DataStax

Starlight-for-RabbitMQ, powered by Apache Pulsar

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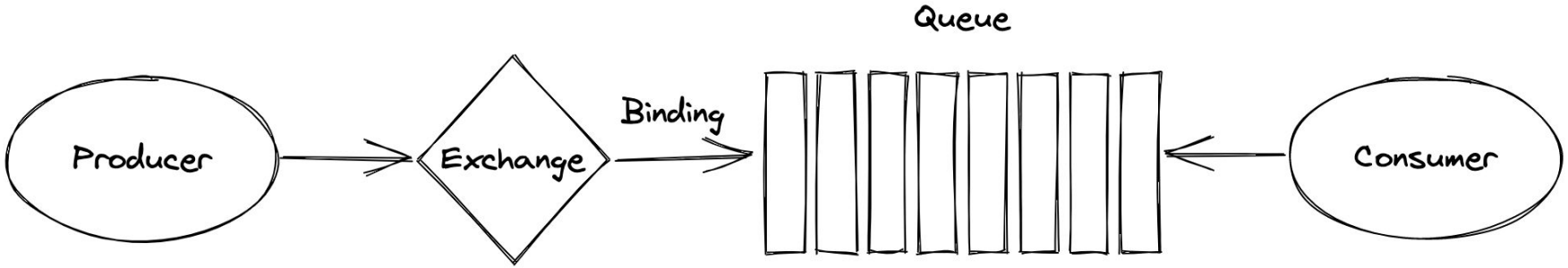
Why Starlight-for-RabbitMQ ?

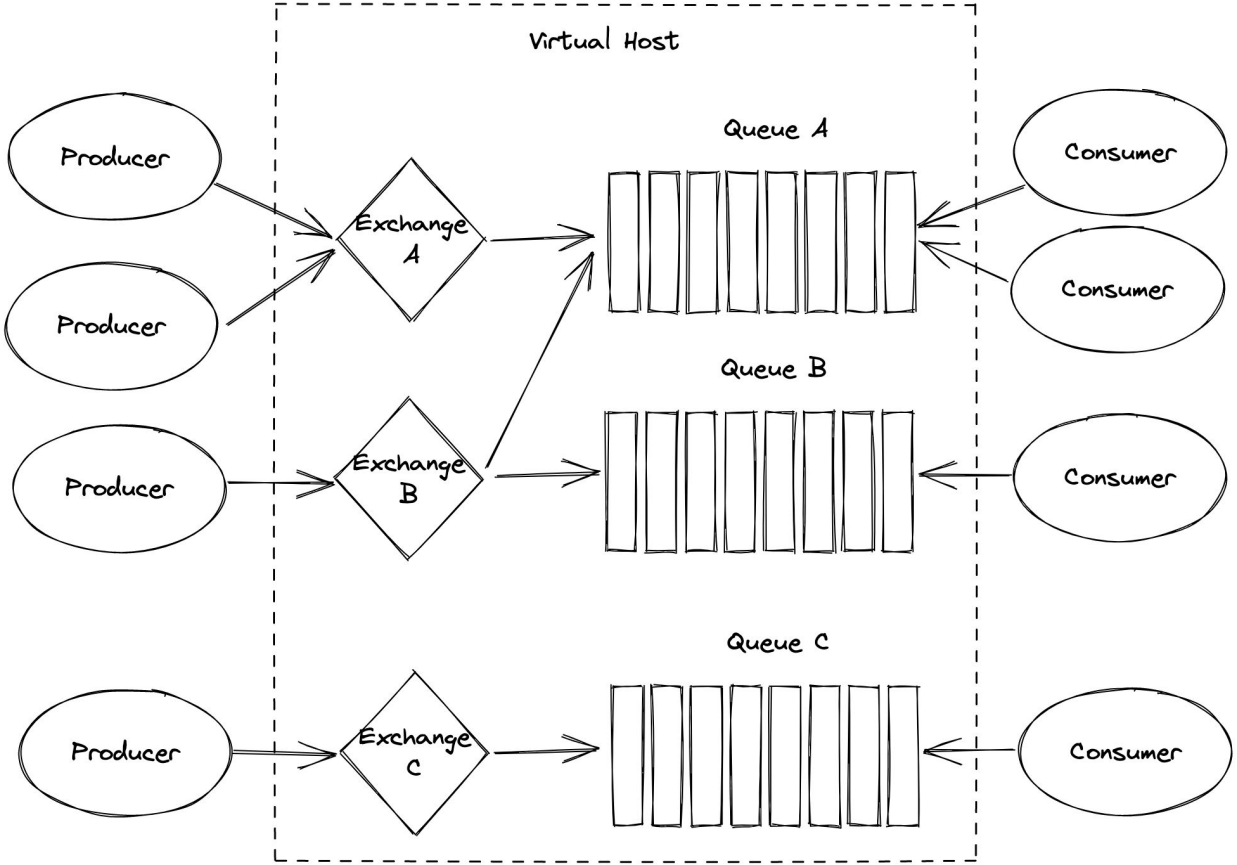
- RabbitMQ is popular in the Message Queue world
- Common troubles with RabbitMQ
    - Scaling
    - Resilience and durability
    - Throughput and predictability
    - Erlang
- Migration from RabbitMQ to Apache Pulsar

AMQP 0.9.1 concepts (RabbitMQ)

