GUARDIAN

Guardian Tokenised Collateral Framework

Market Landscape and Implementation Considerations

November 2026



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Observations and views in this report reflect industry inputs and do not represent a unanimous view of Workgroup participants or the wider collateral market. Examples and proposed next steps are for discussion; responsible persons should conduct their own due diligence, assess the applicable legal, regulatory, risk and operational requirements, and obtain advice appropriate to their arrangements.

Document Version

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1 Executive Summary

Tokenisation is moving into institutional collateral markets. Government securities and investment funds are increasingly represented and mobilised on tokenised infrastructure, alongside developments in custody, market infrastructure and industry documentation. The opportunity is to improve how collateral is mobilised, transferred and managed across secured funding, derivatives and central clearing.

Effective collateral use requires the full transaction lifecycle to work. Assets need to be eligible, reliably valued, transferred and held under effective arrangements, serviced through the transaction, and capable of return or realisation. Tokenisation introduces new ways to represent, record, control and transfer these assets and rights within the legal, operational and market arrangements supporting institutional collateral activity.

The Guardian Tokenised Collateral Framework provides a common approach for assessing these arrangements. Grounded in established conventional collateral practice, it covers bilateral and tri-party repo, variation and initial margin for uncleared derivatives, and collateral posted to central counterparties. The framework follows eight steps across the collateral lifecycle: Agreement, Eligibility and Setup; Delivery and Settlement Finality; Legal Effectiveness and Priority; Holding; Life of the Trade; Return; Default and Enforcement; and Cross-Border Considerations.

The framework is applied to hypothetical examples involving US Treasuries, Singapore Dollar-denominated fixed income securities and tokenised money market funds.

The report builds from these applications to the wider considerations for institutional implementation, including regulatory treatment, settlement arrangements, market liquidity, operating capabilities, interoperability and cross-border infrastructure. Together, the framework and applications provide a structured basis for identifying where demonstrated market practice can be used, where participant arrangements can support implementation, and where further validation can strengthen institutional use.

This report is intended to support the next phase of implementation: selecting use cases with clear market demand, willing participants and identifiable value, and validating them across the full collateral lifecycle.

2 Introduction

2.1 Background

Tokenisation is increasingly being applied to financial assets used in institutional markets. Government securities, investment funds and other financial assets are being issued, represented or mobilised on tokenised infrastructure. Collateral arrangements and market documentation are developing in parallel, including arrangements for tokenised collateral mobilisation and documentation supporting transactions involving digital assets.

These developments are expanding the use of tokenised assets within established financial market activities. Collateral is an important area of application, supporting secured funding, derivatives, central clearing and liquidity management. Tokenisation can improve the mobilisation and processing of collateral, particularly where assets are held or transferred across institutions, infrastructures and jurisdictions.

Realising these benefits requires tokenised assets to perform the functions required of collateral throughout the transaction lifecycle. The asset must be eligible for the relevant collateral arrangement, capable of reliable valuation and liquidity management, and supported by effective arrangements for transfer, holding, settlement, return and enforcement.

Implementation is progressing across the market. Tokenised assets have been used in live collateral transactions, including repo, and market infrastructures and bank networks are developing services for tokenised collateral mobilisation. Recent developments include an overnight tri-party repo using a tokenised US Treasury (UST) on a major tri-party platform.[1] Market infrastructures, including a central counterparty (CCP), and bank networks offer tokenised collateral and repo services.[2, 3, 4]

Regulatory and policy developments are progressing in parallel. In the United States, the Commodity Futures Trading Commission has announced a pilot programme[5] and issued staff guidance relating to tokenised collateral[6]. In the European Union, the European Commission has proposed a broader package of settlement and market infrastructure reforms, including consequential amendments affecting the Financial Collateral Directive.[7] Separately, the European Securities and Markets Authority (ESMA) has identified collateral mobilisation as an important application of tokenisation and sought evidence on whether, and under what conditions, tokenised forms of collateral could be used safely and effectively by EU CCPs.[8] In the United Kingdom, the Bank of England has issued a consultation on supervisory expectations for CCPs seeking to accept tokenised collateral.[9] These references describe developments and consultations rather than operative conclusions about the treatment of any transaction.

Industry documentation is also evolving. ICMA's Global Master Repurchase Agreement (GMRA) Digital Assets Annex addresses specified digital asset repo transactions, and its Digital Bonds Annex addresses repo transactions involving digital bonds.[10,11] The International Swaps and Derivatives Association (ISDA)'s model provisions address tokenised collateral under specified variation margin documentation.[12] Published work by UNIDROIT, the American Law Institute and Uniform Law Commission, and the Law Commission of England and Wales provides reference material on legal questions arising in digital asset arrangements. [13, 14, 15] These materials may inform participant analysis but do not determine the treatment of a proposed tokenised collateral arrangement in another jurisdiction or imply that the rules of a particular foreign jurisdiction apply to it.

Demand for high-quality collateral continues across repo and derivatives markets alongside funding and balance-sheet constraints. Industry participants have identified faster mobilisation, substitution and intraday movement as potential benefits of tokenisation. Together, these developments provide a growing foundation for institutional use and increase the value of a consistent approach to assessing tokenised collateral across different market arrangements.

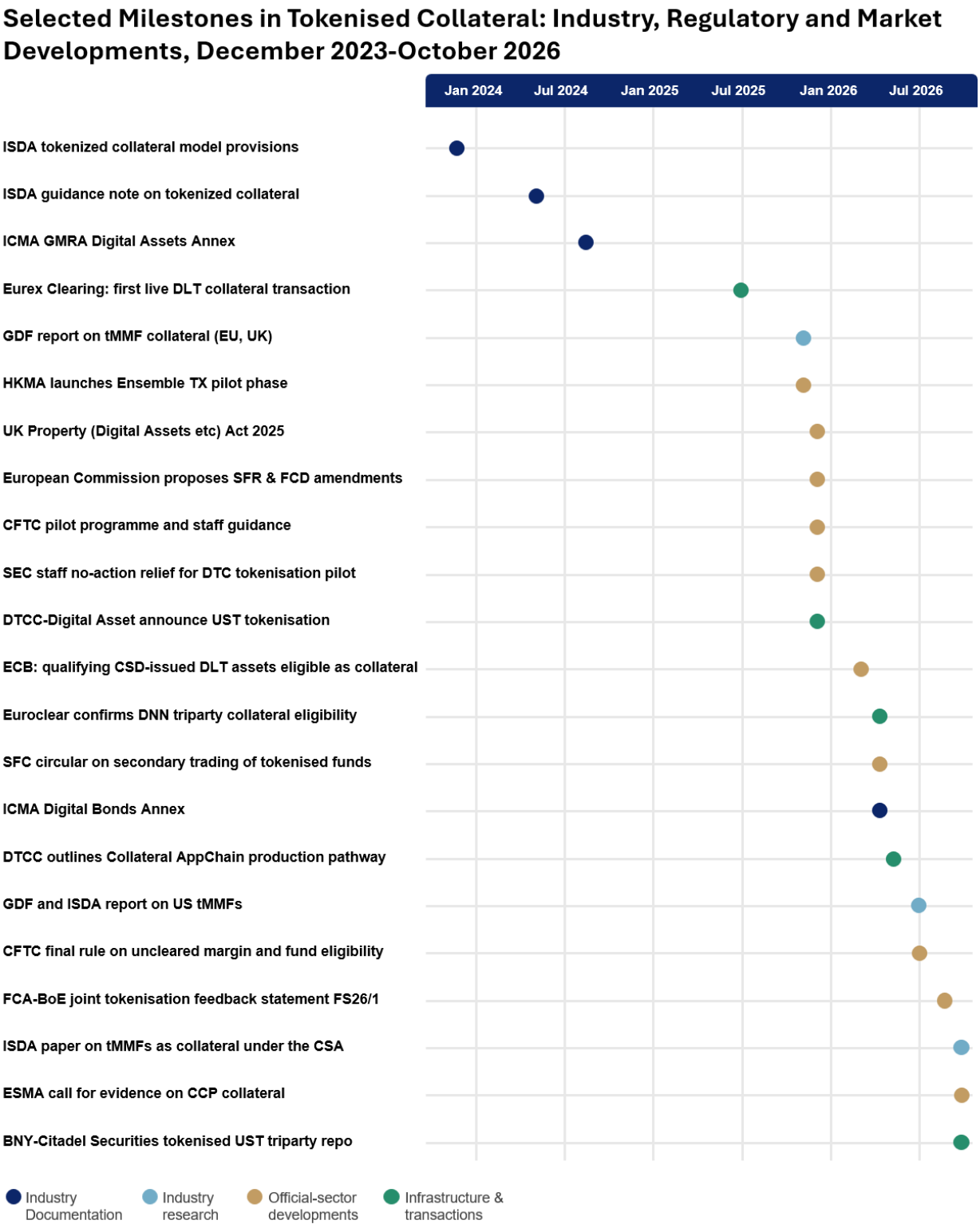


Figure 1: Selected documentation, policy, and infrastructure developments, December 2023 to October 2026.

2.2 Motivation

Conventional collateral arrangements are supported by established documentation, custody arrangements, market infrastructure, and legal frameworks. Account, depository or direct-registration records may establish or evidence the rights of investors and collateral takers, depending on the relevant holding structure and applicable arrangements.

Tokenisation introduces new ways to represent, record and transfer financial assets and associated rights. It can support new control mechanisms, transfer events and interactions between tokenisation platforms and existing holding and settlement systems, which can improve how collateral is mobilised. At the same time, these changes may create additional legal, risk and operational issues across the transaction lifecycle.

The underlying requirements for collateral continue to apply. Assets used as collateral need to be eligible and available for delivery, capable of being held and controlled, reliably valued throughout the transaction, and accessible for return or realisation when required. Tokenised arrangements therefore need to connect asset representation and transfer with the relevant rights, custody, control, settlement and lifecycle processes, requiring these arrangements to be assessed across the full collateral lifecycle.

Three questions are particularly relevant:

a) whether the underlying asset is suitable for use as collateral;
b) whether its tokenised form can be held, transferred and enforced with sufficient certainty; and
c) whether institutions have the commercial rationale and operational capability to use it.

Answering them requires an end-to-end view of the collateral arrangement. The assessment follows collateral from agreement and setup through delivery, holding and servicing to return or enforcement. Cross-border arrangements also involve connections across governing laws, custodians, depositories, token networks and settlement infrastructure.

This lifecycle perspective provides a consistent basis for assessing how tokenisation can operate within established collateral arrangements and where further market development can support broader institutional use.

2.3 Scope and Approach

The Guardian Tokenised Collateral Workgroup brings together financial institutions, market infrastructures, industry associations, asset managers and technology providers. Its work contributes to Guardian's development of practical industry frameworks and reference materials supporting the implementation and adoption of tokenisation in financial markets.

The Workgroup takes an end-to-end approach to tokenised collateral, starting with demonstrated market practice and the functions and protections required across the collateral lifecycle. The analysis covers bilateral and tri-party repo, variation and initial margin for uncleared derivatives, and collateral posted to CCPs. These workflows provide the baseline for assessing how tokenisation interacts with different collateral arrangements.

These considerations are brought together in the Guardian Tokenised Collateral Framework, which organises the assessment across eight steps:

1) Agreement, Eligibility and Setup
2) Delivery and Settlement Finality
3) Legal Effectiveness and Priority
4) Holding
5) Life of the Trade
6) Return
7) Default and Enforcement
8) Cross-Border Considerations

Across these steps, the framework considers how tokenisation affects records, rights, custody arrangements, operations and settlement dependencies, and the evidence available to support implementation. The assessment distinguishes established conventional collateral practice from emerging experience with tokenised collateral, participant-specific arrangements, broader market or jurisdictional dependencies, and areas requiring further testing.

