MODUSBOX

Contributions from ModusBox to support the Community in DFSP Onboarding

mojaloop

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ModusBox have been working with partners on the first implementations of Mojaloop systems.

This experience has thrown up a host of new insights into the practical difficulties of setting up a Mojaloop hub and onboarding DFSPs to a scheme.

As a consequence of these difficulties, ModusBox has been working on ways of easing, in general, the practical tasks of connecting many DFSPs to Mojaloop schemes.

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Support for onboarding:

1. Standard Components
2. An example Scheme Adapter
3. A system to manage certificates and keys

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Support for onboarding:

1. Standard Components

mojaloop

What problems are the Standard Components solving?

During commercial Mojaloop implementations...

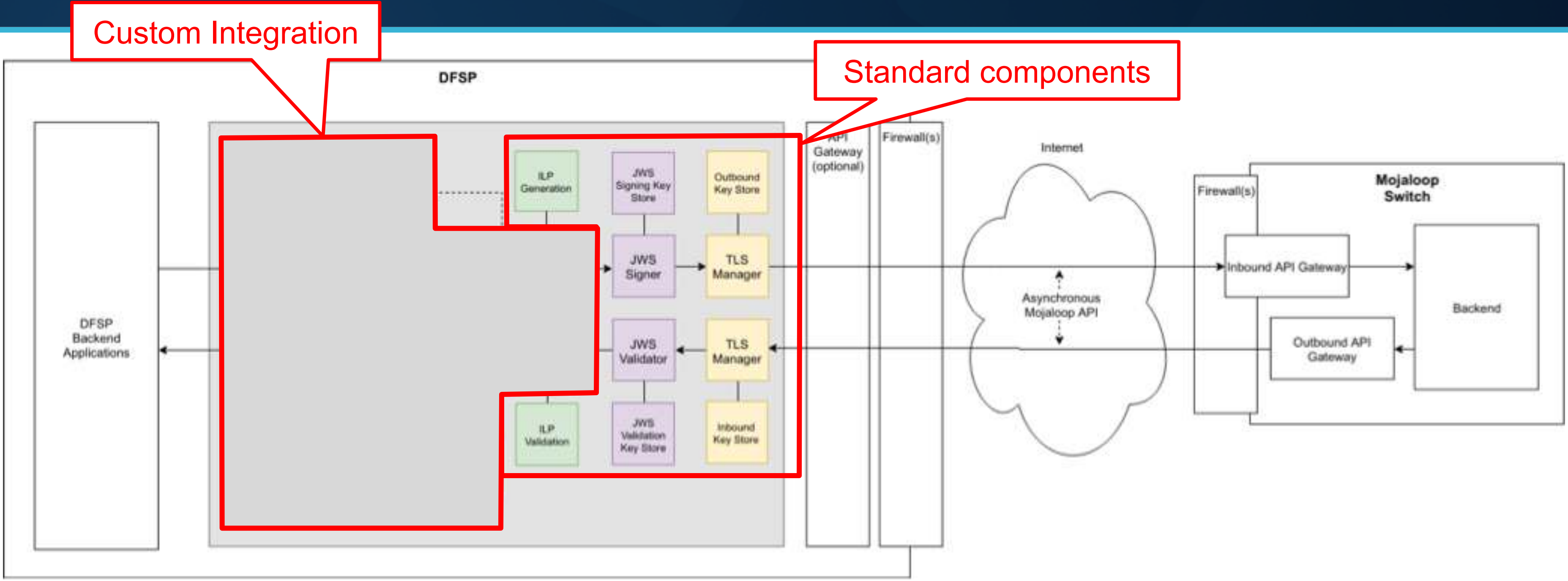
1. We encountered differing interpretations of some aspects of the Mojaloop API specification
    a. E.g. those relating to securing messages, leading to incompatibility between participants
2. These mismatches were only discovered when a participant integrated with the scheme
3. Errors discovered while establishing mojaloop compliant TLS, ILP and JWS led to considerable rework

These project pains led to extended timelines, raised costs and commercial risk for both switch operators and DFSPs.

How do the standard components help?

1. They implement complex operations needed by all participants
   - Real-world implementations
   - Comprehensively tested
2. Specification compliant security implementations out-of-the-box
   - Bidirectional, mutual x.509 authentication
   - Mojaloop spec compliant JWS
   - Interledger protocol packet signing and validation
3. Specification compliant HTTP headers
   - Mojaloop spec compliant headers and header processing out-of-the-box

Standard Component Architecture



Custom Integration

Standard components

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Support for onboarding:

1. Standard Components
2. An example Scheme Adapter

What problem is the Scheme Adapter solving?

During commercial Mojaloop implementations we observed:

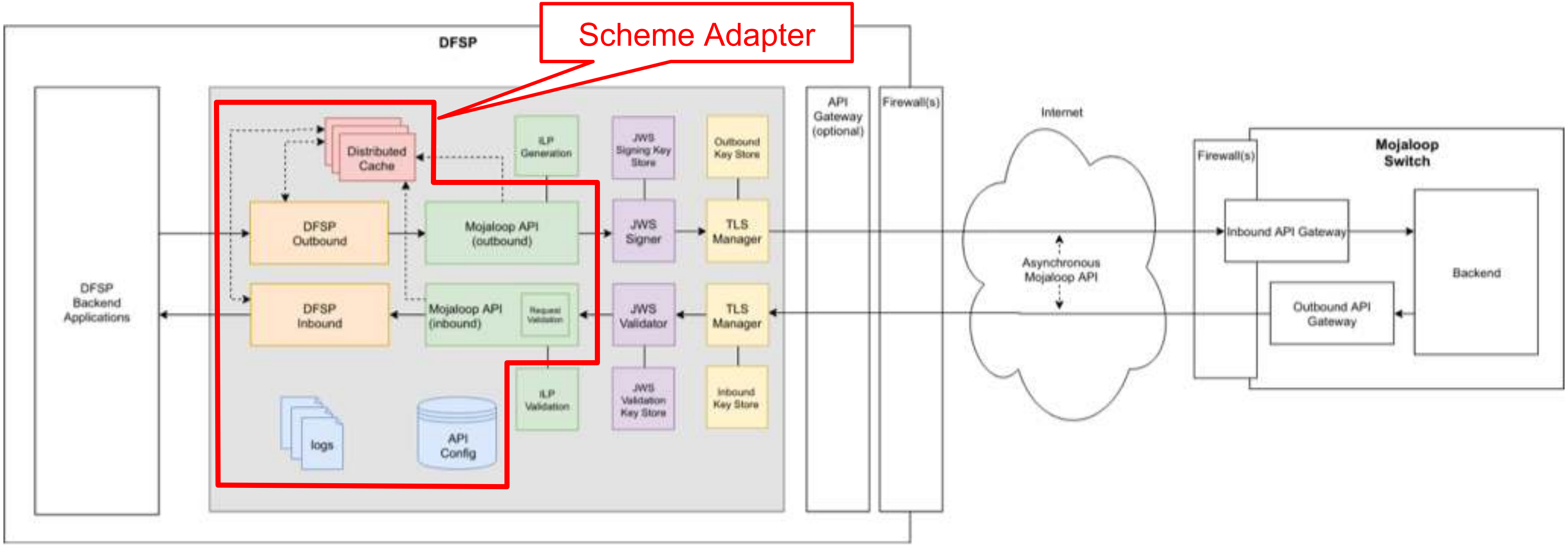
1. Multiple participants platforms are incompatible with native mojaloop API interface requirements.
2. Many problems onboarding participant platforms were discovered late in the integration cycle

These project pains led to extended timelines, raised costs and commercial risk for both switch operators and DFSPs.

