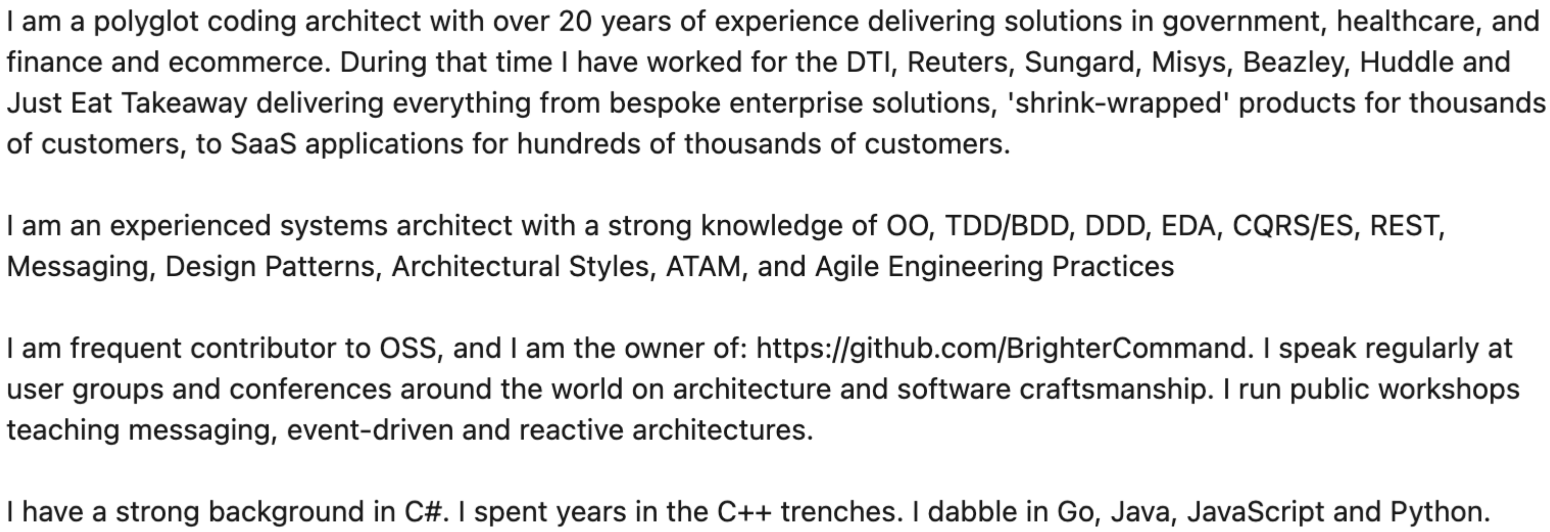
Practical Messaging

A 101 guide to messaging

Ian Cooper

X/Hachyderm: ICooper

Who are you?



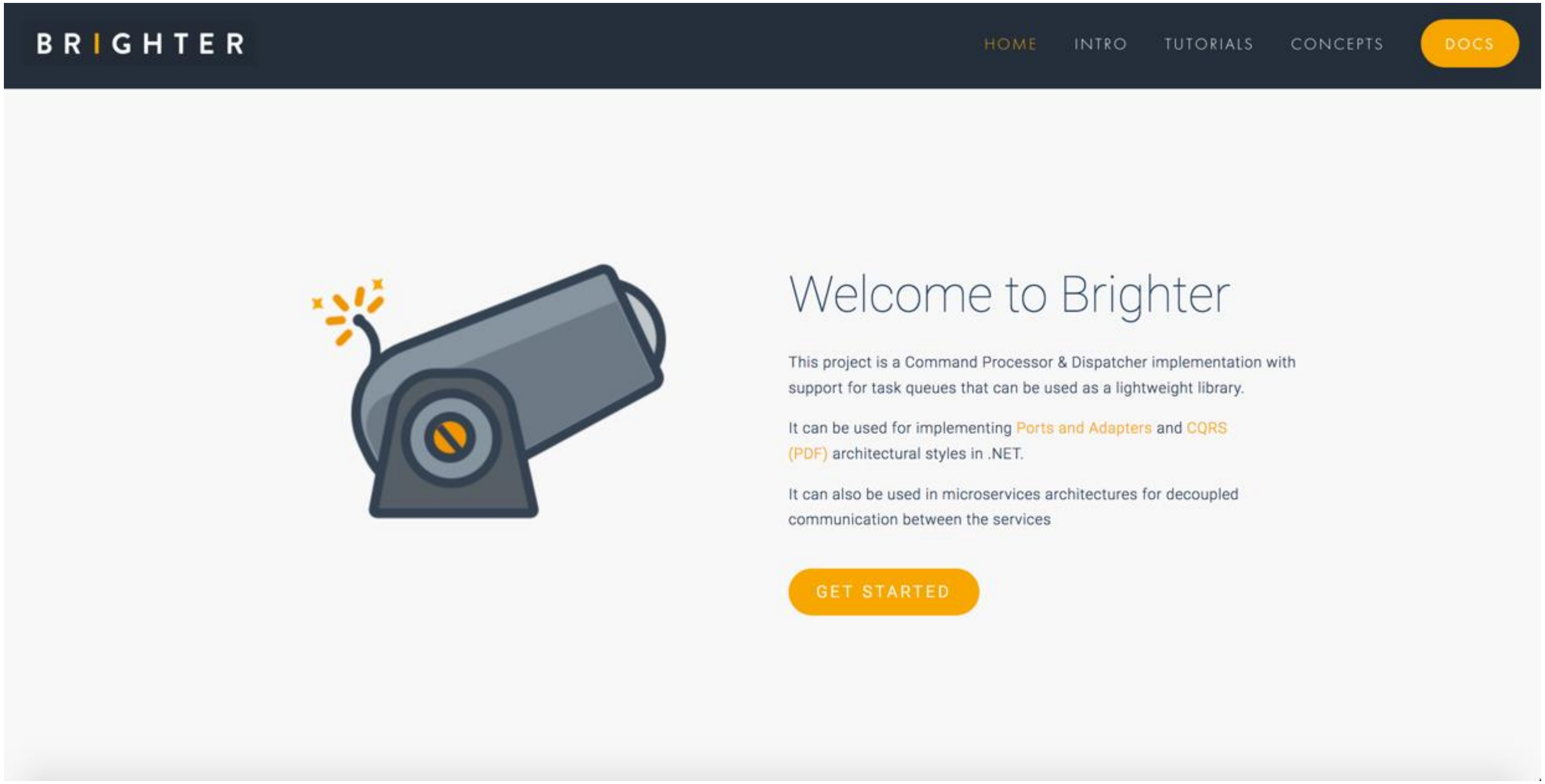
I am a polyglot coding architect with over 20 years of experience delivering solutions in government, healthcare, and finance and ecommerce. During that time I have worked for the DTI, Reuters, Sungard, Misys, Beazley, Huddle and Just Eat Takeaway delivering everything from bespoke enterprise solutions, 'shrink-wrapped' products for thousands of customers, to SaaS applications for hundreds of thousands of customers.

I am an experienced systems architect with a strong knowledge of OO, TDD/BDD, DDD, EDA, CQRS/ES, REST, Messaging, Design Patterns, Architectural Styles, ATAM, and Agile Engineering Practices

I am frequent contributor to OSS, and I am the owner of: https://github.com/BrighterCommand. I speak regularly at user groups and conferences around the world on architecture and software craftsmanship. I run public workshops teaching messaging, event-driven and reactive architectures.

I have a strong background in C#. I spent years in the C++ trenches. I dabble in Go, Java, JavaScript and Python.

www.linkedin.com/in/ian-cooper-2b059b



Welcome to Brighter

This project is a Command Processor & Dispatcher implementation with support for task queues that can be used as a lightweight library.

It can be used for implementing Ports and Adapters and CQRS (PDF) architectural styles in .NET.

It can also be used in microservices architectures for decoupled communication between the services

Day One Messaging

- Distribution
- Integration Styles
- Messaging Patterns
- Queues and Streams
- Managing Asynchronous Architectures

Day Two Conversations

- Conversation Patterns
  - Activity and Correlation
  - Repair and Clarification
  - Reliable Messaging
  - Fat and Skinny
  - Conversations
- Reactive Architectures
  - Message Passing
  - Paper Based Flows
  - Flow Based Programming
- Next Steps

Prerequisites

We will use Rabbit MQ and Kafka for examples. You should have Docker (or an equivalent) installed on your machine, as exercises provide a Docker Compose file to spin up RMQ and Kafka.

You will need to be able to write code with an editor/IDE of your choice.

You can choose from: C#; Java; Python; Go; JavaScript

Course Content

https://github.com/iancooper/practical-messaging

Exercise Code

https://github.com/iancooper/Practical-Messaging-Sharp
https://github.com/iancooper/Practical-Messaging-Python
https://github.com/iancooper/Practical-Messaging-JavaScript
https://github.com/iancooper/Practical-Messaging-Go
https://github.com/iancooper/Practical-Messaging-Java

Day One

What is driving messaging

DISTRIBUTED SYSTEMS

Why Distribute?

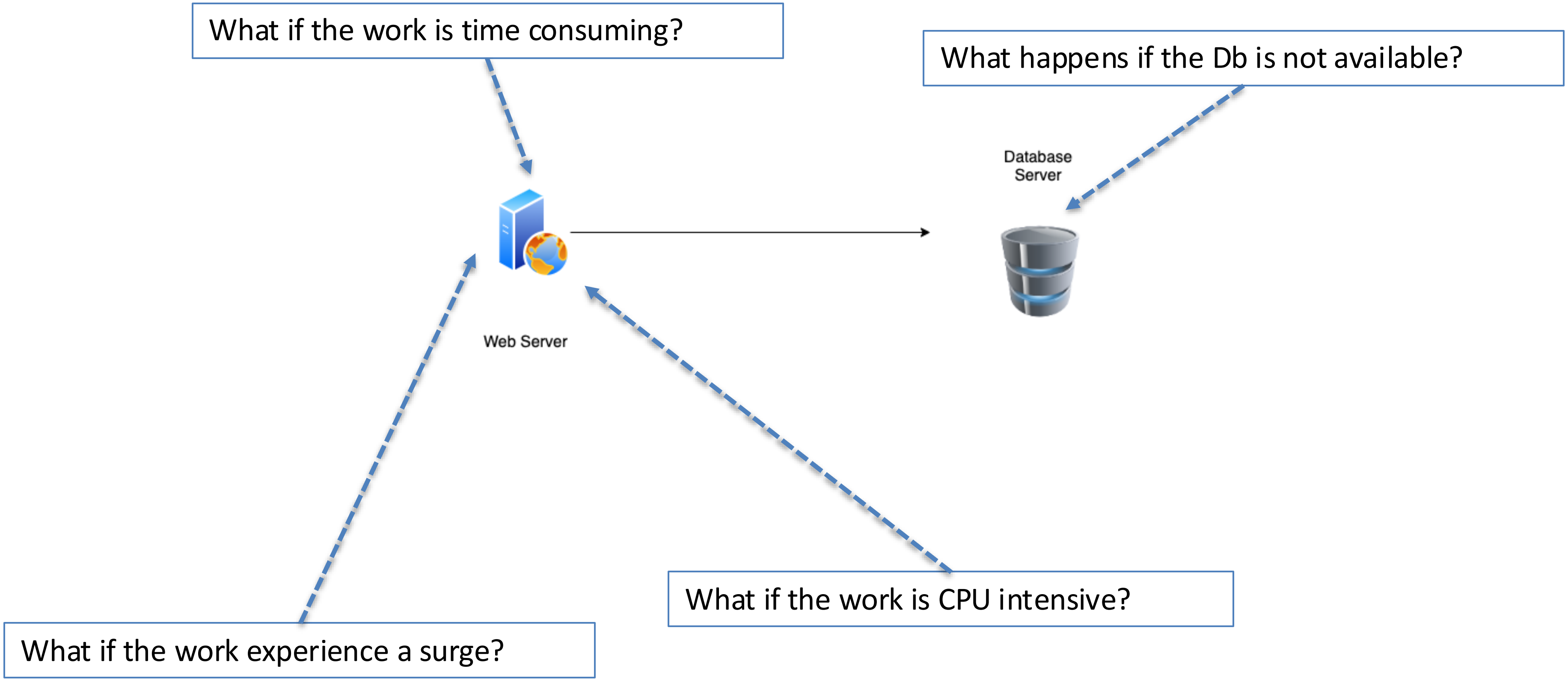
Performance and Scalability

Availability

Maintainability

Inherent Distribution

Example: Task Queues



What if the work is time consuming?

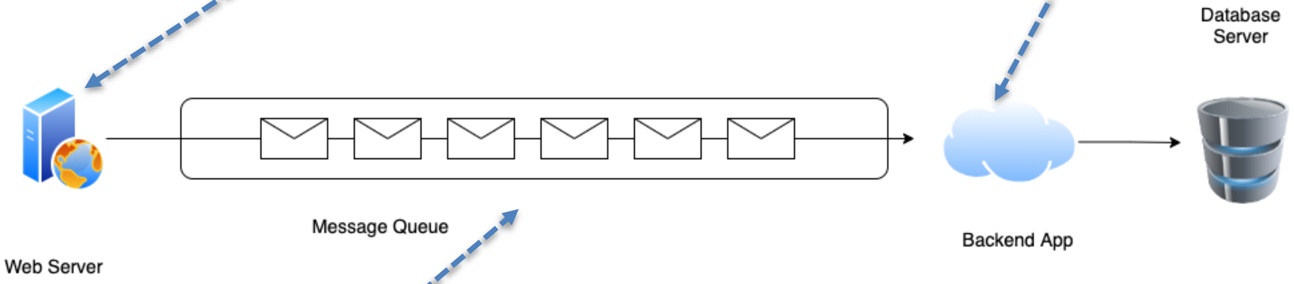
What happens if the Db is not available?

What if the work is CPU intensive?

What if the work experience a surge?

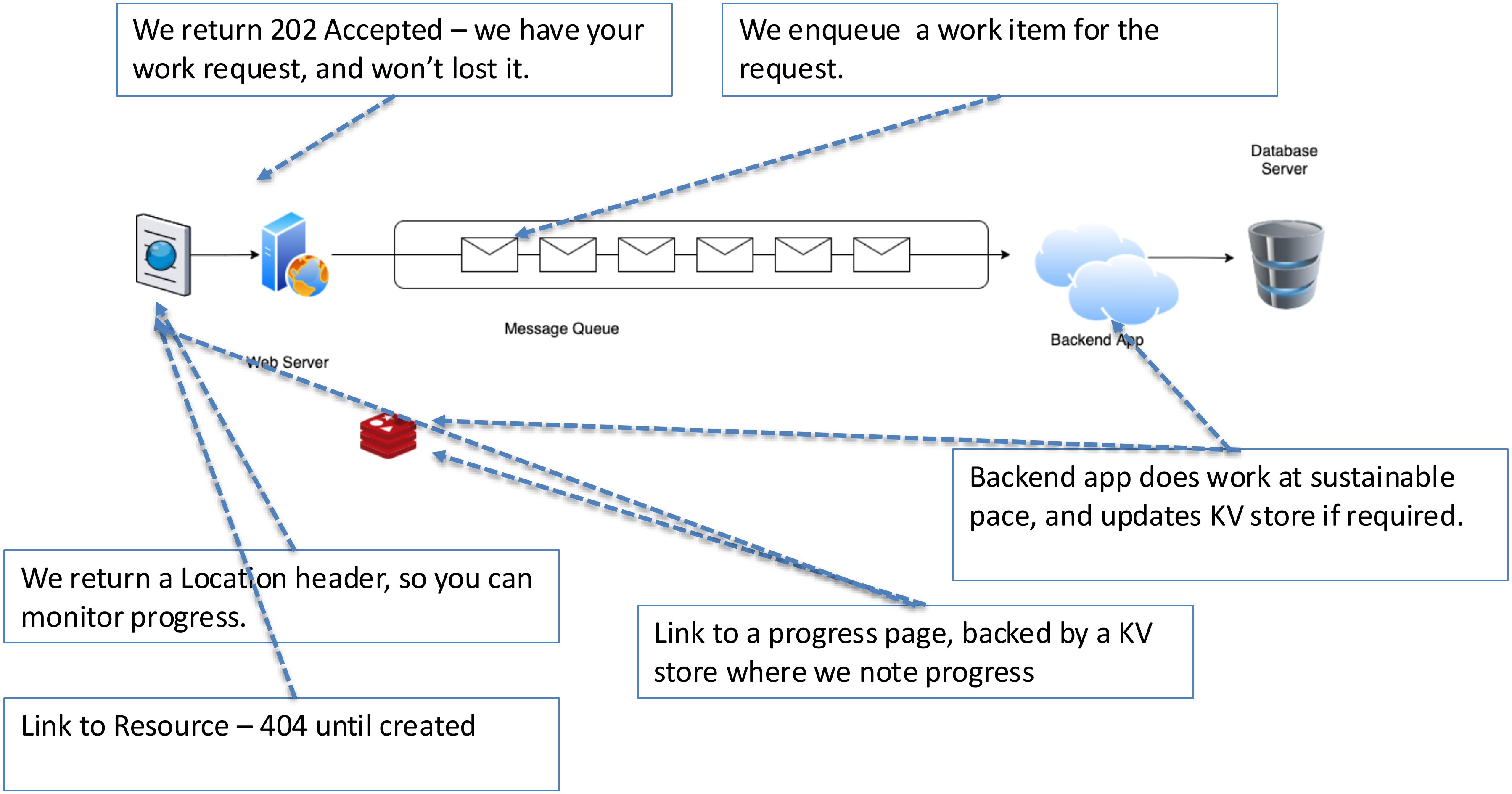
The web server puts the work on a queue

A backend application can perform long-running or CPU intensive work, allowing the web server to service new requests.



The queue stores work until we are ready to consume it. We can *throttle* to prevent surges.

We can scale out the backend services using a competing consumers approach, to ensure the queue does not backup.



We return 202 Accepted – we have your work request, and won’t lost it.

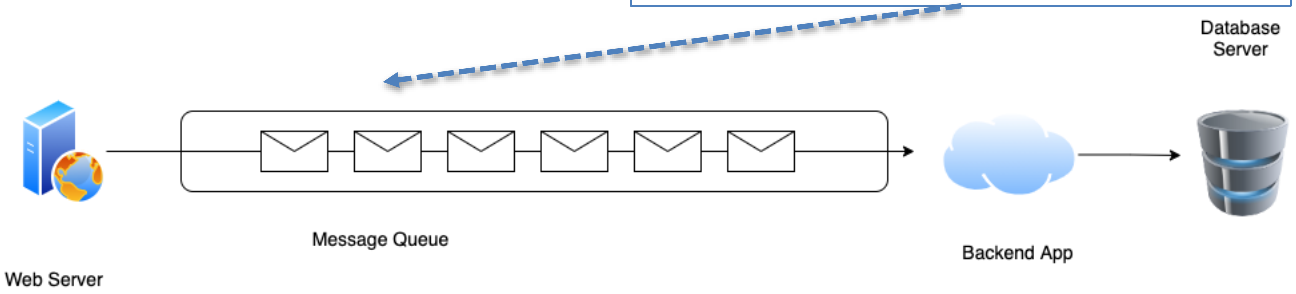
We enqueue a work item for the request.

Backend app does work at sustainable pace, and updates KV store if required.

We return a Location header, so you can monitor progress.

Link to a progress page, backed by a KV store where we note progress

Link to Resource – 404 until created



This general technique is known as Decoupled Invocation – we separate building the command from executing it.

Decoupled Invocation Pattern

Use Decoupled Invocation. A producer puts a message onto a queue at the service endpoint. A consumer reads messages from the queue.

The queue stores messages for eventual processing.

If the rate of arrival at the endpoint is unpredictable, the queue acts as a buffer that makes it possible to predict the rate of consumption.

This makes it simpler to do capacity planning because peaks of requests are smoothed out by the queue.

The consumer must be able to control the rate of processing, otherwise a spike is simply passed down the wire.

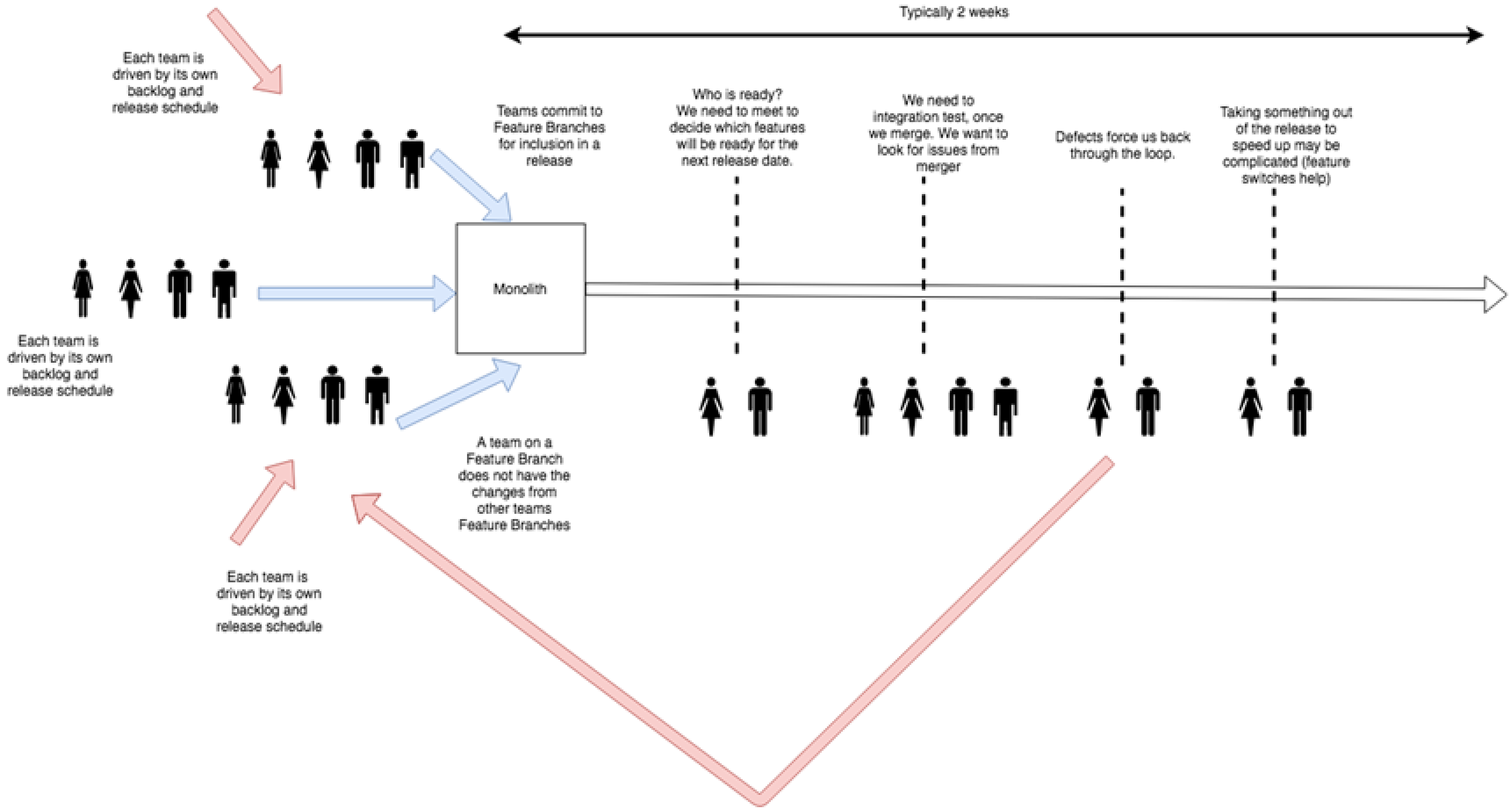
Example: Microservices

It’s all about velocity!!!

“Speed wins in the marketplace”

Adrian Cockcroft, former lead architect at Netflix

Monoliths Do Not Scale To Many Teams!



Typically 2 weeks

Each team is driven by its own backlog and release schedule

Teams commit to Feature Branches for inclusion in a release

Who is ready? We need to meet to decide which features will be ready for the next release date.

We need to integration test, once we merge. We want to look for issues from merger

Defects force us back through the loop.

