

Workgroup: TBD
Internet-Draft:
draft-spinella-event-streaming-open-network-02
Published: 27 January 2022
Intended Status: Informational
Expires: 31 July 2022
Authors: E. Spinella
Syndeno

Event Streaming Open Network

Abstract

This document describes the vision, architecture and network protocol for an Event Streaming Open Network over the Internet.

About This Document

This note is to be removed before publishing as an RFC.

The latest revision of this draft can be found at <https://example.com/LATEST>. Status information for this document may be found at <https://datatracker.ietf.org/doc/draft-spinella-event-streaming-open-network/>.

Source for this draft and an issue tracker can be found at <https://github.com/syndeno/draft-spinella-event-streaming-open-network>.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <https://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on 31 July 2022.

Copyright Notice

Copyright (c) 2022 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust's Legal Provisions Relating to IETF Documents (<https://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Revised BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Revised BSD License.

Table of Contents

- [1. Introduction](#)
- [2. An Open Network for Event Streaming over the Internet](#)
 - [2.1. Free, Open & Neutral Networks \(FONN\)](#)
 - [2.2. Non-discriminatory and open access](#)
 - [2.3. Open participation](#)
 - [2.4. Open Access Infrastructure Resources](#)
 - [2.4.1. Open Access DNS Resource Example](#)
 - [2.4.2. Flow: Event Streaming Internet Resource](#)
- [3. Necessities for an Event Streaming Open Network over the Internet](#)
 - [3.1. Necessity 1: Event Streaming Internet Resource Public Registry](#)
 - [3.2. Necessity 2: Establishment of a User Space for Events](#)
 - [3.3. Necessity 3: An Agnostic Subscription Protocol](#)
 - [3.4. Necessity 4: An Open Cross-sector Payload Format](#)
- [4. Event Streaming Open Network Architecture](#)
 - [4.1. Architecture overview](#)
 - [4.1.1. Flow Events Broker \(FEB\)](#)
 - [4.1.2. Flow Name Service \(FNS\)](#)
 - [4.1.3. Flow Namespace Accessing Agent \(FNAA\)](#)
 - [4.1.4. Flow Processor \(FP\)](#)
 - [4.1.5. Flow Namespace User Agent \(FNUA\)](#)
 - [4.2. Communications Examples](#)
 - [4.2.1. Unidirectional Subscription](#)
 - [4.2.2. Bidirectional Subscription](#)
- [5. Event Streaming Open Network Protocol](#)
 - [5.1. Protocol definition methodology](#)
 - [5.2. Flow Namespace Accessing Protocol \(FNAP\)](#)
 - [5.3. Implementation](#)
 - [5.3.1. Objectives](#)
 - [5.4. Existing components](#)
 - [5.4.1. Flow Events Broker \(FEB\)](#)
 - [5.4.2. Flow Name Service \(FN\)](#)
 - [5.4.3. Components to be developed](#)
- [6. Proof of Concept](#)
 - [6.1. Minimum functionalities](#)
 - [6.2. FNAA - Server application](#)

- [6.3. FNUA - Client application](#)
- [6.4. Use cases](#)
 - [6.4.1. Use case 2: Creating a flow](#)
 - [6.4.2. Use case 3: Describing a flow](#)
 - [6.4.3. Use case 4: Subscribing to a remote flow](#)
- [6.5. Results of the PoC](#)
- [7. Summary & Conclusions](#)
- [8. Security Considerations](#)
- [9. IANA Considerations](#)
- [10. Normative References](#)
- [Acknowledgments](#)
- [Author's Address](#)

1. Introduction

Society is rapidly digitalizing and automating the exchanges of value that constitute the economy. Also, considerable time and energy is spent to assure that key transactions can be executed with reduced human involvement with better, faster, and more accurate results. In this context, Event Streaming can play a key role in how the economic system evolves.

However, most of the application layer integrations executed today across organizational boundaries are not in real time. Also, they currently require employing a variety of formats and protocols. Some industries have adopted data formats for exchanging information between organizations, such as Electronic Data Interchange (EDI). However, those integrations are limited to specific use cases and represent a small fraction of all demanded organizational integrations.

Thus, there is no consistent and common consensus on a mechanism for the exchange of events across organizations. This results in a completely custom landscape for each real-time cross-organization integration. In this scenario, development teams must invest plenty of time into understanding and defining a common interface for events exchange.

In this context, we can now introduce how this landscape could change with the introduction of an Event Streaming Open Network over the Internet. When needing to connect real-time event flows across organizations, developers would have a common basis for finding, publishing, and subscribing to event streams. Also, given a set of standard formats to encode and transmit events, developers could use the programming language of their choice. Overall, this set of standards would drastically reduce the cost of real-time integration, which would also enable experimentation by users.

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [[RFC2119](#)] [[RFC8174](#)] when, and only when, they appear in all capitals, as shown here.

2. An Open Network for Event Streaming over the Internet

In this section, we will argue how Internet standards are developed and why this could be the case for an Event Streaming Open Network.

An interesting example of this phenomenon is the case of ISDN (Integrated Services Digital Network), a set of communications standards for the transmission of voice, video, and data over the PSTN (Public Switched Telephone Network) developed by the ITU-T (Telecommunication Standardization Sector) in 1988. ISDN pretended to use the existing public telephone network to transmit digital data in a time when the Internet connectivity access was not as broadly available as it is today. The main competitor of this standard was the incipient Internet itself, which could be used to transmit the same data.

The Internet alternative needed a protocol to support the same services offered by ISDN, which was initially developed by the conjoint effort of the academic and private sector. Consequently, in 1992 the Mbone (Multicast Bone) was created. This project was an experimental network backbone built over the Internet for carrying multicast IP traffic, which could be used for multimedia content. After some important milestones of this project, the SIP (Session Initiation Protocol) was defined in 1996 and was published as a standard protocol in IETF's [[RFC3261](#)]. The reality today is that SIP has completely won the standards battle for multimedia transmission over the Internet, and ISDN usage has been on continuous decline.

As for Event Streaming, we see a similar scenario set-up today. There are currently several open specifications and implementations for Event Streaming, like AMQP (Advanced Messaging Queueing Protocol), supported by RabbitMQ. However, while AMQP can be used for several purposes, Kafka Protocol specializes on Event Streaming Processing and its specialized features make it more convenient than RabbitMQ (i.e. ordering).

In the case of an Event Streaming Open Network over the Internet, if we guide ourselves by the history of the most widely adopted protocols on the Internet, the governance should be similar to that of the WWW or Email. Both the WWW and Email have open specifications as well as open-source implementations. We can mention the Apache Web Server as an open-source implementation of the HTTP protocol;

Postfix for SMTP; and Bind for DNS. Nevertheless, the governance for these protocols' specifications relies on the IETF.

In order to define the characteristics of an Event Streaming Open Network, we will focus on the definition of shared and openly accessible infrastructure. First, we will review the principles of Free, Open & Neutral Networks and why they should be followed for an Event Streaming Open Network. Then, we will show how DNS complies with the criteria to be considered an infrastructure resource. Finally, we will demonstrate how this is also true for Event Streaming.

2.1. Free, Open & Neutral Networks (FONN)

The main principles of a Free, Open & Neutral Network are:

*It is open because it is universally open to the participation of everybody without any kind of exclusion nor discrimination, and because it is always described how it works and its components, enabling everyone to improve it.

*It is free because everybody can use it for whatever purpose and enjoy it independently of his network participation degree.

*it is neutral because the network is independent of the contents, it does not influence them and they can freely circulate; the users can access and produce contents independently to their financial capacity or their social condition. The new contents produced are orientated to stimulate new ones, or for the network administration itself, or simply in exercise of the freedom of adding new contents, but not to replace or to block other ones.

*It is also neutral with regard to the technology, the network can be built with whatever technology chosen by the participants with the only limitations resulting of the technology itself.

2.2. Non-discriminatory and open access

Services such as DNS, the World Wide Web and Email do not discriminate and are open-accessible. Basically, people and organizations can access these networks as long as they can register an Internet Domain and host the required server components. Nowadays, there are alternatives to avoid having to register a domain name to have a web page or an email, such as Cloud WordPress Hosting or Gmail. However, we will focus on the network participants that provide services to end-users.

In the case of Guifi.net, we can highlight how this principle has been adopted in the fact that everybody can take part in the project

without discrimination. Moreover, an emphasis is made in easing the participation of the disadvantaged collectives, with less resources or less opportunities to access information technologies, telecommunications, and the Internet.

An Event Streaming Open Network should provide resources in a similar way than the most widely adopted Internet Services. Thus, individuals and organizations must be able to register Flow address spaces for which the existing DNS infrastructure could be leveraged. Moreover, the specification of the protocols that implement the Metadata and Payload formats must also be openly accessible.

2.3. Open participation

Internet Services like DNS, WWW and Email provide individuals and organizations with different ways of participation. First, anybody can obtain the protocols' specification and build a custom implementation, which would result in a new product compatible with the protocols. Secondly, anybody can register a domain name and set up servers using compatible products. Thirdly, anybody can join and participate in the IETF, the institution that governs the specifications for these protocols.

As for Guifi.net, not only anybody can extend the network with new nodes but also can also participate in existing projects of network extension. Also, the participants can add services on top of the network such as VoIP, FTP servers, broadcast radios, etc.

Regarding active participation on an Event Streaming Open Network, we can highlight the possibility for individuals and organizations to expand the services provided by the open network. This extensibility could be made possible by different uses of the event payloads and will vary significantly depending on the sector. Since we have already proved how Flow is an infrastructure resource, innovation would play its part and its results would be materialized in services expansion.

We can conclude that the same kind of openness of DNS, WWW and Email is necessary for an Event Streaming Open Network. Anybody should be able to obtain the specifications to build an implementation of the service. Also, since it should leverage the DNS infrastructure, anybody would be able to register Flow address spaces. Lastly, the specification could be governed by an institution such as the IETF, due the dependency of Flow with other Internet Services governed by this institution.

2.4. Open Access Infrastructure Resources

The literature about Commons Infrastructure (Frischmann, 2007) defines a set of criteria to evaluate if a resource can be

considered an infrastructure resource. This analysis is relevant since it can provide some arguments to prove the need of an infrastructure of commons for Event Streaming, which could then be materialized in an Open Network for Event Streaming. The demand-side criteria for evaluating if a given resource can be considered as an infrastructure resource are:

1. The resource can be consumed nonrivalrously.
2. Social demand for the resource is driven primarily by downstream productive activity that requires the resource as an input.
3. The resource is used as an input into a wide range of goods and services, including private goods, public goods and/or non-market goods.

First, a nonrival good describes the "shareable" nature of a given good. Infrastructures are shareable in the sense that the resources can be accessed and used by multiple users at the same time. However, infrastructure resources vary in their capacity to accommodate multiple users, and this variance in the capacity differentiates nonrival resources from partially rival resources. A nonrival resource represents those resources with infinite capacity, while a partially rival resource has finite but renewable capacity. As an example, Broadcast Television is a nonrival resource since additional users do not affect the capacity of the resource. On the other hand, natural oil resources are completely rival since its availability is limited and it is not renewable. In the middle, we have partially rival resources like a highway, which may be congested. This last characteristic is also true for the Internet since it supports additional users without degrading the service to existing users to a certain extent.

Secondly, infrastructure resources consumption is primarily driven by downstream activities that require this resource as an input. This means that the broad audience consumes infrastructure resources indirectly. For instance, highway infrastructure is used to transport every kind of physical good which people and organizations purchase. This facilitates the generation of positive externalities for society through the downstream production of public goods and non-market goods. These positive externalities might be suppressed under a regime where resource availability is driven solely based on individuals' willingness to pay.

Regarding willingness to pay, it is relevant to analyze this factor more exhaustively. Frischmann states that if infrastructure access is allocated based on individuals' willingness to pay the potential positive externalities of that infrastructure might be stifled.

Thus, infrastructure resources behave differently than end-user products: if the former are made available solely based on the end-user demands and willingness to pay, those needed infrastructure resources might never be made available. As an example, we can mention that if airports were built based on individuals' willingness to pay for them, they might not even be built. However, individuals are willing to pay for the airport's downstream activities, such as purchasing a flight or consuming air-transported goods. Then, a whole set of positive externalities are generated by the existence of an airport in a city.

In the third place, infrastructure resources are used as input for a wide range of outputs. This criterion emphasizes both the variance of the downstream outputs and their nature. Thus, the infrastructure resources possess a high level of genericness which enable productive activities that produce different goods with high variance. If we consider how an airport complies with this criterion, we can mention that not only airports serve individuals that need to travel by air but are also used to transport many kinds of physical goods. These goods then enable other activities throughout the downstream value chain. Then, the output variance of the activities that take airport infrastructure as input is significantly high.

2.4.1. Open Access DNS Resource Example

Now, we will provide as an example how DNS complies with these criteria and why it can be considered an infrastructure resource. 1. DNS infrastructure is a partially rival resource because individuals and organizations can register domains in the Domain Name addressing space. It is partially rival because not every actor can acquire the same domain name. However, the access to registering domain names is open and non-discriminatory. Moreover, DNS is also prone to congestion, which emphasizes its partially rival nature. 2. DNS infrastructure demand is driven principally by downstream products and services. An average Internet user is not paying directly for this infrastructure, but all the Internet services the user consumes pay for DNS infrastructure. This is true for all the Internet services due to the ubiquitous nature of DNS infrastructure. 3. All Internet services take as input DNS infrastructure and produce a broad variety of outputs, which then generate positive externalities to society as a whole by means of private goods, public goods and/or non-market goods.

We can conclude that DNS complies with Frischmann criteria for being considered as an infrastructure resource. The resource is represented both by the domain name that can be and by the querying capacity of DNS servers.

2.4.2. Flow: Event Streaming Internet Resource

In this section, we will describe an Event Streaming Internet Resources. For this, we will consider the previously described guidelines for FONN as well as the characteristics of DNS as a resource. This Event Streaming Internet Resource shall be referred to as "flow" from now onwards.

To begin with, we need to define what elements could be considered as infrastructure resources in an Event Streaming Open Network. First, the resource must be capable of delivering streams of events to consumers. Secondly, it must also permit producers to write events to the stream. Thirdly, each stream must be identifiable (i.e., URI) and able to be located (i.e., URL). From now on, we will use "Flow" to refer to the infrastructure resource of an Event Streaming Open Network. The first Frischmann criterion requires the resource to be consumed nonrivalrously. Complete nonrivalrously for any Internet Service cannot be achieved due to the possibility of congestion and potential unavailability of different elements of the network. The same would be true for a Flow resource. Moreover, the public naming addressing space for Flows would be limited to the same level as that of domain names.

We will continue now with the third criterion. To illustrate the potential of Flow being used as inputs for downstream activities, we will refer to Urquhart's vision for Event Streaming. He lists two areas in which significant changes can happen:

1. The use of time-critical data for customer experience and efficiency. This is driven because today's consumers are increasingly expecting great experiences, and organizations are almost always motivated to improve the efficiency of their operations.
2. The emergence of new businesses and business models. Businesses and institutions will quickly discover use cases where data processed in a timely manner will change the economics of a process or transaction. They may even experiment with new processes, made possible by this timely data flow. Thus, flow resources will also enable innovation. These innovations are responsible for generating positive externalities.

Then, we have demonstrated why Flow resources can be considered as infrastructure resources using Frischmann's Demand-side Theory of Infrastructure. These resources can be managed in an open manner to maximize positive externalities, which basically means maintaining its open access, not discriminating, and eliminating the need to obtain licenses to use the resources. Consequently, managing

infrastructure resources in this manner eliminates the need to rely on either market actors or governments.

Lastly, the adoption of an Event Streaming Open Network implies taking Flow resources as inputs for productive activities. These inputs would then be used downstream to generate private goods, public goods and/or non-market goods. Additionally, we can assure that most of the consumers of Flow would not directly consume Flow resources. They would consume the outputs of downstream activities that use Flow as input. Again, the consumers may not be willing to pay for Flow resources directly.

We can conclude this section mentioning that an Event Streaming Open Network would enable one infrastructure resource called Flow. The access to this resource can be managed in an openly manner: maintaining open access, not discriminating users or different uses of the resource, and eliminating the need to obtain approval or a license to use the resource.

3. Necessities for an Event Streaming Open Network over the Internet

In this section, we will describe the main needs for the broad adoption of Event Streaming. The focus will be made on detecting and describing the missing capabilities that could not only enable but also accelerate the event data integration among different organizations. The different necessities detailed in this section will serve as input for an architecture design.

3.1. Necessity 1: Event Streaming Internet Resource Public Registry

A public registry of an organization's available event streams does not exist. We will argue in this section why this is the core component that an Event Streaming Open Network can provide.

Nowadays, when an organization needs to publish an event stream or event flow, they usually follow some form of the following steps:

1. Develop and deploy a producer application that writes events to a queue.
2. Create all necessary networking permissions for external public access to the queue.
3. Inform the remote user the access information (i.e., Hostname/IP, protocol, and port) together with the required client details and technology for accessing the stream (i.e., Apache Kafka Protocol, RabbitMQ API, etc.).

4. Create credentials for consumer authentication and authorization access to the queue.
5. Develop and deploy a consumer application that reads the queue.

Now, we can compare this process to a simple email interaction: 1. Sender opens a graphical Mail User Agent application and sends an email to an email address formatted as user@domain. 2. The message is sent to an SMTP server that routes it to the destination SMTP servers for the given domain. Once received, the message is put into the user mailbox. 3. When the recipient checks its mailbox by IMAP or POP3, the new email is transferred to the Mail User Agent.

In these two scenarios, we can see that the information needed to be exchanged offline by the actors is completely different in size and content.

First, in the case of email, there is a shared naming space given by the Domain Name Service (DNS). The email format has been standardized by the IETF in [\[RFC5321\]](#), section 2.3.11. Thus, there is a common naming space that is used for referencing mailboxes in the format user@domain. Thus, the offline details communicated by the peers is only the recipient email address. There is no analogous standard nor an open alternative for Event Streaming.

Therefore, in the case of Event Streaming, users need to perform plenty of offline communication to agree not only on the technology to use but also on the queue to use. For instance, two organizations may be currently using Apache Kafka and need to share an event stream among themselves. The organization having the source of the stream should provide the following details to the consumer organization: * Bootstrap servers: Fully Qualified Domain Name list of the Apache Kafka brokers to start the connection to the Apache Kafka Brokers. Example: tcp://kf1.cluster.emiliano.ar:9092, tcp://kf2.cluster.emiliano.ar:9092, tcp://kf3.cluster.emiliano.ar:9092 * Topic or Queue name: name of the topic resource in the Apache Kafka Cluster * Authentication information: User and password, TLS Certificate, etc.

In the case these organizations were not both using Apache Kafka, the use case cannot be simply solved without incurring in development or complex configurations as well as adopting proprietary components.

We can conclude that an Event Streaming Open Network should provide a global accessible URI for streams in a similar fashion than email, to reduce offline developers' interactions. This means being able to name event streams in a common naming space like DNS, as well as providing a mechanism for users to discover the location and connections requirements.

3.2. Necessity 2: Establishment of a User Space for Events

Another need for broad adoption is due to the inexistence of a common and agreed user convention. In the general literature, we cannot find reference to the types of users that would consume or produce events to and from an event stream.

In this sense, it is also appropriate to consider the email use case. Basically, an email user only needs to know the email address, the password, the URL of a web mail client or the details of IMAP/POP3 server connection. Once the user has this information, it's possible to access an email space or mailbox where the user can navigate the emails in it. Also, IMAP provides the possibility for the user to create folders and optionally share them with other users.

There is no analogous service currently available for Event Streaming analogous to the email case. This means that the user concept in Event Streaming is limited to authentication and authorization. Thus, the user does not have access to a "streambox". The result is the impossibility for a person or an application to possess a home directory containing all the streams owned by the user.

As a conclusion for this section, we can mention that it is necessary to embrace a user space resource for Event Streaming. This resource should not only solve the users' motivations and requirements but also reduce the offline verbal communications and custom development dependencies. In the next sections, we will refer to this component as the Event User Space Service.

3.3. Necessity 3: An Agnostic Subscription Protocol

A third need for wide adoption is an agnostic protocol to manage subscriptions to event streams. For this need to be solved, it would be necessary first to count with an Event User Space Service. Then, in case a user has created a stream and wants to enable public subscriptions by other users, there is no general protocol to inform other parties of this subscription intention nor its confirmation.

The result is the inability for the users to seamlessly subscribe to an event stream. They either must employ protocols like MQTT or, in the need of employing other application protocols like Apache Kafka, hardcode the subscription details in the different software implementations. This means that there is no general subscription protocol for Event Streaming that is agnostic of the application protocol employed. This protocol implements both the Metadata Payload Format and Payload Format.

A good example to illustrate the difference between a control protocol that implements a Metadata Payload Format from a payload protocol that implements a Payload Format is how SIP (Session Initiation Protocol) works with RTP (Real Time Protocol) to provide VoIP capabilities. The former is a control protocol that initiates and maintains a session or call while the latter is the one responsible for carrying the payloads, which in the case of VoIP it would be coded audio.

Consequently, a similar definition of protocols could potentially mitigate this limitation for Event Streaming. If a protocol can be used to establish and maintain the subscriptions relationships while another different protocol is used for the events payload, all the current application protocols implementations could be supported.

Additionally, by counting also with an Event Streaming Public Registry, it would be possible to provide URI for streams in a similar way as email works with the "mailto" URI. For instance, in web pages one can find that email addresses are linked to mailto URIs which, when clicked, open the default email user application (i.e., Microsoft Outlook) to send an email to the referenced email address.

If a user counts with a user space or streambox, then a user application like an email client could provide access to it. Then, if the user clicks on a link of a stream URI (i.e. "stream:myeventflow"), the streambox application would open and subscribe to the given stream.

Currently, the Metadata Payload Format as well as the Payload Format are both provided by the queue or log application protocol. In the case of Apache Kafka, both formats are implemented within the Apache Kafka Protocol. This introduces a barrier for interoperability among different technologies, meaning that flows of event data cannot be seamlessly connected, without relying on custom development or proprietary software licensing.

We can conclude that there is an actual need for an open specification of an Event Subscription Service for event streams, which implements what Urquhart calls Metadata Payload Format. This specification could be materialized in a network protocol that introduces an abstraction for the event queue or log technologies implemented by different organizations.

3.4. Necessity 4: An Open Cross-sector Payload Format

Currently, the different implementations of Event Streaming combine both the Payload Format with the Metadata Format. This means that

the same protocol utilized for payload transport is used for subscription management.

When a producer intends to publish events to a queue or, using Apache Kafka terminology, when a producer intends to write records to a topic, first it needs to initiate a connection to at least one of the Apache Kafka Brokers. In that initial exchange of TCP packages, the producer is authenticated, authorized, and informed with topic details. This set of transactions would belong to a protocol that implements a Metadata Payload Format. Afterwards, when the Producer starts writing the events to the topic, it encapsulates the event payload in a Kafka Protocol message. This latter behavior makes use of a Payload Format. Thus, we can observe how both theoretical formats are coupled in a single protocol. Similar behavior of a coupled Metadata and Payload Format in one single protocol happens also in AMQP, MQTT and RabbitMQ.

As for the consumer, the behavior is the same with the difference that the initial intention is to subscribe to a queue or, in Apache Kafka terminology, to consume records of a topic. Then, a set of TCP packages encapsulating the Apache Kafka protocol authenticates, authorizes, and informs the Consumer with topic details for consumption. Afterwards, the consumer can start polling for new records in the different partitions of the topic. It is worth mentioning that the consumer needs to implement more queue management logic than the Producer, especially when multiple replicas of a consumer type are deployed.

If we focus on the Payload Format, there is the need for an implementation-agnostic payload format suitable for Event Streaming. In this sense, CloudEvents project of the CNCF proposes a specification and a set of libraries for this purpose. The goal is to use CloudEvents specification as a Payload Format regardless of the Payload Protocol being used. For instance, we could transmit events in the CloudEvents format using the Kafka or AMQP Protocol.

The general structure of the CloudEvents Payload Format includes a standardized methodology to include event data in an event message. For instance, instead of defining a customized JSON structure for sending the events of temperature changes measured by a device, a CloudEvent object could be used. Temperature could be included as an attribute in the CloudEvent object.

We can then conclude that while there is no current protocol candidate that implements the Metadata Format, CloudEvents is a good candidate for the Payload Format needed in an Event Streaming Open Network. In this way, the different CloudEvents libraries made available in several programming could be leveraged.

4. Event Streaming Open Network Architecture

In this section, we will describe the overall architectural proposal for an Event Streaming Open Network. This description will include the different actors in play, the software components required, as well as the network protocols that should be specificized.

4.1. Architecture overview

In Figure 1 we illustrate a high-level overview of an architecture proposal for the Open Network.

- 256 220 JPEG /9j/4AAQSkZJRgABAgEASABIAAD/7QAsUGhvdG9zaG9wIDMuMAA4QklNA+0AAAAABAASAAAAEA AQBIAAAAAQAB/ +4ADkFkb2JlAGTAAAAAAf/bAIQABgQEBAUEBgUFBGkGBQYJCwgGBggLDAoKCwoK DBAMDAwMDAwQDA4PEA8ODBMTFBQTExwbGxscHx8fHx8fHx8fHwEHBwNDA0YEBAYGhURFRofHx8f Hx8fHx8fHx8fHx8fHx8fHx8fHx8fHx8fHx8fHx8fHx8fHx8fHx8fHx8f/8AAEQgA3AEAAwER AAIRAQMRAF/EAAIAAAAHAQEBAQEAAAAAAAAAAQFAwIGAQAHCAKKCwEAAgIDAQEBAQEAAAAAAAAA AQACAwQFBgcICQoLEAACAQMDAgQCBgcDBAIGANMBAgMRBAAFIRIXQVEGE2EicYEUmpGhBxWwQiPB UtHhMxZi8CRygvElQzRTkqKyY3PCNUQnk60zNhdUZHTD0uIIJoMJChgZhJRFRqS0VtNVKBry4/PE 10T0ZXWF1aw1xdXl9WZ2hpamt sbw5vY3R1dnd4eXp7fH1+f30EhYaHiImKi4yNjo+Ck5SVlpeYmZ qbnJ2en5KjpKWmp6ipqqusra6voRAAICAQIDBQUEBQYECAMDbQEAAhEDBCESMUEFURNhIgZxgZey obHwFMHR4SNCFVJicvEzJDRDghaSUyWiY7LCB3PSNeJEgxdUkwgJChgZJjZFGidkdFU38qOzwygp 0+PzhJSktMTU5PRldYWVpbXF1eX1RlZmdoaWprbG1ub2R1dnd4eXp7fH1+f30EhYaHiImKi4yNjo +DLJWWl5iZmpucnZ6fkqOkpaanqKmq6ytrq+v/aAAwDAQACEQMRAD8A9U4q7FXyq7FXyq7FXyq7 FUR8131zp/lfWL+1bhdWljczw0QGPJHCzqaGoNCO+KsE8v8AnHzJY6baazrjajcafcGziu5L+Gxt LeFbx1T6zE9sGd1R2UEPXFuXbFLWfnNqGoapbww/l2f6m72gndRczSCK/f9xMpitnhUCERkww U70WvdHdQhU/OLzFdzaLDf01vZvrTaZcWpe6MwNpftNFtIHkXlXcm1BsdjXqKYpTf8wtD84afqssmm XMsG12dgJ7mwYgtbyWK4LyHldwyuswG9K0oaIV2bfFUHb/mxq6G6kft7a+sY5NSliu4Z3hP1TTIo ZS3otE5LyJNVry67HbFU0fzn1z9G1v8PMNTlaI2UDC+S0a0SCS4fgHtEmdoVio5VCnxBuYgKomH 82tfvpbH9F+XoZre++pQpJLfcGFxqFg15FKiE/BGKqxrU9h2xQgNM/0XWL+5eKy0gzX13As0Frc3 cccELJYfW5FQpbeoQxBHxM1T3Veimk60H81bvWJN0uItISPSdRvLbTkma6/fpPPYC/ZjEIuLIqsE Hx1PWLmULtZ1jzTdan5rbTtah0u38sRx+lAm3jm9UtaLdmS5aT41jbnwHpkfzJxVL0/0W+j0ca3d aLGu1xM1v00dyTObgayNSHGJogoTjVDV698Ut2X5seaLye302Hyx/uWvfv+qGeS5tLd+FsbkBTdw sLsRx4N8PGtdYodlUy8yecvMTeVvKeueX7Yg41iaC5n01uLtJbHTp76W3Ryv2yIeKsAPI9sUMch/ 02/Y3P6MsG1tWku7y3KJ0CLGAXi0ILA29yRiXkPxS8VX9pt8UqrfnbqenwalJqOjCVlubuPSYU1M UkotJ4Y5IhV4yVkjnn9QnvQigxWkev5wX109/eafpMM2iaU8RubprorJNb3F5LZwy26elxqTAz8W YbUANtiqHH5s6udY0RnsEjg12KaGw0/119MyreRQLNcXJiBiHH1KKoatVH2jsq9VxQ7FXyq7FXyq 7FXyq7FXyq7FXyq7FXyq7FXV06tbe7tprw5jWW3nRopomFVZHHF1I8CDiqRwv5e+SbSG5gt9GtY4b yI29zGE+GSiKNwYHTVQcVRE3kzypNqNnqUmlWzXtgI1tJuABjEP91QDY+n+xUfD2piqlc+Q/J1zb RW0+kWzwQRRwQJwpwihf1I0UihAVzUYqq635M8ra7cx3WraZDeXESekskgNTHX16BU15pU14tUYq 638m+vba+uL+DSra06uwY3MgjHxrIoRwv+zRlUAim+KowL8uPIsvjJYpolqLWWVLiSmpwskY4oam poqkqFrShIpQnFudZ+U/LNkwaz0u2tisy3K+lGqATKrIrgKAAQrsB88VU7byb5VtZ0nt9Ktopox SRUAIX0vRp/yK+H5Yq1EX5X6BD5ntdbtyYI7MxNBXRyqKivb25tYv3oQTcFjp8H0lQ022Kprq/kn ynrN/Hf6ppVveXcYcWk1lU81Vx0dQd6NuyqH7T8v8AyxDq17q01nFd315NLN6s6K3BZoUgeMCL CvBCNx0Zh0JxVX0jyP5S0eSkXTNkt7aaF2ki1VayBnT02PM1b7Hw9emKpjFpGmQwWEEVtGk0l8f0 egG0PGJoF4eFinZPKcVSm8/L3yTexpFc6LayRpNjcqhJAHqzknkXApXmVHIHY0GKq0fkjyjHeSXq 6TbC6lma4eXgCfVkjMTuK7AshoadcVWP5D8mu9i7aPbE6Yix2I4CkaIxdF49GCueShq0043xVES+ UfLM1r9Vl0y3e2ETW4iaMFRE8gmZkEhQIH+YriqbAUFpDFXYq7FXyq7FXyq7FXyq7FXyq7FXyqtM kYcIWAadvSqSKn5DDRRYXYErWkjVgrMFZvsgkAn5YQCgkBgds7FXyq7FXyq7FXyq7FXyq7FXyq7FX Yq7FXyq7FXyq7FXyq7FXyq7FXyq7FUB5gZl0HUmUkMLWcgjYgiNsVR+KuxVAzRu1yrem4DE My/BUmPcUPLbrl0Ts0SFy/sRqkAkFT4G1fwr1LeEfDrTJMh40A9EYfAahauKhl10DQaJiz/Yjv JIqVKnwNK/gTlJbgwew1vzZqFnFf/Xbe2S6UTRW6W5cJG45IpdnBZuJHI069MyI4LF240tTRqlf6 75r/A0rpD/0ij/qpkvy472P5o9zvrmv/q6Q/wDSKp8AqPj+XHev5o9zvrmv/q6Q/8ASKP+qmP5 cd6/mj3Ibu9Y82Wm3d4NRhkntDJME+qgcvTUtsVpPatMBWULt1HUkmqYxqH5jahpWoXNhg0r3pNh xW8uo47HjUwL0zJCLd5ONHoMiYRBoshkkRYpe6X+ZFPqd9FYwvmPUPrSrFBbva2quGWhYMDa7ca7 / I+GEQge9icmQC9k68r+atQtvRuPMWrI9he2LXqzXCwwCApJGFQNGsQbm1wo335Lt1p1c4UAe9tx 50IkdzJdN86eVNStRdWmq27QsSoLuIjVTQ/DJwb8MrbuV/iLy/8A9X00/wCR8f8AZVirCfPfnq5s Z3l0vUQLGyhgac2ht5GkmvLgWIrPMsqII+PI7V+LMLVZ5QlGMauV/Y5WDDGQJl0r7WLR/m6Vot7r l9ayEgH/AEe0kReTMq1kS2K/FwY/IVzG0FU9BE/j3t4w4evEmdp5w1/V/qjaRr9x6Fwk0hmkt7X/

AHUEWgUwL+3KK/IjK5doZYA8YFivtv8AUzGjxyrhJ6ptp3mbzdd2FvdG/gRpo0dk+rA8WYA1a8x0
02DJ2tKMioHkmHZ8ZRBtEfpzzb/1cYP+kUf9VMh/LEv5oZfybHvd+nPNv/Vxg/6RR/1Ux/liX80L /
Jse936c82/9XGD/AKRR/wBVMf5Y1/NC/wAmx71G88y+cLW0muUvbaZoEaT0pLYqrcRUqSsLRUDr
k8faxlIAX5sJ9ngRJBZ9FdK9rFcFWAlVX4qC5HIV/ZBzcykAL/a6wRtLtLRYJpK8tqRnjHK0Z+1z
eoNG+LNDpIiEj8vplv1s+e7m6g8QH5zjbyCau6ovIgd+UFj9wB0bGUqFuEBaU2CLDeyueW1VqsU
vJ+Z5AvUdV6ZrdPERyE7/wC1lve+/uc3MeKAH6RtW2ycZtHBdirsVS/zF/yj+p/8wk//ACbbFUwx
Vx23xVDCJZaTjZl3hQ7Cnfl/rfhllgbNdE7q8bh0DCor2PUHuMgRTMG1Eo8/7wHiF3hB7n+Y/Pp8
sldbMKMt1aN+aBqFT0ZT1BHUZEimYNSD8uf8o9pf/MJB/wAmlzPhyDrcn1H3oTzF5w0ry/PaQ36y
1vEmeF41UrWdhVWJZaM3qDj2PTrSrKYjzWGM5JV/wArZ8mVDC4lMDK7Lcei4jPFedASAasu67e3
XbIeNfn4E1035p+U1W4EEs1xNAsjLFHDJ+89KNpX40V4EKq1Y1oKiuHxQjwZJ761pr2gytbSMLS/
hljinKkVRwYCRQafCR8SnuN8lzDD6Sxp9b028T6rfWFhdfwiZbmUThreSRYhCXNYz9qP4V9sp0Qd
RbfHEb2Nklk/l6ylhms9N0u3lgAWGS0dVZQFZdiIv5XYfTgGUDoz0En+JPPy4g+vTSfWLizuYNL
tW05LaCT1ma0V0PKZSAB8MCoPE8spn06Hc3Qx8JJ72e20n2FhALextorW3BLCGFFjQE7khVAG+QbF
fFWA/mBbxQatbx0ktoyXMSRNa3UvpPztJTnFJH8L8uLS/F4HjmDrdL4tG+Ei/tcvS5+CxV2w+e08
u3Fw9xPYaVLPiR8rzqWkuSWFTF3JOYQ0WQChk2co6mBNmCGvdYj0+5tVsEsbdY1lA/f/wCj0uW5
NuEFGElBz7VyEtHQI1LiuuXPb9mzIanlQ4a7/NkbSw6LoDSycpodNtS7+mBzDYI6niCQKtx8c1Zv
Jk85H730FQH7gkrfmX5XBdRJM0iKG9NYyWIMSY026H4ipDUIZSPnf+QyNX5qC4/mX5RohF07ciAw
WGRiLY1kJcKpoFvt/CjeGP5DL3J/NQ70fonmzStZuZraz9T1IVSQh0ZP3ciI6P8AEBQP6nw168SR
tlWXTSxgEs8eaMzQR+r8c8q8/wCMEV8AxA5DD9Y94ZZPpPueg2cyw6TauRU+jGEQdWYqKAZ2GSYi
LechHiNNx+rbS8pm5LcEF2HRJ0gH+qRQf7eUR4sZuX8X2H9XT+1slUxt/D9oRM0qRR136DsNySdg
B7nL5zERZaoxMjQQgetbyG4mPwTUEoHSM9F+Y7E/wzHHA8UuUuf13ftbjUhwjpy80bMw47sVdiq
X+Yv+Uf1P/mEn/5NtiqYYq7FXyqgJwHu0ccqGhqUfkvA1IXb9rLo7Bo1vL+1HKwYaitD4gg/ccpb
wW8VYD5c/wCUe0v/AJhIP+TS5sIcg6zJ9R97Drzz75dnb/nY9KMNPJML0zuXVpEk5TnmP3kcNeD2
0bt6fMD4d65WcG6hsGMjkUDD5m/L9TBH/hz07eVllsv3cBdjNDFehuPLiq+mQ1C+3EACuwjxR7mX
BPvU7Pzf+U8cTXkulpZz0tvazD0lI4zQNHxQgiqJDVW+EEjscROHckwn3pzb+b9F1DRtS07SbGez
iTT7q6XkscahWQSAoq05+Iz126ZLjBBA7mHhkEE97Wt6V57ivL+80KSSk0q6XZerxj9NbRADwLrF
w9cEUIrX/JxlGV7LGua3X6BL+ajarbJq8MKaWzEzzfuPVCcSyhljdhyqnE8aj49vs4Y8d7rLgrbm
nvkwTRXeipYQYXEuKtG5EkjRan1LdmLMqS1b1HbYju2U5eQb8P1SZZ6/mD/AJYrT/pKk/7J8och
LfmF556i04vo2nwUt8HTij3D0pXl8VQ0duOn+XircF0kHma8u3ikENtrhs9PBNrK5jSNr2UzsjsI
nAMaFEBvtQE7Zqe0pAShxfT6vu2djookxlpZibp+atlCGGyjs6tkqyvM8Tc605I5ySeo0ShAtRQ
AmprmdemKLox/Hwcusw026eaUmrSy6cvmJYzeGK85RqF4VVo41IoSPjj5NTwYjtlEzECXh8rj+n9
NNkQSRx89/0ISTXza6dpWmPp7X0F5Yobj+8akB4RMWCxyL9l+Tc2Udd8mcNz1K6I19vzYjJUYirs
JQfM/kk7WxUbPRRdyOJ2uZmSJFDNHPiWkYJ8i4tW6A7HxNDb4GaPpMq5fo/W1+Lj04jf4P6mk178
ubiSJJNFCwTSW7QyNFHuvKZ5Fd1VieP227serBxXJw5x/Fvv+j8fpXxMR/h/G6JtFpNkuGJ7/S9P
ld4YpI/UiSNAFjiBVGyV9l07dePXoMhLR5T6ZH8fgshqMY3iPx+AzPVTXsbwKurBjse3wHwzBw/W
PeHkyfSfc9G0wA6baVHSG0n/AAAs6eZVpZiKsShAXpvkZyAG7KMSTslemS1ZnE03K1Fbk5fnJwv
NQR80xpmu0k6keI/bdnvHc5mojtsPsrbuTcgEEVB6jNmQ4LsVdirsVS/wAxf8o/qf8AZCT/APJt
sVTDfXYq7FUMxkkYTR/ZjPwL/00hP9Ms2Gxa9zuEQjq6BlNQemQIpmDbeBLAfLn/ACj2l/8AMJB/
yaXNhDkHWZPqPvRE2mabNAtvNaQyW6sXWF41ZAxrUhSKVPI/fhoMeIqZ0XRj6dbC3PohFh/dJ8Ai
p6YXbYJT4adMeEJ4j3qVv5c0C3ikii0+ARSyeq6GNWBCvoanWnGp4jo02DhCmZ70RFpWlwgCKZgj
AXgAkaLRSaVHYd0Iph4QjIKCsfl2nLrmnaejXSwbxT1gS8u1X92E4AU1HELXoMozekCnJweom2Uf
4L0L/17/Aok+9/6rZRxy73J80PcraJ5V0HRJJpdNtjFLcbSyPjLMxHivQNKz1QWysQ0p3yNsgE2w
JS7VLq5M8GnWtcLq5DPJPsfRgQgPIAdi5LBUB7mtCFIXVCT+SfLc5ieW1b6xEGbukminfnQsZZY
3R5K1R9snITxxmKkLZRnKPI0s/wL5c/33c/9J17/ANVsQ/KYv5sfk2fmMn84sP8ANHLTRRr6WRSd
7VbRZhe91cuBIzvgzFFITum3yzXdoHwQDjAjfkHN0f72+Mk15ohYIFdXWNQ6rwVgACE/lB8NumaI
yLtaCGXrtIWJ4lsbdYpeIkjESBW4fZ5C1DSu2S8Wd3ZY8Ee5T/w/onrQTCxgWS2f1ISiKoV/iPKi
0BILSRXoTXrh8adEwd180Pcqro+kpXjZW68utIkFevt/lHB4s+8rwr7naoqrPn2qgBRbyAAbAAIc
OH6x7wuT6T7no2mf8c20/wCMMf8AxEZ2bzKvLkKubS0aKvXx+QyM5iIssoxJNBCwPNFMT0AouSGW
n7LUpwJ8eKj6a5j45SjL1fx/Ye75fPbZgEen+H8WjMymh2KuxV2Kpf5i/wCUf1P/AJhJ/wDk22Kp

sEtPyu/MG3ubWFfOE0wLWj2yRwQPNG3ow8XAjjUoN1HwUod6npilkvkvyr5r0XU55dV1p9TsGtLe
GGGWwE1nRF9aSsrEUdwx7nfqAKYoZjirD4fIV7ap6FnrDJaISLe0WBZGRK/CnMMLQo2G3TKJaeJ
NsDAKn+DNX/6vK/9Io/6qZH8rFfDDv8ABmr/APV5X/pFH/VTH8rFfDDv8Gav/wBX1f8ApFH/AFUx /
KxXww7/AAZq/wD1ev/6RR/1Ux/KxXwwitG8pS2WqjUru/a81jiaG3iEaxRp6hBdyAWLMeIHWgHb
LceIQ5JEQGRZYyidiqS6hZRTavJb0eCanZkeouzJLaSaxuh/n/f8AI6gXvGaNfyXlnynUJEQ00F5
G0izRmjUrvxbZ1/ySDiq0xV2KsT80a9rdtrE0nadJDbx/V/re00kZldiz1FVRyRQPhJJ37ZXkycL
k6bT+ITu1v6c82/9XGD/AKRR/wBVMp/MHucz+Tx3u/Tnm3/q4wf9Io/6qY/mD3L/ACe0936c82/9
XGD/AKRR/wBVMfzB71/k8d7v055t/wCrb/0ij/qpj+YPcv8njvUb3zL5wtbSa5jvbaVoEMnpSwx
VWCCpU1ZKioHUYRn35MZ6AAEgs9iuJJbSgdIwWlRX4FqU5CvwmZBdaAOqD0+CaGaSiFhHSFOTg8E
oHoKKK/ayuAILk5pggb89+XVMZC4U1F5N2BNPxywuMK6pdaQTR3UheZb0/hjVnFEWQ8jt4d9/HK4
ggvVkkDEb8/LuR721u88c7xI08IZYpSoLoHpyCt1HLiK0y1xHmnozfn1eWV2sFtp9hIob6uIyjSS
D1uzvKyofSYAVXsqp41UtFPz0kuUdxaxwRzrG0cbRD1Ld0Q5kszcWdqM1023iMVR9ld/mfNa6qn
mmxsrfTv0TORJasCfrYLDiP3kjFTFvuBTb3xV6Dih2KuxV2KuxV2KuxV2KuxV2KuxV2KuxV2Kpbr
P7uTTrqlRBdor068bhWtx9H0VT9GKpb5p0uaVDnrHl60F9eyBEudPPSUAgLKCCCHRdvcU/lGksI8
8+Y9Wuo0ujaXVnLb2fDSZWeMie9u2t3LCJ4/U4qg9M8vu0VZJGwHL02MEEkXy+1hT/mBbWwbtu
bG5a4jqZmiuZV4qHdSfSaV3+ERnkQaVoMhUjyLfeMgjF0tPwy8x/Ub1I7mySa04YsZ5DNW3ZI+PL
kacJZG+1fDIGRHPduhjjKqHDz+xPU1ZoPLH6WuFmrQWZuZ1SgLMOPmwWu3xU2ysjenIE/RxHuslv
zL8sq0qFpmlQBLiSMs7AwrLTwVvik0Y7MpyXhFh+ZivP5l+UQEP1qRuRCSFh1Yp8AkJcKp4hVY1
Ps3hg8Mp/MwR+h+a9K1m5nt7P1PUhVJDzjZP3ciI8bnkBQpZPGv2uJI2wSgQyh1EjQR+rF8AHKvP
+MEn/EDgjjZZPpPueg2byJpVp6a8pGijVR2BKDdvYZnkvpXAJ35Llga1cSjWQPQXG1WLH/dm34+3
yyNU2GfGK03d+pwknARvS/eyKePBTX4j05U6e+SJ7mEYb77BQEElsfXwsrt/vSAN291H+T2Hhkar
ds4xLb13fjzRmTaHYq7FUv8AMX/KP6n/AMwk/wDybbFUwXV2KuxV2KuxV2KuxV2KuxV2KuxV2Kux
V2Kpd5jRm009dATLBGbiEDr6kH72P/h0GKpgrK6hlIZWfVYbgg9CDirHtf8AKtzq0px6jZ3y2kwh
+rzpLCZ0kVWLxkUkhK1S79965CcBLm34dRLHyQP+C9c/6u1r/wBIUn/ZV1fgByP5Qn3Bj0v6Hrdv
rkNsupQLNFbNKtWlqw+GZjGyFwncbGMMD4jITiIt2HLPKegpLNZ1aPSjaaGuntfwktsEn/vGpAGW
FuQSKRacwqS7KKd8rAvdyZS4ajVimPf4o8h3Y110z0RbuVx0bmZ44UAZo5pGDks3IyC1boDsfe0M
+GKX2nxcZ3A/G/6mk8wfl1cNEkmihbeaw3MLtFESXlad1d1DEhR8bfzHkRx8Xh13r4mM9PxiLTz
75Lhhe/0rTpXaGOSP1YkjQBYoqqjMX+y0duvGle3Q4Dj1LZDPDMB+PwGaaoa6TdnPw3kNP8AYHwy
uPNyJ/Sfc9G0z/jm2n/GGP8A4im2DzqvI7KtVRpD/KtK/wDDFcBSBfVK9Mgkgmf905EYEIIEa7bP
V60eR+LKOci5eeYkBVz36+7bZnsucN2KuxV2Kpf5i/5R/U/+YSf/AJNtiqYYq7FXYq7FXYq7FXYq
7FXYq7FXYq7FXYq7FwVWUqwBUihB3BBxVLvLjN+g70Nv7y3j+rS/wDGS3Jhf/hk0KplirsVYP5q /
wCUsX/mAT/k9JmPq0jsuz+qB9KL1RLwX1QvESUHLiTWletK5j0ypCro2kLE8S2NusUVESRIJArc
Ps8hShpXbDxFHA05YdB0Uzwz/UoVlt3MkTKgwjnl8VBQE1diK9Ca9ceIo80PcqJpGkpXhZQLXrSJ
BXR4D/KON1PA052qKq6TdqoAUW8gAGwACHGPNE/pPuejaZ/xzbT/AIwx/wDERmWedVZ5vSj5U50T
xRB1Zj0GammUI2U0iSWr+pI3NZiPXbsr9Aw/yf2fu98iNm0kTFDpyRmTaHYq7FXYq1/mL/1H9T/5
hJ/+TbYqmGKuxV2KuxV2KuxV2KuxV2KuxV2KuxV2KuxV2Kpbo/7uXUrYGqQXb1B3p0iXdf8ADzNi
qZYq7FWMeZfLWrX2rQ6jP00ApB9Xmhu0Y60XV1ZA38xBBGV5MfE5Gn1Bxk7Jd/hXzZ/NYf8ABzf9
U8r/AC/m5X8oeTv8K+bp5rD/AIOb/qnj+X81/lDyd/hXzZ/NYf8ABzf9U8fy/mv8oeTv8K+bp5rD /
g5v+qeP5fzX+UPJRu/Jvmy5tZbYzWEQmUxtKDM5UMKEheK1N0m+EYKLGWvJBFM7t4VggjhUkrEq
oCepCimXuvYZ5p8p+ab/AFK7n0i7t7a06FtLHcSM4mhuLNZuHGP05I2V3eMkt0ofhbFLH7DyB+bK
3ST33mrmB6fKOG4uAnwheQ4shHV0XLvYIIoBirOvJeneY908vQwnmK9TUNVRpDndR12Vgz1lFXck
0U/ygeAxQnmKuxV2Kpf5i/5R/U/+YSf/AJNtiqYYq7FXYq7FXYq7FXYq7FXYq7FXYq7FXYq7FXYq
lqfufMcqkUF5aI6U/mtpCshPuRcJ92KplirsVdirsVdirsVdirsVdiqFs9Rium4qjPvUjLgDmla
chQn8cJFJiPfyEiW21GK419NUdahjG7ABXCnxYrQk9fHCQkhfYE0xV2Kpf5i/wCUf1P/AJhJ/wDk
22KphirsVdirsVdirsVdirsVdirsVdirsVdirsVdiqRecb5NK0xddKNIdJkEzRICWkjKHOyJt7Sc
vCqiu2Ksb1b80Ab0yvDj9Jb0e3iuJ5p0Zrh1e4mNvFASMDKxf1UZw3/rkgLZRjaXw/mpeSsIzqm1
QTEkC3uLeWcbZuH91Lco/wBrbp1w8I72XA09Ltb8y+adYubM6ftvKnGU+jZNNbQsFCsXewGd3Lf
GgUVp8VaYeBPAjL0aa6tIL1L7UFWeNZFU313UB1DAH9775IRDIRCtwuP+w+//wCk67/6q4eALwB3
C4/5b7//AKTrv/qrjwBeA04XH/Lff/8ASdd/9VceALwBD6g1/DY3E0GpX8c0UbSRv9cuHoyDkPhk

