

CASE STUDY

Powering India's Digital Rupee (e₹)

A CBDC Pioneer Implementation



About Client

One of the India's largest private sector bank by assets and market capitalisation, serving millions of retail and corporate customers across the country. The bank is a regulated entity under the Reserve Bank of India (RBI) and operates across retail banking, wholesale banking, treasury, and payments verticals.



The Requirement

Embracing Digital Rupee:

In November–December 2022, the Reserve Bank of India (RBI) launched two CBDC pilots — the Digital Rupee Wholesale (e₹-W) and the Digital Rupee Retail (e₹-R) — within a closed user group (CUG) comprising pilot banks, customers, and merchants. Our client was one of the Bank was selected as one of the pioneer banks to participate in the retail pilot, requiring it to build a robust, compliant, and scalable digital currency infrastructure in a very short time.

Key Challenges Faced:



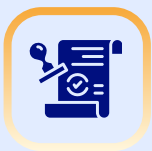
No Established Playbook:

CBDC was a first-of-its-kind implementation in India. There were no precedents, and the technology, regulatory frameworks, and operational processes had to be built simultaneously.



Tight Timelines:

From the signing of the implementation agreement (December 2022) to pilot go-live (January 2023), team had approximately four to six weeks to build, certify, and deploy a full-stack CBDC ecosystem.



Evolving Regulatory Requirements:

RBI and NPCI continued to issue new guidelines and functional additions throughout the pilot, requiring continuous development cycles and constant regulatory alignment.



Interoperability Imperative:

As India's payments ecosystem is built on UPI, achieving seamless CBDC–UPI interoperability — including QR code compatibility — was a non-negotiable requirement for merchant and consumer adoption.



User Onboarding at Scale:

Reaching a meaningful user base meant onboarding customers and merchants quickly and securely, with a frictionless app experience that met the bank's existing KYC and security standards.



Infrastructure Resilience:

The solution needed to handle high transaction volumes reliably while operating within the bank's data centre environment, maintaining the uptime standards expected of a tier-1 financial institution.



The Solution

Mindgate CBDC Solution - Mindgate deployed a full-stack CBDC platform purpose-built for the Digital Rupee retail pilot.

Solution Highlights:



End-to-End Implementation:

Deployed a full-stack RTSP solution with DTSP node support.



Granular Control:

Empowered the bank with precise token and transaction limit management.



Omnichannel Portals:

Provided a complete suite of apps and portals for customers, merchants, and bank administrators.



Seamless Integration:

Facilitated intent-based CBDC app redirection and UDIR-compliant dispute management.



Future-Proof Design:

Built for immediate CBDC and UPI interoperability.

Core Product Modules Delivered:



CBDC Digital Vault

Token repository for the retail distribution of e₹ tokens.



Issuer Switch

Interfaces with NPCI and the Digital Vault to enable e₹ wallet interoperability across the broader CBDC ecosystem.



CBDC T-PSP

Integration layer connecting the CBDC Wallet App to the bank's systems.



White-Label CBDC Wallet App

Consumer-facing iOS and Android application for Bank customers, enabling wallet creation, denomination-based fund loading, P2P/P2M transfers, and token redemption.



Back-Office Portal

For wallet creation and maintenance, GL wallet holding positions, MIS/reports, and EOD DTSP/RTSP file management.



Mobile Banking SDK

For intent-based redirection to the CBDC app from Bank's existing mobile banking app.

Advanced and Customised Use Cases

- **Programmable CBDC - Corporate use case:** Tokens can be configured for use at specific merchants, locations, merchant category codes (MCCs) and validity periods - enabling targeted use cases such as employee benefits and government subsidy disbursement.
- **Programmable CBDC - P2P use case:** Here a person can disburse a programmable token to another person with same MCC, location validity, payment to specific VPA; thus solving the use case example where today a brother can gift programmable token to his sister on the Raksha Bandhan day Or a father can disburse a P-Token to his child ensuring the correct spend of the money
- **Offline CBDC:** Transactions can be completed without internet connectivity, enabling financial access in underserved regions and creating digital footprints for the unbanked.
- **Employee Salary Payouts in CBDC:** Bank issues a portion of employee salaries in CBDC tokens, usable for P2M payments via CBDC-UPI interoperability — a first in India.
- **Wallet Auto-Load:** Automatic fund replenishment based on configured minimum balance thresholds from a linked bank account or via UPI.
- **Bill Payments Integration:** Users can pay utility bills (water, electricity, mobile recharge) directly from their CBDC wallet.

Architecture Overview

The solution is built on a Java Spring Boot microservices framework, enabling modular, cloud-ready deployment in containers or conventional servers. Key architectural components include:

01

Databases:

- Aerospike (in-memory NoSQL) for real-time transaction status
- Yugabyte (PostgreSQL OLTP) for durable data
- MariaDB and CouchDB for supporting services.

02

Messaging:

Apache Kafka for token synchronisation between DTPS and RTPS nodes.

03

Infrastructure:

Kubernetes container platform, NodeJS, load balancers — deployed in Bank's DC/DR data centres in a hybrid construct blending enterprise-licensed and open-source components.

04

Security:

- Hyperledger Fabric for blockchain-backed token integrity
- Robust encryption and authentication protocols meeting RBI standards.



The Implementation & Impact

Following the RBI's ₹-R pilot announcement in December 2022, Mindgate and the Bank executed an accelerated deployment of the DTSP/RTSP infrastructure and NPCI-certified CBDC solution. By January 2023, the partnership achieved one of India's first live CBDC deployments for a Closed User Group (CUG). This momentum continued into June 2023, when our client Bank became the first in the country to launch interoperable CBDC–UPI QR codes. Throughout 2023–2024, the solution evolved beyond basic transactions to include sophisticated features like programmable and offline CBDC, employee salary payouts, and IRCTC integration.

Today, the platform robustly supports approximately 8 lakh active customers and 1.5 lakh merchants, with future-ready use cases like tokenized FDs and cardless ATM withdrawals currently in the pipeline.

8 Lakh+

Active CBDC Users

1.5 Lakh+

Active Merchants on Platform



Future Horizons: Expanding the Digital Frontier

To maintain leadership as the RBI scales the CBDC pilot, Mindgate is deploying high-impact, forward-looking use cases:

Interoperable Cardless Cash Withdrawal:

Enables card-free cash withdrawals at any participating ATM using the CBDC wallet, merging digital currency with physical cash access.



Bill Payments Integration:

Users can pay utility bills (water, electricity, mobile recharge) directly from their CBDC wallet.



IRCTC Integration:

CBDC wallet holders can book railway tickets via a redirection-based approach using both UPI-CBDC interoperability and wallet-to-wallet transactions.



Credit Card:

Voucher gram feature gives an opportunity to convert the HDFC CC rewards into programmable spend tokens



Coupon discount voucher:

This provides merchants with an advantage to create tokenized coupons as rewards for digital purchases made by end customers.



BHIM discoverable:

4 party model, allowing HDFC wallets to be discovered within the current BHIM app which gives a single app user feel, thus fuelling the CBDC adaption



Aadhaar Seeding and NACH integrations:

This will facilitate the seamless integration of DBTs and government initiatives through the use of PCBDC tokens.

These upcoming features ensure the platform remains at the frontier of the digital ecosystem, providing the agility to lead as CBDC adoption goes mainstream.

