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Mifos Lab Updates

Edward Cable, The Mifos Initiative
Istvan Molnar, DPC Consulting

Agenda

- Mifos Overview and Vision
- Payment Hub EE Accomplishments PI-10
- Accelerating Mojaloop Adoption
  - Tier 1 & Tier 2 Institutions
  - Tier 3 & Tier 4 Institutions
  - Fintechs & PISPs
- Bulk Payments & Open G2P
- Roadmap

Mifos Overview

Who is Mifos?

FinTech non-profit leveraging the cloud, mobile, and open source community to transform the delivery of digital financial services to the world's 3 billion underbanked and unbanked.

Mifos Initiative & DPC

- 501(c)3 non-profit guiding Mifos OS community advancing Apache Fineract
- Stewards of roadmap & collaborative center
- Industry thought leader & HFOSS pioneer since 2006
- Guide Ecosystem of Solutions & Network of Partners
- 13 million clients reached across 350 orgs

- 20+ years in IT training, consultancy, software development
- Experience with Instant Payment Systems (Singapore FAST, Hungary HCT Inst, SEPA Instant)
  - Including clearing house solutions, payment hubs, shadow balance solutions from key vendors
  - Developing central clearing house prototype, simulator for participants, payment hub

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Mifos Initiative

FINANCIAL INNOVATION AWARDS 2019 — Highly Commended — Best financial inclusion or outreach initiative — Presented by The London Institute of Banking & Finance

István Molnár

Kristóf Józsa

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Zoltán Nébli

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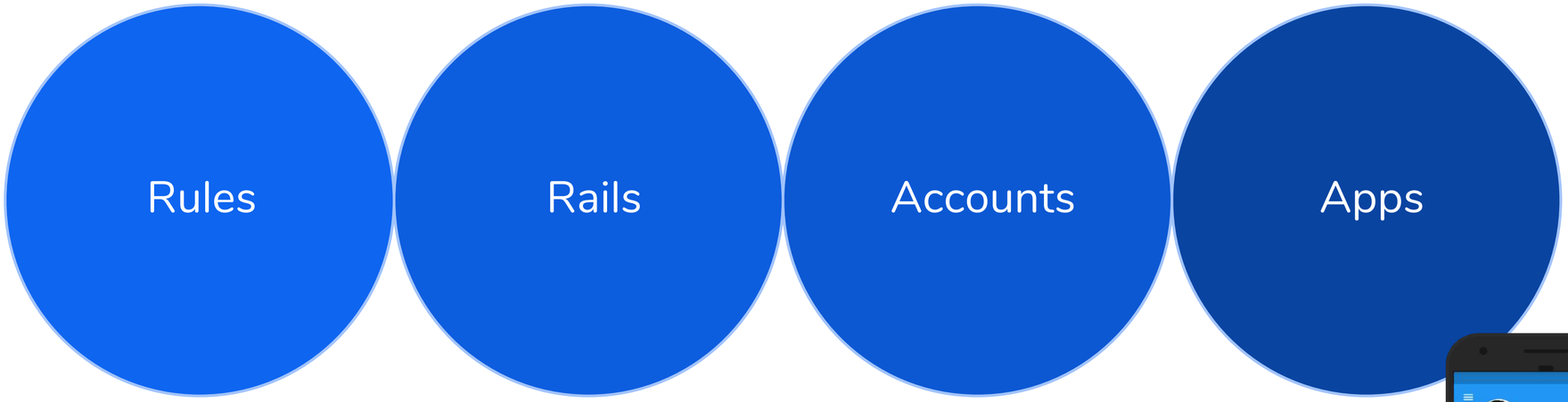
Our Vision

End to End Open Source Stack for Digital Financial Services

- Open Stack
  - OS L1-Aligned Payment Switch - Mojaloop
  - OS Bridge - Payment Hub
  - OS Account Management System - Mifos/Fineract
  - OS Reference Mobile Apps - Mobile Banking, Mobile Wallet



THE LEVEL ONE PROJECT

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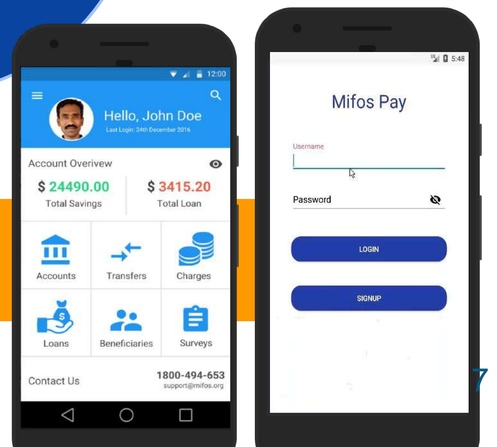
Payment Hub

Mifos®

Open Banking APIs



Four Layers of APIs at 2 Different Levels

Rules

Rails

Accounts

Apps

THE LEVEL ONE PROJECT

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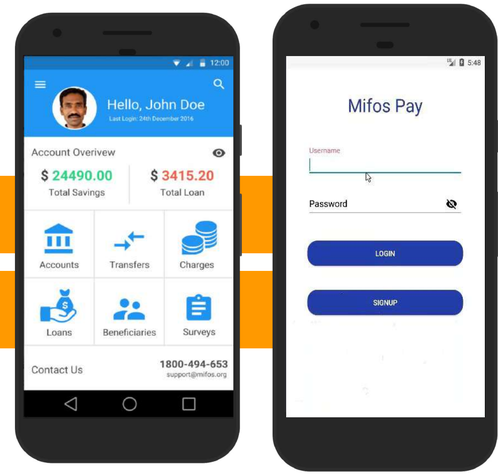
Payment Hub EE

Mifos®

Open Banking APIs

GSMA Mobile Money APIs



Infrastructure

Application

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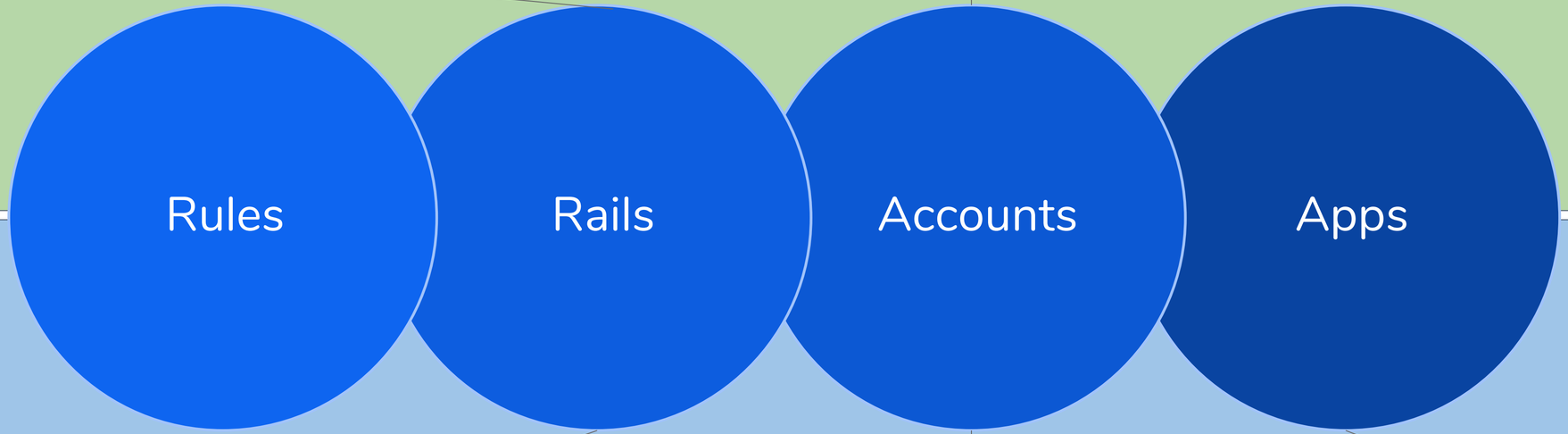
Enabling Access & Meaningful Usage of DFS

MFIs can digitize and digitally transform.

Payment Hub allows simple and low-cost participation in scheme.

Mifos X provides flexible, open production-ready system to digitize all providers, formal & informal.

- Directly offer digital financial services
- Use Open Banking API to partner with fintechs



Payment Hub facilitates easy connection to Mojaloop

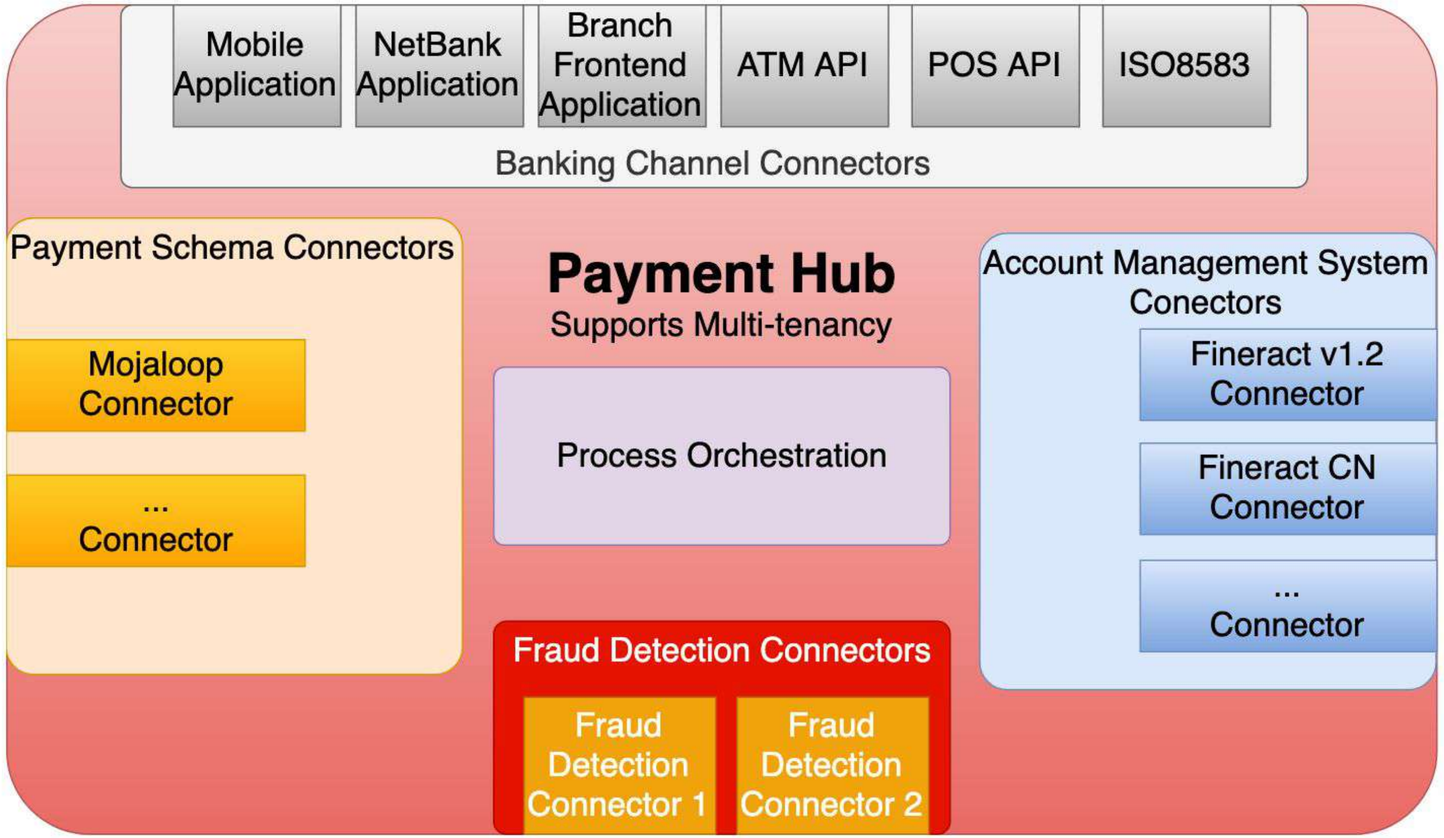
Mobile Wallet Management System with Core Banking Built-in

MMOs can easily roll out adjacent loan & savings services

MMOs can evolve to become payment & service platforms

Payment Hub as an Open Source Asset for the Community

- The role of a payment hub to connect:
  - Financial Institution channels (Mobile, Internet, Branch, Callcenter, ATM, POS, API Gateways)
  - Account Management Systems (AMS / Core banking platform), optionally fraud monitoring tools
  - Payment Schemes, such as Mojaloop
- Need
  - Consistent Way to Connect to Mojaloop
  - Effective Operational Participation
- Additional Capabilities
  - DFSP-level fraud monitoring
  - Bulk Transfer Campaign Management
  - Operational Monitoring
  - Manages the identifier – account relation
  - Trigger notifications
- Built on proven open-source technology:
  - Java, SpringBoot, Kafka, Elasticsearch
  - Apache Camel, Camunda Zeebe
  - Kubernetes



