

Lotus Economic Risk Report

Blockchain Security & Smart Contract Auditing Services

Lotus • November 5th 2026

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Scope

This assessment is based on the GitHub repository `Lotus-Protocol/lotus` at commit `b15126f77a70d1f529e49afa61c2e4abfcc9995d`, supplemented by information the Lotus team provided on protocol strategy, intended markets, and operational arrangements. The live-cascade, borrowing-buffer, repayment-cooldown, and pre-liquidation mechanics in this

report were checked against local commit. This targeted code review does not establish production configuration or independently revalidate the other integration and operational evidence. Findings and recommendations remain subject to the information and assumptions described in this report.

How to read this report

This report explains Lotus, assesses the economic consequences of its implementation, and identifies the conditions under which its lending model is useful.

Borrowers: Start with Sections 1–4, 6–7, and 10–11. These explain tranche selection, funding availability, borrowing costs, collateral management, liquidation, and administrative changes.

Liquidity providers: Start with Sections 1–5, 8, and 10–12. These explain the exposure acquired, how income and losses reach a position, and when assets can be withdrawn. Read Section 9 whenever the selected strategy depends on productive reserve assets.

Due diligence readers: Read the complete report, including the detailed flows, economic qualifications, and assessment scope.

Unmarked material explains the essential economic consequences. ★ identifies detailed mechanics, calculations, or transaction sequences. ★★ identifies specialized integration analysis. Stars indicate depth and applicability, not severity. A specialized integration can be material to every participant in a market that uses it.

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1 Introduction and executive assessment

Relevant to: Borrowers · LPs · Due diligence

1.1 Purpose and principal conclusion

Lotus is an overcollateralized lending protocol in which one market contains several ordered lending books, called tranches. They share a loan token while retaining separate collateral configurations, borrower positions, and supplier shares. Liquidity can support borrowing across eligible tranches; interest and realized losses are distributed through a directional cascade.

The economic proposition is **selective liquidity sharing**. A supplier chooses a boundary on borrower exposure, while a borrower can access a larger eligible funding base than an entirely separate lending book would provide. This creates *useful infrastructure for lending products whose users have different collateral or leverage preferences but a common funding asset*.

The reviewed core establishes meaningful accounting constraints. It independently limits risk-engine liquidity outputs, restricts the direction of interest and loss allocation, and requires exact conservation of distributed interest and realized bad debt. These checks support a clear separation between custody and accounting in Lotus and economic policy in its modules.

The economic assessment depends on market configuration, the distribution of live supply and borrowing, and the terms under which participants can enter and exit. The bundled cascade links junior loss exposure to strictly junior net backing and preserves cumulative backing when its initial constraints hold. Supplier ownership, withdrawal capacity, collateral execution, and external settlement require separate assessment. Borrowers also face a buffered borrowing limit and, after eligible bad-debt events, age-dependent repayment restrictions. Sections 4, 5.5, 7, and 12 explain these conditions. Accounting conservation and preserved backing do not by themselves guarantee immediately withdrawable cash or successful liquidation execution.

1.2 What the design offers

Lotus can reduce fragmentation where independent collateralized borrowing opportunities compete for the same loan asset. Suppliers can choose narrower or broader borrower exposure without requiring

every tranche to maintain a completely independent liquidity pool. Market designers can combine that arrangement with different rate engines, liquidation policies, and vault allocation strategies.

The result is a continuum between isolation and broad pooling. A one-tranche market has no cross-tranche cascade. A multi-tranche market introduces directed sharing, with index-dependent exposure and liquidity constraints. Separate Lotus markets retain separate accounting. These choices allow different products to be built on the same core, but do not make all configurations economically interchangeable.

1.3 How to interpret the assessment

This report evaluates mechanisms and their economic implications. It does not assign a universal expected return, liquidation probability, or loss rating to every possible Lotus market. Such quantities require deployed parameters, collateral liquidity, borrower behavior, and operational evidence.

The assessment describes the economic arrangements reviewed as of the date above. Numerical examples explain mechanisms rather than predict returns or loss frequency. Governance diagrams describe the available architecture and intended role assignment; they do not establish that production ownership has been configured accordingly. Venue observations retain their observation dates and evidence limitations. A particular product also depends on its selected vault, fees, permissions, and operating configuration, which must be assessed before applying the general conclusions to that product.

2 Protocol architecture

Relevant to: Borrowers · LPs · Due diligence

2.1 Markets and positions

A Lotus market is identified by its loan token, risk engine, liquidation module, and ordered tranche configurations. Each tranche specifies a collateral token, oracle, and liquidation loan-to-value threshold, or LLTV. The same collateral can appear at several thresholds, or a market can combine different collateral assets.

Suppliers own supply shares in a particular tranche. Borrowers hold a collateral balance and borrow shares in a particular tranche. Interest changes the assets represented by shares; a supplier loss reduces asset value without burning the supplier's shares. Tranche shares are internal accounting units, not a promise of fixed principal or fixed yield.

The core is a singleton contract. Markets using the same token share its physical contract balance, while their accounting and permissible withdrawals are calculated separately. The useful isolation claim is therefore about market ledgers and enforced operations, not separate custody addresses.

2.2 Responsibilities across the system

Component	Economic responsibility	Boundary of that responsibility
Lotus core	Custody, positions, health checks, accounting updates, and validation of module outputs	Does not choose an economically suitable market configuration
Risk engine	Borrow rates, available-liquidity quotation, interest allocation, and loss allocation	Operates within core checks, but retains discretion within them
Liquidation module	Seizure/repayment quotation and settlement	Trusted to deliver the loan-token repayment it quotes
Oracle	Collateral value in loan-token units	Correctness, freshness, and executable market value are external dependencies
Vault and adapters	Pool investor capital and allocate it into positions or venues	Add allocation policy, valuation, governance, and withdrawal dependencies

Component	Economic responsibility	Boundary of that responsibility
Governance and operators	Configure mutable parameters and administer permitted changes	Protection depends on the actual role holders and timelocks

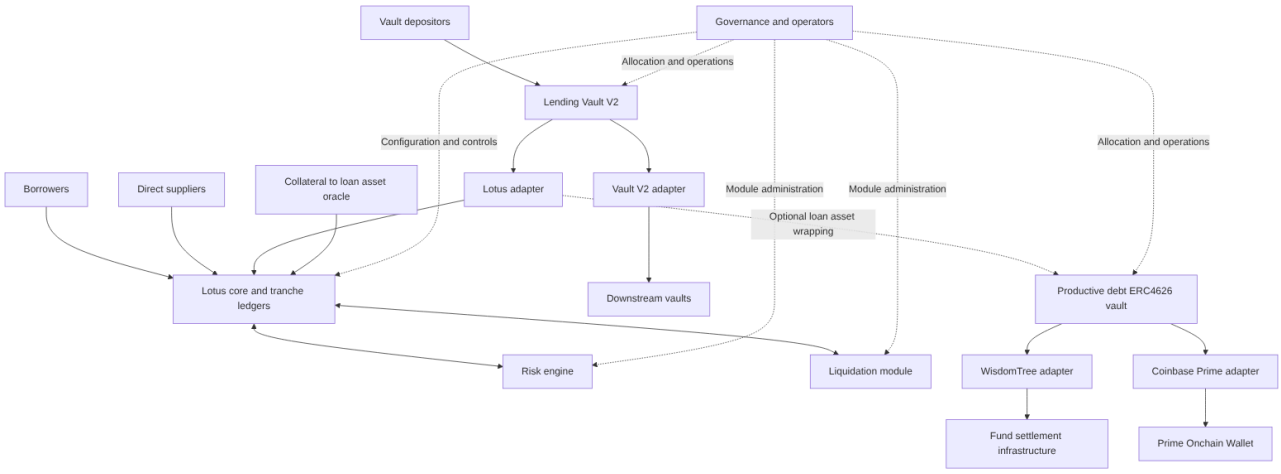


Figure 1 — System architecture. Arrows describe relationships, not simultaneous token transfers. Productive reserve integrations apply only where a vault or loan-asset design selects them.

2.3 What is fixed and what can change

Market identity fixes the loan token, tranche order, collateral tokens, oracle addresses, LLTVs, and module addresses. Changing those choices requires a different market. Fees, hook configuration, pause state, and module parameters remain administrable. Upgradeable module addresses can retain their identity while their implementations change. An immutable market identifier therefore does not imply that every aspect of its future economic behavior is immutable.

Market creation is permissionless, subject to enabled engines, liquidation modules, and LLTV values. That enablement does not automatically endorse token and oracle selection. Initial rate and liquidation settings are not part of market identity. A market with the same identifying parameters can therefore already exist with different initial settings; its configuration must be checked rather than inferred from its identifier.

2.4 Position value and denomination

Three quantities recur throughout this report: **claim value**, **recorded exposure**, and **withdrawable liquidity**. A claim can appreciate while its underlying assets remain borrowed. A vault may record full booked exposure for caps while recognizing only part of a reward in share value. An asynchronous redemption may retain value while producing no immediately withdrawable cash.

Loan-token denomination also matters. If the loan token is an appreciating productive-debt vault share, both supplied assets and borrower liabilities are measured in that share. A borrower who converts borrowed shares into USDC has a share-denominated obligation whose USDC replacement cost can rise even before Lotus borrowing interest is added. Section 9 separates that effect from reserve income earned by shareholders.

3 Tranche choice and the meaning of seniority

Relevant to: Borrowers · LPs · Due diligence

3.1 Two perspectives on the same market

Index 0 is the most senior tranche in the allocation structure; higher indices are more junior. This ordering defines exposure and funding relationships, not an automatic ranking of collateral quality or borrower risk. A supplier at index *i* participates in a lending structure exposed to borrowers at its own index and more senior indices. A borrower at index *i* can use funding supplied at its own index and more junior indices, within the liquidity constraints described in Section 4.

These directions are complementary. They do not mean that a senior supplier lends to every borrower in the market. They also do not identify a particular supplier's tokens with a particular loan. Lotus maintains aggregate ledgers and allocation rules.

Position in a three-tranche market	Eligible borrower origins for supplier income and losses	Eligible funding books for borrowing
T0, most senior	T0	T0, T1, T2

Position in a three-tranche market	Eligible borrower origins for supplier income and losses	Eligible funding books for borrowing
T1	T0, T1	T1, T2
T2, most junior	T0, T1, T2	T2

Eligibility is a direction rule. The amount allocated depends on borrower interest, live supplied assets, and strictly junior net supply, subject to the selected engine and protocol fees.

3.2 What being a senior supplier means

Seniority primarily provides a **boundary on the origin of losses**. A *loss arising in T2 cannot be allocated to T0 or T1*. A *loss arising in T0 can affect T0, T1, and T2*. The supplier chooses how far along this exposure ladder to participate.

The originating tranche and eligible junior tranches share a realized loss according to the cascade. In the bundled engines, the split depends on own supply and strictly junior net supply at the allocation snapshot. Junior borrowing therefore affects the support available to senior loans. This arrangement provides state-dependent sharing, rather than a fixed junior first-loss attachment point.

Seniority also gives a weakly less restrictive free-supply constraint. It does not reserve tokens for senior holders or assign them transaction priority. If two suppliers can withdraw the same remaining cash, the first successful transaction can exhaust the other's available liquidity. Section 11.4 illustrates this distinction.

> **Participant consideration:** A higher index broadens a supplier's eligible borrower exposure; it does not assign a numerical risk rating or guarantee a return premium. For a borrower, actual leverage, collateral liquidity, and liquidation terms matter more than the index label. The intended risk ordering of a particular offering therefore depends on its stated terms, including any exceptions across different collateral assets.

3.3 Comparison with isolated and pooled lending

Property	Independent lending books	Broadly pooled lending book	Lotus directional sharing
Funding availability	Determined separately for each book	Shared within the pool	Shared according to tranche direction
Supplier borrower exposure	Selected book	Admitted borrower set	Selected tranche and more senior origins
Reallocation between opportunities	Usually requires explicit movement	Occurs within the pool's rules	Eligible borrowing can use junior funding without an LP transfer
Loss distribution	Within the isolated book	According to the pool's policy	Origin and more junior tranches, using the configured engine
Configuration burden	Per book	Across the pool	Per tranche and across the joint configuration

These are conceptual lending models, not a claim that all protocols in either category implement identical controls. Lotus combines some benefits of separation and pooling by making exposure directional. The cost is that a supplier must understand the relevant part of the joint market rather than evaluate its tranche in isolation.

3.4 The recurring example

Consider a market with three tranches and the following balances, all measured in the same loan asset. Assume conventional token behavior, no fees or accrued interest for this snapshot, sufficient collateral, and no additional hook restrictions.

Tranche	Supplied assets	Borrowed assets	Own supply less own borrowing
T0	100	50	50
T1	100	130	−30
T2	100	40	60
Total	300	220	80

T1 can borrow more than its own supply because T2 contributes eligible backing. The negative local balance does not by itself mean the market is insolvent. The relevant constraint is cumulative backing over each tranche and the tranches junior to it. T2 borrowers cannot use T0's idle 50 units merely because the market as a whole has cash.

Economic assessment. The design is useful when LPs want control over eligible borrower origins while allowing funding to be shared among those origins. Seniority describes exposure and liquidity rules. Tranche index alone does not prove collateral quality, a particular LLTV ordering, or a higher return for greater exposure.

4 Liquidity and user operations

Relevant to: Borrowers · LPs · Due diligence

4.1 Why free supply exists

A withdrawal and a new loan both remove loan tokens from Lotus. Either operation can reduce the liquidity supporting other claims. *Free supply measures how much can leave through a particular tranche without violating the core's cumulative backing limits at that point in the transaction.*

For a junior tranche, idle cash elsewhere in the market is not sufficient. The operation must also fit within the remaining backing of its own tranche and more junior tranches. This is the operational counterpart of allowing junior capital to fund senior borrowing while limiting senior capital's exposure to junior borrowers.

4.2 ★ Calculating free supply

Let S_i and B_i be live supply and borrow assets at tranche i, and let $n - 1$ be the most junior index.

Define the nonnegative net supply of each suffix:

$$N_j = max\left(0, \sum_{k=j}^{n-1} S_k - \sum_{k=j}^{n-1} B_k\right).$$

The physical liquidity ceiling is:

$$F_i = \min_{0 \le j \le i} N_j.$$

Bundled risk engines return this ceiling; the core rejects a custom engine's quotation if it exceeds the independently calculated ceiling. A custom engine may be more restrictive. These are accounting limits, not checks of externally redeemable wrapper liquidity.

In the recurring example, $N_0 = 80$, $N_1 = 30$, and $N_2 = 60$. Consequently, $F_0 = 80$, $F_1 = 30$, and $F_2 = 30$. T2's own net assets are 60, but only 30 can leave because the combined T1–T2 book needs the rest to support its borrowing.

A T2 withdrawal of 20 changes the suffix values to 60, 10, and 40. The remaining free supply becomes 60, 10, and 10. Each successful exit changes the conditions later users face. A supplier is additionally limited by its claim; a borrower by collateral health. These values are neither individual withdrawal reservations nor guarantees of future availability.

4.3 Reading the transaction diagrams

The following UML sequence diagrams show successful flows and the economically relevant checks. Each core transaction is atomic: if a required check, callback, or token transfer fails, its state changes revert. **TRANSFER** labels identify actual token movements; other arrows are calls, quotations, or bookkeeping. Hook checks shown are the configured optional checks. Full-market accrual includes validation of engine deltas, supplier interest, protocol fee shares, and timestamps.

4.4 ★ Supply

Supply adds a claim to a selected tranche. Anyone can supply on behalf of another account; that does not authorize the supplier to withdraw that account's funds. A supplier chooses assets or shares, with conservative conversion rounding. Supply does not require a collateral-price read.

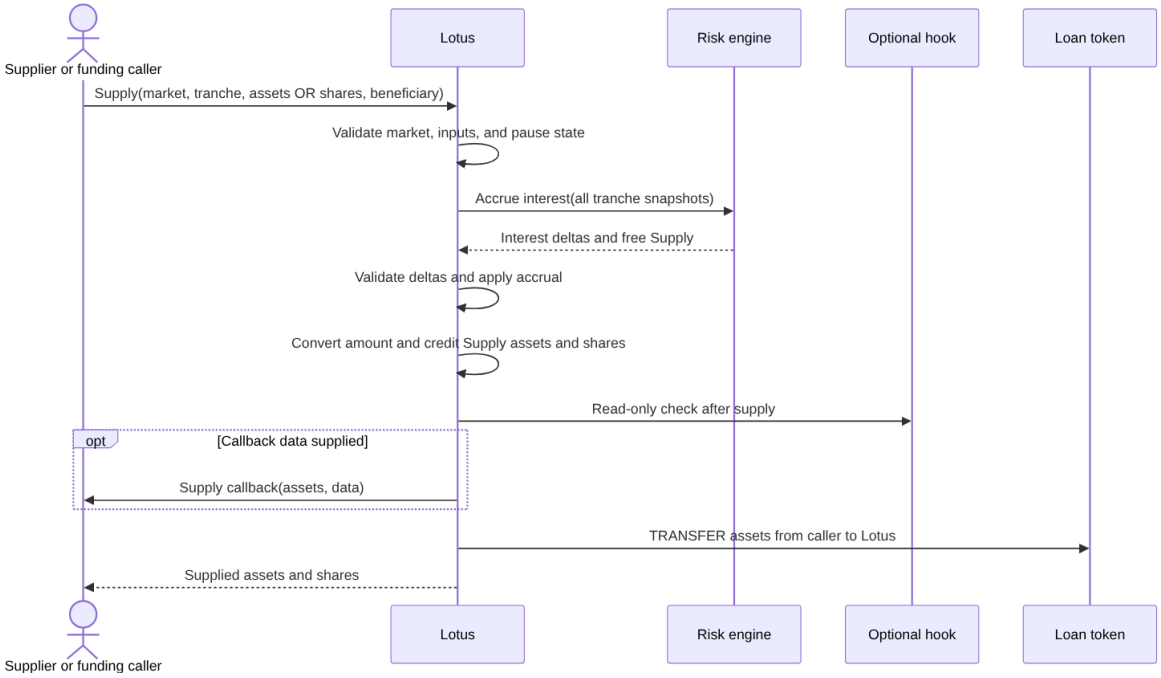


Figure 2 — Direct supply.