The three asset applications that follow—US Treasuries (USTs), Singapore Dollar-denominated fixed income securities, and money market funds (MMFs, or for tokenised money market funds, tMMFs)—are illustrative assessments of hypothetical or emerging collateral structures. They are not proposals to issue or tokenise any particular security. The examples show how asset characteristics, records, custody, eligibility, liquidity, and market access affect the eight lifecycle steps.

The analysis covers institutional collateral use in bilateral and tri-party repo, uncleared derivatives margin and CCP margin. Securities lending and other securities-financing transactions other than the repo workflows described are not covered, and CCP default- or guarantee-fund contributions are outside the detailed assessment. The report does not assess individual CCP rulebooks or prescribe technology designs, determine the status of individual transactions, or provide a prudential-capital assessment.

The report is intended for institutions that provide, take or hold collateral and the legal, risk, operations and policy teams supporting these activities, as a reference for assessing potential tokenised collateral arrangements across the transaction lifecycle. Potential implementation approaches are illustrative. They do not imply adoption, endorsement, or approval of any arrangement by MAS or another named authority.

3 Guardian Tokenised Collateral Framework

Collateral is used across repo, derivatives and central clearing through different legal and operating arrangements. These arrangements shape how collateral is delivered, held and controlled, valued and maintained, returned and realised.

The Guardian Tokenised Collateral Framework is grounded in conventional collateral practice and published examples of tokenised implementations. It identifies the functions and protections required across the collateral lifecycle and provides a common structure for understanding how tokenisation interacts with them.

3.1 Collateral Workflows

Collateral moves through three main channels: bilateral, tri-party and cleared.[16] In bilateral arrangements, the parties agree the transaction and transfer securities against cash in repo or provide collateral to cover derivatives exposures, with valuation, margin maintenance, income payments and return governed by the relevant repo or credit-support documentation. Tri-party arrangements introduce a tri-party agent that supports collateral selection, allocation, valuation and settlement. In cleared arrangements, a CCP becomes the counterparty to each side and manages collateral under its eligibility, custody and risk framework.

Within these channels, the framework is grounded in five established collateral workflows: bilateral repo, tri-party repo, variation margin (VM) for uncleared derivatives, initial margin (IM) for uncleared derivatives, and margin posted to a CCP. Together, these workflows cover different transaction purposes, channels and legal techniques for providing collateral, while sharing lifecycle requirements around delivery, holding and control, valuation, return and enforcement.

Title transfer and security interest techniques may be used across different collateral workflows, including repo and derivatives, subject to the relevant documentation. For uncleared derivatives, VM may use title transfer or security interest depending on the documentation, while IM is typically provided under security interest arrangements with segregation and custody requirements.

Across these workflows, collateral performs a common set of functions. Parties establish eligibility and documentation, deliver collateral, maintain rights and control during the transaction, manage valuation and lifecycle events, return collateral when obligations are discharged, and realise collateral where enforcement is required. The institutions, documentation and legal mechanisms supporting these functions vary by workflow.

The workflows below describe these arrangements in conventional form. Specific requirements depend on the governing law, documentation, counterparties, settlement infrastructure and, where relevant, the rules of the clearing house.

Bilateral Repo under the GMRA

In a bilateral repo, the parties agree on the securities, cash amount, repo rate and term, and where applicable, relevant haircuts and margining arrangements. On the start date, the seller delivers the securities to the buyer against payment of cash, generally on a delivery-versus-payment (DvP) basis.

During the transaction, the securities are revalued. Changes in exposure can result in additional margin being transferred in cash or securities. Coupons paid on the securities are passed back to the seller as manufactured payments, and the seller may substitute other eligible securities where permitted under the agreement and subject to the required consent of the other party.

At maturity, the buyer returns equivalent securities against payment of the repurchase price. Following default, the parties' obligations are valued and incorporated into the contractual close-out process.

The GMRA is widely used as documentation for repo transactions in Singapore.

Tri-Party Repo

In a tri-party repo, the parties agree the repo terms, eligible assets and risk parameters and appoint a tri-party agent. The parties' master documentation governs the repo, while the tri-party arrangements establish the agent's operational role.

The agent applies the agreed eligibility schedule, selects collateral from the provider's available assets and supports allocation and settlement. During the transaction, the agent revalues the collateral and manages substitutions. At maturity, the collateral is returned. Following default, the agent acts in accordance with the applicable service arrangements and instructions.

Variation Margin for Uncleared Derivatives

Variation margin addresses current exposure arising from changes in the mark-to-market value of derivatives. The parties calculate their net exposure, typically each business day, and the party required to post variation margin transfers eligible collateral under the applicable credit support arrangement.

Under an English law title transfer Credit Support Annex (CSA), ownership of the collateral passes to the collateral taker. As exposure changes, equivalent collateral may be returned or further collateral transferred. Interest on cash collateral is paid in accordance with the agreement. Following default, the collateral balance forms part of the contractual close-out calculation.

According to ISDA's industry documentation, English-law title transfer credit support agreements have been used for variation margin in Singapore and other Asia-Pacific markets, while the New York law 2016 VM CSA is structured as a security interest arrangement that generally permits rehypothecation. These examples are not exhaustive, and reuse depends on the applicable agreement and rules. Participants should also assess whether existing ISDA netting and collateral enforceability opinions extend to the proposed tokenised form and credit-support arrangement.[17]

Initial Margin for Uncleared Derivatives

Initial margin addresses potential future exposure over the period required to close out or replace positions following default. Each party determines the initial margin it is required to provide, typically using the applicable regulatory methodology and, where relevant, an industry model.

Eligible securities are generally posted to a segregated account at a third-party custodian under the applicable security agreement and account control arrangements. The collateral provider retains ownership, while the collateral taker receives a security interest supported by the agreed control arrangements. Collateral is revalued and adjusted as requirements change and is generally subject to restrictions on reuse.[18]

Following a provider default, the arrangements enable the collateral taker to access or realise the collateral in accordance with the governing documentation and applicable law.

Margin Posted to a Central Counterparty

Clearing members provide initial and variation margin in accordance with the applicable CCP rulebook. Depending on the CCP model and eligible collateral, securities collateral may be posted to accounts maintained by the CCP or its designated custodian, including through arrangements that distinguish house and client collateral. The CCP sets eligibility criteria, valuation and haircuts, concentration limits and other risk controls under its rulebook and associated procedures. Margin requirements may be recalculated intraday. Clearing members may need to fund client-related intraday calls pending onward payment, creating timing and liquidity dependencies that an operational tokenised collateral design should test. Actual treatment of house and client margin depends on the CCP's rules and account structure.

Following a clearing member default, the CCP applies its applicable default management procedures, including the use or realisation of available collateral and, where relevant, consideration of arrangements for transfer or porting of client positions to another clearing member.

As described by a participating market infrastructure reviewer, SGX accepts USTs as non-cash collateral subject to applicable requirements. A clearing member posting conventional USTs may instruct its US custodian to deliver securities into the relevant SGX custody arrangement. The reviewer described a process that can take around two days in some circumstances, affected by cut-offs and the different operating windows of US and Singapore infrastructure. This timing is illustrative, not a universal T+2 settlement rule.

3.2 How Collateral Arrangements Differ

The five workflows share common lifecycle functions while differing in transaction purpose, holding structure, margin type and method of providing collateral (title transfer or security interest). These characteristics shape the rights of the collateral provider and taker and the arrangements supporting delivery, holding, servicing, return and enforcement.

Holding and Records

Securities may be held directly or through one or more intermediaries. Where securities are held through intermediaries, a central securities depository (CSD) or custodian records the positions of its direct participants or clients, with subsequent intermediaries maintaining records of their clients' entitlements. The relevant record of ownership or entitlement therefore depends on the particular holding structure. In omnibus structures, the intermediary's records are important for identifying the entitlements of individual clients.

For tokenised collateral, the relevant holding chain and the records used to establish or evidence ownership or entitlement need to be identified for each arrangement. A tokenised structure may introduce an additional ledger record alongside a depository, custodian or register record. The relationship between these records affects how ownership or entitlement is evidenced, how collateral is transferred and controlled, and how rights are exercised.

Collateral Purpose and Classification

Collateral arrangements vary according to the transaction they support, the channel through which collateral is provided, the exposure being covered, whether collateral is provided by outright title transfer or by way of security, and the asset being posted.

Repo involves the purchase and repurchase of securities. Derivatives collateral supports exposures arising under derivatives transactions. Within derivatives, initial margin addresses potential future exposure over the period required to close out or replace positions following default, while variation margin addresses current exposure arising from mark-to-market movements. Regulatory initial margin in uncleared markets typically involves segregation and restrictions on reuse.

These characteristics determine the rights, protections and operating arrangements that apply across the collateral lifecycle. They also provide the context for assessing tokenised collateral within the transaction and collateral arrangement in which the asset is used.

Dimension	Categories	Why it matters for this report
Transaction	Repo and cleared/uncleared derivatives (securities lending not assessed in detail)	Repo exchanges securities against cash; derivative collateral supports margin or exposure, under the applicable arrangement
Channel	Bilateral; tri-party; central clearing through a CCP	Determines who holds and controls the collateral, and whose insolvency matters
Margin type (derivatives)	IM; VM; guarantee fund (cleared only; outside scope)	Uncleared IM must be protected if the collecting party fails,[18] so it is usually provided by security interest

Dimension	Categories	Why it matters for this report
How collateral is provided	Title transfer; security interest	Indicates whether title passes outright or a security interest is granted, and what evidence of transfer, third-party effect, and priority may be needed
Asset and tokenisation model	USTs, SGD-denominated fixed income securities, tMMFs; digital twin, custodian-sponsored, digital native	Relevant to identifying the applicable law(s) and the records of ownership or entitlement

Table 1: Ways of classifying collateral

Legal Techniques for Providing Collateral

Two legal techniques are central to the workflows considered in this report.

Title transfer

Under a title transfer arrangement, the relevant asset or entitlement is intended to pass outright to the taker, which is obliged to return equivalent assets in accordance with the contract. Repo under the GMRA and variation margin under an English-law title transfer CSA are examples. In a default, close-out valuation and netting may be contemplated by the transaction documentation; participants must establish the effectiveness of the transfer, contractual close-out and applicable insolvency treatment for their particular transaction. A separate security interest is not ordinarily created by a genuine outright transfer, but whether that characterisation is effective is a matter for the relevant legal analysis.

The right to use or reuse collateral received by title transfer or under a security interest arrangement depends on the applicable terms and rules. Market participants reported use of English-law title transfer CSAs for variation margin in Singapore and other common-law markets in the region; arrangements used in Japan and elsewhere may differ. The 2016 New York-law VM CSA is an example of a security interest form that generally allows rehypothecation. No one rule about reuse should be assumed for all VM arrangements.

Security interest

In a security interest arrangement, the provider is intended to retain the underlying ownership or entitlement while granting a security right, potentially including a pledge or charge, over the specified collateral. Participants must identify which steps are needed to create the security, give it effect against third parties, determine priority and enable enforcement under the applicable documentation and law.

Operational control alone is not equivalent to creation, perfection or priority of a security interest. The necessary steps may include custody, account control, notices or registration, depending on the asset, structure, the party granting security and applicable law; contractual arrangements do not automatically determine third-party effects.

Published comparative studies discuss financial collateral arrangements and insolvency protections in some jurisdictions, including the EU and United Kingdom.[19, 20] Their operation and scope vary, including where insolvency or resolution measures apply. They are useful as prompts for counsel to examine potential stays, collateral formalities and the availability of enforcement protections, rather than as a statement that equivalent rules apply in Singapore.

