LF DECENTRALIZED TRUST

Central Bank Digital Currencies

V3 2025

Contents

Introduction

As central banks around the world explore and test the uses, viability, and needs for a central bank digital currency, they are increasingly turning to distributed ledger technologies (DLTs).

Case in point: The European Central Bank recently concluded a series of tests employing DLT for wholesale settlement in central bank money. The trials involved three Central Banks, 60 organizations, 200+ trades, and over EUR1.6bn in issuance. Per a report by The Value Exchange, these trials "generated significant momentum in the digital innovation domain and provided valuable, fresh insights around the viability of DLT and digital cash."

As the market moves to DLTs, there will be decision points about which platforms to adopt. This ebook explores the importance of open development in creating DLT-based CBDCs and highlight the critical role our projects are playing in new digital currencies..

DLTs hosted by LF Decentralized Trust, which are built in the open with vendor-neutral governance, are widely deployed in production networks in other sectors. They are proven technologies with strong community support.

The track record and transparency of LF Decentralized Trust technologies make them well suited for central banks seeking sustainable, tested platforms that can withstand and adapt to the unique needs of this use case.

We believe that the technology underpinning such an essential public good as digital cash should come from communities working together. Openly sharing ideas, knowledge, and lessons learned to improve and test in a collaborative environment benefits everyone.

Read on for an overview of LF Decentralized Trust, open source development's critical role in central bank projects, and examples of the tech in action in CBDC implementations s around the world.

"Open source software (OSS) stands out for its transparent, collaborative nature, which can be harnessed to build robust and secure financial systems. For central banks, open source presents several compelling advantages."

"Open Source CBDC: Exploring Open Source in CBDC Development" - Digital Euro Association White Paper, Dec 2024

What is LF Decentralized Trust?

This section provides a high-level overview of LF Decentralized Trust.

LF Decentralized Trust is the premier open source foundation for decentralized technology ecosystems. Powered by a diverse and global community, LF Decentralized Trust serves as the neutral home for collaborative development of technologies powering the transition to a digital-first economy.

Decentralized technologies are quickly reshaping markets and disrupting traditional business models and systems. They are modernizing the core infrastructure for finance, trade, government, healthcare, and more. And changing, forever, how we interact, transact, and trust.

Our role at LF Decentralized Trust is to foster the open development of the technologies that put trust at the center of decentralized systems and applications. We do this by hosting open source codebases as projects under the proven model of the Linux Foundation, home to many of the world's most important open technology projects and ecosystems.

Watch the introduction video **here.**

These projects are conceived and built by the developer community as freely available software that vendors, end user organizations, service providers, start-ups, academics, and others can use to build and deploy decentralized applications and commercial solutions.

Open Source Development

Open source development is inherently transparent, making it ideal for decentralized technologies. It unites organizations and individuals with diverse needs to collaboratively create shared solutions, forming a strong foundation for mutual success—much like decentralized technologies themselves

CBDCs and Open Development

Globally, central banks are moving quickly to understand and implement digital currencies. CBDC projects range from prototypes to pilots to production deployments.

The driving forces are efficiency, liquidity, inclusion, and overall innovation. CBDCs will be a game-changing public good that we believe should be built in an open and collaborative manner.

Why Open Development

As the backbones for a new breed of official, government-backed monetary systems, CBDS must meet extremely high standards for security, reliability, adaptability, interoperability, and, most of all, trust.

That's where the LF Decentralized Trust's community and projects come into play. They provide the enterprise-grade building blocks for central banks and their implementation partners to build the money of the future with confidence and transparency.

The proven open development model at the core of LF Decentralized Trust ensures code is not just available under an open source license. It systematizes governance, ensuring rigorous code development, security best practices, vendor diversity; and broad input into project roadmaps.

As many central banks are already discovering, building solutions with our openly developed and governed code brings not just the expected cost benefits of open source but accelerates innovation and delivers trust.

Too often, open source software is shorthand for code that has been dumped in a repository with no ongoing management, maintenance or future. Or serves as strategy for a single vendor to lock-in customers or a market segment.

It's important to contrast those approaches and their pitfalls with the professionally developed and vendor neutral projects of LF Decentralized Trust. These projects are already powering government and financial systems around the world.

CBDCs and Open Development

Accelerating Innovation
As CBDC projects evolve and mature, the collective learnings from testing and deploying LF Decentralized Trust technologies will strengthen them as platforms for all. That's the innovation acceleration effect of collaborative development.

Whether central banks opt to simply adopt our technologies as building blocks or get involved in shaping and even contributing code, they are ensuring that there is a sustainable, secure financial infrastructure. They are also building systems that they can customize for their own markets but can interoperate with others around the world, which is critical for cross border payments, global trade and more.

Security and Privacy
Of course no discussion about CBDCs in complete without talking about security and privacy. The inherent openness of LF Decentralizes Trust's projects and community translates to continuous review for security vulnerabilities and faster fixes for issues.

Software that is built in the open allays privacy concerns and can be adapted more readily to incorporate new technologies like Zero Knowledge Proofs and Multi Party Computing.

