

■ mojaloop

# Mifos Lab Update

September 2019

Edward Cable, The Mifos Initiative  
Istvan Molnar, DPC Consulting Hungary



# Agenda

- Revisiting Mifos Vision
- Mojaloop Traction in Mifos Ecosystem
- Accelerating Community Adoption of Mojaloop
- Mifos Focus Areas & Ongoing Work
- API Gateway Implementation & Demo - Part 2
- API Discussion



# 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.**

# Why Mifos & Mojaloop

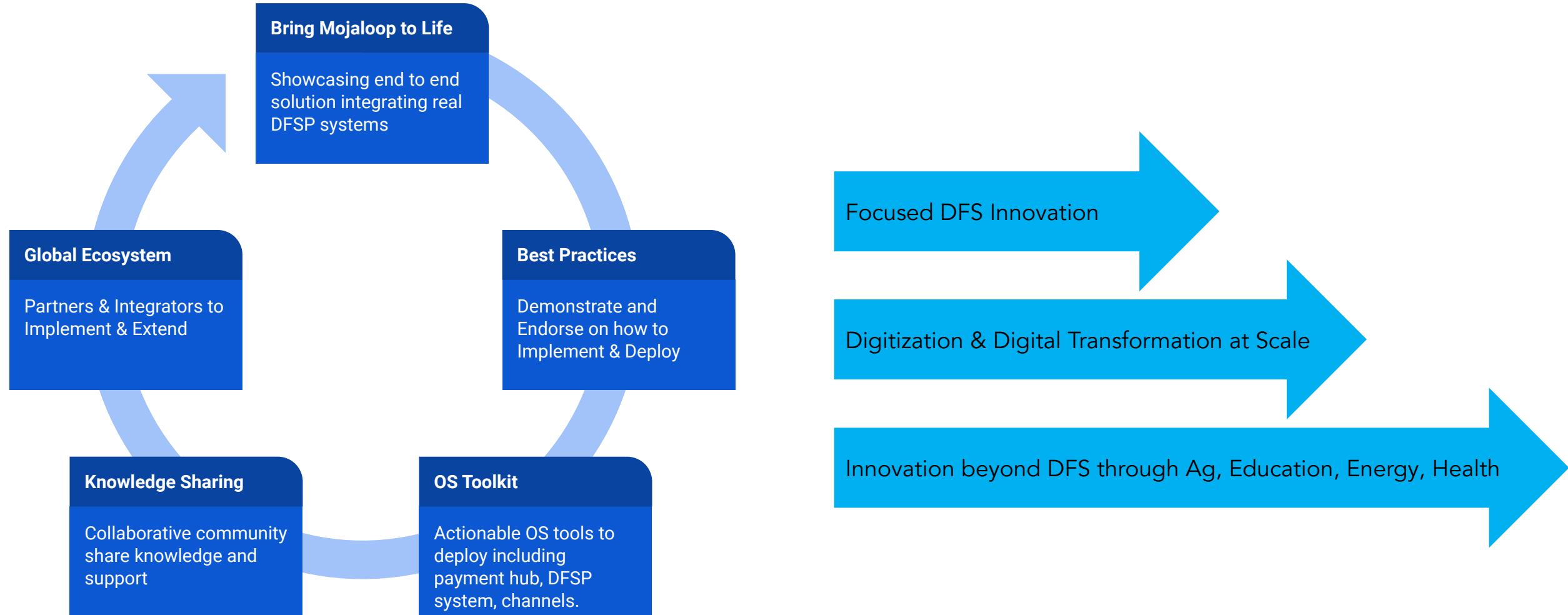
- Highly Complementary Open Source Systems
- Mifos/Fineract - Full Stack Banking Platform
  - Core Banking, Account & Wallet Management, Portfolio Management, Accounting, Business Intelligence, KYC
  - Mifos can be configured as a digital retail bank, an MFI, a savings group management solution, a mobile wallet provider, a savings cooperative, a marketplace lender, a digital credit solution, etc
- Mojaloop - Payment switch and Guiding Principles
  - Payment API, Interoperability, Central Directory



End to End Open Source Architecture for Digital  
Financial Services



# Vision of Mifos Innovation Lab



Mojaloop provides the Digital Rails, Mifos is the  
mojaloop locomotive fueling innovation on top of it.

# Mojaloop Traction in Mifos Ecosystem

mojaloop



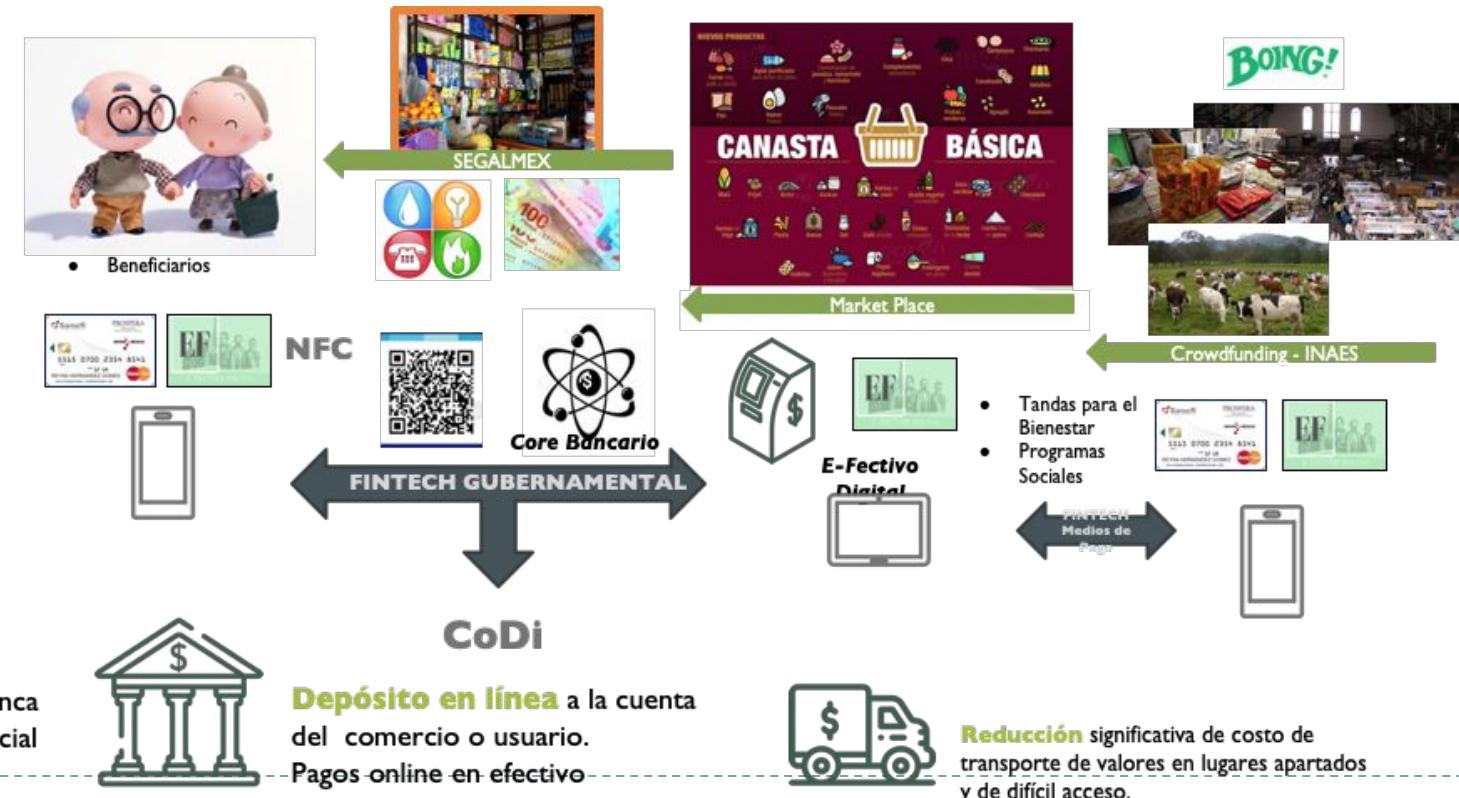
# Interest Level within Mifos Ecosystem

- Argentina
  - Mifos Partner Fintechando is exploring Mojaloop as an option in which to build payment system for bank in country where no real-time payment system exists.
- Mexico
  - Fintechando continuing to explore Mojaloop as payment solution for INAES marketplace and as switch to connect all the cooperatives.
- Ivory Coast - Digital Afrique Telecom seeking to offer interoperability and cloud-based core banking to microfinance institutions using Mojaloop and Mifos.
- Nigeria
  - Finaclusion - fintech startup led by David Alozie providing SaaS banking platform powered by Mifos to MFIs and SACCOs in Nigeria seeking to build low cost payment switch on Mojaloop.
  - Fiter - global Mifos/Fineract partner exploring Mojaloop to power its payment integrations
- Pakistan - Using Mifos and Mojaloop for common solution for PMIC MFI members is still under consideration
- Uganda - Kanzu Code, will be demoing its Kanzu Money solution powered by Mojaloop tomorrow
  - Mojaloop-powered solution to enable wallet to wallet transfers leveraging Mojaloop and Mifos as back-end.



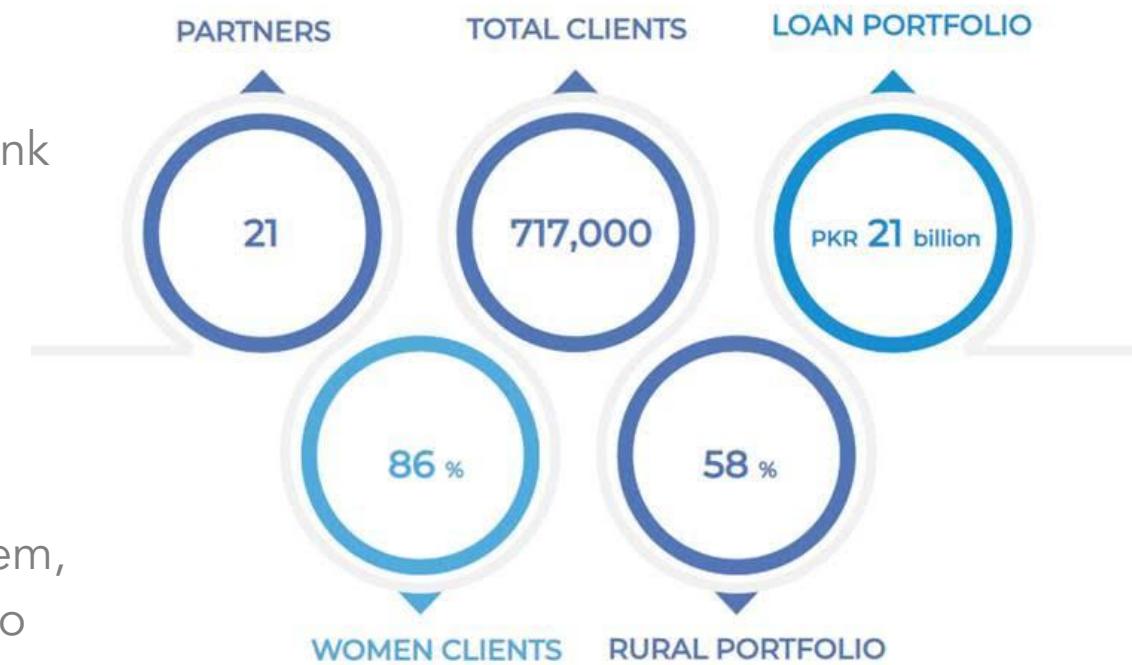
# Mexico - Marketplace for INAES

- Need
  - Government Institution - INAES, National Institute of Social Economy, creates and funds cooperatives
  - Need to build a B2B marketplaces and support Integration Centers where members can withdraw social program/benefits via ATMs



# Pakistan - PMIC Supported by Paysys Labs

- Need:
  - Established by government of Pakistan to serve underserved & reach rural populations where penetration of commercial banks and large-scale MFIs is low.
  - Owned by three shareholders, Pakistan Poverty Alleviation Fund, Karandaaz, & KFW Development Bank
  - Need multi-tenant hosted core banking system to transform & digitize operations of MFIs they provide liquidity for.
- Solution:
  - First deployment of Mojaloop in Pakistan
  - Paysys Labs would deploy Mifos as core banking system, payment hub to connect to Mojaloop and Mojaloop to enable transactions between customers of PMIC MFIs
  - Timeline is to kick off deployment and integrate Mojaloop with 2 MFIs in next six months.



# Accelerating Community Adoption

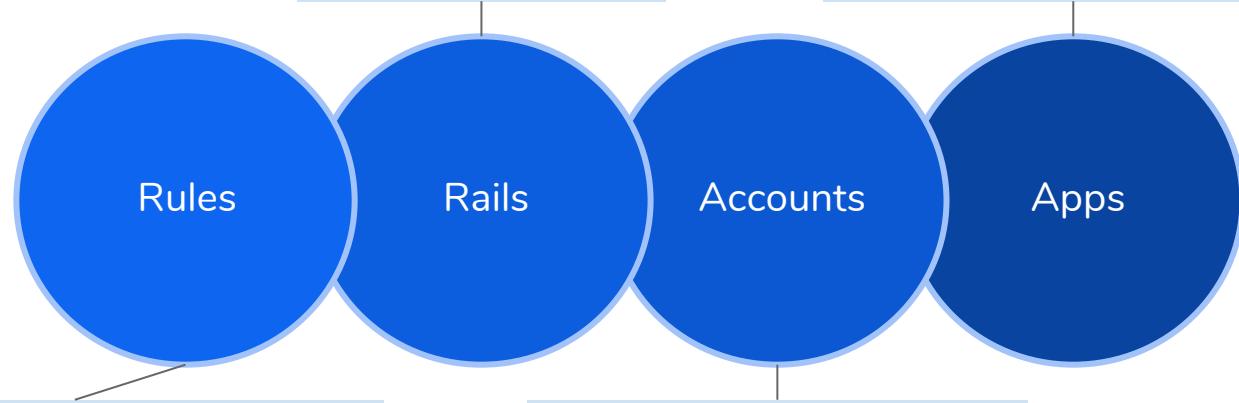
mojaloop



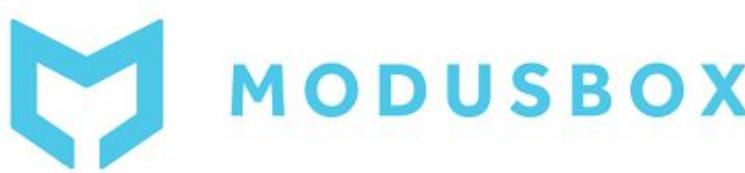
# Solutions for Level One Aligned Platforms

- UNCF Myanmar Level One Aligned Digital Integration Platform for MFIs
  - Along with our local partner, we submitted a proposal proposing a Mifos/Mojaloop integration platform for digitizing loan disbursal and repayments.
  - Mifos ecosystem has had an active presence in Myanmar financial inclusion sector going back 5 years
  - 4 Mifos Partners are supporting 16 MFIs reaching more than 600,000 clients using Mifos-powered core banking solutions.
- ADFI (Africa Digital Financial Inclusion Facility) Call for Papers
  - Helping catalyze and steward the development and submission of ideas from our partner community across East, West, and South Africa for the Call for Papers
    - Egypt, Uganda, West Africa, Nigeria, Somaliland.

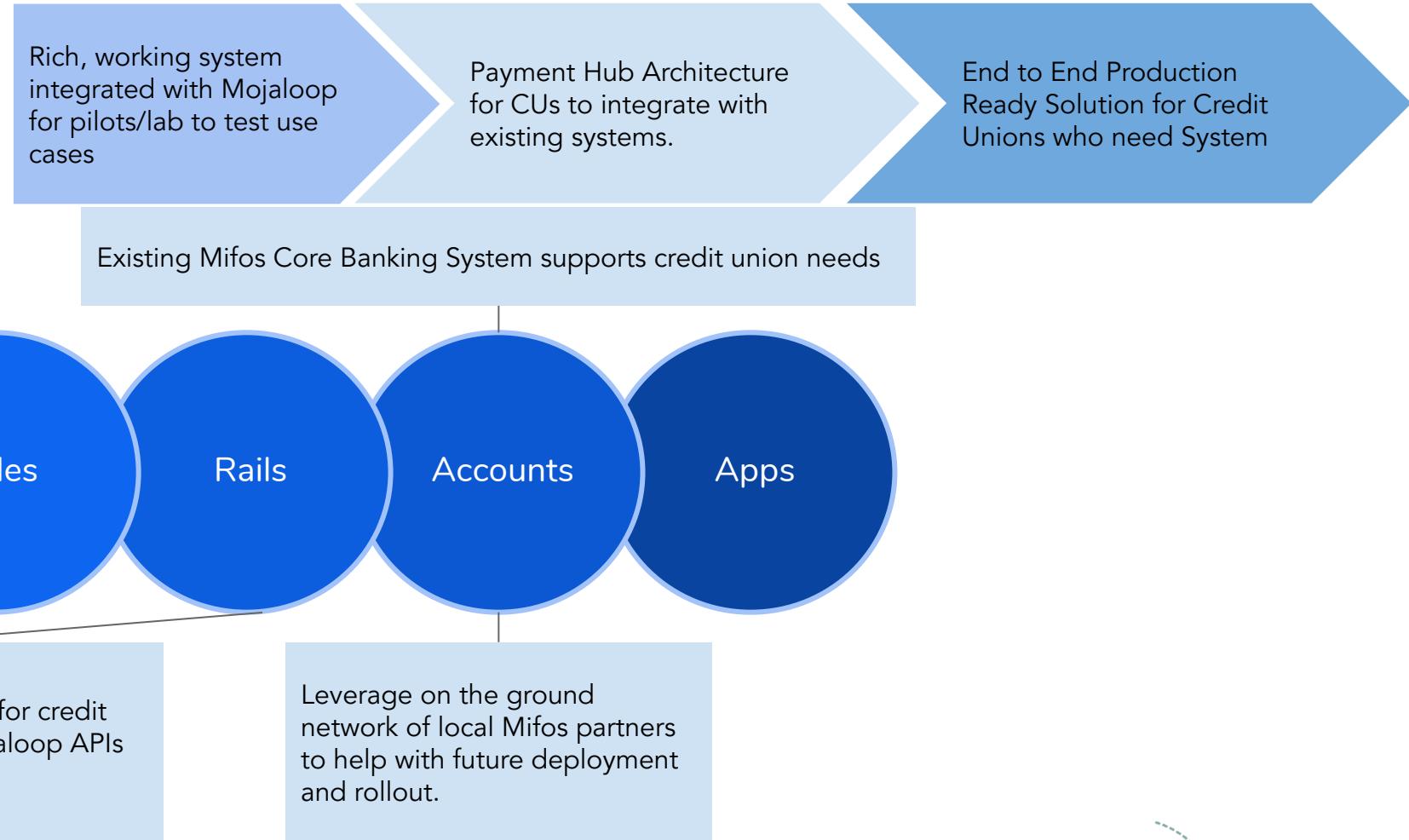
# Accelerate MFI & SACCO Participation in TIPS



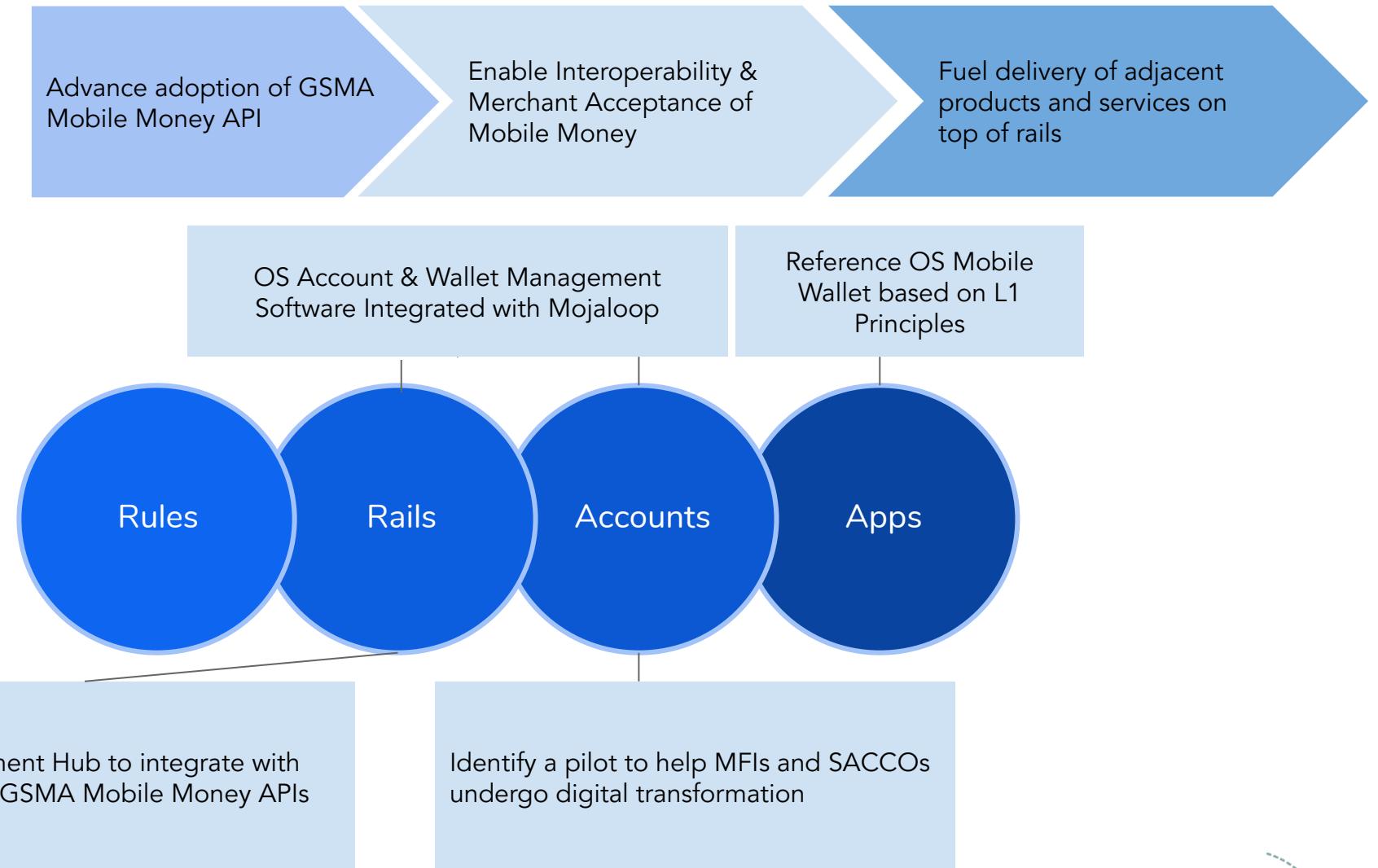
# Accelerate WOCCU Digital Financial Inclusion Project



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# Exploring How Mifos Can Support Vision & Goals of GSMA Lab



# Ongoing Work with Mifos Lab

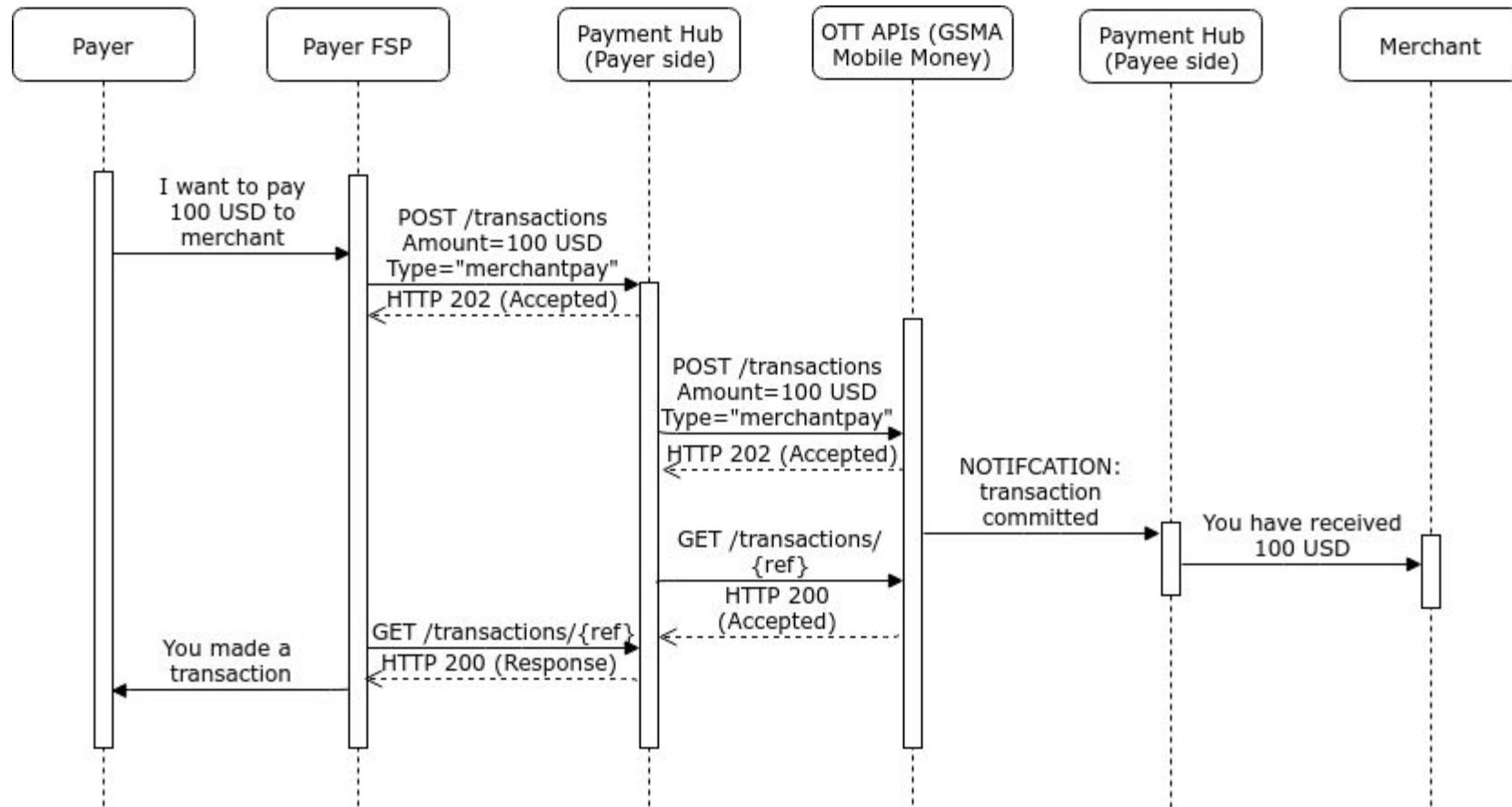


# GSMA Mobile Money API Integration

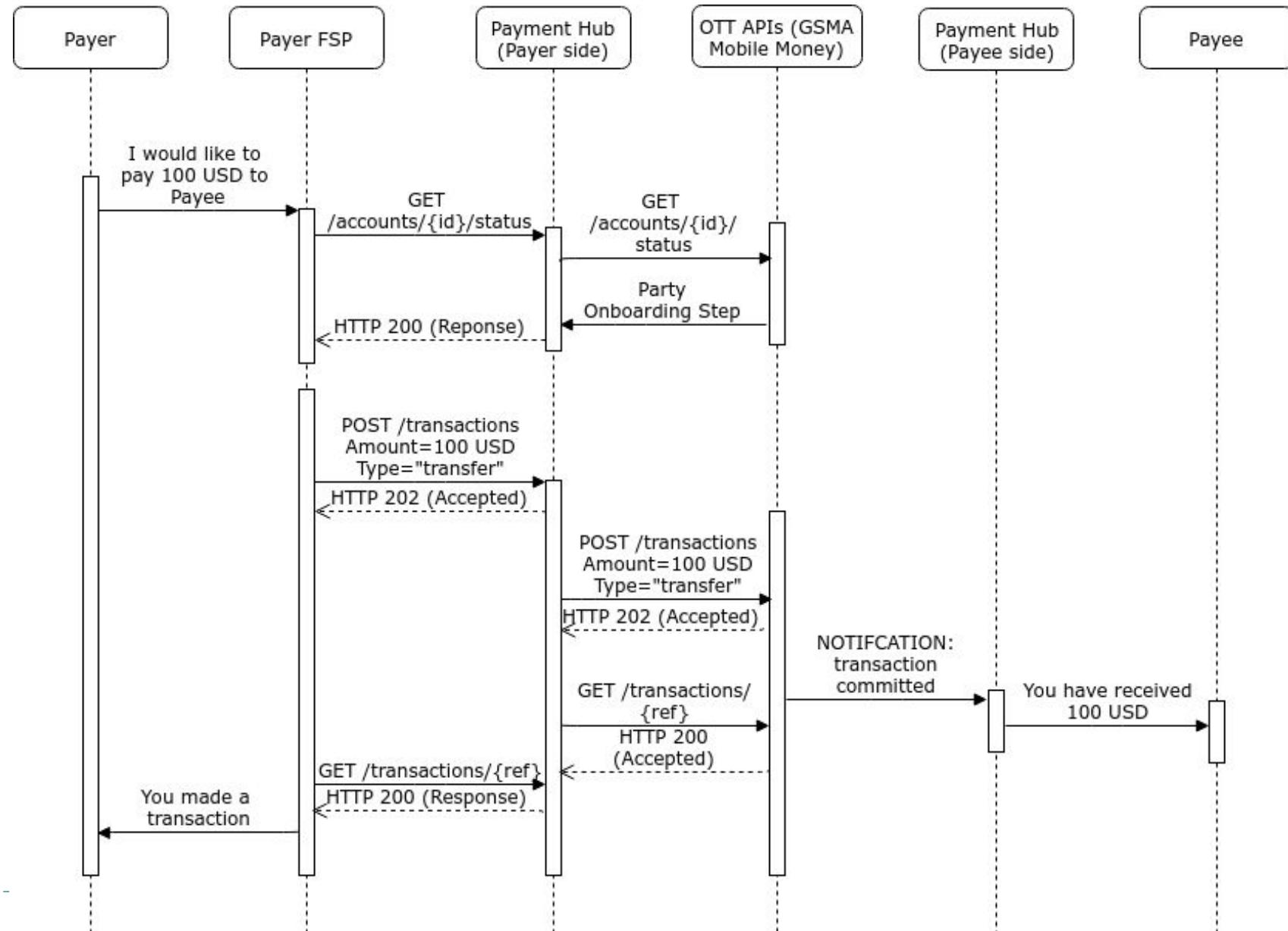
- 2019 Google Summer of Code Project
  - Intern, Sidhant Gupta, mentored by Avik Ganguly
  - Thank you to support of Phil Green of GSMA
- Goal
  - Use payment hub to integrate Mifos with the core microfinance-facing mobile money transactions of disbursing and repaying loans.
  - Act as reference API implementation for other OTT mobile money integrations.
    - Ongoing integration with MTN and Safaricom APIs
  - Progress:
    - Worked on version 1.0 of API - <https://developer.mobilemoneyapi.io/api/v1.0>
    - Integrated with APIs for merchant payment and peer to peer transfer use cases.
    - Roadmap of use cases to incorporate
      - Bill payments and instant notification of payment
      - Basic account management
      - International transfers, including request for quotation
      - Bulk transactions
      - Cash in / Cash out
    - APIs not currently available:
      - batchtransactions, international remittance and debitmandates



# Merchant Payment Transaction



# Peer to Peer Transfer

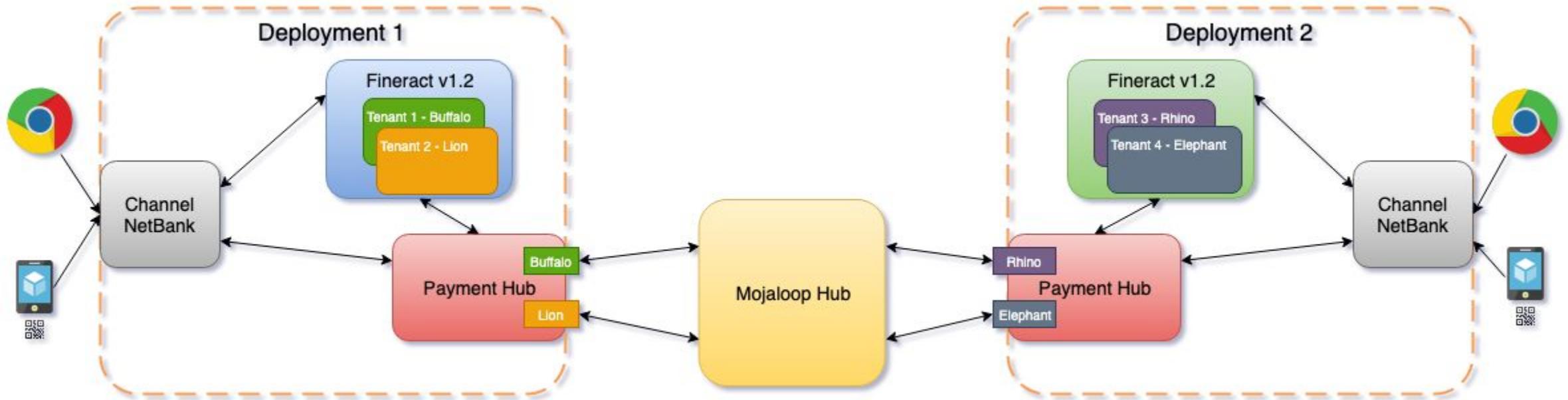


# Lab environment - Available to use

mojaloop

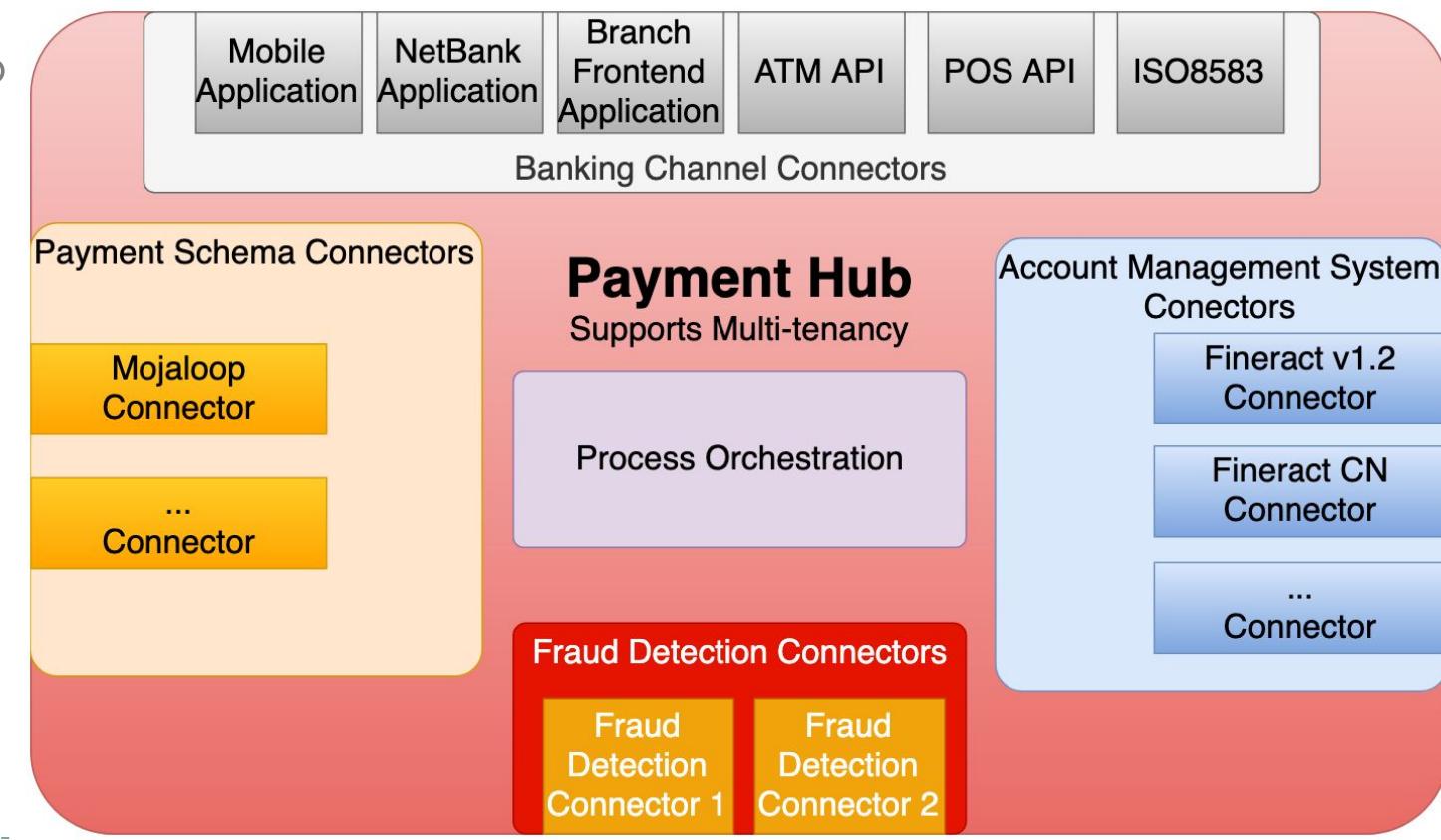


# Logical model of lab environment



# 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)
  - Account Management System (AMS / Core banking platform)
  - 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
  - Trigger notifications
- Built on proven open-source technology:
  - Java, SpringBoot
  - Apache Camel



