Never Lose a Message Again: Building Rock-Solid Event-Driven Streaming Architectures with

VMware Tanzu RabbitMQ and Spring

VMware Tanzu – Data Services

VMware Tanzu

Infrastructure for running modern apps and backing services with consistent, conformant Kubernetes everywhere.

Data Management
Management for Tanzu Data Services instances

GemFire
Fast In-Memory data store for Caching, Transactional and NoSQL support powered by Apache Geode

I need a fast data store

SQL
Relational MySQL or Postgres database for Transactional or Analytic data processing

I need to replatform a relational database

Greenplum
Massively Parallel Processing (MPP) Postgres for Big Data store for analytics, Machine Learning and Artificial Intelligence

I need to drive analytic value of out tons of existing data

Rabbit MQ
High throughput broker for reliable messaging delivery

I need reliable messaging delivery

Spring Cloud Data Flow
Data integration orchestration service for dynamically building data pipelines

I need flexible and manageable data integrations

Features

- ✓ Cloud deployed backing-services
- ✓ On-Premise and Multi-Cloud
- ✓ Self – Service
- ✓ Scaling
- ✓ HA - Fault Tolerant
- ✓ Based on open source
- ✓ World Class Support

RabbitMQ – 101 – Broker, Producers & Consumers

RabbitMQ is a message broker

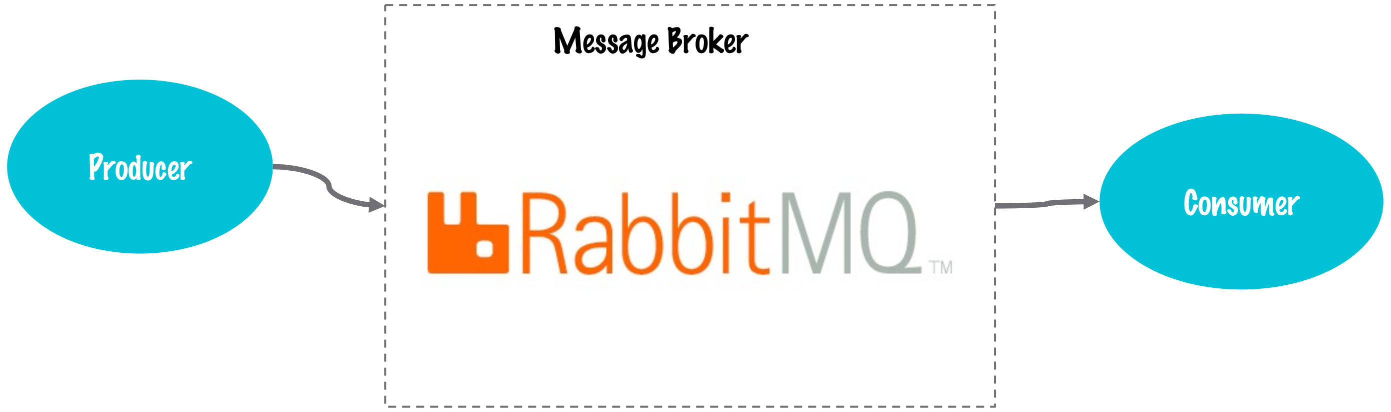
- stores and forwards binary blobs of data – messages.

Producer

- Program that sends messages is a producer

Consumer

- Program that mostly waits to receive messages:



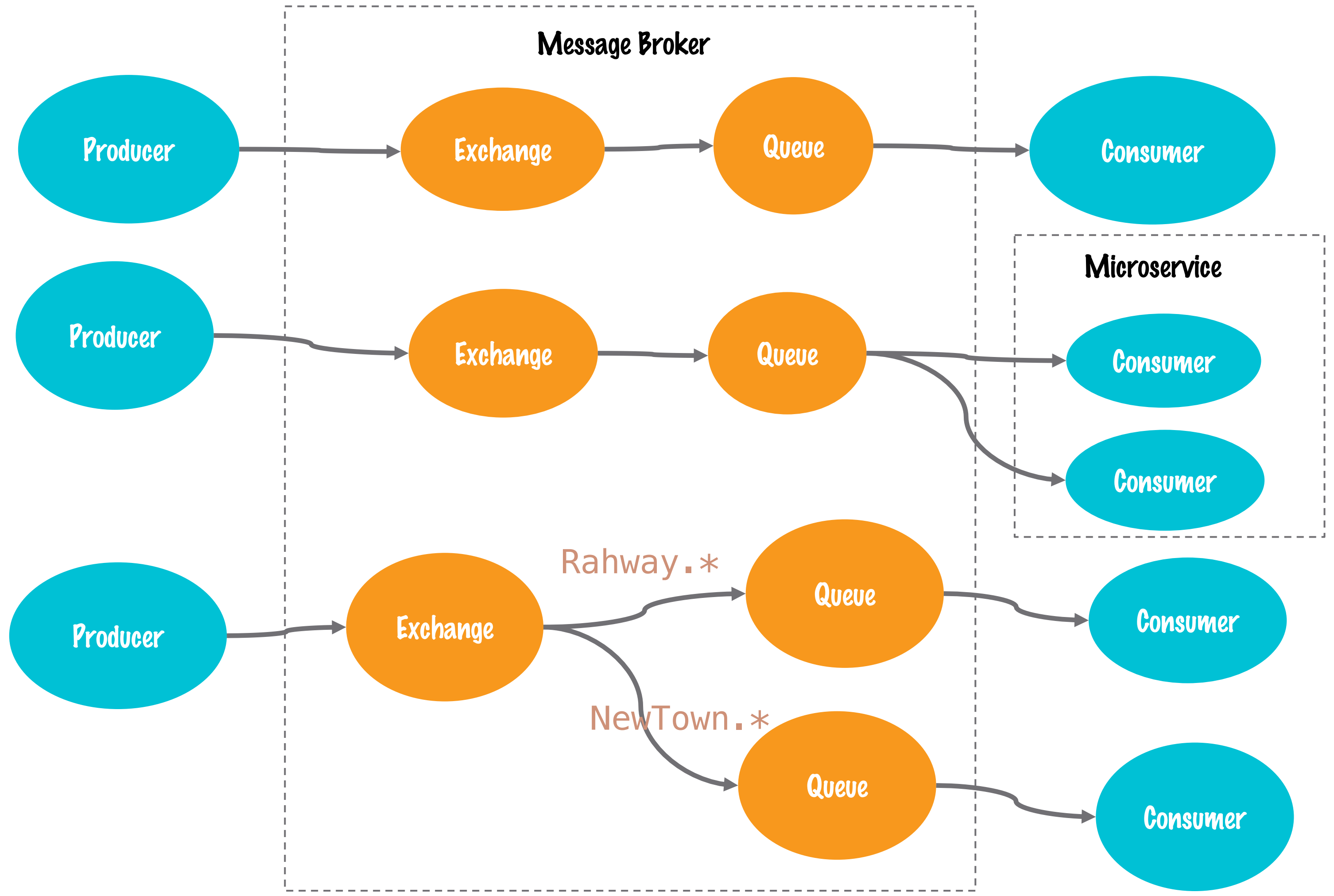
RabbitMQ – Exchanges & Queues

Queue

- Storage destination of messages inside RabbitMQ

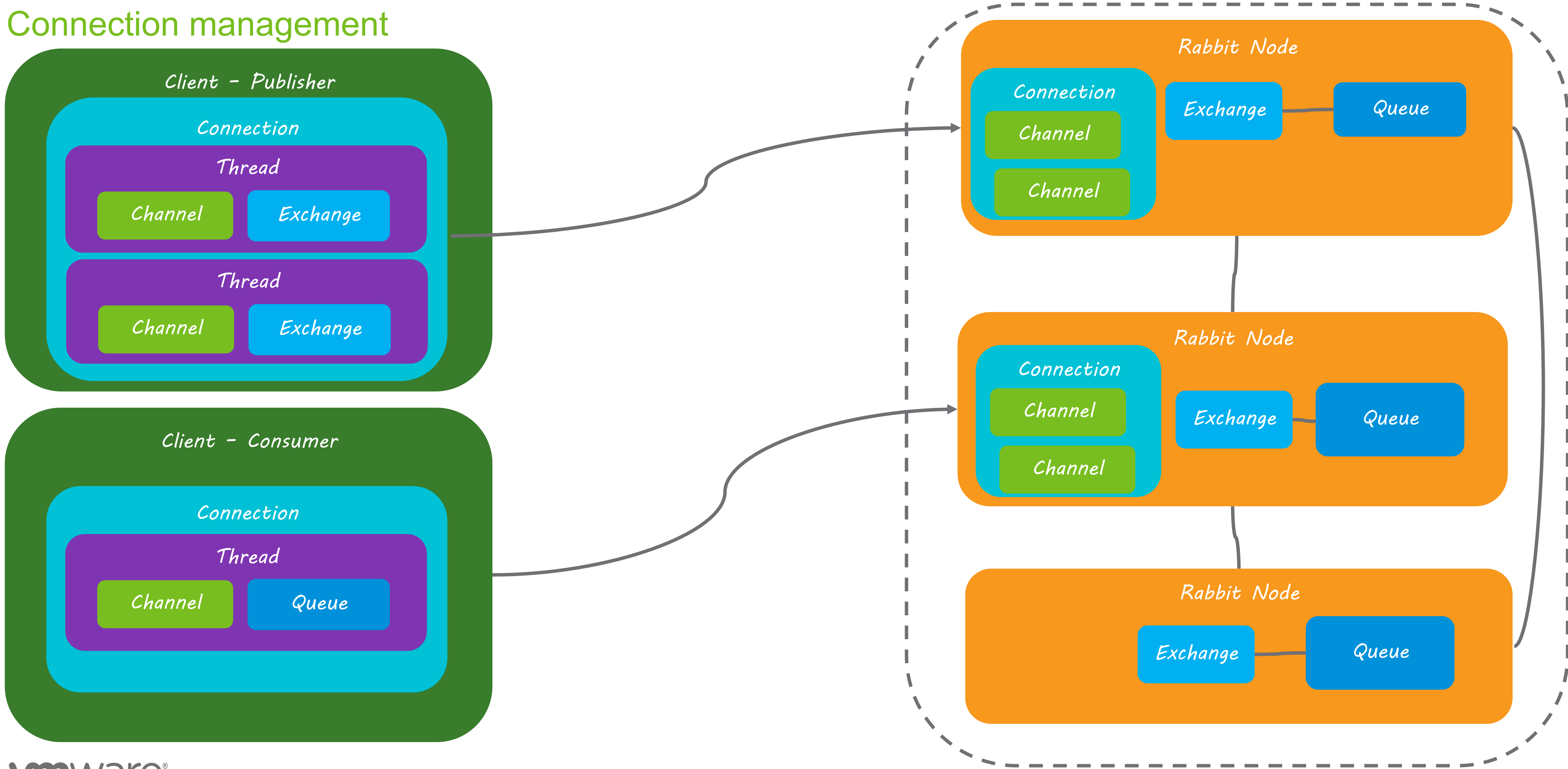
Exchanges

- Messages always sent to exchanges, then forwarded to queues based on routing rules.



RabbitMQ Clustering

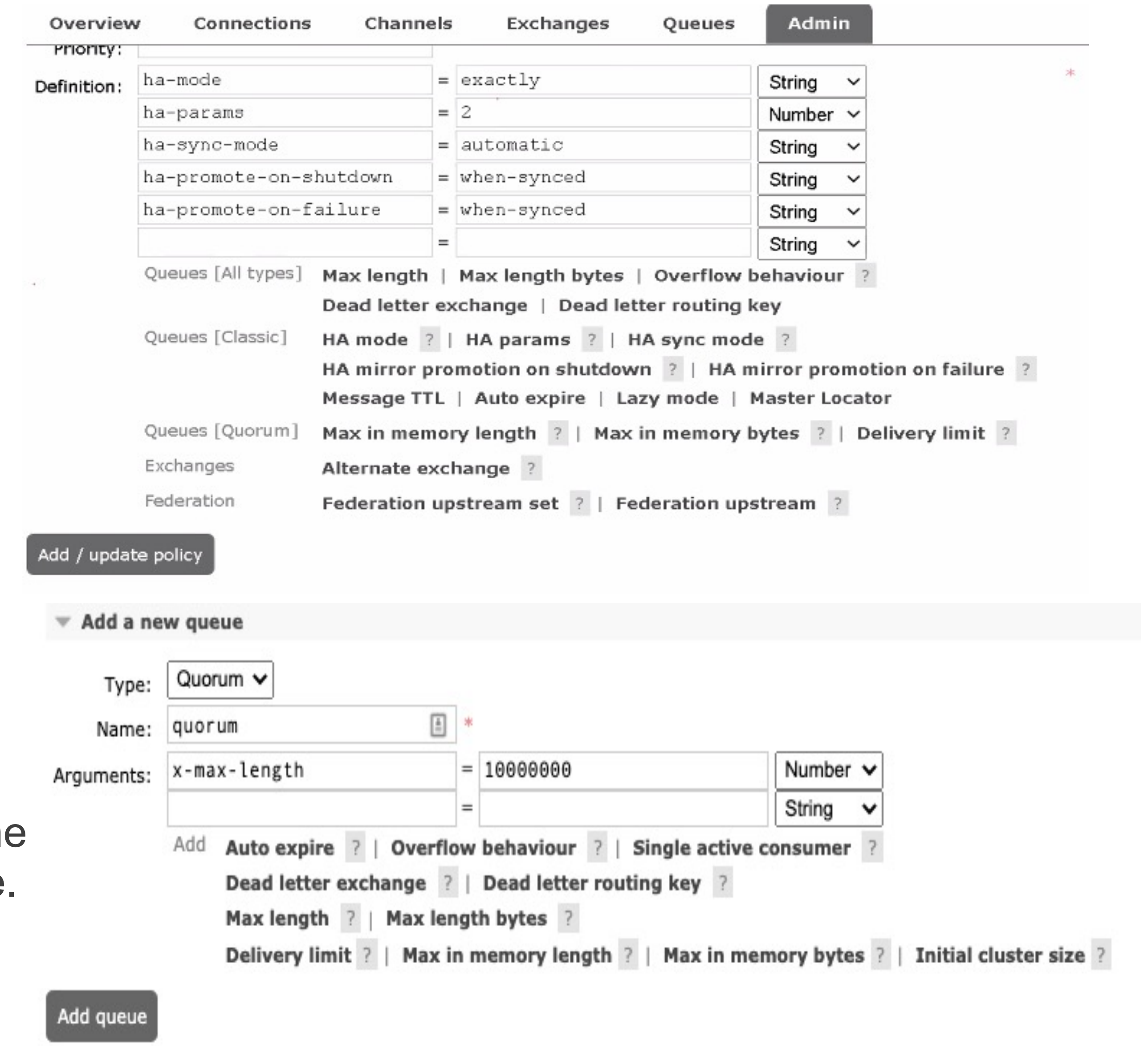
Connection management



Queues

Classic versus Quorum

- Classic Queues
  - Supports In-Memory messages
  - Option durable and or persisted messages
  - Mirrored replication through policy (deprecated)
- Quorum Queues
  - A durable, replicated with persisted messages
  - Based on the Raft consensus algorithm.
  - Preferred queue type over durable mirrored classics queues.
  - Quorum queues should be considered the default option for a replicated queue type.



