WHITEPAPER

Orchestrating the Future of Money:

Interoperability Between Tokenised Money Market Funds and Tokenised Deposits

Authored by

Ant International | Bettr

DBS

FRANKLIN TEMPLETON



1. Introduction

Building on the framework established by the Monetary Authority of Singapore (MAS) in A Field Guide to Extending Settlement Capabilities under the BLOOM initiative[1], this paper explores practical use cases of interoperability between tokenised money market funds and tokenised deposits via an orchestrating protocol built to validate and coordinate state transitions across heterogeneous ledger environments.

A structural mismatch lies at the heart of today's financial markets. Trading activity occurs in milliseconds, prices update continuously, and risk is managed in near real time. However, the transfer of cash and securities continues to rely on infrastructure designed for a fundamentally different operating environment. Settlement cycles, limited operating hours, and fragmented post-trade processes mean that, even when a transaction is executed instantly, the underlying exchange of assets may not be completed for days.

This disconnect extends beyond operational inefficiency. Delayed settlement increases liquidity demands, requiring institutions to maintain larger liquidity buffers to manage settlement risk and funding needs. It also introduces friction throughout the financial system, constraining the speed and efficiency with which capital can be deployed.

As the future of money becomes increasingly real-time and 24/7, financial infrastructure will need to evolve to support the continuous movement of value. This will require seamless transitions between cash and cash equivalents, allowing liquidity to be mobilised efficiently across environments without being constrained by traditional batched settlement cycles.

Tokenisation has emerged as a promising approach to addressing these structural limitations. At its core, tokenisation involves representing financial assets such as fund units, bonds, deposits, and cash as digital tokens recorded on a distributed ledger. By enabling ownership to be transferred directly on a shared ledger, tokenised assets have the potential to reduce reliance on multiple intermediaries and reconcile records in real time. Moreover, the rules governing transfer, compliance, and settlement can be embedded within the token itself, enabling more automated and continuous processing rather than being constrained by back-office operating hours.

[1]BLOOM (Borderless, Liquid, Open, Online, Multi-currency) is a public-private sector collaborative initiative led by the Monetary Authority of Singapore (MAS) to advance next-generation settlement infrastructure for domestic and cross-border payments and financial transactions.

1.1. Tokenised deposits

Digital money has evolved from a niche innovation within cryptocurrency markets into a credible financial instrument increasingly adopted by institutional participants. McKinsey[1] estimates payment flows through tokenised deposit infrastructures at major global systematically important banks to be more than $4 trillion annually.

Notably, tokenised deposits extend regulated commercial bank deposits into blockchain-native environments. While representing claims on funds held within regulated financial institutions, they are issued as on-chain tokens capable of near-instant settlement and integration with programmable smart contracts.

Tokenised deposits provide treasury functions with a practical alternative to conventional payments rails, enabling greater efficiency in liquidity management, settlement and cash operations. Currently, Ant International partners with several Global Systemically Important Banks on tokenised deposits issuance with the goal to perform 24 x 7 cross-border transactions for internal liquidity management.

1.2. Tokenised money market funds (TMMFs)

Money market funds have undergone a similar transformation through tokenisation without altering their underlying investment strategy, with BIS reporting rapid growth from $770 million at end-2023 to almost $9 billion by October 2025.[2]

The core investment objective remains unchanged, with portfolios continuing to consist primarily of short-term, high-quality instruments such as Treasury bills, repurchase agreements, and commercial paper. By issuing fund interest as blockchain-based tokens, tokenised money market funds (TMMFs) enable faster settlement, continuous 24/7 transferability, improved operational efficiency and potential interoperability with emerging digital financial infrastructure.

This creates a more accessible and programmable form of institutional cash management while preserving the familiar risk-return characteristics of traditional money market funds.