# Payment Hub Roadmap

- Goal is to kick off this work during upcoming quarter
- Reach production level maturity of the Payment Hub
  - Operational UI for monitoring, investigation and problem resolution at DFSP
  - Reconciliation automation with reporting, automatic resolution if possible
  - Identifier (MSISDN) - Account assignment management
  - Notification handling (push, sms, email)
  - Advanced error handling, compensation managementPersistence management for recoverability and auditability
  - High Availability, Fault Tolerance
  - Optimization for High Performance
  - Add Security Layer to communicate with production Mojaloop instances
  - Implement necessary tests and QA procedures
  - Draft baseline documentation for setting up, configuring, and extending Payment Hub
  - Integrate with DPC simulator



# Payment Hub Roadmap

- Support for all use cases as they become available by Mojaloop
  - Request To Pay
  - Bulk Payment
  - Agent initiated cash out; cash out authorised on POS
  - Customer initiated cash out
  - Merchant Initiated Merchant Payment; Authorized on POS
  - ATM initiated cash out
  - Refund
  - Secondary identifier registration process
- Update Mifos Reference Apps to Provide Demonstrable User Interface
- Additional Advanced Capabilities of Payment Hub
  - Dynamic QR code generation
  - Bulk Transfer Campaign Management & Processing.
  - Capability to efficiently interface with external fraud monitoring system

# Demo

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## ■ Progression from Past Convenings

- January 2019 - Arusha, Tanzania - Merchant Payment via Mojaloop through Mifos Mobile Wallet app
- June 2019 - Arusha Tanzania - API Gateway - Open Banking API for Account Information Request
- September 2019 - API Gateway - Open Banking API for Payment Initiation via Mojaloop

# The lab user groups

Which user groups the environment could support:

- Hard Core Techies
  - Calling Mojaloop interfaces directly, do not care about the Accounts, Account Management System (AMS)
  - Testing out capabilities of the Hub, understanding the APIs in detail
- Reuse and innovate
  - Use the Payment Hub simplified interface to do the actual transactions to connect the channel, the AMS and Mojaloop
  - Focus on customer journey, improved experience
- The Fintechs
  - DFSP? Switch? What??? Why??? Don't care.
  - Give me some simple APIs to inquire about the customer accounts and let me initiate payments or process customer transaction history for meaningful insights
  - Does not care about Account Management Systems, Payment Hubs, Mojaloop Hub, Settlement

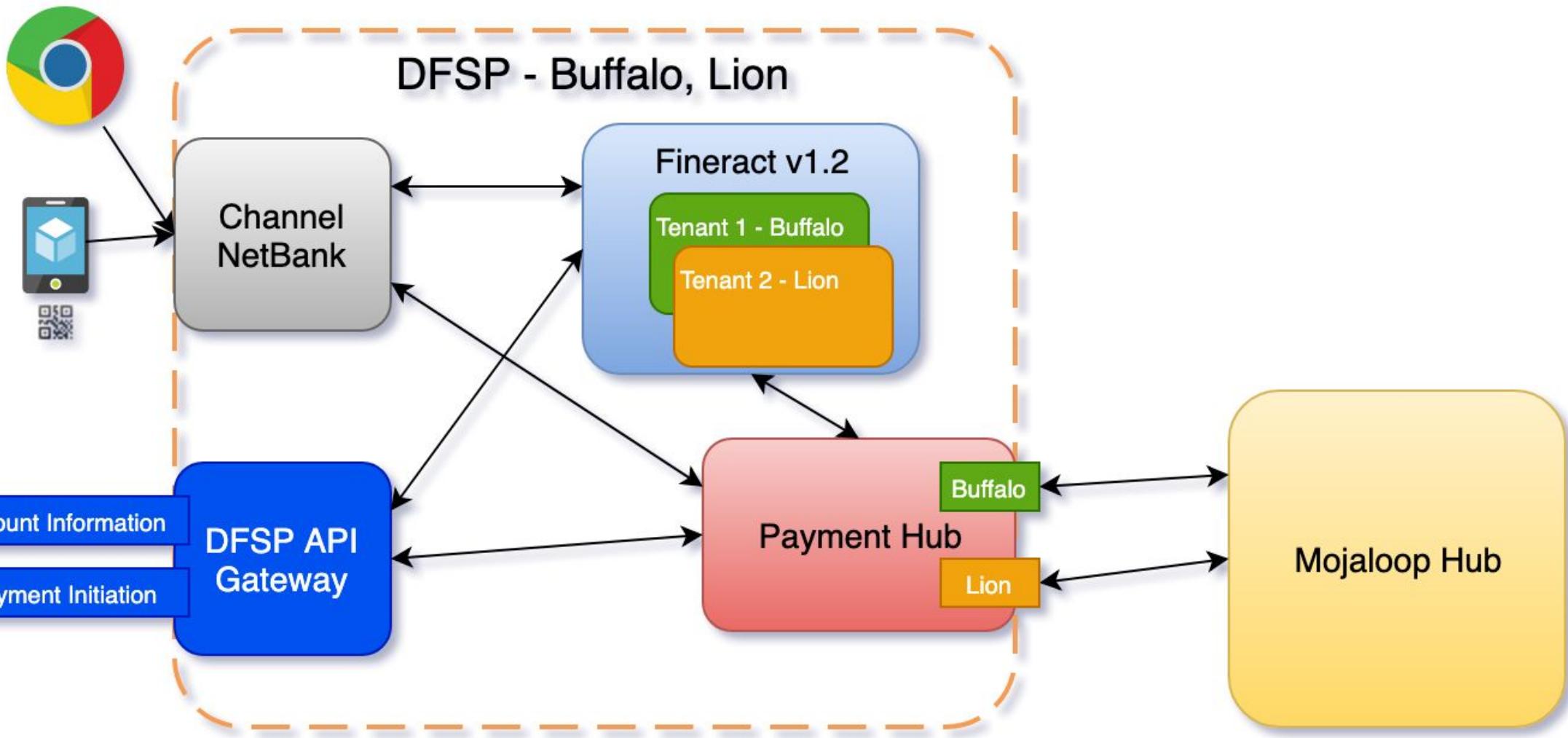


# How to serve the user groups

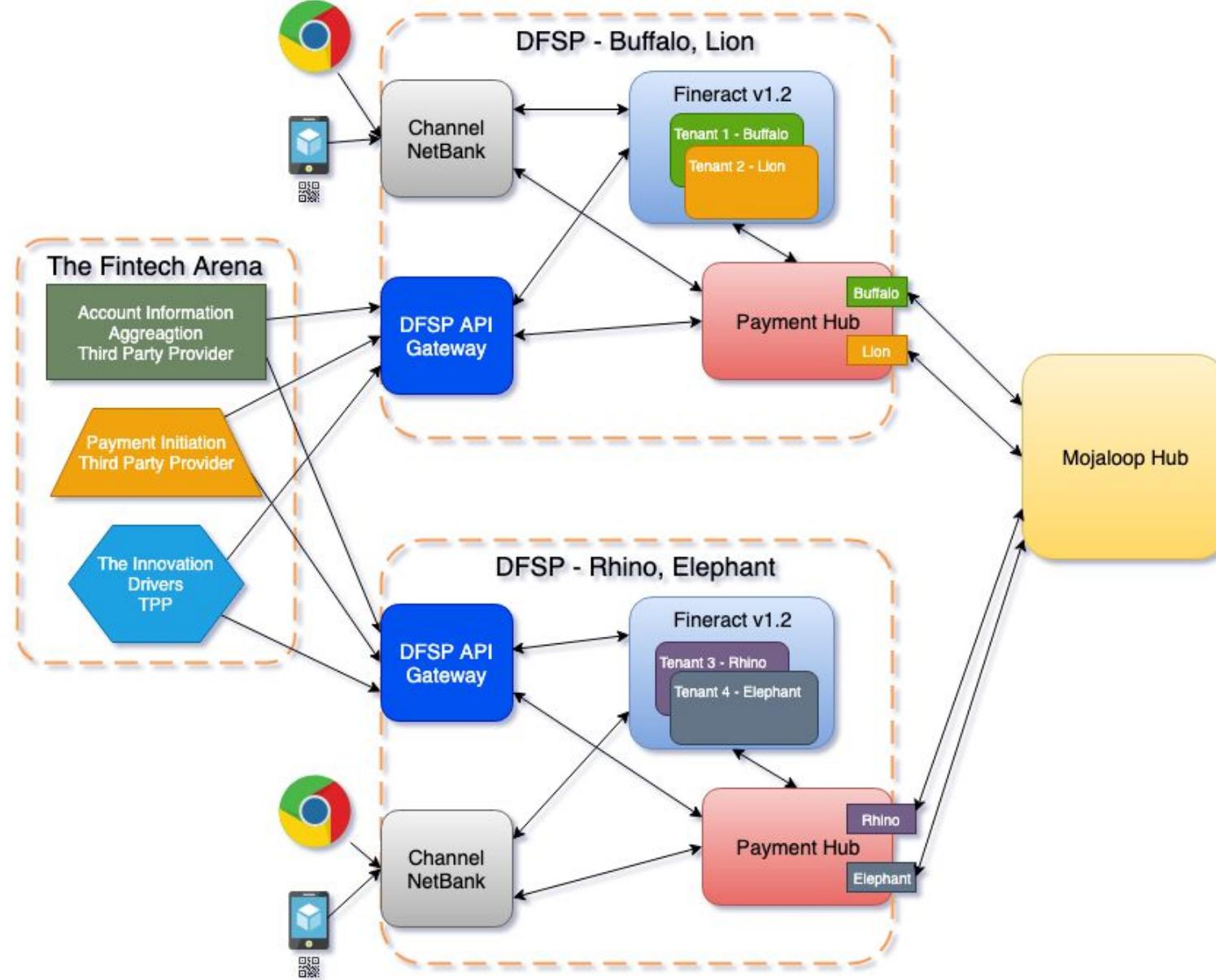
- Hard Core Techies
  - Mojaloop is available to be invoked
  - Improvement: keep it updated, but always in sync with the connecting components
- Reuse and innovate
  - Payment Hub is available, integrated with Mifos AMS, provides simple API to initiate a payment
  - Improvement: keep adding support for the additional use-cases, such as bulk, request to pay
- The Fintechs
  - **Not served yet -> To be served**
  - Improvement: provide a DFSP API Gateway to standardize and simplify their access to the Banking infrastructure. DFSPs are just a utility service provider to enable their innovation.



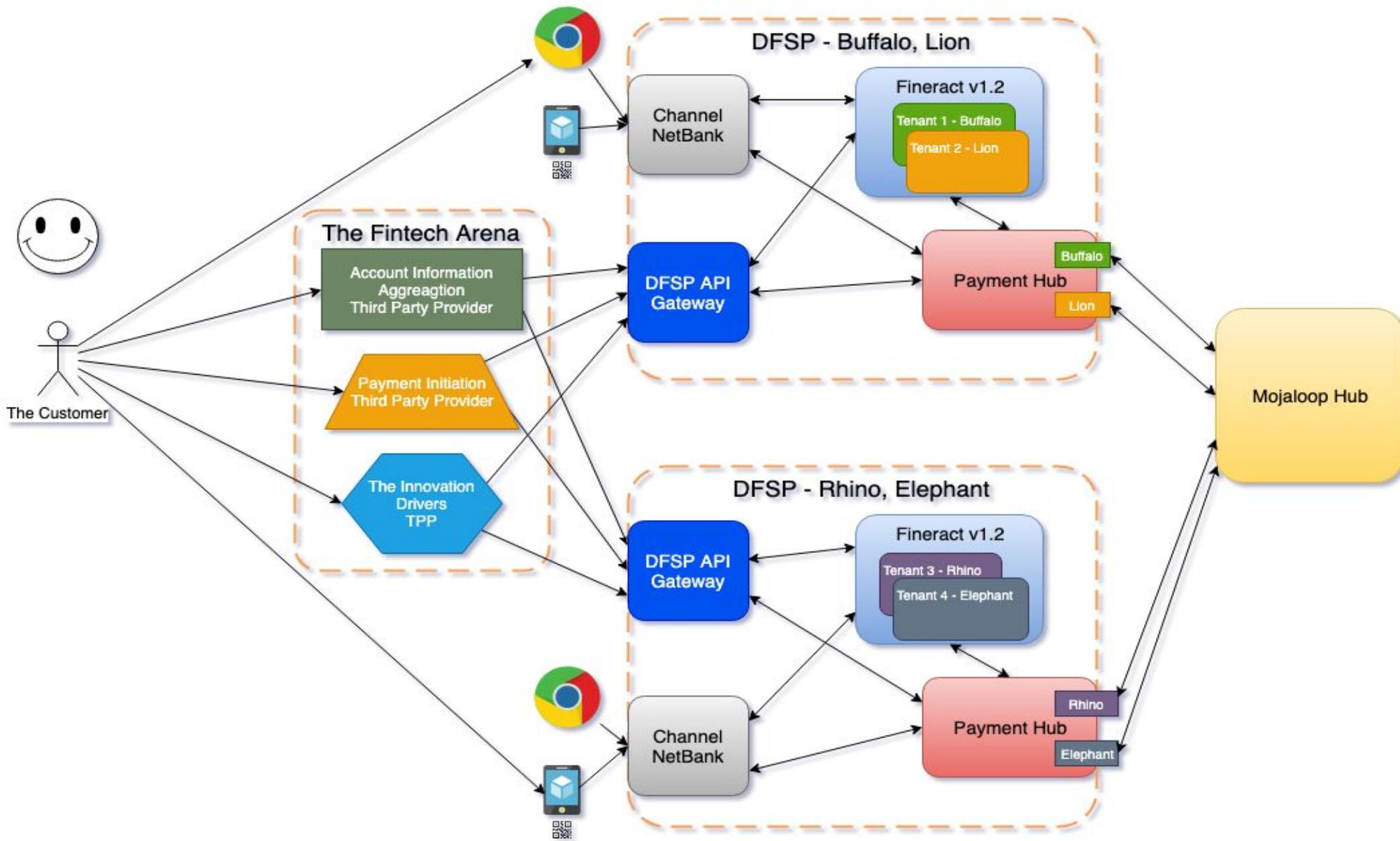
# Openbanking API - DFSP API Gateway



# Openbanking API - DFSP API Gateway - TPP focus



# Openbanking API - DFSP API Gateway - Customer focus



# DFSP API Gateway

mojaloop



# Open Banking API

“Open Banking is the secure way to give providers access to your financial information.”  
“It opens the way to new products and services that could help customers and small to medium-sized businesses get a better deal. It could also give you a more detailed understanding of your accounts, and help you find new ways to make the most of your money.”

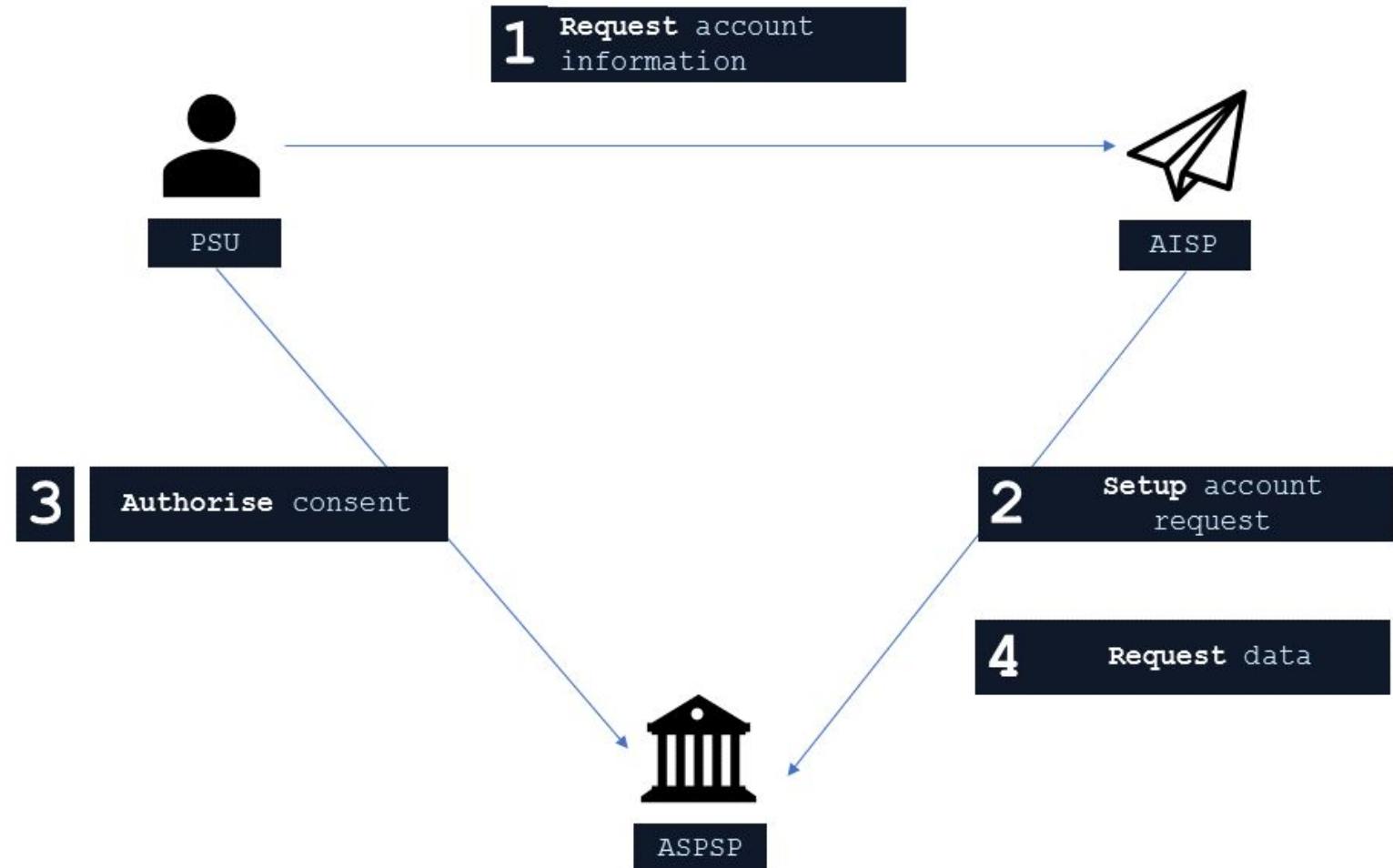
Enable third parties (fintechs) to access multiple DFSPs APIs using a standardised mechanism.

Terminology used:

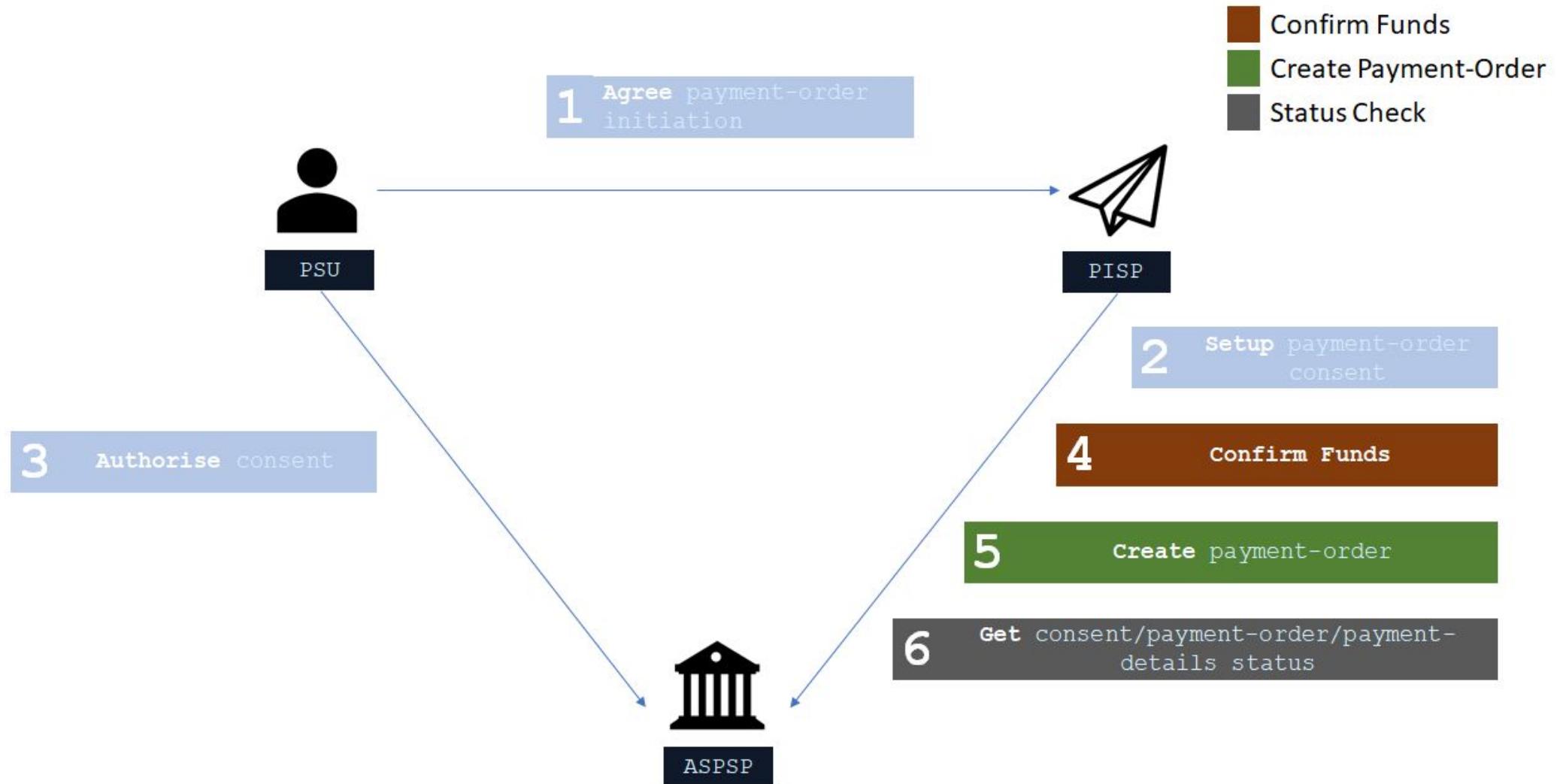
- ASPSP - Account Servicing Payment Service Provider - DFSP
- PSU - Payment Service User - account holder at one or multiple ASPSP
- AISP - Account Information Service Provider
- PISP - Payment Initiation Service Provider



# Account and Transaction Flow



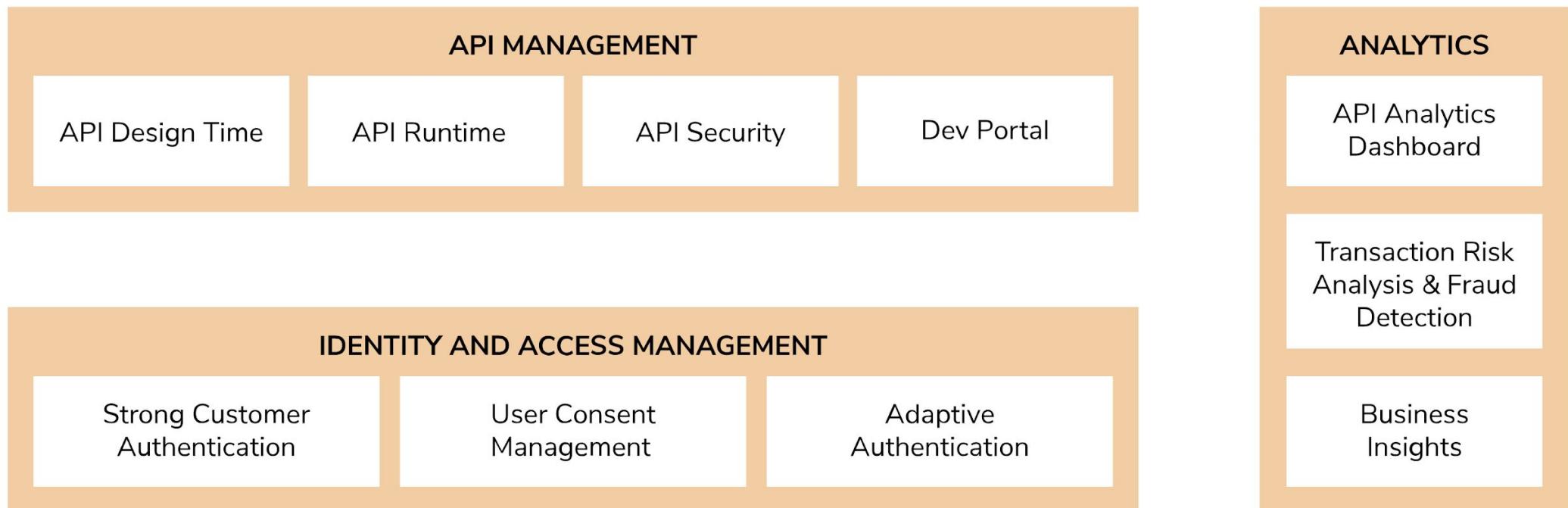
# Payment Initiation Flow



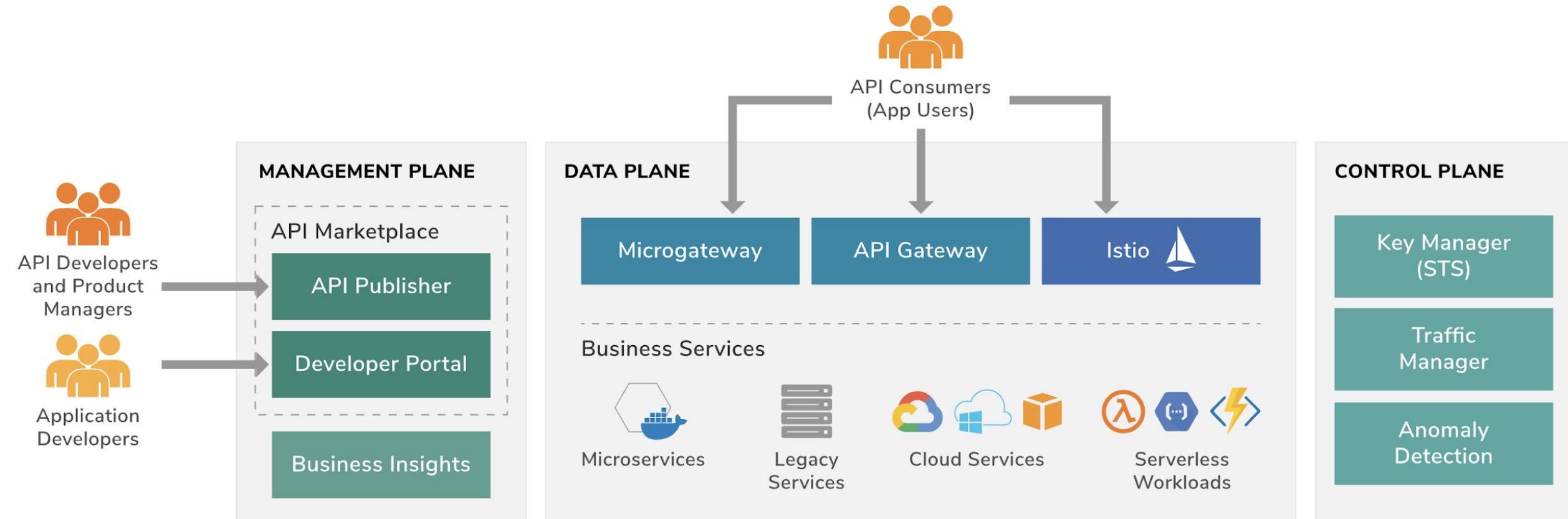
# WSO2 API Elements

## WSO API Manager

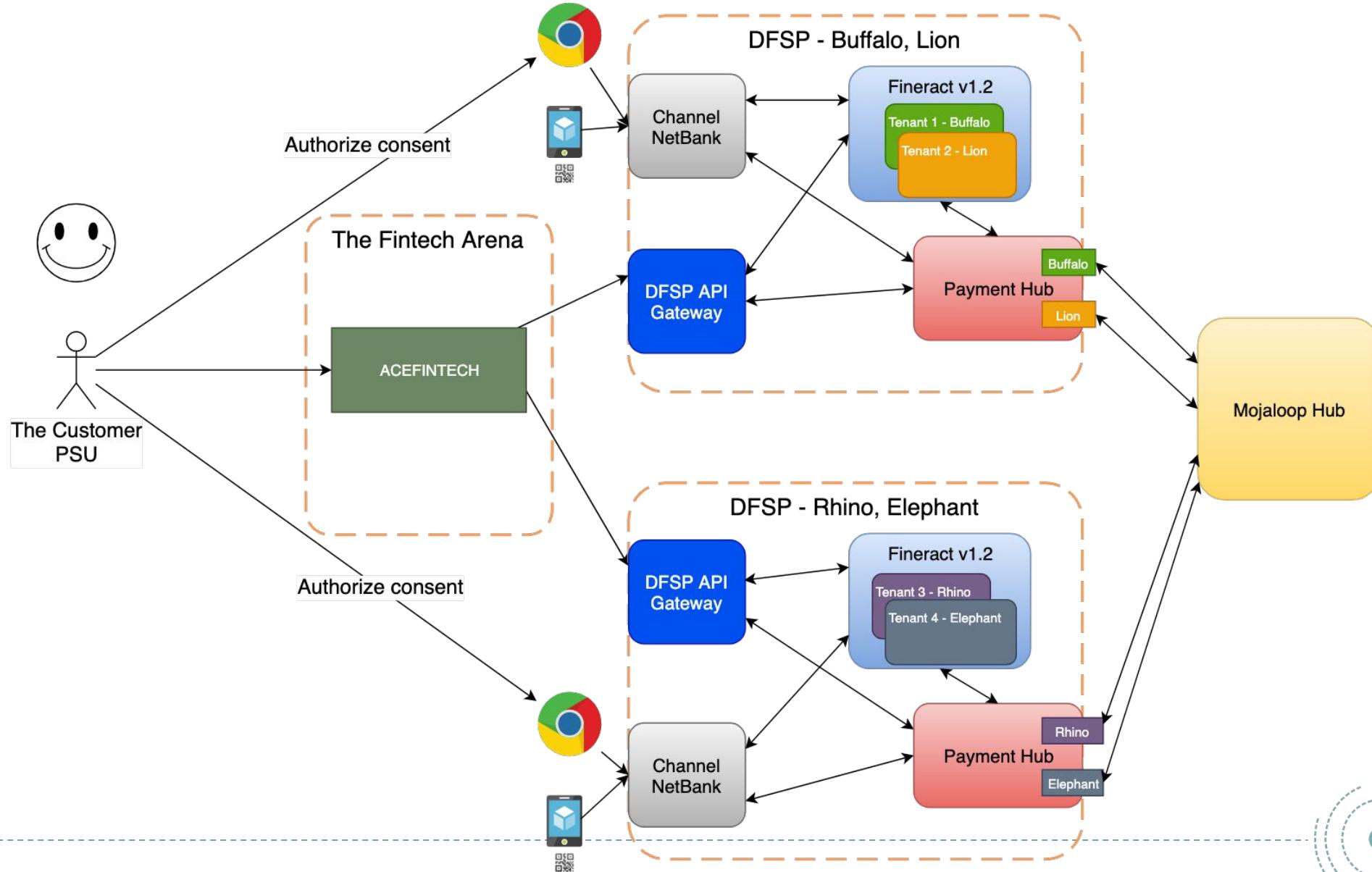
- Publisher (to publish APIs)
- Store (Developer portal; Sandbox)
- Identity and Access Management



# WSO2 API Manager



# The extended lab environment



# ASPSP - DFSP to publish its API

API Publisher Listing - Google Chrome  
Inbox | My Dr | Setup | wso2 | WSO2 | Gettir | CORS | Hacka | API | Hacka | +  
https://api.lion.mlabs.dpc.hu:9443/publisher/  
Apps Chrome Remo... arch | Alvicom... Tamás @ Munka REAMO: Basel... opten0 Other bookmarks  
WSO2 API Publisher  
HOME / APIs  
APIS ANALYTICS MANAGE ALERT TYPES  
+ ADD NEW API  
All APIs  
Search A  
AccountTrans... v3.1.2 admin 1 User PUBLISHED  
Edit Delete  
WSO2 API Manager | © 2019 WSO2 Inc.

WSO2 API Publisher  
HOME / APIs  
APIS ANALYTICS MANAGE ALERT TYPES  
+ ADD NEW API  
All APIs  
Search A P  
AccountTrans... v3.1.2 admin 3 Users PUBLISHED  
Edit Delete PaymentIniti... v3.1.2 admin 3 Users PUBLISHED  
Edit Delete

# WSO2 API Store - Access API for Fintechs

Sign Up - Google Chrome

https://api.lion.mlabs.dpc.hu:9443/store/site/pages/sign-up.jsp

WSO2 API STORE

Create your Account

Username \* acfintech Characters left: 20

Password \* ..... Retype Password \* .....

First Name \* ACE Last Name \* Rintch

Email \* acfintech@apc.hu

View Additional Details

After successful sign in, we use a cookie in your browser to track your session. You can refer our [Cookie Policy](#) for more details.

I hereby confirm that I have read and understood the [Privacy Policy](#).

Sign Up Cancel

WSO2 API Manager 2.6.0 © 2019 WSO2 Inc.

API Store - AccountTransactionAPI - Google Chrome

https://api.lion.mlabs.dpc.hu:9443/store/apis/info?name=AccountTransactionAPI&version=v3.1.2&provider=admin#/Accounts/GetAccounts

APIS APPLICATIONS FORUM ANALYTICS MANAGE ALERTS

string (header) x-fapi-customer-ip-address - The PSU's IP address

x-fapi-interaction-id An RFC4122 UID used as a correlation id.

string (header) x-fapi-interaction-id - An RFC4122 UID used as a correlation id

Authorization \* required An Authorisation Token as per https://tools.ietf.org/html/rfc6750

string (header) Bearer weqrwertwert

Execute Clear

Responses Response content type application/json; charset=utf-8

Curl

```
curl -k -X GET "https://api.lion.mlabs.dpc.hu:8243/open-banking/v3.1/aisp/v3.1.2/accounts" -H "accept: application/json; charset=utf-8" -H "Authorization: Bearer 8369e838-6f47-3b53-8c6b-5d4b4fd1156"
```

Request URL

https://api.lion.mlabs.dpc.hu:8243/open-banking/v3.1/aisp/v3.1.2/accounts

Server response

Code	Details
401	Error: Response body <ams:fault xmlns:ams="http://wso2.org/apimanager/security"> <ams:code>900901</ams:code> <ams:message>Invalid Credentials</ams:message> <ams:description>Access failure for API: /open-banking/v3.1/aisp/v3.1.2, version: v3.1.2 status: (900901) - Invalid Credentials. Make sure you have given the correct access token</ams:description> </ams:fault> Response headers content-type: application/xml; charset=UTF-8
200	Accounts Read

Responses

Code	Description
200	Accounts Read

Example Value Model

API Store - AccountTransactionAPI - Google Chrome

Inbox (9) | Inbox (7) | My Drive | Setup A... | wso2w... | wso2-C... | WSO2-... | Getting... | CORS SU... | Hackath... | API Stor... | Hackath... | +

← → 🔍 https://api.lion.mlabs.dpc.hu:9443/store/apis/info?name=AccountTransactionAPI&version=v3.1.2&provider=admin

Apps Chrome Remo... arch | Alvicom... Tamás @ Munka REAMO: Basel... opten0 Inbox (79) - sip... 20190520 20190522 20190529 Consent Other bookmarks

WSO2 API Store

APIS APPLICATIONS FORUM ANALYTICS MANAGE ALERTS

GO BACK

## AccountTransactionAPI - v3.1.2

A

Version: v3.1.2  
By: admin  
Updated: 21/Jun/2019 19:24:33 PM GMT  
Status: PUBLISHED  
Rating: ★★★★★ 0

Applications Select Application...  
Tiers Unlimited

Subscribe

Overview API Console Documentation SDKs Forum

Production and Sandbox Endpoints

Production and Sandbox URLs:

<http://api.lion.mlabs.dpc.hu:8280/open-banking/v3.1/aisp/v3.1.2>

<https://api.lion.mlabs.dpc.hu:8243/open-banking/v3.1/aisp/v3.1.2>

Description

Swagger for Account and Transaction API Specification

Share

Social Sites Embed Email

f t g+ digg

Comments

Characters left: 450

Add

No comments yet

API Store - AccountTransactionAPI - Google Chrome

Inbox (9) × Inbox (7) × My Drive × Setup Al × wso2 w × wso2-C × WSO2- × Getting × CORS su × Hackath × API Stor × Hackath × +

← → ⌂ https://api.lion.mlabs.dpc.hu:9443/store/apis/info?name=AccountTransactionAPI&version=v3.1.2&provider=admin#tab1

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WSO2 API Store

APIS APPLICATIONS FORUM ANALYTICS MANAGE ALERTS

GO BACK

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Status: PUBLISHED  
Rating: ★★★★☆

Applications Select Application...  
Tiers Unlimited

Subscribe

Overview API Console Documentation SDKs Forum

Try ACE Fintech App v1.0  
Using Production Key

Set Request Header Authorization : Bearer 8369e836-6f47-3b53-8c6b-5d4b4af1156

Swagger ( /swagger.json )

### Account Access

POST /account-access-consents Create Account Access Consents

GET /account-access-consents/{ConsentId} Get Account Access Consents

DELETE /account-access-consents/{ConsentId} Delete Account Access Consents

### Accounts

GET /accounts Get Accounts

GET /accounts/{AccountId} Get Accounts

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https://api.lion.mlabs.dpc.hu:9443/store/apis/info?name=AccountTransactionAPI&version=v3.1.2&provider=admin#tab1

41

API Store - AccountTransactionAPI - Google Chrome

Inbox (9) | Inbox (7) | My Drive | Setup A... | wso2 w... | wso2 - C... | WSO2 - C... | Getting | CORS su... | Hackath... | API Stor... | Hackath... | +

https://api.lion.mlabs.dpc.hu:9443/store/apis/info?name=AccountTransactionAPI&version=v3.1.2&provider=admin#/Accounts/GetAccounts

Apps | Chrome Remo... | arch | Alvicom... | Tamás @ Munka | REAMO: Basel... | opten0 | Inbox (79)-sip... | 20190520 | 20190522 | 20190529 | Consent | Other bookmarks

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APPLICATIONS

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MANAGE ALERTS

## Account Access

POST /account-access-consents Create Account Access Consents

GET /account-access-consents/{ConsentId} Get Account Access Consents

DELETE /account-access-consents/{ConsentId} Delete Account Access Consents

## Accounts

GET /accounts Get Accounts

Parameters

Name Description

x-fapi-auth-date The time when the PSU last logged in with the TPP.  
string  
(header)  
All dates in the HTTP headers are represented as RFC 7231 Full Dates. An example is below:  
Sun, 10 Sep 2017 19:43:31 UTC

x-fapi-customer-ip-address The PSU's IP address if the PSU is currently logged in with the TPP.  
string  
(header)

x-fapi-interaction-id An RFC4122 UID used as a correlation id.  
string  
(header)

Authorization \* required An Authorisation Token as per <https://tools.ietf.org/html/rfc6750>  
string  
(header)

Responses

Code Description

200 Accounts Read

Response content type application/json; charset=utf-8

Example Value Model

```
{ "Data": { "Account": [ ] } }
```



# PaymentInitiationAPI - v3.1.2

**Version:** v3.1.2**By:** admin**Updated:** 22/Jul/2019 13:12:01 PM GMT**Status:** PUBLISHED[Overview](#)[API Console](#)[Documentation](#)[SDKs](#)[Forum](#)

## Production and Sandbox Endpoints

Production and Sandbox URLs:

<https://api.lion.mlabs.dpc.hu:8243/open-banking/v3.1/pisp/v3.1.2>



## Description

Swagger for Payment Initiation API Specification



APIS

GO BACK



APPLICATIONS



FORUM



ANALYTICS



MANAGE ALERTS

P

Version: v3.1.2

By: admin

Updated: 22/Jul/2019 13:12:01 PM GMT

Status: PUBLISHED

Overview

API Console

Documentation

SDKs

Forum

### ⓘ Notice

You require an access token to try the API. Please log in and subscribe to the API to generate an access token. If you already have an access token, please provide it below.