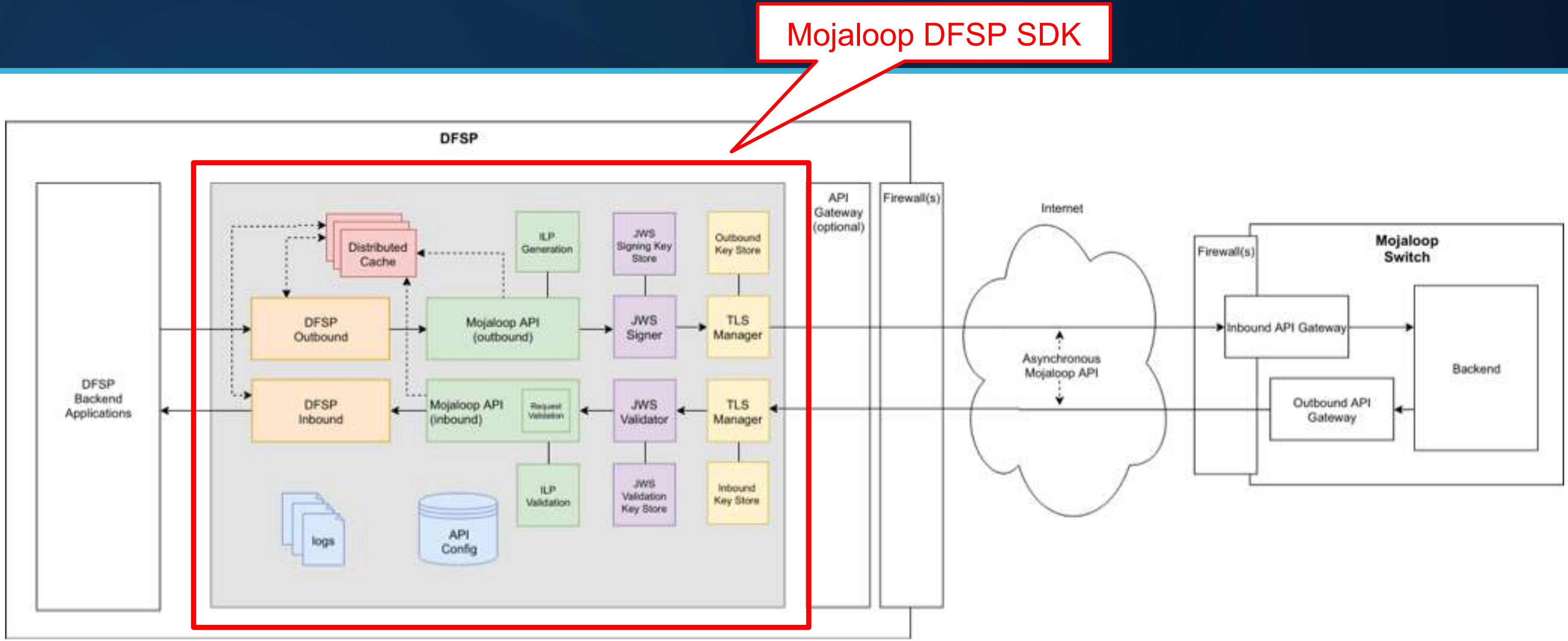
How does the Scheme Adapter help?

1. Manages the complexities of interfacing using the Open API specification
2. Implements a configuration-based approach for defining scheme-specific ways of working
3. Uses standard components to reliably and resiliently perform complex operations
4. It makes it easier for DFSPs to encode the scheme-specific business rules by...
   - Aligning configuration options with decision points in business rules
   - Approaching direct representation of scheme operating guidelines

Scheme Adapter Architecture



Mojaloop DFSP SDK



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Support for onboarding:

1. Standard Components
2. An example Scheme Adapter
3. A system to manage certificates and keys

Mojaloop PKI Admin Server

A Service that greatly reduces the overhead in sharing information, removing many manual errors in the creation, sharing and signing of signatures as well as facilitating the ongoing maintenance as signatures expire

What problem is this trying to solve?

During commercial Mojaloop implementations we observed:

1. Multiple requests for change of IP address whitelists - without an easy to follow audit trail
2. Multiple mistakes in the creation, signing and exchange of TLS certificates due to misinterpretation of configuration settings and manual processes
3. No method to easily distribute JWS certificates for DFSPs

These are project pains that lead to extended timelines, high cost and commercial risk for both switch operators and DFSPs.

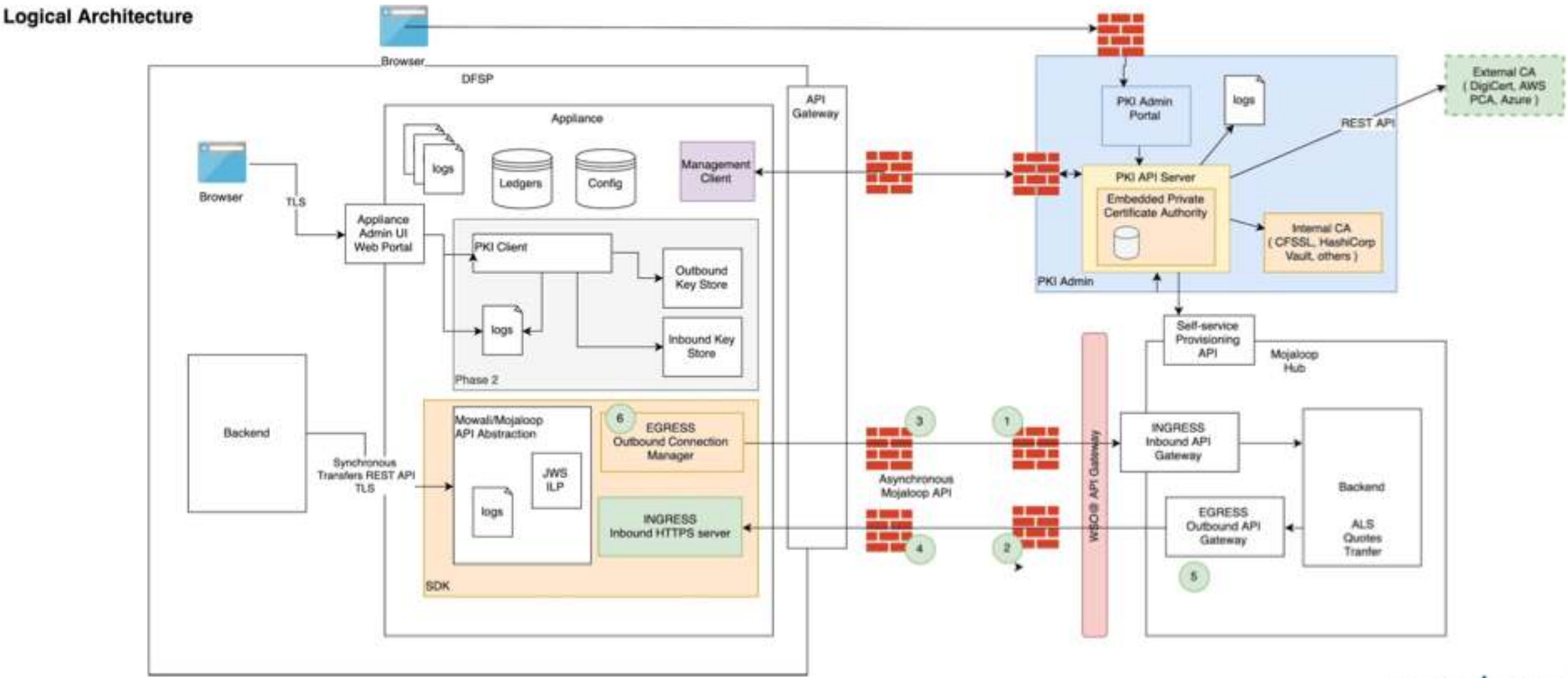
How does the PKI Admin Server help?

1. It greatly reduces the overhead in sharing information.
2. It automates the creation, sharing and signing of signatures, thereby removing multiple opportunities for error in manual processes.
3. It facilitates the ongoing maintenance of signatures by ensuring that best-practice expiry techniques are used, and that the renewal of expired signatures is managed without the need for manual intervention.

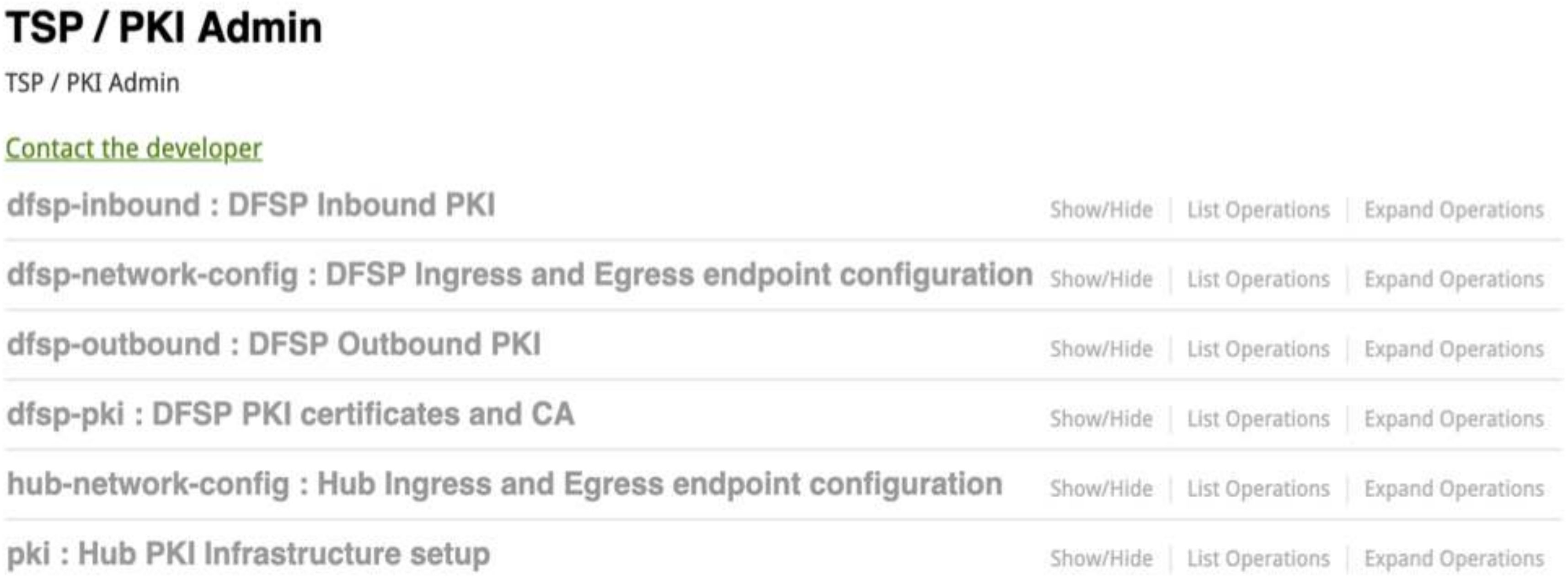
How does the PKI Admin Server help (continued)?

