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A Two-Layer Architecture for Digital Assets: Decoupling Asset Custody from the Ownership Record

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Summary

This paper challenges the prevailing extremes of "native issuance" and "wrapped assets," arguing instead for a "Two-Layer Architecture" that separates the "vault" from the "record." It proposes that value should remain anchored in a regulated Asset Layer (off-chain custody), while the definitive record of ownership circulates on a public blockchain Ownership Layer (on-chain settlement). A regulated entity, the Token Operator, synchronizes the two, providing a framework that satisfies both the need for regulatory accountability and the desire for global, programmable settlement.

Key points

- **Flaws of Native and Wrapped Assets:** The paper critiques native issuance for creating illegal bearer instruments without identity or recourse, and wrapped assets for introducing dangerous bridge vulnerabilities.
- **Separating the Vault and the Record:** The core architectural proposal is to decouple custody from record-keeping; regulated intermediaries maintain the vault (custody, compliance), while the public blockchain becomes the single shared ledger for ownership.
- **The Token Operator as Interface:** A regulated entity called the "Token Operator" connects the two layers, functioning essentially as an issuer-CSD to maintain the definitive record of ownership on the shared infrastructure.
- **Unhosted Wallets as Contingent Rights:** The architecture resolves the unhosted wallet debate by treating them as holding "contingent rights"; wallets can transfer tokens freely, but holders must complete identity verification with the Operator to receive economic benefits like redemption or yield.
- **Coexistence and Transition:** The model allows for a gradual transition where traditional and tokenized forms of a security can coexist, with the Token Operator immobilizing legacy securities to mint tokens on the Ownership Layer.

A Two-Layer Architecture for Digital Assets: Decoupling Asset Custody from the Ownership Record

Introduction

For the past decade, the digital asset industry has pursued the idea of eliminating intermediation by moving assets "onto the blockchain," producing two extremes[1]: native issuance (assets exist entirely on-chain) and wrapped assets (assets live off-chain and settlement occurs on-chain). Both methods assume that fewer intermediaries equals success.

This instinct contains a kernel of truth. Today's financial infrastructure relies on a chain of trusted intermediaries, each maintaining its own record of ownership: issuer to CSD, CSD to custodian, custodian to broker, broker to investor. Blockchain genuinely displaces the need for that chain of proprietary ledgers: it provides a shared, cryptographically verifiable record that no single entity needs to maintain or trust. But the industry drew too broad a conclusion from a narrow insight. Displacing the chain of redundant records does not require displacing custody, identity verification, compliance, or corporate actions. These functions exist because centuries of financial and legal development have proven them necessary.

The issue, then, is not that traditional finance has too many intermediaries, but that each intermediary, custodian, broker, central securities depository, transfer agent, acts as both a vault for the asset and a record-keeper of ownership. These records are independently maintained and they drift. Reconciliation, the continuous, expensive process of detecting and correcting that drift, is not a bug in the system. It is the system. Neither extreme addresses this dual role. Native issuance eliminates the intermediary entirely, discarding the functions that regulated finance requires. Wrapping keeps the intermediary but leaves the fragmented record-keeping intact. Both miss the deeper opportunity: not to minimise intermediation, but to separate the functions that are currently bundled within it.

This paper argues that the vault and the record should be separated. The intermediary keeps the vault: custody, compliance, legal accountability. The blockchain becomes the definitive record of ownership. Not just a settlement layer that moves entries between proprietary books, but the single shared ledger that replaces them.

We propose a formal two-layer architecture defined by an Asset Layer and an Ownership Layer. Value remains anchored in regulated financial infrastructure. The record of claims circulates on a public blockchain. A regulated entity, the Token Operator, binds the two, maintaining the definitive record of ownership on shared infrastructure it operates on but does not own. The hierarchy of institutional authority is preserved. The independent, reconciliation-prone ledger is not.

Why Native Issuance Falls Short

The appeal of native issuance is understandable. If an asset exists entirely on-chain, there is no custodian to trust, no counterparty to fail, no intermediary to extract rent. Possession of the private key equals ownership, and transfer is instantaneous and final. For many early adopters, this elegance represented the fulfilment of blockchain's original promise.

Yet this very elegance creates a fundamental incompatibility with regulated finance. A native on-chain token functions as a bearer instrument: whoever holds the key owns the asset, with no entity responsible for linking on-chain holdings to identifiable persons and no recourse if keys are lost or stolen.