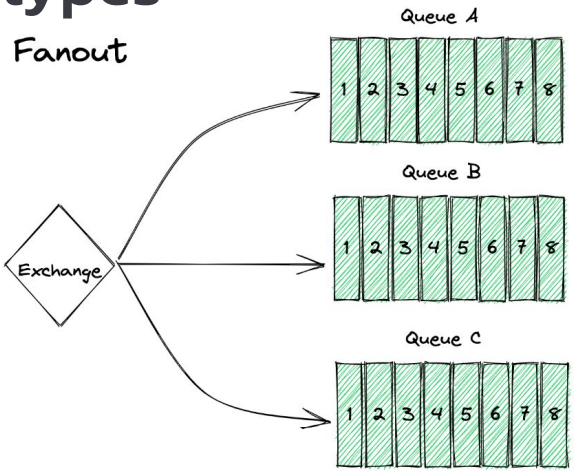
Exchanges and queues

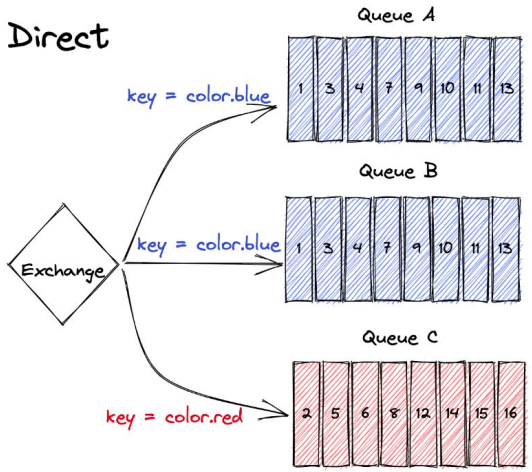


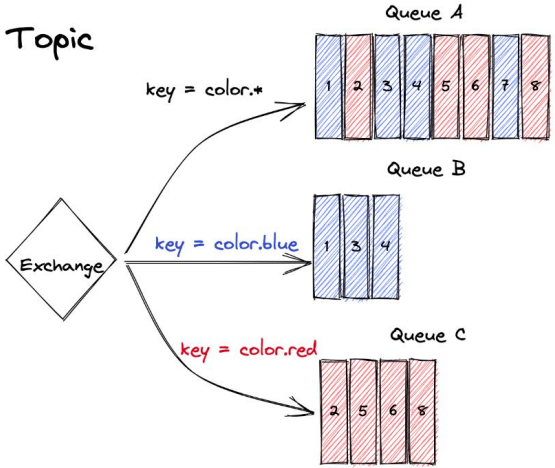
Virtual Hosts

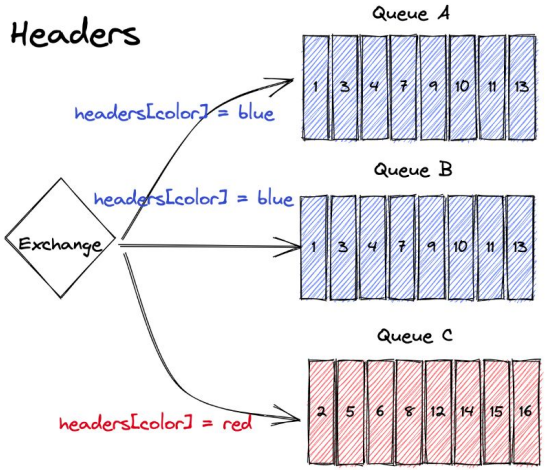


Exchange types







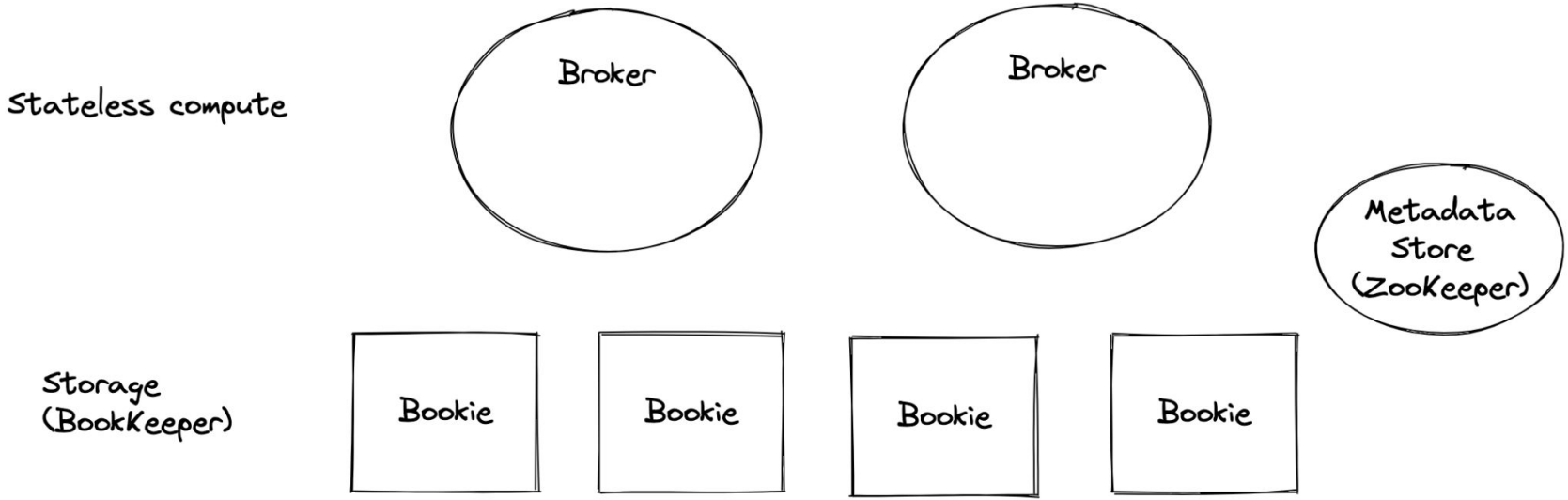


At least once delivery

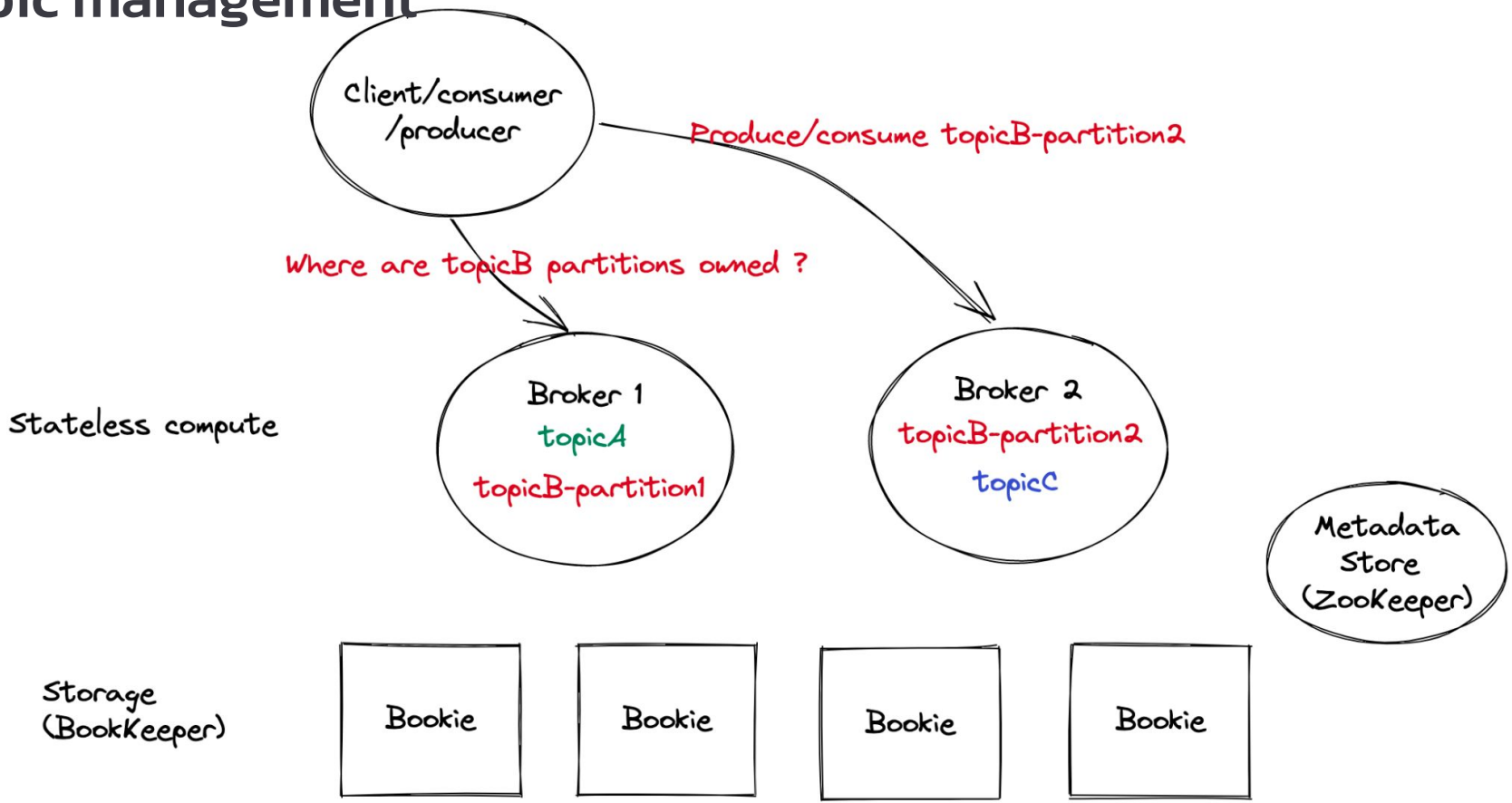
- Durable exchanges and queues
- Publisher confirms
- Consumer acknowledgements
- Persistent messages
    - Messages are removed from queues as soon as they are acknowledged
    - Disk writes are batched and flushed every 200ms
    - A persistent message might not go to disk if it's acknowledged before the batch flush.

