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The Role of Digital Money in Capital Markets

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Introduction

Money fuels markets. The money systems that support our capital markets have been built and refined over decades. They facilitate the movement of commercial bank and central bank money across banks, payment networks, clearinghouses, and central securities depositories to orchestrate reliable and efficient financial transactions.

Digital money—including **tokenized commercial bank money, stablecoins, and wholesale central bank digital currencies (wCBDCs)**—introduces new technological efficiencies that can further improve capital markets transactions. They provide innovative technological solutions to enhance automation, reduce risk, and enable continuous and near-instant settlement. Each form of digital money has different economic and legal characteristics, operates on different infrastructures, and presents different opportunities and constraints for capital markets use cases.

Banks are in the business of money, which underpins economic growth. Capital markets are responsible for the efficient allocation of capital between providers (e.g., investors) and borrowers (e.g., entrepreneurs). These global relationships are facilitated by financial institution intermediaries, which play a critical role in making capital markets work. Efficient capital markets allow capital users to receive lower cost funding over time while allowing investors to identify opportunities to deploy their capital. Ultimately, this powers the economy.

Global Financial Markets Association (GFMA)[1] members are responsible for, and facilitate, the vast majority of global capital markets activity: issuing and distributing securities to match companies with investors to raise capital, facilitating securities transactions, and enabling risk management across the global economy. They are at the forefront of innovating—and building on—these forms of digital money to improve and expand client services, lower risks, and reduce costs.

This report describes how different forms of digital money are being used in wholesale capital markets today and their expected trajectory for the near future. The analysis focuses on three use cases that represent active areas of development: cash leg settlement for securities transactions, repurchase agreement (repo) and securities finance, and derivatives margin.

[1]The Global Financial Markets Association (GFMA) represents the common interests of the world's leading financial and capital market participants, to provide a collective voice on matters that support global capital markets. We advocate on policies to address risks that have no borders, regional market developments that impact global capital markets, and policies that promote efficient cross-border capital flows, benefiting broader global economic growth. The GFMA brings together three of the world's leading financial trade associations to address the increasingly important global regulatory agenda and to promote coordinated advocacy efforts. The Association for Financial Markets in Europe (AFME) in London, Brussels and Frankfurt, the Asia Securities Industry & Financial Markets Association (ASIFMA) in Hong Kong and Singapore, and the Securities Industry and Financial Markets Association (SIFMA) in New York and Washington are, respectively, the European, Asian and North American members of GFMA.

The picture that emerges today is one of meaningful evolution of markets. Ultimately, this modernization will add value to capital markets by:

- Enabling programmatic and atomic delivery-versus-payment (DvP) settlement, reducing counterparty risks, clearing and settlement risks, and operational burdens, and reducing the need for existing reconciliation across systems.

- Moving to intraday and programmable margin calls and reducing funding costs and operational risk from timing mismatches. For clients, this means collateral can be put to more efficient use; for intermediaries, it means more efficient balance sheet management and reduced dependency on rigid clearinghouse operating windows.

- Modernizing money onto interoperable systems automates the entire lifecycle of complex transactions, including repo collateral management, mark-to-market adjustments, and post-trade affirmations. This shift from batch-processing to real-time automation reduces transaction failures and lowers the high operational costs associated with existing fragmented infrastructure.

Currently, digital money in the form of tokenized commercial bank money is the preferred instrument for intrabank transactions. For future interbank use cases, institutions on a global basis are also looking to wCBDCs for their promise of a risk-free settlement asset with enhanced programmability. wCBDC projects are largely still in pilot phases, and central banks and finance ministries play a pivotal role in the timeline for full central bank deployment and accessibility. Private sector initiatives are being developed to deliver digital central bank money equivalents for interbank settlements.

Stablecoins are valued for their open, permissionless, and 24/7 architecture, offering a path for interbank settlement solutions, especially for cross-border transactions. Even as the regulation of stablecoin issuance matures, the use of stablecoins for large value payments and in institutional settings, such as capital markets transactions, will need additional certainty. For example, financial institutions will need to have clarity around the prudential treatment for issuing and holding stablecoins, the eligibility for institutional use, and cross-border recognition of regional frameworks.

Today there is increased commitment by both the public and private sectors to realize the full potential of digital money, for capital markets use cases and more broadly. The benefits of each of these forms of digital money can be realized only by **establishing legal and regulatory clarity, building out the infrastructure to support the different use cases, and developing common industry standards.** Similar infrastructure investments have been made over decades in our existing money systems.

This report focuses on four forms of digital money—tokenized deposits, deposit tokens, wCBDCs, and stablecoins—and how they are, and will be used in the near-term, in three specific capital markets use cases—securities settlement, repurchase (repo) agreements and securities lending, and derivatives margin. Four spotlights provide insights on: alternatives to wCBDCs, stablecoins and the two-tier money system, tokenized money market funds, and the use of tokenized money in intraday FX transactions. The last section describes hurdles to overcome for digital money use cases to scale, with specific near-term calls to action for policy makers and industry.

These observations on new forms of digital money are designed to help inform global capital market participants, including policymakers, to further fuel progress and economic growth through innovation.

Section One

Tokenized Commercial Bank Money, wCBDCs, and Stablecoins

This section focuses on four different forms of digital money: **tokenized deposits, deposit tokens, wCBDCs, and stablecoins**. These instruments all may utilize distributed ledger technology (DLT), yet they **differ significantly in their economic and legal characteristics, the infrastructure on which they are issued, recorded, and transferred, and their regulatory treatment, and as a result in their intended use cases.**

Tokenized Commercial Bank Money: Tokenized Deposits and Deposit Tokens

Two types of tokenized commercial bank money—tokenized deposits and deposit tokens—are demand liabilities made available on DLT through tokenization. The two have different functionalities and characteristics.

Tokenized deposits are initially recorded on existing core banking systems in conventional demand deposit accounts as the authoritative record of the deposit. They are tokenized by issuing digital representations of specially designated deposit balances on a DLT system.

Tokenized deposits are unsecured bilateral demand claims on the issuing bank. They are generally not transferable outside of the issuing bank; that is, they can be held and used only by customers of that bank. Accordingly, initial use cases have primarily involved intrabank transfers among account holders and the issuing bank. Additional use cases may emerge as interbank clearing and settlement networks are further developed, with mechanisms similar to those for traditional bank deposits.

Deposit tokens are commercial bank money issued natively in token form and are designed to be transferable to non-account holders. Unlike tokenized deposits, the DLT system on which a deposit token is issued becomes the authoritative record of the deposit liability.

The aggregate value of deposit tokens a bank issues corresponds to the total deposit liability recorded by the issuing bank. Deposit tokens may circulate within a closed network of participants. The closed network can be intermediated—with users holding deposit tokens through intermediaries such as payment services firms, clearing firms, and exchanges—or, in the future, on systems that allow users who do not have an account relationship with the issuing bank to hold deposit tokens directly.

Although they may circulate among participants in a defined network, deposit tokens typically are redeemable only by clients of the issuing bank. They remain fully convertible at face value either through the issuing bank or through affiliated partner banks, provided a contractual relationship enables that redemption functionality, and like conventional deposits they may bear interest. The use of deposit tokens today is, so far, relatively limited, and their potential for institutional capital markets remains in development. Their transferability is an important feature that could drive adoption for use cases in capital markets.

Both tokenized deposits and deposit tokens may benefit from deposit insurance and may provide funding value to the issuing bank. They are credit exposures to the issuing bank, which may result in holders capping their total balance or setting concentration limits as is the case for conventional deposits.

In either case, tokenization does not alter the underlying legal or economic nature of commercial bank money. The use of DLT-based systems for recordkeeping, accounting, and reporting is a technological evolution that does not change their nature. These electronic book entries serve the same functional purpose as entries used to record assets in traditional electronic books and records systems, with the added benefit of programmable, real-time collateral and settlement assets in modern market infrastructure.

Wholesale Central Bank Digital Currencies (wCBDCs)

Since this report focuses on global capital markets applications (rather than retail uses) of different forms of digital money, it discusses wCBDCs in the context of institutional or wholesale use as a trusted and risk-free settlement instrument between financial institutions.

wCBDCs are digital forms of sovereign money issued as a direct liability of a central bank. Unlike stablecoins and tokenized commercial bank money, wCBDCs derive their value and safety from the issuing central bank. wCBDCs may be implemented using DLT or other digital architectures, such as centralized real-time gross settlement systems, permissioned blockchains, hybrid architecture, message-based architecture with enhanced settlement, or interoperable non-blockchain node-based architectures.

Stablecoins

Stablecoins are digital assets issued, recorded, and transferred natively on a blockchain and are designed to maintain a stable value relative to a reference asset, most commonly a fiat currency, and are redeemable on demand at face value. **This report focuses on stablecoins that reference a single currency, are**

designed to function as payment instruments and are issued by entities subject to regulation for their stablecoin issuance activities under laws designed for that purpose. These stablecoins are called payment stablecoins in the United States, e-money tokens in the EU, electronic payment instruments in Japan, MAS-regulated stablecoins in Singapore, specified stablecoins in Hong Kong, and go by various other designations in other jurisdictions.

Stablecoins are designed to be used as a means of payment or settlement. The most common reference fiat currencies today include US Dollar, Japanese Yen, and the Euro. Stablecoins can also reference other assets, such as gold and other commodities.

Today, the dominant form of stablecoins reference a single currency. Issuers are nonbank corporate issuers as well as bank issuers either on an independent basis or as consortia. The stablecoin represents a liability of the issuer. The issuer seeks to maintain the stablecoin's value against its reference asset through two related stabilization mechanisms. First, the issuer has a legal obligation to redeem issued stablecoins upon demand for face value (e.g., USD 1, JPY 1, or EUR 1) from qualifying stablecoin holders. Second, the issuer holds a dedicated reserve of assets to back its obligation to meet those redemptions. This stabilization mechanism structure is designed to support the stablecoin as a medium of exchange for peer-to-peer transactions. Stablecoins are traded in secondary markets, and their market prices may be different from their face value (at which the issuer will redeem), reflecting short term supply and demand dynamics or, in stress scenarios, credit or operational concerns about the stablecoin's issuer.

Stablecoins operate as bearer instruments in that they can be transferred between blockchain wallets; the transfer of the stablecoin itself functions as the transfer of value. Stablecoins are, however, also commonly held in digital wallets with payment service providers or digital asset intermediaries and transferred either onchain or using internal ledgering systems.

Key legal and economic features of stablecoins are determined both by contract and driven by specific laws that regulate stablecoin issuance.[2] These features include the type, quality, and tenor of the assets that make up the reserve; their segregation from other assets of the issuer; the nature of the claims that stablecoin holders have against the issuer; the nature of redemption rights and the types of stablecoin holders who have direct redemption rights; and the treatment of the stablecoin holders in resolution or bankruptcy of the issuer. Standardizing and minimizing the risks around stablecoin issuance and holding, redemption, and their recognition as a payment instrument is a primary focus of regulations being developed, enacted, and implemented globally.

[2] For example, in the EU, stablecoin regulation under MiCA is final and implemented. In Japan, the Payment Services Act amendments covering stablecoins are in force. In Singapore, the MAS stablecoin framework has been finalized and is in the implementation phase. The U.S. GENIUS Act has been enacted and is being implemented by regulation.

Spotlight 1: Other Central Bank Money Equivalents

The private sector has developed alternative solutions to deliver digital central bank money equivalents, with the goal of giving financial institutions access to low-risk central bank money-based settlement assets without the need to launch a wCBDC. These projects often use DLT to enable interoperability with tokenized systems and the benefits of blockchain rails, including instant settlement, cross-border functionality, and continuous operation.