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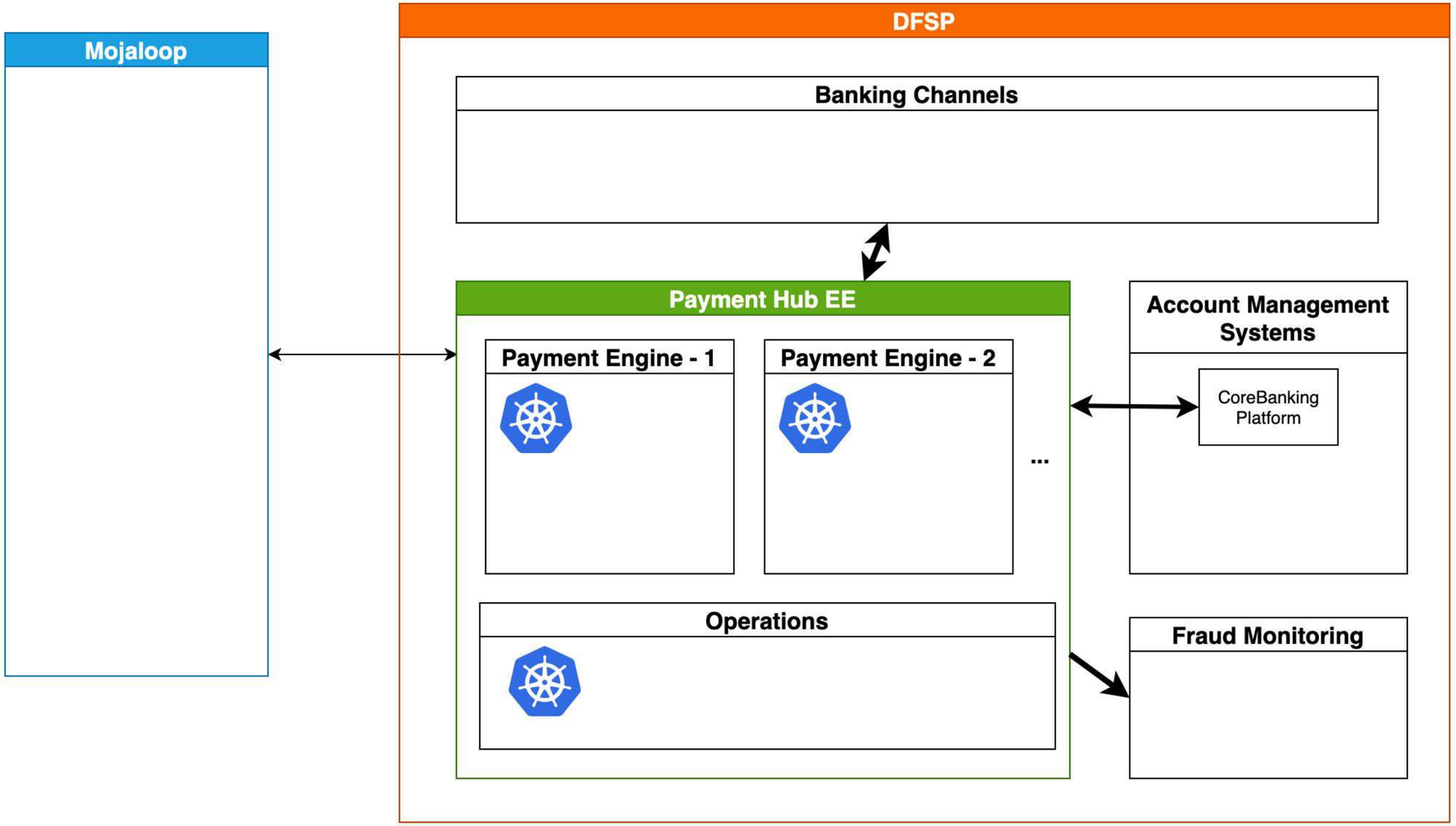
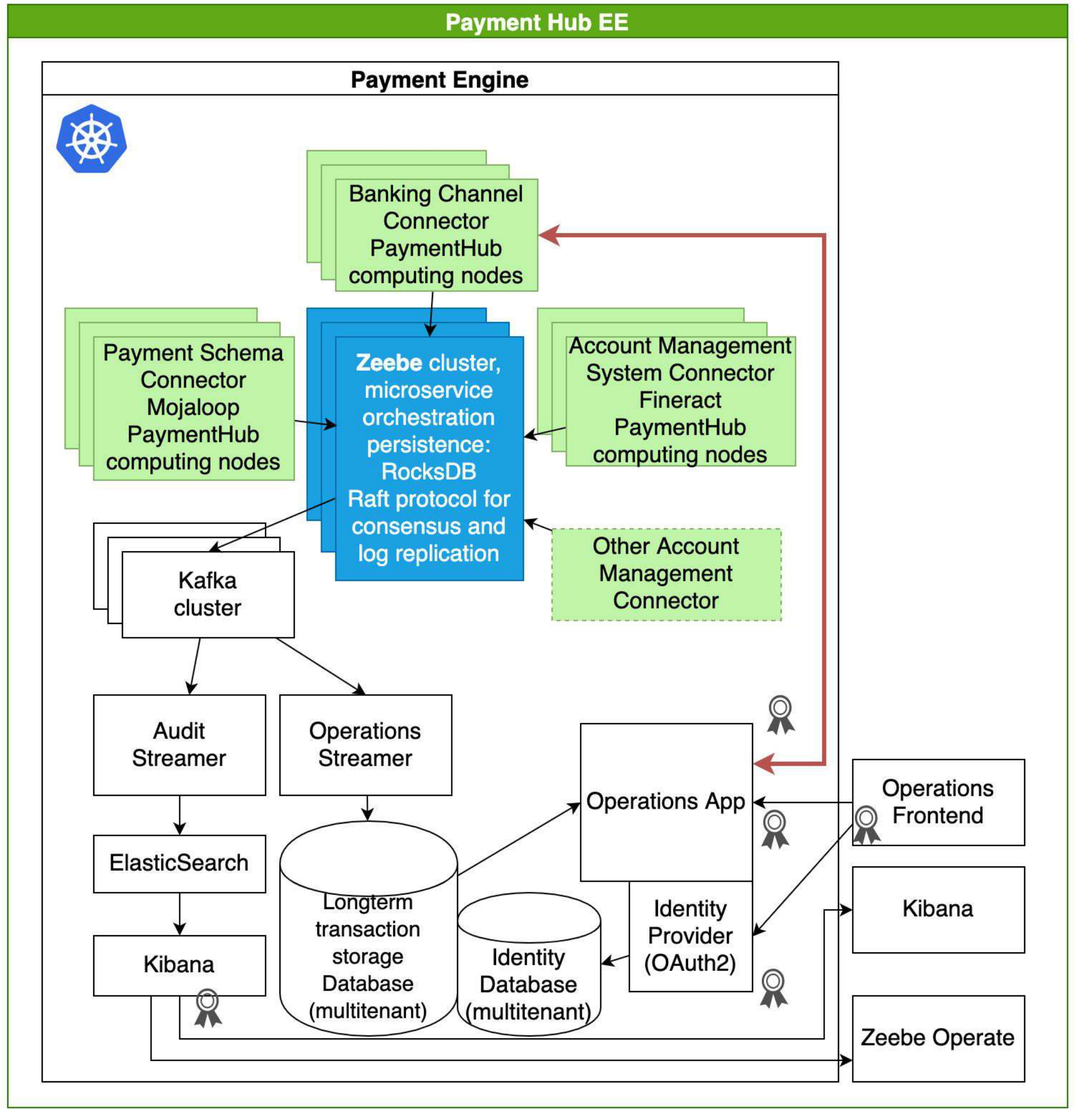
Payment Hub EE in the Payment Context



Payment Hub Components

Microservices based architecture to support easy customization for integrators

- microservices orchestration
- microservices for the connectors
- running in a Kubernetes cluster
- operations application for DFSP command center



Accomplishments for PI-10

Process flow enhancements

- Account Registration Process - Party Identifier Registration
- Payer-Initiated Transaction (P2P)
- Payee-Initiated Transaction (Request To Pay transactions)
  - Automatic and payer approvals according to the corresponding scenario

Multitenancy

Operational Control Center for DFSP actions

Integrated LAB environment with Digital Channels and Fintechs with Openbanking API

Documentation

Moving into Production

An extensible, enterprise-grade integration with Mojaloop

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Payment Hub EE is Production Ready

- ❏ Lab Environment is Available for Access
- ❏ Payment Hub is Production Ready
  - ❏ Being deployed as bridge for other use cases in Mifos Ecosystem
  - ❏ Being tested out for Mojaloop by fintechs like Kanzu Code
  - ❏ Eager to have it used for connection in live Mojaloop deployments.

Tier 1 and 2 Institutions

Scalable, extensible, enterprise-grade Operation Control Center for DFSPs

- Mifos and Core Banking System agnostic → simply build another connector.
- Not just to abstract out the complexity of API integration
- Operational Control Center for a DFSP - monitor, analyze, and respond
- Scalable and Enterprise-grade, deployable in multiple topologies.
- Extensible - powerful bridge to connect to other payment systems.
- Zeebe Workflow Engine for Microservices Orchestration - Orchestrate any end-to-end workflow across your payments, systems, and channels
- Open Source and extensible - ready to be commercialized by integrators or enhanced and extended by in-house IT
- Stand-in System capabilities

Deployment models

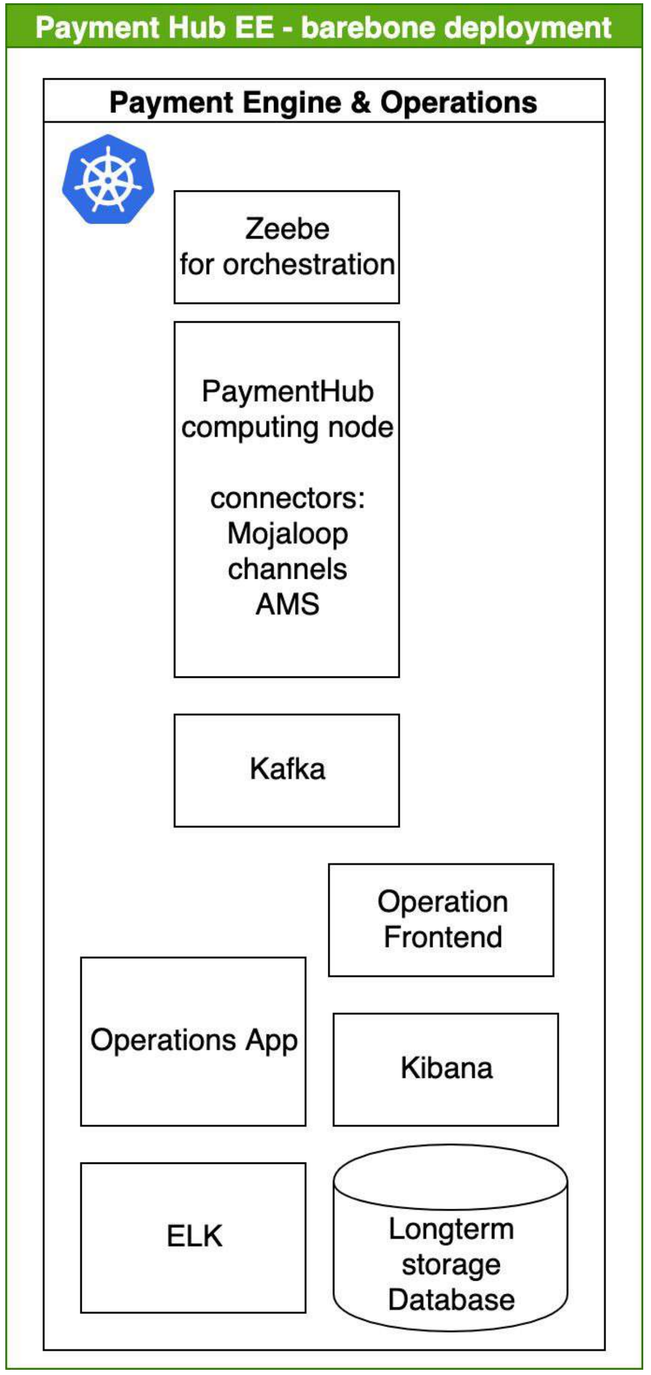
On-premises and any of the cloud providers

Shared service serving multiple DFSPs run by an aggregator (multiple SACCOs, credit unions on a multitenant setup) or dedicated setup

Depending on the DFSP requirements it could be deployed as

- **barebone** - single instance of components, minimized resource usage, no loss of functionality
  Might not run on a feature phone, but we will get there.
- **medium** - single realtime engine
- **fully scaled** - multiple realtime engines

The difference is in availability, fault tolerance and the volume of transactions, which can be handled.



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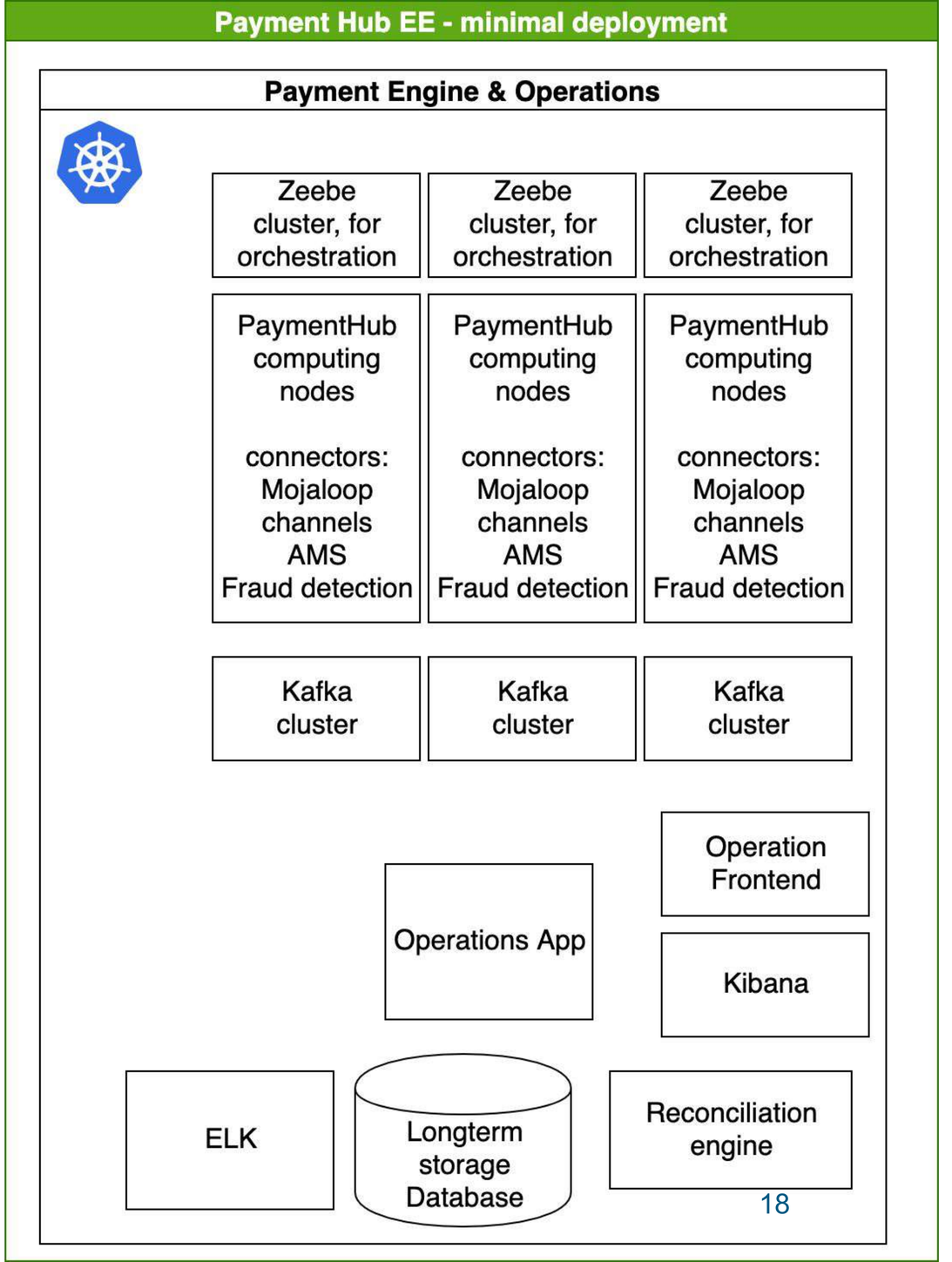
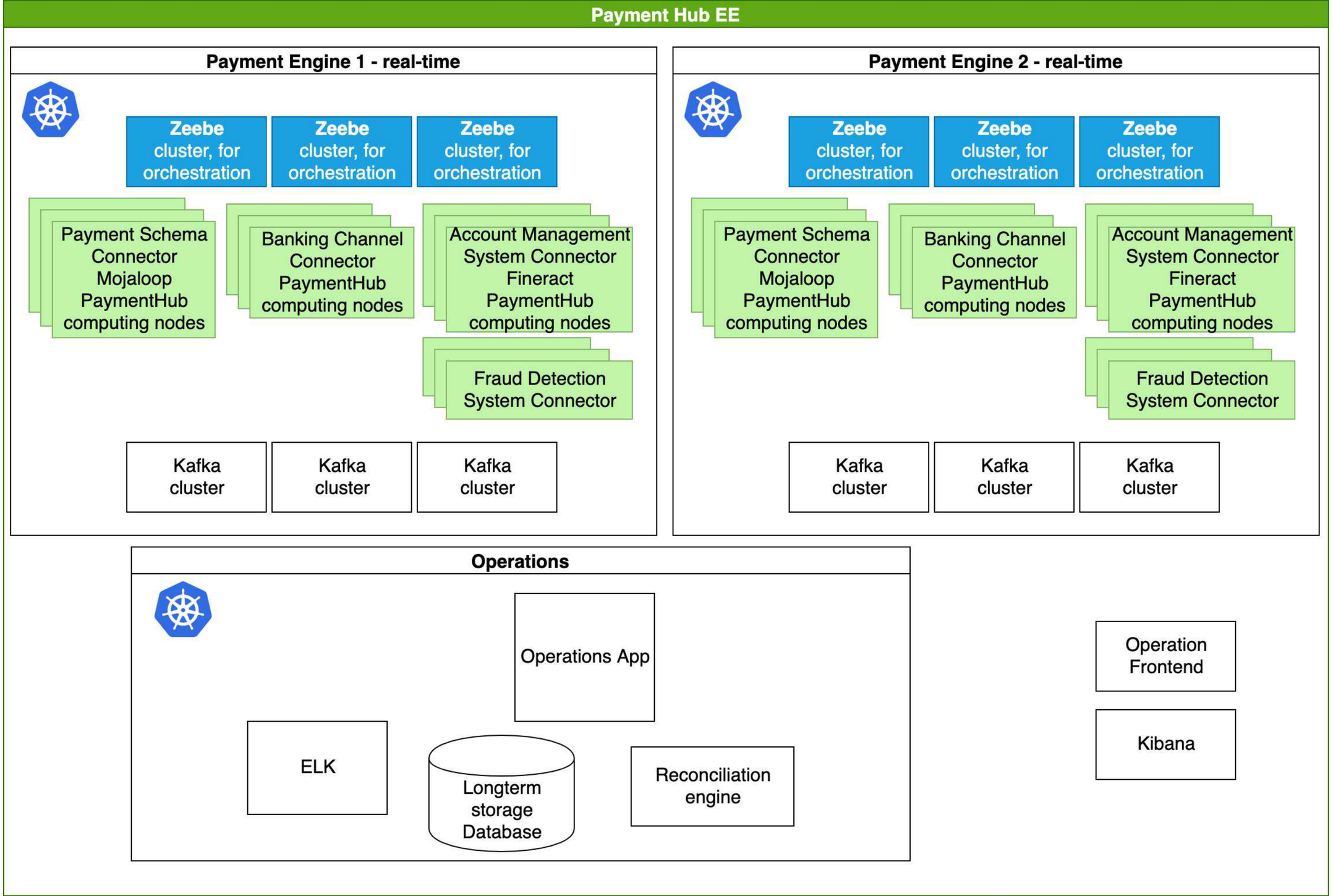
Deployment model - medium