1. Reduces workflow requests
   - Copy and Paste of Key Data
   - Workflow, and feedback to all Partners of where requests are in the process
2. Audit Trail
   - Requests and activity logged and auditable
   - can be linked to Fraud and AML platform for Key Event tracking
3. Standardisation of Certificate Creation
   - Key elements configurable - to reduce entry error
   - Environment identified - to reduce chance of incorrect allocation
   - It could integrate with some external CA to create the certificates
4. Automation of JWS Certificate sharing and Testing
   - Process to distribute JWS Certificates from all DFSPs
   - Option to test working transfers with SDK

Long Term Architecture


Logical Architecture
Browser
DFSP
Appliance
API Gateway
logs
Ledgers
Config
Management Client
Browser
TLS
Appliance Admin UI Web Portal
PKI Client
Outbound Key Store
logs
Inbound Key Store
Phase 2
Backend
Synchronous Transfers REST API TLS
Mowali/Mojaloop API Abstraction
JWS ILP
logs
6
EGRESS Outbound Connection Manager
INGRESS Inbound HTTPS server
SDK
PKI Admin Portal
logs
REST API
External CA (DigiCert, AWS PCA, Azure)
PKI API Server
Embedded Private Certificate Authority
Internal CA (CFSSL, HashiCorp Vault, others)
PKI Admin
Self-service Provisioning API
Mojaloop Hub
3
1
Asynchronous Mojaloop API
WSO2 API Gateway
INGRESS Inbound API Gateway
Backend
ALS Quotes Tranfer
EGRESS Outbound API Gateway
4
2
5

Full API



TSP / PKI Admin

TSP / PKI Admin

Contact the developer

dfsp-inbound : DFSP Inbound PKI

dfsp-network-config : DFSP Ingress and Egress endpoint configuration

dfsp-outbound : DFSP Outbound PKI

dfsp-pki : DFSP PKI certificates and CA

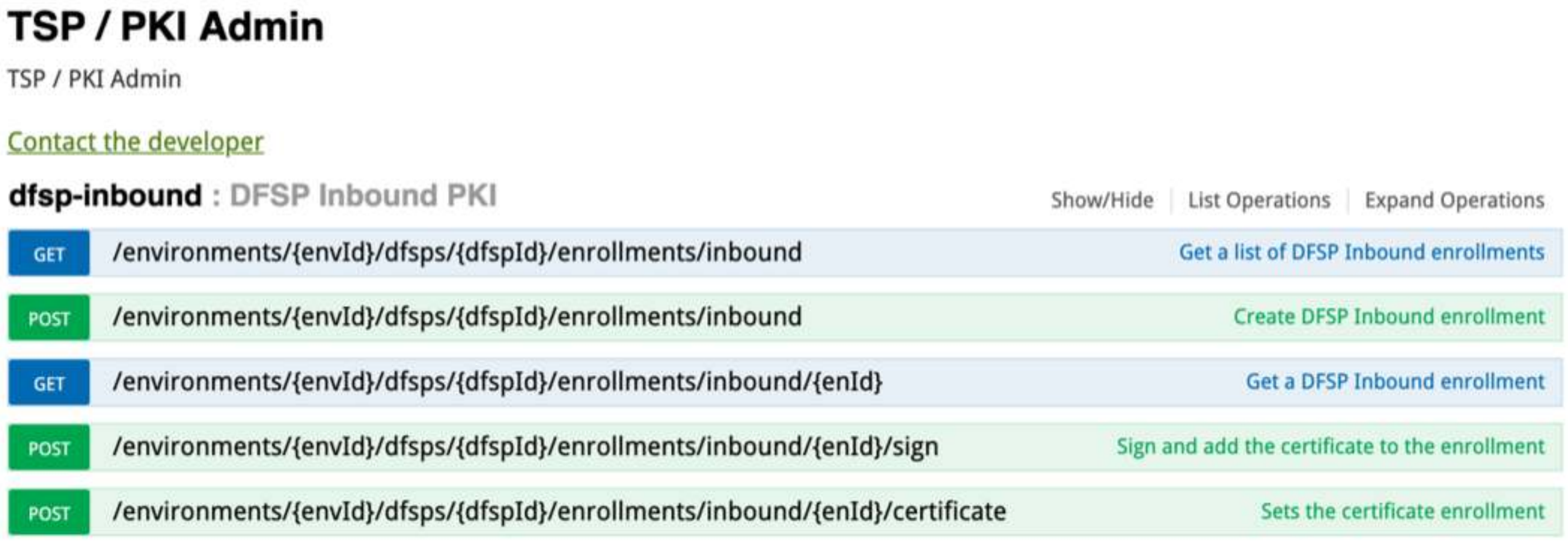
hub-network-config : Hub Ingress and Egress endpoint configuration

pki : Hub PKI Infrastructure setup

Show/Hide | List Operations | Expand Operations
Show/Hide | List Operations | Expand Operations
Show/Hide | List Operations | Expand Operations
Show/Hide | List Operations | Expand Operations
Show/Hide | List Operations | Expand Operations
Show/Hide | List Operations | Expand Operations