4.5 ★ Withdraw

Withdrawal removes the owner's supply claim and transfers loan tokens to a chosen receiver. The caller must be the owner or an authorized delegate. A valuable claim can remain temporarily nonwithdrawable if free supply is insufficient or a hook/pause blocks the operation.

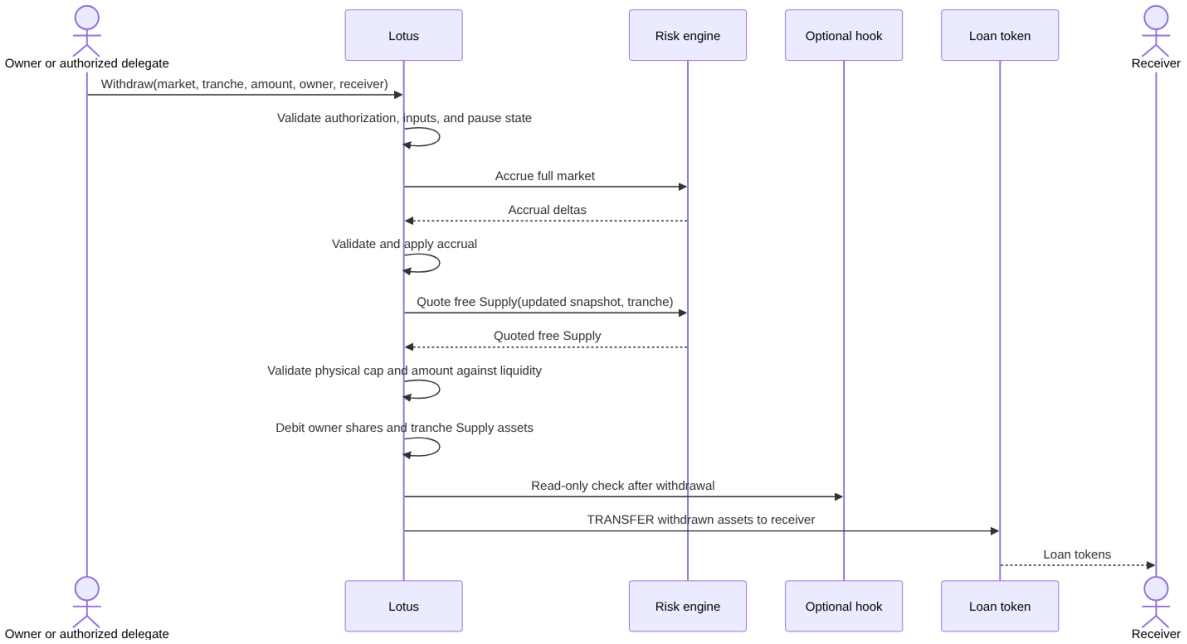


Figure 3 — Direct withdrawal.

4.6 ★ Borrow

Borrowing creates debt in one tranche and must satisfy two limits: available free supply and the borrower's collateral-based borrowing limit. The effective borrowing LLTV is `floor(LLTV × (1 - borrowLtvBuffer))` in WAD arithmetic. Lotus values collateral using the tranche oracle and requires post-borrow debt to fit within that buffered limit. The buffer is a global parameter shared across markets and tranches; liquidation uses the tranche's plain LLTV.

Each borrow updates a share-weighted borrowing timestamp, rounded upward toward the current time. An empty borrowing position starts with the current timestamp; adding debt to an existing position changes its weighted age. This age is used by the repayment cooldown described below.

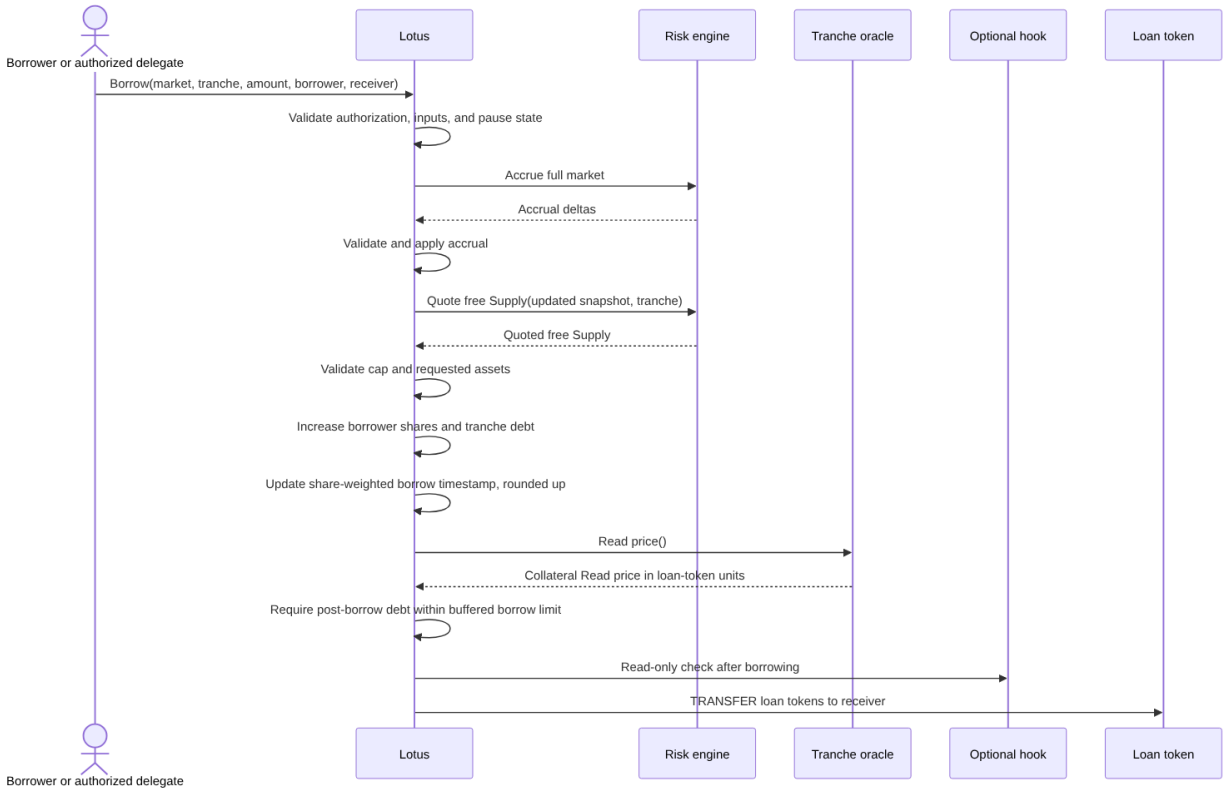


Figure 4 — Borrowing.

4.7 ★ Repay

Repayment reduces debt and restores cash liquidity. Anyone can repay on behalf of a borrower, subject to the applicable pause and repayment cooldown. Repayment accrues the market, converts the specified assets or shares, and rejects zero-repayment shares. It does not require an oracle health check. Repaying all borrow shares is the exact-close route; partial repayments must meet the minimum asset amount.

Realized bad debt arms a cooldown on strictly junior tranches in the same market. The window scales with the loss relative to a configured fraction of supplied assets from the origin through the terminal tranche, up to `MIN_BORROW_DURATION`. A later event can extend an active expiry. While a cooldown is active, repayment requires the borrower's share-weighted age to be at least `MIN_BORROW_DURATION`, or the borrower to be exempt. The check is keyed to the borrower, including when a third party repays, and applies to full and partial repayment.

The owner can clear a tranche's cooldown or administer borrower exemptions, subject to the deployed governance controls. During a cooldown, a young, nonexempt borrower can still add collateral when the market is unpaused, and the configured hook permits it. Ordinary liquidation remains available when debt exceeds the liquidation threshold. A position already old enough satisfies the age check; whether maintaining such a position makes loss-allocation manipulation profitable has not been established by a current reproduction or quantified cost analysis.

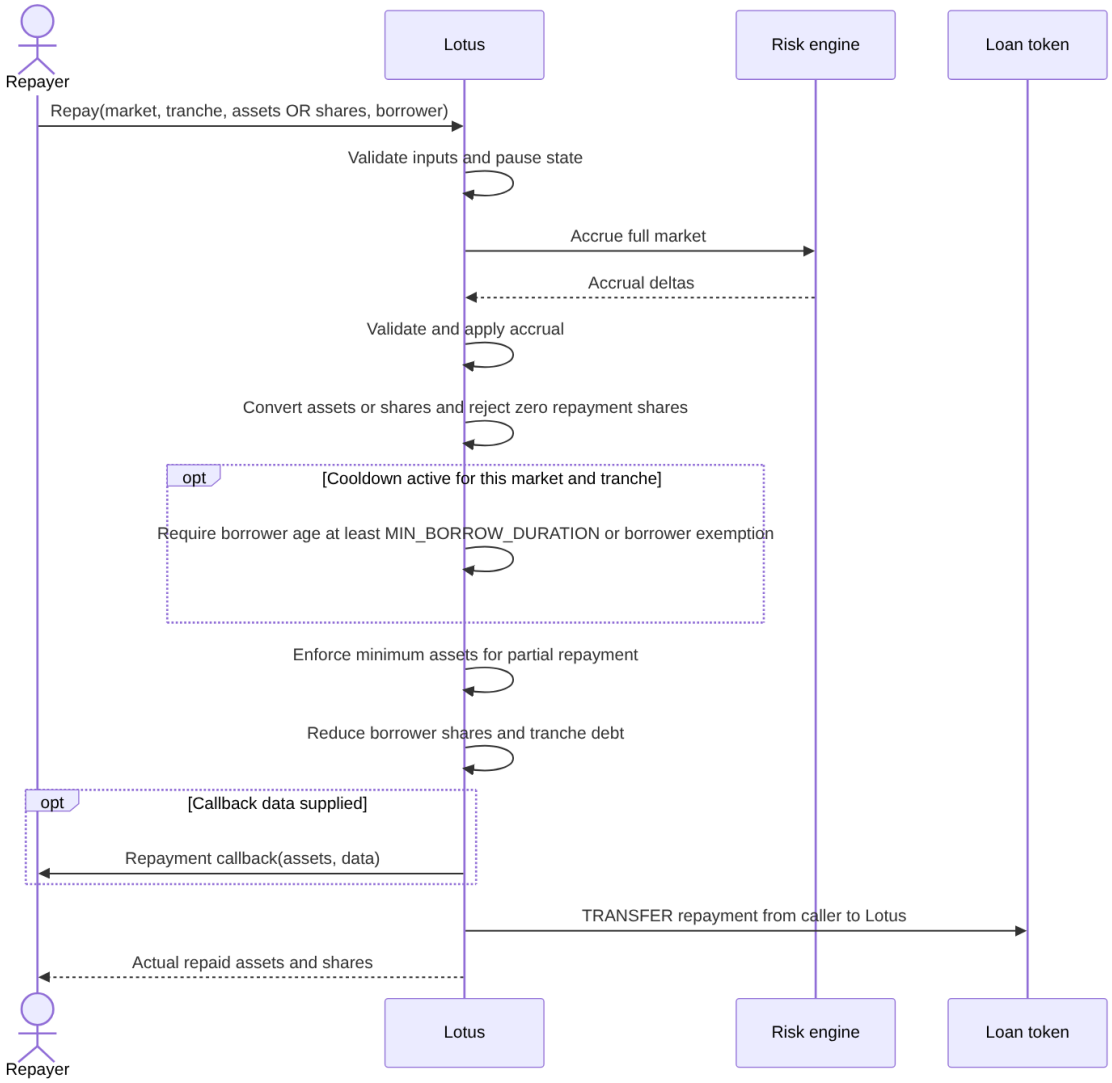


Figure 5 — Repayment.

4.8 ★ Collateral management

Adding collateral increases the borrower’s collateral balance without accruing interest or checking position health in the core entry point. Withdrawing collateral requires owner or delegate authorization, accrues the market, and checks that remaining debt fits within the buffered borrowing limit. When borrow shares are zero, the health check returns successfully without reading the oracle. Both operations are subject to the applicable pause and configured hooks. The repayment cooldown does not directly gate either operation.

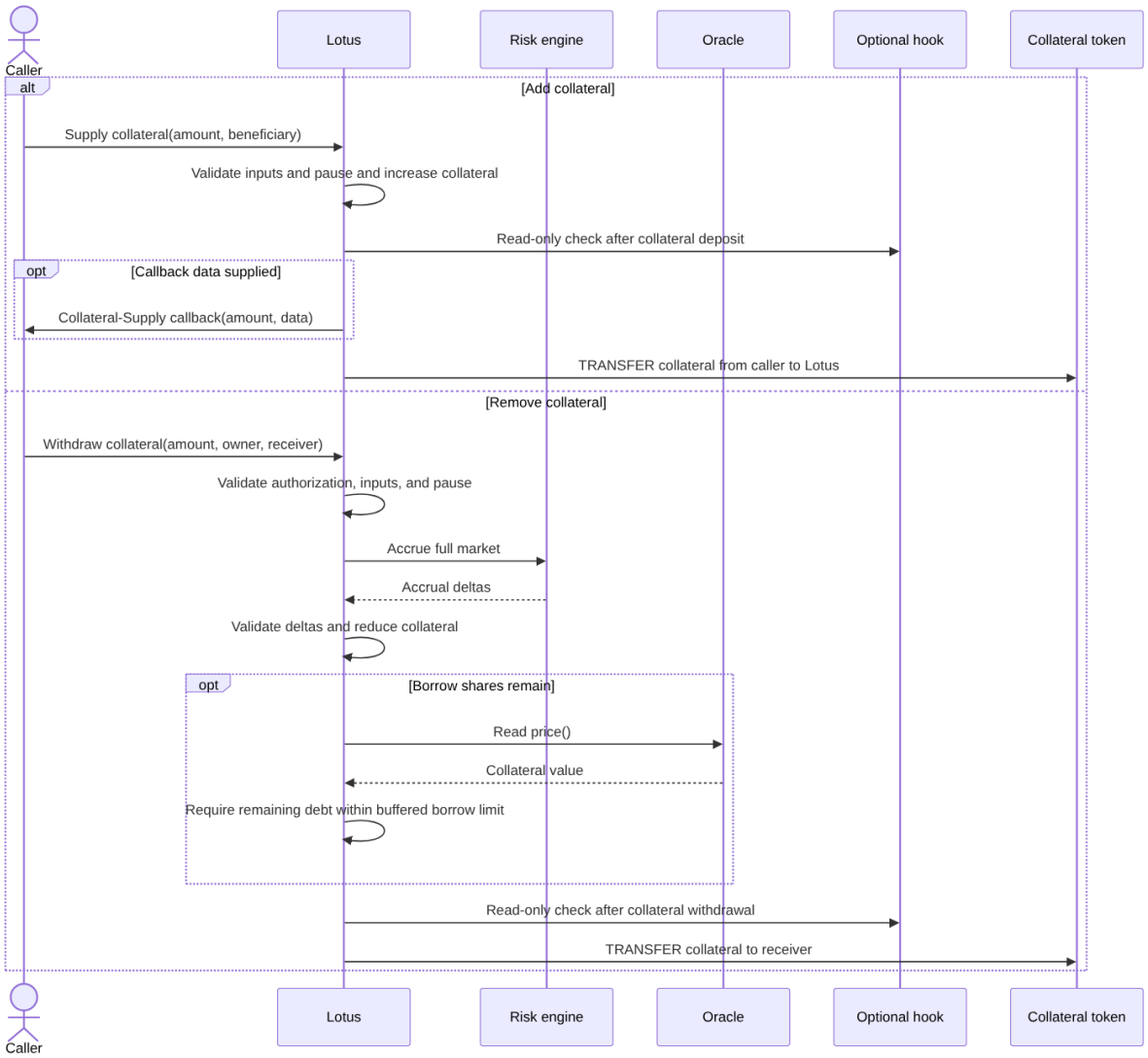


Figure 6 — Collateral supply and withdrawal.

4.9 ★ Shares and rounding

Lotus uses one virtual asset and one million virtual shares in its conversion formulas. For an asset amount a, aggregate assets A, and aggregate shares Q, the idealized share conversion is $a(Q + 10^6)/(A + 1)$, rounded according to the operation. Supply and repayment round asset-specified shares down; withdrawal and borrowing round them up. For share-specified actions, supply and repayment round required assets up, while withdrawal and borrowing round assets delivered down.