Proper governance is the ultimate guardrail for ensuring code quality, consistency, and neutrality.

Building the Future of Money, Together
The introduction of CBDCs has been a deliberate, even cautious process. That is understandable as they are an innovation that will reshape the financial landscape for generations. The business and regulatory due diligence is critical. But so too is building a tech infrastructure that will grow and evolve over time, backed by a diverse community working collaboratively and openly with proper governance.

LF Decentralized Trust is home to a global community of companies, developers, academics, researchers, governments and service providers that actively and openly developing the building blocks for payment innovations around the world. And the work is just getting started!

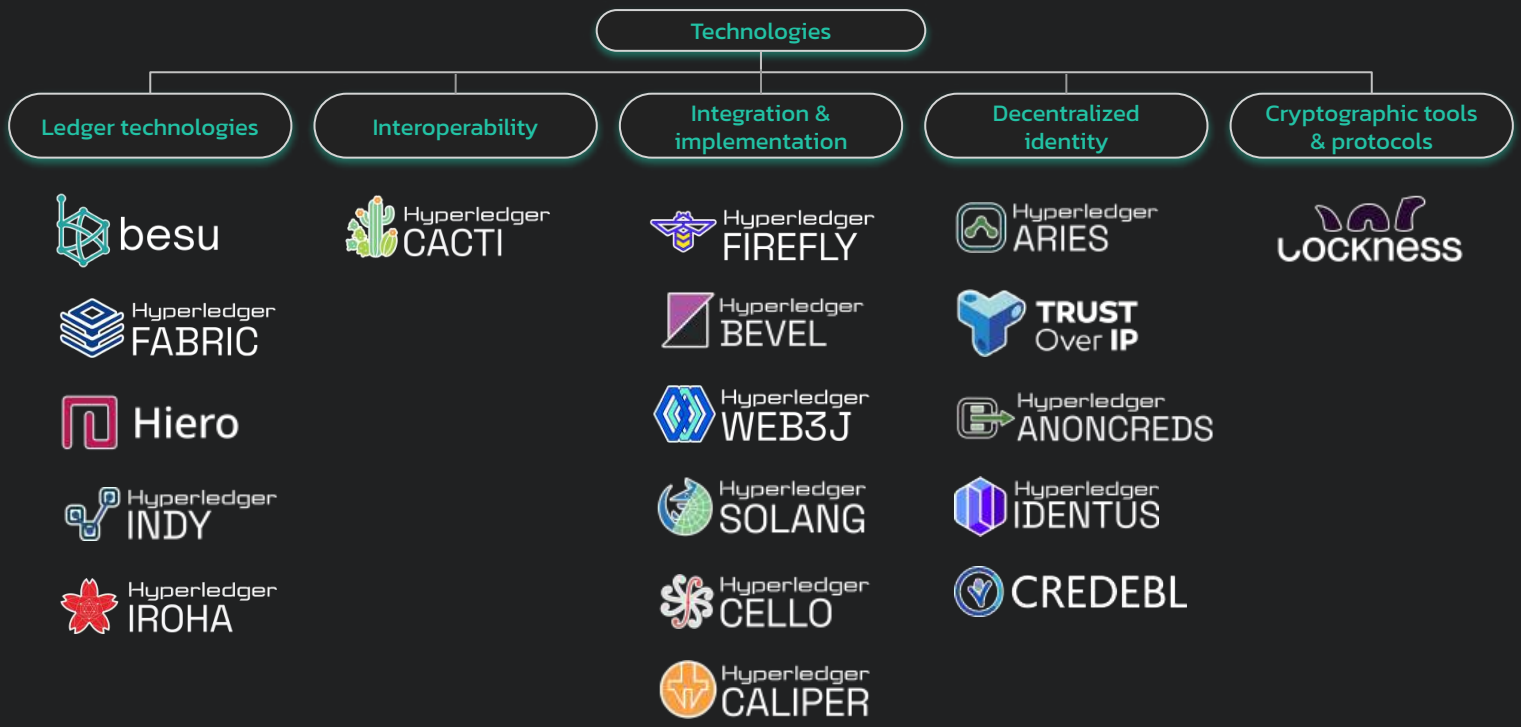
LF Decentralized Trust projects

LF Decentralized Trust projects are all enterprise-grade technologies, built collaboratively under open governance. Each project has its own unique name, developer community, and objectives.

The Project Lifecycle for all projects consists of six possible states between Graduated and Incubating:

- Graduated - Projects seeking to graduate from Incubation must meet the criteria defined in the Incubation Exit Criteria
- Incubating- Approved project proposals enter into Incubation

LF Decentralized Trust Labs provides a space (i.e., GitHub repos) where work can easily be started without the creation of a project that is approved within the Lifecycle.



Community work with CBDCs

As you will see throughout this ebook, the LF Decentralized Trust community is actively championing, developing, and deploying digital currencies.