3.3 Tokenisation Model

Tokenisation can change the records, control mechanisms and timing through which collateral is represented and transferred. The underlying collateral requirements continue to apply. The asset needs to be permitted under the relevant documentation and rules, reliably valued, held under effective arrangements and capable of realisation.

Understanding the tokenisation structure requires identification of the token sponsor, the asset or rights represented by the token and the records that establish or evidence ownership or entitlement. The labels below describe common structures. They are analytical labels rather than legal or regulatory classifications.

Model	Record of ownership	What the token holder has
Digital twin	A token or ledger entry linked to an underlying issuer, transfer agent, depository or intermediary record; which record is relied on to establish ownership or entitlement depends on the documents, holding structure and applicable law.	The rights represented by a token and their relationship to any underlying off-chain record have to be established for the particular structure.
Custodian-sponsored	The custodian/intermediary holds or records the underlying interest, and sponsors a token associated with client rights. This can also be a digital twin structure where a separate record remains relevant.	Rights against or through the intermediary may be contractual, proprietary, or otherwise structured; their treatment if the intermediary fails must be established rather than assumed.
Digital native	The DLT-based ledger is intended to serve as, or form part of, the relevant issuance or holding record for a digitally issued instrument, subject to the rights and record-keeping arrangements established for that instrument.	Whether a token is itself the instrument or evidences another right depends on the governing issuance and holding arrangements.

Table 2: Tokenisation models



Figure 2: Illustrative locations of token and underlying records for three tokenisation models. The diagram is a simplified operating representation, not a conclusion about ownership, entitlement, or which record prevails. Synthetic tokens are outside the scope of this report.

A digital twin describes the relationship between the token and another record. A custodian-sponsored structure describes the role of the intermediary that holds or records the relevant underlying interest and sponsors the token. The two descriptions can therefore apply to the same arrangement.

A digitally native structure incorporates a distributed ledger record into the intended issuance or holding architecture. The issuer or transfer agent may have correction, issuance, redemption, or transfer powers if the relevant documentation and system rules confer them.

The nature of the token holder's rights, the effect of a token transfer and the treatment of the holder on an intermediary insolvency require analysis of the actual issuance documentation, holding structure and applicable law. The examples above do not resolve those questions, and a technical token record should not, by itself, be treated as establishing the rights associated with the particular arrangement.

Published examples include structures representing entitlements to securities held at a depository, intermediary-issued tokens used in tri-party repo, and digitally native securities issued through

infrastructure in which DLT records form part of the recognised ownership architecture. These examples illustrate different implementation models across established market arrangements.

3.4 The Collateral Lifecycle

The Guardian Tokenised Collateral Framework follows the common functions of collateral across eight lifecycle steps. For each step, the framework identifies the established arrangement, the changes introduced by tokenisation, implementation questions and relevant market practice.

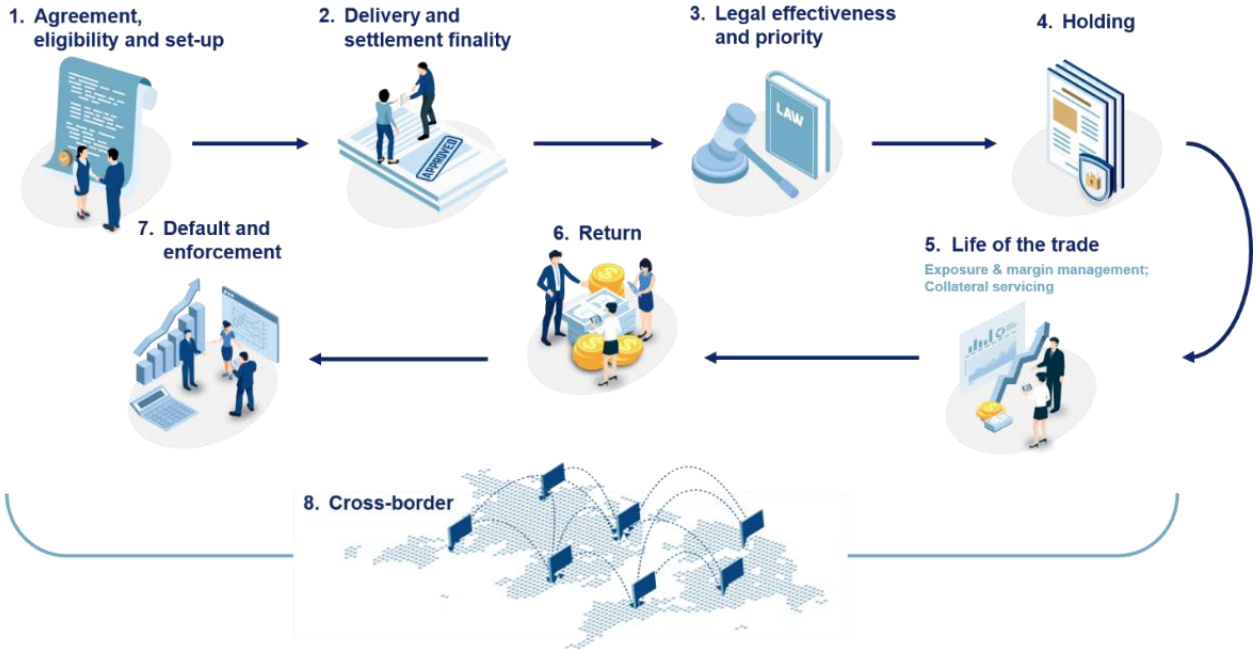


Figure 3: Eight common collateral lifecycle steps

Step	What happens	What it relies on
1. Agreement, eligibility and setup	Contracting, eligibility, haircuts, limits, onboarding, accounts, settlement instructions, reference data	Master documentation; custody and account terms; margin regulations and CCP rulebooks/directives/circulars/ practice notes
2. Delivery and settlement finality	The intended transfer, credit or collateral allocation is recorded; the token event and relevant depository or custody records may occur at different times.	Relevant transaction and account terms; depository/custodian or platform operating rules; determination of the transfer event and its effect; applicable settlement protections; reconciliation and CCP rules where relevant.
3. Legal effectiveness and priority	The intended outright transfer or security interest is documented; the parties identify any additional steps needed to establish rights against third parties and determine priority.	Applicable title transfer and security rules; third-party effect, notices, control or registration where relevant
4. Holding	Collateral is held for the taker, often by a custodian or tri-party agent	Custody and trust law; segregation; protection from the custodian's insolvency
5. Life of the trade (5A / 5B)	5A: exposure, margin and valuation 5B: substitution, income, recall, reuse, reconciliation and corporate actions	Price source governance; margin documentation and applicable CCP rulebooks; risk and operational controls; asset and settlement asset availability

Step	What happens	What it relies on
6. Return	Equivalent collateral is returned after a title transfer, or collateral subject to security is released, when the obligation ends.	Contract and equivalence requirements; operational and conversion arrangements; CCP rulebooks where applicable
7. Default and enforcement	On default, contractual close-out, valuation, netting or enforcement may be engaged; monetisation may involve sale, repo, a facility or another agreed route.	Contract and applicable insolvency/netting rules; any moratorium or stay; CCP rulebooks and default procedures; collateral liquidity and settlement cash
8. Cross-border[^]	The parties, collateral, intermediaries and infrastructure may sit in different jurisdictions	Potentially relevant conflict-of-laws rules, contractual and property-law questions, intermediary records, infrastructure connections and cross-border access.

Table 3: The steps of a collateral transaction and what each relies on

Step 1: Agreement, eligibility and setup

Master agreements and eligibility schedules identify eligible collateral, haircuts, concentration limits and other requirements. Participants complete onboarding, static data setup and relevant trading, repo, margin, custody and control documentation. CCP requirements are established through the applicable CCP framework.

Tokenisation Considerations

A tokenised form of a conventionally eligible asset is not automatically eligible collateral. The parties must assess the rights actually represented or delivered, the applicable collateral schedule, any relevant regulations or CCP rules, the holding and control arrangements, and whether reliable prices and appropriate haircuts can be determined. Eligibility also depends on the capacity to transfer, return and, if needed, realise the collateral within the intended workflow.

Participants should not assume that observations in cases involving other categories of digital assets determine the nature of a tokenised security or fund interest. For each arrangement, the parties should ask whether a token transfer changes the underlying entitlement, which record supports that change, and what evidence is needed to support custody, transfer or security rights.

Relevant questions include:

- What rights does the token represent?
- Does the tokenised form satisfy the applicable eligibility requirements?
- Do the proposed custody, segregation and control arrangements satisfy applicable collateral requirements?
- How are coupons, maturity proceeds and other rights of the underlying treated?
- During market stress, can the proposed valuation source and haircut methodology remain usable, and can the relevant custodians, intermediaries or CCP accept and process the tokenised form under their own rules?

Illustration

A bank and a fund have a CSA that lists USTs as eligible collateral. The fund offers a token representing USTs held by its custodian. The parties need to know whether the token counts as USTs under the schedule, or as a claim on the custodian.

[^] Cross-border is presented as the final assessment step for completeness, but cross-border considerations are not confined to the end of the lifecycle. They should be assessed across Steps 1 to 7 wherever the parties, assets, intermediaries or infrastructure span jurisdictions.

Market Practice

Workgroup participants have referred to the GMRA Digital Assets Annex and Digital Bonds Annex, and ISDA's model provisions and related guidance for specified VM CSAs, as potential documentation reference points.[10,11,12,17] However, the availability of these provisions does not, by itself, establish that a particular tokenised asset is eligible collateral or that the proposed arrangement is adequately addressed under the relevant agreements. Participants must assess the applicable contractual terms, including collateral eligibility, the rights represented by the tokens, transfer and custody arrangements, and the treatment of platform disruptions or failures.

Step 2: Delivery and settlement finality

In conventional account-based securities arrangements, collateral may be delivered through relevant depository or custody account entries, with the effect of the relevant transfer determined by the applicable documents, system rules and legal framework. Other collateral structures use different transfer or control steps. Participants must distinguish operational confirmation from contractual discharge, settlement finality under the governing arrangement, and any additional statutory insolvency protection, where applicable.

Tokenisation Considerations

In a tokenised arrangement, a ledger transfer may be recorded before, after or independently of a change to the relevant depository, custodian or issuer record. The parties should identify what each event evidences, when the intended transfer or discharge is treated as effective, how mismatches are reconciled, and whether any applicable statutory settlement protections extend to that event. Technical confirmation, contractual effect and statutory protections should not be conflated.

Relevant questions include:

- What is the legal effect of a token transfer?
- At which point does the transfer become final and irrevocable?
- Which record prevails if the records diverge?
- What settlement finality protections are applicable to the relevant infrastructure?

For a Singapore-linked arrangement, participants should assess whether the relevant transfer and settlement arrangements provide the required contractual and legal effects, including any applicable settlement finality protections. Technical confirmation of an on-chain transfer should not, by itself, be assumed to establish those effects.

Illustration

A token moves on the ledger at 10 pm Singapore time, but the depository updates its records the next US business day. If the provider becomes insolvent overnight, the parties need to know who owns the security.

Market Practice

Participants described reconciling token records with the relevant underlying records and documenting the operational point at which a transfer is recognised. A digital twin design may rely on an existing register or depository entry, but which event has legal effect depends on the individual structure. ESMA's work on tokenised collateral at CCPs highlights the importance of legally enforceable collateral rights, effective segregation, settlement finality, and operational arrangements supporting collateral realisation. However, the legal effect of token control, including whether it establishes or perfects a security interest and the priority of that interest, must be assessed by reference to the particular tokenisation structure and applicable law.[8]

Step 3: Legal effectiveness and priority

Title transfer requires effective transfer of the relevant right. A security interest arrangement can require steps to create the security, make it effective against third parties, establish priority and support enforcement. In conventional collateral arrangements, the parties typically determine the legal structure

at onboarding and document the relevant transfer, custody, segregation and control requirements under their transaction and collateral agreements.

