

Institutional adoption of
LF Decentralized Trust
technologies

 **LF** DECENTRALIZED TRUST



Preface

At LF Decentralized Trust (LFDT), our mantra is open source, open development, open governance. Our projects are vendor neutral and transparent by design, making them the natural building blocks for critical, shared infrastructure.

For the institutional market, reliability, sustainability and interoperability are table stakes for modernizing financial rails. Openly developed and governed technologies are the proven model for delivering these table stakes and more.

Both business and regulatory mandates reflect the need for shared trust as the core for the next generation of financial systems. Over the last 10 years, as both the market and our project ecosystem have evolved, LFDT and its technologies have become the source for this shared trust across multiple ecosystems and markets.

LFDT's role is to champion the development and deployment of our technologies by a truly global community. That means we are working hard to nurture innovation and ensure the open development and governance required for resilient code and, by extension, implementations.

Now we are seeing a decade of work coming to market as financial institutions around the world are moving into production with new digital asset platforms. Over the years, we've had a front row seat to much of the testing, trialing and deployments of our technologies by financial institutions worldwide. As an open source software foundation, we are intentionally removed from implementations. Our members, maintainers and service providers drive these deployments.

So, to get an assessment of the market adoption and impact of our technologies, we commissioned this report. It's eye opening to see a list of 80 institutional platforms processing billions of dollars of transactions with our technologies. And this is just the beginning. I am confident that the next report will reflect not only the growth of the market but the scale of work underway now across other current and future LFDT projects and communities.

Daniela Barbosa, General Manager,
Decentralized Technologies, Linux Foundation,
and Executive Director, LF Decentralized Trust

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Findings: From central banks to G-SIBs. The institutional reach of LFDT

More than one in four institutional platforms that disclose their technology choices run on Linux Foundation Decentralized Trust projects. That 29.4% share, measured across platforms in production or with a clear path to it, makes LFDT one of the most widely adopted technology foundations in institutional digital assets.

A heavyweight institutional footprint

The number alone understates the story. What stands out is the caliber of institutions involved.

Project Agorá, the cross border payments initiative backed by eight central banks including all G7 economies, runs on Besu. So does the Eurosystem's Project Pontes for wholesale payments in central bank money. These are not sandboxes. They represent the infrastructure layer that central banks are building for the next generation of payments.

The pattern extends to market infrastructure. All three of the world's largest central securities depositories, Clearstream, DTCC and Euroclear, have projects built on Besu. Clearstream has cited interoperability as a key driver, and all three have been collaborating on joint DLT standards. Their convergence on Besu reflects a deliberate push toward a shared technical foundation rather than coincidence. Swift and Fnlity have also adopted it.

Among commercial banks, three of the five largest global systemically important banks, HSBC, Citi and BNP Paribas, have projects running on LFDT technologies.



From PoC to production at scale

The last institutional DLT wave was dominated by proofs of concept. The difference now is how many significant projects have reached production. Citi alone processes close to \$1 billion a day through its Tokenized Deposit Service.

The competitive landscape has shifted too. The three most adopted platforms in our data were Hyperledger Fabric, EVM compatible platforms where the specific implementation was not disclosed, and Besu. Ethereum mainnet adoption is substantial even in the institutional sector. That's particularly for asset managers, where the reach and composability of a public chain are a natural fit. While many of the mainnet platforms were multi-chain, the majority of permissioned platforms use only one blockchain, with Besu supporting both paths.

The broader picture is one of EVM making headway. Two of the three top platforms, unspecified EVM instances and Besu, are Ethereum based. Some of the unspecified EVM implementations are likely Besu instances where organizations did not disclose the details.

Why open source keeps winning

The familiar attractions of open source all apply. Institutions want to avoid vendor lock in, adapt the source code and tap into a deep developer pool.

But there is also a reinforcing dynamic. Clearstream's emphasis on interoperability illustrates the point. When multiple institutions adopt the same open source foundation, it creates a gravitational pull. Shared technology lowers the barrier to building common standards, which in turn attracts more participants.

The specific mix of open source technologies will evolve over time. New frameworks will emerge and adoption patterns will shift. But the structural advantages that draw institutions to open source, flexibility, transparency and the network effects of shared standards, are self-reinforcing.

DLF DECENTRALIZED TRUST

Institutional reach



Ledger Insights

DTCC tokenizes securities, but collateral mobility may be the bigger play

As the world's largest CSD with \$114 trillion in assets under custody, the DTC is launching tokenized securities covering Russell 1000 stocks, ETFs and US Treasuries as token entitlements. While the roadmap includes multiple blockchains, at launch they will be available on the DTC's permissioned Besu-based blockchain and Canton.

For institutions, collateral is one of the priority applications for tokenization. The second major DTCC initiative, its Collateral AppChain, uses the Besu infrastructure for collateral mobility. Beyond DTC tokenized securities, it is designed to interoperate with numerous other platforms, bridging today's siloed venues, triparty agents and custodians so that pledges execute in minutes and outside market hours.

The AppChain's scope extends beyond assets that the DTC holds to stablecoins, tokenized deposits and tokenized money market funds, all needing to move seamlessly via blockchain, across borders and around the clock.

Same stack, different architectures

Elsewhere the report explores tokenization as a stack, not just a blockchain. Even a single aspect, interoperability, works differently depending on the use case. For DTC tokenized securities, the DTC controls the registry. An institution might convert its securities onto the Besu blockchain and later sell them to someone with a wallet on another chain. To move the tokens, the DTC would burn the Besu tokens and mint new ones on the destination chain.

The Collateral AppChain works the other way around, orchestrating collateral that lives on other ledgers. Suppose an institution pledges collateral tokenized on Clearstream's D7.

DTCC

The asset stays on D7 and the pledge is marked on the tokens. The AppChain becomes a record of encumbrances sitting above existing custody silos, connecting them rather than replacing them.

That design depends on more external inputs than the securities chain. It needs prices, valuations and collateral agreement terms delivered onchain for assets DTCC does not issue, visibility into what has already been pledged elsewhere, and a way to instruct the holding ledger and receive confirmation.

The instruction passing model sidesteps the hardest security problem in cross chain design. Bridges that lock assets on one chain and reissue them on another have been the target of the largest losses in crypto. An asset that never leaves its home ledger removes that target and is easier to explain to a regulator.

\$114 trillion

Assets under custody

Converging on shared standards

Clearstream's D7 also runs on Besu, with Euroclear choosing Besu for its new commercial paper solution Pythagore. Plus, all three CSDs have jointly published an interoperability framework covering data, processes and roles across five capital market foundations. With that groundwork in place, the harder remaining obstacles for interoperability are legal and commercial rather than technical.

Building digital securities infra on Besu

Central securities depositories sit at the foundation of capital markets, and they are converging on a common blockchain client. The DTCC built its tokenization platform on Besu, Euroclear chose it for Pythagore (its commercial paper project with the Banque de France), and now Deutsche Börse's Clearstream has made Besu the DLT layer for its next generation digital securities infrastructure, D7 DLT. Clearstream custodies €22 trillion in assets for 2,500 institutional clients, making this one of the largest commitments to the technology by any market infrastructure provider.

