Multipli: A Multi-Collateral Credit Protocol for Tokenized Real-World Assets

Technical Specification and Risk Architecture

Multipli Protocol Research

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Abstract

This paper presents the technical architecture of Multipli, a multi-collateral collateralized debt position (CDP) protocol that accepts institutional-grade tokenized real-world assets (RWAs) as collateral and issues a collateral-backed credit instrument, the Debt Unit (DU), against locked positions subject to conservative solvency constraints. The Debt Unit is a collateral-backed credit instrument; it is not a stablecoin, does not target a fixed price, and does not employ any algorithmic supply mechanism. Its value is determined by the sufficiency of the collateral backing each position at the time of issuance. The design applies proven CDP architecture adapted throughout for the specific characteristics of tokenized RWA collateral: NAV-based pricing, issuer-level redemption mechanics, holder allowlists, and multi-day settlement horizons. Accepted collateral comprises tokenized U.S. Treasury instruments, dollar-denominated cash-equivalent tokens, and tokenized gold. We describe the full contract suite, the two-layer lazy-accrual liability model, WAD/RAY/RAD fixed-point conventions, per-asset oracle design via an Oracle Security Module, the collateral parameter system, Dutch auction liquidation mechanics, operational reserve mechanics, yield deployment pathways, the governance and emergency control surface, and the role and explicit limitations of the MULT governance token.

Keywords: collateralized debt position; real-world asset tokenization; collateral-backed credit instrument; Oracle Security Module; Dutch auction liquidation; DeFi credit infrastructure; governance token.

1 Introduction and Motivation

The tokenization of real-world assets has advanced from a speculative thesis to a measurable market reality. On-chain representations of U.S. Treasury instruments exceeded tens of billions of dollars in aggregate notional by 2025, with projections pointing toward hundreds of billions across tokenized money markets, short-duration sovereign debt, and commodity-backed instruments over the following

decade. Yet on-chain representation alone does not make those assets financially productive within decentralized finance.

The structural obstacle is fragmentation. Each issuer of tokenized RWAs maintains its own legal wrapper, redemption schedule, custody provider, NAV publication methodology, oracle dependency, and compliance posture. From the perspective of a DeFi lending protocol or yield aggregator, each instrument is an idiosyncratic risk object requiring individualized underwriting, price feed integration, liquidation logic, and legal evaluation. Onboarding one hundred tokenized Treasury instruments requires one hundred separate integration efforts, and the resulting liquidity distributes across thin, fragmented markets rather than concentrating in a single deep pool.

Multipli resolves this by internalizing issuer-level complexity inside a single CDP protocol. The system accepts a defined universe of vetted tokenized RWAs as collateral, enforces conservative solvency constraints calibrated for RWA characteristics, and issues the Debt Unit (DU) as a standardized composable credit instrument against locked positions. Downstream protocols interact with DU without needing to reason about the distinctions between any two specific collateral issuers.

The protocol draws on the well-established CDP model, adapting its core solvency mechanics for RWA-specific properties: NAV-based oracle design aggregated through an Oracle Security Module in place of spot price feeds, explicit staleness windows calibrated to fund administrator publication schedules, holder-allowlist handling at the adapter layer, and loan-to-value ratios set for assets that may not be liquidatable at scale on short time horizons.

2 System Model and Core Invariants

The Debt Unit is generated against collateral locked inside collateral positions. Each position is owned by a single address and holds a collateral balance alongside a DU liability that accrues stability fees over time. The lifecycle is straightforward:

> *Deposit:* `collateral tokens --> AssetAdapter custody`
> *Issue:* `DU minted against locked collateral (subject to solvency check)`
> *Accrue:* `liability grows continuously via per-collateral rate index (drip)`
> *Close:* `wipe DU + accrued fees --> collateral unlocked and returned`

2.1 Accepted Collateral Categories

The protocol restricts collateral to deeply liquid, institutional-grade assets whose risk can be clearly assessed. Three categories are accepted:

(i) Tokenized U.S. Treasury instruments. Short-duration T-bill wrappers and money-market fund tokens priced by published NAV per share. Yield accrues continuously; the token price drifts

upward gradually between redemption events.

(ii) Tokenized dollar cash-equivalents. These are third-party fiat-backed tokens accepted as collateral. The protocol monitors these collateral tokens for deviation from their issuer-stated reference values. Algorithmically backed assets are explicitly excluded.