Fnality is an example of such an initiative in which several GFMA members are participating.[3] Fnality is a regulated financial market infrastructure that holds central bank accounts with onchain representations of central bank reserves on its blockchain ledger. The ledger functions as settlement infrastructure that enables real-time interbank settlement in central bank reserves while settlement finality is delivered through harmonized rulebooks and settlement finality designations granted by central banks (where applicable). Interoperability is embedded in the system's governing rules. Fnality's wholesale payment system is live today in the United Kingdom, with additional currencies under development.

[3] For more information, see Fnality's website, at https://fnality.com/news/connecting-thousands-of-stablecoins-with-a-safe-settlement-anchor.

Section Two

Money Infrastructure

How new forms of digital money are and will be used in capital markets depends on their characteristics (described in Section One) and on the **infrastructure used for their issuance and transfer**. This section describes the core characteristics of four types of payments infrastructure: **bank payment systems, central bank systems, permissioned blockchains, and permissionless blockchains**, assessing each against **twelve characteristics** that illustrate how the forms of money they support are used, where they may add value, and where regulatory and infrastructure questions remain.

The governance and design of money infrastructure determines who can directly participate in payment systems, what types of transactions are permitted, how transactions are processed, when settlement becomes final, and what legal and regulatory frameworks govern each participant and each step in the cycle. These aspects, in turn, have **direct consequences for counterparty risk, liquidity management, operational resilience, and regulatory compliance, all of which are central to capital markets activity**.

Money infrastructure—both conventional and new—has several separate yet interrelated components. One is the base layer technology: the "rails" that enable the reliable, safe transfer of value and communications among system participants. The second is the application and rules layer: the software systems and legal frameworks that enable use of the systems for various purposes and govern how the systems may be used by participants. Digital money derives its functionality from the design of these systems, in addition to the characteristics inherent to the money itself.

This section describes four primary money infrastructure types, each of which can, and will in the future, support the different forms of digital money. Permissionless and permissioned blockchains—when operating for payments—**must address the same underlying challenges as existing payment systems**: ensuring the integrity and finality of transactions, managing risk, enabling interoperability, and operating within applicable legal and regulatory frameworks.

Money Infrastructure	Digital Money Issued / Settled
Bank Payment Systems	• Conventional Bank Deposits
Central Bank Systems	• wCBDCs
Permissioned Blockchains	• Tokenized Deposits • Deposit Tokens • wCBDCs • Stablecoins
Permissionless Blockchains	• Tokenized Deposits (with permissioning) • Deposit Tokens (with permissioning) • Stablecoins

Infrastructure Characteristics of Digital Money Systems

This table explores these underlying challenges by comparing the four money infrastructures against **twelve characteristics that span core architectural features** of the technology rails and their governance structures, approaches to membership, access, use, and compliance postures. These characteristics will be used to evaluate where current and future use case opportunities may exist. **Appendix A** includes a more detailed analysis.

Characteristic	Bank Payment Systems	Central Bank Systems	Permissioned Blockchains	Permissionless Blockchains
Network Governance & Operations	Public or private sector network operator; governed by network rules and sometimes statutory frameworks; largest systems subject to or evaluated against PFMI[4] or equivalent	Central bank as operator; network rules and statutory frameworks; largest systems subject to or evaluated against PFMI or equivalent	Public or private sector operator and rulebook; governed by network rules and sometimes statutory frameworks; other frameworks still developing	No central operator; decentralized organization; protocol rules only for operation and use; existing industry governance processes are mitigating risks
Access	Restricted and tiered; direct participants generally limited to banks; indirect participants access through correspondents; generally national or regional only	Restricted and can also be tiered; generally the same access and jurisdictional reach as conventional central bank money systems; generally national or regional only	Restricted; may be internal to one institution or restricted by institution type and jurisdiction; broad participant and jurisdictional reach may be possible but not yet available	Open to all; global operation and use due to open protocol; permissioning through additional software, protocols, or intermediation

[4] The Principles for Financial Market Infrastructure are international risk-management standards for systemic financial utilities, such as payment systems and central counterparties issued by CPMI and IOSCO, https://www.bis.org/cpmi/info_pfmi.htm.

Characteristic	Bank Payment Systems	Central Bank Systems	Permissioned Blockchains	Permissionless Blockchains
Permissible Transactions	Operators control permissible activity through network rules; can suspend participants, restrict access, and implement emergency procedures	Central bank controls permissible activity through rules; can suspend participants, restrict access, and implement emergency procedures	Operators control permissible activity by protocol and through network rules; can suspend participants, restrict access, and implement emergency procedures	Open for all types of transaction activity; no central mechanism to control access to the underlying network; industry solutions to address risks are being implemented at layer 2 (L2) and application layer
Participant Identity	All direct participants formally onboarded and known to the operator; participants maintain compliance records	All direct participants formally onboarded and known to the operator; participants maintain compliance records	Configurable identity: can be limited to one institution or many; identities known or pseudonymous; regulated participants maintain compliance records	Transactions are pseudonymous. Identity solutions being developed; regulated participants maintain compliance records
Transaction Visibility	Visible to participating banks and relevant regulators only; transaction privacy inherent	Visible to participants and configurable visibility for central banks	Tiered and configurable visibility; transaction privacy is available	Public ledger; transaction privacy solutions being developed at L2 and application layers
Clearing & Settlement	RTGS and DNS models; clearing and settlement through central bank systems and reserves; intraday credit and liquidity facilities available; finality established by statute or network rules	Immediate legal finality supported by central bank rules	Supports pre-funded and credit-based models; deterministic finality supported by rulebooks; legal frameworks are developing	Pre-funded RTGS; finality by protocol, bilateral agreement; legal frameworks are developing
Intermediation	Fully intermediated as all direct participants are banks	Fully intermediated; wholesale access for commercial banks and some other regulated institutions	Full range of intermediation models possible; typically envisioned as direct access to intermediaries	No intermediation required at base layer; full range of intermediation models available at L2 and application layers
Interoperability	Interoperability through overlapping bank membership in different systems; messaging and international legal standards reduce frictions	International solutions being explored	Private sector technology and framework solutions being developed	Private sector technology and framework solutions being developed

Characteristic	Bank Payment Systems	Central Bank Systems	Permissioned Blockchains	Permissionless Blockchains
Availability	Historically limited to banking hours; significant advances with some systems near near-continuous operation; operations and resilience frameworks through network operator	Central banks considering extended hours to 24/7; single point of failure risk with central operator and concentrated validators; operations and resilience frameworks through network operator	Often 24/7; risk of single point of failure if one central operator or concentrated validators; operations and resilience frameworks through network operator	24/7 and can be resilient with increased decentralization; no guaranteed uptime
Programmability	Structured programmability through standardized messaging formats; some systems support conditional payment types; complex, linked transaction logic typically requires separate bilateral agreements or layered systems	Structured programmability deployed by central banks; new systems exploring additional programmability and features	Smart contracts developed for the system and deployed with operator approval	Many blockchains have full smart contract support; composable; open development communities
Compliance Posture	Limited to regulated institutions as permitted by regulators and network rules; participants are subject to local law financial integrity, sanctions, and other compliance requirements	Compliance architecture determined by central bank; participants are subject to local law financial integrity, sanctions, and other compliance requirements	Network operator and rules govern eligible participants; regulated participants are subject to financial integrity, sanctions, and other compliance requirements under local law; technological ability to block or freeze at identified blockchain addresses by smart contract; compliance can be embedded at protocol level or L2 and application layers	No limits on types of participants; regulated participants are subject to financial integrity, sanctions, and other compliance requirements under local law; technological ability to block or freeze at identified blockchain addresses by smart contract; compliance solutions being developed at the L2 and application layers or by new chains
Fraud, Error Handling & Reversibility	Network rules establish procedures for errors, unauthorized transactions, and fraud; liability frameworks reflect applicable regulatory regimes	Central bank has authority to reverse, correct, and adjust transactions in accordance with system rules; liability frameworks reflect applicable regulatory regimes	Network rules establish procedures for errors, unauthorized transactions, and fraud	Governed by blockchain protocol or bilateral agreements

Existing bank payment systems and central bank systems follow **long-standing governance models that rely on a central operator to set and enforce access, participation, risk management, and compliance rules**. This includes well-developed frameworks for settlement finality, fraud, error handling, and reversibility. Permissioned blockchains are adapting many of the same features using similar frameworks.

Both permissionless and permissioned blockchains are DLT-based and **enjoy the benefits of programmable smart contract frameworks**. Central bank CBDC systems based on DLT may share that feature. While existing bank payment systems and central bank systems historically have limited operating hours, DLT-based systems operate continuously, which can offer advantages in global or cross-border use cases.

Permissionless blockchains benefit from broader, open-source development communities and the potential for added **resiliency and security characteristics of open networks**, particularly when the operation of those networks is meaningfully decentralized. The benefits are most evident in mature permissionless blockchain networks, such as Bitcoin, Ethereum, Solana, and Stellar, which have operated for years in the environment of the open internet without meaningful disruption.

Despite starting with different access assumptions, permissioned and permissionless systems can have similar access configurations for regulated participants. A central operator can run a highly permissioned blockchain system ledger, where the system is operated only by participants selected by the operator, but where system services, including holding and transferring assets, are open to a broad range of users across jurisdictions. Similarly, a permissionless network can be used to host closed, permissioned ecosystems enforced through smart contracts and permissioned access controls, making access to the network and the ability to hold and transfer assets strictly permissioned.

None of these systems is inherently interoperable. Interoperable infrastructure solutions for bank payments systems have developed over decades: in the national and regional context, interoperability is provided by central bank and private sector clearing and settlement; in the cross-border context, through correspondent arrangements. Central banks and international organizations are working to build new forms of connectivity between national and regional payment systems, globally. For DLT-based systems, interoperability solutions often take the form of technological solutions such as bridges. These solutions are being developed and hardened as the use cases scale. Examples include the Bank for International Settlements' (BIS) Project Nexus for linking domestic bank and central bank instant payment systems, Swift's CBDC "connector" experiments, and certain DLT interoperability layers, such as Canton's Global Synchronizer, Chainlink CCP, and Hyperledger Cacti.

The story is one of trade-offs. These trade-offs may change, particularly if technological and legal standards develop that provide a technology-neutral approach between bank payment systems, permissioned blockchains, and permissionless blockchains, allowing the markets to develop based on what best serves their clients where they want to do business.

Spotlight 2: Stablecoins and the Two-Tier Banking System

Current capital market use cases recognize the balance of (1) the likely primacy of tokenized deposits in the near-term future of digital money, with ongoing work toward interoperability with current payment systems, and (2) the potential for stablecoins to play an important role in digital money systems if certain challenges can be addressed. As legal clarity increases, the market will test whether stablecoins are a viable option to modernize payment services for global capital markets.

Stablecoins most directly implicate today's two-tier banking system, involving commercial bank money and clearing and settlement through central bank reserves. In addition, because stablecoins have unique characteristics—for example, they trade in secondary markets—they raise special considerations for their use as transactional money.

Appendix A: Review of Existing and New Payment Systems describes the four types of payment and settlement infrastructure most relevant to the capital markets use cases and different forms of digital money discussed in this report. Each type of system is evaluated against twelve core architectural features and operational characteristics that determine how value moves, who can participate, and what legal and compliance frameworks apply.

This spotlight focuses on the potential impact of stablecoins on the two-tier banking system and characteristics of stablecoins. It first describes some of the concerns that have been raised for this system as stablecoins potentially scale for mainstream payments use cases. The spotlight then discusses whether and under what circumstances stablecoins could meet modern expectations for a form of transactional money—particularly as stablecoins become regulated under laws designed for this purpose.