Priority:

Definition:

ha-mode	= exactly	String
ha-params	= 2	Number
ha-sync-mode	= automatic	String
ha-promote-on-shutdown	= when-synced	String
ha-promote-on-failure	= when-synced	String
	=	String

Queues [All types] Max length | Max length bytes | Overflow behaviour ?
Dead letter exchange | Dead letter routing key
Queues [Classic] HA mode ? | HA params ? | HA sync mode ?
HA mirror promotion on shutdown ? | HA mirror promotion on failure ?
Message TTL | Auto expire | Lazy mode | Master Locator
Queues [Quorum] Max in memory length ? | Max in memory bytes ? | Delivery limit ?
Exchanges Alternate exchange ?
Federation Federation upstream set ? | Federation upstream ?

Add / update policy

Add a new queue

Type: Quorum

Name: quorum *

Arguments:

x-max-length	= 10000000	Number
	=	String

Add Auto expire ? | Overflow behaviour ? | Single active consumer ?
Dead letter exchange ? | Dead letter routing key ?
Max length ? | Max length bytes ?
Delivery limit ? | Max in memory length ? | Max in memory bytes ? | Initial cluster size ?

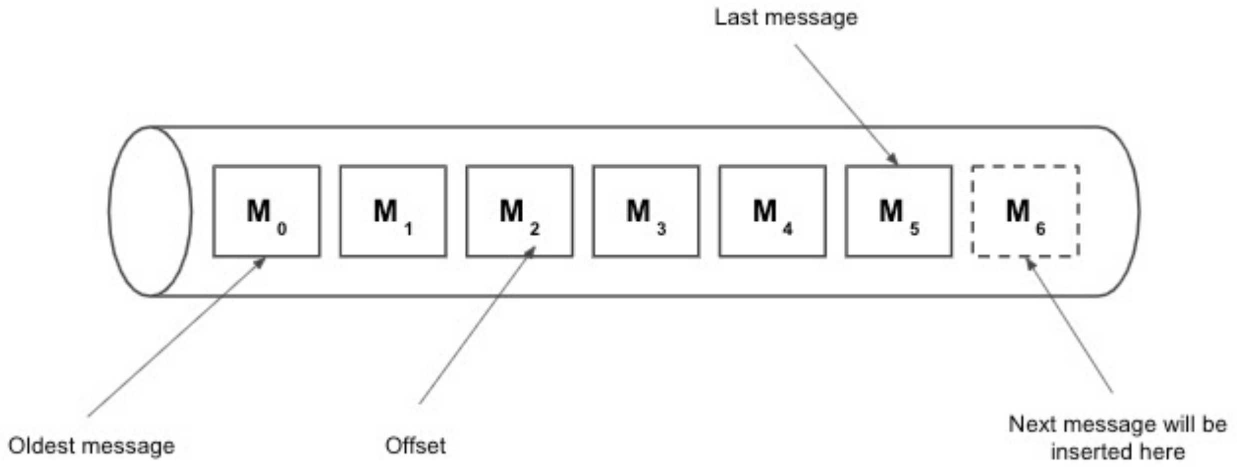
Add queue

Messaging Streaming - Queue

Replay Messages

- Kafka like event logging
- **Large fan-outs:** when several consumer applications need to read the same messages.
- **Replay / Time-traveling:** when consumer applications need to read the whole history of data or from a given point in a stream.
- **Throughput performance:** when higher throughput than with other protocols (AMQP, STOMP, MQTT) is required.
- **Large logs:** when large amount of data need to be stored, with minimal in-memory overhead.

```
channel.queueDeclare(
  "my-stream",
  true,           // durable
  false, false, // not exclusive, not auto-delete
  Collections.singletonMap("x-queue-type", "stream")
);
```