Around the world, our members, which includes the central banks of Brazil, France, Hong Kong, Nigeria and Norway, are doing the hard work of defining new currency models.

Read on for summaries of many of the CBDC projects implementing LF Decentralized Trust technologies, including Besu, Hyperledger Fabric, Hyperledger FireFly, and Hyperledger Iroha.

How can you get involved?

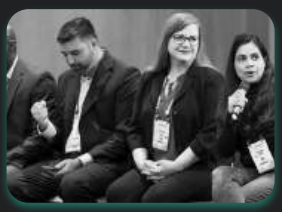
- Join as an LF Decentralized Trust member. Our member companies are leaders in financial services and technology working on these exciting projects. Learn more about membership.
- Explore our Projects.
- Participate in our open communities, like our Financial Markets SIG.
- Deep dive into LF Decentralized Trust projects with training and certifications.
- Attend LF Decentralized Trust events and webinars.

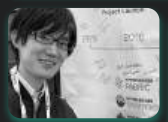





Community driven

Get started today ➤





CBDCs around the globe

CBDC Projects and experimentations with LF Decentralized Trust tech around the world

Global Collaborations

Swift Sandbox

Project Mariana: France, Switzerland, Singapore, & BIS

besu · Hyperledger CACTI · Hyperledger FABRIC · Hyperledger FIREFLY · Hyperledger IROHA

PHASE: RESEARCH

European Central Bank

The European Central Bank's (ECB) investigation phase into a digital euro (Oct 2021–Oct 2023) focused on design options, demand, compensation models, and the distribution framework for a central bank digital currency (CBDC). This included research on a tiered approach to explore how centralized systems could operate alongside distributed ledger technology. During this phase, several European central banks—including those of Spain, Italy, France, Lithuania, Luxembourg, Belgium, and Austria—participated in trials. The research highlighted that platforms like Hyperledger Besu and Hyperledger Fabric, among others, were "fully interoperable with existing fiat systems." Read the full report here and the findings here.

In late 2023, the ECB entered a two-year preparation phase to establish the groundwork for a digital euro, including finalizing the rulebook, selecting infrastructure providers, and conducting further testing. This initiative aims to enhance the ECB's understanding of innovative solutions and their potential applications in central bank money settlements.

The exploratory work is taking place in two waves: first between May and November 2024 and the second from July to November 2024. By the end of 2025, the ECB Governing Council will decide whether to move forward with issuing a digital euro.

PROJECTS USED

besu

Hyperledger FABRIC

Image Copyright: Digital Euro experiment rep

PHASE: RESEARCH

France

Banque de France, a leading central bank in wholesale CBDC research developed, along with Banque Centrale du Luxembourg, the Distributed Ledger for Secure Settlement Systems (DL3S) platform for the issuance, distribution, and redemption of experimental wCBDC in euros. As one of three Eurosystem interoperability solutions, DL3S, built on Hyperledger Fabric, enables secure and efficient tokenized cash settlements and interoperability with securities DLTs through mechanisms like Hashed Timelock Contracts (HTLCs).

In 2020, Banque de France conducted its first experiment, partnering with LF Decentralized Trust Member IBM, on the tokenization of government bonds and their distribution in primary and secondary markets via CBDC.

Smart contracts automated processes such as auto-collateralization, on-flow, and coupon payments leveraging Hyperledger Fabric and Token SDK, a LFDT Lab. In 2021, Banque de France partnered with HSBC and eight other organizations to trial a wCBDC, testing interoperability between a CBDC blockchain and a bond network using Hyperledger Fabric, Cacti, and R3 Corda, with Cacti as the interoperability tool.

In July 2023, a final report concluded 12 experiments conducted since 2020, demonstrating the operational feasibility of three wholesale CBDC models: interoperability, distribution, and integration. These models offer diverse capabilities, tested across various use cases, most notably showing that tokenizing central bank money improves cross-border payments, settlement finality, and security while being operationally feasible.

BANQUE DE FRANCE
EUROSYSTÈME

PROJECTS USED

Hyperledger FABRIC

Hyperledger CACTI

besu

Photo by Tanguy Belin on Unsplash

Please visit IBM for more information on blockchain-based CBDC architectures.

PHASE: RESEARCH

France - cont'd

Banque de France has also participated in Project Mariana with BIS and Monetary Authority of Singapore, using Besu, which focused on CBDCs in automated market makers.

In October 2023, Banque de France hosted a conference titled "Unveiling the Potential of Wholesale CBDC: What Insights and Prospects", where Governor François Villeroy de Galhau highlighted the importance of establishing international standards for interoperability between different CBDC systems to prevent inefficiencies and ensure seamless integration. The event highlighted ongoing advancements in DL3S and collaborative efforts within the Eurosystem's exploratory work on tokenized asset settlement in central bank money.

In December 2024, Banque de France partnered with Société Générale's subsidiary SG-Forge to conduct a groundbreaking on-chain repo transaction. This first-of-its-kind transaction in the euro area utilized bonds issued on the Ethereum blockchain as collateral, while the Banque de France issued central bank digital currency on its proprietary DL3S blockchain. This demonstrated the potential for blockchain technology to redefine financial transactions, improving efficiency and security.