These rules conservatively convert individual claims and introduce small rounding costs. Cascade weights determine tranche-level allocations, while supplier shares determine ownership of the resulting assets. Section 5.5 explains the terminal-tranche accounting conditions relevant to that distinction.

Economic assessment. Free supply makes the direction of sharing enforceable on ordinary borrowing and withdrawal paths. It does not promise a fixed exit date, equal treatment of concurrent withdrawal intentions, or preservation of every backing relationship after an arbitrary loss allocation. Those are different properties and are assessed separately.

5 The interest and loss cascade

Relevant to: LPs · Due diligence; borrower interest charges also concern Borrowers

5.1 How borrower interest reaches suppliers

Interest enters the cascade at the borrower's tranche. The engine allocates part to that tranche's suppliers and passes the remainder toward more junior tranches. Each subsequent tranche adds its own borrower interest before taking its allocation. Senior suppliers do not receive interest from borrowers junior to them.

This structure aligns the direction of eligible income with eligible credit exposure. A broad-exposure supplier can earn from several borrower origins; a narrow-exposure supplier depends on demand in a smaller set. Broader eligibility does not guarantee a higher realized APY because rates, utilization, allocation weights, fees, and supplier balances all affect the result.

5.2 ★ Allocation weights and live funding

The bundled engines use live supplied and borrowed asset balances from the tranche snapshot passed by Lotus. Interest accrual uses the snapshot before the triggering operation changes supply or debt; bad-debt allocation uses the snapshot after the exhausted borrower's remaining debt has been removed, before supplier balances are reduced.

Let `S_i` and `B_i` denote supplied and borrowed assets in that snapshot. Strictly junior net supply is:

```
J_i = max(0, sum(S_k for k > i) - sum(B_k for k > i))
```

For a nonterminal tranche, the allocation weight is:

```
w_i = S_i / (S_i + J_i)
```

The implementation rounds this ratio upward in WAD fixed-point arithmetic and caps it at one. A zero denominator gives weight zero. The terminal tranche is an exception: its weight is always one, even if its supply is zero. Interest accrual, allocation previews, and bad-debt distribution use this same weight calculation.

Strictly junior net supply measures junior capital available to back more senior borrowing. It includes both idle funding capacity and capital already supporting senior loans. Changes in live supply or borrowing are reflected in the next allocation snapshot.

For borrower interest `I_i` and incoming carry `C_(i-1)`, the supplier allocation is `Y_i = floor((I_i + C_(i-1)) × w_i)` and outgoing carry is `C_i = I_i + C_(i-1) - Y_i`. Rounding is to loan-token base units. The terminal weight consumes all remaining interest; this rule alone does not establish that supplier shares exist to receive it.

5.3 ★ Worked interest and loss examples

Using the recurring example's live balances, strictly junior net supply is 30 for T0 and 60 for T1. The weights are `w_0 = 100/(100+30) = 10/13`, `w_1 = 100/(100+60) = 5/8`, and `w_2 = 1`.

If borrower interest over an illustrative interval is 10, 8, and 4 units respectively, the distribution before fees is:

Tranche	Own borrower interest	Incoming carry	Supplier allocation	Outgoing carry
T0	10.0000	0.0000	7.6923	2.3077
T1	8.0000	2.3077	6.4423	3.8654
T2	4.0000	3.8654	7.8654	0.0000
Total	22.0000	—	22.0000	—

These figures are rounded to four decimal places; contract arithmetic uses upward-rounded WAD weights and downward-rounded allocations. The interval amounts illustrate allocation, not quoted annual rates. A tranche fee is taken from its supply interest by minting shares to the fee recipient; it dilutes other claims rather than immediately withdrawing cash.

For a separate 26-unit bad debt originating in T0, retain the recurring example's supply balances and junior borrowing. Removing the defaulted T0 debt does not change either strictly junior net supply used above. The single allocation pass assigns approximately 20 to T0, 3.75 to T1, and 2.25 to T2, subject to base-unit rounding. Each allocation fits within its tranche's live supply. The loss is conserved and never moves above its origin. This demonstrates sharing rather than a junior-first attachment structure.

5.4 How loss capacity is reconciled

Bad debt is recognized after liquidation exhausts collateral while leaving debt. Lotus removes that remaining debt, arms the applicable repayment cooldown on strictly junior tranches, and requests supply reductions from the risk engine. The bundled engine computes live weights once from the supplied snapshot and makes a single pass from the origin toward the most junior tranche. At each step, it allocates the downward-rounded weighted remainder, capped by that tranche's live supplied assets, and passes the unallocated loss onward.

If any loss remains after the eligible tranches have been visited, the engine reverts with `UnsocializableBadDebt`; the entire liquidation reverts. For returned reductions, Lotus checks array length, prohibits losses above the origin, bounds each reduction by live supply, and requires the total to equal the bad debt. Reductions cut supply assets without burning supplier shares.

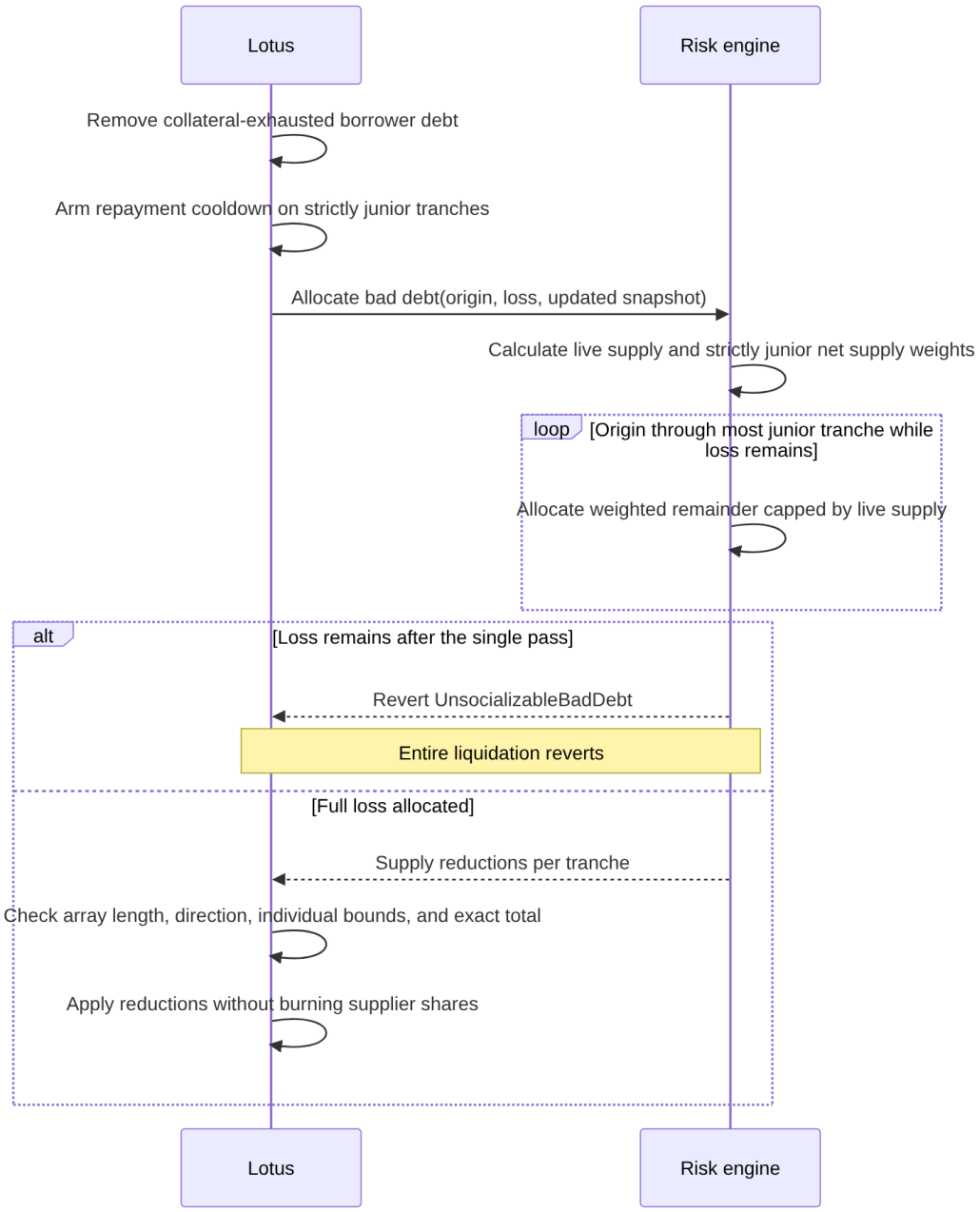


Figure 7 — Loss allocation and core verification using live weights and a single allocation pass. The bundled engine is shown; enabled custom engines remain subject to the core's checks.

Junior borrowing changes loss sharing even when gross junior deposits stay constant. Consider two tranches with equal 100-unit supplies and a 60-unit senior-origin loss. If junior borrowing is zero, strictly junior net supply is 100, the senior weight is one half, and the loss is shared 30/30. If junior borrowing instead equals junior supply, strictly junior net supply is zero, the senior weight is one, and the entire loss falls on the senior tranche. These results follow from the supply and borrowing balances

in the allocation snapshot. The supplier is choosing state-dependent sharing rather than a fixed amount of junior first-loss protection.

> **LP consideration:** Gross junior deposits, strictly junior net supply, and withdrawable liquidity are different quantities. Current junior borrowing can reduce the capital backing senior loans and change the loss split. The live-weight formula does not itself establish whether changing that split is economically profitable; that requires assessing transaction constraints, the repayment cooldown, and the cost of maintaining the borrowing position.

5.5 ★ How changing capital affects allocation

Supply, borrowing, and supplier-share ownership determine how capital changes affect income and loss exposure. The engine calculates allocation weights from the snapshot for each operation, while supplier shares determine claims on the resulting tranche assets. The following considerations distinguish allocation, ownership, and the backing of outstanding loans.

5.5.1 Interest after a complete withdrawal

A nonterminal tranche with zero supplied assets has allocation weight zero and passes incoming interest onward. The terminal tranche has weight one regardless of its supplied assets or supplier-share count. If interest reaches it, the engine assigns the entire remainder to that tranche, and Lotus increases its accounted supply assets.

Allocation does not itself check for an existing supplier claimant. If the terminal tranche has zero supplier shares and its fee is zero, crediting interest increases supply assets without minting supplier shares. With a nonzero fee, accrual can mint shares to the fee recipient, so the resulting ownership must be assessed together with fee configuration. Subsequent deposits are priced against the tranche's accounted assets using the protocol's virtual-share conversion rules.

These are conditional accounting outcomes. Establishing that an emptied terminal tranche can receive a positive remainder also requires a reachable market state that produces that remainder under the live-weight cascade; the unconditional terminal weight alone does not demonstrate such a state.

LP consideration: Interest allocation and supplier ownership are separate accounting steps. Assess the terminal tranche's supply assets, outstanding shares, fee setting, and possible incoming carry together when determining who can claim credited income.

5.5.2 Allocation after a substantial partial withdrawal

A withdrawal accrues interest before reducing the supplier's shares and tranche assets. Accrued income is therefore included in the claim being withdrawn. Later allocations use the resulting live balances. For a nonterminal tranche with positive strictly junior net supply, reducing its own supply reduces its allocation weight if the junior balances remain unchanged. When strictly junior net supply is zero, a positive own supply gives weight one. The terminal tranche always has weight one.

Remaining shareholders retain claims on their tranche's assets, including subsequent supplier interest, subject to virtual-share arithmetic and dilution from protocol fee shares. A small remaining supplier base can have a high interest return relative to its capital if the cascade directs substantial interest to that tranche. Assessing that outcome requires the actual borrower interest, junior net supply, and remaining claims. Any credited interest also increases the capital exposed to later losses.

LP consideration: Project supplier yield from the balances and claims that will remain after withdrawal, together with borrower demand and fees. A high return over a short interval does not establish a sustainable yield or a fixed amount of funding support.

5.5.3 Outstanding debt after a substantial loss

The bundled engine splits a loss between a tranche's supplied assets and the strictly junior net supply available to support it. In exact arithmetic, for own supply `S`, junior net supply `J`, and incoming loss `D`, the amount passed onward is `D × J / (S + J)`. The implementation rounds the own-tranche weight upward and its loss allocation downward, with a cap at that tranche's supplied assets.

When cumulative supplied assets cover cumulative borrowing at every tranche boundary before the loss, this split bounds the loss passed below each boundary by the junior net backing available there. Removing the defaulted debt and applying the corresponding supply reductions therefore preserves backing for remaining loans under the bundled allocation policy. Junior supply can be exhausted where the corresponding remaining junior borrowing is also zero. The formula operates on accounted loan-token assets; it does not establish collateral quality or external asset redeemability.

For example, take two tranches with supplies of 100 each, junior borrowing of 80, and a 60-unit senior-origin loss. Junior net supply is 20, so the senior weight is `100/120 = 5/6`. The allocations are approximately 50 to senior suppliers and 10 to junior suppliers. Junior supply falls to 90 against 80 of outstanding junior debt, leaving 10 of junior net backing, subject to base-unit rounding.

The core independently checks loss direction, per-tranche supply bounds, and the exact total reduction. It delegates the allocation split to the enabled risk engine. The backing property described here depends on the bundled formula and initially valid cumulative backing; an enabled custom engine must be assessed against that property separately. The bundled engine reverts the entire liquidation with `UnsocializableBadDebt` if its allocation pass leaves a remainder.

> **LP consideration:** Realized bad debt reduces supplier claim value. Evaluate remaining debt against cumulative supply at each tranche boundary, the enabled engine's allocation policy, and external asset liquidity. Preserved accounting backing does not guarantee immediately withdrawable cash or successful liquidation execution during market stress.

Economic assessment. Live funding balances determine each tranche's share of interest and losses, while share ownership determines claims on allocated assets. The bundled loss split links junior loss exposure to available junior net backing. An allocation decision should assess these relationships together with borrower demand, fees, withdrawal constraints, collateral quality, and external settlement dependencies.

6 Interest rates and market configuration

Relevant to: Borrowers · LPs · Due diligence

6.1 Borrowing cost and supplier compensation

Each tranche has a borrow rate determined by its engine and configuration. Supplier yield is a different quantity: allocated interest divided by the supplier asset base, after fees. A borrower should compare executable rates and collateral requirements across suitable tranches. An LP should compare received income against all eligible borrower exposures and exit constraints.

The bundled engines share the cascade and free-supply logic. Choosing a different rate model does not remove those common allocation characteristics.

Engine family	Rate behavior	What needs assessment
Fixed rate	Operator-configured rate per tranche	Whether fixed pricing remains suitable as demand and collateral conditions change
Managed linear kink	Rate responds to utilization on an operator-set curve	Target utilization, slopes, discontinuities permitted at the kink, and cross-tranche pricing
Adaptive linear kink	Rate-at-target adjusts from observed utilization within configured bounds	Adaptation speed, gates, bounds, and behavior under stress
Monotonic managed or adaptive	Uses a running maximum of local utilization ratios	Utilization ordering is enforced; rate ordering still depends on each curve

6.2 ★ Utilization and the rate ladder

For the ordinary bundled model, let $G_i = \sum_{k \geq i} S_k$. Utilization is $u_i = 1 - F_i/G_i$, with zero returned when $G_i = 0$. In the recurring example, utilizations are approximately 73.33%, 85%, and 70%. Directional liquidity constraints do not, by themselves, produce monotonic utilization.

The monotonic variants instead calculate a local suffix utilization and carry forward the largest value seen from senior to junior. For example, local utilizations are approximately 73.33%, 85%, and 40%, producing effective utilizations of 73.33%, 85%, and 85%. This changes pricing inputs, not the underlying physical free-supply ceiling.

Managed curves have the form:

$$r_i(u) = \{r_{i,base} + m_{i,1}u,\ u \leq u_i^*,\ r_i^* + m_{i,2}(u - u_i^*),\ u > u_i^*.$$

Rates are capped at the protocol maximum. Each curve can increase smoothly or jump upward at its kink. Higher tranche indices do not, by themselves, guarantee higher borrowing rates or higher collateral risk; actual borrowing terms and exposure determine the economic comparison.

Borrower and LP consideration: Increasing utilization inputs do not, by themselves, guarantee higher rates across tranches with different pricing curves. A rate comparison at one utilization level may change as demand moves through the curves. Borrower pricing also does not directly establish the ordering of supplier yields, which depend on funded borrowing, the interest cascade, and fees.

6.3 ★ Adaptive behavior

The adaptive engine accumulates utilization over time and adjusts the rate at target when its grace period, minimum update interval, and interaction threshold permit. It normalizes deviation from target utilization, applies an adjustment speed, caps each update relative to the existing target rate, and clamps the result within configured minimum and maximum values. Operator changes accrue the old period before changing rate-affecting parameters.

This provides bounded responsiveness to persistent demand. It does not set a rate that clears every market state or exactly compensates for collateral risk. Pausing adaptation freezes adjustment, while a Lotus pause has the separate accrual effects discussed in Section 10.

Borrower and LP consideration: An initially ordered set of rates is not a standing promise that the same ordering will persist through adaptation or permitted parameter changes. The applicable pricing policy determines that protection; automatic adjustment alone does not.