Full API

dfsp-inbound : DFSP Inbound PKI Operations



TSP / PKI Admin

TSP / PKI Admin

Contact the developer

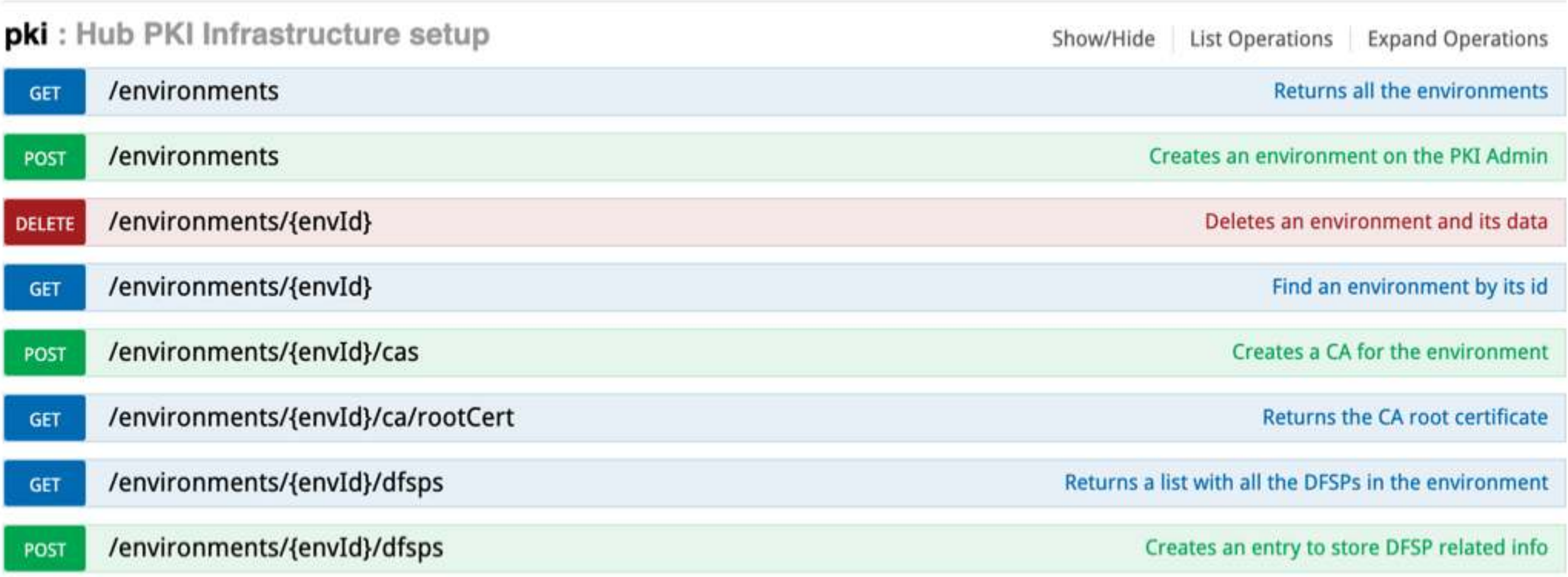
dfsp-inbound : DFSP Inbound PKI

Show/Hide | List Operations | Expand Operations

GET	/environments/{envId}/dfsps/{dfspId}/enrollments/inbound	Get a list of DFSP Inbound enrollments
POST	/environments/{envId}/dfsps/{dfspId}/enrollments/inbound	Create DFSP Inbound enrollment
GET	/environments/{envId}/dfsps/{dfspId}/enrollments/inbound/{enId}	Get a DFSP Inbound enrollment
POST	/environments/{envId}/dfsps/{dfspId}/enrollments/inbound/{enId}/sign	Sign and add the certificate to the enrollment
POST	/environments/{envId}/dfsps/{dfspId}/enrollments/inbound/{enId}/certificate	Sets the certificate enrollment

Full API

Pki : Hub PKI Infrastructure setup Operations

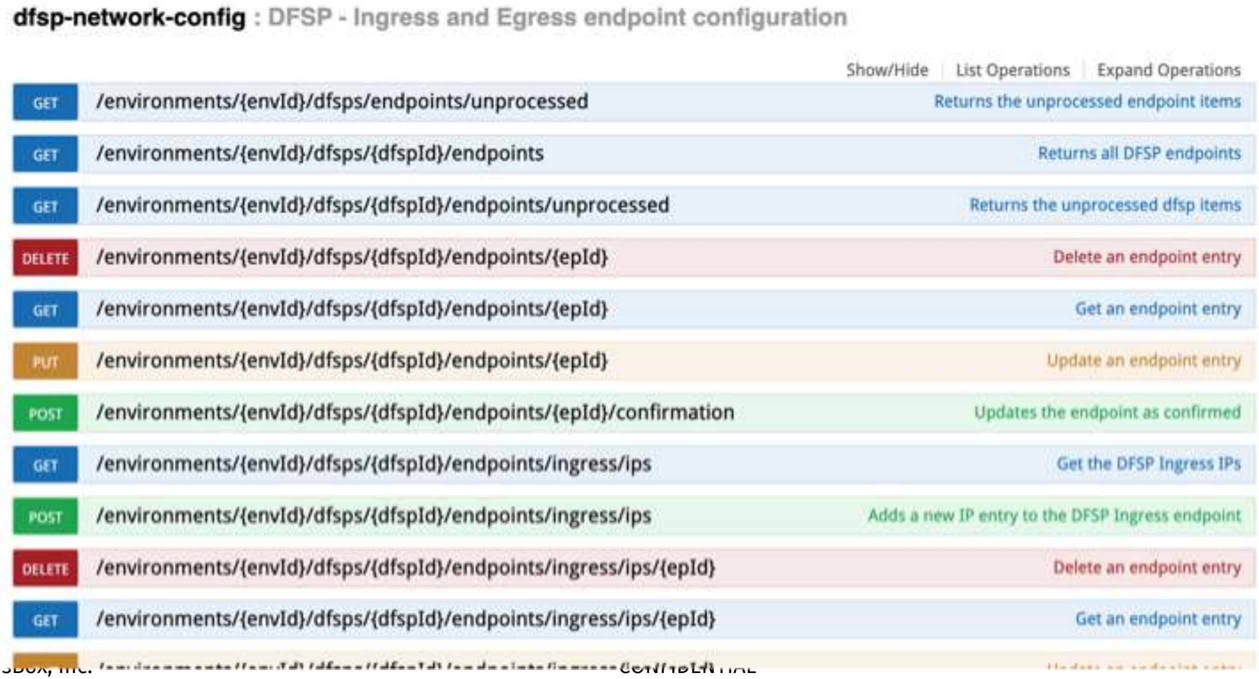


pki : Hub PKI Infrastructure setup

GET	/environments	Returns all the environments
POST	/environments	Creates an environment on the PKI Admin
DELETE	/environments/{envId}	Deletes an environment and its data
GET	/environments/{envId}	Find an environment by its id
POST	/environments/{envId}/cas	Creates a CA for the environment
GET	/environments/{envId}/ca/rootCert	Returns the CA root certificate
GET	/environments/{envId}/dfsps	Returns a list with all the DFSPs in the environment
POST	/environments/{envId}/dfsps	Creates an entry to store DFSP related info

Full API

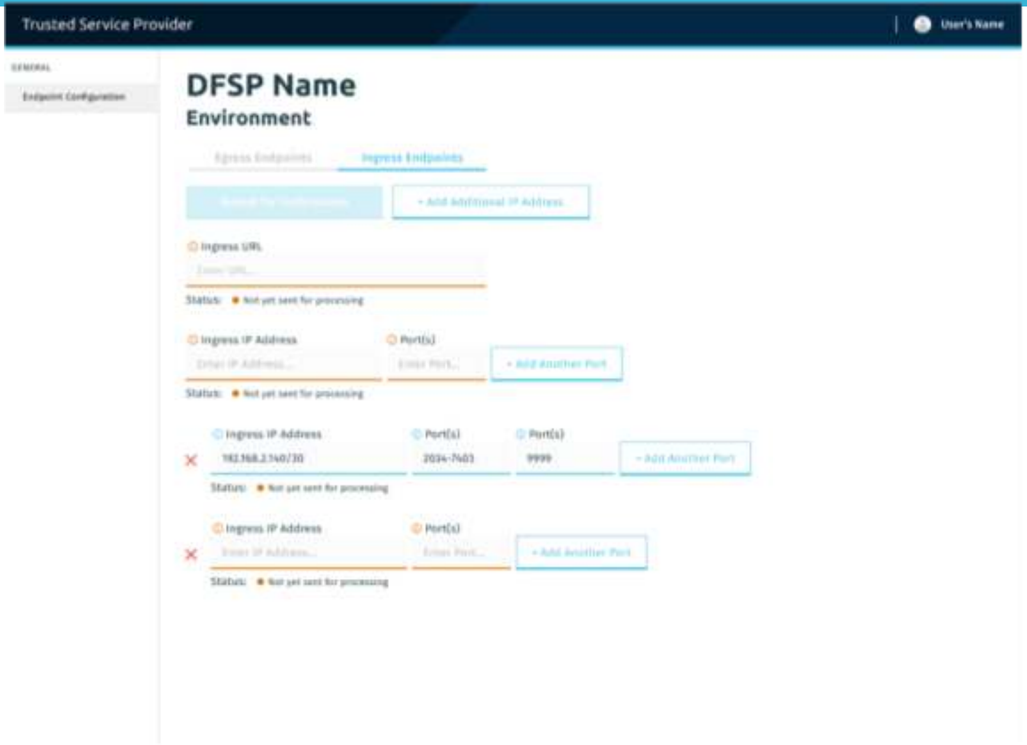
Dfsp-network-config Operations



dfsp-network-config : DFSP - Ingress and Egress endpoint configuration

GET	/environments/{envId}/dfsps/endpoints/unprocessed	Returns the unprocessed endpoint items
GET	/environments/{envId}/dfsps/{dfspId}/endpoints	Returns all DFSP endpoints
GET	/environments/{envId}/dfsps/{dfspId}/endpoints/unprocessed	Returns the unprocessed dfsp items
DELETE	/environments/{envId}/dfsps/{dfspId}/endpoints/{epId}	Delete an endpoint entry
GET	/environments/{envId}/dfsps/{dfspId}/endpoints/{epId}	Get an endpoint entry
PUT	/environments/{envId}/dfsps/{dfspId}/endpoints/{epId}	Update an endpoint entry
POST	/environments/{envId}/dfsps/{dfspId}/endpoints/{epId}/confirmation	Updates the endpoint as confirmed
GET	/environments/{envId}/dfsps/{dfspId}/endpoints/ingress/ips	Get the DFSP Ingress IPs
POST	/environments/{envId}/dfsps/{dfspId}/endpoints/ingress/ips	Adds a new IP entry to the DFSP Ingress endpoint
DELETE	/environments/{envId}/dfsps/{dfspId}/endpoints/ingress/ips/{epId}	Delete an endpoint entry
GET	/environments/{envId}/dfsps/{dfspId}/endpoints/ingress/ips/{epId}	Get an endpoint entry

DFSP End Point Data Entry



DFSP Name

Environment

Ingress URL

Enter URL...