(iii) Tokenized gold. Spot-priced gold tokens such as XAUT and PAXG, where each unit represents a defined quantity of allocated gold. Priced directly from each token's market price feed, with independent OSM instances per token.

2.2 Solvency Enforcement

Solvency is enforced through four stacked mechanisms, each designed to catch failures the layer above might miss.

Layer 1: Conservative valuation. All collateral is priced using OSM-mediated prices subject to a configurable delay. A per-collateral haircut further discounts the accepted price for solvency checks. Issuance is permitted only when discounted collateral value exceeds the outstanding liability scaled by the liquidation ratio.

Layer 2: Loan-to-value threshold enforcement. LTV ratios are calibrated in the 70 to 85 percent range for liquid collateral types, providing overcollateralization sufficient to absorb adverse price movements before a position becomes eligible for liquidation.

Layer 3: Permissionless liquidation. Any position whose collateral value falls below its outstanding liability multiplied by the liquidation ratio can be liquidated by any external actor. The system does not depend on a privileged liquidator.

Layer 4: Explicit bad-debt accounting and operational reserve. If a liquidation auction fails to raise sufficient proceeds to cover a liability, the shortfall is recorded explicitly in the Vow as sin and covered from accumulated surplus. No silent socialization of losses occurs.

2.3 Protocol Invariants

The following invariants serve as formal specifications against which the implementation is audited. Violation of any invariant constitutes a critical protocol failure.

Ref	Invariant	Failure Mode
I-1	Total DU supply equals aggregate recorded collateral liabilities minus explicitly recorded deficits.	Silent loss socialization.
I-2	Any risk-increasing operation (frob to draw or withdraw) must pass the solvency check.	Undercollateralized positions created.

Ref	Invariant	Failure Mode
I-3	Positions below the liquidation ratio are eligible for liquidation by any actor without special permission.	Dependence on privileged liquidator.
I-4	Collateral shortfalls from auction underpayment are recorded explicitly as sin in the Vow.	Opaque balance sheet deterioration.

3 Internal Accounting Model

A naive implementation of continuous fee accrual would require updating every open position's liability on every block, creating gas costs proportional to the number of active positions. Multipli uses a two-layer lazy-evaluation model: normalised debt (art) is stored per position, a per-collateral rate index grows over time via drip, and the current liability is computed on demand by multiplying the two values.

3.1 Fixed-Point Precision Conventions

Three distinct precision levels prevent rounding drift across long-lived positions:

```
WAD (1e18):   token amounts, DU quantities, collateral balances
RAY (1e27):   rate indices, stability fee accumulators, normalised multipliers
RAD (1e45):   intermediate products  WAD x RAY  before normalisation
```

The separation prevents two common failure modes in fee-index designs: accumulator drift from repeated rounding of rate updates, and liability understatement from dividing before completing full-precision multiplication. No intermediate result loses precision before it has been used in a solvency-critical computation.

3.2 Liability Formulas

For a position (urn) and collateral type (ilk), the CDPEngine stores art[ilk][urn] (normalised debt, in WAD) and rate[ilk] (the accumulated fee index, in RAY). Current liability is computed lazily on each interaction:

```
Liability[urn] =   art[ilk][urn]  x  rate[ilk]  /  RAY
```

The protocol enforces a single collateral type per position. This simplifies solvency checks and reduces audit surface area. Multi-collateral positions are deferred to a future release.

3.3 Solvency Check

For each collateral type, the CDPEngine maintains spot[ilk], the OSM-mediated price scaled by the inverse of the liquidation ratio (mat). This spot value is the maximum debt that can be drawn per unit of collateral. A position is solvent if and only if:

```
solvent[urn] iff:   gem[ilk][urn]  x  spot[ilk]  >=  art[urn]  x  rate[ilk]
```

This check gates all risk-increasing operations: drawing additional DU and withdrawing collateral. The spot value already incorporates the liquidation ratio (mat), so a position at the margin of solvency cannot draw additional DU even if the raw collateral value appears sufficient.

3.4 Stability Fee Accumulation

Each collateral type has a duty rate (per-second multiplier, in RAY). The drip function updates the rate index and is called before any frob operation that changes debt:

```
drip(ilk):   rate[ilk]  x=  duty[ilk]  ^  (block.timestamp  -  rho[ilk])
       rho[ilk]   =  block.timestamp
```

The drip function is publicly callable by any actor, allowing keepers to maintain current rate indices. The duty rate translates to an annualized stability fee set by governance and applied uniformly to all positions in that collateral type.