- Medium deployment
  - Single kubernetes cluster to contain all the necessary components
  - Fault tolerance provided by the clustered components
  - Stretched installation across data centers possible, but not ideal
- Full scale deployment
  - Multiple independent payment engines (a single engine is collocated for performance), enabling complete version upgrades without service interruptions
  - Running in different data centers on independent network connections (high availability, fault tolerant even in case of disaster scenarios)
  - Partitioning the load across the engines




Payment Hub EE
Payment Engine 1 - real-time
Zeebe cluster, for orchestration
Zeebe cluster, for orchestration
Zeebe cluster, for orchestration
Payment Schema Connector Mojaloop PaymentHub computing nodes
Banking Channel Connector PaymentHub computing nodes
Account Management System Connector Fineract PaymentHub computing nodes
Fraud Detection System Connector
Kafka cluster
Kafka cluster
Kafka cluster
Payment Engine 2 - real-time
Zeebe cluster, for orchestration
Zeebe cluster, for orchestration
Zeebe cluster, for orchestration
Payment Schema Connector Mojaloop PaymentHub computing nodes
Banking Channel Connector PaymentHub computing nodes
Account Management System Connector Fineract PaymentHub computing nodes
Fraud Detection System Connector
Kafka cluster
Kafka cluster
Kafka cluster
Operations
Operations App
ELK
Longterm storage Database
Reconciliation engine
Operation Frontend
Kibana

Accomplishments for PI-10

Process flow enhancements

- **Account Registration Process - Party Identifier Registration**
- **Payer-Initiated Transaction (P2P)**
- **Payee-Initiated Transaction (Request To Pay transactions)**
  - **Automatic and payer approvals according to the corresponding scenario**

Multitenancy

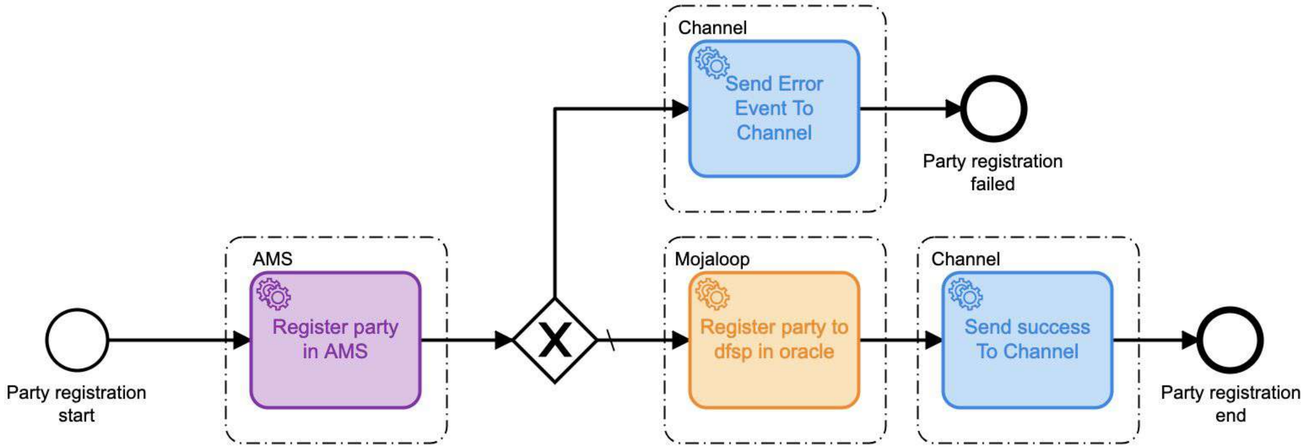
Operational Control Center for DFSP actions

Integrated LAB environment with Digital Channels and Fintechs with Openbanking API

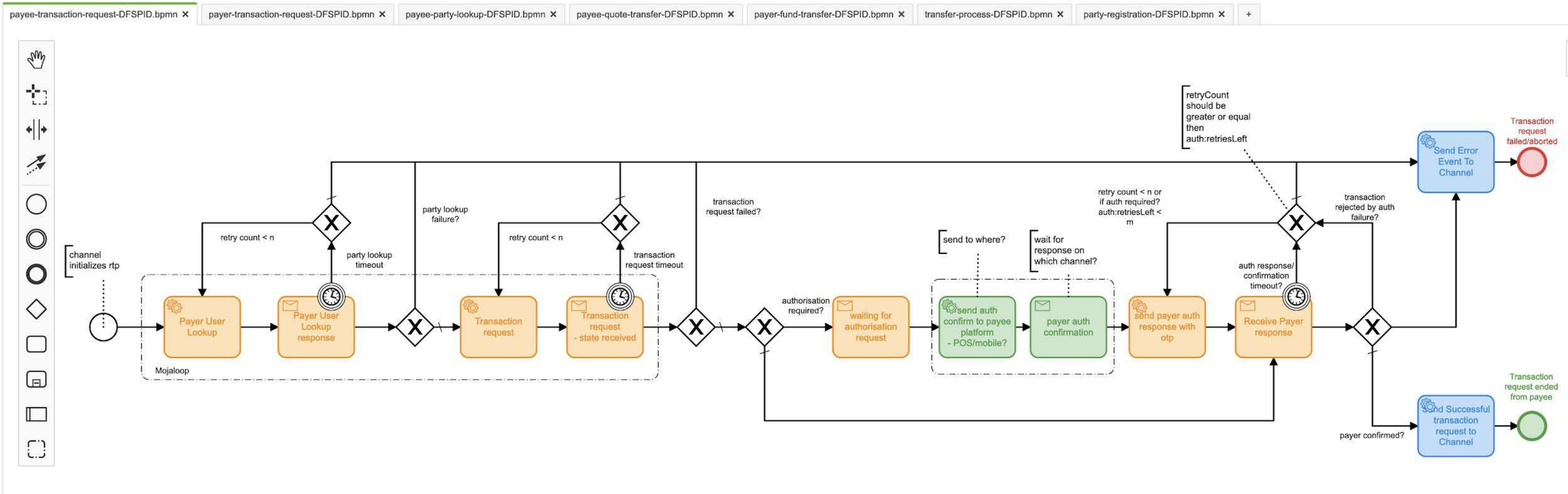
Documentation

Party Identifier Registration

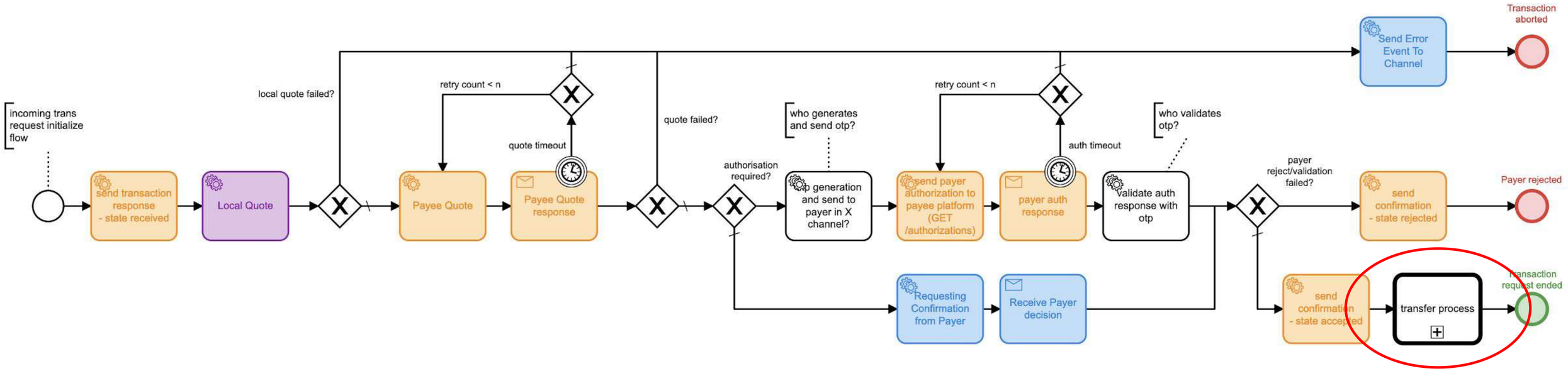
- Initiate the association of a party identifier (MSISDN) with an account at DFSP
- Register identifier in the DFSP systems (in the Account Management System in our environment)
- Manage the registration process with error handling at the “Oracle”