For tokenised collateral arrangements, the additional consideration is whether these documented arrangements achieve their intended legal effect when applied to the particular tokenisation and holding structure. Participants should identify the rights being transferred or provided as security and determine the requirements for establishing their legal effectiveness, priority, and enforceability against third parties, including in insolvency. These requirements depend on the nature of the underlying rights, the holding and transfer arrangements, and the applicable law. Technical control over tokens or wallets does not, by itself, establish that the intended legal rights and protections have been achieved.

While these matters should be assessed at onboarding, Step 3 distinguishes the agreed contractual arrangements from their legal effectiveness when implemented through the relevant tokenisation and holding model.

Tokenisation Considerations

Tokenisation may introduce a distinction between control over a token and the legal rights over the underlying collateral. Depending on the structure, transferring a token or changing control over a wallet may not, by itself, transfer the underlying asset or entitlement, or establish an effective security interest over it.

Relevant questions include:

- What are the intended collateral rights and do the tokenisation and holding arrangements give effect to those rights?
- Can the collateral taker establish its entitlement or security interest, its priority relative to competing claims, and its ability to enforce those rights in the event of default or insolvency?

Illustration

Initial margin is provided as tokens to a wallet requiring signatures from the provider, taker and custodian. The parties need to establish whether the control structure achieves the intended collateral rights and whether any additional steps are required for third-party effectiveness or registration.

Market Practice

Workgroup participants described the use of title transfer arrangements in repo and certain VM transactions, and segregated third-party custody with documented control arrangements for bilateral uncleared initial margin. The parties typically determine the collateral structure, their respective rights and the relevant custody and control arrangements in the transaction documents at onboarding.

For tokenised collateral, these established practices provide a starting point, but participants must also assess whether the intended rights and protections are achieved under the particular tokenisation, transfer and holding arrangements. Although these matters are ordinarily addressed at setup, Step 3 highlights the need to establish their legal effectiveness in the implemented arrangement, rather than treating this as a separate process occurring after delivery.

Step 4: Holding

Custodians, tri-party agents and other intermediaries maintain collateral through the relevant account and custody structures. Holding arrangements may use segregation, trust or other structures intended to protect client assets in the event of an intermediary failure. The effectiveness of those arrangements depends on the particular structure and applicable law.

Tokenisation Considerations

Tokens can be held through institutional wallets controlled by a custodian, platform or participating institution. Omnibus wallet arrangements can serve multiple clients and therefore require reliable allocation records and reconciliation. Issuers or transfer agents can also retain defined intervention powers.

Relevant questions include:

- How are holdings segregated and protected in the event of an intermediary failure?
- How are entitlements allocated and evidenced within omnibus wallets?
- How do the token and underlying records relate to each other and remain reconciled?
- What issuer or transfer agent powers could affect the collateral or the holder's rights?

Holding arrangements also require controls over custody, key management, wallet access, segregation and reconciliation. Where omnibus wallets are used, the participant-level records need to support reliable allocation of entitlements. Governance arrangements should identify responsibility for changes to wallet permissions, recovery procedures and exceptions affecting access to collateral.

Illustration

A custodian holding tokens for several clients through one omnibus wallet becomes insolvent. The records must enable the relevant clients and their advisers to determine each client's quantity of tokens and the associated entitlements and rights.

Market Practice

Workgroup participants identified regulated custody, omnibus wallet structures, trust and segregation arrangements, bankruptcy remoteness provisions, control location agreements, wallet whitelisting and reconciliation of token holdings against underlying assets as relevant implementation approaches. ESMA cautions that technical separation through wallets, permissions or smart contracts may not of itself give legally enforceable segregation, and that for CCP collateral the arrangement must also support porting client positions to a back-up clearing member.[8]

Step 5: Life of the trade

The life of the trade covers two related functions.

- **Exposure and margin management** includes calculation of exposures and calls, asset valuation, price sources, haircuts, concentration limits, top-ups and releases.
- **Collateral servicing** includes substitutions, recalls, income and coupon payments, distributions, corporate actions, permitted reuse and reconciliation.

The operating model also needs controls over automated processes. These include authority for smart contract changes, monitoring of automated margin or substitution events, reconciliation between token and underlying records, and procedures for exceptions or failed processing.

Tokenisation Considerations

Tokenised arrangements can support automated transfers and servicing and extend the hours during which instructions can be initiated. Effective implementation continues to rely on suitable valuation sources, market liquidity, operating controls and exception management.

Key implementation questions include:

- What counts as equivalent collateral following permitted transfers or reuse?
- How are exposures, valuation times, approved prices and haircuts calculated?
- How are income, fund distributions, corporate actions, recalls and substitutions allocated?
- How are ledger and intermediary records reconciled?
- Which settlement instruments and operating windows are available for required payments? Tokenised money is not necessarily required for a free-of-payment collateral transfer, but the applicable cash leg or distribution mechanism must be identified for each transaction.

Illustration

A tMMF posted as collateral pays a daily distribution in additional tokens. The parties need to determine whether those tokens become part of the collateral or are passed to the original holder, and how valuation and books-and-records reconciliation reflect the distribution.

Market Practice

Participants identified provisions covering distributions, equivalent collateral, transfer days and securities-for-securities substitution as useful reference points. Implementation also depends on fund onboarding, issuer controls, operational resilience and the settlement mechanism required for the transaction.[21]

Step 6: Return

When the underlying obligation or repo term ends, equivalent securities or other agreed assets may be returned under a title transfer arrangement, while collateral held as security may instead be released. The relevant procedure may involve depository, custodian, wallet or CCP accounts and remains subject to the transaction terms and operating arrangements.

Tokenisation Considerations

The recipient can receive tokenised collateral where the arrangement supports it. Other circumstances can require redemption, release of the underlying position or conversion to conventional form. The relevant token sponsor, depository or custodian supports the applicable exit process.

Relevant questions include:

- Is conversion to conventional form required, and if so, who is responsible for it?
- What is the associated cost and treatment of the token record when the underlying position is released?

Illustration

At the end of a repo, tokens are returned but the provider needs conventional securities for a further delivery. The exit process depends on the depository, custodian, token issuer and the agreed ability to redeem or detokenise the position.

Market Practice

Workgroup participants described models in which conventional assets are first positioned in an approved custody or depository location before tokens are issued. Subsequent permitted movements can occur between wallets, with exit to conventional holdings carried out through the operator's reconciliation and redemption procedures.

Step 7: Default and enforcement

Following a default, the collateral taker may need to close out outstanding exposures, enforce its rights over collateral, or apply the relevant default management procedures. Depending on the transaction and the rights held, realisation of collateral may involve sale in tokenised or conventional form, repo financing, drawing on a committed liquidity facility, or other permissible arrangements. Participants should assess whether these routes can provide usable liquidity under stressed conditions, including where access to custodians, token-transfer mechanisms or settlement infrastructure is disrupted.

The ability to exercise these rights depends on the applicable contractual arrangements and legal framework, including the treatment of close-out netting, collateral enforcement, insolvency stays or moratoria, and any relevant statutory protections or exceptions. For each arrangement, participants should assess the applicable insolvency, close-out netting, stay and collateral enforcement considerations for the particular tokenised instrument, counterparties, documentation and holding structure, including whether existing industry netting and collateral enforceability opinions cover the proposed arrangement or whether further legal analysis is required.

Tokenisation Considerations

A token may be transferable on a ledger when the underlying asset market is closed, but the ability to move a token, exercise collateral rights and obtain liquidity are separate tests. Participants should identify the permitted monetisation channels for the specific instrument—direct token sale, conversion into conventional securities followed by sale, secured financing or an agreed liquidity facility—and

whether buyers, counterparties, pricing and settlement capacity are available at the required time. Liquidity in the underlying asset does not automatically create liquidity for the particular tokenised form.

Relevant questions include:

- What applicable stays or other constraints could affect the contractual rights to realise collateral?
- Is there sufficient depth and eligibility of counterparties?
- Are liquidity facilities, settlement assets and market data available when required?
- Can the taker realise or finance the token directly, or does it first need to convert the position, and what is the time needed to access conventional markets?
- How would concentration, forced sales and price impact affect the amount recoverable under stress?
- Which operational fallback applies if buyers, custodians, price feeds or payments are unavailable outside ordinary trading hours?

Illustration

A collateral provider defaults on a weekend. Even if token transfers are operationally available, the collateral taker must establish that it has enforceable rights and whether the collateral can be sold or financed in tokenised form, drawn against under an available facility, or converted to conventional form before a market transaction can be completed.

Market Practice

Workgroup participants reported relying on contractual close-out arrangements, documented custody and enforcement processes, and conversion into conventional holdings where necessary to access existing markets. Whether those arrangements are effective against all relevant parties, and whether they yield timely liquidity in stress, requires transaction- and jurisdiction-specific validation. Practical testing should include eligible counterparties, market depth, price impact, cut-off times and fallback financing routes.

Case study: liquidating tokenised collateral (Les Gardiennes)

A Guardian industry case study involving UBS, SG Forge and Banque de France explored smart-contract-driven liquidation triggers for tokenised collateral. It illustrates how operational steps could be automated, but not that automation alone establishes legal enforcement rights or an immediately available buyer, repo counterparty, or liquidity provider. Testing must also cover approved counterparties, collateral status, settlement assets, exception handling, default timing and the ability to convert to and from conventional form. This is a technical and operational illustration, not a prescribed model.

Step 8: Cross-border

Cross-border collateral arrangements can raise questions about which laws are relevant to the contractual relationship, proprietary effects, intermediated holdings, security interests and insolvency. Different aspects of the arrangement may require analysis under different jurisdictions' rules.

Tokenisation Considerations

The ledger, its operator, custodian, collateral provider and taker, and the underlying asset can have links to different jurisdictions. The relevant holding chain, records, infrastructure and legal relationships therefore need to be mapped for the particular arrangement, as there may be no single legally relevant location.

Relevant questions include:

- Do the traditional conflict-of-laws connecting factors for ownership, intermediated securities, transfers and security interests provide a workable answer for this tokenisation structure, or is further analysis required?
- Which law governs the proprietary effects of a token transfer?

- Which intermediary and record are relevant to determining rights in the collateral?
- How do the rules relevant to each participant, asset and intermediary interact where the asset or holding chain spans jurisdictions?
- How do platform, custody and settlement arrangements operate across the jurisdictions involved, including relevant operating hours, cut-off times and settlement cycles?

Illustration

A Singapore bank proposes to receive tokenised USTs from a Hong Kong fund in an arrangement involving a US-operated ledger and a Luxembourg custodian. The parties would need to identify the relevant governing documents and laws, operational records and intermediaries, and obtain advice on the rights and enforcement steps required across the holding chain.

Market Practice

Participants considered identifying the record-keeping intermediary and documented holding chain to be helpful. Transaction-specific analysis may also be required to determine the extent to which contractual governing-law terms address rights involving third parties or proprietary effects. Cross-border issues are therefore considered across all eight steps; interoperability of platforms and custodians, including alignment of operating and settlement windows, may be as material as questions of law.

3.5 Framework Assessment

For a proposed tokenised collateral arrangement, market participants may apply the framework in three stages:

Stage 1: Map the arrangement. Identify the collateral workflow, asset and tokenisation model, rights represented, relevant records, parties, intermediaries, infrastructures and jurisdictions.