4 Contract Architecture

The protocol is decomposed into a set of narrow-responsibility contracts, each with explicit permission boundaries. No contract calls untrusted external code directly. Each component is independently auditable and the trust relationships between them are formally specified. The core contracts are introduced in the table below and described in detail in the subsections that follow.

Contract	Primary Responsibility
CDPEngine	Core accounting: gem (collateral), art (debt), rate (fee index), spot (safe price), line (ceiling), dust. Enforces all solvency checks.
DebtToken	ERC-20 ledger for DU. Mint and burn restricted to CDPEngine exclusively.
CDPManager	User-facing orchestration: position creation, operator permissions, frob/flux/move convenience wrappers.
AssetAdapter	Per-token custody normalization; decimal handling; allowlist enforcement. Joins and exits for each collateral type.

Contract	Primary Responsibility
OSM	Oracle Security Module: collects oracle reports, computes median, publishes with delay. One instance per collateral type.
Jug	Stability fee accumulation via duty rate and drip mechanism.
LiquidationEngine	Liquidation orchestration: verifies unsafe condition via bark, seizes collateral, kicks Clipper auction.
Clipper	Dutch (descending-price) auction for seized collateral. Partial fills supported.
Vow	Surplus and deficit accounting. Accumulates stability fees; covers sin via Flapper/Flopper auctions.

The CDPEngine is the most security-critical component. It never calls untrusted external contracts. All token movements pass through registered AssetAdapters; all collateral seizures pass through the LiquidationEngine into a Clipper auction. The CDPEngine records only state transitions, ensuring that an issue at the adapter layer cannot directly manipulate accounting state.

4.1 DebtToken

The Debt Unit token is a standard ERC-20. Mint authority is restricted exclusively to the CDPEngine; no other address may call mint. Burn authority follows the same restriction. This narrow issuance surface ensures that DU supply cannot increase except through a collateralized position creation that has passed the solvency check.

4.2 CDPEngine

The CDPEngine stores the following core state, kept minimal by design:

gem[ilk][usr]: collateral balance per user and collateral type, in WAD.

art[ilk][urn]: normalised debt per position. Multiplied by rate to get current liability.

rate[ilk]: accumulated stability fee index, in RAY. Updated by Jug.drip.

spot[ilk]: safe price per collateral unit, scaled by inverse of mat. Updated by Spotter.

line[ilk]: maximum total debt (DU) issuable against this collateral type (debt ceiling).

dust[ilk]: minimum position size. Positions cannot be reduced below dust without full closure.

sin: total bad debt recorded when Clipper auction proceeds are insufficient to cover the tab.

4.3 CDPManager

The CDPManager is the primary user-facing entry point. It maintains a mapping from human-readable position IDs to CDPEngine urn addresses and exposes an operator delegation model: owners can grant

operators scoped permissions over collateral management, debt issuance and repayment, and withdrawals. Core operations include frob (adjust collateral dink and debt dart simultaneously), flux (move collateral between positions), and move (transfer internal DU balances within the CDPEngine).

4.4 AssetAdapters

Each accepted collateral token requires a dedicated AssetAdapter (GemJoin equivalent) to normalize non-standard ERC-20 behavior. The adapter handles tokens with non-standard decimal precision, tokens with missing return values on transfer via SafeERC20, and tokens with holder allowlists where the adapter itself must be a pre-approved eligible holder. Fee-on-transfer mechanics are explicitly disallowed. No collateral leaves an adapter without a corresponding CDPEngine gem update.

4.5 Collateral Parameters

Each collateral type is configured with a set of risk parameters stored across the CDPEngine, Jug, Spotter, LiquidationEngine, and Clipper:

Parameter	Description
mat	Liquidation ratio: minimum collateral-to-debt ratio. Positions below mat are eligible for liquidation (e.g., 1.15 = 115% minimum LTV cap).
line	Debt ceiling: maximum total DU issuable against this collateral type.
dust	Minimum position size. Positions cannot be reduced to below dust without full closure.
chop	Liquidation penalty applied to the outstanding debt tab when a position is liquidated.
chip / tip	Keeper incentive: a flat tip per bark call plus a percentage of the tab paid from the Vow.
buf / tau / cusp	Clipper auction parameters: starting price multiplier (buf), auction duration (tau), and price reset threshold (cusp).
duty	Per-second stability fee multiplier applied via Jug.drip.
OSM config	Oracle operator whitelist, median quorum, staleness window, and OSM delay period.