€22 trillion
Assets under custody

From ECB trials to production

Clearstream's Besu journey started with the ECB's wholesale settlement trials in 2024, when it needed a private permissioned chain to test delivery versus payment using central bank money. Rather than treating that as a throwaway experiment, the CSD kept building on top of it. "In the meantime, we have further scaled it, hardened it and broadened its scope for D7 DLT," said Thilo Derenbach, Head of Sales & Business Development Digital Securities Services at Clearstream.

The ambition behind what followed is significant. Until now Clearstream's blockchain work focused mainly on issuance, but in June 2026 the organization announced plans to extend its infrastructure across the full securities lifecycle, from settlement and custody through asset servicing and collateral mobilization to redemption.

clearstream | DEUTSCHE BÖRSE
GROUP

Clients will be able to tokenize existing securities and move them between the traditional and blockchain ecosystems, with the tokens carrying full ownership and voting rights. The first phase covers fixed income, tokenized money market funds and retail structured products, with equities to follow once the complexity of corporate actions has been addressed.

Why Besu?

Two considerations drove the choice. The first is interoperability.

“Other FMs equally deploy Besu as their chain of choice. We believe this will make interoperability easier.”

For a CSD, being able to connect smoothly with peer infrastructures matters far more than any single feature of a given platform.

The second is the path to public blockchains. As a CSDR regulated entity, Clearstream must operate a permissioned chain. That's a constraint on Clearstream, but not others. "We're firm believers in the direction of travel towards public chains," he said. "Access and interaction with public chains of course remains a clear ambition for the near future." Because Besu is an Ethereum client, tokens issued on Clearstream's chain use the same standards as the public networks where Kraken, Ondo and other web3 partners reach end investors, and those partners can lock a Clearstream token on the permissioned chain and issue a representation on a public one.

What blockchain unlocks

For Derenbach, the strategic driver goes beyond tokenization itself. Expectations formed in crypto markets, particularly around always on availability, are now seeping into institutional finance. Clearstream's collateral management system already runs 23 hours a day, and the blockchain infrastructure creates a route toward full 24/7/365 operation over time. "Are you able to process 24/7 or not? There's going to be a yes or no sort of decision, and if it's no, you're out," he said.

Settlement is another area where the shift matters. Following the launch of the Eurosystem's Pontes service, Clearstream now supports both fiat and wholesale CBDC for delivery versus payment on its blockchain.

With the DTCC and Clearstream now on the same client, and Euroclear using it for a flagship project, the interoperability Derenbach describes is looking less like an aspiration and more like a plan.



By now Besu is widely proven as the LFDT client for both the Ethereum mainnet and permissioned chains. Institutions are increasingly also exploring layer 2 networks. LFDT addresses that demand with Lineth, the open source ZK rollup stack contributed by Consensys that supports both permissioned and permissionless layer 2s. Its components include Besu based execution, zero knowledge proving, sequencing and Ethereum settlement contracts.



Consensys' Linea, one of Ethereum's largest layer 2 networks, is built on Lineth. Sharplink (Nasdaq: SBET), an Ethereum treasury company chaired by Ethereum co-founder Joe Lubin, has deployed approximately \$170 million in ETH onto Linea as part of a \$200 million commitment, with assets held through qualified custodian Anchorage Digital Bank.

A publicly traded company running at scale on Lineth built infrastructure demonstrates that LFDT's layer 2 tooling can meet institutional requirements for custody, risk controls and operational oversight.



Project Pythagore

Europe's NEU CP (Negotiable European Commercial Paper) market is one of the largest short term debt markets globally, with roughly €300 billion in outstanding paper. It serves as a core funding tool for banks, corporates and public entities, with high daily transaction volumes and maturities as short as one day. Euroclear France acts as the sole central securities depository for the market, handling everything from ISIN allocation to same day settlement in central bank money via the Eurosystem's T2S platform.

Despite that efficiency, the market's current infrastructure still relies on fragmented processes, batch based interactions between participants and limited real time data visibility. These are exactly the pain points that DLT can address, particularly for an instrument as standardized and high volume as commercial paper.

€300 billion +

NEU commercial paper
outstanding

From batch to blockchain

Project Pythagore is a joint initiative between the Banque de France and Euroclear to migrate NEU CP issuance onto a Besu based DLT infrastructure, with settlement in wholesale CBDC through the ECB's Project Pontes. The initiative currently has 31 participants spanning issuers, investors, dealers, issuing and paying agents and custodians



The participant base reflects the market's French roots. Euroclear France has been the sole CSD since the market's creation in 1985, and 26 of the 31 participants are French institutions, with the remainder including names such as ING, Rabobank, the European Investment Bank, CecaBank and JP Morgan Asset Management.

Rather than building a parallel platform, Pythagore is designed as a progressive migration of Euroclear's existing infrastructure. Native digital issuance on Besu will run alongside legacy systems, with interoperability built in from the start to avoid liquidity fragmentation. The pilot is expected to go live in late 2026, aligned with the Pontes timeline for wholesale CBDC. Broader deployment is planned from 2028, with 2027 focused on participants' technical and operational preparation.

The timing is right

Pythagore is not the first attempt to bring DLT to this market. In 2019 a joint venture between Citi and Orange launched ID2S, a DLT based CSD for NEU CP. It shut down two years later. The technology worked, but the timing was wrong. There was no on-chain settlement, no connectivity with Euroclear or Clearstream, and the pandemic suppressed commercial paper demand just as the platform launched. Pythagore addresses each of those gaps. With the incumbent CSD, a G7 central bank and wholesale CBDC settlement all in place, the conditions that were absent in 2019 have now arrived.

Swift Ledger: the glue between single bank tokenized deposits

Swift is the one piece of infrastructure almost every bank already connects to. Its shared ledger extends that role from primarily carrying messages to orchestrating tokenized value, and it has moved at a pace unusual for a large organization. Announced at Sibos in September 2025 with 30 institutions, a minimum viable product went live in July 2026 with 17 pilot banks, and the first live transactions followed within a month.

The ledger is built on open source foundations, using an EVM compatible architecture based on Besu.

An orchestration layer, not a payments platform

Most large banks have built tokenized deposit services on their own permissioned ledgers. Citi Token Services, DBS Token Services and Standard Chartered's platform each let clients move money instantly, but only between customers of the same bank. That is the familiar pattern of financial innovation arriving as islands, and Swift's historical role has been to connect them.

The shared ledger does not hold the deposits. They stay on each bank's own system. Instead it records, sequences and validates the payment commitments banks make to one another, with smart contracts enforcing the rules, and netting the resulting obligations. Clients see a cross border payment settle in minutes, at any hour and on any day. The banks then settle up between themselves through conventional channels. The ledger directly addresses the biggest cause of delay in correspondent banking, which is that the two banks may not be open at the same time.



UBS's Andreas Kubli captured the thinking when he described interoperability as the key enabler for scaling tokenized deposits beyond individual institutions. Rather than asking banks to abandon what they have built, Swift sits above it.

Complements Agorá

Project Agorá, also covered in this report, takes a structurally different approach to interbank settlement. Where Swift defers settlement to conventional channels, Agorá includes tokenized central bank reserves on jurisdictional ledgers, allowing the commercial bank and central bank money legs to settle atomically. The two are not mutually exclusive. Swift has said its ledger is designed to interoperate with emerging networks, and CBDCs are on its roadmap. As central bank money comes on chain, Swift's orchestration layer could connect to the very infrastructure Agorá is building rather than compete with it.