Status: ● Not yet sent for processing

Ingress IP Address: Enter IP Address...

Port(s): Enter Port...

Status: ● Not yet sent for processing

Ingress IP Address: 192.168.2.140/30

Port(s): 2034-7403

Port(s): 9999

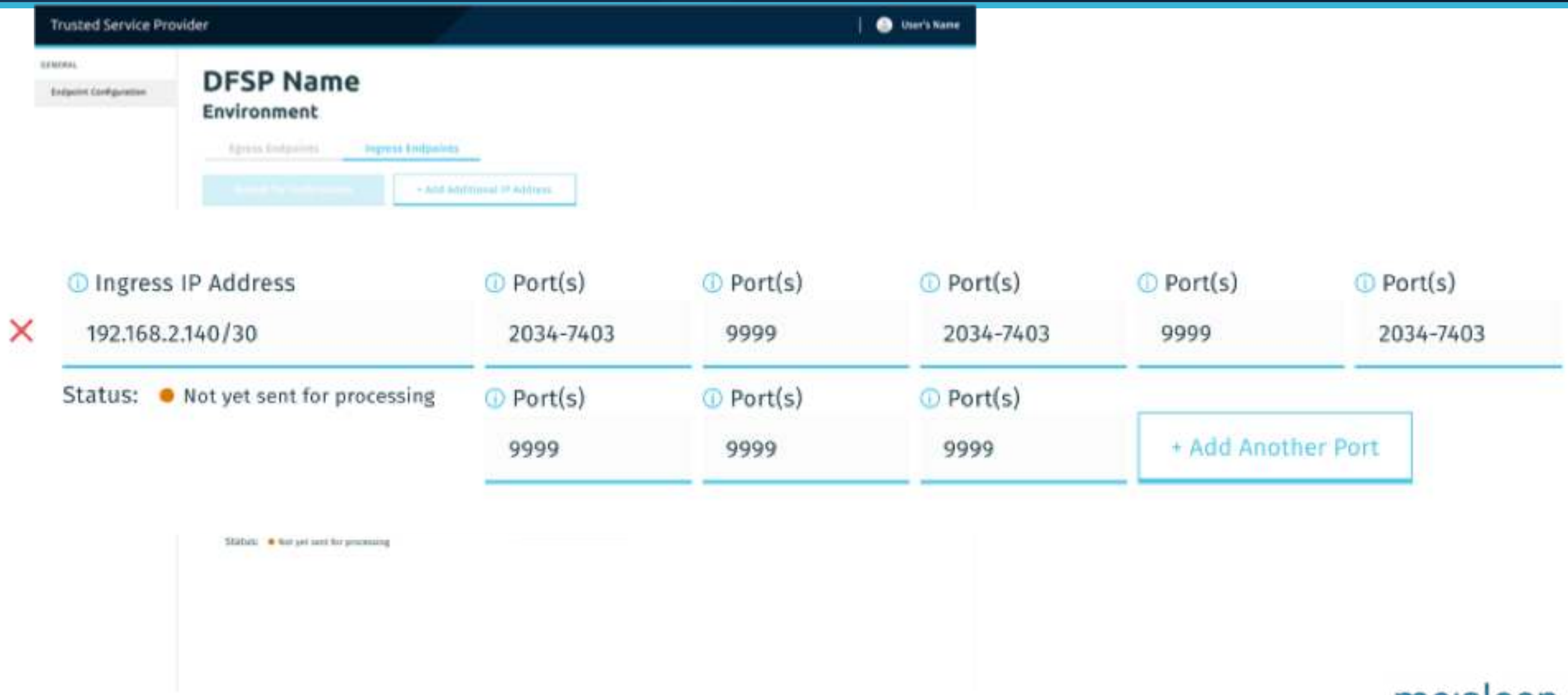
Status: ● Not yet sent for processing

Ingress IP Address: Enter IP Address...

Port(s): Enter Port...

Status: ● Not yet sent for processing

DFSP End Point Data Entry



DFSP Name

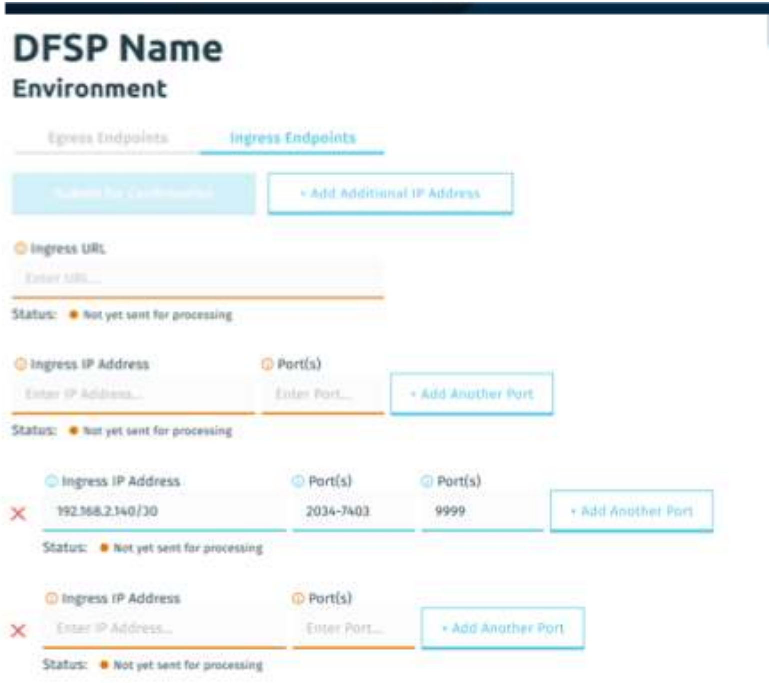
Environment

Ingress IP Address	Port(s)	Port(s)	Port(s)	Port(s)	Port(s)
192.168.2.140/30	2034-7403	9999	2034-7403	9999	2034-7403
	Port(s)	Port(s)	Port(s)		
	9999	9999	9999		

Status: ● Not yet sent for processing

Status: ● Not yet sent for processing

With End-Point Specific configuration options



DFSP Name

Environment

Egress Endpoints | Ingress Endpoints

Submit for Confirmation | + Add Additional IP Address

Ingress URL

Enter URL...

Status: ● Not yet sent for processing

Ingress IP Address: Enter IP Address... | Port(s): Enter Port... | + Add Another Port

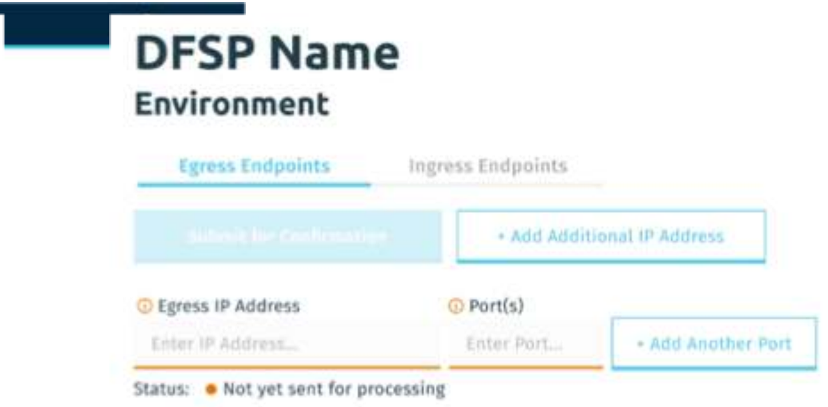
Status: ● Not yet sent for processing

✕ Ingress IP Address: 192.168.2.140/30 | Port(s): 2034-7403 | Port(s): 9999 | + Add Another Port

Status: ● Not yet sent for processing

✕ Ingress IP Address: Enter IP Address... | Port(s): Enter Port... | + Add Another Port