All parameter changes route through a governance timelock. Emergency actions are restricted to tightening risk (reducing line to zero, increasing mat) or pausing bark on a collateral type. No emergency role can loosen any parameter. This asymmetry ensures that the system can only be made safer without timelock; loosening always requires deliberate governance participation through the standard delay.

5 Oracle Design

Pricing is the most critical risk surface of any RWA-collateral protocol. Tokenized RWAs carry characteristics that make direct spot-price oracle designs inadequate: NAV publication schedules measured in business days, redemption timelines that may span multiple settlement cycles, and thin on-chain secondary markets that can deviate materially from fundamental value. The oracle layer is built around fail-closed behavior as the primary design constraint.

5.1 Oracle Security Module (OSM)

All price feeds pass through an Oracle Security Module before reaching the CDPEngine. The OSM collects price reports from a defined whitelist of oracle operators, computes the median of all reported values for that collateral type, and publishes that median with a configurable time delay. The delay gives governance time to react if a compromised or manipulated feed is detected before it affects collateral valuations.

If the median cannot be computed because too few oracle operators have reported within the staleness window, the OSM does not publish a new value. The Spotter contract reads the OSM and updates spot[ilk] in the CDPEngine. A stale OSM reading causes the Spotter to leave spot[ilk] at its last valid value, which may cause positions to appear solvent when they are not. Governance is expected to respond to sustained staleness by reducing the affected collateral's line to zero until the feed is restored.

5.2 Per-Category Pricing

Tokenized T-bill instruments (NAV-based)

T-bill tokens are priced by published NAV per share, which increases gradually as yield accrues. Oracle operators submit signed price reports that are aggregated through the OSM's median mechanism. The OSM's permitted daily-delta guardrail is calibrated to the plausible range of overnight yield accrual for short-duration instruments, rejecting any single report that deviates beyond that bound until a new oracle consensus is established.

Tokenized dollar cash-equivalents

Dollar-equivalent collateral tokens are third-party fiat-backed instruments. The protocol enforces automatic risk controls when such collateral tokens deviate from their issuer-stated reference values:

- Collateral price below 99.5% of reference: new DU issuance suspended for the affected collateral type.
- Collateral price below 98.5% of reference: collateralization requirements tightened for the affected collateral type; spot[ilk] updated to disable further draws.

These thresholds protect position holders from collateral impairment and do not imply any target value for DU itself. They are protocol-enforced controls, not administrative actions. The OSM median mechanism requires a quorum of oracle operators to report a price below threshold before any control fires.

Tokenized gold (XAUT, PAXG)

Tokenized gold tokens are priced directly from their own market price feeds rather than from a derived XAU/USD conversion. Each token (XAUT, PAXG) has its own OSM instance with independently whitelisted oracle operators. The OSM's permitted single-update deviation guardrail is calibrated to the plausible range of gold price movements within the OSM delay window.

5.3 Collateral Eligibility Gate

A collateral token may enter the protocol only if all three conditions hold simultaneously:

Priceability. A quorum of independent oracle operators can produce reliable, timely price reports for this specific token. Staleness behavior and fallback handling must be explicitly defined in the OSM configuration before onboarding.

Transferability. The AssetAdapter and LiquidationEngine can legally and technically hold and transfer the token. Where holder allowlists exist, both must be pre-approved eligible holders before the collateral type can be onboarded.

Operational transparency. Supply, NAV where applicable, and key operational events are observable on-chain or through a transparent off-chain data feed. Clear issuer and custodian posture must be publicly documented.

6 User Lifecycle

All user interaction routes through the CDPManager. The lifecycle proceeds through position creation, collateral deposit, DU issuance, active management, and eventual closure. Each risk-increasing step triggers a CDPEngine solvency check before the state transition is committed. Function names correspond to the actual contract interface.

