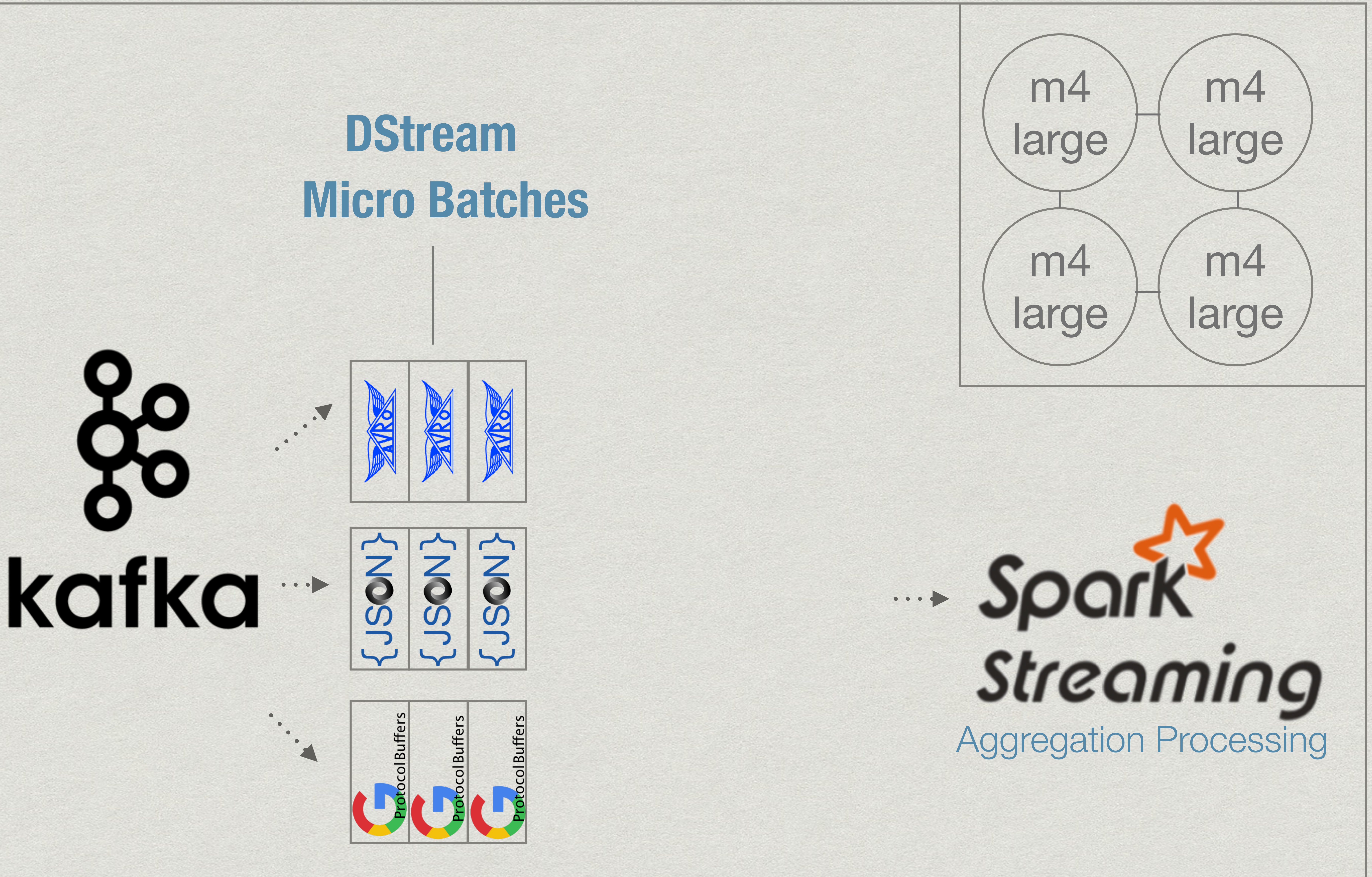


kafka

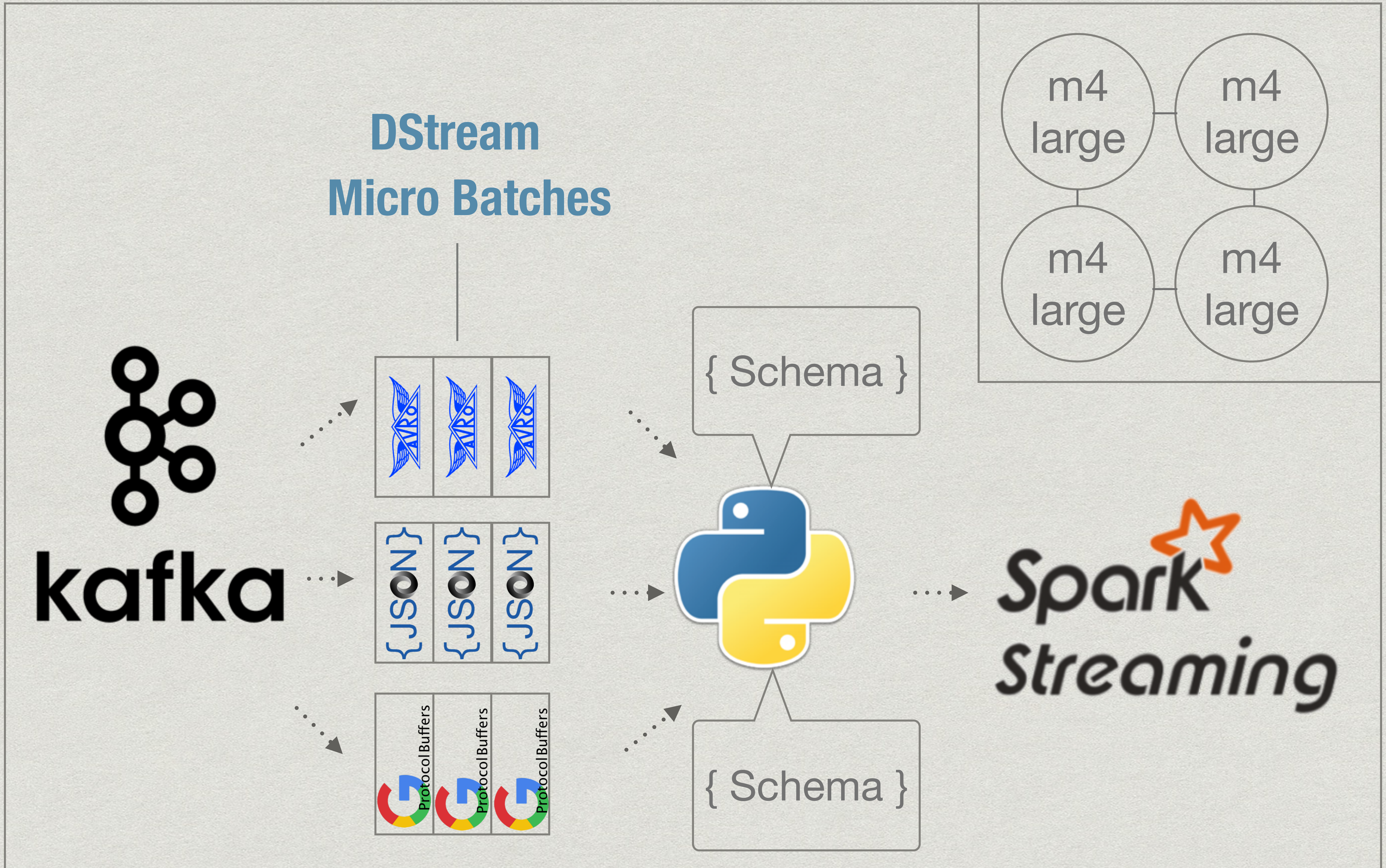
Spark Streaming

Aggregation Processing

Consumer Deserialization