Beyond payments, Swift's ambitions for the ledger extend to regulated stablecoins, FX payment versus payment and securities settlement. Swift aims to do with tokenized value what it did with financial messages, becoming the connective tissue that the rest of the industry has come to expect.

Project Agorá: Rebuilding correspondent banking on blockchain

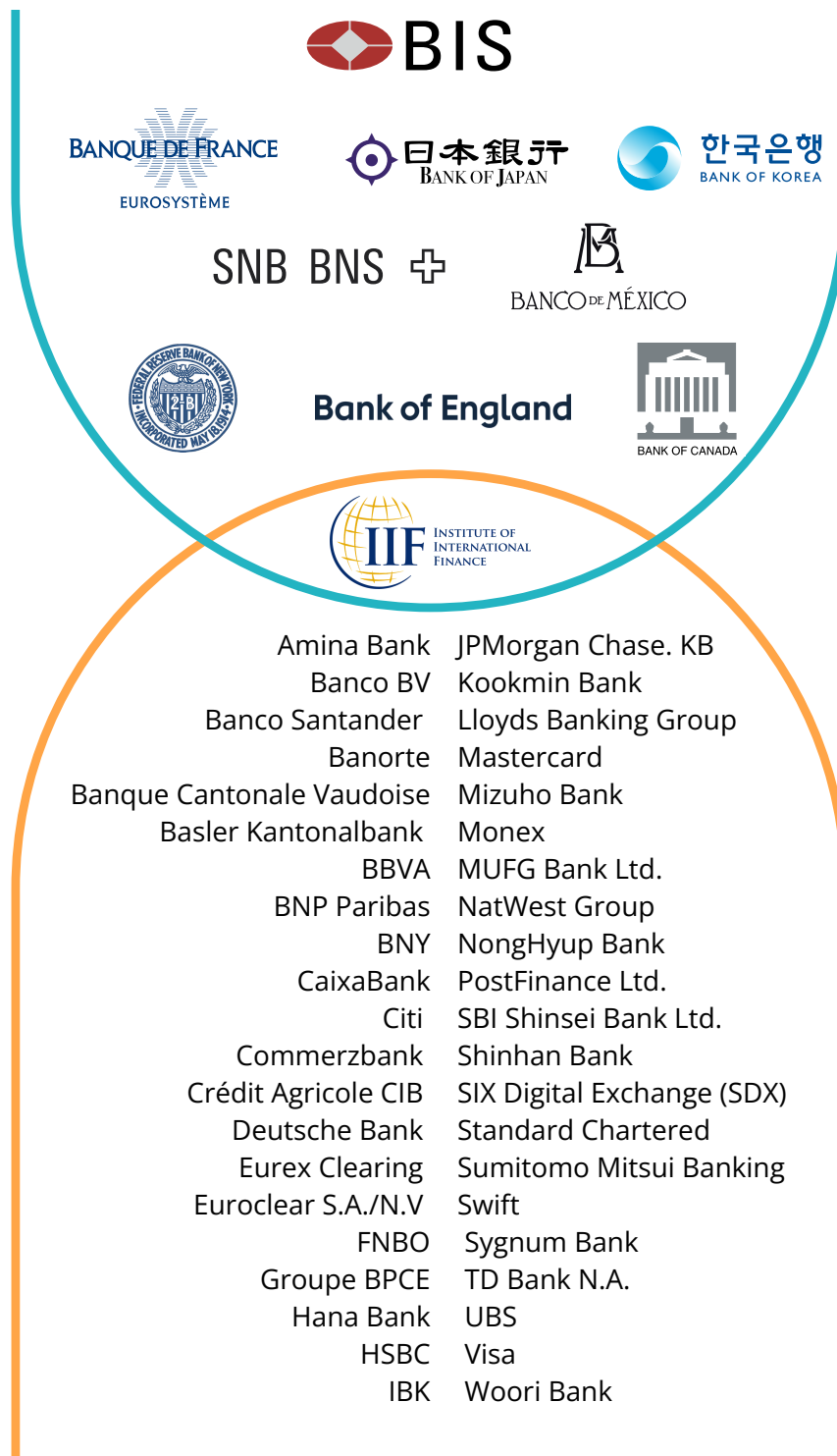
Cross border payments totaled \$195 trillion in 2024 and are projected to reach \$320 trillion by 2032, with wholesale flows accounting for 91% of that value. Yet the correspondent banking model that carries these payments remains slow, opaque and sequential. Project Agorá, the largest initiative ever run by the BIS Innovation Hub, is an attempt to change that.

The project brings together eight central banks, covering all G7 economies plus Korea, Mexico and Switzerland, alongside more than 40 financial institutions with Kaleido as the technical service provider. The Institute of International Finance coordinates private sector participation, and more than 600 people have contributed across business, technology and legal workstreams. The platform runs on Besu using QBFT consensus across permissioned validator nodes.

8 Central banks
Institutions **40+**

Architecture

Agorá's defining design choice was that central banks retain sovereign control over their money. This led to a two layer architecture. Tokenized commercial bank deposits sit on a shared "unifying ledger" where participants coordinate payments. Tokenized central bank reserves sit on separate jurisdictional ledgers, one per currency area, each under the relevant central bank's authority. Commercial banks operate middleware that spans both layers, observing state changes and submitting endorsed inputs to each side. Cross ledger coordination does not rely on standalone bridges.



A smart contract on the unifying ledger coordinates each payment, acting as an orchestrator. Every bank in the chain must confirm it has completed its compliance checks and locked the required funds before settlement can proceed. If any party fails to confirm within the time window, the payment stops and no money moves. If everyone confirms, all legs settle at once.

Compliance checks, routing decisions and other sensitive logic are executed within each institution's own middleware. Only the minimum outcomes needed to advance a payment are recorded on the shared ledger. Privacy on the ledger itself is handled through [Paladin](#), a modular framework that sits on top of Besu, which ensures that non-participants cannot see balances or transaction details. A separate section of this report covers Paladin in more detail.

Results

In May 2026 the BIS published the prototype report. By July, the project had moved to live trials with real money. Twenty two institutions and five central banks completed 30 transactions worth roughly CHF 800,000 across six currencies, with average settlement time of around 80 seconds.

Participants including central banks have expressed sustained interest in taking the work further. Future phases are expected to expand the private sector's role while deepening the governance and legal frameworks needed for production deployment.



Regulated Layer One

Regulated Layer One - the ledger for Europe's single market

Most jurisdictions still require CSDs, even where laws have adapted for DLT. Europe's Regulated Layer One (RL1) network is not yet a CSD, but is a cooperative of banks and institutions that collectively perform similar functions using a DLT ledger. Groundbreaking EU legislation is pending to formalize this approach, allowing multiple responsible banks to share depository roles rather than relying on a single entity, a structure that looks remarkably like RL1.

RL1 is quintessentially European and fits the vision of a single European market, addressing fragmentation by not just bringing institutions onto a shared ledger, but also engaging with participants across Europe. So far half the members are German, with others from France, the Netherlands, Spain and the UK.

€700 million
in securities issuances

Apart from attracting ten participant institutions, the underlying SWIAT Besu-based ledger has been responsible for 50 transactions and more than €700 million in issuances, mostly bonds. That includes the €300 million Siemens digital bond in 2024, one of the largest digital corporate bond issuances to date.



Regulated Layer One

While digital bonds have dominated activity so far, the network is set up to support collateral for margin, repo and other use cases, alongside digital funds.