Potential Impacts of Stablecoins on Existing Banking Systems

Credit provision and bank disintermediation: Stablecoins with 100% reserves of short-term liquid assets, in contrast to commercial bank deposits, cannot create credit. Instead, stablecoin issuance and reserve backing is more akin to narrow banking, which does not create money or enable credit extension. Stablecoins could potentially precipitate deposit migration, similar to the historical shifting of assets into money market funds, Treasury-only vehicles, and other similar products during periods of stress.

Run risk: Despite reserve requirements, stablecoin issuers can be subject to run risk in times of market stress or if there are concerns about the credit quality or operations of the issuer. In two-tier banking, the central bank acts as a liquidity backstop for commercial banks, providing commercial banks with liquidity (at the policy interest rate, against high quality collateral). Whether and how this service may be extended to stablecoin issuers must be carefully assessed.

Sovereign bonds: Stablecoin issuers will typically hold short-term sovereign bonds as one type of reserve asset. While this drives demand for those bonds (a direct benefit for issuing authorities), this may cause crowding out—reducing the availability and impacting the price of these bonds in the market. This dynamic has been observed with money market funds, where concentrated demand for sovereign bonds reduced market depth and redemption runs forced fire sales that amplified stress and spilled over into government bond and repo markets. Stablecoin usage at scale may be structurally capable of driving similar effects.

Integrity: Central banks and finance ministries are responsible for the integrity of financial systems. Stablecoins are private money bearer instruments that can be transferred peer-to-peer outside of traditional payment systems. As with cash, peer-to-peer transfers can be made outside of sanctions, anti-fraud, anti-money laundering (AML), know your customer (KYC), and countering the funding of terrorism (CFT) regulatory regimes. The Financial Action Task Force (FATF) and regulators globally are evaluating whether and how to apply these requirements as stablecoin payments scale. At the same time, stablecoin issuers and digital asset market participants have developed new approaches to addressing some of these compliance considerations, including the ability to freeze assets onchain and to allow-list or block particular blockchain addresses from sending or receiving stablecoins.

Stablecoin Payments

As market participants "re-learn the historical lessons about the limitations of unsound money,"[5] they are challenged to consider how innovations in new payment instruments address the above factors. The debate on the existence and therefore the value of "singleness of money" is at the core—the principle that money used for payments should be accepted at par so that a payment instrument representing $1 will always be accepted as exactly $1.

Singleness requires that money be **fungible across issuers, accepted for payment at par,** and interchangeable 1:1 with other forms of money**.** When singleness is maintained, "a dollar is always worth a dollar," enabling money to

[5] BIS Annual Economic Report, III. The next-generation money and financial system, https://www.bis.org/publ/arpdf/ar2025e3.pdf. See also reports from the Financial Stability Board and the International Monetary Fund describing the regulation, adoption, and money characteristics of stablecoins. FSB, Thematic Review on FSB Global Regulatory Framework for Crypto-asset Activities (Oct. 2025), https://www.fsb.org/uploads/P161025-1.pdf; IMF, Understanding Stablecoins (Dec. 2025), https://www.imf.org/en/publications/departmental-papers/issues/2025/12/02/understanding-stablecoins-570602.

function as an information-insensitive medium of exchange that agents trust and accept "with no questions asked."[6]

The Existing Two-Tier System: Built for Commercial Bank Money

Today's two-tier banking system—in which commercial banks issue deposit money to the private sector and use central bank money to settle payments—is deemed trusted because it creates the requisite singleness. This system depends on commercial bank deposits as the primary form of money available to the public. Deposits are unsecured claims against banks, created primarily by banks' lending to consumers and businesses. A bank loan of $100 creates a deposit of $100 in the borrower's account, generating new money. The deposit is an unsecured liability of the bank—a contractual promise that the bank will transfer deposit funds through payment systems or turn the deposits into cash when the account holder instructs.

As outlined in more detail in Appendix A, commercial bank money, on its own, does not exhibit singleness. Instead, bank deposits achieve singleness thanks to a set of complex institutional arrangements. For example, when a customer of one bank makes a payment to a customer of another, settlement occurs via a transfer of central bank reserves from the sender's bank to the recipient's bank. This process makes commercial bank money issued by different banks uniform payment instruments.

The two-tier system requires regulatory measures, including capital, liquidity, and other prudential requirements for banks, along with public backstops such as access to the central bank credit and liquidity facilities and deposit insurance.

Stablecoins as Payment Instruments

Stablecoins as payment instruments operate differently from bank payments today: they transfer directly between payment counterparties, as opposed to typical deposit-based payments which use a series of ledger updates involving (at a minimum) the payor's bank account, the payee's bank account, and each bank's central bank reserve account. Thus stablecoin payments are not ultimately settled on central bank balance sheets.

Going forward, authorities may need to decouple infrastructure changes from the outcomes that different forms of money deliver for end users. The core innovation of stablecoins is that payments can operationally settle in real time onchain, without relying on the types of clearing or settlement systems that deposit-based payments currently require.

Today, stablecoins from different issuers generally are not interchangeable with each other. The markets correctly distinguish stablecoins, for example, based on

[6] BIS Annual Economic Report, III. The next-generation money and financial system, available at https://www.bis.org/publ/arpdf/ar2025e3.pdf.

regulatory, structural, and economic differences between the issuers of those stablecoins.

Yet stablecoins could achieve characteristics of transactional payment instruments under two primary conditions. *First*, the issuer must, in the normal course, be able to promptly redeem its stablecoin against commercial bank money or convert it to other stablecoins denominated in the same currency. Stablecoins are traded in secondary markets, and these conversion capabilities are designed to enable stablecoins to maintain their peg against par value. *Second*, the issuers must maintain reserves that back their ability to redeem their issued stablecoins, in a way that minimizes and standardizes their liquidity and credit risk, so that the issuers can redeem the stablecoins they issue at face value, even in times of market stress.

In the near-term, **new laws and regulatory frameworks are coming into force that support these conditions.** Regulated stablecoin issuers generally need to hold the same types of high-quality, liquid reserve assets on a 1:1 basis with issued stablecoins to back their obligations to redeem those stablecoins. They will be subject to capital and liquidity requirements reflecting traditional concepts such as credit, market, counterparty, and operational risks as well as risk management requirements focused on operational resilience. Issuer disclosures, including those to bring transparency on their reserves and redemption obligations and processes, will be standardized and provided to regulators and accessible to the public. And the treatment of stablecoin holders in bankruptcy or resolution of the issuer will be clearer. These laws push toward standardization of stablecoin issuance, which may mean increased uniformity across regulated stablecoins.

Even with these standardizations **there are operational risks that capital markets participants must manage.** At the entity level, market participants have governance processes to manage failure, market-wide disruptions, and issuer mismanagement. At a product level, different forms of money have risks related to illicit finance, privacy, fraud and the challenges of cross-border regulatory coordination, particularly for money that—as a technological matter—moves just as easily across borders as within.

Secondary Market Trading

Transactions at **par are important when stablecoins are used or redeemed as part of payment transactions.** In contrast, secondary market trading in stablecoins can and does occur at prices that deviate from par. This has called into question whether stablecoins can exhibit the characteristics of a form of payment, as secondary market trading introduces uncertainty about whether stablecoins can be exchanged 1:1 at all times for other types of money.

Secondary market trading can, however, be viewed through a different lens: **stablecoin secondary market transactions are not payments**. Stablecoin trading enables market participants to acquire more or dispose of excess stablecoins as needed for payments. But they are not themselves payments and need not be viewed as such. They are instead akin to FX transactions or ATM withdrawals, which exchange one type of money for another. Exchanging bank deposits in one currency for those in another or bank deposits for paper cash value commonly involves spreads or fees—this does not detract from our view of bank deposits or cash as money. Small deviations from par in secondary trading markets, driven by transitory supply and demand imbalances, do not necessarily prevent stablecoins from meeting the payments test.

There are different considerations when price deviations occur due to inherent concerns about the stablecoin issuer's ability to promptly redeem all outstanding stablecoins at face value. Risks that large or persistent deviations could erode confidence and impair payment usage are legitimate and could impact the use of stablecoins for capital market use cases. It is recognized today that absent regulatory frameworks, it is difficult to assess whether stablecoin secondary market prices away from par value are driven by typical market dynamics of supply and demand, or due to concerns about the credit, liquidity, or operational risk of the stablecoin's issuer. But as regulatory standards, disclosures, and infrastructure supporting stablecoin markets mature, price deviations from par may become less severe and better understood.

The Future of Payments

Capital markets have just begun to see whether and what improvements new forms of digital money can spur, and the possible "major leaps in economic activity"[7] that can come from the new technology. The forms of money discussed in this report—tokenized deposits, deposit tokens, wCBDC, and stablecoins—can take advantage of some or all of these major leaps.

Policymakers and regulators around the world seem to largely agree. **By regulating stablecoins, they are opening a door to larger opportunities that may be presented by the new payments technology underlying stablecoins and setting the stage for the development of new methods of AML/CFT compliance, digital identity and verified credentials**. These developments and advances can occur while tokenized deposits are used in the near-term, enabling stablecoins to play a role in digital money systems in the future.

[7] Id.

Section Three

Use Cases for Digital Money

This section describes three examples of capital markets use cases–**securities settlement, repo and securities finance, and derivatives margin**–to explicate the potential for different forms of digital money. It focuses on the **new features of these forms of digital money and their infrastructure, such as atomic settlement, programmability, continuous operation, and open networks, to highlight the potential value** of their use in capital markets contexts. It describes both the current state of development and near-term prospects.

Banks are in the business of money. GFMA members are responsible for, involved in, and facilitate the vast majority of global capital markets-related funds movements and payments. They have led the evaluation and adoption of these different forms of digital money in capital markets to enhance client services, lower risks, and mitigate cost drivers.

This capital markets expertise gives them a clear and informed perspective on which forms of digital money are useful in capital markets today, and which hold future promise as the technology develops, legal and regulatory frameworks are developed, and market adoption matures. Importantly, they are currently focused on the key hurdles that must be overcome by both the public and private sectors.

This section focuses on how the different forms of digital money can improve settlement processes, reduce risk, and add value for counterparties and intermediaries for three capital markets use cases: securities transactions, repo and securities finance, and derivatives margin. The following table summarizes the features of digital money **that add value to each use case, the types of digital money being used today to realize these benefits, and near-term plans to develop settlement and payments** associated with these use cases in these forms of digital money.