Stage 2: Assess the lifecycle. For each lifecycle step, record the established arrangement, the effect of tokenisation, unresolved legal and regulatory questions, the evidence and controls supporting implementation, and the relevant dependencies.

Stage 3: Characterise the implementation position. Findings are recorded as:

1. Demonstrated market practice, where the relevant approach has been demonstrated in market use.
2. Participant arrangements, where documentation, custody or operating arrangements can support implementation between the relevant parties.
3. Broader resolution or validation, where implementation involves dependencies beyond a single transaction.
4. Further testing, where additional evidence can support implementation and market development.

The resulting implementation map records the relevant lifecycle requirement, the effect of tokenisation, the supporting evidence or control, unresolved legal/regulatory questions, the implementation position, the party responsible for the relevant function or control, and any area for further validation or testing. Chapter 4 uses USTs, SGD-denominated fixed income securities and MMFs to illustrate how the framework operates across different asset and market settings.

4 Applying the Framework

The Guardian Tokenised Collateral Framework is used to assess illustrative UST, SGD-denominated fixed income securities and MMF structures and to show how the framework operates across different asset and market settings. The applications focus on characteristics of the asset, holding structure and market infrastructure that affect the assessment. Considerations common to tokenised collateral are addressed in Chapter 3.

The three cases cover a globally used government security, a domestic fixed income security, and a fund interest. They provide different settings for understanding custody, ownership records, transfer arrangements, collateral acceptance, liquidity and market access.

4.1 Tokenised US Treasuries

US Treasuries (USTs) are widely used as securities collateral and have an established market infrastructure for custody, settlement and liquidity. Tokenisation provides an opportunity to improve how UST positions are mobilised across institutions and operating windows while drawing on this existing market structure.

Implementation experience is developing. Tokenised USTs have been used in collateral transactions, including an overnight tri-party repo. Depository and intermediary initiatives are also developing structures in which conventionally issued USTs can support tokenised entitlements or transfers.

Market Structure and Implementation Evidence

For Singapore-linked activity, UST collateral can engage US depository and custody infrastructure alongside the Singapore collateral taker or provider and its relevant custody, settlement and risk management arrangements.

Conventional USTs are accepted as non-cash collateral by SGX, subject to its applicable requirements. The conventional mobilisation process described in Section 3.1 provides the reference point for considering where tokenisation could improve the movement and availability of UST collateral.

Workgroup discussions identified two potential sources of value. The first is mobility, including the potential for faster or intraday collateral movement during Asian business hours when conventional US securities settlement infrastructure is closed. The second is immobilisation, where underlying securities remain within an established holding location while associated tokenised positions support permitted transfers without requiring movement of the underlying securities for every transaction.

Tokenisation Approach

The UST structures considered by the Workgroup use conventionally issued USTs as the underlying asset.

A **depository-linked structure** can retain the UST within the existing depository system while a token represents an associated entitlement. The conventional depository records remain relevant to the ownership structure, while permitted transfers occur through the tokenised layer.

An **intermediary-sponsored structure** can involve a broker-dealer, custodian or other intermediary holding or recording the relevant securities interest and administering a token associated with participant rights.

DTCC has described tokenisation of DTC-custodied assets and production transaction testing, providing implementation evidence for structures that connect tokenised representations with established securities infrastructure.[22, 23]

An intermediary-sponsored model also illustrates how tokenisation can change the collateral mobilisation process. Conventionally, a clearing member instructs its US custodian to transfer securities through US settlement infrastructure to the CCP's custody arrangement. Under the

illustrative tokenised model, the underlying UST is first transferred to an authorised control location and represented in an approved wallet. Subsequent permitted postings can occur through token transfers within the arrangement.

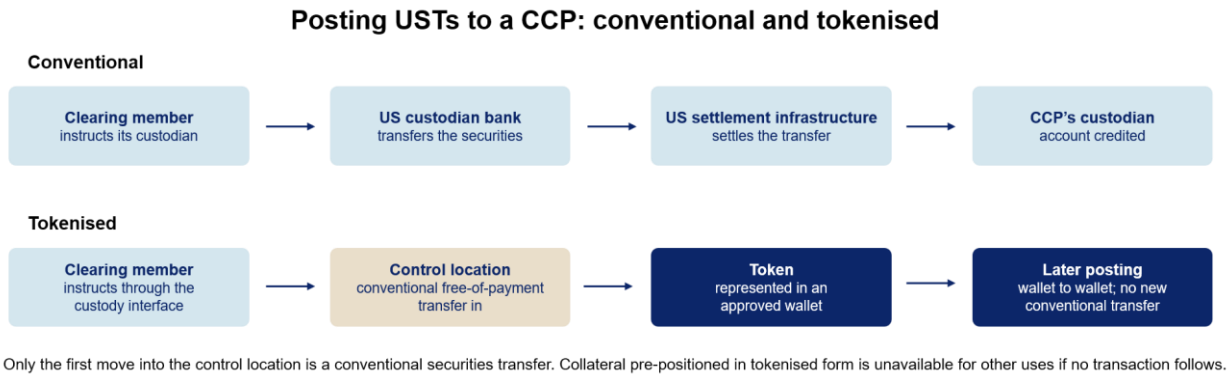


Figure 4: Posting USTs to a CCP in conventional and tokenised form. Illustrative.

Pre-positioning can support faster subsequent mobilisation. It also allocates the underlying collateral to the tokenised arrangement for the period in which it remains pre-positioned.

For the UST illustration, the relevant roles include the underlying securities custodian or control location provider, token sponsor and platform, collateral provider and taker, and (where applicable) the CCP or tri-party agent. Before a corresponding token can be used, the responsible parties should verify sufficient immobilised UST backing and prevent concurrent conventional disposal or pledge of the same securities. Controls should cover custody and wallet access, permitted token creation and redemption, client and CCP eligibility, independent reconciliation, operational cut-offs, exceptions and post-default conversion or financing. These are illustrative control allocations, not a selected UST operating model.

Asset-Specific Considerations

The principal UST considerations arise from connecting tokenised entitlements to established US holding, custody and settlement infrastructure. Depository-linked structures can support token movements while the underlying securities remain immobilised. Reliable alignment and reconciliation between the tokenised entitlement and underlying securities position are therefore important throughout the arrangement.

Liquidity operates at both the underlying and tokenised levels. The conventional UST market provides deep liquidity in the underlying securities. Liquidity in a particular tokenised representation depends on its participants, permitted buyers, networks and settlement arrangements.

Return or realisation can occur through the tokenised arrangement where the required rights, counterparties, liquidity and infrastructure are available; otherwise conversion to conventional USTs may be necessary. A token transfer during Asian hours should not be equated with access to a conventional UST buyer, a USD cash leg or assured settlement at all hours. The implementation case should therefore measure the benefits and costs of pre-positioning, custody, operating window mobility and recovery under stress.

4.2 Singapore Dollar-Denominated Fixed Income Securities

We use a hypothetical example of SGD-denominated fixed income securities to provide a domestic setting for an illustrative application of the Guardian Tokenised Collateral Framework. Existing repo, collateral and settlement arrangements provide an established foundation for considering potential tokenised collateral arrangements.

The use case illustrates how a proposed tokenisation arrangement might interact with an existing domestic securities framework, including book-entry records, custody and settlement infrastructure. The application provides a practical setting for understanding the framework in a Singapore context.

Market Structure and Implementation Evidence

Workgroup discussions considered the potential for tokenisation to support more efficient mobilisation of SGD-denominated fixed income securities. Commercial demand would also reflect factors including collateral eligibility, liquidity, currency requirements and domestic funding preferences. The tokenisation structures considered in this application are illustrative and provide practical settings for assessing how tokenisation could operate with existing arrangements.

Tokenisation Approach

The Workgroup considers two approaches:

A depository-linked digital twin would retain the conventional custody arrangements and add a token or ledger record associated with a proposed entitlement or transfer mechanism, with the intended effect to be established through the actual legal and operating model.

A custodian-sponsored structure would involve an intermediary holding or recording the relevant conventional position and sponsor an associated token. The holder's rights, any permitted token transfer and the treatment of the intermediary's failure would have to be assessed under the actual custody, account and transaction arrangements.

Both structures require a clear relationship between the token and the relevant records. The arrangement identifies the underlying position, the relevant record of entitlement, the effect of permitted token transfers and the processes supporting issuance, transfer, redemption and reconciliation.

The allocation of operational responsibilities also follows from the structure. Existing issuer and market infrastructure roles can be retained while a token sponsor or custodian supports functions associated with token issuance and redemption, backing, reconciliation, custody and wallet administration.

These models are conceptual tools for understanding records, roles and collateral controls. They do not reflect an agreed issuance or tokenisation approach, and no decision by MAS, an issuer, a depository or a market operator to implement such a model should be inferred.

Asset-Specific Considerations

An illustrative tokenised structure would need to connect the token representation, the conventional position, and the relevant custody and settlement records. Parties would need to assess which legal requirements govern the conventional position, the rights intended to be associated with the token and the process for moving, pledging, releasing or realising those rights. Token supply, backing and permitted conventional use must be reconciled throughout the lifecycle.

Roles and responsibilities

Core functions include maintaining entitlement records, custody or safekeeping, reconciliation, segregation, token issuance and redemption, valuation and margin administration, recovery procedures, smart contract governance and default or emergency interventions. Existing issuer, custodian, collateral manager and CCP roles remain relevant. The allocation of tokenisation functions depends on the structure.

The following table examines potential roles in tokenised SGD-denominated fixed income securities collateral. It is illustrative only and does not endorse a specific arrangement. The allocation of these roles depends on the chosen structure and applicable legal and operating arrangements.

Role	Intermediary/custodian-sponsored illustration	Digitally native illustration
Token sponsor and tokenisation platform	Mints or burns tokens against immobilised, reconciled conventional SGD-denominated fixed income securities; verifies that outstanding token claims do not exceed assets available and cannot represent a position simultaneously disposed of or pledged through conventional records.	Mints and burns on the token issuer's instruction; no underlying conventional position to reconcile

Role	Intermediary/custodian-sponsored illustration	Digitally native illustration
Custodian or control location provider	Holds or verifies the corresponding SGD-denominated fixed income securities in an agreed custody/control location; maintains records linking the position to outstanding tokens; ensures the underlying position is blocked from conflicting conventional transfers or pledges while the corresponding token remains outstanding; reconciles and manages custody, wallets and keys.	Wallet and key management; corporate actions maintenance, potentially via smart contracts
Collateral provider	Verifies eligibility; delivers collateral and maintains coverage; gives representations on the collateral	Verifies smart contract logic for transfer, lock and release
Collateral taker	Assesses eligibility and is satisfied with backing, custody and enforcement arrangements	Assesses the governance, resilience and legal certainty of the network and token standard
DLT network provider	Operates the relevant token infrastructure; responsibility for the legally relevant ownership record depends on the model.	Maintains the authoritative ownership record
Smart contract administrator	Manages token lifecycle logic, transfer restrictions, collateral functionality and upgrades	As for the intermediary-sponsored model

Table 4: Illustrative roles for tokenised SGD-denominated fixed income securities collateral

Controls

Common controls include ownership integrity and audit trails, segregation of duties, custody and key management, operational resilience, smart contract assurance and change management, collateral eligibility and valuation controls, and exception management.

An intermediary-sponsored structure adds controls over backing and reconciliation. Token issuance is supported by underlying SGD-denominated fixed income securities held in the relevant custody or control arrangement. Token supply remains aligned with underlying holdings, and breaks between token balances and SGD-denominated fixed income security records require defined investigation and remediation processes.