Pulsar concepts

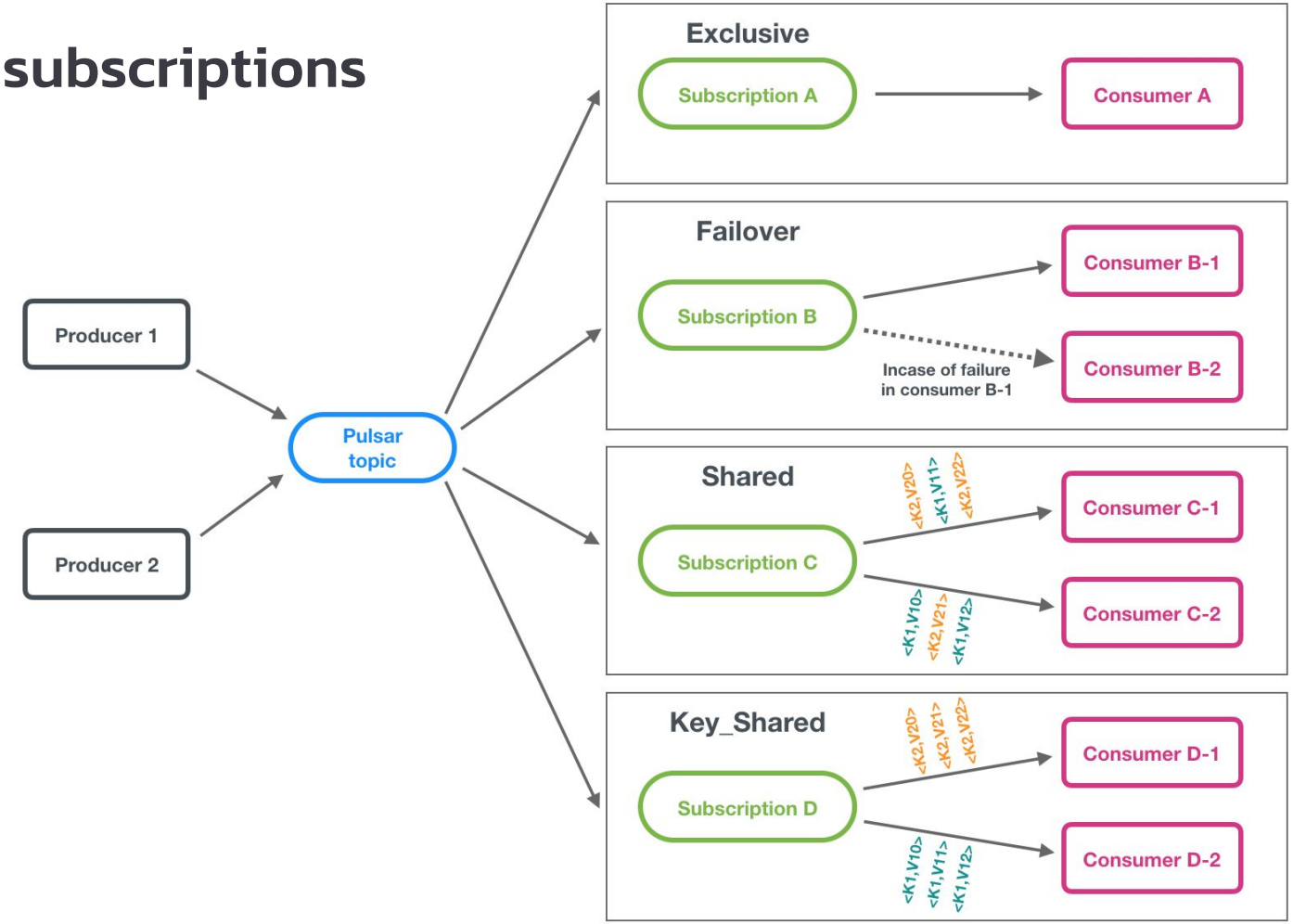
Pulsar distributed architecture



Topic management



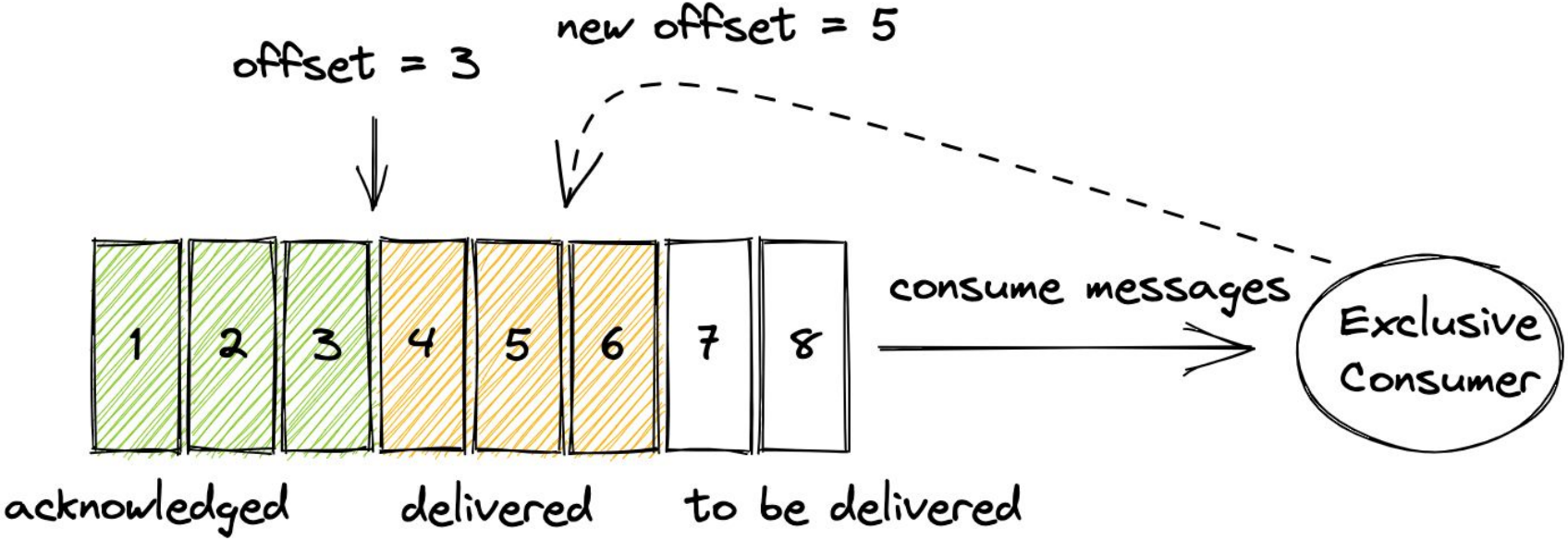
Topic subscriptions



Message Queue or Streaming ?