Use Case[8]	Value Add from Digital Money	Today	Near Future
Securities Transactions	• Atomic delivery-versus-payment (DvP) of cash and securities or faster batched settlement, particularly where securities are tokenized • Programmable settlement for complex transactions and automated post-trade affirmation • 24/7 settlement, including for cross-border transactions • Eases reconciliation	• Several live or near-live tokenized securities platforms in production • Production platforms and active pilots with tokenized deposits • Private sector settlement systems (e.g., Fnality onchain settlement in central bank reserves)	• Stablecoins for settlement, with greater regulatory certainty and practice around institutional settlements

Repo and Securities Finance	• Programmable settlement to:
	  ○ Reduce batch processing
	  ○ Reduce dependencies on clearinghouse/CSD operating constraints
	  ○ Reduce transaction fails
	  ○ Better address timing mismatches
	  ○ Enable intraday settlement
	• Automation of collateral management lifecycle: mark-to-market, substitutions, and termination payments
		• Tokenized deposits in production use for intrabank transfers, including for intraday settlement
		• Private sector settlement systems (e.g., Fnality onchain settlement in central bank reserves)
			• Proof-of-concept work for interbank use[9]
			• Stablecoins, with greater regulatory certainty and practice around institutional settlements

Derivatives Margin	• 24/7 variation margin settlement:
	  ○ Reduce operational timing gaps from payment windows
	  ○ Reduce liquidity buffers needed
	• Intraday variation margin
	• More efficient pledging and movement of tokenized initial margin on shared infrastructure
	• Programmable margin calls to reduce operational risks
		• Tokenized deposits and well-regulated stablecoins may be candidates for variation margin uses
		• Private sector systems (e.g., Fnality for onchain settlement in central bank reserves)
			• Stablecoins with greater regulatory certainty and clearinghouse eligibility approval

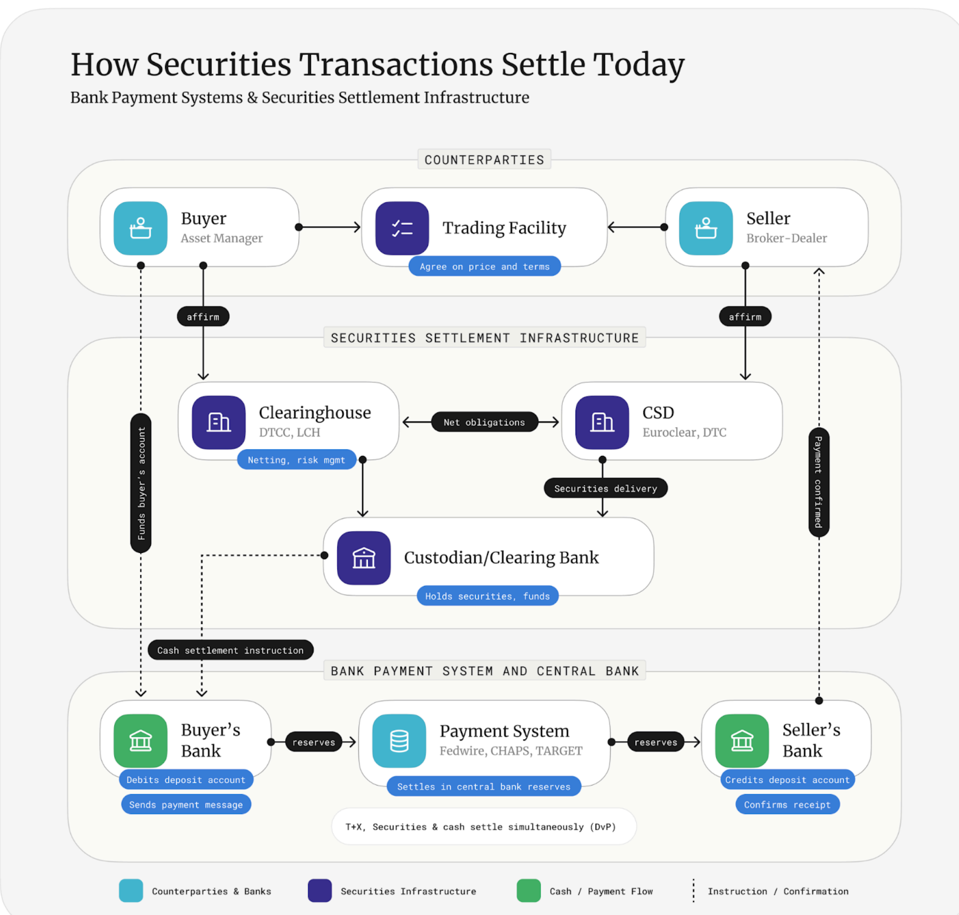
[8] Other factors arise for cross-border payment use cases. These are part of the G20 Agenda to enhance cross-border payments by the end of 2027. See Financial Stability Board, G20 Roadmap for Enhancing Cross-border Payments (Oct 2025), https://www.fsb.org/uploads/P091025-1.pdf.

[9] Broadridge's DLR system is live today for intrabank repo settlement, with interbank settlement as a possible feature in the future. See https://www.broadridge.com/capability/middle-and-back-office-solutions/post-trade-processing/distributed-ledger-repo-solutions.

Cash Settlement for Securities Transactions

Institutional securities transactions are conceptually simple: they involve the purchase or sale of securities in exchange for payment in cash. After execution, however, the trade enters a more complex post-trade process where counterparties affirm the details of the transaction, directly or through intermediaries like broker-dealers and custodians. Once affirmed, the trade is submitted to a securities clearinghouse, when relevant, and then to a central securities depository (CSD), which transfers ownership via book-entry debits and credits. Each participant's net cash obligation is periodically cleared and payment is conducted through specialized or general-purpose bank payment systems.

Below is a stylized diagram of today's securities settlement infrastructure, showing the various systems involved, with securities settlement conducted on securities infrastructure and funds settlement on bank payment infrastructure.



Settlement cycles—such as T+1 settlement where settlement occurs one business day after the trade date—and delivery-versus-payment (DvP) settlement are meant to offer a range of capital, risk management, and operational benefits and to ensure the security and cash transfers are conditional upon each other to mitigate the risk of one party failing to deliver. A delay between trade date and settlement also enables the operational mechanics needed to support other securities services, including securities lending. Clearinghouses offer the ability to net transactions, reducing the capital needed compared with settlement on a gross basis.

However, the timing of trade execution and final settlement, the number of intermediaries, and the separation of securities and cash leg on different systems, gives rise to additional costs and frictions. While the risk that a counterparty defaults due to strategic, operational, or liquidity reasons during the settlement cycle is mitigated by the role of the clearinghouse, the length of the settlement cycle directly correlates with the amount of capital required to be held at the clearinghouse. In addition, there are material reconciliation challenges given the multiple layers of intermediation and the lack of a "live" verifiable audit trail shared among participants. Governance processes exist today to effectively manage these risks.

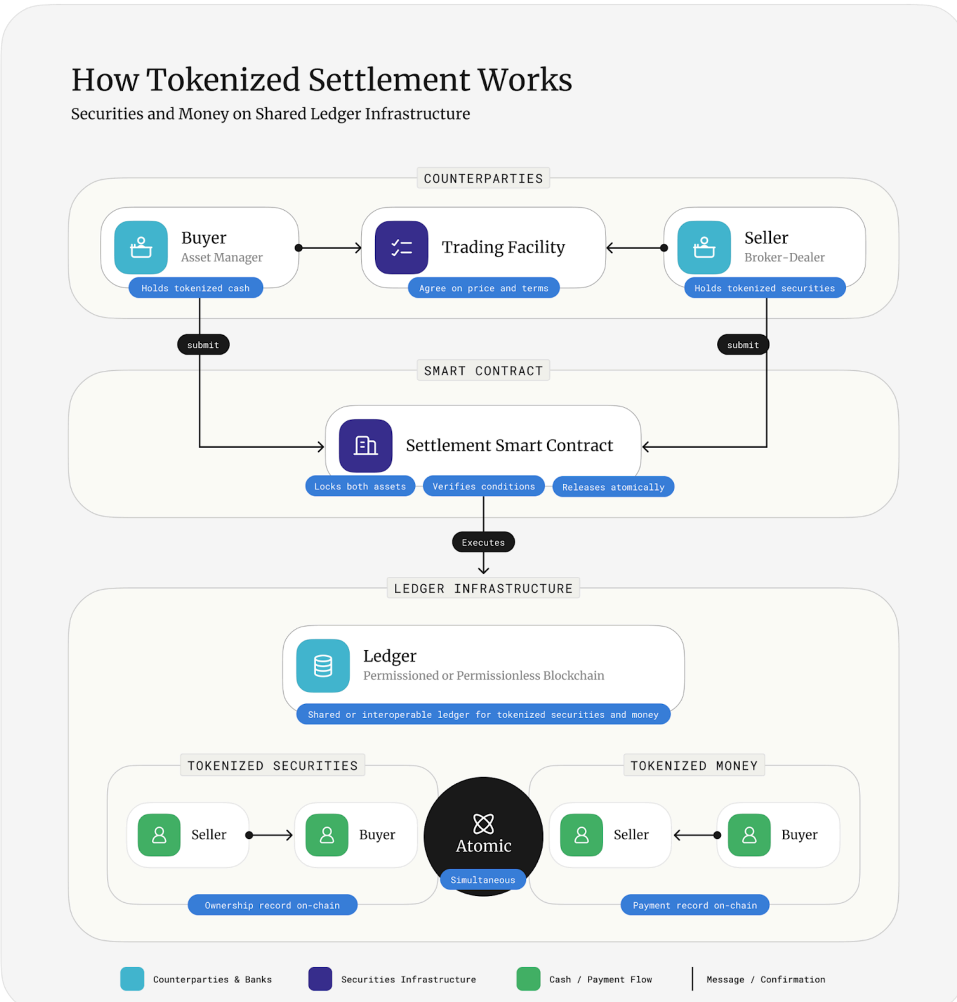
Financial institutions and market infrastructure firms are exploring DLT solutions for how tokenized assets could be settled onchain with different forms of digital money as a means of modernizing the settlement process in three key ways. Ideally, and to achieve the most benefits from the technology, both the security and the cash instrument are tokenized and represented on the same, or interoperable, blockchains.

- *First*, **atomic settlement or intraday batched settlement** presents a meaningful opportunity to reduce counterparty credit risk throughout the settlement cycle and reduce, if not remove, the need for post-trade affirmation, materially lowering both settlement risk and capital and operational costs.

- *Second*, the **programmable nature of DLT** lends itself to new approaches to automation, particularly for more complex or contingent securities transactions and lifecycle events.

- *Third*, **continuous 24/7 availability of DLT systems** reduces operating hour constraints and mismatches inherent in traditional clearing houses, CSDs, and payment system windows.

This stylized diagram shows a tokenized securities settlement system for DvP atomic settlement of a securities transaction. The system enables the settlement of securities against tokenized money on the same (or interoperable) distributed ledger system.



These systems at first will not be a wholesale replacement of existing market infrastructure; instead they will be used to modernize specific high-friction workflows—starting with internal cash/liquidity, collateral/repo, and controlled settlement loops—delivering fewer breaks, faster finality in-scope, and incremental cost and risk reduction. Interoperability and market-wide adoption will likely progress slowly and selectively, via connectivity layers and permissioned networks rather than universal standards arriving at once.

Tokenized deposits have been, so far, the cash instrument of choice for intermediaries exploring the use of digital money in institutional securities transactions. A meaningful portion of securities transactions are conducted between large banking organizations and their customers, and therefore they frequently involve only intrabank payments. Tokenized deposits quickly add value through atomicity and programmability without the need for third-party-issued stablecoins, open networks to enable payments between unrelated parties, and without implicating bank deposit funding. Because T+1 settlement cycles bring funding and operational efficiencies (e.g., netting), continuous, real-time settlement of these transactions is not viewed as a primary feature, or reason to adopt tokenized deposits. As a result, adoption efforts have focused less on replacing netted settlement cycles and more on targeted use cases where real-time finality delivers clear, incremental benefits without undermining existing liquidity models.

Some central banks and market participants are also exploring wCBDCs for institutional securities settlement. For example, the European Central Bank (ECB) is progressing such programs—projects Pontes and Appia—in which GFMA member firms have participated. Some wCBDC projects remain in early pilot phases with the timing for full production use still unclear. In practice, progress from central banks has been constrained by unresolved questions around interoperability with existing market infrastructure, governance, and incremental benefits relative to established RTGS and settlement arrangements.

The use of stablecoins and deposit tokens for securities transaction settlement in institutional settings is in early stages. As the regulation and regulatory implications of stablecoins are clarified, market participants reach a more comprehensive understanding of how stablecoins function, and the infrastructure and legal arrangements for deposit tokens are further developed, and tokenized securities projects begin to scale, it is likely that these instruments will be explored further for securities transactions, including in institutional contexts. Tokenized deposits are also being explored for interbank settlement use cases. Section IV of this report describes some of the potential future developments for these types of platforms.