Taking something out of the release to speed up may be complicated (feature switches help)

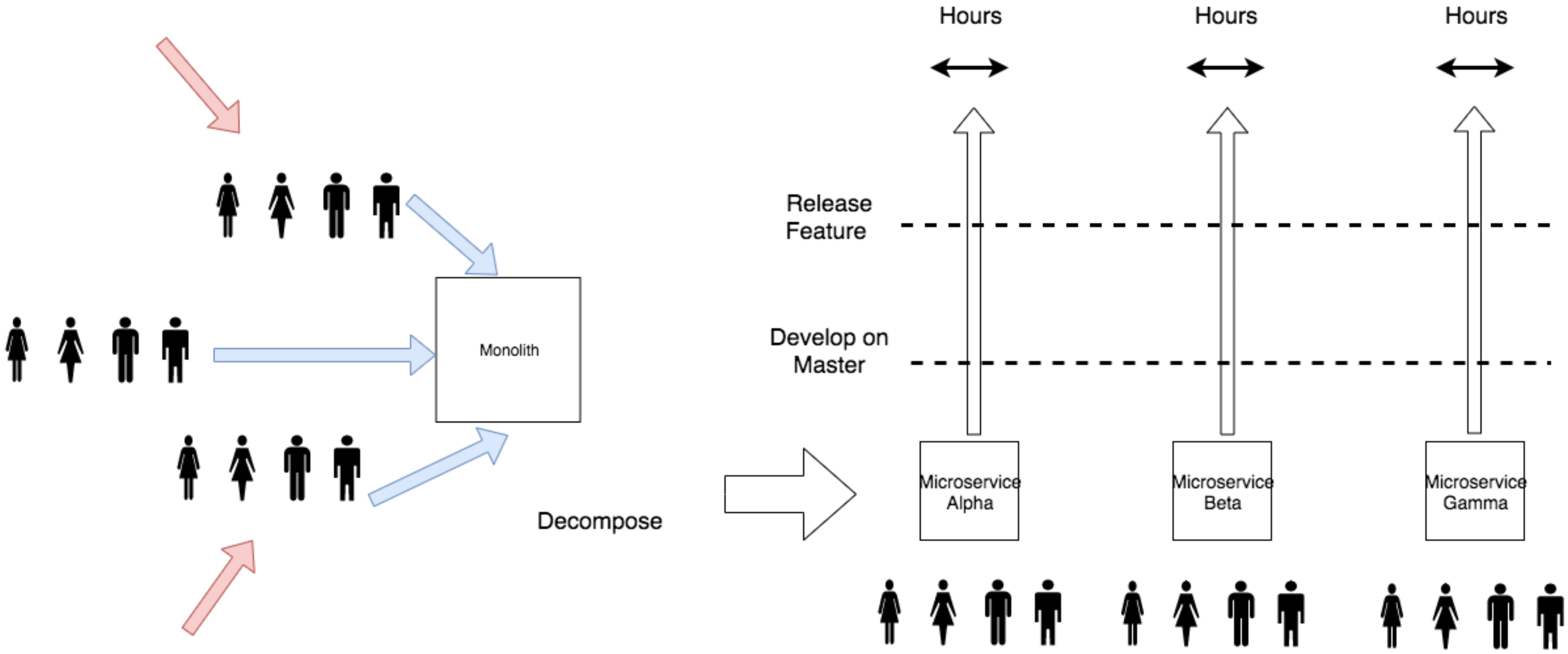
Monolith

Each team is driven by its own backlog and release schedule

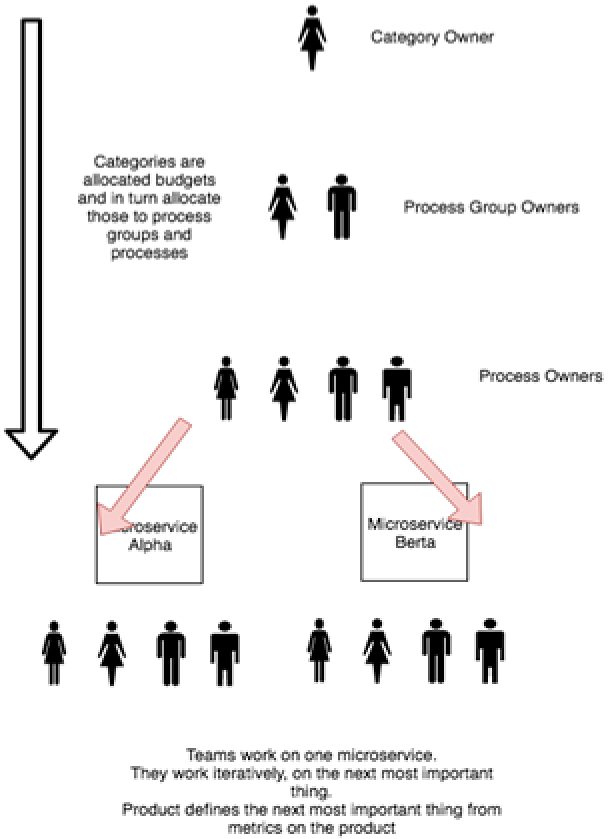
A team on a Feature Branch does not have the changes from other teams Feature Branches

Each team is driven by its own backlog and release schedule

Microservices let us scale an organisation



Product Mode



Category Owner

Categories are allocated budgets and in turn allocate those to process groups and processes

Process Group Owners

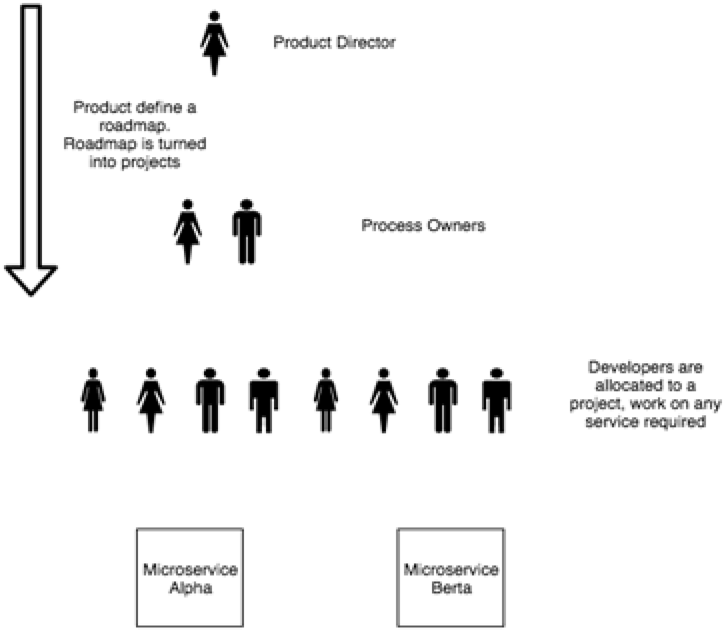
Process Owners

roservice Alpha

Microservice Berta

Teams work on one microservice.
They work iteratively, on the next most important thing.
Product defines the next most important thing from metrics on the product

Product Mode



Product Director

Product define a roadmap.
Roadmap is turned into projects

Process Owners

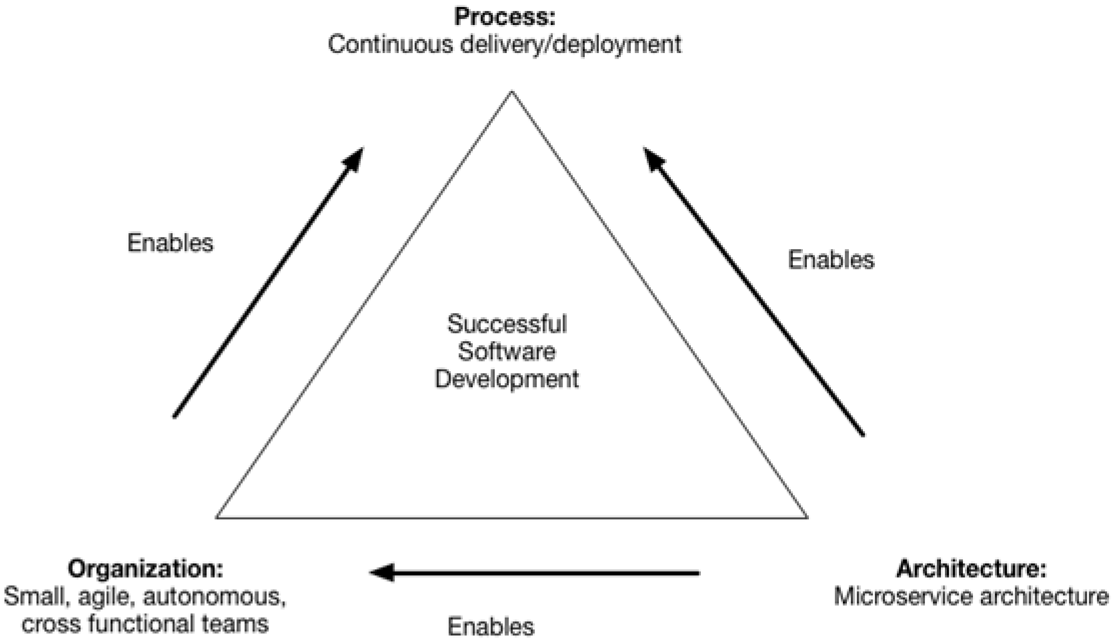
Developers are allocated to a project, work on any service required

Microservice Alpha

Microservice Berta

Projects

Microservices Enable Agility



https://microservices.io/patterns/decomposition/decompose-by-business-capability.html

The Price of Distribution

Fallacies of Distributed Computing

The network is reliable.

Latency is zero.

Bandwidth is infinite.

The network is secure.

Topology doesn't change.

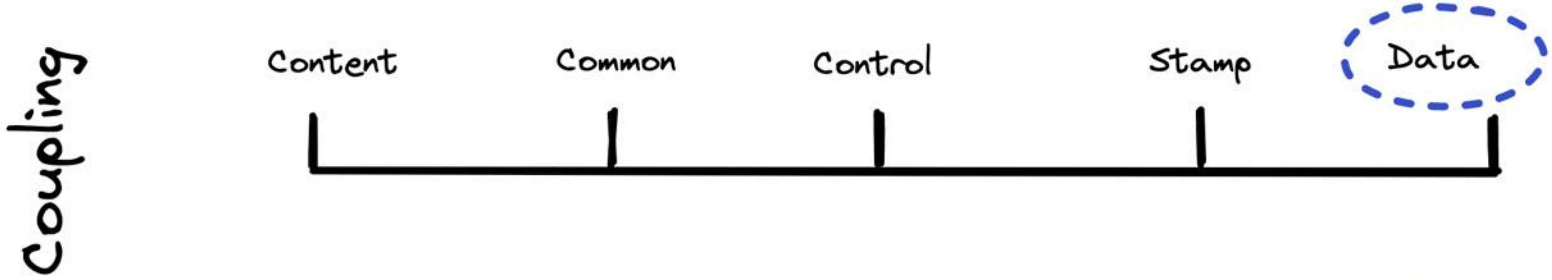
There is one administrator.

Transport cost is zero.

The network is homogeneous.

How do we communicate between microservices?

INTEGRATION STYLES



Coupling

Content

Common

Control

Stamp

Data

Tight

More Interdependency

More Coordination

More Information Flow

Loose

Less Interdependency

Less Coordination

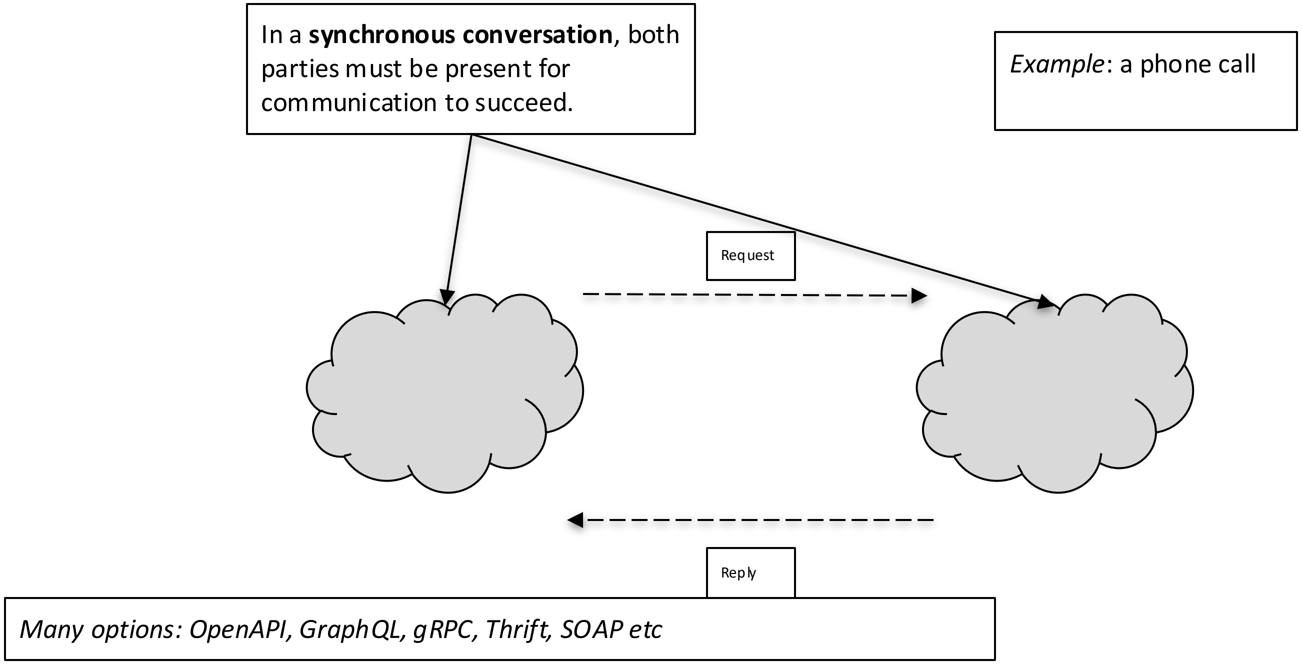
Less Information Flow

Behavioral Coupling: a form of control coupling where we exchange a sequence of calls to complete work

Behavioral Coupling

Temporal Coupling

Synchronous Conversation



In a **synchronous conversation**, both parties must be present for communication to succeed.

Example: a phone call

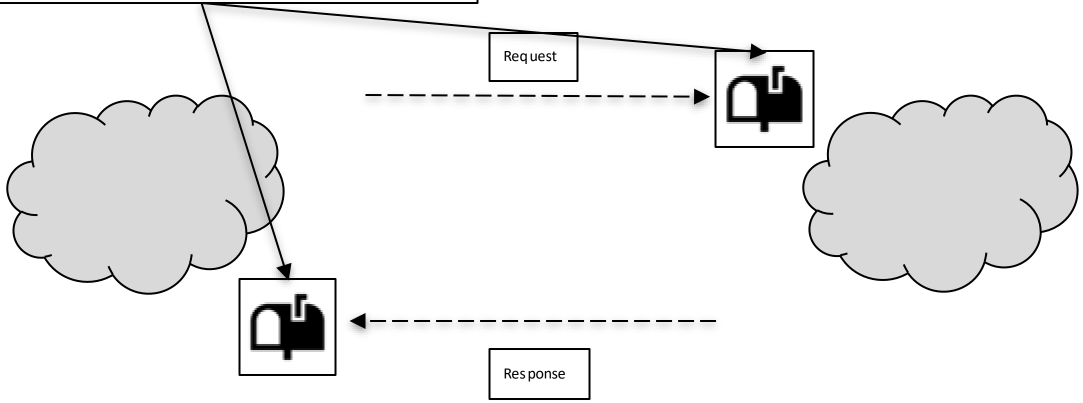
Many options: OpenAPI, GraphQL, gRPC, Thrift, SOAP etc

Temporal Coupling

Asynchronous Conversation

In an a**synchronous conversation**, the *receiver* does not need to be present at the time the *sender* communicates with them, using **store and forward** to pick up the message later.

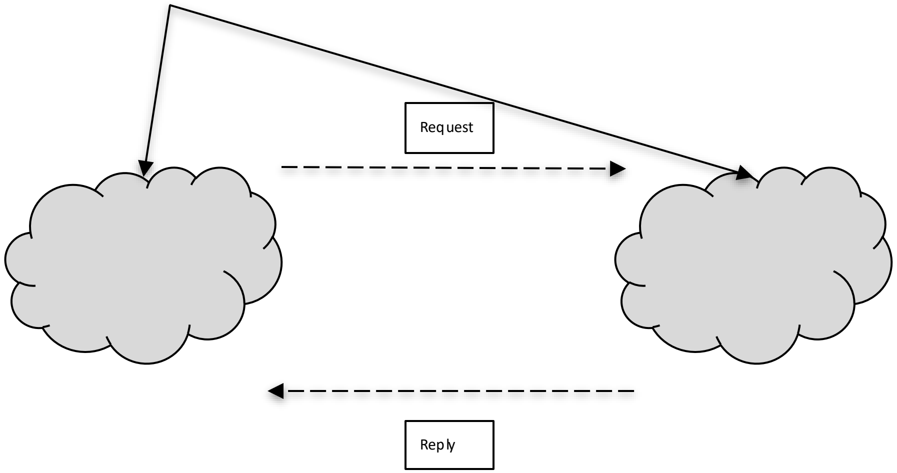
Example: snail mail



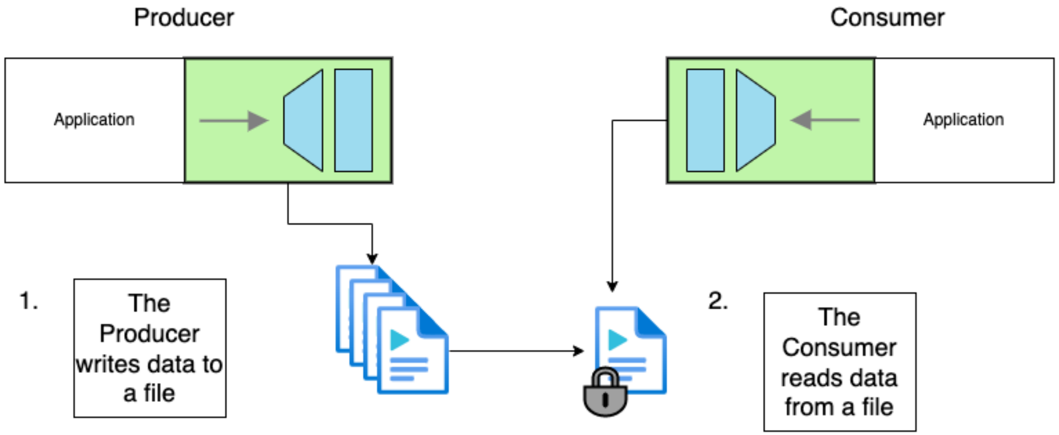
Many options: SQS, Kafka, AMQP 0-9-1 (RMQ), AMQP 1-0, MQTT, S3

Temporal Coupling

If both parties must be present to succeed, we say they are *temporally coupled.* The availability of one has an impact on the availability of another.



File Transfer



Producer

Application

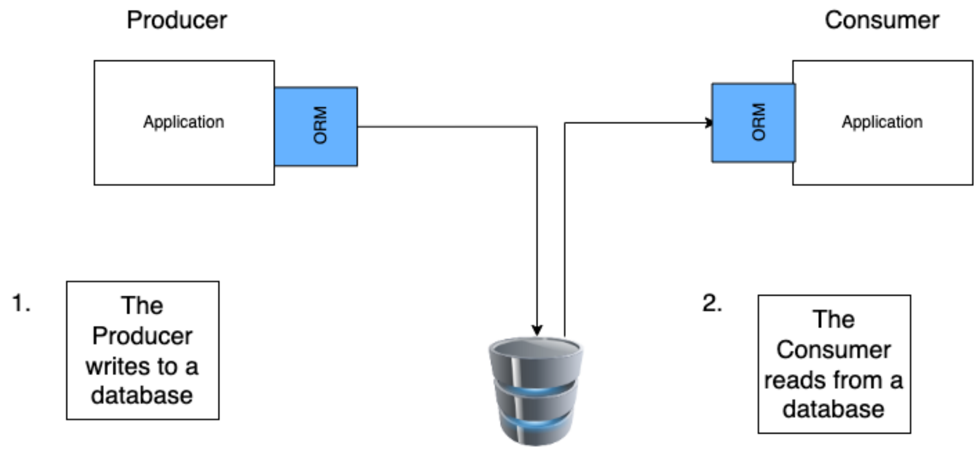
1. The Producer writes data to a file

Consumer

Application

2. The Consumer reads data from a file

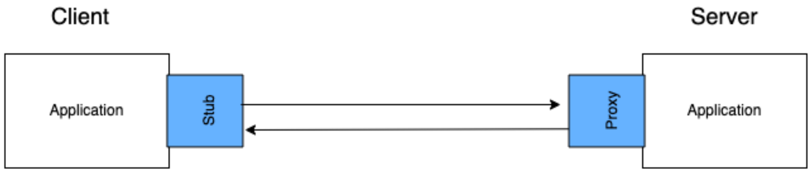
Shared Database



1. The Producer writes to a database

2. The Consumer reads from a database

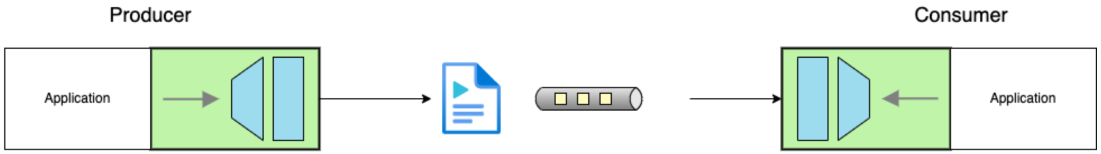
Remote Procedure Call



1. The Client calls a remote procedure on the Server

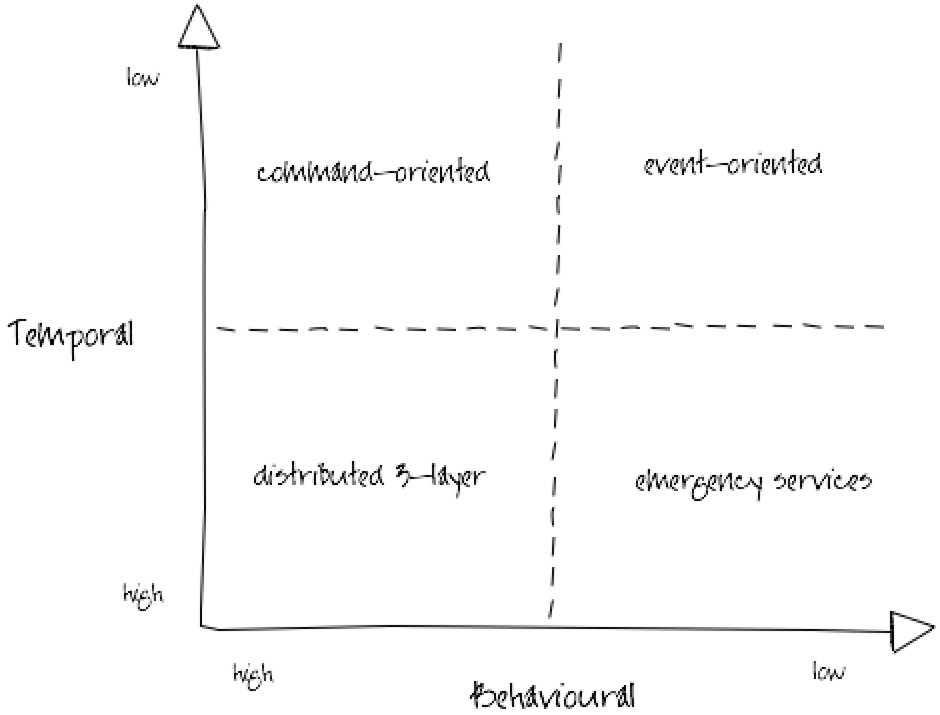
2. The Server listens for calls, actions them, and returns results

Messaging



1. The Producer writes a message to a channel

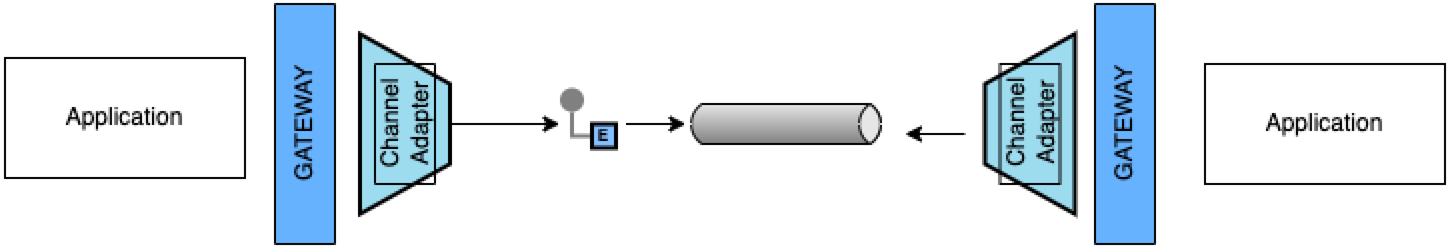
2. The Consumer reads a message from a channel



Ian Robinson: http://iansrobinson.com/2009/04/27/temporal-and-behavioural-coupling/

Integrating using events

MESSAGING PATTERNS


Application
GATEWAY
Channel Adapter
E
Channel Adapter
GATEWAY
Application

What is a message?

A MESSAGE

Message Construction

A message has a header and body

The body contains data for the consumer

The header contains metadata for any *filter* in the pipeline.

The header should indicate the format of the body

Break a large message into pieces as a Message Sequence or use a Claim Check

MESSAGING AND EVENTS

Message Types

Messaging

Has Intent

Request An Answer (Query)
Transfer of Control (Command)
Transfer of Value

Part of a Workflow
Part of a Conversation

Concerned with the Future

Eventing

Provides Facts

Things you Report On

No Expectations

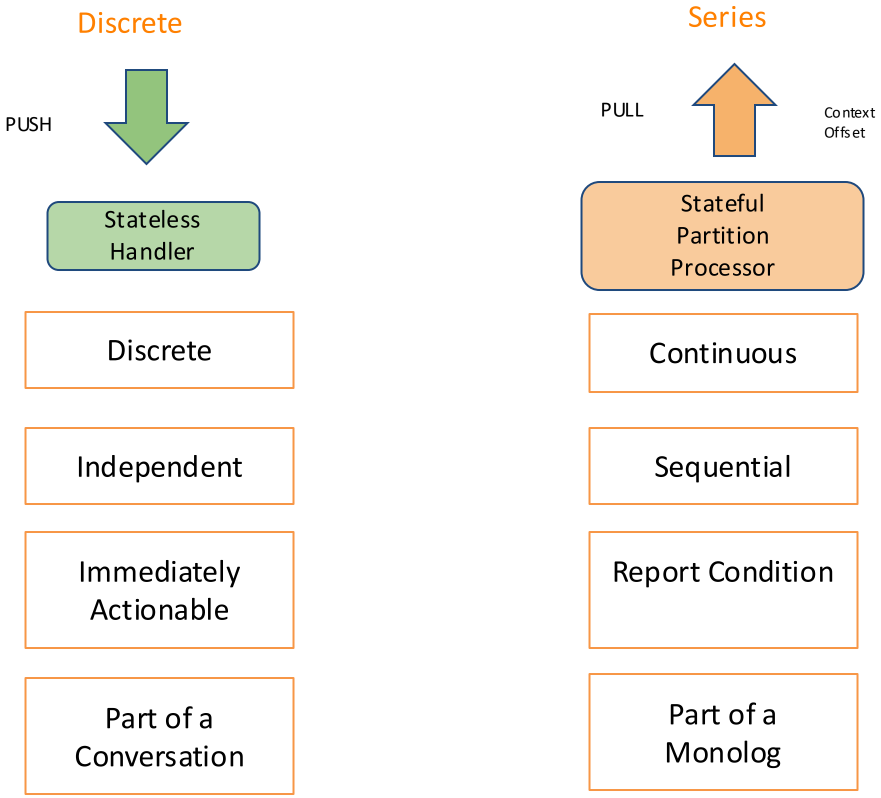
History

Context

Concerned with the Past

After Clemens Vasters https://youtu.be/ITrlLErsqzY

Eventing Types



Discrete

PUSH

Stateless Handler

Discrete

Independent

Immediately Actionable

Part of a Conversation

Series

PULL

Context
Offset

Stateful Partition Processor

Continuous

Sequential

Report Condition

Part of a Monolog

After Clemens Vasters: https://skillsmatter.com/skillscasts/10191-keynote-events-data-points-jobs-and-commands-the-rise-of-messaging

See also: https://en.wikipedia.org/wiki/Discrete_time_and_continuous_time

Message Types

Messaging

Command

Eventing

Event (Notification)

Document

See Gregor Hohpe: https://www.enterpriseintegrationpatterns.com/patterns/messaging/Message.html

Command Message

Use a Command Message to reliably invoke a procedure in another application

Uses the well-established pattern for encapsulating a request as an object. The Command pattern [GoF] turns a request into an object that can be stored and passed around.

Document Message

Use a Document Message to reliably transfer a data structure between applications.

The receiver decides what, if anything, to do with the data

Event Message

Use an Event Message for reliable, asynchronous event notification between applications.

The difference between an Event Message and a Document Message is a matter of timing and content. An event’s contents are typically less important.