6.4 ★ Borrower incentives under recursive borrowing

A useful diagnostic considers a borrower repeatedly converting borrowed funds into yield-bearing collateral. With collateral yield y, effective operating LTV l, and borrowing rate $r(l)$, a frictionless, constant-price, simple-rate approximation gives:

$$ROE(l) = \frac{y - r(l)l}{1 - l}.$$

The effective operating LTV is the borrower's chosen leverage, not necessarily the maximum LLTV. If target return on equity is k, the indifference rate is $r(l) = k - (k - y)/l$. For $k > y$, this component rises and is concave. **A linearly spaced LLTV ladder therefore does not imply that linearly spaced rates create equivalent borrowing opportunities.**

For illustration, $y = 10\%$, $l = 50\%$, and $r = 1\%$ imply 19% simple-model ROE; $l = 90\%$ and $r = 5\%$ imply 55%. These are not return forecasts: they exclude compounding differences, liquidation risk, slippage, basis movements, fees, and utilization feedback. Their purpose is to reveal why borrowers may concentrate in one tranche even when headline rates increase with LLTV.

Economic assessment. Rate flexibility allows differentiated borrowing opportunities within shared funding. Borrower choices affect utilization and rates, while the interest cascade affects supplier returns. The resulting balance of demand and funding depends on those interactions, rather than the visual spacing of headline rates alone.

7 Liquidation and pre-liquidation

Relevant to: Borrowers · LPs · Due diligence

7.1 Borrower health

Lotus applies a borrowing limit and a liquidation threshold to each independent tranche position. Debt is converted from borrow shares with upward rounding; collateral value and the permitted debt limit use downward rounding.

```
Effective borrowing LLTV = floor(LLTV × (1 - borrowLtvBuffer))
Borrowing limit          = collateral oracle value × effective borrowing LLTV
Liquidation threshold    = collateral oracle value × LLTV
```

The multiplication and rounding are implemented in WAD and loan-token base units. Borrowing and collateral withdrawal must leave debt within the borrowing limit. Ordinary liquidation requires debt to exceed the liquidation threshold. A position between the two limits cannot borrow more or withdraw collateral, but can add collateral or repay subject to the applicable pause, hook, and cooldown checks. Equality at the liquidation threshold does not permit ordinary liquidation.

For initial actual LTV `a` and liquidation LLTV `l`, a proportional collateral-price decline greater than approximately `1 - a/l` makes the position liquidatable, holding debt and the loan asset's value constant. Interest accrual can also move a position across the threshold. The borrowing buffer provides initial distance from that threshold; price gaps can cross it immediately. The trigger calculation is not a supplier loss estimate: realized loss also depends on liquidation incentives, oracle timing, market depth, and execution.

7.2 Liquidation pricing

The oracle-incentive module applies a configured factor to collateral value. If a liquidator repays R loan units and the incentive factor is f, its collateral entitlement is approximately Rf/P, where P is collateral value in loan units. The health-discount module instead derives a discount factor from position health, subject to a maximum discount. The liquidator receives approximately $R/(dP)$ collateral units for discount factor d.

Both modules support specifying either collateral to seize or debt shares to repay. Core bounds prevent exceeding the borrower's shares or collateral. Module configuration additionally bounds incentives relative to LLTV: $f \leq 1/LLTV$, or maximum discount $\leq 1 - LLTV$, alongside global bounds. These restrictions constrain incentives near the liquidation boundary; they do not assure execution during a price gap.

Liquidation can be partial. A permitted partial close need not restore health, and further liquidation may still be necessary. Once collateral is exhausted, Section 5's loss cascade processes the remaining debt.

7.3 ★ Ordinary liquidation sequence

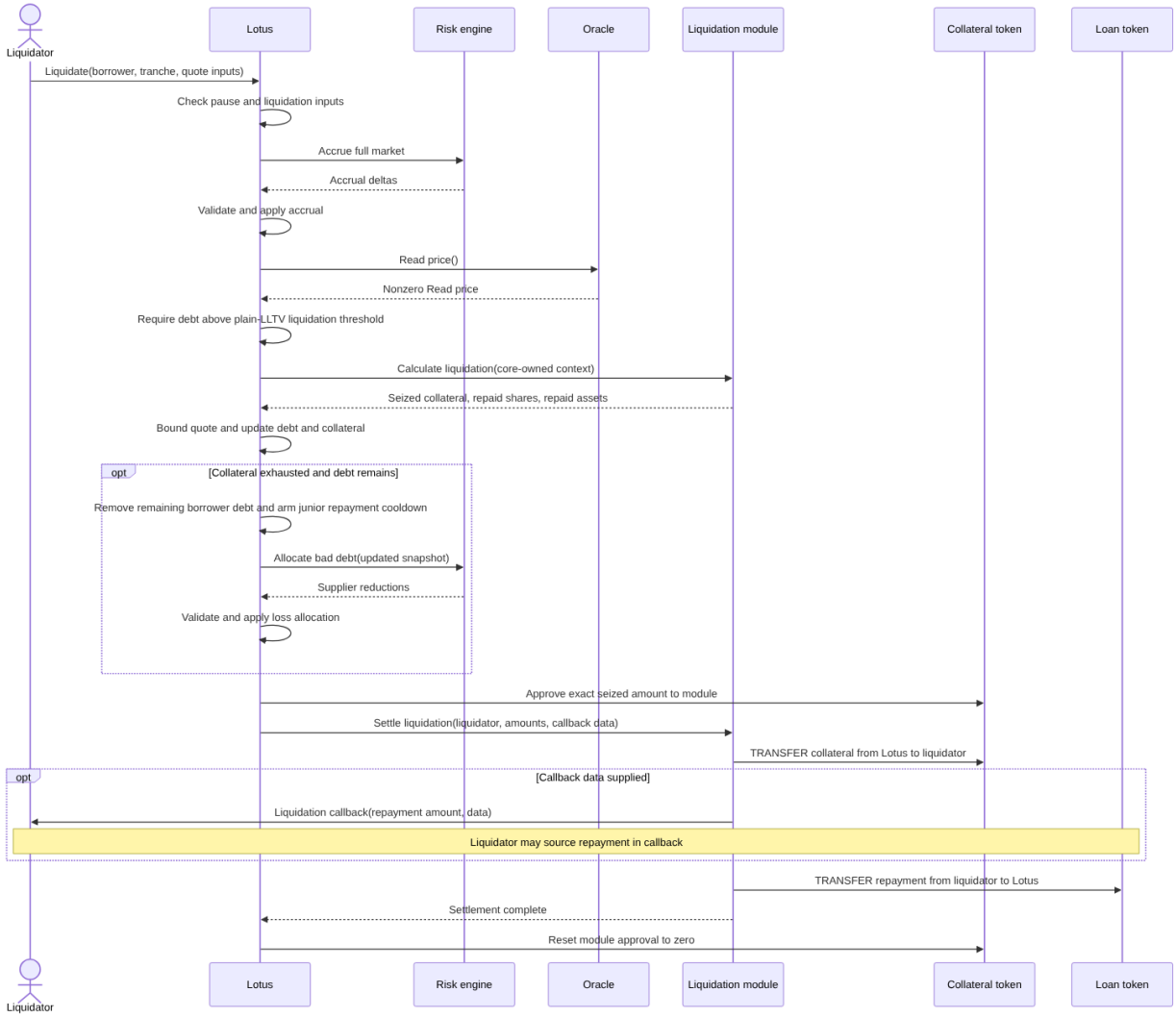


Figure 8 — Liquidation quotation, accounting, and settlement. The bundled settlement implementation is shown. Core trusts the enabled module to collect repayment; it does not independently verify the final loan-token balance increase.

The module's settlement authority is economically significant. The standard settlement process collects the required tokens, but an enabled replacement or upgrade must preserve that behavior. This dependency is stronger than the risk engine's bounded numerical quotation role.

7.4 Optional pre-liquidation

A borrower can authorize a dedicated helper to reduce a position within a configured band: actual LTV must be above the helper's pre-LLTV and at or below the market's plain LLTV. The helper interpolates the incentive and nominal maximum close factor between configured endpoints within this band.

When debt exceeds the buffered borrowing limit, the helper raises the permitted repayment-share ceiling when necessary to allow repayment sufficient for the remaining position to clear that limit after collateral seizure. The ceiling is capped at the borrower's full debt shares and can exceed the interpolated nominal close factor. This widens the permitted repayment size; it does not automatically increase the caller's requested repayment. A smaller request can still revert when the callback attempts collateral withdrawal, and the remaining position fails Lotus's buffered health check.

Pre-liquidation uses Lotus's repayment function and inherits its pause, minimum partial-repayment, and borrower-age cooldown checks. Authorization does not grant a cooldown exemption. A young, nonexempt position in a tranche with an active cooldown cannot use this path, including for full repayment. Ordinary liquidation uses its separate eligibility and settlement path.

The helper caches the tranche oracle and queries the oracle-incentive module during construction and execution to bound the early incentive by the current ordinary incentive. Its compatibility is specific to that module interface. A reduction in the ordinary incentive can make configured pre-liquidation terms ineligible. Successful early deleveraging also depends on borrower authorization, executable prices, liquidator funding, and callback settlement; price gaps can skip the eligible band.

7.5 ★ Pre-liquidation sequence and authorization

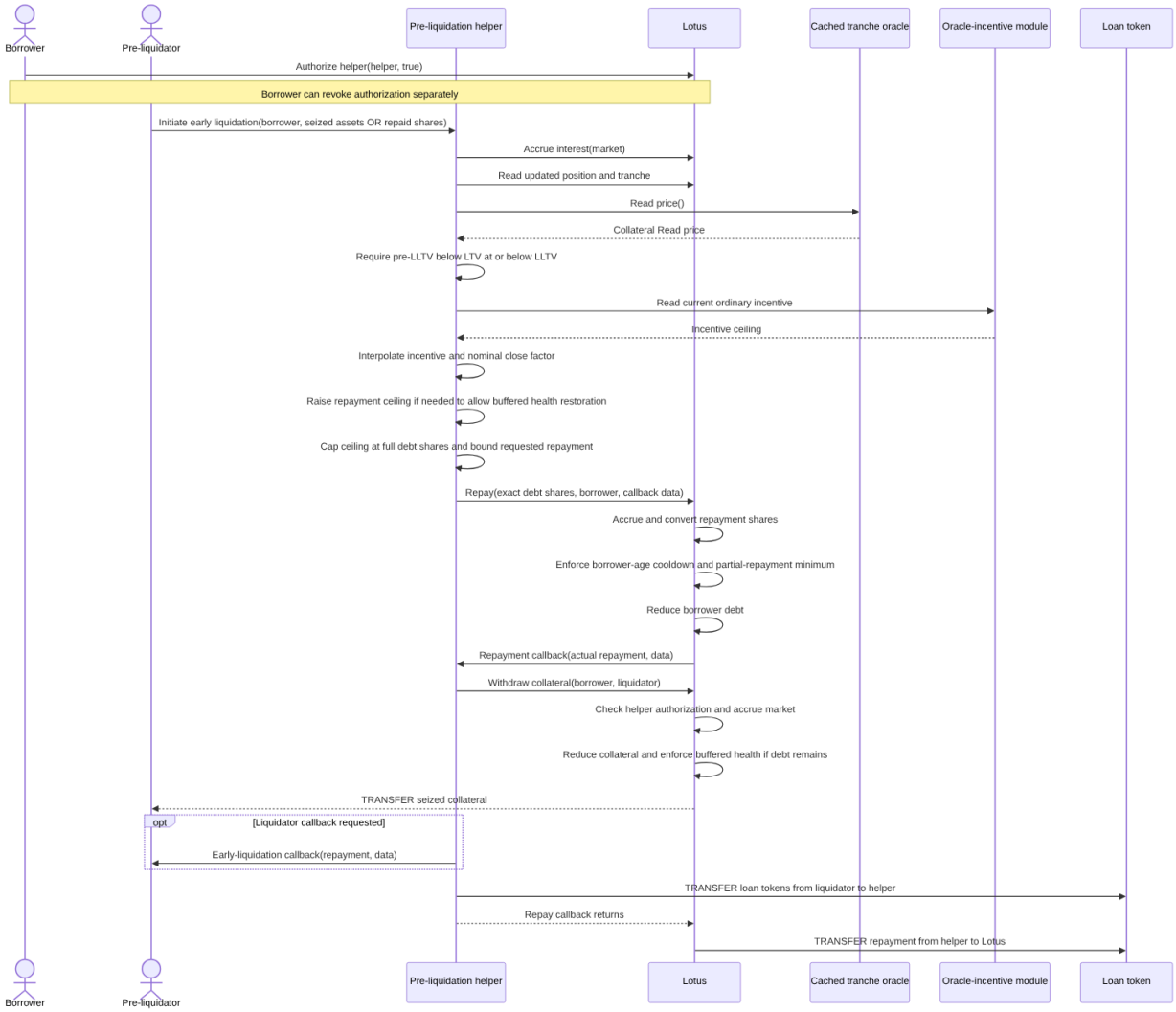


Figure 9 — Borrower opt-in and early repayment. Opt-in is a separate transaction. Lotus authorization is account-wide delegation to that helper address; the helper's immutable market/tranche and checks constrain how this implementation uses it.

Economic assessment. Pre-liquidation provides an authorized route for early deleveraging within its eligibility band. Its usable repayment size depends on the buffered health requirement, and its availability depends on the repayment cooldown as well as pause and authorization checks. Assess borrower protections using these conditions together with collateral buffers, executable prices, and liquidator capacity.

8 Vaults and allocation management

Relevant to: LPs · Due diligence; wrapped loan-asset flows also concern Borrowers

8.1 Direct positions and delegated portfolios

A direct supplier selects a market and tranche. A vault depositor instead owns shares in a portfolio whose allocation is managed under the vault's roles and limits. The vault can hold idle assets, Lotus positions through an adapter, and downstream vault positions through another adapter. The depositor delegates position selection and liquidity management in return for a consolidated claim.

Lotus uses an external vault framework to manage deposits and route assets through adapters. The following sequences describe the allocation and settlement model. A particular vault's fees, permissions, and share-valuation rules also affect the result and must be assessed as part of its product configuration.

8.2 ★ Deposit and mint

Deposit specifies assets; mint specifies desired vault shares. Assets enter the parent vault and can remain idle or be routed through its configured liquidity adapter. Automatic routing is policy selected by an allocator, not a venue selection supplied arbitrarily by each depositor.

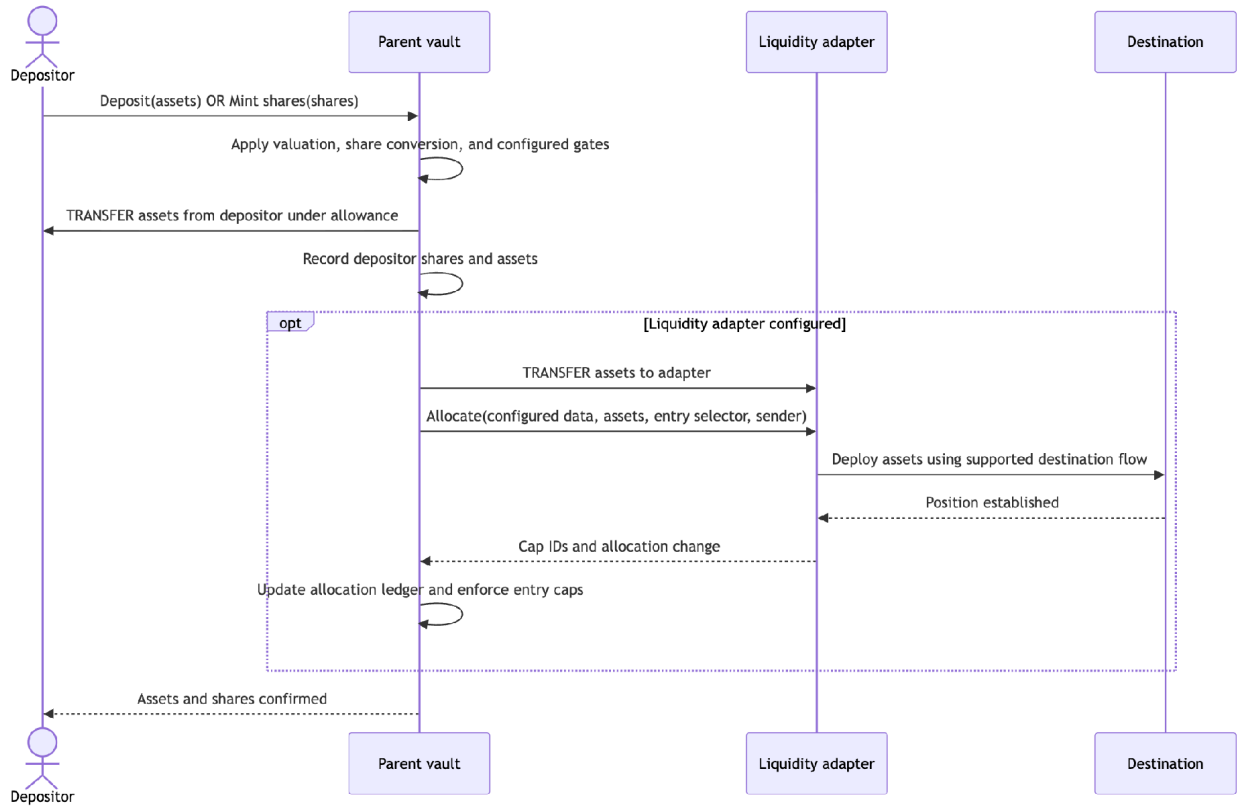


Figure 10 — Vault entry and automatic allocation. Vault pricing/checks are grouped; the adapter transfer precedes the adapter allocation call.