Status: ● Not yet sent for processing



DFSP Name

Environment

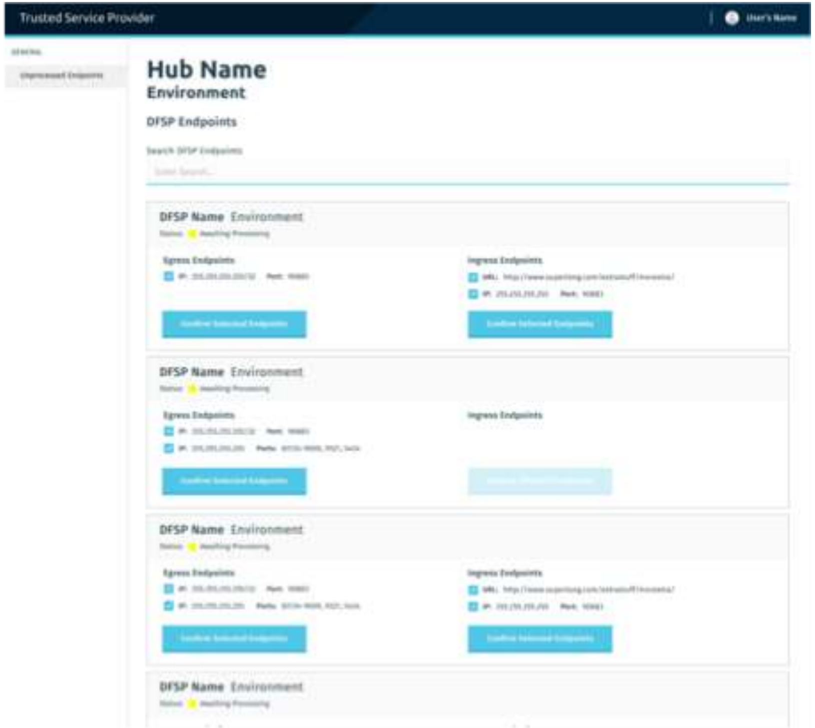
Egress Endpoints | Ingress Endpoints

Submit for Confirmation | + Add Additional IP Address

Egress IP Address: Enter IP Address... | Port(s): Enter Port... | + Add Another Port

Status: ● Not yet sent for processing

And clarity where the information is in the flow



Trusted Service Provider

User's Name

[illegible]

Unprocessed Endpoints

Hub Name

Environment

DFSP Endpoints

Search DFSP Endpoints

Enter Search...

DFSP Name Environment

Status: Awaiting Processing

Egress Endpoints

☑ IP: [illegible] Port: [illegible]

Ingress Endpoints

☑ URL: [illegible]

☑ IP: [illegible] Port: [illegible]

DFSP Name Environment

Status: Awaiting Processing

Egress Endpoints

☑ IP: [illegible] Port: [illegible]

☑ IP: [illegible] Ports: [illegible]

Ingress Endpoints

DFSP Name Environment

Status: Awaiting Processing

Egress Endpoints

☑ IP: [illegible] Port: [illegible]

☑ IP: [illegible] Ports: [illegible]

Ingress Endpoints

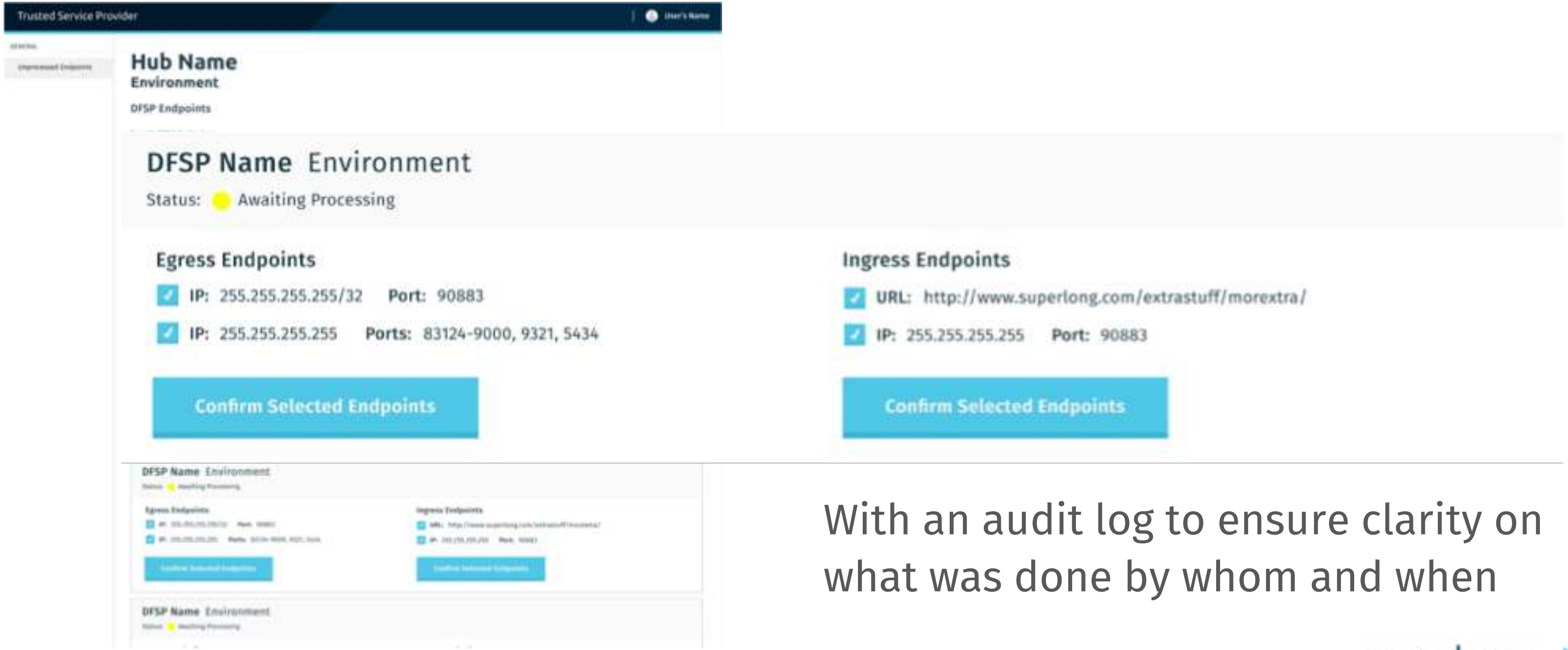
☑ URL: [illegible]

☑ IP: [illegible] Port: [illegible]

DFSP Name Environment

Status: Awaiting Processing

And clarity where the information is in the flow



Trusted Service Provider

User's Name

Unprocessed Endpoints

Hub Name

Environment

DFSP Endpoints

DFSP Name Environment

Status: ● Awaiting Processing

Egress Endpoints

☑ **IP:** 255.255.255.255/32 **Port:** 90883

☑ **IP:** 255.255.255.255 **Ports:** 83124-9000, 9321, 5434

Confirm Selected Endpoints

Ingress Endpoints

☑ **URL:** http://www.superlong.com/extrastuff/morextra/

☑ **IP:** 255.255.255.255 **Port:** 90883

Confirm Selected Endpoints

DFSP Name Environment

Status: ● Awaiting Processing

Egress Endpoints

☑ **IP:** 255.255.255.255/32 **Port:** 90883

☑ **IP:** 255.255.255.255 **Ports:** 83124-9000, 9321, 5434

Confirm Selected Endpoints

Ingress Endpoints

☑ **URL:** http://www.superlong.com/extrastuff/morextra/

☑ **IP:** 255.255.255.255 **Port:** 90883

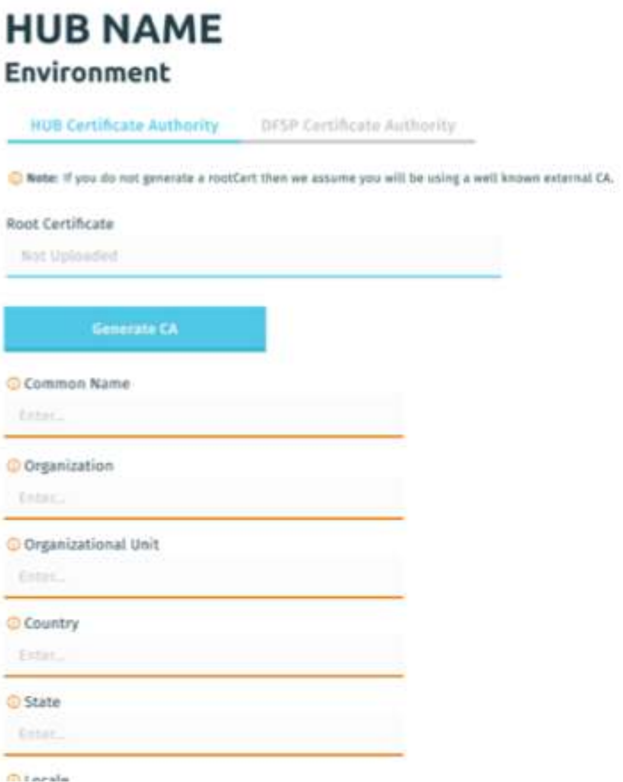
Confirm Selected Endpoints

DFSP Name Environment

Status: ● Awaiting Processing

With an audit log to ensure clarity on what was done by whom and when

Certificate Authorities can be Self Signed or External



HUB NAME

Environment

HUB Certificate Authority | DFSP Certificate Authority

Note: If you do not generate a rootCert then we assume you will be using a well known external CA.