[1]https://www.mckinsey.com/industries/financial-services/our-insights/beyond-stablecoins-the-emerging-architecture-of-on-chain-money

[2]https://www.bis.org/publ/bisbull1115.htm

2. Problem Statement: An Architectural Interoperability Gap

The primary function of a corporate treasury is to hold and deploy cash as operational liquidity for day-to-day payments, while using money market funds to invest surplus cash and earn short-term returns. As funding and investment activities become increasingly real-time, the requirement for treasury functions to transition between cash and investments dynamically is becoming more immediate.

Tokenised deposits solve for moving cash while TMMFs solve for holding yield-bearing cash equivalents. Although they represent important advances in the digitalisation of financial assets, they have largely evolved within separate blockchain ecosystems. Tokenised deposits are typically issued on permissioned distributed ledger platforms operated by individual banks or banking consortia, while TMMFs may be issued on different blockchain networks chosen by fund managers or transfer agents. These platforms are often designed independently and do not natively interoperate.

From a market infrastructure perspective, it is neither practical nor commercially efficient for fund managers to issue the same TMMF across every proprietary blockchain operated by individual financial institutions. Conversely, banks are unlikely to converge on a single common ledger for issuing tokenised deposits. As adoption grows, the digital financial ecosystem is therefore expected to remain characterised by multiple tokenised cash and asset networks rather than a single unified platform.

As a result, transferring value between tokenised deposits and TMMFs frequently requires participants to step outside the respective blockchain environments. Investors typically redeem TMMF units into fiat before subscribing to tokenised deposits issued on a separate network, or vice versa. These off-chain redemption and reissuance processes of both cash and asset introduce friction in settlement, operational complexity and reliance on traditional financial intermediaries, reducing many of the efficiencies that tokenisation seeks to achieve.

From the practical standpoint of corporate treasuries, this fragmentation limits the seamless movement of liquidity between payment and investment activities. Liquidity held in a TMMF cannot readily be deployed for on-chain payments, while tokenised deposits intended for operational cash management cannot be seamlessly exchanged for yield-bearing assets. Addressing this interoperability gap will require mechanisms that enable secure, atomic settlement of tokenised deposits against TMMFs across heterogeneous blockchain networks, unlocking the full potential of TDs and TMMFs by eliminating delayed settlement, shrinking the liquidity buffers corporate treasuries must hold, and reducing settlement risk across the financial system.

3. Design Principles

The proposed interoperability framework leveraged the BLOOM Field Guide to support the design of its implementation across the end-to-end transaction between tokenised deposits and TMMFs. It is designed around the following three core principles:

1. Interoperability across heterogeneous ledgers

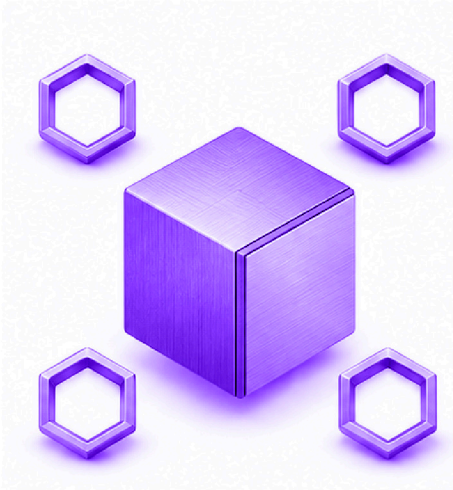
Enabling tokenised deposits and TMMFs to interact across independent blockchain networks without requiring a common ledger or replication of assets across multiple platforms. This approach preserves the finality of each participating network.

2. Trustless Delivery versus Payment (DvP)

Settlement is coordinated such that neither the cash leg nor the asset leg is completed independently. The exchange is executed only after predefined settlement conditions have been verified across both networks, enabling organisation-agnostic settlement between participating parties and reducing principal settlement risk without reliance on a central settlement intermediary.

3. Synchronisation of settlement events

Settlement events are synchronised between participating networks, providing a shared and verifiable view of transaction progress that supports automated reconciliation, exception handling, and near real-time treasury reporting. This ensures that the status of cash and asset movements on the respective blockchains remain consistently aligned, atomically settling against each other, reducing discrepancies and improving operational efficiency.