Set Request Header

Authorization : Bearer

Access Token

Swagger (/swagger.json)

## Domestic Payments



POST

/domestic-payment-consents Create Domestic Payment Consents



GET

/domestic-payment-consents/{ConsentId} Get Domestic Payment Consents



GET

/domestic-payment-consents/{ConsentId}/funds-confirmation Get Domestic Payment Consents



POST

/domestic-payments Create Domestic Payments



GET

/domestic-payments/{DomesticPaymentId} Get Domestic Payments



# Interaction for the payment service user (PSU)

The image consists of five screenshots illustrating the interaction flow for a payment service user (PSU) through a mobile application interface.

- Login Screen:** Shows a message "You are not logged in." and a "Login" form with fields for "Username" (tppuser) and "Password" (\*\*\*\*\*). A blue "Login" button is at the bottom.
- Connected Banks Screen:** Displays the user's profile "John Smith" and a "CONNECTED BANKS" section. It lists two banks: "Rhino Bank Ltd." and "Buffalo Bank Ltd.". A blue "Add Bank" button is located at the bottom right.
- Accounts Screen:** Shows the user's profile "John Smith" and an "ACCOUNTS" section. It lists four accounts:
  - Bills Credit: 1230.00 GBP
  - Household Debit: 57.36 GBP
  - Bills Credit: 1230.00 GBP
  - Household Debit: 57.36 GBPA blue "Add Account" button is at the bottom right.
- Account Details Screen:** A detailed view of one of the accounts. It shows:
  - Nickname:** Bills
  - Status:** Enabled
  - Owner:** Mr Kevin
  - Type:** Credit
  - Amount:** 1230.00 GBP
  - Credit line amount:** 1000.00 GBPA back arrow is on the left, and a blue "Edit" button is at the bottom right.
- Supported Banks Screen:** A list of supported banks under the user's profile "John Smith". It includes:
  - Lion Bank Ltd. (represented by a lion icon)
  - Elephant Bank Ltd. (represented by an elephant icon)
  - Rhino Bank Ltd. (represented by a rhino icon)
  - Buffalo Bank Ltd. (represented by a buffalo icon)

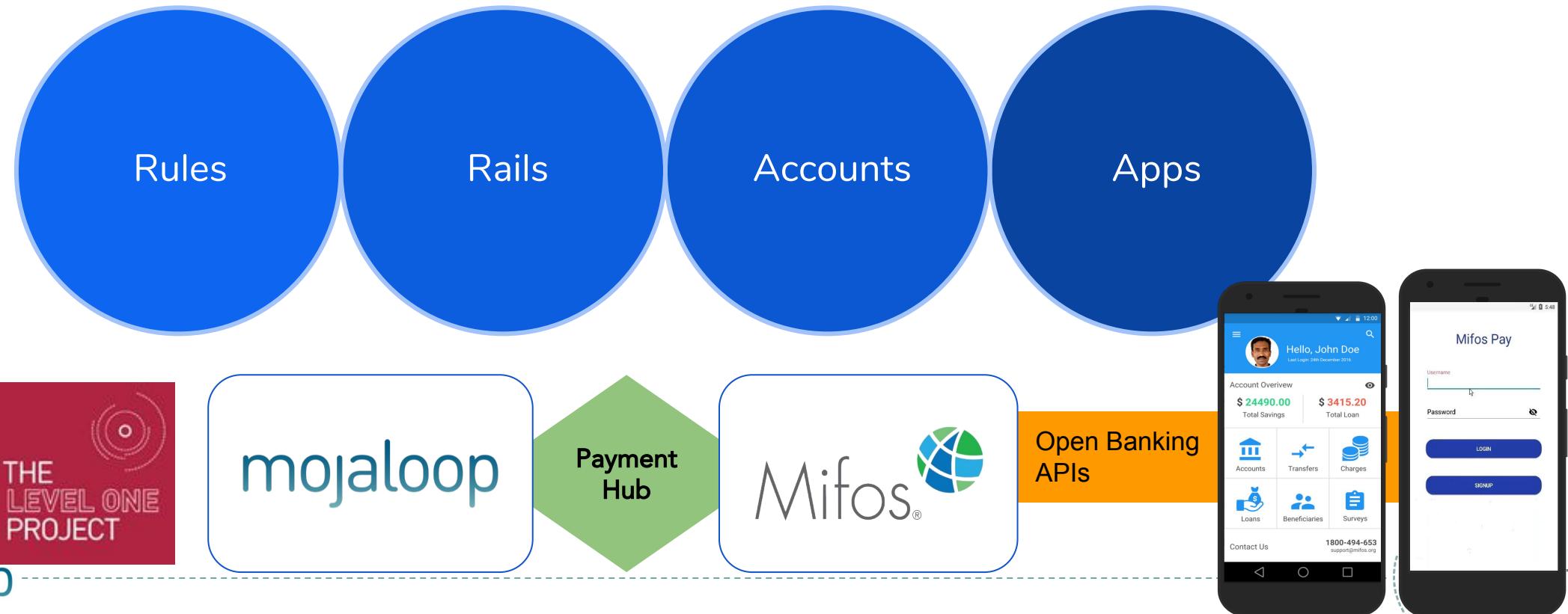
# API Discussion



# End to End Open Source Architecture for Digital Financial Services

## Open Stack

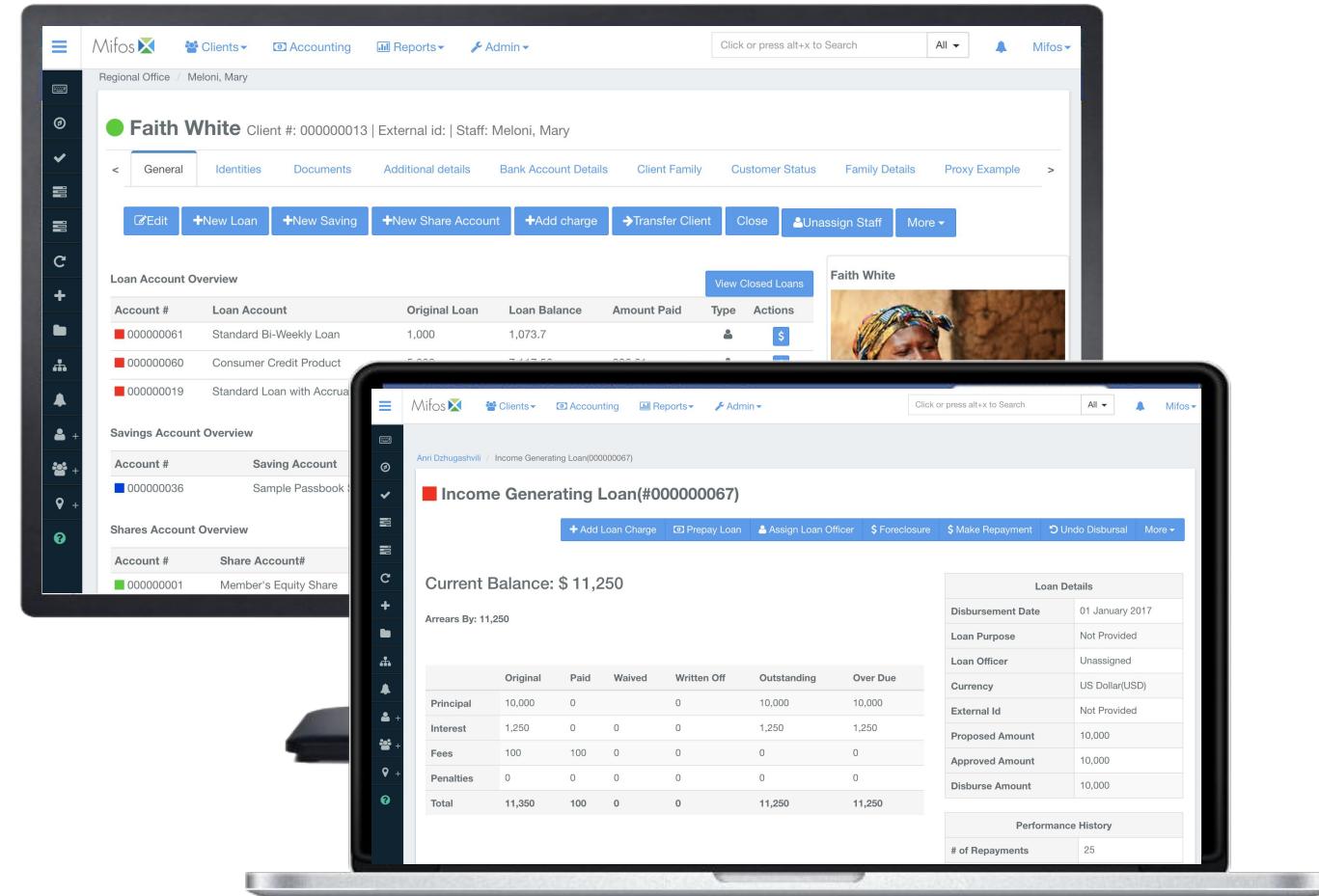
- OS L1-Aligned Payment Switch - Mojaloop
- OS Bridge - Payment Hub
- OS Account Management System - Mifos
- OS Reference Mobile Apps - Mobile Banking & Mobile Wallet
- Open Banking APIs



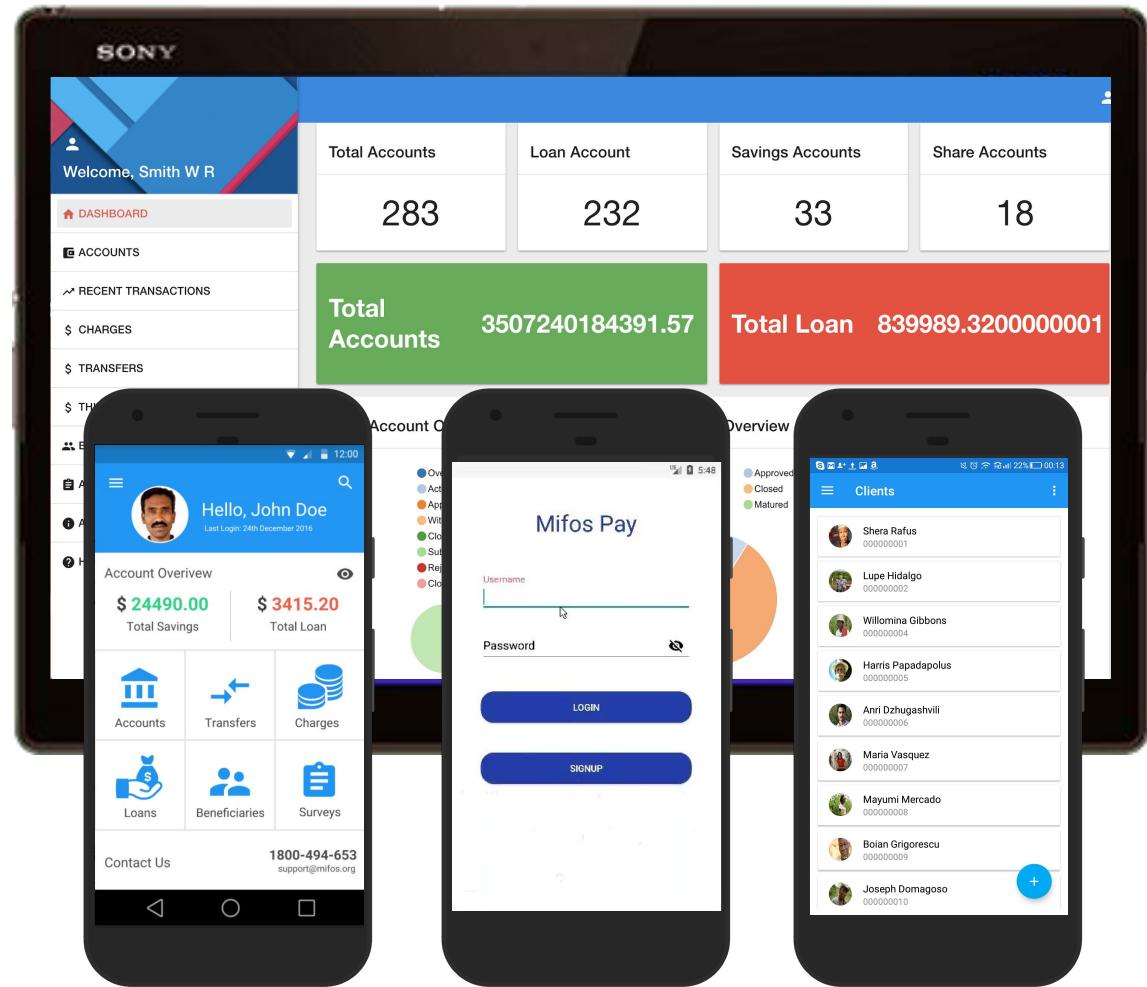
# Open Technology Stack for DFS Innovation

Online Banking App

Platform & APIs



Web App



Mobile Banking

Mobile Wallet

Mobile Field Ops

# Infrastructure vs App APIs

## Foundational Infrastructure:

Build entire digital financial service systems & platforms

Payment Switch - Mojaloop (Rails)

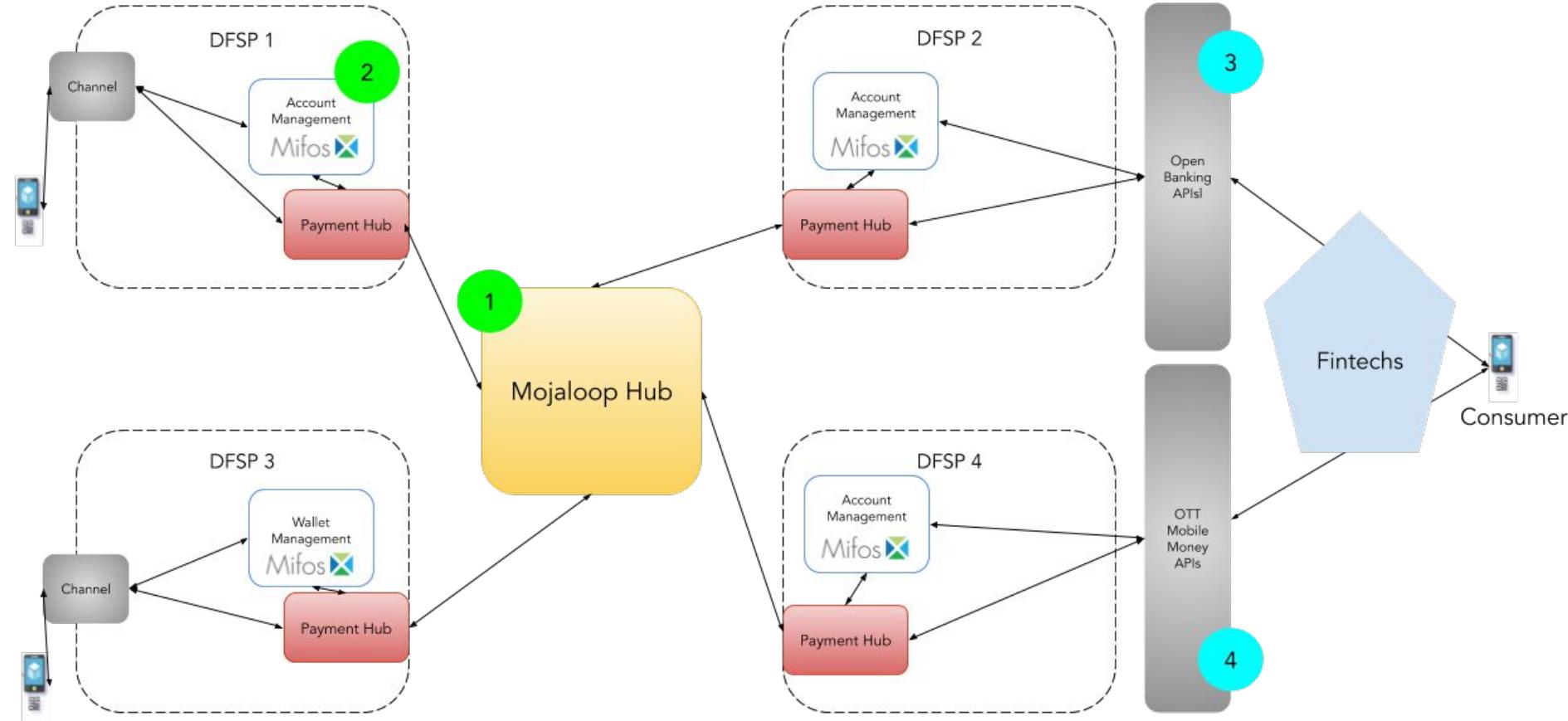
Account Management - Mifos (Accounts)

## Apps & Innovation:

Third parties can build apps on infrastructural layer.

Open Banking API

OTT Mobile Money APIs



# Infrastructural API - Payment System - Back-End Switching & Settlement (Mojaloop)

- Assumptions
  - Mojaloop APIs connect DFSPs, so should be 100% "backend" transactions
- Purpose
  - Build digital, interoperable payments platforms that drive financial inclusion on a national scale by providing set of centralized services and standard interfaces for multiple DFSPs to connect.
  - Key Functions
    - Transaction processing, routing
    - Central directory
    - Settlement,
    - Mojaloop doesn't hold value - DFSP account management systems do.
  - Example Use Cases
- Sample APIs
  - POST /quotes - Get a quotation from payee to validate account and receive conditions
  - POST /transfers - Initiates to book the payment on merchant side

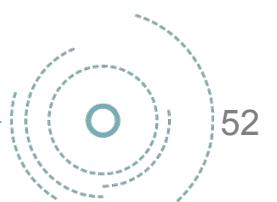
# Infrastructural API - Core Banking & Account Management (Mifos)

- Assumptions
  - Primarily internal-facing but could also be external-facing
- Purpose
  - Can use to build an entire core banking system or digital financial services application (mobile wallet, digital credit, etc.)
  - Key Functions
    - Digital account system designed to support operations that "hold value"
      - Bank account, MFI account, wallet account, etc.
      - Customer KYC
    - Run the Operations of a financial institution
      - Portfolio management - balance and transactions for loans, savings, etc
    - Example Use Cases
- Sample APIs
  - Loan
  - Client
  - Permissions for Staff, etc
  - Create New Office
  - First Demo



# Application API - Open Banking API

- Assumptions
  - External Customer-Facing
- Purpose
  - Can enable clients to consent to third parties accessing their data and initiating transactions on their behalf.
- Opportunity
  - Allow unbanked to be reached by more fintechs and SACCOs/MFIs to monetize this trusted relationship.
- Progress/Traction
  - UK - Open Banking Standard
  - Europe - Berlin Group
  - Mexico - UK Open Banking Standard
  - Australia
  - Africa - efforts in Nigeria, South Africa
- Sample APIs
  - Account Information
  - Payment Initiation



# Application API - OTT/Wholesale APIs (GSMA Mobile Money API)

- Assumptions
  - External Facing
- Purpose
  - Allow for third parties to initiate transaction via mobile money as rails.
- Examples
  - GSMA Mobile Money API
  - Beyonic API
  - MTN Uganda Mobile Money API
  - Safaricom API
- Sample APIs (pull from GSMA or other docs)
  - /transactions (create, view; with "type": "transfer", "withdrawal", "deposit", "disbursement", "adjustment", "reversal")
  - /transactions/reversals (with "type": "reversal", "adjustment")
  - 
  -
-

## Discussion on APIs

- What are the boundaries between these APIs?
- How does one draw the line between what is external facing and what is internal facing?
- At what point do mobile money API and Open Banking API converge?
- What role does mobile money API play with a Mojaloop Open API?
- How do all the parties fit together?
- Valuable discussion for context of labs, how do different players in ecosystem interact with Mojaloop stack?
- If value of transactional revenue decreases in Mojaloop switch, how do these APIs enable the delivery of platform business models?

# Thank You

- Márta Jankovics, Tamás Sipos and colleagues at DPC to implement the software
- Philip Green
- Miller Abel
- Kim Walters

Edward Cable

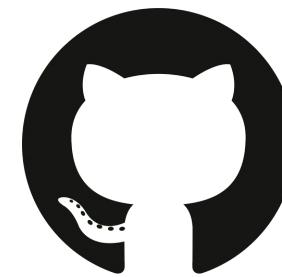
[edcable@mifos.org](mailto:edcable@mifos.org)

<https://mifos.org>

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[istvan.molnar@dpc.hu](mailto:istvan.molnar@dpc.hu)

<https://dpc.hu>



[github.com/openMF](https://github.com/openMF)  
[github.com/openMF/payment-hub](https://github.com/openMF/payment-hub)  
[github.com/openMF/mobile-wallet](https://github.com/openMF/mobile-wallet)  
[github.com/apache/fineract](https://github.com/apache/fineract)  
[fineract.apache.org](https://fineract.apache.org)



# Appendix



# Progress to Date for Phase 1

## Completed During Phase 1

- Mojaloop and Fineract infrastructure fully deployed in AWS via Terraform Scripts
- Designed & implemented Payment Hub architecture
- Integration with Mojaloop APIs for merchant proximity payment & peer to peer push payment

### Implementation details

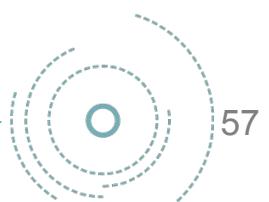
- Flows for Merchant and Peer to Peer Payment
- Components of solution
  - Enhancing Fineract APIs
  - Payment Hub
  - Client apps
  - APIs to connect
- Reference apps to demonstrate merchant & customer interactions
  - React Applications
  - Android mobile wallet

## Additional Work to Be Done

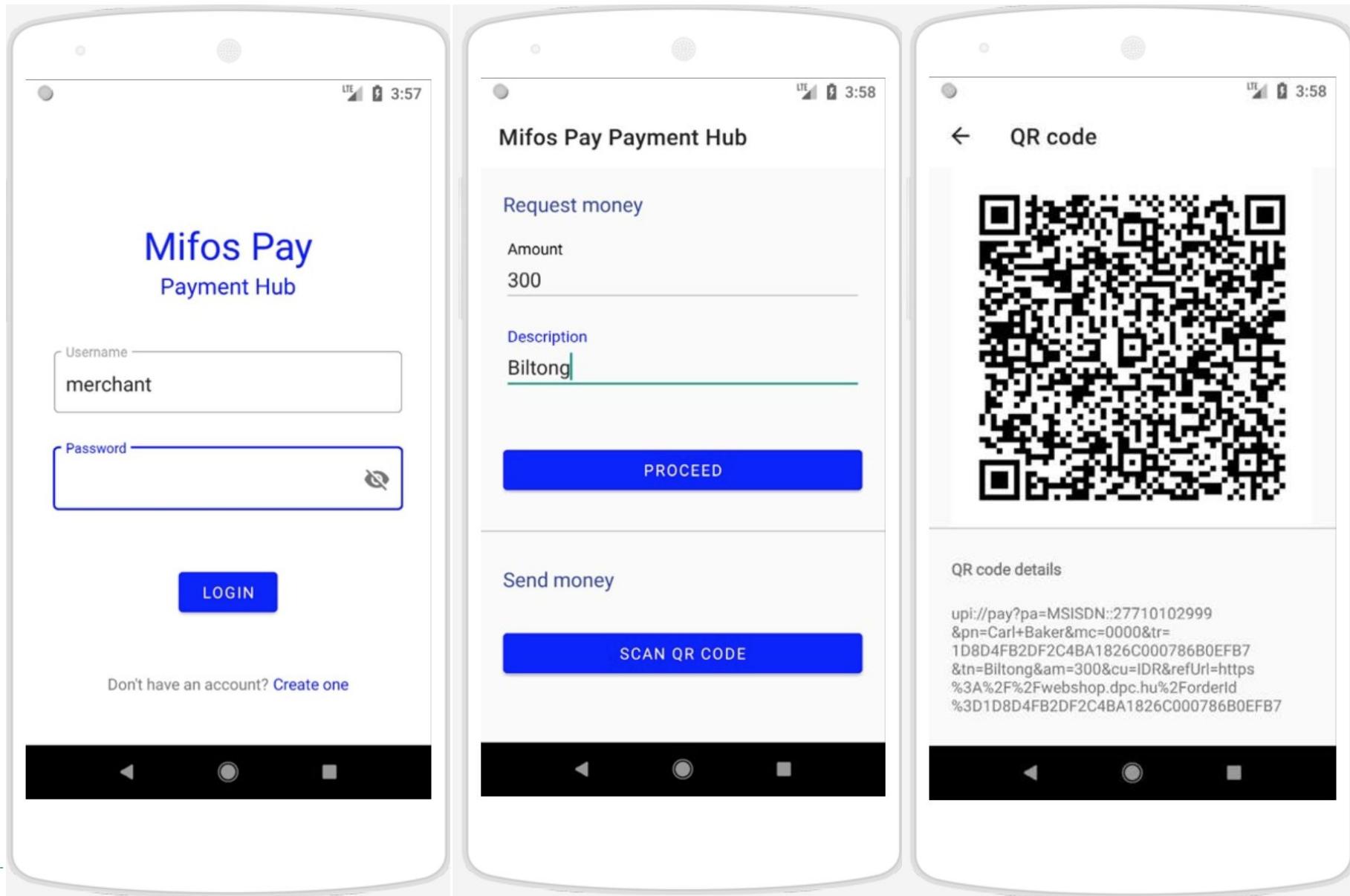
- Integrate with Bulk Payment API and Merchant Request to Pay when completed
- Upgrade to Latest Version of Mojaloop including Account Lookup Service
- Leverage additional OSS tools from ModusBox

## Take Action

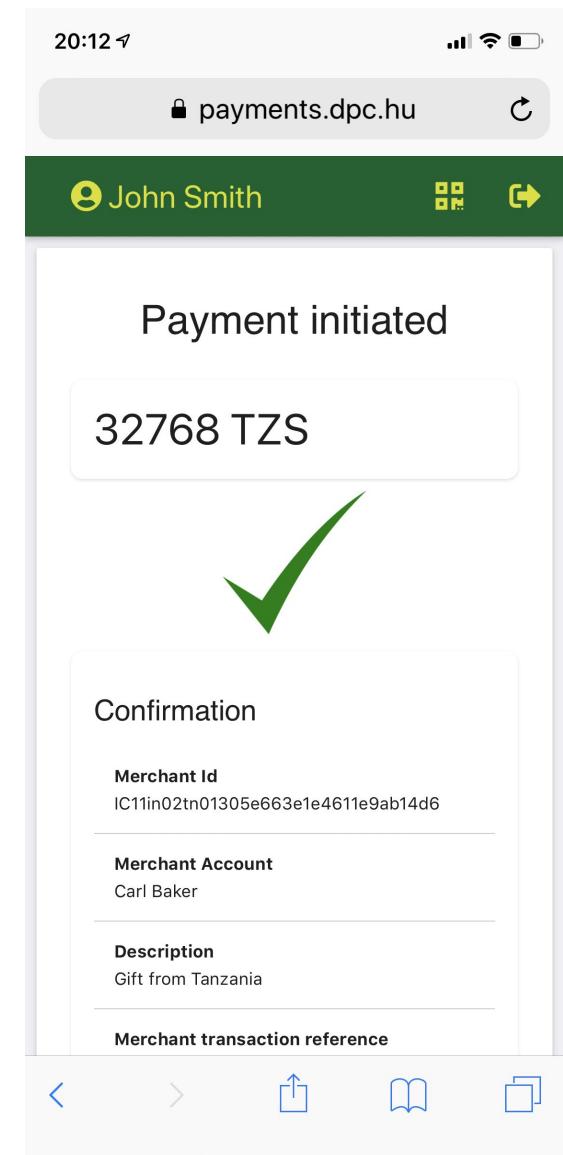
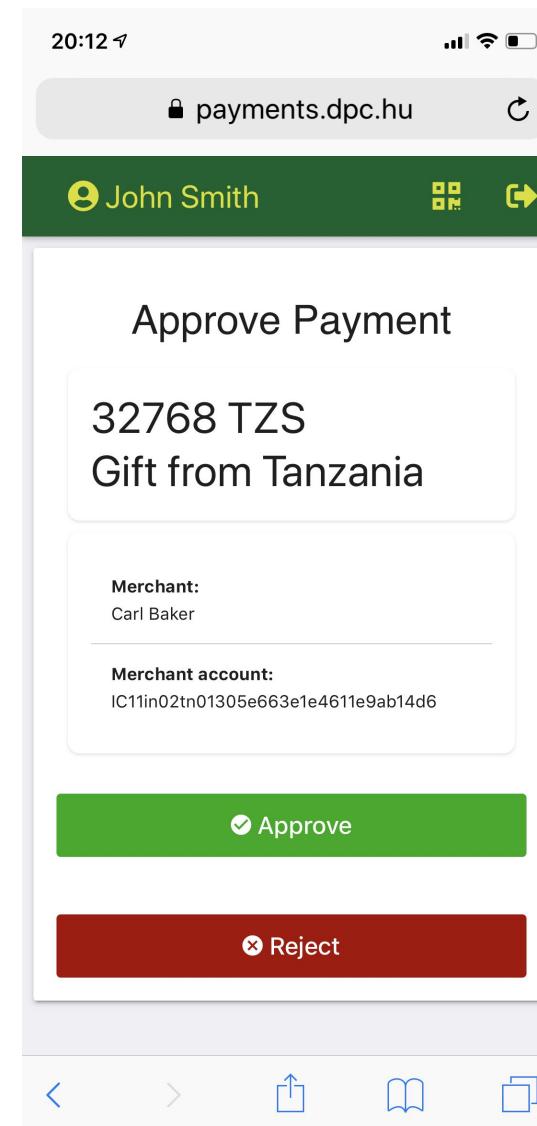
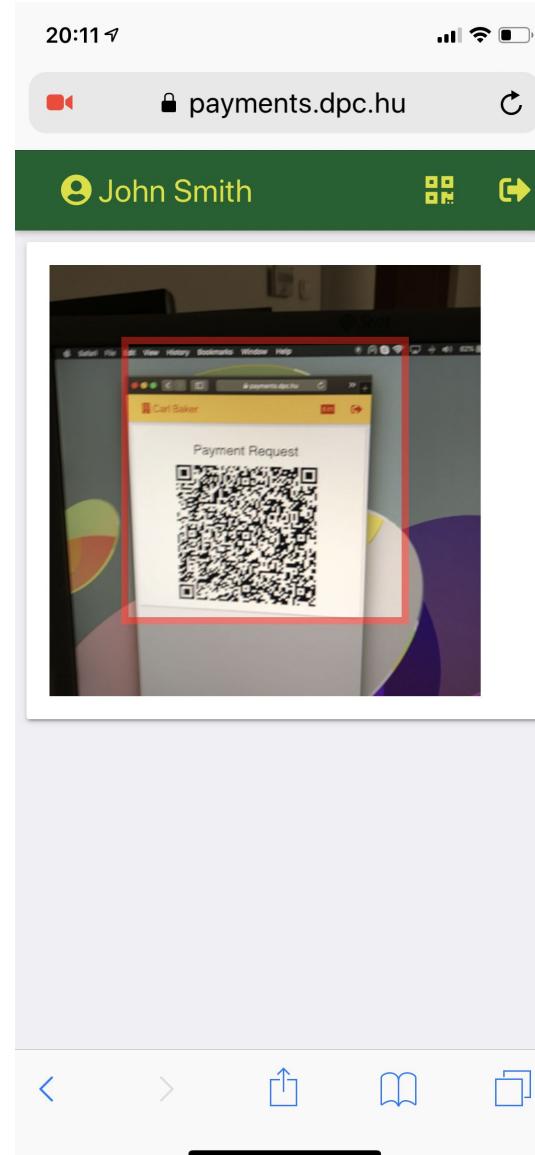
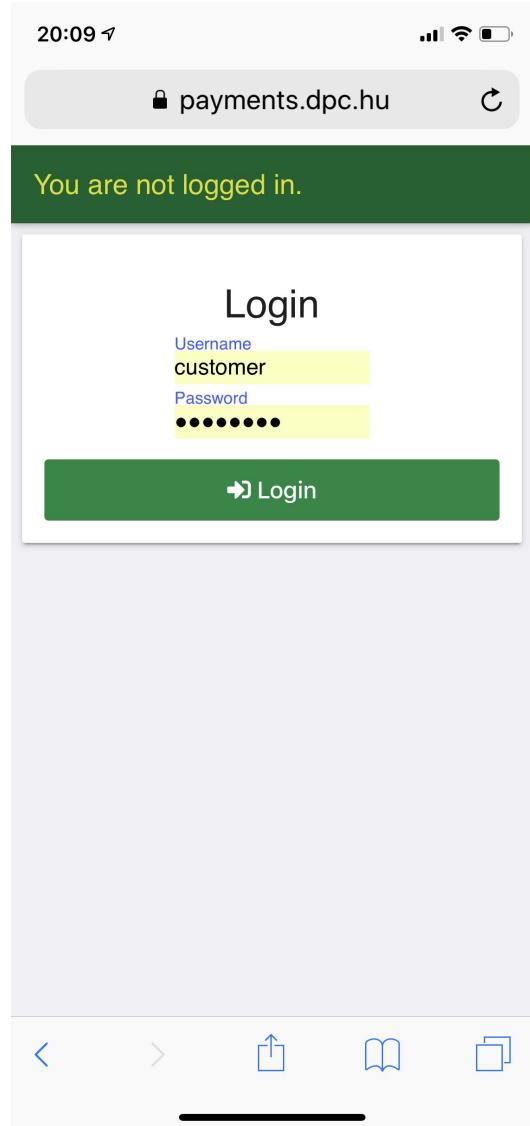
**Source Code:** [github.com/openMF/payment-hub](https://github.com/openMF/payment-hub)  
**Docs:** <http://bit.ly/mifos-moja-docs>