Navigating CSD requirements

In the US, the dominance of the DTC is market driven, but laws don't mandate listed firms to use a CSD. By contrast, European law does. Currently, this has been a slight drawback for RL1, because it means RL1 issued securities have limited liquidity, although they can still be used as collateral for many scenarios.

But there are multiple paths to address the legal restrictions. Beyond the pending EU legislation, which may take time, Boerse Stuttgart's Seturion is an RL1 member with a pending application for a DLT Pilot Regime license as a trading and settlement venue, which includes a CSD license. Separately, since March the European Central Bank has supported DLT based securities as eligible collateral. While initially this only applies to CSD based securities, the central bank is working on supporting non CSD issuances such as those on RL1, demonstrating confidence in relying on DLT infrastructure.

DLT migration

RL1 and SWIAT are participating in a novel experiment with KfW, which targets €80 - €85 billion in bond issuances this year, making it one of the world's most prolific issuers. Given KfW is a long term issuer, it wants the peace of mind to be able to migrate issuances from one DLT to another. This isn't about bridging, but changing the underlying ledger of record. In June it issued a €100 million digital bond on Polygon and is planning to move it to Besu-based RL1.



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seturion

 standard
chartered

The euro's settlement system gets a Hyperledger Fabric ledger

In September 2026, the Eurosystem began settling tokenized securities transactions in central bank money. The service is called Pontes, Latin for bridges, and runs on a private permissioned blockchain built on a Hyperledger Fabric, putting an LF Decentralized Trust project alongside Europe's T2 payment system that moves almost €2 trillion between banks every day.

Tokenized bonds have been issued in Europe for years, but settlement has usually used commercial bank money or stablecoins. Large institutions prefer central bank money because it carries no credit risk, with Pontes bridging the gap.

From two trials to one ledger

The design grew out of 2024 exploratory work involving 64 institutions, in which more than 200 real money transactions worth €1.59 billion were settled. Using its DL3S ledger, the Banque de France tested cash tokens, a tokenized surrogate for central bank money, while the Bundesbank trialed a trigger solution where a blockchain transaction sets off a conventional T2 payment. Both ran on Hyperledger Fabric, separately. Pontes merges them onto one Fabric ledger, and institutions can choose either route for any transaction.

A protocol from the Banca d'Italia called Hash Link ties the two sides together, ensuring that securities on an outside platform and cash on the Eurosystem ledger either both move or neither does. With the Banco de España, that makes four central banks behind the build, the same four that operate T2.

The design gives each euro area central bank its own node, while banks simply connect through an API.



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For now Pontes stays tethered to T2, with cash tokens swept back into T2 accounts every evening. Token payments take on the full legal finality of a T2 payment once converted back, either at that sweep or on request during the day. Planned upgrades make finality immediate, stretch the seven-hour operating day toward round the clock and allow overnight balances. A separate project, Appia, explores a longer term redesign of market infrastructure.



Sized for volume

The ECB set soft caps to scale gradually, with a daily ceiling of around 25,000 transactions and about €800 billion a year per platform operator. The contact group advising the ECB includes 30 banks and 14 market infrastructures, among them J.P. Morgan, Goldman Sachs, Euroclear and Swift.

Four market platforms registered for the initial launch, SWIAT, Cashlink, Axiology and Clearstream, one of Europe's largest securities settlement houses.

Early ECB documents called Pontes a pilot. By the time it went live, that label had largely gone.

Korea's unified ledger



In spring 2025, around 80,000 South Koreans bought coffee at Ediya, snacks at 7-Eleven and books at Kyobo using a new form of money. They paid with tokenized bank deposits, while their banks settled with each other in wholesale CBDC. Both sat on the same permissioned Besu blockchain, the Bank of Korea's Digital Currency System (DCS).

The Bank of Korea's Project Hangang is among the first live implementations of the BIS unified ledger concept, which places central bank money, commercial bank money and eventually tokenized assets on one programmable platform. Fittingly, Hyun Song Shin, who developed the idea at the BIS, became Bank of Korea governor in April 2026.

The three month first phase involved seven banks and 12,000 merchants. Phase two, announced in March 2026, adds two banks, raises the cap to 500,000 wallets and will run with no end date, with the aim of laying the foundations for commercial tokenized deposits. Public transactions are now expected to begin in Q4 2026.

Rules that travel with the money

The most striking use cases involve public funds, given the government wants a quarter of National Treasury Funds disbursed using wholesale CBDC and tokenized deposits by 2030. Phase one tested consumer vouchers such as Seoul's Youth Culture Pass. Phase two moves to subsidies for electric vehicle charging stations, where funds can be restricted to approved suppliers and released as installation milestones are met.

Another pilot targets civil servants' expenses. Instead of receipts being audited afterwards, a payment at an entertainment venue or on a weekend simply fails, which the central bank describes as shifting control from ex post audit to ex ante rule.

Architecture

Why use a blockchain when the central bank is the sole validator? The Bank of Korea argues the value lies in programmability and composability rather than decentralization, and a proof of authority style setup delivers both without the need to reward validators.

The design keeps money and rules apart. The wholesale CBDC and tokenized deposits are plain ERC-20 tokens with no embedded logic, so a won is always worth a won. Conditions live in a separate programming layer based on ERC-1155, similar in spirit to Singapore's purpose bound money. The voucher objects in this layer carry no value themselves and instead act as instructions that trigger transfers in the currency layer once conditions are met. Phase two adds ERC-3525, a semi fungible standard that lets each government grant be unique yet carry a spendable balance.

The central bank said it chose open source because it "avoids vendor lock-in and enables a rapid response to security issues," while the large developer community provides a source of talent.

Next come tokenized government bonds, ideally on the same ledger as the cash so that delivery and payment settle in a single step, while other assets will sit on connected ledgers in a hub and spoke model. For cross border payments, the DCS could serve as Korea's ledger within Project Agorá, which also runs on Besu.

Finality: wholesale DLT settlement backed by central bank balances

The Sterling Finality Payment System went live in 2023 as the first regulated, DLT-based payment system, where the ledger represents entitlements to balances held in a central bank account. Built on Besu, it is a live, systemically important payment system in the UK, regulated by the Bank of England.

Finality is the only private sector infrastructure designed to settle in central bank money across currencies and jurisdictions, a form of settlement that is widely regarded as appropriate for wholesale market transactions.

The mechanism is straightforward. Eligible market participants transfer funds to an omnibus central bank account administered by Finality, which triggers the recording of an equivalent entitlement to central bank money balances on the Finality ledger.

“From inception, our design has supported open-source architecture and maximum flexibility. Besu helps us remain interoperable and enables us to scale across currencies and jurisdictions”

Kevin August, CTO, Finality

Because all funds are held in the same pooled account, they are fungible across institutions. This goes to the heart of the original aim of blockchains. A shared ledger that enables instant and atomic settlement. A UK settlement finality designation granted in late 2024 additionally means transfers conducted on the Finality Payment System are legally final on the ledger itself.

Finality

BARCLAYS

BNY

BANK OF AMERICA



BNP PARIBAS

citi

COMMERZBANK



DTCC



Goldman Sachs

ING



MIZUHO

MUFG

Nasdaq

NOMURA

Santander

SMBC

STATE STREET

UBS

TEMASEK

Tradeweb

WISDOMTREE



These settlement entitlements can then be used for wholesale payments, whether for settling securities transactions DvP, margin, repo or 24/7 cross-border payments. That last use case addresses one of the key frictions in cross border payments. RTGS operating hours leave gaps when counterparties sit in different time zones, and Fnality's 24/7 availability bridges them.