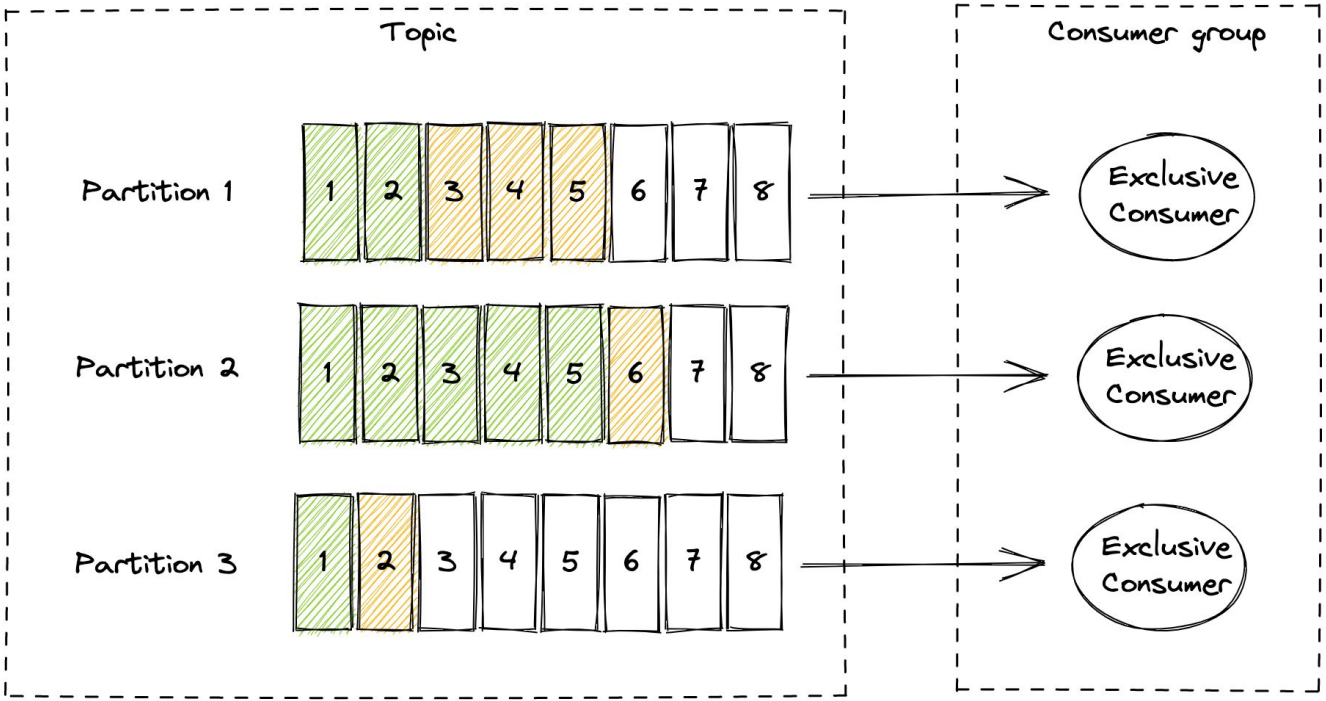
Streaming = in-order exclusive consumer

- Pulsar Exclusive subscription
- Kafka
- RabbitMQ



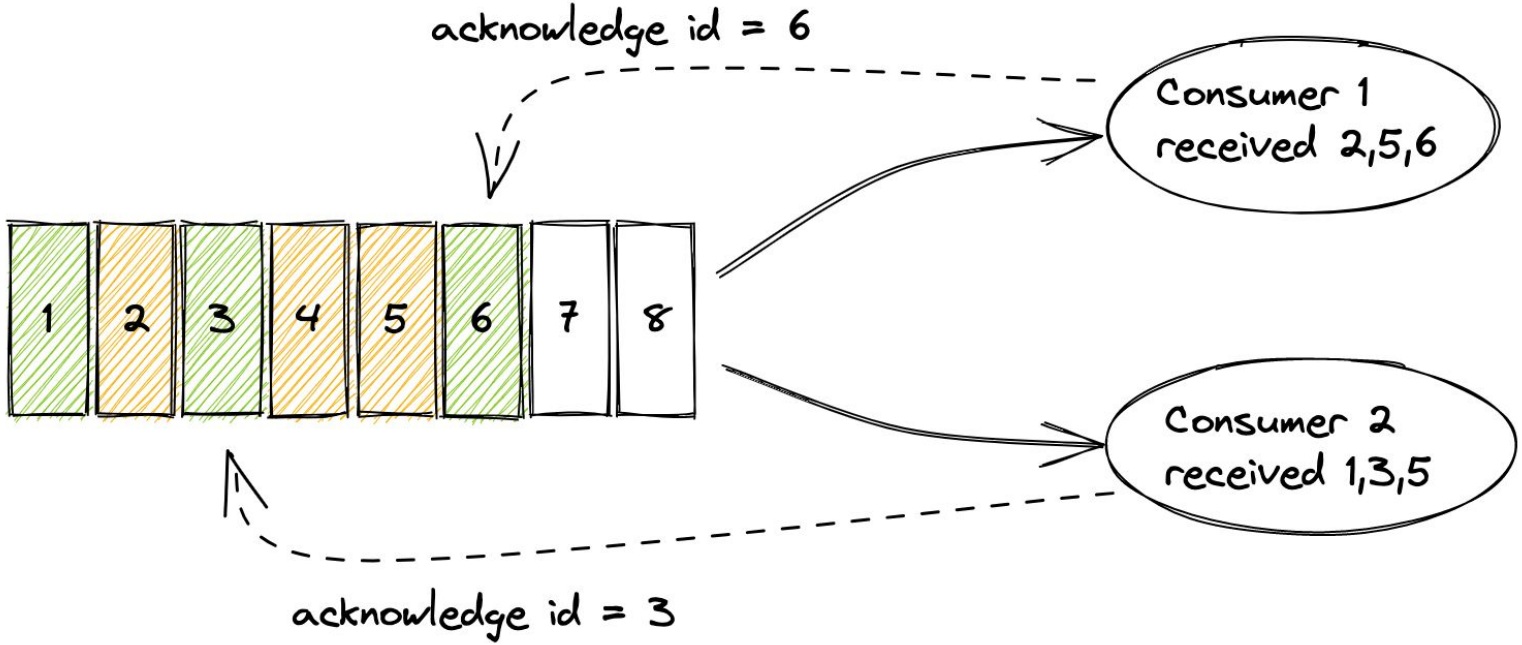
Streaming with partitioned topics

- Pulsar Failover subscription
- Kafka

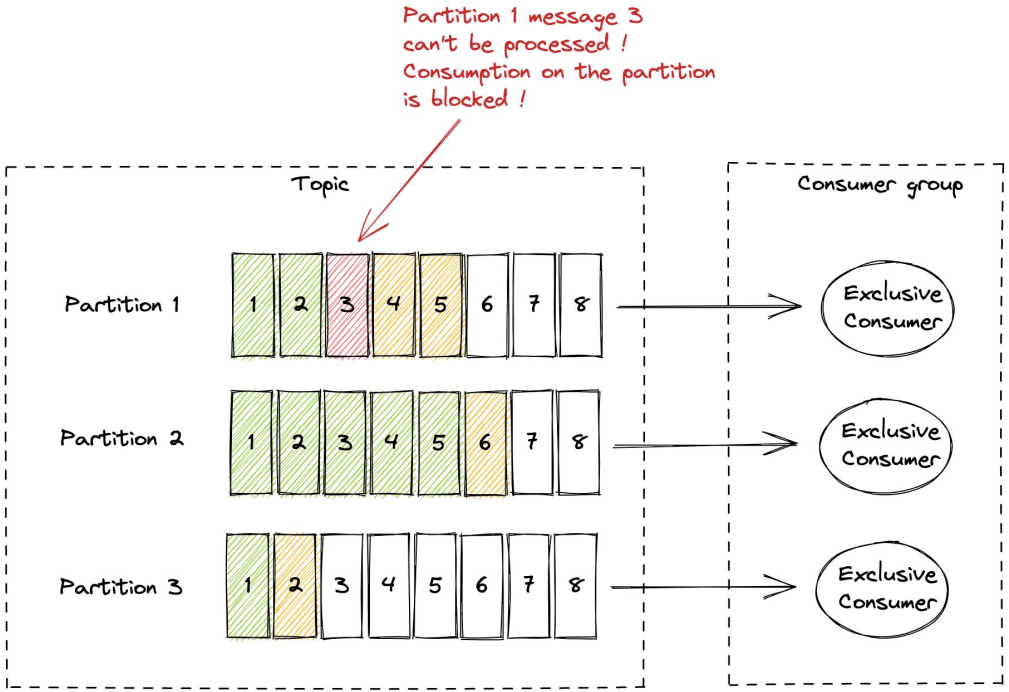


Message Queue = unordered competing consumers

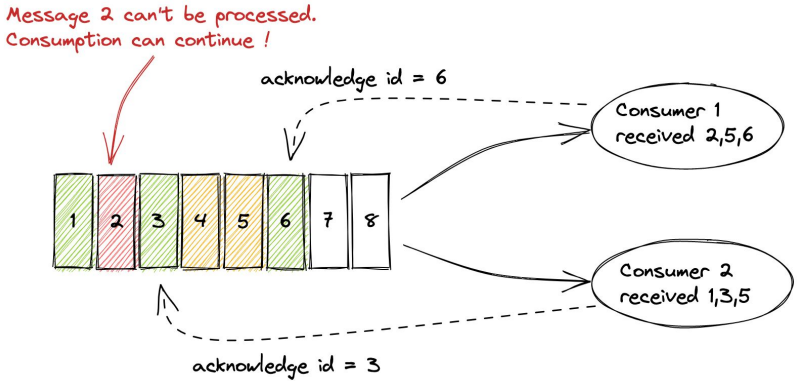