# Merchant Prepares Transaction Using Android Mobile Wallet App



# Customer Initiate Payment using React App

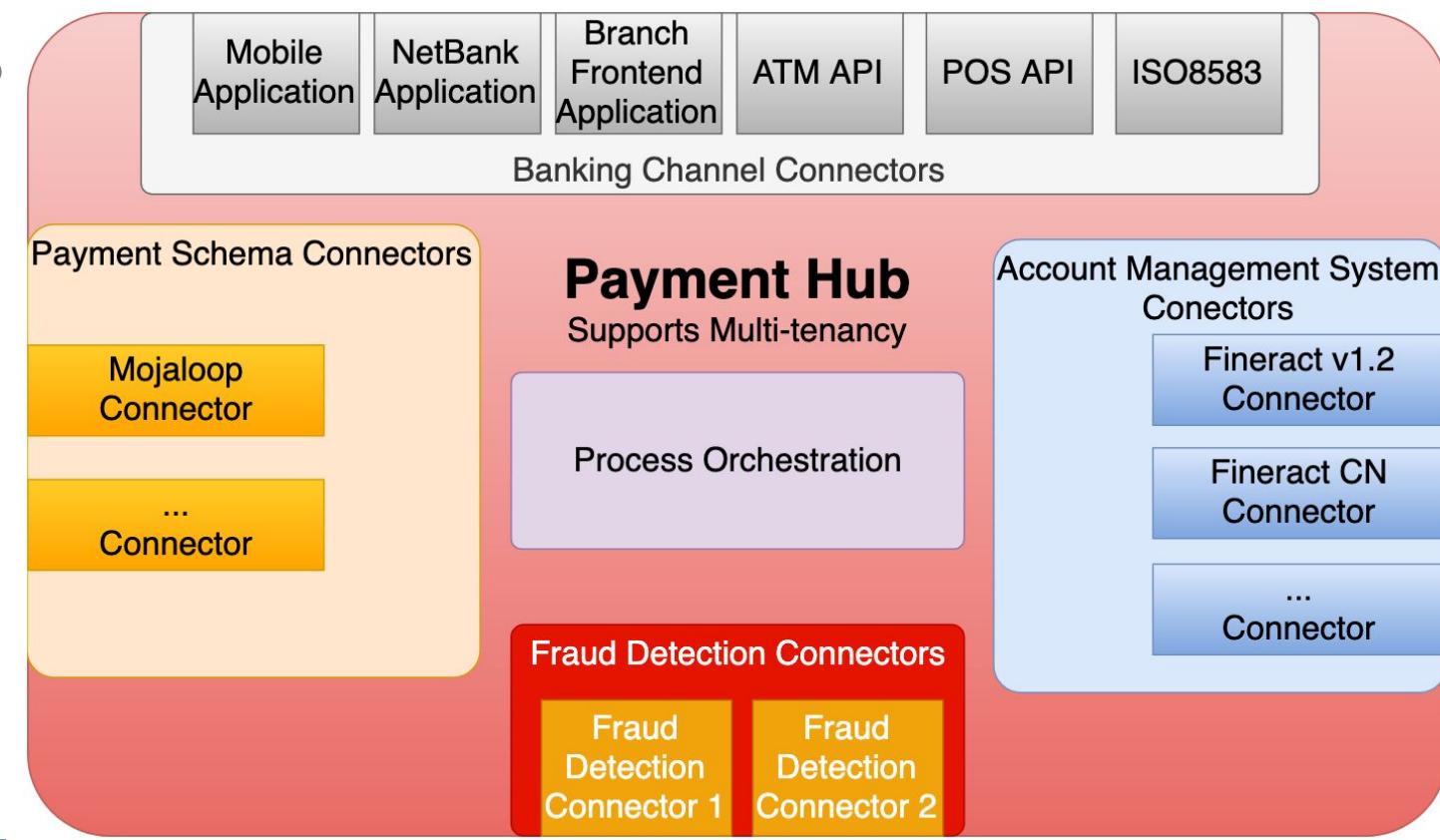


# Payment Hub Vision & Roadmap



# Payment Hub

- The role of a payment hub to connect:
  - Financial Institution channels (Mobile, Internet, Branch, Callcenter, ATM, POS)
  - Account Management System (AMS / Core banking platform)
  - 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
  - Trigger notifications
- Built on proven open-source technology:
  - Java, SpringBoot
  - Apache Camel



# Payment Hub internals

Orchestrate the message flow between

- banking channel
- AMS
- Mojaloop

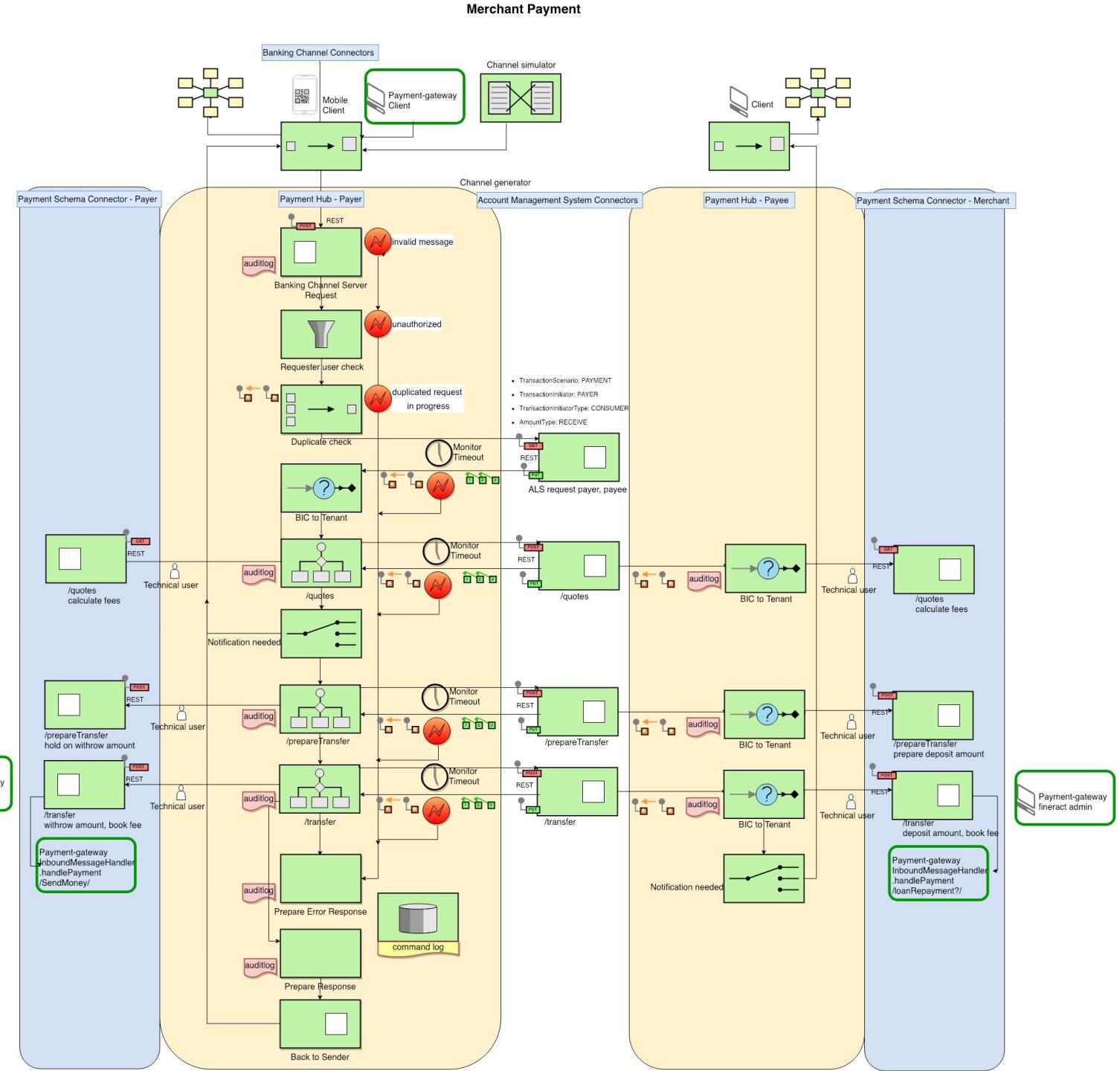
both at the payer and the payee

Implementation is utilising Apache Camel in a Springboot container.

Deployment options:

- co-located with the AMS
- separate infrastructure to handle higher load
- autoscaling microservice

mojaloop



# ■ Why does the Community Need a Payment Hub?

- Payment Hub is Vital to Ecosystem and should be part of Mojaloop OSS Stack
  - Unify Disparate POCs by having different integration points in payment hub
    - ISO 8583 integration, GSMA Mobile Money API, etc.
  - Critical Tool for Mojaloop Adoption at FSP Level
    - Abstracts Complexity and eases integration for implementers i.e. TIPS
    - OS but others can package and distribute as their own proprietary solution.
  - Implement as Part of Common Lab Environment
    - Extend upon experience with DFS Lab hackathon
    - GSMA Lab/Mowali with reference open source mobile wallet.
    - COIL ATM/POS integration
    - Can enable lab with mobile wallet, financial institutions, telcos participating.

*Does the Payment Hub add Value to the Community? What would you like to see?*



# Payment Hub Advanced Capabilities

- Support for all use-cases as they become available by Mojaloop
- Operational UI for monitoring, investigation and problem resolution at DFSP
- Capability to efficiently interface with external fraud monitoring system
- Settlement API
- Reconciliation automation with reporting, automatic resolution if possible
- Identifier (MSISDN) - Account assignment management
- Notification handling (push, sms, email)
- Advanced error handling, compensation management
- Persistence management
- High Availability, Fault Tolerance
- Optimisation for High Performance
- Dynamic QR code generation for all banking channels



# Payment Hub Additional Use Cases

These use-cases could be implemented as they become supported by Mojaloop:

- Request To Pay
- Bulk Payment
- Agent initiated cash out; cash out authorised on POS
- Customer initiated cash out
- Merchant Initiated Merchant Payment; Authorized on POS
- ATM initiated cash out
- Refund
- Secondary identifier registration process



## ■ Operational UI at DFSP

- Implement an user-interface for the DFSP operational staff to:
- Monitor the flow of transaction
- Check the detailed state of transactions for investigation purposes
- Combine the bank internal data of a transaction and Mojaloop internal state to provide full detail of a transaction on a single UI (utilizing Mojaloop APIs to inquire additional data)
- Workflow to resolve troubled transactions, enable actions on transactions
- Initiate refund
- Reporting functionality to provide aggregated and real-time metrics on the transaction flow



# ■ Interfacing with External Fraud Monitoring System

- DFSP could implement a separate fraud monitoring system which could be invoked by the Payment Hub as part of the outgoing or incoming payment flow.
- DFSP side fraud monitoring could utilize much more information about the customer, compared to simply monitoring the flow of transactions, such as: A priori knowledge of customer's accounts, typical transaction mix, channels, geolocations, devices used, rate of typing.
- Transactions can be:
  - Stopped - in case of scoring high by the fraud monitoring system
  - Paused - contacting the customer for validation on other channel and resume the transaction later
  - Let it go through
    - Fraud monitoring does not alert on the given transaction
    - Fraud monitoring subsystem is not responding in the given timeframe



# Advanced error handling, compensation management

A financial transaction could fail in a distributed system for multiple reasons.

ILP protocol wish to eliminate as much as possible of those cases, but we believe, that inside the DFSP systems, issues can arise.

Handling of those errors, such as timeouts, uncertain outcomes, retries should be automated as much as possible. Preparation of system failure and graceful handling of those cases also requires additional design refinements.

This includes:

- Doing automated investigation for not complete transactions
- Creating compensation transactions for permanently failed scenarios



## ■ High Availability, Fault Tolerance

The Payment Hub should provide adequately high availability at the DFSP. This depends on environment, availability of the overall environment (dual data centers, network redundancy), customer expectations and regulatory requirements.

The Payment Hub should be able to receive transactions, even in the case the Account Management System (AMS) is not available on behalf of the DFSP.

To fulfill these requirements and reduce overall cost, in a modern architecture, software based replication, clustering, coordination services can be utilized, although easy installation and operation should not be compromised. This will require the necessary enhancements in the Payment Hub.



## ■ Provide a DFSP simulator

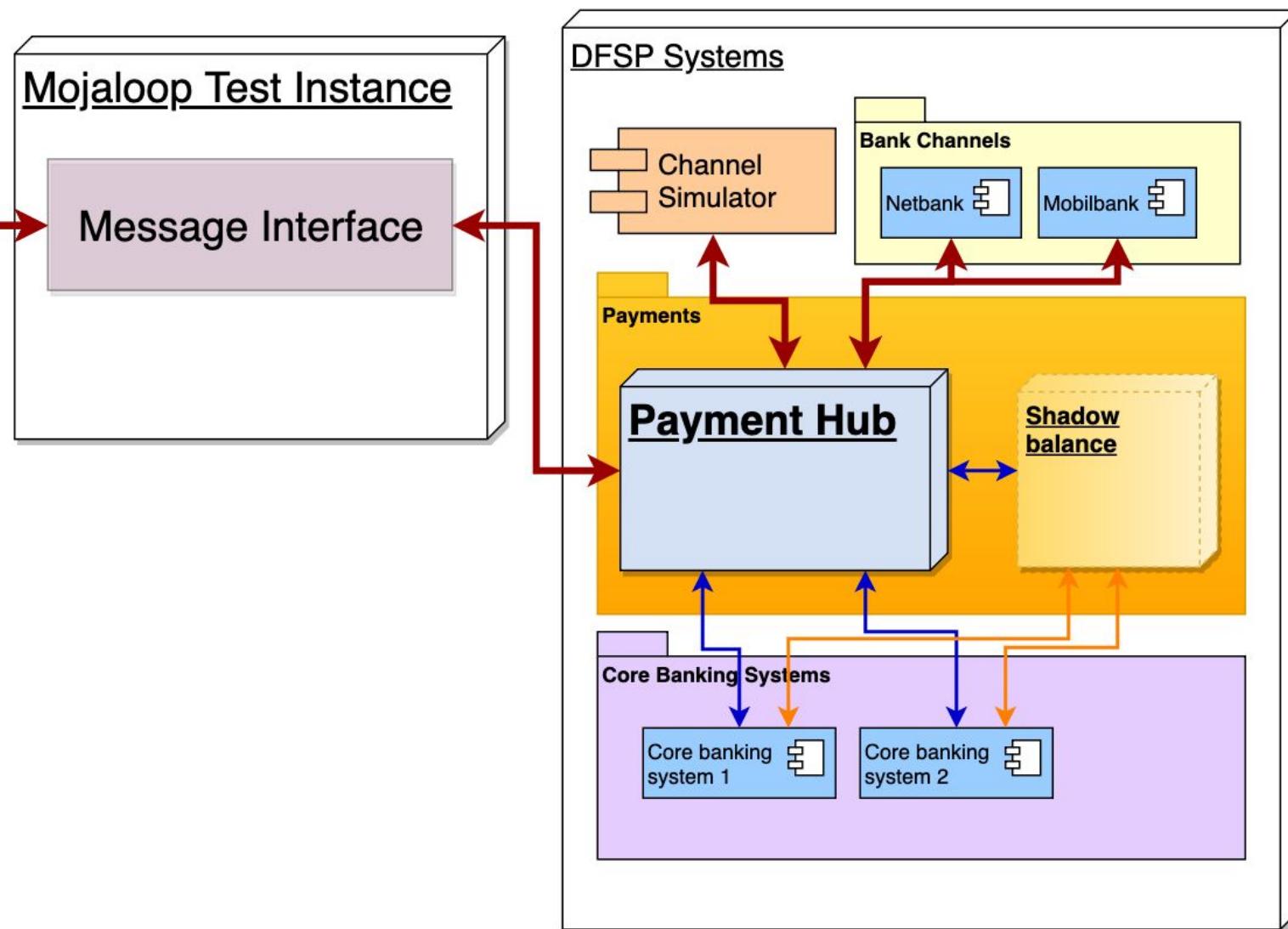
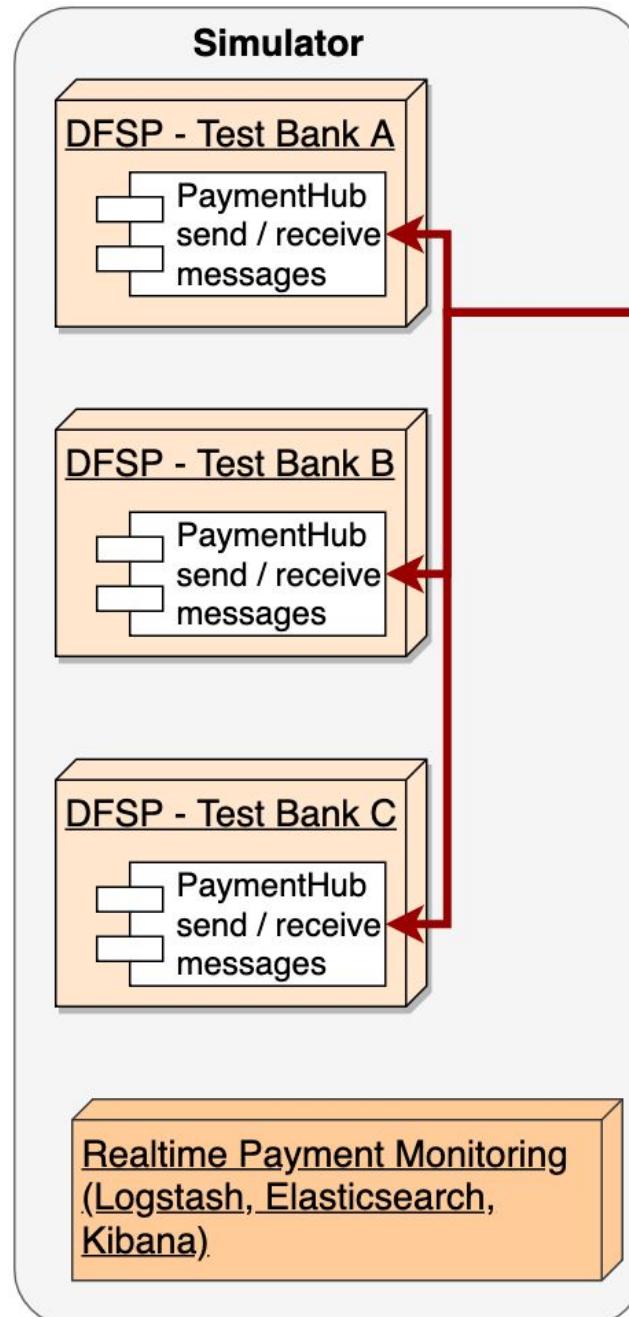
Easy to use, simple to setup test environment for development, testing for DFSPs and their developers.

Could be used for UAT testing by the DFSPs.

Requires a single computer to run all the components to enable:

- Functional testing
- Happy scenarios
- Modelling failure scenarios by artificially injecting delays, error cases
- Performance testing





## Run Test Suite

AFR-FHB-GIRA.xlsx

AFR-FHB-JZB.xlsx

AFR-FHB-Rafi.xlsx

AFR-JZB-FHB.xlsx

AFR-JZB-GIRA.xlsx

AFR-Test-Delay.xlsx

AFR-Test-RJCT.xlsx

AFR-Test-Suite-01.xlsx

AFR-Test-Suite-03.xlsx

AFR-Test-bkq.xlsx

AFR-Test-bkq01.xlsx

AFR-Test.xlsx

FHJBHUH0-TAKBHUUH0.xlsx

SuccessRequestToPay.xlsx

SuccessRequestToPayWithDelay.xlsx

**SuccessfulCreditTransfer.xlsx**

### Run Test Suite Details

**File**

SuccessfulCreditTransfer.xlsx

**TPS**

1

**Iteration Count**

1

**Start at** ASAP Next Minute**Remark**

**17:35:56 Test Suite was successfully queued.**  
Filename: SuccessfulCreditTransfer.xlsx

**Run Test Suite****Download File****Delete Suite**



## VIPS-Main Metrics

**100,000**  
Count**750,457,942**  
Sum of amount**7,504.579**  
Average amount

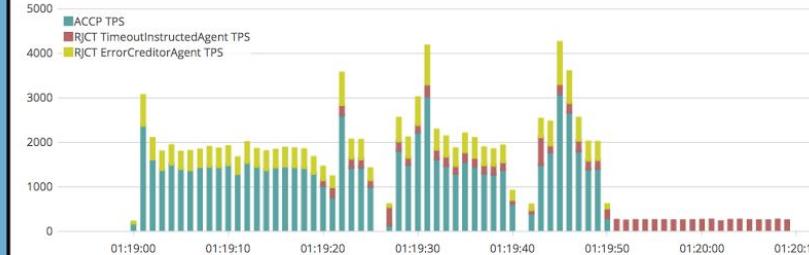
## VIPS-TPS



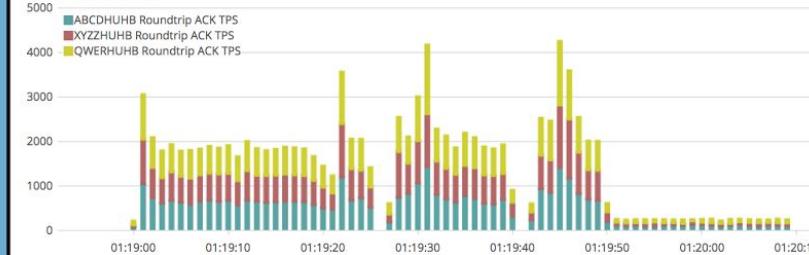
## VIPS - BANK - TPS



## PSP - debtor ack receive TPS



## PSP - debtor ACK TPS



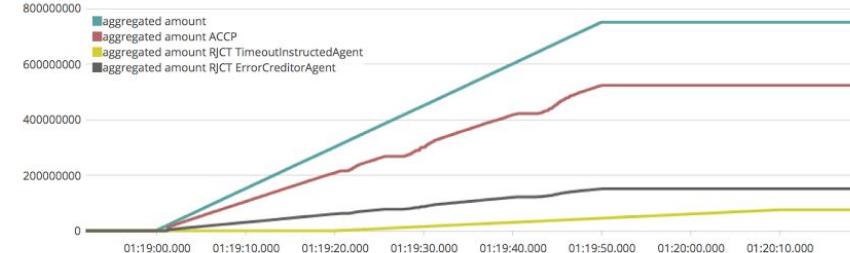
## ACCP Count

**70,000**  
Successful count**523,860,038**  
Successful amount

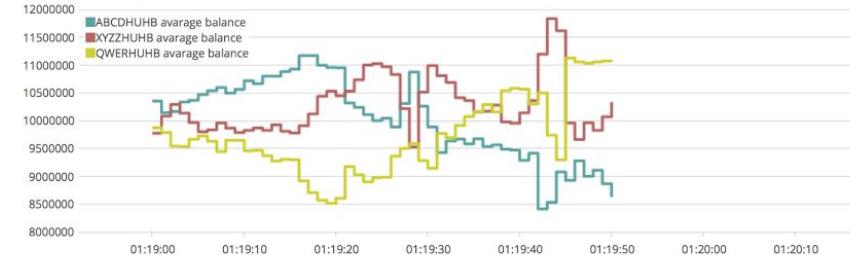
## RJCT count

**30,000**  
Rejected count**226,597,904**  
Rejected amount

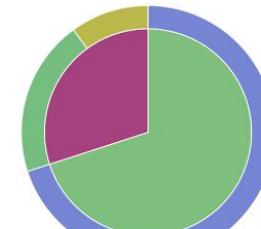
## VIPS - aggregated amount / ACCP/RJCT



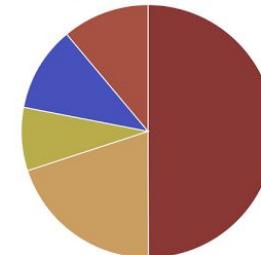
## VIPS - BANK - Average balance



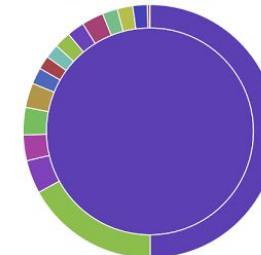
## Status-Reason pie

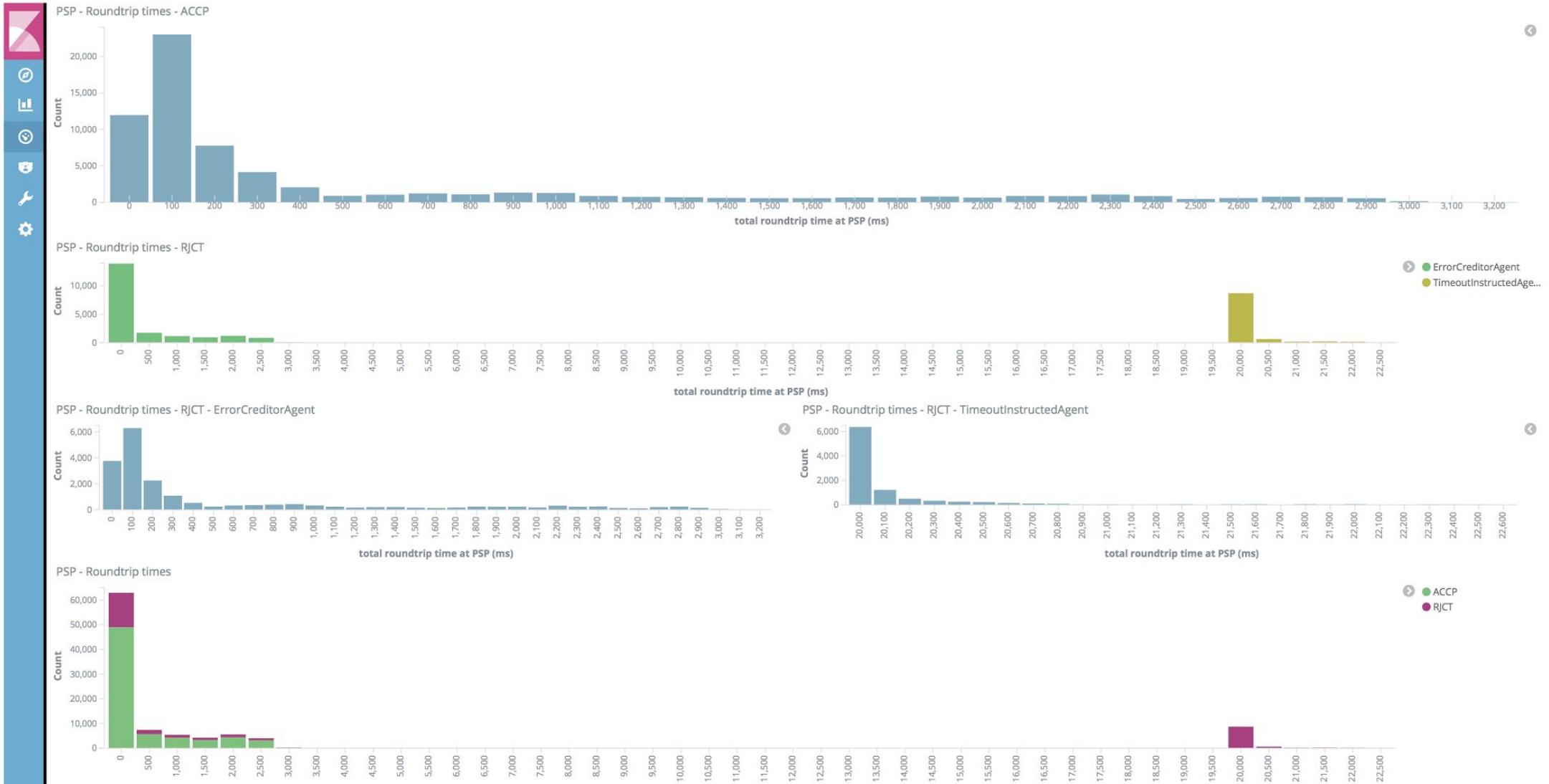


## PSP - roundtrip - distribution - ACCP



## PSP - roundtrip - distribution - ACCP - piechart 5sec





# Thank You

- Modusbox developer and QA teams who have assisted via Slack or on phone calls
  - Murthy, Samuel, Nico, Miguel, and more.
- Márta Jankovics and colleagues at DPC to make the hackathon environment working
  - Miller Abel
  - Kim Walters

Edward Cable

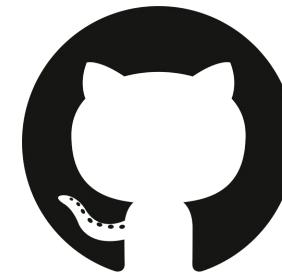
[edcable@mifos.org](mailto:edcable@mifos.org)

<https://mifos.org>

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[istvan.molnar@dpc.hu](mailto:istvan.molnar@dpc.hu)

<https://dpc.hu>



[github.com/openMF](https://github.com/openMF)  
[github.com/openMF/payment-hub](https://github.com/openMF/payment-hub)  
[github.com/openMF/mobile-wallet](https://github.com/openMF/mobile-wallet)  
[github.com/apache/fineract](https://github.com/apache/fineract)  
[fineract.apache.org](https://fineract.apache.org)



# Appendix

January 2019 - Tanzania



# Agenda

- Overview of Mifos & Ecosystem
- Mifos Gen 2 and Gen 3 Technology Stack
- Vision for Mifos Lab
- Goals, Objectives, and Use Cases for Mifos Lab
- Architecture and Design Overview & Diagrams
- API Walkthrough
- Live Demo
- Lessons Learned
- What's Next
- Take Action



# Who is Mifos?



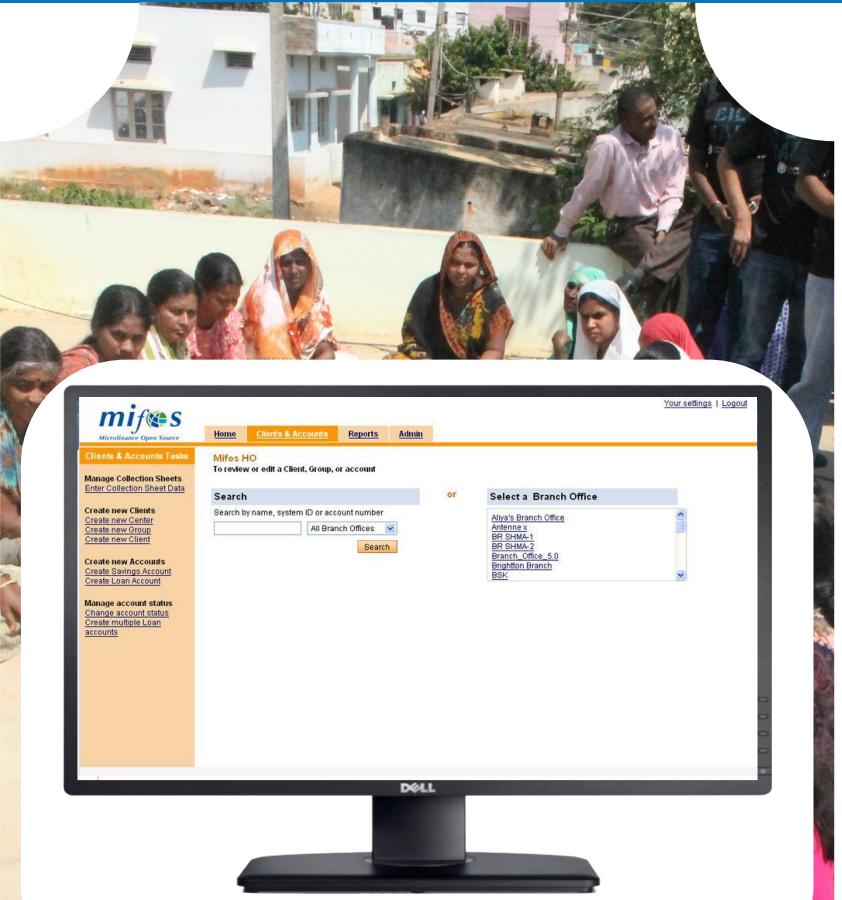
**FinTech non-profit leveraging the cloud, mobile, and open source community to transform the delivery of digital financial services to the world's 3 billion underbanked and unbanked.**

---

**12M** clients  
**350** orgs



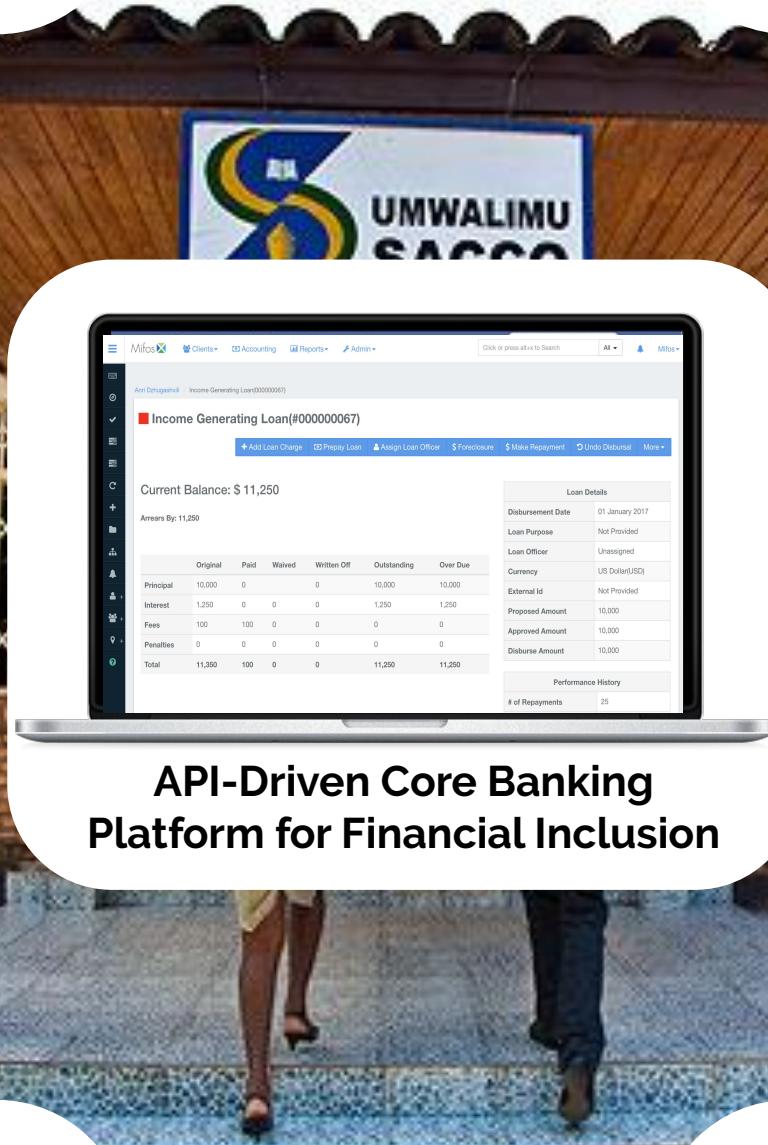
# Evolving Technology



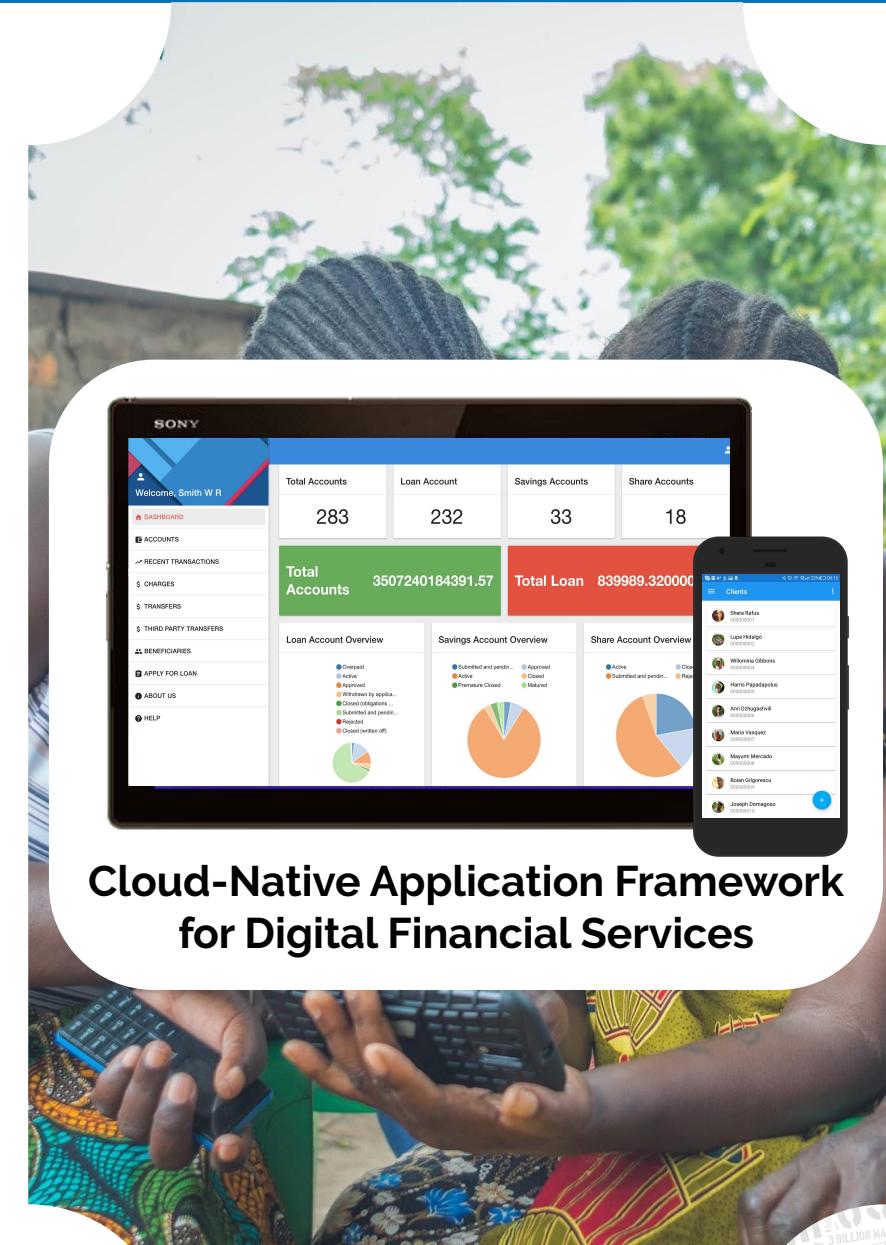
Web-based MIS for Microfinance



Microfinance

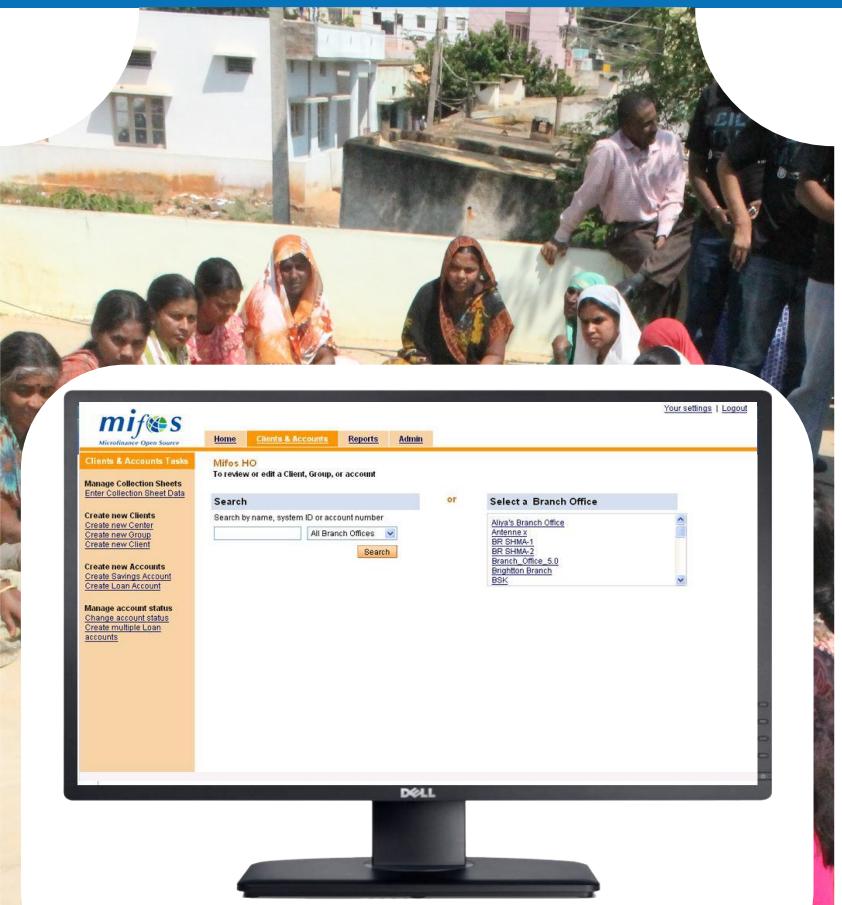


API-Driven Core Banking Platform for Financial Inclusion



Digital Financial Services

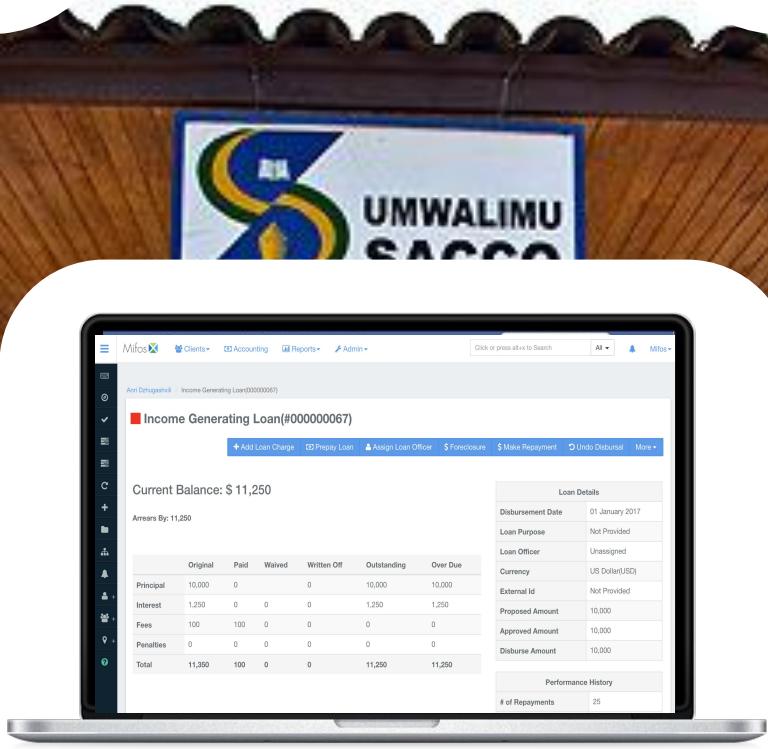
# Evolving Community & Governance Structure