If routing cannot complete, the entry transaction reverts rather than partially investing. Caps can therefore limit deposits and discretionary rebalances. A vault with no active liquidity adapter needs a separate allocator action to invest its idle assets.

8.3 ★ Withdrawal and redemption

Withdraw specifies underlying assets; redeem specifies shares. The vault uses idle assets first. If there is a shortfall, its liquidity adapter must return the missing assets through its supported deallocation path. A share-price quotation does not establish that this step can complete.

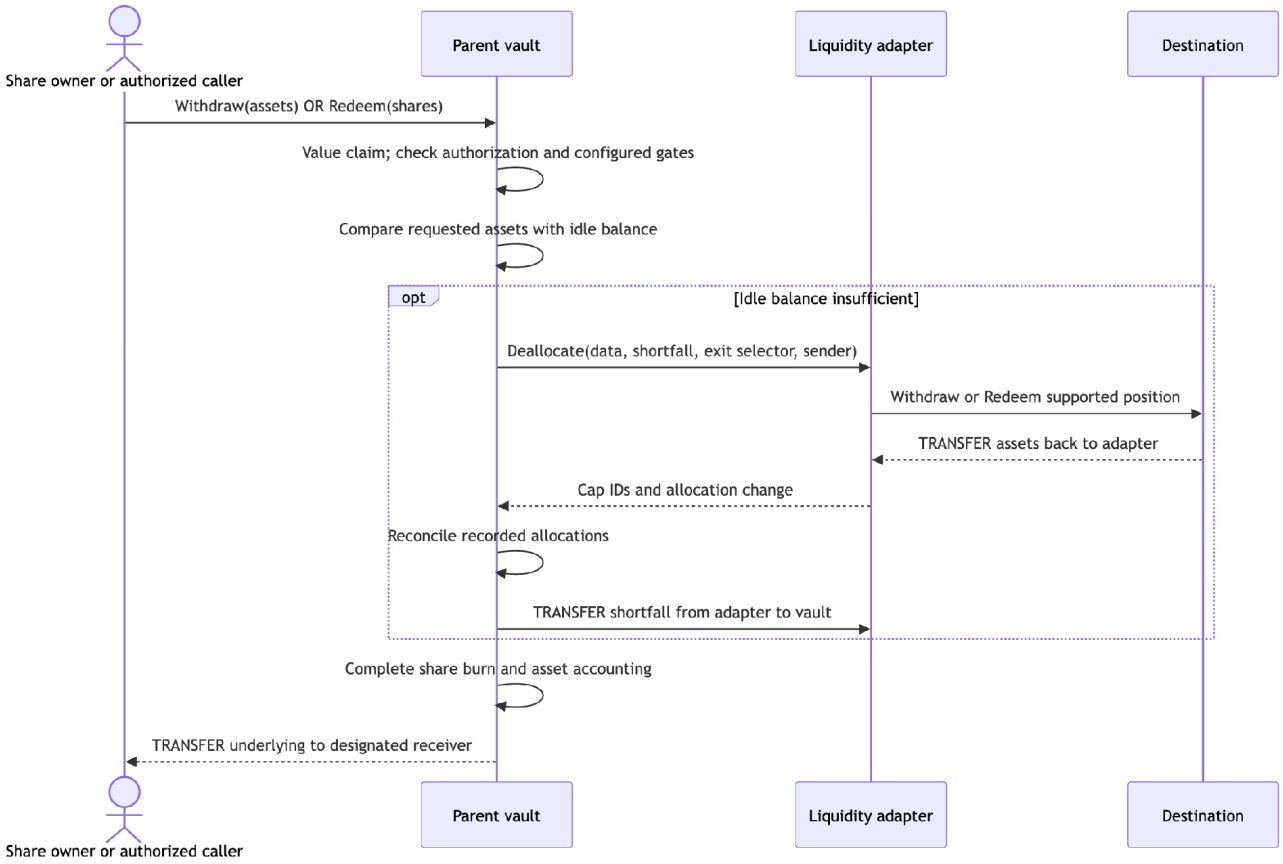


Figure 11 — Vault exit using idle funds and an adapter.

8.4 ★ Allocation and rebalancing

Rebalancing combines withdrawing from one destination and allocating to another, potentially within one transaction. Allocators can move assets within the allowed destinations and caps; a sentinel's deallocation authority does not by itself authorize new allocations.

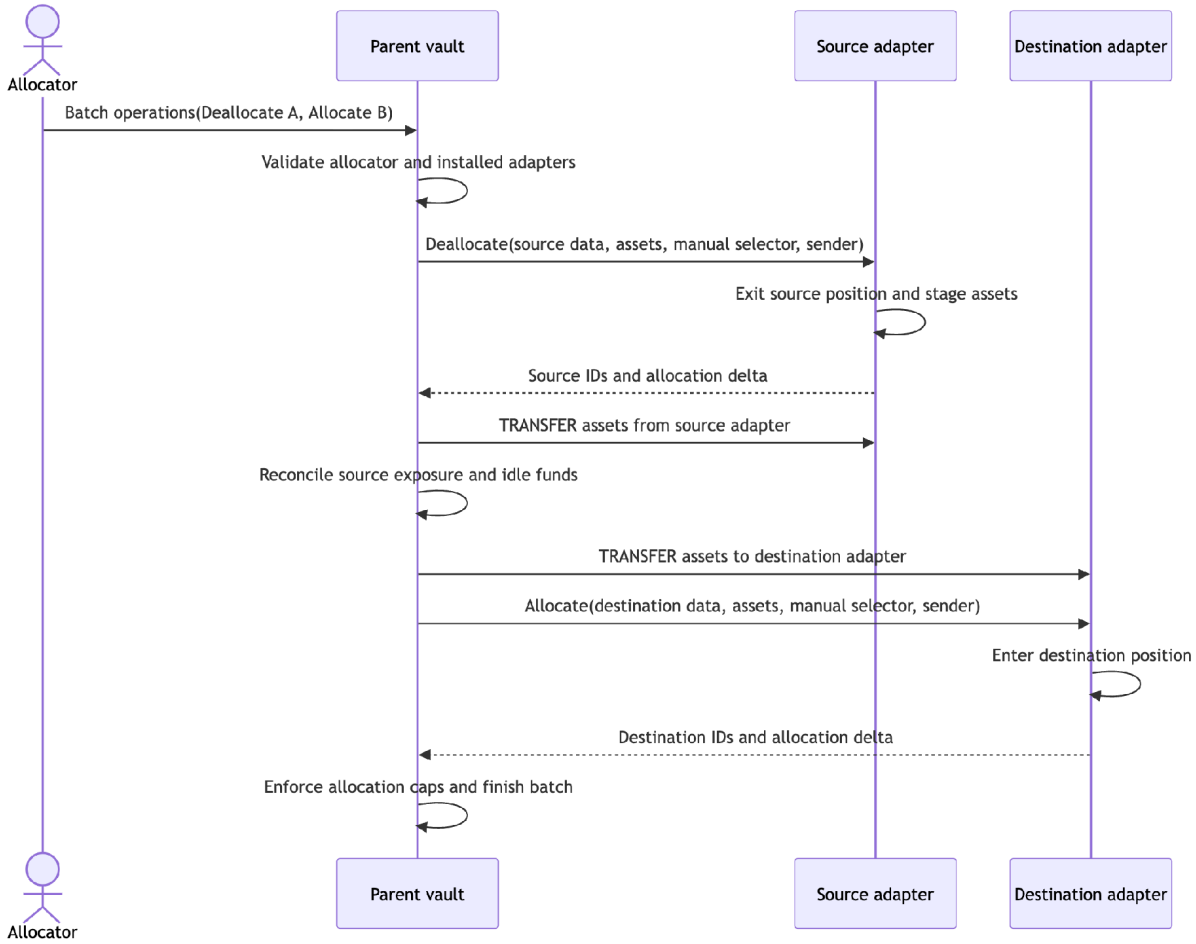


Figure 12 — Rebalance through vault idle assets.

This can be atomic for synchronous positions. If the source is an asynchronous fund holding, initiating redemption and subsequently investing the cash are different transactions separated by settlement. Until then, the portfolio retains a pending claim rather than usable rebalance proceeds.

8.5 ★ Lotus adapter mechanics

The Lotus adapter is bound to one parent vault. Manual operations name one market/tranche position. Automatic inflows use the first position in the configured liquidity array. Automatic outflows search that array, then tracked positions, for one position with enough estimated withdrawable value to satisfy the entire shortfall. They do not combine several smaller positions in one callback.

Thus, two positions each offering 30 units do not necessarily satisfy a single automatic shortfall of 50. An allocator may first stage liquidity into the parent vault through multiple deallocations, if each

underlying exit is available. Search estimates also do not guarantee execution through an external wrapper: a live redeem can still fail.

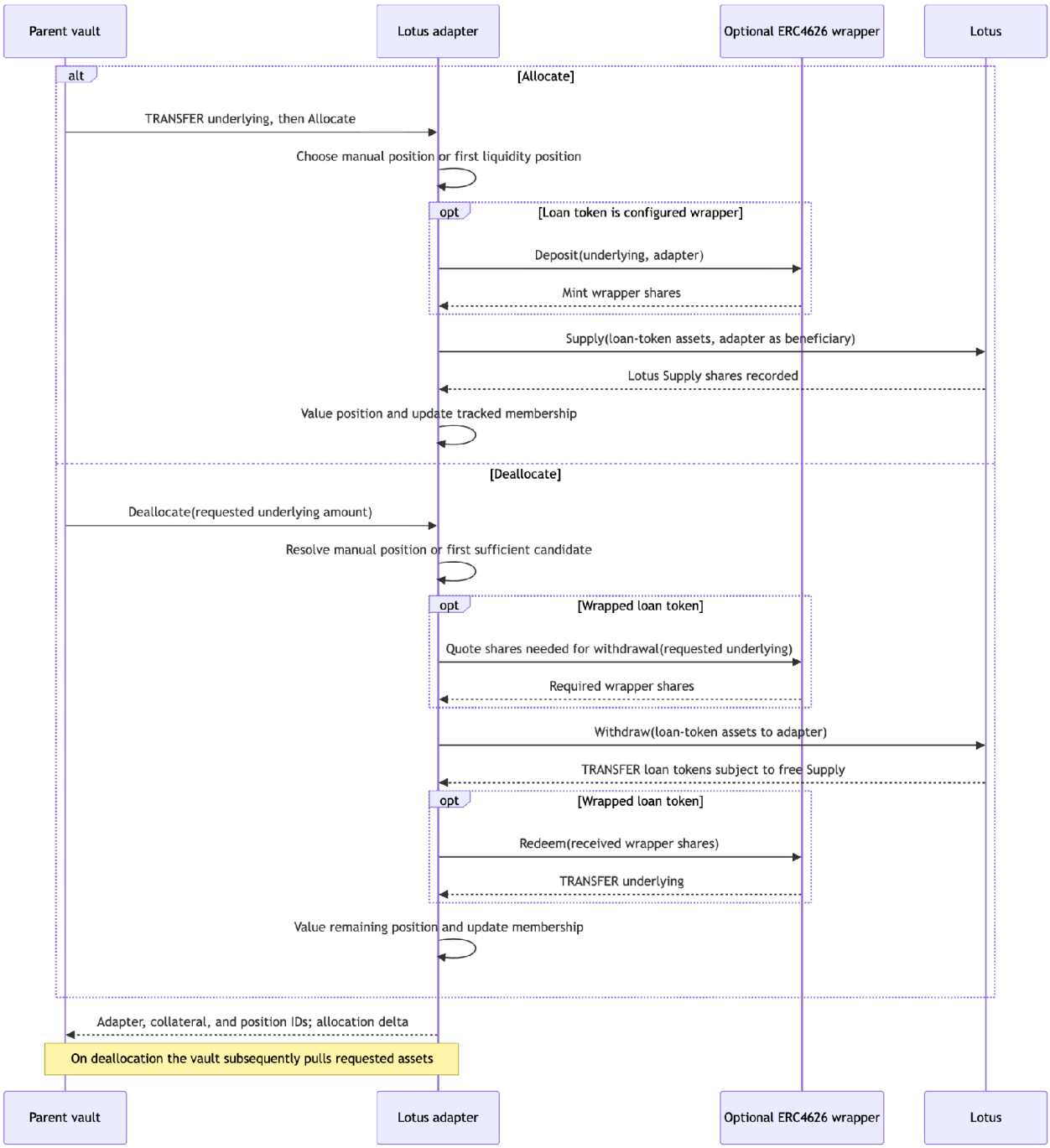


Figure 13 — Lotus adapter allocation and withdrawal.

Automatic outflows skip untracked priority entries and select one tracked position sufficient for the request. Configured liquidity entries require operational validation: malformed data can block vault

entry or exit. The tracked position list has no onchain size bound, and valuation work grows with its length.

The adapter returns three cap identifiers: adapter-wide, collateral-token, and market/tranche position. Its delta reconciles the new position value against the parent vault's recorded allocation, bringing interest into that ledger. The reported asset value sums estimated claim value across tracked positions, including accrued-interest previews and wrapper conversion when relevant.

Collateral IDs are useful allocation controls, but a position's own collateral label does not describe every senior borrower origin it can fund. Aggregating true economic collateral exposure requires looking through the cascade. A cap on vault allocations is also not a global cap on all direct Lotus supply.

8.6 ★ Vault-to-vault allocation

The vault-to-vault adapter deposits the parent asset into downstream ERC4626 positions with the same underlying asset. It reports value by converting held child shares to assets and tracks adapter-wide and child-position cap IDs. It rejects the parent itself as a child and protects active child share tokens from skimming.

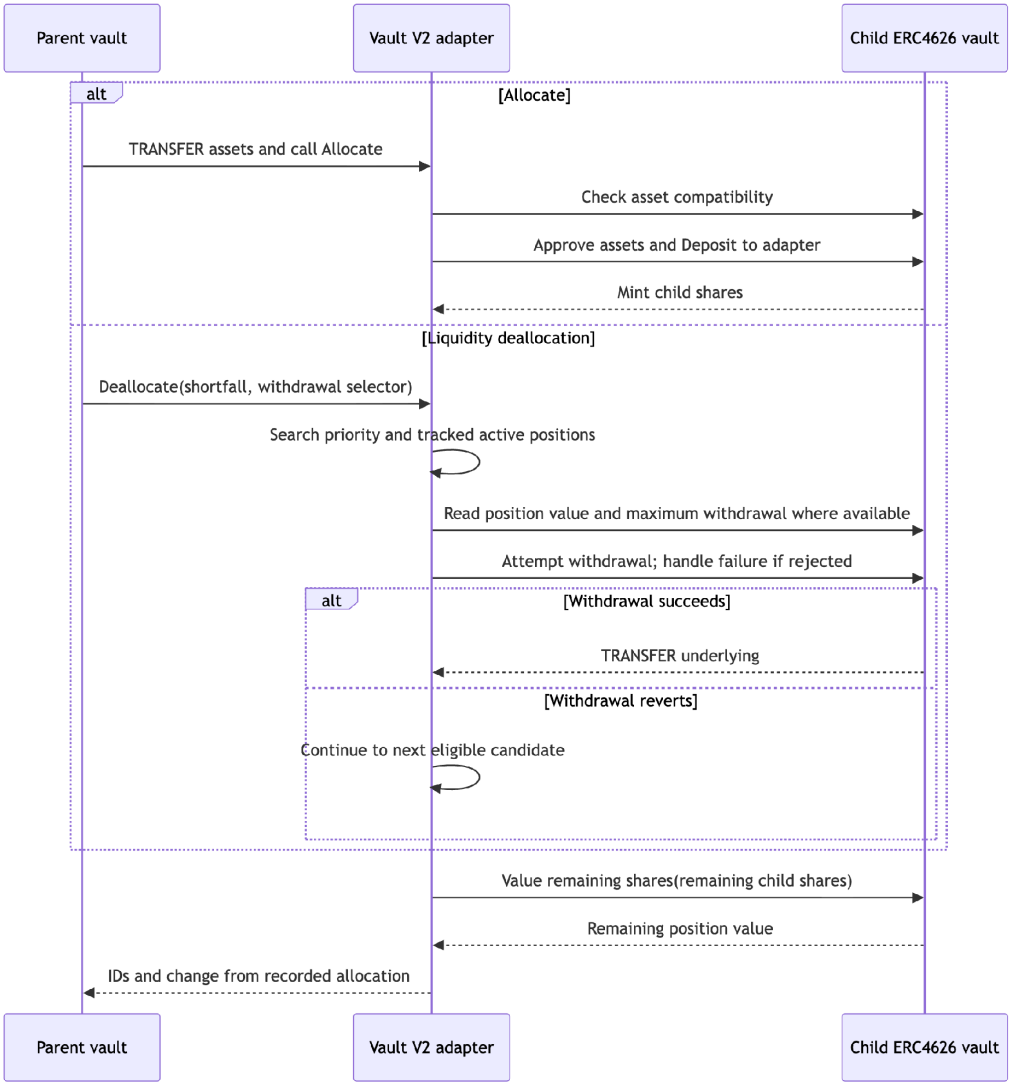


Figure 14 — Downstream vault entry and exit.