Spotlight 3:
Intraday FX Liquidity Management, a Capital Markets Building Block

As capital market participants increasingly see the tokenization of assets and a move to faster and more frequent settlement, they also face greater demands to manage risk. These needs arise acutely in global capital markets activities, where FX liquidity management is inherent to many transactions. Leveraging DLT technology solutions for intraday FX swaps can enable capital market participants to meet their demands for faster settlement cycles and to operate more efficiently. The ability to optimize their balance sheet at scale has the potential to deliver greater value to clients.

While use of digital money in these intraday FX markets is limited today, capital markets participants are exploring how digital money can improve the precision and certainty with which FX trades, and, in particular, intraday FX swaps can settle. Reduction in both existing operational frictions and fragmented settlement times (e.g., current central bank RTGS cut-off times) may enable market participants to precision settle and better manage their liquidity requirements and buffers.

Technology partners are developing and integrating digital money solutions to deliver payment versus payment (PvP) settlement for these intraday FX swaps to enable firms to efficiently manage liquidity demands by moving cash in near real time and at scale.

Repo and Securities Finance

Repo and securities lending transactions are essential to foster efficient capital markets, providing short-term funding and liquidity, preventing settlement failures, and supporting the allocation and reallocation of collateral across the financial system. A repurchase agreement (repo) functions economically as a collateralized loan where one party sells a security to another and agrees to repurchase it at a future date, often overnight or otherwise on a short-term basis. Securities lending similarly involves transferring a security to a borrower—typically to facilitate short selling, settlement coverage, or market-making—in exchange for cash collateral. Both legs of these transactions, securities and cash, must settle in a coordinated manner to reduce settlement risk.

Today, repo transactions rely on the **same intermediary infrastructure as cash securities transactions** (described above): clearinghouses, CSDs, and bank payment systems. In tri-party repo—the dominant market structure—a third-party agent manages collateral selection, valuation, and substitution on behalf of the parties. These transactions generate significant operational demands due to their short tenor, the need to reverse the initial exchange of securities (or loan) and payment, and the need for collateral management during the term of the contract.

Throughout the life of a repo or securities loan, collateral must be marked to market, margin calls calculated and met, and collateral substitutions processed within intraday timeframes. These demands, when coupled with the limitations of conventional payment and settlement systems (including operating hours and processing cycles) can lead to settlement delays, failed transactions, and increased costs.

These characteristics make repo and securities finance particularly **well-suited to benefit from programmable, continuously available settlement** as enabled by these forms of digital money. **Early choices about which form of money to use fall largely along the same lines as for spot securities transactions**. Because many of these transactions occur between a bank (or an affiliate) and its customer, tokenized deposit systems can help realize significant benefits within the perimeter. Today, at least one at-scale platform for repo transactions using tokenized deposits is operational.

At the same time, firms are exploring deposit token, wCBDC, and stablecoin solutions as a future solution for interbank settlement. Central bank are progressing pilot programs that enable cash settlement for securities transactions in wCBDC. The timing of wCBDC settlement depends on whether, how, and when central banks open those services to their members. In parallel, other projects are being developed to accelerate the availability of onchain central bank money for settlement.

Market infrastructure providers—including CSDs and clearinghouses—are also operating pilots for securities lending and repo transactions, which may be exploring the use of stablecoins. Firms may need additional legal and regulatory clarity and infrastructure developments to incentivize the adoption of these instruments for securities lending and repo transactions. The increasing adoption of stablecoins could slow if interoperability solutions develop using tokenized commercial bank money for interbank settlement. Stablecoins may scale faster if markets prioritize portability, neutrality, and exit optionality over balance-sheet integration, netting efficiency, and regulatory backstops.

Derivatives Margin

In both exchange-traded and over-the-counter (OTC) derivatives markets, counterparty credit risk and member default risk are typically managed through the exchange of collateral or margin. Initial margin is posted at the inception of a trade to cover potential close-out costs, while variation margin is exchanged daily or intraday to reflect mark-to-market changes in the value of the contract.

Today, margin settlement **relies on traditional bank payment infrastructure**. Variation margin calls are typically issued by clearinghouses or counterparties with strict payment deadlines, while initial margin is transferred to establish positions. Because eligible collateral is generally limited to cash or highly liquid, low credit risk securities, this process creates significant liquidity demands. The limited operating hours of current payment systems mean participants may need to maintain liquidity buffers, in unproductive collateral assets.

Tokenized deposits, deposit tokens, and stablecoins have been identified as possible candidates for initial and variation margin use. The continuous and automated settlement and programmability of digital money can address inefficiencies, and continuous and instant settlement can reduce or eliminate the need for large liquidity buffers.

Automating intraday margin payments via programmable triggers—where transfers occur automatically when a threshold is crossed—reduces the risk of manual failure or delay. This is particularly valuable for prime brokerage customers and markets currently restricted to daily cycles. Both tokenized commercial bank money and stablecoins can thus streamline the pledging of margin, lowering overall operational risks and costs.

Tokenized commercial bank money and stablecoins, however, both face challenges to scale for this use case. Tokenized deposits today are currently limited to intrabank settlement; use with clearinghouses that serve many counterparties likely requires the development of supporting infrastructure. Deposit tokens may provide a solution, once the necessary infrastructure is developed. Stablecoins face legal and regulatory uncertainties, including regarding haircuts for margin and, in some cases, eligibility for use for regulated derivatives transactions. While pilots and proof-of-concepts have been launched, no live institutional deployments exist as of publication.

Spotlight 4:
Tokenized Money Market Funds

Some types of money market funds (MMFs) may be used today for collateral in a range of capital markets use cases. Tokenized money market funds are MMF shares issued or recorded on blockchain ledgers—either natively or as an additional record after being issued in the usual way. Several asset managers have launched or are piloting tokenized MMF products, including on both permissioned and permissionless infrastructure.

Tokenized MMFs offer the benefits of blockchain infrastructure for collateral: near instant transfers, 24/7 availability, and full programmability. In turn, this can enable more efficient collateral mobilization—including intraday substitutions, automated top-ups, and the ability to pledge collateral more easily across multiple venues, for cleared and uncleared transactions.[10] Several market infrastructure providers and custodians are actively developing or piloting the use of tokenized MMFs for collateral.

Today, tokenized MMFs are not widely viewed as a more general type of transactional money. Instead, tokenized MMF shares are primarily being explored as collateral instruments.[11] However, like the forms of digital money discussed in this report, there are regulatory challenges that must be addressed for tokenized MMFs to be used at scale as collateral. This includes the legal treatment of these instruments in the context of existing collateral regimes, regulatory constraints on the use of MMFs more generally as collateral, and operational challenges. Projects are nonetheless moving forward, including using tokenized MMFs for repo, securities lending, and cleared and uncleared derivatives collateral.[12]

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[10] Use cases for tokenized MMFs as eligible collateral across jurisdictions will differentiate based on the current treatment of MMFs as collateral under local standards for both cleared and uncleared variation margin (VM) and initial margin (IM).
[11] USD stablecoins are, today, being used for securities settlement in the context of tokenized fund subscriptions and redemptions. See, for example, Circle, the issuer of the US dollar stablecoin USDC, enables purchases and sales of the Blackrock BUIDL money market fund in USDC.
https://www.circle.com/pressroom/circle-announces-usdc-smart-contract-for-transfers-by-blackrocks-buidl-fund-investors.
[12] See, for example, the work of the US TMMF Working Group, https://www.gdf.io/working-group/us-tmmf-working-group/.

Section Four

Looking Forward

Moving from initial pilots and intrabank deployments to production systems operating at scale: **regulatory hurdles, infrastructure builds, and industry governance standards are necessary for success**. The **institutions and jurisdictions that establish the necessary legal certainty, infrastructure, and standards first will shape the capital markets of the future**.

The next eighteen months are critically important as the industry brings new capital markets services, powered by digital money, to market to serve client demand. This section describes hurdles to be addressed by policymakers, regulators, and industry participants in the near-term to support their safe and timely development. Each topic includes a call to action summary.

Regulatory Hurdles

Strides have been made globally by policymakers and regulators in clarifying the legal and regulatory treatment of different forms of digital money. That work remains fundamental to the pilots and services using tokenized deposits, deposit tokens, wCBDCs, and stablecoins. However, just as the **legal and regulatory frameworks that govern payments and more complex capital markets funds transfers were developed iteratively over decades, so too will those that govern transactions using different forms of digital money**.

Below are key areas where legal or regulatory clarity is needed to support further development of institutional capital markets use cases for tokenized deposits, deposit tokens and stablecoins.

Tokenized Deposits and Deposit Tokens:

Clear Treatment as Deposits for All Purposes

The laws in the United States, EU, UK, Japan, Hong Kong, and Singapore are reasonably clear that **tokenized commercial bank money is just that: commercial bank money with the same characteristics as classic bank deposits,** represented on a different type of ledger. Tokenized deposits carry the same legal rights, protections, and limitations as conventional deposits, and deposit tokens share many of these characteristics. However, clarity on this point is not uniform across all jurisdictions or across all areas of law that affect the status and use of tokenized commercial bank money. Industry welcomes the ongoing public and private collaboration under the G20 for enhancing cross border payments by the end of 2027 since further global coordination among regulators on developing principles that apply to cross-border tokenized deposit activity is integral to reducing the cost of that work and facilitating scaling.

As firms seek to further develop intrabank and interbank use cases for tokenized deposits and deposit tokens, they will also need additional clarity and guidance on how these instruments can be used in ways different from conventional bank deposits. This includes when and how they can be transferred outside of the issuing bank's network and what safeguards should apply.

Call to Action

Regulators and policymakers should prioritize global coordination to acknowledge that using a digital ledger to issue commercial bank money does not change the relevant regulatory treatment. In addition, they should seek to work with the industry to identify and resolve challenges to using deposit tokens beyond an issuing bank's network, supporting scaling and new institutional use cases.

Stablecoins:

Capital and Margin; Accounting; Insolvency and Bankruptcy; Cross-Border Recognition

In most jurisdictions, stablecoins currently face more legal and regulatory gaps for at-scale adoption than tokenized commercial bank money. They **have the potential for global reach** using today's infrastructure. The basic scaffolding to support institutional stablecoin payments at scale—capital and margin, accounting treatment, insolvency and bankruptcy, and cross-border recognition—is being built.

Some regulatory frameworks are largely final, while others are being developed in major jurisdictions. The Markets in Crypto-Assets Regulation (MiCA) in the European Union (EU) and a stablecoin licensing regime in Hong Kong are in force. The Guiding and Establishing National Innovation for U.S. Stablecoins (GENIUS) Act in the United States has been enacted and is in the regulatory implementation process. A stablecoin legislative framework has been finalized in Singapore and is in the implementation phase. These frameworks have not, to date, been well-coordinated across jurisdictions. This creates risk of regulatory market fragmentation and friction for capital markets activities that routinely involve counterparties globally.

Capital and margin. A leading priority is the capital treatment for holding well-regulated stablecoins on financial institution balance sheets and applicable haircuts when posting those stablecoins for margin purposes or with central banks as collateral for credit lines. **Capital and margin treatment is a fundamental**

building block for all types of stablecoin use cases, and the current proposed approaches under some regional capital frameworks for cryptoassets **must be revisited** to reflect significant regulatory and market developments over the past several years. Exposures to regulated stablecoins, where the issuers are subject to robust reserve, redemption and prudential requirements, should be subject to a risk-appropriate capital treatment. Well-regulated payment stablecoins should be deemed eligible collateral for cleared and uncleared derivatives transactions, with appropriate risk management conditions and provisions (e.g., margin haircuts).