- Pulsar Shared subscription
- RabbitMQ



Individual acknowledgements are essential for competing consumers



Streaming



Message Queue

How do we map Pulsar to RabbitMQ ?

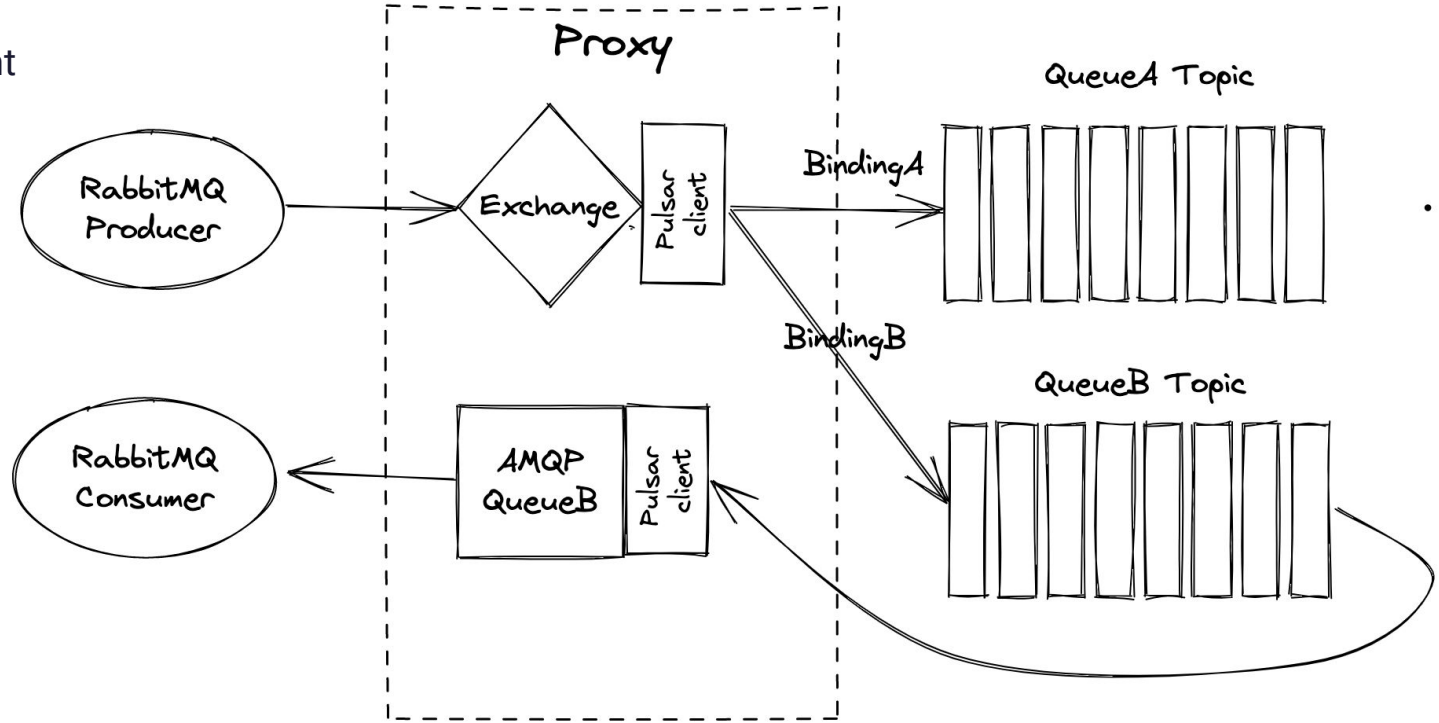
Solution #1: copy full message to all bound queues

Pros

- “Simple” to implement
- Scales with the number of brokers
- Pulsar client optimizations (batching, …)