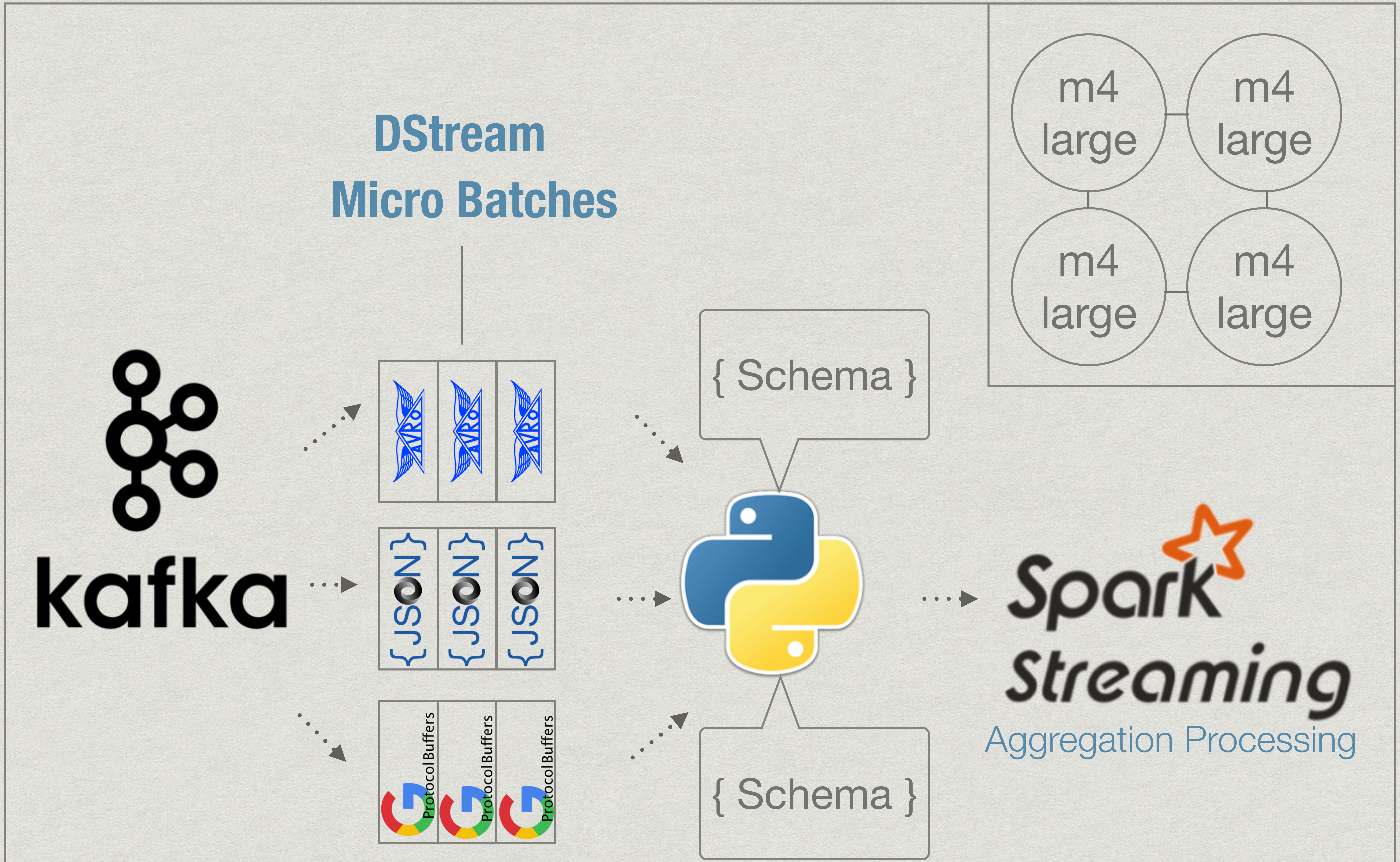


Consumer Deserialization

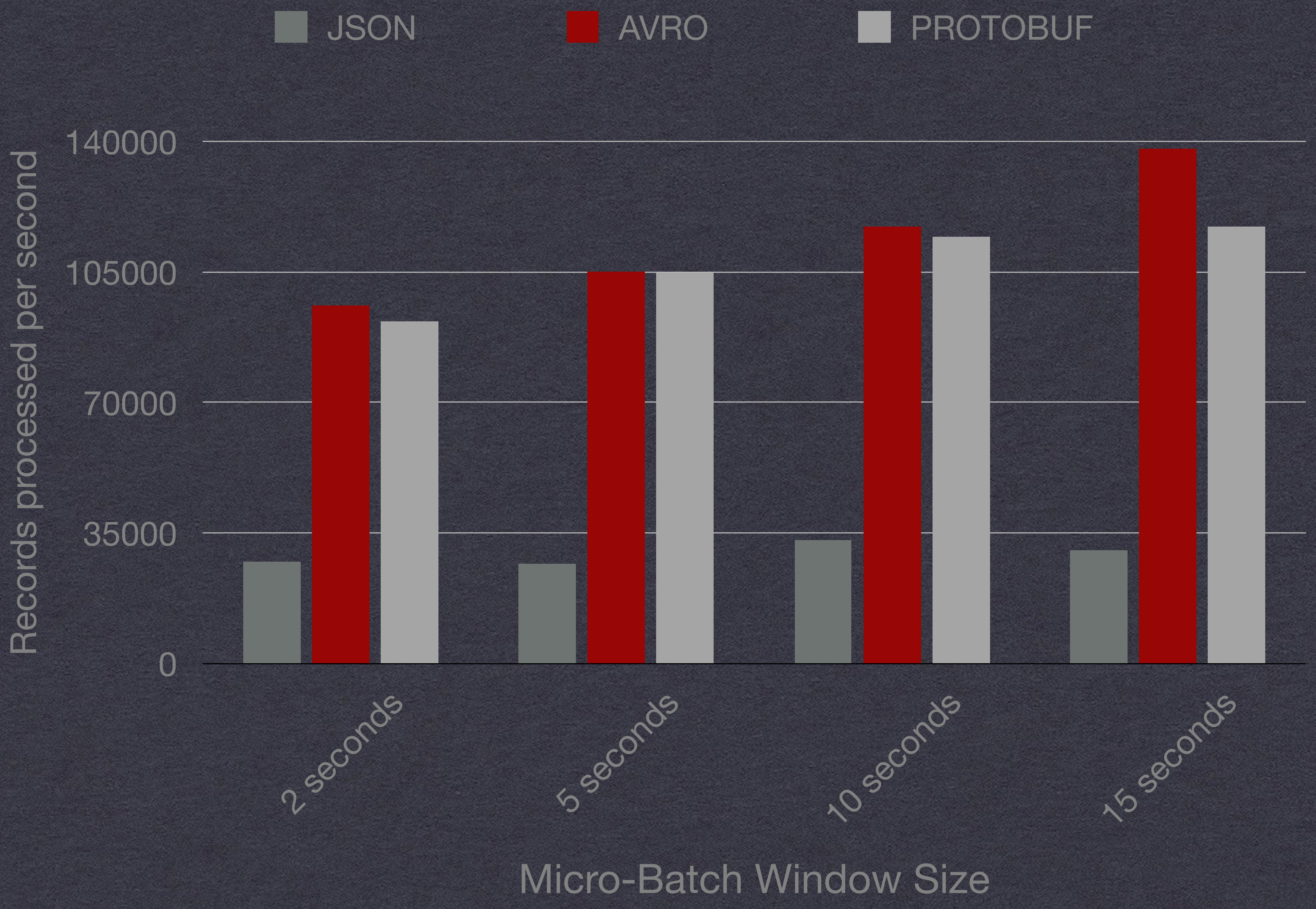


Consumer Deserialization

Consumer Deserialization



COMPARISON OF SERIALIZATION AND BATCH SIZE
3 instances, 3 JVMs per instance



Challenges

- Serializing in Java and de-serializing in Python - no docs
- Java kafka producer API is new - conflicting docs
- Computing throughput
- Debugging in Pyspark
- Parallel reads with receiver-based consumer