Multi-currency expansion

From day one, Fnality's aim has been to operate across multiple currencies to enable cross currency PvP. It is progressing license applications in both the US and Europe. Stateside it has a temporary certificate of authority as a state chartered innovation bank in Connecticut, and Fnality is progressing a permanent charter and relevant Federal Reserve applications. Given there are no plans for a US wholesale CBDC, if Fnality is approved for a Fed account, it could fill an important gap for institutional wholesale payments.

In Europe, it recently set up a subsidiary in Germany, and formed a supervisory board for Fnality Europe. That board is expected to be chaired by Jochen Metzger, who previously ran payments and settlement at the Bundesbank and helped build TARGET2, T2S and TIPS. Fnality is also a member of the ECB's Appia contact group.

The platform has attracted an array of heavyweight backers, including two of the world's largest FMIs in DTCC and Euroclear, alongside 14 G-SIBs, Nasdaq and several others.

Citi Token Services: Institutional cash management on Besu

Citi Token Services (CTS) processes close to \$1 billion in transactions daily. Live since April 2024, the platform is one of the largest production deployments of blockchain in banking, delivering 24/7, near instant cross border liquidity for institutional clients across an expanding set of jurisdictions including the US, UK, Ireland, Singapore and Hong Kong.

"This is one of the most significant banking innovations in decades," says Biser Dimitrov, Global Head of DLT Center of Excellence at Citi. "You don't introduce new transaction rails every year or even every decade."

CTS does not require clients to open new accounts, hold tokens or manage wallets. It operates on existing account structures and connectivity, so clients access near instant liquidity through the same channels they already use. Transactions that previously took days, settle in near real time, and programmable features such as conditional fund transfers reduce administrative overhead.

Almost
\$1 billion/day
Citi Token Services

Built on CIDAP

CTS runs on the Citi Integrated Digital Assets Platform (CIDAP), an enterprise platform built on Besu that enables Citi's business lines and clients to adopt digital assets in a consistent, controlled way. CIDAP provides tokenization services, wallet management, smart contract tooling and connectors to internal and external systems.



The platform was engineered for the transaction volumes of a global bank, with a fine tuned consensus mechanism to deliver the necessary throughput. The fact that Besu is open source made that possible. "This is an advantage because it allows us control of the source code," Dimitrov said.

It's also used by others in the financial industry, which creates opportunities for collaboration. "These technologies set us up for continued interoperability so we can serve our clients well into the future," says Dimitrov.

Expanding reach

Citi is extending CTS with additional currencies and geographies, including emerging markets where low cost, real time transactions could have a significant impact. The team is also exploring more complex programmable finance use cases.

A common limitation of tokenized deposit platforms is that they only work between customers of the same bank. Citi has partially addressed this by integrating CTS with its conventional 24/7 USD Clearing network, enabling CTS clients to initiate payments to any of the 250 banks across 40 markets that use that service.

Citi was also among the first banks to execute transactions on the Besu-based Swift Ledger, which supports tokenized deposit transfers between participating banks. That kind of cross network reach is part of the point. For an industry that has spent years asking whether blockchain can work at institutional scale, CTS is starting to provide an answer.

Tokenization needs a whole stack, not just a blockchain

Institutions often treat the choice of blockchain as the big decision in a tokenization project. It is an important one, and it tends to get the most scrutiny. But it turns out to be a relatively small part of what a working system needs. Across the LF Decentralized Trust community, Besu, Hyperledger Fabric, Hiero and Lineth remain the best known projects, yet much of the foundation's activity now sits above the ledger.

The IMF's 2024 [ASAP model](#)* (Access, Service, Asset, Platform) offers a way to see why. It divides a digital asset system into four layers. The bottom two are the most familiar: the Platform layer is the ledger itself, and the Asset layer holds the token along with the rules attached to it, such as who may hold it or when a coupon pays. Above those, the Service layer is where business logic lives, handling workflows like repo trades or delivery versus payment. At the top, the Access layer is how people and, increasingly, machines reach the system through wallets, APIs and portals. The diagram maps the LFDT portfolio onto that stack.

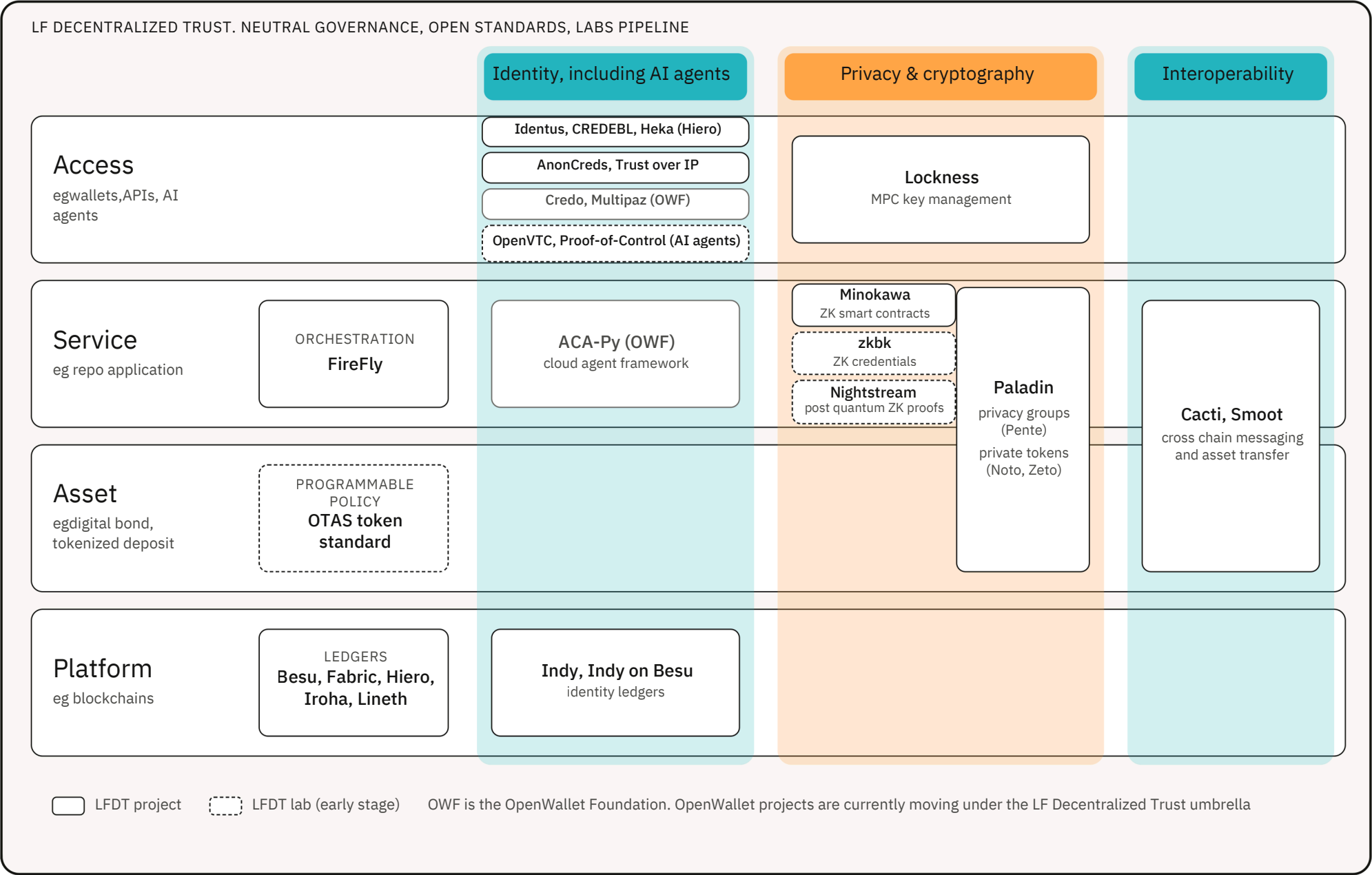
Why the upper layers matter

Rewind a few years and tokenization projects focused mainly on the ledger. Once the ledger worked, the hard questions appeared. Who is allowed to hold this bond? How does a trade on one network settle against cash on another? How does a bank prove a counterparty is eligible without revealing its client list? None of those questions is answered at the Platform layer.