Self-paced material

EXERCISES

EXERCISE MATERIAL

Introduction to Exercises

- Readme
- Videos
- Scripts & Slides

Introduction to RMQ

CHANNELS

Channels

A virtual pipe that connects producer and consumer

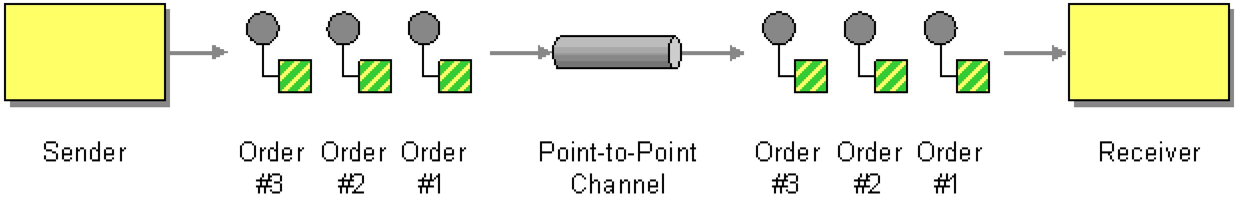
Logical Address (Topic or Routing Key)

Unidirectional

One-to-One or One-to-Many

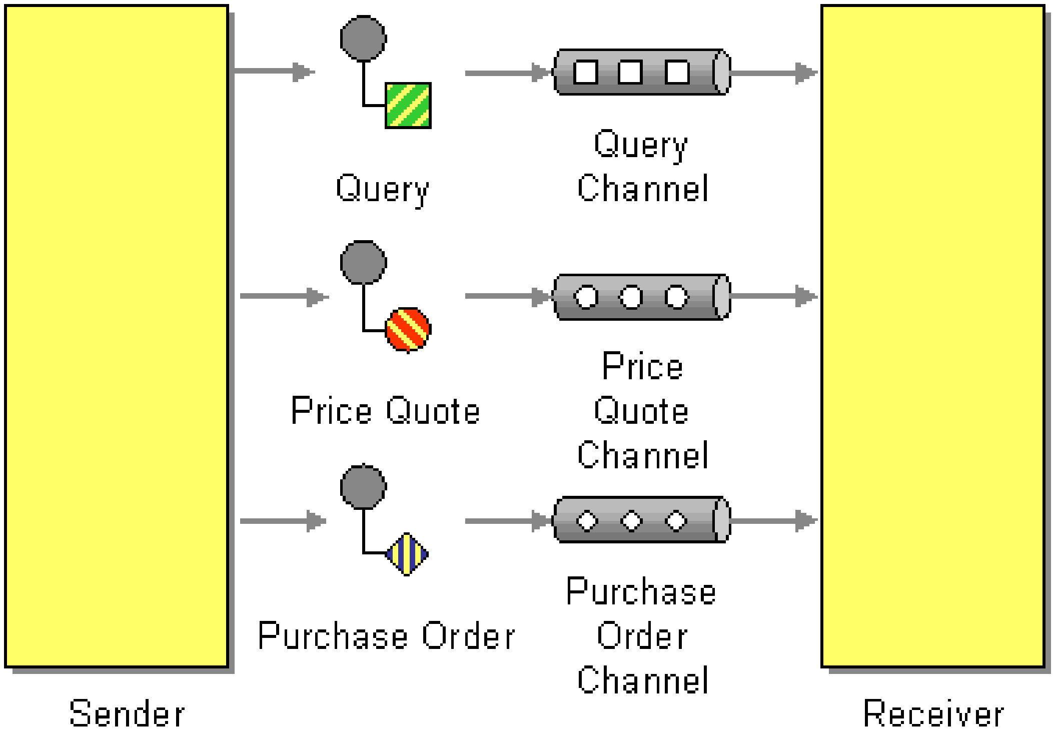
Messaging is a ‘pipe’ not a ‘bucket’.

Point-to-Point Channel



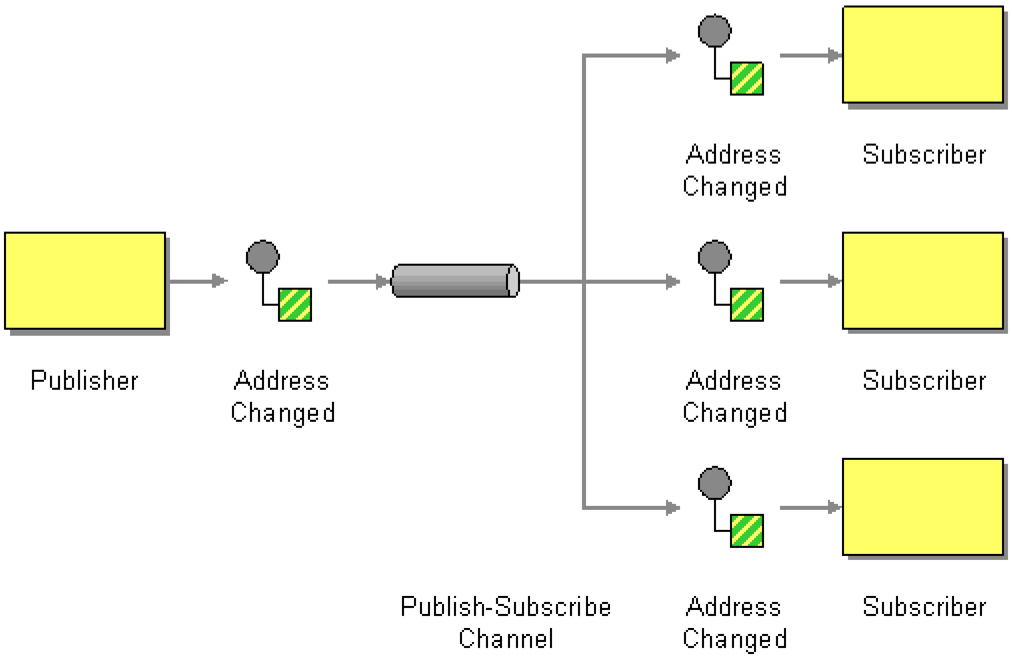
http://www.enterpriseintegrationpatterns.com/patterns/messaging/PointToPointChannel.html

Datatype Channel



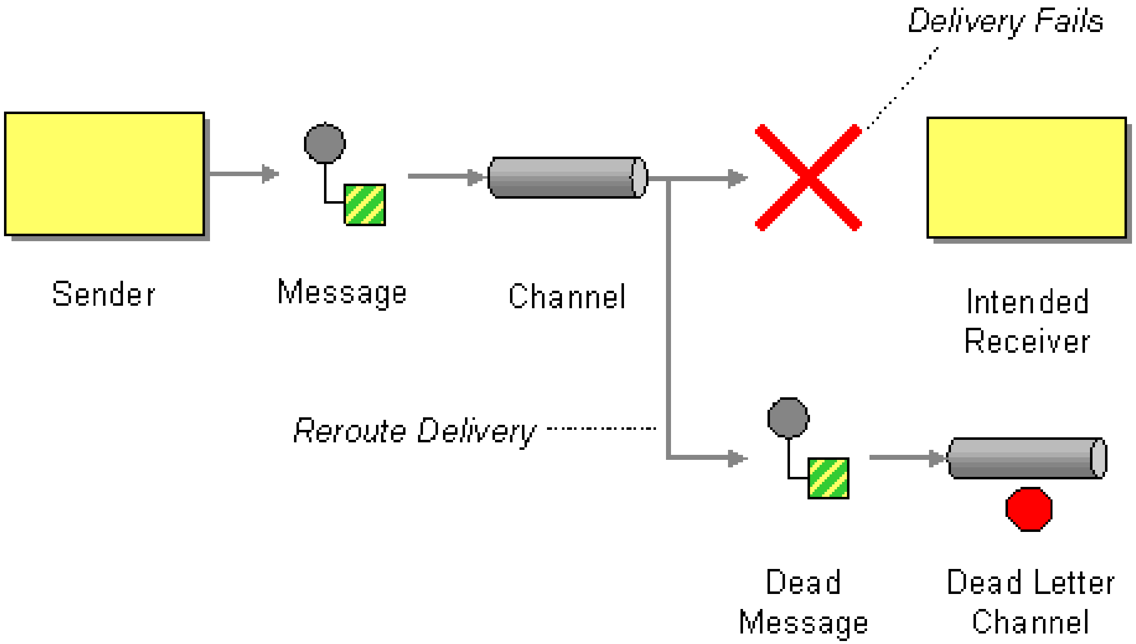
http://www.enterpriseintegrationpatterns.com/patterns/messaging/DatatypeChannel.html

Publish-Subscribe Channel



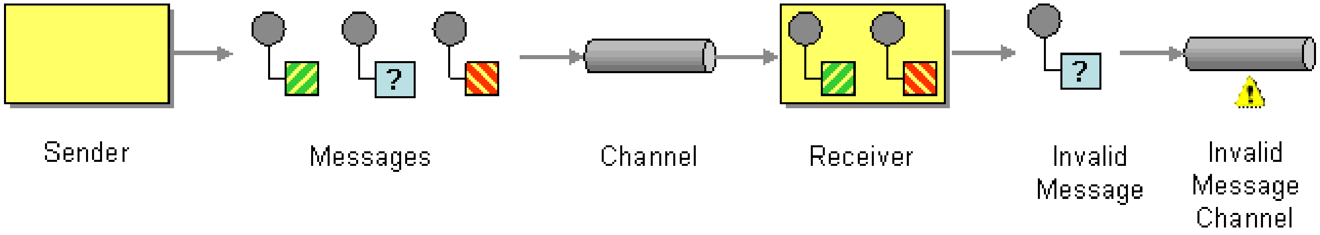
http://www.enterpriseintegrationpatterns.com/patterns/messaging/PublishSubscribeChannel.html

Dead Letter Channel



http://www.enterpriseintegrationpatterns.com/patterns/messaging/DeadLetterChannel.html

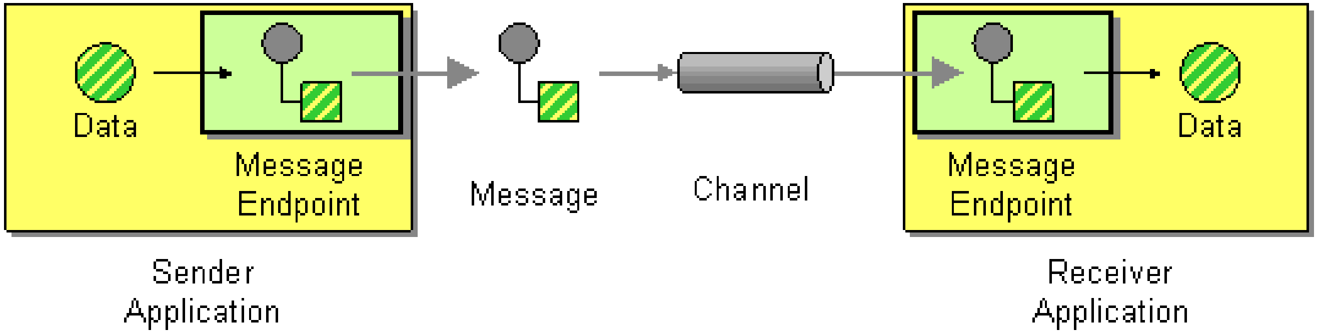
Invalid Message Channel



http://www.enterpriseintegrationpatterns.com/patterns/messaging/InvalidMessageChannel.html

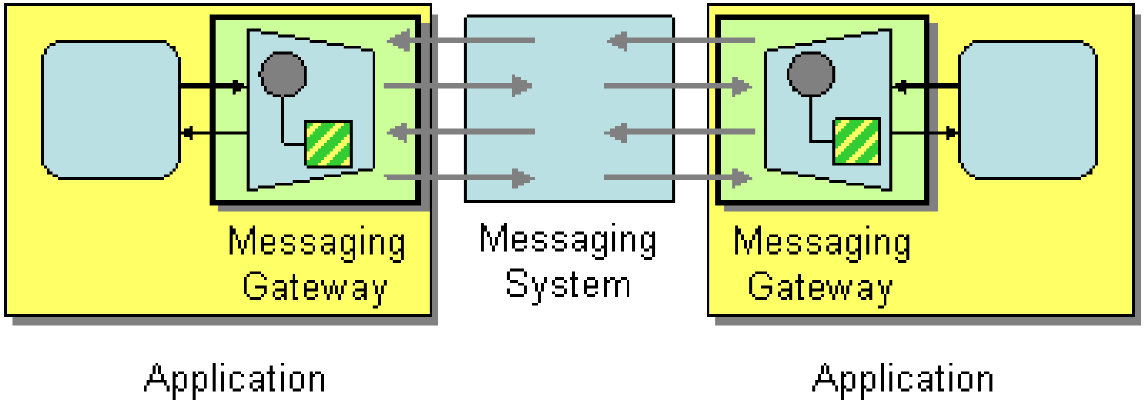
ENDPOINTS

Message Endpoint



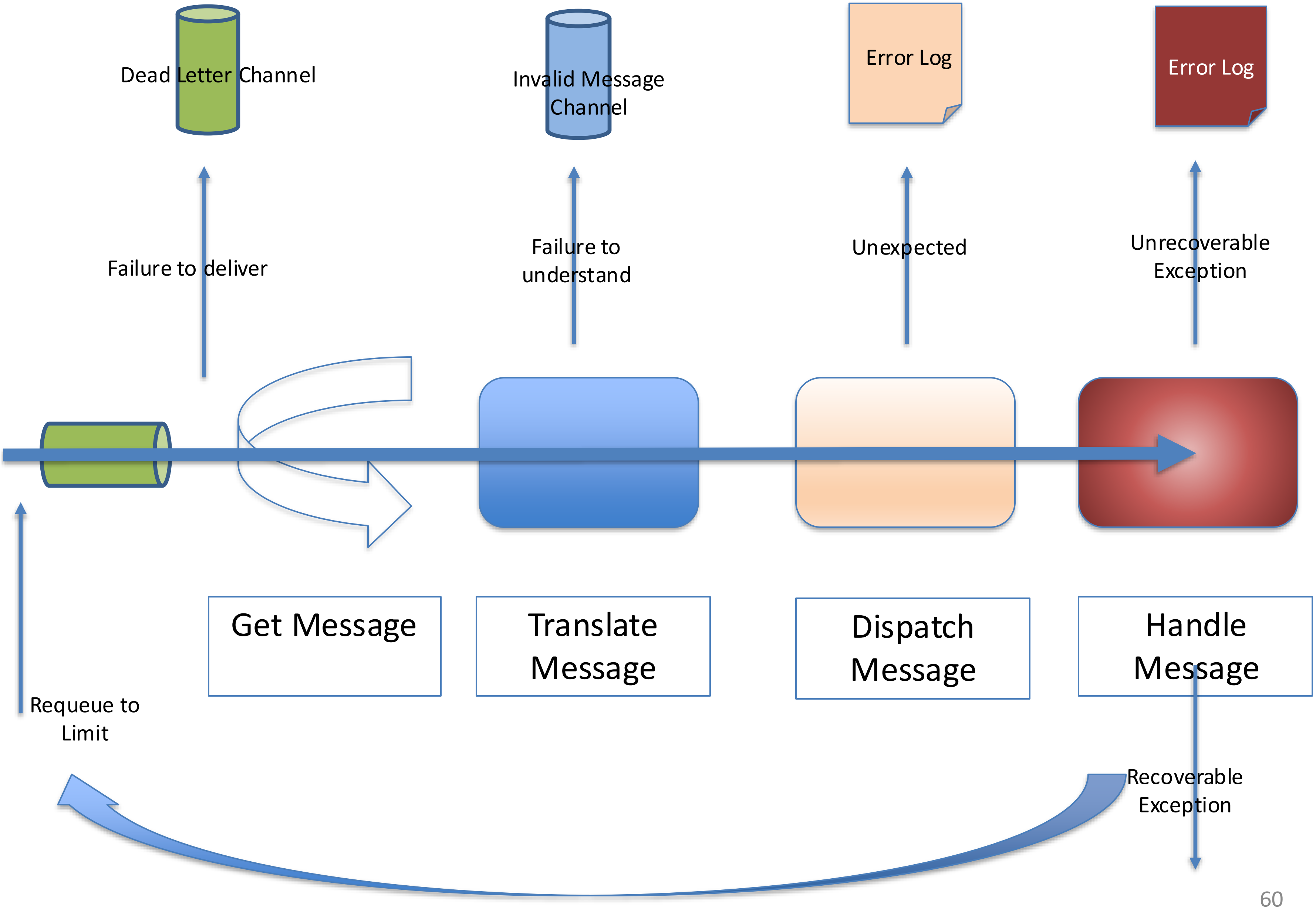
http://www.enterpriseintegrationpatterns.com/patterns/messaging/MessageEndpoint.html

Messaging Gateway



http://www.enterpriseintegrationpatterns.com/patterns/messaging/MessagingGateway.html

THE MESSAGE PUMP



Dead Letter Channel

Invalid Message Channel

Error Log

Error Log

Failure to deliver

Failure to understand

Unexpected

Unrecoverable Exception

Get Message

Translate Message

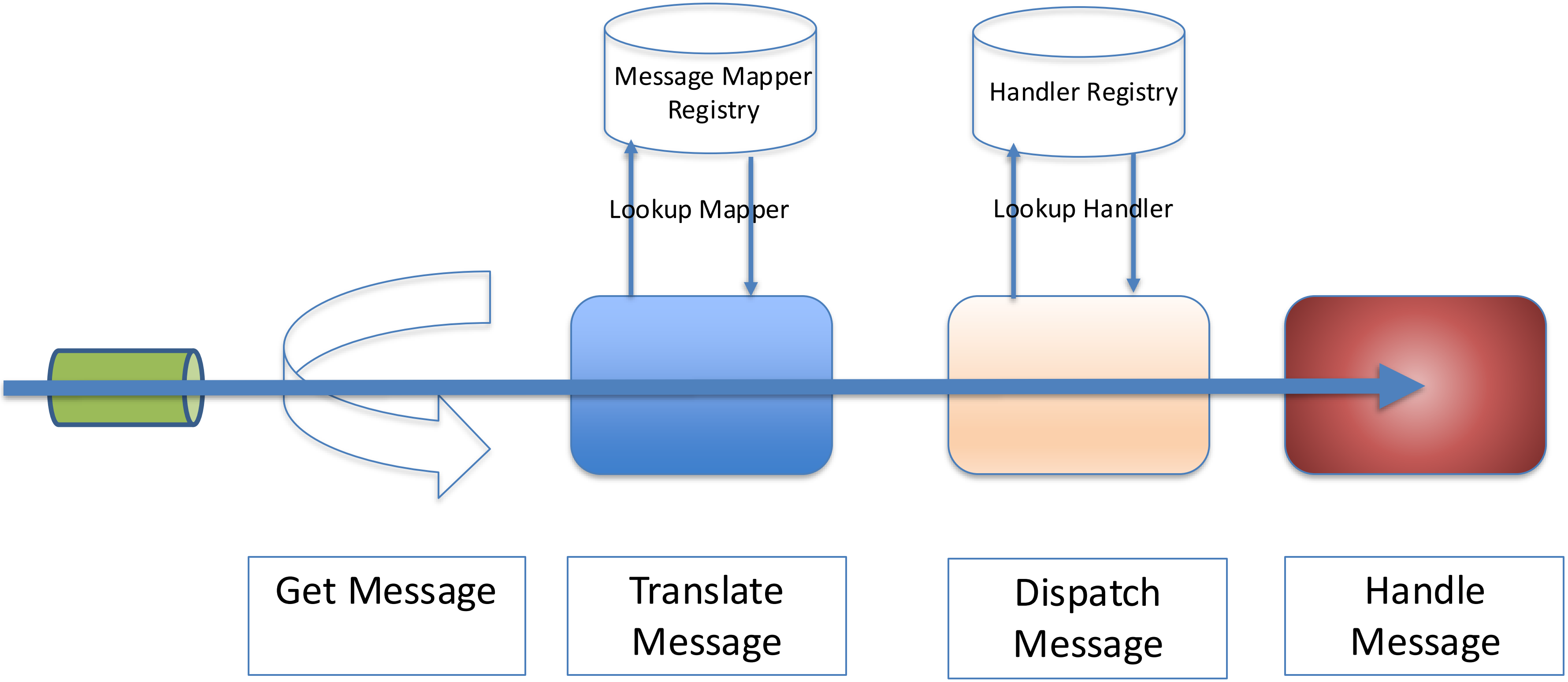
Dispatch Message

Handle Message

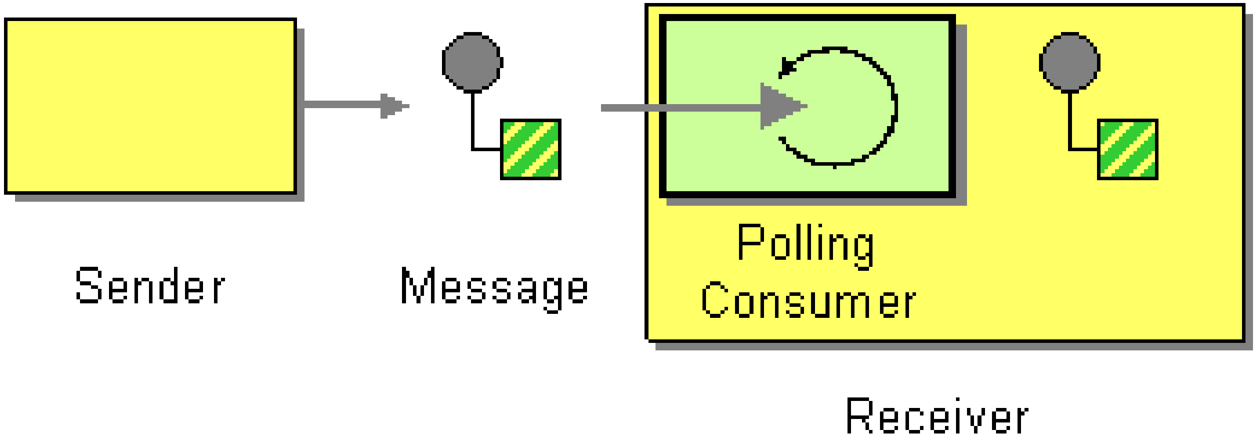
Requeue to Limit

Recoverable Exception

Translate and Dispatch

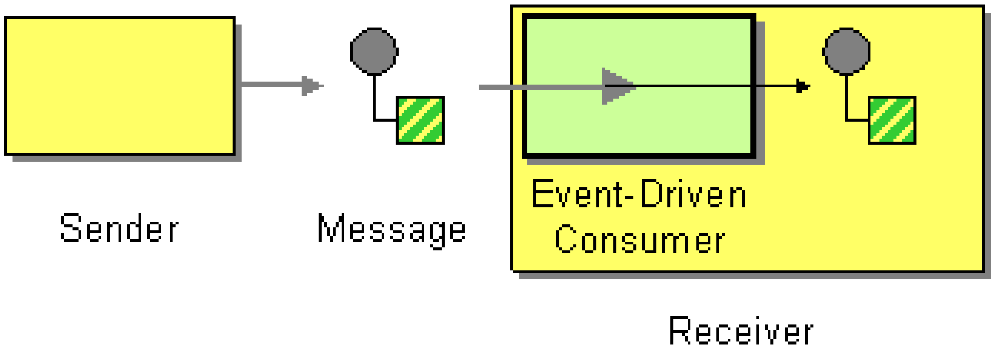


Polling Consumer



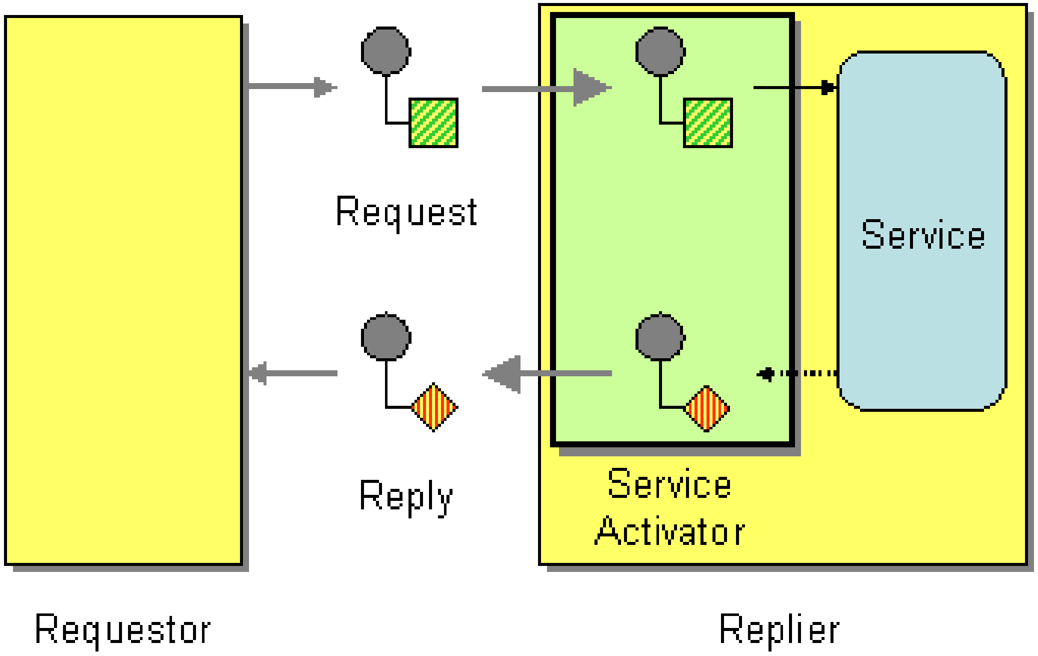
http://www.enterpriseintegrationpatterns.com/patterns/messaging/PollingConsumer.html

Event Driven Consumer



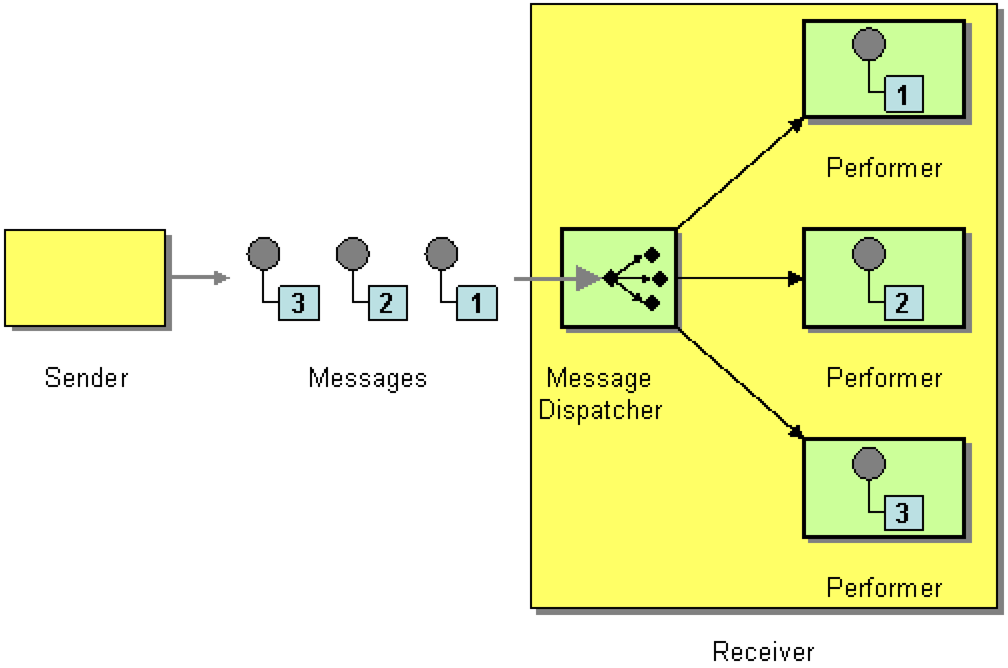
http://www.enterpriseintegrationpatterns.com/patterns/messaging/EventDrivenConsumer.html

Service Activator



http://www.enterpriseintegrationpatterns.com/patterns/messaging/MessagingAdapter.html