Web-based MIS for Microfinance



Microfinance

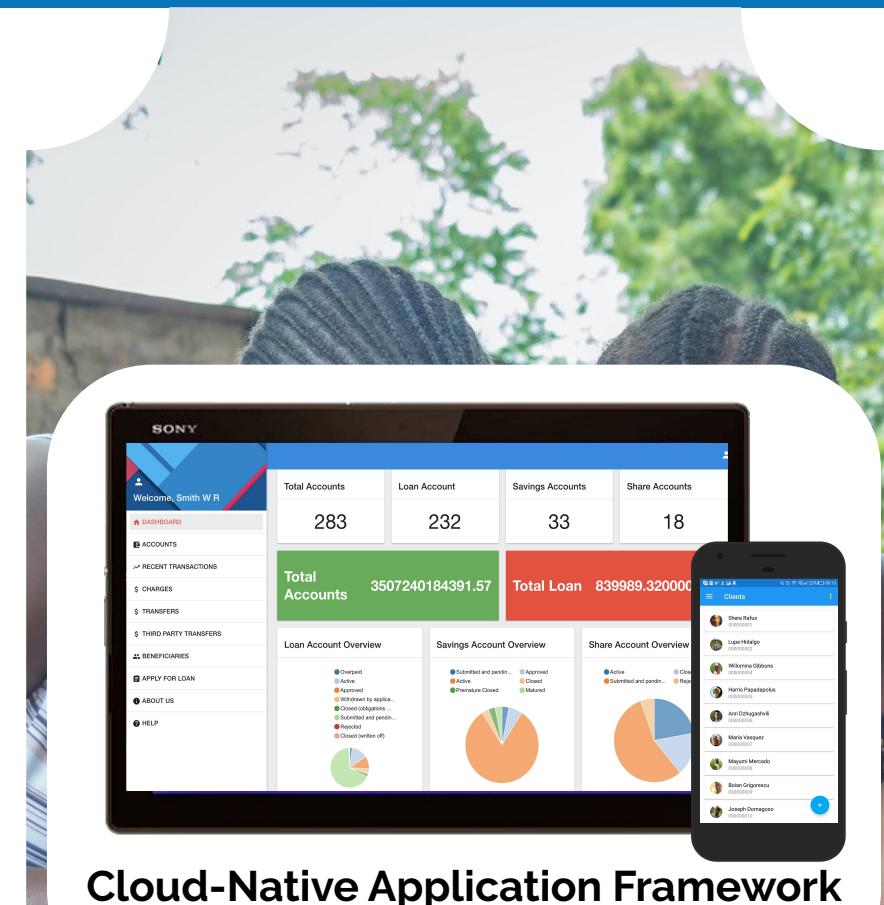


API-Driven Core Banking Platform for Financial Inclusion



Mifos Initiative

Financial Inclusion



Cloud-Native Application Framework for Digital Financial Services



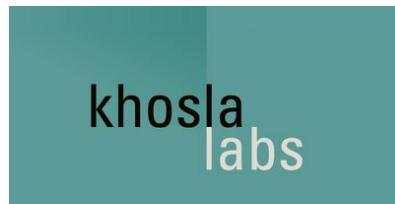
Digital Financial Services



# Powering the Enterprise



On-site deployment reaching 2.5 million clients in Indonesia



On-site deployment of Novobank to Microfinance Bank in India reaching 2M+ clients

mojaloop



Innovation Lab in Parallel to SAP



German Bank migrated mortgage loan portfolio to streamline processes and lower costs.

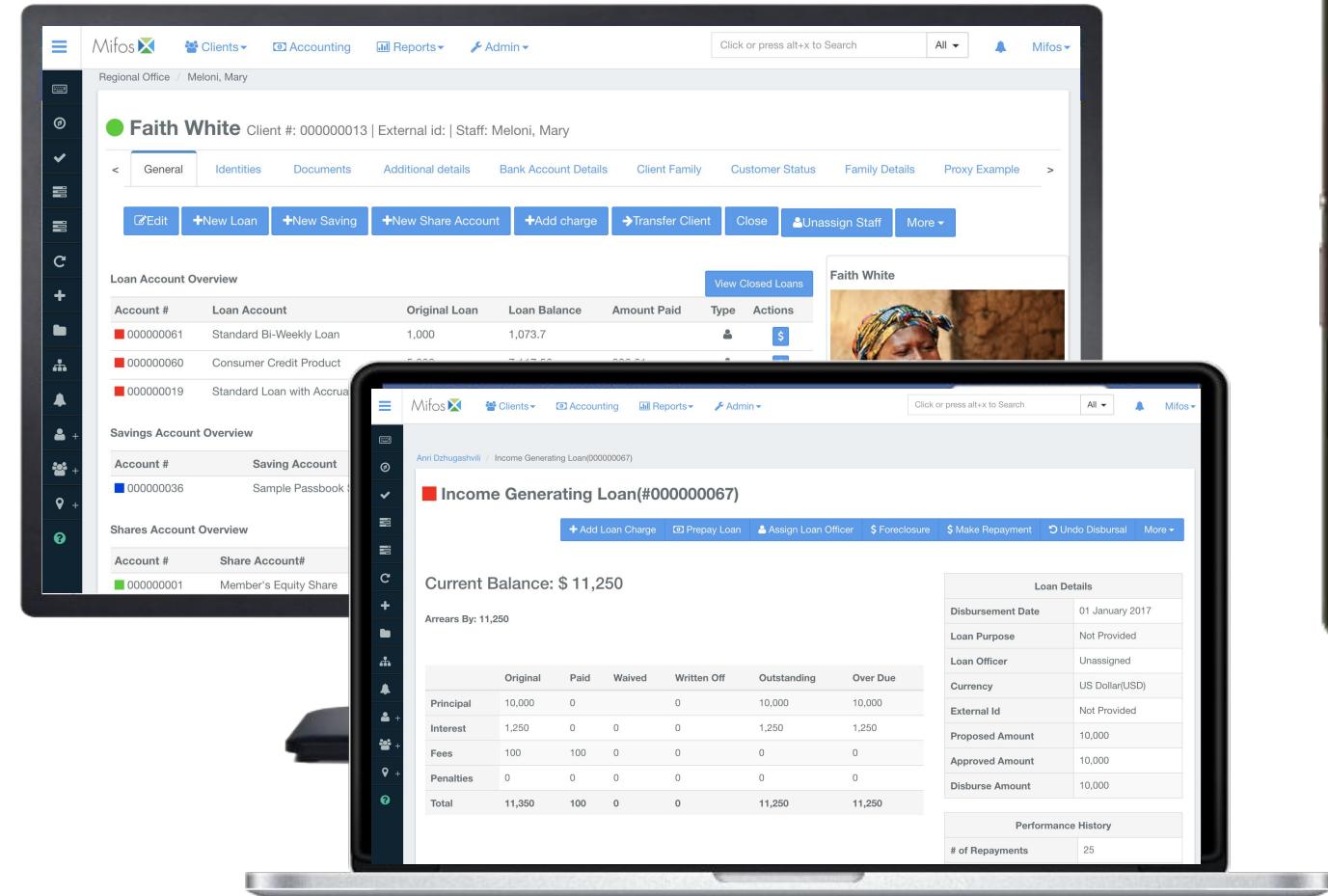
# Ecosystem - Fintech Powered by Mifos X



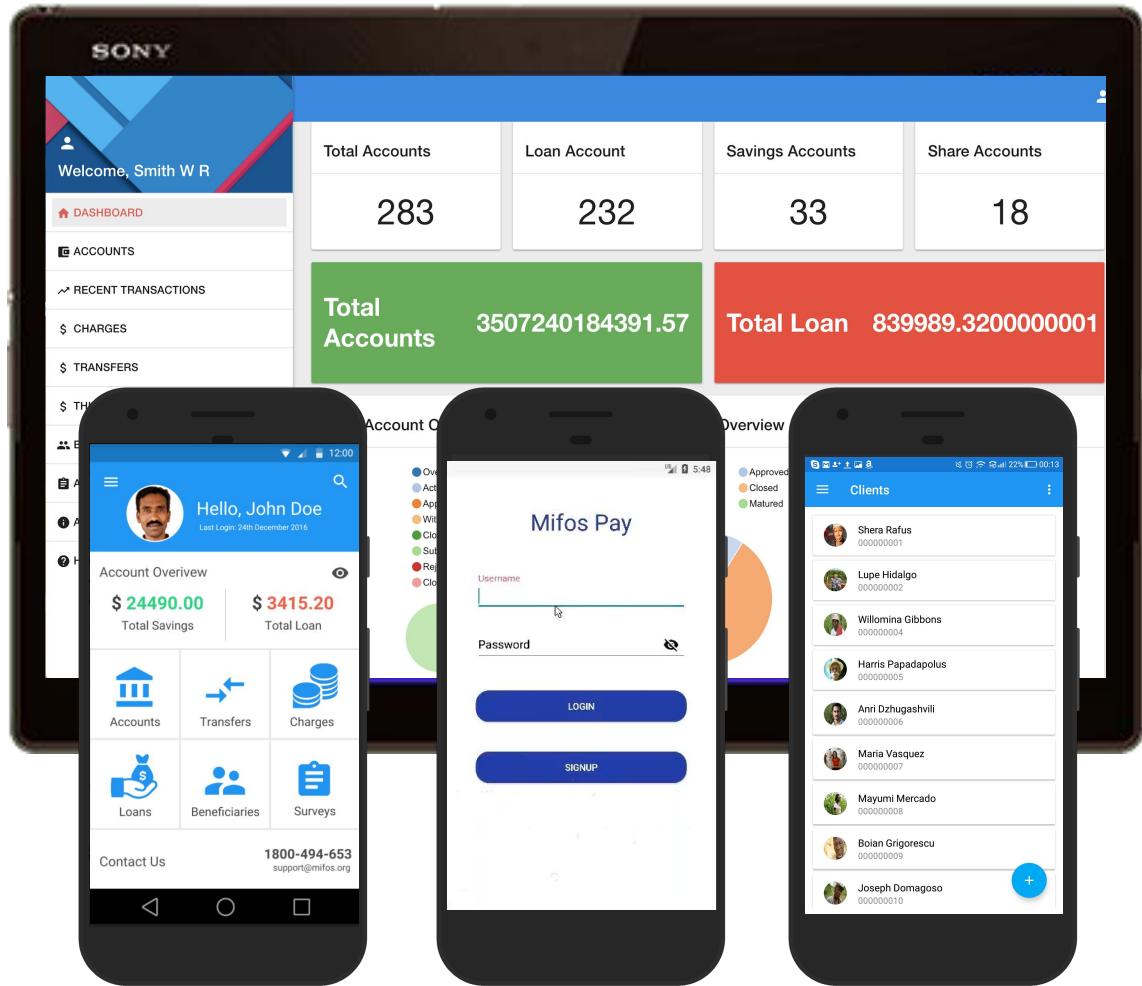
# Open Technology Stack for DFS Innovation

Online Banking App

Platform & APIs



Web App



Mobile Banking

Mobile Wallet

Mobile Field Ops

# Entire Market is Ripe for Open Innovation



## Financial Inclusion

### Financial Inclusion 2.0

Assist financial inclusion providers to make the digital transformation. For some, that will be deploying a solution at scale. For others that have already digitized, it will be in helping them to go digital or branchless.

- Banking as a Service
- Digital Financial Services Platforms
- Omnichannel Banking

## Fintech

### Build Apps Not Infrastructure

Fintech, and Digital Financial Service providers require flexible extensible architecture to rapidly build digital financial service innovations Telcos & Banks need cost-effective systems that allow them to scale and make profitable mobile money.

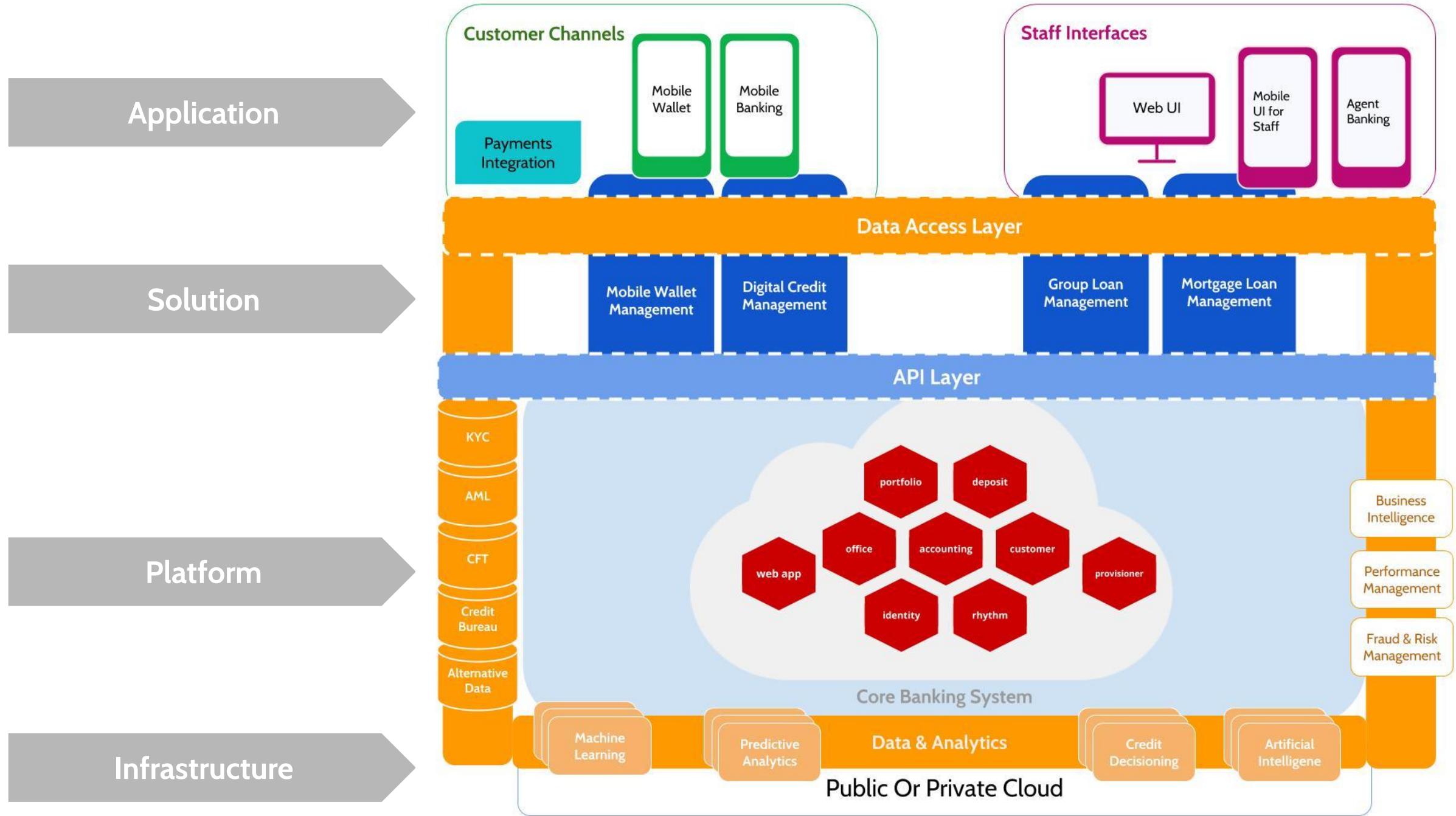
- Platform as a Service
- Enterprise Architectural Consulting
- Innovation Labs
- Application Framework

## Financial Sector

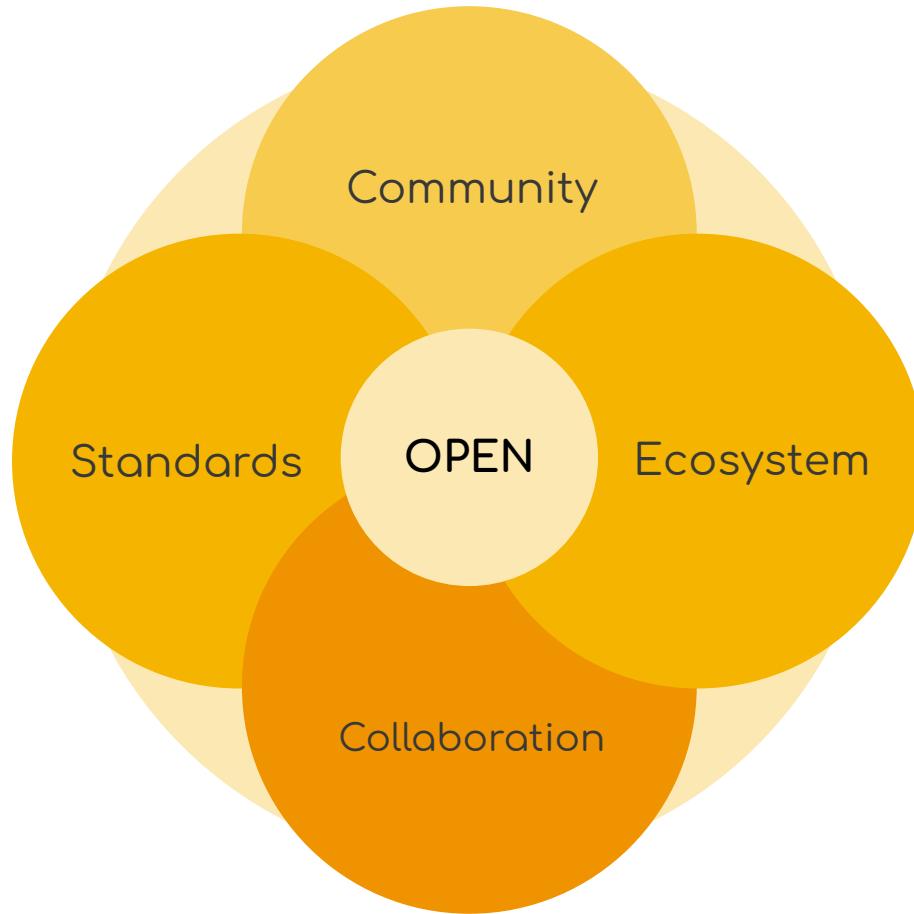
### Open Banking

Banks need to modernize their legacy core banking systems with more agile, responsive systems to improve customer experience. They need flexible architecture and APIs to compete and collaborate with fintech companies.

- Platform as a Service
- Enterprise Architectural Consulting
- Utilize front-end apps for innovation



# Open Goes Beyond Just the Technology Stack



# Why Mifos & Mojaloop

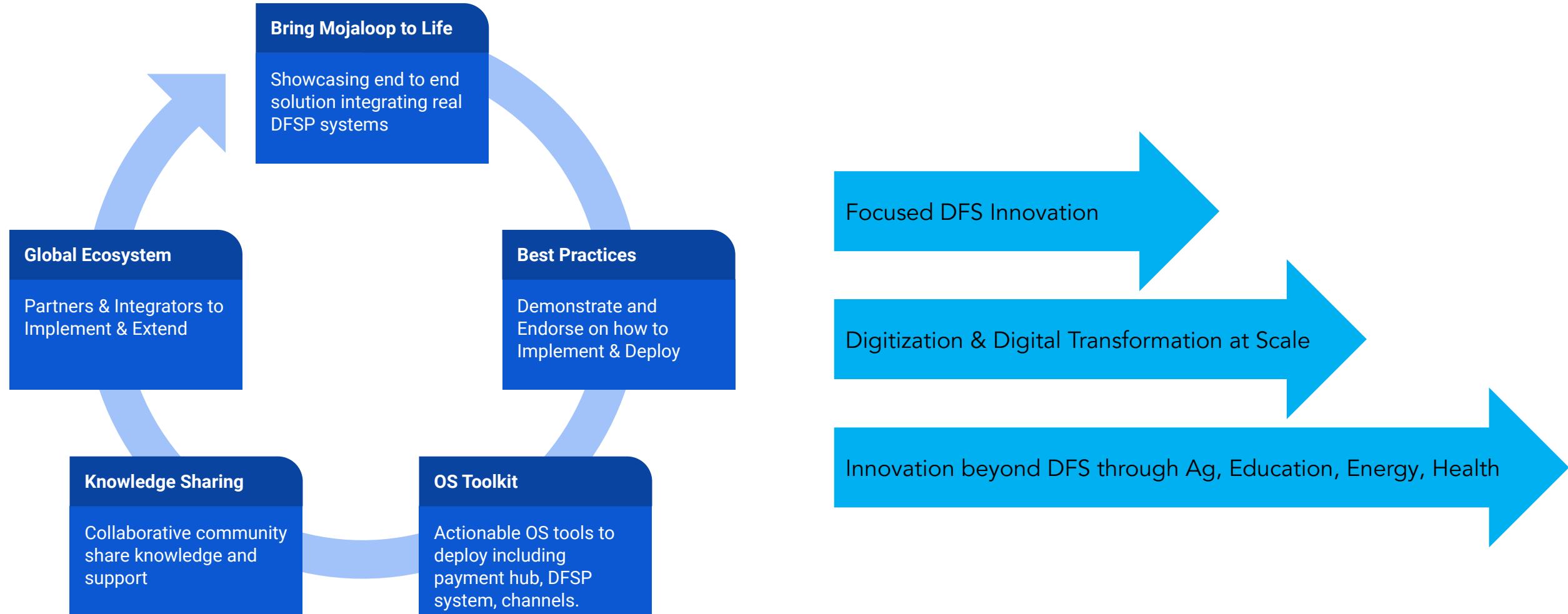
- Highly Complementary Open Source Systems
- Mifos/Fineract - Full Stack Banking Platform
  - Core Banking, Account & Wallet Management, Portfolio Management, Accounting, Business Intelligence, KYC
  - Mifos can be configured as a digital retail bank, an MFI, a savings group management solution, a mobile wallet provider, a savings cooperative, a marketplace lender, a digital credit solution, etc
- Mojaloop - Payment switch and Guiding Principles
  - Payment API, Interoperability, Central Directory
- 



End to End Open Source Architecture for Digital  
Financial Services



# Vision of Mifos Innovation Lab



Mojaloop provides the Digital Rails, Mifos is the  
mojaloop locomotive fueling innovation on top of it.

## Turn this Vision into a Reality

- Phase 1 being funded by Strategic Grant from DIAL to the Mifos Initiative
- Payment Hub Development & Integration with Mifos/Fineract being led by DPC Hungary
- Front End Channel Extension being led by developers from Mifos community'
- Mifos ecosystem provides a captive audience ready to consume and promote this integration.



# About DPC

- 20+ years in IT training, consultancy, software development from our own startup to support enterprises
- 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
- Experience with Fineract & Fineract CN
- Meet the Team



Istvan Molnar



Peter Santa



Marta Jankovics

with the support of Adam Nemeth, Karoly Torok, Tamas Szabo, Janos Meszaros, Kristof Jozsa, Zoltan Mezei

# Phase 1 Objectives & Functional Use Cases

- Setup and Configure Mojaloop in the Cloud
- Setup & Configure 4 DFSP instances across Fineract and Fineract CN (Mifos Gen 2 & 3)
- Build Payment Hub providing a Mojaloop Connector which enables transactions to flow via Mojaloop across the different DFSPs.
- Support four key transaction flow which demonstrate:
  - **Merchant Proximity Payment:**
    - Merchant displays dynamic QR code for client to scan with their smartphone (C2B)
  - **Peer to Peer Push Payment:**
    - Pay somebody just by knowing their phone number (P2P)
  - **Request for Payment:**
    - Receive a request for a payment and send back the funds to be paid (P2P/C2B)
  - **Bulk payment:**
    - Through online banking app, user initiates bulk payment by uploading CSV file. (B2C)



# What We've Done So Far?

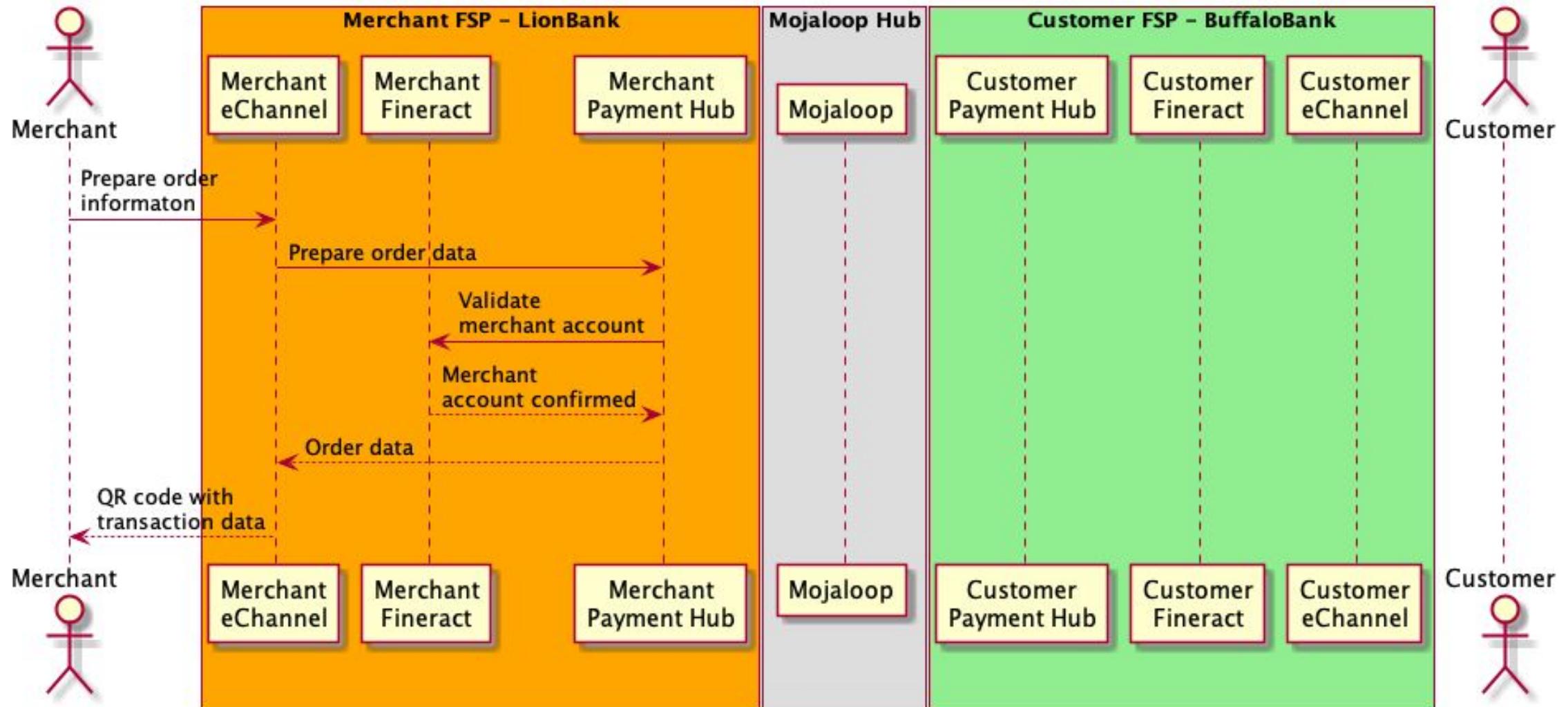
- Mojaloop and Fineract infrastructure fully deployed in AWS via Terraform Scripts, Fineract deployments are automated
- Designed the Payment Hub architecture
- Demo

## Implementation details

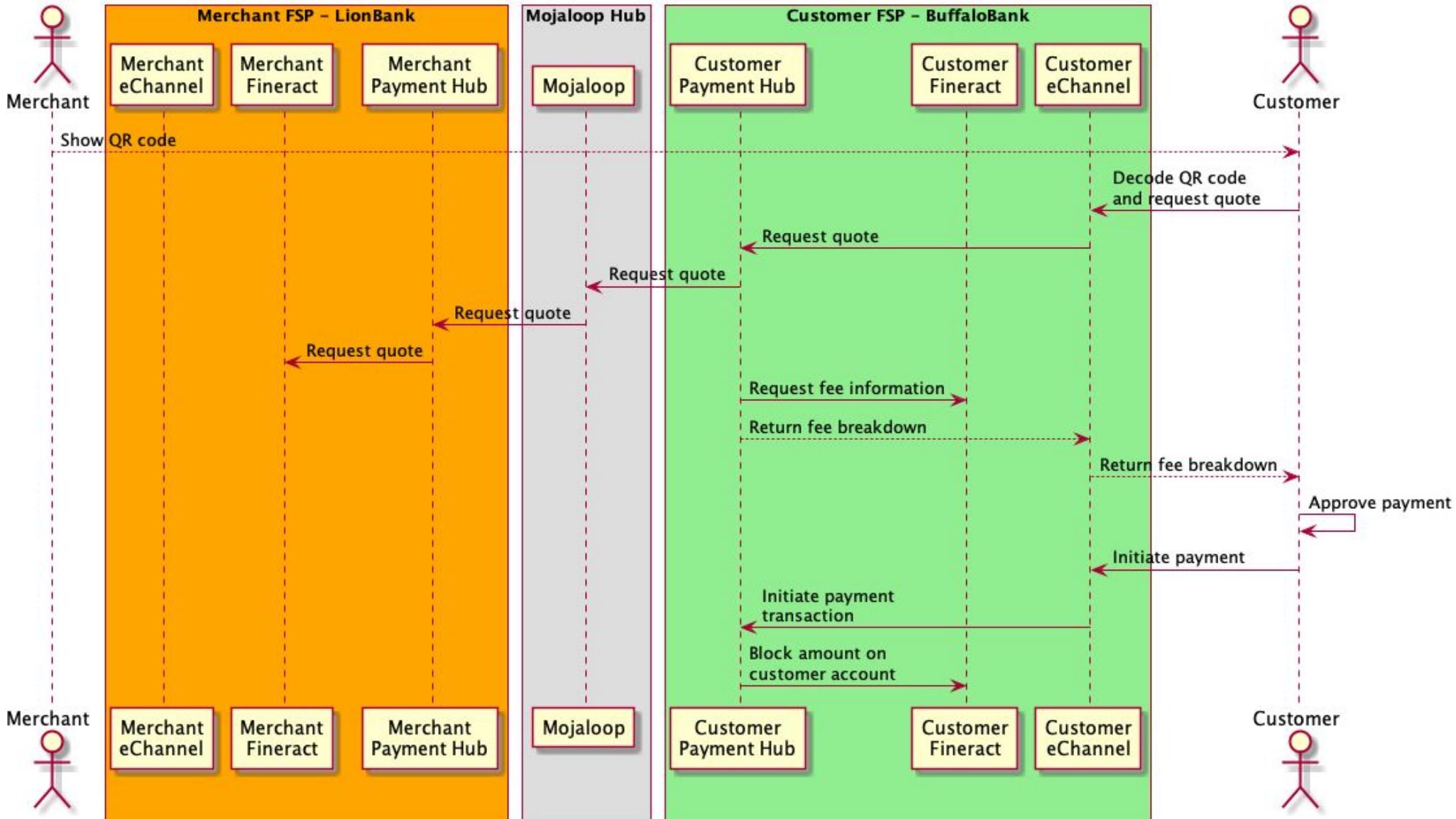
- Merchant payment flow
- Components of solution
  - Enhancing Fineract APIs
  - Payment Hub
  - Client application
- APIs to connect
- React Application to demonstrate
  - merchant interactions
  - customer interactions
- Fineract account details