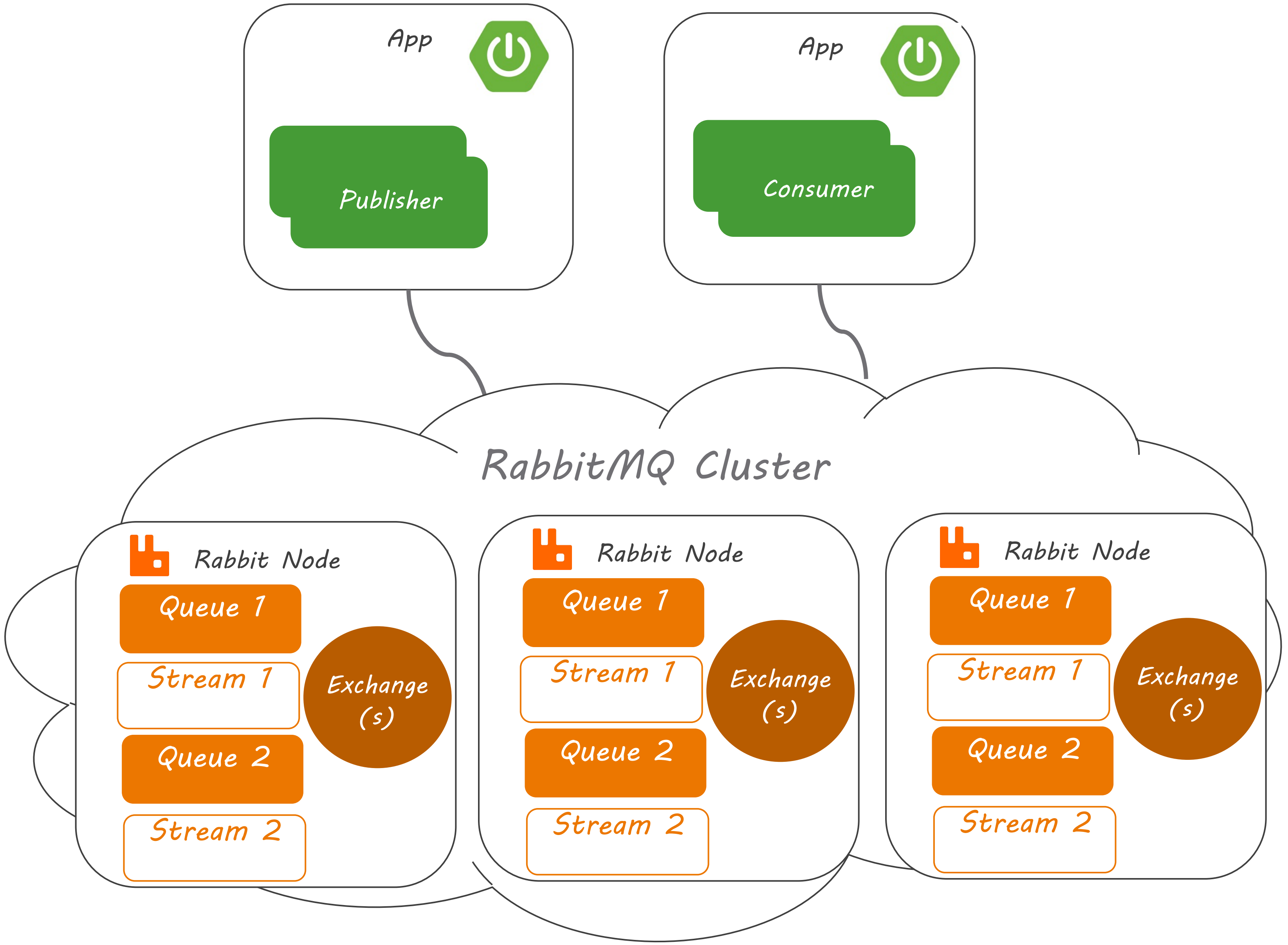


```
channel.basicConsume(
  "my-stream",
  false, // not auto-ack
  Collections.singletonMap("x-stream-offset", 0),
  (s, delivery) -> { }, // delivery callback
  s -> { } // cancel callback
);
```

RabbitMQ

Scalability/Reliability

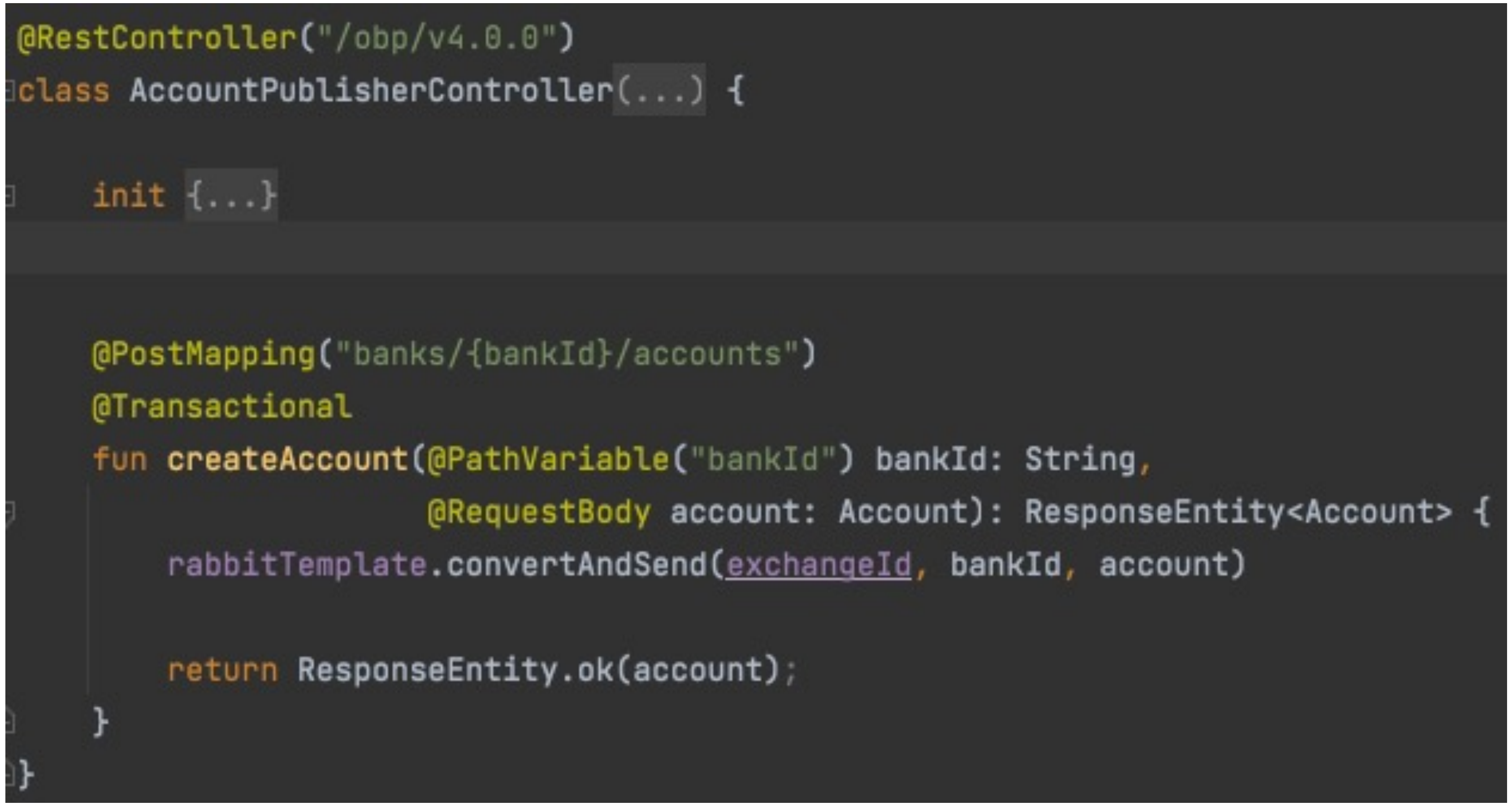
- An odd number of cluster nodes are recommended (ex: 1, 3, 5, 7) by several features that require a consensus between cluster member
- A client can connect to any node.
- Nodes will route operations to the leader.
- Add more queues for Scability across the cluster