Step	Function	Solvency Check	Key Effect
1	open(ilk, usr)	None	Creates new urn; emits NewCdp(usr, own, cdp)
2	join(ilk, usr, wad)	None	Transfers collateral from user to AssetAdapter; credits gem in CDPEngine
3	frob(cdp, +dink, +dart)	Post-frob check	Locks collateral and draws DU; fails if position would be below mat
4	frob(cdp, 0, -dart) [wipe]	None	Repays DU; reduces art; unlocks no collateral
5	frob(cdp, -dink, 0) [free]	Post-frob check	Withdraws collateral; fails if position would be below mat

Step	Function	Solvency Check	Key Effect
6	exit(ilk, usr, wad)	None	Transfers collateral from AssetAdapter back to user wallet
7	Full wipe then exit	None (art = 0)	Position fully closed; all collateral returned

7 Liquidation Mechanics and Auction Design

When a position's collateral value falls below its outstanding liability multiplied by the liquidation ratio, the position becomes eligible for liquidation. The mechanism is permissionless: any external actor can trigger liquidation of any eligible position. This ensures the system does not depend on a privileged liquidator to remain solvent during periods of market stress.

7.1 Liquidation Condition

A position is eligible for liquidation when the following condition holds, evaluated using the current spot[ilk] value from the CDPEngine (which already incorporates the OSM median and the inverse of mat):

> *eligible[urn] iff:* `gem[ilk][urn] x spot[ilk] < art[urn] x rate[ilk]`

7.2 Liquidation via bark and Clipper

Seized collateral is sold through a Clipper: a descending-price (Dutch) auction with partial fills. This mechanism converges quickly, supports a simple keeper strategy (monitor the current price and purchase when it crosses threshold), and performs better under volatile conditions than thin on-chain order books.

bark(ilk, urn, kpr). Any actor calls bark on the LiquidationEngine to trigger liquidation of an eligible position. The engine verifies the unsafe condition, transfers gem to the Clipper via the AssetAdapter, computes the tab (debt plus penalty), and kicks the auction. The caller receives a flat tip plus chip percent of the tab as incentive.

take(id, amt, max, who, data). Bidders purchase seized collateral at the current descending price. The price starts at OSM price multiplied by buf and decays according to the tau parameter over time. When the price is at or below max, the bidder transfers DU (which is burned immediately by the CDPEngine) and receives collateral. Partial fills are supported; the remaining tab and collateral continue in the same auction.

Settlement. If the full tab is covered: any residual collateral is returned to the original position owner via the CDPEngine. If the auction expires without covering the full tab: the shortfall is passed to the Vow as sin and resolved through the operational reserve mechanism described in Section 8.

8 Operational Reserve Mechanics

The protocol's solvency backstop is the Vow contract, which accumulates stability fee revenue and liquidation penalties, records any bad debt arising from under-collateralized liquidations, and resolves the two through on-chain auction mechanisms. The Vow holds these funds in a smart contract exclusively for operational solvency. Protocol revenues in the Vow do not accrue to governance token holders under any circumstances.

8.1 Surplus Accumulation

The Vow receives stability fees collected via Jug.drip as they accrue on outstanding debt, and liquidation penalty proceeds from the chop component of Clipper auction settlements. Surplus DU above the configured hump threshold is periodically auctioned via a Flapper mechanism: DU is sold to the market in exchange for a reference asset, which is then burned. This reduces the outstanding DU supply and constitutes the protocol's mechanism for deploying accumulated surplus to operational purposes.

8.2 Bad-Debt Accounting and Coverage

If a Clipper auction settles with a shortfall, the outstanding debt is passed to the Vow as sin:

```
sin += max(0, tab - auctionProceeds)
```

The Vow periodically reconciles its DU surplus against any outstanding sin. If sin exceeds available surplus, a Flopper auction is triggered: the protocol mints additional recap tokens and sells them for DU, which is used to write down the sin balance. Bad debt is never silently socialized; it is always recorded explicitly in the Vow and resolved through the on-chain auction process.

8.3 Recap Asset

The asset minted and sold in a Flopper auction is a dedicated recap instrument, not the MULT governance token. The MULT token is a governance token only. It carries no claim on protocol revenues, no role in the bad-debt resolution process, and cannot be diluted as a consequence of protocol losses. The specific design of the recap asset is subject to a separate specification and governance vote prior to deployment.

9 DU Deployment

DU is a collateral-backed credit instrument. The Multipli protocol does not provide, arrange, manage, or guarantee any yield or return on DU holdings. Once issued, DU may be deployed by holders into third-party DeFi protocols or held as a credit position against their collateral. Any returns depend entirely on external market conditions and the holder's chosen strategy. Users are solely responsible for evaluating the risks of any deployment.