DL3S has been integral to the Eurosystem's exploratory work, connecting with 18 market DLTs and over 40 institutions. According to the Banque, it has facilitated over 800 transactions, including delivery vs. payments and cross-border transfers, totaling €1 billion. In 2025, Banque de France will continue collaborating internationally to refine DLT use for wholesale CBDCs, emphasizing interoperability and scalability.

BANQUE DE FRANCE
EUROSYSTÈME

PROJECTS USED

Hyperledger FABRIC

Hyperledger CACTI

besu

Photo by Tanguy Belin on Unsplash

Please visit IBM for more information on blockchain-based CBDC architectures.

PHASE: RESEARCH

Project Venus

Led by Banque de France and Banque centrale du Luxembourg, Project Venus, demonstrated the successful issuance and settlement of a €100 million EIB digital bond using wholesale CBDC. Underwritten by Goldman Sachs, Société Générale, and Santander, the project employed a dual-DLT model: GS DAP for bond issuance and custody, and DL3S for tokenized cash settlement.

Key innovations included HTLCs for trustless interoperability, enabling T0 atomic settlement and reducing counterparty risks. The project validated wholesale CBDC's potential to enhance cross-border payments, settlement finality, and operational security. DL3S, built on Hyperledger Fabric, enabled strict control over access and transaction confidentiality while supporting HTLC-based atomic settlements. GS DAP, powered by Besu as a Layer 1 solution, served as the secure messaging bus for Canton nodes and facilitated cross-DLT interactions. This setup showcased how DLTs can coexist and support tokenized capital markets effectively.

In the final report from June 2024, the key takeaways underscore the feasibility of integrating wholesale CBDC into capital markets using DLTs, with Hyperledger Fabric and Besu playing pivotal roles in enabling secure, efficient, and interoperable settlements. Project findings support continued exploration of DLT-based financial ecosystems and further Eurosystem-level cooperation.

BANQUE DE FRANCE
EUROSYSTÈME

BANQUE CENTRALE DU LUXEMBOURG
EUROSYSTÈME

European Investment Bank

PROJECTS USED

besu

Hyperledger FABRIC

Please visit IBM for more information on blockchain-based CBDC architectures.

PHASE: RESEARCH

Project Mariana

Project Mariana aims to expand on wCBDC experiments by focusing on improving the effectiveness, safety and transparency of FX trading and settlement. Two key dimensions are involved to achieve this: combining FX trading and settlement into one step using a wholesale CBDC, and testing cross-border interoperability using a common technical standard. This would be game-changing in enabling various domestic CBDC projects to exchange in a future tokenized financial system.

Project Mariana expands research into DeFi mechanisms, e.g. automated market-makers (AMM) and testing a common standard for fungible wCBDC tokens. This would enable interoperability of wCBDCs within the same protocol and in the use of AMMs. Project objectives are:

1. Research & test wCBDC token design based on a technical standard with governance features that meet central bank requirements
2. Test interoperability via bridges for the seamless and safe wCBDC transfer between domestic and international networks
3. Build and test transactions in a FX interbank market using an AMM.

The results of the latest phase demonstrate novel approaches in the international aspect of wCBDC ecosystem design, and contributes to the G20 goal of enhancing cross-border payments.

Read the interim report and final report.

BANQUE DE FRANCE
EUROSYSTÈME

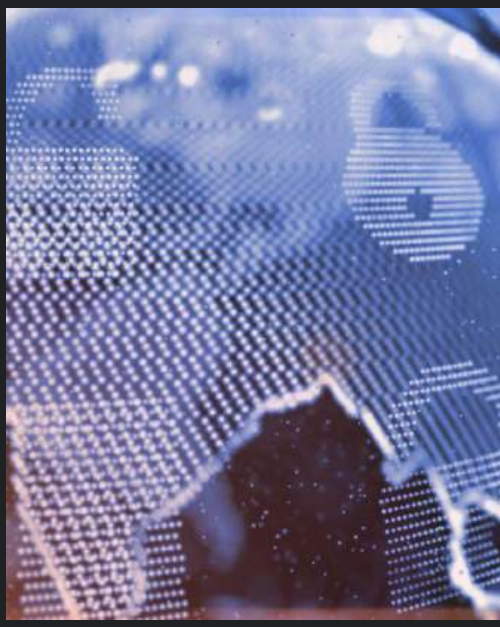
SCHWEIZERISCHE NATIONALBANK
BANQUE NATIONALE SUISSE
BANCA NAZIONALE SVIZZERA
BANCA NAZIUNALA SVIZRA
SWISS NATIONAL BANK

MAS Monetary Authority of Singapore

BIS

PROJECT USED

besu



PHASE: RESEARCH

India

In 2022, the Reserve Bank of India (RBI) launched pilot programs for wholesale and retail CBDCs, the Digital Rupee, leveraging Hyperledger Fabric. Its goals included reducing operational costs in physical cash management, increasing efficiency for settlements, payments system innovation, and fostering financial inclusion.