4. Coordinated Interoperability Solution

4.1. Overview

The interoperability solution explored in this paper is founded on the interaction of two independent state-generating infrastructures and an orchestration protocol capable of validating and coordinating state transitions across heterogeneous ledger environments.

The bank's programmable payments mechanism and the asset manager's TMMF smart contract enables the creation and maintaining of authoritative sub-transaction states within their respective infrastructures. Programmable payments establish conditional cash states while the TMMF's minting and burning mechanisms establish conditional asset states. The Orchestration Protocol acts as the coordination mechanism between the heterogeneous environments by validating and relaying state transitions, ensuring that the cash and asset states progress in a synchronised and mutually consistent manner.

4.1.1. Orchestration Protocol

Ant International's Whale Orchestration Protocol introduces an interoperability model based on validated state synchronisation. The Orchestration Protocol does not function as a settlement layer, asset bridge, or intermediary ledger. It acts as both a validation and transaction relay mechanism that facilitates the progression of state transitions.

Its core features include:

- **State validation and relay:** The protocol verifies the integrity and validity of each transaction state before relaying it between heterogeneous ledgers

- **Controlled state progression:** Transactions advance only when predefined conditions are satisfied, creating a deterministic and sequenced settlement workflow up to the point of execution of the exchange

- **Validation loops and reconciliation:** Invalid or incomplete states are prevented from progressing and are returned for remediation until a valid state transition is achieved, failing which the protocol will coordinate a rollback to the last mutually validated state

4.1.2 Tokenised Deposits & Programmability

DBS Token Services brings commercial bank deposits onto the blockchain in the form of tokenised deposits, enabling programmability & real-time settlement on a 24/7 basis. Compared with traditional fiat-based fund subscription/redemption, which may be subject to banking hours, cut-off times, with settlement cycles of T+1 or longer, tokenised deposits can facilitate 24/7 settlement and thus more timely movement between cash and TMMF positions, supporting more efficient treasury liquidity management.

In addition, the use of programmability allows institutions to embed settlement rules on the underlying tokenised deposits in addition to the settlement instructions. This ensures settlement of the cash leg is contingent upon successful completion of specified on-chain events (e.g. mint/burn of TMMF). This approach is central to realizing an atomic DvP, which minimizes settlement risk through clear and verifiable state transitions across blockchain networks.

The implementation operates through a secure, programmable mechanism that manages funds in the form of tokenised deposits across two distinct states:

- **Lien State:** Upon initiation of a subscription or redemption, the required tokenised deposits are placed into a reserved state under a formal lien within the Bank's blockchain environment as part of the scheme creation. This ensures funds are committed exclusively to the TMMF transaction. While ownership remains with the originating party, the smart contract programmatically restricts the funds from alternative use, providing the counterparty with certainty of fund availability.

- **Release State:** The release of these funds is automated and deterministic. The bank's mechanism monitors the Orchestration Protocol for verified state updates and mint/burn activities. Upon receipt of a cryptographically validated confirmation such as the mint of TMMF tokens during subscription or burn of TMMF tokens during redemption, the lien is automatically lifted, and the tokenised deposits are released or transferred to the designated beneficiary's wallet.



4.1.3. Tokenised Money Market Funds

The TMMF represents the investment leg of the interoperability framework, enabling investors to transition between tokenised bank deposits and a yield-bearing cash management instrument while preserving the underlying characteristics and governance framework of the money market fund.

- **On-chain representation of fund interests:** The TMMF token provides a blockchain-based representation of an investor's interest in the underlying money market fund. Tokenisation changes the mechanism through which fund interests can be recorded and transacted, rather than the underlying investment strategy or portfolio management of the fund. Conditional minting and burning could potentially be programmed within the smart contract.

- **Controlled minting and burning:** The TMMF smart contract provides the state-generating infrastructure for the asset leg of the transaction. Minting and burning of TMMF tokens can be linked to validated subscription and redemption instructions and remain subject to the fund's applicable eligibility, compliance, transfer agency and operational controls.