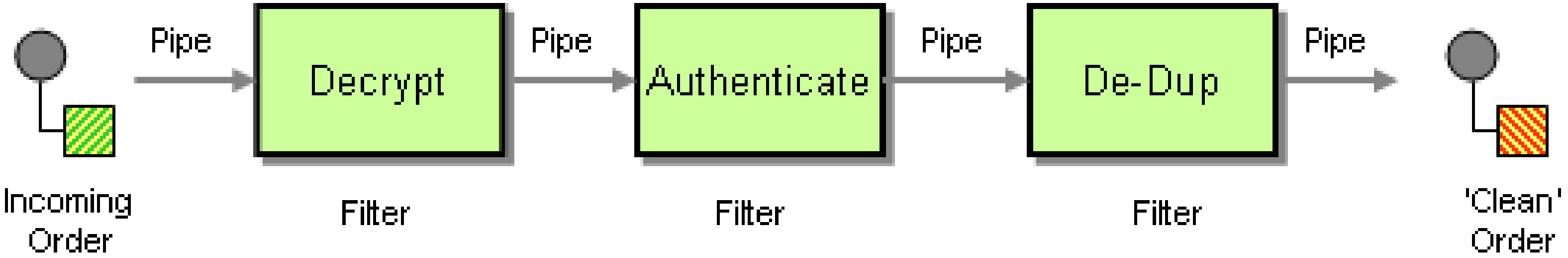
Competing Consumers



http://www.enterpriseintegrationpatterns.com/patterns/messaging/MessageDispatcher.html

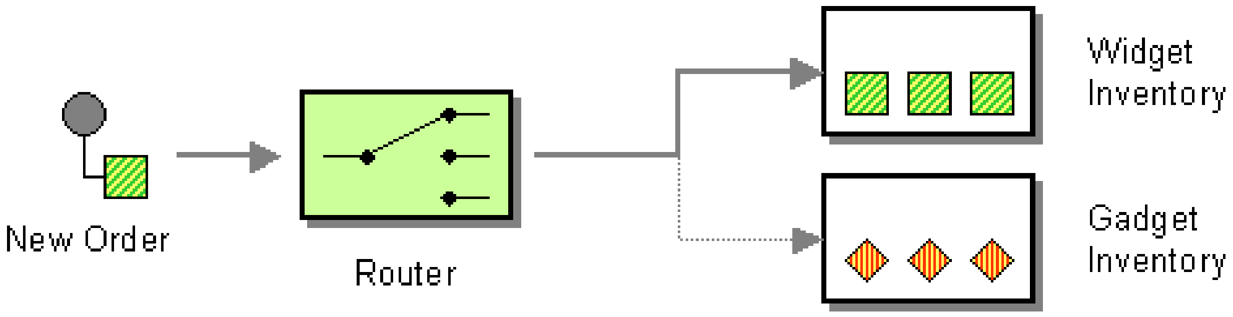
PIPELINES

Pipes and Filters



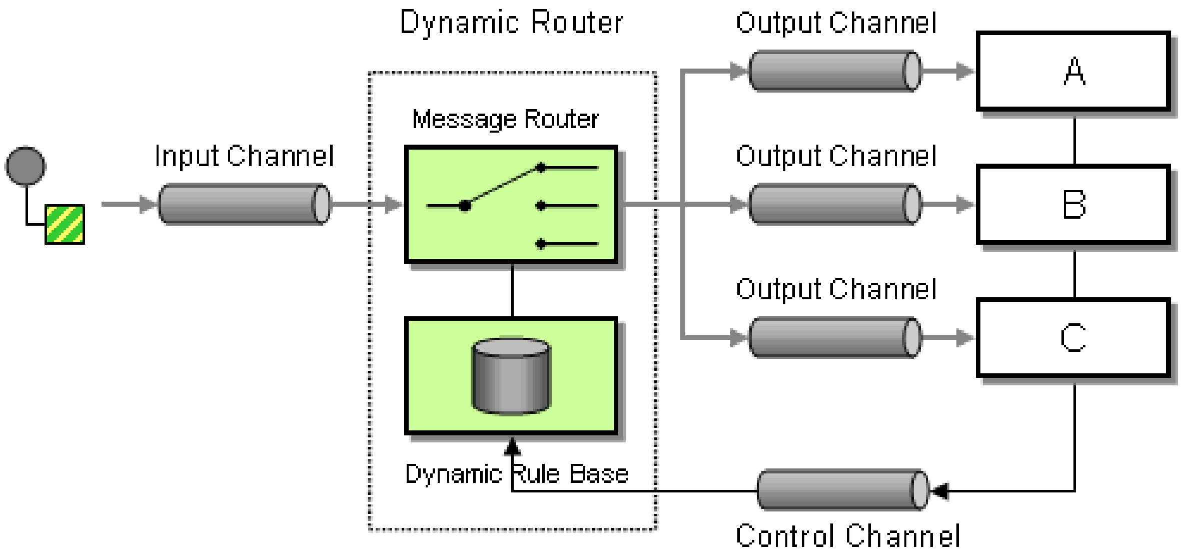
http://www.enterpriseintegrationpatterns.com/patterns/messaging/PipesAndFilters.html

Content Based Router



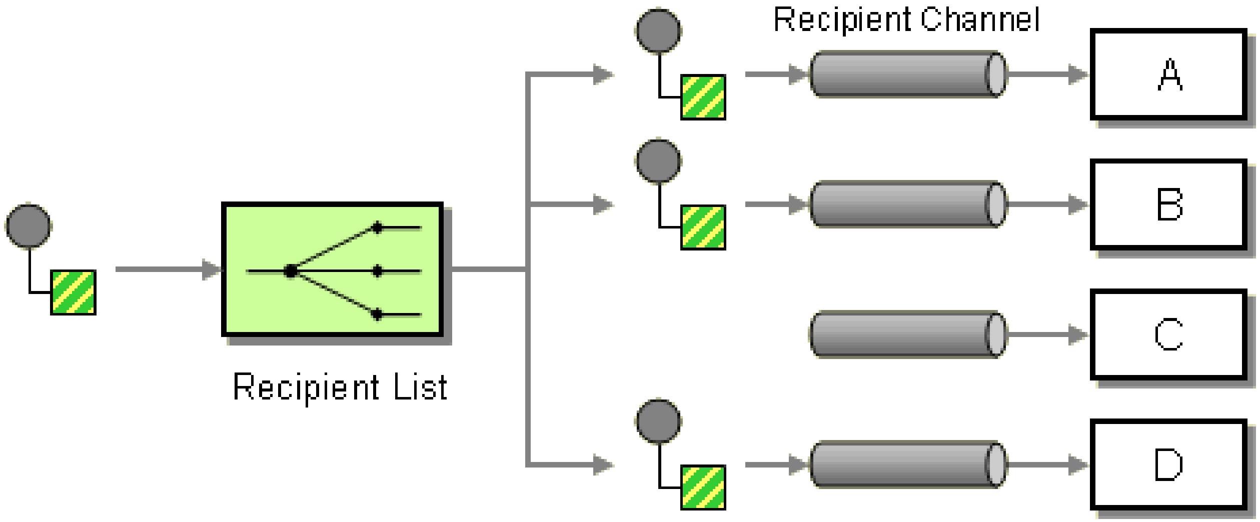
http://www.enterpriseintegrationpatterns.com/patterns/messaging/ContentBasedRouter.html

Dynamic Router



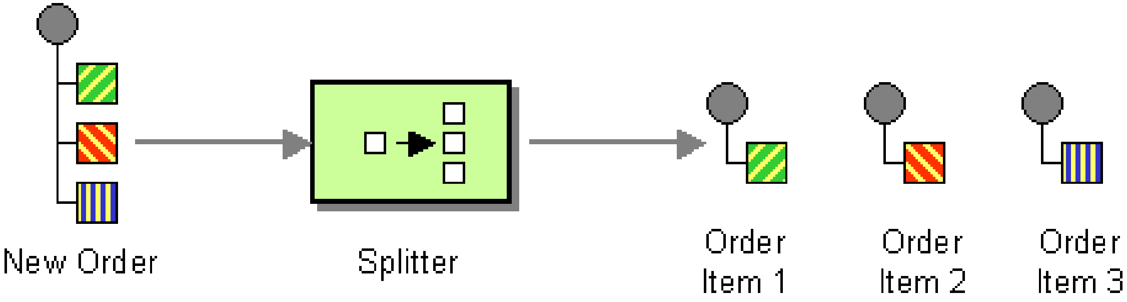
http://www.enterpriseintegrationpatterns.com/patterns/messaging/DynamicRouter.html

Recipient List



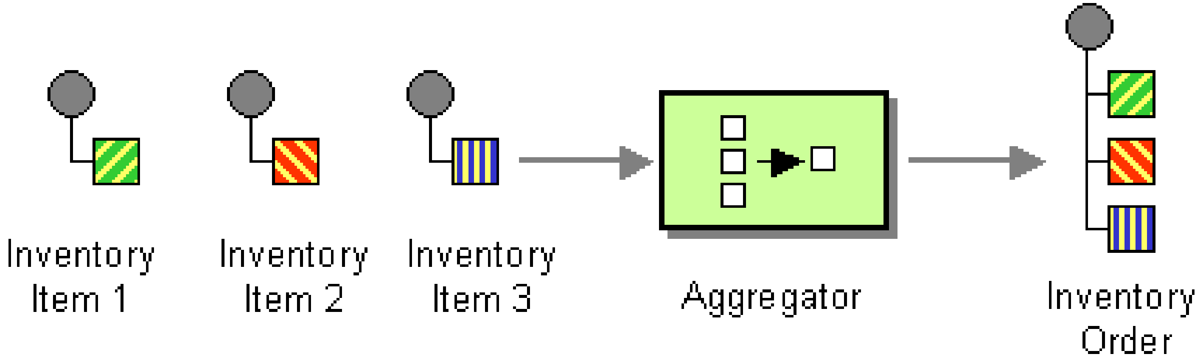
http://www.enterpriseintegrationpatterns.com/patterns/messaging/RecipientList.html

Splitter



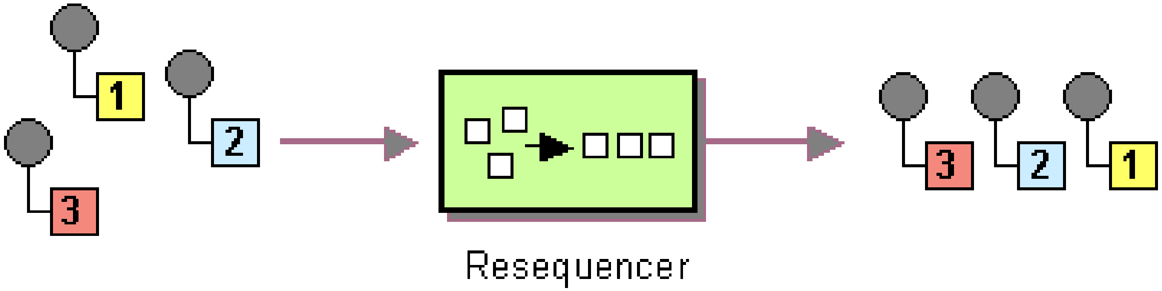
http://www.enterpriseintegrationpatterns.com/patterns/messaging/Sequencer.html

Aggregator



http://www.enterpriseintegrationpatterns.com/patterns/messaging/Aggregator.html

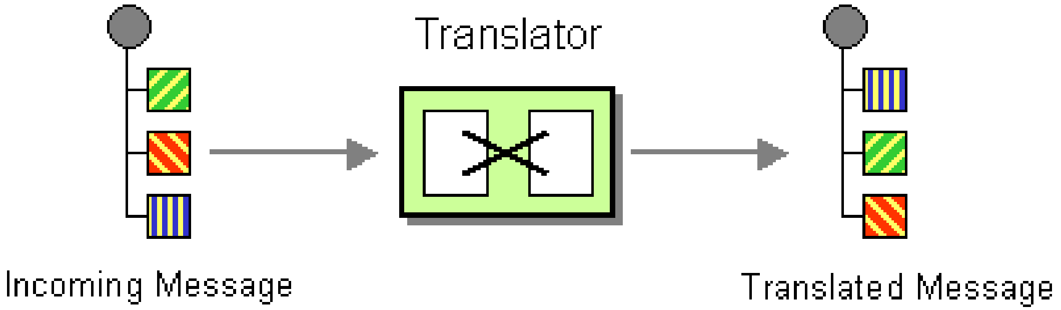
Resequencer



http://www.enterpriseintegrationpatterns.com/patterns/messaging/Resequencer.html

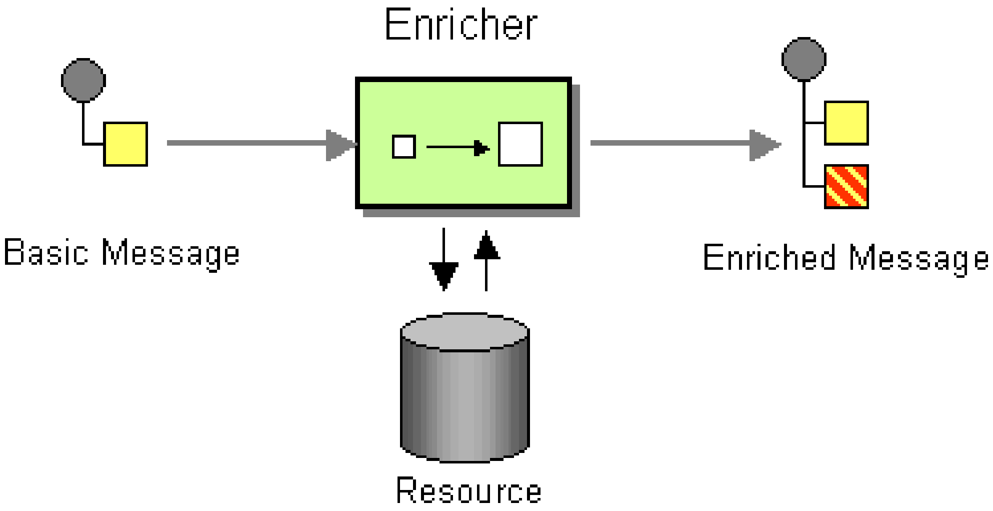
TRANSFORMATION

Message Translator



http://www.enterpriseintegrationpatterns.com/patterns/messaging/MessageTranslator.html

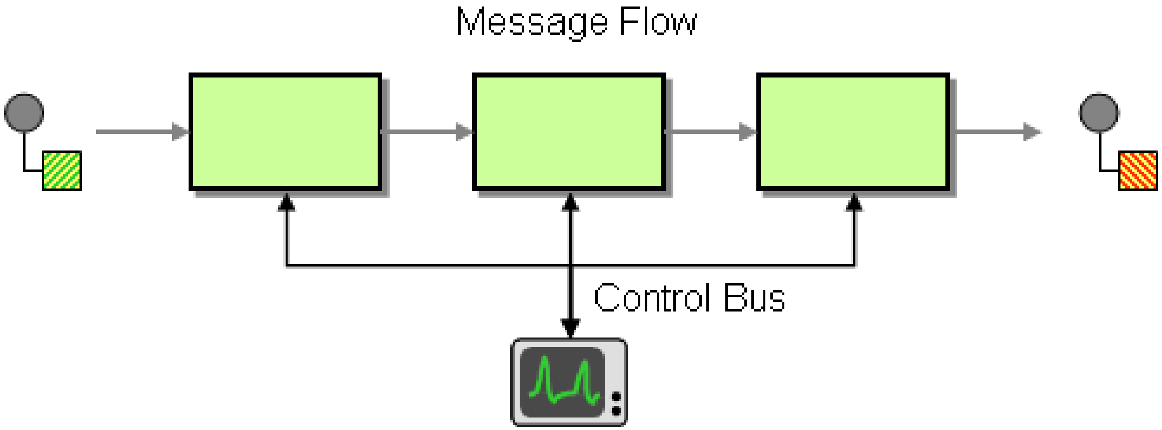
Content Enricher



http://www.enterpriseintegrationpatterns.com/patterns/messaging/DataEnricher.html

MANAGEMENT

Control Bus

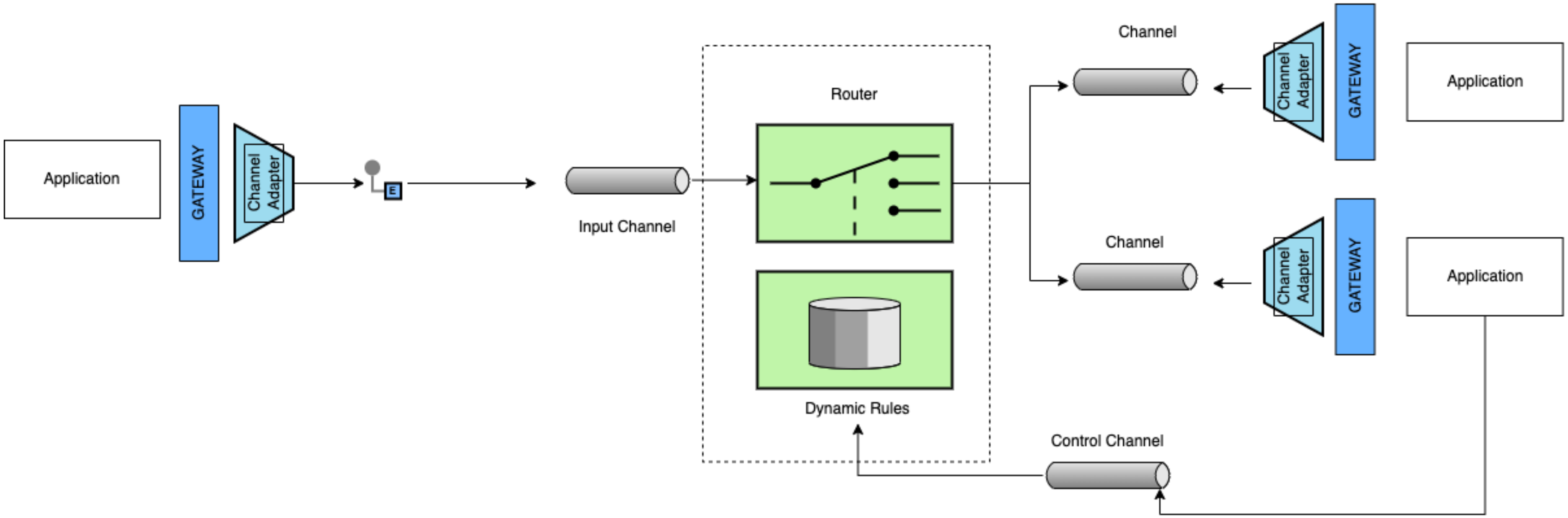


http://www.enterpriseintegrationpatterns.com/patterns/messaging/ControlBus.html

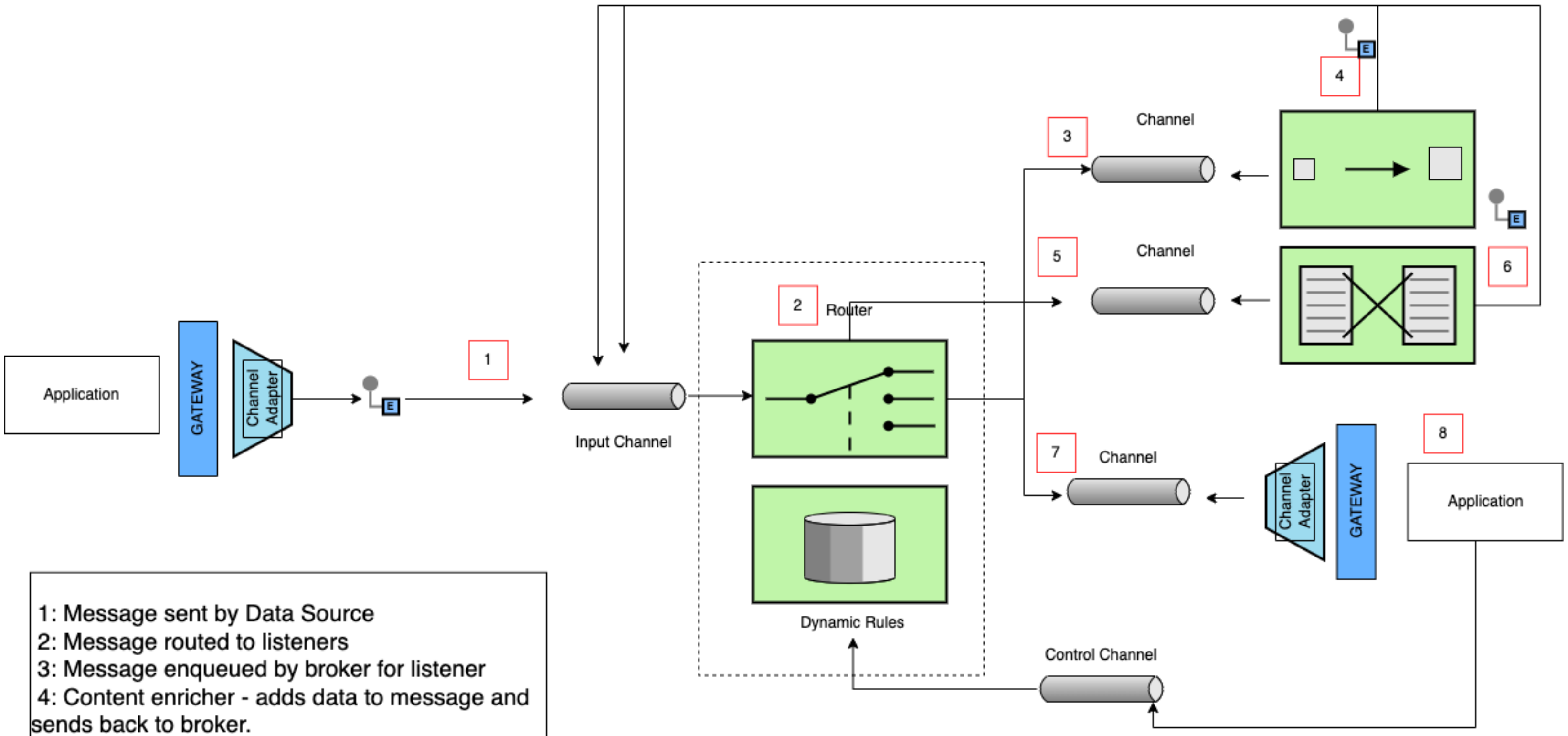
Integrating using events

BROKERS AND PIPELINES

Messaging with A Broker



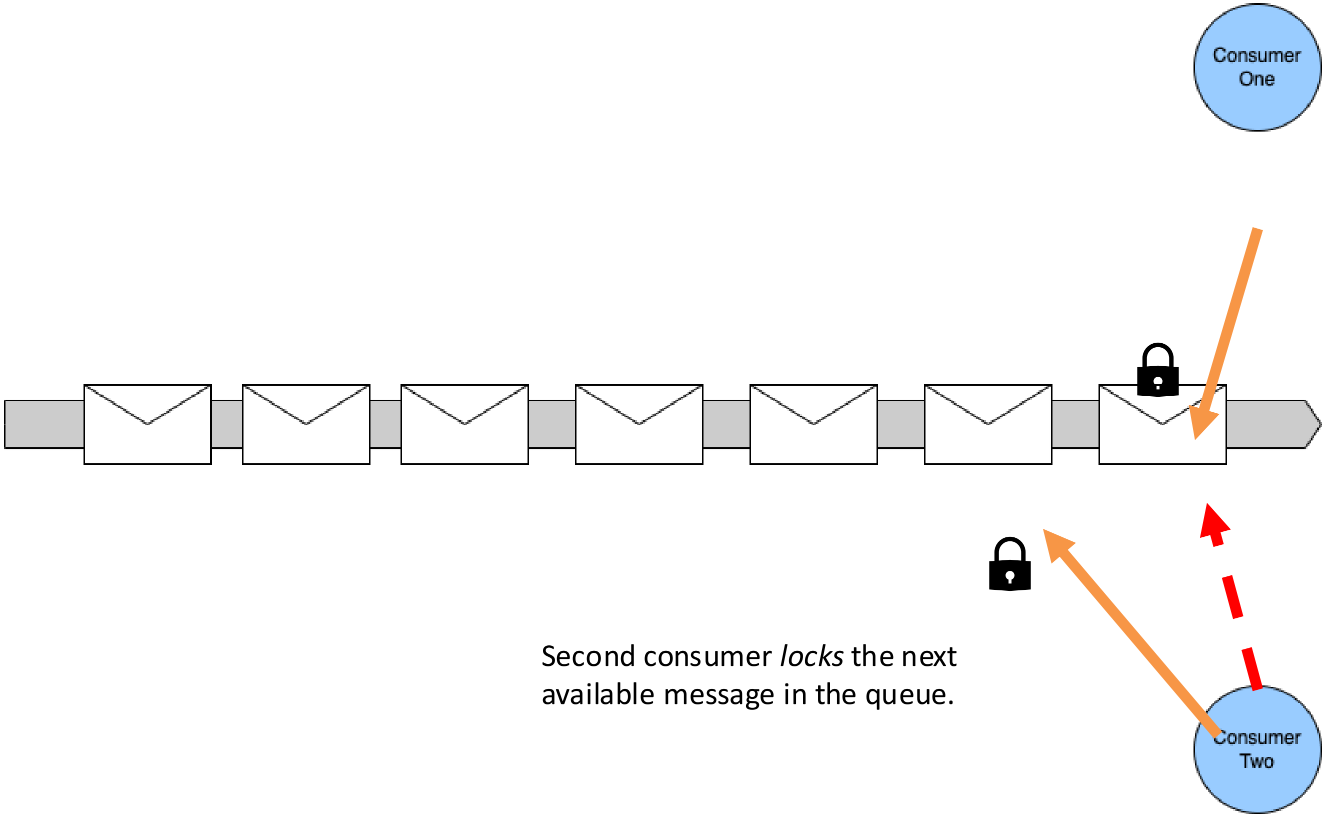
Pipes and Filters



1: Message sent by Data Source
2: Message routed to listeners
3: Message enqueued by broker for listener
4: Content enricher - adds data to message and sends back to broker.
5: Message routed and enqueued by broker for listener
6: Message translated - changes shape and sends back to broker
7: Message routed and enqueued for data sink
8: Data sink processes the final message

QUEUES AND STREAMS

Queues

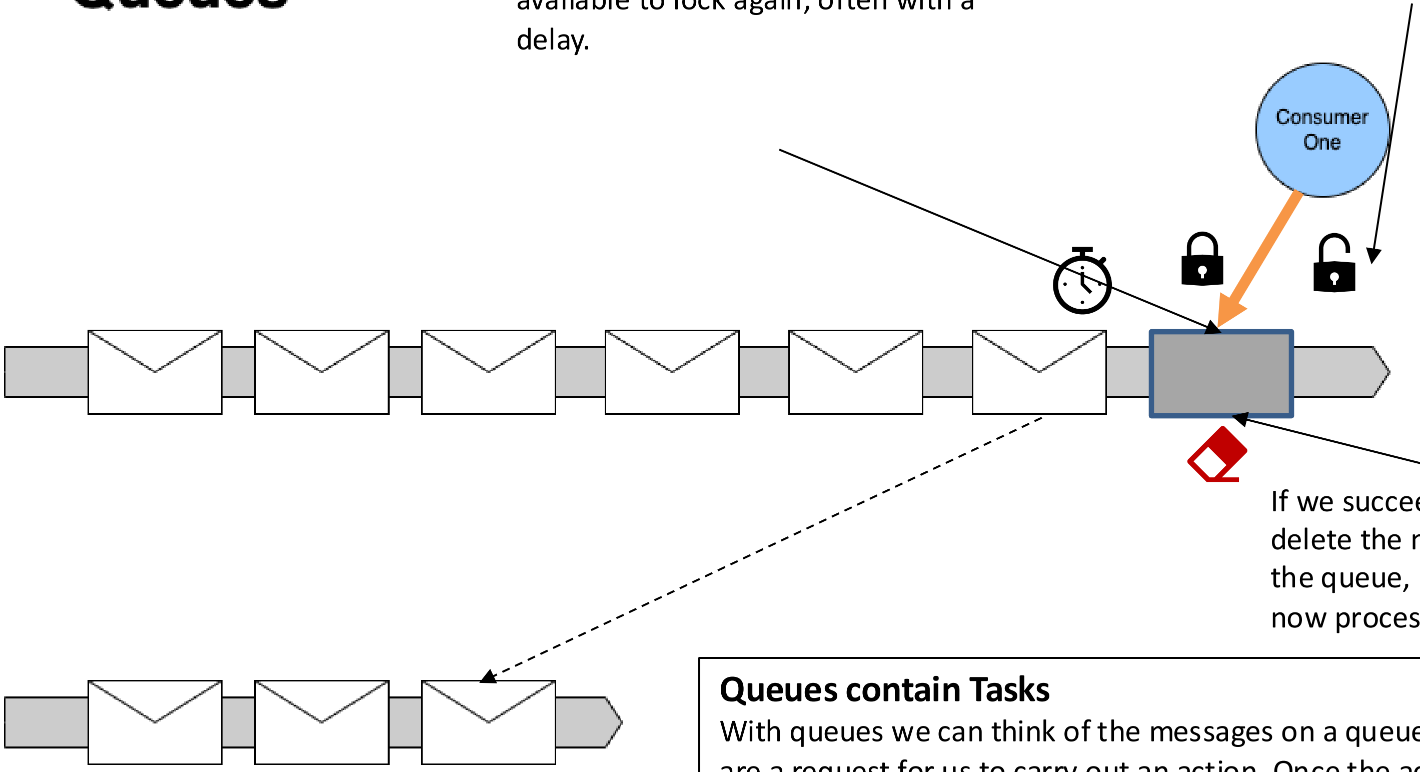


First consumer *locks* the next message in the queue whilst it processes it.