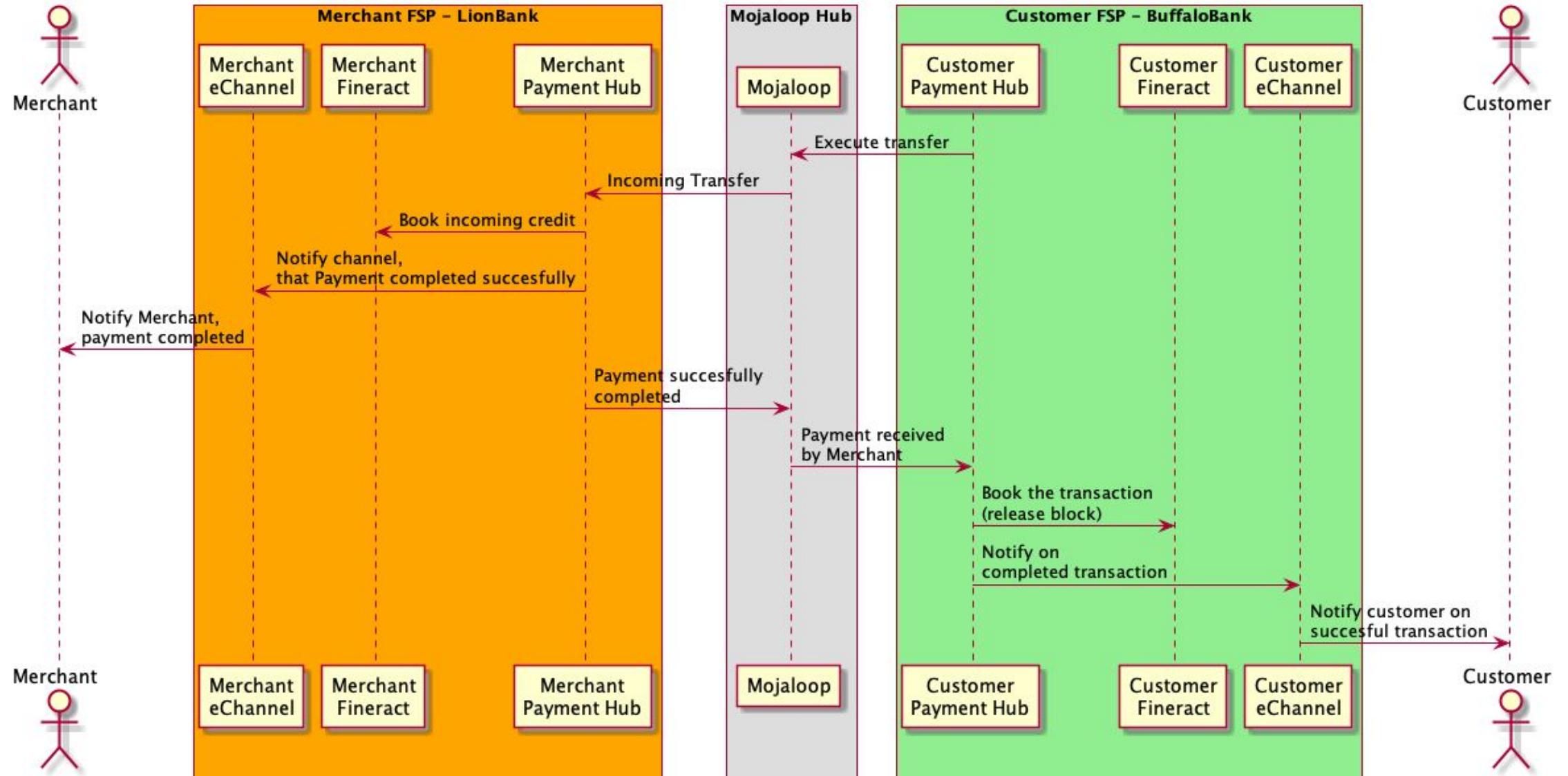
# Merchant prepare order information



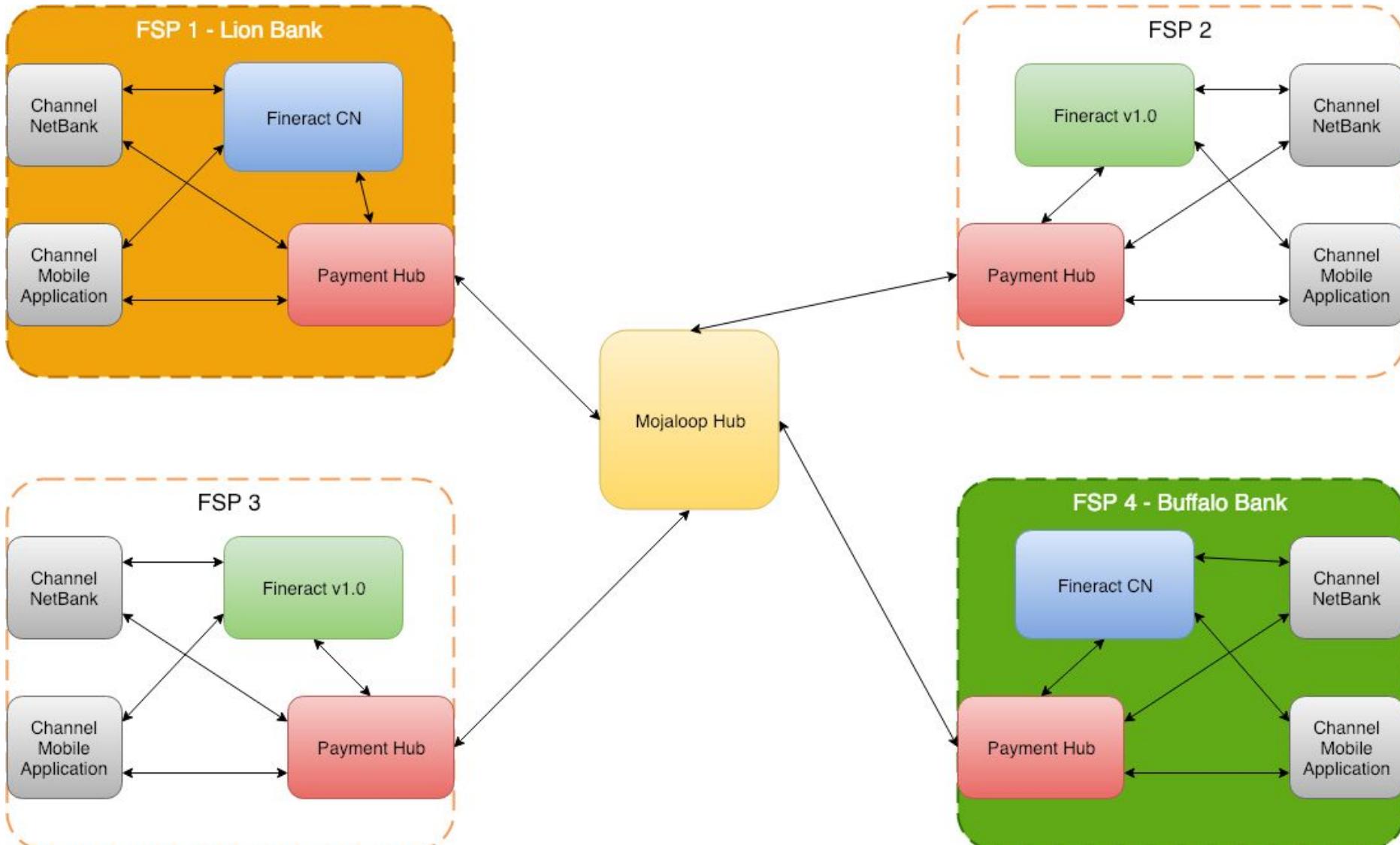
# Payment Initiated by Customer



# Payment received

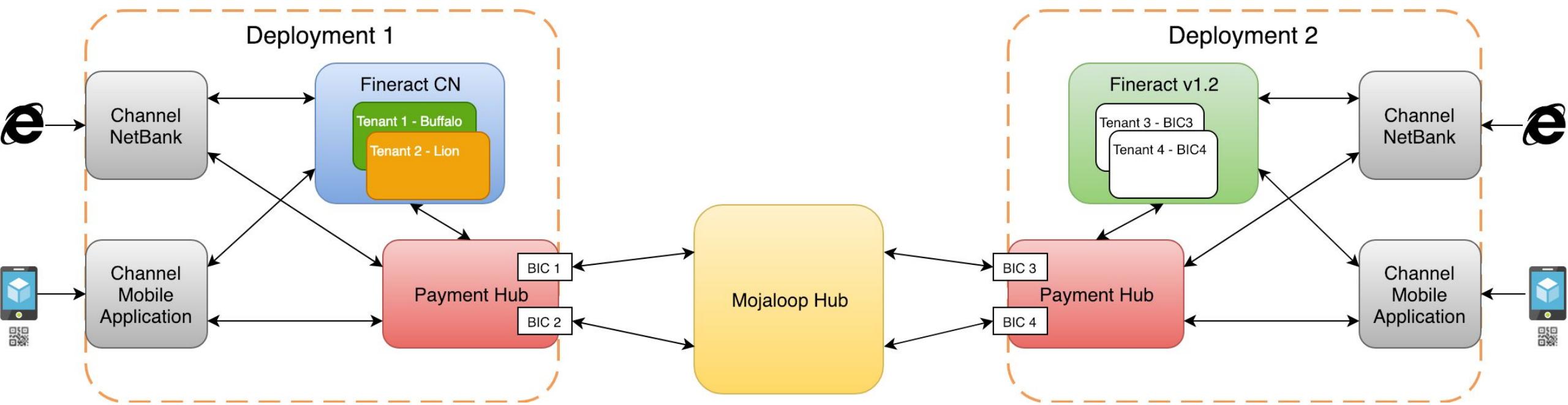


# Logical model of Lab Environment



# Lab environment deployment model

Utilizing Fineract multi-tenant capability



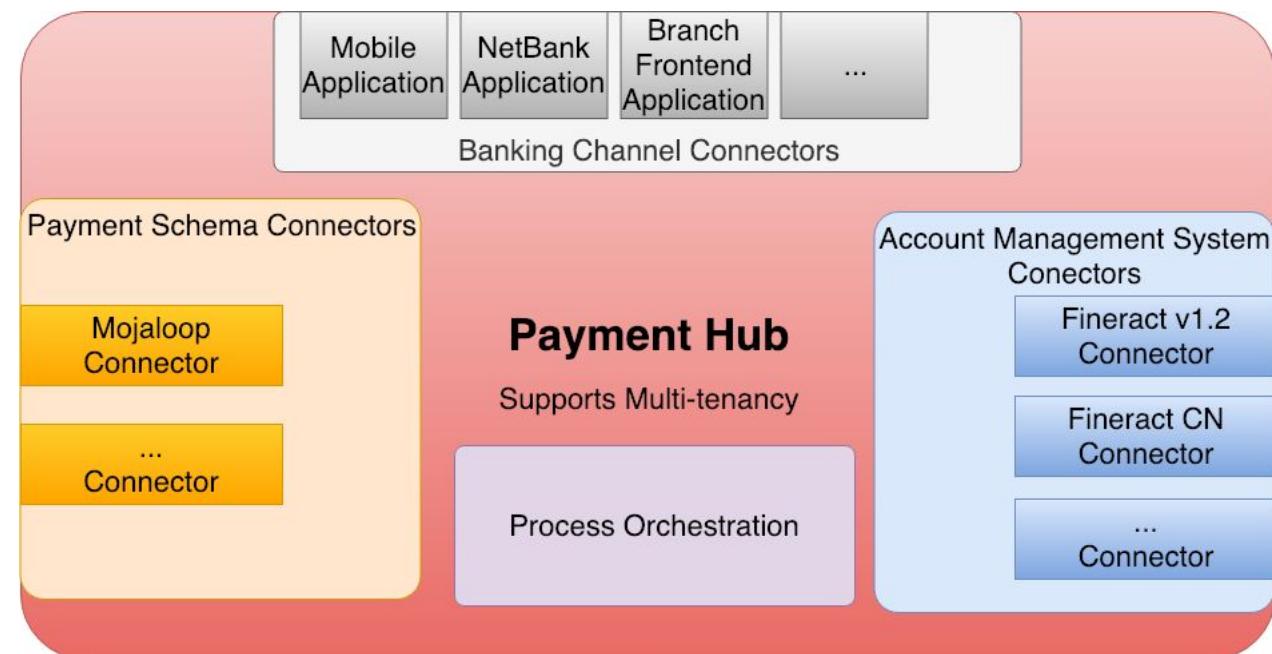
# Payment Hub at DFSP

The role of a payment hub to connect:

- Financial Institution channels (Mobile, Internet, Branch, Callcenter)
- Account Management System (AMS / Core banking platform)
- Payment Schemas, such as Mojaloop

Additional capabilities:

- Supports operation teams with investigation
- Could interface with Fraud monitoring system
- Automate reconciliation
- Manages the identifier – account assignment
- Trigger notifications



## Shadow Balance (?)

Enabling participation in realtime payment schemas by 24x7 operation, with 99.9+% availability.

Hold all the account states and balances, synchronized with the AMS (Account Management System)

Main functionality:

- Enable receiving funds continuously
- Making funds available for outgoing transactions (for electronic channels, card transactions)

Usage models:

- Always stand in – manage load, better response time
- Authorization (blocking) is passthrough, booking is asynchronous
- Passthrough when AMS is available, stand in when unavailable



# Payment Hub internals

Orchestrate the message flow between

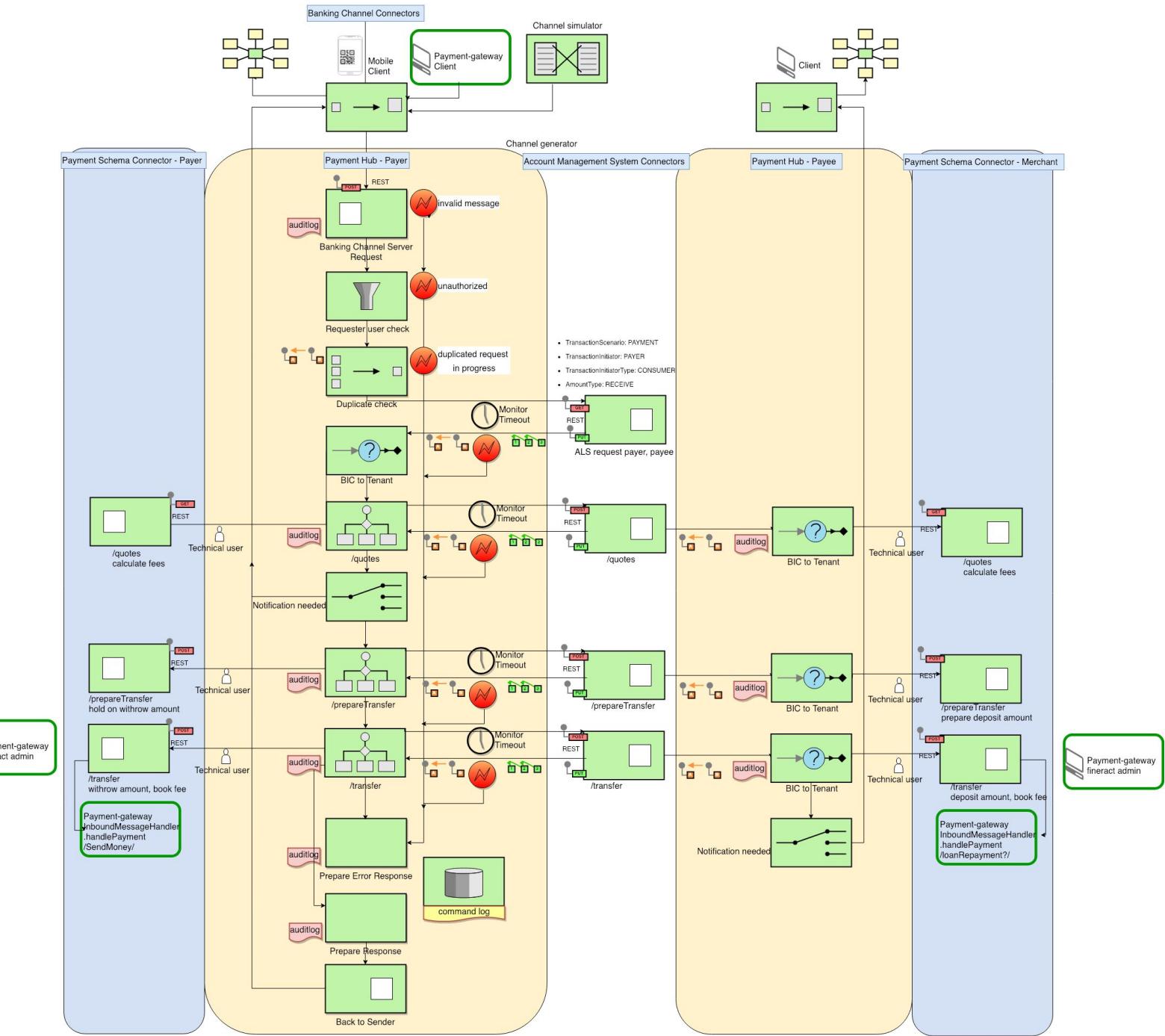
- banking channel
- AMS
- Mojaloop

both at the payer and the payee

Implementation is utilising Apache Camel in a Springboot container.

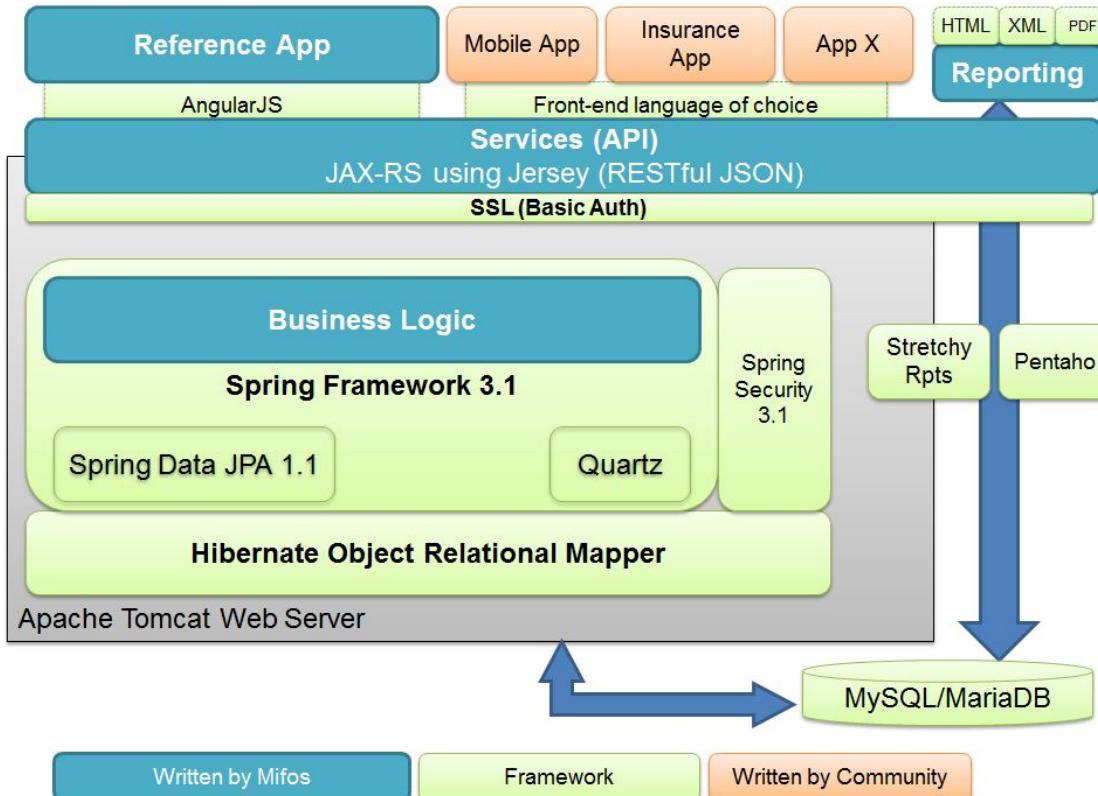
Deployment options:

- co-located with the AMS
- separate infrastructure to handle higher load
- autoscaling microservice

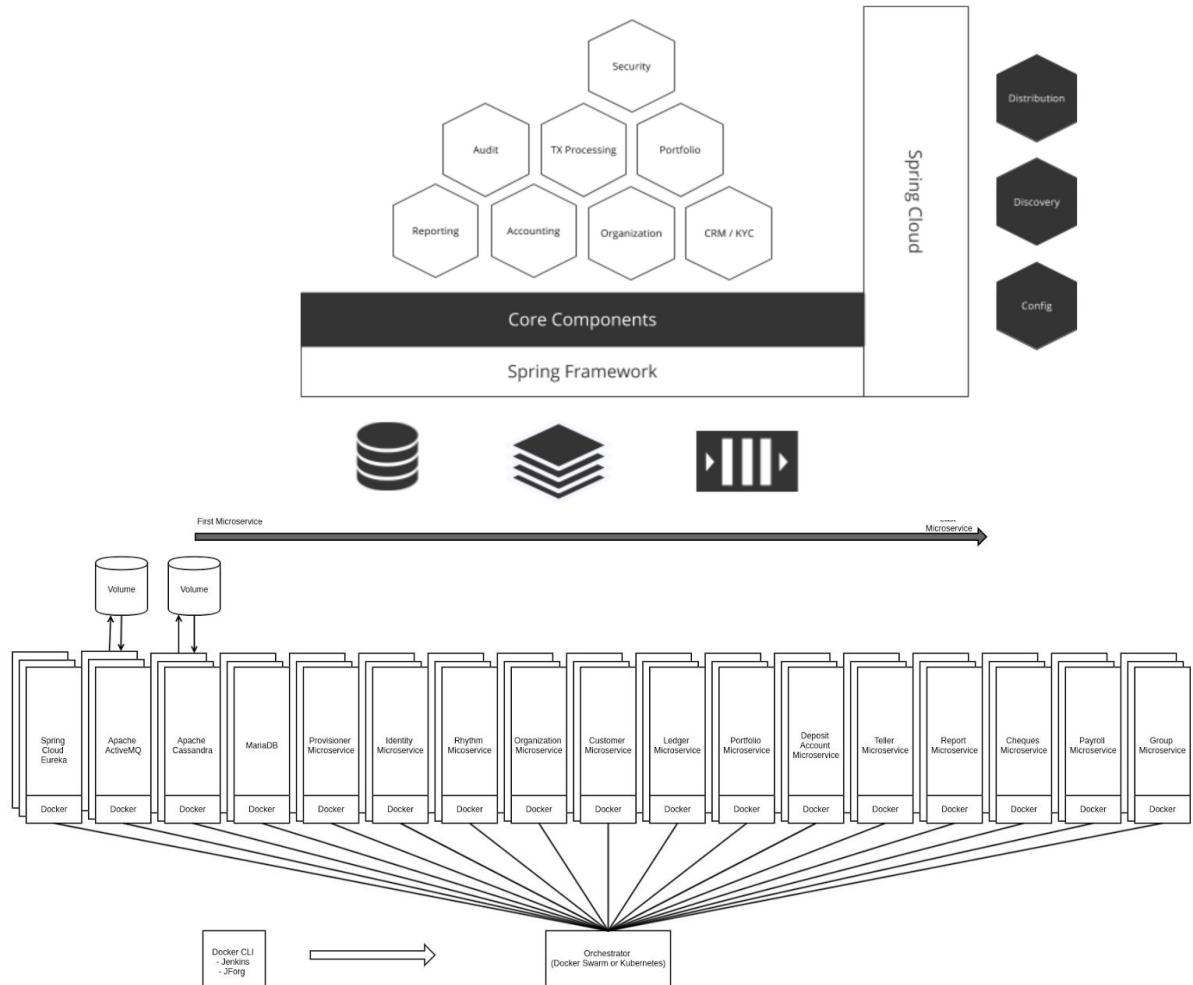


# Fineract Architecture

Fineract 1.x - Generation 2

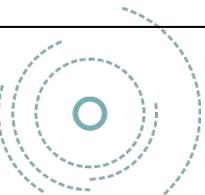


Fineract CN - Generation 3



# Fineract CN and 1.2 APIs supporting Payer integration

API	Description
GET /interoperation/v1/health	Checkpoint of the application is up and running
POST /interoperation/v1/requests	Ask a payer for approval to transfer funds to payee (for payee initiated transactions only)
POST /interoperation/v1/quotes	Calculation of possible fees and commissions involved in performing the payment
POST /interoperation/v1/transfers ?action=PREPARE	“Blocking” amount and quotes on customer account
POST /interoperation/v1/transfers ?action=CREATE	“Booking” Debit on customer account



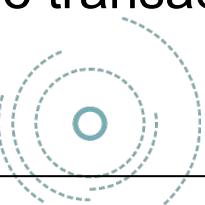
# Fineract CN and 1.2 APIs supporting Payee integration

API	Description
GET /interoperation/v1/health	Checkpoint of the application is up and running
POST /interoperation/v1/quotes	Calculation of possible fees and commissions involved in receiving the transaction
POST /interoperation/v1/transfers ?action=CREATE	“Booking” Credit on merchant account



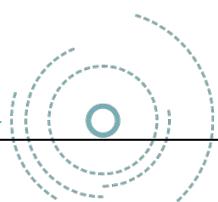
# Payment HUB API for banking channels

API	Description
POST /channel/transactions	Customer initiates payment
GET /channel/transactions	Inquiry of Payment State based on the transaction identifier
GET /channel/transactions/client	Inquiry of Payment State based on the channel client reference identifier
POST /interoperation/notifications/quote	Notification sent from Payment HUB to customer to confirm calculated transaction amount and costs
POST /interoperation/notifications	Notification sent from Payment HUB to merchant when the transaction has been performed
PUT /interoperation/transactions/{id}	Response from Payment HUB to customer when the transaction has been finished /error if transaction failed



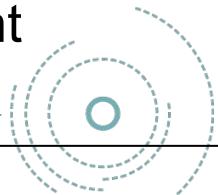
# Payment HUB API for Mojaloop

API	Description
POST /participants/{idType}/{id}	MSISDN based lookup to find out in which FSP the customer and merchant are located
PUT /switch/participants	Callback to inform the client of a successful lookup /error if Mojaloop was unable to find the provided identity
POST /switch/quotes	Payer HUB sent a quoting request to Mojaloop and merchant HUB receives it
PUT /switch/quotes/{id}	Payer HUB receives the result of the calculated Payee quotes /error if quote calculation failed
POST /switch/transfers	Transfer request to the Payee (merchant) from Mojaloop
PUT /switch/transfers/{id}	Callback endpoint for Mojaloop where the response of successful transfer is received /error if transfer failed



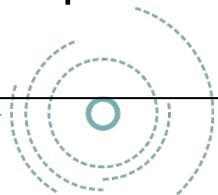
# Mojaloop APIs utilized for transfer from Payer

Mojaloop API	Description
POST /participants/{idType}/{id}	MSISDN based lookup to find out in which FSP the customer and merchant are located
POST /quotes	Get a quotation from payee to validate account and receive conditions
POST /transfers	Initiates to book the payment on merchant side
Callback API (invoked by Mojaloop)	Description
PUT /participants/{idType}/{id}	Callback to inform the client of a successful lookup /error if the server was unable to find the provided identity
PUT /quotes/{id}	Guarantees that payee quotes are applicable until the quote expires /error if something went wrong calculating the payee quotes
PUT /transfers/{id}	Initiates that merchant has booked the transfer amount /error if merchant was unable to perform the transfer

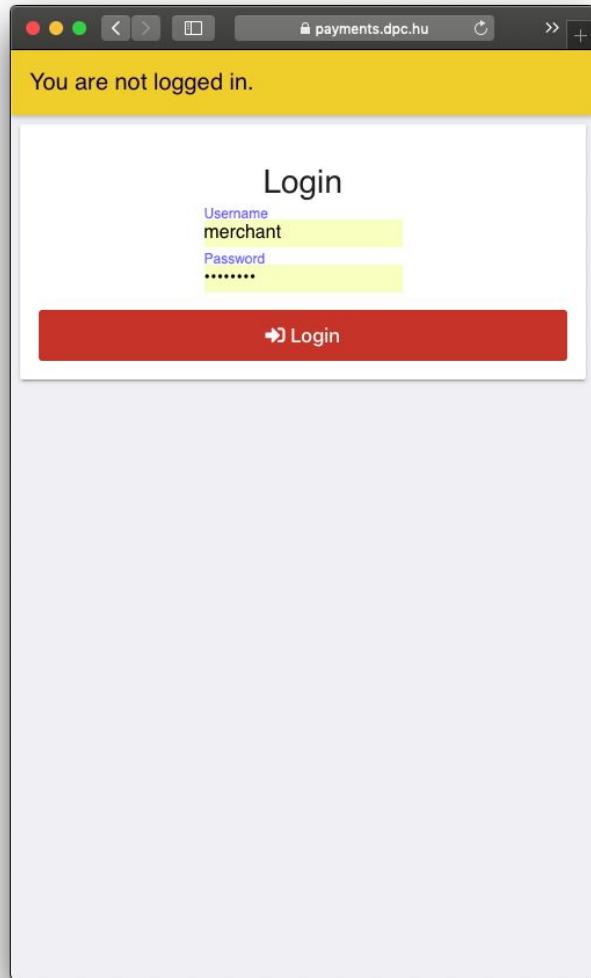


# Mojaloop APIs utilized for transfer to Payee

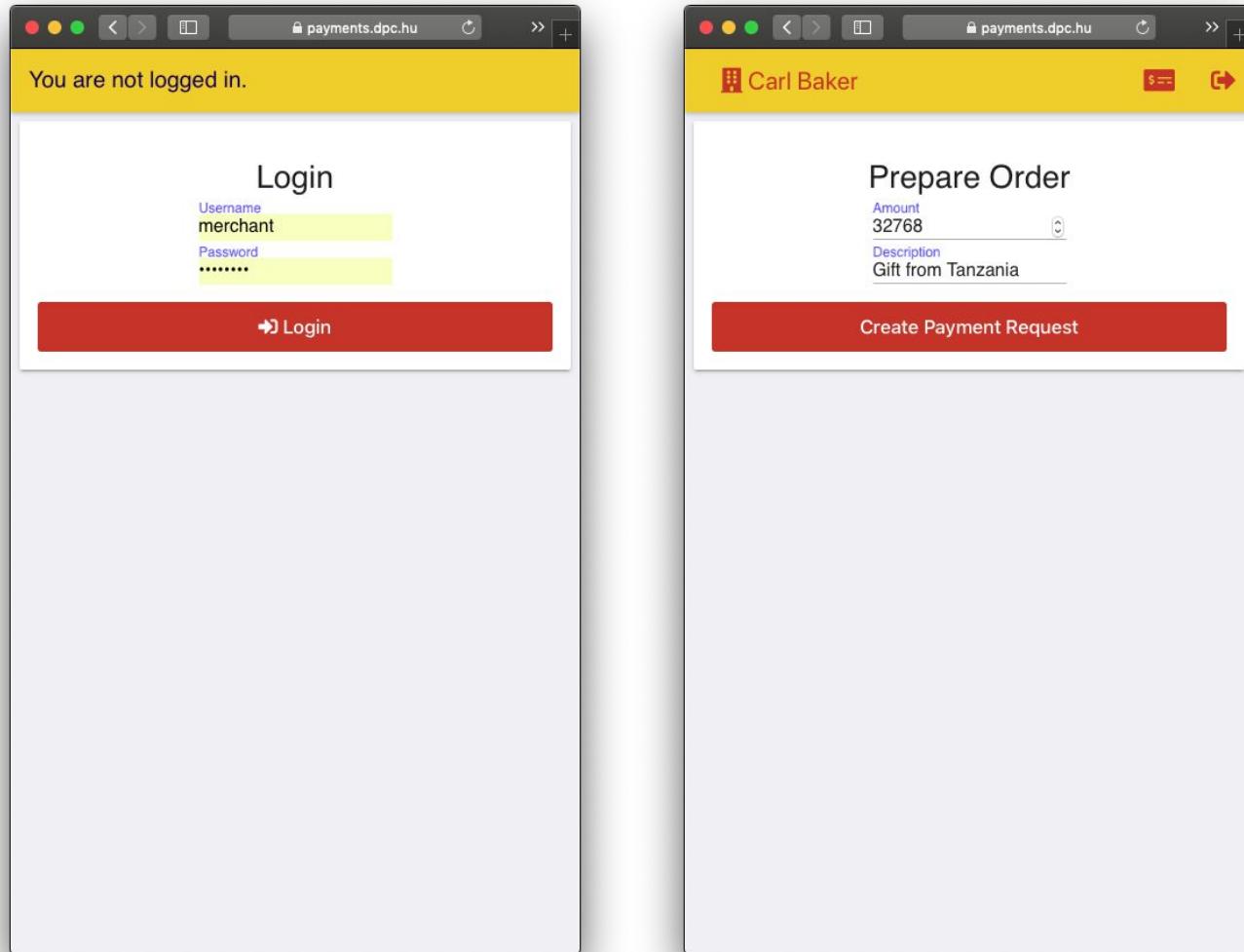
<b>Callback API (invoked by Mojaloop)</b>	<b>Description</b>
POST /quotes	Requests quotation from payee to validate account and receive conditions
POST /transfers	Initiates to book the payment on merchant side
<b>Mojaloop API</b>	<b>Description</b>
PUT /quotes/{id}	Payee quotes are calculated and applicable until the quote expires
PUT /quotes/{id}/error	Initiates that something went wrong calculating the payee quotes
PUT /transfers/{id}	Callback that merchant has successfully booked the transfer amount
PUT /transfers/{id}/error	Merchant was unable to perform the transfer, or another processing error occurred



# Merchant prepares transaction

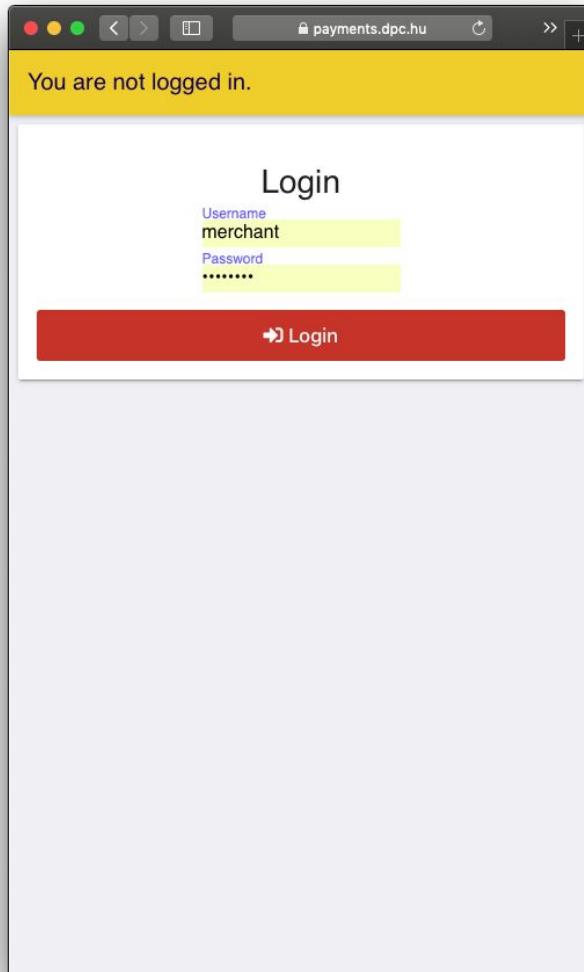


# Merchant prepares transaction



# Merchant prepares transaction

Dynamic QR code includes transaction details



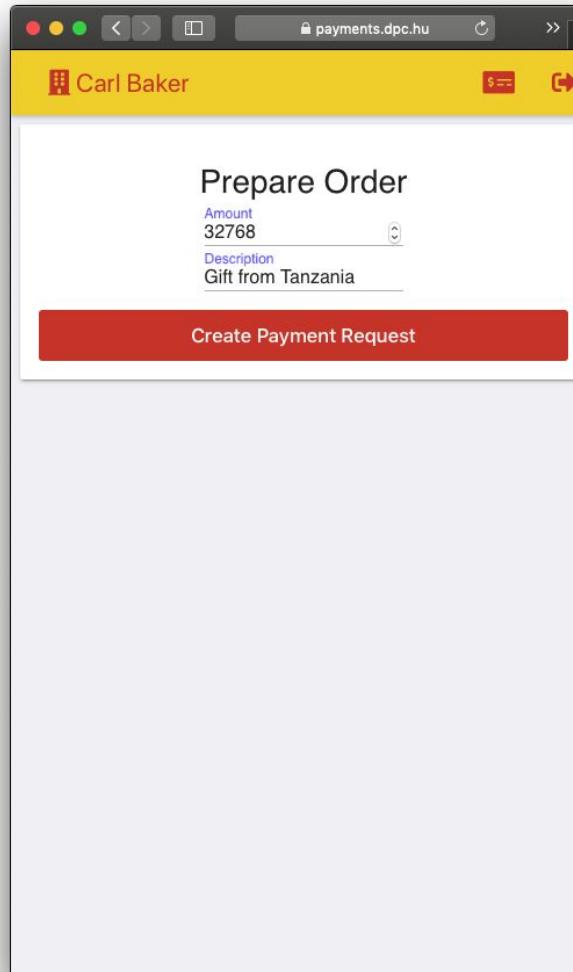
You are not logged in.