Control area	All models	Additional for the intermediary-sponsored model
Ownership integrity	Accurate, complete and tamper-resistant ownership records; audit trails	Reconciliation of token records against underlying records
Issuance of token	Approval workflow and segregation of duties for minting and redeeming a token representing a conventional SGD-denominated fixed income security position (where the model uses such a token)	Confirm underlying SGD-denominated fixed income securities are available and immobilised before token creation; keep token liabilities within verified holdings and prevent double-use of the same securities.
Custody and safekeeping	Asset segregation, access controls, key management, recovery procedures	Safeguard underlying SGD-denominated fixed income securities, maintain segregation of backing pools and test that immobilised holdings cannot be moved or pledged outside the agreed process while corresponding tokens remain outstanding.

Control area	All models	Additional for the intermediary-sponsored model
Operational resilience	Business continuity, cyber security, monitoring, incident management	Monitoring synchronisation between conventional custody and the platform
Smart contract governance	Independent code review, testing, change management, emergency intervention	Independent code assurance, governance of issuance and reconciliation and any emergency intervention logic
Collateral management	Eligibility checks, valuation controls, substitution, reporting	Verification that collateral remains redeemable into underlying SGD-denominated fixed income securities
Exception management	Escalation, investigation and remediation	Resolution of breaks between token balances and SGD-denominated fixed income securities holdings

Table 5: Illustrative controls for tokenised SGD-denominated fixed income securities collateral

Forced transfers, suspensions, clawbacks, token burning and emergency intervention powers require clear role assignment, segregation of duties, audit records and alignment with client and collateral taker rights.

Collateral movement

A tokenised arrangement can place underlying SGD-denominated fixed income securities in an authorised holding or control location and immobilised against conflicting use before a corresponding representation token is issued or credited. Subsequent permitted movements can then occur within the tokenised arrangement.

The collateral process records the margin requirement and allocates eligible collateral against it. Eligibility, valuation, haircuts, concentration limits, availability and sufficiency are checked before movement is authorised. Failed checks trigger an exception process and the collateral does not move.

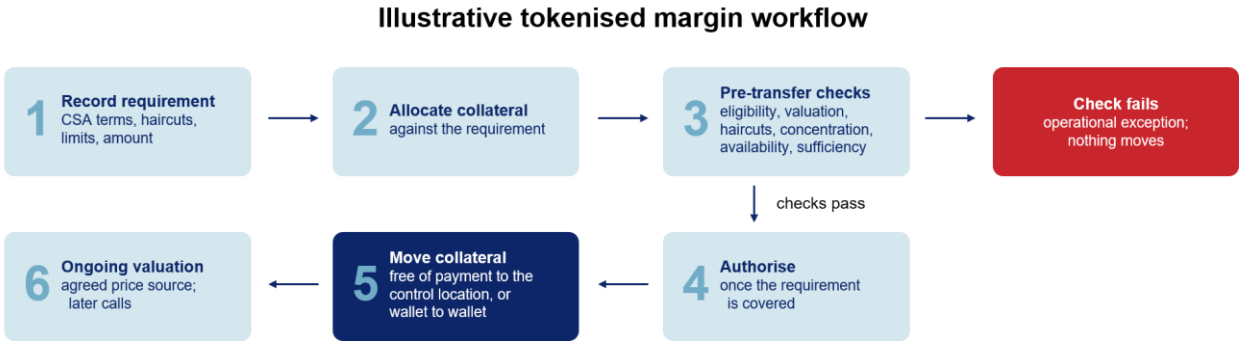


Figure 5: Illustrative tokenised margin workflow, as described in this section. Adapted by participants from a live intraday repo workflow; shown for illustration and not as a prescribed operating model.

Where collateral remains in conventional form, the securities first move through the relevant custody or depository interface into the authorised holding or control arrangement. Token issuance or crediting follows when the required conditions are met. Collateral already tokenised within the arrangement can subsequently move between permitted wallets. These events can have different legal and operational effects.

Ongoing management covers valuation and margin calls, coupon and record-date treatment, substitution, reconciliation between token and underlying records, concentration monitoring, permitted reuse and treatment of maturity or redemption. The legal effect of any proposed token transfer, settlement arrangements, custody responsibility, possible system dependencies and routes to default realisation would require transaction-specific assessment.

The structure therefore builds on Singapore's existing repo and settlement foundations while providing defined roles, controls and operating processes for tokenised collateral mobilisation.

4.3 Tokenised Money Market Funds

Money market funds (MMFs) provide a fund-based setting for applying the Guardian Tokenised Collateral Framework. Tokenised fund interests can combine the investment characteristics of an MMF with more direct transfer mechanisms, creating potential for the fund interest to be mobilised as collateral within appropriate legal, operational and market arrangements.

The tMMF case brings fund registration, investor eligibility, transferability, valuation, liquidity and redemption into the collateral arrangement. Participants should assess how the tokenised fund interest can be held, transferred, valued and realised as collateral in the particular fund and transaction.

Market Structure and Implementation Evidence

An MMF interest represents an interest in a collective investment vehicle. The fund's constitutive documents and register establish the relevant investor rights and govern how interests are issued, transferred and redeemed. Investor eligibility and transfer restrictions can also determine who may hold the fund interest.

For collateral use, these features affect whether a collateral taker can receive and hold the fund interest, how the position is valued and how it can subsequently be returned or realised.

Conventional fund interests may require redemption with the fund, cash transfer and a fresh subscription when value is moved through primary-market transactions. Transfers of existing fund interests between investors are a different process and depend on the fund’s rules. Tokenised fund interests may support permitted investor-to-investor transfers without that redemption/subscription sequence, provided the register, eligibility, onboarding and transfer controls allow them.

Industry activity includes tokenised fund issuance and transfer projects and technical studies of their use as collateral. ISDA and Global Digital Finance have published a report assessing US tokenised MMFs for derivatives margin and securities-financing transactions; their industry sandbox explored several margin configurations, including bilateral variation margin, segregated uncleared initial margin and cleared initial margin.[24] This is evidence of exploration and testing, not confirmation that the particular fund interest is accepted by a CCP or under every collateral agreement.

The collateral value proposition therefore rests on the ability to combine efficient transfer with the investment characteristics, valuation arrangements and liquidity of the underlying fund.

Tokenisation Approach

ISDA, including in its work with Global Digital Finance, describes issuer-sponsored digital native funds, issuer-sponsored digital twins and third-party-sponsored custodial tokens as recurring structures.[24] Some tMMFs use an on-chain register as the authoritative ownership record, while others retain an authoritative register outside the token network.

In a **digital native structure**, the distributed ledger constitutes or forms part of the authoritative fund register. Earlier Guardian work includes a Singapore variable capital company (VCC) sub-fund whose tokenised register is its only register[25], providing a domestic example of a fund structure in which the tokenised record carries the ownership record.

In a **digital twin structure**, the issuer or transfer agent maintains the authoritative register outside the token network, while the token provides an associated representation. The token record and fund register therefore need to remain aligned throughout the arrangement.

In a **third-party-sponsored custodial structure**, an intermediary holds or records the relevant fund interest and supports rights through an associated token. The token holder's rights follow from the relevant custody, account and other legal arrangements.

Fund constitutions, investor-onboarding requirements and transfer agent controls can restrict transfers to eligible investors or approved wallets. These requirements determine who can receive and hold the tokenised fund interest and therefore form part of its collateral utility.

Issuer and transfer agent powers over transfers, corrections and register administration also remain relevant where they affect a collateral taker's ability to receive, hold, transfer or realise the fund interest.

Asset-Specific Considerations

A tokenised MMF used as collateral needs to connect the tokenised representation with the fund register, investor requirements, valuation process and liquidity arrangements.

Eligibility and transferability

The collateral taker needs to satisfy the applicable investor and transfer requirements. Onboarding, investor-status requirements, wallet whitelisting and transfer agent controls can therefore form part of the collateral setup.

The authoritative fund register and token records need to support the intended collateral transfer and holding structure. Where the token provides an additional representation of an existing fund interest, reconciliation maintains alignment between the token and the fund register.

Transferability also affects collateral utility. A tokenised fund interest has greater practical utility where the collateral taker can transfer the position to another eligible holder or access an effective redemption or realisation route.

Valuation and servicing

Reliable valuation requires appropriate net asset value (NAV) and price information. Haircuts can reflect the characteristics of the fund, liquidity, enforceability, applicable rules and the collateral taker's risk appetite.

Fund distributions, record dates and other servicing events need to be reflected in collateral valuation and the relevant records. Where distributions are delivered through additional tokens, the collateral arrangement determines their treatment within the collateral position and the corresponding valuation and reconciliation processes.

Liquidity and realisation

The liquidity available to a collateral taker depends on the fund's redemption arrangements and any permitted transfer or secondary-market mechanisms. An effective route to realisation is therefore part of the collateral arrangement.

Realisation can occur through redemption with the fund, transfer to another eligible investor or an available secondary-market arrangement. Each route depends on the fund terms, eligible counterparties, onboarding arrangements and relevant market infrastructure.

The liquidity of the underlying portfolio supports the economics of the fund, while the liquidity available to a collateral taker also depends on the transfer and redemption arrangements for the fund interest itself.

The implementation case for tMMFs rests on collateral taker acceptance, reliable valuation, effective transferability and a dependable route to liquidity. These conditions determine the utility of the tokenised fund interest within an institutional collateral arrangement.

5 Implementation Considerations

Tokenised collateral operates within the wider infrastructure and market practices that support institutional collateral activity. Documentation and eligibility establish the basis for collateral use. Custody and operating models support holding and mobilisation. Settlement, liquidity and market access enable collateral to be transferred and realised when required. Connectivity across institutions and infrastructures links these elements across the transaction lifecycle.

Financial institutions and market infrastructures can address many of these matters through documentation, custody models, risk management, operating processes, systems integration and connectivity. Regulatory requirements, market infrastructure and cross-border linkages form the wider environment for institutional use.

The discussion below covers three areas: regulatory treatment, operational and market arrangements, and domestic and cross-border dependencies. Together, these shape the practical use of tokenised collateral across institutional markets.

5.1 Regulatory Considerations

The regulatory treatment of a proposed tokenised collateral arrangement depends on the rights, asset, workflow, participants and services involved. Workgroup participants highlighted three implementation checks: collateral eligibility and custody, valuation and risk/prudential treatment, and access or licensing of the relevant Singapore activities. The discussion reflects questions raised by participants and does not constitute an interpretation of regulatory requirements or indicate regulatory treatment of any jurisdiction.

Issue	Questions raised	Implementation approach reported by participants
Eligibility	• Do the relevant collateral agreements, collateral taker and CCP rules and any applicable regulations permit this particular tokenised interest to be accepted, valued and held? • Can custody, control, segregation and ongoing record maintenance requirements be satisfied for the relevant workflow?	Transaction- and rulebook-specific eligibility review, with evidence of the rights delivered, the accepted custody/control arrangement, price sources and applicable haircuts; conventional underlying asset eligibility alone does not establish eligibility of the tokenised form. For uncleared derivatives, participants should also consider the MAS Guidelines on Margin Requirements for Non-Centrally Cleared Derivatives, including any applicable IM custody and maintenance requirements.
Haircuts and prudential treatment	• How would the proposed tokenised form affect valuation, market liquidity, concentration, haircut methodology and time or cost of realisation under stress? • Which prudential requirements apply to the relevant regulated institution and exposure? • The assessment should distinguish currently applicable requirements from consultations or deferred proposals.	Risk-based assessment by collateral takers and CCPs; prudential treatment for banks' exposures to cryptoassets is separate. The March 2025 consultation on banks' exposures to cryptoassets has closed and the proposed implementation was deferred. Participants should refer to MAS's currently applicable requirements and subsequent supervisory communications for the interim treatment, rather than treating a draft consultation proposal as an operative rule.