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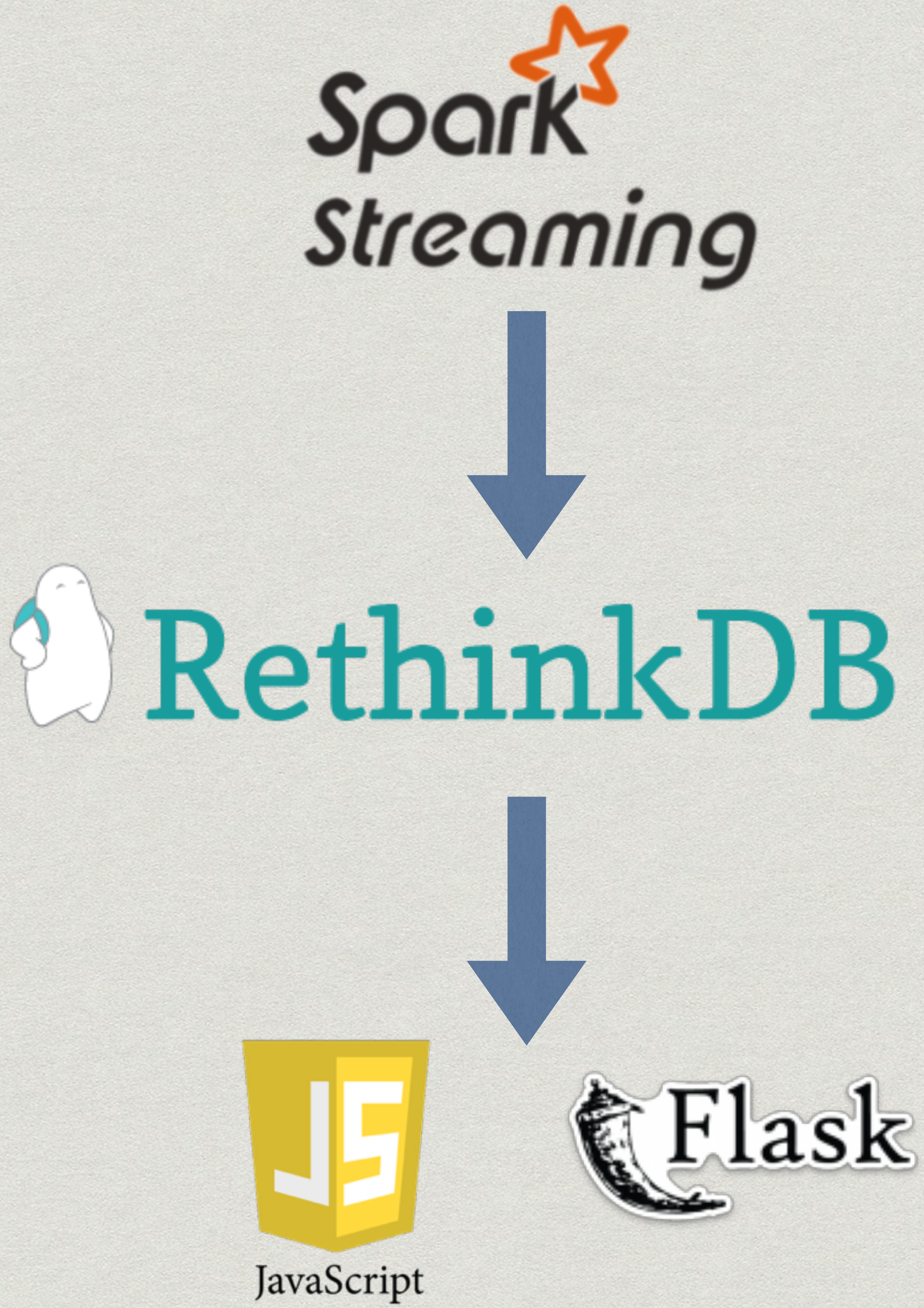
VCU
VIRGINIA COMMONWEALTH UNIVERSITY