A0TbYqmGKuxV2KoYtI7C4QVjSoVe7KftH8NswTKUj4g+kd08dT+rvrz2toD0nmiFZWUM...
ZCQscmsim8KGAeXf+Uf0z/mEg/5NrnBav++n/WP3u3x/SPck+oflt5TvrVLeW1MfCc3J...
ZgZGwnPiX+Hl0+Va3Q7QyxN30pBwxLX/ACrby2GtGT6xG1ksSQskzKaQwLbAkjerQoEa...
Jvy3vp3m/vXwYpen5PeUzbSw9z686PKsqESshVY1Konwn+U7nvlp7Vy3YobMfAinuieT...
hKsqwi3JZ6hkCoo5C1K/u13zGzaueQVKuds44w0Sc2P/AClemf8AGG6/VHm17B+qXuDj...
g0xV2KuxV2KuxV2KuxV2KuxV2KuxV2KuxV2KuxV2Ksd/MHVpNJ8n6nerb/WQIvSkj...
pchs1eP0tMVT20lm1tIZZ4vq88katLBy5cHYAsnIUrx01cVvcVSHzfHr5tLSTRYnuJYp5Dc28c...
l43tZ4l3cqpCzSRuQT2qNwBgItIYLa2X5+RXMNo11ALK2aGH6yv1d2lSNAGd/VDSEPQ8mqH5H2QA...
aqso8lx/mJHqt5H5la0TTUt7db0VfQV2n4/v2Kwr3au54jprTucQKUswoedaU2pw0nw9jda...
Zxrby4W1RvSHDmjpUFwPUZyuq7JzHJIxogm/m7HHqI8Itf/Xrj/Aktl/wD9Isn9Mo/kjP3...
Q73fXrj/Aktl/wD9Isn9Mf5Iz932r+Yh3u+vXH/Vsv8A/pFk/pj/ACRn7vtX8xDvd9euP+r...
SLJ/TH+SM/d9q/mId6vokeoXfma2uPqFxbWlpBN6s9yhiBeUoqoit8TH4SSaUGbfsnQ5MJK...
GUSoBmebpxXYq7FXyq7FXyq7FXyq7FXyq7FXyq7FXyq7FXyq7FXyq7FXyq7FXyq7FVK7+qfVpfrnp/VeJ9...
nx78uw1PniqrirsVdirsVdirsVdirsVdirsVdirsVdirsVdirsVdirsVdirsVdirsVdirsV...
dirsVf/Z

- White CMYK
PROCESS
0.000000
0.000000
0.000000
100.000000
- Black CMYK
PROCESS
0.000000
0.000000
100.000000
100.000000
0.000000
- CMYK Red
CMYK
PROCESS
0.000000
100.000000
100.000000
0.000000
- CMYK Yellow
CMYK
PROCESS
0.000000
0.000000
100.000000
0.000000
- CMYK Green
CMYK
PROCESS
100.000000
0.000000
100.000000
0.000000

- CMYK Cyan CMYK PROCESS 100.000000 0.000000 0.000000
0.000000
- CMYK Blue CMYK PROCESS 100.000000 100.000000 0.000000
0.000000
- CMYK Magenta CMYK PROCESS 0.000000 100.000000
0.000000 0.000000
- C=15 M=100 Y=90 K=10 CMYK PROCESS 15.000000
100.000000 90.000000 10.000000
- C=0 M=90 Y=85 K=0 CMYK PROCESS 0.000000 90.000000
85.000000 0.000000
- C=0 M=80 Y=95 K=0 CMYK PROCESS 0.000000 80.000000
95.000000 0.000000
- C=0 M=50 Y=100 K=0 CMYK PROCESS 0.000000 50.000000
100.000000 0.000000
- C=0 M=35 Y=85 K=0 CMYK PROCESS 0.000000 35.000000
85.000000 0.000000
- C=5 M=0 Y=90 K=0 CMYK PROCESS 5.000000 0.000000
90.000000 0.000000
- C=20 M=0 Y=100 K=0 CMYK PROCESS 20.000000 0.000000
100.000000 0.000000
- C=50 M=0 Y=100 K=0 CMYK PROCESS 50.000000 0.000000
100.000000 0.000000
- C=75 M=0 Y=100 K=0 CMYK PROCESS 75.000000 0.000000
100.000000 0.000000
- C=85 M=10 Y=100 K=10 CMYK PROCESS 85.000000 10.000000
100.000000 10.000000

- C=90 M=30 Y=95 K=30 CMYK PROCESS 90.000000 30.000000
95.000000 30.000000
- C=75 M=0 Y=75 K=0 CMYK PROCESS 75.000000 0.000000
75.000000 0.000000
- C=80 M=10 Y=45 K=0 CMYK PROCESS 80.000000 10.000000
45.000000 0.000000
- C=70 M=15 Y=0 K=0 CMYK PROCESS 70.000000 15.000000
0.000000 0.000000
- C=85 M=50 Y=0 K=0 CMYK PROCESS 85.000000 50.000000
0.000000 0.000000
- C=100 M=95 Y=5 K=0 CMYK PROCESS 100.000000 95.000000
5.000000 0.000000
- C=100 M=100 Y=25 K=25 CMYK PROCESS 100.000000
100.000000 25.000000 25.000000
- C=75 M=100 Y=0 K=0 CMYK PROCESS 75.000000 100.000000
0.000000 0.000000
- C=50 M=100 Y=0 K=0 CMYK PROCESS 50.000000 100.000000
0.000000 0.000000
- C=35 M=100 Y=35 K=10 CMYK PROCESS 35.000000
100.000000 35.000000 10.000000
- C=10 M=100 Y=50 K=0 CMYK PROCESS 10.000000 100.000000
50.000000 0.000000
- C=0 M=95 Y=20 K=0 CMYK PROCESS 0.000000 95.000000
20.000000 0.000000
- C=25 M=25 Y=40 K=0 CMYK PROCESS 25.000000 25.000000
40.000000 0.000000

- C=40 M=45 Y=50 K=5 CMYK PROCESS 40.000000 45.000000
50.000000 5.000000
- C=50 M=50 Y=60 K=25 CMYK PROCESS 50.000000 50.000000
60.000000 25.000000
- C=55 M=60 Y=65 K=40 CMYK PROCESS 55.000000 60.000000
65.000000 40.000000
- C=25 M=40 Y=65 K=0 CMYK PROCESS 25.000000 40.000000
65.000000 0.000000
- C=30 M=50 Y=75 K=10 CMYK PROCESS 30.000000 50.000000
75.000000 10.000000
- C=35 M=60 Y=80 K=25 CMYK PROCESS 35.000000 60.000000
80.000000 25.000000
- C=40 M=65 Y=90 K=35 CMYK PROCESS 40.000000 65.000000
90.000000 35.000000
- C=40 M=70 Y=100 K=50 CMYK PROCESS 40.000000 70.000000
100.000000 50.000000
- C=50 M=70 Y=80 K=70 CMYK PROCESS 50.000000 70.000000
80.000000 70.000000
- Grays 1
- C=0 M=0 Y=0 K=100 CMYK PROCESS 0.000000 0.000000
0.000000 100.000000
- C=0 M=0 Y=0 K=90 CMYK PROCESS 0.000000 0.000000
0.000000 89.999400
- C=0 M=0 Y=0 K=80 CMYK PROCESS 0.000000 0.000000
0.000000 79.998800

- C=0 M=0 Y=0 K=70 CMYK PROCESS 0.000000 0.000000
0.000000 69.999700
- C=0 M=0 Y=0 K=60 CMYK PROCESS 0.000000 0.000000
0.000000 59.999100
- C=0 M=0 Y=0 K=50 CMYK PROCESS 0.000000 0.000000
0.000000 50.000000
- C=0 M=0 Y=0 K=40 CMYK PROCESS 0.000000 0.000000
0.000000 39.999400
- C=0 M=0 Y=0 K=30 CMYK PROCESS 0.000000 0.000000
0.000000 29.998800
- C=0 M=0 Y=0 K=20 CMYK PROCESS 0.000000 0.000000
0.000000 19.999700
- C=0 M=0 Y=0 K=10 CMYK PROCESS 0.000000 0.000000
0.000000 9.999100
- C=0 M=0 Y=0 K=5 CMYK PROCESS 0.000000 0.000000
0.000000 4.998800
- Brights 1
- C=0 M=100 Y=100 K=0 CMYK PROCESS 0.000000 100.000000
100.000000 0.000000
- C=0 M=75 Y=100 K=0 CMYK PROCESS 0.000000 75.000000
100.000000 0.000000
- C=0 M=10 Y=95 K=0 CMYK PROCESS 0.000000 10.000000
95.000000 0.000000
- C=85 M=10 Y=100 K=0 CMYK PROCESS 85.000000 10.000000
100.000000 0.000000

- C=100 M=90 Y=0 K=0 CMYK PROCESS 100.000000 90.000000 library 15.00
0.000000 0.000000
- C=60 M=90 Y=0 K=0 CMYK PROCESS 60.000000 90.000000
0.003100 0.003100

Figure 1: Figure 1

We can identify different Network Participant (NP) in Figure 1 represented by different colors. The different NPs act as equals when consuming or producing events as part of the Flows they own. All of NPs implement the Event Streaming Open Network Protocol, which is described in the next chapter.

In the diagram, an initial flow starts on the orange NP to which a user in the blue NP is subscribed. After processing the events received in the first flow, the results are published to a new flow in NP blue, to which the orange NP is subscribed as well. Now, the green participant is subscribed to the same flow, enabling downstream activities across the rest of the network participants.

It is possible to observe how the high-level architecture allows sharing the streaming of events across different network participants and their users. Also, there is also the need for security, in order to allow or deny the access to write to and read from flows.

Regarding security, the architecture considers the integration with an Identity & Access Management service, which could implement popular protocols such as OAuth, SAML or SASL. However, the network should also enable anonymous access in the same way FTP does. This means that a given NP could publicly publish flow and allow any party to subscribe to it.

For example, nowadays the Network Time Protocol (NTP) is used to synchronize the day and time on servers. There are many NTP servers available that allow anonymous access, meaning that the service is openly available. The same must be considered for the Event Streaming Open Network.

Additionally, the NP must be able to expand the capacity to support any number of flows, as well as extending the network with new services. Not only NP must be able to include any given set of data within events but also, they must be able to build applications and services on top of the network by employing the architecture primitives.

AFTxVKtStpxrej63KSXnoaRVH7k9P3eKU1+qT/8ts33Q/8AVPFDFdbi/NUatImhy6e2l/B6U14S
Jd1+PkI0ps/SnbFKlPF+cCrKYJNKl1b1CYg7PH+7EjAKaRSVZo1B5bUJ6bYqmWkRefZNT/wBzD21v
pohkp9U1E0hmEiiOvqw8QC10R6HFCe/VJ/8AltM+6H/qnirvqk//AC2zfdD/ANU8Vd9Un/5bZvuh
/wCqeKsX1fSXstXtp2v7q7+tySv6Vy6tHFSPpCqqnAGu4y7B9TRqPpSDzNoWpXTwyaTaaVI3CVbl
dRgLiTkQ8ahkFQvqFnb3zJlE9KcSEg0dpY2gecZpvrF3YeXZ5zxBdoJiaFuUtCys1W5N360NNzke
GXky4o98mUvZwtFbw2kSwqG8tDSFFQBjcx/FQDjX6MOUVErinZDMfQk/wDy2zfdD/1TzBdg76pP
/wAts33Q/wDVPFxfVJ/+w2b7of8AqniqQea4fzBRbf8AwRNayuQ/1k6jQAGqenw9JBXbnyr7fIqo
JoPzbCRlZ9MaTggkQ8wnNnm5EP6ZNFjE03Ddi29AMUqunr+aD3NlHqIsYrcE/X57ecyMQGIHPbPb
JxqtDu5xVk/1Sf8A5bZvuh/6p4od9Un/A0W2b7of+qeKpTpdTmdc1ofW5QQ9vUgRVP7hev7vFLem
ac1j5inVry4vPXheflcsr10c1eEfu4ov7K9sVX+bfK0m+aLC3sdQlniht7hLpTbsqMzIrKFJZX2
o56UNaEEYoQ3lPyHpnllmNneXlyDF6CLdyrIETmZKLREPvu9dsVTTU/97dJ/5i2/6hJ8Vd5i/wCU
f1P/AJhJ/wDk22Ku8u/8o/pn/MJB/wAm1xVMMVdiqGtP7+9/4zD/AJmX4qicVdiqU6n/AMd3Rv8A
XuP+TJxVNsVdirsVdirsVdirsVSzW9Hl1A20kNwtvNbMxBeMyqVdeJBUNga9N+wShPhNsJw4hSA/
w3q//Vxt/wDpFf8A7Kmt/MFp/LDvQ0labrN/Hc01xHbG3uZraklpIA4hcoJEJnFvcV4e+P5gr+W
Hejk8sag00LXF/E8MuscZJHbsjMYnEigMzNa+JRX4emCWykUyhgETbIsPb3Yq7FXyq7FXyq7FXyq
lGlf8d7W/wDjJb/8mFxVEXdhdvepeWlwkMoiMLrLEZVZSwYEBXiIPvirXoeYP8AltT+kWT/sox
V3oeYP8AltT+kWT/soxVowGpS3VtNeXUMkdq7SokMDREuY3i3ZpZdqSht174q35i/5R/U/+YSf/
AJNtirvLv/KP6Z/zCQf8m1xVV1PUoN0tfrEqvJvljSOMasz0aADkVh3nCBZpBNCyl3+Kl/6t1399
t/1WyzwZNXjw71GDzKULuWbTLuksgdd7boI0X/f3iuPgyXx4d6o/m+3iQyTWf3FCg5SSn0GCqOrE
JKzEAb7AnAcUgkZ4nqn2vtqU6n/x3dG/17j/AJMnFU2xV2KuxV2KuxV2KuxVAatrE0miEPDLPJcM
VjihCcvhXkxJdkWg+eSjEnkx1IRfLA/4rX/q2Xn323/VfJ+DJr/MQYvqui+XdavFvtV0jUnukPFP
RuUhXgk8s0dRHcpv++NT17Vx8GS/mIqY8reSHurfnPwPwgeRIRILOhKuQQRh/TuGdl+F0x33PFAc
UgLRZrJJoMo0fyLom1ajFqEE15NcwQ+hCbq6nuFRKUPFZWYcvfK2xkOKuxV2KuxV2KuxV2KpRpX/
AB3tb/4yW/8AYXFU3xV2KuxV2KpF5i/5R/U/wDmEn/5NtirvLv/ACj+mf8AMJB/ybXFUJ5s/wB4
bb/mLh/wcni+oNeb6S8/1z8w/Kdut9p15qUmnXQWWBZfS1LhqtGZiVTVieDDr/bmXLI0ThRxS2NM
ftfM0kafeRyS+eLqXT4J5Ga2mtXcsqs8hjecoWNBGwr3HTtkBID+JsMSf4WwnzRo0saZqkem3YuG
t7V3morqArK6g1ZVB3RumTMwQaaxAgi2ff4i8v8A/VzTP+R8f/NWYLSur1LXtDbwtIddRtSiNPzY
TRKCsJAqa4pTT/EXl/8A6udp/wAj4/8AmrFDv8ReX/8Aq52n/I+P/mrFXf4i8v8A/VzTP+R8f/NW
Ku/xF5f/AOrnaf8AI+P/AJqxV3+IvL//AFc7T/kfH/zVirv8ReX/APq52n/I+P8A5qxV3+IvL/8A
1c7T/kfH/wA1YqkuuX9vd3WkvFUcxLioam6PGCrAgKEH20XYPqaNR9KC1LurLTb0S9vZPStoioeT
izU5sEXZQx3ZHz2LjpwQCTQS/TP0XlJjU7q0zsdQimu5VLrbivOgHI1FNqd8AmCy00Q5ppc/atf8A
mMtP+omPI5fpLLD9YZnmC7F2KuxV2KuxV2KuxV2KpRpX/He1v/jJb/8AJhcVtFFXYq7FXyq1/mL/
AJR/U/8AmEn/AOTbyq7y7/yj+mf8wkH/ACbXFUJ5t/3htv8AmLh/wcni+oNeb6SwzUtI82y3l3Pp
+tpawyENawyWyy8P3IRKJJG3qJK+5FKZmGmuhCESjw4S3U9B/MJjbnYa1atK0Mc7z2qDi0LmSVA
A/x0z8Su2wG/WsTGXeyEodQmEwn67Z6VqzatqKX/AKlu/o8IVhCUEjNsvWvMdfDDRANosEig9QzB
dil0p/8AHd0b/XuP+TJxVZ5m8paT5jito9RMwFpIZYwgaJg5FK1XfFUh1/KPy5J9Wb69qqy2ks0
1v0L6YyKZ1RHQMxY8KRCg+eKbVJPyr0d7IDq2tBVYuzDUrirkgj4qsR+1WtK++5qoV3/LfSnVPU
1PV3eNzLDK1/OXjk4PHYqk/CQkrLt2xVu5/LbR7q2nt59R1eRLhgZctSumovUKKKXKH7IPxKd98V
UI/yq8vKCXu9SmmKyL9Ze9lEowUkkB0KmgJ2+Q98U2rWn5aaHa/VFjvdTaGxmhuLe3kvp5IQ1u3K
MekzFOPTanbFct5htoLe70xYUCATnWnU0QUqfbl12D6mjUfs86k1DzzHeSWMuqaDK9vJC00dy0iS
gkB1UKFVQehVt996Dp11y5WHHqP0ihIdT1m0u7SWG98ro0qRx+vETGGYsjFvdSzfGpbj0FWUdTgs
j+ayIBH8TLdDutVu7K3udQuLG59W/tDby6azPDwFxEpHJieREGbcYZk8BtjAATFPScw3PdirsVdi
rsVdirsVdiqUav/x3tb/AOMlv/yXFU3xV2KuxV2KpF5i/5R/U/+YSf/AJNtirvLv/KP6Z/zCQf8
m1xVGNtBxULQXMSTwvTnFIodTQ1FVao2IriqC/w35d/6tVn/wBI8X/NOG0UhrXy55eM94DpLoQJ
gFBgjNB6MzoPh2wWmkUvlzy8rKy6XaKyKMrCCIEEGoI+HG0UmGKUp1P/AI7ujf69x/yZ0KppLIku
byyGiIpZj1oAKnpiqRR+b45I1kTTLwo4DKf9GGxFR1ny3wZnJzxXf4rH/VrvPvtf+q+PgyX8x+F3+
Kx/1a7z77X/qvj4Ml/MRTPTNqi1CyS6iR41ZnQxyUDK0bmNgeJZftKehysim0GxakWJdirHvNP8A
vdpf+tN/xAZdg+po1H0s08x+XIXAvNM0exu9RkmR7l7pVHOJCZGHKh+JuIRa9K16DMiUe40JCfeU
k0BRNcupLIa15Y0mzsB6byrHGpnT92uwAagKsvihd3pkRE9QGyUgORLL7PSrDSrKwLCL0LSG8tf

SiqzU5Xa027Fm3ZieuHIAIEBjikTMEs+zCdG7FXYq7FXYq7FXYq7FUo0r/jva3/xkt/+TC4qm+Ku
xV2KuxVL/MX/ACj+p/8AMJP/AMm2xv3l3/1H9M/5hIP+Ta4qmGKuxVDWn9/e/wDGYf8AJmPFUTir
sVSnU/8Aju6N/r3H/Jk4qjdT/wC0bd/8YZP+InFXm2vW0tT6VaT6brH6HjtYDJcyGISHlCqykhug
ThX36dCcziDwXp10SL3FsXh8xyrdwL9J52ie3lKGS3a3VKxORIy8QrcX4MFxv4k0IyHF5tnB04U8
8sp5g1C4g1L/ABMmqAXfCs+pDHaLbhx6TKsdR8X7t3B71p2yUb097MJ0Nqos28r2etekblNRQWBk
u0Swa3DcX+tv+89U0rHodum+YuT6i5uL6QreY9S856eLf9D6VHrJk5+vxdLb0uIHD+9l+LmSenSm
+QZq/l678132mJPrFnFpF+wdZLLa5AUMeLLLHLQhloegPtiqF8yQ6itxp9w6m4hiaRXftBIzKXTY
lVaVqbeGW4pAHdpzxJjsgfrLf8st5/0iXP8A1TzJ8WPe4ngz7lqXgcVS3u2AJUKwlyd1NCP7vsRT
HxY96+DPuWiR7q4t4Ybe5Lpd2xk5W86KojmjlbkzoqrRBXc5DJkiY0GzFikJAKM3zEc12KuxV2Ku
xV2KuxV2KpRpX/He1v8A4yW//JhcVTfFXyq7FXYq1/mL/1H9T/5hJ/8Ak22Ku8u/8o/pn/MJB/yb
XFUwXV2Koa0/v73/AIzD/kzHiqJxv2KpTqf/AB3dG/17j/kycVRup/8AHNu/+MMn/ETirBNRtdUu
vLgg0uaKC9e0H03nQSRFQVMiOpBqroGU/PNGeHZ1gIEt2NnRvzLt4JZIZ9JuLheToDDweR6MS7M
EVfUdxGegFVGv8M/Js4oebIPLMHm20KRvMVzbTyMqeilshXiQWL8iQK1BUbeGWQ4urXMx6Mx8qf8
cZf+Yi7/A0oqXMLJ9Rdhi+kJvkGbsVdirsVQ2n/3D/8AGaf/AJPPirrT+/vf+Mw/5Mx4qicVdiqC
1XwtI0iC0fVlyGxglkWCOW4dY0MjgLV5MQKnivRFpewL5brCwk8dxbvXhNEyuh4kqaMpINCKYqq
4q7FXYq7FUo0r/jva3/xkt/+TC4qm+KuxV2KuxVL/MX/ACj+p/8AMJP/AMm2xv3l3/1H9M/5hIP+
Ta4qmGKuxVDWn9/e/wDGYf8AJmPFUTirsVSnU/8Aju6N/r3H/Jk4qmroroy0AyMCGU9CDsRiqSL5
P09FCx3F2iKKKgMjAA6CpBP3nJ+JLva/Cj3Jfeew501nTre2mnewlS4a/kaYh04BPS4Cm9Wahw+L
LvXwY9yYf4Ssv+Wu7/5G/wBmPiy70eDHuTTT7C3sLRLW3DekhY1ZizFnYuzEnuzMTkCbbAKSDWtR
8/2+ssmk6Tax+k+mnF5J/Ql5kn1PiJfpQADh369sCUMmq/mhWFm0LTypircR8ZWWy2y0EcMoSm
5A+L2xS1aap+aUtmjT6Hp0F2jKJEN2zJIPQkZyvFTw/fqiivLYnFC9NY/Mwo/Ly5YhyXh/uQNFD
A+oW/c/Fxp7dfauKp15bvDdaWGleJru0Wa0+jgc0sdwJGMkdQTTiT00+KoxrNvVeS04ki9QhnVBG
QSFC1+NGPRRirX1Sf/ltm+6H/qnirvqk/wDy2zfdD/1TxVQu9FgvPR+tyG4+ryrcw/qx27+nNH9i
R0UR4utdmG4xVuz0i0yt0tr0Zra2jrwHjt40XkSxoqxAcPj0Kq31Sf/AJbZvuh/6p4q3ZtLyuI5
HMnpSBFdgoJBjR9+IudW8MVRGKuxVKNK/wC09rf/ABkt/wDkwuKpvirsVdirsVS/zf/yj+p/8wk/
/JtsVd5d/wCUf0z/AJhIP+Ta4qmGKuxVDWn9/e/8Zh/yZjxVE4q7FUp1P/ju6N/r3H/Jk4qm2Kux
VDSf8dKD/jDN/wASixVE4q7Fut1/zDpmg2SXmou6QySpAvpo8jcpD/KgJooBzJ4A4qhvLHnPy/5m
S4fR53mS2KCQvFJCSsgJR1EiqSrUNPlirXmW9voZLGC1uGtvXeQySIqM1ESoUeorrSp8MsxRejRa
s0zEWEt9fwv+rtcf8i7X/qhmR4EXF/MSUBwLULVHS31KeJZJHmkCx2vxSSsXdj+561jj4EV/MSVf
r2swTwznUppla5t43idLfiyyzJGwPCJW6N20QniAFtmPPIyALL8xnLdirsVdirsVQ1p/f3v/ABMH
/JmPFUTirsVSjSv+09rf/GS3/wCTC4qm+KuxV2KuxVL/ADF/yj+p/wDMJP8A8m2xv3l3/1H9M/5h
IP8Ak2uKphirsVQ1p/vRe/8AGZT/AMkY8VR0KuxVKdT/A007o3+vcf8AJk4qm2KuxVTmt4pqcwar
9l1ZkYV6/EpBxVS/R8H883/I+b/mvFXfo+D+eb/kfN/zXirv0fB/PN/yPm/5rxV36Pg/nm/5Hzf8
14qx3Xls/wBI2AgmMrxv0kqmZ5eLcAaEMzcTl2D6mjUfStzMcB2KqNz9q1/5jLT/AKiY8ry/SW3D
9YZnmC7F2KuxV2KuxVDWn9/e/wDGYf8AJmPFUTirsVSjSv8Aja3/wAZL8A5MLiqb4q7FXYq7FU
v8xf8o/qf/MJP/ybbFXeXf8AlH9M/wCYSD/k2uKphirsVUprS0nYNNDHkWFAXUMafSMVU/0Zpv8A
yyQ/8i1/pirv0Zpv/LJD/wAi1/piqValp2njw9HUW0QVnn5DgtDSE9dsUp+jNN/5ZIf+Ra/0xQ7
9Gab/wAskP8AyLX+mKu/Rmm/8skP/Itf6Yq79Gab/wAskP8AyLX+mKu/Rmm/8skP/Itf6Yq79Gab
/wAskP8AyLX+mKu/Rmm/8skP/Itf6Yq79Gab/wAskP8AyLX+mKu/Rmm/8skP/Itf6Yq79Gab
/wAskP8AyLX+mKu/Rmm/8skP/Itf6Yq79Gab/wAskP8AyLX+mKu/Rmm/8skP/Itf6Yq79Gab
PpY5H+YfkyQV/SkSVIVvcMjNUAiIMax6+GZPiR73E8KXcvbZ95PRmWTU4o3UuCsGd+7ryoGUE/Z
PTRThXI96+FLuRlprWmaosL2E4nWK+s0kIDDixuIyaQwHUGuRySBiaZ4okTFVqcwnPdirsVdirsV
Q1p/f3v/ABMH/JmPFUTirsVSjSv+09rf/GS3/wCTC4qm+KuxV2KuxVL/ADF/yj+p/wDMJP8A8m2x
v3l3/1H9M/5hIP8Ak2uKphirsVdirsVdiqU6n/x3dG/17j/kycVTbFXyq7FXYq7FXYq7FWPeaf8A
e7S/9ab/AIGMuwFU0aj6WIEZtA1K4S2bQk0+C4hYl2vLdZFIWpjGoopYUIXoRsMyZRPRxITHW0ss
vLfm9b0NdRaG1q80cs4S2bmVDKH4fCPjMfqbsW3bsMiIy8mRnGurKvqparbJawRwIby0JWJVQV+
tr9lAxyiolcRjMgc5h0wdirsVdirsVQ1jIjzXpQ1An4n5rFGD+IxVF4q7FUo0r/jva3/AMZLf/kw
uKpvirsVdirsVS/zf/yj+p/8wk//ACbbFXeXf+Uf0z/mEg/5NriqYYq7FXYq7FXYq10p/wDHd0b/
AF7j/kycVTbFXyq7FXYq7FXYq7FWPeaf97tL/wBab/iAy7B9TRqPpQeZjgOxVltbdFhtvVKMfSbi
M3E4YoUCVdDzBHGsquotffIT5b8mcLvbmXQeZfNo141YZEDSBnGrypQD+7KgzNyH3VG/wN4RRwjuH

zcnIPefkjrLXLqWztG1e/On3D3JS4SDVJZV9L03ZCX9X4auFB/twiMeqD0fS/kzry9q...
UTWvoK0N/JOVknqaKzwiM+mxUcjuRv26Zjnm5Q5bpJ5p1K/jvNQR7oWt5HbK2m25upI...
BYGQUY+3XLccQQbacspAiuTDrfX/ADuJGinltGXlCAXK6tPSiAtCRH69aSbL1BHU0yXC...
PyVG13zTbvccNbWdmAZZ49YmiDyCMipVpCaVRV3NaU+h4R3D5o4j3n5Kw8weZzdRryt...
OzJGZDVuPqDkRHTp3x4R3D5rxy7z8noXlC7acXwS5e6tY5UEMrSNNQmMF1EjFiexpX...
SY7orSv+09rf/GS3/wCTC5W2pvirsVdirsVS/wAxf8o/qf8AzCT/APJtsVd5d/5R/TP+...
iqYYq7FXyq7FXyq10p/8d3Rv9e4/5MnFU2xV2KuxV2KuxV2KuxVj3mn/AHu0v/Wm/w...
+lB5m0A7FVG5+1a/8xlp/wBRMeV5fLbh+sMzzBdi7FXyq7FXyq7FXyq7FUo0r/jva3...
uKpvirsVdirsVS/zF/yj+p/8wk//ACbbFXeXf+Uf0z/mEg/5NriqYYq7FXyq7FXyq10p...
AF7j/kycVTbFXyq7FXyq7FXyq7FUNf6ZZX8aJdRlXG30NlZkdWoRVXQqW2NNjhBIQ...
5bj/AKS7r/qpkvEl3sfDj30/wro38tx/0l3X/VTHxJd6+HHuVIPLWjwzxzLFI7xMHj9...
kd1q0xptgMyeqRADkEzyLJ2KuxV2KuxV2KuxV2KpRpX/AB3tb/4yW/8AyYXFU3xV2...
5R/U/wDmEn/5NtirvLv/ACj+mf8AMJB/ybXFUwxVgFv51/MhbWJ7nyRK83BwnEV3Co...
5b9jTr1UotPNfn2U3o/wi9t6CwtbCS5ikMtZo1m4A1VqIpGZfi6p77KpjpGvearnV...
Z5NR+tRSxExqVVRUq1W2NDSn0YoZHIqU6n/x3dF/17j/AJMnFU2xV2KuxV2KuxV2K...
9nbzaLpn6VnedY57c0sblCUcmRS5VdnC9T0JxVj0PnXz8yMZPI06vwLqBewU5FSyo...
UeavPqaZb3j+UzNM9vE1xZx3SpMlw0kqyKAYlCipGrV5V+IAcuyhQXzp5/jSATeTz...
UNFYaKjnkAGChfioSTUDoCpZH5c1fWdSseTUtJfSeBHoRySCRnUltzxAA2ANPFFC...
q7FXyqk+lf8AHe1z/Xt/+TC4qkL+b/PscxQ+TpJo/UaNJUu415BQxDlSp4qaAd+v...
Kn1GVHjEfGGS5iJkZlQyBSOPEIzkBiN6Vp2CqgnnL8wSjV81SVX4+X1yIDhzYEUK...
Z/0PnaMc18mzyBOSyIt1CWL+oUX09viWi8qmm2KprPf6je+T9RuNR09tLuvq92j2...
Qyjlho/4Aqa/oqtTWv1ate+Ku/50D/tU/8ATtirv+dA/wC1T/07Yq7/AJ0D/tU/902...
/wDTtirv+dA/7VP/AE7Yq0f+Ve8hX9E8t+P+81femKt/86B/2qf+nbFXf86B/wBq...
/ap/6dsVd/zoH/ap/wCnbFXf86B/2qf+nbFXf86B/wBqn/p2xV3/ADoH/ap/6dsVd...
bFXf86B/2qf+nbFXf86B/wBqn/p2xV3/ADoH/ap/6dsVd/zoH/ap/wCnbFXf86B...
/wBqn/p2xV3/ADoH/ap/6dsVd/zoH/ap/wCnbFXf86B/2qf+nbFXf86B/wBqn/p2...
6dsVaH/Kvamn6J5ftU+rV+nFW/8AnQP+1T/07Yq7/nQP+1T/AN02Ku/50D/tU/8A...
T/07Yq4f4AqKfoqtRSn1ate2Kv8A/9k=

- Black CMYK
 - White CMYK
 - Yellow
 - CMYK Red
 - CMYK Green
- PROCESS
0.000000
0.000000
100.000000
0.000000
- PROCESS
100.000000
0.000000
100.000000
0.000000

- CMYK Cyan CMYK PROCESS 100.000000 0.000000 0.000000
0.000000
- CMYK Blue CMYK PROCESS 100.000000 100.000000 0.000000
0.000000
- CMYK Magenta CMYK PROCESS 0.000000 100.000000
0.000000 0.000000
- C=15 M=100 Y=90 K=10 CMYK PROCESS 15.000000
100.000000 90.000000 10.000000
- C=0 M=90 Y=85 K=0 CMYK PROCESS 0.000000 90.000000
85.000000 0.000000
- C=0 M=80 Y=95 K=0 CMYK PROCESS 0.000000 80.000000
95.000000 0.000000
- C=0 M=50 Y=100 K=0 CMYK PROCESS 0.000000 50.000000
100.000000 0.000000
- C=0 M=35 Y=85 K=0 CMYK PROCESS 0.000000 35.000000
85.000000 0.000000
- C=5 M=0 Y=90 K=0 CMYK PROCESS 5.000000 0.000000
90.000000 0.000000
- C=20 M=0 Y=100 K=0 CMYK PROCESS 20.000000 0.000000
100.000000 0.000000
- C=50 M=0 Y=100 K=0 CMYK PROCESS 50.000000 0.000000
100.000000 0.000000
- C=75 M=0 Y=100 K=0 CMYK PROCESS 75.000000 0.000000
100.000000 0.000000
- C=85 M=10 Y=100 K=10 CMYK PROCESS 85.000000 10.000000
100.000000 10.000000

- C=90 M=30 Y=95 K=30 CMYK PROCESS 90.000000 30.000000
95.000000 30.000000
- C=75 M=0 Y=75 K=0 CMYK PROCESS 75.000000 0.000000
75.000000 0.000000
- C=80 M=10 Y=45 K=0 CMYK PROCESS 80.000000 10.000000
45.000000 0.000000
- C=70 M=15 Y=0 K=0 CMYK PROCESS 70.000000 15.000000
0.000000 0.000000
- C=85 M=50 Y=0 K=0 CMYK PROCESS 85.000000 50.000000
0.000000 0.000000
- C=100 M=95 Y=5 K=0 CMYK PROCESS 100.000000 95.000000
5.000000 0.000000
- C=100 M=100 Y=25 K=25 CMYK PROCESS 100.000000
100.000000 25.000000 25.000000
- C=75 M=100 Y=0 K=0 CMYK PROCESS 75.000000 100.000000
0.000000 0.000000
- C=50 M=100 Y=0 K=0 CMYK PROCESS 50.000000 100.000000
0.000000 0.000000
- C=35 M=100 Y=35 K=10 CMYK PROCESS 35.000000
100.000000 35.000000 10.000000
- C=10 M=100 Y=50 K=0 CMYK PROCESS 10.000000 100.000000
50.000000 0.000000
- C=0 M=95 Y=20 K=0 CMYK PROCESS 0.000000 95.000000
20.000000 0.000000
- C=25 M=25 Y=40 K=0 CMYK PROCESS 25.000000 25.000000
40.000000 0.000000

- C=40 M=45 Y=50 K=5 CMYK PROCESS 40.000000 45.000000
50.000000 5.000000
- C=50 M=50 Y=60 K=25 CMYK PROCESS 50.000000 50.000000
60.000000 25.000000
- C=55 M=60 Y=65 K=40 CMYK PROCESS 55.000000 60.000000
65.000000 40.000000
- C=25 M=40 Y=65 K=0 CMYK PROCESS 25.000000 40.000000
65.000000 0.000000
- C=30 M=50 Y=75 K=10 CMYK PROCESS 30.000000 50.000000
75.000000 10.000000
- C=35 M=60 Y=80 K=25 CMYK PROCESS 35.000000 60.000000
80.000000 25.000000
- C=40 M=65 Y=90 K=35 CMYK PROCESS 40.000000 65.000000
90.000000 35.000000
- C=40 M=70 Y=100 K=50 CMYK PROCESS 40.000000 70.000000
100.000000 50.000000
- C=50 M=70 Y=80 K=70 CMYK PROCESS 50.000000 70.000000
80.000000 70.000000
- Grays 1
- C=0 M=0 Y=0 K=100 CMYK PROCESS 0.000000 0.000000
0.000000 100.000000
- C=0 M=0 Y=0 K=90 CMYK PROCESS 0.000000 0.000000
0.000000 89.999400
- C=0 M=0 Y=0 K=80 CMYK PROCESS 0.000000 0.000000
0.000000 79.998800

- C=0 M=0 Y=0 K=70 CMYK PROCESS 0.000000 0.000000
0.000000 69.999700
- C=0 M=0 Y=0 K=60 CMYK PROCESS 0.000000 0.000000
0.000000 59.999100
- C=0 M=0 Y=0 K=50 CMYK PROCESS 0.000000 0.000000
0.000000 50.000000
- C=0 M=0 Y=0 K=40 CMYK PROCESS 0.000000 0.000000
0.000000 39.999400
- C=0 M=0 Y=0 K=30 CMYK PROCESS 0.000000 0.000000
0.000000 29.998800
- C=0 M=0 Y=0 K=20 CMYK PROCESS 0.000000 0.000000
0.000000 19.999700
- C=0 M=0 Y=0 K=10 CMYK PROCESS 0.000000 0.000000
0.000000 9.999100
- C=0 M=0 Y=0 K=5 CMYK PROCESS 0.000000 0.000000
0.000000 4.998800
- Brights 1
- C=0 M=100 Y=100 K=0 CMYK PROCESS 0.000000 100.000000
100.000000 0.000000
- C=0 M=75 Y=100 K=0 CMYK PROCESS 0.000000 75.000000
100.000000 0.000000
- C=0 M=10 Y=95 K=0 CMYK PROCESS 0.000000 10.000000
95.000000 0.000000
- C=85 M=10 Y=100 K=0 CMYK PROCESS 85.000000 10.000000
100.000000 0.000000

- C=100 M=90 Y=0 K=0 CMYK PROCESS 100.000000 90.000000 library 15.00
0.000000 0.000000
- C=60 M=90 Y=0 K=0 CMYK PROCESS 60.000000 90.000000
0.003100 0.003100

Figure 2: Figure 2

Now, we provide a brief description of all the components that appear in the diagram of Figure 2. In the next sections further details of the components are provided.

*Flow Events Broker (FEB): a high-available and fault-tolerant service that provide queues to be consumed by network services, by users, and their applications. An example of an Event Queue Broker can be Apache Kafka, AWS SQS or Google Cloud PubSub. The payload format implemented by these tools are what in 3.1.4 we called Event Streaming Payload Format.

*Flow Name Service (FNS): a DNS-based registry that acts as an authoritative server for a set of domain names, which are used to represent flow addresses in a flow namespace. These domains contain all the necessary information to resolve flow names into flow network locations. This component refers to what in 3.1.1 we named Event Streaming Registry.

*Flow Namespace User Agent (FNUA): an application similar to User Mail Agents like Microsoft Outlook or Gmail. This application provides access to flow namespaces to users of the network. The definition of this component implies the specification of a dedicated protocol. We will refer to this protocol as FNAP (Flow Namespace Accessing Protocol).

*Flow Namespace Accessing Agent (FNAA): the server-side of the Flow Namespace User Agent. This component is the one that must provide convenient integration methods for GUI. This component refers to what in 3.1.2 we named Event User Space Service. This component must implement the same protocol selected for the Flow Namespace User Agent: FNAP (Flow Namespace Accessing Protocol).

*Flow Processor (FP): a flow processing instance used to set up subscriptions that connect local or remote flows on demand. This component implements the processing part of what in 3.1.3 we called Event Subscription Service. This component will be created and managed by a FNAA instance, and the communication is held through an Inter-process Communications (IPC) interface. Also, this service must implement an Event Payload Format, for which we will mainly consider CNCF's CloudEvents and Protobuf.

*Flow Namespace Accessing Protocol (FNAP): the protocol implemented in the Flow Namespace Accessing Agent as well as in the Flow Namespace User Agent. The former will act both as a server and a client while the latter only as a client. This protocol is described in the next chapter.

4.1.1. Flow Events Broker (FEB)

The FEB implementation that we will mostly consider is Apache Kafka. This open-source project is quickly becoming a commodity platform, and major cloud providers are building utilities for it. However, as a design decision, it should be possible to use the same protocols to support other applications, such as RabbitMQ, Apache Pulsar or the cloud-based options like AWS SQS or Azure Events Hub.

Apache Kafka is the ecosystem leader in the Event Streaming space, considering mainly adoption. There is a growing set of tools and vendors supporting its installation, operation, and consumption. This fact makes Apache Kafka much more appealing to enterprise developers. However, the broker should provide a common set of functionalities which can be seen in the diagram of Figure 3.