The RBI launched a digital rupee pilot in the wholesale segment with nine banks in November 2022, to settle secondary market transactions in government securities. The retail digital rupee pilot began in December, enabling users to transact through a digital wallet offered by participating banks and stored on mobile devices.

In August 2024, the RBI said the CBDC pilot program had more than five million users and 16 participating banks. The RBI is undertaking new use cases, such as using the e-rupee to connect purpose-bound money with generating agricultural carbon credits. Some banks now provide programmed CBDC loans to farmers for specific uses, such as buying fertilizers, where the CBDC can only be utilized in a fertilizer depot.

The central bank is looking to enable additional functionalities of programmability and offline capability in CBDC retail payments. It has also announced plans to make its e-rupee accessible to more retail users by including non-bank payment system operators to offer CBDC wallets. RBI is also exploring the possibility of using its CBDC in commercial papers (CPs) and certificates of deposits (CDs) on a trial basis.

See more on India's CBDC initiatives in this update.

भारतीय रिज़र्व बैंक
RESERVE BANK OF INDIA

PROJECT USED

Hyperledger FABRIC

PHASE: RESEARCH

Swift Sandbox

In October 2022, Swift announced a solution to enable transactions between CBDCs across DLT-based and fiat-based systems within the existing financial framework. Testing began in a sandbox with 18 central and commercial banks, including Banque de France, Deutsche Bundesbank, Monetary Authority of Singapore, BNP Paribas, HSBC, and Société Générale. Hyperledger Firefly served as the blockchain platform, providing tools for secure data sharing, token management, and transaction orchestration.

Over 12 weeks, participants evaluated the Swift CBDC connector, transaction flows, roles, responsibilities, and considerations like identity and privacy. Results confirmed the interlinking solution met the requirements for interoperable cross-border CBDC payments.

In 2024, the sandbox expanded to 38 banks conducting over 750 transactions across trade, FX, and securities use cases. Hyperledger Fabric and Besu played pivotal roles: Fabric supported delivery-versus-payment scenarios by simulating tokenized securities and CBDC transactions, while Besu enabled cross-border FX operations, demonstrating secure interoperability between DLTs. These experiments showcased the solution's ability to simplify global trade flows, improve FX settlement efficiency, and advance tokenized securities markets.

These findings confirmed Swift's ability to integrate CBDCs into traditional systems while tackling scalability and interoperability. As a next step, Swift announced live trials for tokenized assets and digital currencies in 2025 to further validate their seamless integration into global financial infrastructure.

PROJECT USED

besu

Hyperledger FABRIC

Hyperledger FIREFLY

PHASE: PILOT

Brazil

After years of research and organizing the LiFT Challenge to explore use cases and MVPs, the Banco Central do Brasil announced June 2023 that it would be launching a CBDC pilot.

Its goals are to provide greater efficiency to financial markets and financial inclusion through Drex, previously referred to as the Real Digital, which will be implemented at the retail level via a regulated financial intermediary.

The Drex platform, built on Hyperledger Besu, will allow regulated financial intermediaries to convert balances of demand deposits and electronic money in Drex providing the market with new financial services enabled by smart contracts.

The International Monetary Fund (IMF) has praised Drex as its flagship initiative, stating that, "the Brazilian central bank is at the forefront of financial innovation," having already onboarded millions with its instant payment system Pix, the CBDC will build on it to allow for a "smart platform".

BANCO CENTRAL DO BRASIL

DREX

PROJECT USED

Hyperledger FABRIC

Please visit Kaleido for more information on blockchain-based CBDC architectures.

PHASE: RESEARCH

Norway

NORGES BANK

Norges Bank continues to advance CBDC research through a multi-phase study. In Phase 4, completed in June 2023, the bank developed a CBDC sandbox on Besu, allowing CBDCs to be issued, transferred to private banks, and distributed to customers. The phase showcased large-scale batch payments via APIs and smart contracts, along with pioneering features never before tested like integrating verifiable credentials with Norway's social security registry and calculating per-second interest rates for transactions, including minting and burning of CBDCs.

In Project Icebreaker, Norges Bank collaborated with the Bank of Israel, Sveriges Riksbank, and BIS to explore cross-border retail CBDC payments. It tested the technical feasibility of connecting different DLT systems, identifying benefits, trade-offs, and challenges for instant cross-currency transactions.

In 2024, Norges Bank extended its research to prepare for a potential CBDC introduction, focusing on both retail and wholesale designs. Known for transparency, it remains the first central bank to publish its CBDC code on GitHub, promoting open-source collaboration. The bank aims to ensure any CBDC decision safeguards financial stability and payment system efficiency.