Spring AMPQ

Publisher

- Define a Topic Exchange bean for automatic exchange creation
- RabbitTemplate can be used for sending messages
- Use @Transaction for Publisher confirms

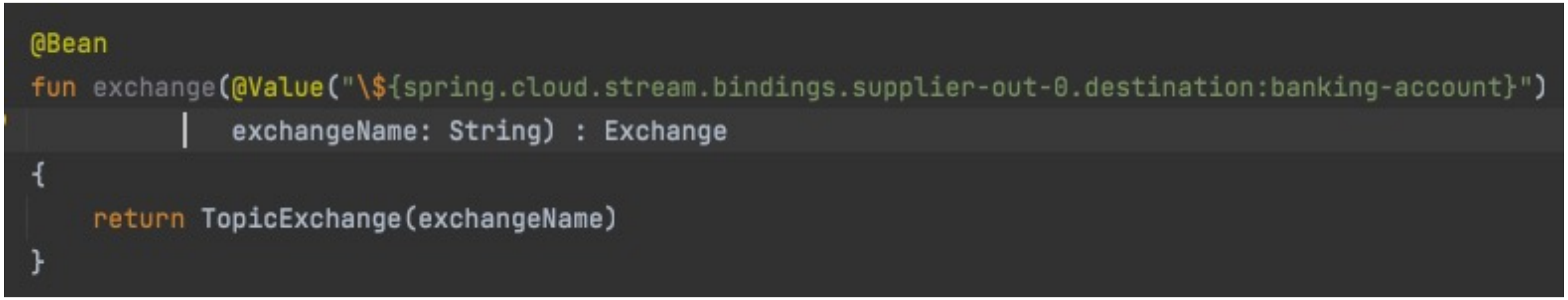


```kotlin
@RestController("/obp/v4.0.0")
class AccountPublisherController(...) {

    init {...}


    @PostMapping("banks/{bankId}/accounts")
    @Transactional
    fun createAccount(@PathVariable("bankId") bankId: String,
                      @RequestBody account: Account): ResponseEntity<Account> {
        rabbitTemplate.convertAndSend(exchangeId, bankId, account)

        return ResponseEntity.ok(account);
    }
}
```



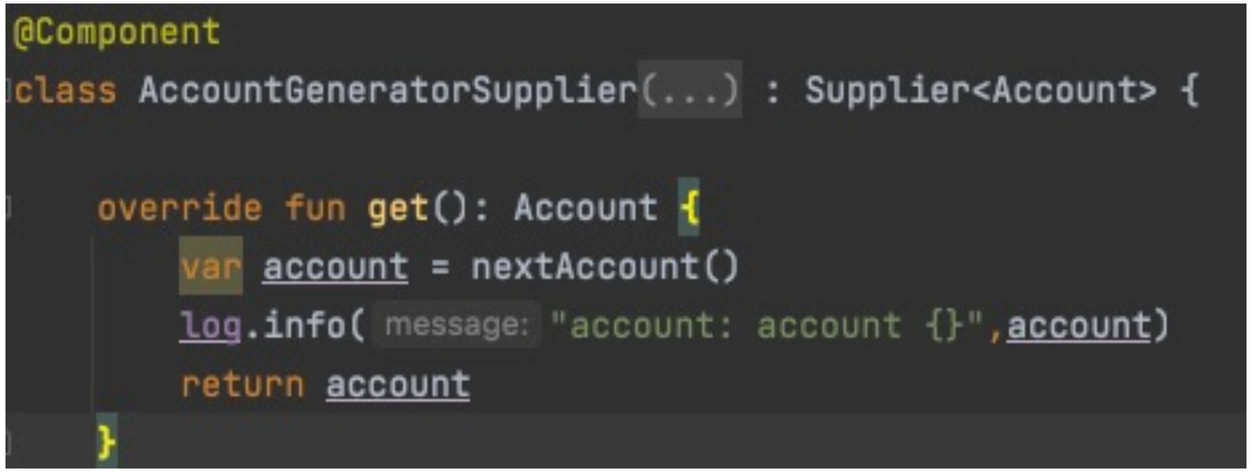
```kotlin
@Bean
fun exchange(@Value("\${spring.cloud.stream.bindings.supplier-out-0.destination:banking-account}")
             exchangeName: String) : Exchange
{
    return TopicExchange(exchangeName)
}
```