Root Certificate: Not Uploaded

Generate CA

Common Name: Enter...

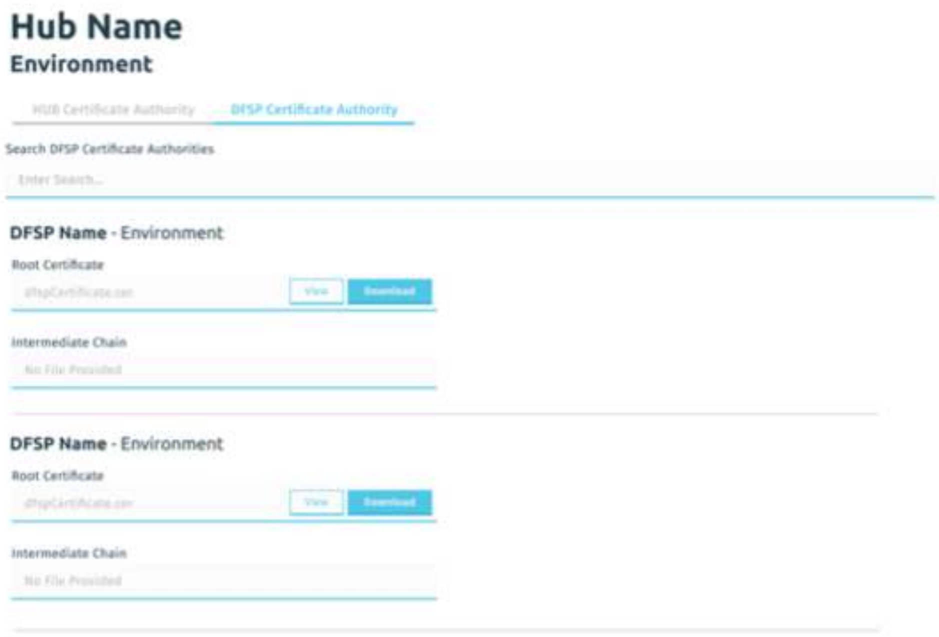
Organization: Enter...

Organizational Unit: Enter...

Country: Enter...

State: Enter...

Locale



Hub Name

Environment

HUB Certificate Authority | DFSP Certificate Authority

Search DFSP Certificate Authorities: Enter Search...

DFSP Name - Environment

Root Certificate: dfspCertificate.cer

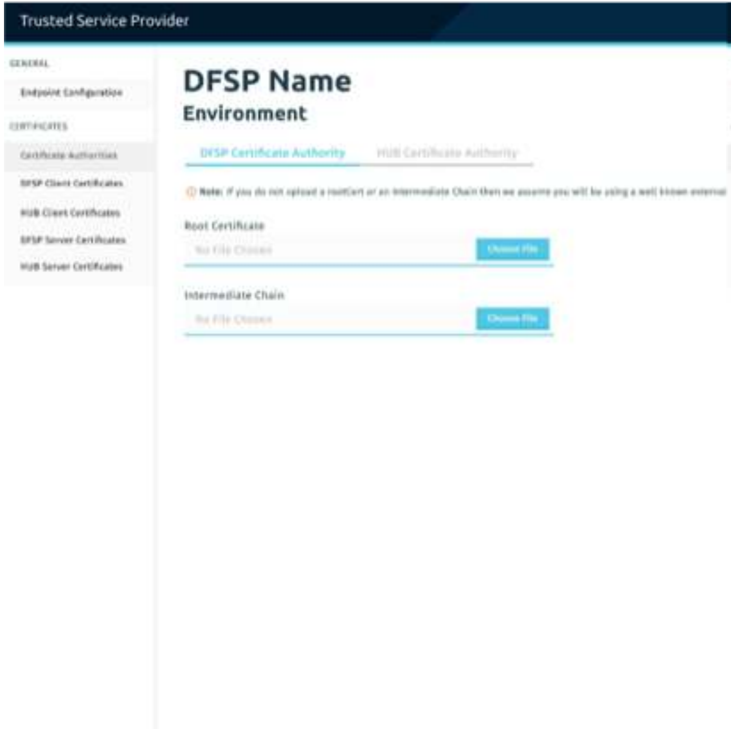
Intermediate Chain: No File Provided

DFSP Name - Environment

Root Certificate: dfspCertificate.cer

Intermediate Chain: No File Provided

… also available for DFSP



Trusted Service Provider

GENERAL

- Endpoint Configuration

CERTIFICATES

- Certificate Authorities
- DFSP Client Certificates
- HUB Client Certificates
- DFSP Server Certificates
- HUB Server Certificates

DFSP Name

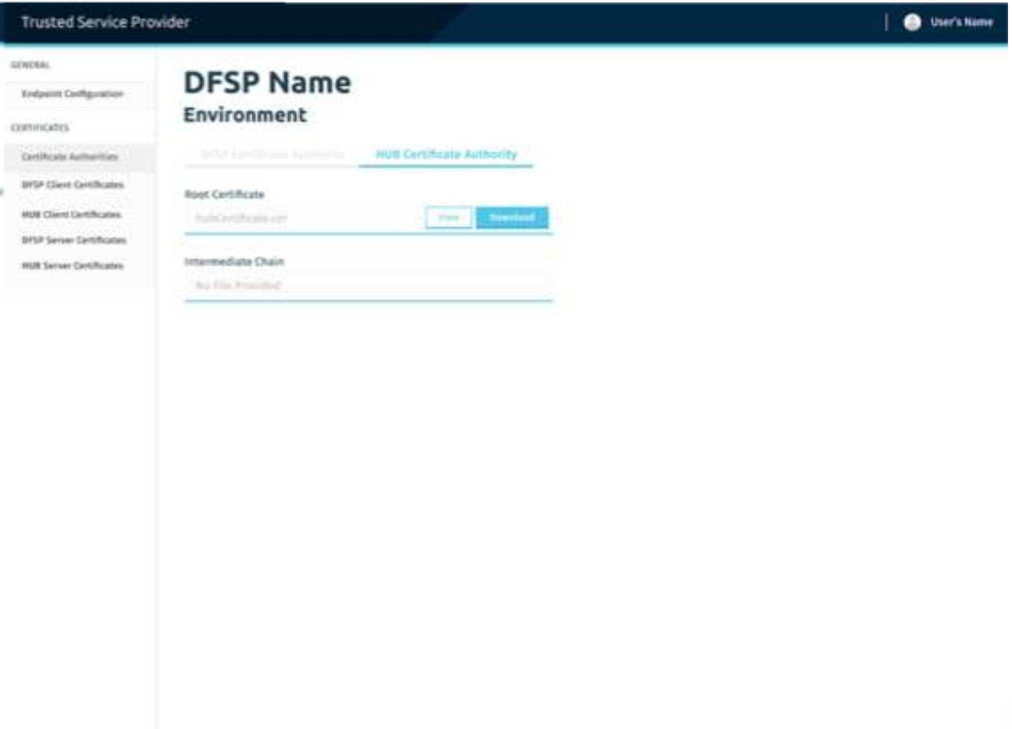
Environment

DFSP Certificate Authority | HUB Certificate Authority

ⓘ **Note:** If you do not upload a rootCert or an Intermediate Chain then we assume you will be using a well known external

Root Certificate: No File Chosen [Choose File]

Intermediate Chain: No File Chosen [Choose File]



Trusted Service Provider | User's Name

GENERAL

- Endpoint Configuration

CERTIFICATES

- Certificate Authorities
- DFSP Client Certificates
- HUB Client Certificates
- DFSP Server Certificates
- HUB Server Certificates