Bearer instruments are prohibited or heavily restricted across major jurisdictions, and for good reason. The US Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA) denies tax deductions for interest on bearer bonds and imposes penalties on issuers. The UK Companies Act 2006 abolished bearer shares. EU Anti-Money Laundering Directives require identification of beneficial owners. These restrictions reflect a deeper principle: **legal recognition of ownership requires identity**. Courts cannot adjudicate disputes over assets whose owners are anonymous. Creditors cannot pursue claims against unidentified debtors. Tax authorities cannot assess liabilities on invisible holders.

For registered securities, the incompatibility runs deeper than regulatory prohibition. Corporate law in every major jurisdiction requires issuers to know their shareholders. Under the UK Companies Act 2006, legal title to shares is conferred by inclusion in the company's register of members. US state corporate codes require similar shareholder records for voting, dividends, and proxy solicitation. These are not compliance overlays that could be reformed; they are structural features of how corporations function. A company cannot hold a shareholder meeting, distribute dividends, or process a rights issue without an authoritative record of who owns what. Native issuance, by design, provides no such record. For equities and other registered securities, native tokens are not merely problematic; they are a structural impossibility without wholesale legislative reform.

Native issuance also discards centuries of mechanisms for handling loss and theft. If a private key is lost, the asset is gone with no issuer to petition and no court to appeal to. If a key is stolen, the thief acquires good title, indistinguishable from the original owner. Stop payments, replacement certificates, court-ordered transfers: none of these exist in a native model.

Insolvency compounds the problem. Creditors and insolvency practitioners need to identify what the estate owns and who has claims against it. Pseudonymous on-chain holdings frustrate both inquiries, making it impossible to distinguish debtor assets from customer assets or to establish documentary evidence of claims.

Native issuance, in short, collapses both the vault and the record onto the blockchain, leaving no entity accountable for either. This paper argues that only the record needed to move: the cascading, independently maintained ledgers of today replaced by a single shared one.

Why Wrapped Assets Leave Key Risks Unresolved

If native issuance creates bearer instruments, an obvious alternative is to wrap real-world assets: hold the asset with a custodian and issue tokens representing the custodied collateral. This approach draws on the depositary receipt model that has functioned effectively for a century. American Depositary Receipts (ADRs), for instance, allow US investors to hold interests in foreign securities through a robust legal framework of regulated depositaries, contractual obligations, and judicial oversight.

The analogy, however, breaks down when applied to blockchain. ADRs work because of a comprehensive legal cage. Wrapped crypto assets replace this cage with a smart contract that has no legal personality, no regulatory status, and no established mechanism for handling disputes.

It is worth noting that "wrapped" bundles two distinct risks. The first is **representation risk**: even on a single chain, the holder's legal claim, the issuer's authority over lifecycle events, and the treatment in insolvency must all be clearly defined. A smart contract can express rules, but legal enforceability sits with entities. The second is **mobility risk**: when representations move across chains via bridges, the attack surface expands dramatically. A bridge is a smart contract that locks tokens on one blockchain and mints equivalent representations on another; when the bridge is exploited, through validator compromise, smart contract vulnerabilities, or consensus failures, attackers can mint unbacked tokens or drain the locked collateral. The consequences have been severe. The Ronin bridge lost $625 million. The Wormhole bridge lost $320 million. The Nomad bridge lost $190 million. In each case, the "wrapper" failed, and holders of wrapped tokens discovered they held claims against an empty vault. The custody seam between the real asset and its on-chain representation proved to be a vulnerability rather than a feature.

The natural response is to ask why we cannot simply build a better cage: more robust smart contracts, clearer legal terms, regulated custodians. This is the right instinct, but it does not go far enough. The depositary model provides a governed representation of an underlying asset, but it does so by adding another proprietary record to a chain of records that must all be kept in sync. It manages representation within a fragmented ledger structure rather than replacing that structure. The two-layer model proposed here is different: it separates custody from record and places the authoritative record of entitlement on shared infrastructure, so that other records become derivative rather than independently maintained sources of ownership truth.

The Architecture: Separating the Vault from the Record

Native issuance collapses the vault and the record onto the blockchain, discarding the regulated entity entirely. Wrapped structures keep the vault with a custodian, but add another proprietary record to a chain of records that must still be kept in sync. The two-layer architecture proposed here is different: the vault remains in regulated infrastructure, while the authoritative record of entitlement moves to a shared ledger.