Spring Cloud Stream

Publishers

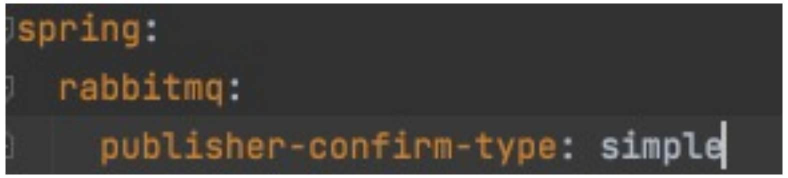
- Publisher implement java.util.function.Supplier

- spring.rabbitmq.publisher-confirm-type
  - SIMPLE
    - Use RabbitTemplate#waitForConfirms() (or wait ForConfirmsOrDie() within scoped operations.



```
@Component
class AccountGeneratorSupplier(...) : Supplier<Account> {

    override fun get(): Account {
        var account = nextAccount()
        log.info( message: "account: account {}",account)
        return account
    }
```

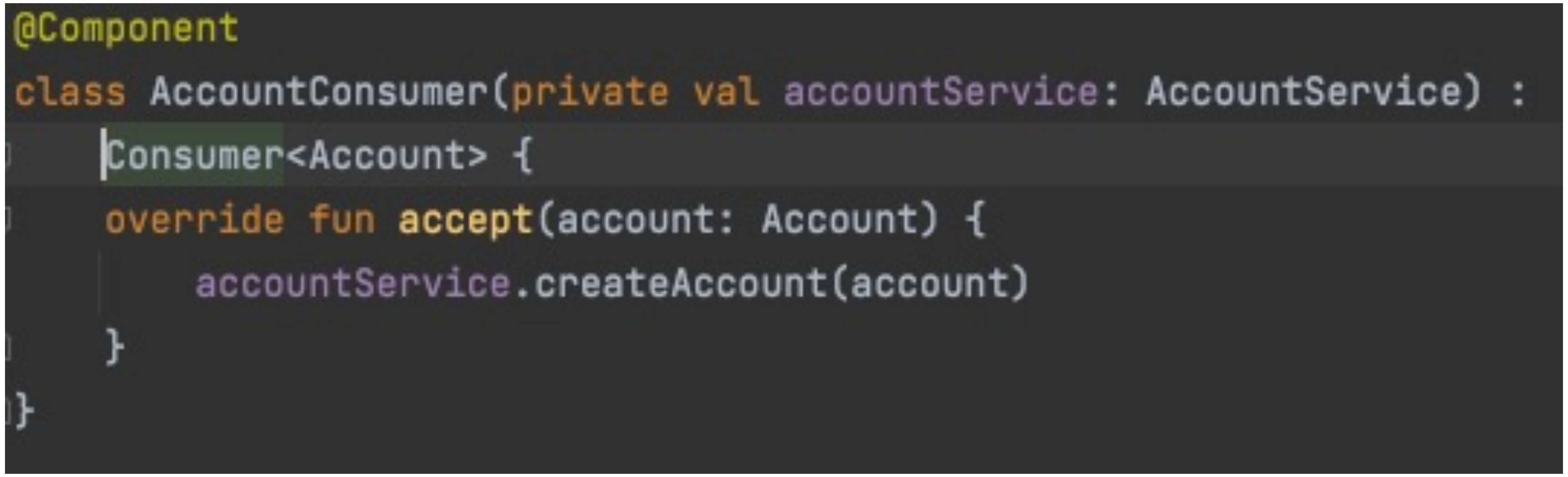


```
spring:
  rabbitmq:
    publisher-confirm-type: simple
```

Spring Cloud Stream

Consumers

- Publisher implement java.util.function.Consumer
- Default AcknowledgeMode = AUTO
  - Auto - the container will issue the ack/nack based on whether the listener returns normally, or throws an exception.
    - spring.cloud.stream.rabbit.bindings.<channelName>.consumer..



```
@Component
class AccountConsumer(private val accountService: AccountService) :
    Consumer<Account> {
    override fun accept(account: Account) {
        accountService.createAccount(account)
    }
}
```

Spring Cloud Data Flow

Build, Deploy, and Monitor streaming and batch data pipelines

- Spring Cloud Data Flow for VMware Tanzu automates the deployment of data pipelines backed by cloud native applications

Spring Cloud Stream

- Spring Cloud Stream is a framework for building highly scalable event-driven microservices connected with shared messaging systems.