- **Conditional settlement:** Within the proposed interoperability framework, the minting or burning of TMMF tokens can form part of a conditional settlement process. The relevant asset-side state can be communicated to the Orchestration Protocol so that the corresponding movement of tokenised deposits occurs only when the required conditions on both sides of the transaction have been satisfied. This supports the DvP principle described elsewhere in the paper, under which neither leg should complete independently.

- **Preservation of asset-manager control:** The interoperability layer does not require the TMMF to be transferred onto, or replicated within, the bank's proprietary ledger. The TMMF continues to operate within its existing blockchain and fund infrastructure, while validated transaction states are communicated between the respective networks.

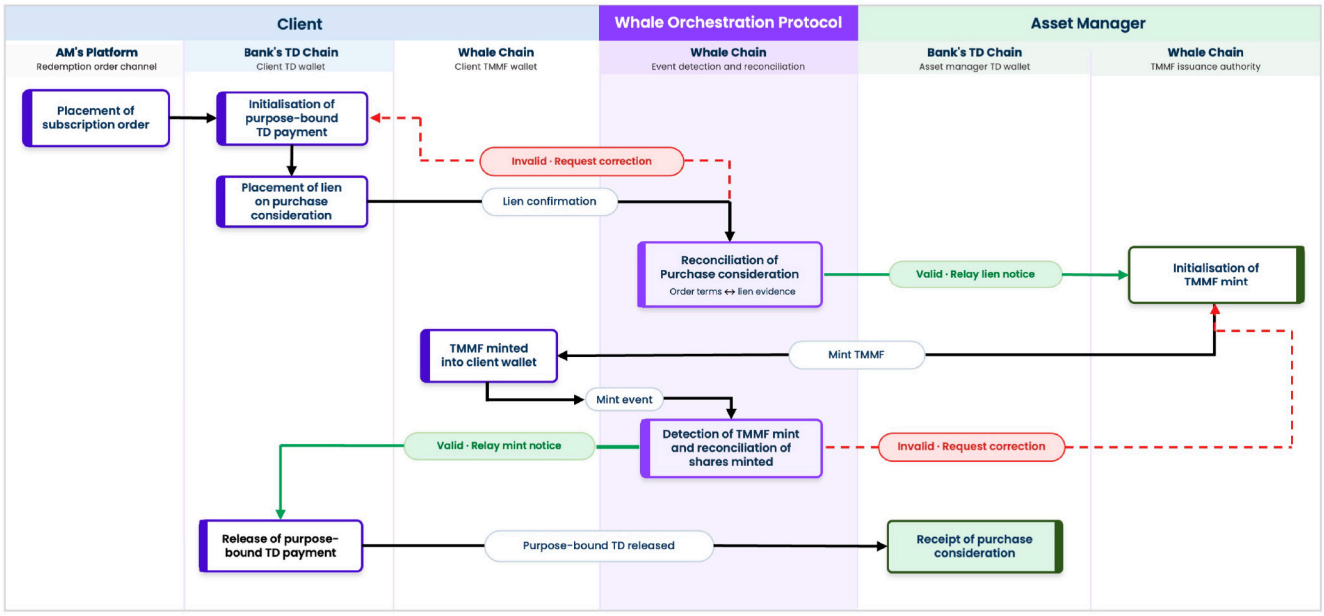
- **Improved settlement efficiency:** Synchronising the TMMF subscription/redemption process with the tokenised deposit payment leg has the potential to reduce settlement delays, manual reconciliation and the need for separate off-chain cash movements between investment and payment environments.

- **Enhanced liquidity mobility**: Interoperability can enable institutional investors and corporate treasuries to move more efficiently between operational cash represented by tokenised deposits and yield-bearing liquidity represented by TMMFs. This directly addresses the friction identified in the paper, where investors may otherwise need to redeem into fiat before moving between the two ecosystems.