Blockchain as Ownership Record

Most industry discussion frames blockchain as a settlement system: faster plumbing for moving entries between existing books. This paper makes a different claim. The blockchain is not a settlement layer but the ownership record itself[1]. Settlement, the transfer of title from one party to another, is what happens when the record updates. The distinction matters. A settlement system leaves proprietary ledgers in place and moves entries between them more efficiently. An ownership record replaces those ledgers. The first accelerates reconciliation. The second eliminates the need for it.

Layer 1: The Asset Layer

The bottom layer consists of traditional banking and custodial infrastructure. This is where value resides. US dollars sit in FDIC-insured bank accounts; Treasury securities sit in Fedwire or with custodians like BNY Mellon. This layer provides safety, recourse, and legal **certainty**. It does not move frequently; it anchors.

Layer 2: The Ownership Layer

The top layer is the public blockchain. This is where the *token* resides. Crucially, the token is not the asset itself; it is an indirect claim on the asset in Layer 1, mediated by the Token Operator. This layer provides what a private SQL database cannot: open access and user-led composability. A private ledger requires bilateral agreements with every counterparty. A public blockchain is accessible to anyone, anywhere, at any time. It enables integration with decentralised finance protocols, atomic settlement with other on-chain assets, and composability that closed systems cannot match. This openness also provides the liquidity access that has historically motivated asset wrapping, but without the bridge risk that wrapping entails.

Why use a public blockchain rather than a private database? Because the Ownership Layer's value lies in two properties. First, it is shared: all participants read from and write to the same ledger, eliminating the independently maintained records whose drift the introduction identified as the core problem. Second, it is open: ownership can change hands instantly, across borders, and programmatically, without requiring the underlying heavy machinery of Layer 1 to move.

The Interface: The Token Operator

Connecting these two layers is the Token Operator: an active, regulated entity responsible for synchronising the state between them. Functionally, the Token Operator performs the issuer-CSD role: it records the initial issuance and maintains the definitive record of ownership, much as a Central Securities Depository does in traditional markets[1]. This means no novel regulatory framework is required; the function maps directly to existing CSD regulation, adapted for the issuer-operated model.

This framing has gained regulatory recognition. In January 2026, the SEC's Division of Corporation Finance issued a statement on tokenized securities that effectively distinguishes between issuer-sponsored token models, where a regulated operator maintains the record of ownership, and third-party-sponsored models that operate without such an entity. The architecture proposed here aligns with the issuer-sponsored category.

The Token Operator performs five critical functions:

1. **Asset control:** holding or controlling the underlying value in the Asset Layer (Layer 1)
2. **Identity management:** maintaining the link between on-chain addresses and real-world identities
3. **Compliance execution:** freezing addresses, reversing transactions, screening for sanctions
4. **Lifecycle management:** handling issuance, redemption, and corporate actions
5. **Multi-chain coordination:** synchronising supply across multiple blockchains in the Ownership Layer (Layer 2)

An issuer-CSD, and thus a Token Operator, is not the same as an issuer. In traditional securities markets, these are typically separate entities: Apple issues shares (issuer), while DTC maintains the definitive record of ownership (issuer-CSD). With stablecoins, Circle performs both roles: it creates the liability and maintains the on-chain record of ownership. However, this collapse of roles is not inherent to the architecture. For other asset classes, the roles can and often should be separated. A corporate bond, for example, might be issued by the corporation while a third-party Token Operator (analogous to a transfer agent) maintains the on-chain record. The Token Operator function is the issuer-CSD role, whether performed by the issuer itself or by a separate entity. The institutional design differs accordingly: for a stablecoin, the Token Operator is both obligor and record-keeper, and the holder's claim is on the operator. For a tokenised security, the operator is record-keeper only, and the holder's claim runs to the underlying issuer.

Circle demonstrates the issuer-CSD architecture at scale. The dollars backing USDC sit in bank deposits and Treasury securities (Layer 1). Circle maintains the reserves, handles issuance and redemption, and manages USDC natively on more than 30 blockchain networks. Its Cross-Chain Transfer Protocol (CCTP) enables burn-and-mint transfers across a growing subset of these chains, coordinating supply without bridges or wrapped tokens. Circle is not merely an issuer; it is the interface between layers.

The concept of a CSD operating as a "Master Interface" to blockchain infrastructure was articulated as early as 2018, when it was proposed that CSDs could whitelist securities and market participants on-chain while retaining control over registration and compliance. What remained theoretical in 2018 has since been validated by stablecoin issuers operating at scale.