ZKhP3do0TRV335UFMUtal+aX5czw1va6zoMsE0qvGFQLB8aLcK0bM0UinifVCcT2qG2NCqqr+e/1
K6Ds2izySSQma5X/AEaSqwCRkHNXZX4tE1N/h296K0u/5Wh5E/SE0kjyxIGnP1KKM29qQbf1/TZA
qm44+urH0+90WKpj5U80eVvNXmCTT28rw2sotYb6Se6S1d2KxwSW4AQPy4w3SMdy+HpTFwW+eP8A
lC9f/wC2bd/8mHxQ7yP/AMoXoH/bNtP+TCYqnWkoe907T75ES9tYbpI25Is0ayBW8QGBocVwvp0l
uwZ70BmUSBWaNcQJyTL1H+7Cx5eNd8Vcmk6UkJSJZQLIzB2cRIGLK5kDEgdQ7Fq+0+KorFXyqktp /
wAppqv/AGzd0/5P32Kp1irsVdirsVdirsVdirsVdirsVdirsVdirsVdirsVdirsvSW7/A0U00r/tm6j/
AMn7HFU4kjjljjeKVA8bqq6MAVZSKEEHqDiqi2m6c1eVrC3IktWNTUksStt4yuf8AZHx0KrP0RpXp
+n9SgCcSnERoBxK8C0n8u3yxVB6V5R8taVzRz2WnxJbqHAEgMzUkpyBeUu5B4gUJ6ADtiqNXSdKW
RZVsoBIjc0cRIGDVY8gabH4239z44qvhsLGBg0NvFEy/ZKIqkfCqbUH8iKvyAHbFus88f8oXr/8A
2zbv/kw+KpfpC+cdH0u00ldKtbyPT4UtorpbwXepHEoRGMbQvxYqByFTviqL/SnnL/qw2/8A0n/9
eMvd+lPOX/Vht/8ApP8A+vGku/SnnL/qw2//AEn/APXjFXfpTz1/1Ybf/pP/A0vGku/SnnL/AKsN
v/0n/wDXjFXfpTz1/wBWG3/6T/8ArxiqpoInrDarf6tqkMnrJdQ29tDaQyGbjHbNM/J5CsYLM1wd
guwAxV08VdirsVdirsVdirsVdirsVdirsVdirsVdirsdqSa3Z6wuq2GraXDDdSwsNxbTkw0hh5
R3LQvysQLIAytbjYruCcVU/0p5y/6sNv/wBJ/wD14xV36U85f9WG3/6T/wDrxirv0p5y/wCrDb/9
J/8A14xV36U85f8AVht/+k//AK8Yq79Kecv+rDb/APSf/wBeMvd+lPOX/Vht/wDpP/68YqhNXXzj
rG13ektpVrZx6hC9tLdNeGX045VK0wjWF0TBSQiQn8VvRtZzqt/bR3mn+XrqexnH02naa2iMkZ+y
4R5AwdDcV7Yqq/p7zJ/1LNx/0k2f/VXFXfp7zJ/1LNx/0k2f/VXFXfp7zJ/1LNx/0k2f/VXFXfp7
zJ/1LNx/0k2f/VXFXfp7zJ/1LNx/0k2f/VXFXfp7zJ/1LNx/0k2f/VXFUvo+uSX9zdWdzYzaffwi
xSSQTGN6xzchG6PEzqQTG4+YxVncVdirsVdirsVdirsVdirsVdirsVdirsVdirsdqVaxrk1hc2
tnbWM2oX12sskEjJskcPES07ysigAyIPmcVQv6e8yf9SzcF9JNn/wBvcVd+nvMn/Us3H/STZ/8A
VXFXfp7zJ/1LNx/0k2f/AFVxV36e8yf9SzcF9JNn/wBvcVd+nvMn/Us3H/STZ/8AVXFXfp7zJ/1L
Nx/0k2f/AFVxVSu/Nmq2FtJeah5euoLGAc7mdZraUxxj7T1EkLEKNZTtiqK8j/8AKF6B/wBs20/5
MJiqdYqwXznqnmoebNP0nRZbxIZbGa6nSwj0+STkk0UYZjfvGvACQ/ZNfbFwKN+a/mjTLIGHU0Ex
f9Iz2JSNaXkas0NpCOI+GRLkCNgKVBU98Uun/M7zpDoInYRwS3HmrTrieXXU+qkM9laKsqn0AKxf
WUuIlDbu+KnTFXr91ew17ZwXtq4ktrmNJoJB0ZJFDKw+YOKfbFWK3Sa+3nXUP0TLax002w9f63HJ
JX9/e8eHpvHTvWuKov0vPv8Ay1aV/wBI9x/1XxV3peff+WrSv+ke4/6r4q70vPv/AC1aV/0j3H/V
fFXel59/5atK/wCke4/6r4q70vPv/LvPx/SPcF8AVfFWH+cvI3nnW9Z0zUJj2pQ2iPEtmZr6xih
kdLzboei707qFKkchtSmKUt/wR+d6NFND5nHqiwmjKsac1Bd00gHwCFgwmnB6gqR37qug/L/wD0
WK+srh/McdWuIjNteG6mHqJBGI/SPAVIPDky/tFt/s1xVHa5oP5sJ+YP1rTdSe40S5kw5ht2meG3
js3kts1vKFjcJ6iCUBhy571A7qpbZ+Svz3jY3E/m00WT07ZRbm5dUJSIRyVpC3Fg1XLA/H3FcvTv
yZ5a/N7Tbq9n1fW7a7E6xLDFctLcxrxQciqKICjV2J5n1p3xVlfpfeff+WrSv+ke4/6r4od6Xn3/
AJatK/6R7j/qvirvS8+/8tWlF9I9x/1XxV3peff+WrSv+ke4/wCq+KpH5us/zZmsrUaNd2QuLuVZ
2tkaEiPg4Jk+sSoyVIqvEmtD2xVEaHB5rh8y6UnmS5tLm8Gm6gFezR0FPXsqlyxAYn/ACUXFWZ4
q7FUL1Dzr5T07UTpt9qlvb36hS1u70cBhVaj3GKoVpZi8iPatdJrdq1ukiRNKH2EKqu6L06ssTkf
I4qn9pd2t5bRXVpM1xbTqJIZ4mDo6MKh1YVBBGKquKpL54/5QvX/APtm3f8AyYfFXeR/+UL0D/tm
2n/JhMVTrfUHq12mn6bean6Q1eZt5ZQteJYRqXKcGnLjirziX85dMsoba51zQ3gilhw5tktd3U
Mjzs3+mxWGyrCTyj5An7JY9FLJfKn5heWvMusTWmm208d8kBluJZokSip6YKMwZiSskrR06co37A
FLDLURIOVEUIiAKqqKAAbAADFW8VYrdJr7eddQ/RMtrHTTbD1/rccklf397x4em8d09a4qi/S8+/
8tWlF9I9x/1XxV3peff+WrSv+ke4/wCq+Ku9Lz7/AMtWlF8ASPcf9V8Vd6Xn3/lq0r/pHuP+q+Ku
9Lz7/wAtWlF9I9x/1XxVIf0vLxzz5k0VdKkvrGKGW5tmnkt054pFiSZWkILSsGolFh7+OKWG2HkT
88NKtFs7TzHBDbw2X100S4uGdwleU1NTGWDFfiQ1quyDpiqe6B5N/NP/ABZHqvmHVoZ1isLi2hmh
fkkU80UMYdIPSiG7wmQ771pQd1Uj0Py5+fBm8UurNzgu0haa5nfiUjNpKZYqwgSxuPVTp/MN+6qL
svKf58w6dFBLrsU10yVny9wW9JwZaAr6P7ypkU/Jab7Yqy3ylpX5o6f5ftbXVNTsLu+QMZpbi0ae
T4nJcMvHhDUB/l+/rihN/S8+/wDLVpX/AEj3H/VfFXel59/5atK/6R7j/qvirvS8+/8ALVpX/SPc
f9V8Vd6Xn3/lq0r/AKR7j/qviqRecLf82msbX9C3NmbsXKlZaxmIiPg9TIbmSRGStKjJwTmVRWiJ
5rTzNpQ8yS2ct5+jtQ4myWQLT17GvMv1b/VUDFWZYq7FWGa15Cur3VvMV/8AXpIf0rBFFaQwzSRx
8o4GiP1hFFGXkffbFKRJ5A86DS9LtG+q89LuIp1I1bVqyKlncWrBZOPqQf70BqREA0odsVZ35U0m
60fy5p2l3Usc091AsLSRLwSiCihR7LQV79cUJriqS+eP+UL1/wD7Zt3/AMmHxV3kf/1C9A/7Ztp/
yYTFVHzj5qPluDTPrY3Ntc3gt7x1ryhtxBNNJOAAEQiWHkw/lrirENM/PTytqNo1vdwVw949jFd

XtrEsUsfCSza6n48pF5JGkba1FT0pilC6v8Amv5I9Sa0v/K1xczacjK1u9tbSiKS2ll...
mKkGg7Yqtj/Pn8u7H17pNLntiFTnLGLpyk5uZpFHpTMW4t00n+USxHc4qm4/03y4+ow...
qS2t5Y/QkqkMogeVo0lawNfUbYSKpK/F7Yop6JirFbq11mfzrqH6Nv47Hjpth6vqW/1...
R8aU0Kov9F+cv+r9b/8ASB/1/wAVd+i/OX/V+t/+kD/r/irv0X5y/wCr9b/9IH/X/FXf...
63/6QP8Ar/irv0X5y/6v1v8A9IH/AF/xV555/wBF1qy1NpL3zJpLudWW2lieflY3LXG...
hyadFLM4oaYpSuTyL59d9Eg1LzmiagkslwLhcxN0sZtPSnLE1ZZJYizM3qNRRQKab4...
Ba+e66mhisrqaG7uUmCJW59H1AWJYrc8qMteKqa0c0VZD5z8jfmDqPmC2udC8zXEdp6...
hmjtJisrxxMqFZZTFyopcE1HwjFCBH5b/mlLeTTznzJ6qI5S0ju7oQrI908yxyLT1x9F...
uKUb5T8hfmXYa5PFx/nJrhREYxZl5ruBHduVGglKfs0Kvy5b0pTFWZ/ovz1/1frf/pA/6...
OX/V+t/+kD/r/irv0X5y/wCr9b/9IH/X/FXfovz1/wBX63/6QP8Ar/iqReb/AC7+ZN5Zw...
uRcq7MktWdECPXk6yTF1rT400/XtiqK00x8y2fmXS09f1KLU7s6bqBEsUAH4/v7Gqkq...
xV5B/wAQu87W0nwT6ZqCrqzGRrzhKLdipuF00uBHI1Xi5LyZTxwJtPPKPlr80LHwbC...
jIu4wxLSuIKg/ZXYZ3MnWnwX4VSnR/IPn/T9Phg0680nXbmgLUJ5JopkkjA5ySxiKGF+...
x4u3xdaqoc+Q/wA5LjS5Le58w8LmWH0gUupWRS8cscjMfTVjuyu047dKYqzTyDpfn0...
a656Yv1h7qRIjWqs7RxCnQKAPn4lQmfj/1C9f8A+2bd/wDjH8V5z8wJoH5V6Xqhj9a...
V/eTyxRwxptU/FIwBoDtiqQf8rs0C5t09TS3mnmjW3WSN5bSNY7u5AjkhpcSRuoq9...
TSE/5XB5CS7WI6A0dbgWHqtHaKAp52x359AIeBHTjQV7Yqo2f5t+UNYUjNhlSxMc...
Lmb11mLP8S/u1k4UrU13rXFVXR/03kY+VdX1zRfL0UvWLu3SG1n9KQz3VyqSuWaIz...
8IIOkqUf5yfl/DNHHbeXqSxBLqD047Z0F1KluHHGqyRuBcKhcqORUgVpirJdK/Na...
odTmMUNzcSQxjgv1kFggZySHsyvE067V7q0mV1pUt/511D09QurD0tNsK/VGjXny...
UIv/AARdf9TDqv8AyMt/+qGku/wrdf8AUw6r/wAjLf8A6oYq7/Ct1/1M0q/8jLf/AK...
M0q/8jLf/qhirv8Act1/1M0q/wDIy3/6oYqx7zJ+W8euy2obzNdH1LW8tSs6207S...
kY+KhpWu2KW0z/8AON/l+aK+ih1i4V7mWZ5GK8yBK6Sosg5ipWLGK8eSkdOuKo60...
6lBfTqmmTRXCQUALSRRxICJVKuBw3VgDyp8Xjsqp61+RE0oecL3WoNTa2t74vcSA...
Iy+p9pvh2ABAXw1G3/5x20y2juTBrUy3M7L+/eFXpH9VltXQozcDVZ2KNSq++Kp3...
Za3fpLqMivK8JSM1V5Fvc0JlbiXahAG23vihkn+Fbr/qYdV/5GW//VDFXF4Vuv8Aq...
9UMVd/hw6/6mHVf+Rlv/ANUMVd/hw6/6mHVf+Rlv/wBUMVSLzF8Alnfa9Y21qnmG...
oVHWqLEkJ51bb4ulcVRWieX5tE8zaVay6peaox07UCZb1xIykT20ybcgvsScvZl...
TrrU5rHVIRn9Rmnnkniu5+Rcx3n1WiJDCAqS3ELOrF+XE/FT4SpU4Py0/NmA3lxH...
dlwIr15E53CwpJLSB2hFQPtchQqtVXoXkjQ9e0nTpU13UH1G/kZKSmaSVVRiKXiA...
7KGRYqkvj/1C9f/A02bd/8AJh8VU/JcUE3kry76iLJ6dhZsnIBuLrAqK9CMVTRT...
PWJjQ860ZBy23o5Lb998VafR9JduT2Vuzer9Yq0SE+t09Tcfb/yuuKrYtD0WEU...
pbjs01WJp74qh9F8raBosLQ6bZpBG8xuTutIfVKenyDSF2FEHEUow2GKqcfk7yw...
Ln1Vo2wqMf3LExAlokJIwPifCvTMWvkG5C3jDV5cuC1rzMlen85LFPfFWXVnq11...
TbATD0Un5kz3hX7ZHHj/ABxVF/oXzb/1Mf8A05Q/1xv36F82/wDux/8AT1D/AFx...
OUP9cVd+hfnv/Ux/9OUP9cVd+hfnv/Ux/wDT1D/XFWD335Xeel3y1aaG2rWlpHp9...
kkL116DpCRs052xSjYfyr1628sXWlxa2JL27u7S9uLhjdR+sYIo454ZXjn9XhIY...
AJM+cX10+mHmh2srqXkLcy3iloyrgK5aaQ/uuYRNzVftGvVW1sX5PfmDAdQlj8...
t1Pb0xIcEmrTqye6122XFw2/Jbzc0Vyw8zzRXc5l4yrcXTIFlw8V19MsF39e2FR...
cG08W8Hmqb10ltHh1kmujiQBEVkuLzP9sinsBuuKvRv0L5t/6mP/AKcof64od+hfn...
wBcVd+hfnv/AFmf/T1D/XFXfoXzb/1Mf/T1D/XFui83eUPzA1Kytot08ycZ47LZw...
ODk7fapx6HFUVom167pvmfS4dZ1g6v0d01D05TckBUCaxqvwk1/md8VznirsVdir...
PJWvkmg/R12N/eBxirHD/wAqx5yej9Z4c3r9U/SXocuR5+n6H7qnKv2NsUu/5Bv/A...
G/8A2sf+5xirv+Qb/wDax/7nGku/5Bv/ANrH/ucYq7/kG/8A2sf+5xirv+Qb/wDax...
pwu/0DX10a/XvU9b1+XH4PU+sfvacfs128MUJ/irsVdirsVdirsVdirsVdirsVdirs...
VSDzZ/hThafp6vqc2+o+n63r8uPx+n9X/e04/apt44qkH/IN/wDtY/8Ac4xS7/kG...
7/kG/wD2sf8AucYq7/kG/wD2sf8AucYq7/kG/wD2sf8AucYq7/kG/wD2sf8AucYq7...
s80aU+ufpL00Xic0fr/uqcqfa2xV/9k=

- CMYK Cyan CMYK PROCESS 100.000000 0.000000 0.000000
0.000000
- CMYK Blue CMYK PROCESS 100.000000 100.000000 0.000000
0.000000
- CMYK Magenta CMYK PROCESS 0.000000 100.000000
0.000000 0.000000
- C=15 M=100 Y=90 K=10 CMYK PROCESS 15.000000
100.000000 90.000000 10.000000
- C=0 M=90 Y=85 K=0 CMYK PROCESS 0.000000 90.000000
85.000000 0.000000
- C=0 M=80 Y=95 K=0 CMYK PROCESS 0.000000 80.000000
95.000000 0.000000
- C=0 M=50 Y=100 K=0 CMYK PROCESS 0.000000 50.000000
100.000000 0.000000
- C=0 M=35 Y=85 K=0 CMYK PROCESS 0.000000 35.000000
85.000000 0.000000
- C=5 M=0 Y=90 K=0 CMYK PROCESS 5.000000 0.000000
90.000000 0.000000
- C=20 M=0 Y=100 K=0 CMYK PROCESS 20.000000 0.000000
100.000000 0.000000
- C=50 M=0 Y=100 K=0 CMYK PROCESS 50.000000 0.000000
100.000000 0.000000
- C=75 M=0 Y=100 K=0 CMYK PROCESS 75.000000 0.000000
100.000000 0.000000
- C=85 M=10 Y=100 K=10 CMYK PROCESS 85.000000 10.000000
100.000000 10.000000

- C=90 M=30 Y=95 K=30 CMYK PROCESS 90.000000 30.000000
95.000000 30.000000
- C=75 M=0 Y=75 K=0 CMYK PROCESS 75.000000 0.000000
75.000000 0.000000
- C=80 M=10 Y=45 K=0 CMYK PROCESS 80.000000 10.000000
45.000000 0.000000
- C=70 M=15 Y=0 K=0 CMYK PROCESS 70.000000 15.000000
0.000000 0.000000
- C=85 M=50 Y=0 K=0 CMYK PROCESS 85.000000 50.000000
0.000000 0.000000
- C=100 M=95 Y=5 K=0 CMYK PROCESS 100.000000 95.000000
5.000000 0.000000
- C=100 M=100 Y=25 K=25 CMYK PROCESS 100.000000
100.000000 25.000000 25.000000
- C=75 M=100 Y=0 K=0 CMYK PROCESS 75.000000 100.000000
0.000000 0.000000
- C=50 M=100 Y=0 K=0 CMYK PROCESS 50.000000 100.000000
0.000000 0.000000
- C=35 M=100 Y=35 K=10 CMYK PROCESS 35.000000
100.000000 35.000000 10.000000
- C=10 M=100 Y=50 K=0 CMYK PROCESS 10.000000 100.000000
50.000000 0.000000
- C=0 M=95 Y=20 K=0 CMYK PROCESS 0.000000 95.000000
20.000000 0.000000
- C=25 M=25 Y=40 K=0 CMYK PROCESS 25.000000 25.000000
40.000000 0.000000

- C=40 M=45 Y=50 K=5 CMYK PROCESS 40.000000 45.000000
50.000000 5.000000
- C=50 M=50 Y=60 K=25 CMYK PROCESS 50.000000 50.000000
60.000000 25.000000
- C=55 M=60 Y=65 K=40 CMYK PROCESS 55.000000 60.000000
65.000000 40.000000
- C=25 M=40 Y=65 K=0 CMYK PROCESS 25.000000 40.000000
65.000000 0.000000
- C=30 M=50 Y=75 K=10 CMYK PROCESS 30.000000 50.000000
75.000000 10.000000
- C=35 M=60 Y=80 K=25 CMYK PROCESS 35.000000 60.000000
80.000000 25.000000
- C=40 M=65 Y=90 K=35 CMYK PROCESS 40.000000 65.000000
90.000000 35.000000
- C=40 M=70 Y=100 K=50 CMYK PROCESS 40.000000 70.000000
100.000000 50.000000
- C=50 M=70 Y=80 K=70 CMYK PROCESS 50.000000 70.000000
80.000000 70.000000
- Grays 1
- C=0 M=0 Y=0 K=100 CMYK PROCESS 0.000000 0.000000
0.000000 100.000000
- C=0 M=0 Y=0 K=90 CMYK PROCESS 0.000000 0.000000
0.000000 89.999400
- C=0 M=0 Y=0 K=80 CMYK PROCESS 0.000000 0.000000
0.000000 79.998800

- C=0 M=0 Y=0 K=70 CMYK PROCESS 0.000000 0.000000
0.000000 69.999700
- C=0 M=0 Y=0 K=60 CMYK PROCESS 0.000000 0.000000
0.000000 59.999100
- C=0 M=0 Y=0 K=50 CMYK PROCESS 0.000000 0.000000
0.000000 50.000000
- C=0 M=0 Y=0 K=40 CMYK PROCESS 0.000000 0.000000
0.000000 39.999400
- C=0 M=0 Y=0 K=30 CMYK PROCESS 0.000000 0.000000
0.000000 29.998800
- C=0 M=0 Y=0 K=20 CMYK PROCESS 0.000000 0.000000
0.000000 19.999700
- C=0 M=0 Y=0 K=10 CMYK PROCESS 0.000000 0.000000
0.000000 9.999100
- C=0 M=0 Y=0 K=5 CMYK PROCESS 0.000000 0.000000
0.000000 4.998800
- Brights 1
- C=0 M=100 Y=100 K=0 CMYK PROCESS 0.000000 100.000000
100.000000 0.000000
- C=0 M=75 Y=100 K=0 CMYK PROCESS 0.000000 75.000000
100.000000 0.000000
- C=0 M=10 Y=95 K=0 CMYK PROCESS 0.000000 10.000000
95.000000 0.000000
- C=85 M=10 Y=100 K=0 CMYK PROCESS 85.000000 10.000000
100.000000 0.000000

- C=100 M=90 Y=0 K=0 CMYK PROCESS 100.000000 90.000000 library 15.00
0.000000 0.000000

- C=60 M=90 Y=0 K=0 CMYK PROCESS 60.000000 90.000000
0.003100 0.003100

Figure 3: Figure 3

The selection of the Events Broker will impact on the implementation of the Flow Namespace Accessing Agent. This last component will be responsible for knowing how to set up and manage flows on top of different Events Brokers.

4.1.2. Flow Name Service (FNS)

FNS is a core component for the overall proposed architecture. This component provides all needed functionalities for obtaining Flow connection details based on a Flow URI (Uniform Resource Identifier). Thus, it is required to define a URI format for Flow resources and to specify mechanisms for resource location resolution.

In this section, we will focus on describing both the URI for Flow as well as the DNS mechanism for obtaining Flow network location details.

4.1.2.1. Leveraging DNS infrastructure

As mentioned previously, this component must maximize its leverage on the existing Internet DNS infrastructure. The reason for this requirement is to avoid defining new protocols and services that prevent broad adoption. Currently, DNS is the de facto name resolution protocol for the Internet, and there exist libraries for its usage on every programming language.

Whereas DNS is mainly used to resolve FQDN (Fully Qualified Domain Names) into IP addresses, there are many other functionalities provided by the global DNS infrastructure. Theoretically, DNS is an open network of a distributed database. Individuals and organizations that want to participate in the network need to register a domain name and set up Authoritative DNS servers for domains.

It is not in the scope of this work to detail the different available usages of DNS functionalities, but we can mention that it provides special Resource Records (i.e., types of information for a FQDN) that are solely used by special protocols. For instance, the MX Resource Records are used by SMTP servers to exchange email messages.

For the Flow Open Network, it will be required to define a URI format for flows as well as the mechanism to resolve an URI into all the needed information to connect to a flow. In the case of email, a URI is the email address while the connection details will be the SMTP server responsible for receiving emails for that account. For instance, an email URI could be user@domain.com while its connection

details could be `smtp://mail.domain.com`. The way in which the connection details are obtained is by resolving the MX DNS Resource Records of `domain.com`, which in this example is `mail.domain.com`.

4.1.2.2. Flow URI

As we mentioned previously, the first needed element is a URI definition for flow resources. These resources identification must capture the following details: * Domain, a registered domain in which create flow resources references. For example, `airport.com`. * Flow Namespace, a subdomain which is solely used by users to host flow names. This subdomain must be delegated to the Flow Name Server component and desirable should not be used for any other purpose other than flow. * Flow Name, a name for each flow that must be unique within its domain. The combination of flow name and flow domain results in an FQDN. For instance, we could have a flow named `arrivals` of the domain `flow.airport.com`. Thus, the FQDN of the flow would be `arrivals.flow.airport.com`. Also, the name can contain dots so that the following FQDN could be also used: `airline.arrivals.flow.airport.com`.

Thus, the general syntax of a flow URI would be:

```
flow://flow_name.flow_namespace.domain
```

This URI has the advantage that is similar to "mailto" URI and could be implemented in HTML to refer to flow resources. Some examples:

```
*flow://entrances.building.company.com
```

```
*flow://exits.building.company.com
```

```
*flow://temperature.house.mydomain.com
```

```
*flow://pressure.room1.office.mydomain.com
```

The flow URI must unequivocally identify a flow resource and provide, by means of DNS resolution mechanisms, all the information required to use the flow. Among these parameters, at least the following should be resolvable:

*Event Queue Broker protocol utilized by the flow. For instance, if Apache Kafka is used, the protocol would be "kafka"; In case RabbitMQ is used by the flow, "amqp". Also, it must be informed if the protocol is protected by TLS.

*Event Queue Broker FQDN or list of FQDNs that resolve to the IP address of one or a set of the Event Queue Brokers. For instance, `kafka-1.mycompany.com`, `kafka-2.mycompany.com`.

*Event Queue Broker Port used by the Event Queue Brokers. For instance, in the case of Kafka: 9092, 9093.

*Event Queue Broker Transport Security Layer can be implemented. Thus, it is needed to know if the connection uses TLS before establishing it.

*Queue Name hosted in the Event Queue Broker, which must be equal to that of the corresponding flow name.

The general syntax of the Flow URI would be as follows:

flow://flowName.flowCategory.myNameSpace.domain.tld

*Flow Namespace FQDN: myNameSpace.domain.tld

*Flow Name: flowName.flowCategory

*Flow FQDN: flowName.flowCategory.myNameSpace.domain.tld

The following are examples of this URI Syntax:

flow://notifications.calendar.people.syndeno.com

*Flow Namespace FQDN: people.syndeno.com

*Flow Name: notifications.calendar

*Flow FQDN: notifications.calendar.people.syndeno.com

flow://created.invoice.finance.syndeno.com:

*Flow Namespace FQDN: finance.syndeno.com

*Flow Name: created.invoice

*Flow FQDN: created.invoice.finance.syndeno.com

4.1.2.3. Flow name resolution

In Figure 4, we can see how a Flow FQDN can be resolved by means of the Flow Name Service.

- CMYK Cyan CMYK PROCESS 100.000000 0.000000 0.000000
0.000000
- CMYK Blue CMYK PROCESS 100.000000 100.000000 0.000000
0.000000
- CMYK Magenta CMYK PROCESS 0.000000 100.000000
0.000000 0.000000
- C=15 M=100 Y=90 K=10 CMYK PROCESS 15.000000
100.000000 90.000000 10.000000
- C=0 M=90 Y=85 K=0 CMYK PROCESS 0.000000 90.000000
85.000000 0.000000
- C=0 M=80 Y=95 K=0 CMYK PROCESS 0.000000 80.000000
95.000000 0.000000
- C=0 M=50 Y=100 K=0 CMYK PROCESS 0.000000 50.000000
100.000000 0.000000
- C=0 M=35 Y=85 K=0 CMYK PROCESS 0.000000 35.000000
85.000000 0.000000
- C=5 M=0 Y=90 K=0 CMYK PROCESS 5.000000 0.000000
90.000000 0.000000
- C=20 M=0 Y=100 K=0 CMYK PROCESS 20.000000 0.000000
100.000000 0.000000
- C=50 M=0 Y=100 K=0 CMYK PROCESS 50.000000 0.000000
100.000000 0.000000
- C=75 M=0 Y=100 K=0 CMYK PROCESS 75.000000 0.000000
100.000000 0.000000
- C=85 M=10 Y=100 K=10 CMYK PROCESS 85.000000 10.000000
100.000000 10.000000

- C=90 M=30 Y=95 K=30 CMYK PROCESS 90.000000 30.000000
95.000000 30.000000
- C=75 M=0 Y=75 K=0 CMYK PROCESS 75.000000 0.000000
75.000000 0.000000
- C=80 M=10 Y=45 K=0 CMYK PROCESS 80.000000 10.000000
45.000000 0.000000
- C=70 M=15 Y=0 K=0 CMYK PROCESS 70.000000 15.000000
0.000000 0.000000
- C=85 M=50 Y=0 K=0 CMYK PROCESS 85.000000 50.000000
0.000000 0.000000
- C=100 M=95 Y=5 K=0 CMYK PROCESS 100.000000 95.000000
5.000000 0.000000
- C=100 M=100 Y=25 K=25 CMYK PROCESS 100.000000
100.000000 25.000000 25.000000
- C=75 M=100 Y=0 K=0 CMYK PROCESS 75.000000 100.000000
0.000000 0.000000
- C=50 M=100 Y=0 K=0 CMYK PROCESS 50.000000 100.000000
0.000000 0.000000
- C=35 M=100 Y=35 K=10 CMYK PROCESS 35.000000
100.000000 35.000000 10.000000
- C=10 M=100 Y=50 K=0 CMYK PROCESS 10.000000 100.000000
50.000000 0.000000
- C=0 M=95 Y=20 K=0 CMYK PROCESS 0.000000 95.000000
20.000000 0.000000
- C=25 M=25 Y=40 K=0 CMYK PROCESS 25.000000 25.000000
40.000000 0.000000

- C=40 M=45 Y=50 K=5 CMYK PROCESS 40.000000 45.000000
50.000000 5.000000
- C=50 M=50 Y=60 K=25 CMYK PROCESS 50.000000 50.000000
60.000000 25.000000
- C=55 M=60 Y=65 K=40 CMYK PROCESS 55.000000 60.000000
65.000000 40.000000
- C=25 M=40 Y=65 K=0 CMYK PROCESS 25.000000 40.000000
65.000000 0.000000
- C=30 M=50 Y=75 K=10 CMYK PROCESS 30.000000 50.000000
75.000000 10.000000
- C=35 M=60 Y=80 K=25 CMYK PROCESS 35.000000 60.000000
80.000000 25.000000
- C=40 M=65 Y=90 K=35 CMYK PROCESS 40.000000 65.000000
90.000000 35.000000
- C=40 M=70 Y=100 K=50 CMYK PROCESS 40.000000 70.000000
100.000000 50.000000
- C=50 M=70 Y=80 K=70 CMYK PROCESS 50.000000 70.000000
80.000000 70.000000
- Grays 1
- C=0 M=0 Y=0 K=100 CMYK PROCESS 0.000000 0.000000
0.000000 100.000000
- C=0 M=0 Y=0 K=90 CMYK PROCESS 0.000000 0.000000
0.000000 89.999400
- C=0 M=0 Y=0 K=80 CMYK PROCESS 0.000000 0.000000
0.000000 79.998800

- C=0 M=0 Y=0 K=70 CMYK PROCESS 0.000000 0.000000
0.000000 69.999700
- C=0 M=0 Y=0 K=60 CMYK PROCESS 0.000000 0.000000
0.000000 59.999100
- C=0 M=0 Y=0 K=50 CMYK PROCESS 0.000000 0.000000
0.000000 50.000000
- C=0 M=0 Y=0 K=40 CMYK PROCESS 0.000000 0.000000
0.000000 39.999400
- C=0 M=0 Y=0 K=30 CMYK PROCESS 0.000000 0.000000
0.000000 29.998800
- C=0 M=0 Y=0 K=20 CMYK PROCESS 0.000000 0.000000
0.000000 19.999700
- C=0 M=0 Y=0 K=10 CMYK PROCESS 0.000000 0.000000
0.000000 9.999100
- C=0 M=0 Y=0 K=5 CMYK PROCESS 0.000000 0.000000
0.000000 4.998800
- Brights 1
- C=0 M=100 Y=100 K=0 CMYK PROCESS 0.000000 100.000000
100.000000 0.000000
- C=0 M=75 Y=100 K=0 CMYK PROCESS 0.000000 75.000000
100.000000 0.000000
- C=0 M=10 Y=95 K=0 CMYK PROCESS 0.000000 10.000000
95.000000 0.000000
- C=85 M=10 Y=100 K=0 CMYK PROCESS 85.000000 10.000000
100.000000 0.000000

- C=100 M=90 Y=0 K=0 CMYK PROCESS 100.000000 90.000000 library 15.00
0.000000 0.000000
- C=60 M=90 Y=0 K=0 CMYK PROCESS 60.000000 90.000000
0.003100 0.003100

Figure 4: Figure 4

In order to illustrate the Flow Name resolution procedure by the FNAA (Flow Namespace Accessing Agent), we can consider the following flow URI:

```
flow://notifications.calendar.people.syndeno.com
```

First, the FNAA will perform a query to the DNS resolvers. These will perform a recursive DNS query to obtain the authoritative name servers for the Flow Namespace: people.syndeno.com. Thus, the authoritative name servers for syndeno.com will reply with one or more NS Resource Record containing the FQDN for the authoritative name servers of people.syndeno.com.

Secondly, once these name servers are obtained, the FNAA will perform a PTR query on the Flow FQDN adding a service discovery prefix. The response of the PTR query will return another FQDN compliant with SRV DNS Resource Records [[RFC2782](#)] and DNS Service Discovery [[RFC6763](#)].

```
In this case, the query for PTR records would be as follows: ~~~ ;;
QUESTION SECTION: ;notifications.calendar.people.syndeno.com. IN PTR
~~~ The response would be in the following form: ~~~ ;; ANSWER
SECTION: notifications.calendar.people.syndeno.com. 21600 IN PTR
_flow._tcp.notifications.calendar.people.syndeno.com. ~~~ Using the
FQDN returned by this query, an additional query asking for SRV
records is made: ~~~ ;; QUESTION SECTION:
;_flow._tcp.notifications.calendar.people.syndeno.com. IN SRV

;; ANSWER SECTION:
_flow._tcp.notifications.calendar.people.syndeno.com. 875 IN SRV 30
30 65432 fnaa.syndeno.com.
_flow._tcp.notifications.calendar.people.syndeno.com. 875 IN TXT
"tls"
```

```
_queue._flow._tcp.notifications.calendar.people.syndeno.com. 875 IN
SRV 30 30 9092 kafka.syndeno.com.
_queue._flow._tcp.notifications.calendar.people.syndeno.com. 875 IN
TXT "broker-type=kafka tls" ~~~ First, the response informs the
network location of the FNAA server, in this case a connection
should be opened to TCP port 65432 of the IP resulting of resolving
fnaa.syndeno.com: ~~~ ;; QUESTION SECTION: ;fnaa.syndeno.com. IN A
```