Second consumer *locks* the next available message in the queue.

Second consumer *reads past* any locked message in the queue.

Queues



If we fail, then we may decide others could succeed later, so we let it become available to lock again, often with a delay.

When we are done processing, we unlock it.

- Usually because we finish processing it
- May be because we fail.

If we succeed, then we delete the message from the queue, no one else can now process it.

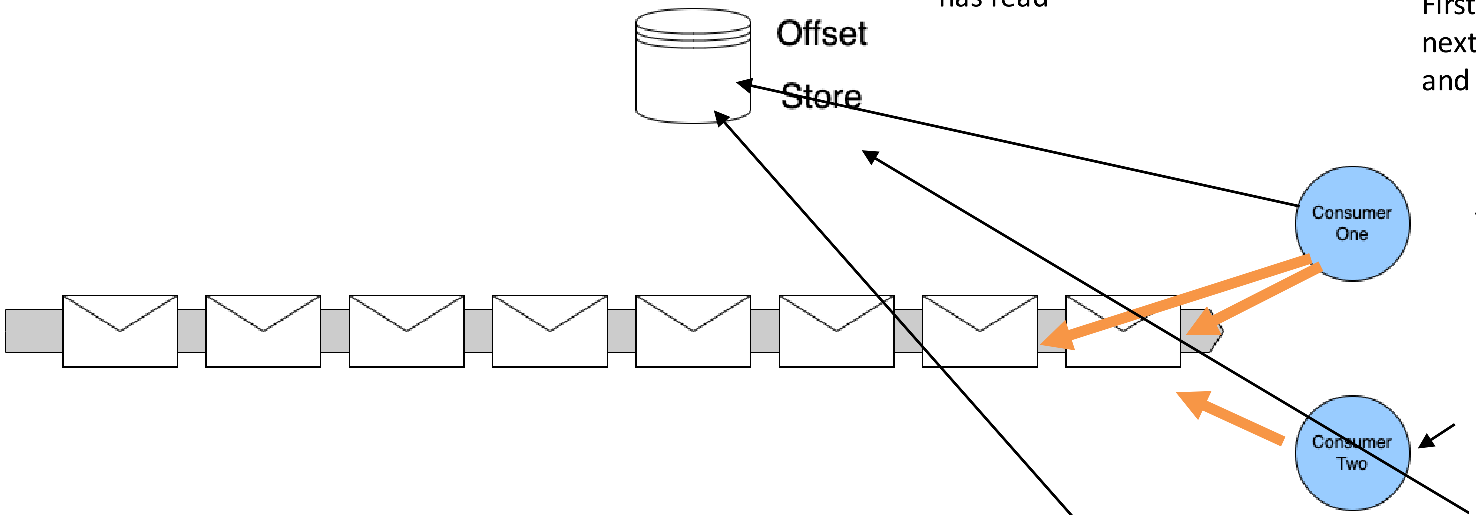
After a certain number of re-queues we may move the message to a dead-letter channel, it turns out that no one action the request within in a reasonable time frame

Queues contain Tasks

With queues we can think of the messages on a queue as tasks - they are a request for us to carry out an action. Once the action is done, we can delete the task.

- We don't anyone else to action it, it's already been done.
- Someone receiving a done task will have to discard it.
- If we can't action it, someone else will need to action it.

Streams



First consumer *stores an offset* to mark how far it has read

First consumer *reads* the next message in the queue and processes it.

First consumer *reads* the next message in the queue and processes it.

If a consumer *restarts*

It reads the store to determine the last message it processed

Second consumer *stores an offset* to mark how far it has read

Second consumer *reads* the next message in the queue and processes it.

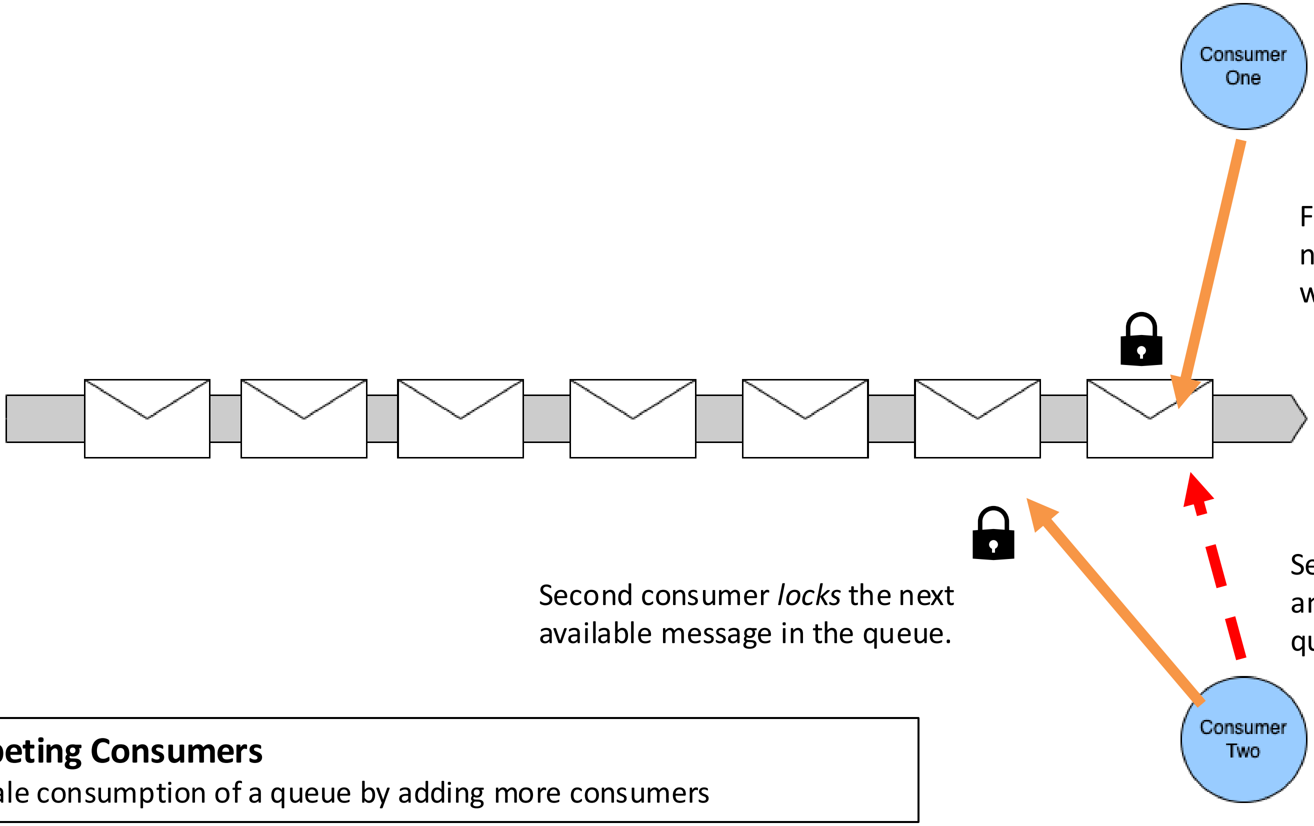
Streams contain Facts

With streams we can think of the records on the stream as facts - they are records that indicate there has been a change in state.

- We can view facts as an ‘inverse database’ they represent how current stat is arrived at
- We can navigate offsets to calculate a position at a ‘point in time’
- We don’t consume facts by reading them, they persist

Scaling Queues and Streams

Queues



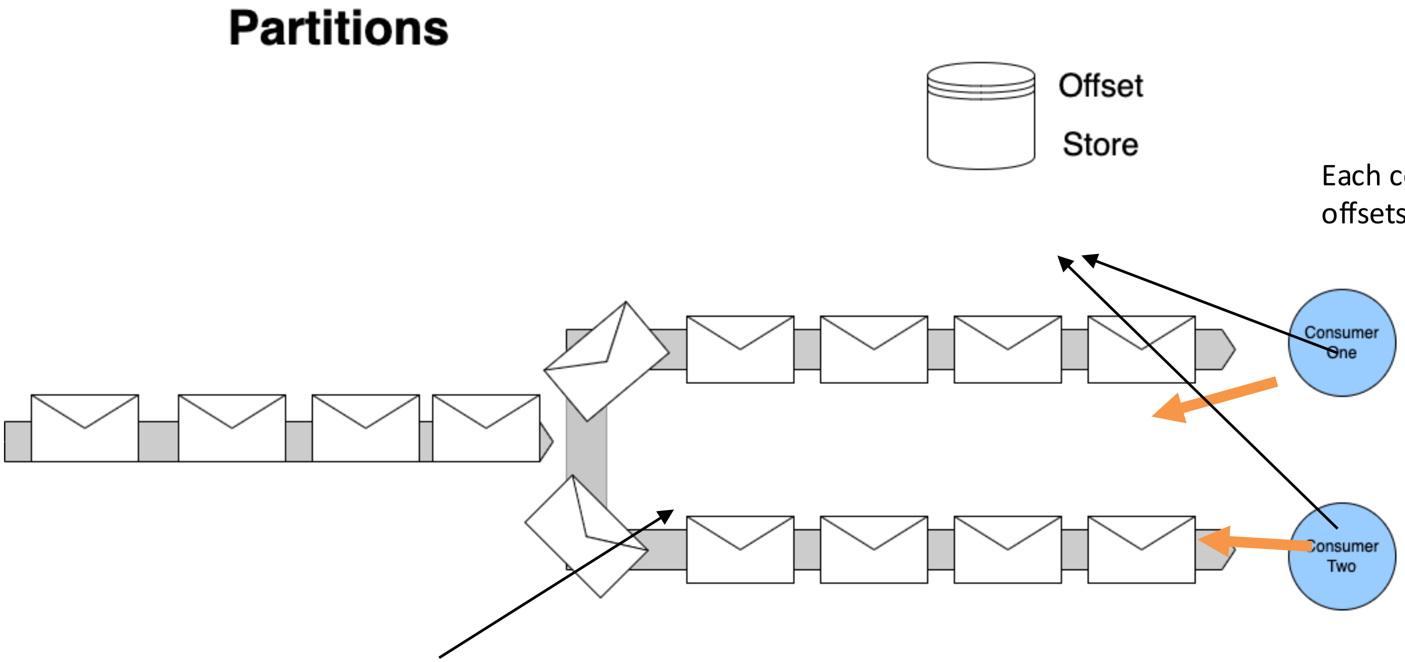
First consumer *locks* the next message in the queue whilst it processes it.

Second consumer *locks* the next available message in the queue.

Second consumer *reads past* any locked message in the queue.

Competing Consumers
We scale consumption of a queue by adding more consumers

Streams



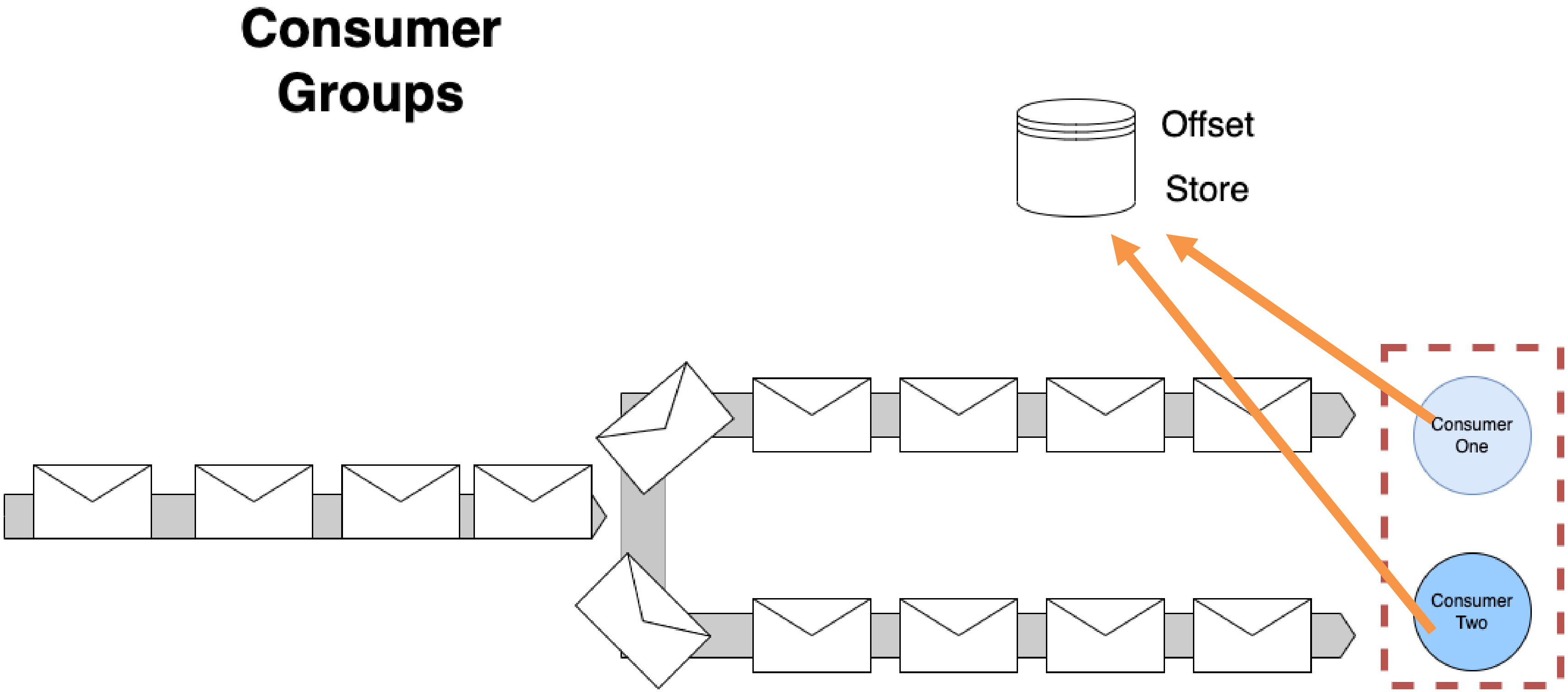
Each consumer manages offsets for their partition.

To scale out we must divide the stream up. We partition the stream to allow multiple consumers to read it.

For any set of events that must be processed sequentially - all changes to one entity for example - we use consistent hashing to push messages with the same identifier to the same partition. This allows us to scale, whilst preserving our ordering.

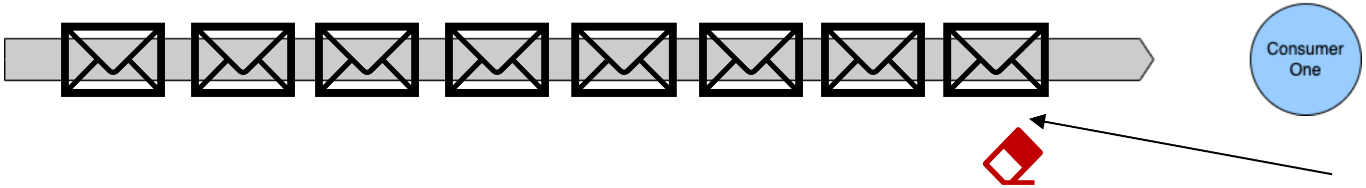
Streams

To provide availability – only one consumer in a group can read from a partition at a time – but a consumer in a group may read from more than one of the partitions owned by that group



Archive and Replay

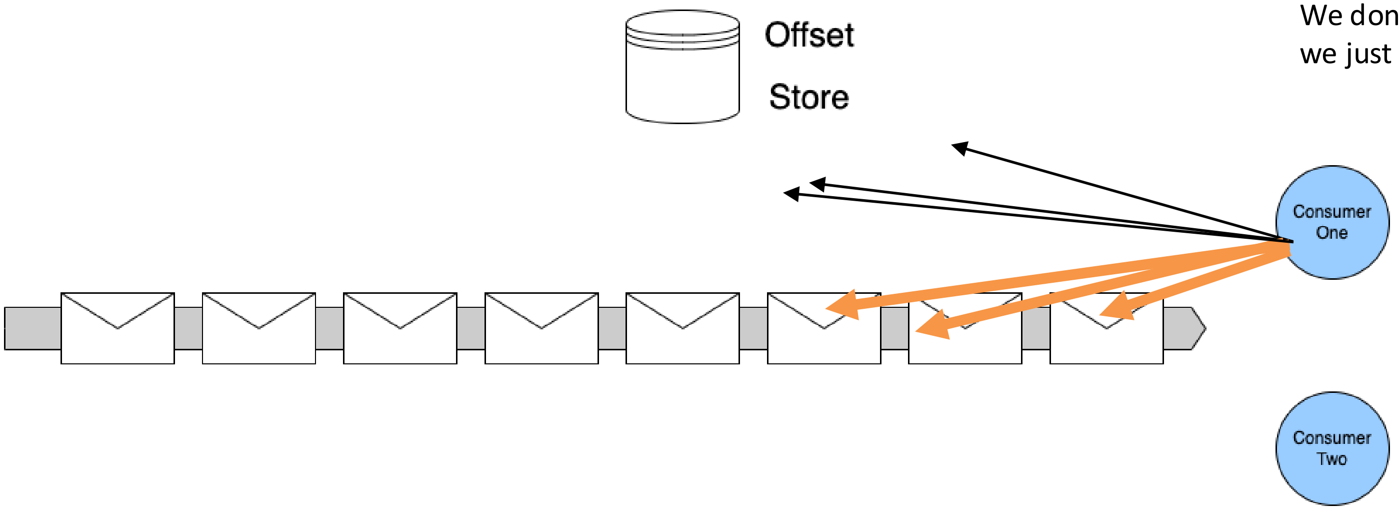
Queues



If we succeed, then we delete the message from the queue, no one else can now process it.

No Archive and Replay
With queues we delete a message once we have completed the associated action. That means we have no way to replay the request for work. Our only option is to ask the producer to resend their request.

Streams



We don’t delete a message,
we just increment the offset.

Archive and Replay
Archive and Replay is straightforward as nothing is deleted. We simply reset the consumer’s offset to re-read the stream

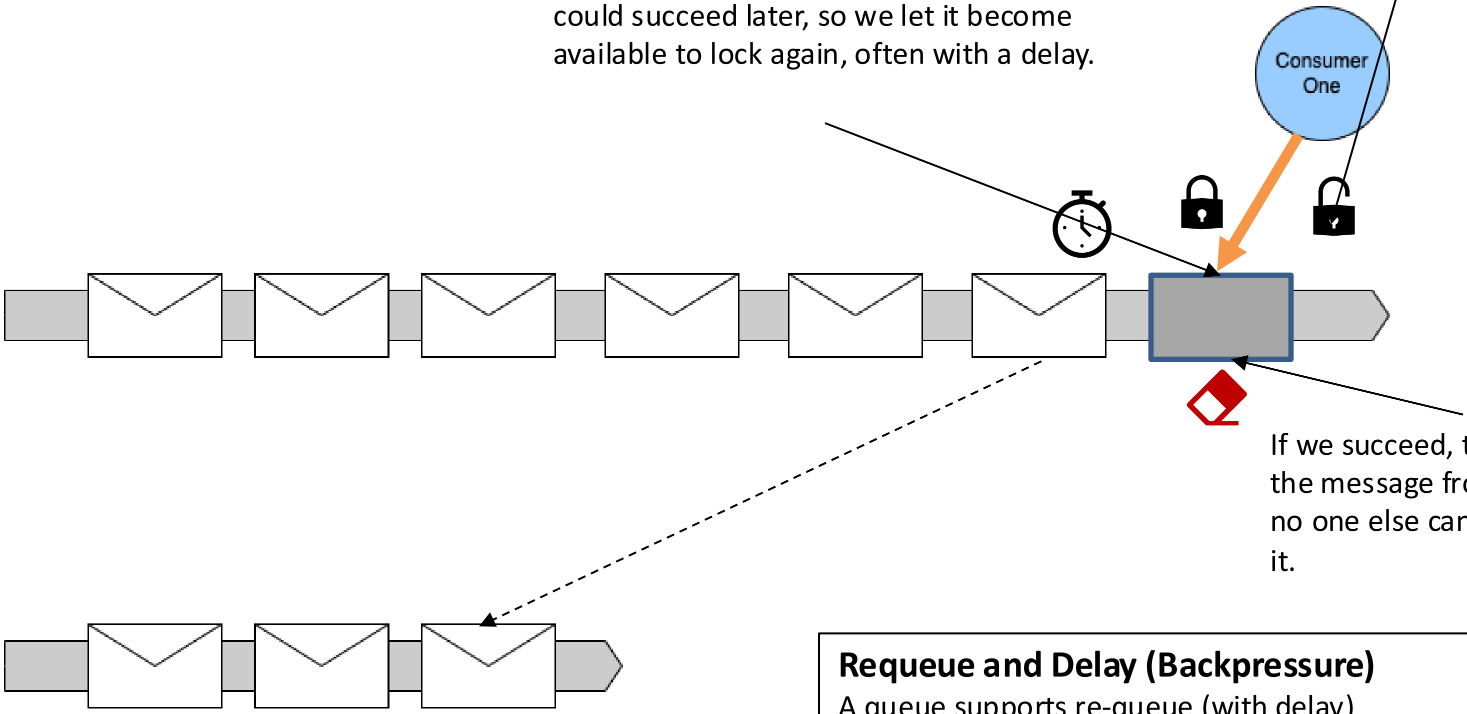
Requeue and Delay (Backpressure)

Queues

When we are done processing, we unlock it.

- Usually because we finish processing it
- May be because we fail.

If we fail, then we may decide others could succeed later, so we let it become available to lock again, often with a delay.



If we succeed, then we delete the message from the queue, no one else can now process it.

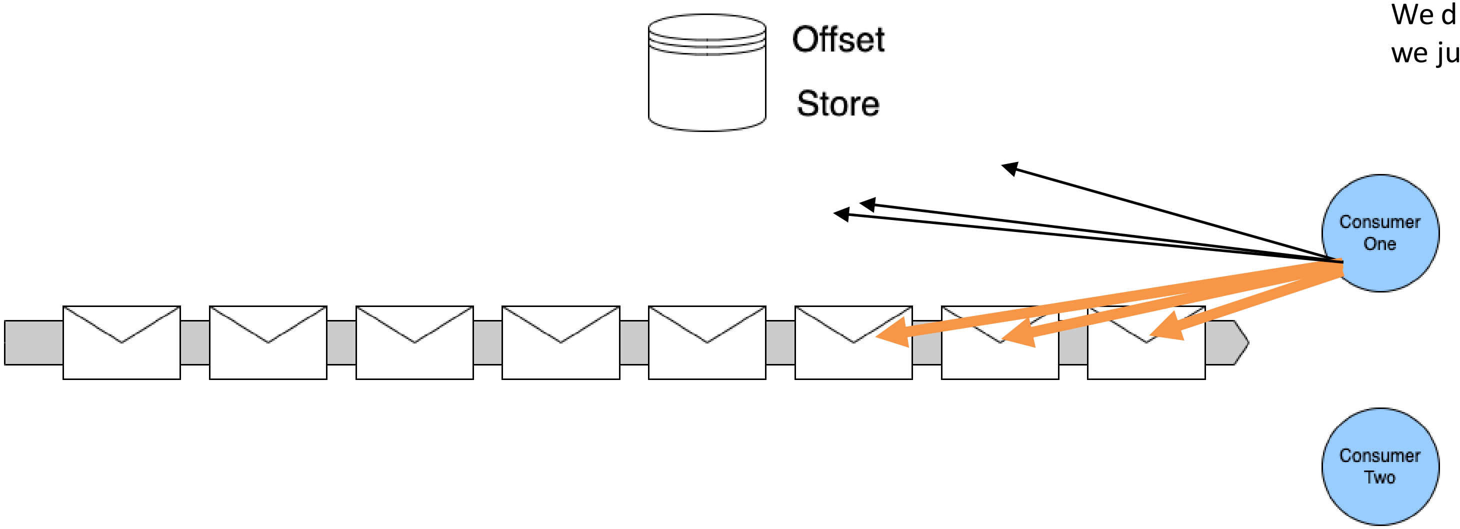
After a certain number of re-queues we may move the message to a dead-letter channel, it turns out that no one action the request within in a reasonable time frame

Requeue and Delay (Backpressure)

A queue supports re-queue (with delay)

- If the work is not done/acked, just make it available again to the next consumer
- If the work could not be done because of a transient issue, delay to let is pass

Streams



We don't delete a message, we just increment the offset.

No Requeue or DLQ

Because we do not lock items, we do not requeue items, including requeue with delay. Your strategy is:

- Ignore and Continue (Load Shedding)
- Retry (Backpressure)
- Copy to another stream (a delay or DLQ stream)

	Messaging	Discrete Event	Series Event
Queue	✓	✓	✗
Stream	✗	✓	✓

	Ordering	Archive and Replay	Requeue with Delay
Queue	✓ ✗	✗	✓
Stream	✓	✓	✗

EXERCISE MATERIAL

Introduction to Kafka

- Readme
- Slides

MANAGING ASYNCHRONOUS APIS

Versioning

Be strict when sending and tolerant when receiving. Implementations must follow specifications precisely when sending to the network, and tolerate faulty input from the network.