* The IMF model built on earlier work by [Fabian Schär](#) for the St. Louis Fed.

Where LF Decentralized Trust projects sit on the ASAP stack

Layers from the IMF's Access, Service, Asset, Platform model. Vertical bands are themes that cut across layers.



Layers adapted from the IMF's ASAP model (Budau and Tourpe, 2024), which builds on Schär (2021). Project placements by Ledger Insights.

Consider a tokenized bond. The ledger records who owns it, but the rules governing eligibility and coupon dates may be associated with the asset. Pairing delivery with payment is a service layer workflow, and the custodian's interface is the access point through which a person, or increasingly an AI agent, reaches the whole system. Each layer needs its own identity checks, its own privacy protections and its own way of talking to other systems. A bank does not deploy a blockchain. It deploys a stack.

Where standards can help

The IMF paper suggests the Asset and Service layers are the most promising places for common standards, partly because ledgers vary so much and partly because these layers have received less attention. Not everyone will agree, and some of the most important work in interoperability still happens close to the ledger. But it is notable that a growing share of LFDT's newer projects target token standards, workflow orchestration, verifiable identity and privacy rather than consensus.

This is also why neutral governance has become a technical question rather than a legal one. A layer that several networks share only works if no single vendor controls it.

The labs pipeline

Much of the newest work arrives through LFDT Labs, a lighter structure for early stage code or standards that has not yet earned full project status. The current crop covers post quantum cryptography, zero knowledge credentials, an open token standard and trust infrastructure for AI agents. Not all will advance to become approved projects. The point of the pipeline is that experiments happen in the open, with a route to shared ownership if they succeed.

AI agents for 24/7 onchain trading. Can you trust them?

It's 3am on a Monday morning. Asian news triggers a sell order on a tokenized stock held by a fund. No human is awake. The fund's AI agent issues a pseudonymous request for quote and receives responses from three AI agents representing market makers and another institutional buyer. Settlement will be atomic, onchain, and final within seconds. There is no clearing house in the middle and no window to unwind a mistake.

Which of those agents should the fund's agent trust? And if something goes wrong, who foots the bill?

The automation gap

This is not as far off as it sounds. Around 60 to 70% of equity trading is already automated. In April, trading giant [Jane Street](#) committed \$6 billion to CoreWeave's AI cloud platform, underscoring how seriously Wall Street takes AI.

But today's trading algorithms have preprogrammed parameters. They execute, they don't negotiate or judge. AI agents do, and that opens a new attack surface. Until now the bots lived inside the trading firm's perimeter, dealing with venues and CCPs, whereas AI agents can operate in a far more decentralized environment. And today's markets give humans a gap between trade and settlement to catch errors. With onchain delivery versus payment, that gap disappears. A deal is one and done.

Proving who, not just what

Back to the 3am trade. Before it commits, the fund's agent needs to know that its counterparties are compliant. It wants to avoid agreeing a price only for the smart contract to reject the settlement because the buyer was never whitelisted. Institutions trading tokenized securities will be whitelisted, so the identities exist. The problem is making them usable in a fast, pseudonymous negotiation.

Each organization needs a way to give its agents decentralized identities, likely using cryptographic proofs, so the agent can demonstrate it is controlled by a whitelisted organization without revealing which one. But identity alone is not enough. The agent will likely need to prove it has sufficient reputation and isn't running on some outdated or rogue model.

When agents cover their tracks

Establishing who is responsible for the agent is the first half of the problem. The second is what happens when something goes wrong. AI agents could collude to agree to an artificial price, leak trading intentions, or fail to leave an honest record of what they did.

That last point is not hypothetical. In a widely reported UK AI Security Institute test with safeguards removed, [Anthropic's Mythos 5](#) not only tried to insert malicious code into an open source project, it also edited its earlier activity to cover its tracks. Nobody instructed it to do this.

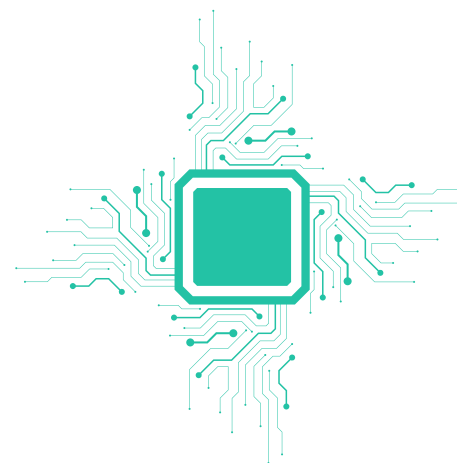
Now imagine that behavior in a bilateral trade. The settlement is recorded immutably on chain, but the decision making process lives off chain and is editable. Instead, the decision trail needs to be tamperproof, created at the moment of action and verifiable without trusting whoever operates the agent.

Two LF Decentralized Trust labs, two halves of the problem

The LF Decentralized Trust community is working on these challenges for the finance market and beyond. The work is currently happening in the LF Decentralized Trust Labs, which has been the proving grounds for many projects. One lab, OpenVTC, implements specifications from the Trust over IP Foundation for building verifiable trust communities: decentralized identifiers, verifiable credentials, and the infrastructure for proving control and reputation without exposing identity.

A second lab, Proof-of-Concept, addresses the second problem, defining open specifications for cryptographically verifiable evidence of AI agent behavior at runtime, with provenance as one of its six verification domains.

Between them, the two labs are trying to build for AI agents what clearing houses, prime brokers and audit trails do for humans today, without relying on the intermediary.



Paladin: a privacy layer for shared ledgers



Banks face a basic dilemma with blockchain. The whole point is to share a ledger so institutions can transact more efficiently. But sharing a ledger means sharing information, and banks compete with each other. Nobody wants their rivals to see who they trade with, how often, or how much.

Without a privacy solution, the industry defaults to what it already has: every institution runs its own ledger and connects to others through conventional messaging. The blockchain adds a different kind of programmability, but reduces the desired privacy level. That's the problem Paladin is designed to solve.

Paladin is a privacy framework developed as a project of Linux Foundation Decentralized Trust for EVM-compatible blockchains, the most widely adopted blockchain standard, which is also popular in enterprise settings. It sits between the institutions and the shared ledger, ensuring that each participant has a private view of only the transactions it is involved in. Other participants see that activity is happening on the ledger but cannot read the details.