Login

Username  
merchant

Password  
\*\*\*\*\*

Login



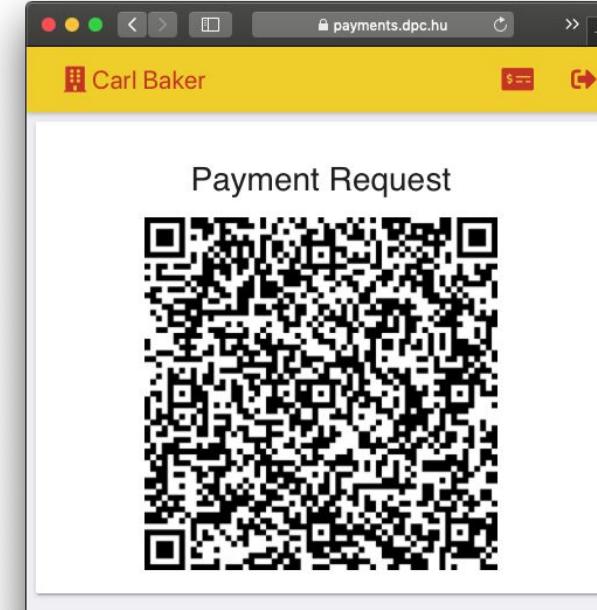
Carl Baker

Prepare Order

Amount  
32768

Description  
Gift from Tanzania

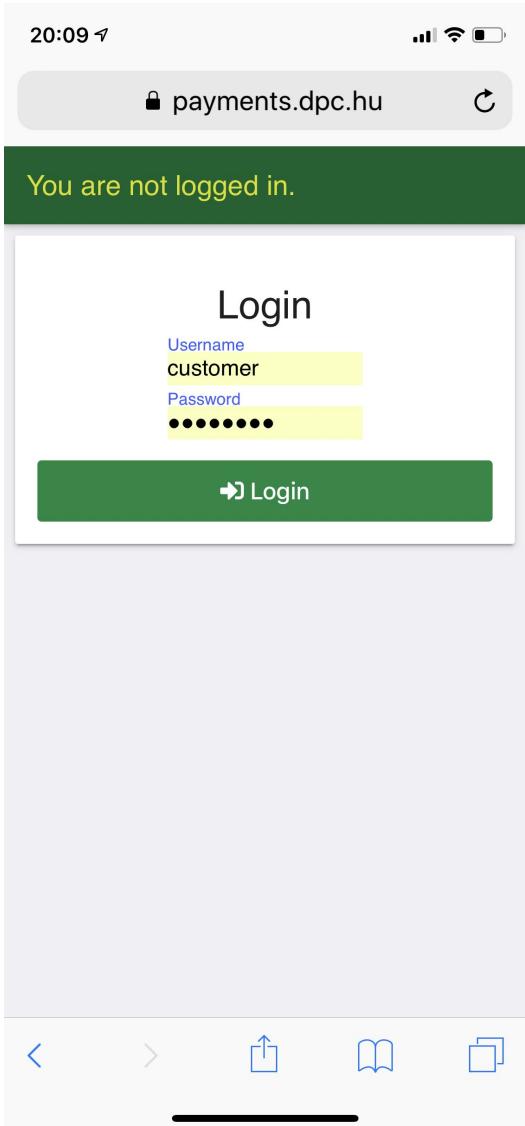
Create Payment Request



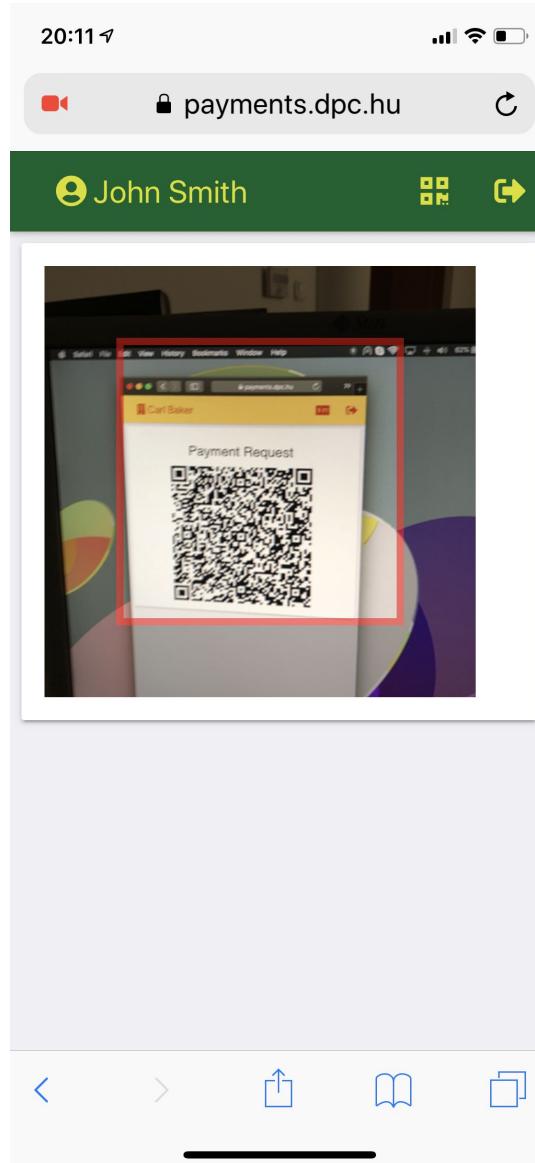
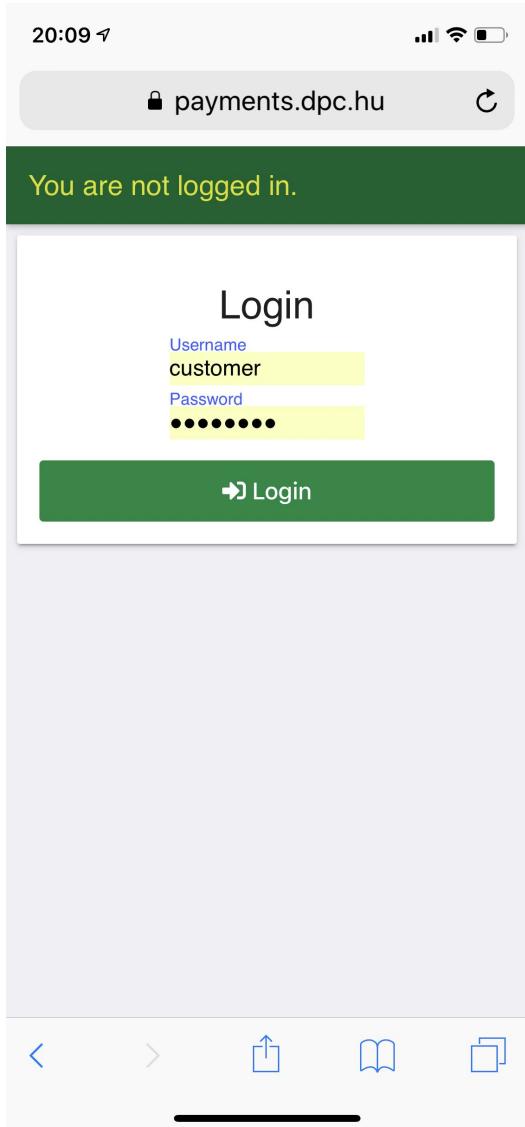
```
upi://pay?pa=IC11in02tn01305e663e1e4611e9ab14d6&pn=Carl%20Baker&mc=0000&tr=f9fb43a0-20d4-11e9-9250-9b947ad8cda0&tn=Gift%20from%20Tanzania&am=32768&cu=TZS&refUrl=https://webshop.dpc.hu/orderId=f9fb6ab0-20d4-11e9-9250-9b947ad8cda0
```



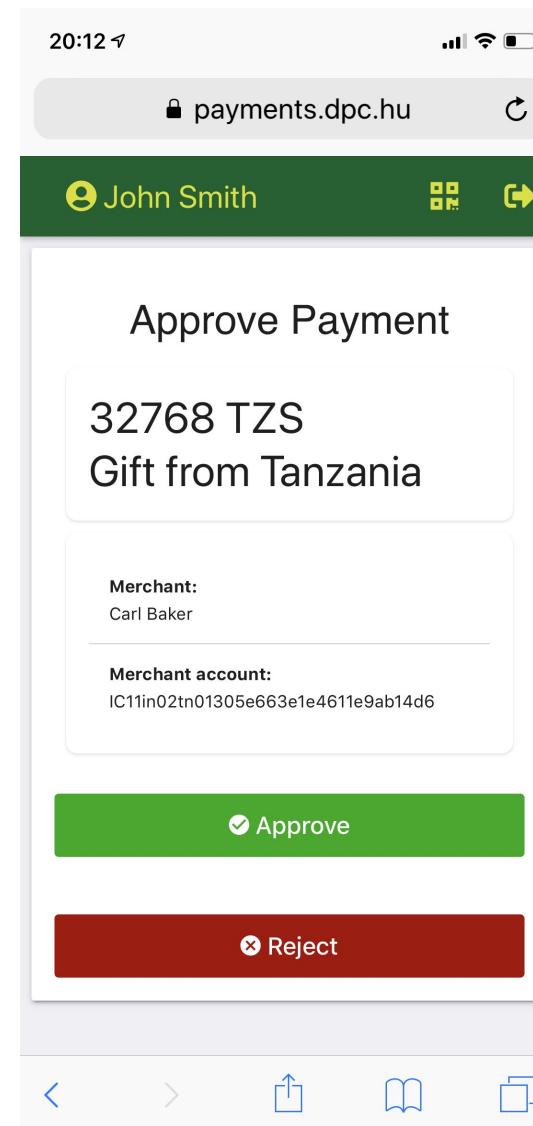
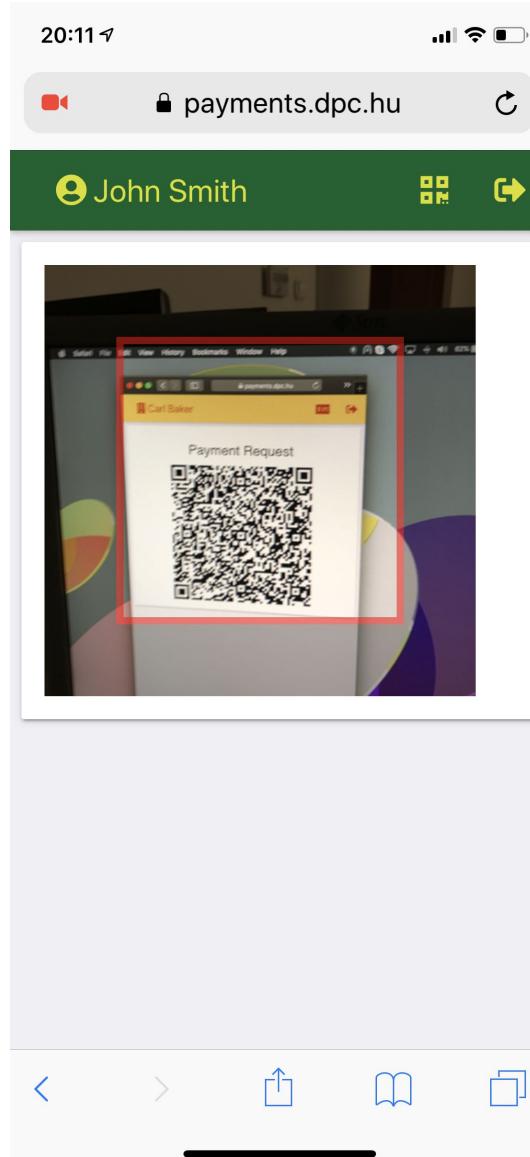
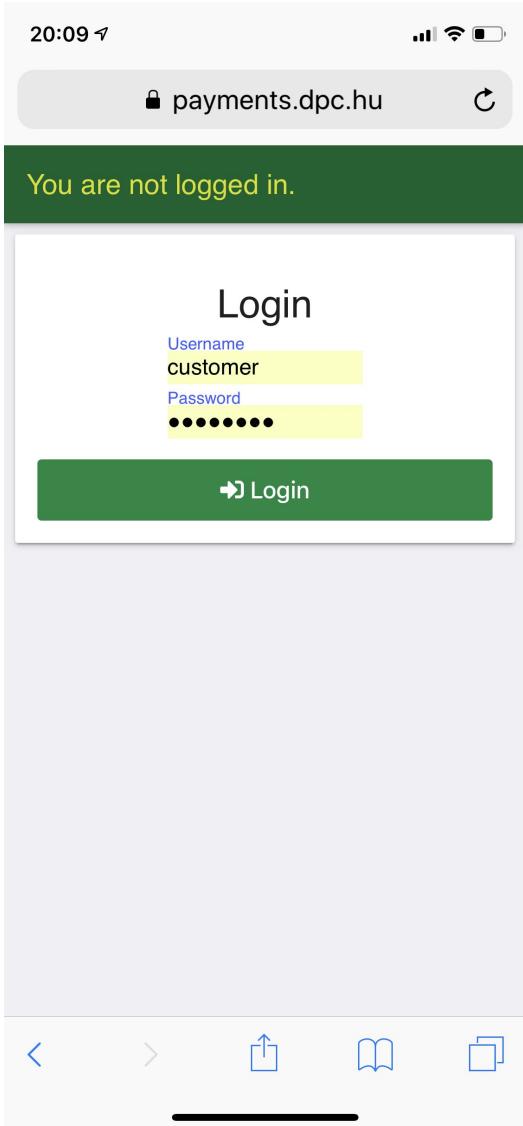
# Customer Initiate Payment



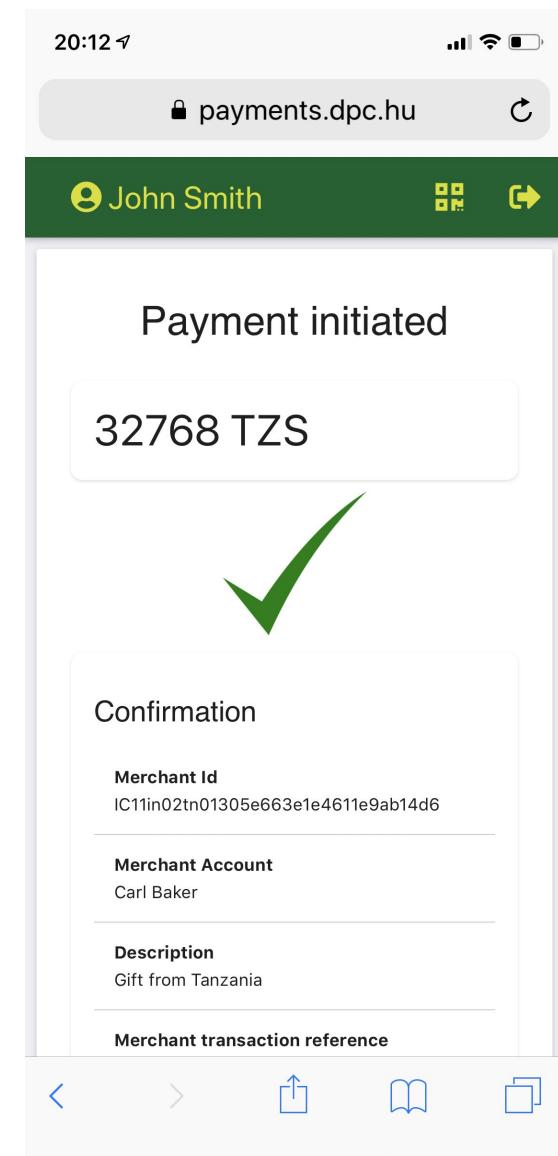
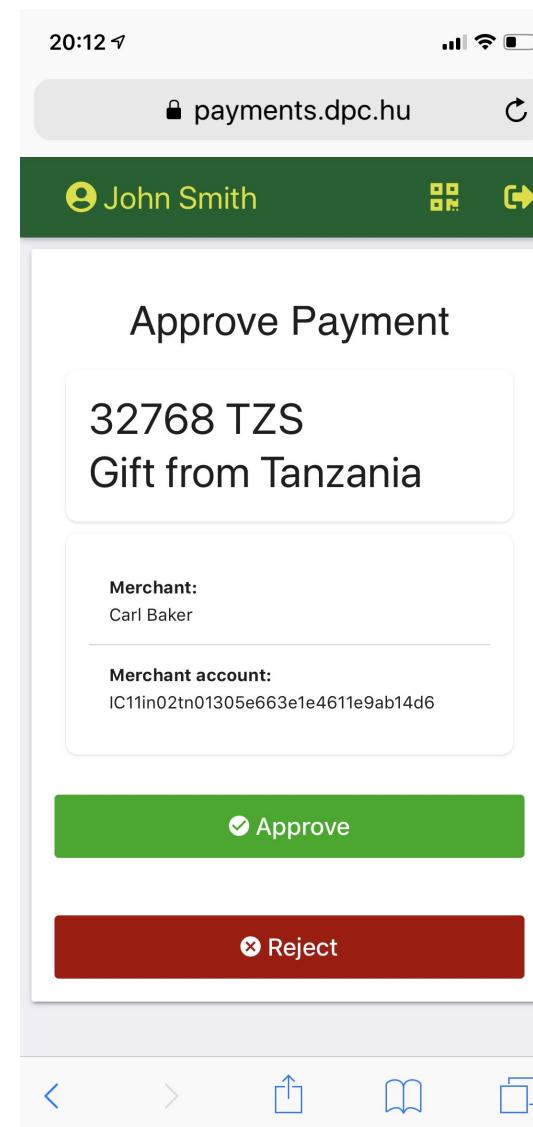
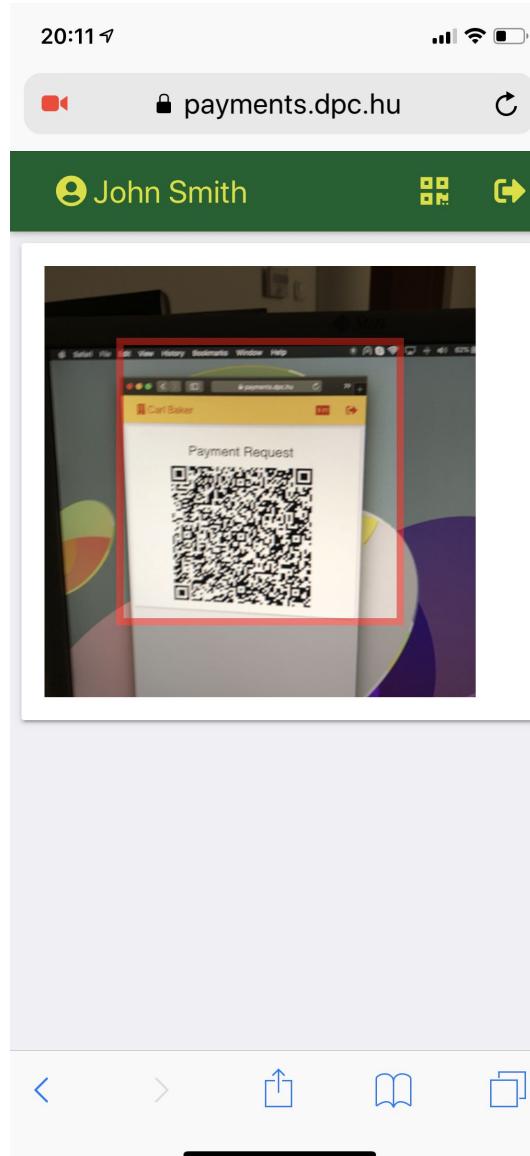
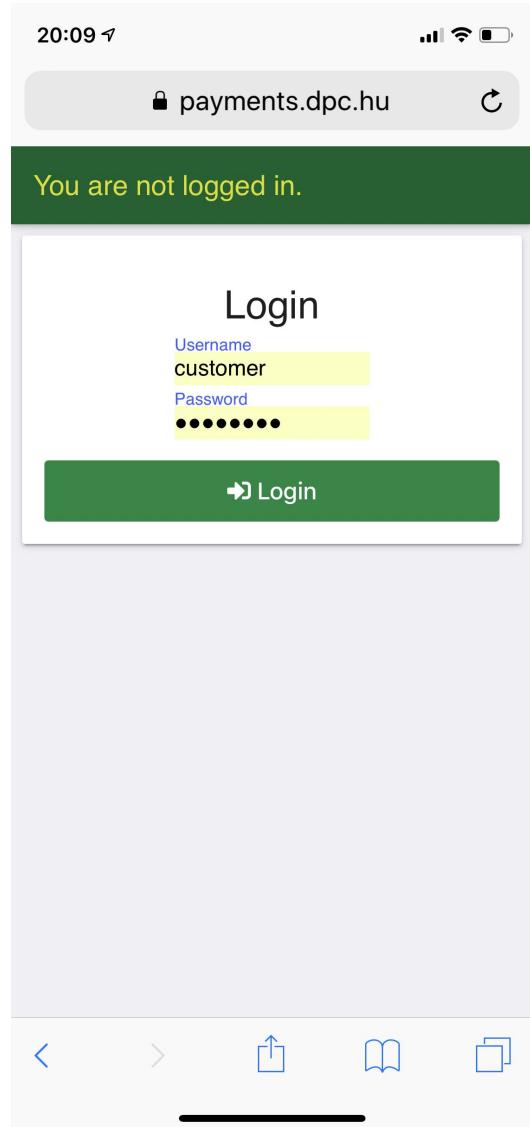
# Customer Initiate Payment



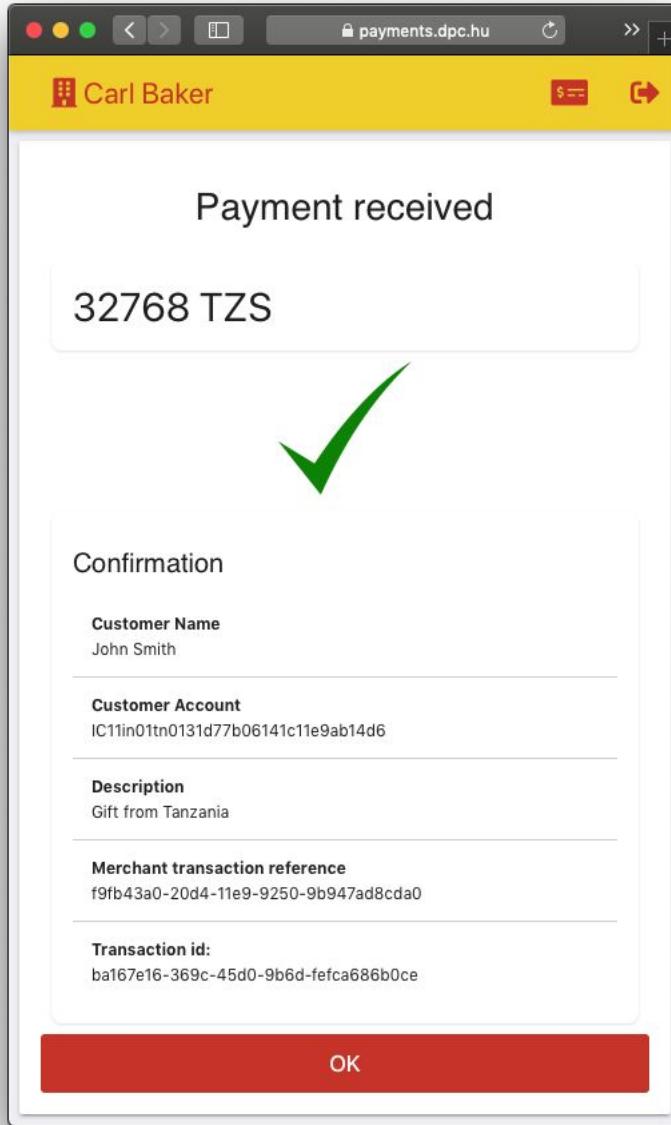
# Customer Initiate Payment



# Customer Initiate Payment



# Payment received by Merchant



# Merchant bank account in Fineract – Lion Bank

The screenshot shows the Fineract web application interface. The left sidebar contains navigation links: Quick access, Offices (Manage offices), Roles/Permissions (Manage roles and permissions), Employees (Manage employees), Accounting (Manage ledger accounts), Member (Manage members), Loan products (Manage loan products), Deposit (Account management), and Teller (Teller management). The main content area displays account entries for account 83c4ed1c074b484e85cc79, filtered by start date 2019-01-29 and end date 2019-01-29. The table includes columns for Transaction date, Type, Message, Amount, and Balance. The entries show multiple debit transactions from various sources, with a final balance of 1051000.

Transaction date	Type	Message	Amount	Balance
1/29/2019, 10:47 PM	DEBIT	Gift from Tanzania	32768	1141990
1/29/2019, 6:02 PM	DEBIT	this is african mask	5000	1109222
1/29/2019, 6:01 PM	DEBIT	tanzanite is not enough	8000	1104222
1/29/2019, 6:00 PM	DEBIT	one more tanzanite	9000	1096222
1/29/2019, 6:00 PM	DEBIT	one more tanzanite	9000	1087222
1/29/2019, 5:57 PM	DEBIT	one more tanzanite	9000	1078222
1/29/2019, 5:57 PM	DEBIT	7th purchase from the bank	6000	1069222
1/29/2019, 5:56 PM	DEBIT	tanzanite 3	2222	1063222
1/29/2019, 5:55 PM	DEBIT	tanzanite 2	10000	1061000
1/29/2019, 5:54 PM	DEBIT	tanzanite	30000	1051000

# Customers bank account in Fineract – Buffalo Bank

The screenshot shows the Fineract web application interface for Buffalo Bank. On the left is a sidebar with various management links: Quick access, Offices (Manage offices), Roles/Permissions (Manage roles and permissions), Employees (Manage employees), Accounting (Manage ledger accounts), Member (Manage members), Loan products (Manage loan products), Deposit (Account management), and Teller (Teller management). The main content area displays account entries for a specific account. The title bar says "Account entries for account 31d77b06141c11e9ab14d6". The search filters show "Start date: 2019-01-29" and "End date: 2019-01-29". The table lists transactions with columns: Transaction date, Type, Message, Amount, and Balance. The transactions are:

Transaction date	Type	Message	Amount	Balance
1/29/2019, 10:47 PM	DEBIT	Gift from Tanzania #release on hold	327.68	776903.56
1/29/2019, 10:47 PM	DEBIT	Gift from Tanzania #release on hold	32768	809671.56
1/29/2019, 10:47 PM	CREDIT	Gift from Tanzania	327.68	776248.2
1/29/2019, 10:47 PM	CREDIT	Gift from Tanzania	32768	743480.2
1/29/2019, 10:47 PM	CREDIT	Gift from Tanzania #put on hold	327.68	809343.88
1/29/2019, 10:47 PM	CREDIT	Gift from Tanzania #put on hold	32768	776575.88
1/29/2019, 6:02 PM	DEBIT	this is african mask #release on hold	50	814771.56
1/29/2019, 6:02 PM	DEBIT	this is african mask #release on hold	5000	819771.56
1/29/2019, 6:02 PM	CREDIT	this is african mask	50	814671.56
1/29/2019, 6:02 PM	CREDIT	this is african mask	5000	809671.56

At the bottom, there are pagination controls: "Rows per page: 10", "1-10 of 96", and navigation arrows.

# What We've Learned

- Challenges
  - Knowing status of whether an API has been implemented yet or not
  - Viewing transaction end to end flow in Mojaloop
  - Simulators for pathfinder works with MSISDNs only at the current form
  - Having a complete running instance requires adequate resources
- Suggestions
  - Create a simulator of Mojaloop for DFSPs with a very small footprint (single container) to help DFSPs or their system integrators with development effort
  - Enable the simulator to accept transactions with predetermined successful and failure scenarios
  - Enable the simulator to generate transactions
  - Having a Mojaloop instance online to register and utilize for development and testing purposes



## Phase 2 - What's Next?

- Extend Payment Hub with
  - persistent flow management
  - operation team support capability (UI, search),
  - failure scenario investigation,
  - resolution of in doubt transactions (investigation messages),
  - reconciliation support
- Monitoring Dashboard at the DFSP level
- Testing Harness
- Implement and Test Components to be Released
  - Bulk Payments
- Pilot Implementation
- Refine User Interfaces and Harden security of the channels.
  - Extending Tiered KYC support
  - Implementation of ILP Protocol Description
- Community Contributions Towards
  - Merchant Registry
  - Centralized Fraud Detection
  - Cross-Ledger Transactions within Remittance Corridors
- Make the Lab a true lab
  - Infrastructure to spin up sandboxes for individual instances.
  - Allow govts to see how an entire ecosystem working on an open stack could work



## How Can You Help?

- What functional use cases would you like to see supported next?
- How can we extend Fineract CN to better support DFSP requirements?
- What would you like to see Mifos community contribute to Mojaloop?
- We're seeking implementers:
  - Would you like to implement Payment Hub?
  - Are you a financial institution needing a DSFP system?
  - Are you a fintech innovator needing a DFSP to build your application?
- What would an ideal innovation sandbox look like for you?



# Backup Slides





**Solution:** Mifos X

**Total Client Base:** 3M customers,  
\$1.7B portfolio

**Location:** Mexico

**Support Partner:** Mifos Initiative/Fiter



- ❖ Needed to rapidly innovate and not be bogged down by legacy core banking system.
- ❖ Innovation Lab, FiinLab, uses Mifos X as its innovation platform to roll out and test new innovations and products:
- ❖ Long term plan to migrate core banking from SAP to Apache Fineract



“With SAP, in order to get to market with new functionality it took over a year. With Mifos, we were able to shorten development cycles to one week. Mifos is really flexible and has such a strong API that we were able to do it faster than on SAP”

- Eduardo Licona, Director of Innovation Platforms



**Solution:** Mifos X (Apache Fineract 0.6)

**Total Client Base:** 50,000 customers

**Location:** Germany

**Support Partner:** DPC Consulting Hungary

- ❖ Entasked with reducing operational costs from 900M euros to 700M euros per year.
- ❖ Migrating mortgage loan portfolios to Apache Fineract to lower costs and streamline processes.
- ❖ Strong champion in executive leadership but skepticism amongst German IT staff
- ❖ Recently acquired by IBM who is exploring as part of a managed service offering to other banks.



**“Loan portfolio can now run “unattended” without the monthly manual error-prone and time-consuming review processes”**

- **Frank Klingspor, Managing Director**



**Solution:** KwikCash

**Total Client Base:** 1,000,000 customers

**Location:** Nigeria

**Support Partner:**  
Mines.io



- ❖ Mteka data analytics platform can process terabytes of data in seconds so needed a banking platform with a modern architecture that could match that level of scale.
- ❖ Open source freed them to focus on customer experience and partnerships with telcos and microfinance banks
- ❖ Achieved fast time to market and reliable scale



“Mifos saved us considerable time and money in accelerating our platform and accelerating our financial inclusion efforts. The redesign and continuous improvement for scale and pluggable microservices is critical for us to continue using it vs. developing something on our own.”  
**(Ekechi Nwokah, CEO & Co-Founder)**



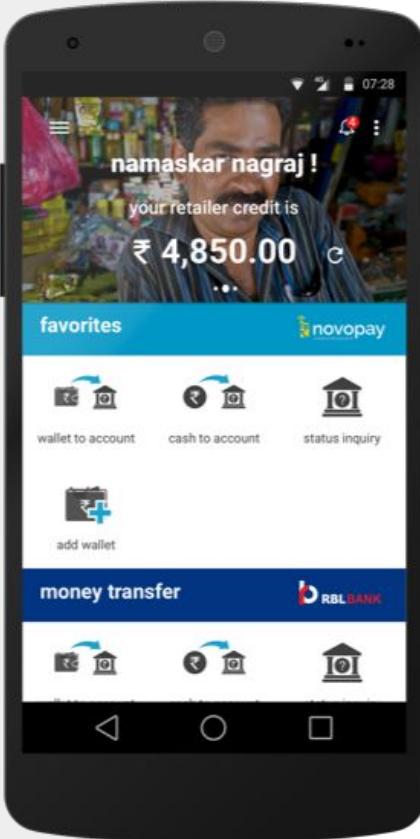
**Solution:** Novopay

**Total Client Base:** 2.1M customers

**Location:** India

**Support Partner:**

Conflux Technologies & Khosla Labs

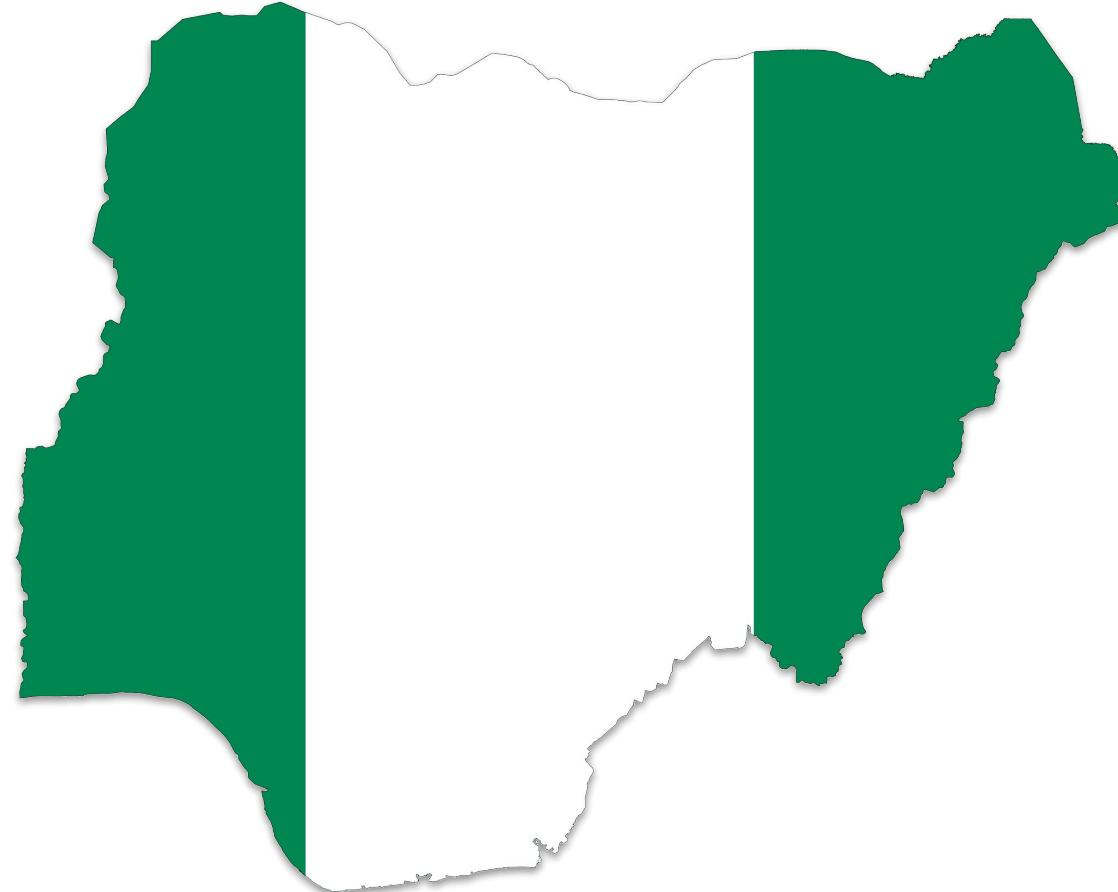


- ❖ First mover advantage leveraging proven Mifos X core banking system
- ❖ Mobile wallet solution enabling agent-led money transfers, account openings, bill payments, cash management, financial services & more.
- ❖ Gold standard for agent management - real-time visibility into agent activity and transaction workflows



“Mifos has played an integral role as part of our open source stack. We have scaled to a billion dollars worth of gross transaction value in a year using Mifos for wallet management & accounting.”  
**(Arun Sevakule, CTO Novopay)**

# Nigeria



- Population of 197 Million
- 70% of adults are underbanked
- Highly fragmented mobile money market

# MINES.IO

Modern financial services for emerging markets





**Solution:** KwikCash

**Total Client Base:** 400,000 customers

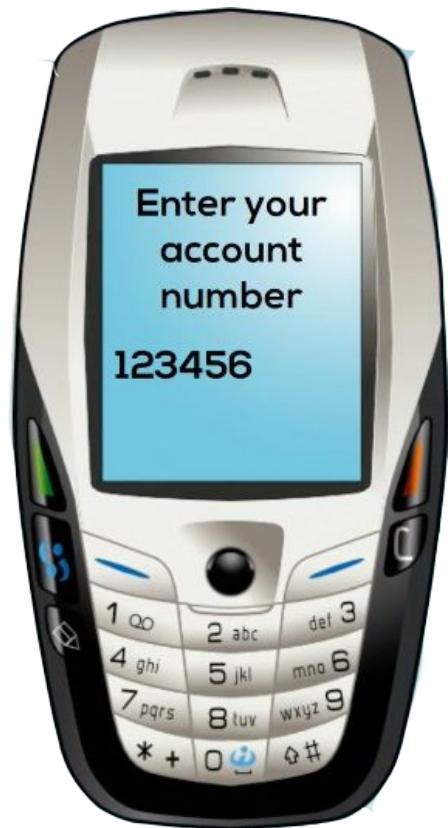
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# Offering a white-labeled lending service in emerging markets, Mines raises \$13 million

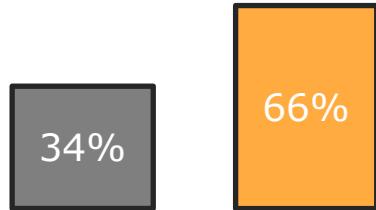


Jake Bright @JakeRBright / 2 months ago

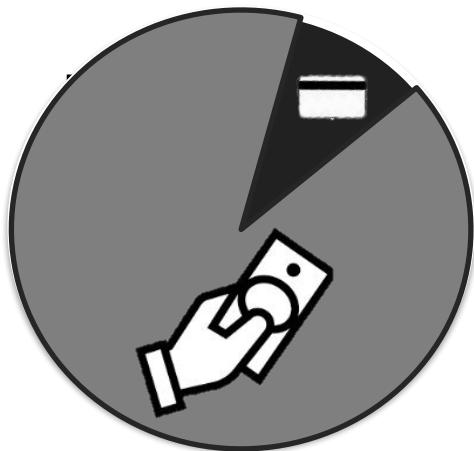
Comment



**120 M** Mexico's total population.



**60%** Of Mexicans **don't have a banking account.\***



**90%** Of transactions in Mexico are in cash

**6M** Merchants in Mexico do not accept electronic payments



\*Source: Mexico's Financial Inclusion Report

# What is Gentera and Fiinlab?

Gentera is a financial group with social responsibility, with 25 years of existence composed by the following companies and brands



Bank offering savings and microfinance loans.

3 M customers  
1.7 Bn USD portfolio.



Remittances company with 4.4 M remittances per year



Financial correspondents network with 2,700 merchants.