Robustness Principal or Postel’s Law – Jon Postel RFC 1958

Tolerant Reader

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "type": "object",
  "properties": {
    "orderid": {
      "type": "string"
    },
    "customerName": {
      "type": "string"
    },
    "addressLineOne": {
      "type": "string"
    },
    "postCode": {
      "type": "string"
    },
    "pinCode": {
      "type": "string",
      "pattern": "^[0-9]+$"
    }
  },
  "required": ["orderid", "customerName", "addressLineOne",
"postCode", "pinCode"],
  "additionalProperties": false
}
```

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "type": "object",
  "properties": {
    "orderid": {
      "type": "string"
    },
    "customerName": {
      "type": "string"
    },
    "addressLineOne": {
      "type": "string"
    },
    "postCode": {
      "type": "string"
    },
    "pinCode": {
      "type": "string",
      "pattern": "^[0-9]+$"
    },
    "latitude": {
      "type": "number",
      "minimum": -90,
      "maximum": 90
    },
    "longitude": {
      "type": "number",
      "minimum": -180,
      "maximum": 180
    }
  },
  "required": ["orderid", "customerName", "addressLineOne",
"postCode", "pinCode"],
  "additionalProperties": false
}
```

Ignore New Fields

Tolerant Reader

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "type": "object",
  "properties": {
    "orderid": {
      "type": "string"
    },
    "customerName": {
      "type": "string"
    },
    "addressLineOne": {
      "type": "string"
    },
    "postCode": {
      "type": "string"
    },
    "pinCode": {
      "type": "string",
      "pattern": "^[0-9]+$"
    },
    "latitude": {
      "type": "number",
      "minimum": -90,
      "maximum": 90
    },
    "longitude": {
      "type": "number",
      "minimum": -180,
      "maximum": 180
    }
  },
  "required": ["orderid", "customerName", "addressLineOne",
"postCode", "pinCode"],
  "additionalProperties": false
}
```

Default Latitude: 0
Default Longitude: 0

Note: not required

Default Missing Fields

Breaking Change

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "type": "object",
  "properties": {
    "orderid": {
      "type": "string"
    },
    "firstName": {
      "type": "string"
    },
    "surName": {
      "type": "string"
    },
    "addressLineOne": {
      "type": "string"
    },
    "pinCode": {
      "type": "string",
      "pattern": "^[0-9]+$"
    },
    "latitude": {
      "type": "number",
      "minimum": -90,
      "maximum": 90
    },
    "longitude": {
      "type": "number",
      "minimum": -180,
      "maximum": 180
    }
  },
  "required": ["orderid", "firstName", "surName",
"addressLineOne", "pinCode", "latitude", "longitude"],
  "additionalProperties": false
}
```

We might be able to write code to deal with this change, but we have to know that a required field is missing and we have new fields instead

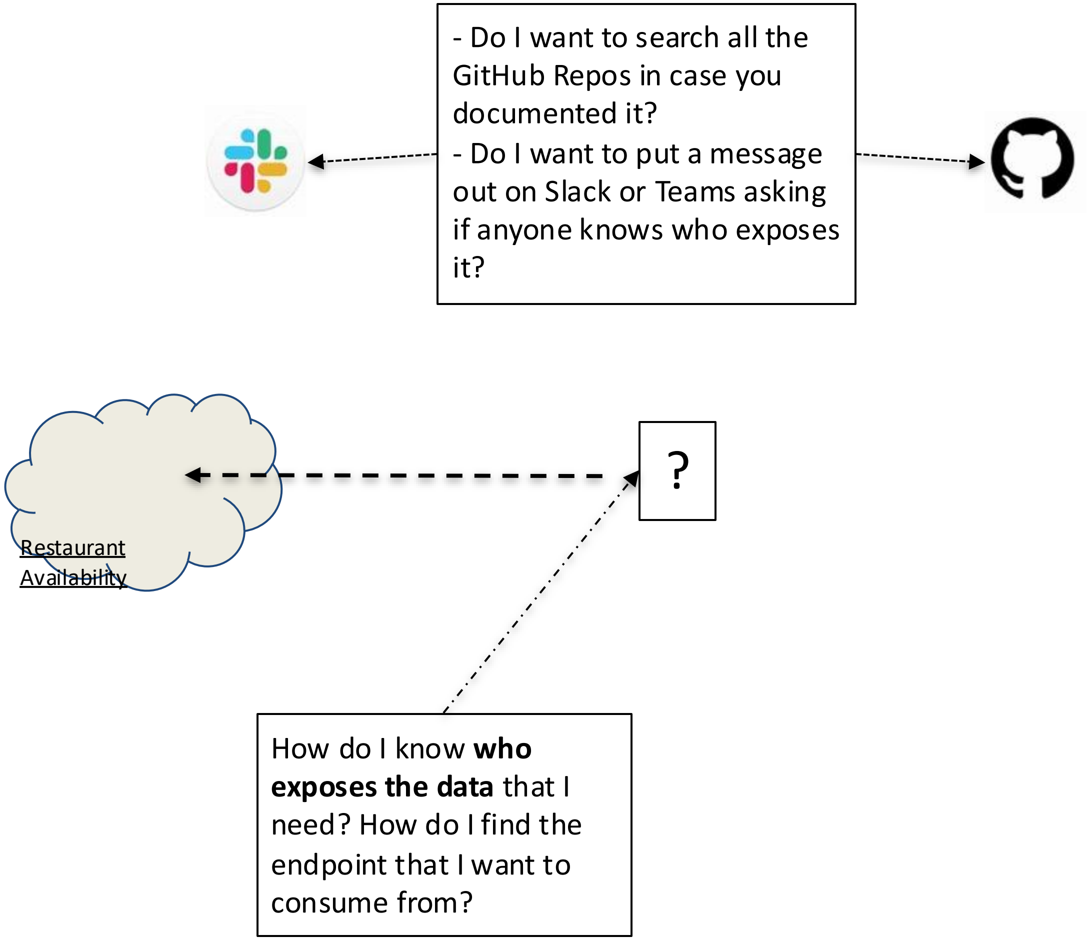
For this we need to rely on a version in the header, and the ability to process messages with this new version, alongside old ones to allow us to run out the old until new replaces it.

Documentation

Endpoints are **places where messages are sent or received** (or both), and they define all the information required for the message exchange.

An *endpoint* describes in a standard-based way **where messages should be sent, how they should be sent, and what the messages should look like**.

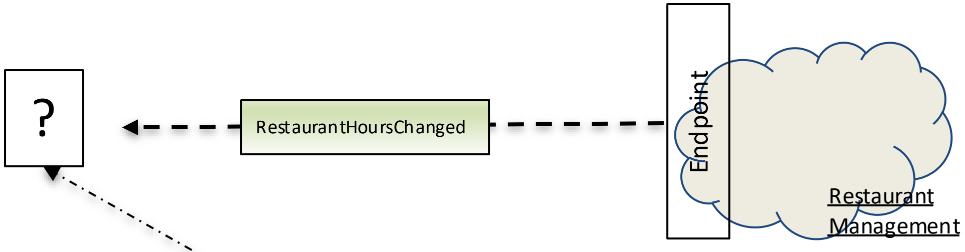
https://docs.microsoft.com/en-us/dotnet/framework/wcf/fundamental-concepts



- Do I want to search all the GitHub Repos in case you documented it?
- Do I want to put a message out on Slack or Teams asking if anyone knows who exposes it?

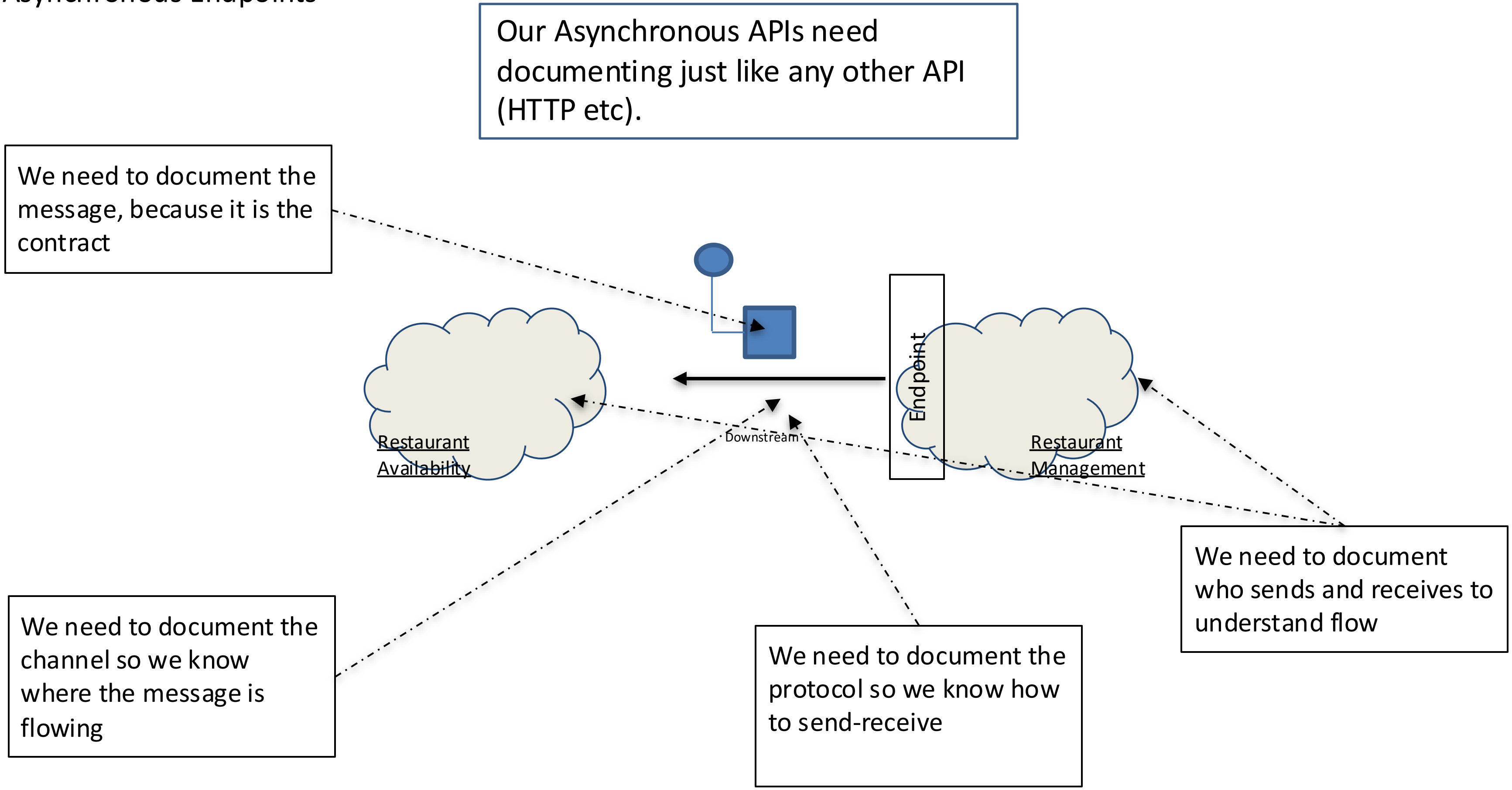
How do I know **who exposes the data** that I need? How do I find the endpoint that I want to consume from?

- Do I search all the GitHub Repos looking for the name of my message hoping to find it?
- Do I want to put a message out on Slack or Teams asking if anyone consumes it?



Who consumes the messages I send? Whom do I have a contract with?

Asynchronous Endpoints



Our Asynchronous APIs need documenting just like any other API (HTTP etc).

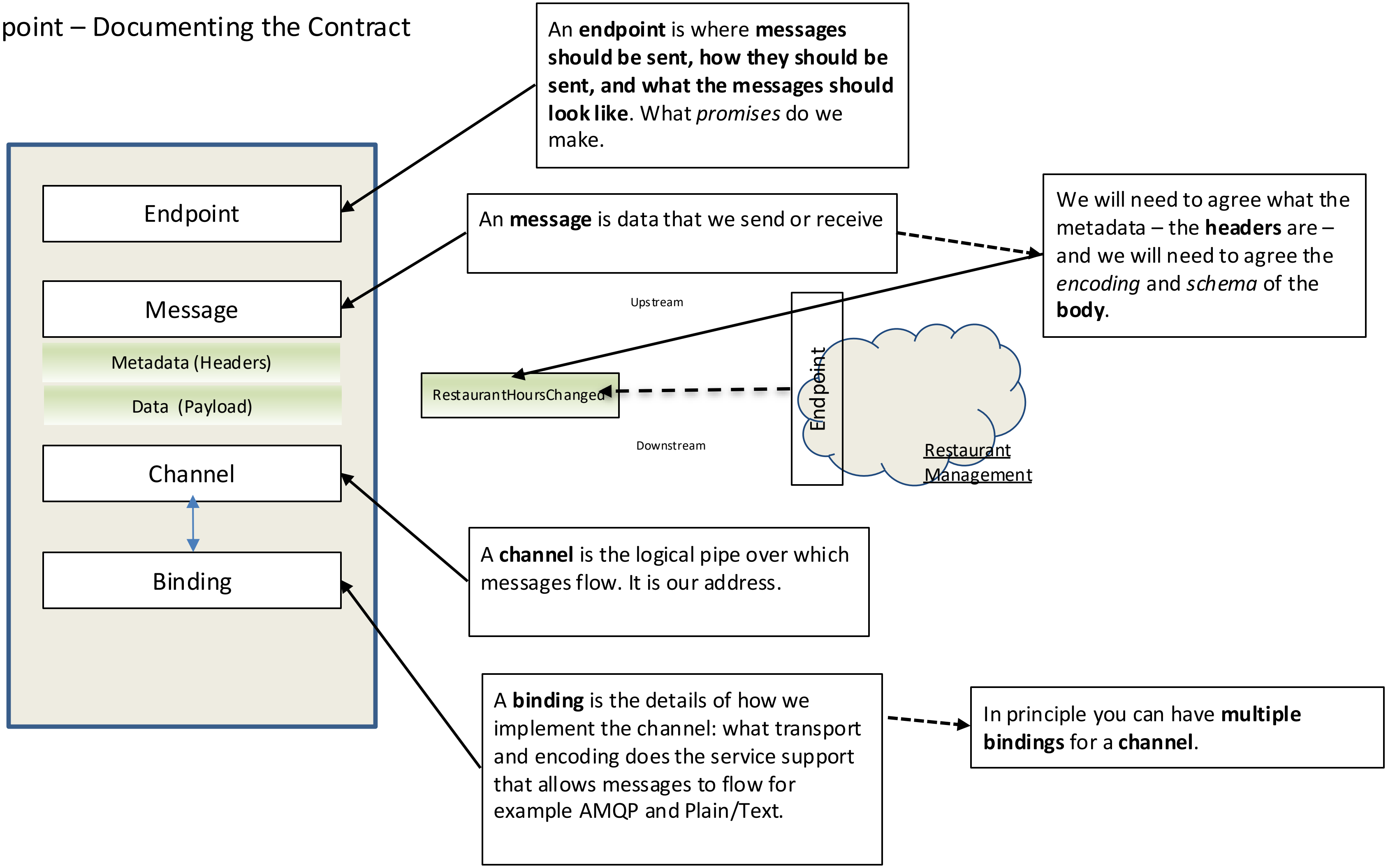
We need to document the message, because it is the contract

We need to document the channel so we know where the message is flowing

We need to document the protocol so we know how to send-receive

We need to document who sends and receives to understand flow

Endpoint – Documenting the Contract



An **endpoint** is where **messages should be sent, how they should be sent, and what the messages should look like**. What *promises* do we make.

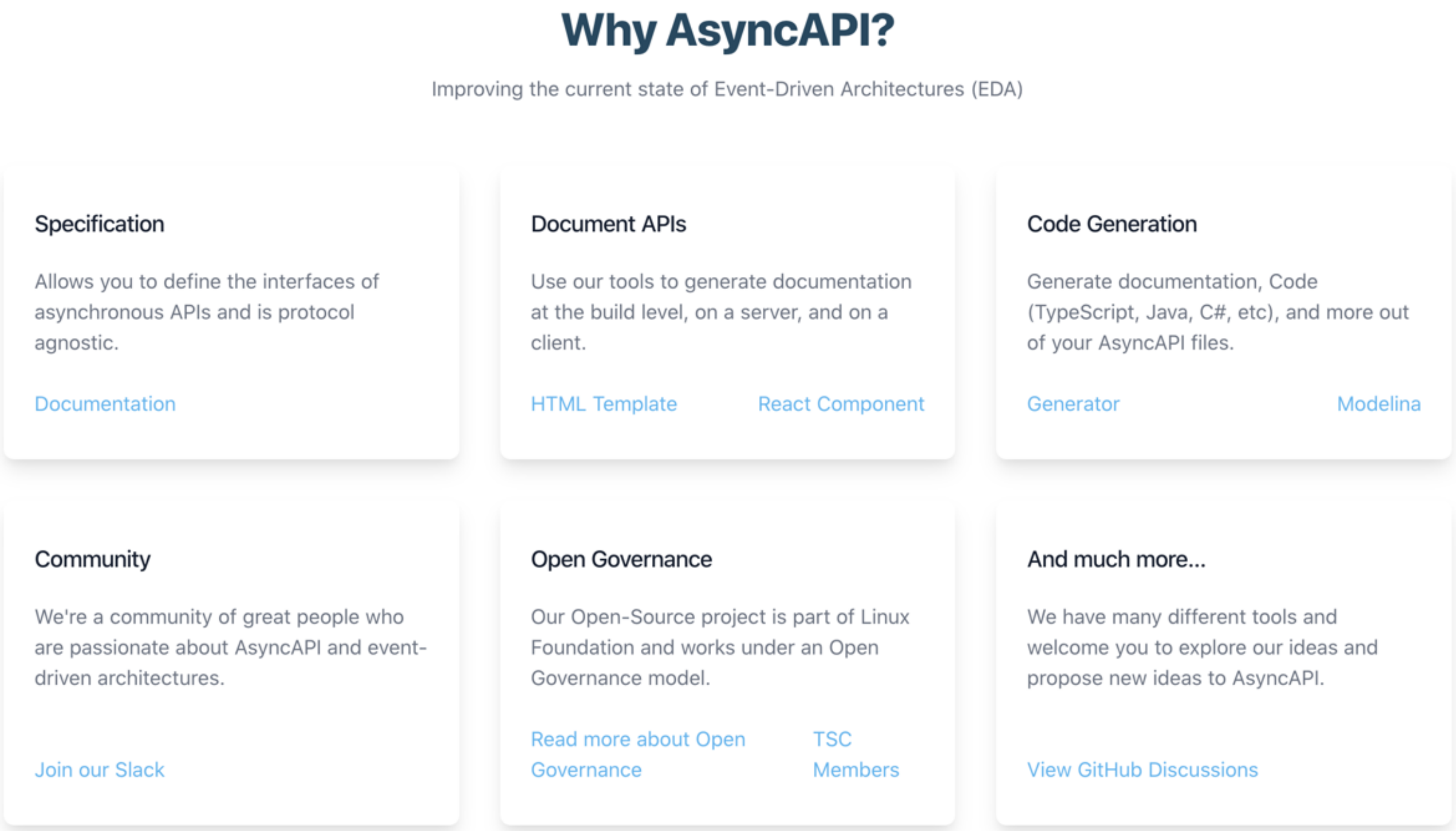
An **message** is data that we send or receive

We will need to agree what the metadata – the **headers** are – and we will need to agree the *encoding* and *schema* of the **body**.

A **channel** is the logical pipe over which messages flow. It is our address.

A **binding** is the details of how we implement the channel: what transport and encoding does the service support that allows messages to flow for example AMQP and Plain/Text.

In principle you can have **multiple bindings** for a **channel**.



Why AsyncAPI?

Improving the current state of Event-Driven Architectures (EDA)

Specification

Allows you to define the interfaces of asynchronous APIs and is protocol agnostic.

Documentation

Document APIs

Use our tools to generate documentation at the build level, on a server, and on a client.

HTML Template   React Component

Code Generation

Generate documentation, Code (TypeScript, Java, C#, etc), and more out of your AsyncAPI files.

Generator   Modelina

Community

We're a community of great people who are passionate about AsyncAPI and event-driven architectures.

Join our Slack

Open Governance

Our Open-Source project is part of Linux Foundation and works under an Open Governance model.

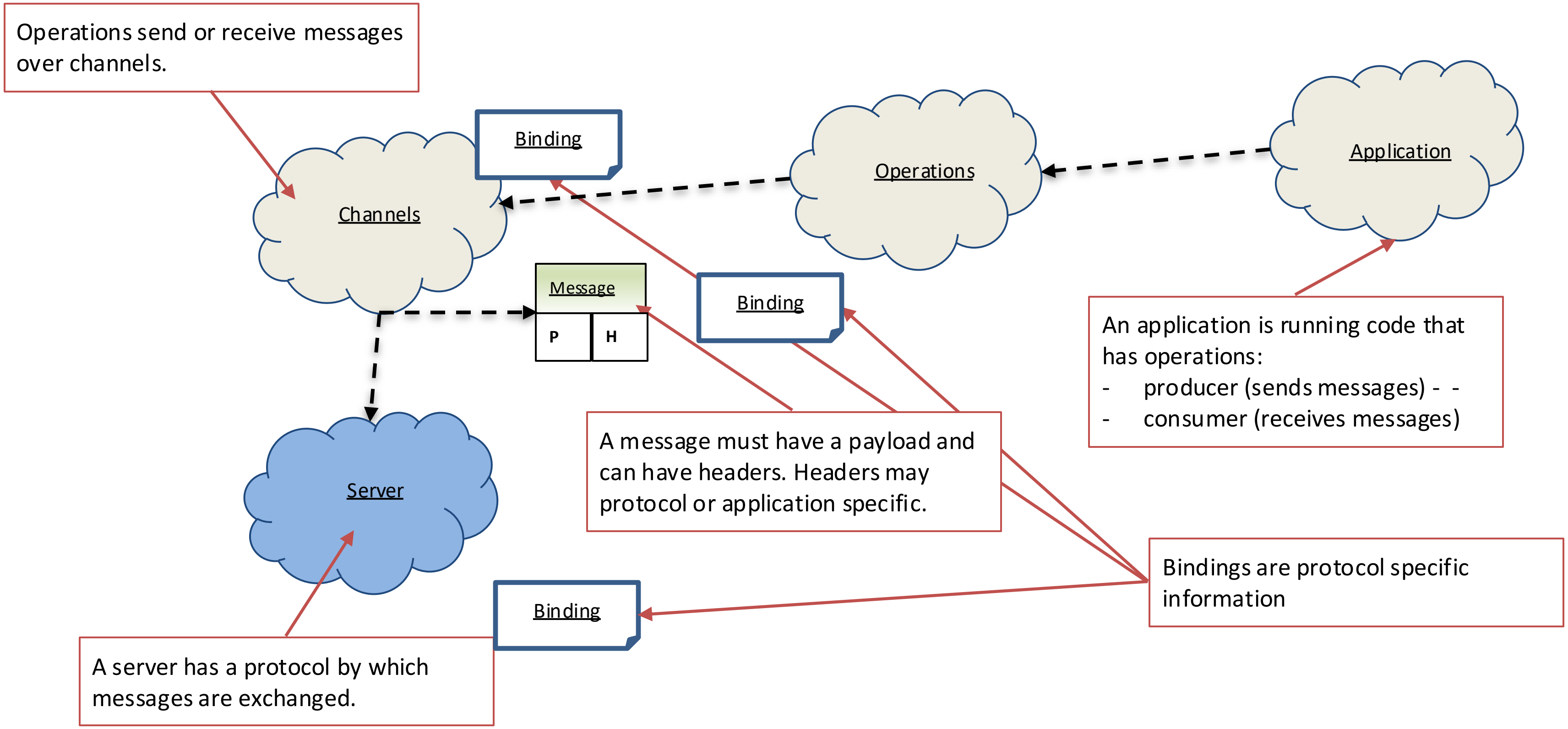
Read more about Open Governance   TSC Members

And much more...

We have many different tools and welcome you to explore our ideas and propose new ideas to AsyncAPI.

View GitHub Discussions

AsyncAPI Elements (V3)



Operations send or receive messages over channels.

An application is running code that has operations:

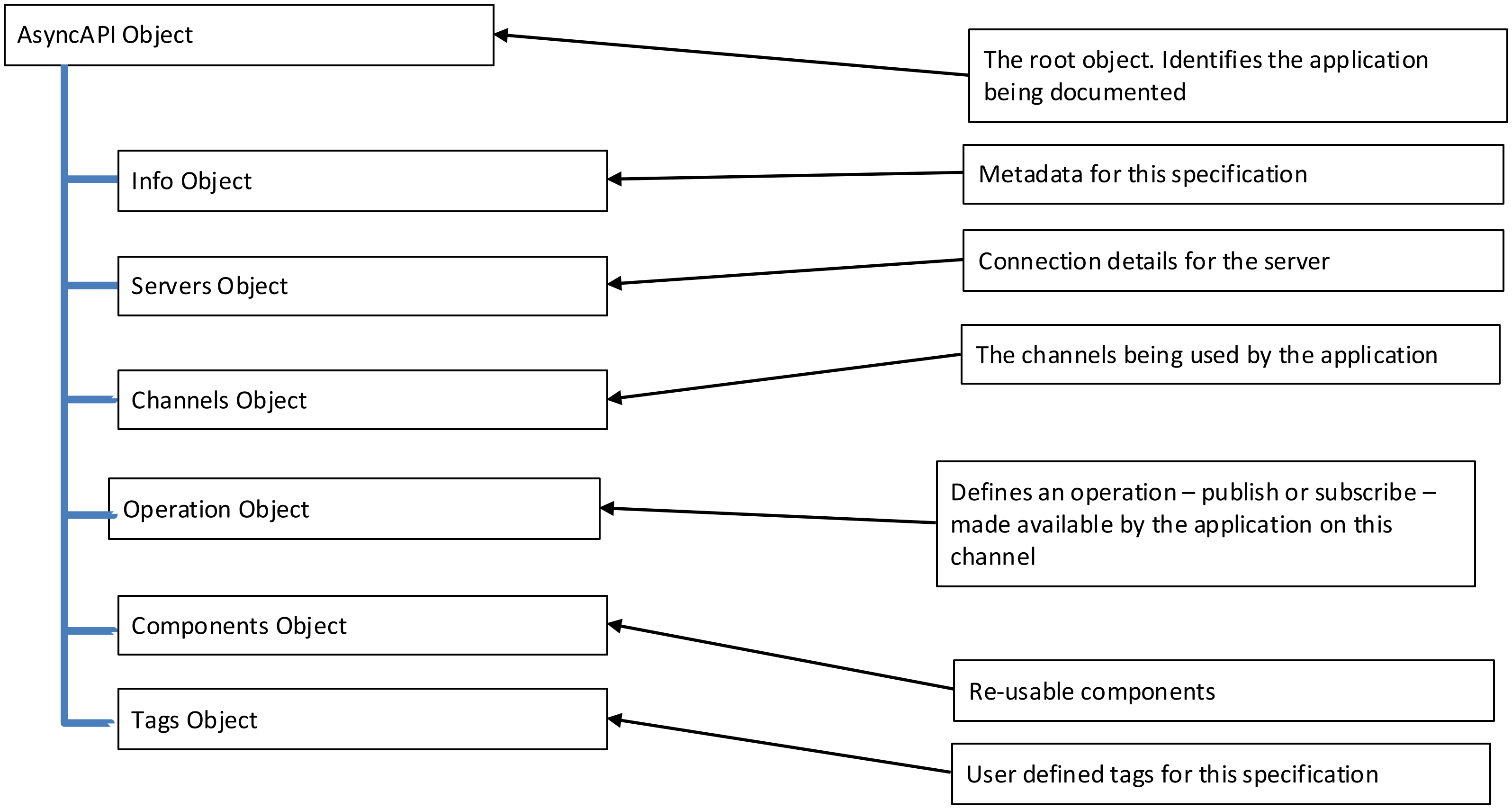
- producer (sends messages) - -
- consumer (receives messages)

A message must have a payload and can have headers. Headers may protocol or application specific.