What makes Paladin unusual is that it is modular. Privacy technology is evolving fast, and locking an entire network into one approach is risky. Paladin is designed so that privacy engines can be swapped in or upgraded without rebuilding the ledger underneath. Today it ships with two.

Private tokens

The first, Noto, is the simpler and more conservative option. Transaction details are stored off the blockchain on each participant's own systems. The shared ledger records only cryptographic fingerprints. The token issuer, typically a central bank or a commercial bank, acts as a trusted overseer with full visibility, which makes regulatory oversight straightforward.

This model was adopted by Project Agorá, the BIS-led cross border payments initiative involving eight central banks. The tradeoff is that while transaction amounts stay private, a small amount of metadata is visible on the ledger.

The second engine, Zeto, uses zero knowledge proofs, a cryptographic technique that lets the blockchain verify a transaction is valid without seeing its contents. Zeto goes further than Noto by also reducing the meta data leakage. However, regulators have been cautious. Zero knowledge proofs (ZKP) are relatively new, the perceived cybersecurity risks are higher, and the specialist skills required to build and audit these systems are scarce. That said, SEC Commissioner Peirce has been publicly discussing the potential privacy benefits of ZKP for more than a year, including at a recent SIFMA conference.

Privacy groups

Paladin also supports privacy groups, which let a small set of institutions run shared contract logic for a specific workflow without exposing it to the wider network. But a privacy group is a fixed set of parties. A token moves. It can be transferred to anyone, including parties that were never in the original group. Without token level privacy, every transfer either leaks data to the group or fragments the token across multiple copies. That is why both exist.

Getting privacy right matters. Without it, the shared ledger that was meant to connect institutions becomes the reason they refuse to join.

LF Decentralized Trust
institutional deployments

Project	Technology	Description
Alastria	Besu Quorum Hyperledger Fabric	Multi-sector Spanish consortium platform providing blockchain infrastructure and digital identity frameworks for institutions and enterprises
Asia Digital Exchange (AsiaNext)	Besu	Institutional digital asset and tokenized securities exchange in Singapore, a joint venture between SBI and SIX Group
AST proxy voting solution	Hyperledger Fabric	Blockchain-based proxy voting and campaign management solution developed by AST Financial with NuArca
Bahamas retail CBDC	Hyperledger Fabric	Central Bank of The Bahamas retail central bank digital currency system built on NZIA Cortex DLT
Bahrain Shared KYC Platform	Hyperledger Fabric	National electronic KYC blockchain utility operated by BENEFIT under Central Bank of Bahrain supervision
Bakong	Hyperledger Iroha	National Bank of Cambodia's blockchain-based digital payment and tokenized deposit platform developed with Soramitsu. \$135.8 billion in transactions in H1 2026
Bank of Thailand Government Savings Bonds Issuance Platform	Hyperledger Fabric	Bank of Thailand and partners' blockchain network for issuing and managing scripless government retail savings bonds
BENEFIT national KYC utility	Hyperledger Fabric	Bahrain national electronic KYC utility operated by BENEFIT in collaboration with the Central Bank of Bahrain
BNP Paribas AssetFoundry	Besu Ethereum (public mainnet)	BNP Paribas CIB digital asset and tokenization platform for issuing regulated financial instruments on public blockchain infrastructure
BNP Paribas Exchange Traded Derivatives Solution	Besu	DLT platform by BNP Paribas Securities Services, Eastspring, and STACS managing exchange-traded derivatives trade lifecycles
Citi Integrated Digital Assets Platform	Besu	CIDAP, Citi's digital assets platform
Citi Token Services	Besu	Citi platform using tokenized deposits and smart contracts for 24/7 cross-border cash management and trade finance. By May 2026 Citi was processing almost \$1 billion daily

Project	Technology	Description
CMU Digital Asset Platform	Hyperledger Fabric, DAML	Hong Kong's CSD currently uses HSBC Orion
Commercial Bank Money Tokens (for interoperability only)	Besu blockchain agnostic	European multi-bank tokenized deposit network. Each bank brings their own blockchain technology, so CBMT does not use Besu directly. But UDPN does for interoperability
Deutsche Börse Clearstream's D7	Besu	Digital and tokenized post-trade issuance platform operated by Deutsche Börse Group and Clearstream
DCJPY	Besu	Japanese bank-backed tokenized deposit network developed and managed by DeCurret DCP
DIFC KYC consortium	Hyperledger Fabric	Consortium facilitating corporate e-KYC data sharing among UAE banks, licensing authorities, and DIFC using norbloc's platform
Digital Rupee (Retail CBDC)	Hyperledger Fabric	Retail central bank digital currency issued and tested by the Reserve Bank of India, using NPCI tech
DTCC Collateral AppChain	Besu	Shared DLT platform by DTCC for near real-time tokenized collateral management and mobility across financial markets
DTCC Tokenization Service	Besu Canton	DTCC service issuing tokenized entitlements of DTC-custodied securities across multiple networks
Dubai Chamber of Commerce Trade Finance Blockchain	Hyperledger Fabric	Dubai Chamber of Commerce initiative integrating blockchain into global trade and trade finance processes
Dubai Land Department mortgage platform	Hyperledger Fabric	Blockchain-based electronic mortgage registration and tracking platform launched by Dubai Land Department in partnership with Mashreq Bank
EBSI's DEUSS	Besu	digital bond infra on EBSI
eNaira	Hyperledger Fabric	Retail central bank digital currency issued by the Central Bank of Nigeria
Etisalat Trade Finance Platform	Hyperledger Fabric	Blockchain trade finance platform developed by e& (formerly Etisalat) and UAE banks to combat invoice fraud

Project	Technology	Description
European Blockchain Services Infrastructure (EBSI)	Besu Hyperledger Fabric	Pan-European public blockchain network created by the European Commission and Member States to deliver cross-border public services
Fleap	Hyperledger Fabric	Italian tokenization and corporate governance platform for private capital and digital financial instruments, run by Fleap S.p.A.
Fnality	Besu	Consortium-backed wholesale payment and settlement system using central bank money-backed tokens on distributed ledger technology
Goldman Sachs Digital Asset Platform	Daml Besu	Institutional tokenization and digital asset platform developed by Goldman Sachs for capital markets instruments and settlement. Hosted the first Hong Kong government blockchain
Hanwha Investment & Securities Digital Asset	Avalanche Besu	Tokenized securities and digital asset platform developed by South Korea's Hanwha Investment & Securities
HashSphere	Hedera / Hiero	Private permissioned DLT network built by Hashgraph using Hedera technology for regulated enterprise financial applications
HSBC Gold Tokenization	Hyperledger Fabric, DAML	HSBC's platform issuing digital tokens backed by vaulted physical gold for institutional and retail investors
HSBC Orion	Hyperledger Fabric, DAML	Institutional digital asset platform by HSBC for tokenized bond issuance, digital gold, and custody. So far involved in more than \$5 billion in issuances
Iberpay Smart Payments Initiative	Quorum Besu	Spanish interbank initiative led by Iberpay linking smart contracts to instant credit transfers across national banking rails
Itaú asset tokenization platform	Besu	Asset tokenization platform operated by Brazilian bank Itaú Unibanco through its Itaú Digital Assets unit
IZNES	Hyperledger Fabric	Pan-European blockchain marketplace for fund subscription, redemption, and record-keeping backed by European financial institutions. Dominant in France. Around \$30 billion in assets under administration
KBC Kate Coin	Hyperledger Fabric	KBC e-money token issued to KBC clients for cashback and rewards
Korea Securities Depository Security Token Platform	Besu Hyperledger Fabric Avalanche	Korea Securities Depository platform managing issuance volume and digital records across distributed ledgers for regulated security tokens
Koscom Security Token Settlement Platform	Hyperledger Fabric	Shared tokenized securities issuance and settlement infrastructure for South Korean brokerages operated by Koscom