DFSP Name

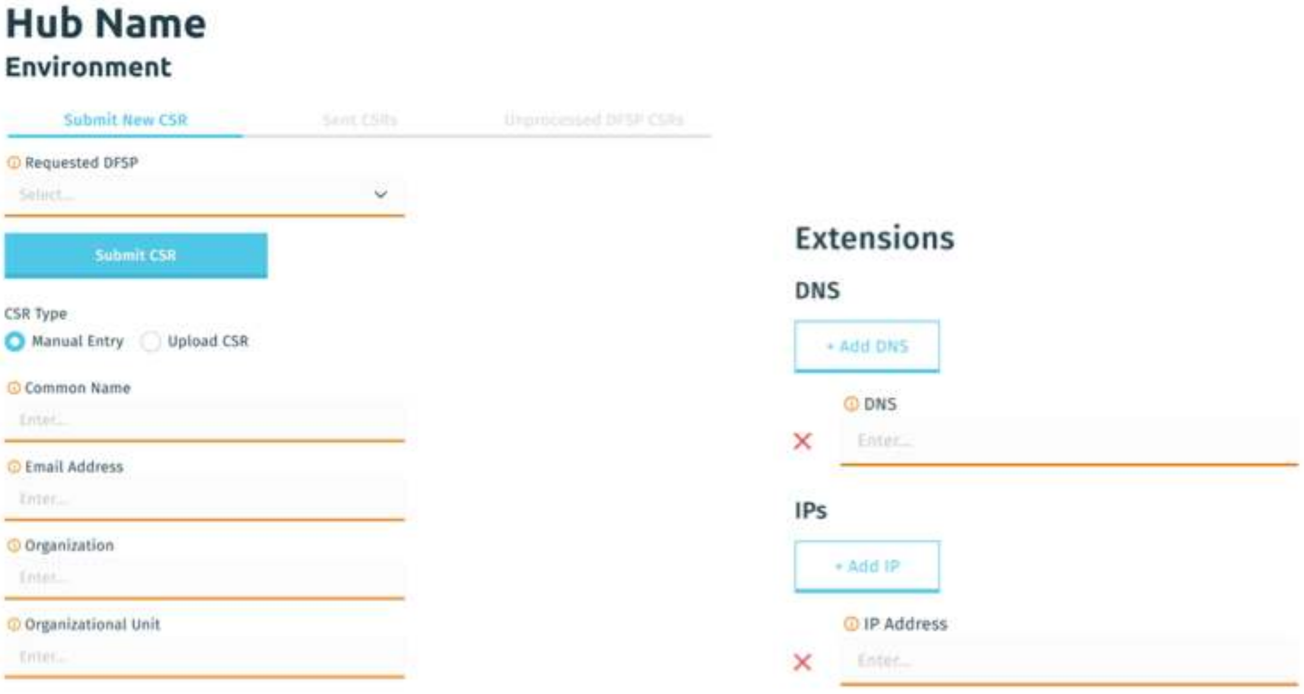
Environment

DFSP Certificate Authority | HUB Certificate Authority

Root Certificate: HubCertificate.cer [View] [Download]

Intermediate Chain: No File Provided

With Initiation of Certificate Signing Requests (CSRs)



Hub Name

Environment

Requested DFSP: Select...

CSR Type

● Manual Entry ○ Upload CSR

Common Name: Enter...

Email Address: Enter...

Organization: Enter...

Organizational Unit: Enter...

Extensions

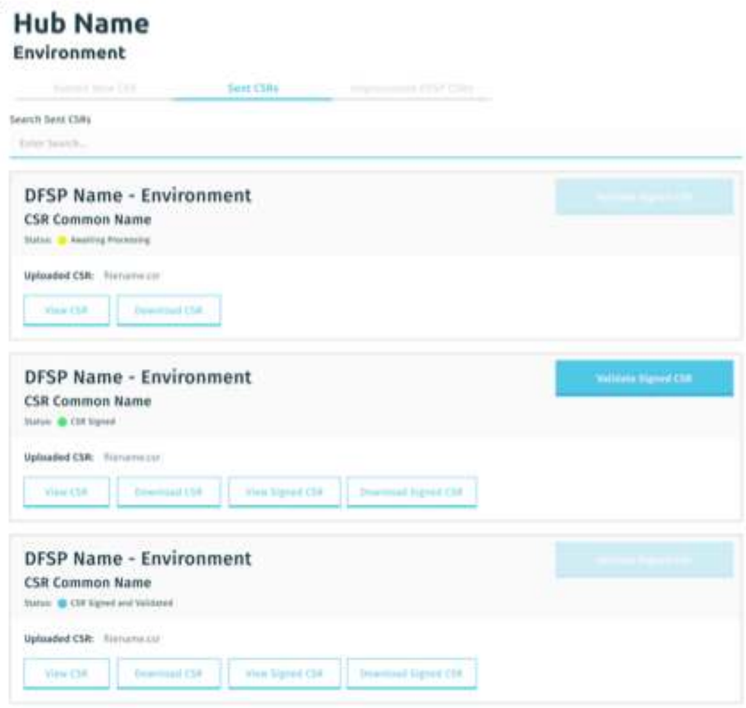
DNS

✕ DNS: Enter...

IPs

✕ IP Address: Enter...

CSR status Easily identified



Hub Name

Environment

Search Sent CSRs

Enter Search...

DFSP Name - Environment

CSR Common Name

Status: ● Awaiting Processing

Uploaded CSR: filename.csr

DFSP Name - Environment

CSR Common Name

Status: ● CSR Signed

Uploaded CSR: filename.csr

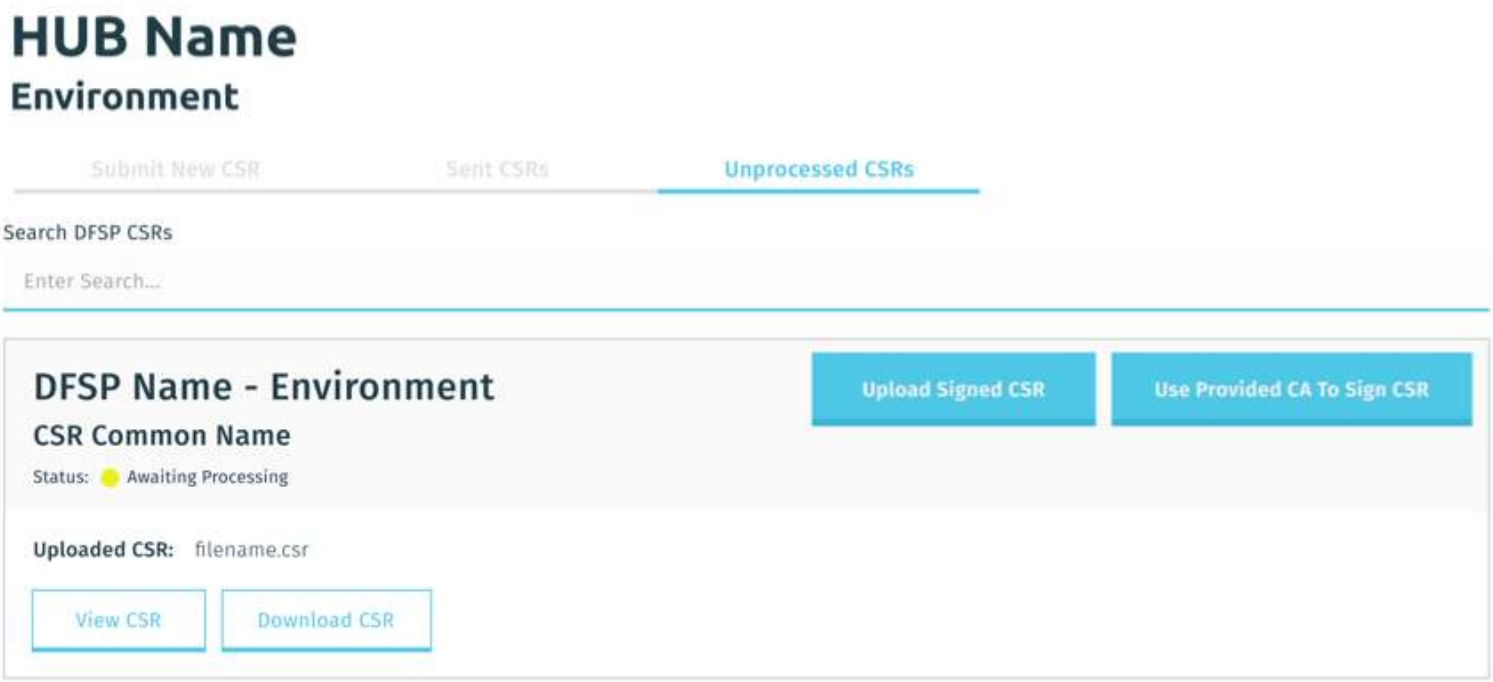
DFSP Name - Environment

CSR Common Name

Status: ● CSR Signed and Validated

Uploaded CSR: filename.csr

CSR status Easily identified



HUB Name

Environment

Search DFSP CSRs

Enter Search...

DFSP Name - Environment

CSR Common Name

Status: ● Awaiting Processing

Uploaded CSR: filename.csr

And we are now working on the JWS certificate sharing

- Share DFSP JWS Certificate
- Receive other DFSP JWS Certificates
- When connected to SDK - send test transactions to DFSPs
- Automated Connection to receive new JWS certificates
- Revoking of JWS Certificates

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Thank You

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