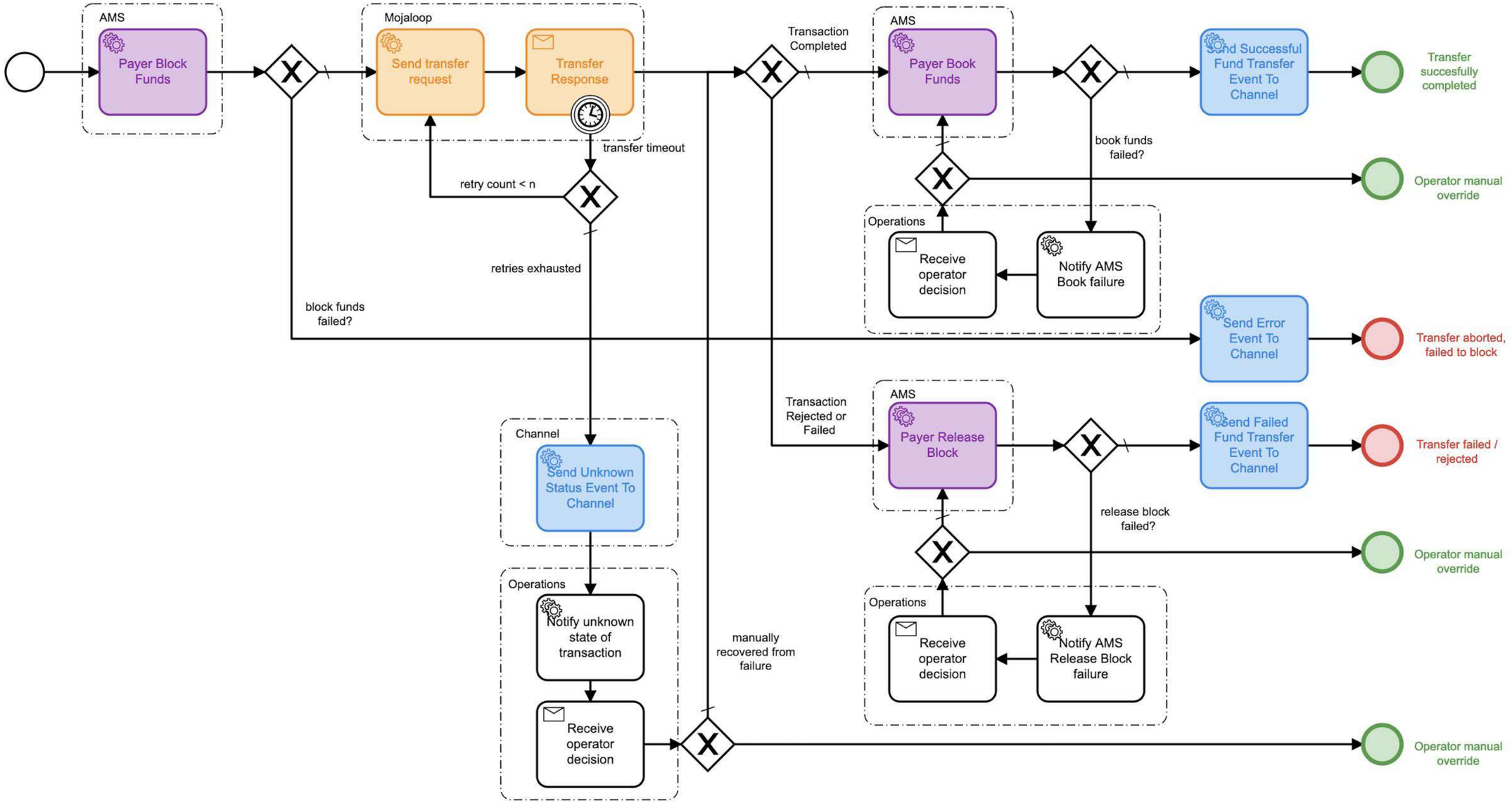
Payee Initiated flows - Request To Pay



Accepting request to pay at Payer



Payer Fund Transfer



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Documentation

Operational Control Center for DFSP actions

Authentication and authorization with privileges for different actions

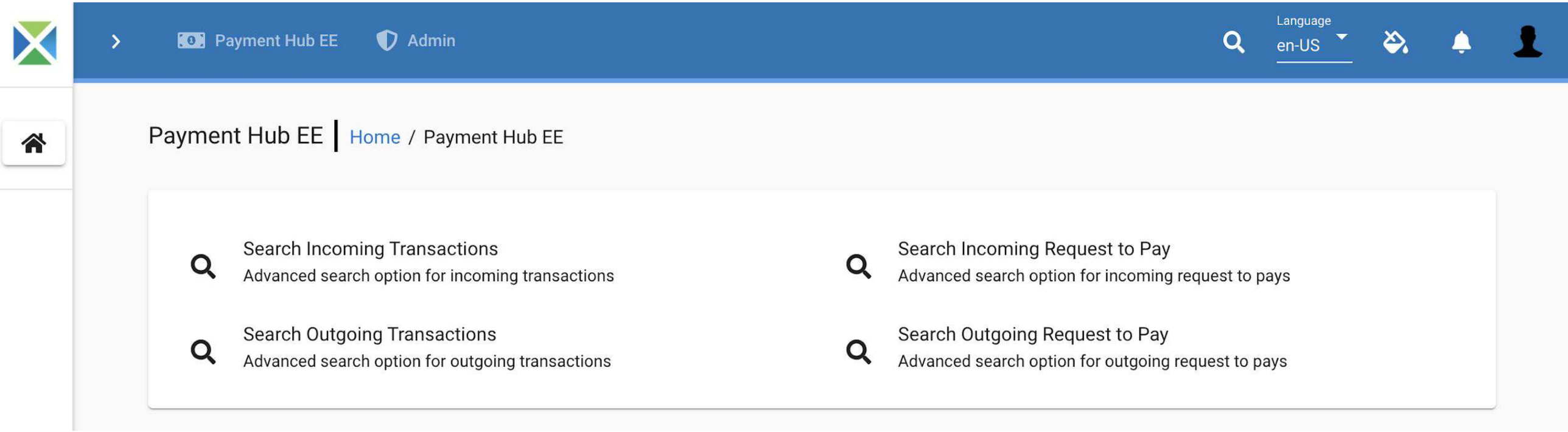
Complete segregation of tenants, separate databases and users

Search and detailed view of transactions

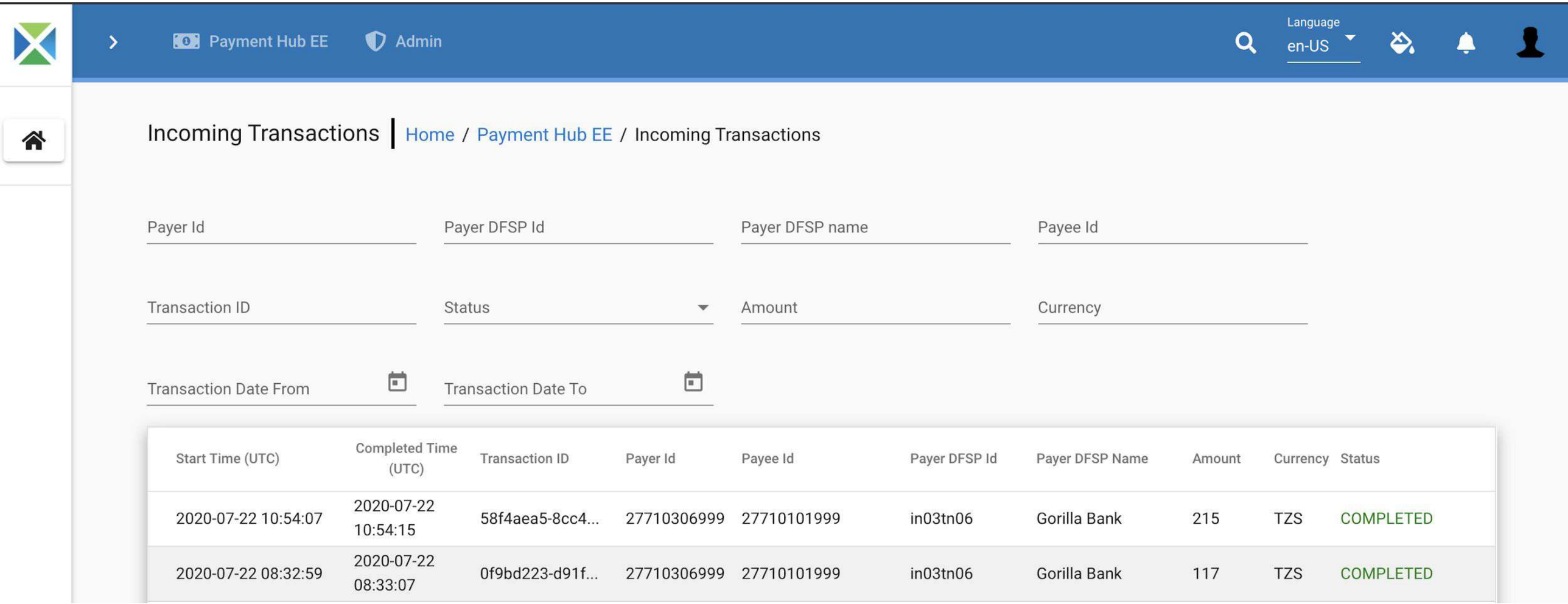
Refund capability for privileged operators on successful incoming transfers

After multiple automated attempts, transactions can be handed over to operations to retry or resolve manually

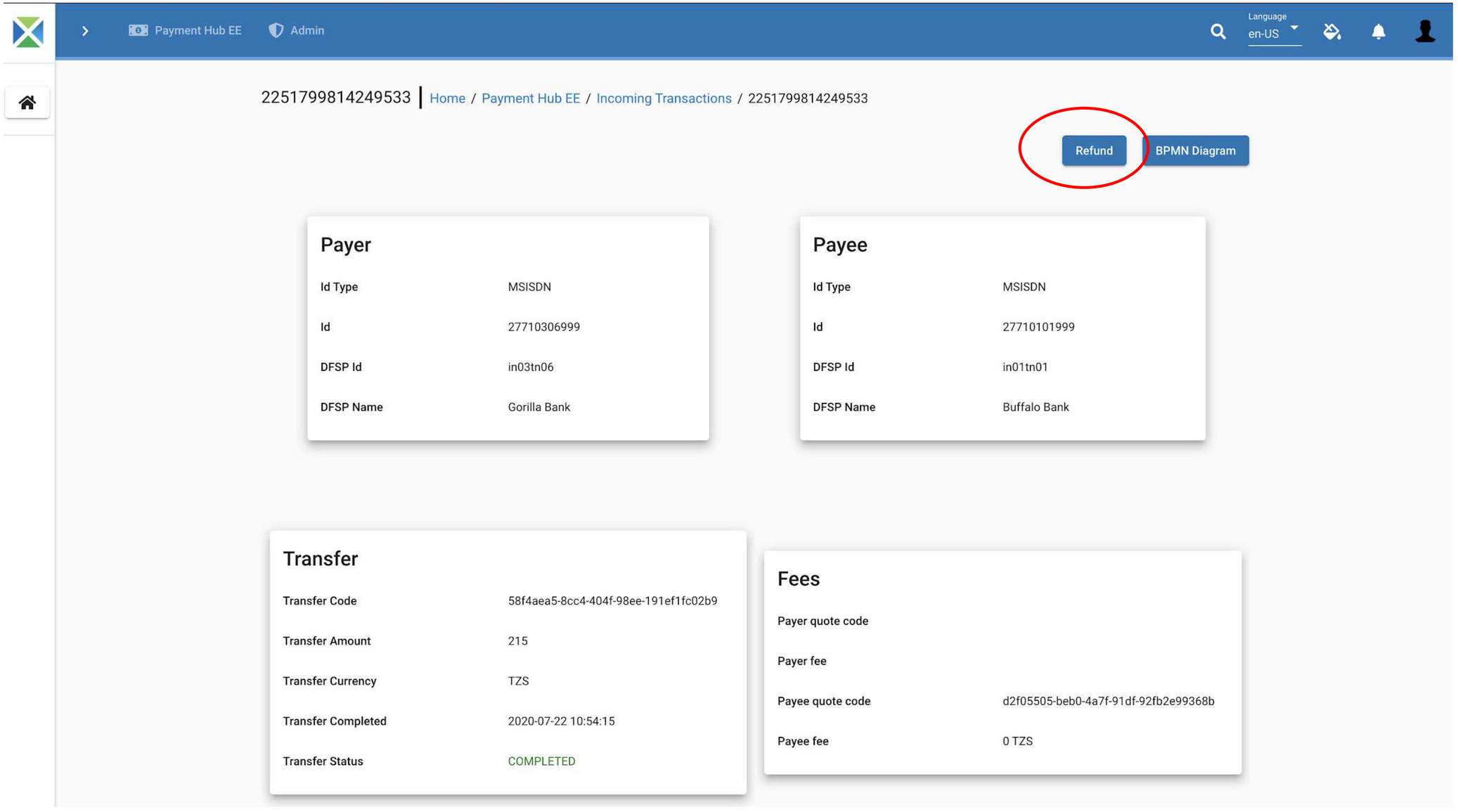
Search capability for the different flows