A zero or unavailable maximum-withdrawal quotation is treated as inconclusive, because the targeted Vault V2 behavior can deliberately underestimate availability. The adapter then relies on attempting the withdrawal. Manual deallocation directly attempts the specified active position. Recursive investment adds the child vault's governance, valuation, and liquidity conditions; the ERC4626 interface does not eliminate them.

8.7 ★ Forced deallocation

Forced deallocation moves exposure to parent-vault idle assets and may charge a configured penalty to the account on whose behalf it is performed. It does not transfer the withdrawn principal to the force-deallocator. Support is adapter-specific. Lotus and vault-to-vault adapters support this operation; the reviewed WisdomTree and Coinbase adapters reject it.

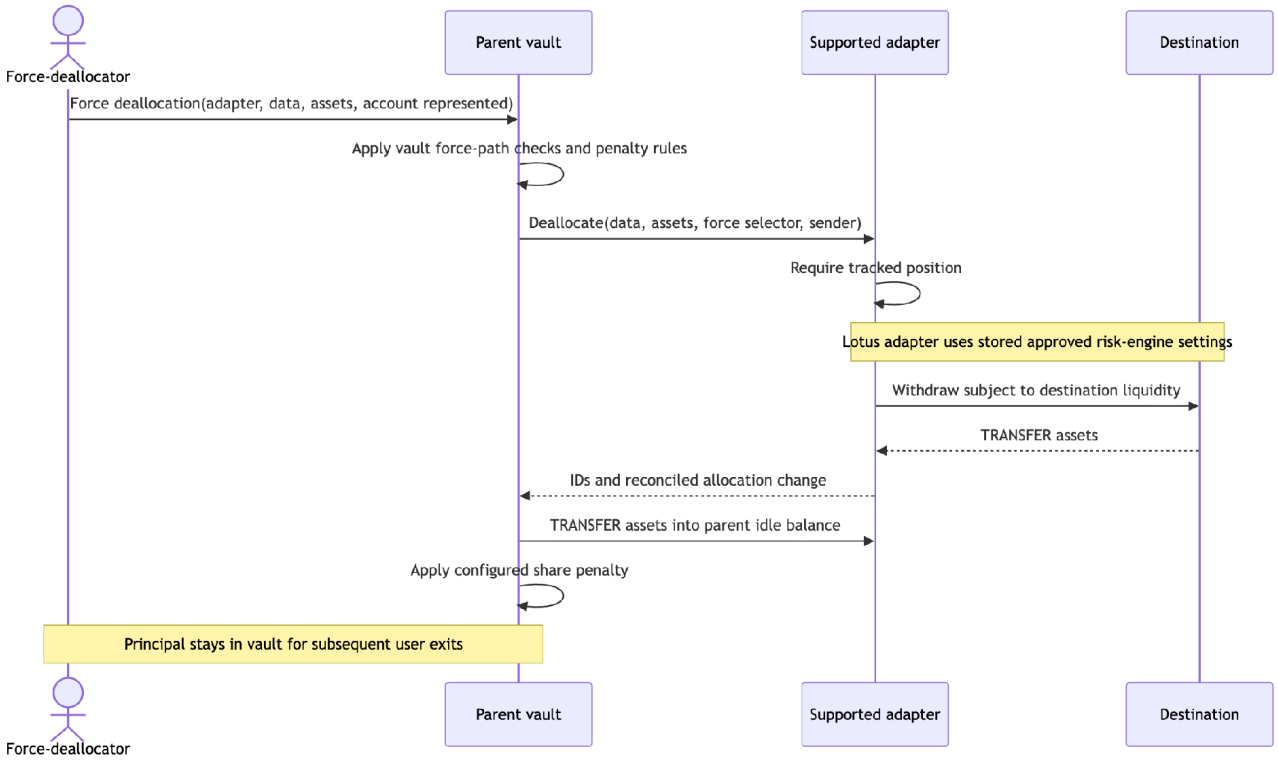


Figure 15 — Supported forced deallocation.

Permissionless invocation is not permissionless access to otherwise locked capital. Lotus free supply, wrapper liquidity, child-vault restrictions, and the parent penalty rules continue to apply.

8.8 ★ ERC4626 bundler routes

The ERC4626 transaction adapter is a transaction convenience layer, distinct from a vault portfolio adapter. Only its configured Bundler3 can invoke action entry points. Borrow and withdrawal routes act for the bundler initiator and require the appropriate Lotus authorization. Supply and repay can name an on-behalf account. End-to-end slippage limits compare underlying tokens with Lotus position shares.

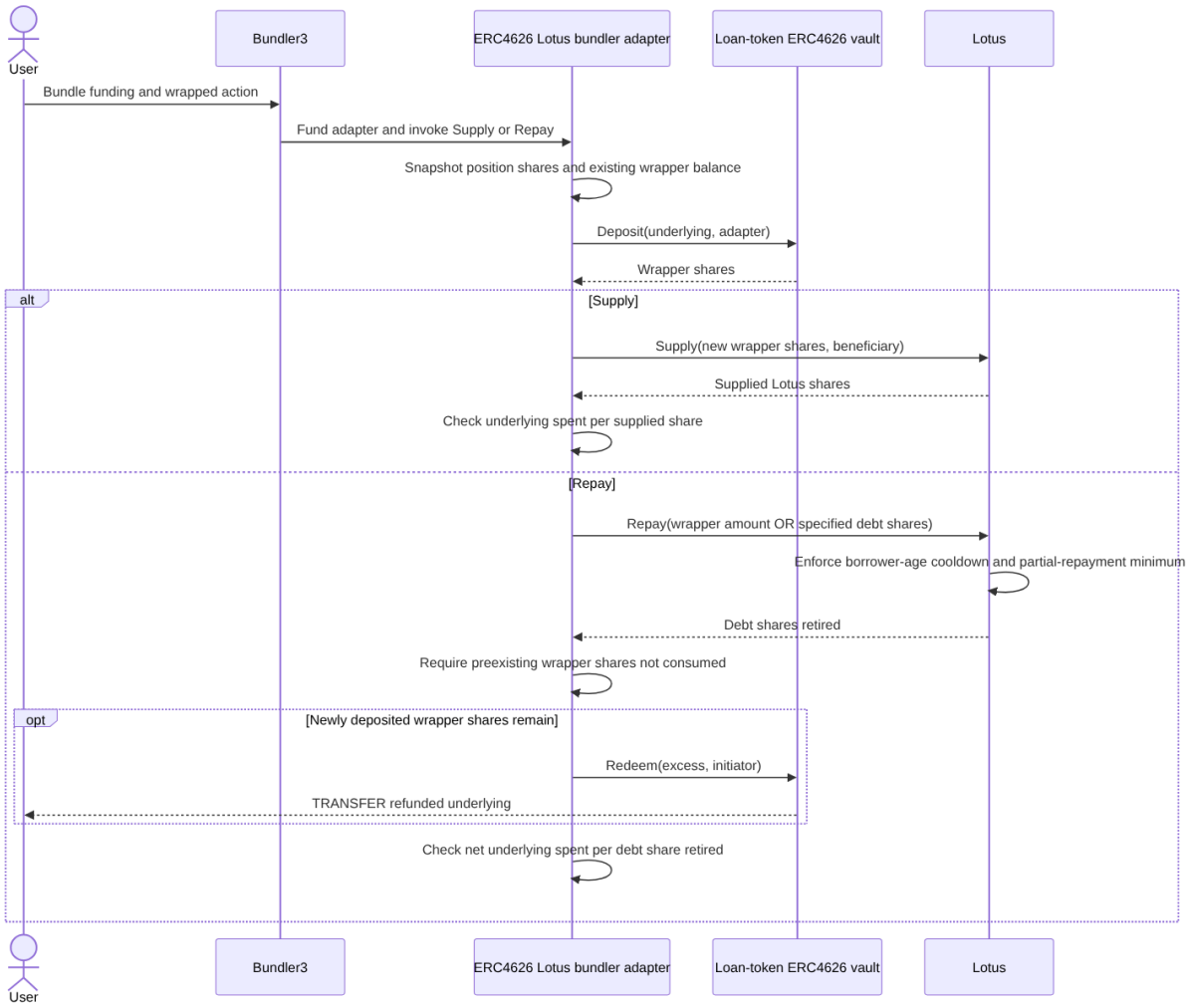


Figure 16 — Wrapped supply and repayment.

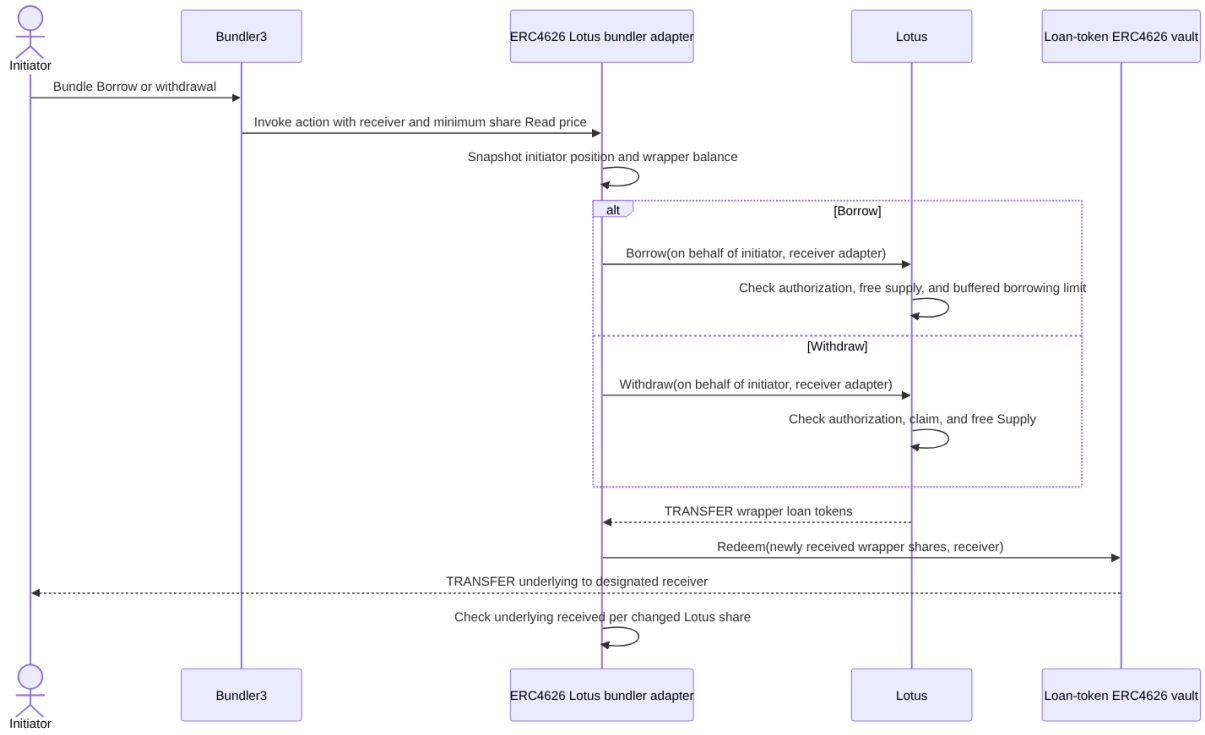


Figure 17 — Wrapped borrow and withdrawal. Borrow/withdraw asset inputs are Lotus loan-token units; proceeds are converted to underlying before the end-to-end slippage check.

8.9 Valuation and capital limits

The Lotus adapter's live value includes expected interest; productive adapters separately distinguish booked exposure from released income. Parent-vault share pricing may apply its own recognition and fee rules. These layers should be reconciled rather than assuming every reported asset-value increase immediately becomes a withdrawable increase in the parent share price.

The factory deploys a parent vault with Lotus and vault-to-vault adapters, registers and installs them, sets roles, and pins the adapter registry by abdicating the registry-change function. Caps are deliberately left to the curator. This establishes a deployment pattern, not evidence that a particular market has suitable exposure limits or withdrawal buffers.

Economic assessment. Vaults translate the lending primitive into a managed product. They can make diversification and limits operationally convenient, but do not remove the underlying exposure or create liquidity. A product's deposit policy, idle buffer, routing, caps, and operator authority deserve the same attention as its headline yield.

9 Productive assets and external integrations

Relevant to: LPs · Due diligence; Borrowers using productive-debt loan assets

9.1 What productive debt changes

A productive-debt vault share can serve as the Lotus loan token. Its reserve portfolio may generate income independently of Lotus borrowers. Loan-token holders participate in that reserve value, while Lotus supply positions can additionally earn borrower interest denominated in the share. The planned integration context includes wstETH and cbBTC collateral markets funded with productive-debt vault shares markets on Ethereum and Arbitrum; this assessment did not establish finalized production addresses.

For illustration, if one loan share grows in underlying value by 4% over a year and debt measured in shares grows by 3%, the underlying replacement cost grows by $1.04 \times 1.03 - 1 = 7.12\%$, before transaction costs. These assumed rates are not product quotations. A supplier's combined result must similarly account for reserve value, received Lotus interest, both layers' fees, and any losses without double counting income.

A reserve impairment can reduce supplier value even if every Lotus borrower repays its share-denominated debt. It may also change borrower health through the collateral/share oracle. A reserve liquidity interruption can impair a liquidator's ability to obtain or redeem the loan asset. These effects make reserve integration relevant to the entire market, not only to the reserve vault's direct depositors.

If a borrower redeems borrowed loan shares for underlying cash, that redemption removes backing from the reserve vault. The economic model must not count that same cash as both deployed with the borrower and still earning income in the reserve. Remaining shares follow the reserve's exchange rate, and the borrower's obligation to replace shares transmits that exchange-rate change into its repayment cost.

9.2 ★★ Common accounting model

Both productive adapters book only eligible observed inflows, using unique identifiers and role-restricted settlement functions. New reward value can be released gradually through a configured

drip. This prevents an unreceived reward estimate from immediately increasing reported assets. It does not turn an offchain claim into onchain cash before settlement.

The adapters distinguish locally observable custody loss from pending external claims. Their views account for observed shortfalls before an operator reconciles the corresponding counters. Unreleased reward value absorbs such a loss first, so later deficit booking should not deduct the same loss twice. A market-price change is a separate valuation event.

Let V be booked exposure at the relevant price, L an observable custody shortfall, and D unreleased drip. The shared intuition is recognized value $max(0, V - max(L, D))$. For WisdomTree, constructing V and L requires separate cash, settled-share, and pending-request calculations; this compact expression does not imply all pending claims are observable.

The active drip snapshots its start and duration. Adding a reward blends the carry's remaining duration with the new reward's interval by value. Changing the configured interval does not retroactively reset an already running cycle. Drip smooths recognition; it is neither insurance nor an unconditional distribution entitlement for an exiting depositor.

9.3 ★★ WisdomTree economic structure

WTGXX is a share in the WisdomTree Treasury Money Market Digital Fund. Its stated objective includes income, liquidity, capital preservation, and a stable $1 NAV. That objective is not a guarantee against loss. Fund description

The reviewed prospectus limits normal investments to cash, Treasuries with at most 93 days remaining maturity, overnight Treasury-collateralized repo, and registered government money market funds. It lists annual operating expenses of 0.25%. Its transfer framework relies on permissioned wallets and transfer-agent registration; a peer-to-peer blockchain transfer is not legally effective until registered. These are material distinctions between observing a token and establishing the associated legal holding. WisdomTree prospectus

The portfolio may suit a reserve strategy seeking short-duration income, provided its settlement and control model matches the product's liquidity commitments. The principal integration question is broader than Treasury credit quality: cash availability, fund-share transferability, operational reconciliation, and token administration must remain functional as a unit.

WisdomTree's institutional 24/7 service introduces dealer-provided liquidity against its own inventory or capital. It can extend access beyond ordinary fund dealing hours, but does not imply unlimited continuous primary fund redemption. A Lotus allocation must distinguish access to a secondary dealer from completion of its own configured create/redeem process. [WisdomTree 24/7 service]

9.4 ★★ Creation and redemption through the adapter

The WisdomTree integration concerns **WTGXX**, the fund share described above. The selected fund token and settlement destinations determine the exposure. Allocation and deallocation are manual paths: the adapter rejects deposit/mint and withdraw/redeem liquidity callbacks as well as forced deallocation. After settlement, an allocator or sentinel must deallocate recognized claimable cash to restore parent-vault liquidity. Depositor exits therefore depend on operator and allocator availability as well as external settlement.