Bindings are protocol specific information

A server has a protocol by which messages are exchanged.

Document Structure (V3)



The root object. Identifies the application being documented

Metadata for this specification

Connection details for the server

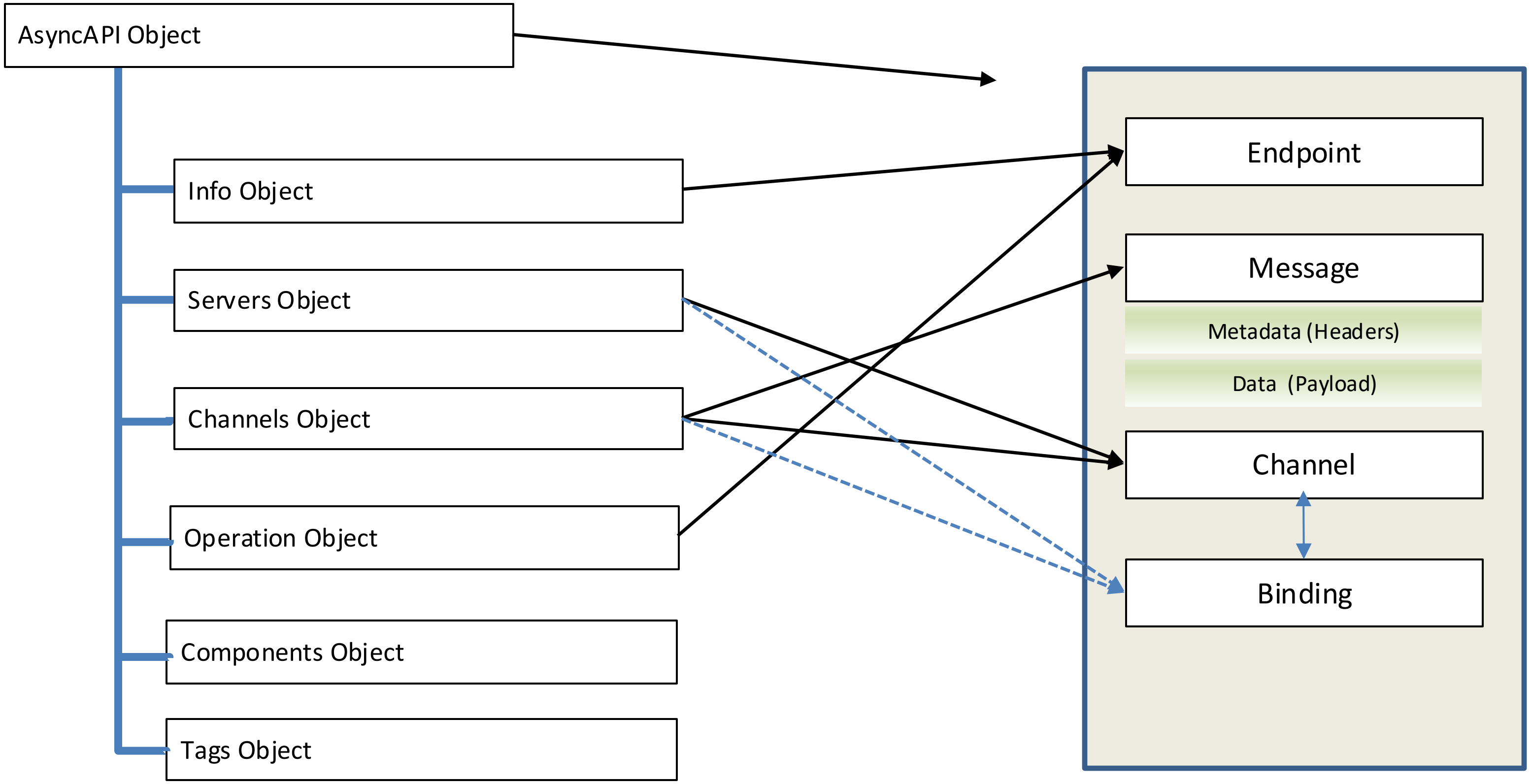
The channels being used by the application

Defines an operation – publish or subscribe – made available by the application on this channel

Re-usable components

User defined tags for this specification

AsyncAPI (V3) and Endpoint ABCs



AsyncAPI Object

```
id: https://github.com/brightercommand/greetings/
```

We use a specification file for an app, which is a producer or consumer, and identify them by id

Info Object

```
info:
  contact:
    name: Paramore Brighter
    url: https://goparamore.io/support
    email: support@goparamore.io
  license:
    name: Apache 2.0
    url: https://www.apache.org/licenses/LICENSE-2.0.html
  description: Demonstrates sending a greeting over a messaging
transport.
  title: Brighter Sample App
  version: 1.0.0
tags:
  - name: brighter examples
```

Servers Object

```
development:
  description: A Kafka broker for local development
  url: localhost:9092
  protocol: kafka
```

Channels (V3)

```
greeting:
 address: ‘goparamore.io.greeting’
  summary: For sending greetings
  description: This channel contains greeting messages
  servers:
   - $ref: '#/servers/development’
  messages:
     greeting:
       $ref: "#/components/messages/greeting”
  bindings:
    kafka:
      partitions: 20
      replicas: 3
```

Operations (V3)

```
sendGreeting :
  action: send
  summary: sends a greeting
  description: The application sends a greeting to a consumer.
  channel:
   $ref: "#/channels/greeting”
  bindings:
    kafka:
      partitions: 20
      replicas: 3
```

Components

```yaml
components:
  messages:
    greeting:
      name: greeting
      title: A salutation
      summary: This is how we send you a salutation
      contentType: application/json
      traits:
        - $ref: '#/components/messageTraits/commonHeaders'
      payload:
        $ref: "#/components/schemas/greetingContent"

  schemas:
    greetingContent:
      type: object
      properties:
        greeting:
          type: string
          description: The salutation you want to send
 …
```

JSON Schema (AsyncAPI Schema Object)

$schema

$id

title

description

type

properties

```
{
  ”$schema” : "https://json-schema.org/draft/2020-12/schema",
  “$id” : “https://goparamore.io/greeting.schema.json”,
  “title” : “greeting”,
  “description” : “A greeting message”,
  “type” : “object”,
  “properties” : {
     “greeting” : {
        “description” : “the salutation”
        “type” : string
      }
  }
}
```

Avro

Complex Types: **records** **enums** **arrays** **maps** **unions** **fixed**

Records:

- **name**
- **namespace**
- **doc**
- **alias**
- **fields**
  - **name** **doc** **type** **default**

Avro

```
{
  “type” : “record”,
  “name” : “greeting,”
  “title” : “greeting”,
  “fields” : [
     {“name” : “greeting”, “type” : “string”}
  ]
}
```

Avro

Encodings:

- JSON
- Binary

Languages:

- C
- C++
- C#
- Java
- Perl
- Python
- Ruby
- Others…

Protobuf

```
syntax = "proto3";

message Greeting {
   string greeting = 1;
}
```

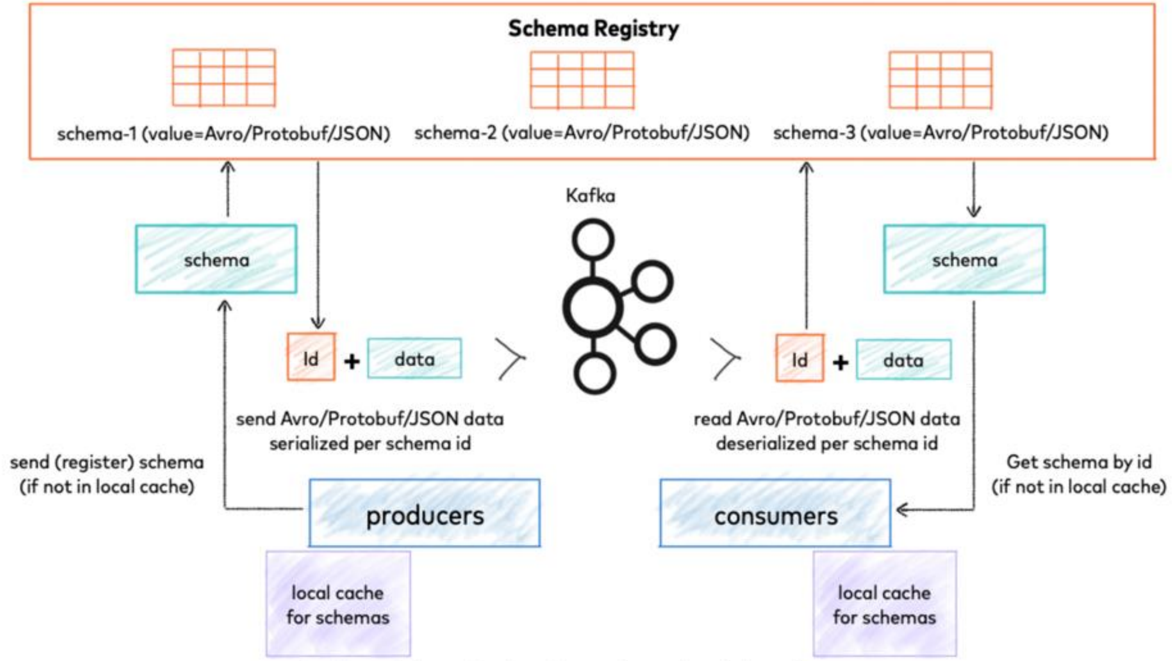
Protobuf

Encodings: **Binary**

Languages:

- **C++**
- **C#**
- **Dart**
- **Go**
- **Kotlin**
- **Java**
- **Objective-C**
- **Python**
- **Ruby**
- **Others…**

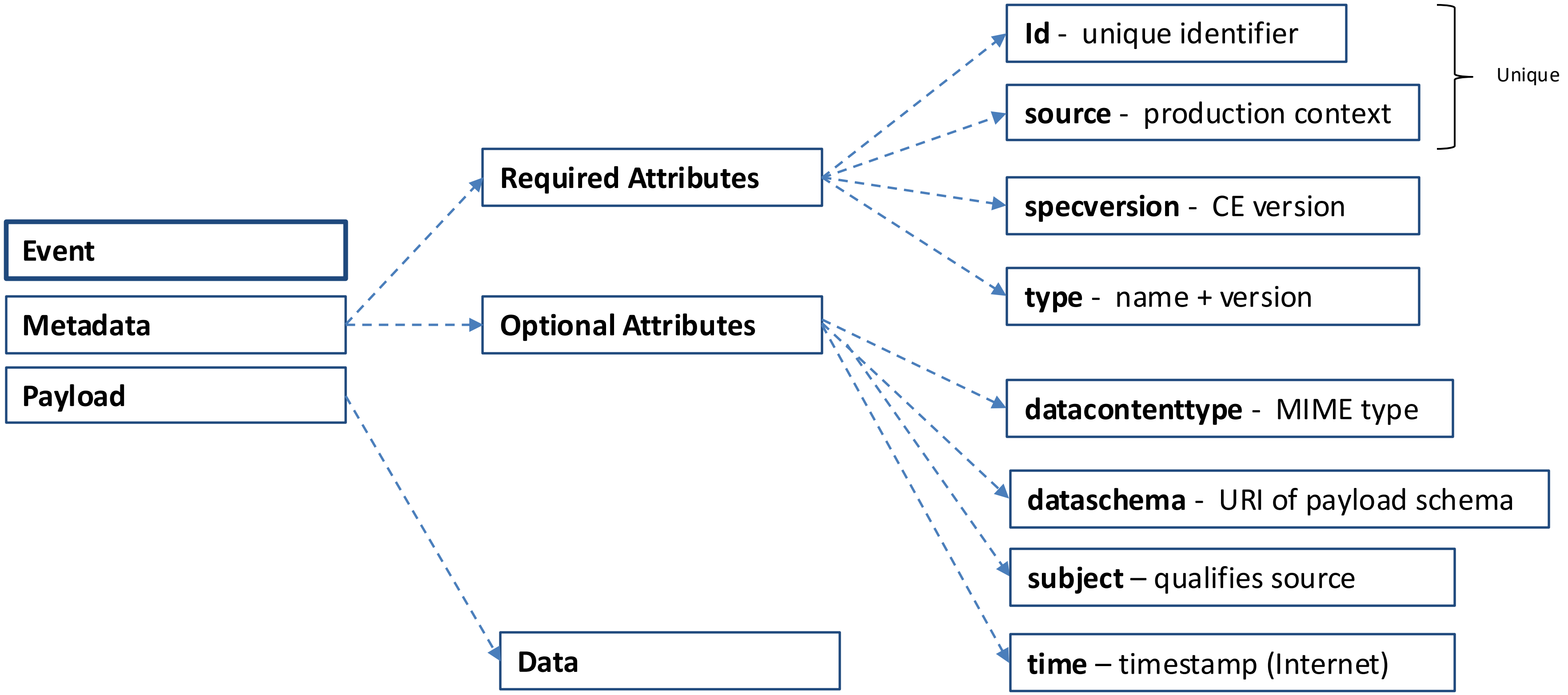
Schema Registry


Schema Registry
schema-1 (value=Avro/Protobuf/JSON)
schema-2 (value=Avro/Protobuf/JSON)
schema-3 (value=Avro/Protobuf/JSON)
Kafka
schema
schema
Id
+
data
Id
+
data
send Avro/Protobuf/JSON data serialized per schema id
read Avro/Protobuf/JSON data deserialized per schema id
send (register) schema (if not in local cache)
Get schema by id (if not in local cache)
producers
consumers
local cache for schemas
local cache for schemas

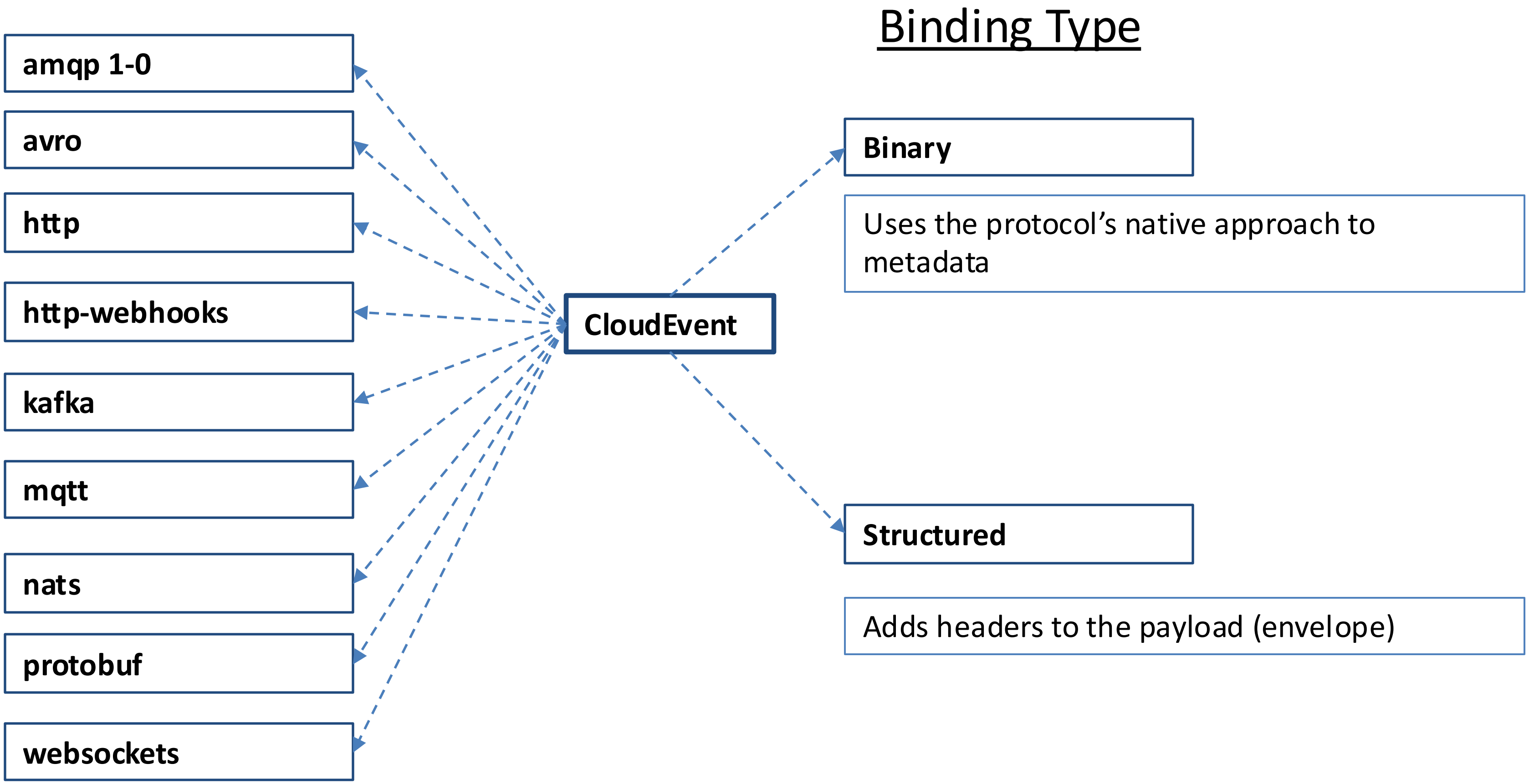
Confluent Schema Registry for storing and retrieving schemas

https://docs.confluent.io/platform/current/schema-registry/index.html

Cloud Events


Event
Metadata
Payload
Required Attributes
Optional Attributes
Data
Id - unique identifier
source - production context
Unique
specversion - CE version
type - name + version
datacontenttype - MIME type
dataschema - URI of payload schema
subject – qualifies source
time – timestamp (Internet)

Protocol Binding



amqp 1-0

avro

http

http-webhooks

kafka

mqtt

nats

protobuf

websockets

CloudEvent

Binding Type

Binary

Uses the protocol’s native approach to metadata

Structured

Adds headers to the payload (envelope)

Protocol Binding

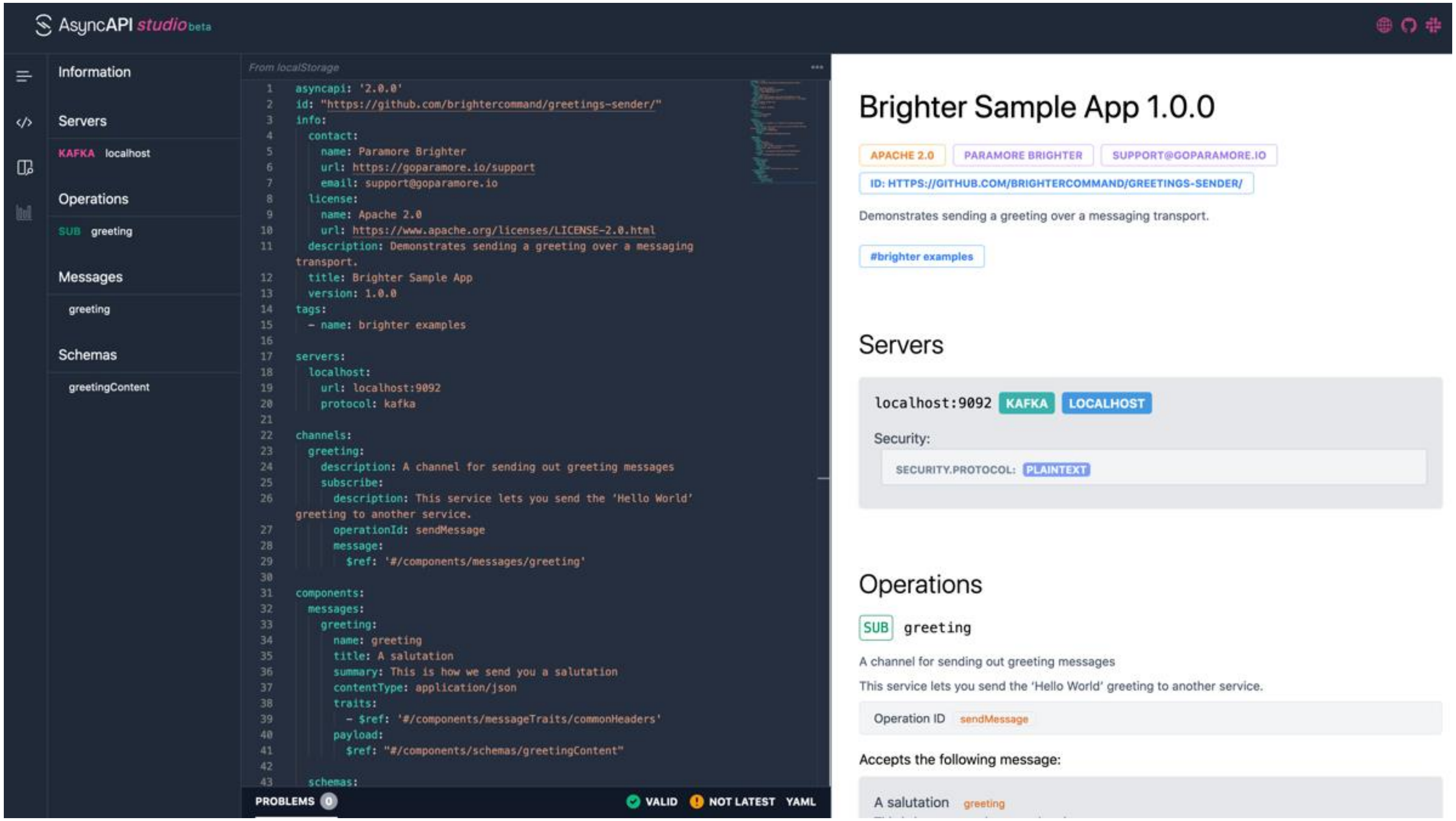
Binary

```
----------------- Message ------------------
Topic Name: mytopic
 ------------------ key ---------------------
Key: mykey
----------------- headers ------------------
ce_specversion: "1.0"
ce_type: "com.example.someevent"
ce_source: "/mycontext/subcontext"
ce_id: "1234-1234-1234"
ce_time: "2018-04-05T03:56:24Z"
content-type: application/avro
------------------ value -------------------
 ... application data encoded in Avro ...
--------------------------------------------
```

Structured

```
----------------- Message ------------------
Topic Name: mytopic
 ------------------ key ---------------------
Key: mykey
----------------- headers ------------------
content-type: application/cloudevents+json; charset=UTF-8
------------------ value -------------------
 {
         "specversion" : "1.0",
         "type" : "com.example.someevent",
         "source" : "/mycontext/subcontext",
         "id" : "1234-1234-1234",
         "time" : "2018-04-05T03:56:24Z",
         "datacontenttype" : "application/json",
         "data" :         {
                  ... application data encoded in JSON ...
         }
 }
--------------------------------------------
```

AsyncAPI Studio



```yaml
asyncapi: '2.0.0'
id: "https://github.com/brightercommand/greetings-sender/"
info:
  contact:
    name: Paramore Brighter
    url: https://goparamore.io/support
    email: support@goparamore.io
  license:
    name: Apache 2.0
    url: https://www.apache.org/licenses/LICENSE-2.0.html
  description: Demonstrates sending a greeting over a messaging transport.
  title: Brighter Sample App
  version: 1.0.0
tags:
  - name: brighter examples

servers:
  localhost:
    url: localhost:9092
    protocol: kafka

channels:
  greeting:
    description: A channel for sending out greeting messages
    subscribe:
      description: This service lets you send the 'Hello World' greeting to another service.
      operationId: sendMessage
      message:
        $ref: '#/components/messages/greeting'

components:
  messages:
    greeting:
      name: greeting
      title: A salutation
      summary: This is how we send you a salutation
      contentType: application/json
      traits:
        - $ref: '#/components/messageTraits/commonHeaders'
      payload:
        $ref: "#/components/schemas/greetingContent"

  schemas:
```

Brighter Sample App 1.0.0

APACHE 2.0 PARAMORE BRIGHTER SUPPORT@GOPARAMORE.IO

ID: HTTPS://GITHUB.COM/BRIGHTERCOMMAND/GREETINGS-SENDER/

Demonstrates sending a greeting over a messaging transport.

#brighter examples

Servers

localhost:9092 KAFKA LOCALHOST

Security:

SECURITY.PROTOCOL: PLAINTEXT

Operations

SUB greeting

A channel for sending out greeting messages

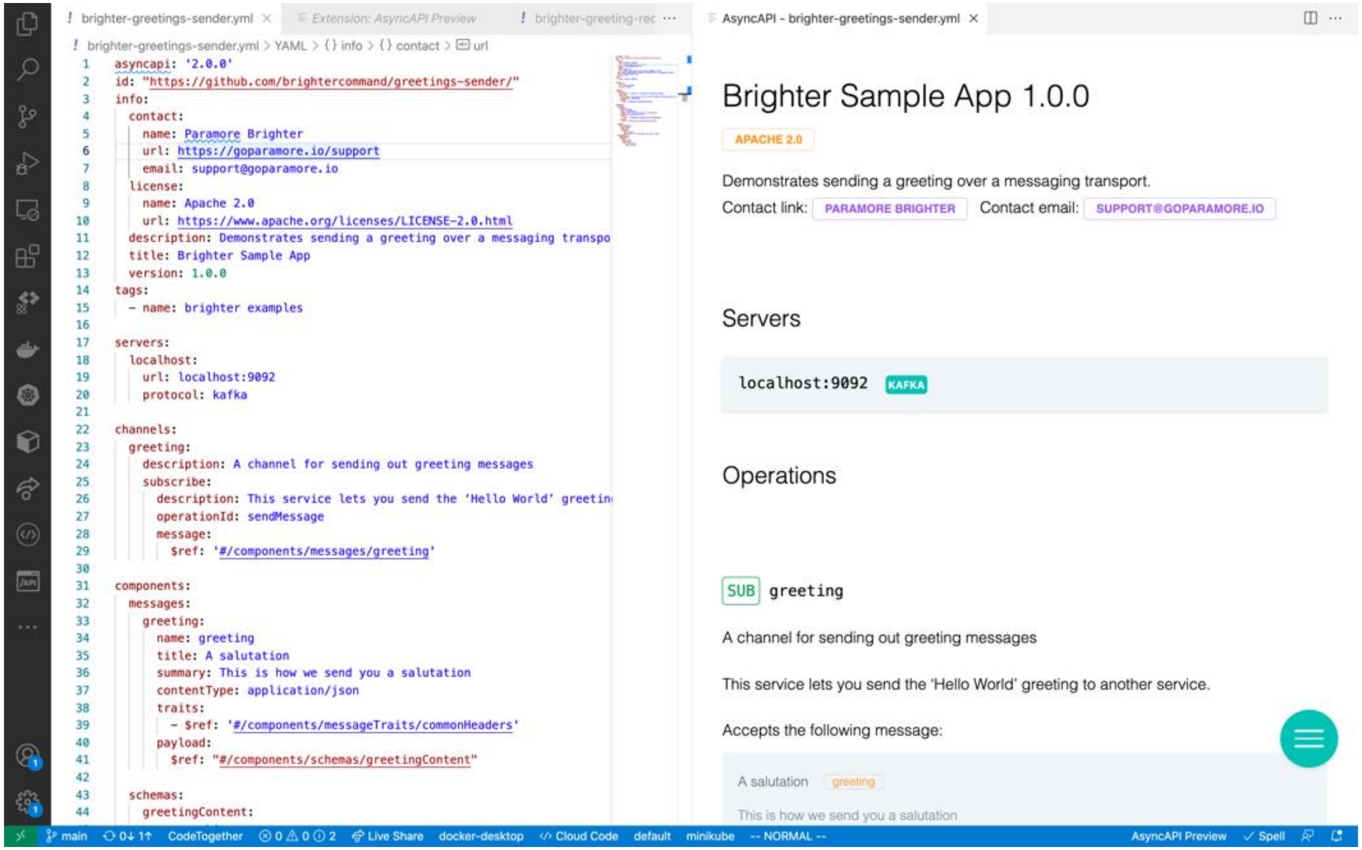
This service lets you send the 'Hello World' greeting to another service.