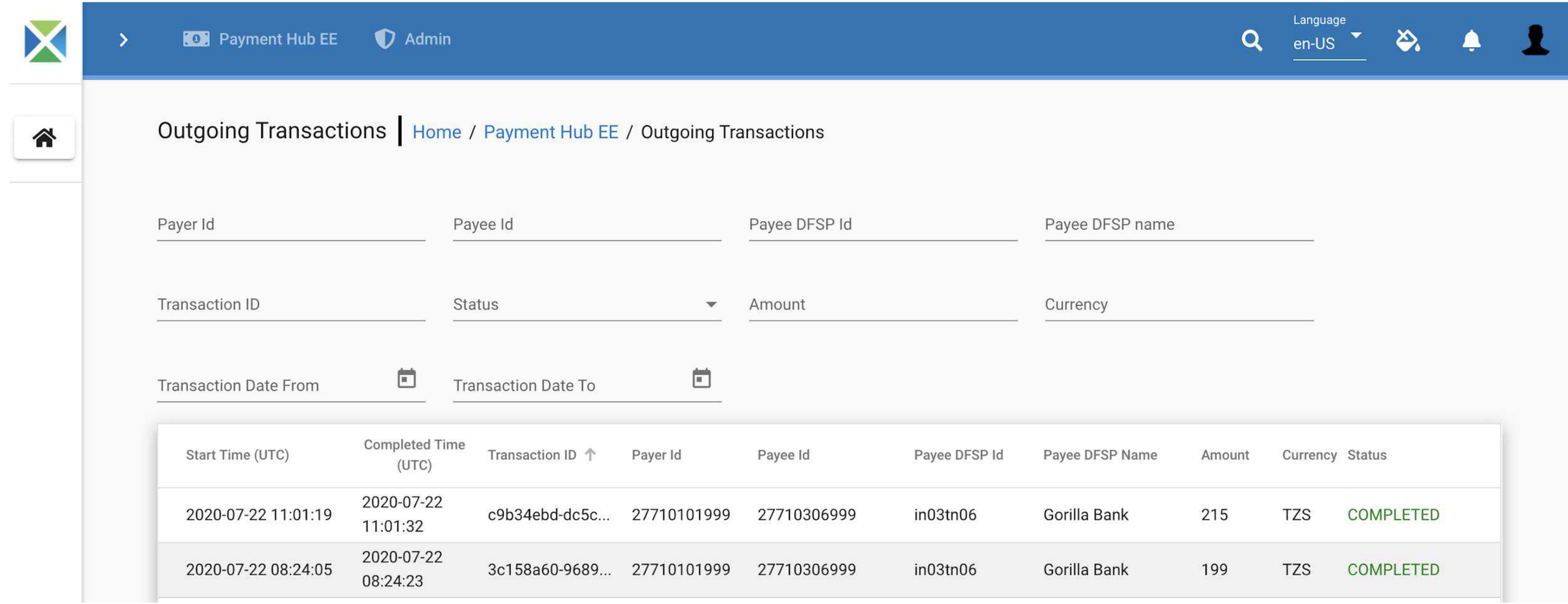
Incoming Payment at Payee



Incoming transfers with Refund capability



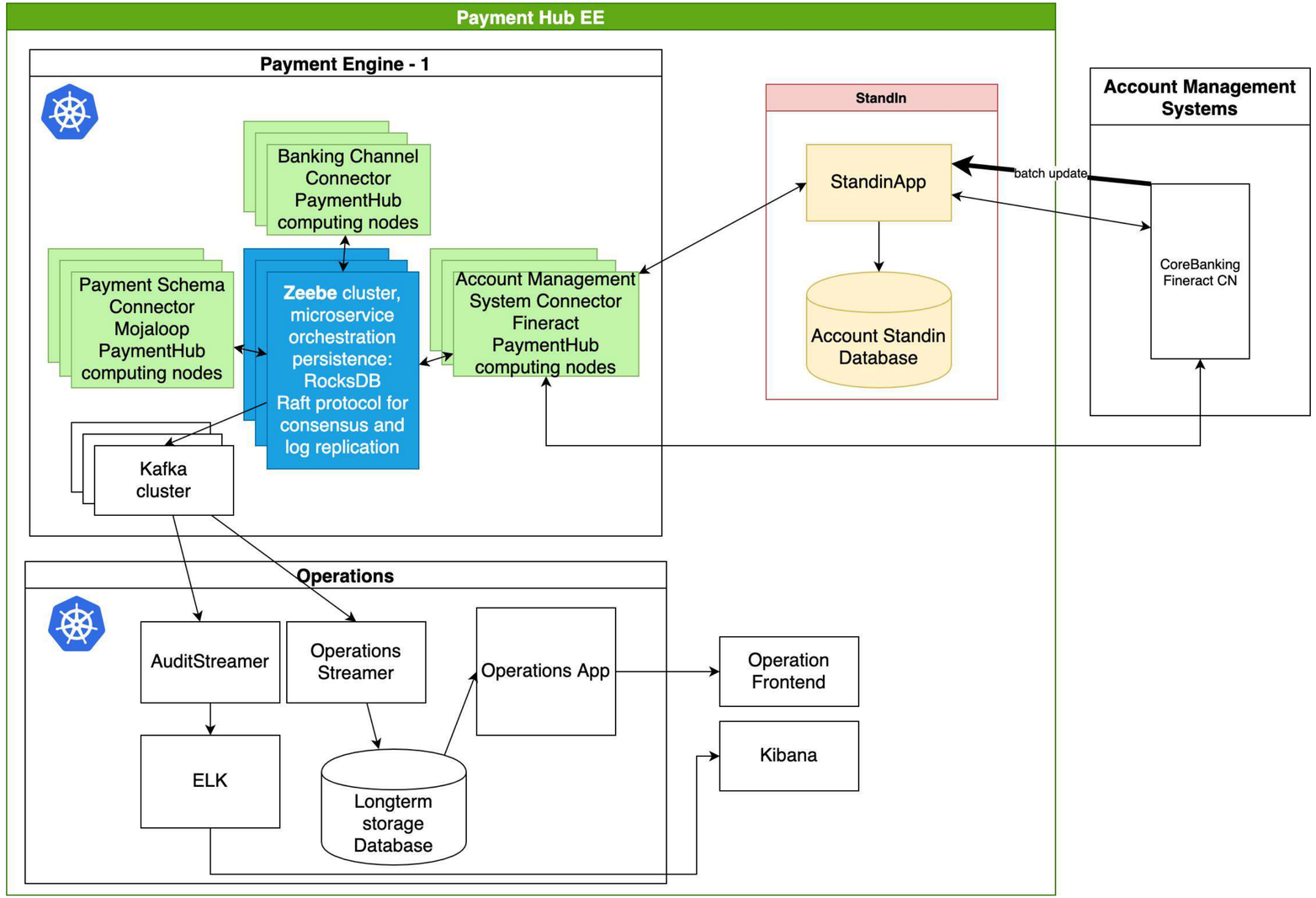
Outgoing Transfer - The Refund



Stand-in

Integrated into the Payment Hub EE solution a stand-in system could provide functionality in case the Account Management System is not available.

- only incoming transactions - simple solution, requires only synchronizing the valid account and party ids
- both incoming and outgoing transactions - requires more complex solution to minimize risk of overdraft



Tier 3 and 4 Institutions

Turnkey solution for digitization & digital transformation of MFIs & SACCOs

- ❏ Deployment and domain expertise to equip MFIs and SACCOs to get regulated
- ❏ Cloud solution for digitizing and automating core banking operations
- ❏ Native, pre-built integration to Mojaloop APIs
- ❏ Multi-tenancy of Mifos and Payment Hub EE enabling economies of scale for shared service providers
- ❏ Backed by a network of local on-the-ground integrators and support partners

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NATIONAL BANK of ETHIOPIA

BANK OF TANZANIA

BCEAO
BANQUE CENTRALE DES ETATS DE L'AFRIQUE DE L'OUEST

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Accomplishments for PI-10

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Documentation

Multitenancy

Single deployment serving multiple DFSPs

Isolated audit logs for the different DFSPs served with separate user databases for the DFSP operators

Benefits:

- Single operator could provide services for multiple individual DFSPs while sharing operational costs
- In case using a multi-tenant core banking platform (e.g. Mifos) a single Payment Hub EE deployment could serve all tenants (DFSPs)

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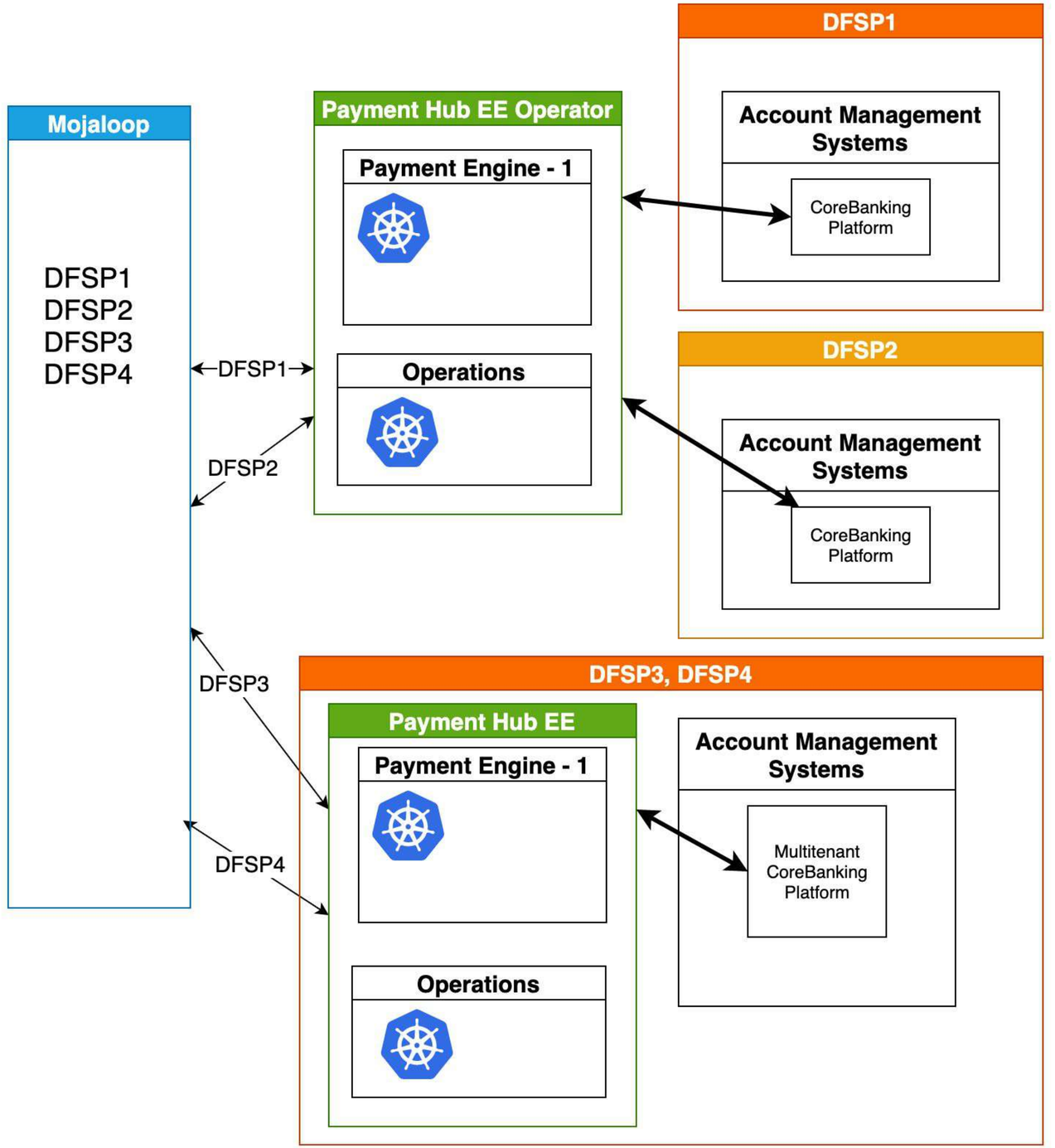
Aggregator model for multiple smaller DFSPs

Multi-tenant model for already aggregated DFSPs served from a single multit-enant core banking



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An Immersive User Experience

Robust & Accessible Lab Environment

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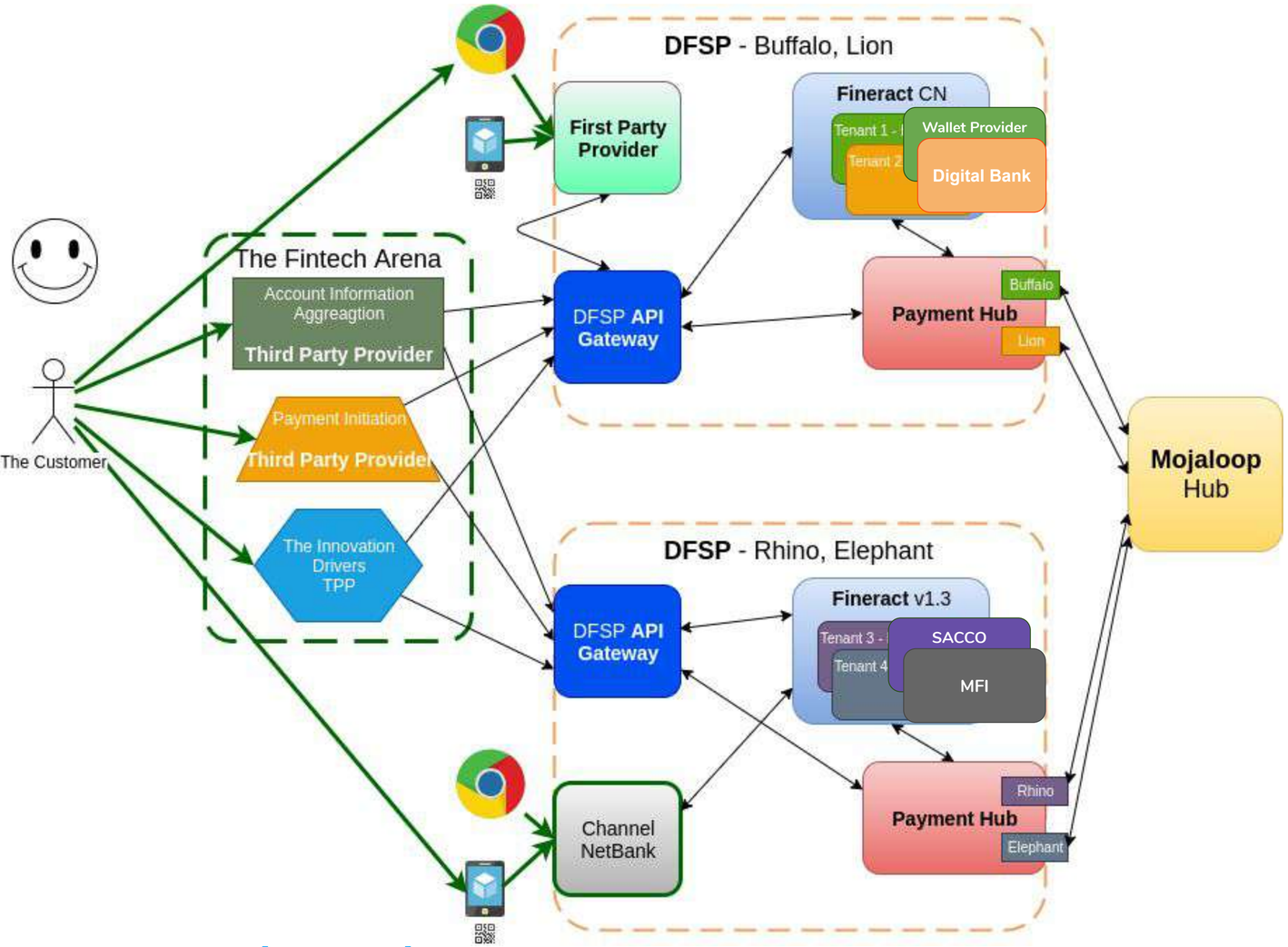
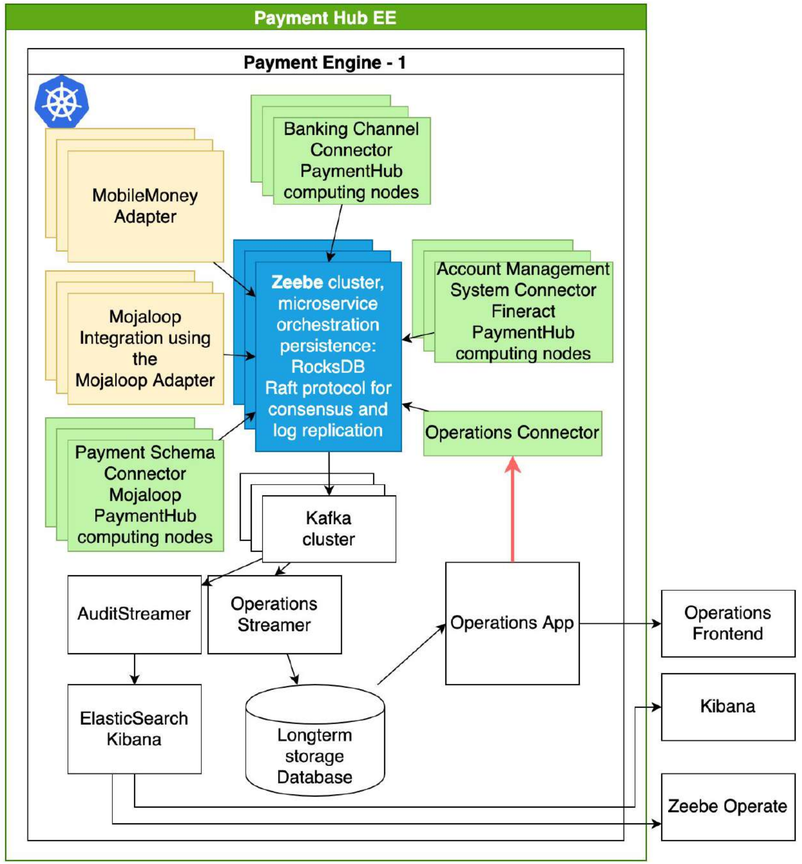
Sandbox Environment for Hackathons

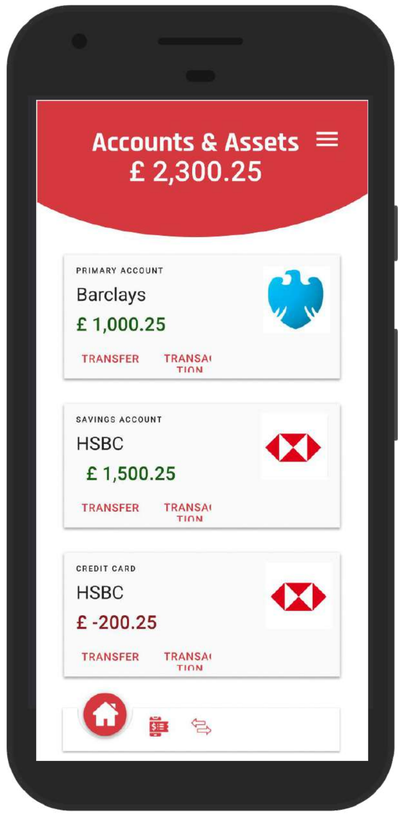


Audience	API Layer	OS Toolset
Fintechs	**- Open Banking API Layer** **- GSMA Mobile Money API (in progress)**	➢ Mobile Wallet App ➢ Mobile Banking App ➢ Online Banking App ➢ Open Banking Fintech App
DFSPs Banks, MFIs, SACCO, MMOS	**Mifos/Fineract API Layer** - Identity & KYC - Wallet/Account Management - Loan & Savings Management - Accounting & Ledger - Reporting	➢ API-Driven Open Source Core Banking Platform ➢ Angular Web UI for staff ➢ Android Mobile UI for staff
Hub Operators, Regulators	**Mojaloop API Layer** - Peer to Peer - Merchant Proximity Payment - Merchant Request to Pay - Bulk Payment/Transfer (upcoming)	➢ Payment Hub EE ○ Operations UI ○ BPMN Workflow Engine