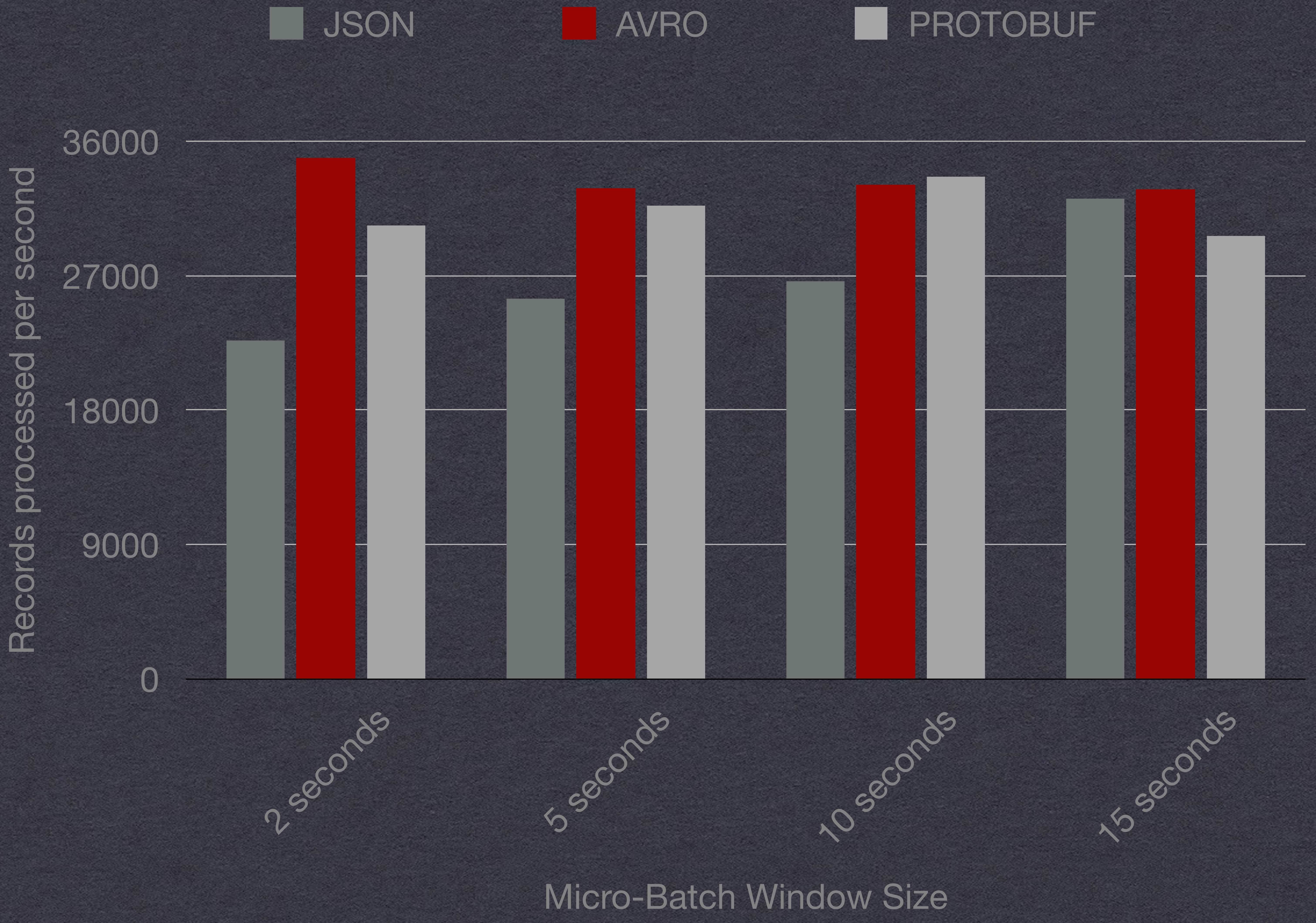

Spark Streaming
RethinkDB
JavaScript
Flask

Experimental Parameters

Producer Machines	Producer jvm per machine	Thread spawn rate	Total Sensors per jvm
2/3	1/3	5 sec	125,000

Kafka Partitions/ Replication	Spark Read Parallelism	Spark Compute Parallelism	Spark micro-batch window
6/2	6	6	2/5/10/15 sec

COMPARISON OF SERIALIZATION AND BATCH SIZE
2 instances, 1 JVM per instance



Findings

- Avro and Protobuf serialization greatly improves throughput over JSON
- Overall Avro and Protobuf show similar performance, the differences are in their characteristics

Image credits

- Disney, Star Wars
- BrainlessTales.com
- Settlers of Catan
- Apache: Spark, Avro, Kafka
- Python, rethinkDB, flask