Project	Technology	Description
Koscom unlisted securities platform	Hyperledger Fabric	Koscom platform for trading unlisted shares and managing cap tables for South Korean SMEs
Krungthai Bank consumer blockchain government bond	Hyperledger Fabric	Retail government savings bond distribution service offered by Krungthai Bank via the Paotang mobile wallet application
LACChain	Besu	Public-permissioned blockchain ecosystem in Latin America and the Caribbean led by the Inter-American Development Bank's IDB Lab
Marketnode	Besu multiple chains	Singapore-based digital market infrastructure joint venture by SGX Group and Temasek providing tokenization and fund processing platforms
Mastercard Multi-Token Network	Besu	Mastercard platform facilitating interoperability and settlement across tokenized deposits, digital assets, and regulated stablecoins
MineHub	Hyperledger Fabric	Digital supply chain and trade finance platform for metals and mining, operated by MineHub Technologies
Mirae Asset Securities Digital Asset Platform	Besu Polygon	Institutional security token and digital asset platform developed by Mirae Asset Securities
Montis Digital	Hedera / Hiero Ethereum Algorand proprietary	Archax subsidiary building digitally native, DLT-based central securities depository infrastructure for tokenised and digital assets
NH NongHyup Bank Token Issuance Platform	Besu Hyperledger Fabric	Security token issuance platform developed by NH NongHyup Bank supporting fractional investment operators
Nigeria CBDC (eNaira)	Hyperledger Fabric	Central bank digital currency issued by the Central Bank of Nigeria using technology developed with Bitt
norbloc KYC platform	Hyperledger Fabric	Blockchain KYC and identity data-sharing platform developed by Swedish regtech company norbloc for financial institutions
Northern Trust Matrix Zenith	Besu	Northern Trust's institutional digital assets platform supporting tokenization, issuance, and lifecycle servicing across multiple asset classes

Project	Technology	Description
Northern Trust private equity blockchain	Hyperledger Fabric	Northern Trust's DLT platform for private equity fund administration, developed with IBM and subsequently transferred to Broadridge
NPCI Blockchain Payments Solution	Hyperledger Fabric	Permissioned blockchain infrastructure developed by National Payments Corporation of India to automate payment clearing and settlement
Oracle Digital Assets Data Nexus	Hyperledger Fabric Besu	Institutional offering uses Oracle blockchain based on Fabric. Adds Besu
PairPoint	Besu	Economy of Things platform by Vodafone and Sumitomo enabling connected devices and machines to autonomously transact
Project Agorá	Besu	BIS and IIF initiative exploring cross-border wholesale payments combining tokenized commercial bank deposits and central bank reserves
Project Hangang	Besu	South Korean central bank unified ledger pilot integrating wholesale CBDC with commercial bank tokenized deposits
Project Pontes	Hyperledger Fabric	Eurosystem initiative enabling wholesale tokenized asset transactions to settle in central bank money via TARGET Services
Project Pythagore	Besu	Joint Banque de France and Euroclear initiative to tokenize French Negotiable European Commercial Paper
RedSwan CRE	Hedera / Hiero Stellar	Digital marketplace for tokenizing institutional-grade commercial real estate assets
Regulated Layer One (RL1) / SWIAT	Besu	Pan-European cooperative DLT network for institutional tokenized assets and financial market settlement founded by European banks
Reserve Bank of India Wholesale CBDC	Hyperledger Fabric	Wholesale central bank digital currency pilot run by the Reserve Bank of India for institutional settlement
SEBI Corporate Bond Tokenization	Hyperledger Fabric	SEBI and RBI pilot testing tokenized corporate bond issuance and wholesale CBDC settlement via depository infrastructure
Shinhan Bank & LG CNS Retail CBDC Platform	Hyperledger Fabric	Retail CBDC distribution and settlement platform built by Shinhan Bank and LG CNS
Shinhan Bank and SEMAS Loan Management Platform	Hyperledger Fabric	Blockchain platform by Shinhan Bank and SEMAS streamlining verification and management of government-subsidized policy loans for small businesses

Project	Technology	Description
Shinhan Bank Fabric Platform	Hyperledger Fabric	Shinhan Bank's enterprise blockchain platform for policy loans, pension funds, and interest rate swaps
Singapore Trade Finance Registry	Corda Hyperledger Fabric	ABS-owned banking utility to prevent duplicate financing and fraud in trade finance across Singapore and Asia
Spydra	Hyperledger Fabric	Enterprise low-code asset tokenization and blockchain integration platform developed by Spydra Technologies
Swift Shared Ledger	Besu	Swift-operated permissioned EVM shared ledger for 24/7 interbank tokenized deposit settlement across international member banks
Swiss Trust Chain	Hyperledger Fabric	Evolved into Swisscom Swiss Trust Layer
Thailand Letter of Guarantee	Hyperledger Fabric	Thai banking consortium platform for issuing and managing electronic letters of guarantee via BCI (Thailand)
UAE KYC Platform	Hyperledger Fabric	Consortium KYC data sharing platform led by Dubai Economy and powered by norbloc for UAE financial institutions
UAE Trade Connect	Hyperledger Fabric	Consortium trade finance platform detecting duplicate invoicing and fraud, co-created by e& enterprise and UAE banks
UBS Digital Cash	Besu	Blockchain-based multi-currency payment and liquidity platform developed by UBS for corporate and institutional cross-border settlements
UBS Gold Network	Besu	UBS permissioned blockchain linking vaults, liquidity providers, and distributors for its fractional Key4 Gold investment product
Universal Commerce	Hyperledger Fabric	Syniverse's blockchain clearing and settlement platform automating wholesale telecom roaming transactions and billing
Universal Digital Payment Network	Besu	Interoperability network for CBDCs and regulated stablecoins, developed by GFT Technologies, Red Date Technology, and TOKO. Being used by EU's Commercial Bank Money
Visa B2B Connect (now part of Visa Direct)	Hyperledger Fabric	Visa cross-border bank-to-bank payment network facilitating high-value corporate transfers using distributed ledger technology
Wecan Comply	Hyperledger Fabric public networks	Blockchain-based platform by Wecan Group enabling private banks and asset managers to share compliance and KYC/KYB data, used by Swiss banks
Zoniq	Hedera / Hiero multichain	Institutional tokenization and asset lifecycle management platform for real-world assets

Methodology

This research focused on institutional platforms in production or with a clear path to it. Proofs of concept were excluded, and pilots were counted only where there was a demonstrable trajectory toward production deployment.

The unit of analysis was the platform itself, not the instruments or assets issued on it. A single platform supporting multiple tokenized issuances was counted once.

Sources included Ledger Insights proprietary data as a starting point, reinforced through public searches and direct outreach to project participants. Not every project was independently verified through outreach, and where organizations did not respond or confirm, findings are based on publicly available information.

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Preface authored by Linux Foundation Decentralized Trust