PROJECT USED

besu

Photo by Oliver Cole on Unsplash

PHASE: PILOT

Nigeria

The Central Bank of Nigeria (CBN) launched the live eNaira CBDC in October 2021, built on Hyperledger Fabric to ensure a secure, scalable, and efficient infrastructure. Within its first year, the platform facilitated approximately 700,000 transactions worth $18.3 million. Two applications were introduced, the eNaira Speed Wallet and the eNaira Merchant Wallet, to enable citizens and merchants to access and utilize the eNaira.

eNaira's objectives include improving access to central bank money, streamlining tax collection, supporting a resilient payment system, enabling welfare distribution, and facilitating remittances and cross-border payments. In 2023, the CBN expanded access to individuals without bank accounts to boost financial inclusion. For more details on the eNaira's design, read the white paper.

In 2024, the CBN reported a 57% increase in the value of eNaira transactions, reaching N18.32 billion, while initiating a comprehensive review of its implementation to ensure a broad and positive economic impact. The eNaira was integrated into the Nigeria Inter-Bank Settlement System to enhance interoperability, with further collaborations with fintech firms to broaden its accessibility and utility.

CBN Governor Olayemi Cardoso emphasized the eNaira's role in the Payment System Vision 2025 initiative, highlighting its potential to boost trade, investment, and economic growth. Plans include enabling quick, affordable cross-border payments and improving confidence in the payment system. Continued enhancements to features, security, and usability aim to meet Nigeria's National Financial Inclusion Strategy goals.

PROJECT USED

Hyperledger FABRIC

Image Copyright: eNaira

PHASE: RESEARCH

United Kingdom: Project Rosalind

Bank of England

BIS

In collaboration with the BIS London Innovation Centre, Bank of England, set out to answer key questions that revolve around the implementation of a retail CBDC system. These include approaches with the private sector engagement, enabling interoperability, adoption, and a healthy competitive ecosystem.

The project explored the necessity for a universal and adaptable API layer. In collaboration with the private sector, the initiative delved into the foundational elements of a CBDC ecosystem, examining how APIs could support innovative use cases.

A prototype API layer comprising 33 endpoints across six functional categories was developed and tested in 30 identified use cases. This research underscored the potential of a well-designed API layer to facilitate CBDC payments, while emphasizing the importance of aligning API design with broader privacy considerations integral to CBDC implementation.

The project underscored the need for ongoing efforts in CBDC infrastructure development.

Read the final report here.

PROJECT USED

besu

Photo by Samuel Regan-Asante on Unsplash

PHASE: LIVE

Cambodia

The National Bank of Cambodia (NBC) launched Bakong – the first large-scale blockchain-powered central bank-run interbank payment system in production – in 2020. The NBC developed Bakong with LF Decentralized Trust member Soramitsu, leveraging Hyperledger Iroha.

While often described as a CBDC, Bakong is more of a tokenized deposit system since the digital currency is a liability of commercial banks. Bakong enables users to transfer and receive digital funds via smartphones without traditional bank accounts and has grown to more than ten million wallets in the population of 17 million.

The NBC has been pursuing CBDC integration with countries in the region such as Vietnam, Thailand, and UnionPay in China. The central bank seeks to expand its cross-border payment scheme with other countries including India, Japan, Singapore, and South Korea. NBC and Ant International have partnered to launch cross-border QR code payments between the Bakong payment system and Ant International's Alipay+.

In August 2024, the NBC launched the Bakong Tourist mobile payment system enabling international visitors to deposit money, via a bank or at their hotel, then make payments with QR codes at more than 3 million locations. In November the NBC and Mastercard announced that users can now transfer funds from Mastercard accounts to Bakong Tourists wallets.

Read more about Bakong's development in the LF Decentralized Trust Case Study.

PROJECT USED

Hyperledger IROHA

Please visit Soramitsu.co.jp for more information on blockchain-based CBDCs

PHASE: PILOT CONCLUDED

Eastern Caribbean Central Bank

In April 2021, the Eastern Caribbean Central Bank (ECCB) launched DCash, its retail CBDC, in four territories: Grenada, St. Kitts and Nevis, Antigua and Barbuda, and Saint Lucia. The pilot aimed to improve payment efficiency, financial inclusion, and economic resilience.

By March 2023, DCash had expanded to all eight ECCB member territories, with approximately USD 2.45 million in circulation, 21 participating financial institutions, 10 agencies, and nearly 400 merchants involved. Integration into merchant systems was a key focus.

The DCash Pilot concluded in January 2024 after 34 months validating the use of DLT for a retail CBDC with high availability, fast transaction settlement (< seven seconds), and robust security. Use cases included intra-regional commerce and small-value spending, but user adoption challenges highlighted the need for user-centric design.

The ECCB has since announced plans for DCash 2.0, a commercial-grade retail CBDC solution. Preparations included conducting public surveys in the late 2024 to inform the new system's design and a relaunch of the DCash website.

The ECCB is committed to leveraging the lessons learned from the pilot to enhance DCash's functionality and user experience, with the goal of furthering financial inclusion and economic development in the Eastern Caribbean.

PROJECT USED

Hyperledger FABRIC

PHASE: RESEARCH

Thailand

Bank of Thailand's Project Inthanon was one of the first to demonstrate how blockchain can enhance efficiency and support innovations in payments and supply chain financing by leveraging CBDCs.