Cons

- Not efficient in I/O and disk usage
- Network hop due to proxy



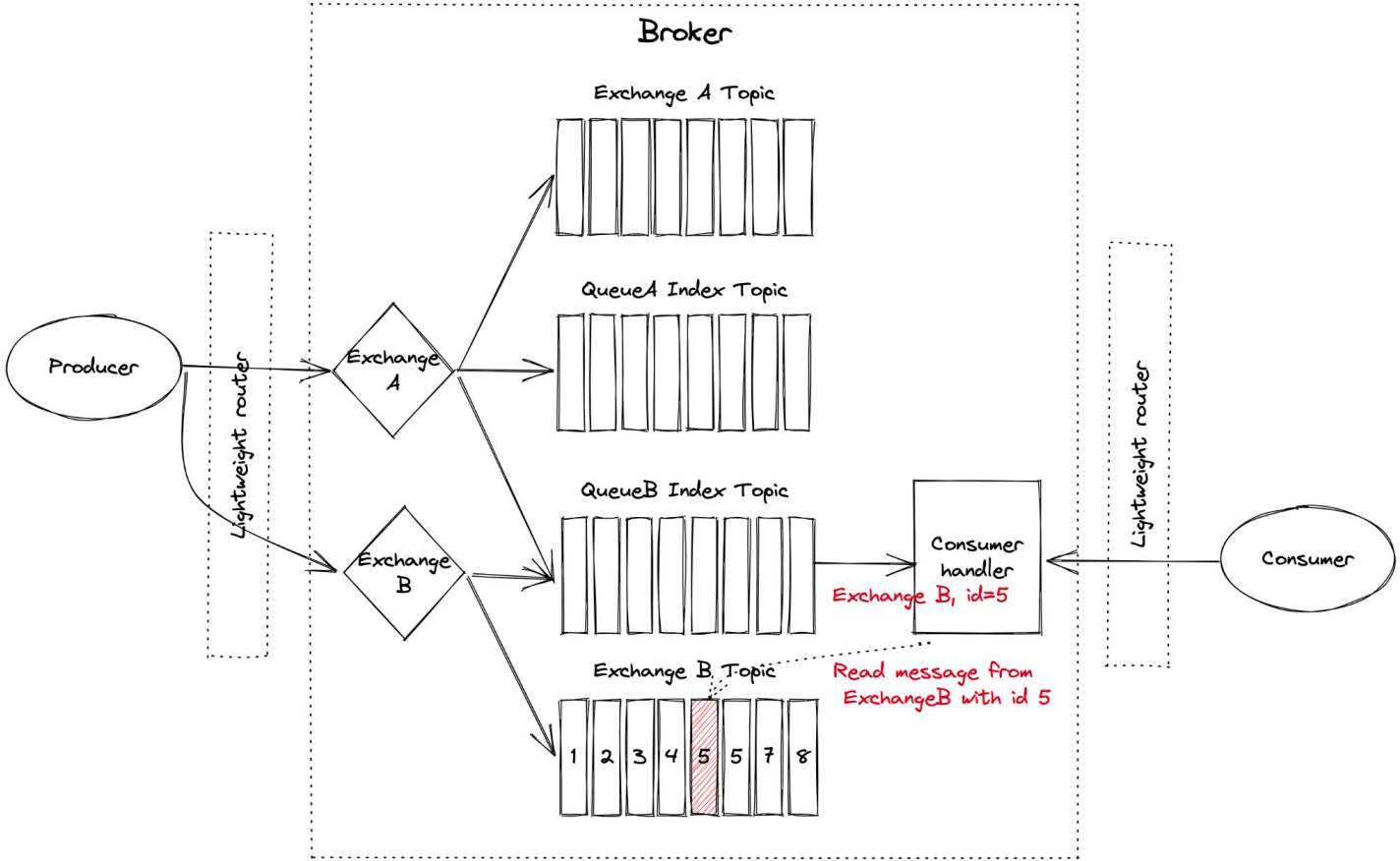
Solution #2: copy message index to all bound queues (AoP)

Pros

- Direct read/write to ledger is performant
- Zero-copy techniques can be used

Cons

- Can't scale a VHost as all Exchanges and Queues for a given VHost must be owned by the same broker
- Network hop due to proxy/router



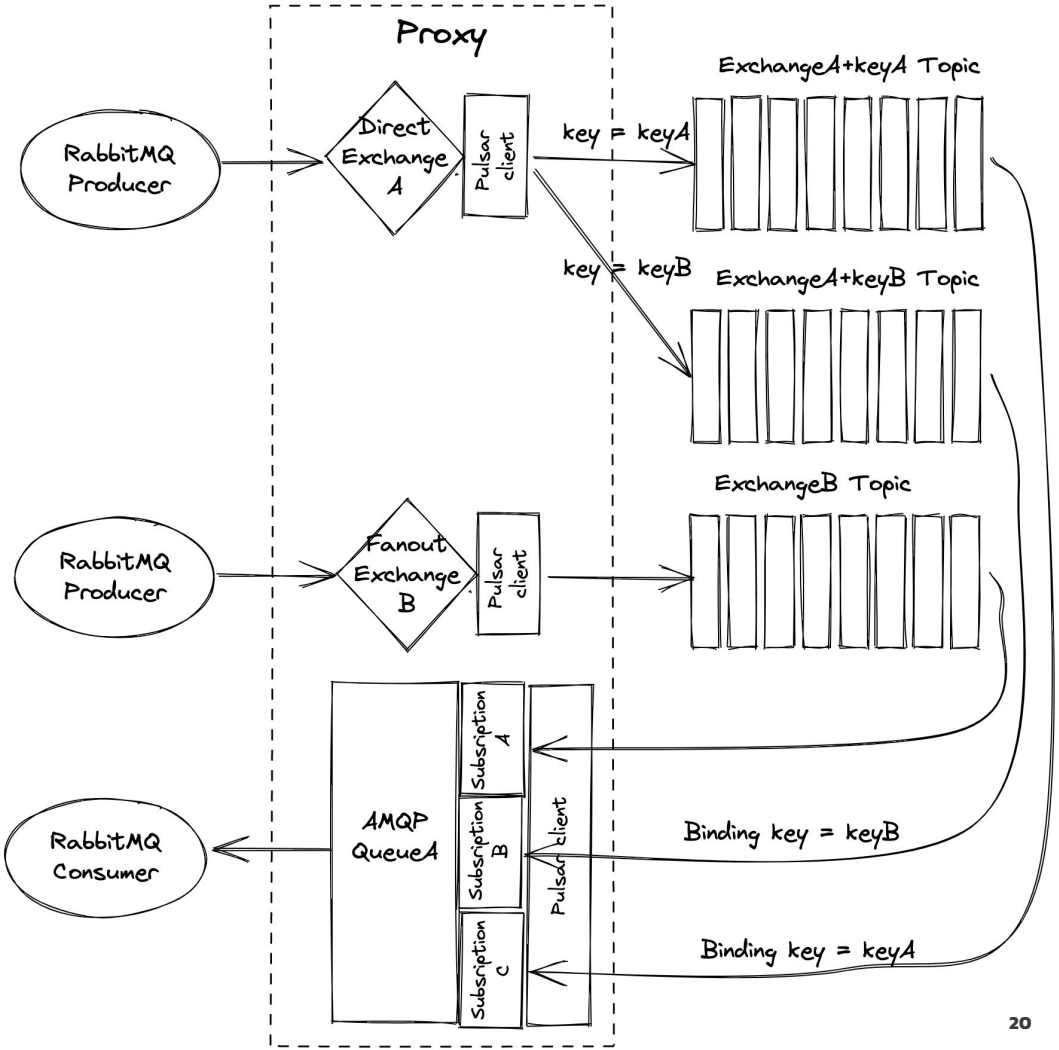
Solution #3: use subscriptions as bindings (Starlight-for-RabbitMQ)

Pros

- Scales with the number of brokers thanks to Pulsar Shared subscriptions
- Pulsar client optimizations (batching, …)

Cons

- More memory copies than reading/writing directly from the ledger
- Network hop due to proxy