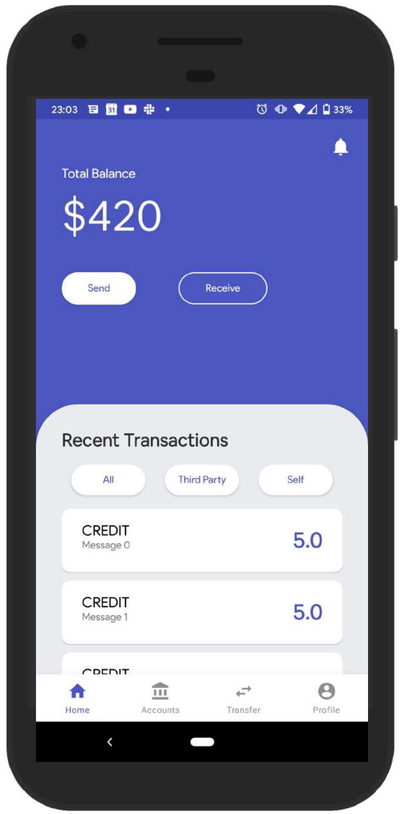
Lab Environment Updates

- GSMA Mobile Money API Connector

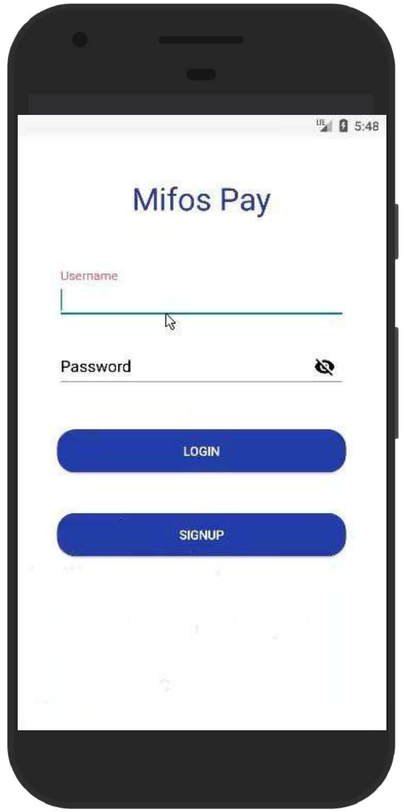




Open Banking App



Mobile Banking



Mobile Wallet

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Accomplishments for PI-10

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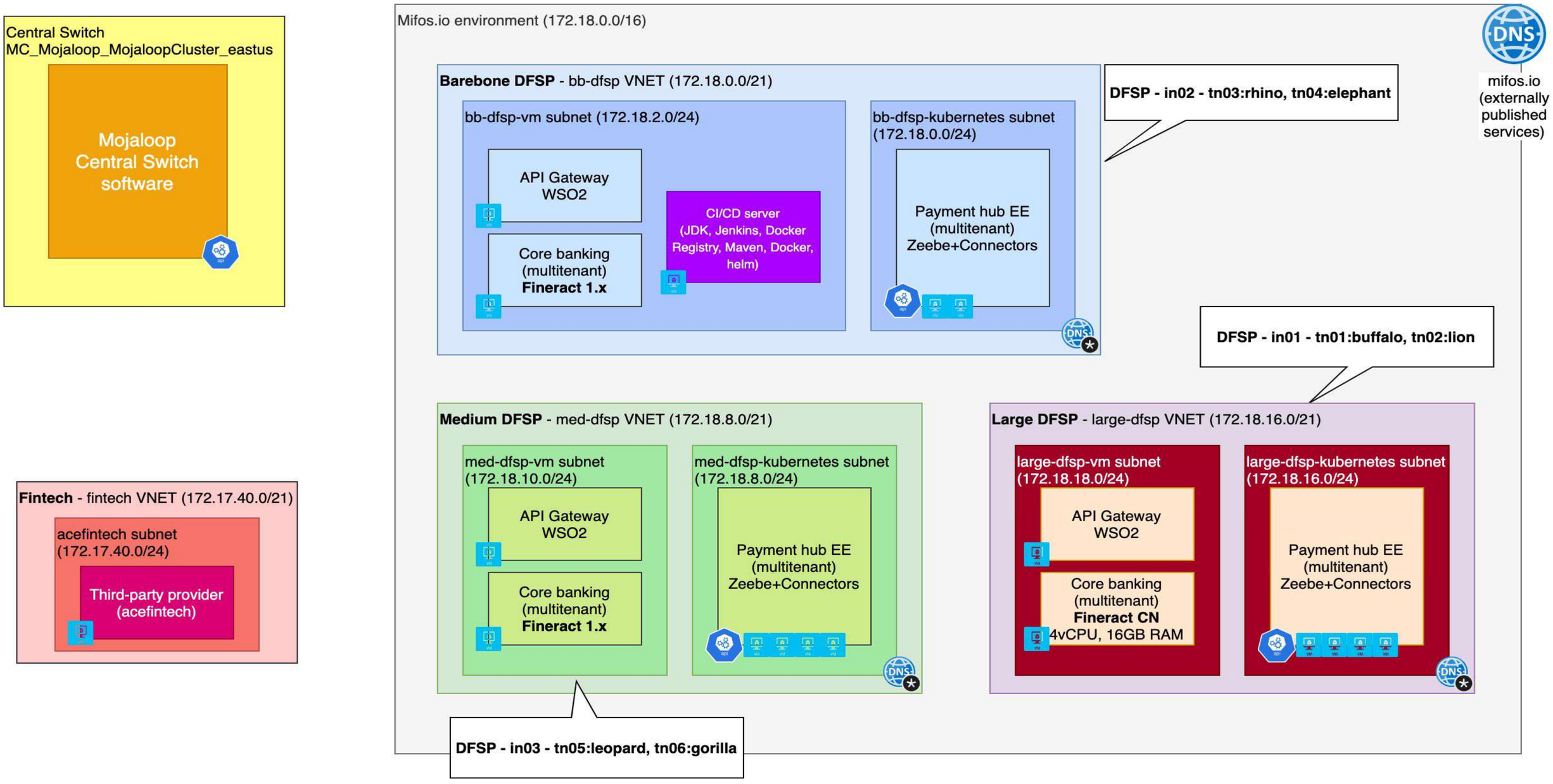
Documentation

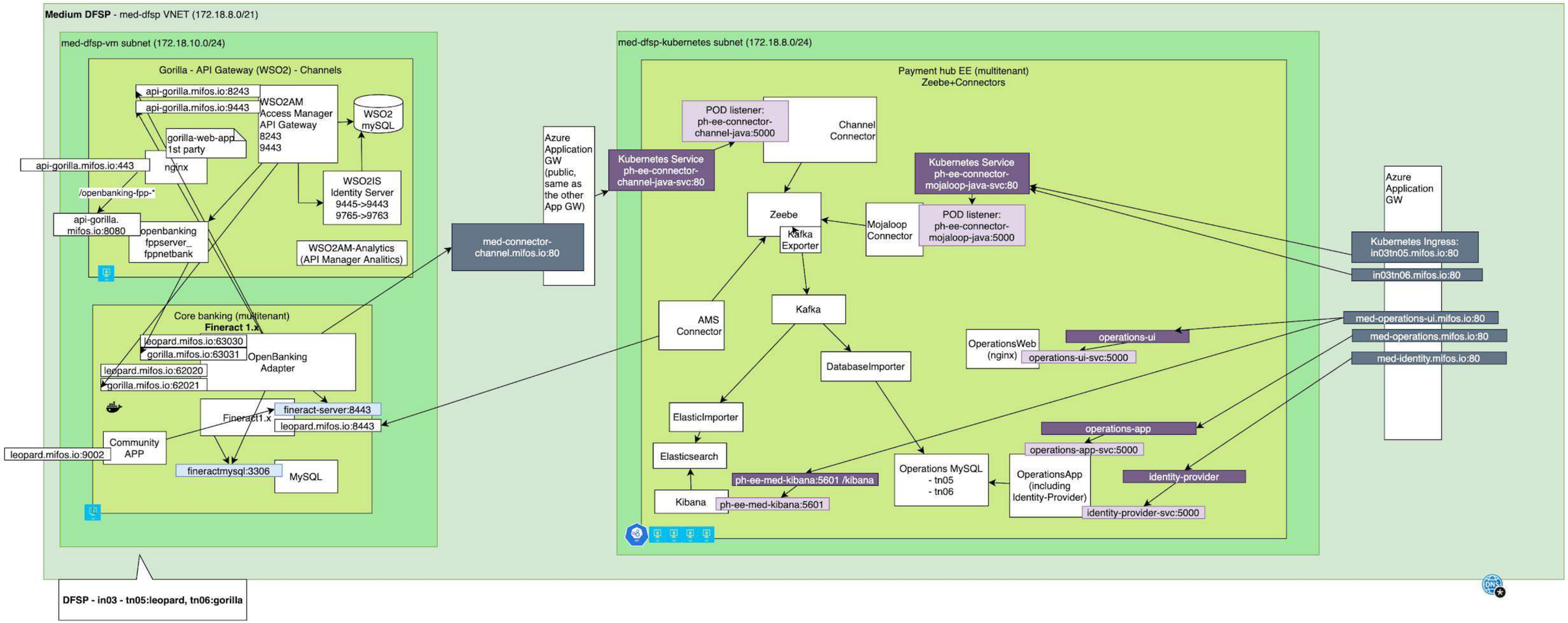
Integrated LAB Environment

- 3 independent deployments
- 2 Mifos 1.x and 1 Mifos CN multitenant core banking deployments
- 2 DFSPs in each deployment unit utilising the multitenant capability of Fineract (one tenant corresponds to a DFSP)
- 1 Mojaloop instance to enable instant payments across the 6 DFSPs
- 1 Fintech application to utilise the OpenBanking APIs provided by the DFSPs. This enables to demonstrate an account information aggregation and payment initiation third party
- 1 CI/CD server to be able to build and deploy the various microservices of the payment hub
- Join the Mifos Slack to get access to the environment!

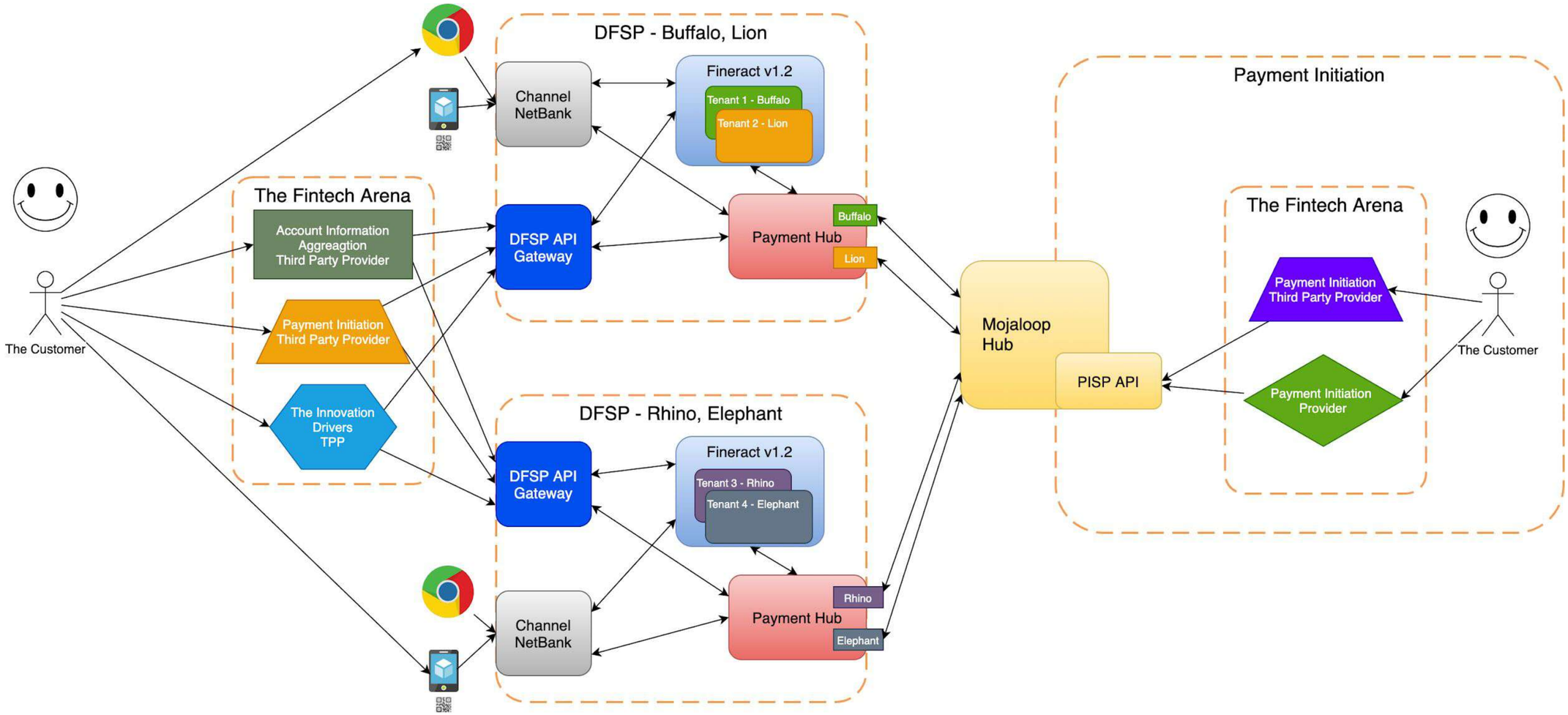
Mifos Lab - Full featured lab environment