Operation ID sendMessage

Accepts the following message:

A salutation greeting

VS Code


! brighter-greetings-sender.yml ×
Extension: AsyncAPI Preview
! brighter-greeting-rec ···
! brighter-greetings-sender.yml > YAML > {} info > {} contact > url
AsyncAPI - brighter-greetings-sender.yml ×

```yaml
asyncapi: '2.0.0'
id: "https://github.com/brightercommand/greetings-sender/"
info:
  contact:
    name: Paramore Brighter
    url: https://goparamore.io/support
    email: support@goparamore.io
  license:
    name: Apache 2.0
    url: https://www.apache.org/licenses/LICENSE-2.0.html
  description: Demonstrates sending a greeting over a messaging transpo
  title: Brighter Sample App
  version: 1.0.0
tags:
  - name: brighter examples

servers:
  localhost:
    url: localhost:9092
    protocol: kafka

channels:
  greeting:
    description: A channel for sending out greeting messages
    subscribe:
      description: This service lets you send the ‘Hello World’ greetin
      operationId: sendMessage
      message:
        $ref: '#/components/messages/greeting'

components:
  messages:
    greeting:
      name: greeting
      title: A salutation
      summary: This is how we send you a salutation
      contentType: application/json
      traits:
        - $ref: '#/components/messageTraits/commonHeaders'
      payload:
        $ref: "#/components/schemas/greetingContent"

  schemas:
    greetingContent:
```

Brighter Sample App 1.0.0

APACHE 2.0

Demonstrates sending a greeting over a messaging transport.

Contact link: PARAMORE BRIGHTER Contact email: SUPPORT@GOPARAMORE.IO

Servers

localhost:9092 KAFKA

Operations

SUB greeting

A channel for sending out greeting messages

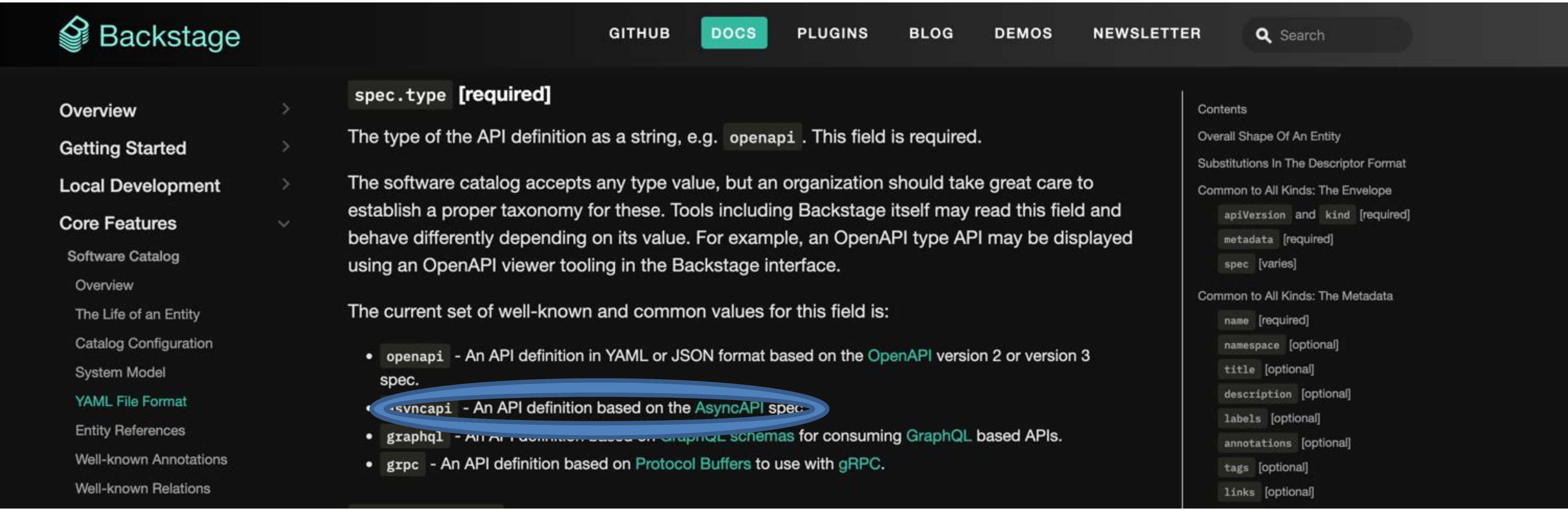
This service lets you send the 'Hello World' greeting to another service.

Accepts the following message:

A salutation greeting

This is how we send you a salutation

Backstage



`spec.type` [required]

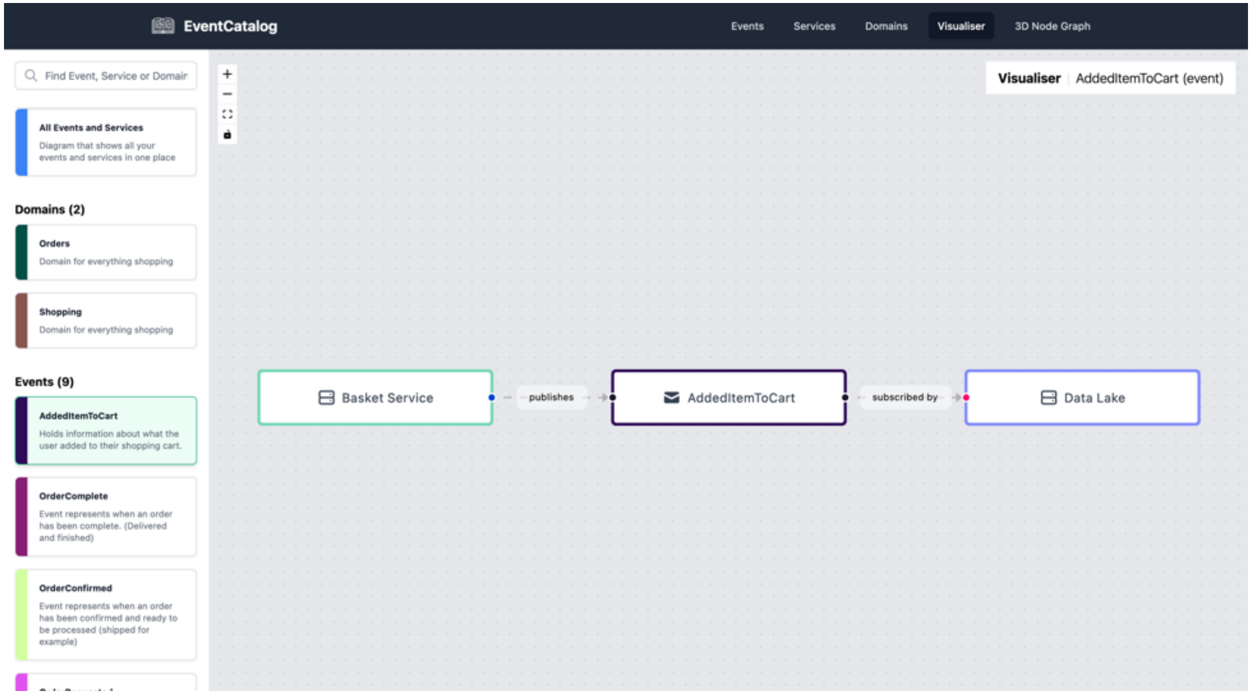
The type of the API definition as a string, e.g. `openapi`. This field is required.

The software catalog accepts any type value, but an organization should take great care to establish a proper taxonomy for these. Tools including Backstage itself may read this field and behave differently depending on its value. For example, an OpenAPI type API may be displayed using an OpenAPI viewer tooling in the Backstage interface.

The current set of well-known and common values for this field is:

- `openapi` - An API definition in YAML or JSON format based on the OpenAPI version 2 or version 3 spec.
- `asyncapi` - An API definition based on the AsyncAPI spec.
- `graphql` - An API definition based on GraphQL schemas for consuming GraphQL based APIs.
- `grpc` - An API definition based on Protocol Buffers to use with gRPC.

Event Catalog



All Events and Services
Diagram that shows all your events and services in one place

Domains (2)

Orders
Domain for everything shopping

Shopping
Domain for everything shopping

Events (9)

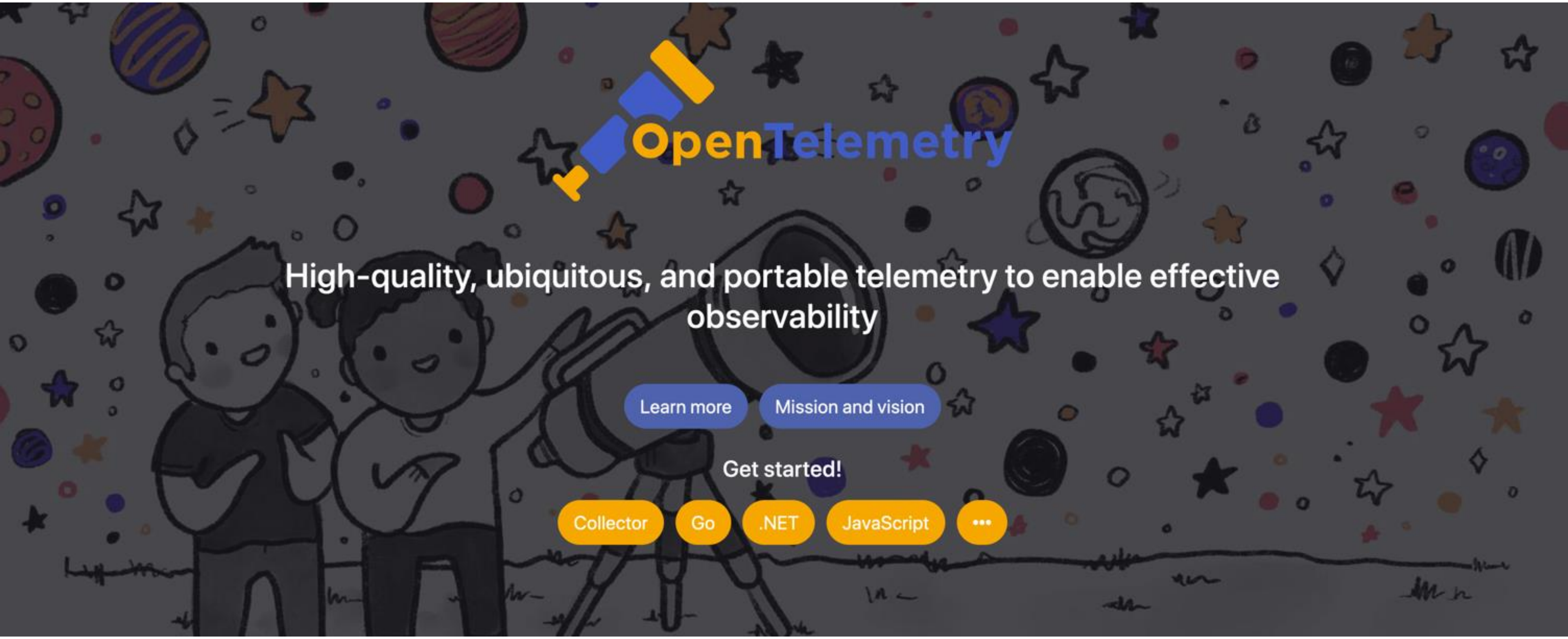
AddedItemToCart
Holds information about what the user added to their shopping cart.

OrderComplete
Event represents when an order has been complete. (Delivered and finished)

OrderConfirmed
Event represents when an order has been confirmed and ready to be processed (shipped for example)

https://github.com/boyney123/eventcatalog

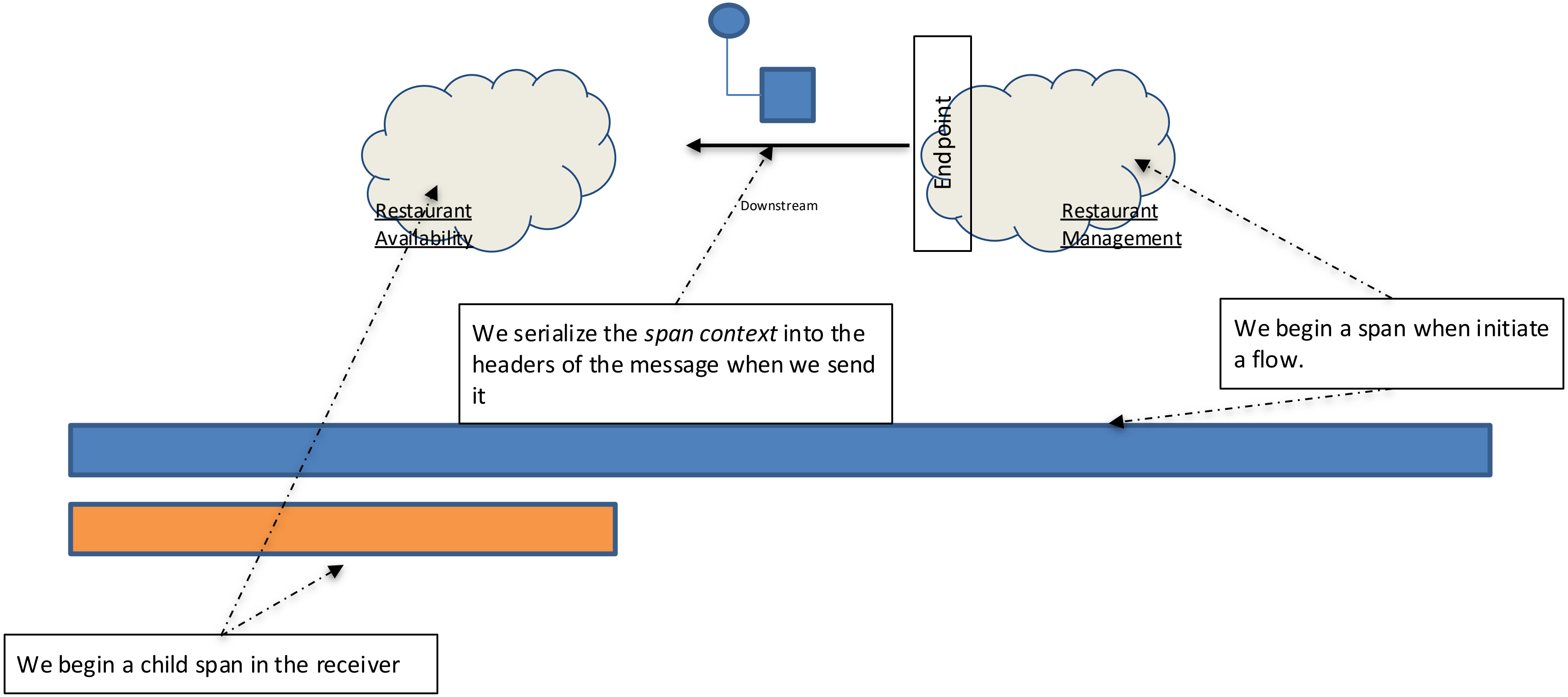
Observability



High-quality, ubiquitous, and portable telemetry to enable effective observability

Get started!

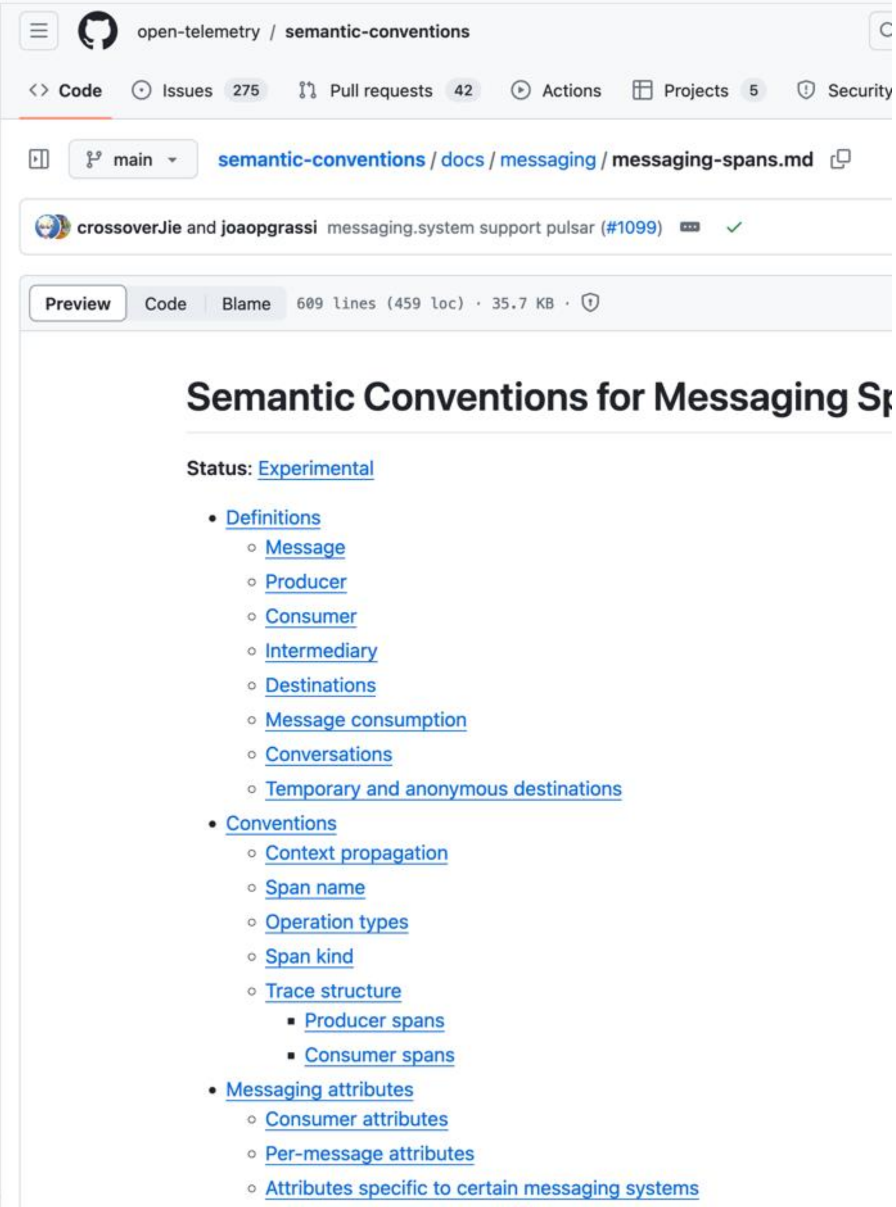
OpenTelemetry Tracing



We serialize the *span context* into the headers of the message when we send it

We begin a span when initiate a flow.

We begin a child span in the receiver



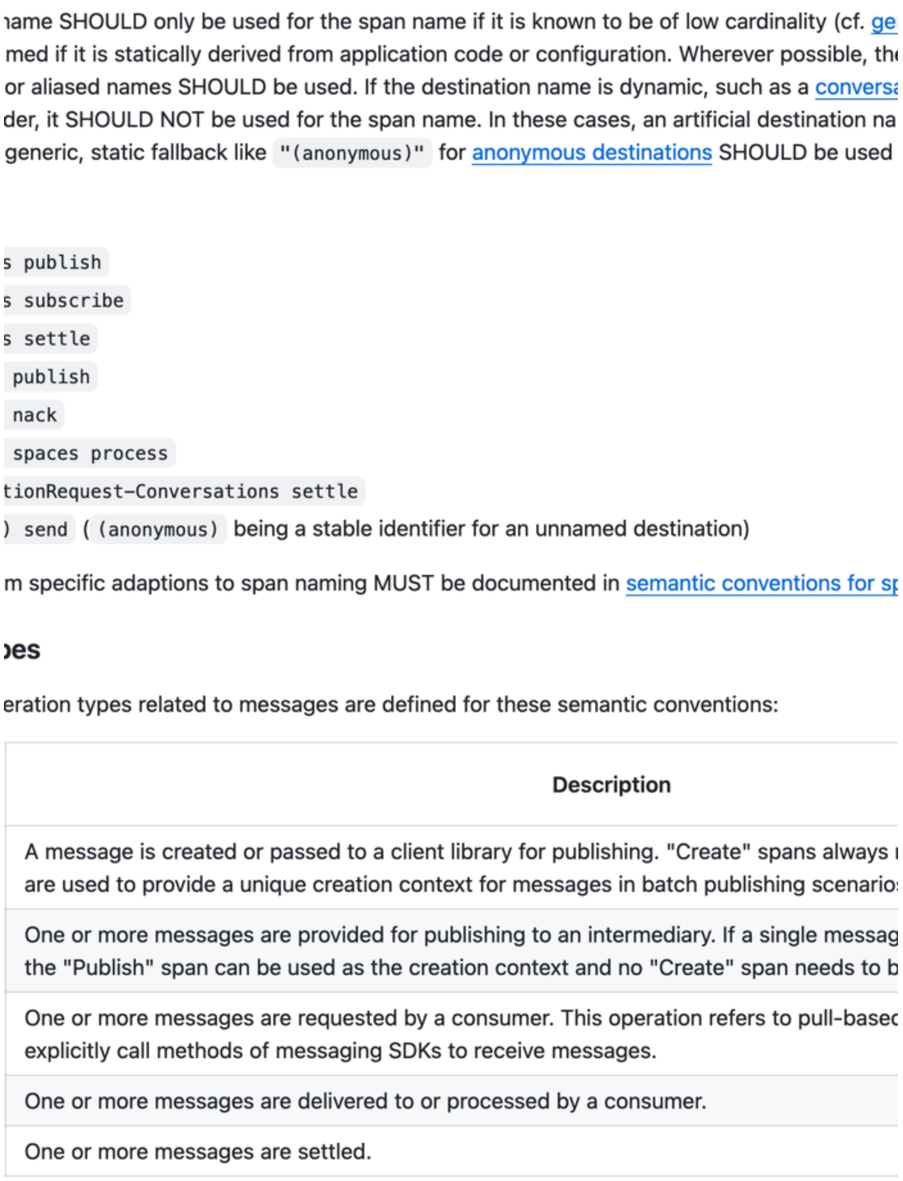
semantic-conventions / docs / messaging / messaging-spans.md

crossoverJie and joaopgrassi messaging.system support pulsar (#1099)

609 lines (459 loc) · 35.7 KB

Semantic Conventions for Messaging Sp

Status: Experimental



ıame SHOULD only be used for the span name if it is known to be of low cardinality (cf. ge
med if it is statically derived from application code or configuration. Wherever possible, th
or aliased names SHOULD be used. If the destination name is dynamic, such as a conversa
der, it SHOULD NOT be used for the span name. In these cases, an artificial destination na
generic, static fallback like `"(anonymous)"` for anonymous destinations SHOULD be used

`s publish`

`s subscribe`

`s settle`

`publish`

`nack`

`spaces process`

`tionRequest-Conversations settle`

`) send` (`(anonymous)` being a stable identifier for an unnamed destination)

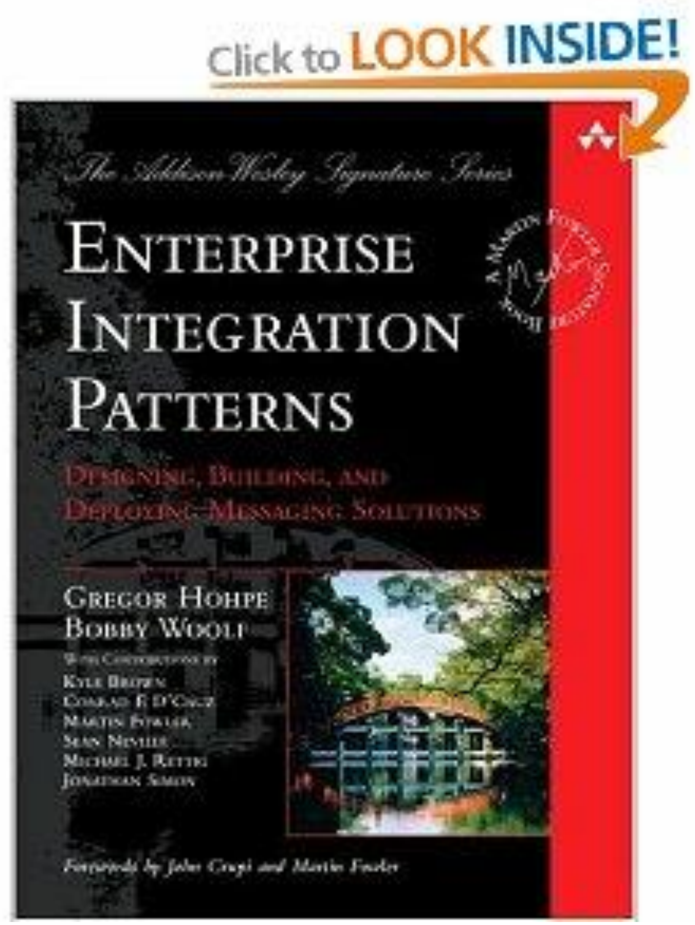
m specific adaptions to span naming MUST be documented in semantic conventions for sp

ɔes

eration types related to messages are defined for these semantic conventions:

Description
A message is created or passed to a client library for publishing. "Create" spans always ı are used to provide a unique creation context for messages in batch publishing scenario:
One or more messages are provided for publishing to an intermediary. If a single messag the "Publish" span can be used as the creation context and no "Create" span needs to b
One or more messages are requested by a consumer. This operation refers to pull-basec explicitly call methods of messaging SDKs to receive messages.
One or more messages are delivered to or processed by a consumer.
One or more messages are settled.

Further Reading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Q&A