9.1 Third-Party Deployment

DU holders may choose to deploy their holdings into third-party DeFi protocols including lending markets, borrowing strategies, or structured vaults. Such deployments are undertaken entirely at the holder's discretion and risk. The Multipli protocol has no involvement in, control over, or responsibility for any third-party deployment or its outcomes.

Third-party service providers may independently offer DU deployment services or managed strategies. Any such services are wholly independent of the Multipli protocol, are not endorsed or affiliated with the protocol, and are subject to applicable regulations in their operating jurisdictions. The protocol makes no representation regarding their suitability, safety, or regulatory status.

9.2 Stability Fees as Operational Revenue

The protocol's primary revenue stream is the stability fee: a per-collateral per-second carry charge accumulated via Jug.drip that accrues against outstanding normalised debt. This revenue flows into the Vow and is used exclusively for operational solvency. Protocol revenues do not accrue to MULT governance token holders. The MULT token confers governance voting rights only and represents no claim on stability fee income or any other protocol revenue stream.

10 MULT Governance Token

The MULT token is the governance token of the Multipli protocol. Its function is to confer voting rights in the on-chain governance process. This section defines precisely what the MULT token is and what it is not, in the interest of regulatory clarity.

10.1 Governance Rights

MULT token holders may participate in on-chain governance votes to propose and ratify changes to protocol parameters, including collateral onboarding, stability fee rates, liquidation ratios, debt ceilings, and oracle configurations. All parameter changes are subject to the timelock delay described in Section 11. The governance token does not carry any right to direct protocol revenues, protocol assets, or treasury funds.

10.2 Explicit Limitations

The following limitations apply to the MULT token without exception:

No revenue claim. MULT holders are not entitled to any share of stability fees, liquidation penalties, or any other protocol revenue. All protocol revenues are held in the Vow and used exclusively for operational solvency, with any surplus above the hump threshold auctioned to reduce DU supply.

No buyback or burn mechanism. The protocol does not commit to any mechanism that purchases MULT tokens from the market or reduces MULT supply as a function of protocol performance or revenue. No such mechanism exists or is planned.

No role in bad-debt recap. MULT is not the recap asset. In the event that operational reserves are insufficient to cover bad debt, the Flopper auction mechanism sells a separately designated recap instrument. MULT token holders are not diluted as a consequence of protocol losses.

No artificial scarcity design. The MULT token supply and distribution schedule are not designed to create artificial scarcity for the purpose of price appreciation. Any value attributable to the token derives solely from its utility as a governance instrument.

10.3 Consumptive Utility

The utility of holding MULT is the ability to participate in governance decisions that affect the protocol's risk parameters and operational configuration. This is a consumptive utility: the token is used to exercise a vote, not held passively in anticipation of a financial return derived from the protocol's commercial activities. Governance participation requires active engagement with the on-chain voting process.

10.4 Protocol Revenue Disposition

For completeness, the disposition of protocol revenues is as follows. Stability fees and liquidation penalties flow into the Vow smart contract. The Vow uses surplus to cover any sin recorded from undercollateralized liquidations. Surplus beyond the configured hump threshold is auctioned via the Flapper mechanism, with proceeds used to reduce the outstanding DU supply. At no stage do protocol revenues flow to MULT token holders or to any discretionary treasury controlled by token-holder vote.

11 Governance and Emergency Controls

The governance architecture addresses a fundamental tension: governance that is too slow cannot respond to emerging risks, while governance that acts too quickly can be captured or manipulated. Multipli resolves this by stratifying the action space. Risk-increasing actions require longer delays; risk-reducing actions can be executed faster by a narrower set of actors.

11.1 Role Hierarchy

Role	Capabilities	Constraints
Timelock Governor	Modify per-collateral risk parameters (mat, line, dust, chop, duty); onboard new collateral types; update OSM configurations; adjust stability fee rates.	Minimum 24-hour delay on all actions. Cannot bypass timelock.
Emergency Multisig	Reduce debt ceilings (line) to zero or current outstanding level; tighten liquidation ratios (mat); pause bark on specific collateral types; trigger global settlement via End.	Cannot loosen any parameter or increase any line. Actions are restricted to making the system safer only.
Oracle Admin	Rotate OSM oracle operator whitelists; update feed configurations.	Subject to timelock. Rotation requires explicit governance procedure.