Internals of a DFSP



Supporting the PISP APIs



- Support the new APIs, so PISPs could execute the transactions

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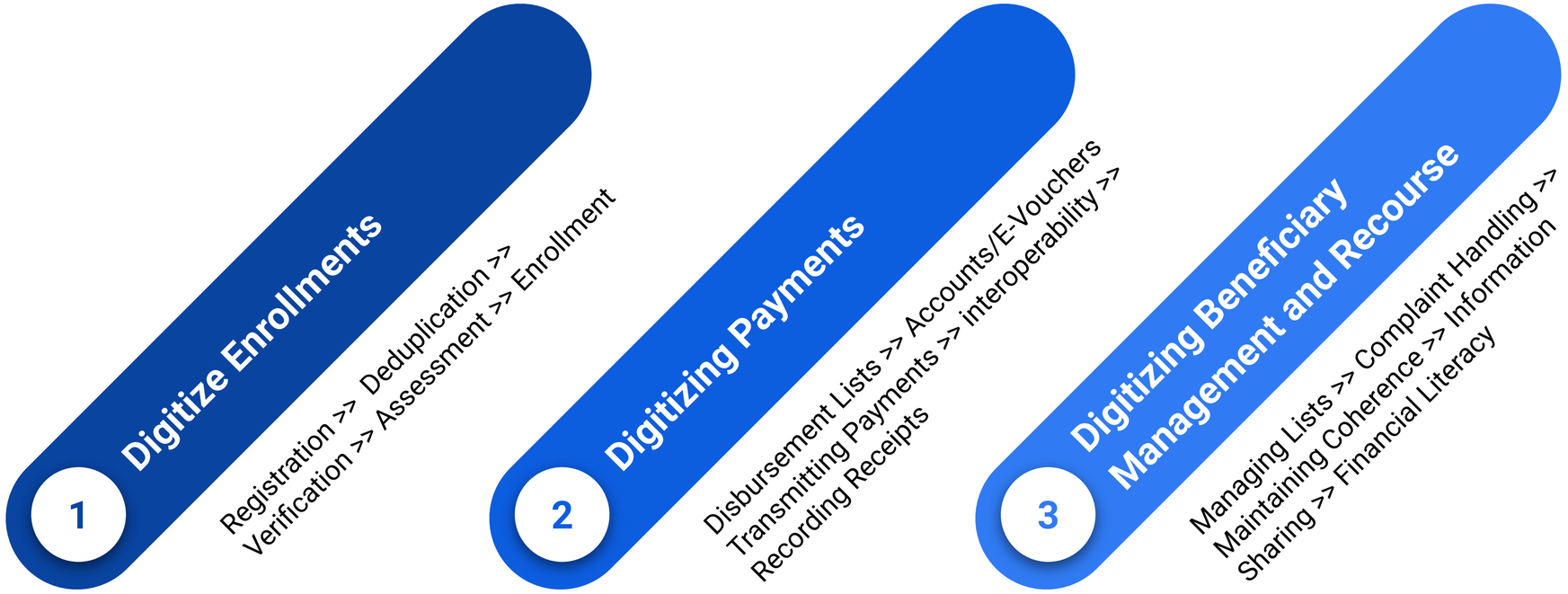
G2P & Bulk Payments

Open G2P

Digital public good digitizing large scale cash transfers with open source building blocks

- **COVID-19 Opportunity**: Accelerating cash transfer is the single most important response to getting assistance in the hands of people who need it most in a timely and transparent manner.
- **Origin:** Originated from iDT Labs and Government of Sierra Leone when they saved more than $10M digitizing payments to 30,000 health workers during Ebola crisis
- Addresses **common challenges** in effectively digitizing government to persons & large-scale social protection transfers.



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Open G2P

What is it?

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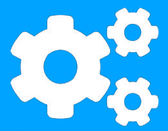
OpenG2P Reuses & Augments Existing Systems

Building blocks approach means programs deploy only components addressing gaps without discarding what works or start from scratch!

Mobile Tools:
Mobile-based solutions to enrolling, complaint handling, & beneficiary management in resource-challenged rural & perimeters

Deduplication Engine:
Extensible entity resolution & biometric framework for deduplicating & finding/matching beneficiaries usually lacking unique identities

Verification Service:
Abstraction layer and tools for connecting to identity sources, e.g. civil registry, & verifying beneficiary identity against

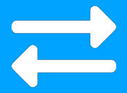


Disbursement Engine:
Abstraction layer and tooling for integrating with the financial system through existing payment rails and payment initiators

E-Voucher Engine:
Solution for serving beneficiaries outside the reach of the formal financial sector or running conditional cash transfers

Proof of Receipt Service:
Solutions to irrefutable proof of receipt, asserting recipient's uniqueness, & running "non-preassembled list" transfers

OpenG2P ERP
A ERP, built on the Odoo ERP, for managing programs, enrolment, beneficiary data, disbursements, complaints, and more



Discovery Specification:
Open specification for information sharing among independent programs serving similar demographic

Eligibility Rules Engine:
Being iterated off continued Inputs from Mifos, DIAL, the Government of Sierra Leone, & other thought leaders

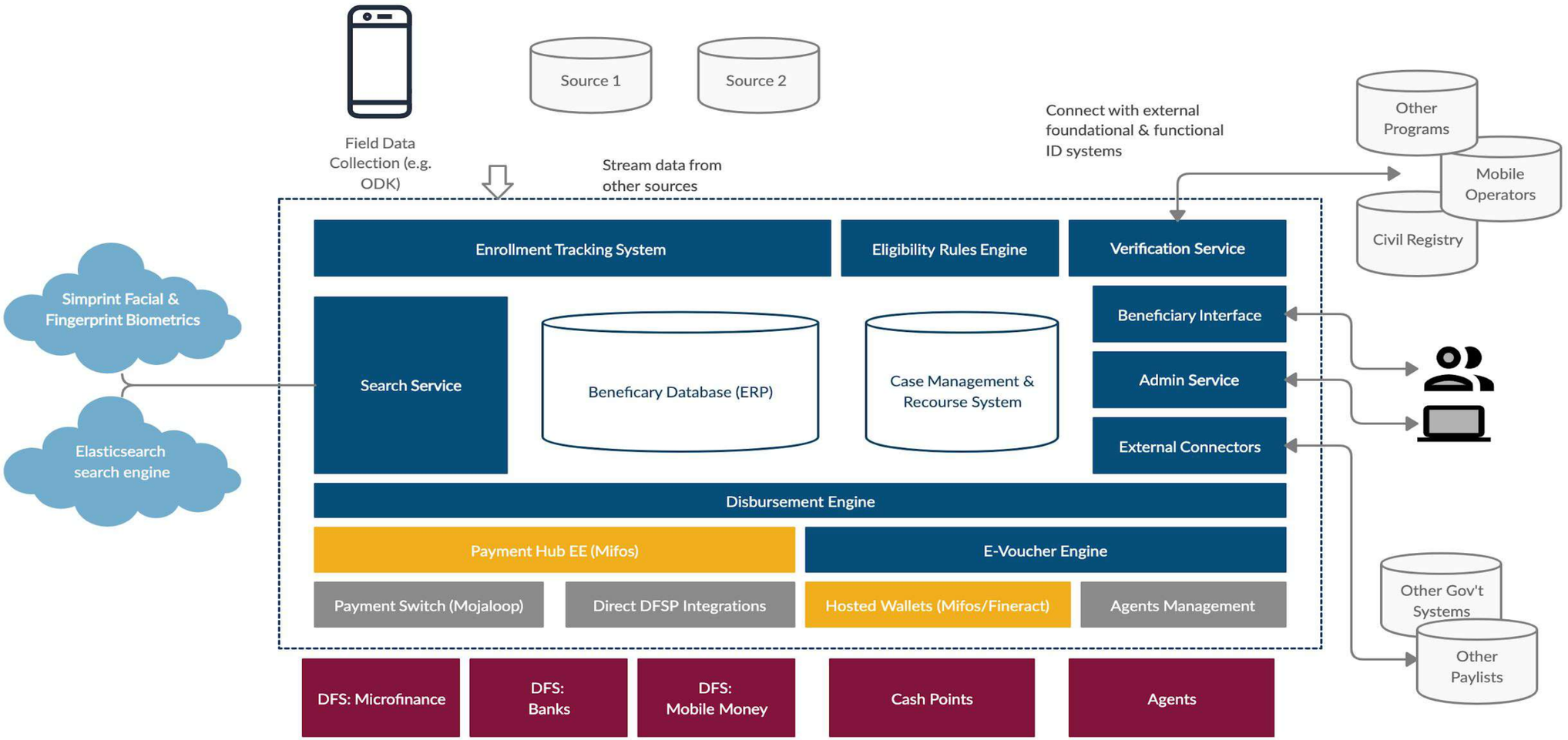
Our Guiding Ideals

It's a work in progress, but these principles guide us

- **Identification** - implement solutions consistent with ID4D principles but provide options for functional identification as long as protective of consumer privacy, user rights and provide sufficient functionality for deduplication and verifying people as unique recipients
- **Open Source First** - always include an open source version of the components.
- **Agnostic** - provide the "glue" between different core components and remain agnostic and "vendor neutral".
- **Sustainability** - be low cost, open source for reference, and additive to existing efforts.
- **Gender Intentional** - promote women's financial empowerment in the development of the solutions and in execution.
- **Community Engagement** - enable a toolkit or lab approach such that others can evaluate the solutions and to encourage agile and iterative software development, and take on feedback and ideas
- **Prioritize Urgent Needs** - design with the urgency of this moment for both COVID-19 physical distancing and economic crisis in many countries,