4.2. Subscription Workflow

Whale Orchestration Protocol — Subscription Process

Purpose-bound tokenised-deposit reservation • TMMF mint • reconciliation • controlled payment release



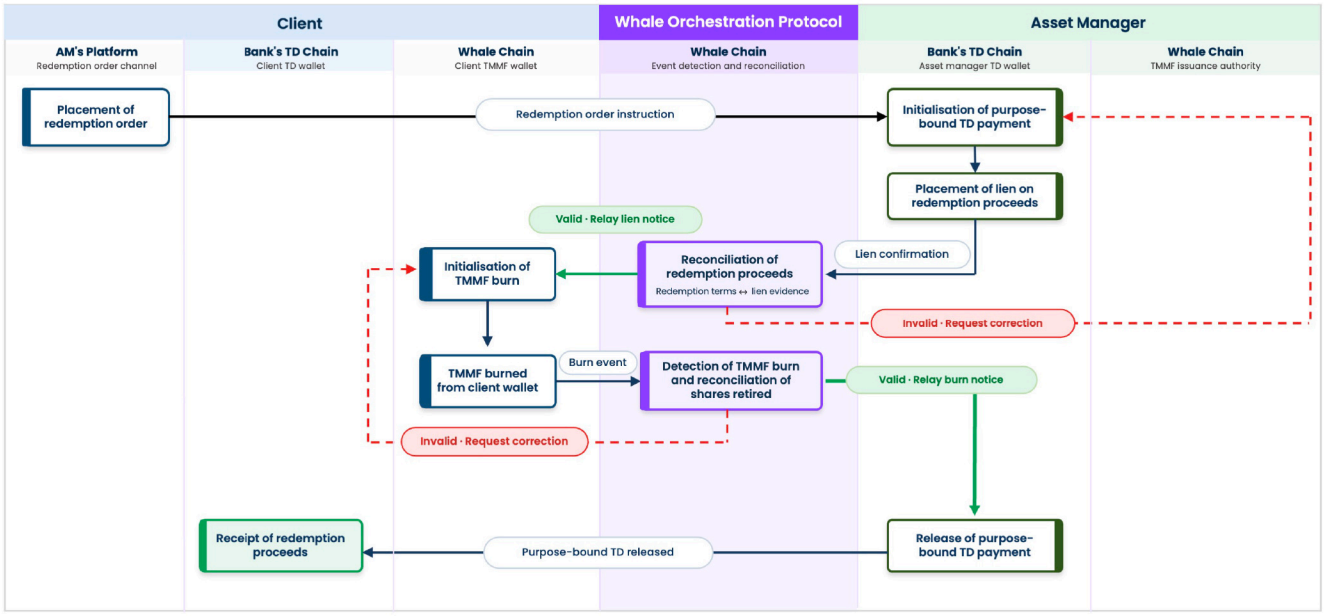
Valid reconciliation — — — Correction loop

Whale Orchestration Protocol coordinates the cash and token legs; lane ownership and source topology are preserved.

4.3. Redemption Workflow

Whale Orchestration Protocol — Redemption Process

Purpose-bound redemption proceeds • TMMF burn • reconciliation • controlled payment release



Valid reconciliation — — — Correction loop

Whale Orchestration Protocol coordinates the cash and token legs; lane ownership and source topology are preserved.

5. Conclusion

Ant International's Whale Orchestration Protocol seeks to apply the framework set out under MAS' BLOOM initiative to provide a trustless and organisation-agnostic framework for enabling interoperability across heterogeneous blockchains. By focusing on validated state transitions, secure coordination and purpose-bound settlement, it reduces fragmentation while preserving the independence of individual networks.

Going forward, collaboration across banks, asset managers, blockchain networks and infrastructure providers will be key to establishing common standards that support security and scalability. The Orchestration Protocol aims to contribute to this effort by providing a unified approach to interoperability and enabling cash to transition seamlessly into yield-bearing assets, revolutionising corporate cash management across payments and investments.

In Partnership with

BLOOM

Authored by

Ant International | Bettr DBS FRANKLIN TEMPLETON