```
;; ANSWER SECTION: fnaa.syndeno.com. 21600 IN A 208.68.163.200 ~~~
Secondly, this response offers other relevant information, like the
TCP port where the queue service is located (9092). It also includes
a TXT Resource Record that establishes the protocol of the Event
Queue Broker, defined in the variable "broker-type=kafka".
```

Now, using the returned FQDN for the queue, kafka.syndeno.com, the resolver can perform an additional query: ~~~ ;; QUESTION SECTION:
;kafka.syndeno.com. IN A

;; ANSWER SECTION: kafka.syndeno.com. 21600 IN A 208.68.163.218 ~~~

4.1.3. Flow Namespace Accessing Agent (FNA)

The Flow Namespace Accessing Agent is the core component of a Network Participant. This server application implements the Flow Namespace Accessing Protocol that allows client connections.

In the diagram of Figure 5 we can see the different methods that the FNA must support.

FXev5g/5YrT/AKSpP+yfFXev5g/5YrT/AKSpP+yfFXev5g/5YrT/AKSpP+yfFWLXn5baFeXrX1z5
bsJLt5/rckv125Befm8gd6QjkQ0jU5dBsNsUqB/Kfyuyup8r6eRjXmfr11yPjWU1b0q7hz+HgKkQ
0P5aadBT0fLdhHxY0pw9uQVYKUqtIfh+E027Yrarov5e6Rot7b3u1+XrG2urQyG3lW9uWkmVPTc/
FCwNU+Hftihkvr+YP+Wk0/6SpP8AsnxV3r+YP+Wk0/6SpP8AsnxV3r+YP+Wk0/6SpP8AsnxV3r+Y
P+Wk0/6SpP8AsnxV3r+YP+Wk0/6SpP8AsnxV3r+YP+Wk0/6SpP8AsnxV3r+YP+Wk0/6SpP8AsnxV
LvL+oedbjUr2LWtKtrTT45ZBZ3UU5Z3jDEJ+7o1ajfkSn+riqIf/AJTKL/tnSf8AJ+PFU5xV2Kux
V2KpT5u/5RTWv+YC5/5MtirvKP8Ayimi/wDMBbf8mVxVNsVdirsVdiqTJ/ymUv8A2zo/+T8mKouT
XdDika0TubZJEJV0aaMMrA0IIJ2IxVb/AIi8v/8AVztP+R8f/NWku/xF5f8A+rnaf8j4/wDmrFXf
4i8v/wDVztP+R8f/ADVirv8AEXl//q52n/I+P/mrFXf4i8v/APVztP8AkfH/AM1Yq7/EXl//AKud
p/yPj/5qxVgPnW18x6rrb3Gh+cLTTrBoIYokF96XpuJGM7GFEdZS6leLeopFKdDilJb3SPzFk0S3
tLfz1YLfwmr3Jv2Uyc4Y0ILLD0jkhLqOPxc2BpSrKprf/wCP01q6vdM846Q1rLHCsFtdTrwWREtR
K/BY3AEjRTfCD8PKoPxGiqyG6/NNY5DL5w8vy0TGI0DIoC+jKsnx+kaH1WjYfArt2FVZVDabffm6
3rpd+a9Cj4TwJHLI8DlokiPrugijSoerhxDBT8P7I2ZV1H1DVfMvtLIPNHmLSL6AwRCI20qLIs4J
9UsQsKlTXbbw2G5ZVk/+IvL/AP1c7T/kfH/zVih3+IvL/wD1c7T/AJHx/wDNWku/xF5f/wCrnaf8
j4/+asVd/iLy/wD9X00/5Hx/81Yq7/EXl/8A6udp/wAj4/8AmrFXf4i8v/8AVztP+R8f/NWkqeme
afLmqXMrp+o29xcwu6SQI49QGM0YhDRiv8AlAUPjiqk/wDymUX/AGzpp+T8eKpzirsVdirsVSnz
d/yimtF8wFz/AMmWxV3lH/1FNF/5gLB/AJMriqbYq7FXyq7FUmT/AJTKX/tnR/8AJ+TFU5xV2Kux
V2KuxV2KuxVJ/M3mW10C3s7m6Ci3ubuk0lmdxEkKy1/euzCnFePtirD7b87dLuZ7i0g0q5a7tLWw
6nq8Xogx2s10kaurMxZ1iI3QEeBGKaQtt/zkB5fETHUDJ1C0uEDs8EaJMVWNUd8vijYFWDV+HoKg
neitK8/5/wDk6CPnLY6kjBkVomhhsQGSiyj4XmWtApDFa0PtvitK8H55eVJ5rWGOx1MyXZt/TUW6
EgXKswJUSFvh47gAk1XgGqMvpmf13XbLX9EtNyslks1vE9SJZl4SAVIlZaneo8cUjjirsVdirsVd
irsVQVloej2NzPdWl1DBdXLvJcXCIokdpGLsWenI1Y+0KoN/+Uyi/wC2dJ/yfjxV0cVdirsVdiqU
+bv+UU1r/mAuf+TLyq7yJ/yimi/8wFt/yZXFU2xV2KuxV2KpMn/KZS/9s6P/AJPyYqI5N0u3kZl1
S5jViSI1W24qCeg5QsaD30Krf0Ze/wDV2u/+BtP+qGku/Rl7/wBXa7/4G0/6oYq79Gxv/V2u/wDg
bT/qhirv0Ze/9Xa7/wCBtP8Aqhirv0Ze/wDV2u/+BtP+qGku/Rl7/wBXa7/4G0/6oYq79Gxv/V2u /
wDgbT/qhiqSa55i0LQbq011fzTLaxMsZmSB1ti5jWvxcVtyafCaenDTpiqBbz95Mwzjvw85N9U1
cxJPxtihdUjdHuw23FbiMmvSvzxVEXHmLyxJeto1x5neSaaMB4HS1aJ45YvVFXNuYirxHl9rpilN
4GguJvQt/MUK01cFsjayZqKaE8RDXy4oRXX6Mvf8Aq7Xf/A2n/VDFXfoY9/6u13/wNp/1QxV36Mvf
+rtd/wDA2n/VDFXfoY9/6u13/wADaf8AVDFXfoY9/wCrtD/8Daf9UMVd+jL3/q7Xf/A2n/VDFXfo
y9/6u13/AMDaf9UMVS7QPL3mDT9Su7m+8wT6hZzyyQWmKcYEYdiVBlIL/Cv7KcVB7UxVEP/AMp1
F/2zpP8Ak/Hiqc4q7FXyq7FUp83f8oprX/MBc/8AJlsVd5R/5RTRf+YC2/5MriqbYq7FXyq7FUmT /
lMpf+2dH/yfkxVGXN3qcczJBYetEKcZfVRK7b/CRXriq19f1n/q1/8AJeP+mKu+v6z/ANWv/kvH /
TFXfX9Z/wCrX/yXj/pirvr+s/8AVr/5Lx/0xV31/Wf+rX/yXj/pirvr+s/9Wv8A5Lx/0xV31/Wf
+rX/AMl4/wCmKsd8w+ULPzBem81PRJJJntxaShL5o45IVcyIssaEI/FnanIH7R9qKUqn/Kjy1Naf
VW8vyrEPshNqD0I2BC8WAwqKkZI3KkQ9BiqLuvy78v3JYzewVLMlI5i5U0I4bb6qkayD4wgi7V6/
F1xVW8u+SNK8uarNqmj+Xvq13ND9Xdhd8gIvg+EBif8AfSn7/E4qyb6/rP8A1a/+S8f9MU0+v6z/
ANWv/kvH/TFXfX9Z/wCrX/yXj/pirvr+s/8AVr/5Lx/0xV31/Wf+rX/yXj/pirvr+s/9Wv8A5Lx/
0xV31/Wf+rX/AMl4/wCmKpf5f1zzRfajdw+paC1hZQyypDfmdCJAjkJ+6ID7r+100Kol/wDlMov+
2dJ/yfjxV0cVdirsVdiqU+bv+UU1r/mAuf8Aky2Ku8o/8opov/MBbf8AJlcVtBFXyq7FXyqkyf8A
KZS/9s6P/k/JiqNuNZ0e2maG4vreGZKco5JUvHUVFQSD00Kqf+IvL/8A1c7T/kfH/wA1Yq7/ABF5
f/6udp/yPj/5qxV3+IvL/wD1c7T/AJHx/wDNWku/xF5f/wCrnaf8j4/+asVd/iLy/wD9X00/5Hx/
81Yq7/EXl/8A6udp/wAj4/8AmrFXf4i8v/8AVztP+R8f/NWksd82X9xeS2cmh67YwCNLm06jkvfQ
DevFwikBjWxk0TfGAafMYpY1DYecZbPU4b7zxZF7kLBobrgYIluYpKl41hcuYhI1RQ9BU9Qqsww
8+2kEkGm/mBp6xhm9E3LpcsQ0zGrPceU44wkALy0/fuVWSeSr/wbEX3+KfM+namZWiNmZYV4cY+
MteKQgBm3UUNPHFWtF4i8v8A/VztP+R8f/NWKhf4i8v/APVztP8AkfH/AM1Yq7/EXl//AKudp/yP
j/5qxV3+IvL/AP1c7T/kfH/zVirv8ReX/wDq52n/ACPj/wCasVd/iLy//wBX00/5Hx/81Yq7/EXl /
wD6udp/yPj/AOasVUNK83+wdWvZ7HT9RhuLy3dkktw1HqhoxVWoXUfzLUe+KrX/AOUyi/7Z0n/J
+PFU5xV2KuxV2KpT5u/5RTWv+YC5/wCTLYq7yJ/yimi/8wFt/wAmVxVNsVYja/mp5LmETzXn1GG4
Aa3nvF9C0SvHjxLkVqGr8q+GK0nm1+ZNA1aQx6bfwXciqHZYnDEKVVgTT/JkU/TiqZYqkyf8p1L/

kCxMyAuEDM3rgLTY00+KUHm/m7+Udx9SU6fHFLdTxQTxNaxMbczRNkj0Y/UVh8IX4SSK79DiQu/5
qf1CbcyW9ks8vpPKsAsKP+7Lgq1U+H+6ap6Ade+KqLn+Zv5STwI0LnHFctI0Bs/qPqSCRZY4Qo4I
ysWMykcT0+WKsq8syeSfMukpqulWftJa08kdXtUjcPE5R1ZGUEGoxQmv+HfL/wD1bLT/AJER/wDN
OKu/w75f/wCrZaf8iI/+acVd/h3y/wD9Wy0/5ER/804q7/Dv1/8A6t1p/wAiI/8AmnFXf4d8v/8A
VstP+Ref/NOKu/w75f8A+rZaf8iI/wDmnFUNpXk3yvpN/PqGn6dDBe3DM8lwAWerklghYngpr9la
DFXP/wAp1F/2zpP+T8eKpzirB9Y/JzyXqAthDbGwMMkbztbk8rhY2Z+MzNyLli5q5+I9z0xTaPtP
yw8jWlobS300pbni0BnuGpwjmiWhaQkcUupAKEPsKKGU4q1Pm7/1FNa/5gLn/ky2Ku8o/wDKKaL/
AMwFt/yZXFUP54PmUeWrj/DRZdZaw2WB190oRrmMTH96kqCkJfco10tCcVef3t3+fNpqF1bw8f1y
1k5w2VwRasY3aKKMSSO1bcMiySGVW9Na8WBW1Bi1NvLerfmxN5g0k6xpzQ6NHbrY6uP3HKS8CyM1
6vgjCM1EWimnxdPBV6RihJk/5TKX/tnR/wDJ+TFUXJDrhkYx3dssZJ4K1tIzBa7AsJ1qfegxVb6H
mD/ltp+kWT/ALKMvd6HmD/ltp+kWT/ALKMvd6HmD/ltp+kWT/ALKMvd6HmD/ltp+kWT/ALKM
Vd6HmD/ltp+kWT/ALKMvd6HmD/ltp+kWT/ALKMvQlxY30pq1vcX0m3qw0GaKSzMoSQAJU3DcW
64q1FoFxDHJHENMjjlBEqJYFQwK8SGAn3qu3yxVRby+lvw1ZdIh9Nk90Q6fx4svwpXPrIHQYquX
QeJFso0oFEJWEWFKIXYH4fx2BLN95xv0+mfU4kknm0m2ijctG72Xpqr1hISpNwAG5RhvmK9sVRdr
puq2kCwWk1jwbLURFFZ0iAk1NFW4A30KqvoeYP8Altp+kWT/soxV3oeYP8Altp+kWT/soxV3oe
YP8Altp+kWT/soxV3oeYP8Altp+kWT/soxV3oeYP8Altp+kWT/soxV3oeYP8Altp+kWT/sox
VLvL+n+dbfUb2XWtUtruwk1kNnaxQFXSMsSn7yq0oD9kh/8AwXVEP/ymUX/b0k/5Px4qn0KvIIvz
+uBZ6fd3XlxooNSiMsLrPPRkvGiBzNaQAqzS0Dxc0rQV32Vvn/5yG0JbC4ul093aHUVqiQCT4nse
LP8AXx+7+zxjb4PGg5b4pp6wj6h0IZGAKsDUEHoQcUJV5u/5RTWv+YC5/5MtirvKp8Ayimi/wDM
Bbf8mVxVC+frLzHe+VL228uytDqz+kYwj1EEhRZUaVI5iGEbPGGUMrtirzjUPLf542s4uNBvJY6w
cVivL5b4xlmhND6qxR06qHFSn0k/EVKeaDp350/4htZde1CGTSIrjnNDbfV4+UZNWlP7ssy8TC5B
IPh8QxV6XihJk/5TKX/tnR/8n5MVRcms2kcjRtHclkJUlBs5Zag02ZYyCpYqt/Tt1/vu7/6Q7v/
AKpYq7902X++7v8A6Q7v/q1irv07Zf77u/8ApDu/+qWku/Tt1/vu7/6Q7v8A6pYq7902X++7v/pD
u/8Aq1irv07Zf77u/wDpDu/+qWkv0L38sPLk+palqFtqwtWM+qztc3htra5TkzNMENRDxhS4oV6G
g71xS3B+Wu1xx1X8w+ZJm5TSLJJHds3qSRrHG7ViPL0fTur8hirtR/LLy/e+XLjQX1TWntZrqC7j
a4tbi4MRt4fR4oJIaUYbn6PeqqEP5SaMfrTfp7XvVuB0vM21yKlKorFbjEpZY1XpUV0+Kqs/5UeX
J7SW2m1fXZRL6v7yS3uWYGZAJH+5ox2NCRsNumKptonkrR9L1mz1R9U1y+azSMR29zDdtFzjgMHI
KIhTY8uPSuKs2/Tt1/vu7/6Q7v8A6pYod+nbL/fd3/0h3f8A1SxV36dsv993f/SHd/8AVLFXfp2y /
wb93f8A0h3f/VLFXfp2y/33d/8ASHd/9UsVd+nbL/fd3/0h3f8A1SxVLTa862etalD2ENjFQtaS
ywtczw7rbs0T1SBJ+y1N+LhT2xVEP/ymUX/b0k/5Px4qivM0oT6bo0o6hbosk9pbTTwxsGKs8cZZ
Q3AM1CRvQYq8Z0j86muLG0trvyat4WtpGLwRiC2VI5SFiRJMcnOnfiD05FdgCuppffmzHZ30VtL
5GZnSwbSjZFaMrF9V21hVvR+KJY5FYAbFSfDFXqP12+lv9CsL2S0Fg1zAkoswwf01YVVeShR9mnQ
YoUfN3/KKa1/zAXP/JlsVd5R/wCUU0X/AJgLB/kyuKptirsVdirsVVSZP+Uy1/wC2dH/yfkxV0cVd
irsVdirsVdirsVdirDfOmpfmNZ65pX+GN0hv9Kow1RJCqsayKoRHLlXNG09DTrQ0piqTT+cPzcuF
toYfKP1NpZbITXrmjKCI4D3VEJB+EbAn3HUYpXR61+c1teiWXR4L+1neZI4EdIfRQXSxxPKTvUw8
jRSdjyPSmKsi8j6z5z1SG7fzNo6a08TIttGj+oZAQWZianpVR864oZPirsVdirsVdirsVdirSuj
qsGAJFQa7qaEfQRiqTv/Amp1F/2zpP8Ak/Hiqc4q7FXyq7FUp83f8oprX/MBc/8AJlsVd5R/5RTR
f+YC2/5MriqbYq7FXyq7FumT/lmpf+2dH/yfkxVFyaNaSSNI0lyGcliFu71VqTXZvKAA9hiq39BW
X+/Lv/pMu/8Aqrirv0FZf78u/wDpMu/+quKu/QV1/vy7/wCky7/6q4q79BWX+/Lv/pMu/wDqrirv
0FZf78u/+ky7/wCquKu/QV1/vy7/A0ky7/6q4q79BWX+/Lv/AKTLv/qrirFvN/mzyX5SuYbfWrjU
InuIzLAUubtw4UNVRsAvKqgfN18cUqNh57/Le9vGtI9WuY3EsUEckt1eJHJL0qtGi0Z0JY8+nzPT
fFVNPP8A+Xg1K7sLq/vLJ70ea1kmubu5SNpbeZYJFUidj9p67gfDVugxVPPL+oeT/MKzNouqTXy2 /
H1jFe3nw8+XgtZB14HFCb/oKy/35d/9Jl3/ANvcVd+grL/fl3/0mXf/AFVxV36Csv8Af13/ANJ1
3/1VxV36Csv9+Xf/AEmXf/VFXfokY/35d/9Jl3/ANvcVd+grL/fl3/0mXf/AFVxV36Csv8Af13/
ANJ13/1VxVL9C8i6Domp3ep2YnN7eSSszSyzyPX1W5FstQrAHowBb3xVXF8A5TKL/tnSf8n48VTn
FXyq7FXyq1Pm7/1FNa/5gLn/AJMtirvKp/KKaL/zAw3/ACZXFU2xV2KuxV2KpMn/ACmUv/b0j/5P
yYqiZf0/6j+19U9Lkft5epy412rTatMVW/8A0yf8uf8AyVxV3/Oyf8uf/JXFXf8A0yf8uf8AyVxV
3/Oyf8uf/JXFXf8A0yf8uf8AyVxV3/Oyf8uf/JXFXf8A0yf8uf8AyVxVLTv8vT6u0LapYaZetb19
AzpI/Dky0eNfFokP0YpUE8nQJIKq6RpHqxmNo5DCxZTCkccfFiKjgkKKPYyqT+V2uFjW403S51i

- CMYK Cyan CMYK PROCESS 100.000000 0.000000 0.000000
0.000000
- CMYK Blue CMYK PROCESS 100.000000 100.000000 0.000000
0.000000
- CMYK Magenta CMYK PROCESS 0.000000 100.000000
0.000000 0.000000
- C=15 M=100 Y=90 K=10 CMYK PROCESS 15.000000
100.000000 90.000000 10.000000
- C=0 M=90 Y=85 K=0 CMYK PROCESS 0.000000 90.000000
85.000000 0.000000
- C=0 M=80 Y=95 K=0 CMYK PROCESS 0.000000 80.000000
95.000000 0.000000
- C=0 M=50 Y=100 K=0 CMYK PROCESS 0.000000 50.000000
100.000000 0.000000
- C=0 M=35 Y=85 K=0 CMYK PROCESS 0.000000 35.000000
85.000000 0.000000
- C=5 M=0 Y=90 K=0 CMYK PROCESS 5.000000 0.000000
90.000000 0.000000
- C=20 M=0 Y=100 K=0 CMYK PROCESS 20.000000 0.000000
100.000000 0.000000
- C=50 M=0 Y=100 K=0 CMYK PROCESS 50.000000 0.000000
100.000000 0.000000
- C=75 M=0 Y=100 K=0 CMYK PROCESS 75.000000 0.000000
100.000000 0.000000
- C=85 M=10 Y=100 K=10 CMYK PROCESS 85.000000 10.000000
100.000000 10.000000

- C=90 M=30 Y=95 K=30 CMYK PROCESS 90.000000 30.000000
95.000000 30.000000
- C=75 M=0 Y=75 K=0 CMYK PROCESS 75.000000 0.000000
75.000000 0.000000
- C=80 M=10 Y=45 K=0 CMYK PROCESS 80.000000 10.000000
45.000000 0.000000
- C=70 M=15 Y=0 K=0 CMYK PROCESS 70.000000 15.000000
0.000000 0.000000
- C=85 M=50 Y=0 K=0 CMYK PROCESS 85.000000 50.000000
0.000000 0.000000
- C=100 M=95 Y=5 K=0 CMYK PROCESS 100.000000 95.000000
5.000000 0.000000
- C=100 M=100 Y=25 K=25 CMYK PROCESS 100.000000
100.000000 25.000000 25.000000
- C=75 M=100 Y=0 K=0 CMYK PROCESS 75.000000 100.000000
0.000000 0.000000
- C=50 M=100 Y=0 K=0 CMYK PROCESS 50.000000 100.000000
0.000000 0.000000
- C=35 M=100 Y=35 K=10 CMYK PROCESS 35.000000
100.000000 35.000000 10.000000
- C=10 M=100 Y=50 K=0 CMYK PROCESS 10.000000 100.000000
50.000000 0.000000
- C=0 M=95 Y=20 K=0 CMYK PROCESS 0.000000 95.000000
20.000000 0.000000
- C=25 M=25 Y=40 K=0 CMYK PROCESS 25.000000 25.000000
40.000000 0.000000

- C=40 M=45 Y=50 K=5 CMYK PROCESS 40.000000 45.000000
50.000000 5.000000
- C=50 M=50 Y=60 K=25 CMYK PROCESS 50.000000 50.000000
60.000000 25.000000
- C=55 M=60 Y=65 K=40 CMYK PROCESS 55.000000 60.000000
65.000000 40.000000
- C=25 M=40 Y=65 K=0 CMYK PROCESS 25.000000 40.000000
65.000000 0.000000
- C=30 M=50 Y=75 K=10 CMYK PROCESS 30.000000 50.000000
75.000000 10.000000
- C=35 M=60 Y=80 K=25 CMYK PROCESS 35.000000 60.000000
80.000000 25.000000
- C=40 M=65 Y=90 K=35 CMYK PROCESS 40.000000 65.000000
90.000000 35.000000
- C=40 M=70 Y=100 K=50 CMYK PROCESS 40.000000 70.000000
100.000000 50.000000
- C=50 M=70 Y=80 K=70 CMYK PROCESS 50.000000 70.000000
80.000000 70.000000
- Grays 1
- C=0 M=0 Y=0 K=100 CMYK PROCESS 0.000000 0.000000
0.000000 100.000000
- C=0 M=0 Y=0 K=90 CMYK PROCESS 0.000000 0.000000
0.000000 89.999400
- C=0 M=0 Y=0 K=80 CMYK PROCESS 0.000000 0.000000
0.000000 79.998800

- C=0 M=0 Y=0 K=70 CMYK PROCESS 0.000000 0.000000
0.000000 69.999700
- C=0 M=0 Y=0 K=60 CMYK PROCESS 0.000000 0.000000
0.000000 59.999100
- C=0 M=0 Y=0 K=50 CMYK PROCESS 0.000000 0.000000
0.000000 50.000000
- C=0 M=0 Y=0 K=40 CMYK PROCESS 0.000000 0.000000
0.000000 39.999400
- C=0 M=0 Y=0 K=30 CMYK PROCESS 0.000000 0.000000
0.000000 29.998800
- C=0 M=0 Y=0 K=20 CMYK PROCESS 0.000000 0.000000
0.000000 19.999700
- C=0 M=0 Y=0 K=10 CMYK PROCESS 0.000000 0.000000
0.000000 9.999100
- C=0 M=0 Y=0 K=5 CMYK PROCESS 0.000000 0.000000
0.000000 4.998800
- Brights 1
- C=0 M=100 Y=100 K=0 CMYK PROCESS 0.000000 100.000000
100.000000 0.000000
- C=0 M=75 Y=100 K=0 CMYK PROCESS 0.000000 75.000000
100.000000 0.000000
- C=0 M=10 Y=95 K=0 CMYK PROCESS 0.000000 10.000000
95.000000 0.000000
- C=85 M=10 Y=100 K=0 CMYK PROCESS 85.000000 10.000000
100.000000 0.000000

- C=100 M=90 Y=0 K=0 CMYK PROCESS 100.000000 90.000000 library 15.00
0.000000 0.000000
- C=60 M=90 Y=0 K=0 CMYK PROCESS 60.000000 90.000000
0.003100 0.003100

Figure 5: Figure 5

The clients connecting to a FNAA server can be remote FNAAs as well as FNAs. The rationale is that users of a NP connect to the FNAA by means of a FNA. On the other hand, when a user triggers a new subscription creation, the FNA of his NP must connect as client to a remote FNA server.

4.1.4. Flow Processor (FP)

Whenever a new subscription creation is triggered and all remote flow connection details are obtained, the FNA needs to set up a Processor for it. The communications of the FNA to and from the FP is by means of an IPC interface. This means that there can be different implementations of Processors, one of which will be the Subscription Processor.

In the diagram of Figure 6, we can see the initial interface methods that should be implemented in a Flow Processor.

tYqi/Kwh/nXBcRT63q8Miw+sfqsrJIkrssSL6jRQxsE5erIgxcfCCeuKsv8A+d//A01T/wBPOKHf
87//ANqn/p5xV3/0/wD/AGqf+nnFULqZ83jTrk6kNGawEbG6Eq3DRmOnxc1INRTFW0HSvMdnHpch
1C0ufL02o2DQW0Ly3AjP1h0PoSyVb0/8kswH7NMUvTcU0xV2KuxV2KuxVJfPH/KF6/8A9s27/wCT
D4q7yP8A8oXoH/bNtP8AkwmKoiz8y+Xb28NlZana3V2pYPbwTRyOpTZgyoSVpTvirXmbR7TwvL9/
pV5KYLW8ha0aYUBVCnz8W334qw+7/K/8vtet7iPS5ooYJ7NUjGnvGwj9V/UjuUI5buAV8GwoxSqX
H5N6HNAEGoXyTyyTm/nEzf6Rb3VBNbmMn00Vo4405IoaiLWuKso8u+WbPQfr0d1LK1re3H1oQTSP
MY5GRVkpJIXkbyczyY7k4oTffXYqwfypGuT+XLSW312e0hYy8LdILZ1X964oGeNmp0nFKc/oHz
J/1M1x/0jwf/AFSxQ79A+ZP+pmuP+kaz/wCqWku/QPmT/qZrj/pGs/8Aqliqyfy55hmgkhfzJcMk
q1GU21pQhhQg0jB+44q8ysvys0z9K6ZLa+cLdJrYxzPa2sLwSM0wnqtqJCKdzayaUSwsHcvuSdtsU
qukfK/b22tRWV55rLanAizT2kKS04tGuuccaSt0zqGckHkWJqPpVXeUvyxv7LzBo7w+Y01bToJ5r
nUZoZ2HqfVzEIIhEZLhmb6xB6kjcGASy0xV2m/lx+X+v3+oa5o3mLzTqn1Ka8vbq1k48LeewSf6t
wWRePxSL+8aoPH705Gkt6Z+TV5awqPL5z9RRBcm0QGYej6yRwrcw/wC1Cj1jq5aqsQA0uKrW/Ju
8jt4YR5sgX6tYSWcwf6zR3uHaVCx+uAqoL1QrSvcMvw4qr6f+TV0mpVvPOUlzGFtYJYk9RJZDbmD
lEaXFEFLchOK8hzNa0xV6H+gfMn/AFM1x/0jwf8A1SxQ79A+ZP8AqZrj/pGs/wDqlirv0D5k/wCp
muP+kaz/A0qWkQv1pXmC2tpbiTzJdskSL2W0ztZHIAR8KJCzmfYDFWKDy/ZQiw1nS9ce9s7rVLET
W0SQxw7SG4SrNFEqBJB+1sG/mxS9PxQ7FW0/mDq0q6d5UurrSpHiv11tY4XjWnnpLdRRUFeqvHUo
5FWFBirF5pvzL11X6jYXF4k0UFn04u20sxp6110kn1gxw4Z1aKEcRDRh364pelYodiqS+eP+UL1/
tm3f/Jh8Vd5H/5QvQP+2baf8mExVhvm78rdA/w3I95rEt1bWRmuZ7m7L3VuA9wtwQbaVzGq/Dx4
xgcvc0xS7y3+WPljQLxp115rgLB6KxTSR0Rr1CkUnXqTNOV/mMp9sVS64/J7yy72v1Pz09pDay+p
FDG0JUPbRn1gp5cgA7M7qD8IZ16Uoqp61+TvkyS20y0bw1t1vp4obVwq8bpvRKpGGR1J+E0yffsX
79CraHP5JawmtxyHzHFDam4urgCNYkuR0XjkdULF/iQRfG5JNDx48TiqRY/kdoVzZy6fD5l+vcLe
KNf3cMskXC5ecfEG5pC8hkBRCTaD4qrir1fRdLh0nR7HS4GZ4bGCK2jZiSSsSBATUnwxQwbyraaM
+hWzT+ZLiy1Jk52qXqRkn71tghFR44pTb6j5f/6m67/7imf9Mvd9R8v/APU3Xf8A3EY/6Yq76j5f/
wCpuu/+4jH/AEXV31Hy/wD9Tdd/9xGP+mKvDf01j5QfzRPoNzql7NYabMZm1MrBNbwWj1/NGvp
Kzym81wEQuKcvh98CpPr3l38or1brWDr+rSwtzIJqwRepJS2jgkasrx8zQahGeUh+EbdFwqmf1xv
yw0XWtZ846Pf3mp3H12BjLaNEkKn6zIwcxMVjBVWmZS0230qpFZw/kpP5YgjuLfvLC7htpIpX9Bp
p5nn/cRzc19SKqrbvUUEDjyoMcr5NI/J5NImt31m/e3vzHZR3o0xKNOLh7h3tpDBVIkaqyRRFdvG
owq1f+X/AmPHwcPq+o2lvcSrp37zT0pC+noC3qEx19RkYcaUanUEVGBU28kaD+VF15lW8s9Zvzde
pLdxR3UC24gr6vBpZigHqq8xZHx2Q0mFXqH1Hy/wD9Tdd/9xGP+mKu+o+X/wDqbrv/ALimf9MV
d9R8v/8AU3Xf/cRj/piql2Wkraym0813D3QRvQsXUkRC9PhDMqsQK9aDFWkwR5ZfVLK4iu7qLzC
2o2K3VnPCJKsy/WE+NZIGeUAvZq1HcDFWdeevM0q6LaaadMiWw5v75LMhoj0QrRSyEpGstvyb91/
OMUMGT8+ms7q6sdS0h5rmykyY55bdhEW9C8e2Vlt2MrBeKrybmQHqMU0nNx+Y/mLUNK0i+8vaRym
1T64Yb04XnI/1QqgBiLgWINISCzcqdaHFUu1L8+YLDUJLSXRHoEZoZDcxpypK8QdwyjhEDGS8lSF
xw10b/nIGygMnraM6iK5t7WX/SUJUzqWZuPdk3SqcA3Mb1XFaULX/nIywuKcNDlJAufUvLiN2Bt4
3kHCi0k2T94VNEqNzitPRP0R1byLrjTKEl013RkRW5KrfV2qAxC1APegxQv8j/8AKF6B/wBs20/5
MJiqr5k8u2fmCwj0+9k1Wye8c9xFC5jMohPNY2da0q+oFb4SDtirDLf8j9Chdw+vzSenPFPEZrey
nYLFb/VfTdp4JTIvpUpzqA3xAVxSgv8AoXny56MEQ1W+Kwi4Wr+hIzLPCsCqS8Z2jRF2/Vitp4Py
m0o6PpWmyaheMNEhdNNnVxG8dw8yzi5IiCB2R414qwk/Tvihjenf84/WDJ02qajKJJJJ+EdoQsZj
khijLgoOUitDzLGPYn4izVYqbZ55Y8k6Z5cvdQubB2C6jI0j2/GNY46zSTBYwqgd1iKVp0xQyH
FWD+TpaeXLQf4fnvKGX/AE1PqXF/3r7j1Z0f23XFKc+v/wB+tcfdp3/ZTih3r/8AfrXH3ad/2U4q
71/+WuPu07/ALKcVS7zHd6lH5e1STS/LFympPaTtYt6dhLScRMYj6azyF/jp8IU18DirzXT7r81
bb63pGqeVbXU4dTmmk1aeaycxSRwwRegAbdYo3IC1BMYJI47MMUqK2+tTWsmX8trEX1xGzSgaZcR
wLUW4YjZ+Ufx2tuEVt6N0G2Kouzu/0iX/wCjbb8urC20zVrmGLUZ9UnjU26Nxo7ii7c0asV4r3Fd
yqiNe0T8x9S8ya1cz6PYalodxfw2Fva6ha8i6JMqXJ9JEL9KC0eU+pz0x02KoDTPONzdos35ba
dApvRMHaxlQc4gAairUQjmx9Y/u+vw10Kowxh80eLYyXH5baZE7Jd3PBdMun90YRn0i9W2DNEqsm
503EbjFUXoGqfmDp8kUGm/15ZwSTQRrI5sbiFAx13Zzzf4Q0jFDu4HxdNsVeswzTCFBP5XmaYKPV
aMaeELU+IqGua0r0rihf6/8A361x92nf9l0KtNcEakeVblj4AadX8bkYqhrU7m21tz5Tv4hKjJ6
sTaYki8hTkjC72I7Yqxuf/EsM+nWuo6My2S6lYm31eUUVVp9JX93LHayzBq/wA68fde+KXpuKH
Y7FXYq7FXYqkvnj/AJQvX/8Atm3f/Jh8VSPYj508t2f1nTNP1C8Wwv8AT7aKzu7S5BjKSW3QRuKH

- CMYK Cyan CMYK PROCESS 100.000000 0.000000 0.000000
0.000000
- CMYK Blue CMYK PROCESS 100.000000 100.000000 0.000000
0.000000
- CMYK Magenta CMYK PROCESS 0.000000 100.000000
0.000000 0.000000
- C=15 M=100 Y=90 K=10 CMYK PROCESS 15.000000
100.000000 90.000000 10.000000
- C=0 M=90 Y=85 K=0 CMYK PROCESS 0.000000 90.000000
85.000000 0.000000
- C=0 M=80 Y=95 K=0 CMYK PROCESS 0.000000 80.000000
95.000000 0.000000
- C=0 M=50 Y=100 K=0 CMYK PROCESS 0.000000 50.000000
100.000000 0.000000
- C=0 M=35 Y=85 K=0 CMYK PROCESS 0.000000 35.000000
85.000000 0.000000
- C=5 M=0 Y=90 K=0 CMYK PROCESS 5.000000 0.000000
90.000000 0.000000
- C=20 M=0 Y=100 K=0 CMYK PROCESS 20.000000 0.000000
100.000000 0.000000
- C=50 M=0 Y=100 K=0 CMYK PROCESS 50.000000 0.000000
100.000000 0.000000
- C=75 M=0 Y=100 K=0 CMYK PROCESS 75.000000 0.000000
100.000000 0.000000
- C=85 M=10 Y=100 K=10 CMYK PROCESS 85.000000 10.000000
100.000000 10.000000

- C=90 M=30 Y=95 K=30 CMYK PROCESS 90.000000 30.000000
95.000000 30.000000
- C=75 M=0 Y=75 K=0 CMYK PROCESS 75.000000 0.000000
75.000000 0.000000
- C=80 M=10 Y=45 K=0 CMYK PROCESS 80.000000 10.000000
45.000000 0.000000
- C=70 M=15 Y=0 K=0 CMYK PROCESS 70.000000 15.000000
0.000000 0.000000
- C=85 M=50 Y=0 K=0 CMYK PROCESS 85.000000 50.000000
0.000000 0.000000
- C=100 M=95 Y=5 K=0 CMYK PROCESS 100.000000 95.000000
5.000000 0.000000
- C=100 M=100 Y=25 K=25 CMYK PROCESS 100.000000
100.000000 25.000000 25.000000
- C=75 M=100 Y=0 K=0 CMYK PROCESS 75.000000 100.000000
0.000000 0.000000
- C=50 M=100 Y=0 K=0 CMYK PROCESS 50.000000 100.000000
0.000000 0.000000
- C=35 M=100 Y=35 K=10 CMYK PROCESS 35.000000
100.000000 35.000000 10.000000
- C=10 M=100 Y=50 K=0 CMYK PROCESS 10.000000 100.000000
50.000000 0.000000
- C=0 M=95 Y=20 K=0 CMYK PROCESS 0.000000 95.000000
20.000000 0.000000
- C=25 M=25 Y=40 K=0 CMYK PROCESS 25.000000 25.000000
40.000000 0.000000

- C=40 M=45 Y=50 K=5 CMYK PROCESS 40.000000 45.000000
50.000000 5.000000
- C=50 M=50 Y=60 K=25 CMYK PROCESS 50.000000 50.000000
60.000000 25.000000
- C=55 M=60 Y=65 K=40 CMYK PROCESS 55.000000 60.000000
65.000000 40.000000
- C=25 M=40 Y=65 K=0 CMYK PROCESS 25.000000 40.000000
65.000000 0.000000
- C=30 M=50 Y=75 K=10 CMYK PROCESS 30.000000 50.000000
75.000000 10.000000
- C=35 M=60 Y=80 K=25 CMYK PROCESS 35.000000 60.000000
80.000000 25.000000
- C=40 M=65 Y=90 K=35 CMYK PROCESS 40.000000 65.000000
90.000000 35.000000
- C=40 M=70 Y=100 K=50 CMYK PROCESS 40.000000 70.000000
100.000000 50.000000
- C=50 M=70 Y=80 K=70 CMYK PROCESS 50.000000 70.000000
80.000000 70.000000
- Grays 1
- C=0 M=0 Y=0 K=100 CMYK PROCESS 0.000000 0.000000
0.000000 100.000000
- C=0 M=0 Y=0 K=90 CMYK PROCESS 0.000000 0.000000
0.000000 89.999400
- C=0 M=0 Y=0 K=80 CMYK PROCESS 0.000000 0.000000
0.000000 79.998800

- C=0 M=0 Y=0 K=70 CMYK PROCESS 0.000000 0.000000
0.000000 69.999700
- C=0 M=0 Y=0 K=60 CMYK PROCESS 0.000000 0.000000
0.000000 59.999100
- C=0 M=0 Y=0 K=50 CMYK PROCESS 0.000000 0.000000
0.000000 50.000000
- C=0 M=0 Y=0 K=40 CMYK PROCESS 0.000000 0.000000
0.000000 39.999400
- C=0 M=0 Y=0 K=30 CMYK PROCESS 0.000000 0.000000
0.000000 29.998800
- C=0 M=0 Y=0 K=20 CMYK PROCESS 0.000000 0.000000
0.000000 19.999700
- C=0 M=0 Y=0 K=10 CMYK PROCESS 0.000000 0.000000
0.000000 9.999100
- C=0 M=0 Y=0 K=5 CMYK PROCESS 0.000000 0.000000
0.000000 4.998800
- Brights 1
- C=0 M=100 Y=100 K=0 CMYK PROCESS 0.000000 100.000000
100.000000 0.000000
- C=0 M=75 Y=100 K=0 CMYK PROCESS 0.000000 75.000000
100.000000 0.000000
- C=0 M=10 Y=95 K=0 CMYK PROCESS 0.000000 10.000000
95.000000 0.000000
- C=85 M=10 Y=100 K=0 CMYK PROCESS 85.000000 10.000000
100.000000 0.000000

- C=100 M=90 Y=0 K=0 CMYK PROCESS 100.000000 90.000000 library 15.00
0.000000 0.000000
- C=60 M=90 Y=0 K=0 CMYK PROCESS 60.000000 90.000000
0.003100 0.003100

Figure 6: Figure 6

Depending on the use of the processor, different data structures should be added to the different methods. In the case of a Subscription Processor, the minimum information will be the remote and local Flow connection details. Moreover, the interface also should include methods to update the Processor configuration and to destroy it, once a subscription is revoked. Finally, due to the nature of the stream communication, there could also be methods available to pause and to resume a Processor.

There can be different types of Processors, which we can see in Figure 7.

Nf0axs5NWEe9nqE800ifVvXZ4ZLRY2f618HBRM427kYoSG1/MD8wLC2l07VrWyOrWJ0u0uLidqf6
Tqsnpq8og/dcYxu/A9dh4hSvj/NLzRLf32lPbPmF5ojXB1S9vJ5La0mSC4jHAgZuRiY+qKlyWduH
fFUJD+cPnG5F5NbaHE9u63H6N58o6Nb3KwDnI8irMwqfHQKedE3ritLv+VweY1MBkbtNbe2Z01q5
MV4PQdbgRenNAA09qeDD4ykictgeuK03d/nB5mtNntdVlsLKS11dLiTS7ZG1WaL6tewXwW6Y8geS
zdVUCw2ocVes2v1n6tD9a4fWuC+v6VfT9Snxc0W/GvSuKEH5i/5R/U/+Ysf/AJNtiqj5R/5RTRf+
YC2/5MriqbYq7FXyq7FXyq7FXyqwbyxoFv5m0ilZBrdxdXNzqfKeKCK7uIIbeIsRHDGkEkY+FQOR
NSTiqA83ad5Y8uz2KHTb+7iug7TSJq0oj0kjkhjqQsj1qbgdSPvxShPLV9+W3mPV10rT7XVxcmL1
+Ut1fJGIWAWb19ZP2S6rt3YUqDXFWU33kfytaWVxdGG9cW8Ty1BqF/VuC1qD9/3pihjemeUprPyM
vmS11S7j176p+k0nNXLJABw9dbZopHZwi4/CeVT3rirMdp8AN9hdWNvcvbx0bzRJIyCwvXALKCQG
WEqw9wcVY75n/N/TdA1i0sZNNu7iC5j5tKI5IJIPIqFWC4Siv068sVTDQdT1Pzvc3kcM9usujWh
9G6ieCVf9KudmRwPvG2KsvXvg+o65+XusazNYeY9IHnZpzNCs+rWtu6BvTE5WN3MhAMX7w9Bx30K
r5PN/wCUtoC7XemRAJBdFljTcW/BLdvHxDouSgg+0vQdMVSTWZ/yw10270+xfT7eZihYabb2zSMY
t9YVsrxtDiRyKOCu3iN1LX126/JVdB0z1JrG9Fs8s0dzqMUDTzTzMLiX1SqCOih7hdhRQaBdwMV
ZiPNXleeLStYtMf7HqEv1Cwv4IjJxm7DkrSURGjPEvIG1SB4YoSnX/NfkW11DVLVD9NV42ltbXV7
qaC3aByyxvD65duTpEs6tVlou9MUqFtqf5L39rYQRJpM9vbu360ha3jISRNVX9NGT4WMjLXbc79R
ihVtrj8o73XbztUtdM0tahJPa3lvJbRrLcNBITKG5J8Y5xk1/aKk78d1VKeL8sbfRPNsp12A2+ix
q2CRmxjWUXEk0cS8FlCEhpZ1bkx3+174qpQeYfyiw/uku70w07U7+QLdw3VvAJZyViugz1PUBHJ1
arHdwT1FcUsx0bzFomtJJJpV5HeJFQSNHUGFq03p7Yob8xf8o/df/MJP/wAm2xvJvK3mPT4/LGkR
tDe8ksrdWK2F661wJRsywSrdwINMVSzP+b+m6BrNpYyaZdz29zHzab05IJIPIqFWC4jiL90vLFU
RLqL+a9es9MD3unaUtib+7tiJbk5mdpfSSJz8EgjUBieDfFtviqtrvlHyrp0iahrw97MthbTXRi
XUb8FxDGZOIPrgleNMVYU/mf8trNpYdYsdwBqBqTxreajIqLT7bM0sTAA7EFa4ppntn5G8rXVnB
crBfxCeNJRHF36uodQ3FgJzRhxFFCRp5K0i88630nrLdw6bp1nBNLbc+vC081y8nEszSswSNYf2
SNziqG+t6z/ib/AP6UuPqfret+kfUP136p6HrfV/V+1y5/t/a44pZJF5R1rT2li0LXwsNND2ljsZ
ba05WjPcWcRuzIwQsa8T0xQqfOpzx/1NEf8A3D4v+qmKu/Qfnj/qaI/+4fF/1UxvX0LzuQqfM8ZB
2IONRf8AVTFUqsfy41iLTrOt35kkn8v1o+nRwYqsYurYw+vzeQRmtCP5dumKs6RERFRFCooAVQKA
AbAADFVhtrY3AuTEhuFXgs3EchwNePLrSvbFWPwf+TGvv+2Paf8AUVC4qyTFWP6n5E8t6nPeZxLu
0j6hy+tfvHUNZthaGnEin7oU2+eKpV/yp7yMNH0kRWssVkw5hEnkqpK8TQsTt7HbFNqtr+vHk21i
WGKG49F0fpxPdTuieqgSQgruQC9KsepPXXFFoaH8lvy/ililFnM8sBYxyPcTMw5IiChLbcBEvCn2e
2K2htY0vyd5W0ay0b09Sa001JdYVLOR3dVhmQtJIEs1HqS1A6D4jsATil3nG0/L6ebUbfVdKuLyw
9Wa/vpoYmVmGnxRI8azMYyf3canghNfmRVVHad+vfkRj7HVYLeS4uLd47q2vJJ5Zhd1le4WRmZjz
Jewu/t4YoR0f5c+Vo/MQ8wJDMt+Jjc8fX1MjMik+MxFuFqbiVhTsXbxvWvTyNoYtb20m9e6tr+6h
vrmK5laVwmt5UmQ0avwlol5DuBQ4qgNQ/KfyP6hNez2TK844ywxSyRQKCH0F/dR1U+BK8dtia4q
nPlryrov1qxsdiHMFtLKZ3Qsz/vGVUJqxpZBiqt5i/5R/U/+Ysf/k22KqPlH/1FNf/5gLb/AJMr
iqZG2tjcc5MSG4VeCzcRzCE148utK9sVSjxVlkuoXlrvHfPpmrWavHHdIiyq8U1C8UsbUDrVQRv
sd8VQn6D88f9TRH/ANw+L/qpirv0H54/6miP/uHxf9VMVd+g/PH/AFNEf/cPi/6qYqgJvJpM2TV4
9XTzSsv+kX1ZpFsI6PDy58HUY8TRqkHqMVRP+AIVnqfpG9p/wvr/6c4p6vr8PTp6d0Hpen8Hp9
KYqyzFXyq7FXyq7FXyq7FwNwf+TGvv8Atj2n/UVc4qyTFXYq7FXyq7FU113yfpmtXy3F40gja1ms
byCKSSH14JwV+DPE8bjydyjQhiDiqH1fyFpGoW5UT3kV0sEttBdNeXcxjxnXhL8EsrIxZe7g70OK
shtreG2t4raBBHCixxRjoqIKKB8gMVVMVdirsVdiqX+Yv8AlH9T/wCYsF8A5Ntiqj5R/wCUU0X/
AJgLB/kyuKptirsVdirsVdirsVdirsVdirsVdirsVdirsVY7rGia9+nV1rQ7i2S4e2FndW94jtG0
aSNJGymNLYMrSMPAg4qp8fzL/wB+aN/yLuv+a8Vdx/Mv/fmjf8i7r/mvFXcfzL/35o3/ACLuv+a8
Vdx/Mv8A35o3/Iu6/wCa8Vdx/Mv/AH5o3/Iu6/5rxV3H8y/9+aN/yLuv+a8Vdx/Mv/fmjf8AIu6/
5rxV3H8y/wDfmjf8i7r/AjrxV3H8y/8Afmfj8i7r/mvFXcfzL/35o3/Iu6/5rxV3H8y/9+aN/wAi
7r/mvFXcfzL/AN+aN/yLuv8AmVFG90/8xb+znsprRSyIbqNoZZoor1pFSQcWZAz8SwB2rirJN0s
orDT7axhJMvREKEZbdisahRX3oMVRGKuxV2KuxV2KuxV2Ksbn89WAup7ex0/UNV+r00M891b84V1
X7Uf0yQKwvxriq3/G0v/Uuaz/0jR/8AVXFXf421/wCpc1n/AKRo/wDqrirv8bS/9S5rP/SNH/1V
xVCaf+aeg3bB5L0/srEyeh+kri3paCSvHi00bSKPi2qdvfFWY4q7FW0axrPmB9fXRNDitRNHare3
Vze+oUCSSNFgiLeQeRMbEknFVNh8y/8Afmfj8i7r/mvFXcfzL/35o3/Iu6/5rxV3H8y/9+aN/wAi
7r/mvFXcfzL/AN+aN/yLuv8AmVFXcfzL/wB+aN/yLuv+a8Vdx/Mv/fmjf8i7r/mvFXcfzL/35o3/

mdm5Fq+tcNMyjf7IGKq02kt5U1uz1Kws7u/0j6mdPuYowlu7mEiX1Y5Ars7uhqwKr9nsMVVta8z6
Zquj3+lzabrUcV/by2sjpp13yVZkKEisfUBsVYbfeV/LU9xPPbN5qsX1PKJIL08CRmL0Q5RMzNTu
zYptnNp5x0y1tYbaLS9Z9KBFijrpt4TtXBRUmPfyY0SyeapLTzhcajDourz6fqVrDDcsNPuRJFNa
vIUPFkWqMsx6GtRiqH/R/mD/ABD/AI8/Rc/D1/S/Q9B9b+pej6XrcK/3nL4vT60264pelYodirsV
dirsVdirsVY3B/5Ma+/7Y9p/1FX0KskxV2KuxV2KuxV5pr3kvWtW843t3bcr08triG+0zVW5GMK1
l6UMQoCCEu1l9V06Se+KwrDyd5hsdF8rWsaZdcXui3CzXEpu3ZVQW6xuIUZGC8iS0Kj9n1l1c4qyz
yDZXF5VtIZ7d7SslzLb2kmzw281zJJBRMP2THA6Lx7UpihkGKuxV2KuxVL/ADF/yj+p/wDMJP8A
8m2xVR8o/wDKKaL/AMwFt/yZXFU2xV2KuxV2KuxV2KuxVgXlHypoHmHQ7fX9dtU1TU9T5TzS3FZB
HVjxhjUmiLGBxoMVQ/mvy15a0d7RbDyXbanHMHa5kQBfRVJIox8AVi5b1jQDw8K0UoTy3a+R9b1V
NPPkSaw5Q+ubq7tVjhoAQQDE77uvHbcGvY4qyXUPy/8AI9tYXNzH5ftJJiYnkSP0h8RRSQu3jTFD
F9M8i+XrL8vU8w2dLbXRY/pRNvhZkKTen6/EIP4emPsFONCPFFwa6b5j1S6061um0G95TxJIXVrM
LV1BPEPchqeFRXFWm+aPzF82aV5gs7Gw8sz3cM0Bl1tWaa4JDleSvbPcxqn+sK4qmuhXl3eeeLm4
u7KTT7h9GtOdrK0bsp+tXP7Ub0tPx9hirL8VdirsVdirsVdirsVdirsVdiqX+Yv+Uf1P/mE
n/5Ntiqj5R/5RTRf+YC2/wCTK4qm2KuxV2KuxV2KuxV2KsaPk2e1nnfRNau9JguJGmls41t5oBI5
5M0azxyGPkxJIU09sVb/AM0eaP8AqbLz/pFsP+qGKu/w55o/6my8/wCkww/6oYq7/Dnmj/qbLz/p
FsP+qGKbbp/5Yxw9sNPutavrzRvU9VtKb0o4GYtzKt6aBvT5b+mpC4qzYAAUHTFXyqxDVtVtC88
NqOpLLFp97psVtFdJfJKgmgnldo29NXIJWUEVHY4qif+VkeTv+W2T/pFuv8Aqlirv+VkeTv+W2T/
AKRbr/qlirv+VkeTv+W2T/pFuv8Aqlirv+VkeTv+W2T/AKRbr/qlirv+VkeTv+W2T/pFuv8Aqlir
v+VkeTv+W2T/AKRbr/qlirv+VkeTv+W2T/pFuv8Aqlirv+VkeTv+W2T/AKRbr/qlirv+VkeTv+W2
T/pFuv8Aqlirv+VkeTv+W2T/AKRbr/qlirv+VkeTv+W2T/pFuv8Aqlirv+VkeTv+W2T/AKRbr/ql
iqD1rz/5YutHvrW0nmbu4t5Yre3jtbnk8joVRRWMCpJxVxKl20ns/L+mWlwvCe3tIIPvQDR0jVW
FR7jFUwxV2KuxV2KuxV2KuxV2KuxV2KuxV2KuxV2KpBrPmS+ttXj0jStMbU74wfw5wZkt444S5jQ
l2DVZmU0AHbFVD90eeP+pXj/A04hF/1TxV36c88f9SvH/wBxCL/qnirv0554/wCpXj/7iEX/AFTx
V36c88f9SvH/ANxCL/qnirv0554/6leP/uIRf9U8Vd+nPPH/AFK8f/cQi/6p4q790eeP+pXj/wC4
hF/1TxV36c88f9SvH/3EIV8Aqnirv0554/6leP8A7iEX/VPFXfpzzx/1K8f/AHEIv+qeKu/Tnnj/
AKleP/uIRf8AVPFxfpzzx/1K8f8A3EIV+qeKqdz5n8321vLdXXlgC2gUyTmk+idxGgqxVCi8iA0l
d8VZJZxcF5ZwXcB5QXMaSxMdqo6h1NPkcVVeS8uNRypwnemKpXrvmTTtG9BLgSz3d2Ww0sbZDLPK
UFW4IOyjckkAYq13+Npf+pc1n/pGj/6q4q7/ABtL/wBS5rP/AEjR/wDVXFxf42l/6lzWf+kaP/qr
iqEuPzLtlE8hsZNC1j67cAtDbLbRtIyLsz8RLXi05xVMf8deXf0P+1PVk9P1vqn1X0n+tfWq0+r+
hTn6lf2ae/TfFWYq7FXYq7FXYq7FXYqXuD/AMmNff8AbHtP+oq5xV0rnVtLtbio2ubyCC5lAMUM
kiI7Amg4qxBO+KqyXNvJNLBHKjzQ8fwiVgWtmKryUbio6VxVUxVQtNQsL1S1ncxXKgIxaF1kAEiC
RD8J0zIwZfEGuKq+KuxVDX2qaZYKjX93DaK5IRp5EjEdQ0ZFcVV45I5I1kjYPG4DI6moIO4II6g
4quxV2KuxV2KpF5i/wCuF1P/AJhJ/wDk22KpF5W8txSewdJk0oX6mSzt3KrdSKo5RkAKaAAdSMVS
fzP+U95r0vWeoQa9c2kdpFwVi0twG5lqJJVCo36knFUT6Vv5V822Fqx19PPP8+ntYwatfur8bgT
+qY5ZQqBea/ZLdeNK4qn0t+Y9AvNGv7Sy8w2NreXntNfbXQuogYpXjKpICrVHFidtirDJP8AEdtc
T/or8xd0jtd8UMV1JDctypT4nmMjqu3RW/tUs8tfnPlqK2hjn1+xuJkRVlnNxApkYcjoVVuI5Heg
xQx1PNnle08/3U9zql00GoWfVfZ3gnjaKNoJJTLczgkIX9RWFaVp44qkn1+1/wAbf40o3+FvrX1b
69xPp+r9V9D61T/ffP8Adep0xS9Fv/MvlzTp/q+oarZ2c9AfSuLiKJ6HoeLsDihd/wCOPJf/AFf9
N/6S4P8AmvFXf448l/8AV/03/pLg/wCa8Vd/jjyX/wBX/Tf+kuD/AJrxVws/NXle+uFtrLWLK6uH
+xDDcxS0fkqsScVTFXYqxuD/wAmNff9se0/6irnFWM+crSzXz9Jear5dute0ubrFtY0gsjdqZ/r
UjFK04o3A9SRilhx0f8AMbStkhtLiTVFktobZRHareyxuVs2/ctNysJ1Mb1VDKRR8h8fw9QqZ+U9
P83yeb4Uu4Nb0+K8v/r2rSySzGF4m0qH0Y31FImZLiJkfgg/sr04gFUHpmmed4XtjDFq9vrVy2gg
uBPHatGmnwx6gb1v7rkvEqfU3DU478sVU7y4876tD5dN7peumy0yDSDrEbr3CTPd2lyyXUsYRler
mUh+Q3Io3bZVXjj/ADDexhjtW16PVGhjXzFJ0bn0xdHvBYA2PqAxUFv63L0f3fpfa3rir0f0flrU
dQ1nytBZJDNDzi7We51G2fUIVHoKqmZPVgLM5GzF+vjihit55P8AOhl+1u9L0a81Cw10/SYZLY2I
NvdJcXGo3Ml4IYgwUSJbSujQMSPH6kLi1Dz/AOJRPMXPmr/CJnuv0ULMXJ1f1RFael6vr/vvQ5/W
PT9bb+famKof0/zMk1zV/Vudct6nUuPp280fS0ZFmUImjsTIvwsBbr6leQPbFUPczfmCdMVo01z
lbS3QtoEGrBbo1CjJK4N3AytyCleI8VeXxUpiqK1b/ly31e+exGuL5gB1dtRwtwbMQ/F+jxZV/c
E/3fh0fj+1y2xV6zql0LTyrf24mln90znBmnf1JGJjYksx+eKG/KP/KKaL/zAw3/ACZXFU2xVLde

VfirErrs901P8xJo9Rto7yG10mB7eGdFkjR5rmYSMFYEciI1FcVtf/CP1T/qy2H/AEjQ/wDN0KpX
rch5d6I9tHqG1W0nvC62tvBp5suppPTX1IVit4pZCEXdxoMVW6RH+XGrxNcWgm2MloI4pRdNZxxx
MJmdFCs6L8QaMqy9QdjiqYDQPI5IA03TCWIVQIbfmdJAA+HqeJ+7FUJqIn+XumWct3c6bp5iglhg
mEdtDIYSXEYwRh1VSRWRwMVQet3X5YaJffUdR0y2S5EAu3WLTJLhUgLLPUkeCCREXkpHxEXYqmcGj
+QZ7NLYGw0t7SRF1ScQ2/Ao6qytXj0Kup+kYqrf4b81/uv8AcXpv78Vg/cQfGKV+D4fi28MVW/4f
8j01P6N0ykBpOfQt6Ie1H+H4fpxVv/D3knnEn6M0znMOUK+hb1daVqo47j5Yq0v17yQ70qaZpjNG
wjccc3JVyaBT80xr2xVWxyn5SZQy6NYFSKgi2hIIP+xxVL/MX1LysNA1IrpFkjrazMjpbxKysIyQ
ysqggg7gjFUz8sTSz+WtJmmcySy2Vu8kjGrMzRKSSfEnFUebq2FwtsZkFyy81gLDmVG3IL1p74q1
mu+ZrXSZba1FvPfajecvqthaqrSsEHx0xZkREWoqzHFUF/iPzR/1Kd5/01WH/VfFxf4j80f9Snef
9JVh/wBV8Vd/iPzR/wBSnef9JVh/1XxVA3Pn/VrfUoNmK8r3xv7hDLHBHNaSH01IUuXSVgi1NKtS
pxVG/wDKwNE/Rf1307n6z9Z+o/or0v8ATfrXX0fSrSvH4q8uN0+KpXoHmTRvLX1/RteuF067jvbq
4inuKqt1FcZNMkyyEcWNH4sK1FMVQPnLWPJHmSKKJfN80nrFFcJ+5dw5PMgVgAPG0ZFadfBlxShN
L1nTrbXYNQvfzIS8sommMmmkRoknqM5Xk6sKcaptxpsQKKQFVZd/ysjyH/1fbP8A5GjFDFPJ35g+
VtP8sto73AvNTsnnijs4FaY3heVnjMJUMG9bmK16GtcVZL5V8razp/lzTb0fWby3mgt41kt4xa0k
bU3Rwkt5GIXoKscVSz1+XGu69faVPb+Yri3+oGZjcyLGJkMnDj6ItktuvD4uTeF0+Koryzpd1pn
nS6s7nUZ9U1TR7St1dcPUP8ApNztVVU0/wBYk++Ks0xViHn/AELUNSFTriz00ag1mZqPDeY6dewP
KoUSQXEZC8SAQ6N128Mvedah5U806MbXXfNkcWswxT6cLuGdnnj1WNdQiX13jgc1txeQ/G0fFmB7
0xSp+Uvys1W88sveT2EcV7LHpkuiz0eMsHo6jcxEzJzCvH+4lQivXpirVj+UPnaC7nvTa2qzXTRQ
3wSeNRJ6eqwX/wBZjSOCP4RHCupI5k367UxV6Hr3ke+1nzw+ove3Vjpt6StjJJZSpFJJ9Yd2jaq
uwTg3VafPFdH9R/K+6gvb2507Sra6tbfUtMlSrCARR6+n20nx2rW5dw9AsqBwH2YoCcUoLS/y08x
2N7bzzaHp1+ty8ckMc05CaMF1C4uy1txvWYC04QD0yPiXf4cVSzS/wAnvM1tYSwXdiLmS3hhgrHd
2cQuwJulupWRRY/EV90o+ts9eTA9a4qi7b8sv0i30kz/AFG0tr6P0hPeI9s0EMud5LcAfVxbqY51
ST4xtXRS3amKrtP/ACp8wc9KjuNjSrW206PTrPUUimVxqH1a9Sae7kARA1jRjxf4jyIxV7PHHFG
kUSBI0AVEUAKqgUAAHQDFCB8xf8AKP6n/wAwk/8AybbFUm8r+XdP18s6RK0t6GksrdmCX96i1MSn
4VWYKo9gKYq1Hmj8n9M8waxaXsupXcFvbx+m8PqSTyseRYFZ7iSUp16ccVVJYLLy51sr+8luJNH
l082DancySXLRTL6o9Z25FEkXYU+EEdBiqM1rzx5H1LRr/To/MlrayXlvLbpdJIC0TSoUEigFd1
rXqMvYw/6LguJm0n8zVsLZzzigKRygpSnJ/jRW27BQDi1ndp+YpKwC1hgbzDbTNEio00koLuVAHJ
j4nqcUJcN5g+TbPzzdXcmqQTWepWvVFFdo3MQyW0kpaJuNWU0JgwPSoxVBfWD/i7/Hv1eb/Dv1j6
v6vpNz9P6t6P1306cvS5/Dwle0/tillMGr+btZubyXRPqFrpVrPJawzXkc08k7wMULkURSrKsYcF
V3NaV2xQhtX1jzdo8ayanrGiWyuHZ0Vpdk1Yxyc0W4Joo0+Kq4u/OpnWAaxoJnYsqxehPzJQ8WAX
61X4W20Kon0PzG/5btH/A0kS6/7KcVSXSNe/MvUdMn1a2j0q5so3lFrCsdxFndJC5Q1D6six8yp4
cq++Ksy0bVlfVtJs9Ttq+heQpNGD1Ada0Pu0hxVD6z5o0DRZ7SDVr20ye+Li2M1VRvT48qvTgtOY
+0RiqV6fc29z+YF3PbSpPBJo1oY5Y2Dow+tX04Zag4qyjFWM+c4/MwN1NoV5cxMXmWe2hit5I2CW
k8sZcyxS0vKe00PZh1p1NcVeeap+Z351aPffaXfLZCa7hluYorikWNh6Vq80hAa4XhFG0aJetat8
S0xTSP8ALf5gfmprgh1h0mzSxmaIJf8A1a5aNo5LtYHmULOVIRCzF0daDly44qjov0f5pP5NXUP0
FGNeOpG0e3a0uUjW19Esswh9VpmX1eKc9u540FcVauPN35vpfwwpoFt6AuZraaT0blw6wPGRMjpJ
8EcsUjCwPwXKR3AxVLLvzr+ddtN636Djmh5QxCKKwGDc19SV1UT81ZeaJ8b8DRj1BGKp/q3mL8y
bHztHp1rpy3mg3V7Cq3X1WRvTtXFusn75JVR0PKd+Tqd1pSjLihE6NqHn4+dJLXUInby9JNfPbXH
oovBI2VionYctKfHG/7XJga8RiljF3r35zaPpenXi2Umq3lzaB7mF4frIjkeMMA0vtDpzI/qDgU5
PwDE1amKqmo+e/znt/rAj8sxH0GKiRLW5uPU4yCI8EjmwvLi7r8X2eNcVesws7RIZqVd1BZSACCR
uCAW/wcUIHzF/wAo/qf/ADCT/wDJtsVsbYv5o8sw+wdIhm1eyj1jsrdJI3uIlZWWJQVYFqgg4qh9
Z/NnyVpOpw9lcXnqpOnP65bcbiBNy0LmJmcNt0CnFVSfz1Lq13Z2PlCW0u5LiFrq4vp+bwQwKwQA
xoUcyM5oFJFKb4qqXb+fr01mu7rUtGhtreNpZ5WtLoKiICzMF9J6ACuKoK013zRdgmHXNBJD+kVa
2uUbnTlx4vcqemKphGn5hSxpLFqGjPG4DI62tyVZSKggi53BxVLTqn5kP5i0i282kStDbrC3lyba
6VI1kcpEm1wxZ34MabbDFXf428wev/h76nb/AOLfrPoUrJ9T9D0vw+t/z80G3DLX1tXFURYp5n8u
T31jbaQ2r6VLcS3VhLbzwRPELhzK8MiTvH9mRmKsCdjiqF16G815UXvfJV3cC00aKMNdWHwi4UI7
L+/2ag+Fuo7Yqlum+V7TTdag1my8iXkwoW3P0ZfrtmQvqepy2NwR0mI9gFH7IxVlH+I/NH/Up3n/
AElWH/VfFUG8vSfmFpekS6LbeXTGiPKul31xd23GK0Vyyeukbys3pcv2PtAdBirItH8h+WNP0u0s
pNntLuW3iWOS61t4meRlHx0xKk1Y74qhda/K/wAlavPaSX0nRxJa8/3FqFt0k9Tj/e+kFduPH4fi

HU4qpaFo2laR57vLPTLWkzthpFo3pRKFBb6zcDk1N2YgDc74qyPXPPrn6E1D6jy+u/Vpvc...
eHH35UpiryMHZh+eiWMyby8sgFtMwuXtyJRK0axEwi4Yn4lQU7g8t8Utyeavz1lsJWxQ15...
H7008cZLONrAETIXV15fANzSm6qbalrn5sWt/pNnp2nia1ksbU3dzNAZaTsJ+u0kgmjKs...
gXNRTFUTqcv50XEX1/6vILaWvPitVa03DRrLHcxrHM6GT1Ajwh2KhqePUYqo6Lrf5q6hpe...
Zzx28RsIokanzK1CQHdSWHA1beqtt7BVJr3zj+dMF7b2FvpkVzcywJclRaInnhty6MTNR5...
hgygUFcVtMz8wfm1PZa7f/ox43js0brBKa3RS06zSeqSvqK5YQtHRWajHp3qqpaXc/mzq...
lp+syXGmxasjQkiJF60ZmleMNL9pHb1V5HiAQOmKo1f+Vg6nY6I5insbiafUZdSt2nFv...
azYLmVGM0wifeO+KsetPMX56RrHappAf0obaMy3EP7ckCJ6h1Ev7w+qxUcRx40xvk3kxX...
zFfw+ZNNFlpJto7iyYRCckknFvRaTm3NkV6Gi9V3p3VZZ5i/5R/U/wDmEn/5NtihR8o/8o...
bf8AJLcVXaj5X8valqEwoajp8N5dwx+1E86iQKhPKGRqp17oriqW61pur20u2uvalaLFB...
dIWMPP1I3hZ+KBkaoksaEHFVHUT17UtOutOu/KN49reQyW86C7sATHKpRhUT7bHFWL6j...
ln8g3iyXAozRX1pGFHhGqXIVR8him2W2+ueYreCOChyhdPCqxxoLqwoqqKAD9/2GKEp...
axaeVrhra8to7a+t5LuyVucDu0UqMJnr8MrKV27GuKqf+GfNP6T/AMZfVov096/L9Deq...
H1vs+t+3y+zXbpiqN0fTbjzR9c1e+10+gga6uLews7K5ktY44LaVoQXELAtI7IWJY/LF...
Xhgd59evWmjnl4wajenilsgdy3Fn4ijfaI4juRilDaXrHkbVNct9FstX8wSXt0ZRFW9v...
0gpX0nI7/CR1FMVZd/gwx/6umsf9x07/A0qmKGN+VvK+o6v5ebWI/MGqwXt200mnxtetz...
rpIz+p9j4+XiQMVD5d87Wuo6FYXtz3a3NxAjziGxvJI+ZHxcHSJ1Za9CCcVS7zZ+bGle...
sLya3vDKJZDBNbunp8KcEuI4hJXnvrtpxvU8ta5Z6350udQtI544ZNHTkLcRPC/+9Nwe...
aWq++Ks0xV2KuxV2KuxV5z5km8+N55k/QzymGwj7mKx5hbe5gEc5ljb1tzlkhphv2Dw...
5qfVYJ2luiiWmn21/BMYowDPIzXdxFIj7tEEQmxi5I7HqoxVnvkifUryjnpc2pM73jw...
03kHZ2Tize+KE7xV2KuxV2Kp5i/5R/U/wDmEn/5NtiqTeV/MwnxewdIiaK9LR2VurF...
LLCVYe4NMVSzL+b+h6BqtVz3dleNBPEZPX9GSF1bkVp6NwsLMNvtA4qrTaqfNeu2wnw...
0oXDRCWzuJi0npRxmVJFRaMxK/a2xVw1vyzpk6Nf6pLq0tSx2FtNdPGmp3fJlhqyFV...
h83+SLZpYtVv/MNhPC1JY2vb88EoDzk5MjJvtQrXFNM6s/J2nXVpBdJqwtIk8ayqj6...
Q0IrvihJo/KzXxNg502PwDXh0/TbSGaZBqN0XlmuXkC7s7URFhPShqcVqV17Xf8AEf8...
v636W5j659T9D1vQ9SlefqfD6NxjirJm8q61Z395caDrC2ntfym5ns7i2+tIs7/3j...
+KufRP08m0mv2T7Ffi0snZtiN7rvirQ0LzqH9Qa9Yh/5/wBF79z1+tf5R+/FV/6J8+...
9lWkPtZeQfNFta3dgvmcR6ZeySSTw1vZLgyCckyrBI80vpciT2NK7UxVmdhY21hY29...
Cg3oiAKo+4YquLS7SweK4lgjKnt+XoTMqs8f0nLgxFV5UFaYqxPVNZ03QvPj3mrTCz...
BERlguJnePn0DcZVMVRv/KyPIf/AFfbP/kaMvd/ysjyH/1fbP8A5GjFXf8AKyPIf/V9...
d/ysjyH/ANX2z/5GjFXf8rI8h/8AV9s/+RoxV3/KyPIf/V9s/wDkaMvd/wArI8h/9X2z...
/KyPIf8A1fbP/kaMvd/ysjyH/wBX2z/5GjFXf8rI8h/9X2z/AORoxV3/ACSjyH/1fbP...
rI8h/wDV9s/+RoxVA67+YXkubRL+G31e3uLiW31jhghb1JHd0KqkTSSSaYqyHy1bzw...
PBZ28cqHqrpEqsD8iMVRMnafJeR3s1rE97EvCK5aNTKqnfirkcgPpxVLNd8uz317ban...
VolufTEySQQzRSxkpyXkoI+IEHFUK+j+eXuO/mCyZGBDKdMJB6gj61iqx9B860rK+u...
1BPv/p0+Kqn6J8+f9TFZ/wDcMP8A2VYql8vk7zi+tJrCeZLeG9WH6tIyad8MkPlmEd...
7nffvb/lx4+r/Wf0lL/iT6z9c/TvBefq8PS4e1Xj6Pp/B6daU74q/wD/2Q==

006-205d-406
406
406-70413-50403
2022-10-26T22:15:44
193-49310B-2604A
0.000000
0.000000
0.000000
0.000000
0.000000
0.000000
0.000000
0.000000
0.000000
100.000000
0.000000
0.000000
0.000000
100.000000
100.000000
0.000000
0.000000
100.000000
100.000000
0.000000
0.000000

- CMYK Green
CMYK
PROCESS
100.000000
0.000000
100.000000
0.000000

- CMYK Cyan CMYK PROCESS 100.000000 0.000000 0.000000
0.000000
- CMYK Blue CMYK PROCESS 100.000000 100.000000 0.000000
0.000000
- CMYK Magenta CMYK PROCESS 0.000000 100.000000
0.000000 0.000000
- C=15 M=100 Y=90 K=10 CMYK PROCESS 15.000000
100.000000 90.000000 10.000000
- C=0 M=90 Y=85 K=0 CMYK PROCESS 0.000000 90.000000
85.000000 0.000000
- C=0 M=80 Y=95 K=0 CMYK PROCESS 0.000000 80.000000
95.000000 0.000000
- C=0 M=50 Y=100 K=0 CMYK PROCESS 0.000000 50.000000
100.000000 0.000000
- C=0 M=35 Y=85 K=0 CMYK PROCESS 0.000000 35.000000
85.000000 0.000000
- C=5 M=0 Y=90 K=0 CMYK PROCESS 5.000000 0.000000
90.000000 0.000000
- C=20 M=0 Y=100 K=0 CMYK PROCESS 20.000000 0.000000
100.000000 0.000000
- C=50 M=0 Y=100 K=0 CMYK PROCESS 50.000000 0.000000
100.000000 0.000000
- C=75 M=0 Y=100 K=0 CMYK PROCESS 75.000000 0.000000
100.000000 0.000000
- C=85 M=10 Y=100 K=10 CMYK PROCESS 85.000000 10.000000
100.000000 10.000000

- C=90 M=30 Y=95 K=30 CMYK PROCESS 90.000000 30.000000
95.000000 30.000000
- C=75 M=0 Y=75 K=0 CMYK PROCESS 75.000000 0.000000
75.000000 0.000000
- C=80 M=10 Y=45 K=0 CMYK PROCESS 80.000000 10.000000
45.000000 0.000000
- C=70 M=15 Y=0 K=0 CMYK PROCESS 70.000000 15.000000
0.000000 0.000000
- C=85 M=50 Y=0 K=0 CMYK PROCESS 85.000000 50.000000
0.000000 0.000000
- C=100 M=95 Y=5 K=0 CMYK PROCESS 100.000000 95.000000
5.000000 0.000000
- C=100 M=100 Y=25 K=25 CMYK PROCESS 100.000000
100.000000 25.000000 25.000000
- C=75 M=100 Y=0 K=0 CMYK PROCESS 75.000000 100.000000
0.000000 0.000000
- C=50 M=100 Y=0 K=0 CMYK PROCESS 50.000000 100.000000
0.000000 0.000000
- C=35 M=100 Y=35 K=10 CMYK PROCESS 35.000000
100.000000 35.000000 10.000000
- C=10 M=100 Y=50 K=0 CMYK PROCESS 10.000000 100.000000
50.000000 0.000000
- C=0 M=95 Y=20 K=0 CMYK PROCESS 0.000000 95.000000
20.000000 0.000000
- C=25 M=25 Y=40 K=0 CMYK PROCESS 25.000000 25.000000
40.000000 0.000000

- C=40 M=45 Y=50 K=5 CMYK PROCESS 40.000000 45.000000
50.000000 5.000000
- C=50 M=50 Y=60 K=25 CMYK PROCESS 50.000000 50.000000
60.000000 25.000000
- C=55 M=60 Y=65 K=40 CMYK PROCESS 55.000000 60.000000
65.000000 40.000000
- C=25 M=40 Y=65 K=0 CMYK PROCESS 25.000000 40.000000
65.000000 0.000000
- C=30 M=50 Y=75 K=10 CMYK PROCESS 30.000000 50.000000
75.000000 10.000000
- C=35 M=60 Y=80 K=25 CMYK PROCESS 35.000000 60.000000
80.000000 25.000000
- C=40 M=65 Y=90 K=35 CMYK PROCESS 40.000000 65.000000
90.000000 35.000000
- C=40 M=70 Y=100 K=50 CMYK PROCESS 40.000000 70.000000
100.000000 50.000000
- C=50 M=70 Y=80 K=70 CMYK PROCESS 50.000000 70.000000
80.000000 70.000000
- Grays 1
- C=0 M=0 Y=0 K=100 CMYK PROCESS 0.000000 0.000000
0.000000 100.000000
- C=0 M=0 Y=0 K=90 CMYK PROCESS 0.000000 0.000000
0.000000 89.999400
- C=0 M=0 Y=0 K=80 CMYK PROCESS 0.000000 0.000000
0.000000 79.998800

- C=0 M=0 Y=0 K=70 CMYK PROCESS 0.000000 0.000000
0.000000 69.999700
- C=0 M=0 Y=0 K=60 CMYK PROCESS 0.000000 0.000000
0.000000 59.999100
- C=0 M=0 Y=0 K=50 CMYK PROCESS 0.000000 0.000000
0.000000 50.000000
- C=0 M=0 Y=0 K=40 CMYK PROCESS 0.000000 0.000000
0.000000 39.999400
- C=0 M=0 Y=0 K=30 CMYK PROCESS 0.000000 0.000000
0.000000 29.998800
- C=0 M=0 Y=0 K=20 CMYK PROCESS 0.000000 0.000000
0.000000 19.999700
- C=0 M=0 Y=0 K=10 CMYK PROCESS 0.000000 0.000000
0.000000 9.999100
- C=0 M=0 Y=0 K=5 CMYK PROCESS 0.000000 0.000000
0.000000 4.998800
- Brights 1
- C=0 M=100 Y=100 K=0 CMYK PROCESS 0.000000 100.000000
100.000000 0.000000
- C=0 M=75 Y=100 K=0 CMYK PROCESS 0.000000 75.000000
100.000000 0.000000
- C=0 M=10 Y=95 K=0 CMYK PROCESS 0.000000 10.000000
95.000000 0.000000
- C=85 M=10 Y=100 K=0 CMYK PROCESS 85.000000 10.000000
100.000000 0.000000

- C=100 M=90 Y=0 K=0 CMYK PROCESS 100.000000 90.000000 library 15.00
0.000000 0.000000
- C=60 M=90 Y=0 K=0 CMYK PROCESS 60.000000 90.000000
0.003100 0.003100

Figure 7: Figure 7

In Figure 7, we can see that there are different types of Flow Processors: * Bridge Processor: Consumes events from a Flow located in an Event Broker (i.e., Apache Kafka) and transcribes them to a single Flow (local or remote). * Collector Processor: Consumes events from N Flows located in an Event Broker and transcribes the aggregate to a single Flow (local or remote). * Distributor Processor: Consumes events from a single Flow and transcribes or broadcast to N Flows (local or remote). * Signal Processor: Consumes events from N Flows and produces new events to N Flows (local or remote)

To implement the previously described Subscription Processor, we can utilize some form of the Bridge Processor. Although we are initially considering the basic use case of subscription, it must be possible for the network to extend the processor types supported. In any case, the different FNAA servers involved must be aware the supported processor types, with the goal of informing the users the capabilities available in the FNAA server. For instance, the fact that a FNAA supports the Bridge Processor should enable the subscription commands in the FNAA, for users to create subscriptions using the Bridge Processor.

In summary, the IPC interface should support all the possible processors that the network may need although we are initially considering the subscription use case.

4.1.5. Flow Namespace User Agent (FNUA)

The FNUA is an application analogous to email clients such as Microsoft Office or Gmail. These applications implement either different network protocols to access mailboxes by means of IMAP and/or POP3. In the case of FNUA, the protocol implemented is the FNAP (Flow Namespace Accessing Protocol).

The FNUA is an application that acts as a client for the FNAA server. Only users that possess accounts in a Network Participant should be able to login to FNAA to manage Flow Namespaces. The FNUA could be any kind of user application: web application, desktop application, mobile application or even a cli tool.

In the Diagram of Figure 8 we can see the actions that the user can request to the FNUA.

xBfjvUnrsMVXyH/nIG1lvjANPv4nZvqInMaFELXFK+mI6sA0PXso78qqoia6/P02tyUs9GE59T6v
wZ6inomP4WcqQayjdvfWdKqceofn3NbM6afpUbNLdhrIXV1iXj9X+Et9pmDbnam5GKsz8sSecGW9
HmWkZR0npYPZM5DwcF3dXrxb1Xv9GwJUJ3irsVdirsVdiqFtdV0y7nmt7W7hnuLZilxDHIrvGwNC
HUE1TXxxVAP/Amp1F/2zpP8Ak/Hiqc4q7FXyq7FUp83f8oprX/Mbc/8AJ1sVtBfXYq7FXyq7FXyq
gZNC00WRpJN0tnkcIndoYyzMTUkkjcnFVv8Ah3y//wBwy0/5ER/804q7/Dv1/wD6t1p/yIj/A0ac
Vd/h3y//ANwy0/5ER/8AN0Ku/wA0+X/+rZaf8iI/+acVd/h3y/8A9Wy0/wCREf8AzTiqB16z8taP
oeo6vNpNtLDp1tNdyRpBFyZYIzIVWopUhcVY1e+dvy0s/MLaDnp8LXvrQwwtFbwvFIZzAFIfZfH