Recognizing permitted payment stablecoins as eligible margin would provide important efficiency and risk-management benefits and more efficient markets as discussed above for tokenized eligible collateral through faster settlement, reducing liquidity stress during periods of market volatility, mitigating collateral scarcity, and potentially reducing procyclical demand for non-cash collateral in stress scenarios. The extent to which stablecoins mitigate collateral scarcity or procyclical demand dynamics will depend on their regulatory treatment, haircut frameworks, and performance under stress relative to existing cash and high-quality collateral.

Accounting. The accounting treatment for stablecoins is another fundamental building block for capital markets use cases, in particular whether they qualify as cash equivalents. **Without clear accounting guidance, institutions cannot easily hold or transact in stablecoins in ways that are consistent with their financial reporting obligations.** In the United States, the Financial Accounting Standards Board (FASB) is beginning to consider this topic. In Europe, the treatment of crypto and digital assets is on the agenda of the International Accounting Standards Board (IASB) for 2026. These efforts should be prioritized to provide necessary certainty.

Insolvency and bankruptcy. All market participants must have clarity as to how stablecoins held in digital wallets—whether the wallet is provided by a bank, payment service provider, or another intermediary or custodian—will be treated in instances of bankruptcy or resolution of the intermediary or custodian. Similarly, the application of bankruptcy safe harbors to stablecoin-settled repo and derivatives margin transactions will need to be confirmed before they can be used at scale for these purposes.

Cross-border recognition. To mitigate regulatory market fragmentation, a necessary next step is for national and regional regulators to move quickly to address the legal and regulatory treatment of well-regulated stablecoins when they are transferred and held outside of their home jurisdiction. In doing so, policy makers and regulators should focus on core features of stablecoin issuer regulation, such as issuer licensing, reserve and custody requirements, segregation of client assets, mandatory redemption rights, and AML and CFT obligations.

Consistent with hard-earned experience in global markets regulation, regulatory cooperation agreements should be outcomes-based, forward-looking and designed to enhance market certainty over a defined period of time, seeking to put in place principles-based and proportionate recognition frameworks. They should also seek to strengthen supervisory coordination across jurisdictions and to address the potential for conflicts between regulatory and supervisory regimes. This coordination should keep pace with market developments to avoid holding back banking organization engagement while stablecoin activities proceed outside the banking sector.

Call to Action

Regulators must revisit proposed capital frameworks to grant well-regulated stablecoins risk-appropriate capital treatment. They should also clarify the regulatory treatment of well-regulated stablecoins as collateral for cleared and uncleared derivatives transactions, subject to appropriate haircuts. At the same time, policymakers and national regulators must proceed with global coordination to establish clear, forward-looking cross-border recognition frameworks to mitigate market fragmentation and facilitate institutional adoption.

Infrastructure Builds

Interoperability

Two key themes have emerged:

- First, new infrastructure may be needed for interbank settlement for tokenized deposit and deposit token transactions, both for domestic and cross-border transactions.
- Second, additional, institutional-grade interoperability solutions are needed to facilitate liquidity across the market and transfers between stablecoins, tokenized deposits, deposit tokens, and conventional deposits.

Ultimately, the infrastructure builds should aim to bring together the new forms of digital money, including through interoperable systems, thereby allowing market participants to use the forms of money best suited to their particular needs. Interoperability across systems will be critical to creating a coherent system for payments and value transfer.

Several infrastructure approaches are being explored:

Central bank interoperability. In some jurisdictions, central banks are building the infrastructure that allows tokenized commercial bank money issued by different banks to settle against each other. These initiatives are designed to provide for interbank settlement and benefit from the legal clarity and institutional authority of central banks and risk-free settlement in central bank reserves.

Private-sector interoperability infrastructure. Intermediaries and market infrastructure providers are building private-sector interoperability solutions for tokenized deposits, deposit tokens, and stablecoins. These initiatives may come to market more quickly than central bank developments and are designed specifically for capital markets use cases. Their legal and governance frameworks must be established carefully to ensure that settlement on the platform—whether in tokenized commercial bank money or stablecoins—carries the same finality as conventional interbank settlement. Examples include Swift's shared blockchain ledger initiative and UK Finance's GBTD pilot.[13]

Shared blockchain infrastructure. A third approach involves the exploration of shared ledger infrastructure on which tokenized commercial bank money from multiple banks or stablecoins could reside and settle on a common platform, thereby reducing reliance on bilateral interoperability arrangements. Initiatives such as Project Agora, convened by the BIS with central bank and commercial bank participation, are examining this model. However, such efforts to date remain largely experimental. Private sector examples include Circle's Arc and Swift's shared blockchain ledger. These initiatives are largely in pilot phases.

Call to Action

The industry and public-private partnerships should focus on building and supporting multilateral infrastructure for interoperability that enables interbank payments, whether using tokenized deposits, deposit tokens, wCBDCs, or stablecoins.

Industry Governance Standards

Control Frameworks; Data; Settlement Mechanics; and Privacy

Industry governance standards will build upon existing control frameworks to support market integrity, investor protection, and safety and soundness to manage evolving client services.

Control Frameworks

Institutions are applying comprehensive institutional-grade controls for each of the forms of digital money described in this report. These controls will evolve as use cases are identified, move into production, and scale. The box below shows a stylized map of the types of considerations and comprehensive assessment approaches financial institutions use today in evaluating the use of new digital money and other types of new financial infrastructure.

[13] For Swift's initiative, see https://www.swift.com/news-events/news/swifts-blockchain-based-shared-ledger-progresses-mvp-implementation; for UK Finance's GBTD pilot, see https://www.ukfinance.org.uk/news-and-insight/blog/reflecting-2025-tokenised-deposits-and-future-payments.

Data

For tokenized commercial bank money and stablecoins, common data and messaging standards (such as ISO 20022), technical protocols, and operating standards for permissionless blockchains and permissioned blockchains will become increasingly important to provide the same type of legal and commercial certainty as financial institutions enjoy for conventional payments. BIS's Project Agora and Swift"s work on blockchain interoperability are examples of initiatives exploring these standards.

Settlement Mechanics

For tokenized commercial bank money to be used for interbank transfers and to scale, the industry will need to work towards common technical standards and an underlying digital settlement mechanism that is functionally equivalent to today's RTGS systems.

Privacy

Developing standards around transaction privacy and digital identity will be necessary to protect market data and user information and enable better mechanisms for how information can be shared among third parties (including government agencies). Alignment on these questions will enable institutions to build systems that satisfy their regulatory obligations and allow regulators to confirm that compliance frameworks are being met.

Call to Action

As the use of digital money moves beyond proof-of-concepts, for use cases to scale, the industry will need to demonstrate best practices and continue to develop increasingly sophisticated approaches to risk management.

Conclusion

Capital markets activities today are fueled by different forms of money—primarily central bank reserves, and commercial bank money. New forms of digital money are now being added to the mix. Instruments will be suited for varying use cases, depending on their legal and economic characteristics and the rails on which they run.

This report has focused on specific capital markets use cases in relation to digital forms of money: securities settlement, repo and securities lending, and derivatives margin.

- **Tokenized deposits and deposit tokens** benefit from the long history of commercial bank money being used as a settlement asset in institutional settings. They generally **inherit the legal and economic features of conventional commercial bank money,** and they are well understood by intermediaries, regulators, and bank clients. **Programmability, atomic settlement, and continuous availability can provide meaningful near-term upgrades** for intrabank funds settlement. Today, tokenized deposits are being used for securities settlement, and repos and securities lending for services within the issuing bank's customer base. The future path, where tokenized commercial bank money can be used more broadly for interbank services, requires both public and private sector solutions to deliver new infrastructure, legal frameworks, and industry governance standards.

- **wCBDCs** can provide **settlement in the risk-free asset** with improved programmability, atomic settlement, and longer operating hours. Institutions see promise in central bank wCBDC initiatives, but it is not clear when these programs will become available, and they may not be made available in every jurisdiction. Private sector services are being built to provide interbank settlement for transactions involving tokenized deposits and deposit tokens using central bank reserves, creating interbank networks that mirror today's two-tier money system. New private sector initiatives that build on central bank systems for settlement may, however, come to market more quickly without requiring a wCBDC launch.

- **Stablecoins** are a bearer form of digital payment instrument native to permissionless networks and come with **smart-contract functionality and**

the benefits of an open developer ecosystem. Currently capital markets participants are focusing on cross-border payments use cases for stablecoins. At the same time, they are making investments for near-term services using stablecoins for interbank securities settlement, repo and securities lending, and margin services, as well as for other interbank settlement use cases. Redemption, liquidity, credit, and legal and regulatory uncertainties, the most pressing being those regarding capital treatment and cross-border recognition, are hurdles to institutional, at-scale adoption.

Regulators and industry each have important roles to play in seeing these forms of digital money reach their potential—enhancing the utility and integrity of financial systems, reducing risks and costs, and bringing important benefits to all capital markets participants.

As tokenized securities and real-world assets become more prevalent on blockchain systems, the demand for digital money that can settle those assets will also grow. Current capital markets use cases recognize the balance between (1) the likely primacy of tokenized deposits in the near-term future of digital money, with ongoing work toward interoperability with current payment systems, and (2) the potential for stablecoins to play an important role in digital money systems if certain challenges can be addressed. As legal clarity increases, the market will test whether stablecoins are a viable option to modernize payments services for global capital markets. **The institutions and jurisdictions that establish the necessary legal certainty, infrastructure, and standards first will shape the capital markets of the future.**

Appendix A:
Review of Existing and New Payment Systems

This appendix describes the four types of payment and settlement infrastructure most relevant to the use cases and different forms of digital money discussed in this report: **bank payment systems, central bank systems, permissioned blockchains, and permissionless blockchains**.

For each, the system is evaluated against **twelve core architectural features and operational characteristics** that determine how value moves, who can participate, and what legal and compliance frameworks apply.

A. Bank Payment Systems

Bank payment systems power the vast majority of payments today, moving funds in the form of conventional commercial bank money. They therefore serve as the baseline for payments and value transfers, against which new systems and innovations are evaluated.

Bank payment systems have evolved over decades as well-intermediated infrastructure. Their architecture is designed to deliver systemic stability and support a variety of payment flows designed for particular uses, institutional and retail, and provide for settlement finality backed by central bank money with deeply embedded regulatory compliance. These strengths come with some trade-offs: restricted and tiered access, dependence on intermediaries and potential single points of failure, limited native programmability, and, historically, constrained operating hours and geographical constraints. These trade-offs affect the cost and speed of these systems for capital markets transactions and have created openings for new infrastructure developments, including those using distributed ledger technologies.

Over time, new systems may be developed for payments using tokenized commercial bank money. Those systems may have different technological underpinnings—perhaps some using blockchain technology—but will need to address the same legal and commercial considerations as systems that enable bank payments today.

Fundamentally, these systems rely upon a two-tier monetary architecture involving (1) commercial bank deposits held and used by businesses and individuals and (2) payments among banks and between customers of different banks, which are ultimately cleared and settled in central bank reserves. This two-tier system is necessary because commercial bank deposits are account-based money and central bank clearing ensures fungibility of deposits across issuing banks. This section describes—at a high level—the architecture of existing bank payment systems, focusing on institutional payments and the characteristics and features that affect how commercial bank deposits move.

When a payment occurs between two customers of the same bank, settlement is achieved through an intrabank book entry—a debit to the payer's deposit account and a corresponding credit to the payee's—on the bank's core ledger. Because the transfer is purely internal, the bank's aggregate deposit liabilities remain constant and settlement requires no movement of reserves or use of external payment infrastructure.