OpenG2P High Level Architecture

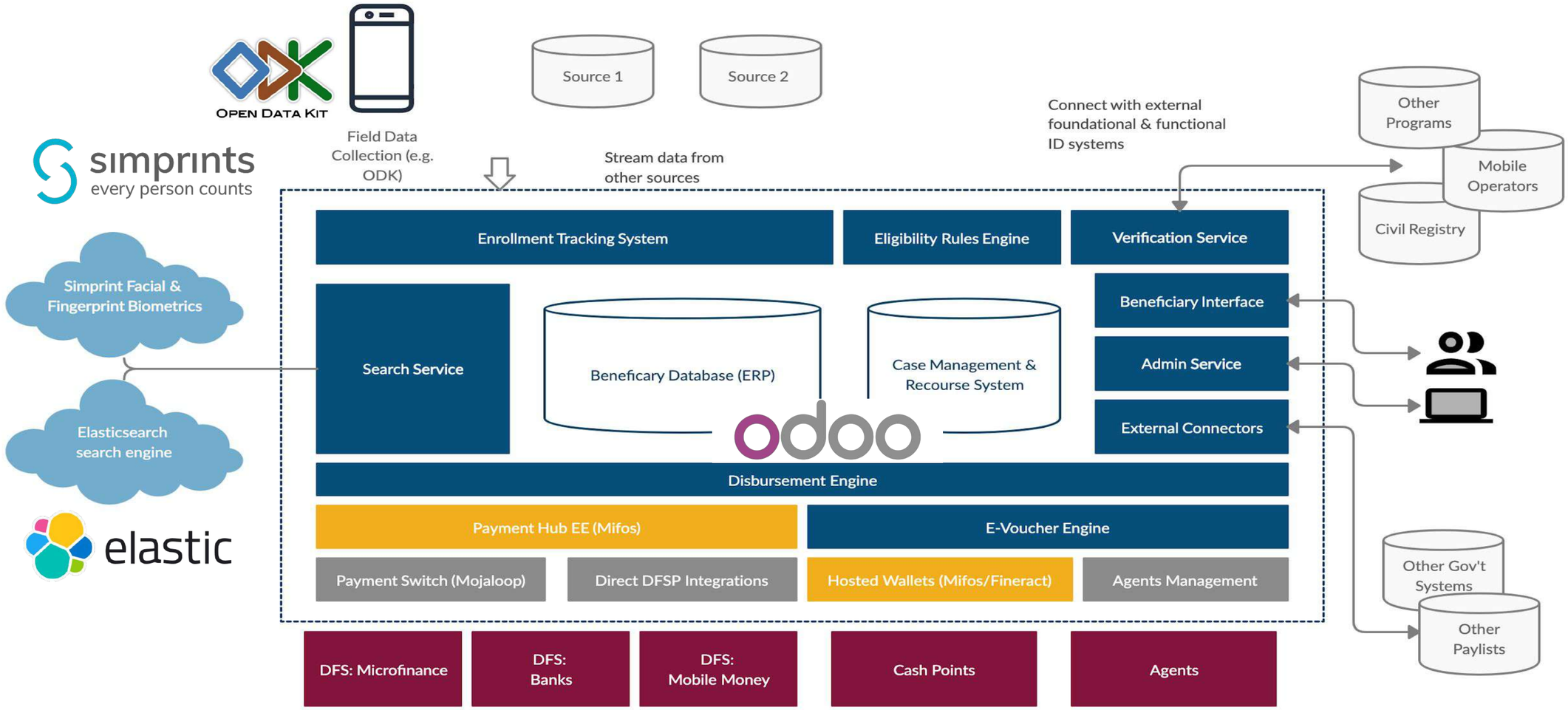
Each component is easily switched out



OpenG2P High Level Architecture

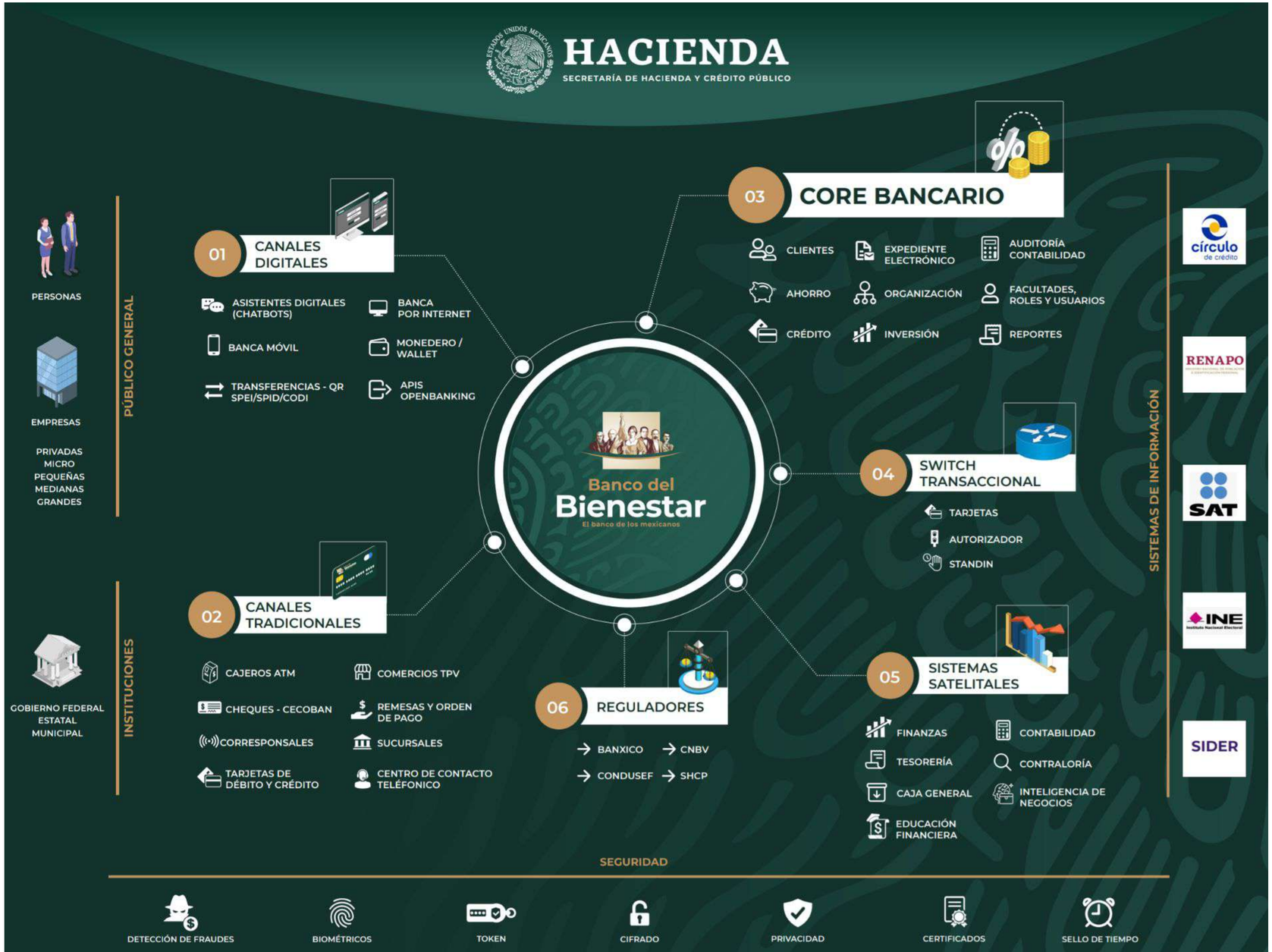
Deployment in Sierra Leone

Government of Sierra Leone



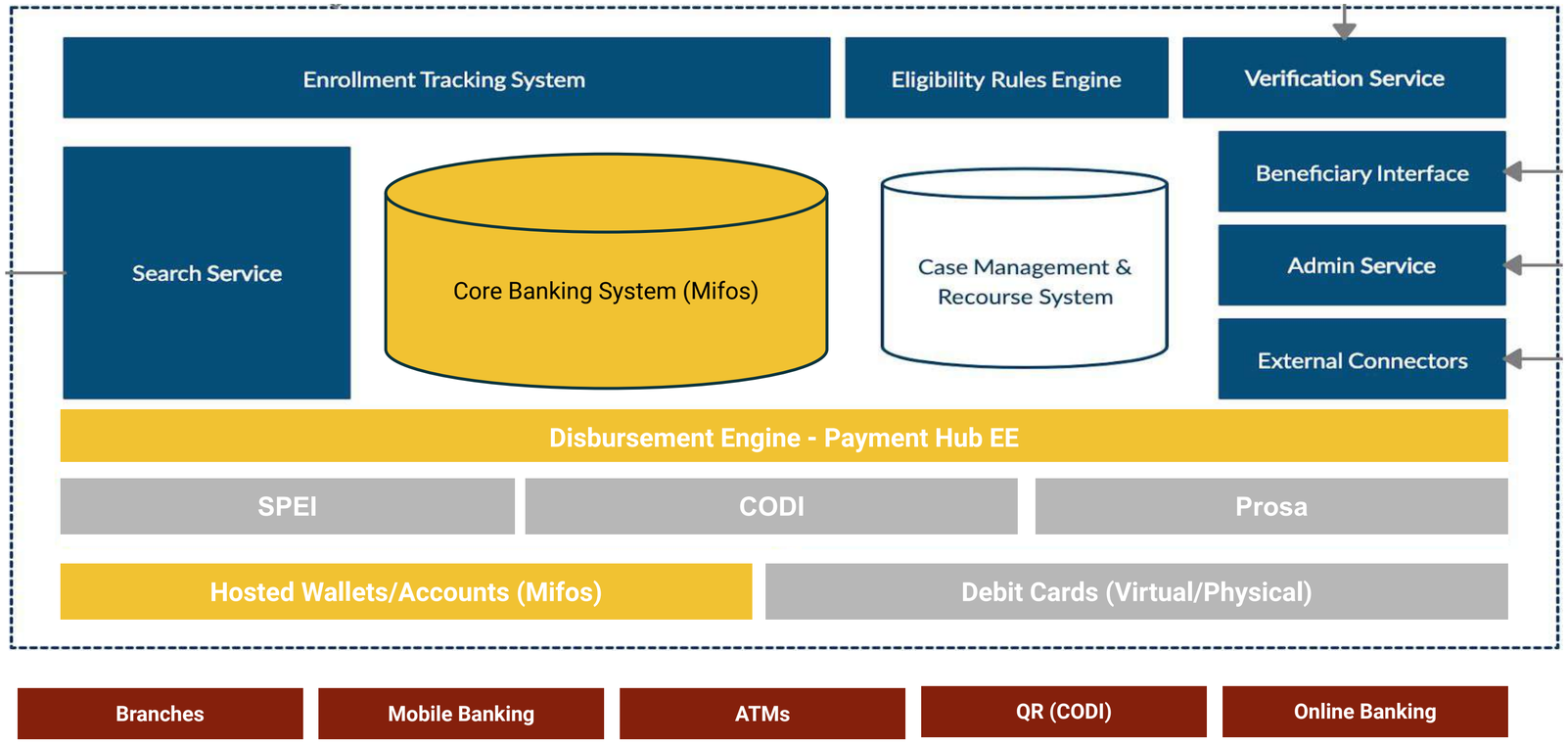
OpenG2P High Level Architecture

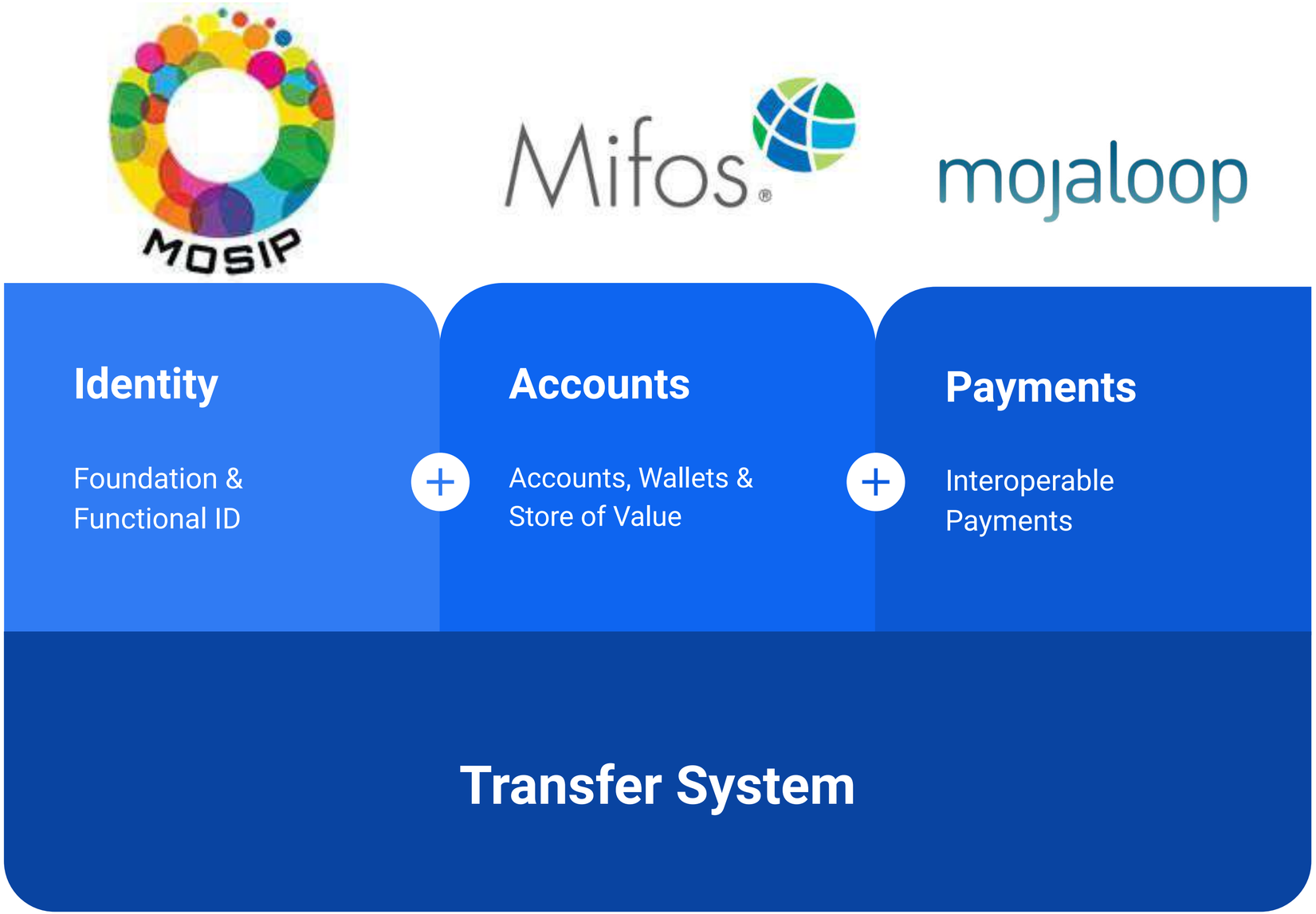
Deployment in Mexico



OpenG2P High Level Architecture

Deployment in Mexico




MOSIP
Mifos
mojaloop
Identity
Foundation &
Functional ID
Accounts
Accounts, Wallets &
Store of Value
Payments
Interoperable
Payments
Transfer System

Documentation

Business Overview

- Vision
- Benefits
- Target Users

Technical Overview

- Deployment models
- Lab Environment
- Source code
- Installation instructions

mojaloop foundation

app.gitbook.com/@mifos/s/docs/payment-hub-ee/overview

Edits 3
Activities
Share
Design
Teams
Integrations
Analytics
Advanced

LionFintech FPP demo application
How to

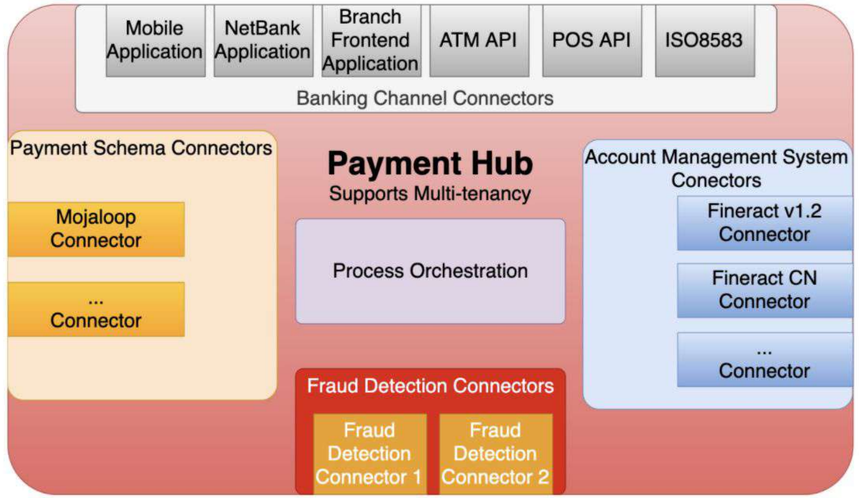
PAYMENT HUB EE

Business Overview
- Vision
- Benefits of Payment Hub EE
- Target Users of Payment Hub EE
- Using Payment Hub EE
- Use cases

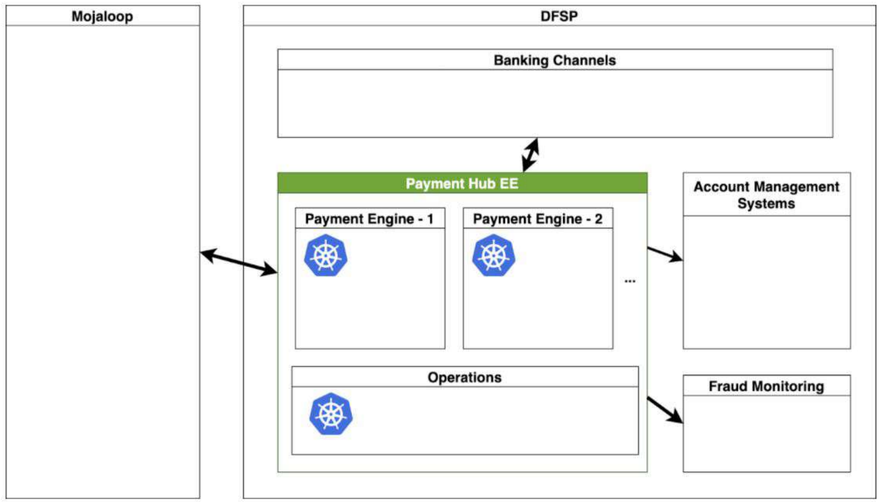
Technical Overview
- Deployment models
- Microservices orchestration - Zeebee
- Lab environment
- Example
- Secondary Identifier Storage and Registration
- Payment Hub APIs
- Source Code repositories
- Installation instructions

New
Files

Design



Logical Model of the Payment Hub



The role of the Payment Hub EE at a DFSP

Roadmap for Payment Hub EE

Add support for bulk payments

Continue performance testing and tuning

Provide a platform for Cross Network Payments

- ISO20022 (Payments Clearing and Settlement - pacs.008, pacs.002) realtime payment network integration

Participate in the PISP initiated transactions

Integrate with the SDK with the availability of the asynchronous APIs

Providing stand-in capability for Tier 1 and 2 institutions

Bulk Payment Support

- Preprocessing bulk payments
  - Lookup Payee's DFSP ID for the transactions to determine target DFSP
  - Splitting the incoming bulk into smaller batches per target DFSP
    - On-us transactions can be handled differently
  - Manage communication with Mojaloop for the batches
  - Aggregate incoming results to provide response to the bank's channel
  - In case transfering from a single account (pension, aid), booking can be individual, aggregated by target DFSP or single grand total

Thank You

- Miller Abel, Kim Walters & Ariel Delaney
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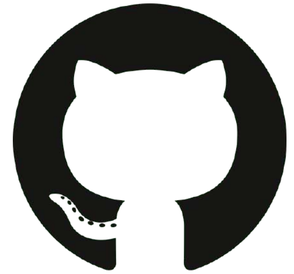
github.com/openMF
github.com/apache/fineract
https://fineract.apache.org



Browse the Docs:
https://mifos.gitbook.io/docs/payment-hub-ee

Explore the Code:
https://github.com/openMF?q=ph-ee

Discuss on Slack: https://bit.ly/3eMoVS1

Request Access to the Lab:
https://mifos.gitbook.io/docs/payment-hub-ee/overview/lab-environment