Linking to Existing Market Infrastructure

The Token Operator's scope extends naturally beyond newly issued digital assets. For securities that already exist within traditional market infrastructure, the Token Operator must also perform a linkage function: connecting to issuer CSDs in other jurisdictions, immobilising securities at the source, and issuing tokens on the Ownership Layer that represent those holdings. This linkage function, traditionally associated with investor CSDs, becomes a core capability of any Token Operator seeking to offer broad market access. During transition, traditional and tokenised forms of the same security coexist. The Token Operator's create-and-cancel mechanism, immobilising securities to mint tokens and releasing them on redemption, allows arbitrage between the two forms, ensuring price convergence without requiring wholesale migration from existing infrastructure.

The implication is CSD convergence at the transfer layer, though not the disappearance of existing CSD roles. In traditional markets, issuer CSDs and investor CSDs perform distinct functions that often fragment the view of ownership across jurisdictions. A Token Operator that both records issuance on the Ownership Layer and links to existing FMI infrastructure collapses this fragmentation for on-chain participants, even as the underlying CSD roles persist for the assets they custody. The on-chain record replaces the cascading proprietary ledgers of the intermediary chain, not the institutional roles that anchor assets to legal systems. National ownership registration and tax-withholding rules will continue to require local intermediaries, but the compliance function becomes thinner: reading a shared ledger rather than reconciling bilateral links. Each operator competes on the breadth of its connections and the markets it can serve. Whether this produces sustained competition or concentration driven by high fixed costs and regulatory capital is an open question, but the architecture at least enables the possibility rather than recreating the territorial exclusions of today's CSD landscape.

Unhosted Wallets: Permissionless Transfer with Contingent Rights

This layered architecture elegantly resolves one of the most contentious issues in digital asset regulation: **unhosted wallets**.

Unhosted (or self-custodied) wallets are wallets not controlled by a regulated intermediary: the wallets in your phone, your hardware device, your browser extension. Regulators have struggled with unhosted wallets because they enable pseudonymous transfer outside the traditional financial system.

The Ownership Layer accommodates unhosted wallets without compromising compliance. An unhosted wallet can hold tokens and transfer them freely on the Ownership Layer. However, the Token Operator does not recognise unhosted wallets for redemption, interest payments, or corporate actions. To receive economic benefits, the holder must complete identity verification with the Operator.

What, then, does the unhosted wallet holder actually own? They hold a contingent right: a claim that becomes enforceable only upon completing KYC with the Token Operator. This is not a novel legal concept. Many financial instruments have conditions precedent to payment. A contingent right can be transferred and has economic value (someone will buy it knowing they can complete KYC). But it is not a bearer instrument, because the Operator controls access to the underlying value in Layer 1.

The elegance of this model is that it satisfies both sides of the regulatory debate. DeFi proponents retain permissionless transfer: anyone can hold and send tokens without permission. Regulators achieve compliance: no anonymous redemption, no bearer instrument, full KYC for economic benefits. Issuers gain a single architecture that works globally without restricting which wallets can hold tokens.

Two caveats should be stated plainly. First, fungibility tiers may emerge: if market participants treat contingent holdings as harder to monetise, claims may trade at discounts that intermediaries compress through onboarding and compliance wrappers. Second, redemption gating is necessary but may not be sufficient in all regimes. Additionally, some supervisors may still view broad unhosted circulation as elevating sanctions and AML risk, even if cash-out is controlled and transparency improved.

The practical scope of contingent holding varies by instrument. For non-yielding tokens such as stablecoins, the holder need only identify themselves at redemption, making the contingent rights window indefinite: a wallet can hold USDC for years without the operator needing to know the holder's identity. For instruments with periodic cash flows, the window narrows sharply. Bond coupon payments, deposit interest, fund distributions, and equity dividends all require the operator to identify the recipient at each distribution date. Voting and corporate actions impose the same requirement. For these instruments, the contingent rights model still applies in principle, but the practical reality is that holders must onboard with the Token Operator or a delegated service provider promptly after acquisition. The architecture accommodates this range. The same two-layer structure supports both indefinite anonymous holding of stablecoins and rapid-onboarding flows for interest-bearing securities. What changes is not the architecture but the operational cadence of identity verification.

Interoperability as Token Operator-Mediated State Synchronisation

This layered approach fundamentally reframes the interoperability problem. In a "wrapped" world, moving assets between blockchains requires dangerous bridges that lock assets on one chain and mint representations on another. In a layered world, the Asset Layer never changes.

To move value from Ethereum to Solana, the Token Operator simply updates the Ownership Layer via a burn-and-mint sequence (as demonstrated by Circle's CCTP). The token is extinguished on Chain A and re-issued on Chain B. The underlying asset in the bank account never moves. Interoperability becomes a lower-risk accounting entry rather than a high-risk asset transfer.