A payment between customers of different banks involves the payer's deposit claim against its bank being extinguished and a corresponding claim being created in favor of the payee against the recipient bank. Bank deposits, because they are demand obligations of the issuing bank that are backed by that institution's balance sheet (and, failing that, depositor protection schemes), are by their nature not transferable nor inherently fungible with a deposit issued by another bank. Instead, interbank payment systems achieve fungibility for deposit money by clearing and settling interbank obligations in central bank reserves.

Bank payment systems vary in their institutional, operational, and regulatory architectures, yet each is designed to safeguard transaction integrity and the stability of participating institutions. For example, some systems use real-time gross settlement (RTGS), while others use deferred net settlement (DNS). In RTGS systems—such as Fedwire in the United States, CHAPS in the United Kingdom, TARGET in the European Union, and MEPS+ in Singapore—each payment instruction is processed and settled individually, on a gross basis, with immediate finality achieved through the transfer of central bank reserves between member institutions. In DNS systems—such as the Automated Clearing House (ACH) in the United States, BACS in the United Kingdom, STEP2 in the European Union, and the Interbank GIRO (IBG) system in Singapore—payment instructions are accumulated and netted over a defined cycle, with final settlement occurring at designated intervals through the transfer of net positions in central bank reserves.

To facilitate clearing and settlement, banks maintain reserve balances at the central bank, either directly or indirectly through correspondent relationships with other banks. In RTGS systems, participants must hold sufficient reserves to fund each transaction as it is processed, requiring active intraday liquidity management. DNS systems are less liquidity-intensive, as multilateral netting reduces the reserve balances required to discharge each settlement cycle. Central banks typically offer intraday liquidity facilities, such as collateralized daylight overdrafts or intraday repos, to support banks' reserve management and mitigate the risk of settlement gridlock.

Regardless of their specific design and settlement methodology, commercial bank payment systems share a set of core characteristics relevant for capital markets applications and for understanding how value transfers occur in institutional contexts.

Bank Payment Systems • Key Characteristics	
Network governance and operations	Bank payment systems have identified network operators that are responsible for network governance and operations. Payment system operators establish membership criteria, operational rules, risk management frameworks, and compliance requirements that all participants must satisfy. These operators onboard and remove participants, throttle or suspend access, modify system rules, and intervene in system operations to maintain orderly functioning and financial stability. Network rules set and are used to enforce admission requirements and participant activity and behavior on the network. Changes to system rules are promulgated by the operator—typically following a defined consultation or notice process—and are binding on all participants. These payment systems are often subject to specific licensing, legal, and regulatory requirements under local law. The governance frameworks and network rules of the largest payments systems—those determined to be systemically important—are reviewed under the PFMI, which are international standards developed by CPMI-IOSCO.
Access	Access to bank payment systems is restricted and tiered, specified by network rules, and enforced by the central network operator. Direct participants must typically hold accounts at a central bank or maintain settlement accounts with the system operator, satisfy minimum capital and liquidity requirements, demonstrate adequate operational and technical capabilities, and comply with all applicable regulatory requirements—including AML, CFT, and sanctions obligations. Indirect participants access payment systems through correspondent banking relationships or agency arrangements with direct participants, relying on the direct participant to submit and settle transactions on their behalf. This tiered access model enables regulatory oversight and risk management at the institutional level. It also creates dependencies and concentration risks, particularly where a small number of direct participants provide access to many indirect participants.
Intermediation	Bank payment systems are, by design, fully intermediated. Every payment requires the involvement of at least one bank or regulated financial institution, and cross-border payments typically require several, connected correspondent banking relationships.
Transaction visibility	Transaction information is visible selectively to participants and relevant regulatory and supervisory authorities. No public record of payment flows exists. Regulatory authorities can obtain information about transactions—and those conducting transactions—from banks. This architecture supports commercial confidentiality while preserving regulatory visibility.

Bank Payment Systems • Key Characteristics	
Permissible transactions	Payment system operators exercise control over the types of payment activities in which network participants can engage. These change based on demand for, technological capabilities needed for, and risks associated with, different types of payment activities. Network operators can suspend participants, restrict access, modify operating parameters, and implement emergency procedures, in accordance with the authority granted to them under their network rules. This discretionary authority is important for risk management and regulatory compliance. It also results in significant dependencies on the network operator.
Participant identity	All participants must meet eligibility criteria and must complete formal onboarding processes before being accepted as members and accessing the system. Thus, the identity of each direct network participant is known to the network operator and can be discovered and coordinated across network participants. In addition, banks are required to maintain detailed customer information and transaction records to enable regulatory compliance and support the integrity of the system.
Clearing and settlement	Bank payment systems exhibit varying clearing and settlement characteristics depending on their design. RTGS systems provide intraday, real-time clearing and settlement for individual transactions, with each payment settled immediately and irrevocably across central bank accounts. DNS systems batch payments and settle on a net basis at designated intervals, creating intraday credit exposure among participants until final settlement occurs. Bank payment systems often support credit-supported transactions as a core feature. Banks routinely extend intraday credit to customers and may provide daylight overdrafts—subject to regulatory limits, collateral requirements, and pricing mechanisms—to facilitate settlement. Payment system operators implement sophisticated liquidity-saving mechanisms—including gridlock resolution algorithms, payment queuing, and multilateral offsetting—to optimize liquidity usage and reduce the aggregate reserve balances required to process a given volume of payments. Legal frameworks for settlement finality—including the precise moment at which settlement becomes irrevocable and enforceable against third-parties—are typically established by statute or regulation and reinforced through network rules. They vary by jurisdiction and payment system.
Interoperability	In general, bank payment systems are not interoperable with each other and operate independently, whether within a jurisdiction or cross-border. Instead, they are connected by overlapping networks of members, who participate in multiple payment networks. Cross-border interoperability depends on correspondent banking networks, bilateral linkages between payment systems, or multilateral arrangements such as CLS Bank for foreign exchange settlement. Initiatives to improve cross-border payment interoperability—including efforts to link domestic fast payment systems across jurisdictions and the adoption of common messaging standards such as ISO 20022—are underway in a number of regions and remain at varying stages of implementation.

Bank Payment Systems · Key Characteristics	
Availability	Bank payment systems have traditionally operated during defined business hours aligned with their home jurisdiction, though many have significantly extended their operating windows in recent years to support global financial markets and cross-border activity. RTGS systems in major jurisdictions now often operate extended hours with some approaching near-continuous operations. Payment system operators maintain operational resilience frameworks, business continuity plans, and recovery procedures designed to minimize the duration and impact of service interruptions.
Programmability	Bank payment systems provide structured programmability through standardized messaging formats and processing rules. Some payment systems support a variety of payment types and instructions, request-to-pay functionality, payment holds, and conditional releases. However, conditional logic and complex transaction dependencies—such as the simultaneous settlement of multiple linked obligations—typically require implementation through separate bilateral or multilateral agreements, manual coordination, or layered systems built on top of the core payment infrastructure. Automated settlement of linked transactions—such as the simultaneous exchange of securities and cash on a DvP basis—generally require coordination between separate payment and securities settlement systems through dedicated interfaces and procedural protocols, rather than integrated protocol-level execution.
Compliance posture	Payment system operators—as well as banks and other financial institutions that access these systems—are subject to comprehensive regulatory regimes, including capital and liquidity requirements, operational resilience standards, conduct-of-business regulations, AML/CFT obligations, and recovery and resolution frameworks. Compliance with these requirements is enforced both by regulators and by the payment system operator under the network rules. In addition, serious and ongoing non-compliance can result in revocation of system access.
Fraud, error handling, and reversibility	Bank payment systems provide mechanisms for addressing erroneous or unauthorized transactions, which vary by system and jurisdiction. Payment system rules typically establish procedures and timeframes for errors, unauthorized transactions, fraudulent transactions and apportion liability and responsibility for these situations. Often the network rules reflect regulatory frameworks in relevant jurisdictions, which impose obligations on banks and other financial institutions under consumer protection, data privacy, finality, or other legal regimes.

B. Central Bank Systems

Central bank systems provide the foundational settlement layer in risk-free central bank reserves. They are the backbone of bank payment systems. Central bank digital currencies, and in the context of institutional capital markets transactions, wCBDCs, represent an extension of this role into tokenized and blockchain environments.

The core characteristics of central bank systems are shaped by their public mandate and institutional structure, with the unique power of central bank money as the settlement asset through which interbank obligations are discharged. At the same time, access to central bank systems is restricted, in most jurisdictions, to licensed deposit-taking institutions approved by the central bank, and central bank systems have historically operated on limited schedules, with functionality and services that take time to develop, and with settlement occurring during designated windows on business days.

Central Bank Systems · Key Characteristics	
Network governance and operations	Central banks operate their payment and settlement systems under statutory mandates. Governance frameworks are set by the central bank, in accordance with applicable law, with participation rights and system rules established and enforced by the central bank as the operator. Changes to system rules typically are not subject to participant vote: they are promulgated by the central bank, typically following public consultation where appropriate. The largest central bank payment systems are subject to oversight under the PFMI.
Access	Access to central bank reserve accounts and systems is restricted, in most jurisdictions, to licensed commercial banks and limited types of other eligible financial institutions. Nonbank financial institutions, payment service providers, and non-financial firms generally access central bank settlement indirectly through correspondent banking relationships with direct participants.
Intermediation	Central bank systems operate within the two-tier monetary architecture: the central bank settles obligations between direct participants (commercial banks and other eligible institutions), while commercial banks intermediate access for their own customers. This tiered intermediation model is fundamental to the design of central bank systems and is not expected to change materially, even as wCBDC designs expand direct access to a wider range of regulated participants.
Transaction visibility	Transaction information is not publicly visible. The central bank, as the system operator, has full visibility into all transactions processed through its systems. Direct participants can view their own transaction activity and account balances. Indirect participants access transaction information through their correspondent or agent bank. Regulators and supervisors may access transaction data through defined supervisory channels.
Permissible transactions	Central bank systems process transactions in accordance with system rules established by the central bank. The central bank, as the operator, has the authority to block prohibited transactions, suspend participant access, and intervene in system operations in response to legal requirements or to preserve financial stability. The range of permissible transactions is defined by the system rulebook and may be constrained by statute or regulatory requirements.

Central Bank Systems · Key Characteristics	
Participant identity	All participants in central bank systems are known to the central bank and have undergone formal onboarding and supervisory approval. There is no pseudonymity; participant identity is verified as a prerequisite for access. This identity architecture supports AML/CFT compliance and sanctions screening obligations, which are embedded in the onboarding and ongoing participation requirements.
Clearing and settlement	Central bank systems are the ultimate settlement layer for most financial systems. RTGS systems settle each payment individually and with immediate finality upon posting to the central bank's ledger. DNS systems net obligations over a defined cycle, with final settlement at designated intervals in central bank reserves. Settlement in central bank money carries no credit or liquidity risk, and finality is recognized in law in most jurisdictions. Central banks typically provide intraday liquidity facilities to support participants' reserve management during the settlement cycle.
Interoperability	Central bank systems are not natively interoperable with one another or across jurisdictions. Cross-border payments involving different central bank currencies are processed through correspondent banking networks, PvP linkages between central bank systems, or multilateral arrangements. Interoperability between central bank systems and emerging tokenized asset infrastructure—whether permissioned blockchains or permissionless blockchains—remains a significant open challenge and an active area of central bank experimentation.
Availability	Traditional central bank RTGS systems operate on business day schedules with defined operating windows. Several central banks have extended operating hours in recent years, and wCBDC designs contemplate around-the-clock availability.
Programmability	Traditional central bank payment systems have limited native programmability. Conditional settlement logic—such as linked or simultaneous transfers—must typically be implemented through layered infrastructure rather than at the core settlement layer. wCBDC platforms under development in various jurisdictions are exploring how smart contract functionality can be incorporated into central bank settlement infrastructure, potentially enabling atomic DvP or PvP settlement directly in central bank money.
Compliance posture	Access is restricted to supervised institutions, participant identity is fully verified, and the central bank has direct authority to enforce compliance through system rules and access controls. Regulatory obligations—including AML/CFT, sanctions, and capital requirements—are embedded in the onboarding and participation framework.