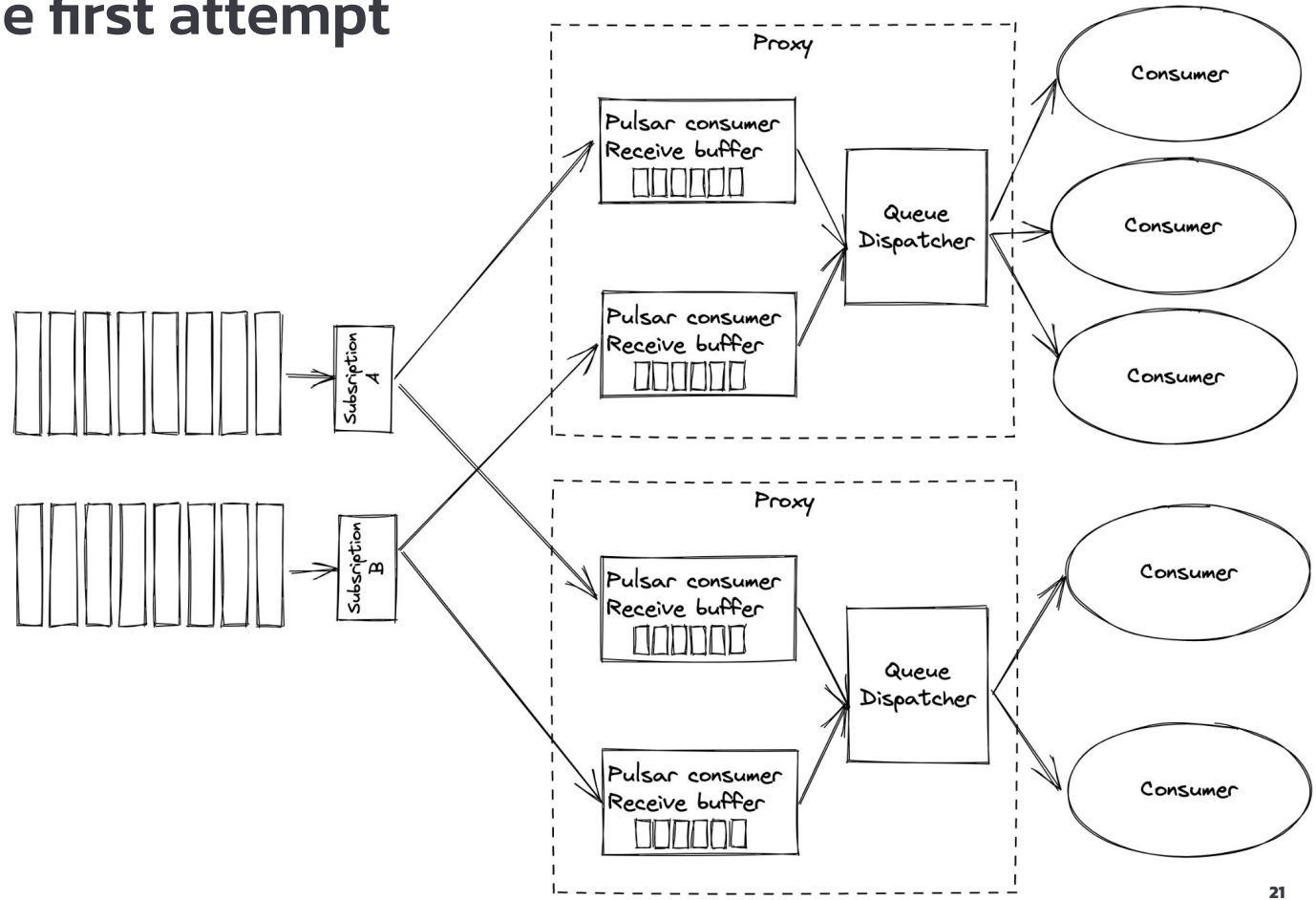
Consuming-side first attempt

Pros

- The lifecycle of the channel and consumer can be very AMQP 0.9.1 spec compliant.

Cons

- Uneven distribution of messages per consumer.
- Messages can get stuck in the proxy receive buffers if there are no consumers.



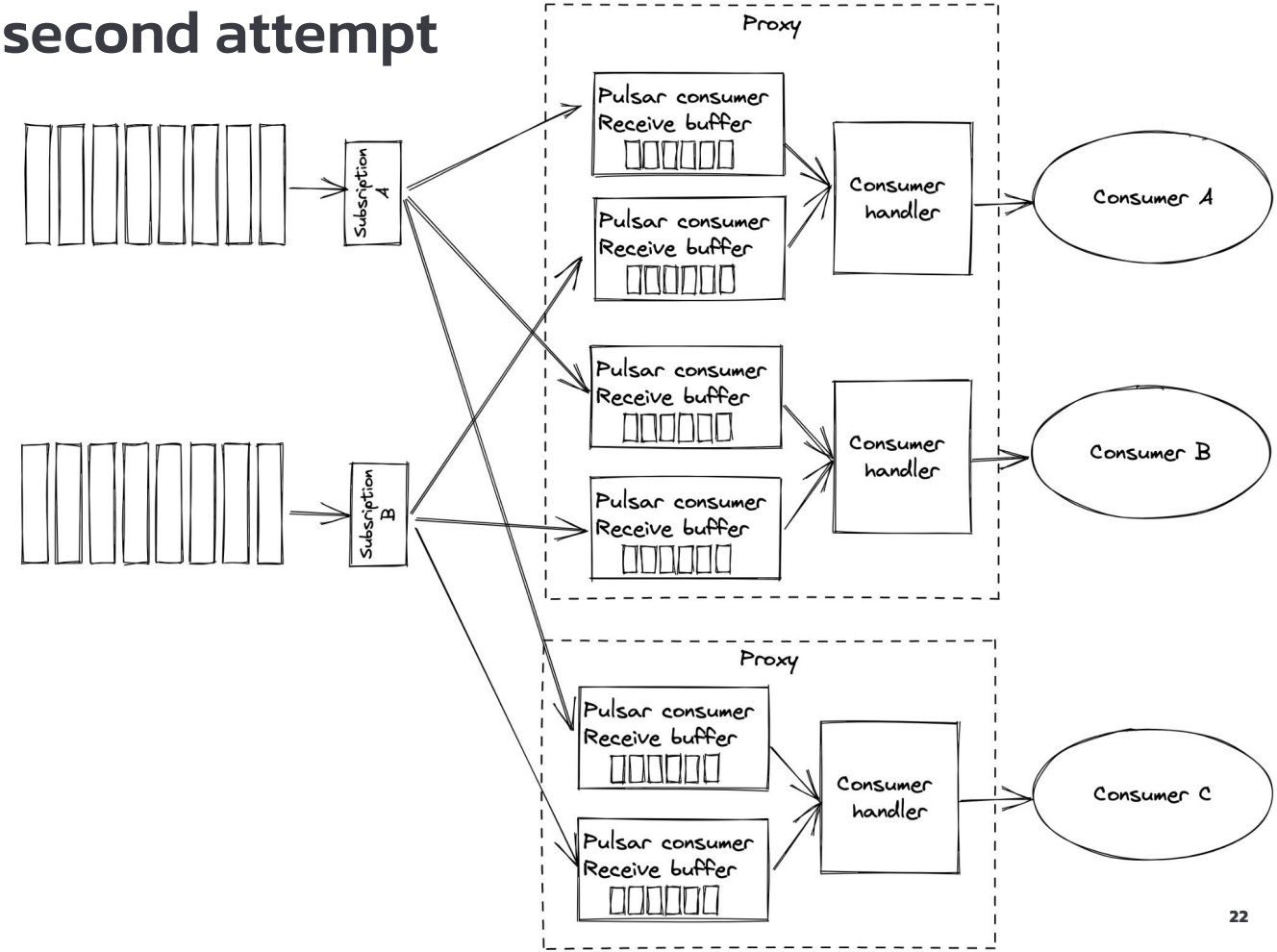
Consuming-side second attempt

Pros

- Messages distributed evenly among the consumers
- If a consumer is canceled, the messages in the receive buffer are sent to another consumer.