Dashboard

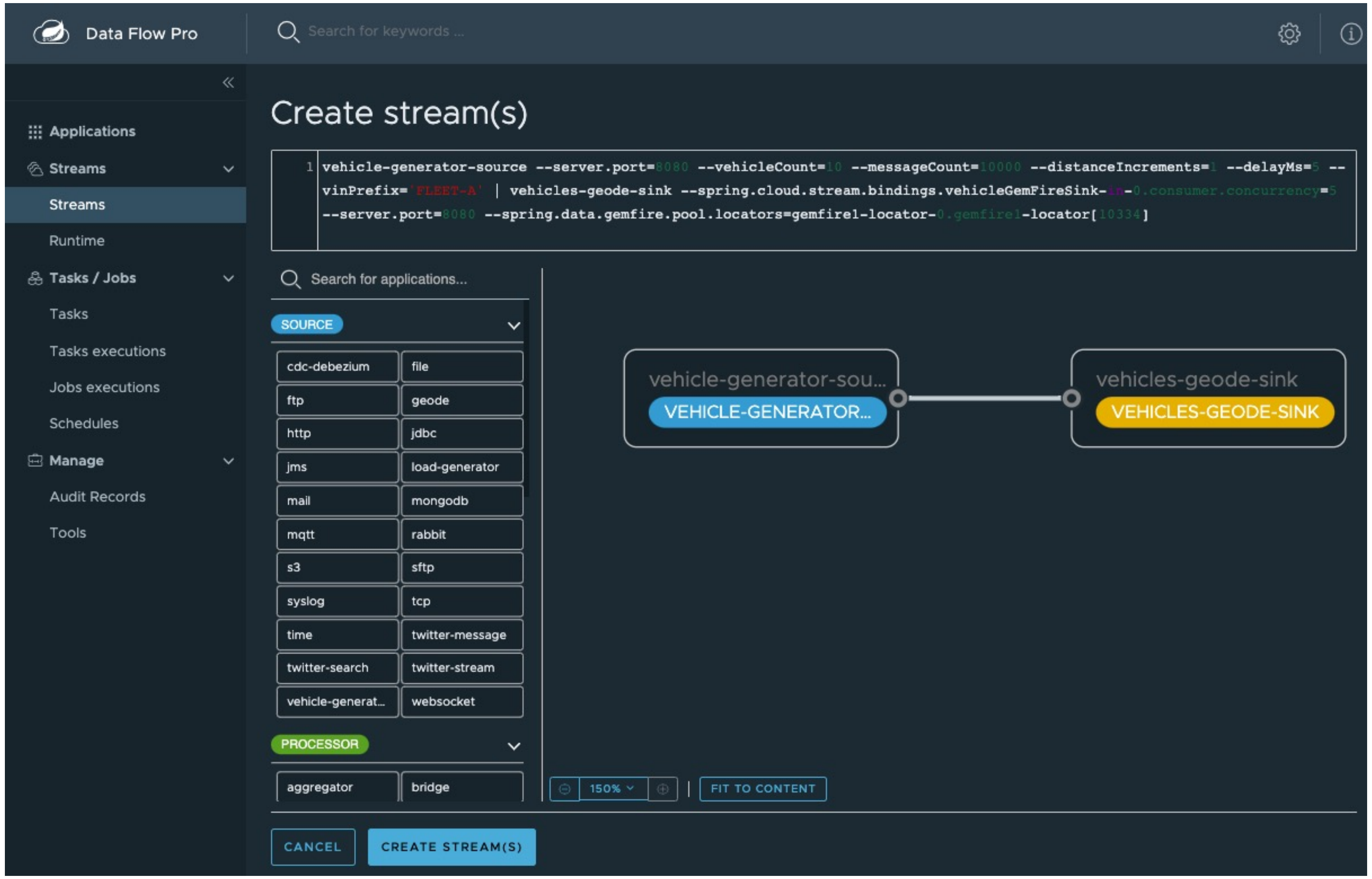
- GUI for managing data pipelines

DSL

- Pipeline definitions language similar to UNIX commands
  - **Ex: file | s3**

REST API & shell interface

```
dataflow:>stream list
```



Create stream(s)

```
vehicle-generator-source --server.port=8080 --vehicleCount=10 --messageCount=10000 --distanceIncrements=1 --delayMs=5 --
vinPrefix='FLEET-A' | vehicles-geode-sink --spring.cloud.stream.bindings.vehicleGemFireSink-in-0.consumer.concurrency=5
--server.port=8080 --spring.data.gemfire.pool.locators=gemfire1-locator-0.gemfire1-locator[10334]
```

Exercises

See https://github.com/Tanzu-Solutions-Engineering/tanzu-rabbitmq-event-streaming-showcase.git

Lab 1 - Setup RabbitMQ on K8
Lab 2 - Create a RabbitMQ Cluster with HA
Lab 3 - Spring Apps with Quorum Queues
Lab 4 - Spring Apps with Streams
Lab 5 - Spring Cloud DataFlow
Lab 6 - Provision RabbitMQ Topology Operation
- Users, Permissions, Queues, Vhost, etc.