Hyperledger Foundation Member Consensys, alongside SCG and Digital Ventures, used Hyperledger Besu to meet both the functional and non-functional requirements of a retail CBDC.

One of the business cases tested the use of a CBDC to simulate daily commerce, automate payments, and support procurement and financial management system called Procure-to-Pay (B2P) developed by Digital Ventures.

Read the full report.

PROJECT USED

besu

Please visit consensys.net for more information on blockchain-based CBDC architectures.

PHASE: RESEARCH

Inthanon-LionRock2

Project Inthanon-LionRock2 (ILR2), later renamed the mCBDC Bridge Project then Project mBridge, was led by the Bank for International Settlements HK Innovation Hub, Hong Kong Monetary Authority and Bank of Thailand.

Phase 2, which leveraged Hyperledger Besu, produced a prototype that enabled central bank control and monitoring of flow, balances, and transactions with their respective CBDCs.

It demonstrated the ability to program privacy and automate compliance, as well as a significant increase in cross-border transaction speed and cost reduction.

For Phase 3, the People's Bank of China and the Central Bank of the United Arab Emirates joined the others to form the mBridge Project to demonstrate the completion of an international exchange of multiple CBDCs in seconds as opposed to several days.

Phase 3 also involved further experimentation with design and technology choices and a future roadmap for a production-ready network that will be open sourced for public use.

Read the full report.

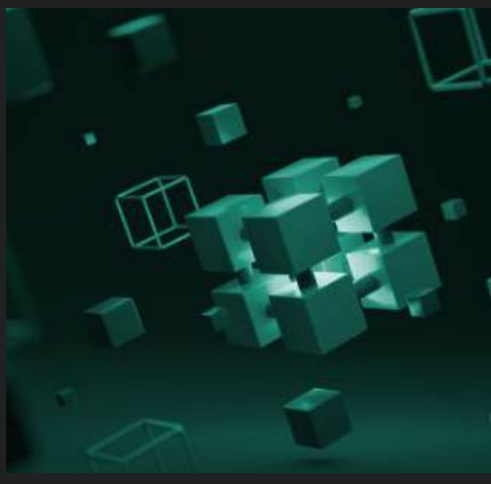
BIS

中国人民银行
THE PEOPLE'S BANK OF CHINA

HONG KONG MONETARY AUTHORITY
香港金融管理局

PROJECT USED

besu



Please visit consensys.net for more information on blockchain-based CBDC architectures.

PHASE: RESEARCH

Philippines

In 2023, the Bangko Sentral ng Pilipinas (BSP) launched Project Agila to explore a wholesale CBDC aimed at enhancing interbank payment systems. The project utilizes Hyperledger Fabric as the underlying technology.

In December 2024, BSP and participating financial institutions completed testing for the initiative, enabling financial institutions to conduct fund transfers beyond traditional business hours, including evenings, weekends, and holidays, through Oracle Cloud Infrastructure.

The testing phase involved evaluations covering functional, performance, security, and programmability assessments, ensuring the system's robustness and security for real-world applications.

BSP plans to integrate Project Agila into broader financial operations, including securities settlement and cross-border payments. The central bank aims to launch a wholesale CBDC during BSP Governor Eli M. Remolona Jr's term, which ends in 2029. 2025 or 2026 have been previously floated as potential timeframes.

PROJECT USED

PHASE: RESEARCH

Spain

BANCO DE ESPAÑA
Eurosistema

The Spanish financial sector completed the Smart Money experiment on the technical aspects of a digital euro's distribution, use, and design options.

The initiative–led by Iberpay, 16 banks (CaixaBank, Santander, BBVA, ING, etc.), and with the Bank of Spain observing–aimed to test the technical features outlined in the European Central Bank's report for a digital euro.

Using the Red-i blockchain network, based on Hyperledger Besu, Smart Money demonstrated the viability of a digital euro for the Spanish financial sector, including offline payments, and confirmed the two-tier infrastructure model as preferable over a centralized model.

Read the full report.

PROJECT USED

besu

Hyperledger WEB3J

PHASE: RESEARCH

Australia

In September 2024, the Reserve Bank of Australia (RBA) announced a three-year research program on the future of digital money in Australia. The program will launch a new project with industry on wholesale CBDC and tokenized commercial bank deposits.

Project Acacia will focus on understanding how ledger arrangements and concepts such as 'programmability' and 'atomic settlements' in tokenized markets could benefit Australia's financial system and economy. Future phases could involve cross-border applications with regional central banks.

The RBA and Treasury said they will reassess the merits of a retail CBDC over time and plan a follow-up paper in 2027.

The RBA is seeking industry feedback on technology design, risk management, governance, and regulatory considerations associated with different settlement models for wholesale tokenized asset markets. This consultation process will inform the selection of technologies for Project Acacia's next phases.