Circle's CCTP proves this at scale. USDC is natively supported on more than 30 blockchain networks, and CCTP enables burn-and-mint transfers across a growing subset of them, all without bridges or wrapped tokens. Circle *is* the interoperability layer: the API that keeps multiple Ownership Layer instances synchronised with a single Asset Layer.

The implications are significant. There is no bridge contract to exploit. There are no wrapped tokens with counterparty risk. The Operator simply decides which ledgers to recognise. What appeared to be a hard technical problem dissolves into an operational decision.

Boundaries and Implications

The Ownership Layer model works when the regulatory focus is on the asset and its issuer. It does not work when the focus is on the **infrastructure itself.**

Firms such as Fnality, a wholesale payment system designated as systemically important under the Banking Act 2009, cannot use public blockchains because CPMI-IOSCO principles require operational control over settlement finality. CREST and DTCC face the same constraint under CSDR and SEC Rule 17Ad-22 respectively. Stablecoins work on public chains because Circle is regulated as an issuer, not as infrastructure. Wholesale payment systems require private, permissioned chains where the operator controls every aspect.

This is not a flaw in the model. Different regulatory regimes serve different purposes. Retail and commercial instruments need issuer accountability; the Ownership Layer provides this. Wholesale infrastructure needs systemic resilience; private chains allow Token Operators to provably satisfy that requirement.

Reliance on public blockchains introduces its own dependencies. Chain governance can change fee structures or consensus rules. Validators and sequencers extract value through transaction ordering. A chain provider's failure or abandonment, while unlikely for established networks, would require migration. The layered architecture contains this risk: because the Asset Layer is entirely off-chain, no blockchain failure can destroy the underlying value. The Token Operator's multi-chain coordination capability, already demonstrated by Circle across multiple networks, means the Ownership Layer can migrate between chains without affecting asset safety. The blockchain is replaceable infrastructure; the value it records is not.

For investors, the architecture offers tangible improvements over current market structure. Settlement becomes near-instantaneous rather than T+1 or T+2. Self-custody eliminates the multi-layer intermediary chain that currently separates investors from their holdings. Portfolio visibility is real-time and cryptographically verifiable rather than dependent on periodic statements from custodians. And because the Ownership Layer operates continuously, markets are no longer constrained by the business hours of any single jurisdiction.

No novel regulation required. For regulators, the task is recognition rather than invention. The GENIUS Act and MiCA already provide explicit regimes for stablecoin issuers. Banking regulation covers deposit tokens (the bank is the Token Operator). Securities regulation addresses tokenised bonds (the issuer or its agent is the Token Operator). Because the Token Operator function maps to the issuer CSD role, existing frameworks for CSDs, payment tokens, and securities already provide the necessary accountability structures. The architecture requires no new regulatory category.

Conclusion

The digital asset industry has spent years debating native versus wrapped, decentralised versus centralised, on-chain versus off-chain. These are the wrong axes. The real problem is that today's financial infrastructure bundles the vault and the record, identity and compliance, into opaque, vertically integrated stacks. The solution is not to collapse these functions onto a single blockchain, nor to wrap them behind fragile bridges, but to separate them.

The two-layer architecture does exactly this. Value remains anchored in the regulated Asset Layer, benefiting from established legal protections. Ownership circulates freely on the Ownership Layer, benefiting from blockchain's global reach, programmability, and 24/7 availability. The Token Operator, functioning as an issuer-CSD, synchronises the two.

This is not a theoretical framework. It is a description of how $250 billion in stablecoins already operate. The insight is simply to recognise it, name it, and extend it to other asset classes: deposits, bonds, fund units, real estate.

The asset remains off-chain. The record of who has a claim to ownership circulates on-chain. That separation is the architecture. The interface between them is operational and regulatory, not merely technical. An upcoming companion paper, *From "Trust the Issuer" to "Verify the Ledger": Designing the Token Operator*, examines how this interface can be constructed so that the operator's records are deterministic functions of on-chain events, addressing the hierarchy of records, liability for discrepancies, and the operational mechanics of identity verification, corporate actions, and multi-chain coordination.

About the author

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Rhomaios Ram is an Honorary Research Fellow at the Gillmore Centre. He is the Founder of Fnality International and served as CEO until the end of 2024. Prior to Fnality, Rhom worked across a wide variety of wholesale banking businesses including sales, trading, product management and technology over more than 22 years.