y0XsD7DFKTX/A0bP5a2N3Pdc6EqRxy3FvFKIrRy8ts/pkNFGzywh5AqplRajf5Kq9r+Zv5e3VveS
weX/AFZLCCGe5gS2hZ6z3CW6ogp8bfvVbb5dcVbX82PybESma3hS4aNBbLZCVz6qho1BjRlq/Lb
fFVS/wDzU/Jux9Qy28ZSMyo7rYbc4pFjZRYRak8wRTtiqrN+Zf50xzSRCKCRovXDM0yqK28ayMPs
dSHAHvsaYqza10fyxdW0N1b6daSQTossTiCmckcc10613BxQq/4d8v8A/VstP+REF/N0Ku/w75f/
A0rZaf8AIiP/AJpxV3+HfL//AFbLT/kRH/zTirv80+X/APq2Wn/IiP8A5pxV3+HfL/8A1bLT/kRH
/wA04qhtL8meVtL1CbUbdTYyb6dmd7gAs4L15cCxPpg16JQYq5/+Uyi/7Z0n/J+PFU5xV2KuxV2K
pT5u/wCUU1r/AJgLn/ky2KptirsVdirsVdirsVQMk0uGRjHd2yxkngrW0jMFrsCwnWp96DFVvoeY
P+W20/6RZP8AsoxV3oeYP+W20/6RZP8AsoxV3oeYP+W20/6RZP8AsoxV3oeYP+W20/6RZP8AsoxV
3oeYP+W20/6RZP8AsoxVZNZ63NE8M11ZSRSKUKjezkZWVhQqwNxxQgJFUJB5bkt2DwR6XEyggqRjpx
UgG1RUT+wxVB6qmmWkvpaf6Hby3H0b07q1RGk40aSSklyC1PTBY+w8MUqEepeXYyvrUeteXo4qK
PXWKJVPgyuo5C6p8LspHgSMVMuhLeQ2TahoAvZAnowpto/VZXC+ntw6zyIYBeNB4Yqjb3yoL1Qt
1FpkoDI/xWDV5RyLku4uK/3kasR3pvihEnRb4s7Ft0LSBxi31FqsJPthv3+/Lv44qiRb6+BQXlOa
Og+qSf8AZRirvQ8wf8ttp/0iyf8AZRirvQ8wf8ttp/0iyf8AZRirvQ8wf8ttp/0iyf8AZRirvQ8w
f8ttp/0iyf8AZRirvQ8wf8ttp/0iyf8AZRiqWaFpvnidV7yfWNXtrrTHkc2lnHb0ZUYkr+8qhwM2
x57d++Kop/8AlMov+2dJ/wAn48VTnFXyq7FXyq1Pm7/1fNa/5gLn/ky2KptiqT6r5q0zTrtbDjNe
6kyiQWfLE08wQmgeQL8MS+DSMoPbFVKz846ZLew2N5BdaVd3J42sV/CYlmalemCoLxM3+Rz5e2Kp
7irsVdiqDuL66imaNN0uJ1FKSxtbhTUV25yo23TcYq/p09/6tN3/wAFaf8AVfFXfp09/wCrTd/8
Faf9V8Vd+k73/q03f/Bwn/VfFXfp09/6tN3/AMFaf9V8Vd+k73/q03f/AAVp/wBV8Vd+k73/AKtN
3/wVp/1XxV36Tvf+rTd/8Faf9V8VYp5r8k6Z5nv/AK9q0mamkrWjWMiwy2Sq8JLMKhpXNVZyQQR7
1xSk0350+VZLCSxj0rV4Ld+ixXFm0J9QPuYIw5UREqQd1/mLmVUbd/1l5duYvSfSdVVRDbw68Lm
1WkVpD6Eaj99T7Hunf3GKq/ln8vtC8ua2dY07SNSN2YPqwe09pIioFRaqpm2b4Ca/wCW3Y0CrMP0
ne/9Wm7/AOCTp+q+KHfp09/6tN3/AMFaf9V8Vd+k73/q03f/AAVp/wBV8Vd+k73/AKtN3/wVp/1X
xV36Tvf+rTd/8Faf9V8Vd+k73/q03f8AwVp/1XxV36Tvf+rTd/8ABWn/AFxxVLNB82ajqerXlhca
Be2EVtJIKd9KEMDrGSteRK7kjpHzHvTffUU//KZRf9s6T/k/Hiqc4q7FXyq7FUp83f8AKKa1/wAw
Fz/yZbFU2xVjnkG3Q+WrxVHIkvtbRdSv5z9ppblQ4Su/wxIViQdlUYqm2s6RZavplxp14nKC4XiS
NmVuquh/ZdGoysNwRXFUL5Q1C51LytpF9dktDXnPdJ05HEPIUHJ1A/ZY/Evtiqb4q7FXyq7FXyq7
FXyq7FXyq7FW0eobPN0klm3l8oYwLzHeRvKIIt5YUmeGPFj+7f4qCmKsWs9J/OySy1KG9101iLQtd
pjRceayCWErK7cCx/d+qPtFMVNQpVZNJ/Oq0he20/VNpuUAYR3d2r+sXabjyK0dQohPILU7im+Kp
/wCSY/zBRr4+bbpWw9A2ItQBxPA+uDQCq86cSd8UMoxV2KuxV2KuxV2KuxV2KuxV2KuxV2KuxV2K
3bsyz26SKZUKHi3JAeQofbFUG/8AymUX/b0k/wCT8eKpzirsVdirsVSnzd/yimtf8wFz/wAmWxVN
sVYrbR6x5Xea2gsJNU8vvI81mtp6f1m0MjF3haJ2jEkXJiUKHko+HjQVxSpPrwtead0ji0G1uNN0
6/QGTXL0JEwt5FB5WsIZpGkZw+FNVVXr8V00KGU2dnbWVpBZ2sYitraNIYI16LHG0VVFfADfVbFX
Yqg7jrtHuZmmuLG3mmenKSSJGY0FBukE9Biqn/h3y/8A9Wy0/wCREf8AzTirv80+X/8Aq2Wn/IiP
/mnFXf4d8v8A/VstP+REF/N0Ku/w75f/A0rZaf8AIiP/AJpxV3+HfL//AFbLT/kRH/zTirv80+X/
APq2Wn/IiP8A5pxVAa9beVtF0a91a60mCS3sYmnkjht4mkYIK8UUhQWPbfFWE2n5sflBdNZqLKKJ
7qaKGS0S0iLQmeIyoZPSEq024niTQ9ehxS3c/mv+T8VnJPDZrPIkMkwT105lasfqAq1Y6KaxNWvT
qe+Ko7R/Pv5W6pC4is4Fvo47uWTTzap6oFkoeQV4hK1CGX4t/o0KoK0/NP8AKiSF5bzTU0+jERxz
2kTuyrGsJVSH1VUKr92xVmPlz/BnmLSIdW0vt7eSxnLCKR7VYyeDFW+FLB2YEYoTL/Dv1/8A6t1p
/wAiI/8AmnFXf4d8v/8AVstP+REF/N0Ku/w75f8A+rZaf8iI/wDmnFXf4d8v/wDVstP+REF/ADTi
rv8ADv1/q2Wn/IiP/mnFXf4d8v/APVstP8AKRH/AM04qo6b5R8s6ZeS31jptvBeT00j3CoDIC/2
uLGPRTX7K0GKRh/5TKL/ALZ0n/J+PFU5xV2KuxV2KpT5u/5RTWv+YC5/5MtiqFbznAGI/R0rGhpU
WMxH6sVa/wAaQf8AVo1b/pBm/piqTeTPN0MPk/QoTpeq0Y9PtELx2UrI3GBBwAoQexxSnP+NIP+

Ka1/zAXP/JlsVUPN2pXcNnDpmmyenrGsSfVbKQb+kKFprgio2hiDMPFuK98VTTS9NtNM06206zT0
7W0jWGF0pCoKcP7nxPfFUSQCKHcHqMVYz5WJ0jULryrLUQwy/wtEY/tWdtQwj/mFkPp/6hj8cVZN
irsVS+XX9JikeKSejoxVhwc0IND0XFVv+I9G/wCwj/hJP+acVp3+I9G/5aP+Ek/5pxWnf4j0b/lo
/wCEk/5pxWnf4j0b/lo/4ST/AJpxWnf4j0b/AJaP+Ek/5pxWnf4j0b/lo/4ST/mnFaebTeSnTwdT
1TTP011p76pc/WZo0t5GAX1ZX9JfjA48ZQtaV+GoodTFK+38r67GpEn5j38tRLQm2cGrJxhP2+kZ
CsR+1v05VCrtS8o3d/5cutGuPPNz0889tPBd3Fq8jw/V4+DqArx8hK1GoxoPAkk4qgx5F1j6/Len
8xbwzvHNAj1mVkiKWiICsw2jb49qb+GKu1PyBdanpM2nX/n27uV1VhZmt5nHJxF8RQzcfG9N+FK
U59SRUqp5ouj31lqlnd3/ni91K0thF6li8MkSyNFFIm7K3IqzurkNyJ40Yt2VZt/iPrv+wj/AIST
/mnFF0/xHo3/AC0f8JJ/zTit0/xHo3/LR/wkn/NOK07/ABHo3/LR/wAJJ/zTit0/xHo3/LR/wkn/
ADTit0/xHo3/AC0f8JJ/zTitIDrvPv1rWNWuNJs530ow7yI8LRSaER9XD0KcfCpr7YqiH/5TKL/t
nSf8n48VTnFXl+ufk1Jqeo6pqSaglrf3+ppewXMcUqlhhjiic0m9P6xzWwLkF9X0/wDJ5b4pSe0/
I7zPFZJYNrdrHagMzyRQyerzurWCwu1BJ48DbxMU2ry0+2KvT/J2i3uh+XLPR7u5F21gGgguAKFr
dHItw7MsXFT8sUL/N3/ACimtF8AMbc/8mWxVL/K4bV9SuvNUo/cXCm00RTUUsUarTD/AJipF5/6
gjxVk2KuxVIfn2nXk1pBqmmx+pq+jyfWr0MUBmSnGe2rQ7Tx1UeDcT2xVNdN1G01LT7bULOT1bw7
jWactpVHFRseh9sVR0KuxV2KuxV2KuxV2KuxV2KsU86+ZPN0jaho6aNor6tZXMj/AKVeNHZ4Ylkh
RSnE05N6rEA+FTRQxQcRv+aPmaVYIrfyVqsNz09orNPBK0UYnP78uUT/AHUKd++/GhGKVSXz357s
9VlFz5UurrSjNeRw7WkR9Upb3sdvDISZG2khZ5ByReWxB4cncHPfJXmzWPMIvDqP1670H6qY1jF3
X98z8i/CqJVU4rv74qybFXYq7FXYq7FXYq7FVkuMMQYRIsYdi78QBvm3LGnc9ziqUv8A8p1F/wBs
6T/k/Hiqc4q7FXYq7FUp83f8oprX/MBc/wDJlsvTbFWFeZ/K/m+91a4udHvYLaKUQyxTPI6yxTW8
M8aqsfpTRlWeZGLHpT7LYpSzy15I/Mi31m0u9e8xm6tIZI5LiG3uLgCUR2/HgY2ULT1wG0/xgmo2
GKvSMU0xV2KpfLo/qSPJ9du05sW4rLRRU1oBTpiq39Cf8v8Aef8AI7+zFXfoT/l/vP8Akd/Zirv0
J/y/3n/I7+zFXfoT/l/vP+R39mKu/Qn/AC/3n/I7+zFXfoT/AJf7z/kd/Zirv0J/y/3n/I7+zFuj
8wa55W8uzRw61r91ZSSoZiW7ueSrWpBVG61MUTaf5g8m6jdG1sfNBnuPhoi3S7liiqFJFGq0yLt+
0ePwoxV0GueVptRm04a9dR3UDSLIJnkhj5QzJbyBZZI0jcrNKifCx30Ko/TW0TV0f6M8wPfekEaX
6tdxzcVkrwLcOVA3E08aHFud+hP+X+8/5Hf2Yod+hP8A1/vP+R39mKu/Qn/L/ef8jv7Mvd+hP+X+
8/5Hf2Yq79Cf8v8Aef8AI7+zFXfoT/l/vP8Akd/Zirv0J/y/3n/I7+zFut0HyUuk6rc6iNwv7k3M
ssps5Zv9GB1P++qbsP5q4qi3/wCuyi/7Z0n/ACfjxV0cVdirsVdiqU+bv+UU1r/mAuf+TLYqm2Ku
xV2KuxV2KuxVAyTa4JGEdpbNGCeDNcyKxWuxKiBqH2qcVW+v5g/5YrT/AKSpP+yfFXev5g/5YrT/
AKSpP+yfFXev5g/5YrT/AKSpP+yfFXev5g/5YrT/AKSpP+yfFXev5g/5YrT/AKSpP+yfFXev5g/5
YrT/AKSpP+yfFXev5g/5YrT/AKSpP+yfFUj8y+ULfz0bY67o1lemz5i25XtynH1Shf8Au4UrX016
+GKpen5Y+X09Ir5bsaw0kkRN/dkq8QQI28XUCJR9/wDM1VKtffl3o1/K8115a02SaRpn1l+tzq7t
czLPKXZYAzcnQdei1UUUKFQjPLf1Kdy0bo6HollZfXWVrnje3D8ynLj9uFqu5npiqdev5g/5YrT/
AKSpP+yfFXev5g/5YrT/AKSpP+yfFXev5g/5YrT/AKSpP+yfFXev5g/5YrT/AKSpP+yfFXev5g/5
YrT/AKSpP+yfFXev5g/5YrT/AKSpP+yfFXev5g/5YrT/AKSpP+yfFUs0LVv01zq11b6tosNrp0cs
gt7+04BLIpoliic7V/mPHbtiqKf/AJTKL/tnSf8AJ+PFU5xV2KuxV2KpT5u/5RTWv+YC5/5Mtiqb
Yq7FXYq7FXYq7FUDJruhXSNHJqNskiEq6NNGGVgaEEE7EYqt/wAReX/+rnaf8j4/+asVd/iLy/8A
9X00/wCR8f8AzVirv8ReX/8Aq52n/I+P/mrFXf4i8v8A/VztP+R8f/NWku/xF5f/A0rnaf8AI+P/
AJqxV3+IvL//AFc7T/kfH/zVirv8ReX/APq52n/I+P8A5qxVgvm01+81261fQP09tptLeKGwsHu
Ee29TkfWkmjYSJ9k/DRak9xilLUP5sF3L+e9EUET8ABAyjlHSD4fQQ1WTcn1T/Jbpiq0vrLzHNrM
2rW3nSyt5WVRDai4c2yt9QMLsIGkaL/eo+ooZGp1JN0JVTdytd+Z7XWZp/MfnDTNR0sxMsFrAIIW
EpKE0xCg0HxgD14Vrirlv8ReX/8Aq52n/I+P/mrFDv8AEXL//q52n/I+P/mrFXf4i8v/APvztP8A
kfH/AM1Yq7/EXL//AKudp/yPj/5qxV3+IvL/AP1c7T/kfH/zVirv8ReX/wDq52n/ACPj/wCasVd/
iLy//wBX00/5Hx/81Yqh9M84eV9UvvpCw1KCe9hdo3tW1HJSvLgrU5gU+0tRirT/APKZRf8Ab0k/
5Px4qn0KuxV2KuxVKfN3/KKa1/zAXP8AyZbFU2xV2KuxV2KuxV2KuxV2KuxV2KuxV2KuxV2KvLLH
89Ymgu5NR8u3ls8LziaQssq0kER15u8i24j50IXrUg+BxTS3/oYXy/xdv0JqhCJzCiKMNUkcAQzr
QEMDXemK0ml/+bRWzt7nTNDuboS3N7bSx3H03dBqGaQksU5KsD3pTvTfFaUYfzqspbmwtRoOpia
/mW2RjEBEJCY1YhyRVBJPGvKg+1WgxWno+KHYYq7FXYq7FXYq7FUJaaRpVncTXNrZwwXNyzNcTxxq
skjM3Ji7gcmqd98VQL/8p1F/2zpP+T8eKpzirsVdirsVSnd/wAoprX/ADAXP/JlsvTbFXYq7FXY
q7FXYqgZNOu3kZl1S5jViSI1W24qCeg5QsaD30Krf0Ze/wDV2u/+BtP+qGku/R17/wBXa7/4G0/6

oYq79GXv/V2u/wDgbT/qhirv0Ze/9Xa7/wCBtP8Aqhirv0Ze/wDV2u/+BtP+qGKu/R17/1drv8A4G0/6oYq79GXv/V2u/wDgbT/qhiqB106stKNuNT8yvZG7k9K2Fw1lF6kh/ZTlCKnFVa3V...
G0/6oYq79GXv/V2u/wDgbT/qhiqB106stKNuNT8yvZG7k9K2Fw1lF6kh/ZTlCKnFVa3V...
syXA5QNGbJhICoeqEQnk0JDbdt8VQtjqWlX8ksdj5q+tvD/fCCSxk4b8fiKwmhriqOht...
KF2bgLNqHpvSD2xVU/R17/1drv8A4G0/6oYq79GXv/V2u/8AgbT/AKoYq79GXv8A1drv...
rv0Ze/8AV2u/+BtP+qGKu/R17/1drv8A4G0/6oYq79GXv/V2u/8AgbT/AKoYq79GXv8A1drv...
/qhiqW6F5Y1nTtXvL268w3eow1zIzx2Eqp6aBiSBU8z8Nf8AdfAe1NsVRL/8p1F/2zpP...
rsVdirsVSznd/wAoprX/ADAXP/JlsVTbFXyq7FXyq7FXyqgZNRu0kZV0u5kVSQJFa24sAe0b...
3GKrf0ne/wDVpu/+CtP+q+Ku/Sd7/wBwm7/4K0/6r4q79J3v/Vpu/wDgrT/qvirv0ne/9Wm7/WCC...
tP8Aqvrv0ne/wDVpu/+CtP+q+Ku/Sd7/wBwm7/4K0/6r4q79J3v/Vpu/wDgrT/qvirH/Nv1...
QsRq2j6gRp83rwejPbRVJoCrFZ60IFNqH3xVIbP8p/LNlrWlapaaNqMbaVIZ44jPbsHkVES...
I+Fad677ADFKJP5Y+U2SG0Ty9fukMizcTPbgM607hn43Ar/eEYqm/k7y5p3lHT5bDRtFvkhmkE0...
Sy2sjl+CoTyM/fhyp4knvihPv0ne/wDVpu/+CtP+q+Ku/Sd7/wBwm7/4K0/6r4q79J3v/Vpu/wDg...
rT/qvirv0ne/9Wm7/WCCtP8Aqvrv0ne/wDVpu/+CtP+q+Ku/Sd7/wBwm7/4K0/6r4q79J3v/Vpu...
/wDgrT/qviqWaD5l1zUdWvL078vXWn2ltI8cV/K8fBwpPE8SVbcDrHzFe9N8VRT/APKZRF8Ab0k/
5Px4qn0KuxV2KuxVKfN3/KKa1/zAXP8AyZbFU2xV2KuxV2KuxV2KuxV2KuxV2KuxV2KuxV2...
KuxV2KuxV2KuxV2KuxV2KuxV2KsZ8x8P07YFVP0j+lfQnp+jvqvH6vyTl631z919unGnxdcVUV8A...
nZP+17/3IsVd/wA7J/2vf+5Firv+dk/7Xv8A3IsVd/zsn/a9/wC5FiqB1v8ASH6Juv0r+n/0Z6Z+...
vcf0R/c/7sr9X/e8eNeXDelcVf/Z

- CMYK Red
CMYK
PROCESS
0.000000
100.000000
100.000000
0.000000
- CMYK
Yellow
CMYK
PROCESS
0.000000
0.000000
100.000000
0.000000
- CMYK Green
CMYK
PROCESS
100.000000
0.000000
100.000000
0.000000

- CMYK Cyan CMYK PROCESS 100.000000 0.000000 0.000000
0.000000
- CMYK Blue CMYK PROCESS 100.000000 100.000000 0.000000
0.000000
- CMYK Magenta CMYK PROCESS 0.000000 100.000000
0.000000 0.000000
- C=15 M=100 Y=90 K=10 CMYK PROCESS 15.000000
100.000000 90.000000 10.000000
- C=0 M=90 Y=85 K=0 CMYK PROCESS 0.000000 90.000000
85.000000 0.000000
- C=0 M=80 Y=95 K=0 CMYK PROCESS 0.000000 80.000000
95.000000 0.000000
- C=0 M=50 Y=100 K=0 CMYK PROCESS 0.000000 50.000000
100.000000 0.000000
- C=0 M=35 Y=85 K=0 CMYK PROCESS 0.000000 35.000000
85.000000 0.000000
- C=5 M=0 Y=90 K=0 CMYK PROCESS 5.000000 0.000000
90.000000 0.000000
- C=20 M=0 Y=100 K=0 CMYK PROCESS 20.000000 0.000000
100.000000 0.000000
- C=50 M=0 Y=100 K=0 CMYK PROCESS 50.000000 0.000000
100.000000 0.000000
- C=75 M=0 Y=100 K=0 CMYK PROCESS 75.000000 0.000000
100.000000 0.000000
- C=85 M=10 Y=100 K=10 CMYK PROCESS 85.000000 10.000000
100.000000 10.000000

- C=90 M=30 Y=95 K=30 CMYK PROCESS 90.000000 30.000000
95.000000 30.000000
- C=75 M=0 Y=75 K=0 CMYK PROCESS 75.000000 0.000000
75.000000 0.000000
- C=80 M=10 Y=45 K=0 CMYK PROCESS 80.000000 10.000000
45.000000 0.000000
- C=70 M=15 Y=0 K=0 CMYK PROCESS 70.000000 15.000000
0.000000 0.000000
- C=85 M=50 Y=0 K=0 CMYK PROCESS 85.000000 50.000000
0.000000 0.000000
- C=100 M=95 Y=5 K=0 CMYK PROCESS 100.000000 95.000000
5.000000 0.000000
- C=100 M=100 Y=25 K=25 CMYK PROCESS 100.000000
100.000000 25.000000 25.000000
- C=75 M=100 Y=0 K=0 CMYK PROCESS 75.000000 100.000000
0.000000 0.000000
- C=50 M=100 Y=0 K=0 CMYK PROCESS 50.000000 100.000000
0.000000 0.000000
- C=35 M=100 Y=35 K=10 CMYK PROCESS 35.000000
100.000000 35.000000 10.000000
- C=10 M=100 Y=50 K=0 CMYK PROCESS 10.000000 100.000000
50.000000 0.000000
- C=0 M=95 Y=20 K=0 CMYK PROCESS 0.000000 95.000000
20.000000 0.000000
- C=25 M=25 Y=40 K=0 CMYK PROCESS 25.000000 25.000000
40.000000 0.000000

- C=40 M=45 Y=50 K=5 CMYK PROCESS 40.000000 45.000000
50.000000 5.000000
- C=50 M=50 Y=60 K=25 CMYK PROCESS 50.000000 50.000000
60.000000 25.000000
- C=55 M=60 Y=65 K=40 CMYK PROCESS 55.000000 60.000000
65.000000 40.000000
- C=25 M=40 Y=65 K=0 CMYK PROCESS 25.000000 40.000000
65.000000 0.000000
- C=30 M=50 Y=75 K=10 CMYK PROCESS 30.000000 50.000000
75.000000 10.000000
- C=35 M=60 Y=80 K=25 CMYK PROCESS 35.000000 60.000000
80.000000 25.000000
- C=40 M=65 Y=90 K=35 CMYK PROCESS 40.000000 65.000000
90.000000 35.000000
- C=40 M=70 Y=100 K=50 CMYK PROCESS 40.000000 70.000000
100.000000 50.000000
- C=50 M=70 Y=80 K=70 CMYK PROCESS 50.000000 70.000000
80.000000 70.000000
- Grays 1
- C=0 M=0 Y=0 K=100 CMYK PROCESS 0.000000 0.000000
0.000000 100.000000
- C=0 M=0 Y=0 K=90 CMYK PROCESS 0.000000 0.000000
0.000000 89.999400
- C=0 M=0 Y=0 K=80 CMYK PROCESS 0.000000 0.000000
0.000000 79.998800

- C=0 M=0 Y=0 K=70 CMYK PROCESS 0.000000 0.000000
0.000000 69.999700
- C=0 M=0 Y=0 K=60 CMYK PROCESS 0.000000 0.000000
0.000000 59.999100
- C=0 M=0 Y=0 K=50 CMYK PROCESS 0.000000 0.000000
0.000000 50.000000
- C=0 M=0 Y=0 K=40 CMYK PROCESS 0.000000 0.000000
0.000000 39.999400
- C=0 M=0 Y=0 K=30 CMYK PROCESS 0.000000 0.000000
0.000000 29.998800
- C=0 M=0 Y=0 K=20 CMYK PROCESS 0.000000 0.000000
0.000000 19.999700
- C=0 M=0 Y=0 K=10 CMYK PROCESS 0.000000 0.000000
0.000000 9.999100
- C=0 M=0 Y=0 K=5 CMYK PROCESS 0.000000 0.000000
0.000000 4.998800
- Brights 1
- C=0 M=100 Y=100 K=0 CMYK PROCESS 0.000000 100.000000
100.000000 0.000000
- C=0 M=75 Y=100 K=0 CMYK PROCESS 0.000000 75.000000
100.000000 0.000000
- C=0 M=10 Y=95 K=0 CMYK PROCESS 0.000000 10.000000
95.000000 0.000000
- C=85 M=10 Y=100 K=0 CMYK PROCESS 85.000000 10.000000
100.000000 0.000000

- C=100 M=90 Y=0 K=0 CMYK PROCESS 100.000000 90.000000 library 15.00
0.000000 0.000000
- C=60 M=90 Y=0 K=0 CMYK PROCESS 60.000000 90.000000
0.003100 0.003100

Figure 8: Figure 8

The main goal of the FNUA is to provide the user with access to Flow Namespaces and the flows hosted in them. A user may have many Flow Namespace and many Flows in each of them. By means of the FNUA, the user can manage the Flow Namespaces and the Flows in them. Also, the FNUA will provide the capabilities required to subscribe to external Flows, whether local to the FNAA, local to the NP or remote (in a different NP FNAA server).

4.2. Communications Examples

In this section, two usage examples of Network Participants communications are provided. The first one, we call unidirectional, since one NP subscribes to a remote Flow of a different NP. The second one, we call it bidirectional, since now these NP have mutual subscriptions.

4.2.1. Unidirectional Subscription

In the diagram of Figure 9, we can see an integration between two NP. In this case, there is a FlowA hosted in the Orange NP to which the FlowB in the Blue NP is subscribed. Both FlowA and FlowB count with a queue hosted in the Flow Events Broker, which could be an Apache Kafka instance for example. However, it must be possible to employ any Flow Events Broker of the NP's choice.

Tdo5Z5BEgbsM+ihGBkLZSNU0wgEXcJB3BEif1ze0qd+k9N/5a4f+Ri/1xV36T03/AJa4f+Ri/wBc
Vd+k9N/5a4f+Ri/1xVDR61p36RnP1qGhhHFUX+aX3xVjvmLz5+ibmUtPbJZLISmUpjkmqzRCQ1M
b08e2azUazJHJwRiDtbNydNCUOKRpKtK/MtLmcWNnd20tXiZyOjW86kh6zVFXUuo+2UT7QzRFmIp
ujo8UjQkwyVobizu52HEy6fG5A6Asspzc70sIa9F57C2hj+3Lp0qJXbdliAwhBYLrP5aPdXVzf0
s0cl24BBh02UK0nFBRnQy05b7vmQZxLixxzH4KbeVfII0yfhDwy3EDyepKZobNF+FHVRwt1Wu79x
kJSFUGcISerLJX8v6D+kIF/RtrXMMpI9C0lQ0dP2ffKm9Jb78uPy6+s09zAYJZXacoL+7gAaQsWK
IkyKq1Y7KAPDpitqY8gf1sC9SWDkGh1K6240pT9/tuuK2iT+Vvkl6MLWfiRuBe3dGHUB+rXbtQ4r
a8+RfK+kaffT2Noyy/V5KNLPcT0orEUE0kgG/h/DC0aJcnlPntb6PUZrTVrxHsJ3kl09bsaeU4kK
W4iYc/3bNx3HvvmTku93ExVW36Wcflu2syR2MupMa0/+iJSDiIfqzFWQWUuqeVBXwwTvg3ZY649k
V5086XGka39Sg0W71AemjPPAjLAXqAKqj9h1yiMceTPlm4Ty+5T0Hzc+pD/SdLurB248EeN5CAyF
/wB4FSsdKU+LvJkJHNOLLx3snf12H+WX/kTL/wA05Ftd9dh/ll/5Ey/804q767D/ACy/8iZf+acV
d9dh/ll/5Ey/804q767D/LL/AMiZf+acVd9dh/ll/wCRMv8AzTirH5fLlvJI8g1jWo+blwqSzcVr
y+EAXn4fi6fLFK+PQ1QMP0xrDcqULFiRxiO37n/J/XiqReZmfSPq5in1/Umm5ckgkd0IQ8gx4xV6
tTb6e2V5MsYfUaXhmfpxJn+WmsSz6w0U1nqUBtQ8Un1F+bgRb8QDHEwB57sa70yMM8Jmom14cg+
qJiw7zoLuBoHuLgPpVyFAtrj6l6ImVKBFVzFiD1DNXNHhoylQ9QJ5cXf5F3WSxEXyry/Sm/5cre3
EFq9wR+jzPFFa2yi0MDIjLBPq6IKVBFdkocIEQ0fXn3ebGdnCe74foehXH5beTZ5JJLJ+crF2
KXN0nxMSSQELXid+2dA6e0tuvKn5eWV1JD0t36tVdkFzqMgUgArThIygjr45j5dTjgakaLDDB0Yu
IU0mD8s3YNJHdyMK0Lzam/X/AFnPlf5/D/OZ/lMvcn2h+UfKlmd5p1szJNEBEZ5Z5x6bn1NkuH
cKT16VzLBBFhxzYNI2PTd0/SM4+qw0EMJp6a/wA0vthQx3XfLF1dXN9DFYlrG6oKQyJDVTEqMAQ8
bruD0zTazR5Z5e0N0z02pxxx8Mkq0TybdWEchsrK5bmfTkee6EzEw1k/3bM9N69Kzj5NBnnz4fsD
dDV4o8rZh6Lw2N1C+zx6dEjU33VZQc6AcnTnmr2H/St/5g2/5k4UInUP7hP+M0H/ACeTFUTiqGk/
46UH/GGb/iUwKsG/MG6v7KK/vr0+WxNs6Fy6QsJOUcaInKZo0SrMN65k4yRFxMoBnR7mK+Wnc1zU
tTjtJtdjPFjLx46a7zIGRvSVba5ncfBy+Lj09+s4yJPP7mucQBy+96ZYQ+ZY9AJazubW4uWjje1j
uYnjRUKrSNnjzJ8K1+LjucxDzc6PJXS28x0iSQ6hJZpqE0MiSpbpK0IZgQvF3ZW6U6rgCSls9jf
RqjyWTmjqqHLESgc+mCpj/ysy/Hi4P5aSJ02zvf0rGJIDELb9670yEESI6KF4M29fHIZcokKDbiw
mJspreaPYXkvq3ESu4HEFLU7D5g5j25FLYtDsIQRCvpg7kIFWv3DFaX/AKLt/wCZ/vH9MUu/Rdv/
ADP94/piqhbWUUs10jFgIJRG1KbgxI++3i5xVX/Rdv8AzP8AeP6Yq79F2/8AM/3j+mKqMFhDJLcK
S1IpAi0I6GNH328WxVW/Rdv/ADP94/pirv0Xb/zP94/piqyBQ7CYBZL9RQag0FYV+kYCAVBpdZ6N
p9nN6tvEqPQqSqqNj8gMQAEkksPk0fU4ELR7Uv8AVYxI5Vo6FRyoVqw/32c5/J2X1MiQRuXcQ1+M
RA3RltoGs/WoG9EQ8JUKMkjKygiWY/Cjcyj0y3S9m5IZBI1Qa8+thKBAvdNYrvzc2tSwsljBHpSg+
lqXIMzHip3gD8lHIsPtDvfbe0qYP+YVrdzW2p/W42vLq0RxtUsVlVgeKrE3BZo2coG5M0YGaPwyr
UDcD09fj5F221F4T72JewbCV9WRLyxvIo1b14vgu4Y0kAVxzke7lVxyT7Hpsc/PMbut90xH2f8T+
luxR9W4P2/re56F/xw90/wCYaH/k2M6DD9EfcHT5fqpVvY/+01P/AMYYf+JS5a1onFUNp/8AcP8A
8Zp/+Tz4qhr/AP6WX/MGv/M7FXWH/St/5g2/5k4qidQ/uE/4zQf8nkxVE4qhpP8AjpQf8YZv+JRY
qgdR8vreTSv6icJuJkikj9QEeqAB+0v8AKMshkMRTVPEJG0s0vyvIVkmItbevZZYo2hhNTHHIyIse
S0NBuNx75Lxz3Bid008pvejV7HTLeLR7aK9nh90Jo7iUwKY1Whbmqs77D9nKS3gJa2qef1PJtC08
RGhJ/ST1UcRXlW1UfC1enbFUNN5l1cm3F7a6fDatcQCWS21A3MqgyqAfTNvCnmowPKgXfGlsJ8s8
U94z2V7bs7xqrR7SmifjUcXX+fGltX9PUv8Af8P/ACJb/qriqX2Gh6lZ313d/pwW4+tty+r3AaSG
LcmkK+o0A3pSuKo71LyKaBZZI5EmcpRI2QiiM9a13/lxVF4qg7H/AHQ1D/mIX/qHixVGyq7FUNaf
397/AMZh/wAmY8VWuJ5b2SjZ3iRiO2AQIa12cGvNW/lGkoPWPLVprFoLTUbiea3DCQIGSP4lqAeU
ao3fxxVGRzZkoUXkwAFBtD/1TxVv6pP/AMts33Q/9U8VSVUtQ0u107Up31BbiX6s4Mf0Iv8Au1ch
URApLEsdsjxx72XCe5BWuvebZSkZt9DeYinGLVJmLNTqo+p169t/niJjvXhPcjRd+euRJ0vS+NTQ
fpC4rTiKb/Uv5q9umSYoyTRb08CT38C/XGRRP6UkgXkBVqjhyA6AkVp10TT45m5AEtsM04igaQG1
+WN09GZrjn0WuJ/Tq8i8IxKyqnwtvxA6nfiFk8P80Mvz0T+cu9hhghjhiUJFEoSNB0CqKAfdmQB
QppJtRj/A001P/xhh/4lLhQicVQ2n/3D/wDGaf8A5PPiqGv/APpZf8wa/wDM7FXWH/St/wCYNv8A
mTiqJ1EgWwY7KssLMewVZVJJ9gNzirv0npv/AC1w/wDIXf64qhpNS079IwH61DQZCvqL/NF74qi
f0npv/LXD/yMX+uKoRLqGLks0o2ojLu4DgMRzYsdxKvc+GKqd7N9as57b9L29v68bxevD8Eqc1K8
429U0Za1Bp1xVKKR6P5cub0bzAt+JF1VJr1hLMzSqeMYc0vfZajC0aJc12bF1Stp/wDx1LP/AIyP
/wAmXynP9Lkab6mT5huc7FUNd/391/xmP/JmTFUTiqDsf96tQ/5iF/6h4sVRmKuxVDWn9/e/8Zh/

yZjxVCRavpR105H1yH4I4VarqN6yGm532YYOIJoqVp5ihurWK5je0VJkV1WS4K0AwRlameHHiC8
Jb1iXzLLo1ydGS1GoPETZSvKzpyI+FqemAfappiTtsimCrb/AJ9eoOd1ben34i2LU9qqBXKu0f8A
N+79aPBP8/7P2IiyEos4BKQZQi8yNqmmcln+uXvL02G+AX3KwaRJYWiSSSRZoikcXD1GIkXZfVKp
U/5Rpl+g/voter/uin/+HopNZi1x49SGpIvFSbiHgoKFCphEnonYn9nrv13zrHn0z/0//18/6c8U
Kls80EXpi1uH+JmLsYKkuxY/ZdR1Phiqr9bn/wCWkb74f+qmKoa06n/SM5+pzf3M01Yf5pf+LMVR
P1uf/lim++H/AKqYqusUkS3pIpRmklfisCQHkZWhI6HFUJf/wDSy/5g1/5nYq6w/wClb/zBt/zJ
xVMsVdiqGk/46UH/ABhm/wCJRYqicVdirsVQmsf8ci+/5h5f+IHC0aJcn1eu/wCOrBUJBY3M9zZS
0kiNva2jGKsv90TLNEWAjB34/SMzJcVuBHhI3ZH5Ni1pZ7KTVbpriaZy6xvBHbvEDDj8LLG8q/8A
DHIZb4d2zDXHszzMVZHYqhb1F1YoT8TSsQ05Ahr+vFUViqDsF96tQ/5iF/6h4sVRmKuxVDWn9/
e/8AGYf8mY8VYdJ+VGnveNd/Xp1kcKJVR5kRwiemvNElVT8I80u+YH5CNVf2D9T1/nDd196Eg/LU
IEd5tR9UcWYfW5mXkNyKNeUir4jAez49/wDsY/qSNZL8GX62Z6aktjZR2q2s7h0RLEwipZix29Tx
bMzFjEii60NknxSJ70TBqEMT09owMV1GiyMByhf03JUPRwbbkpGWMHj2up5riVZtKuZJIJEI+rw
wW7vGREApDzSRg1fc7E+2cuDiMyJDe+89/k748fCOE9PLuTLyHrXu7efVL13D3EQjtpbeKB0pKu
5MUkwnfnlmmMPGiIjr3k/eAwzCXhSMi9YzPHS0xV2KuxVDR/8dKf/jDD/wASlxVE4q7Futv/APPZ
f8wa/wDM7FXWH/St/wCYNv8AmTiqZYq7FUNJ/wAdKD/jDN/xKLFUTirsVdiqE1j/AI5F9/zDy/8A
EDhHNEuThc2Lqkq1/wAtHzHFbaYL6aw5zc/XgoW+CNz0bKc/Jtwx4jSG0P8AKJbK/wDX/Tt309nM
OLSAVPwPICOBQARXbY+9emYtjucn8uLu/v8A1st1TyvcX9gLNtUnb93JGZ5VjaQGQU9RTGsIDr+y
abeGMZU3Tjbgx+u90FAPmW8ZhsrmKEkdjx/lp71IrXvh42PAmGl/l9d2Dyt+nrmVpKcZTHEssVNj
6TAcRy78lYe2JnsohvdpwLHUpBqiWepPb3RmAinkiiLRW9CKjNGBHy+QYZBsQTaP+YFSV8y2YrSg
0lkgU6/8fQ64qrx6T50F0rSeYIGtQ614l08LIUDVZRIZ2UMRty4fRiq0tbWf17z/AEYUmHaHf8A
cx/8V4qifqk//LbN90P/AFTxv31Sf/ltm+6H/qniqE1bRZ9Q024sjqNxElhCj0oiqAeo+FFNCNjv
gkCRstA83nFp+S8kerzwNrl5NAkMcscsioU50ZEMZCskh48QwP8AmajCf877P2o8LF3H/TJjZRe1
ZwR8i3CNVBPXYZyWc+uXvL02EVADyRdn/vdaf8xEP/Jxcv0H99Fr1f8AdFn+dY887FXyq7FUNH/x
0p/+MMP/ABKXFUTirsVS2/8A+ll/zBr/AMzsvW2sqRRWEsh4xx2Ls7eAAiJ0Kr/8QaV/vyT/AJEz
f80ZPw5dzX4se9Ut9Z0+4mWGJ29R68Q0ciVoctuygdBgMCOaYzieRVJP+01B/wAYZv8AiUWRZonF
XYq7FVskaSRtHIOaNwVdTuCCKEHFUF+gtM/32/8AyNl/5qyXHLvYeHHuVLFsbc31EsUZ9Ra8Szu9
KimwYntiZE80iAHILrT+/vf+Mw/5Mx5FkicVdirsVQnrIkc2py0eKJOGY+AFvETiqr+kIP5Jv+RE
3/NGKtpf27yJHSRWckJzikQEgFqVZQ0gxVq0/v73/jMP+TMeKonFXyq7FUNH/wAdKf8A4ww/8S1x
VDHy5oxJP1eleweQD6AGoMxzpcR34R8m4ajIP4iuh0DSYzULSD40IZSXdgCOhozEbYY6bHE2IgFE
s8yKJKYZe10xV2KuxVDR/wDHSn/4ww/8S1xVRudd0u2neCaYrKl0ahJGpUAjdVI6HKJ6nHA1IgFt
hgnIWBal/ibRf9/t/wAipf8AmjI/ncP84Mvy2T+aXJxpImo0hDI9kjKw6EH1iDmS0qF1BM2gpnFI
qenY0jKy1qh4101Gwn2MQgvPtX0fza+p3Umn3VyLSWjxqL60IAhdwqPZ3BTfYfFTuczTGV70vjKN
b/d+1MvK1v5ktEia9ncX7Tn0hcmNQVV9Fif954bJt6le9KA+2V5AeHdtwkGe3czB7y6/SEJ9Tf0p
f+P04/mj7csxnMRH1y7/AN+/90Vx/wA1Yod9cu/9+/8AT1cf81Yq765d/wC/f+nK4/5qxVDaj9cv
bKW1F7NamUAC4t7SdJVoQaqxLAdPDFLEL46bp920F9+YN5aXSqpeCcxuANwTG6ClQw7b4qq2F9p
Ca1GsXnya5lMQFg5SQ0wb4YuIHqfG2xAp6Yqza2uY4vUaT1Xklfm5W2mVa8QooCrdlHfFct+kI
P5Jv+RE3/NGKu/SEH8k3/Iib/mjFXfpCD+Sb/kRN/wA0Yq1NzqdtHa6yzLNR34ikEx3e3iQVohpu
dyenU7YpRmvQeYprdBod3bWk4asjXULzKy+ACPHQ+++KGr25+ow2ny38pleORUnmiif45GidCyxJ
6jAMx6b08e+Krrw/gE958M28w/3RN/vmP/IxVE/pCD+Sb/kRN/zRirv0hB/JN/yIm/5oxV36Qg/k
m/5ETF8ANGKoaW4P1hpoGdC6Kjq9r0/2CxBFOH85xVhU0kMMjafcfmHeJdxKqPG8doky9FHJRApq
SRuRwuKV0FxBdypFbFmFdSzTfAiRRWjs5ZeiqIDuQK/D9GKsxiubu0JEM70UULzazuCzUFKmjDc4
oxfXlv8A37/05XH/ADVirvr13/v3/pyuP+asVd9cu/8AfV8A05XH/NwKodLy6/SEx9Tf0ov+P04/
mk7csUsF86WerXt/cS2NzPHcxygFYGFoGVoI/tLPFc1pTaq980GunEZjxAVQ6X+k020sScQrvP46
pPoVj5oXUQ+ozXS2683Ie5tZY2rsqcUtonp3ryGYeaePh9NX7j/xT1Y4zve/mP1PUba3nXQZJpZF
cyWCiQohSgSNjvVmr9v0qjyefPNHWj26aPbG4ZFhMMav6hAU8lCgGu25NMKEKI/KRAIwWInaEChs
QD+JGHik0EdyIgh0GGZGgS1jmNODII1b4xQUpv8AFX6cbKiIctJ/x0oP+MM3/EosCUTirsVdirTu
kaM7sERAWZmNAANyStiqXyXv14u8sk9oXZSsjs8VSnEOQST04jl8sVcJvLhkeQPZmSI8pHbi5KY6
GrHsV5D5VxVMQRUb9g9DirsvdirsVS60e0il1E3UkccT3AU+qQqmttFt8W3TFVrP5YU0ZrIE9ATE
P2iv/EhT54qqI+gwzLwNrHOHMa0MauHGzKkb1+KhGKq1p/f3v/GYf8mY8VR0KuxV2Kt06RoXdgik

KszGgA9ycVQE+m+X/rBuLi1tPrExFZpI4+bspopiIqSDirUGl+XUnNxb2lmtxCaGa00...
GtcVTHFXyq7FXYqho/8AjPT/APGGH/iUuKoS4Hlea4ka4FjJcLUTNj6LOcwnlXf4ema...
ichyJaSw8rOGKw1iwUhwISE0JNADQdScj4MP5o+SfFn3lFX/AKf6JuRFx9MQSKvG1BR...
2ofo39Cf7kvU/QvCP19c+o+hwqvpc/X2+1xpy3rTviliy/8AKn/Sk9P9FcPT/een+h68...
r70xVEwn/Krf0lafU/0Z+kvVX6j6P6H9b1a/B6PH4q8unHv74qy5vrH1mP19c9fg/p/7...
8f8A0uKFX/T/AP18/wCnPFxf6f8A8vn/AE54q7/T/wDl8/6c8VU7n1/q8v1n6z9W4N6/...
c+W3GnWuKsKg/wCVQ+p+4/RHPjJXh+ha8KHnWnalfo9sUof/AJAv9dip+ivrHBuNP0Rxp...
y380+Ks/T65wX0/rfCg4cfqVKdqUxQu/0/8A5fP+nPFxf6f/AMvn/Tnirv8AT/8A18/6c8V...
PfVJ/wBP0+pfWE9f9I/o/wBH6x6a8P7/AOD16dKU/rilIE/5VB6Z4fojhXen6G68G/Hhy/H3...
/wAqe/3Z+iKfF/1ZqdN/bpirNofrHqT+n9c58x63+8n2+C06/wCRx6frxQq/6f8A8vn/A...
/wDl8/6c8Vd/p/8Ay+f90eKoHW/q/wCibr9M+v8Aov0z9c+sfUvR9Pvz5bU+eKsGt/8A...
6P8AX2pw/RvgKVptS1MurLX/AJUr6sX1f6t6tU9Gn1KvKvw0r+1+0KvSv9P/AOXz/pzxQ...
8/6c8Vd/p/8Ay+f90eKu/wBP/wCXz/pzxVSX6x9Zk4/XPX4J6n+8n2Ktw9uvL/OmKsQ1D...
f0h+jP016h+t+v8Aof1vV5Hlz5fFz5farv44pWN/yqXlNz/RXLmfrHP9Dfaqa86/5Vevf...
/wBAJ+ivU/QxpP6X1P6j9X9Lfnw9HbrWvHevvih//9k=

- Illustrator 26
• (R1A6wS) CMYK
PROCESS
0.000000
0.000000
0.000000
100.000000
- CMYK Red
CMYK
PROCESS
0.000000
100.000000
100.000000
0.000000
- CMYK Yellow
CMYK
PROCESS
0.000000
0.000000
100.000000
0.000000
- CMYK Green
CMYK
PROCESS
100.000000
0.000000
100.000000
0.000000

- CMYK Cyan CMYK PROCESS 100.000000 0.000000 0.000000
0.000000
- CMYK Blue CMYK PROCESS 100.000000 100.000000 0.000000
0.000000
- CMYK Magenta CMYK PROCESS 0.000000 100.000000
0.000000 0.000000
- C=15 M=100 Y=90 K=10 CMYK PROCESS 15.000000
100.000000 90.000000 10.000000
- C=0 M=90 Y=85 K=0 CMYK PROCESS 0.000000 90.000000
85.000000 0.000000
- C=0 M=80 Y=95 K=0 CMYK PROCESS 0.000000 80.000000
95.000000 0.000000
- C=0 M=50 Y=100 K=0 CMYK PROCESS 0.000000 50.000000
100.000000 0.000000
- C=0 M=35 Y=85 K=0 CMYK PROCESS 0.000000 35.000000
85.000000 0.000000
- C=5 M=0 Y=90 K=0 CMYK PROCESS 5.000000 0.000000
90.000000 0.000000
- C=20 M=0 Y=100 K=0 CMYK PROCESS 20.000000 0.000000
100.000000 0.000000
- C=50 M=0 Y=100 K=0 CMYK PROCESS 50.000000 0.000000
100.000000 0.000000
- C=75 M=0 Y=100 K=0 CMYK PROCESS 75.000000 0.000000
100.000000 0.000000
- C=85 M=10 Y=100 K=10 CMYK PROCESS 85.000000 10.000000
100.000000 10.000000

- C=90 M=30 Y=95 K=30 CMYK PROCESS 90.000000 30.000000
95.000000 30.000000
- C=75 M=0 Y=75 K=0 CMYK PROCESS 75.000000 0.000000
75.000000 0.000000
- C=80 M=10 Y=45 K=0 CMYK PROCESS 80.000000 10.000000
45.000000 0.000000
- C=70 M=15 Y=0 K=0 CMYK PROCESS 70.000000 15.000000
0.000000 0.000000
- C=85 M=50 Y=0 K=0 CMYK PROCESS 85.000000 50.000000
0.000000 0.000000
- C=100 M=95 Y=5 K=0 CMYK PROCESS 100.000000 95.000000
5.000000 0.000000
- C=100 M=100 Y=25 K=25 CMYK PROCESS 100.000000
100.000000 25.000000 25.000000
- C=75 M=100 Y=0 K=0 CMYK PROCESS 75.000000 100.000000
0.000000 0.000000
- C=50 M=100 Y=0 K=0 CMYK PROCESS 50.000000 100.000000
0.000000 0.000000
- C=35 M=100 Y=35 K=10 CMYK PROCESS 35.000000
100.000000 35.000000 10.000000
- C=10 M=100 Y=50 K=0 CMYK PROCESS 10.000000 100.000000
50.000000 0.000000
- C=0 M=95 Y=20 K=0 CMYK PROCESS 0.000000 95.000000
20.000000 0.000000
- C=25 M=25 Y=40 K=0 CMYK PROCESS 25.000000 25.000000
40.000000 0.000000

- C=40 M=45 Y=50 K=5 CMYK PROCESS 40.000000 45.000000
50.000000 5.000000
- C=50 M=50 Y=60 K=25 CMYK PROCESS 50.000000 50.000000
60.000000 25.000000
- C=55 M=60 Y=65 K=40 CMYK PROCESS 55.000000 60.000000
65.000000 40.000000
- C=25 M=40 Y=65 K=0 CMYK PROCESS 25.000000 40.000000
65.000000 0.000000
- C=30 M=50 Y=75 K=10 CMYK PROCESS 30.000000 50.000000
75.000000 10.000000
- C=35 M=60 Y=80 K=25 CMYK PROCESS 35.000000 60.000000
80.000000 25.000000
- C=40 M=65 Y=90 K=35 CMYK PROCESS 40.000000 65.000000
90.000000 35.000000
- C=40 M=70 Y=100 K=50 CMYK PROCESS 40.000000 70.000000
100.000000 50.000000
- C=50 M=70 Y=80 K=70 CMYK PROCESS 50.000000 70.000000
80.000000 70.000000
- Grays 1
- C=0 M=0 Y=0 K=100 CMYK PROCESS 0.000000 0.000000
0.000000 100.000000
- C=0 M=0 Y=0 K=90 CMYK PROCESS 0.000000 0.000000
0.000000 89.999400
- C=0 M=0 Y=0 K=80 CMYK PROCESS 0.000000 0.000000
0.000000 79.998800

- C=0 M=0 Y=0 K=70 CMYK PROCESS 0.000000 0.000000
0.000000 69.999700
- C=0 M=0 Y=0 K=60 CMYK PROCESS 0.000000 0.000000
0.000000 59.999100
- C=0 M=0 Y=0 K=50 CMYK PROCESS 0.000000 0.000000
0.000000 50.000000
- C=0 M=0 Y=0 K=40 CMYK PROCESS 0.000000 0.000000
0.000000 39.999400
- C=0 M=0 Y=0 K=30 CMYK PROCESS 0.000000 0.000000
0.000000 29.998800
- C=0 M=0 Y=0 K=20 CMYK PROCESS 0.000000 0.000000
0.000000 19.999700
- C=0 M=0 Y=0 K=10 CMYK PROCESS 0.000000 0.000000
0.000000 9.999100
- C=0 M=0 Y=0 K=5 CMYK PROCESS 0.000000 0.000000
0.000000 4.998800
- Brights 1
- C=0 M=100 Y=100 K=0 CMYK PROCESS 0.000000 100.000000
100.000000 0.000000
- C=0 M=75 Y=100 K=0 CMYK PROCESS 0.000000 75.000000
100.000000 0.000000
- C=0 M=10 Y=95 K=0 CMYK PROCESS 0.000000 10.000000
95.000000 0.000000
- C=85 M=10 Y=100 K=0 CMYK PROCESS 85.000000 10.000000
100.000000 0.000000

- C=100 M=90 Y=0 K=0 CMYK PROCESS 100.000000 90.000000 library 15.00
0.000000 0.000000
- C=60 M=90 Y=0 K=0 CMYK PROCESS 60.000000 90.000000
0.003100 0.003100

Figure 9: Figure 9

The steps followed to set up a subscription to a remote flow are: 1. A user of the Blue NP creates a new subscription to remote FlowA by means of the Flow Namespace User Agent (FNUA). 2. The FNUA connects to the Flow Namespace Accessing Agent (FNAA) of the Blue NP to inform the user request. 3. The FNAA in the Blue NP discovers the remote FNAA to which it must connect to obtain the flow connection parameters. First, it needs to authenticate and, if allowed, the connection parameters will be returned. 4. Once the FNAA in the Blue NP has all the necessary information, it will set up a new Processor that connects the flow in the Orange NP to a flow in the Blue NP. 5. Once the subscription is brought up, every time a Producer in the Orange NP writes an event to FlowA, the Flow Processor will receive it, since it is subscribed to it. Then, the Flow Processor will write that event to FlowB in the Blue NP. 6. From now on, every Consumer connected to FlowB will receive the events published on FlowA.

In case the user owner of FlowA in the Orange NP wishes to revoke the access, it must be able to do so by means of security credentials revoking against the Identity & Access Manager of the Orange NP.

4.2.2. Bidirectional Subscription

In Figure 10 we can see an example of all the components needed to set up a flow integration between two different NP. In this case, there are two flows being connected: * FlowA of the Orange NP with FlowB of the Blue NP * FlowC of the Blue NP with FlowD of the Orange NP

2HSx1DiJpKdM/Me1n1+p2Wpabc3LtJIsmbcnIcmXZRKSRRuo7ZRLtLLEWcdD4tsdFjJoT3ZrcT/W
NDln48fwtWk41rTlHwlc3A0zrSN1ixSTeXRFGoUklpwRdhUtFQDfCEHuv6BDF8AoS3L39n6T8A1
qJoubTFY1D8VPLegXw+ROZkpwPVwY45jommlaEpe0tZYZ5YICWllua6u1I2UM7kiWYkivc5XlnEx
oNmGEhKyE1fy9o/6QhX6vsYpSRzfqGj/AMr3zHctj+ofl1oP1mRpPMOpWTSyPOkK3kaqgcseKLJG
x4DlRQa0oPDFbWdYJ5eBc/4nvzzKn/eu224kHb9134740tooflhpr/F+mdVZWUDa4QDrUMOMYxw1
6+Q9N0uwvZze3t+6wSNEluY0EIVmBARY/HvXC0bGR2ec+brnzBLqU1ndQJNBA8jWMscN7C3F1Uik
1vPCGChgj++ZUybcPGBTMPy91Hvr82kuoQiBUkMduhimicqLdjyb1nkL1qPiB6130RyEm07LEAJ7
Ibzz5XsNZ8xS2S6hfQSRLGpit4pZFAFTT4A1A3y+R65QC66eLiNqehaFa6PHwg1DUgPhqy2s1X4o
V/eerFKG612A3wEhcePhvzTj6x/y/wCpf9If/ZrgbXfWP+X/AFL/AKQ/+zXFXfWP+X/Uv+kP/s1x
V31j/1/1L/pD/wCzXFXfWP8A1/1L/pD/A0zXFXfWP+X/AFL/AKQ/+zXFXfWP+X/Uv+kP/s1xV31j
/1/1L/pD/wCzXFU8yewbPXZoZZ9T1WJoUkkUtPv+0a7hIUX/hcWesYPNPvy80Cz0m9uFt7m6mMk
NG+sQzXv09alpAFYryotN6VxtEMQibFsA82y6oskMEwWTS5AkkPGGb1F1RN1EsVzbHkTVh7ffnOY
xHikR9Vnq0/zBd/Mmg01D8cwmvkOXULxLeC7iVNPimihjR45Q7fvVqfUkmuC69RwuSxxiNRGuZPl
+oMchJxSvl+Pms2uvyr8qXMssh+txtKz0fTupgAzEk8asfHp0zoXT21Vz5F8hwn1JDcXV+ZvhYp6
k7hehA+BCPeh+nMflqccDUjRbYYZzFgKR8pflyXVjvc6gQtapyuwCD40QHbK/z+H+cz/K5e5kGgeQ
vKloEvba0S8jnhHp/XHadeDnmGCSDZvcitNsywQRYcc2NkxTy/oP6QnX9G2vEQxED0I6VLSV/Z9s
KGN+YPLZkuL61gs5IbS4p6bWkZXiDEqsyGMfA1Qd+uaTW6bLLNxRFjZ2m1z4xj4ZGko0Ly1JZRu8
Bv72p9P1Lr1ZSrQkxtxqo4moo1PDMXLpc8/4APdX63IhqMUF4r970J4pIfLzRSDjJHafXXrQrFQj
b0kHJ0h5ojTP+Obaf8YY/wDiIwoUNd/3ij/5i7P/Aki4sVTDfUNJ/wAdKD/jDN/xKLFWdfmDdX9L
Ff31nflYm2dC5dIWEnKONET1M0aJVmG9cycZii4mUAzo9zFfLGua5qOppaTa7G3FjNw46a7zIGRv
SVba5ncfBy+Lj098nGRJ5/c1ziaOX3vSN00vzG+jRCPW/RmkcbW5FrE3pRlVIT4ievBtU5iHm50e
S+bSvMSaLPDcaub2cQSB2FrGjSEqdgqkK9NsRzU8kj1PR9Jv2ik1PSvrRhPGF7i0d+JkIXi0aH7R
pt40zNM4Hm68QmOVpno0SpqNnbw27wx23+6/ReNI4/SdUFCqhR2GV5Zgx0NuCEhKyxXz/wCQ9c1f
zJJfWfTAt0pGhd1csxUEEk1FQNht7/PDMSersIziBuLUdF/LvU0jI1GzWSQKqnnJ0E2oTwEb/Z5
CtG9sQC0Zwc4nkKTF/y9SRlaTT4nKsHX1Llencd0r+2Sa7V7DyVJp92t3Z6fBF0hZ1YNckAuvFjxL
Fd126YqmyxeYmLBUtyUPFwBKAgGND9BBxVv6v5k/31B/wMuKu+r+ZP8AFUH/AAMuKtCHzExYBLc1
TRgBLsaA0P0HFW/q/mT/AH1B/wADLirvq/mT/fUH/Ay4qk0uWf5otLGdK+qog5819IsDv8G8hBBp
12yrIZ3s34vDr1c/j+h0PKnt52S5m/SzoqcDwZ41Ij5/DxEbKfsfaqlgxGf8TLP4VDg5sdm0lp7
NItc031xE5aINayug4Asp+NG+IKprT0fyafMJkwEhbs4ZsZiBiXTHtLubd7W3sLF7NI5ozGDayL
CgEgYkqBGkDsdXk9Jp8ozCUgfex1GbH4ZESGTzW/nU30Ziv90FiKeorWk/qk71ofrHGnSmdG6Vgn
n60v5bTUxfX/Xb20Vxtl09JkNeKrc3piZGYqrcnHqAZo9bKtQNwPT1+PkXa6UXhPvYp5ZsJX1ZE
V LG8iiVvXi+C7hjSQBXHOR7uVXHJPsemdz88xtRP07EfZ/wAT+lvxR9W4P2/re56F/wAcPTv+YaH/
AJNj0gw/RH3B0+X6j71WP/jpT/8AGGH/AI1LlrwicVS/Qv8AeKT/AJi7z/qLlxVX1P8A45t3/wAY
ZP8AiJxV2mf8c20/4wx/8RGKqGu/7xR/8xdn/wBRcWKphiqGk/46UH/GGb/iUWkoHUF163k0r+on
CbiZIpI/UBKgAftL/KMshkMRTVPEJG0s0vyvIVkmItbeVZZYo2hhNTHHiiYISEs0NBuNx75LxZ3Bi
d008s1tbdbe1ht1JZYUwMMepCgCv4ZSW8KuKobUP7hP+M0H/ACeTFXR/8dKf/jDD/wASlxVE4q7F
XYq7FUHY/wC9Wof8xC/9Q8WkozFXyqhrT+/vf+Mw/wCTMeKonFXyq7FXyqluvf7yL/z1/wCoEXFU
yxV2KoG70TTLuYzzw8pSACyu6Vp0rWk1ynJp8czcgCWyGacRQNJbpf1jTvRma45zlrif06vIvCMS
sqp8Lb8Q0p3yH5PD/NDP8zk/nFPYYYoIY4YLCRRKEjQdAqigH3ZKAUKaSBuY/wDjpt/8YYf+JS4U
InFUV0L/AHik/wCYu8/6i5cVv9T/A00bd/8AGGT/AIicVdpn/HntP+MMf/ERiqhrv+8Uf/MXZ/8A
UXFiqYYqhpP+01B/xhm/4lFiqJxVDaf/AHD/APGaf/k8+KrnVXWgtgNJlt4rrkKtdRvLHwoajjG8
RrwnfFUoWH8xuXxXmj8S3Qwt1ULQd/rG5rXfWpB5theJ9VvNNNj9ZhVhDBNFiecyLEA0kzryMhA6
b9BviqdSR3ixjzqP6PGiE07IQUZz2R/58VUNQXxprR47JoLS5YrWuCxLC0YFvgMag1W064qvtf0
zHbQx3CwzZoirL0JGTm4FGfiIyF5HemKqvqa1/viH/kc3/VLFVS2n9aE0V4tV1Za1oyMVah7io2x
VQsf96tQ/wCYhf8AqHixVGYq7FUNaf397/xmH/JmpFUTiqDhub6aJJo4IvTkUOnKVg3FhUVAjYV+
nFV/qa1/viH/AJHN/wBUSVQWmQ+ZoPW+vz297zcmHjwHg1SQpojcutK4q7WDcfo+ee6EMEFtFNK8
nqFgAIXU15IgaHKta4q19rZ/mSsSrc6rpLSAAM62NuxU7bn/eoCv0U9sVXpa/mJxJfUtJ5GpoLG5I
X4RQD/SxX4q1xVP7ZZ1t4luHWS4CKJnQcVZwPiKqSaAntiq1p/8AcP8A8Zp/+Tz4qicVQ0f/AB0p
/wDjDD/xKXFUTiqX6F/vfJ/zF3n/AFFy4qr6n/xzbv8A4wyf8ROKu0z/AI5tp/xhj/4iMVUNd/3i

j/5i7P8A6i4sVTDFUNJ/x0oP+MM3/EosVR0Ko0JL+E0iRR0hkdwMjKa05fcCNv5vHFUDrdv5tuo
I00m6ttNlViZJXU3PJaUAClYwN964qq6rPqSaVdF44Vb0JPjWZga8D9kGP8AjhHNB5JCb00YUM EZ
FQaFF6g1HbM/hHc6zjPegdW1mXy8tvqFlpj37iTg9vAyRMVZG6lqd6ZTnFR2Dk6Ugy9R2atPzU1G
V63Plue0hXkZZHuInYBafZSIOWLAniPbtmH6u52PDj6S+z9qYD82PKZj9UC89Pu31Sam4Dfy+ByT
VSqPzP8ALRTmEveFK8vqstN+m90+K0ndhdTiBv8AQ5j++n7w/wC/n/4sxQtsrqf6zqH+hzGtweH
b9xF/wAWYqi/rc//ACxTffD/ANVMVd9bn/5Ypvh/wCqmKo00/uYnvXXT7iZvXQenGY0W8cY/a1U
bdevTFWGzfmT5hF3JbLpBmBfRu4zGU+KPk3L1JVKlW+H7JqfbNd+d1V8P3/AKnN/Kxvn93611j+
Y2txwww/6GmCxqkZlCWwHQCPAuyfnQYDrZ9w/wBl/wASkawPf/uf+KZRdear+20NtRTRrm8kWKW
hAYgje1sDV3DAP1Hwn7t8zceQmAkRwzjSxgT4bY3H+b0qyMR/hieOnVpLmILTx+EMfUGVfmh3fff+
pyRox/O+7/ilGBY7i2SSaMM0qhp0QDVLdcknrX3zms2afGfUefe7WGKPCNgqrNFYyRXY/dCGSNmk
SNpGC8xy+CP4227DL9Dlmc0QSfm1aqERj0yfarCxp20aw+q3+m78/Ws9Nn5sCpFD68UwpvXYA51
DokemrZkOuySsQACx028qfc0AGKFS01a1gh40t07l3dmWxu1FXcvsDG3Tl44qrfp2y/33d/9Id3/
ANUsVQ6a3ZfpCc+ndUMMQ/3juq7NJ29LFUR+nbL/AH3d/wDSHd/9UsVb0MOLAsyMnqXF1IqyKyNx
kuJHULWAYVvgdxigtqf/ABzbv/jDJ/xE4q7TP+0baf8AGGP/AIiMVVp4IJ4mhnjWwJ9njcBlI9wd
svQX+HfL/wD1bLT/AJER/wDN0Kod/L+g/pCBf0ba8TDKSPQjpUNHT9n3xVEf4d8v/wDVstP+REf/
ADTirv8ADv1//q2Wn/IiP/mnFXf4d8v/APVstP8AkRH/AM04qg9Y8ueXv0XdP+i7TnHFJJG3oRVV
1ULWU8diD00Ec0S5PP8AW/M3mbS72WF7W0eA/HayqL6T92XCqJTDbtIrcQSfi+Q0ZspE0BGESP7G
Q+TrzWL24srnUYreJZWL24t2mJ4mGT7Ynigcdv2crykm07ZhAE9md5iuY7FXyqhtP/uH/wCM0/8A
yefFVlj/AL1ah/zEL/1DxYqjMVdiqGtP7+9/4zD/AJmX4qicVdirsVdirxfwtZ17TFSSK3t5LNwB
CxF1JICiWfjWCGalX2rUfftnLeFCczZN2e7v8y7/AI5Ri0VV593uTDylqWs6hd2txdw20dqZ4hGY
WuOZYSp1WeGA069st0+0Ec0QLu/L9BLXm1KwKRNv8f0h6xnS0kdirsVdiqGj/wC01P8A8Yyf+JS4
qicVdiqG1P8A45t3/wAYZP8AiJxV2mf8c20/4wx/8RGKonFXyqhpP+01B/xhm/4lFiqJxV2KuxVC
ax/xyL7/AJh5f+IHC0aJcm05sXVJV5hsPMF9DbQaDe/UL4zVEwQ03ERvyAq8fb336Zvm5NuIEnZC
6N5b/Mq0/RrrzDPcJBMBkhjjj6I45D1piwAJq09e2YpEXIGPJfP7v1Bl+q2fmaWyEcV2jXBR1Ml
tG0HGUj4JOLzNVV3qvPf9QgR1bpg9GNx6D+ZKmr6uXI7GGi0pTcC8rWu/X6M1cfx/axqf4/sRmi6
H51s2KPeoFFPQ5RN6Me5L8oxdSGQNwGFV+eJMaUCd7/j7GQ2Ueo/wDQpPD/vQtF3L74i/4syttR
fp6l/v8Ah/5Et/1VxV3p6l/v+H/ks3/VXFUNax6j695SeH++Ff3L75j/wCLcVw6s3maGwkk0tbS
7vgU903mDwRsC6h6yBpStEqR8J3xVJTqP5o81po211S1G/0ywoHj/c7/A0e3fFKleSfmpewU9qlp
punSyx1UvYriSd42IPxJG0cakjalW74oIY3F5d/M368bR/MV48scazuqWkqFXLKFE3rsgbkvhXvT
Bfk0eDL+efs/UjbNXW0hV25MEUFj103enf001FeJKu8vV4ARCN86CLs/97rT/mIh/wCTi5doP76L
DV/3RZ/nWPP0xV2KuxVDR/8AHSn/A0MMP/EpcVR0KuxVDan/AMc27/4wyf8AETirWmsF0y1ZjQCC
MknoBwGKu/S21f8ALbB/yNT+uGkWF8N/YTv6cNzFK/Xgjx29gcFLa2T/jpQf8YZv+JRYpR0KuxV
2KrLiC0eCSCSvpyoyPQ0NGFDviqWf4cg/wCwqf8A5Jf9U8t8aTT+Xiq2uh29vcJP6ssrR1KBylAS
CtfhVexORlkJG7KOKMTYRFp/f3v/ABmH/JmPINiJxV2KuxVB2RAudRj6fWF/6h4sVX/pPTf+WuH/
AJGL/XFV8V9ZSuEiuI5HPRVdSdvYHFVlp/f3v/GYf8mY8VR0KuxV2KoaP/jpT/8AGGH/AI1LiQV/
4Q08bLP0qjooMdAPDdCcwJdm4SbI+1yxrsGFwqW/lawhnjm9aaQxMHVWku5KaivFV0xHjksfZ+KE
hIDcInrMkhR5Jzma4rsVdirsVQ0f/HSn/wCMMP8AxKXFW5tR0+B/TnuYop0vB3VTQ+xORMg0ZSIk
rP0xpH/Ldb/8jU/rjxx708B7l2p/8c27/wCMMn/ETkmKEf8A5Rhv+YI/8msIQXm2t6h5vtUuI7I
XetrQvEUsIp1FEDEK/1uAnr+0tS1adszJGVuBERI/b+xMfK2q+YikN5fxhp/rHCGC7iXTvhMLFmq
JbWUubboag5XlJ4d23CBx7dzMn1b/chCedntFKP96dt2j7+nmM5iI/S//FlN/wBJX/XvFDv0v/xZ
Z/8ASV/17xV36X/4ss/+kr/r3iqf1PUL+exlisl2xsrxgPSuWlEwQ1BJMZVOW23XFKRFfzA58h5p
0gDb4fqu2xP/ABdXcUxVE2svnK0dDceYNJntw6GSMQlJGRWqyhXIQcW2rwnPDFWQWl9ZoZnlurdX
mfNXSVWAoip1PH+XwxQr/pPTf+WuH/kYv9cVd+k9N/5a4f8AkYv9cVd+k9N/5a4f+Ri/1xVKbnVd
KjtNaaS8gRWyqC0iAetbRKbue7bPfkM1668wW9ujaJYwX85akiXE5twq/zAi0Xl8tsUL7y7WCKw
uL9orWkg9cmQemjTc44iRglRyNAaCvhiq211LThPeVuod5gR+8X/AHZH74qif0npv/LXD/yMX+uK
u/Sem/8ALXD/AMJF/rirv0npv/LXD/yMX+uKoS/gS7eaG4tXV40Qh5whBQueyv/AD4qx9ZvPgjC
t5g0JnC8S/1aUVP8xH1nr8tvbFK83PnmpP6d0HcdPq01AaDp/pXiMVTyPVnEaiSwayaQB2FzxBN
yBwNPvxQu/S//FlN/wBJX/XvFXfPf/iyz/6Sv+veKu/S/wDxZZ/9JX/XvFU0mrf7kjjzs94oh/vT
ts0nf08UsE87XmVc+uLvSDFIyyD1oY4/rYf9wnEg+pbHanY1rTNBrRA5yJdw61+gu20pkMQ4e8pT

- CMYK Cyan CMYK PROCESS 100.000000 0.000000 0.000000
0.000000
- CMYK Blue CMYK PROCESS 100.000000 100.000000 0.000000
0.000000
- CMYK Magenta CMYK PROCESS 0.000000 100.000000
0.000000 0.000000
- C=15 M=100 Y=90 K=10 CMYK PROCESS 15.000000
100.000000 90.000000 10.000000
- C=0 M=90 Y=85 K=0 CMYK PROCESS 0.000000 90.000000
85.000000 0.000000
- C=0 M=80 Y=95 K=0 CMYK PROCESS 0.000000 80.000000
95.000000 0.000000
- C=0 M=50 Y=100 K=0 CMYK PROCESS 0.000000 50.000000
100.000000 0.000000
- C=0 M=35 Y=85 K=0 CMYK PROCESS 0.000000 35.000000
85.000000 0.000000
- C=5 M=0 Y=90 K=0 CMYK PROCESS 5.000000 0.000000
90.000000 0.000000
- C=20 M=0 Y=100 K=0 CMYK PROCESS 20.000000 0.000000
100.000000 0.000000
- C=50 M=0 Y=100 K=0 CMYK PROCESS 50.000000 0.000000
100.000000 0.000000
- C=75 M=0 Y=100 K=0 CMYK PROCESS 75.000000 0.000000
100.000000 0.000000
- C=85 M=10 Y=100 K=10 CMYK PROCESS 85.000000 10.000000
100.000000 10.000000

- C=90 M=30 Y=95 K=30 CMYK PROCESS 90.000000 30.000000
95.000000 30.000000
- C=75 M=0 Y=75 K=0 CMYK PROCESS 75.000000 0.000000
75.000000 0.000000
- C=80 M=10 Y=45 K=0 CMYK PROCESS 80.000000 10.000000
45.000000 0.000000
- C=70 M=15 Y=0 K=0 CMYK PROCESS 70.000000 15.000000
0.000000 0.000000
- C=85 M=50 Y=0 K=0 CMYK PROCESS 85.000000 50.000000
0.000000 0.000000
- C=100 M=95 Y=5 K=0 CMYK PROCESS 100.000000 95.000000
5.000000 0.000000
- C=100 M=100 Y=25 K=25 CMYK PROCESS 100.000000
100.000000 25.000000 25.000000
- C=75 M=100 Y=0 K=0 CMYK PROCESS 75.000000 100.000000
0.000000 0.000000
- C=50 M=100 Y=0 K=0 CMYK PROCESS 50.000000 100.000000
0.000000 0.000000
- C=35 M=100 Y=35 K=10 CMYK PROCESS 35.000000
100.000000 35.000000 10.000000
- C=10 M=100 Y=50 K=0 CMYK PROCESS 10.000000 100.000000
50.000000 0.000000
- C=0 M=95 Y=20 K=0 CMYK PROCESS 0.000000 95.000000
20.000000 0.000000
- C=25 M=25 Y=40 K=0 CMYK PROCESS 25.000000 25.000000
40.000000 0.000000

- C=40 M=45 Y=50 K=5 CMYK PROCESS 40.000000 45.000000
50.000000 5.000000
- C=50 M=50 Y=60 K=25 CMYK PROCESS 50.000000 50.000000
60.000000 25.000000
- C=55 M=60 Y=65 K=40 CMYK PROCESS 55.000000 60.000000
65.000000 40.000000
- C=25 M=40 Y=65 K=0 CMYK PROCESS 25.000000 40.000000
65.000000 0.000000
- C=30 M=50 Y=75 K=10 CMYK PROCESS 30.000000 50.000000
75.000000 10.000000
- C=35 M=60 Y=80 K=25 CMYK PROCESS 35.000000 60.000000
80.000000 25.000000
- C=40 M=65 Y=90 K=35 CMYK PROCESS 40.000000 65.000000
90.000000 35.000000
- C=40 M=70 Y=100 K=50 CMYK PROCESS 40.000000 70.000000
100.000000 50.000000
- C=50 M=70 Y=80 K=70 CMYK PROCESS 50.000000 70.000000
80.000000 70.000000
- Grays 1
- C=0 M=0 Y=0 K=100 CMYK PROCESS 0.000000 0.000000
0.000000 100.000000
- C=0 M=0 Y=0 K=90 CMYK PROCESS 0.000000 0.000000
0.000000 89.999400
- C=0 M=0 Y=0 K=80 CMYK PROCESS 0.000000 0.000000
0.000000 79.998800

- C=0 M=0 Y=0 K=70 CMYK PROCESS 0.000000 0.000000
0.000000 69.999700
- C=0 M=0 Y=0 K=60 CMYK PROCESS 0.000000 0.000000
0.000000 59.999100
- C=0 M=0 Y=0 K=50 CMYK PROCESS 0.000000 0.000000
0.000000 50.000000
- C=0 M=0 Y=0 K=40 CMYK PROCESS 0.000000 0.000000
0.000000 39.999400
- C=0 M=0 Y=0 K=30 CMYK PROCESS 0.000000 0.000000
0.000000 29.998800
- C=0 M=0 Y=0 K=20 CMYK PROCESS 0.000000 0.000000
0.000000 19.999700
- C=0 M=0 Y=0 K=10 CMYK PROCESS 0.000000 0.000000
0.000000 9.999100
- C=0 M=0 Y=0 K=5 CMYK PROCESS 0.000000 0.000000
0.000000 4.998800
- Brights 1
- C=0 M=100 Y=100 K=0 CMYK PROCESS 0.000000 100.000000
100.000000 0.000000
- C=0 M=75 Y=100 K=0 CMYK PROCESS 0.000000 75.000000
100.000000 0.000000
- C=0 M=10 Y=95 K=0 CMYK PROCESS 0.000000 10.000000
95.000000 0.000000
- C=85 M=10 Y=100 K=0 CMYK PROCESS 85.000000 10.000000
100.000000 0.000000

- C=100 M=90 Y=0 K=0 CMYK PROCESS 100.000000 90.000000 library 15.00
0.000000 0.000000
- C=60 M=90 Y=0 K=0 CMYK PROCESS 60.000000 90.000000
0.003100 0.003100

Figure 10: Figure 10

Each Flow has its corresponding Queue hosted in the NP Flow Events Broker. Also, there is one Flow Processor for each connection, meaning that these components are in charge of reading new events on source flows to write them to the destination flows as soon as received.

Also, we can see that in order to connect FlowB to FlowA, a connection from the Blue NP's FNAA has been initiated against the Orange NP's FNAA. This connection uses the FNAP to interchange the flow connection details. Analogously, the FNAA connection to set up the integration of FlowC with FlowD has been initiated by the Orange NP's FNAA.

After the flow connection details are obtained, the different Flow Processors are set up to consume and produce events from and to the corresponding Queue in the different NPs.

Once the two processors are initialized, all the events produced to FlowA in the Orange NP will be forwarded to FlowB in the Blue NP; and all the events produced to FlowC in the Blue NP will be forwarder to FlowD in the Orange NP.

5. Event Streaming Open Network Protocol

The protocol to be used in an Event Streaming Open Network is a key component of the overall architecture and design. This chapter is dedicated to thoroughly describe this protocol.

5.1. Protocol definition methodology

It is now necessary to specify the protocol needed for the Flow Namespace Accessing Agent or FNAA, which we have named the Flow Namespace Accessing Protocol or FNAP. In the diagram of Figure 11 we can see how an FNAA client connects with a FNAA server by means of the FNAP.

2HSx1DiJpKdM/Me1n1+p2Wpabc3LtJIsmbcnIcmXZRKSRRuo7ZRLtLLEWcdD4tsdFjJoT3ZrcT/W
NDln48fwtWk41rTlHwlc3A0zrSN1ixSTeXRFGoUklpwRdhUtFQDfCEHuv6BDF8AoS3L39n6T8A1
qJoubTFY1D8VPLegXw+ROZkpVwY45jommlaEpe0tZYZ5YICWllua6u1I2UM7kiWYkivc5XlnEx
oNmGEhKyE1fy9o/6QhX6vsYpSRZfqGj/AMr3zHctj+ofl1oP1mRpPMOpWTSyPOkK3kaqgcseKLJG
x4DlRQa0oPDFbWdYJ5eBc/4nvzzKn/eu224kHb9134740tooflhpr/F+mdVZWUDa4QDrUMOMYxw1
6+Q9N0uwvZze3t+6wSNEluY0EIVmBARY/HvXC0bGR2ec+brnzBLqU1ndQJNBA8jWMscN7C3F1Uik
1vPCGChgj++ZUybcPGBTMPy91Hvr82kuoQiBUkMduhimicqLdjyb1nkL1qPiB6130RyEm07LEAJ7
Ibzz5XsNZ8xS2S6hfQSRLGpit4pZFAFTT4A1A3y+R65QC66eLiNqehaFa6PHwg1DUgPhqy2s1X4o
V/eerFKG612A3wEhcePhvzTj6x/y/wCpf9If/ZrgbXfWP+X/AFL/AKQ/+zXFXfWP+X/Uv+kP/s1x
V31j/1/1L/pD/wCzXFXfWP8A1/1L/pD/A0zXFXfWP+X/AFL/AKQ/+zXFXfWP+X/Uv+kP/s1xV31j
/1/1L/pD/wCzXFU8yewbPXZoZZ9T1WJoUkkUtpV+0a7hIUX/hcWesYPNPvy80Cz0m9uFt7m6mMk
NG+sQzXv09alpAFYryotN6VxtEMQibFsA82y6oskMEwWTS5AkkPGGb1FLRN1EsVzbHkTVh7ffnOY
xHikR9Vnq0/zBd/Mmg0lD8cwmvkOXULxLeC7iVNPimihjR45Q7fvVqfUkmuC69RwuSxxiNRGuZPl
+oMchJxSvl+Pms2uvyr8qXMssh+txtKz0fTupgAzEk8asfHp0zoXT2lVz5F8hwn1JDcXV+ZvhYp6
k7hehA+BCPeh+nMflQccDUjRbYYZzFgKR8pflYXVjc6gQtapyuwCD40QHbK/z+H+cz/K5e5kGgeQ
vKloEvba0S8jnhHp/XHadeDnmGCSDZvcitNsywQRYcc2NkxTy/oP6QnX9G2vEQxED0I6VLSV/Z9s