Cons

- Divergence from AMQP spec as messages are resent when the consumer is closed instead of when the channel is closed



Authentication and authorization

- JWT authentication
  - In RabbitMQ: rabbitmq_auth_backend_oauth2 plugin + AMQP “PLAIN” auth mechanism
    - Username ignored
    - JWT passed in password
  - Reuse Pulsar Token authentication implementation
- TLS authentication
  - In RabbitMQ : rabbitmq-auth-mechanism-ssl + AMQP “EXTERNAL” auth mechanism
  - Reuse Pusar TLS authentication implementation
- Authorization
  - AMQP Virtual Host mapped to Pulsar tenant+namespace
  - Check that the namespace exists
  - Check that the authenticated role is admin of the Pulsar tenant with the PulsarAdmin client.

Development

Fully open-source under Apache Software Licence

In Java, so most people can understand the code and contribute

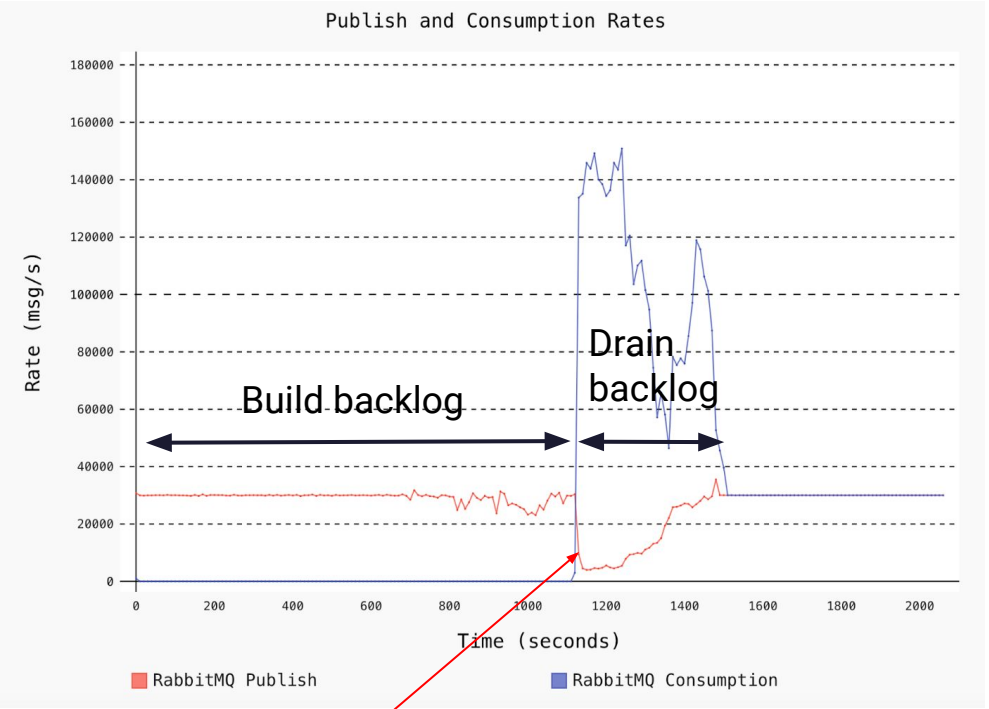
Use the Apache QPid protocol library to implement the AMQP protocol layer

Integration tests using the tests from the rabbitmq-java-client

Performance tests

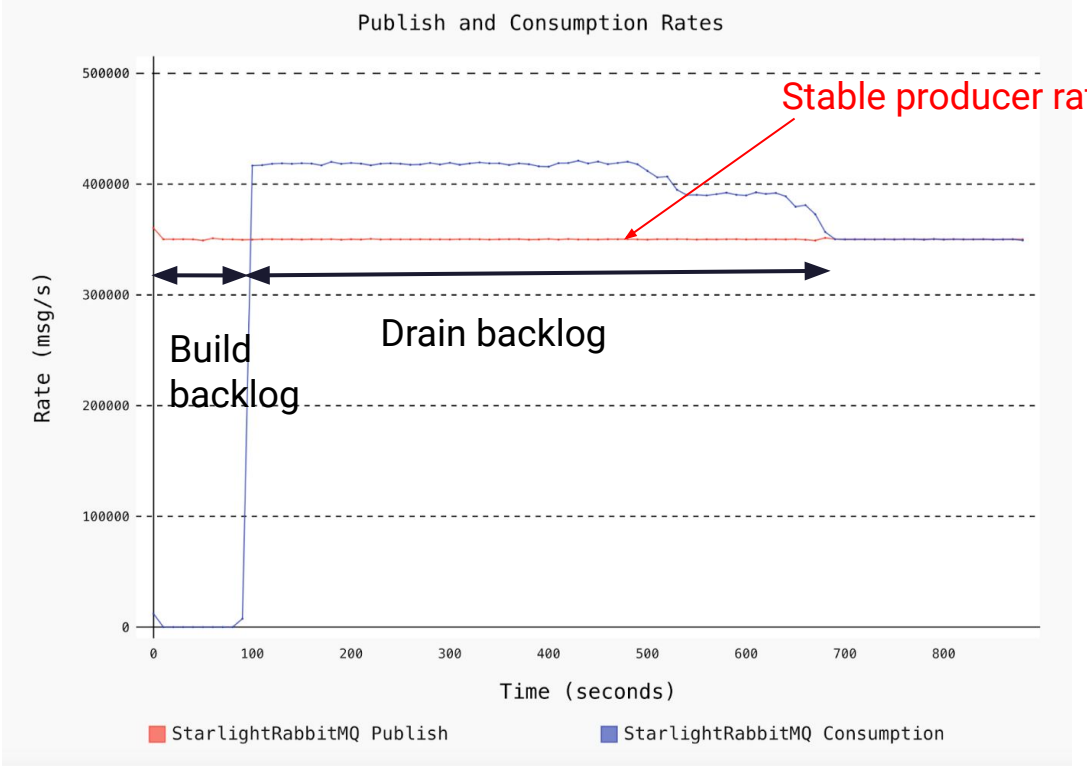
- Done with the OpenMessaging Benchmark Framework
- Distributed on a cluster of 3 nodes
- Setup for at-least-once delivery
  - Use of “mirrored queues” for RabbitMQ
- Message size: 1kB
- Consumer stopped, build a backlog of 30 GB
- Then resume the consumption and drain the backlog

RabbitMQ



Performance tests

Starlight-for-RabbitMQ



Let’s discuss

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Thank You!