In 2020-21, the RBA with Commonwealth Bank of Australia, National Australia Bank, Perpetual and ConsenSys, among others, undertook a CBDC research project. Project Atom developed a proof-of-concept (POC) for the issuance of a tokenized CBDC that could be used by wholesale market participants for the funding, settlement and repayment of a tokenized syndicated loan. Project Atom used LF Decentralized Trust's Besu as its underlying DLT platform.

The RBA said Project Atom demonstrated benefits and implications of wholesale CBDC and identified questions and issues that needed to be explored further.

PROJECT USED

besu

PHASE: RESEARCH

Saudi Arabia and U.A.E.

A CBDC pilot using Hyperledger Fabric completed by the central banks of Saudi Arabia and the United Arab Emirates (U.A.E.) found that distributed ledger technology can improve cross-border transactions and meet the demands of financial privacy in a purely digital context.

In this report on Project Aber, the two central banks outlined the lessons learned from a yearlong proof-of-concept meant to test the viability of a shared digital currency. This project was one of the first to test cross-border transactions and has been referenced in future projects elsewhere in other jurisdictions.

PROJECT USED

Image Copyright: Project Aber

Please visit IBM for more information on blockchain-based CBDC architectures.

LF DECENTRALIZED TRUST
MEMBER SUMMIT 2025

Exclusive members-only annual event where industry leaders gather to direct the future

- ❏ Network with business and technical leaders
- ❏ Brainstorm to advance project scaling
- ❏ Share best practices and lessons

The LF Decentralized Trust Member Summit is a pivotal gathering for innovators advancing secure, openly developed decentralized technologies. It provides members with a collaborative platform to shape the future of blockchain, cryptography, distributed identity, and related projects through strategic discussions, workshops, and working groups.

By directly contributing to technical roadmaps and governance frameworks, participants align projects with real-world needs while staying ahead of emerging trends.

Members benefit from unparalleled networking opportunities, connecting with global experts across industries like finance, healthcare, and IoT. These collaborations often lead to innovative partnerships and practical solutions that enhance efficiency, security, and scalability.

Ultimately, the event underscores the power of open collaboration, empowering members to co-create technologies that build trust on a global scale. For organizations shaping the decentralized future, the summit is an essential venue for influence, insight, and innovation.

Additional Videos & Recordings

Blockchain engineers at Banque de France and IBM, provide a technical presentation and feedback on the Banque de France Venus CBDC experiment and how Hyperledger Fabric addresses many of the requirements for CBDC use cases. This video shows how Hyperledger Technologies helped build a CBDC, how it was used to orchestrate interoperability with HTLC, and will offer a deep-dive and hands-on session on the Hyperledger Fabric Token SDK lab. Watch it here.

Watch a curated selection of Hyperledger CBDC member webinars, special interest group presentations, global forum keynotes and more here.

Listen to experts at Davos in government–Central Bank, open source technology development and collaboration share their views on why open source tech and collaboration is the key to accelerating progress on CBDC research, adoption in financial services and in government.

Jim Cunha, senior vice-president, secure payments and fintech of Hyperledger Foundation Member Federal Reserve of Boston, discusses the "Boston Fed's CBDC Project" as well as the wider impact of distributed ledger technology on the financial system.

Governance, standards and interoperability: Getting past the roadblocks to peer-to-peer financial transactions with IBM, Consensys and Soramitsu - discussing the use of Hyperledger technologies in wholesale and retail CBDC projects.

Watch: How to Create a Currency Management Application and Deploy it on a Hyperledger Fabric Network with IBM Research. This shows two essential aspects of the Fabric Token-SDK, how to develop and deploy a token application ensuring a seamless integration with your blockchain infrastructure.

Watch: Hyperledger Besu for Financial Services Workshop.

Additional Resources

Reports and Trackers

- Making Headway – Results of the 2022 BIS survey on central bank digital currencies and crypto
- International Monetary Fund - A guide to Central Bank Digital Currency Product Development
- How should central banks approach Central Bank Digital Currency?
- World Economic Forum - Central Bank Digital Currency Global Interoperability Principles
- CFA Institute Global Survey on Central Bank Digital Currencies
- CBDC Transactions to Exceed $213 Billion by 2030 Globally, as New Payment Models Acceleration Financial Inclusion
- Expanding Financial Inclusion or Deepening the Divide? MIT & the Digital Currency Initiative
- The Federal Reserve Bank of Boston and the Digital Currency Initiative at the Massachusetts Institute of Technology released the findings of Project Hamilton, which describes a theoretical high-performance and resilient transaction processor for a CBDC by developing open-source research software, OpenCBDC.
- OMFIF Retail CBDCs: The next payments frontier
- Using CBDCs Across Borders: Lessons Learned from Practical Experiments - BIS June 2022
- Central Bank Digital Currencies and a Euro for the Future - EU Blockchain Observatory and Forum

CBDC Trackers:

- Atlantic Council CBDC Tracker
- Kiffmeister Wholesale CBDC Tracker
- Kiffmeister Retail CBDC Tracker
- BCG CBDC Tracker

Photo by Mark Boss on Unsplash

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Thank You

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