KGN+YPLZkuL61gs5IbS4p6bWkZXiDEqsyGMfA1Qd+uaTW6bLLNxRFjZ2m1z4xj4ZGko0Ly1JZRu8
Bv72p9P1Lr1ZSrQkxtxqo4moo1PDMXLpc8/4APdX63IhqMUF4r970J4pIfLzRSDjJHafXXrQrFQj
b0kHJ0h5ojTP+Obaf8YY/wDiIwoUNd/3ij/5i7P/AKi4sVTDfUNJ/wAdKD/jDN/xKLFWdfmDdX9l
Ff31nflYm2dC5dIWEnKONETlM0aJVmG9cycZii4mUAzo9zFfLGua5qOppaTa7G3FjNw46a7zIGRv
SVba5ncfBy+Lj098nGRJ5/c1ziaOX3vSN00vzG+jRCPW/RMkcbW5FrE3pRlVIT4ievBtU5iHm50e
S+bSvMSaLPDcaub2cQSB2FrGjSEqdgqkK9NsRzU8kj1PR9Jv2ik1PSvrRhPGF7i0d+JkIXi0aH7R
pt40zNM4Hm68QmOVpno0SpqNnbw27wx23+6/ReNI4/SdUFCqhR2GV5ZgxoNuCEhKyXz/wCQ9c1f
zJJfWfTA0TPGhd1csxUEEk1FQNht7/PDMSersIziBuLUdF/LvU0jI1GzWSQKqnnJ0E2oTwEb/Z5
CtG9sQC0Zwc4nkKTF/y9SRlaTT4nKsHXlLencd0r+2Sa7V7DyVJp92t3Z6fBF0hZlYNckAuvFjxL
Fd126YqmyxeYmLBUtyUPFwBKAgGND9BBxVv6v5k/31B/wMuKu+r+ZP8AFUH/AAMuKtCHzExYBLc1
TRgBLsaA0P0HFW/q/mT/AH1B/wADLirvq/mT/fUH/Ay4qk0uWf5otLGdK+qog5819IsDv8G8hBBp
12yrIZ3s34vDr1c/j+h0PKnt52S5m/SzoqcDwZ41Ij5/DxEbKfsfaqlgxGf8TLP4VDg5sdm0lp7
NItc031xE5aINayug4Asp+NG+IKprT0fyafMJkwEhbs4ZsZiBiXTHtLubd7W3sLF7NI5ozGDayL
CgEgYkqBGkDsdXk9Jp8ozCUgfex1Gbh4ZESGTzW/nU30Ziv90FiKeorWk/qk71ofrHGnSmdG6Vgn
n60v5bTUxfX/Xb20Vxtl09JkNeKrc3piZGYqrcnHqAZo9bKtQNwPT1+PkXa6UXhPvYp5ZsJX1ZE
V LG8iiVvXi+C7hjSQBXHOR7uVXHJPsemdz88xtRP07EfZ/wAT+lvxR9W4P2/re56F/wAcPTv+YaH/
AJNj0gw/RH3B0+X6j71WP/jpT/8AGGH/AI1LlrwicVS/Qv8AeKT/AJi7z/qLlxVX1P8A45t3/wAY
ZP8AiJxV2mf8c20/4wx/8RGKqGu/7xR/8xdn/wBRcWKphiqGk/46UH/GGb/iUWkoHUF163k0r+on
CbiZIpI/UBKgAftL/KMshkMRTVPEJG0s0vyvIVkmItbeVZZYo2hhNTHHiiYISeS0NBuNx75LxZ3Bi
d008s1tbdbe1ht1JZYUwMMepCgCv4ZSW8KuKobUP7hP+M0H/ACeTFXR/8dKf/jDD/wASlxVE4q7F
XYq7FUHY/wC9Wof8xC/9Q8WkozFXyqhrT+/vf+Mw/wCTMeKonFXyq7FXyqluvf7yL/z1/wCoEXFU
yxV2KoG70TTLuYzzw8pSACyu6Vp0rWk1ynJp8czcgCWyGacRQNJbpf1jTvRma45zlrif06vIvCMS
sqp8Lb8Q0p3yH5PD/NDP8zk/nFPYYYoIY4YlCRRKEjQdAqigH3ZKAUKaSBuY/wDjpt/8YYf+JS4U
InFUV0L/AHik/wCYu8/6i5cVv9T/A00bd/8AGGT/AIicVdpn/HntP+MMf/ERiqhrv+8Uf/MXZ/8A
UXFiqYYqhpP+01B/xhm/4lFiqJxVDaf/AHD/APGaf/k8+KrnVXWgtgNJlt4rrkKtdRvLHwoajjG8
RrwnfFUoWH8xuXxXmj8S3Qwt1ULQd/rG5rXfWpB5theJ9VvNNNj9ZhVhDBNFiecyLEA0kzryMhA6
b9BviqdSR3ixjzqP6PGiE07IQUZz2R/58VUNQXxprR47JoLS5YrWuCxlc0YFvgMag1W064qvtf0
zHbQx3CwzZoirL0JGTm4FGfiIyF5HemKqvqa1/viH/kc3/VLFVS2n9aE0V4tVlZa1oyMVah7io2x
VQsf96tQ/wCYhf8AqHixVGYq7FUNaf397/xmH/JmpFUTiqDhub6aJJo4IvTkUOnKVg3FhUVAjYV+
nFV/qa1/viH/AJHN/wBUSVQWmQ+ZoPW+vz297zcmHjwHg1SQpojcutK4q7WDcfo+ee6EMEFtFNK8
nqFgAIXU15IgaHKta4q19rZ/mSsSrc6rpLSAAM62NxU7bn/eoCv0U9sVXpa/mJxJfUtJ5GpoLG5I
X4RQD/SxX4q1xVP7ZZ1t4luHWS4CKJnQcVZwPiKqSaAntiq1p/8AcP8A8Zp/+Tz4qicVQ0f/AB0p
/wDjDD/xKXFUTiqX6F/vfJ/zF3n/AFFy4qr6n/xzbv8A4wyf8ROKu0z/AI5tp/xhj/4iMVUNd/3i

j/5i7P8A6i4sVTDFUNJ/x0oP+MM3/EosVR0Ko0JL+E0iRR0hkKdWmjKa05fcCNv5vHFUDrdv5tuo
I00m6ttNlViZJXU3PJaUAClYwN964qq6rPqSaVdF44Vb0JPjWZga8D9kGP8AjhHNB5JCb00YUM EZ
FQaFF6g1HbM/hHc6zjPegdW1mXy8tvqFlpj37iTg9vAyRMVZG6lqd6ZTnFR2Dk6Ugy9R2atPzU1G
V63Plue0hXkZZHuInYBafZSIOWLAniPbtmH6u52PDj6S+z9qYD82PKZj9UC89Pu31Sam4Dfy+ByT
VSqPzP8ALRTmEveFK8vqstN+m90+K0ndhdTiBv8AQ5j++n7w/wC/n/4sxQtsrqf6zqH+hzGtweH
b9xF/wAWYqi/rc//ACxTffD/ANVMVd9bn/5Ypvh/wCqmKo00/uYnvXXT7iZvXQenGY0W8cY/a1U
bdevTFWGzfmT5hF3JbLpBmBfRu4zGU+KPk3L1JVKlW+H7JqfbNd+d1V8P3/AKnN/Kxvn93611j+
Y2txwww/6GmCxqkZlCWwHQCPAuyfnQYDrZ9w/wBl/wASkawPf/uf+KZRdear+20NtRTRrm8kKWX
hAYgje1sDV3DAP1Hwn7t8zceQmAkRwzjSxgT4bY3H+b0qyMR/hieOnVpLmILTx+EMfUGVfmh3fff+
pyRox/O+7/ilGBY7i2SSaMM0qhp0QDVLdcknrX3zms2afGfUefe7WGKPCNgqrNFYyRXY/dCGSNmk
SNpGC8xy+CP4227DL9Dlmc0QSfm1aqERj0yfarCxp20aw+q3+m78/Ws9Nn5sCpFD68UwpvXYA51
DokemrZkoUySsQACx028qfc0AGKFS01a1gh40t07l3dmWxu1FXcvsDG3Tl44qrfp2y/33d/9Id3/
ANUsVQ6a3ZfpCc+ndUMMQ/3juq7NJ29LFUR+nbL/AH3d/wDSHd/9UsVb0MOLAsyMnqXF1IqyKyNx
kuJHULWAYVvgdxigtqf/ABzbv/jDJ/xE4q7TP+0baf8AGGP/AIiMVVp4IJ4mhnjWwJ9njcBlI9wd
svQX+HfL/wD1bLT/AJER/wDN0Kod/L+g/pCBf0ba8TDKSPQjpUNHT9n3xVEf4d8v/wDVstP+REf/
ADTirv8ADv1//q2Wn/IiP/mnFXf4d8v/APVstP8AkRH/AM04qg9Y8ueXv0XdP+i7TnHFJJG3oRVV
1ULWU8diD00Ec0S5PP8AW/M3mbS72WF7W0eA/HayqL6T92XCqJTDbtIrcQSfi+Q0ZspE0BGESP7G
Q+TrzWL24srnUYreJZWL24t2mJ4mGT7Ynigcdv2crykm07ZhAE9md5iuY7FXyqhtP/uH/wCM0/8A
yefFVlj/AL1ah/zEL/1DxYqjMVdiqGtP7+9/4zD/AJmX4qicVdirsVdirxfwtZ17TFSSK3t5LNwB
CxF1JICiWfjWCGalX2rUfftnLeFCczZN2e7v8y7/AI5Ri0VV593uTDylqWs6hd2txdw20dqZ4hGY
WuOZYSp1WeGA069st0+0Ec0QLu/L9BLXm1KwKRNv8f0h6xnS0kdirsVdiqGj/wC01P8A8Yyf+JS4
qicVdiqG1P8A45t3/wAYZP8AiJxV2mf8c20/4wx/8RGKonFXyqhpP+01B/xhm/4lFiqJxV2KuxVC
ax/xyL7/AJh5f+IHC0aJcm05sXVJV5hsPMF9DbQaDe/UL4zVEwQ03ERvyAq8fb336Zvm5NuIEnZC
6N5b/Mq0/RrrzDPcJBMBkhjjj6I45D1piwAJq09e2YpEXIGPJfP7v1Bl+q2fmaWyEcV2jXBR1Ml
tG0HGUj4JOLzNVV3qvPf9QgR1bpg9GNx6D+ZKmr6uXI7GGi0pTcC8rWu/X6M1cfx/axqf4/sRmi6
H51s2KPeoFFPQ5RN6Me5L8oxdSGQNwGFV+eJMaUCd7/j7GQ2Ueo/wDQpPD/vQtF3L74i/4syttR
fp6l/v8Ah/5Et/1VxV3p6l/v+H/ks3/VXFUNax6j695SeH++Ff3L75j/wCLcVw6s3maGwkk0tbs
7vgU903mDwRsC6h6yBpStEqR8J3xVJTqP5o81po211S1G/0ywoHj/c7/A0e3fFKleSfmpewU9qlp
punSyx1UvYriSd42IPxJG0cakjalW74oIY3F5d/M368bR/MV48scazuqWkqFXLKFE3rsgbkvhXvT
Bfk0eDL+efs/UjbNXW0hV25MEUFj103enf001FeJKu8vV4ARCN86CLs/97rT/mIh/wCTi5doP76L
DV/3RZ/nWPP0xV2KuxVDR/8AHSn/A0MMP/EpcVR0KuxVDan/AMc27/4wyf8AETirWmsF0y1ZjQCC
MknoBwGKu/S21f8ALbB/yNT+uGkWF8N/YTv6cNzFK/Xgjx29gcFLa2T/jpQf8YZv+JRYpR0KuxV
2KrLiC0eCSCSvpyoyPQ0NGFDviqWf4cg/wCwqf8A5Jf9U8t8aTT+Xiq2uh29vcJP6ssrR1KBylAS
CtfhVexORlkJG7KOKMTYRFp/f3v/ABmH/JmPINiJxV2KuxVB2RAudRj6fWF/6h4sVX/pPTf+WuH/
AJGL/XFV8V9ZSuEiuI5HPRVdSdvYHFVlp/f3v/GYf8mY8VR0KuxV2KoaP/jpT/8AGGH/AI1LliqV/
4Q08bLP0qjooMdAPDdCcwJdm4SbI+1yxrsGFwqW/lawhnjm9aaQxMHVWku5KaivFV0xHjksfZ+KE
hIDcInrMkhR5Jzma4rsVdirsVQ0f/HSn/wCMMP8AxKXFW5tR0+B/TnuYop0vB3VTQ+xORMg0ZSIk
rP0xpH/Ldb/8jU/rjxx708B7l2p/8c27/wCMMn/ETkmKEf8A5Rhv+YI/8msIQXm2t6h5vtUuI7I
XetrQvEUsIp1FEDEK/1uAnr+0tS1adszJGVuBERI/b+xMfK2q+YikN5fxhp/rHCGC7iXTvhMLFmq
JbWUubboag5XlJ4d23CBx7dzMn1b/chCedntFKP96dt2j7+nmM5iI/S//FlN/wBJX/XvFDv0v/xZ
Z/8ASV/17xV36X/4ss/+kr/r3iqf1PUL+exlisl2xsrxgPSuWlEwQ1BJMZVOW23XFKRFfzA58h5p
0gDb4fqu2xP/ABdXcUxVE2svnK0dDceYNJntw6GSMQlJGRWqyhXIQcW2rwnPDFWQWl9ZoZnlurdX
mfnxSVWAoip1PH+XwxQr/pPTf+WuH/kYv9cVd+k9N/5a4f8AkYv9cVd+k9N/5a4f+Ri/1xVKbnVd
KjtNaaS8gRWyqC0iAetbRKbue7bPfkM1668wW9ujaJYwX85akiXE5twq/zAi0Xl8tsUL7y7WCKw
uL9orWkg9cmQemjTc44iRglRyNAaCvhiq211LThPeVuod5gR+8X/AHZH74qif0npv/LXD/yMX+uK
u/Sem/8ALXD/AMjF/rirv0npv/LXD/yMX+uKoS/gS7eaG4tXV40Qh5whBQueyv/AD4qx9ZvPgjC
t5g0JnC8S/1aUVP8xH1nr8tvbFK83PnmpP6d0HcdPq01AaDp/pXiMVTyPVnEaiSwayaQB2FzxBNn
yBwNPvxQu/S//FlN/wBJX/XvFXfPf/iyz/6Sv+veKu/S/wDxZZ/9JX/XvFU0mrf7kjjzs94oh/vT
ts0nf08UsE87XmVc+uLvSDFIyyD1oY4/rYf9wnEg+pbHanY1rTNBrRA5yJdw61+gu20pkMQ4e8pT

- CMYK Cyan CMYK PROCESS 100.000000 0.000000 0.000000
0.000000
- CMYK Blue CMYK PROCESS 100.000000 100.000000 0.000000
0.000000
- CMYK Magenta CMYK PROCESS 0.000000 100.000000
0.000000 0.000000
- C=15 M=100 Y=90 K=10 CMYK PROCESS 15.000000
100.000000 90.000000 10.000000
- C=0 M=90 Y=85 K=0 CMYK PROCESS 0.000000 90.000000
85.000000 0.000000
- C=0 M=80 Y=95 K=0 CMYK PROCESS 0.000000 80.000000
95.000000 0.000000
- C=0 M=50 Y=100 K=0 CMYK PROCESS 0.000000 50.000000
100.000000 0.000000
- C=0 M=35 Y=85 K=0 CMYK PROCESS 0.000000 35.000000
85.000000 0.000000
- C=5 M=0 Y=90 K=0 CMYK PROCESS 5.000000 0.000000
90.000000 0.000000
- C=20 M=0 Y=100 K=0 CMYK PROCESS 20.000000 0.000000
100.000000 0.000000
- C=50 M=0 Y=100 K=0 CMYK PROCESS 50.000000 0.000000
100.000000 0.000000
- C=75 M=0 Y=100 K=0 CMYK PROCESS 75.000000 0.000000
100.000000 0.000000
- C=85 M=10 Y=100 K=10 CMYK PROCESS 85.000000 10.000000
100.000000 10.000000

- C=90 M=30 Y=95 K=30 CMYK PROCESS 90.000000 30.000000
95.000000 30.000000
- C=75 M=0 Y=75 K=0 CMYK PROCESS 75.000000 0.000000
75.000000 0.000000
- C=80 M=10 Y=45 K=0 CMYK PROCESS 80.000000 10.000000
45.000000 0.000000
- C=70 M=15 Y=0 K=0 CMYK PROCESS 70.000000 15.000000
0.000000 0.000000
- C=85 M=50 Y=0 K=0 CMYK PROCESS 85.000000 50.000000
0.000000 0.000000
- C=100 M=95 Y=5 K=0 CMYK PROCESS 100.000000 95.000000
5.000000 0.000000
- C=100 M=100 Y=25 K=25 CMYK PROCESS 100.000000
100.000000 25.000000 25.000000
- C=75 M=100 Y=0 K=0 CMYK PROCESS 75.000000 100.000000
0.000000 0.000000
- C=50 M=100 Y=0 K=0 CMYK PROCESS 50.000000 100.000000
0.000000 0.000000
- C=35 M=100 Y=35 K=10 CMYK PROCESS 35.000000
100.000000 35.000000 10.000000
- C=10 M=100 Y=50 K=0 CMYK PROCESS 10.000000 100.000000
50.000000 0.000000
- C=0 M=95 Y=20 K=0 CMYK PROCESS 0.000000 95.000000
20.000000 0.000000
- C=25 M=25 Y=40 K=0 CMYK PROCESS 25.000000 25.000000
40.000000 0.000000

- C=40 M=45 Y=50 K=5 CMYK PROCESS 40.000000 45.000000
50.000000 5.000000
- C=50 M=50 Y=60 K=25 CMYK PROCESS 50.000000 50.000000
60.000000 25.000000
- C=55 M=60 Y=65 K=40 CMYK PROCESS 55.000000 60.000000
65.000000 40.000000
- C=25 M=40 Y=65 K=0 CMYK PROCESS 25.000000 40.000000
65.000000 0.000000
- C=30 M=50 Y=75 K=10 CMYK PROCESS 30.000000 50.000000
75.000000 10.000000
- C=35 M=60 Y=80 K=25 CMYK PROCESS 35.000000 60.000000
80.000000 25.000000
- C=40 M=65 Y=90 K=35 CMYK PROCESS 40.000000 65.000000
90.000000 35.000000
- C=40 M=70 Y=100 K=50 CMYK PROCESS 40.000000 70.000000
100.000000 50.000000
- C=50 M=70 Y=80 K=70 CMYK PROCESS 50.000000 70.000000
80.000000 70.000000
- Grays 1
- C=0 M=0 Y=0 K=100 CMYK PROCESS 0.000000 0.000000
0.000000 100.000000
- C=0 M=0 Y=0 K=90 CMYK PROCESS 0.000000 0.000000
0.000000 89.999400
- C=0 M=0 Y=0 K=80 CMYK PROCESS 0.000000 0.000000
0.000000 79.998800

- C=0 M=0 Y=0 K=70 CMYK PROCESS 0.000000 0.000000
0.000000 69.999700
- C=0 M=0 Y=0 K=60 CMYK PROCESS 0.000000 0.000000
0.000000 59.999100
- C=0 M=0 Y=0 K=50 CMYK PROCESS 0.000000 0.000000
0.000000 50.000000
- C=0 M=0 Y=0 K=40 CMYK PROCESS 0.000000 0.000000
0.000000 39.999400
- C=0 M=0 Y=0 K=30 CMYK PROCESS 0.000000 0.000000
0.000000 29.998800
- C=0 M=0 Y=0 K=20 CMYK PROCESS 0.000000 0.000000
0.000000 19.999700
- C=0 M=0 Y=0 K=10 CMYK PROCESS 0.000000 0.000000
0.000000 9.999100
- C=0 M=0 Y=0 K=5 CMYK PROCESS 0.000000 0.000000
0.000000 4.998800
- Brights 1
- C=0 M=100 Y=100 K=0 CMYK PROCESS 0.000000 100.000000
100.000000 0.000000
- C=0 M=75 Y=100 K=0 CMYK PROCESS 0.000000 75.000000
100.000000 0.000000
- C=0 M=10 Y=95 K=0 CMYK PROCESS 0.000000 10.000000
95.000000 0.000000
- C=85 M=10 Y=100 K=0 CMYK PROCESS 85.000000 10.000000
100.000000 0.000000

- C=100 M=90 Y=0 K=0 CMYK PROCESS 100.000000 90.000000 library 15.00
0.000000 0.000000
- C=60 M=90 Y=0 K=0 CMYK PROCESS 60.000000 90.000000
0.003100 0.003100

Figure 11: Figure 11

In order to define a finite state machine for the protocol and the different stimuli that cause a change of state, the model presented by M.Wild (Wild, 2013) in her paper "Guided Merging of Sequence Diagrams" will be employed. This model is beneficial since it provides an integrated method both for client and server maintaining the stimuli relationship that trigger a change of state in each component.

eG7ClvTEhAJX7XxcAvtXvir1ttZsLzzPaWUBl+sWnq+urwyxq0cQZfjdVU1B6A1xSi9e81eXtAEB
1m+jshc1hB61fjMYBa1AegNcUJdY/mX5Fvrhbe11eKSd5kt44ysilpZHEaKvJRY5MaAjBFUz8xzw
W+mCeerYoY7mzaSVyFVVF1FUx2AxVZ/i7yp/wBXqw/6SYf+asVS65/M3yBbzPFJrtpzjKqXR/UX
kzceIZAyswP2gdVe9MVvtP8AzC8kX5m+q63aN9XYRy15BEORUPRTJxDbMK8a06HfFwn8y+XtR1nT
b0w1K2urqK5Z3hh1R24m0m+IcSajcVixVU1rz35T0TURp2qagtted6yISKjH0as0VUVh+w23XFU
oX85Py8e6W2j1JpHMnouy29xxR+XABiYx1bbav3b4rSa30taZrflNtT0yb6xY3FpSm4sleE3Bvhc
KwoykbjFKcajP9lqvJPYX0Kz2d0jRTwt0ZGFCnt/pgKEg8nflT5P8nyXMuhWx0T3e0szs0j8K1Ea
sxnFB7d+9aYqMth/x2tU/wCeH/EDiqOnt7edAk8SSoDyCuoYVHehxVuKGGFPThRY4wSeCAKKsSzG
g8SanFUFF/ykFl/zCXX/ACct8VTDFwVXUqWkwoyncEHscVQGlkfxDx9rtK/wDSJBiqL+q2pYOY
U5KeStxFQfEGmKtrbW6v6ixIJB+2FFfDriqDg/5SC9/5hLT/AJOXOKphirsV57QWj2MoNGH1u8BH
X/j7lXVGCztA4cQRhxSjBVqKdN6dsVXLbwKwZY1DC1CFFRQFR9ymmKoLSyPrur+12lf+kSDFvFT/
A04f/jNP/wAnnxVQ0z/e3Vv+Ytf+oSDFW0Rf1D5Di82/4qSwI1T1PXUc29IT8uXrBK/ar9HtirIb
/wD470l/89/+TYxVE32l6ZqCql/aQ3aLXis8aSActjQ0D1xVAnyf5V5x0ukWkbwyxzxPHCKbCWFu
UbVQKfhYVGKq+u/7xR/8xdn/ANRCwKphiqlNZ2k1fWgjkRseaQ1R9IxVuK3t4mdookjaShkZVALE
dK064qluo21pFqmm3KxRzzXfGackod6Ws6oGbqfAVxVNsVWJDDG0jxoqNM30VLABdgoTkxHU8VA
qewGKpVrNpZ2Xl2W2tIY7a2j4LFBExovKVdlVQAKk4qnGKuxVC3WlaXdyCW7s4LiUdiHljR2Cgk
0qw025xVR/w75f8A+rZaf8iI/wDmnFXf4d8v/wDvstP+Ref/ADTiqvaaZptmzPaWkNu7gB2ijRCQ
OgJUCuKonFXyqHlnSNJupfWubKCeUgAySxI7UHQVYE4qpF4d8v8A/VstP+Ref/N0Ku/w75f/A0rZ
af8AiiP/AJpxVE2lhY2astpbxW6uAusSKgJ6VPEDFVfFXyqg59F0a4maaewt5pn+3JJEjMaCm5Iq
dhiqA1TRPLdvZmeSws4oo5ImklaKJVVBKvIsxFA0PXFULodx+X2umb9Dx6feiCnqtFDGVHIkAg8a
H7PbFWQW1pa2sQhtYUgiBJEcShFqepooAxVT0/8AuH/4zT/8nnxVQ0z/AHt1b/mLX/qEgxVMMVUL
yws72NY7qJZVRuSV6q1CKqRuDQkbYqhP80aN/wAs/wDw8n/NWKpdxLyE2051FumkN1cei0ZkXjC
JWEaH4tyoFK4pTSHQdIhmSZLZfUjPJcXzQn4gMSK4oR+KuxV2Kqdx29zC0NxEk0L05RyKGu0NRU
Go6jFUH/Aid8v/8AVstP+Ref/N0Kpc1j5Psp5xfw+n23q3CxcwCZII+TGKP4U5AVNT0GKwo7/APLu
BlnjuNiZGJSVxtlKtGaGjA7FT18MUMixV2KuxV2KuxV2KuxV2Ko041nSLaYw3N9bwzLQtHJKiMK
7ioJBxVT/wAReX/+rnaf8j4/+asVd/iLy/8A9X00/wCR8f8AzViqJtL+xvFZrS5iuVQ8XMTq4Bpw
h4k0xVxxV2KokbXNFhleGbuLa0Wm0eN5o1ZT1oQTUYqlwueZtNSG0S0uLS7Et3bpcD6zEnpQ+oGe
WnxcuPH7P44qi7TUvKfMhFndafbCVUghkhTkAWrcSKmgpiqY2t5aXcfq2s8dxECVMkTq61HUVU
kVxVZp/9w/8AXmn/AOTz4qoaZ/vbq3/Mwv8A1CQYqmGKoXU11NrCzdMaFL8j9w9wGaIGoryC0PTF
WLxw/m96axy3WhEmNveZYrs0H4qGYAsUNDyI2322GKsn0r1fqf70qZfVm9QRULy9Vq0rU0riQLxV
Bz61o9vK0Nxf28MyfajklRwFRXcEg4qp/wCivL//AFc7T/kfH/zVirv8ReX/APq52n/I+P8A5qxV
GW9zbXMqmt5UmhavGSNg6mhoaEVGKqmKpLdeW/L+r3dxJqmm217JDMBE88SSMoMUZIBYE0JHTFUM
fy38gleJ0CkX7/7pTvUHT/1HFWR4q7FULXT7C+1rUDe20V16SwLF6yLJxUqWIXkDspPbFUV/h3y/
/wBwy0/5ER/804q7/Dvl/wD6t1p/yIj/A0acVQ6Wdhp+twi1hjtIZbs4e4WJRGjGKSHizBaD4RI2
/viq/wAy6+dDsFu10691NmKEYt9PhM8o+EsWKjovw0r40GKovS743+nW14YJbVp41dra4Ro5Y2I3
R1YAgqdsVQ9jLFDc61LK6xxR3IeSRiFVW0gJZidgAMVXnzBoIt/rJ1K1Fv8P74zx8PjFV+L1T4h
uMVVRq21l1QXkBD2VEUSJVnflxUCu5b02oPY+GKpXql/dafeapeWtm1/cxWdmY7NHNW5CZrgcVZ/
hrvt49MVSww88ed7hYfX8jXdvI4Yyobu3IWgqArHgDwnfj90KUVpnm/zZPd2lvf+ULqyScqJ7lbi
CaKEMaVNCjMF7/D0xQnekSww6bcTSusUMdzfPJI5CqqrdsImYnYAd8VXy+YdAig+sS6naRwAsDK0
8YSqMEb4i1PhZgd74qr22qaZdPGltdwzvNH68SxyI5eL4f3ihSar8a/Entx44qoaZ/vbq/8AzFr/
ANQkGKq+n/3D/wDGaf8A5PPiqhpn+9urf8xa/wDUJBiqYYq7FXYqg4muLYPH9XeUGSR1eMx0pI5f
9tkNRyxVf9bn/wCWkb74f+qmKoby+a6fIxUoWu7w1TSop1qXrSoxVMsVaR0kRXRg60AyspQCC
MVSC3vdUg1+/gt9Ma5sZLkNcXiSxIY2FpDQek5UvUgbg98VTf63P/wAsU33w/wDVTFV1pHIDPJiv
AzScwhIJACKm9Kivw9sVV8VdirsVS2w/470qf88P+TZxVINS/LaLULqaSfzBrP1a4Nw0lmLqsYNx
KsqhAVICRcSqKQaD5Yqv0v8ALwWN3BcSeYNYuxbzia0Ce55xMFRERJVKnnQR9agkk4qmWuaNper6
tZWmpwyXVuLe5kVJBWjrLb0ZT1B9xiqZ/ozTf+WSH/kwv9Mvd+jNN/5ZIf8AkWv9MVQFhp9lJ+nL
JoVFPcencLCo4KvktIQ4+GnWpxVL0/K/yCl2l2ujQeuhDKxLkVAUbqW4mvAcqjfvWpxW1aP8vPJK
WoR6jFpccD5Fcg7SZGkUiYsz8qBqU50xCO0k9MvVbrRtK1HzHJJfwsdxJaQWkts8ig1H9S43U+9N
x00Kpp+jNN/5ZIf+Ra/0xV36M03/AJZIf+Ra/wBMVQWk2VrNo1zZSRKbwae+ikiHwgo9zKRL8NKV

B7Yq1A/Kb8vAgRdGjVQSdpJgatStSHqa8R92K2m0ieR/Kmh3zX2laelPdNEYw1RnNY24EijMRuY1
Pz+ZqqrWNjZTajq8ktvHJJ9aQc3RWNbawUFSPfFU1VVRQqgKqiiqNgA0gAxVAAz/vbq3/Mwv/UJB
iqYYq7FXyqhhesxb0raWVFZk5qYwCujVqcnU7EeGKu+tz/8ALFN98P8A1UxVD+X2Lae7FShN1eEq
aVH+lS7GhIXVI9V/KzyXql9c315aSNdXjc7h0uJ4wzcXTdUdV+zIR0xV0vLflzTvL2kx6Xp4f6vG
zvy1bk5Lsw+JqDoPhXwUAdsVQdvc6xHrt9Da2Mc9lLc/v7pp/TaJls4SB6fpvyDbCoP0Yqm3qa1/
viH/AJHN/wBUSvVLadpfUV04SRNwcA8hXiG2NBXZh2xVvX2KuxVL5dPv1vZrquyY4vrCoJo5oWl
FY6gMpWSIjY71r9GKqV0PMMFrNMLy0YxIzgfVZd+IJ/5aMVVfQ8wf8ttp/0iyf8AZRirdrZXZvRe
XdzH08cbwwrDEYlAdlMnLk8pJrGo6imKo/FXYql82jQyXEs8dxcw7zknksMhVwZVCBqGu/FQnVDF
Vv6E/wCX+8/5Hf2Yq79Cf8v95/y0/sxVXstNhtJJZRJLNNMFV5ZnLtxSpVR2ABdj90KovFXyqlra
HD6kjRXNzAsjtI0UUpCBnPJiAa05MScVS/wdN1S3S0awu7iXndwR3fqT0428j8XZNhVhUUXSmH6E
/wCX+8/5Hf2Y0RNjYQ2aSLGzyNM/qSyysXdm4hKknwVANvDFUTiqX6Z/vbq3/Mwv/UJBiqYYqlHm
C580RCBdBsre5duTTYXUpjVQoqqhVBjL9K9F9+YqY63+a5eZYfLVgoRG9F3v+SyMFHHoiflfi7U3
8R3Uso0dpmsFadBHM0kpljBqFYtyFR4HFCNxVLho8sbP9X1G5t4nkeX0UFuyhpGLvQyR027MTuc
Vb/Rl7/1d7v/AIG0/wCqGKu/Rl7/ANXe7/4G0/6oYqr2Nitosv72SeWeT1ZppePJM4qg2RUUUUVAN
hiqJxVIR7zT5c0W7nj1bUrexkuJh6KTSKjMBDHVqHfjXbl0qQ0pGKoe3/MvyFczpBBrlrJNI6RpG
H3Z5GCIoFNySR948RirJcVdirsVQ2p/8c27/AOMMn/ETirGNT/KbyRqFxc3MtpNHc3kwnuporq4Q
yN6hlKsofHxZnbYDau1DQ4rahJ+TXka2UlrDZZ2yyQfVjJDD3IYQ8ufAAyMtOW+69d+uKss0rSrD
SdPh07T4vQs7cFYyUTNXBJY7sWY7nucVReKuxV2KuxV2KuxV2KuxVB6uszWRWFxHMZIRG7LzVW9V
aEqcVIA9qjFUV8taf5stDcHX9Wh1MOV+riG3FvwpUnoT1rShr0G/XFU8xV2Kpfpn+9urf8xa/wDU
JBiqYYq7FXyqlug3ou7a4YQywiG7uof3oC8ik7AslC1VrsDiqZyq7FXyq7FXyq7FUAtLz3U12LmC
0cL0CokRXoTBGDTkD2xVtNB00Ny6adaq5oSywxg/Cajcdsd8VR2KuxVlHuNVuNRube1lggitljqZ
YnlZmkBYmqyAClNqHFVHUtJ1fUdPudPubu1a3u4ngmAtZAeEilTT/SOTdiqtBY61bwRwQ3VmkMS
hI0fPJRvUUAH+kdhiq6CfUotSjtLuWgzJoZZUaKJ4ipienSDyk15cvV9qUXVMcVdiqUg6rd3t6sN
4ttDayrCicJXJrDHKWYsetZKbYqqfUNZ/wCrfp/yQj/rirvqGs/8AV0/5IR/1xVvT5b5NqubK6nFw
IooZkkCCNV3rSqVIBIIHpVHzxVMcVdiqT2w1e+Es6Xy28YnnijiwFwosMrRCrMaknhXFV8216vKo
VtUNAyvtBH1Rgw7+Ixvf9Q1n/q6f8kI/64qv0qa7dryC6kWZ7wCRLKF4FlaG0X4gCRUGQjbFufiq
X6Z/vbq3/Mwv/UJBiqYYql0r21vdanplvcxJPAWmYwyKHQssexKmqKmmKq3+HfL/wD1bLT/AJER
/wDN0Ku/w75f/wCrZaf8iI/+acVQmpaRpVpDBcWl1Bb3CXVqEmijRHAE4jRgGUA/ErFT7HFU7xVh
9z+b35cwx1E2txKYWKOPTmJqFDHjRdyFGG61HbritJr5Z86eXPMY3B0a6+s/VeHrgo6FFu5Bftqv
eN8xiqI1qK0eXTbaZRjzbXRWaft0cLbzSAM0hAdFND4Yqv/AM0+X/8Aq2Wn/IiP/mnFXf4d8v8A
/VstN/8AiiP/AjpxVA63o2kWumyXFzRQQXETRtFNFEi0rCRdwygEYqn2KuxVLbD/AI70qf8APD/k
2cVY9q0rfmkt3LBYaLYtEHuDBcyTFlaJJEHJQ6E08ZJYdB49sUr9M1X8zZr63jvtGsr9cJdzL
MXyRkicnjXkK8nZuJPQDcdKqp5et0NesfRRHb6rdvDsfUPUt+4V8UIXzJoeo67YlZm5n01VkEhm0
+7MMpopAUs0D/D8VaeIGkq1naazpWhLZwi+mtIClVJdXBawRlB4CRxFGD2FdsVXaDjFP+lJLqC0
G8Nype3SuyIrFVIKL6hRCfc8MVYyouo/nf6ADaVpfpq+pUkSH7BHLb95T4W+H5e+KU10a//M2bULYa
pp2nW+nGWRbt4nkMwRFAVkusV+0Qkj/JHSpGKr/MugS69eX2mi5uLOJ7W0Z5706a1mp6lyCnJUKD
Iw040KEuP5aTtIryazq0vHmQkmqSOP3gKn7UB0ysVHtim1ay8ma3o92+padqN7f3pjWFLXUtRlmt
CtQKsnog1UVYEd6/LFU5sZNWxy1dyWUML6sJL5oLd3JhM/1iwi16ISvLvRa+2KGP2V3+c0k9pDc2
Wl28PMi6uqtIQinZuCyLXkv8vQ+22Kux0S8/MqbUbNdascL1sayNeyW0j0390BGqhf921JPhQdj
VQnmmf726v8A8xa/9QkGKphiqX6Z/vbq3/Mwv/UJBiqYYqlt/wD8dnS/+e//AcBgKpRrH5d6TqmQ
3GpyX2o21xc+n6i2ty0Kfu4zG0KqNqg9evh3xw0DbflJoVrEYrbUtVgRnawX07xkLy01WdiBwVH4
du1e5JxTad30l2+new9P0qFpGt7N90tYndv3hSK4hRSzLx+Ki7kUxQmf6Pg/nm/5Hzf814qsk0ix
laNpBI7RMxiLTSkqxUoStW2PFiPkTiq8adbGUDTADoPXm/5rxVKLjRle18wWF/HcXTvcXBROJJ5J
IF42kw5LGxIDHiKt1xVZ5o8mDXplmXWNR0yQIKrfjP6SFFYsarT7Z5bN2IHuCqlsP5VaXBGyrbWd
YgiZubxx3fFweoqxHDqUHD5f5XyYpt0b7T49N8pR6dFJJLFZQQW6SzENIyxFED0QFByhanbFCeYq
7FUoaaax1W8la1nmuiViMckKhxVFKsp3BBHyxVv/Tf8Ay4Xn/In+3FXfpv8A5cLz/kT/AG4qtT5Z
rzV4rkW00ENvbzRs06h0TPEwCip0wiNfoXVNMVdiqUxyX1nfaGRp81xHcTLLFLE0HHj6EUZBEks
bV5Rntiqt+k73/q03f8AWvp/1XxV36Tvf+rTd/8ABWn/AFXxVqWf1LqV1eTWz2sckMEKJK0ZymJp
WY/unKFP3o7164qmOKuxVKL0a/sklT202eb/AEi4kWwJ7fgyzTPKt0cqN0ehqvXFVf8ASd7/ANWm

7/4K0/6r4q79J3v/AFabv/grT/qvirtJS59S/nnga2+s3AkjikKM/FYIo6n02dd2jPfx...
3t1b/mLX/qEgxVMMVQd/Yy3DwTwSiG5tmYxuy+ohDrxZXSqEingw3+4qqfoeYP8Altt...
V3oeYP8AlttP+kWT/soxVa+n6ncNEt5dwvbxYJM0cMDRSzRMHQFn1l25qCaDFUyxV2K...
IheGUQ3FtJ6sLsvNeXBoyGwqkgo7dGGKqPoeYP8AlttP+kWT/soxV3oeYP8AlttP+k...
N1W7j9C7vIDbMymVYbd0chWDUDNNIBWLD80KppirsVdirsVdirsVdirsVdirsVdirsV...
VdirsVdiqEsrawG51CRwONxcLJFQ/siCKPf/AGSHFUXirsVdirsVdirsVdirsVdirsVdir...

- White CMYK
(White)
PROCESS
0.000000
0.000000
0.000000
- Black CMYK
PROCESS
0.000000
0.000000
0.000000
100.000000
- CMYK Red
CMYK
PROCESS
0.000000
100.000000
100.000000
0.000000
- CMYK Yellow
CMYK
PROCESS
0.000000
0.000000
100.000000
0.000000
- CMYK Green
CMYK
PROCESS
100.000000
0.000000
100.000000
0.000000

- CMYK Cyan CMYK PROCESS 100.000000 0.000000 0.000000
0.000000
- CMYK Blue CMYK PROCESS 100.000000 100.000000 0.000000
0.000000
- CMYK Magenta CMYK PROCESS 0.000000 100.000000
0.000000 0.000000
- C=15 M=100 Y=90 K=10 CMYK PROCESS 15.000000
100.000000 90.000000 10.000000
- C=0 M=90 Y=85 K=0 CMYK PROCESS 0.000000 90.000000
85.000000 0.000000
- C=0 M=80 Y=95 K=0 CMYK PROCESS 0.000000 80.000000
95.000000 0.000000
- C=0 M=50 Y=100 K=0 CMYK PROCESS 0.000000 50.000000
100.000000 0.000000
- C=0 M=35 Y=85 K=0 CMYK PROCESS 0.000000 35.000000
85.000000 0.000000
- C=5 M=0 Y=90 K=0 CMYK PROCESS 5.000000 0.000000
90.000000 0.000000
- C=20 M=0 Y=100 K=0 CMYK PROCESS 20.000000 0.000000
100.000000 0.000000
- C=50 M=0 Y=100 K=0 CMYK PROCESS 50.000000 0.000000
100.000000 0.000000
- C=75 M=0 Y=100 K=0 CMYK PROCESS 75.000000 0.000000
100.000000 0.000000
- C=85 M=10 Y=100 K=10 CMYK PROCESS 85.000000 10.000000
100.000000 10.000000

- C=90 M=30 Y=95 K=30 CMYK PROCESS 90.000000 30.000000
95.000000 30.000000
- C=75 M=0 Y=75 K=0 CMYK PROCESS 75.000000 0.000000
75.000000 0.000000
- C=80 M=10 Y=45 K=0 CMYK PROCESS 80.000000 10.000000
45.000000 0.000000
- C=70 M=15 Y=0 K=0 CMYK PROCESS 70.000000 15.000000
0.000000 0.000000
- C=85 M=50 Y=0 K=0 CMYK PROCESS 85.000000 50.000000
0.000000 0.000000
- C=100 M=95 Y=5 K=0 CMYK PROCESS 100.000000 95.000000
5.000000 0.000000
- C=100 M=100 Y=25 K=25 CMYK PROCESS 100.000000
100.000000 25.000000 25.000000
- C=75 M=100 Y=0 K=0 CMYK PROCESS 75.000000 100.000000
0.000000 0.000000
- C=50 M=100 Y=0 K=0 CMYK PROCESS 50.000000 100.000000
0.000000 0.000000
- C=35 M=100 Y=35 K=10 CMYK PROCESS 35.000000
100.000000 35.000000 10.000000
- C=10 M=100 Y=50 K=0 CMYK PROCESS 10.000000 100.000000
50.000000 0.000000
- C=0 M=95 Y=20 K=0 CMYK PROCESS 0.000000 95.000000
20.000000 0.000000
- C=25 M=25 Y=40 K=0 CMYK PROCESS 25.000000 25.000000
40.000000 0.000000

- C=40 M=45 Y=50 K=5 CMYK PROCESS 40.000000 45.000000
50.000000 5.000000
- C=50 M=50 Y=60 K=25 CMYK PROCESS 50.000000 50.000000
60.000000 25.000000
- C=55 M=60 Y=65 K=40 CMYK PROCESS 55.000000 60.000000
65.000000 40.000000
- C=25 M=40 Y=65 K=0 CMYK PROCESS 25.000000 40.000000
65.000000 0.000000
- C=30 M=50 Y=75 K=10 CMYK PROCESS 30.000000 50.000000
75.000000 10.000000
- C=35 M=60 Y=80 K=25 CMYK PROCESS 35.000000 60.000000
80.000000 25.000000
- C=40 M=65 Y=90 K=35 CMYK PROCESS 40.000000 65.000000
90.000000 35.000000
- C=40 M=70 Y=100 K=50 CMYK PROCESS 40.000000 70.000000
100.000000 50.000000
- C=50 M=70 Y=80 K=70 CMYK PROCESS 50.000000 70.000000
80.000000 70.000000
- Grays 1
- C=0 M=0 Y=0 K=100 CMYK PROCESS 0.000000 0.000000
0.000000 100.000000
- C=0 M=0 Y=0 K=90 CMYK PROCESS 0.000000 0.000000
0.000000 89.999400
- C=0 M=0 Y=0 K=80 CMYK PROCESS 0.000000 0.000000
0.000000 79.998800

- C=0 M=0 Y=0 K=70 CMYK PROCESS 0.000000 0.000000
0.000000 69.999700
- C=0 M=0 Y=0 K=60 CMYK PROCESS 0.000000 0.000000
0.000000 59.999100
- C=0 M=0 Y=0 K=50 CMYK PROCESS 0.000000 0.000000
0.000000 50.000000
- C=0 M=0 Y=0 K=40 CMYK PROCESS 0.000000 0.000000
0.000000 39.999400
- C=0 M=0 Y=0 K=30 CMYK PROCESS 0.000000 0.000000
0.000000 29.998800
- C=0 M=0 Y=0 K=20 CMYK PROCESS 0.000000 0.000000
0.000000 19.999700
- C=0 M=0 Y=0 K=10 CMYK PROCESS 0.000000 0.000000
0.000000 9.999100
- C=0 M=0 Y=0 K=5 CMYK PROCESS 0.000000 0.000000
0.000000 4.998800
- Brights 1
- C=0 M=100 Y=100 K=0 CMYK PROCESS 0.000000 100.000000
100.000000 0.000000
- C=0 M=75 Y=100 K=0 CMYK PROCESS 0.000000 75.000000
100.000000 0.000000
- C=0 M=10 Y=95 K=0 CMYK PROCESS 0.000000 10.000000
95.000000 0.000000
- C=85 M=10 Y=100 K=0 CMYK PROCESS 85.000000 10.000000
100.000000 0.000000

- C=100 M=90 Y=0 K=0 CMYK PROCESS 100.000000 90.000000 library 15.00
0.000000 0.000000

- C=60 M=90 Y=0 K=0 CMYK PROCESS 60.000000 90.000000
0.003100 0.003100

Figure 12: Figure 12

In Figure 12 we have the method proposed by Wild for SMTP, in which there are boxes representing states and arrows representing transitions. Each transition has a label composed of the originating stimulus that triggers the transition and a subsequent stimulus effect triggered by the transition itself. For instance, when a client connects to an SMTP Server, the client goes from "idle" state to "conPend" state. The label of this transition includes "uCon" as the stimulus triggering the transition, which triggers the effect "sCon". Then, on the diagram for the server we can see that the "sCon" triggers the transition from "waiting" state to "accepting" state in the server.

This method will be used to define the states and transitions for the Flow Namespace Accessing Protocol both for client and server.

5.2. Flow Namespace Accessing Protocol (FNAP)

Using the model proposed by Wild described previously, we define the finite-state machine for the FNAA Server, which we can see in Figure 13.

9JbUmcn1hK0tsEAIpSsMnKtT8qYq1lv5p86s8Xr+wFjjaRVmK3UjMkZYBnA+rAMVWpAqK+2KU8v9
VtC9va8ZhNPLGY6284WiSoWLOU4L1/aIr0GKEH5h88aJoVwbW7W6LuvSM6w21tNLVd6A0q+nyYqQ
ByxVfpPnLSNV1V9LtUuLuo0lkk9e2mgVRA6Rs0UqrU85KcNge1Kqo2yvYUikUrKSJ5weMMRd++fo
QpBxVLtd8weYLV0/Q+jfpJDx9QyyTWrAktWgNvKDSg798VSZ/Nn5j/vCn1WGgkAQG6lqYyDv/v0N
waV/j2Usn0vVrmaxik1G0e0vDy9W3jSaZVoxC0f00rywh6bdN+uKFiaxZT6g7RiallD0J+UE6GoM
TEIGQGTb+SuKpR/ytHyn6pjJvQwLgVsbsV4Akmhj5UNNiRitIzTfN0m+YLSaSwSdUtbm3jknxC8F
WMin8IcAmnjqYwf8pBe/wDMJa/8nLjFXaF/vFJ/zF3n/UXLiYqYqoX0by2VxFGKu8Tqo6VJUgdc
VWPfSoj09pKqKCzMQgADckkyYqkp/MLyqqxtLfQQ+pFF0izXNrc3pzjlgxwSVWHIdKjFU30a4hu
d0juYHWSG4aSwJ0ZXBWSRmX4lJHq9jijqNv2KuxV2KoST1orySVYHmSSONBwKChRnJrzZf58Va0o
SiVYjZzc3VmarD0UgH/dn+UMVWXX1q6iWfYJbcmSN/WJhPEJIrn9qTstPs4qrrYwnkZ/9JZ6AtKE
0y1oKKqrtyPbvirM03TmjEbWsJjHRDGPxPtpTFV0NjZQEGG3jiK1K1EVacutKDviqirXEFcxkW0k
qyyB1ZDHSnpov7Tqeq4qv+tz/wDLFN98P/VTFVqGeW9jlaB4kSKRSXKGpdkIpwZv5TiqLxV2KqF9
HI8FI15srxvxFASEkViBwg6DFVv1uf8A5Ypvh/6qYq763P/AMsU33w/9VMVUNHj1WNLkX6wqjXE
j2axciwhdi49Wu30rGvHbFUwxV2KuxVC3PrJdwzJC0yrHIjBCgILMhH22X+U4q0+oSo0atZzVkb
i8PUKW/354KcVWzvczqkYtZE/erMYxUASRWP2XY9B4Yqsg/5SC9/wCYS1/50XGKu0L/AHik/wCY
u8/6i5cVTDfVK6mMFrNOF5mJGcLWleIjPwhpiqn6mpf74h/5HN/1SxVL49FT0ES50yxuJQkayyvu
XMqOpNyM029N9sVTGwCNaqFiWBYy0QijNUURMUAXZdvh8MVRGKuxV2KuxV2KoaT/AI6UH/GGb/iU
WkonFXyq7FXyq7FXyq7FXyq7FXyq7FXyq7FXyq7FXyq7FXyq7F7WJX/mHzYNQiSLypcPBHcMIZmvLJDIPQ
f4uHqsV+In3pv7YpZBo15qN5p0Vxq0ntpd49fVsnljmKUJA/eREoajfbFCyD/1IL3/mEtf8Ak5cY
q7Qv94pP+Yu8/wCouXFUwxVK9Qe8l1ttRVZI0hhV4k1CWI9JXPxcwP2qfZxVU1qy1a7tUj0vUf0Zc
LIrt0YUuAyaEGMo5FKkg1BrtiqG8uaZ5isVuRr0sDV2kcGBxbpb8Fp8QohPUNx7e+Kr9PttVE11M
t6htZJXENq8FfSKyyczzV1Lc6jr0piqN9PUv9/w/8iW/6q4qx3Wfy70XWb5r7Uoo57lypZ+V2gqi
8VoiXKqKdWvhv1xTaM8v+UbPy9FNFo6xW0c5VpV4zyAlBQH9509NvDFCbenqX+/4f+RLf9VcVd6ep
f7/h/wCRLf8AVXFW4ref6ws08quyIyIEQoK0VJrVnr9gYqiMVdirsvdiqEE17LP0sTxxpC4QBkZy
aor1qHT+bFV3p6l/v+H/AJEt/wBvcVajku0u0hme0RZI3cFEZCCjI07PwvPFUVirsVdirsVU/rNs
GCGVORQyheQqYxSr0/l3G+Kr1dGLBWBKHi4BqQaA0PhsQcVbxV2KuxVDXEtz9ZiggZE5o7szqX+w
UAAAZP58VQ15pv/c3dlcteiNrKRpvjjSRUk5xtHxkUS0YDnyHuPniqIle/gC08kUiGSNGURspo7h
NiXbpyr0xVTg/wCUGvf+YS1/50XGKu0L/eKT/mLvP+ouXFUwxVBxRJM2oR0KpJJwYDbZoIwdxiq5
rS64njey8qfDUQ0r2r+7xVijecvqVpbJejWlQ8MUXryWemyPE8rfDJ6bGDjxBq3WnHoTvilP/Les
W2p2cjQ213amKRle0/ha3lLMerfgwHwsx0KE2xV2KuxV2KuxV2KuxV2KuxV2KpbcWtxdw61b293J
YzSTLwuogj0lIoiaBwy7gU6YqksHknWopG1bzdqsjtJGx5fVuPCN0JTh6XAcYzEAH78VTJ9LvBD
p1gmp3CXFvamOS/AiaaX0zErNJ6i0tZ0rEAGvQ4qmp1Sf/ltm+6H/qnirvqk/wDy2zfdD/1TxV31
Sf8A5bZvuh/6p4qh9Q0SHub0WypnubSYcZYJFhKsAa0I9PxGKpBH+U3kaNmZNNhDMoUn0oDsDud
Y8U2nwkewbDRrT6npTNZ2vIv6MSQqvIgAmnp+wxQjfqk/wDy2zfdD/1TxV31Sf8A5bZvuh/6p4q7
6pP/AMts33Q/9U8VSzVtKv7qW03t9WuLOVo2YXmawF1CSRMygG0lH6H8MVSxfI+urGiDzfqhCAUL
CAktzZ6k+nU/aAoTSgp0xSrQ+WtXsiJrnzHfX4PCJY5Vt1VWkuYmEoCxiRKE4j1UuJxVpBLTjbx
E1xJcy3U0yRxs0oiFFjLlQBEkY6yHrihT0L/eKT/mLvP+ouXFUwxVBxycdQmevC0Tm10tFgjJxVf
9bn/AOWKb74f+qmKswk8g+VbwRT6j5dM95wAlkZ0NWIHLpNQiVbpiN/L3lNy3pTSXWkWAspJV9G
UAat0iyjiRyZdmruMUJ3irsVdirsVdirsVdirsVdirsVUHsbd5GkPNwc1fhJIgJAAQrAVoMVQc1t
FDduZDdGf0eFCS4kHIM/PZGamxXriqlcapo0lgXd5PjBJ/dLNdeuFq3xcQZdqnh+GKoeDz/A0Tb
i7Szt9WgmupCBHBS7swAK0VQSa12xWk3/SEH8k3/Iib/mjFXfpCD+Sb/kRN/wA0Yq79IQfyTf8A
Iib/AJoxV36Qg/km/wCRE3/NGKu/SEH8k3/Iib/mjFXfpCD+Sb/kRN/zRirv0hB/JN/yIm/5oxV3
6Qg/km/5ETf80YqozzWmZKzpcB0BCskdwho1KiqKvXiMVQ01sZ7izFnLcxIkxa7En1kB4fScceTs
nE+oUNRvt4VxVHjT7bKpPqPxiYB5ZXWqmoPFmI2IriqJxVIodTGM6NNdG1uby15eD0bSizSn/Spj
so+WkoD/AJWFHwd/8067xRluf7j3q3JeVqteVF6HbriqUXvnnVWlkht/LGqJaXspjubi6t3i9JHj
EKyfd6g48lqakUHwnXFKf+YdT89QTyw6FolrdxhVMN3cXfpgsSOQaEJXap/b7e+KFGz1X8xpLizj
utCs7eFnUX1wt56nF0dGKR8E34f5X34qyHT/A04f/jNP/wAnnXVE4q7FXyq7FXyq7FXyq7FXyq7F
XYq7FUT8waFDrdh9SmuJbaMtyZ4BEXI4leNZo5eP2uqgN70rVVjNv+VFjb3H1iDW9SimHEq6Lp68
Sq8aoFtAFJH8v0b4ptmdnbnm2tYbczSXBiqJ60xDSPxFOtKbQWPc0xQq4q7FXyq7FXyq7FXyq7FXy

- CMYK Cyan CMYK PROCESS 100.000000 0.000000 0.000000
0.000000
- CMYK Blue CMYK PROCESS 100.000000 100.000000 0.000000
0.000000
- CMYK Magenta CMYK PROCESS 0.000000 100.000000
0.000000 0.000000
- C=15 M=100 Y=90 K=10 CMYK PROCESS 15.000000
100.000000 90.000000 10.000000
- C=0 M=90 Y=85 K=0 CMYK PROCESS 0.000000 90.000000
85.000000 0.000000
- C=0 M=80 Y=95 K=0 CMYK PROCESS 0.000000 80.000000
95.000000 0.000000
- C=0 M=50 Y=100 K=0 CMYK PROCESS 0.000000 50.000000
100.000000 0.000000
- C=0 M=35 Y=85 K=0 CMYK PROCESS 0.000000 35.000000
85.000000 0.000000
- C=5 M=0 Y=90 K=0 CMYK PROCESS 5.000000 0.000000
90.000000 0.000000
- C=20 M=0 Y=100 K=0 CMYK PROCESS 20.000000 0.000000
100.000000 0.000000
- C=50 M=0 Y=100 K=0 CMYK PROCESS 50.000000 0.000000
100.000000 0.000000
- C=75 M=0 Y=100 K=0 CMYK PROCESS 75.000000 0.000000
100.000000 0.000000
- C=85 M=10 Y=100 K=10 CMYK PROCESS 85.000000 10.000000
100.000000 10.000000

- C=90 M=30 Y=95 K=30 CMYK PROCESS 90.000000 30.000000
95.000000 30.000000
- C=75 M=0 Y=75 K=0 CMYK PROCESS 75.000000 0.000000
75.000000 0.000000
- C=80 M=10 Y=45 K=0 CMYK PROCESS 80.000000 10.000000
45.000000 0.000000
- C=70 M=15 Y=0 K=0 CMYK PROCESS 70.000000 15.000000
0.000000 0.000000
- C=85 M=50 Y=0 K=0 CMYK PROCESS 85.000000 50.000000
0.000000 0.000000
- C=100 M=95 Y=5 K=0 CMYK PROCESS 100.000000 95.000000
5.000000 0.000000
- C=100 M=100 Y=25 K=25 CMYK PROCESS 100.000000
100.000000 25.000000 25.000000
- C=75 M=100 Y=0 K=0 CMYK PROCESS 75.000000 100.000000
0.000000 0.000000
- C=50 M=100 Y=0 K=0 CMYK PROCESS 50.000000 100.000000
0.000000 0.000000
- C=35 M=100 Y=35 K=10 CMYK PROCESS 35.000000
100.000000 35.000000 10.000000
- C=10 M=100 Y=50 K=0 CMYK PROCESS 10.000000 100.000000
50.000000 0.000000
- C=0 M=95 Y=20 K=0 CMYK PROCESS 0.000000 95.000000
20.000000 0.000000
- C=25 M=25 Y=40 K=0 CMYK PROCESS 25.000000 25.000000
40.000000 0.000000

- C=40 M=45 Y=50 K=5 CMYK PROCESS 40.000000 45.000000
50.000000 5.000000
- C=50 M=50 Y=60 K=25 CMYK PROCESS 50.000000 50.000000
60.000000 25.000000
- C=55 M=60 Y=65 K=40 CMYK PROCESS 55.000000 60.000000
65.000000 40.000000
- C=25 M=40 Y=65 K=0 CMYK PROCESS 25.000000 40.000000
65.000000 0.000000
- C=30 M=50 Y=75 K=10 CMYK PROCESS 30.000000 50.000000
75.000000 10.000000
- C=35 M=60 Y=80 K=25 CMYK PROCESS 35.000000 60.000000
80.000000 25.000000
- C=40 M=65 Y=90 K=35 CMYK PROCESS 40.000000 65.000000
90.000000 35.000000
- C=40 M=70 Y=100 K=50 CMYK PROCESS 40.000000 70.000000
100.000000 50.000000
- C=50 M=70 Y=80 K=70 CMYK PROCESS 50.000000 70.000000
80.000000 70.000000
- Grays 1
- C=0 M=0 Y=0 K=100 CMYK PROCESS 0.000000 0.000000
0.000000 100.000000
- C=0 M=0 Y=0 K=90 CMYK PROCESS 0.000000 0.000000
0.000000 89.999400
- C=0 M=0 Y=0 K=80 CMYK PROCESS 0.000000 0.000000
0.000000 79.998800

- C=0 M=0 Y=0 K=70 CMYK PROCESS 0.000000 0.000000
0.000000 69.999700
- C=0 M=0 Y=0 K=60 CMYK PROCESS 0.000000 0.000000
0.000000 59.999100
- C=0 M=0 Y=0 K=50 CMYK PROCESS 0.000000 0.000000
0.000000 50.000000
- C=0 M=0 Y=0 K=40 CMYK PROCESS 0.000000 0.000000
0.000000 39.999400
- C=0 M=0 Y=0 K=30 CMYK PROCESS 0.000000 0.000000
0.000000 29.998800
- C=0 M=0 Y=0 K=20 CMYK PROCESS 0.000000 0.000000
0.000000 19.999700
- C=0 M=0 Y=0 K=10 CMYK PROCESS 0.000000 0.000000
0.000000 9.999100
- C=0 M=0 Y=0 K=5 CMYK PROCESS 0.000000 0.000000
0.000000 4.998800
- Brights 1
- C=0 M=100 Y=100 K=0 CMYK PROCESS 0.000000 100.000000
100.000000 0.000000
- C=0 M=75 Y=100 K=0 CMYK PROCESS 0.000000 75.000000
100.000000 0.000000
- C=0 M=10 Y=95 K=0 CMYK PROCESS 0.000000 10.000000
95.000000 0.000000
- C=85 M=10 Y=100 K=0 CMYK PROCESS 85.000000 10.000000
100.000000 0.000000

- C=100 M=90 Y=0 K=0 CMYK PROCESS 100.000000 90.000000 library 15.00
0.000000 0.000000
- C=60 M=90 Y=0 K=0 CMYK PROCESS 60.000000 90.000000
0.003100 0.003100

Figure 13: Figure 13

The model in right side of Figure 13 shows that the FNAA server starts in a "waiting" state, which basically means that the server has successfully set up the networking requirements to accept client connections. Then, when a client connects, a transition is made to "accepting" state, in which internally the authentication procedure is made. If the authentication is successful, a transition is made to "ready" state, meaning that the client can now execute commands on the FNAA server.

For each command that the client executes, a transition is made to "cmdRecvd" state. Then, a response is returned to the client, transitioning again to "waiting" state. When the client executes the "Quit" command, a transition is made to the "waiting" state and the server must free all used networking resources for the now closed connection.

On the left side of Figure 13, we also have the client state machine with its corresponding transitions. The client triggers a connection to the server and once established, an authentication is needed. Once the authentication is correctly done, the client can start requesting commands to the server. For each command executed by the client, a transition is made to "cmdPend" state, until a response is returned by the server.

Eventually, a "Quit" command will be executed by the client and the connection will be closed.

5.3. Implementation

In this section, we provide an approach for the overall implementation of the proposed Event Streaming Open Network. Considering the components defined previously for the architecture, we will define which existing tools can be leveraged and those that require development.

5.3.1. Objectives

The objective of this implementation is to provide specifications for an initial implementation of the overall architecture for the Event Streaming Open Network. Whenever it is possible, existing tools should be leveraged. For those components that need development, a thorough specification is to be provided.

5.3.1.1. Implementation overview

In Figure 14, we have a diagram of the overall implementation proposal. The components that have the Kubernetes Deployment icon are the ones to be managed by the FNAA server instance. Then, we

have a Kafka Cluster that provides a Topic instance for each flow. Finally, the DNS Infrastructure is leveraged.

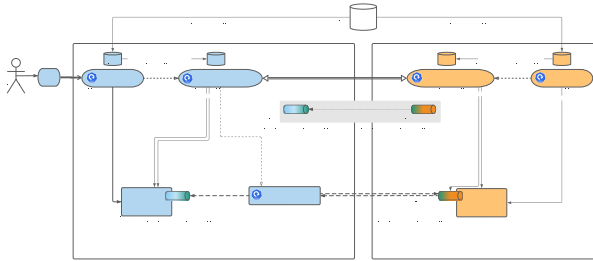


Figure 14: Figure 14

5.4. Existing components

In this section, we describe the existing software components that can be leveraged for implementation.

5.4.1. Flow Events Broker (FEB)

Since there are currently many implementations for this component, it is necessary to develop the needed integrations of other components of the architecture to the main market leaders. Thus, we will consider the following Flow Events Broker for the implementation: Apache Kafka, AWS SQS and Google Compute PubSub.

In summary, this component does not need to be developed from scratch. However, the FNAA will need to be able to communicate with the different Flow Events Broker, meaning that it must implement their APIs as a client.

5.4.2. Flow Name Service (FN)

This component can be completely implemented by leveraging on the ISC Bind9 software component, which is the de facto leader for DNS servers. A given NP will need to deploy a Bind9 Nameserver and enable both DNSSEC and DNS Dynamic Update.

The impact of adopting Bind9 for the implementation means that the FNAA component needs to be able to use a remote DNS Server to manage the Flow URI registration, deregistration and execute recursive DNS resolution.

5.4.3. Components to be developed

In this section, we describe a set of tools that require development. These components, especially the FNAA, are the core components of every Network Participant. Moreover, these are the components that implement the network protocol FNAP.

Since these are the core components of the network, they are the natural candidates for validation. In the next chapter, we will show the feasibility of the core network components in the form of a Proof of Concept.

5.4.3.1. Flow Namespace Accessing Agent (FNAA)

The Flow Namespace Accessing Agent is a server component that triggers the creation of child processes that implement the different Flow Processors. This means that the instance running the FNAA will bring up new processes for each processor. One way of implementing this functionality can be a parent process that creates new child processes for each processor. However, this would imply the need of creating and managing different threads in a single FNAA instance.

The problem with the approach of a parent process and child processes for the FNAA is on the infrastructure level. The more processor a FNAA needs to manage, the more compute resources the FNAA would need. In the current cloud infrastructure context, this is problem because it means that additional compute resources should be assigned to the FNAA, depending on the quantity of processors and the required resources for each of them. In summary, this approach would be vertically scalable but not horizontally scalable.

Then, to avoid the scalability issue, the approach we propose is by implementing a Cloud Native application. By leveraging on Kubernetes, it is possible to trigger the creation of Deployments, which are composed of Pods. Each Pod can contain a given quantity of containers, which are processes running in a GNU/Linux Operating System. In this way, we can dedicate a Pod to run the FNAA server and different Pods to run the Processors. This approach provides a convenient process isolation and enables both horizontal and vertical scalability.

Moreover, the way in which the FNAA would bring up and manage Processor instances would be through an integration with the underlying Kubernetes instance, by means of the Kubernetes API. The result is a Cloud Native application that leverages the power and flexibility of Kubernetes to manage the Processor instances.

On the other hand, the programming language for the FNAA must also be defined. For this, we consider that it must be possible to implement the FNAA and the Flow Processors in different programming languages. For the FNAA it is recommended to employ Golang, since Kubernetes CLI tool is implemented in this language and there are several libraries available for integration. As for the Flow Processors, it must be possible to use any programming language as long as the IPC interface is correctly implemented.

Regarding the IPC interface for the communications between the FNAA and the Flow Processors, the recommendation is to employ gRPC together with Protobuf. The rationale for choosing this technology is the fact that gRPC enables binary communications, which are the desired type of communication for systems integration. Then, both the FNAA and the Flow Processors must share this Protobuf interface definition and implement it accordingly through gRPC.

Finally, the FNAA must implement the protocol we have named FNAP, which provides the main set of functionalities for the Event Streaming Open Network. The implementation of FNAP must be stateful, in the sense that it is connection-based. Additionally, the implementation must be text-based, with the goal that humans can interact with FNAA servers in the same way that it is possible for SMTP servers. The transport protocol must be TCP with no special definition for a port number, since the port should be able to be discovered by means of DNS SRV Resource Records.

Regarding security for the FNAA servers, TLS must be supported. This means that any client can start a TLS handshake with the FNAA servers before issuing any command.

In conclusion, the implementation of the FNAA over Kubernetes provides the needed flexibility and set of capabilities required for this component. It is recommended to implement the FNAA in Golang and enable the implementation of Flow Processors in any programming language as long as the Protobuf interface is correctly implemented. Finally, the FNAA must implement the protocol FNAP in a connection-based and text-based manner.

5.4.3.2. Flow Namespace User Agent (FNUA)

The Flow Namespace User Agent (FNUA) can have different implementations as long as they comply with the protocol FNAP.

We propose the initial availability of a CLI tool that acts as a Flow Namespace User Agent. This CLI tool must provide a client implementation of all the functionalities available in the FNAA server. Among the functionalities to be implemented as a must, we can mention: * Discover the FNAA server for a given Flow URI. * Connect to the FNAA server to manage Flow Namespaces and Flows, as exemplified in Figure 8.

Additionally, the FNUA should be able to discover the Authoritative FNAA server for a given Flow Namespace. This discovery shall be performed by leveraging on the DNS-SD specification. Refer to Annex D to review the discovery process.

Regarding the implementation of the CLI tool, it is recommended to employ Golang together with Cobra, a library specialized to create

will review different use cases to prove how the network could be used by network participants and its users.

Lastly, we will provide a conclusion for this Proof of Concept, where we mentioning if and how the minimum established requirements have been met or not.

6.1. Minimum functionalities

Network Participants system administrators must be able to run a Server Application that acts as FNAA.

Users using a Client Application acting as a FNUA must be able to:

1. Access the flow account and operate its flows.
2. Create a new flow.
3. Describe an existing flow.
4. Subscribe to an external flow.

6.2. FNAA - Server application

The FNAA server application must implement FNAP as described in Section 6. Basically, the FNAA will open a TCP port on all the IP addresses of the host to listen for new FNUA client connections.

The chosen language for the development of the FNAA is GoLang. The reason for choosing GoLang is because Kubernetes is written in this language and there is a robust set of libraries available for integration. Although there is no integration built with Kubernetes for this Proof of Concept, the usage of GoLang will enable a seamless evolution of the FNAA application. In future versions of the FNAA codebase, new functionalities leveraging Kubernetes will be easier to implement than if using a different programming language.

When the FNAA server application is initialized, it provides debug log messages describing all client interactions. In order to start the server application, a Network Participant system administrator can download the binary and execute it in a terminal:

```
ignatius ~ 0$./fnaad
server.go:146: Listen on [::]:61000
server.go:148: Accept a connection request.
```

Now that the 61000 TCP port is open, we can test the behaviour by means of a raw TCP using telnet command in a different terminal: ~~~
ignatius ~ 1\$telnet localhost 61000 Trying 127.0.0.1... Connected to localhost. Escape character is '^]'. 220 fnaa.unix.ar FNAA ~~~ We can now see that the server has provided the first message in the connection: a welcome message indicating its FQDN fnaa.unix.ar.

On the other hand, the server application starts providing debug information for the new connection established:

```
ignatius ~ 0$./fnaad
server.go:146: Listen on [::]:61000
server.go:148: Accept a connection request.
server.go:154: Handle incoming messages.
server.go:148: Accept a connection request.
```

6.3. FNUA - Client application

In order to test the FNA server application, a CLI-based FNUA application has been developed. The chosen language for this CLI tool is also GoLang. The reason for choosing GoLang for the FNUA is because of its functionalities for building CLI tools, leveraging on the Cobra library. Thus, the FNUA for the PoC is an executable file that complies with the diagram in Figure 14.

One of the requirements for the flow CLI tool is a configuration file that defines the different FNA servers together with the credentials to use. An example of this configuration file follows:

```
ignatius ~/ 0$cat .flow.yml
agents:
```

```
-
  name: fnaa-unix
  fqdn: fnaa.unix.ar
  username: test
  password: test
  prefix: unix.ar-
-
  name: fnaa-emiliano
  fqdn: fnaa.emiliano.ar
  username: test
  password: test
  prefix: emiliano.ar-
```

```
namespaces:
```

```
-
  name: flows.unix.ar
  agent: fnaa-unix
-
  name: flows.emiliano.ar
  agent: fnaa-emiliano
```

In this file, we can see that there are two FNA instances described with FQDN fnaa.unix.ar and fnaa.emiliano.ar. Then, there are two namespaces: one called flow.unix.ar hosted on fnaa-unix and second namespace flows.emiliano.ar hosted on fnaa-emiliano. This configuration enables the FNUA to interact with two different FNA, each of which is hosting different Flow Namespaces.

Once the configuration file has been saved, the flow CLI tool can now be used. In the following sections, we will show how to use the minimum functionalities required for the Open Network using this CLI tool.

6.4. Use cases

```
### Use case 1: Authenticating a user
After the connection is established, the first command that the client must execute is the authentication command. As previously defined in Chapter 5, every FNAAs client must first authenticate in order to execute commands. Thus, the authentication challenge must be supported both by the FNAAs as well as the FNUAs.
```

It is worth mentioning that the chosen authentication mechanism for this PoC is SASL Plain. This command can be extended furtherly with other mechanisms in later versions. However, this simple authentication mechanism is sufficient to demonstrate the authentication step in the FNAP.

The SASL Plain Authentication implies sending the username and the password encoded in Base64. The way to obtain the Base64 if we consider a user test with password test, is as follows:

```
ignatius ~ 0$echo -en "\0test\0test" | base64
AHRlc3QAdGVzdA==
```

Now, we can use this Base64 string to authenticate with the FNAAs. First, we need to launch the FNAAs server instance:

```
ignatius~/ $./fnaad --config ./fnaad_flow.unix.ar.yaml
main.go:41: Using config file: ./fnaad_flow.unix.ar.yaml
main.go:57: Using config file: ./fnaad_flow.unix.ar.yaml
server.go:103: Listen on [::]:61000
server.go:105: Accept a connection request.
```

Then, we can connect to the TCP port in which the FNAAs is listening:

```
ignatius ~ 1$telnet localhost 61000
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
220 fnaa.unix.ar FNAAs
AUTHENTICATE PLAIN
220 OK
AHRlc3QAdGVzdA==
220 Authenticated
```

Once the client is authenticated, it can start executing FNAP commands to manage the Flow Namespace of the authenticated user. For

simplicity purposes, in this Proof of Concept, we will be using a single user.

In the case of the CLI tool, there is no need to perform an authentication step, since every command the user executes will be preceded by an authentication in the server.

6.4.1. Use case 2: Creating a flow

Once the authentication is successful, the client can now create a new Flow. The way to do this using the CLI tool would be:

```
ignatius ~/ 0$./fnua create flow time.flow.unix.ar
Resolving SRV for fnaa.unix.ar. using server 172.17.0.2:53
Executing query fnaa.unix.ar. IN 33 using server 172.17.0.2:53
Executing successful: [fnaa.unix.ar. 604800 IN SRV 0 0 6100
Resolving A for fnaa.unix.ar. using server 172.17.0.2:53
Executing query fnaa.unix.ar. IN 1 using server 172.17.0.2:53
Executing successful: [fnaa.unix.ar. 604800 IN A 127.0.0.
Resolved A to 127.0.0.1 for fnaa.unix.ar. using server 172.17.0.2:53
C: Connecting to 127.0.0.1:61000
C: Got a response: 220 fnaa.unix.ar FNAA
C: Sending command AUTHENTICATE PLAIN
C: Wrote (20 bytes written)
C: Got a response: 220 OK
C: Authentication string sent: AHRlc3QAdGVzdA==
C: Wrote (18 bytes written)
C: Got a response: 220 Authenticated
C: Sending command CREATE FLOW time.flow.unix.ar
C: Wrote (31 bytes written)
C: Server sent OK for command CREATE FLOW time.flow.unix.ar
C: Sending command QUIT
C: Wrote (6 bytes written)
```

The client has discovered the FNAA server for Flow Namespace flow.unix.ar by means of SRV DNS records. Thus, it obtained both the FQDN of the FNAA together with the TCP port where it is listening, in this case 61000. Once the resolution process ends, the FNUA connects to the FNAA. First, the FNUA authenticates with the FNAA and then it executes the create flow command.

If we were to simulate the same behavior using a raw TCP connection, the following steps would be executed: ~~~ ignatius ~ 1\$telnet localhost 61000 Trying 127.0.0.1... Connected to localhost. Escape character is '^]'. 220 fnaa.unix.ar FNAA AUTHENTICATE PLAIN 220 OK AHRlc3QAdGVzdA== 220 Authenticated CREATE FLOW time.flows.unix.ar 220 OK time.flows.unix.ar ~~~

Now, the client has created a new flow called `time.flows.unix.ar` located in the `flows.unix.ar` namespace. The FNAA in background has created a Kafka Topic as well as the necessary DNS entries for name resolution.

6.4.2. Use case 3: Describing a flow

Once a flow has been created, we can obtain information of it by executing the following command using the CLI tool:

```
ignatius ~/ 1$./fnua describe flow time.flow.unix.ar
Resolving SRV for fnaa.unix.ar. using server 172.17.0.2:53
Executing query fnaa.unix.ar. IN 33 using server 172.17.0.2:53
Executing successful: [fnaa.unix.ar. 604800 IN SRV 0 0 6100
Nameserver to be used: 172.17.0.2
Resolving A for fnaa.unix.ar. using server 172.17.0.2:53
Executing query fnaa.unix.ar. IN 1 using server 172.17.0.2:53
Executing successful: [fnaa.unix.ar. 604800 IN A 127.0.0.
Resolved A to 127.0.0.1 for fnaa.unix.ar. using server 172.17.0.2:53
C: Connecting to 127.0.0.1:61000
C: Got a response: 220 fnaa.unix.ar FNAA
C: Sending command AUTHENTICATE PLAIN
C: Wrote (20 bytes written)
C: Got a response: 220 OK
C: Authentication string sent: AHRlc3QAdGVzdA==
C: Wrote (18 bytes written)
C: Got a response: 220 Authenticated
C: Sending command DESCRIBE FLOW time.flow.unix.ar
C: Wrote (33 bytes written)
C: Server sent OK for command DESCRIBE FLOW time.flow.unix.ar
Flow time.flow.unix.ar description:
flow=time.flow.unix.ar
type=kafka
topic=time.flow.unix.ar
server=kf1.unix.ar:9092
Flow time.flow.unix.ar described successfully
Quitting
C: Sending command QUIT
C: Wrote (6 bytes written)
```

In the output of the describe command we can see all the necessary information to connect to the Flow called `time.flow.unix.ar`: (i) the type of Event Broker is Kafka, (ii) the Kafka topic has the same name of the flow and (iii) the Kafka Bootstrap server with port is provided. If we were to obtain this information using a manual connection, the steps would be:


```
ignatius ~ 1$telnet localhost 61000
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
220 fnaa.unix.ar FNAA
AUTHENTICATE PLAIN
220 OK
AHRlc3QAdGVzdA==
220 Authenticated
DESCRIBE FLOW time.flows.unix.ar
220 DATA
flow=time.flows.unix.ar
type=kafka
topic=time.flows.unix.ar
server=kf1.unix.ar:9092
220 OK
```

Now, we can use this information to connect to the Kafka topic and start producing or consuming events.

6.4.3. Use case 4: Subscribing to a remote flow

In this section, we will show how a subscription can be set up. When a user commands the FNAA to create a new subscription to a remote Flow, the local FNAA server first needs to discover the remote FNAA server. Once the server is discovered by means of DNS resolution, the local FNAA contacts the remote FNAA, authenticates the user and then executes a subscription command.

```
Thus, the initial communication between the FNUA and the FNAA, in which the user indicates to subscribe to a remote flow, would be as follows: ~~~ ignatius ~ 1$telnet localhost 61000 Trying 127.0.0.1...
Connected to localhost. Escape character is '^]'. 220 fnaa.unix.ar
FNAA AUTHENTICATE PLAIN 220 OK AHRlc3QAdGVzdA== 220 Authenticated
SUBSCRIBE time.flows.unix.ar LOCAL emiliano.ar-time.flows.unix.ar
220 DATA ksdj898.time.flows.unix.ar 220 OK ~~~
```

Once the user is authenticated, a SUBSCRIBE command is executed. This command indicates first the remote flow to subscribe to. Then, it also specifies with LOCAL the flow where the remote events will be written. In this example, the remote flow to subscribe to is time.flows.unix.ar, and the local flow is emiliano.ar-time.flows.unix.ar. Basically, a new flow has been created, emiliano.ar-time.flows.unix.ar, where all the events of flow time.flows.unix.ar will be written.

The server answers back with a new Flow URI, in this case ksdj898.time.flows.unix.ar. This Flow URI indicates a copy of the original flow time.flows.unix.ar created for this subscription.

Thus, the remote FNAAs have full control over this subscription, being able to revoke it by simply deleting this flow or applying Quality of Service rules.

The remote FNAAs have set up a Bridge Processor to transcribe messages in topic `time.flows.unix.ar` to the new topic `ksdj898.time.flows.unix.ar`. Another alternative to a Bridge Processor would be a Distributor Processor, which could be optimized for a Flow with high demand. Moreover, instead of creating a single Bridge Processor per subscription, a Distributor Processor could be used, in order to have a single consumer of the source flow and write the events to several subscription flows.

The user could use the FNAAs CLI tool to execute this command in the following manner:

```
ignatius ~ 0$./fnua --config=./flow.yml subscribe time.flows.unix.ar --n
Initializing initConfig
    Using config file: ./flow.yml
Subscribe to flow
Agent selected: fnaa-emiliano
Resolving FNAAs FQDN fnaa.emiliano.ar
Starting FQDN resolution with 172.17.0.2
Resolving SRV for fnaa.emiliano.ar. using server 172.17.0.2:53
Executing query fnaa.emiliano.ar. IN 33 using server 172.17.0.2:53
FNAAs FQDN Resolved to fnaa.emiliano.ar. port 51000
Resolving A for fnaa.emiliano.ar. using server 172.17.0.2:53
Resolved A to 127.0.0.1 for fnaa.emiliano.ar. using server 172.17.0.2:53
C: Connecting to 127.0.0.1:51000
C: Got a response: 220 fnaa.unix.ar FNAAs
Connected to FNAAs
Authenticating with PLAIN mechanism
C: Sending command AUTHENTICATE PLAIN
C: Wrote (20 bytes written)
C: Got a response: 220 OK
C: Authentication string sent: AHRlc3QAdGVzdA==
C: Wrote (18 bytes written)
C: Got a response: 220 Authenticated
Authenticated
Executing command SUBSCRIBE time.flows.unix.ar LOCAL emiliano.ar-time.fl
C: Sending command SUBSCRIBE time.flows.unix.ar LOCAL emiliano.ar-time.f
C: Wrote (67 bytes written)
C: Server sent OK for command SUBSCRIBE time.flows.unix.ar LOCAL emilian
Flow emiliano.ar-time.flows.unix.ar subscription created successfully
Server responded: emiliano.ar-time.flows.unix.ar SUBSCRIBED TO ksdj898.t
Quitting
C: Sending command QUIT
C: Wrote (6 bytes written)
Connection closed
```

This interaction of the FNUA with the FNAA of the Flow Namespace emiliano.ar (fnaa-emiliano) has trigger an interaction with the FNAA of unix.ar Flow Namespace (fnaa-unix). This means that before fnaa-emiliano was able to respond to the FNUA, a new connection was opened to the remote FNAA and the SUBSCRIBE command was executed.

The log of fnaa-emiliano when the SUBCRIBE command was issued looks as follows:

```
server.go:111: Handle incoming messages.
server.go:105: Accept a connection request.
server.go:253: User authenticated
server.go:347: FULL COMMAND: SUBSCRIBE time.flows.unix.ar LOCAL emiliano
server.go:401: Flow is REMOTE
client.go:280: **#Resolving SRV for time.flows.unix.ar. using server 172
server.go:417: FNAA FQDN Resolved to fnaa.unix.ar. port 61000
client.go:42: C: Connecting to 127.0.0.1:61000
client.go:69: C: Got a response: 220 fnaa.unix.ar FNAA
server.go:435: Connected to FNAA
server.go:436: Authenticating with PLAIN mechanism
client.go:126: C: Sending command AUTHENTICATE PLAIN
client.go:133: C: Wrote (20 bytes written)
client.go:144: C: Got a response: 220 OK
client.go:154: C: Authentication string sent: AHRlc3QAdGVzdA==
client.go:159: C: Wrote (18 bytes written)
client.go:170: C: Got a response: 220 Authenticated
server.go:444: Authenticated
client.go:82: C: Sending command SUBSCRIBE time.flows.unix.ar
client.go:88: C: Wrote (30 bytes written)
client.go:112: C: Server sent OK for command SUBSCRIBE time.flows.unix.a
server.go:456: Flow time.flows.unix.ar subscribed successfully
server.go:457: Server responded: ksdj898.time.flows.unix.ar
server.go:459: Quitting
```

We can see how fnaa-emiliano had to trigger a client subroutine to contact the remote fnaa-unix. Once the server FQDN, IP and Port is discovered by means of DNS, a new connection is established and the SUBSCRIBE command is issued. Here we can see the log of fnaa-unix:

```
server.go:111: Handle incoming messages.
server.go:105: Accept a connection request.
server.go:253: User authenticated
server.go:139: Received command: subscribe
server.go:348: [SUBSCRIBE time.flows.unix.ar]
server.go:367: Creating flow endpoint time.flows.unix.ar
server.go:368: Creating new topic ksdj898.time.flows.unix.ar in Apache K
server.go:369: Creating Flow Processor src=time.flows.unix.ar dst=ksdj89
server.go:370: Adding DNS Records for ksdj898.time.flows.unix.ar
server.go:372: Flow enabled ksdj898.time.flows.unix.ar
server.go:139: Received command: quit
```

Thus, we were able to set up a new subscription in fnaa-emiliano that trigger a background interaction with fnaa-unix.

6.5. Results of the PoC

We can confirm the feasibility of the overall Event Streaming Open Network architecture. The test of the proposed protocol FNAP and its implementation, both in the FNAA and FNUA (CLI application), show that the architecture can be employed for the purpose of distributed subscription management among Network Participants.

The minimum functionalities defined both for the Network Participants and the Users were met. Network Participants can run this type of service by means of a server application, the FNAA server. Also, the CLI-tool resulted in a convenient low-level method to interact with a FNAA server.

In further implementations, the server application should be optimized as well as secured, for instance with a TLS handshake. Also, the CLI-tool could be enhanced by a web-based application with a friendly user interface.

Nevertheless, the challenge for a stable implementation of both components is the possibility of supporting different Event Brokers and their evolution. Not only Apache Kafka should be supported but also the main Public Cloud providers events solutions, such as AWS SQS or Google Cloud Pub/Sub. Since the Event Brokers are continuously evolving, the implementation of the FNAA component should keep up both with the API and new functionalities of these vendors.

Regarding the protocol design, it would be needed to enhance the serialization of the exchanged data. In this sense, it could be convenient to define a packet header for the overall interaction between the FNAA both with remote FNAA as well as with FNUA.

Regarding the subscription use case, it would be necessary to establish a convenient format for the server response. Currently,

the server is returning a key/value structure with the details of the Flow. This structure may not be the most adequate, since it may differ depending on the Event Broker used.

Also, the security aspect needs further analysis and design since its fragility could lead to great economical damage for organizations. Thus, it would be recommended to review the different security controls needed for this solution as part of an Information Security Management System.

Finally, the implementation should leverage the Cloud Native functionalities provided by the Kubernetes API. For example, the FNAA should trigger the deployment of Flow Processors on demand, in order to provide isolated computing resources for each subscription. Also, a Kubernetes resource could be developed to use the kubectl CLI tool for management, instead of a custom CLI tool.

7. Summary & Conclusions

In this chapter we will provide a summary of everything that has been described in this document as well as some conclusions about it.

We have identified a use case for which there is currently no adequate solution provided by existing tools. This use case is based on the cross-organization integration of real-time event streams. Nowadays, organizations intending to integrate these kind of data streams struggle with offline communication to achieve a common interface for integration. In this context, we proposed an Open Network for Event Streaming as a possible solution for this difficulty.

For this Open Network, we have followed the main necessities from the technical perspective. While there already exist many components that can be leveraged, some components require analysis, design, and implementation. Then, we referred to the Commons Infrastructure literature in order to show how Event Streaming can be considered an Infrastructure Resource that can enable downstream productive activities. Finally, we established the main guidelines that an Open Network should follow, basing these definitions on Free, Open & Neutral Networks.

Using the previous definitions, we have designed an architecture for the Event Streaming Open Network, establishing the components that the different Network Participants should implement in order to participate in the network. After providing a thorough description of all the components, we showed some use cases of integration among different Network Participants.

Once the architecture was defined, we proposed an implementation approach which describes the existing components that can be leveraged as well as those that need to be developed from scratch. The outcome was that a server-side application called FNAA had to be developed. This application implements the protocol FNAP and can be accessed by a client application, which we named FNUA.

Finally, we proved the feasibility of the proposed architecture by providing an implementation of the minimum functionalities required, in the form of a Proof of Concept. The results of this PoC were encouraging since it was possible to implement the initial functionalities for the FNAA and FNUA components.

As conclusion, we can mention that there is great potential for an Open Network for Event Streaming among organizations. In the same way the email infrastructure acts as an open network for electronic communications among people, this kind of network would enable developers to integrate real-time event streams while minimizing offline agreement of interfaces and technologies.

However, there are many difficulties that could be furtherly worked on. First, a robust implementation for the Event Streaming Open Network main components must be provided, mainly for the FNAA and FNUA. In order to achieve an acceptable level of quality and stability, the development of a community around the project is needed.

Secondly, we found that the proposed architecture is a convenient starting point. However, it can suffer modifications based on the learning process during the implementation. For example, while designing the architecture, we avoided the need of a database for the FNAA component, leveraging on the DNS infrastructure. While this can be sufficient for the minimum functionalities described, it will most probably be necessary for the FNAA to persist data in a database of its own. In this sense, we believe that leveraging the Kubernetes resources model could be a convenient alternative.

Thirdly, during the PoC execution, we identified some difficulties implementing the security functionalities of authentication and authorization. Although we were able to implement an authentication mechanism, the reality indicates that integration with well-established protocols is needed (i.e., OAuth, GSSAPI, etc.).

Finally, there is also the need to leverage on the Cloud Native architecture, basically Kubernetes, to provide hyper-scalability and enable Network Participants to agnostically choose the underlying infrastructure. The selection of Golang for the PoC implementation showed to be convenient, given the vast number of available libraries for integration of third-party components and services.

Notwithstanding the difficulties, we firmly believe that cross-organization real-time event integration can provide great benefits for society. It would enhance the efficiency of business processes throughout organizations. Also, it would provide broad visibility to the final users, enabling experimentation and entrepreneurship. New business models for existing productive activities could be developed, as well as enabling innovation, which in turn would conform the positive externalities of the Event Streaming Open Network.

8. Security Considerations

TODO Security

9. IANA Considerations

This document has no IANA actions.

10. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <<https://www.rfc-editor.org/rfc/rfc2119>>.
- [RFC2782] Gulbrandsen, A., Vixie, P., and L. Esibov, "A DNS RR for specifying the location of services (DNS SRV)", RFC 2782, DOI 10.17487/RFC2782, February 2000, <<https://www.rfc-editor.org/rfc/rfc2782>>.
- [RFC3261] Rosenberg, J., Schulzrinne, H., Camarillo, G., Johnston, A., Peterson, J., Sparks, R., Handley, M., and E. Schooler, "SIP: Session Initiation Protocol", RFC 3261, DOI 10.17487/RFC3261, June 2002, <<https://www.rfc-editor.org/rfc/rfc3261>>.
- [RFC5321] Klensin, J., "Simple Mail Transfer Protocol", RFC 5321, DOI 10.17487/RFC5321, October 2008, <<https://www.rfc-editor.org/rfc/rfc5321>>.
- [RFC6763] Cheshire, S. and M. Krochmal, "DNS-Based Service Discovery", RFC 6763, DOI 10.17487/RFC6763, February 2013, <<https://www.rfc-editor.org/rfc/rfc6763>>.
- [RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <<https://www.rfc-editor.org/rfc/rfc8174>>.

Acknowledgments

SPINELLA E. (2022) [Online] Event Streaming Open Network Master's Thesis https://drive.google.com/file/d/1R9H-4knAztez_yUPlr7aZSkbUjs8jL3j

URQUHART J. (2021) Flow Architectures

FRISCHMANN B. (2007) [Online] Infrastructure Commons in Economic Perspective < <https://firstmonday.org/article/view/1901/1783>>

WIDL M. (2013), Guided Merging of Sequence Diagrams

NAVARRO L. (2018) [Online] Network Infrastructures: The commons model for local participation, governance and sustainability <https://www.apc.org/en/pubs/network-infrastructures-commons-model-local-participation-governance-and-sustainability>

BRINO A. (2019) Towards an Event Streaming Service for ATLAS data processing.

GUTTRIDGE, Gartner (2021) "Modern Data Strategies for the Real-time Enterprise" Big Data Quarterly 2021

Author's Address

Emiliano Spinella
Syndeno

Email: emiliano.spinella@syndeno.com