Central Bank Systems · Key Characteristics	
⚠ Fraud, error handling, and reversibility	Central bank system rules establish defined procedures for addressing erroneous transactions, operational failures, and unauthorized instructions. The system operator has the technical and legal authority to reverse, correct, or adjust transactions in accordance with system rules and applicable law.

C. Permissioned Blockchains

Permissioned blockchains combine features of traditional payment systems and permissionless blockchains. Permissioned blockchains are operated by networks of computers that each maintain a copy of the system blockchain. They support the transfer of tokenized digital assets. Like bank payment systems, permissioned blockchains are centrally managed by a network operator and are run on computers whose access is approved and monitored by the central network operator. The network operator can take the form of a single entity or a consortium or other organized governing authority. This network operator grants access to the network-to-network validators that operate the system and to participants who use the system.

These networks can either be permissioned at the participant level, enabling the transfer of value among a restricted set of identified participants, or can be open to any type of participant.

Like permissionless blockchains, permissioned blockchains are being used today for stablecoin issuance and transfer. Tokenized deposits and deposit tokens are also often deployed on permissioned blockchains. The limited, known set of participants and network validators creates opportunities for efficiencies and allows permissioned networks to address network security, risk management, and regulatory compliance using the same approaches as traditional payment systems. In addition, they can employ low-energy consensus approaches rather than the resource-intensive mechanisms more common in permissionless systems. Like traditional payment systems, permissioned networks can support high transaction throughput and immediate deterministic finality—where a transaction is considered settled the moment it is included in a block—without the need to wait for subsequent confirmations, because they are governed by network rules supported by protocol operations.

Permissioned Blockchains · Key Characteristics	
Network governance and operations	Permissioned blockchains are governed by a central network operator, whether a single entity, a consortium, or some other governing body. As with traditional payment systems, permissioned networks are governed through a rulebook, agreed upon by the network operator, validators, and participants. The network operator is responsible for maintaining and updating the network software, maintaining the rulebook, and enforcing the rulebook against network validators and participants. Changes to the protocol are coordinated through formal channels by the network operator with network validators.
Access	Participation is restricted to approved entities, often banks, payment service providers, or other types of regulated financial institutions. No participant can join the network, run a network validator node, or submit transactions for execution without prior onboarding and approval by the network operator. Participation may be open or limited to approved types of users.
Intermediation	Permissioned blockchain systems can limit direct participants to regulated financial institutions or can be open to a wider variety of participants. They provide paths for less-intermediated activities directly on the network or can require full intermediation, depending on the design of the particular network.
Transaction visibility	While the permissioned blockchain provides a single source of truth (like a permissionless blockchain), visibility can be restricted or tiered. These features can be used to protect transaction privacy and provide differentiated visibility to participants and regulators.
Permissible transactions	The network operator can enforce compliance at the protocol level or, contractually, through the network rules, or both. The network operator often has the ability to unilaterally block prohibited transactions, freeze accounts in response to legal orders, and alter network rules to remain compliant with changing laws or regulatory requirements.
Participant identity	As in traditional payment systems, access can be limited to participants that are known to the network operator and that undergo traditional financial services onboarding.
Clearing and settlement	Permissioned blockchains are often optimized for high-performance settlement, supporting both pre-funded models and credit-based systems. Because validators are trusted or contractually bound, settlement can occur quickly. These networks can support netting and batching processes, as the governance framework can establish the legal and technical rules for how obligations are offset before the final transfer of value.
Interoperability	Interoperability between different blockchains remains a challenge, as permissioned blockchains face the same silo challenges as permissionless blockchains. Interoperability can be solved through coordination across networks by network operators, coordinating with network participants. Standards or specialized bridging solutions can also be used to connect different permissioned environments.

Permissioned Blockchains · Key Characteristics	
Availability	Permissioned blockchains—because they are often operated by many distributed computers—may have 24/7 availability similar to permissionless blockchains. However, if the network operator or key network nodes are compromised, the entire network may become inaccessible.
</> Programmability	Permissioned blockchains typically support smart contracts, which are deployable with the approval of the network operator. Smart contracts are used to provide transaction functionality as well as enforce regulatory compliance.
Compliance posture	Compliance measures can be incorporated into the architecture of permissioned blockchains. These can include network-level access controls, membership vetting, verified identities, configurable privacy, and operator accountability, which would directly support counterparty due diligence, sanctions screening, AML/CFT, and other obligations.
Fraud, error handling, and reversibility	As in traditional payment systems—because permissioned blockchains can be governed by a rulebook—they can address fraud, error handling, and reversibility in traditional ways. The rulebook can specify how these issues are to be handled by network participants, and the network operator has the authority to intervene in the blockchain to correct mistakes, reverse unauthorized transactions, and address other issues with the network or transactions.

D. Permissionless Blockchains

Permissionless blockchains are operated by networks of computers running open-source software that enable the trustless transfer of value among network participants. Unlike traditional financial databases or permissioned blockchains, they do not rely on a central administrator to grant access, validate transactions, or manage system operations. The most widely adopted permissionless blockchains today include Bitcoin, Ethereum, Solana, and Stellar, though dozens of other blockchains operate with varying degrees of adoption and specialization.

Much of today's nonbank stablecoin issuance and transfers occur on permissionless blockchains. There are also projects that aim to issue tokenized deposits or deposit tokens on this infrastructure, using permissioning software at a layer above the protocol level to address legal and compliance considerations, as discussed below.

Different permissionless blockchains employ different combinations of computational, economic, and governance measures to ensure the integrity of the blockchain and support the ongoing operation of the network.

Permissionless Blockchains · Key Characteristics	
Network governance and operations	Permissionless networks have no central operator to provide governance, operational, or administrative services to the network and its participants. The operation and security of the network, at the base layer, are governed by the rules encoded in the open-source software protocol and enforced through the economic incentives of the consensus mechanism. Changes to the protocol are typically proposed through open governance processes and adopted only if a sufficient proportion of network participants elect to run the updated software.
Access	Any person running the network software can join the network, though different participants may assume different roles. In general, all participants can read the blockchain and submit transactions for processing. Some may operate validator or full-node software, contributing to the addition of new transactions and data to the chain and, therefore, to the security of the network. None of these roles requires prior approval from, or onboarding by, a central authority.
Intermediation	The core innovation of blockchain technology is preventing double-spend—that is, the ability to prevent a digital asset from being duplicated or spent more than once—without reliance on a central intermediary to validate and process each transaction. This enables the trustless transfer of value between participants who have no prior relationship and no shared third-party. Permissionless blockchains can therefore support non-intermediated payment flows, but are also open to intermediaries and fully intermediated flows through allow-listing and other mechanisms deployed above the protocol layer.
Permissible transactions	The network protocol defines the kinds of transactions that can be conducted on the network. Because network nodes can freely enter and exit, no single entity can unilaterally block a transaction permitted by the protocol, freeze an account at the base layer (although assets may be frozen by issuers using smart contracts), or alter the rules of the network. Permissionless networks enable permissioning and transaction privacy through additional software layers such as: token-level transfer restrictions enforced by smart contracts (such as allow-listing of approved addresses), zero-knowledge proof systems that enable transaction validation without revealing underlying data, and privacy-preserving protocols that shield transaction details from public view while still enabling compliance verification.
Participant identity	As a technological matter, participants using permissionless blockchains are not required to have their real-world identities verified by an intermediary or to undergo any onboarding process in order to interact with the network. However, identity verification and onboarding requirements may be—and in regulated contexts typically are—imposed by intermediaries and applications that operate and provide services on the network.
Transaction visibility	Every onchain transaction, asset issuance, and smart contract deployment is recorded on a publicly viewable blockchain. Any party can audit the complete history of the blockchain in real-time, including onchain transactions. Privacy solutions are provided by layer 2s, applications, or other technology layers; some newer types of blockchains are designed with inherent transaction

Permissionless Blockchains · Key Characteristics	
	privacy.
Clearing and settlement	At the base layer, permissionless blockchains are designed to enable real-time gross settlement of value transfers. Blockchain protocols will execute a transfer only if the sender's address holds sufficient assets at the time the transaction is submitted to the network for processing. Transactions are validated and settled individually, on a gross basis, and with probabilistic operational finality determined by the specific protocol—typically achieved as a matter of market consensus after a specified number of blocks has been added to the chain, with block times ranging from sub-second (on networks such as Solana) to approximately ten minutes (on Bitcoin). These systems do not natively support netting. Instead, netting, credit extension, batching, and other transaction features commonly found in traditional payment infrastructure can be implemented through additional software layers, smart contracts, off-chain protocols, or intermediated services.
Interoperability	Permissionless blockchains are not natively interoperable, and assets issued on one network cannot be directly transferred to another. Instead, interoperability across blockchains and blockchain systems is addressed through a variety of cross-chain infrastructure. Cross-chain bridges enable the transfer of assets between blockchains, typically by locking assets on the source chain and minting corresponding representations on the destination chain. Cross-chain messaging protocols allow smart contracts on different networks to communicate and trigger coordinated actions.
Availability	Permissionless blockchains are inherently global, and generally operate continuously. These networks can experience degraded performance or temporary outages due to spikes in demand, software bugs, consensus failures, or coordinated attacks, but many major networks have historically generally operated without downtime. Because there is no central network operator responsible for uptime, there is no institutional guarantee of continuous availability. Reliability of network availability is instead addressed by the decentralized architecture, which is specifically designed to make sustained disruption difficult as new network nodes can freely enter to help resolve and bolster network operations.
Programmability	Permissionless networks that support smart contracts, and self-executing code stored on and enforced by the blockchain, enable a wide range of programmable financial activity. Smart contracts can automate complex transaction logic, including PvP and DvP settlement on an atomic basis, meaning that either both legs of the transaction execute simultaneously or neither does. This composability—i.e., the ability to combine and sequence smart contracts in novel configurations—allows increasingly complex financial operations to be constructed and automated without reliance on intermediaries to execute or coordinate the underlying steps.

Permissionless Blockchains • Key Characteristics	
Compliance posture	The open architecture of the base layer presents new compliance challenges at the system level. Financial institutions and other regulated participants cannot rely on a central operator, network-level access controls, or membership rules to vet counterparties or restrict participation. Counterparty due diligence, customer identification, and sanctions screening are conducted off-chain and bilaterally or among groups of network participants. A growing ecosystem of blockchain analytics and compliance tooling has developed to support these requirements, including transaction monitoring services, wallet screening tools, and onchain attestation frameworks.
Fraud, error handling, and reversibility	Once a transaction is settled on a permissionless blockchain, it generally cannot be reversed, amended, or unwound at the protocol level. There is no central authority with the power to revert erroneous or unauthorized transactions. Instead, these must be addressed through off-chain legal processes, application-layer controls, or, in the case of certain token standards, issuer-level functionality such as the ability to freeze or claw back tokens. Bilateral arrangements between network participants address these topics. And networks are beginning to develop broader frameworks to address common payment failure scenarios, errors, chargebacks, reversals, and corrections.

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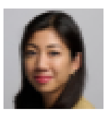

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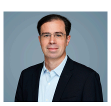

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