11.2 Pausing New Issuance

New DU issuance against any collateral type can be effectively paused by reducing that collateral's debt ceiling (line) to its current outstanding debt level or to zero. This prevents any new debt from being drawn while leaving existing positions fully operational. Repayments, collateral withdrawals following repayment, and liquidations continue without interruption. This mechanism provides fine-grained per-collateral control without requiring a global system pause.

11.3 Global Settlement

In the event of a severe failure, including oracle compromise, a critical exploit, or an irrecoverable implementation issue, the protocol can enter global settlement via the End contract. Global settlement freezes all new issuance, fixes collateral prices at the last valid OSM values, and initiates an orderly wind-down procedure. Outstanding DU liabilities are settled against remaining collateral. This emergency mechanism is designed for catastrophic failure scenarios only and does not constitute a routine redemption facility or guarantee of any recovery amount. The settlement procedure is audited independently.

12 Risk Taxonomy

12.1 Solvency Risk

The primary risk for any credit-backed on-chain instrument is that collateral value falls below outstanding liabilities. This can arise from correlated collateral price declines, oracle compromise, or redemption timelines that prevent timely liquidation. Mitigants include conservative LTV ratios in the 70 to 85 percent range for liquid collateral types, fail-closed OSM behavior, and explicit bad-debt accounting with on-chain coverage via the Vow.

12.2 Liquidity Risk

Liquidity risk manifests when seized collateral cannot be sold at sufficient prices within the Clipper auction window. This is most acute for collateral types with thin on-chain secondary markets or multi-day off-chain redemption timelines. The collateral eligibility gate requires demonstrated price observability and transferability before onboarding. Clipper parameters are calibrated conservatively per collateral type.

12.3 Issuer and Custody Risk

Each accepted collateral type carries the credit and operational risk of its issuer and custodian. A fund administrator freeze, custody failure, or regulatory action can impair both oracle price and redemption path simultaneously. The protocol manages concentration risk through per-collateral debt ceilings and the requirement for operational transparency as a condition of onboarding.

12.4 Regulatory Risk

Tokenized RWAs exist at the intersection of traditional financial regulation and on-chain infrastructure. Regulatory actions including transfer restrictions and holder-eligibility changes can impair oracle price and liquidation feasibility without prior warning. The protocol maintains the ability to reduce debt ceilings to zero for affected collateral types and, via global settlement if necessary, to provide an orderly exit for all participants.

12.5 Smart Contract Risk

The modular architecture reduces smart-contract risk by isolating the CDPEngine from all peripheral contracts. The CDPEngine never calls untrusted external code; all external interactions are mediated through registered AssetAdapters with explicit permission boundaries. Published audit scope, methodology, and findings accompany each protocol version; critical findings are resolved before mainnet deployment.

Risk Category	Primary Mitigants
Solvency	Conservative LTV ratios (70-85%); OSM-mediated prices with delay; explicit sin accounting in Vow.
Liquidity	Collateral eligibility gate; Clipper Dutch auction; per-collateral debt ceilings (line).
Issuer and custody	Per-collateral debt ceilings; issuer diversification; operational transparency gate.
Regulatory	Debt ceiling reduction to zero; global settlement via End contract.
Smart contract	CDPEngine isolation; no untrusted external calls from core contracts; public audit programme.

13 Conclusion

Multipli introduces a structured approach to a problem that has no clean resolution at the DeFi application layer: the combinatorial complexity of integrating a fragmented and rapidly expanding universe of tokenized real-world assets into productive on-chain use. The approach concentrates issuer, oracle, custody, and liquidation complexity inside a single CDP protocol and exposes a standardized composable credit unit to downstream integrators.

The protocol's core mechanics are grounded in CDP design patterns that have been extensively audited and proven in production. The adaptations are targeted at the characteristics that distinguish tokenized RWA collateral from crypto-native assets: NAV-based pricing aggregated through an OSM, extended settlement horizons reflected in conservative LTV ratios, holder allowlists handled at the adapter layer, and issuer-level operational risk managed through per-collateral debt ceilings. These adaptations apply established mechanisms to a new collateral universe without introducing new trust assumptions.

The MULT governance token is a governance instrument and nothing more. It confers voting rights over protocol parameters and carries no claim on protocol revenues, no buyback or burn commitment, and no role in the bad-debt recap mechanism. Protocol revenues flow exclusively to the Vow for operational solvency. This structure is transparent, auditable, and designed to be compatible with regulatory frameworks that distinguish between governance instruments and investment contracts.