5.7 M tx processed



5 Million active insurances



Financial Inclusion lab devoted to creating new business models



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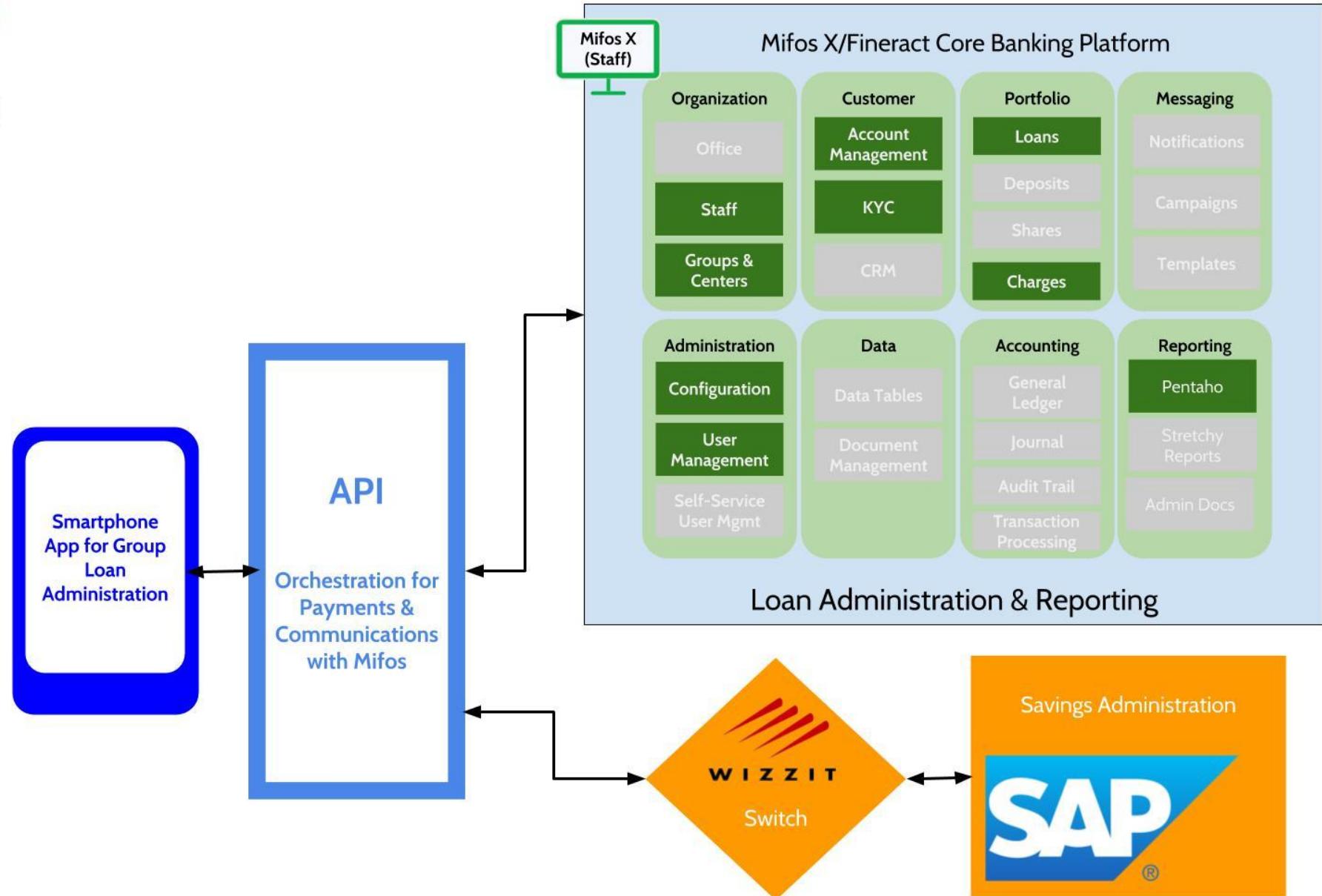


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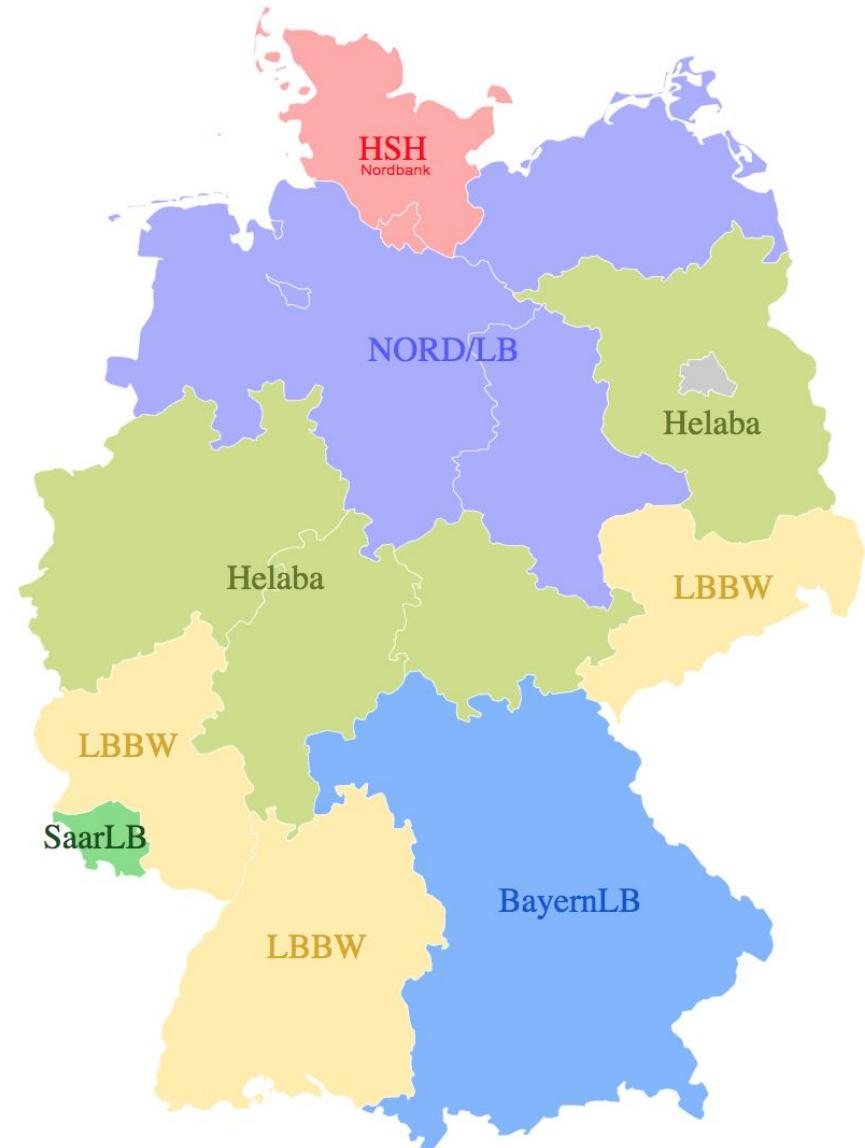


## Mobile App for Group Loan Administration



# Erste Financial Services

- Landesbanken - state-owned banks focused on wholesale lending
- Landesbanken sector hit especially hard by the financial crisis - 70B Euro Bailout
- Some, had to be completely restructured - WestLB Bank became EAA Bank





**Solution:** Mifos X (Apache Fineract 0.6)

**Total Client Base:** 50,000 customers

**Location:** Germany

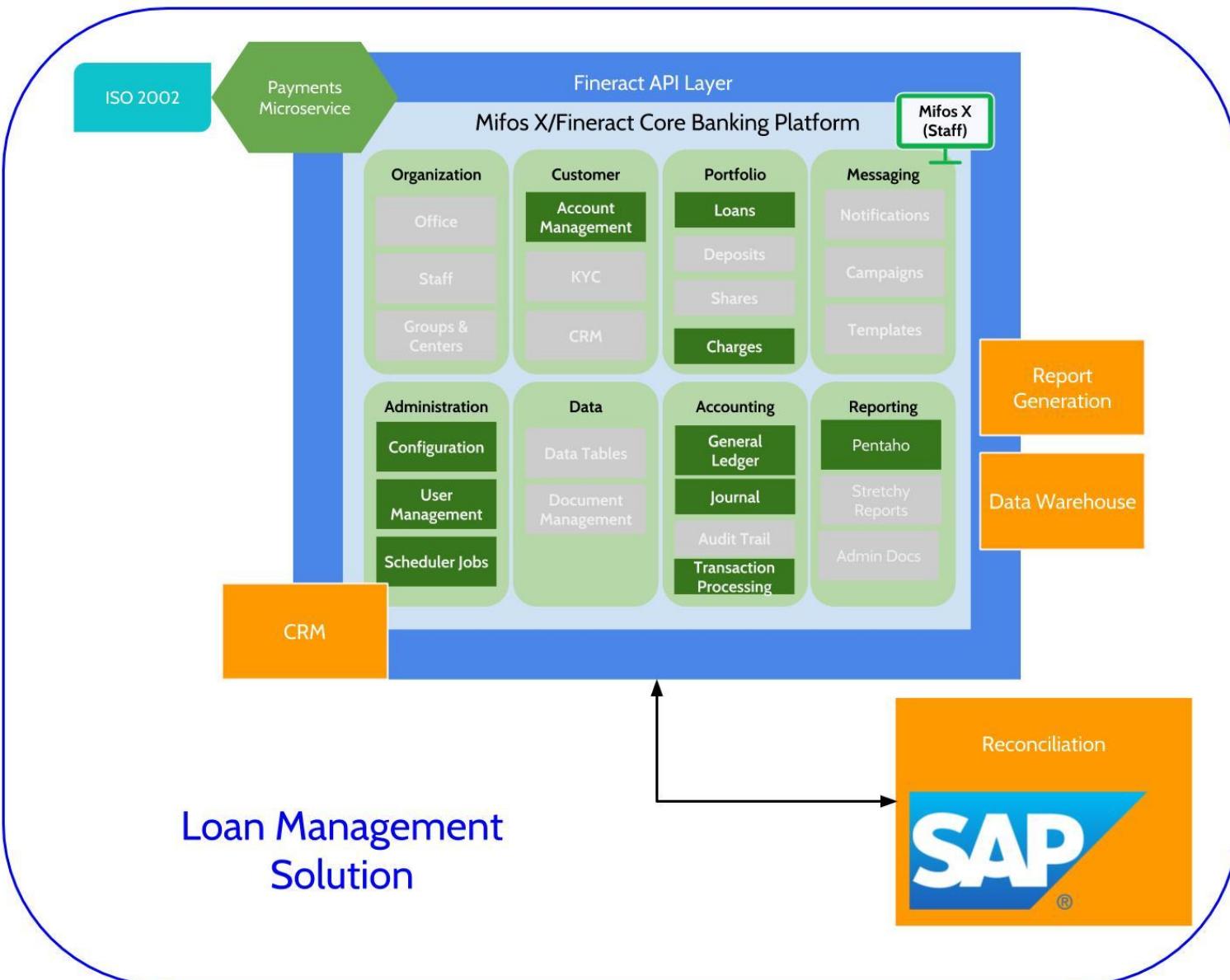
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- ❖ Strong champion in executive leadership but skepticism amongst German IT staff
- ❖ Recently acquired by IBM who is exploring as part of a managed service offering to other banks.

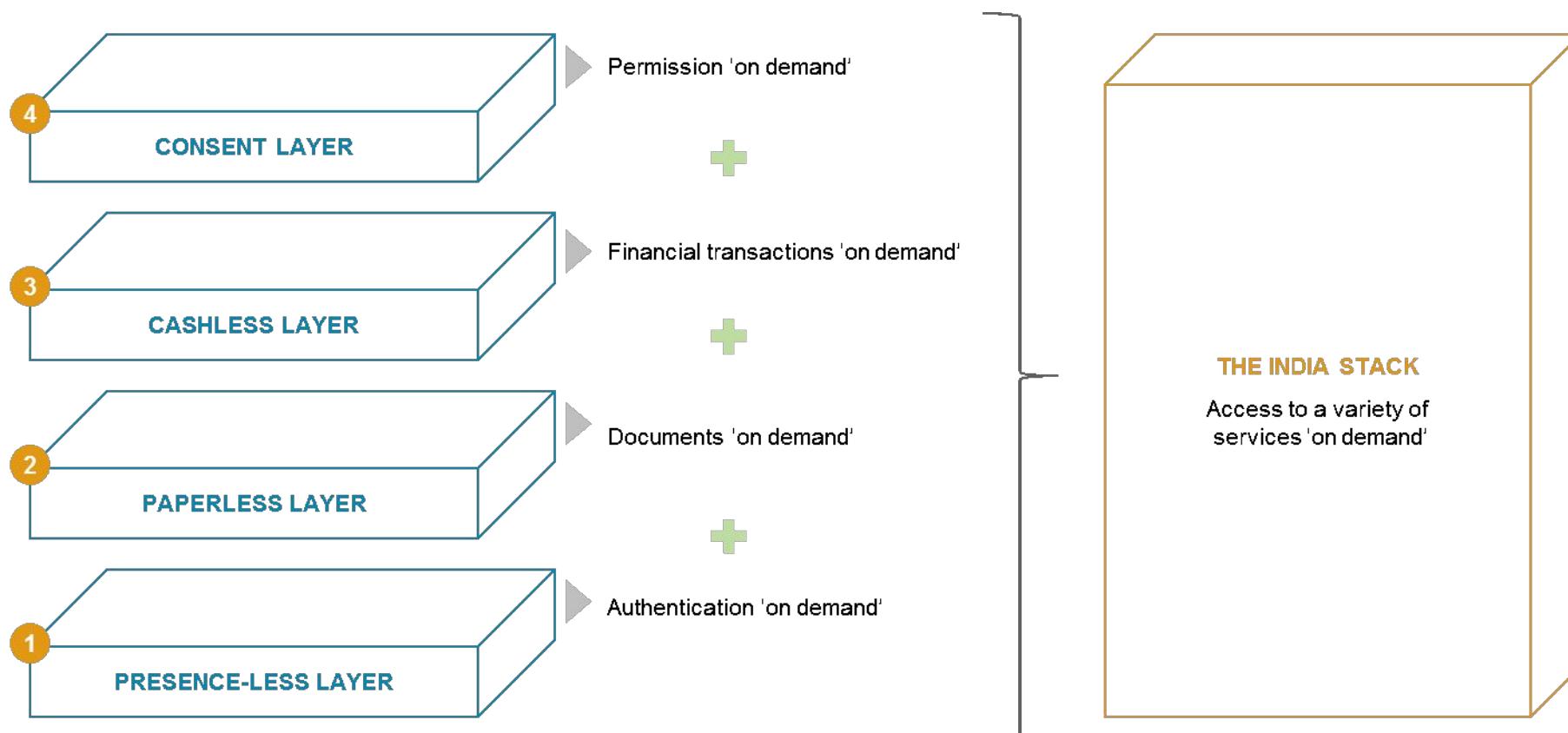


**“Loan portfolio can now run “unattended” without the monthly manual error-prone and time-consuming review processes”**

- **Frank Klingspor, Managing Director**

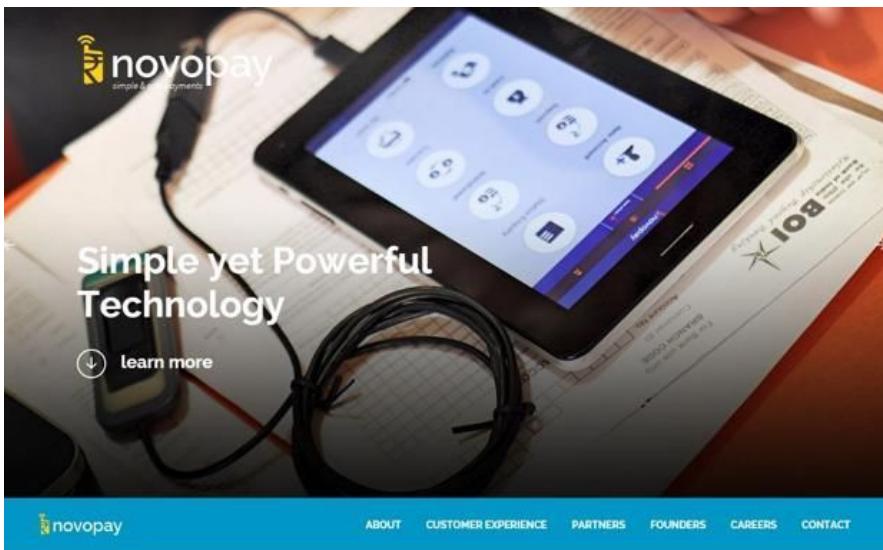


# India





100M Adults, 70% are unbanked or underserved by banking system, highly fragmented mobile money market with very low adoption



# Mission

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Bring banking to billions using hundreds



**1.5 million**

unique consumers served  
Apr 2018

# Business

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India-wide last mile financial services delivery network & SaaS branchless banking platform



**\$124 million**

Transaction Value in Apr 18 (Annualized GTV of USD 1.5 bn)



**>40,000**

Active Retail Outlets

# Vision

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Transform payments & banking for all by providing retail financial services points across India. Provide the next generation banking platform for mobile-based, AI-enabled seamless banking.



**Solution:** Novopay

**Total Client Base:** 2.1M customers

**Location:** India

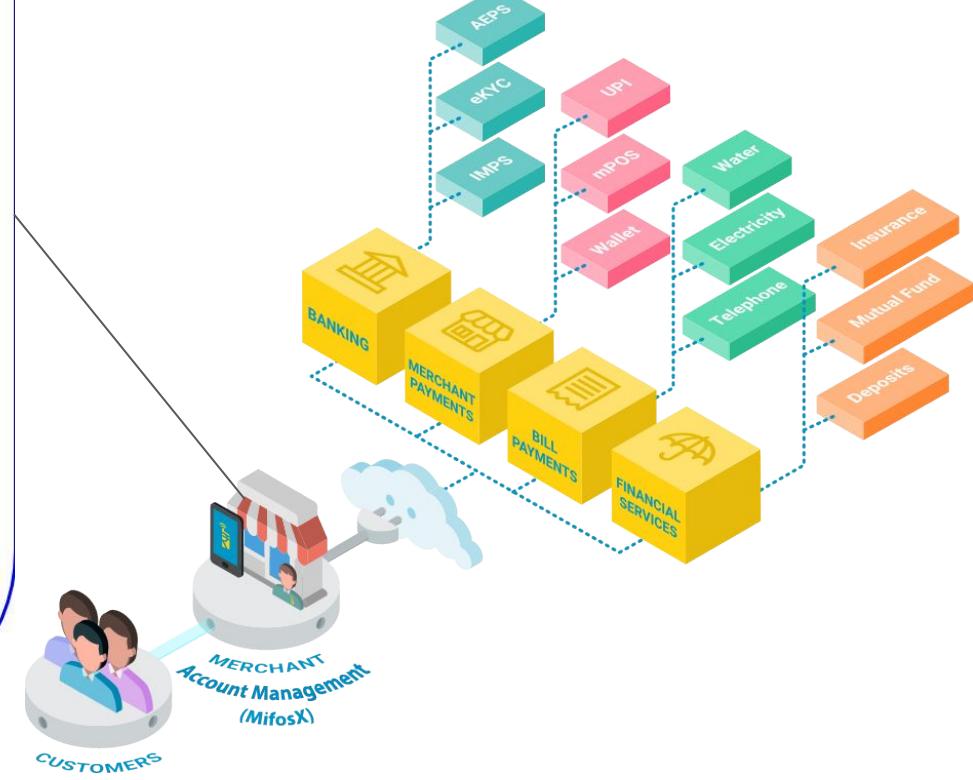
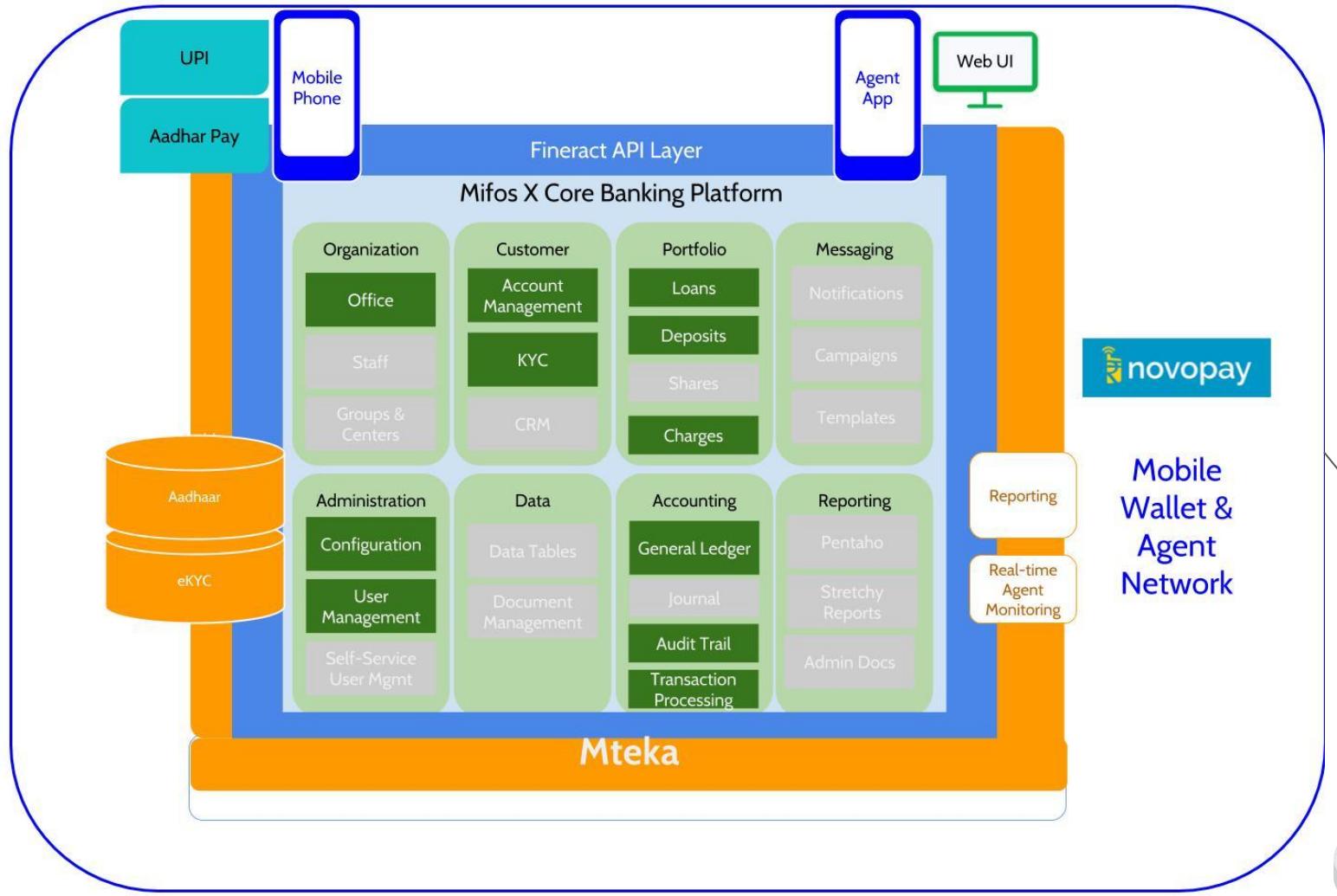
**Support Partner:**

Conflux Technologies & Khosla Labs

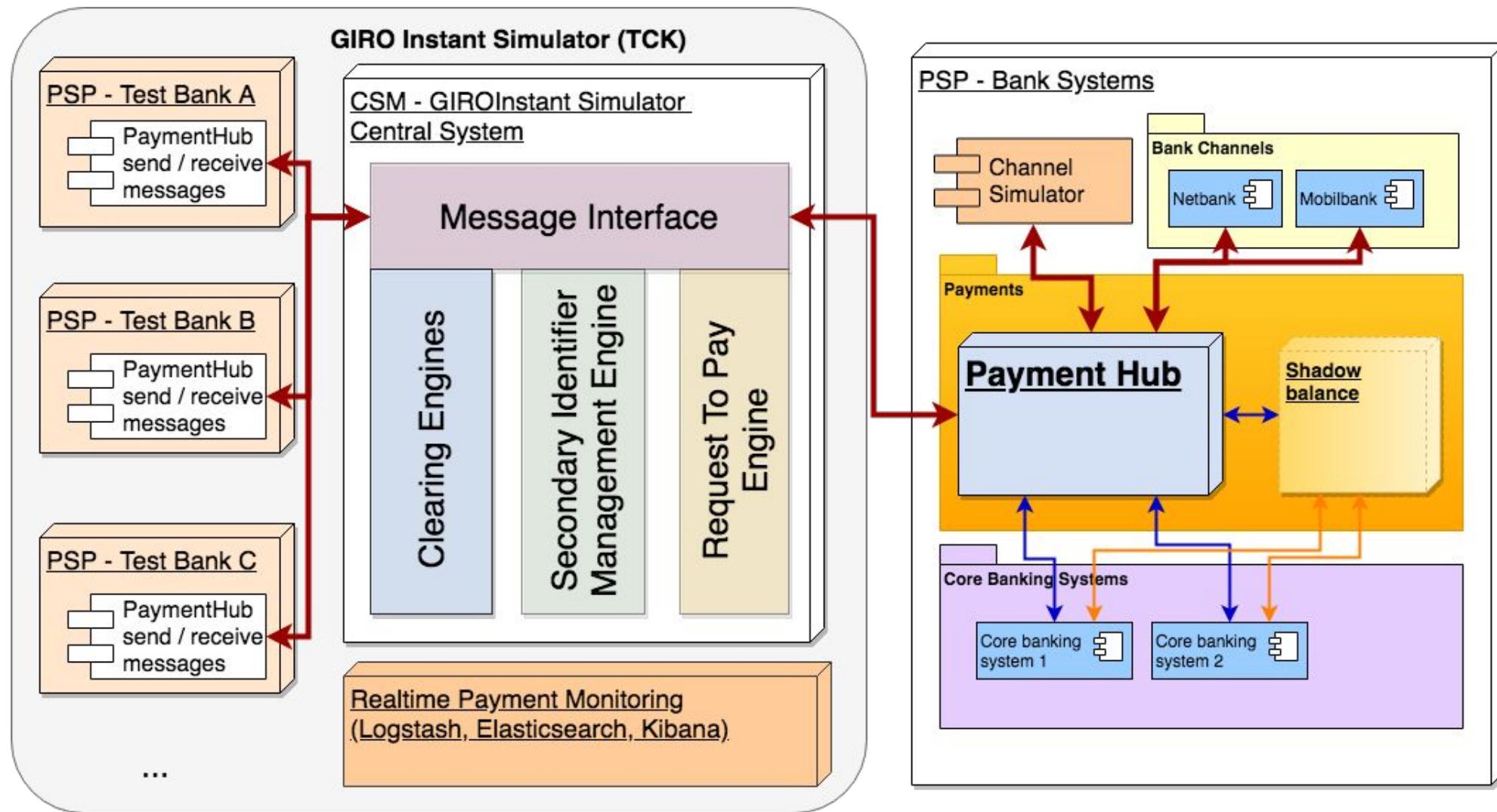


- ❖ First mover advantage leveraging proven Mifos X core banking system
- ❖ Mobile wallet solution enabling agent-led money transfers, account openings, bill payments, cash management, financial services & more.
- ❖ Gold standard for agent management - real-time visibility into agent activity and transaction workflows

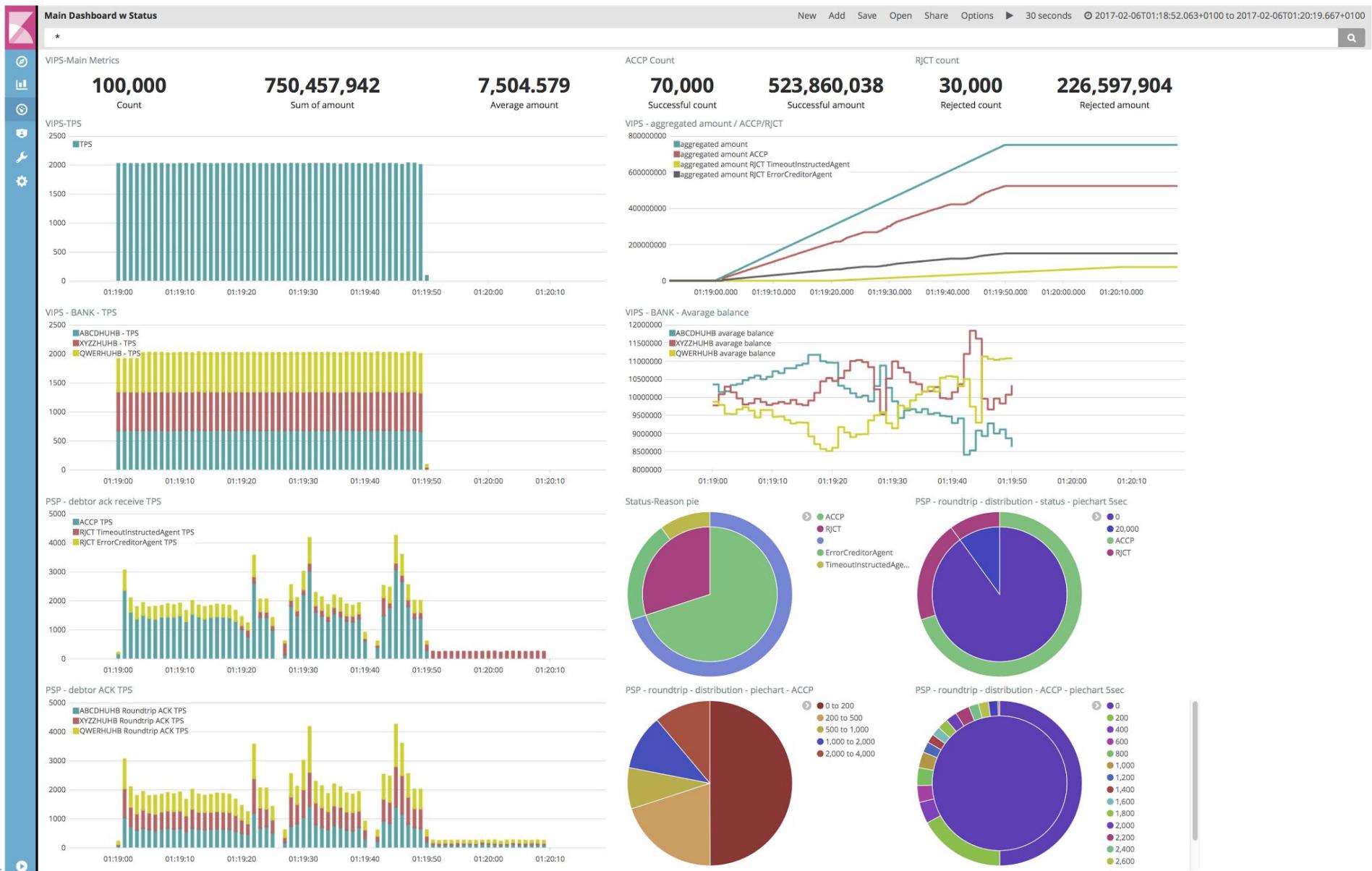
“Mifos has played an integral role as part of our open source stack. We have scaled to a billion dollars worth of gross transaction value in a year using Mifos for wallet management & accounting.”  
(Arun Sevakule, CTO Novopay)



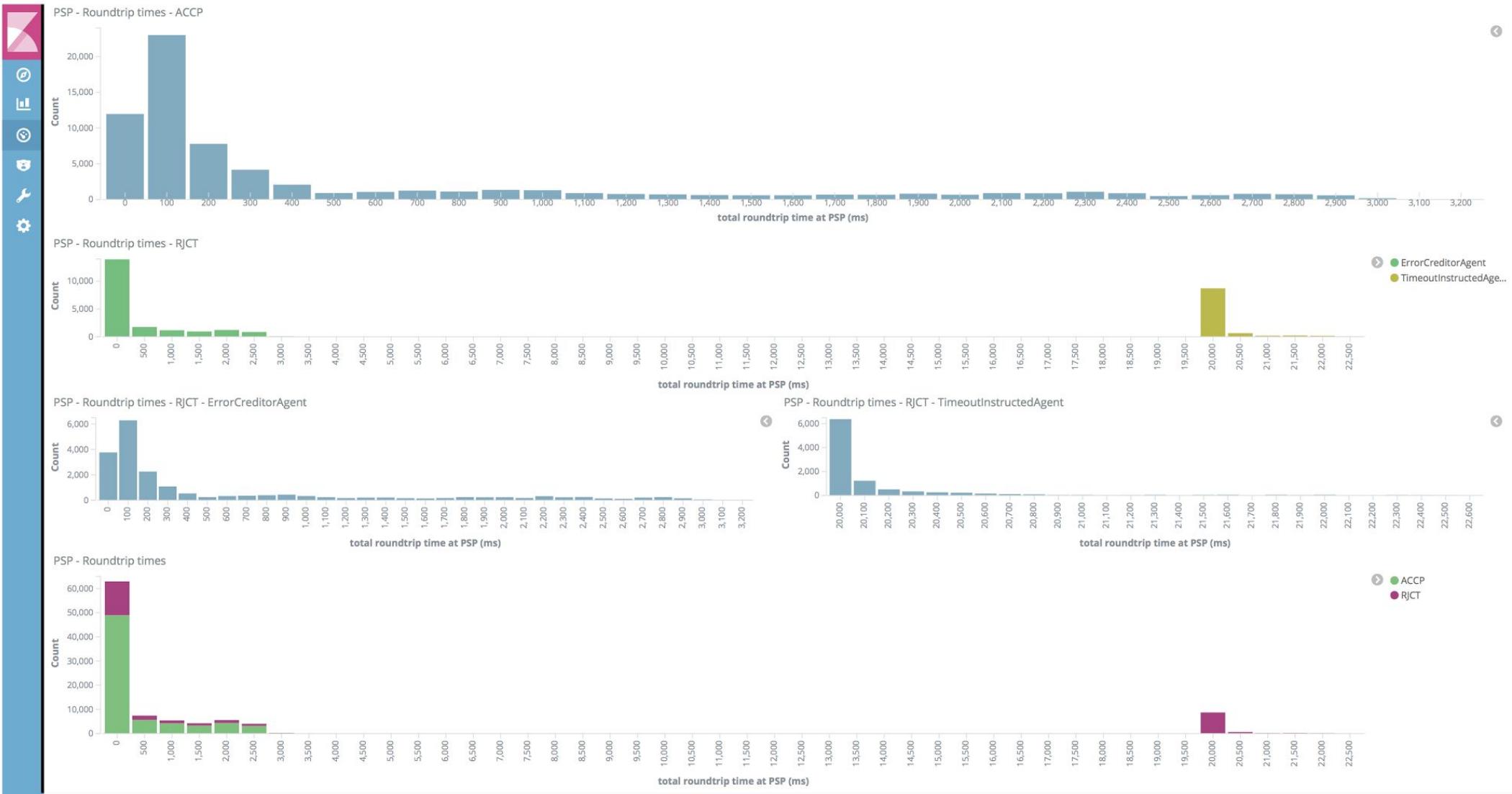
# Central clearing house simulator and load generator



# Test execution (1/2)



# Test execution - time distribution (2/2)



- October 17th 2017, 17:44:59.959 ISO20022: pacs.008 LogDtTm: October 17th 2017, 17:44:59.959 TxOrgnldtTm: October 17th 2017, 17:44:59.903 amount: 6,039,681 Description: VIPS incoming transfer request pacs\_008 ABCDHUHB VostroBalance: 10,228,274,852 XYZHUHB VostroAvail: 9,643,672,788 creditorBIC: ABCDHUHB type: audit tags: vips, audit, xml debtorBIC: XYZHUHB @timestamp: October 17th 2017, 17:44:59.967 XYZHUHB VostroBalance: 9,705,476,383 XML: <?xml version="1.0" encoding="UTF-8" standalone="yes"?> <Document xmlns="urn:iso:std:iso:20022:tech:xsd:pacs.008.001.02"> <FIToFICstmrcdtTrf> <G

Table JSON

[Link to /auditlog-2017.10.17/audit/pacs.008-625bd8f5-c66e-4d38-9e2b-d61ac709ca8e](#)

①	@timestamp	Q Q □ * October 17th 2017, 17:44:59.967
t	@version	Q Q □ * 1
#	ABCDHUHB VostroAvail	Q Q □ * 10,266,700,423
#	ABCDHUHB VostroBalance	Q Q □ * 10,228,274,852
t	Description	Q Q □ * VIPS incoming transfer request pacs_008
t	ISO20022	Q Q □ * pacs.008
①	LogDtTm	Q Q □ * October 17th 2017, 17:44:59.959
①	TxOrgnldtTm	Q Q □ * October 17th 2017, 17:44:59.903
t	XML	Q Q □ * <?xml version="1.0" encoding="UTF-8" standalone="yes"?> <Document xmlns="urn:iso:std:iso:20022:tech:xsd:pacs.008.001.02"> <FIToFICstmrcdtTrf> <GrpHdr> <MsgId>c355d165-58cd-4f4c-b714-6e0824787694</MsgId> <CreDtTm>2017-10-17T15:44:59.903Z</CreDtTm> <NbOfTxns>1</NbOfTxns> <TtlIntrBkSttlmAmt Ccy="HUF">6039681</TtlIntrBkSttlmAmt> <IntrBkSttlmDt>2017-10-17</IntrBkSttlmDt> <SttlmInf> <SttlmMtd>CLRG</SttlmMtd> </SttlmInf> <PmtTpInf> <SvcLvl> <Cd>VIPS</Cd> </SvcLvl> <LclInstrm> <Cd>INST</Cd> </LclInstrm> </PmtTpInf> </GrpHdr> <CdtTrftxInf>