Issue	Questions raised	Implementation approach reported by participants
Access and licensing	• For activities carried on in Singapore, which licences, exemptions or service-specific permissions, if any, apply to the token sponsor, control location provider, custodian, market operator, fund intermediary or liquidity provider? • What is each entity's actual custody, market-making, distribution or payment role? • Do existing requirements address the identified activity, or is a transaction-specific clarification needed?	Participants should map each entity's actual service and jurisdiction, consult the applicable licensing and custody framework and seek appropriate professional or supervisory clarification as necessary.

Table 6: Regulatory questions raised

In the Singapore context, MAS adopts a technology-neutral approach to the regulation of tokenisation in the capital markets. The Guide on The Tokenisation of Capital Market Products explains how existing regulatory requirements apply to tokenised capital market products and related capital market activities. MAS will be updating the Guide as the market develops, including on the treatment of tokenised collateral. This provides a regulatory starting point, but does not, by itself, determine whether a tokenised asset can be accepted and used as collateral in a particular transaction.

For assets such as USTs and SGD-denominated fixed income securities, participants can build on established collateral practices, including standard documentation, valuation methodologies, custody arrangements and eligibility criteria. However, acceptance of an asset in its conventional form does not automatically extend to its tokenised form. Participants must assess the rights represented by the token, the arrangements for holding and transferring those rights, the relevant operational and settlement requirements, and whether the tokenised form is acceptable under the collateral taker's or CCP's rules and contractual arrangements.

5.2 Operational and Market Considerations

Tokenisation can improve the movement and management of collateral. Its practical value also reflects the operating environment around the transaction: the settlement assets available, the hours during which markets and service providers operate, the depth of liquidity, and the ability of participants and infrastructures to work together.

Settlement and the Cash Leg

Securities collateral can generally be posted or substituted free of payment, or without a corresponding cash payment. However, certain transactions such as repos involve a cash leg linked to delivery of securities, while the enforcement of collateral following a default may require the collateral to be liquidated for cash. Other payments may arise from distributions, close-out or realisation after default, and conversion to cash can require a sale, financing transaction or agreed liquidity facility. Access to safe and reliable settlement assets is therefore important at specific stages of the collateral lifecycle; it need not be assumed for every collateral movement.

Tokenisation can improve securities mobility while cash settlement continues through conventional payment infrastructure. Further integration becomes possible where an appropriate settlement asset is available with the required liquidity, legal treatment and operating capability. Different forms of digital money also carry different credit, liquidity, legal and operational characteristics.

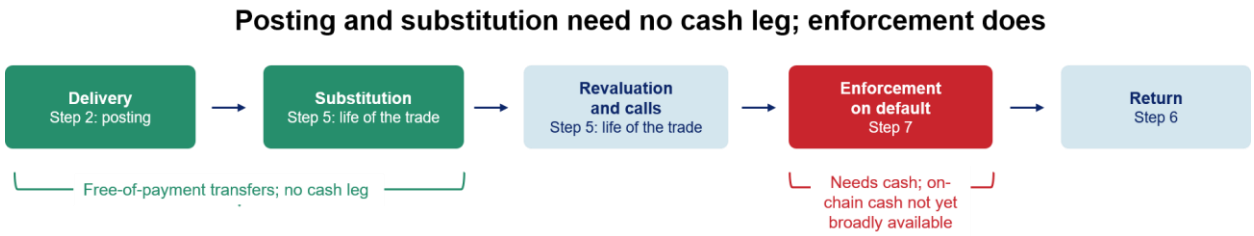


Figure 6: Illustrative points where a payment or settlement asset may be needed during the collateral lifecycle. The cash leg depends on the underlying transaction and should not be assumed for every margin movement.

Tokenised settlement arrangements are also being explored alongside tokenised assets. In Singapore, MAS is working with the industry to develop capabilities to settle tokenised MAS Bills using SGD wholesale CBDC, bringing tokenised assets and central bank money together on digital settlement infrastructure. This example describes development work and does not assert that a particular design has attained legal or statutory settlement finality.

Operating Hours and Liquidity

Tokenised assets can support transfers beyond conventional securities market operating hours. The benefit increases where valuation data, counterparties, settlement capability, market liquidity and operational support are available during the same period.

The liquidity of a tokenised collateral representation should be assessed separately from the underlying asset's conventional market liquidity. For example, a tokenised UST may link to a deep conventional government-securities market but have only a limited group of approved token buyers; a tokenised MMF may invest in liquid holdings while transfers and redemptions remain restricted by eligibility, onboarding, cut-offs and fund rules. Participants should test available sale, financing, redemption and conversion routes at relevant times, including during stress.

The relevant measure of collateral utility is the ability to move, value and realise the position when the transaction requires it.

Operating Model and Ecosystem Readiness

Institutional collateral activity extends across counterparties, custodians, CCPs, client treasuries, payment providers and market infrastructures. Tokenised collateral also needs to connect with booking, accounting, risk, reporting and collateral management systems.

Institutional use therefore extends beyond the token network. Custody processes maintain the required rights and records. Risk systems provide valuation and exposure information. Operations teams support servicing, reconciliation and exceptions. CCPs and collateral takers incorporate the arrangement into their collateral and risk frameworks.

Tokenised and conventional holdings are also likely to coexist as these capabilities develop. Reconciliation, issuance and redemption processes, fallback arrangements and continued access to established settlement infrastructure allow both forms to operate within the same market environment.

Connectivity and Interoperability

Collateral frequently moves across institutions and infrastructures. Tokenised arrangements need effective connectivity across networks, custodians, wallets, depositories, CCPs and settlement systems.

Different technical and operating models can provide this connectivity. For Singapore-linked activity, the relevant test is whether participants can move and manage collateral across the domestic and international infrastructures required by the transaction while maintaining consistent rights, records and controls.

Interoperability therefore includes technical connectivity and the operating arrangements that allow institutions and infrastructures to transact across different systems.

The Business Case

Tokenisation introduces new capabilities alongside implementation costs. Participants can incur costs for custody, systems integration, compliance, legal analysis and operating processes, including the maintenance of conventional and tokenised arrangements during transition. Pre-positioning models can also allocate collateral to a control location, affecting its availability for other uses while it remains there.

These costs can be assessed against measurable improvements in collateral mobility, settlement time, intraday availability, substitution and operational processing.

A strong implementation case starts with an identifiable collateral need and demonstrates how the tokenised arrangement improves the end-to-end process.

5.3 Domestic and Cross-Border Considerations

Collateral activity can span the domicile of the underlying asset, providers and takers, custodians, token networks, market infrastructure and settlement providers. The arrangements may therefore cross contractual and operational as well as jurisdictional boundaries. The parties should map where records, participants and operations sit rather than assume that a token network defines a single legal location.

For cross-border collateral, the practical focus is the complete holding and settlement chain. Ownership and entitlement records need to remain aligned, intermediaries need clear responsibilities, and the infrastructures supporting transfer, custody and settlement need to work together. The applicable legal frameworks also need to support the rights created across the transaction.

For each cross-border tokenised collateral structure, the parties and their counsel should consider which law addresses the intended proprietary effects of a transfer, any third-party requirements and priority of security rights, and enforcement after default. Conventional connecting factors may require particular analysis where a distributed ledger has operators, nodes and participants in different locations. Contractual choice-of-law terms, platform rules, account arrangements and the location of relevant intermediary records should be examined together rather than assumed to resolve all third-party effects.

The nature of these dependencies differs by asset. For tokenised USTs used by a Singapore institution, the underlying securities may remain held and settled through US depositories and custodians, while the collateral arrangement involves Singapore-based participants and their local custody, risk and operational processes. SGD-denominated fixed income securities rely more directly on domestic book-entry, custody and settlement infrastructure. Tokenised funds can involve the fund register, transfer agent, administrator and custodian, which may operate in the fund's domicile, alongside the infrastructure through which the tokenised interest is held and transferred.

A clear map of the holding and settlement chain therefore remains important. It identifies the relevant records, intermediaries, infrastructures and jurisdictions and provides the basis for assessing transfer, custody, settlement, enforcement and access to liquidity across the transaction lifecycle.

5.4 Singapore-Linked Implementation

Singapore's existing securities, repo, custody, payment and clearing infrastructure provides an established base for tokenised collateral activity. Domestic use cases may build on existing book-entry securities, standard repo and derivatives documentation, including relevant ISDA credit-support terms, custody arrangements and settlement infrastructure. Cross-border use cases can draw on these capabilities together with the foreign infrastructure through which the underlying collateral is issued, held and traded.

For tokenised USTs, this can involve Singapore financial institutions using collateral that remains held within US securities and custody infrastructure. For tokenised SGD-denominated fixed income securities, the starting point is Singapore's existing securities, custody and settlement arrangements.

TMMFs can draw on Singapore fund structures while using the register, transfer, custody and liquidity arrangements relevant to the particular fund.

Uncleared derivatives variation and initial margin also provide relevant Singapore-linked workflows. For any tokenised securities or fund interest proposed as collateral, participants should assess its eligibility under the governing CSA and any applicable MAS Guidelines on Margin Requirements for Non-Centrally Cleared Derivatives, the relevant segregation and custody arrangements, the available collateral taker or CCP approval, and whether industry opinions address the particular instrument and holding model. This is a checklist for participant review, not a conclusion that every tokenised interest meets these conditions.

Workgroup discussions also considered cross-currency securities financing, including an illustration involving Singapore dollar and US dollar assets. Any such use case would require assessment of the specific instrument, currencies, collateral eligibility, settlement arrangements and market demand.

The practical opportunity lies in use cases that bring together clear market demand, suitable collateral, willing participants and a workable end-to-end arrangement. Singapore's existing financial market infrastructure provides a foundation for progressing such use cases through targeted implementation and testing.

The next step is to identify where market practice already provides a sufficient foundation for implementation, where participant-led arrangements can advance adoption, and where further validation or testing would strengthen the path to institutional use.

6 Market Position and Next Steps

Tokenised collateral has been used in selected live repo, custody, and collateral mobilisation arrangements, alongside developments in industry documentation, market infrastructure, and regulatory and policy work. These examples do not yet demonstrate that every tokenised asset can be accepted, valued, transferred or realised across all collateral workflows. Institutional implementation requires participant arrangements, operational validation and, where needed, further legal or regulatory analysis.

The Guardian Tokenised Collateral Framework provides a common basis for locating these elements within the collateral lifecycle. The applications in Chapter 4 and the implementation considerations in Chapter 5 show where existing practice provides a foundation for institutional use and where targeted work can advance implementation.

6.1 Where the Market Stands

Established conventional collateral practices and emerging tokenised implementations offer a foundation for further work, but should be distinguished in assessing readiness.

Conventional depository, issuer, and intermediary records are used in many tokenised structures, and particular DLT arrangements are being developed in which ledger records form part of the intended issuance or holding model. The actual rights represented, operative records and transfer consequences must be determined for each structure rather than inferred from a common model label.

For conventional collateral, repo and some VM arrangements use title transfer, while security interests are common where the provider retains ownership, including uncleared initial margin. Participants should assess whether the proposed tokenised form can be accommodated in the intended transaction and custody documents, including segregation, control, third-party effect and enforcement questions where relevant to the particular structure and applicable law.

Industry documentation includes the ICMA GMRA Digital Assets Annex and Digital Bonds Annex, ISDA model provisions for specified VM CSAs, and ISDA's published consideration of tokenised MMFs as derivatives collateral. These materials identify potential documentation approaches but do not establish tokenised asset eligibility, legal enforceability or opinion coverage for a particular transaction. Any required contractual amendments and counsel analysis remain transaction specific.