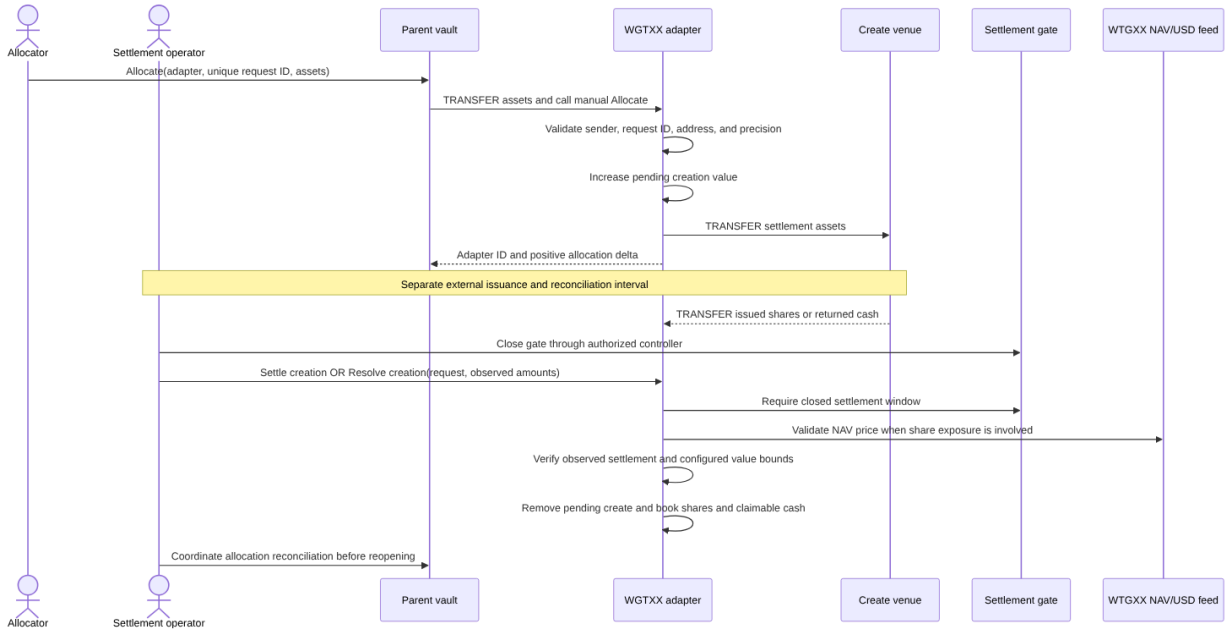


Figure 18 — WisdomTree create request and later settlement. The external venue arrow represents an operational process, not a callback atomically guaranteed by Lotus.

Pending creates are carried at the assets sent. The adapter cannot continuously observe losses at the remote create destination. A failed or impaired request requires a loss-resolution operation; the absence of a local custody deficit does not prove the pending claim's recoverability.

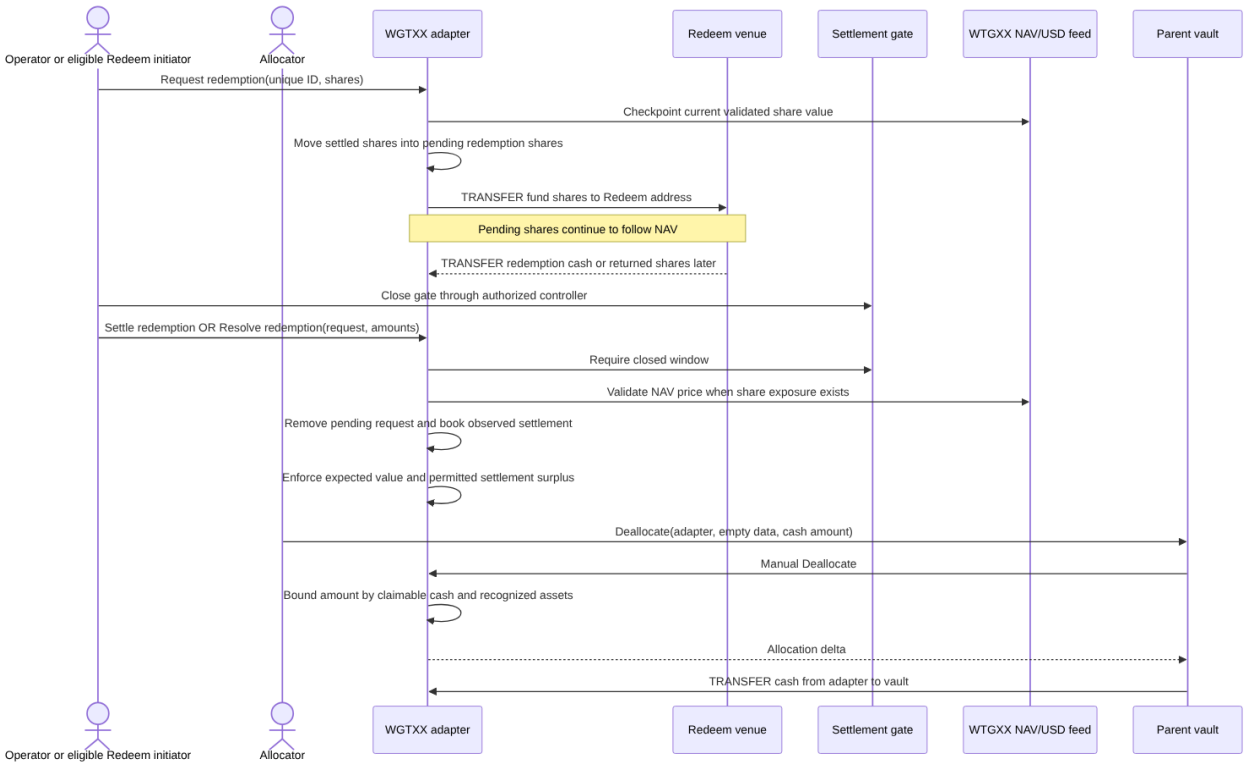


Figure 19 — WisdomTree redemption and cash withdrawal.

Successful request settlement enforces expected value, applicable create-settlement rounding tolerance, and the configured maximum surplus. Accepted surplus is added to the dividend drip. Owner-authorized create/redeem loss resolutions run through parent-vault zero-asset deallocation so the write-down and allocation reconciliation occur together. A request may settle with shares, cash, or both. Generic dividends cannot be booked while requests remain pending because fungible arrivals do not identify which request they satisfy.

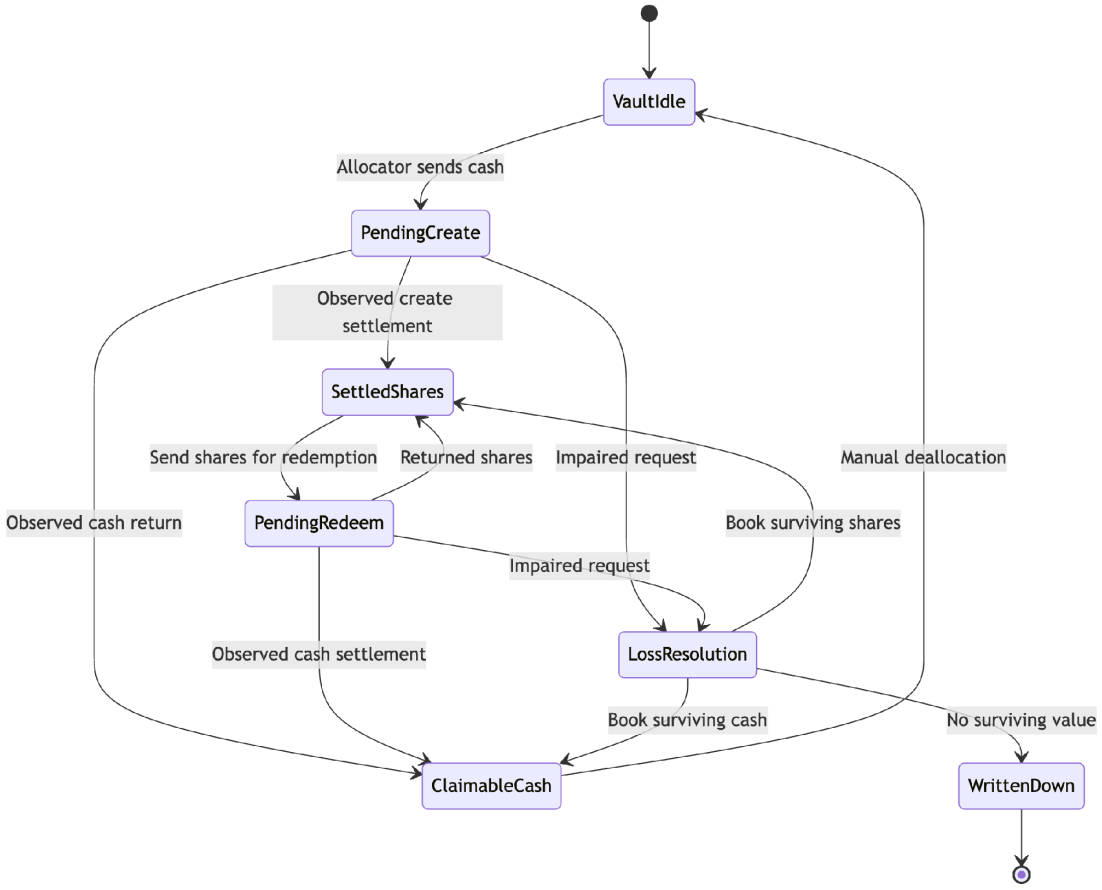


Figure 20 — WisdomTree economic state transitions. Multiple requests can coexist; the diagram represents a single request's lifecycle within aggregate balances.

9.5 ★★ WisdomTree valuation and control dependencies

The adapter uses a single WTGXX NAV/USD feed and assumes USD/USDC parity when expressing fund-share value in the settlement asset. It validates positive, complete, fresh observations, timestamp consistency, decimal handling, and a configured price range. Settled and pending-redeem shares use the validated NAV, while pending creates are carried at assets sent and claimable cash is denominated in the vault asset. A USDC depeg is an economic basis risk that this feed configuration does not independently measure.

Observable settled-share and cash shortfalls reduce recognized value according to the loss/drip rule. Pending external claims remain valued until reconciled. Price-only changes revalue shares without consuming dividend drip, which preserves symmetry if a mark later recovers. An invalid or stale NAV feed can stop valuation-dependent operations when share exposure exists. A fund impairment can

breach the configured NAV range; an out-of-range observation need not be an oracle error. Cash-only and pending-create-only states can remain operable without a current NAV observation.

The underlying control review records an 8 September 2026 snapshot and subsequent management representations through 14 September. It identified concentrated token, compliance, and upgrade authority across shared infrastructure. It also records reported cold administration and MPC protections, while distinguishing those reports from independently validated signing policies. This report carries that distinction forward and does not represent a fresh chain-state verification snapshot. Section 13.1 describes the dated evidence boundary.

An externally owned account-shaped address does not establish that one human or one device controls its signature. Conversely, an MPC signing arrangement does not, by itself, establish an onchain delay, independent veto, or constrained upgrade power. Shared upgrade infrastructure can amplify an administrative mistake across products even when each token's accounting is otherwise correct.

Published audits provide evidence about reviewed code. The OpenZeppelin whitelist-context review also identifies privileged administrative assumptions; code review and operational control assurance answer different questions. OpenZeppelin audit

Economic assessment. WTGXX offers recognizable short-duration fund exposure, but its usefulness as a liquidity reserve depends on how Lotus can turn that exposure into cash. Transfer-agent processes, permissioning, dealer capacity, feed availability, and privileged administration are economically relevant alongside portfolio quality. The adapter makes several reconciliation rules explicit; it cannot independently establish remote settlement solvency or uninterrupted redemption access.

9.6 ★★ Coinbase rewards and principal

Coinbase Prime Rewards are a discretionary incentive for eligible USDC balances. The terms state that Coinbase has no right to use USDC in the account or Onchain Wallet. Rewards therefore should not be described as a loan of the principal to Coinbase or as a direct contractual share of Circle reserve income. The annual reward rate is non-compounding; eligibility and rates can change, and termination forfeits accrued unpaid rewards. The published terms limit program-related liability to USD 1,000 to the extent enforceable. These provisions concern the program and should not be generalized into a liability limit for every unrelated custody or wallet service. Coinbase program terms

The terms target credit within seven business days of the following month, with a 30-day outside limit. Developer documentation describes the seventh calendar day at midnight UTC and a portfolio-level credit to Trading Balance. That operational description and the contractual timing are distinct; account-specific evidence is needed to assess actual realization. Coinbase terms, reward documentation

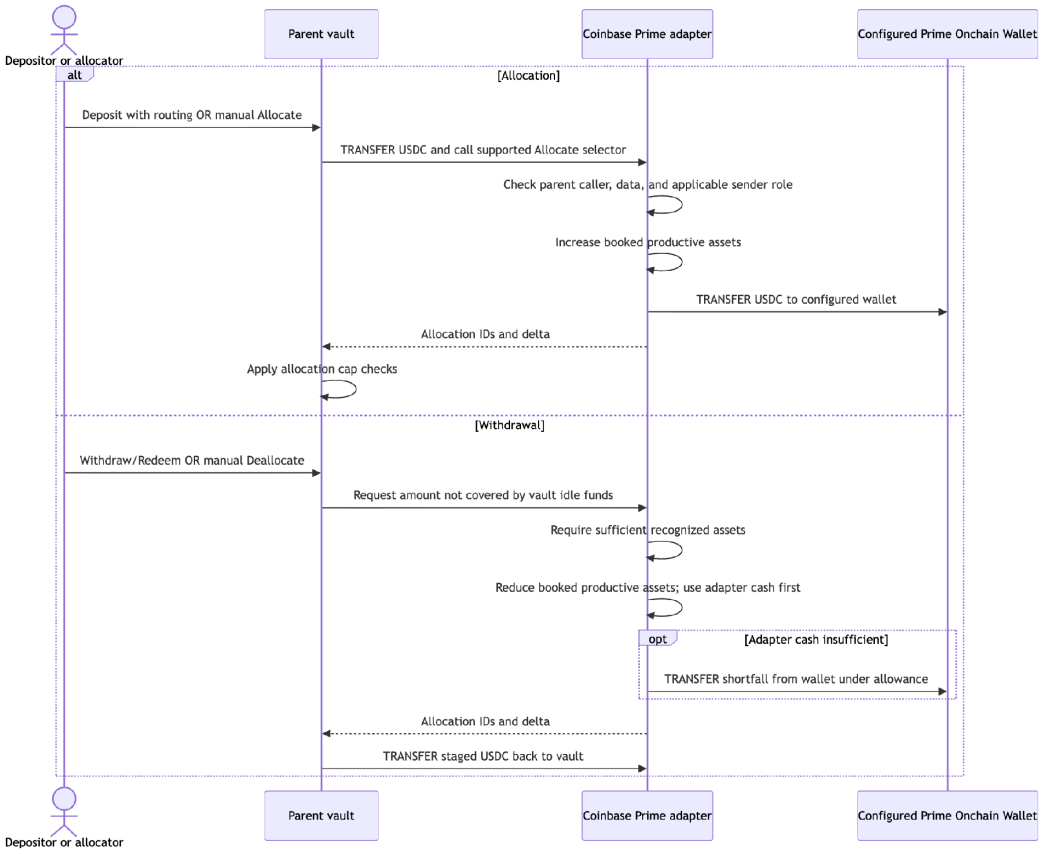
The economic benefit is incremental income on an otherwise useful USDC balance. Its durability depends on the program rather than on Lotus utilization. A product can preserve its principal-accounting design when rewards fall to zero, while its expected yield becomes less attractive. Account-specific rates, fees, and executed contractual terms were not established for this assessment, so this analysis does not assert numerical net-yield superiority.

Coinbase describes Prime Onchain Wallet as non-custodial MPC infrastructure with client-side signing and organizational permissions. Those controls are a matter for principal access, separately from reward entitlement. The Lotus adapter relies on the configured wallet holding funds and maintaining its allowance; it does not enforce the wallet controller's internal approval policy. Prime Onchain Wallet overview

9.7 ★★ Coinbase allocation and withdrawal

The adapter supports manual allocation and optional automatic liquidity routing when liquidity data is empty. It sends allocated assets to the designated Prime wallet and tracks booked productive assets. Withdrawals use adapter-held assets first, then pull any shortfall from the wallet, up to its allowance. There is no supported forced-deallocation selector.

Figure 21 — Coinbase principal flows.



Positive automatic callbacks reconcile the complete productive exposure to the parent allocation ledger. Ordinary positive manual flows return the amount added or removed, with zero-asset sync available separately. Automatic entry therefore needs cap headroom for the complete reconciled exposure, including settlements since the last sync. Where the vault routes its full inflow to this venue, the relative allocation cap must permit full exposure; adequate absolute-cap headroom is also needed for newly booked value.

Observed balance is the adapter's USDC plus the configured wallet's USDC. A deficit lowers recognized value before formal booking; surplus remains unrecognized until booked. Wallet rotation changes that observation boundary immediately. Migrating custody, permissions, and allowance is therefore part of the economic operation, not merely replacing a label in configuration.