The operating environment is also developing. Tokenised assets can support faster collateral mobilisation and more flexible transfer arrangements. Institutional use continues to draw on custody, liquidity, settlement assets, interoperability, risk approval and an identifiable commercial case. These elements are at different stages of development across individual markets and use cases.

This points towards a practical sequencing principle, starting with collateral assets and transaction structures familiar to market participants, then introducing tokenised transfer, custody and settlement capabilities where they deliver identifiable value. Workgroup participants also identified free-of-payment collateral mobilisation and substitution as possible starting points before more complex DvP or direct-token liquidation arrangements.

6.2 Priorities for Implementation

The next phase should bring willing institutions together around defined asset-workflow combinations with demonstrable market demand, implementation readiness and identifiable value. This places the focus on the complete collateral use case and the market need it addresses.

Priority use cases should bring together a clear collateral or liquidity need, willing participants, suitable collateral, established legal and market foundations, workable custody and settlement arrangements, reliable valuation and a credible route to usable liquidity under stress. The value of tokenisation should be measurable against the existing process, including collateral mobility, settlement time, operational effort and the implications of pre-positioning assets.

Mobilising conventionally eligible USTs within repo, uncleared derivatives margin or CCP workflows is one potential near-term pathway, subject to collateral taker or CCP approval and the particular documentation. In some Asia-Pacific markets USTs are used as uncleared derivatives initial margin, providing a familiar conventional starting point; the tokenised form still needs eligibility, custody and liquidity review. Measurable tests include Asian-hours mobility, settlement time, control location costs and the use of pre-positioned assets.

Tokenised MMF collateral provides another possible pathway, including selected derivatives margin arrangements where applicable. This could be pursued if the relevant collateral taker is willing, onboarding and valuation requirements can be met, and an effective redemption or liquidity route exists. Singapore-linked use cases can similarly build on established domestic market foundations where there is clear participant demand and a workable end-to-end arrangement.

Initial implementations can establish the value delivered and the institutional arrangements needed before similar approaches are extended across additional assets or workflows.

6.3 Implementation and Validation

Selected use cases should move through end-to-end implementation using the same lifecycle established in the Guardian Tokenised Collateral Framework. This keeps implementation anchored to the legal rights, records, controls and operating processes identified through the framework.

Normal transaction processing covers onboarding and eligibility, delivery, holding, valuation and servicing, substitution, return and any conversion between tokenised and conventional forms. Validation under stressed conditions establishes whether the arrangement continues to function when demands on collateral are greatest.

Relevant scenarios include participant or custodian default, infrastructure unavailability, discrepancies between token and underlying records, failed margin calls, close-out of repo or derivatives positions, access to segregated initial margin, delayed or blocked fund redemption, unavailable settlement assets and enforcement outside conventional market operating hours.

These scenarios provide evidence that legal rights can be exercised, records remain reliable, controls operate as intended and collateral remains accessible and realisable when required. They also allow participants to refine responsibilities, exception processes, recovery arrangements and routes to liquidity before broader use.

Implementation can progress into recurring use as participating institutions establish the contractual, regulatory, risk, operational and internal arrangements required for the transaction.

6.4 Building Market Practice and Next Steps

Each implementation can contribute practical material for subsequent transactions and wider market use. Useful outputs include end-to-end workflow blueprints, governance and reconciliation controls, common terminology, questions for legal counsel and implementation lessons for subsequent use cases.

These materials can capture where demonstrated market practice was sufficient, where participant arrangements were needed, where broader validation was required and how particular operating models performed in practice. They provide reference material for subsequent implementation and do not constitute standard-form legal agreements or public-sector commitments.

Repeated institutional use can strengthen market practice across different assets and workflows. Experience from implementation can refine operating models, documentation, governance and reconciliation arrangements, while transaction-specific legal, regulatory, risk and commercial decisions remain with the relevant participants.

The Guardian Tokenised Collateral Framework provides a common structure for taking this work forward. Grounded in established collateral practice, the framework follows the collateral lifecycle from

agreement and eligibility through delivery, holding and servicing to return, enforcement and cross-border considerations. The applications to USTs, SGD-denominated fixed income securities and tMMFs illustrate its use across different assets, ownership records, custody structures and market infrastructures.

Many of the foundations for tokenised collateral already exist in established collateral practices, legal techniques, custody arrangements, documentation and market infrastructure. Tokenisation introduces new ways to represent, transfer and mobilise collateral, together with additional requirements around records, control, connectivity and operating arrangements. Financial institutions can progress many of these elements directly, while others benefit from wider market coordination or further validation.

The next phase is targeted implementation around use cases with clear demand, willing participants and identifiable value. End-to-end implementation and validation can build on existing market foundations, strengthen the evidence base and translate the Guardian Tokenised Collateral Framework into reusable market practice for broader institutional use.

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8 Annex I: Framework at a Glance

This table summarises the eight common collateral lifecycle steps and their application to tokenised collateral.

Step	Main question raised	Market practice reported	Where the question is engaged
1. Agreement, eligibility and setup	Is the tokenised interest covered by the documentation and eligibility rules, and are onboarding, static data and custody arrangements ready?	Master agreement, credit support and collateral schedule amendments where needed, onboarding, operating procedures and review by relevant legal/risk teams	Contractual terms; applicable margin requirements and CCP rules
2. Delivery and settlement finality	Which records and transfer events have the intended contractual and legal effects, and when (if at all) does the arrangement provide finality beyond technical confirmation?	Specified ledger/account updates and reconciliation; applicable system rules; contract terms for operational events	Contractual terms; applicable settlement finality requirements and CCP rules
3. Legal effectiveness and priority	What rights are intended to pass or be created, and which steps must be confirmed for third-party effectiveness, priority or enforcement under the selected structure?	Agreed collateral technique, account/control arrangements and counsel review of perfection and priority	Potentially relevant contractual, property, company, insolvency and third-party effect considerations, subject to transaction-specific legal review
4. Holding	How can client holdings and entitlements be evidenced, segregated, reconciled and accessed if a relevant intermediary fails?	Agreed segregation and custody/control arrangements; wallet permissions, access recovery, underlying asset reconciliation and contingency procedures.	Potentially relevant contractual, property, trust and insolvency considerations; intermediary holding and account documentation; transaction-specific legal review where required
5. Life of the trade 5A: margin 5B: servicing	5A: how are exposures, prices, haircuts and concentration limits monitored and adjusted? 5B: how are substitutions, income, reuse, corporate actions and settlement assets managed and reconciled?	Risk and collateral management processes, operator rules, fund/custody agreements, exception procedures	Contract; where relevant, CCP rules
6. Return	How is equivalent collateral returned, following title transfer, or security collateral released; and who can convert any tokenised position to conventional form?	Agreed token return, detokenisation or redemption route via the relevant custodian or issuer	Contract; operating arrangements; where relevant, CCP rules

Step	Main question raised	Market practice reported	Where the question is engaged
7. Default and enforcement	What rights and practical monetisation routes are available on default, including sale, secured financing, cash facilities and action outside market hours?	Documented close-out or default management arrangements; liquidity routes, eligible counterparties, token/conventional conversion and scenario tests	Relevant contractual and insolvency questions; CCP rules if applicable; market depth, concentration and cut-off times
8. Cross-border	Which laws and records are relevant to the proposed transfer, security interest and third-party effects across the involved jurisdictions?	Mapped parties, intermediaries, underlying and token records, contractual terms, relevant jurisdictions and operational/settlement windows	Potentially relevant conflict-of-laws and contractual rules in the jurisdictions identified by the arrangement

9 Annex II: Key Terms

The definitions below explain how selected terms are used in this report. They are provided to support understanding of the common framework and should not be interpreted as definitive legal or regulatory definitions.

Central counterparty (CCP): An entity that becomes the counterparty to each side of a cleared transaction and takes collateral from clearing members under its rules, eligibility criteria and risk management framework.

Collateral provider: The party that delivers, transfers or grants a security interest over collateral in support of an obligation.

Collateral taker: The party that receives collateral, or obtains rights over it, to secure or support the performance of an obligation.

Control location: An agreed account, custodian, depository, wallet or other arrangement in which collateral is held or controlled for a transaction. Its legal effect depends on the relevant rights, documentation and applicable law.

Conversion to conventional form: The process by which a tokenised position is converted, redeemed or otherwise returned to a conventional security, fund interest or account-based holding supported by existing market infrastructure.

Custodian-sponsored token: A token associated with an interest held or recorded through a custodian or other intermediary. The holder's specific rights, the relationship to the underlying record and the treatment of an intermediary failure depend on the actual contractual and legal structure and require assessment.
Delivery-versus-payment (DvP): A settlement arrangement designed to link delivery of securities or other assets with a corresponding payment so that securities delivery is conditional on the required payment under the agreed process. The particular operational and legal effects depend on the system and transaction rules.

Digital native asset: An instrument or interest for which a DLT record is intended to constitute or form part of the issuance or relevant holding architecture. The actual ownership or entitlement effect of that record requires confirmation for the specific instrument.

Digital twin: A token or ledger representation linked to an issuer, transfer agent, depository or intermediary record. The model describes a relationship between records, not a conclusion about which record is legally determinative or whether a transfer of the token transfers the underlying asset.

Effect of transfer: Whether a proposed transfer produces the intended change in ownership, entitlement or other rights under the relevant documents and applicable law. A technical token movement should not, by itself, be treated as establishing that outcome.

Haircut: A risk adjustment applied to the market value of collateral when determining the amount of exposure it can support. The haircut may reflect price volatility, liquidity, concentration, enforceability and the expected cost or time required to realise the collateral.

Initial margin (IM): Collateral collected to address potential future exposure during the period needed to close out or replace positions following a counterparty default.

Perfection and priority: In security interest arrangements, "perfection" is used here to denote any steps the relevant parties may need to take for third-party effectiveness under the applicable law; "priority" concerns competing claims. Whether those steps are needed, and the effect of operational wallet control, depend on the actual instrument and jurisdiction.

Relevant ownership or entitlement record: A record used or intended to establish or evidence ownership, entitlement or a transfer for a particular instrument or holding arrangement. Which record has the required effect should be established under the relevant documentation and applicable law; a ledger entry should not be assumed to be determinative by itself.

Security interest: An interest, such as a pledge, charge, lien or mortgage, granted over collateral while the provider retains ownership or the relevant entitlement. Its creation, third-party effectiveness, priority and enforceability depend on the applicable law and documentation.

Settlement finality: The legally or contractually recognised point at which a particular transfer or discharge becomes irrevocable and unconditional under the relevant framework. This is distinct from technical confirmation, and any statutory settlement finality protection must be separately assessed for the relevant system and transfer.

Title transfer: An arrangement under which the relevant asset or entitlement passes outright to the collateral taker, which is obliged to return equivalent collateral in accordance with the agreement.

Tokenised collateral: A token-represented financial asset, interest or entitlement proposed or used to support an obligation. Its collateral eligibility, holder rights, legal effect, valuation, custody and realisation characteristics must be assessed under the relevant transaction and market arrangements.

Tokenised money market fund (tMMF): An interest in a money market fund represented or recorded through a token. Depending on the structure, the authoritative fund register may be maintained on or off a distributed ledger.

Tri-party agent: A service provider that holds, selects, values, allocates, substitutes or returns collateral within agreed eligibility criteria and operating arrangements. Unlike a CCP, a tri-party agent does not become a principal counterparty to the underlying transaction.

Variation margin (VM): Collateral transferred to address current exposure arising from changes in the market value of a transaction or portfolio.