9.8 ★★ Coinbase reward recognition

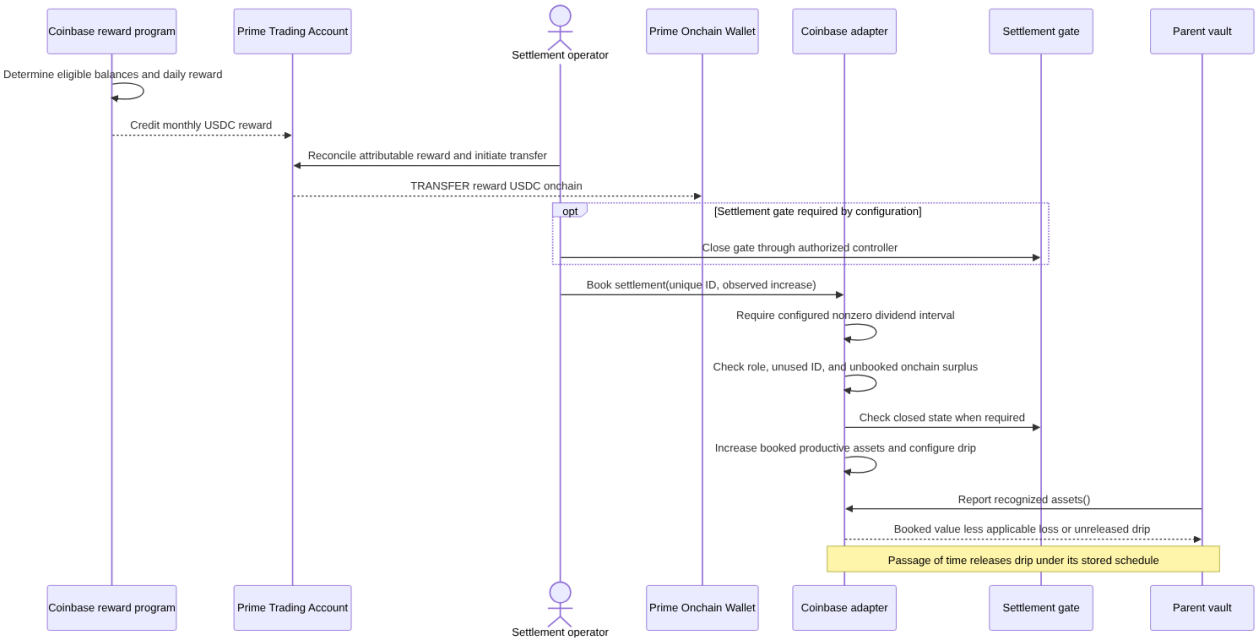


Figure 22 — Reward accrual to recognized onchain value. Offchain accrual and Trading Account credit do not themselves increase the adapter's reported assets.

The operator must attribute arrivals correctly. A fungible wallet balance proves that USDC is present, not which portfolio earned it or which beneficial owner is entitled to it. Dedicated balances or a documented attribution process are needed where Lotus and other balances participate together.

For evaluation, realized reward yield is rewards actually received divided by time-weighted eligible capital, annualized over the observation period. Net benefit also deducts operational costs, fees, and foregone alternative income. A quoted program rate, a Trading Account receivable, an onchain receipt, and a released vault return should be reported as different stages.

Economic assessment. The adapter's recognition boundary is a useful control: forecast rewards do not automatically support NAV. That supports a conservative accounting interpretation, while leaving program discontinuation, payment timing, attribution, USDC behavior, and wallet access as separate dependencies. A reward-rate reduction primarily affects future income; principal risk must be assessed through the wallet, token, and operational control model rather than inferred from the rewards program alone.

9.9 ★★ Deficits, settlement gates, and recovery

Both productive integrations route booked deficits through zero-asset parent-vault deallocation with encoded loss data. The original caller needs both the relevant adapter permission and the parent permission to deallocate. The documented setup uses sentinel authority for loss booking, which also carries cap-reduction and revocation powers; it is not a loss-only role.

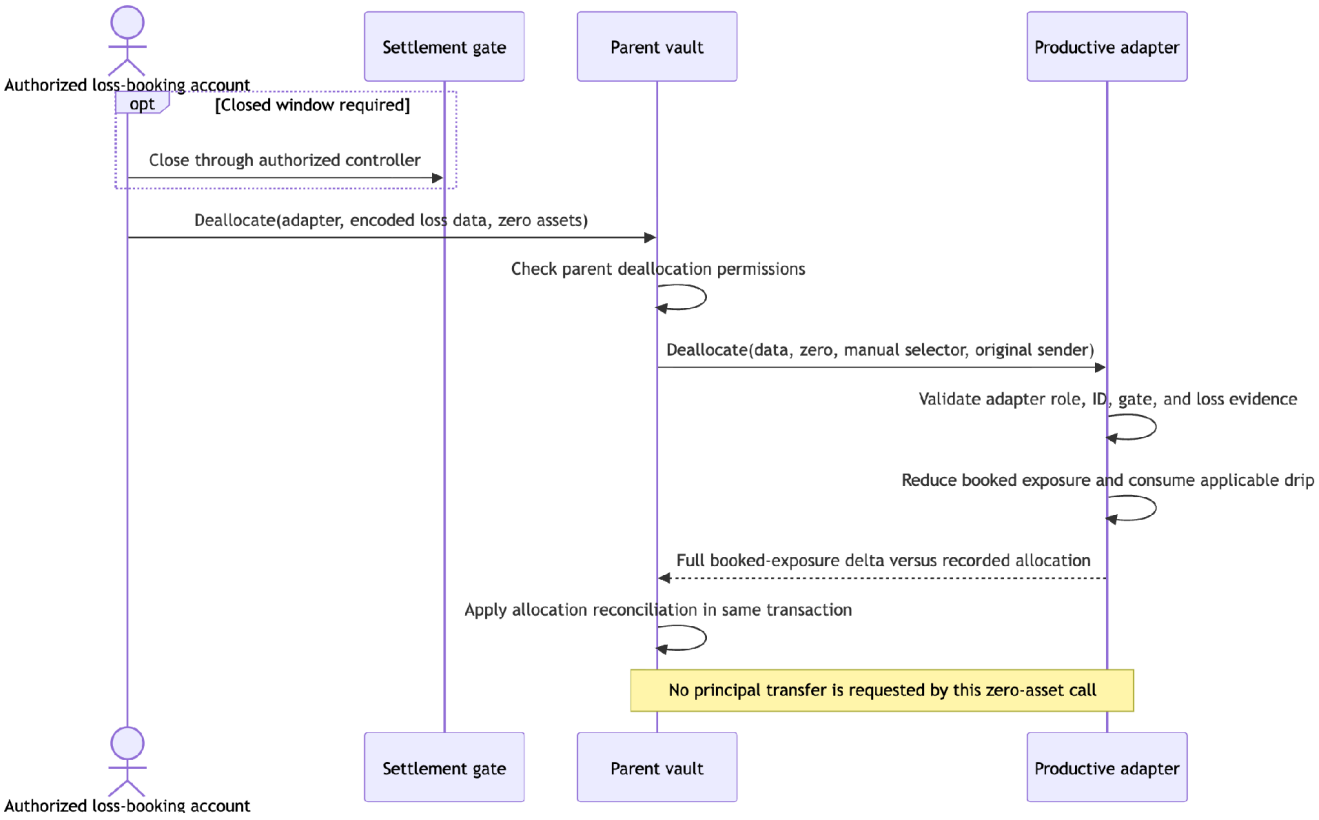


Figure 23 — Loss booking and allocation reconciliation.

The settlement gate starts open. Closing it only blocks the user operations to which the vault has wired it. The documented arrangement uses send-assets and send-shares gates to coordinate entry, exit, and transfers, while leaving the reverting gate off receive-shares so fee accrual and recovery can remain available. Checking the gate's address in an adapter does not prove correct parent-vault wiring.

If a write-down reduces the parent allocation to zero and later settlement restores value, the ordinary deallocation path can remain unavailable until an allocator restores the ledger. A zero-asset allocation books the complete recovered exposure under normal cap checks. Recovery is not a withdrawal and

cannot be assumed to succeed without sufficient absolute and relative cap headroom. For WisdomTree share exposure, it also depends on valid feeds.

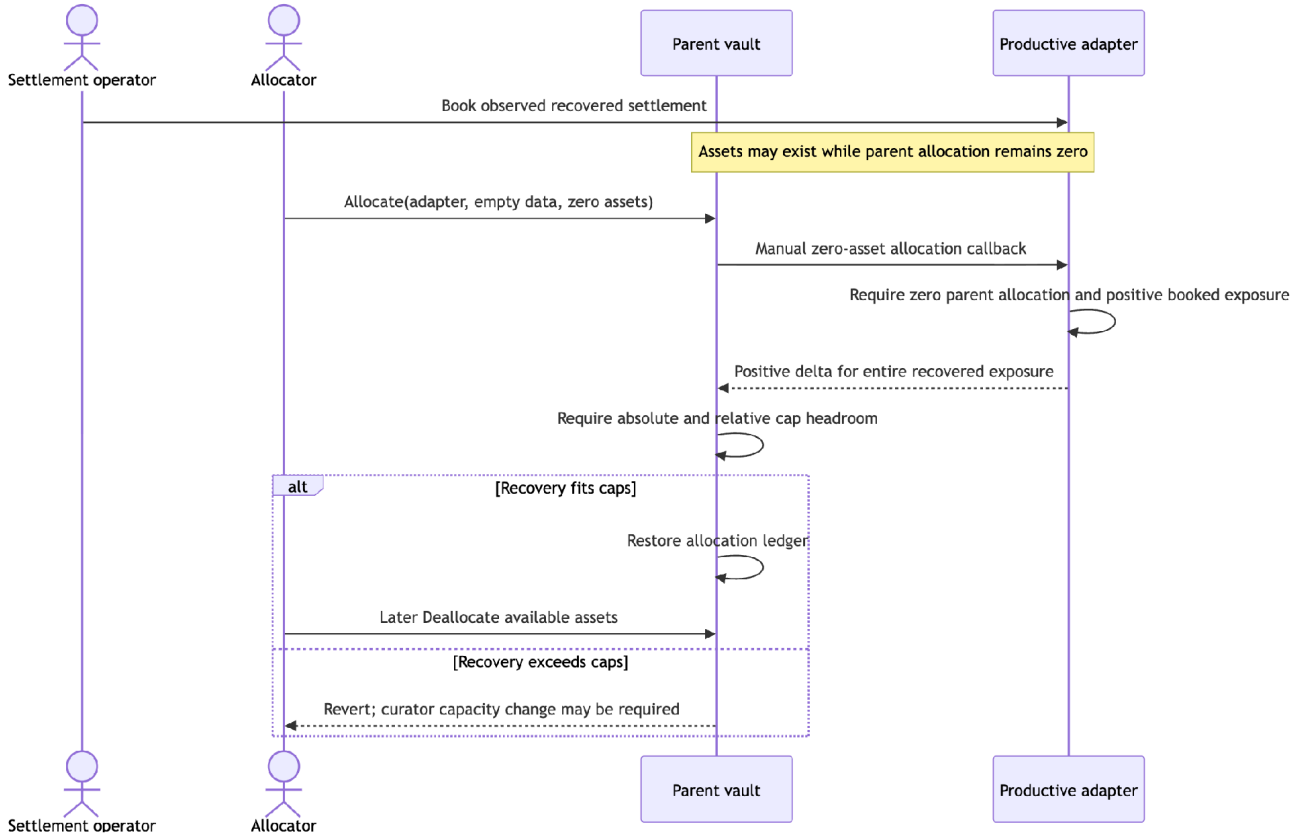


Figure 24 — Recovery after a zero allocation.

9.10 Integration comparison

Dimension	WisdomTree adapter	Coinbase Prime adapter
Economic position	Fund shares, pending requests, and claimable cash	Booked USDC held by adapter and configured wallet
Additional income	Observed share/cash distributions	Observed USDC rewards

Dimension	WisdomTree adapter	Coinbase Prime adapter
Entry	Manual asynchronous creation	Manual or configured automatic transfer
Exit	Redemption settlement, then claimable-cash deallocation	Adapter cash, then approved wallet pull
Valuation dependency	WTGXX NAV/USD feed, USD/USDC parity assumption, custody, and request accounting	Observed USDC balances plus booked exposure and drip
Remote observability limit	Pending claims can remain valued away from adapter custody	Wallet balance is observable; entitlement attribution and control remain operational
Forced deallocation	Unsupported	Unsupported
Key liquidity distinction	Fund value is not settled cash	Wallet balance is not sufficient without valid allowance and transferability

The two integrations provide different income and liquidity profiles. Combining them can diversify income sources, but shared exposure to USDC, vault governance, operational keys, or settlement infrastructure must still be aggregated. No portfolio benefit should be inferred merely from having two adapter addresses.

10 Governance and risk controls

Relevant to: Borrowers · LPs · Due diligence

10.1 Authority is part of the economic design

Governance determines who can change borrowing terms, introduce modules, upgrade trusted logic, constrain flows, or pause operations. Those powers influence both expected returns and the ability to react to new information. Assigning a timelock contract to the relevant role provides different protections than leaving the role with a directly controlled account.

Lotus core is not upgradeable and has no direct administrative withdrawal route. Risk engines and liquidation modules are UUPS upgradeable by their owner. The upgrade check requires the implementation to report the same Lotus address; that binding does not prove the replacement's economic behavior is unchanged or safe.

The intended topology places core ownership and module upgrade authority with the Lotus governance timelock, and module operation with the separate operator timelock. Governance accounts own both, and guardians can revoke pending actions. This topology must be verified for each deployment; the core does not impose it automatically.

10.2 Actions and delays

Authority or action	Available mechanism	Economic meaning
Fee decreases; module-manager removal	Governor immediate owner action	Can reduce fees or future enablement authority without delay
Pause and unpause	Governor immediate owner action	Fast incident response, but reopening can immediately expose unhealthy positions to liquidation
Fee increases, fee recipient, LLTV/module enablement, hooks	Governor standard timelock	Advance notice for changes in costs, available modules, and restrictions

Authority or action	Available mechanism	Economic meaning
Module upgrades and ownership changes	Governor long timelock	Delay on changes to trusted execution and control
Rate and liquidation parameters	Operator timelock when assigned the relevant role	Notice before mutable economic policy changes
Increasing the borrowing buffer	Immediate governor owner action	Tightens borrowing and collateral-withdrawal limits across markets
Reducing the borrowing buffer	Governor standard timelock	Provides notice before increasing permitted leverage
Clearing a tranche cooldown	Immediate governor owner action	Restores repayment access subject to remaining checks
Borrower cooldown exemption	Addition uses the standard timelock; removal is immediate	Exemption is keyed to the borrower account
Pending-action cancellation	Guardian and/or owner as defined by the path	Veto capability; guardian cannot originate or execute policy
Vault destinations, caps, and allocation	Separate vault roles and configuration	A second governance boundary, not automatically governed by Lotus delays

Both timelock constructors require at least one day for the standard tier and three days for the long tier, with the long tier no shorter than the standard. Actual immutable durations can be longer. These are minimum governance-delay requirements, not a statement of deployed durations.

10.3 ★ Proposal, veto, and execution

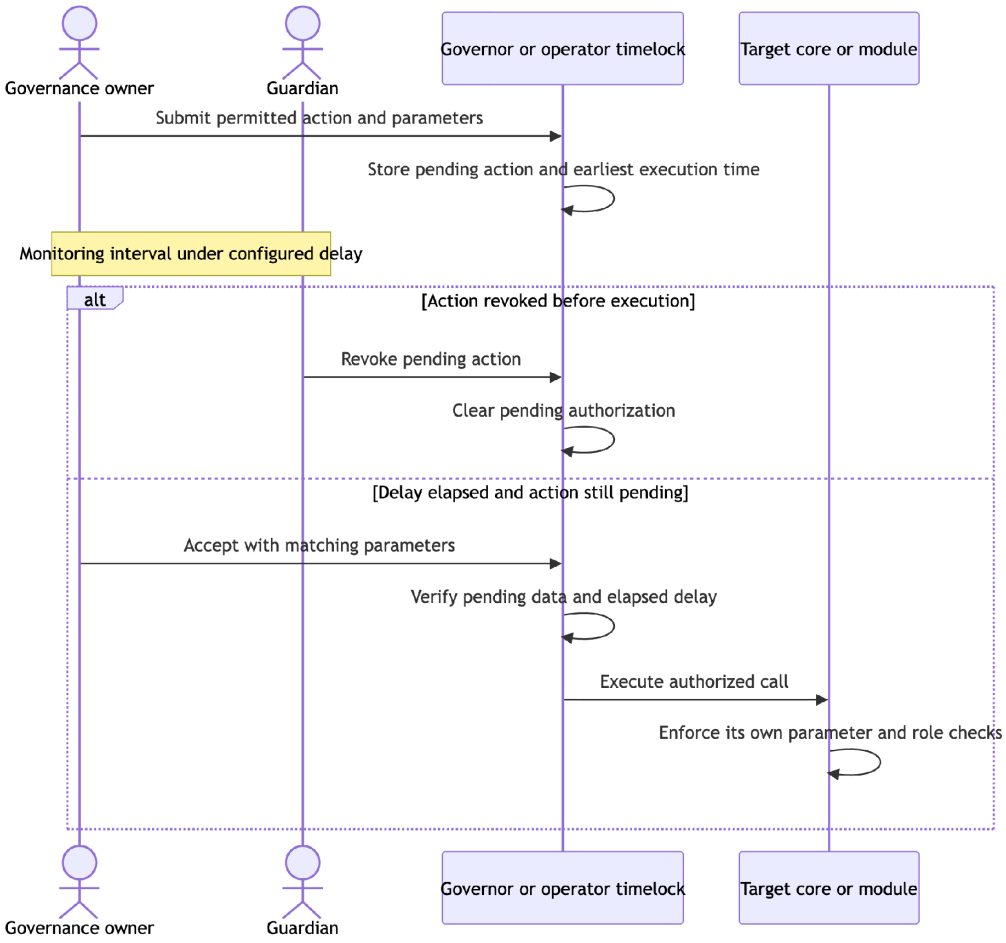


Figure 25 — Timelocked governance action. The owner proposes and executes; permissionless execution is not assumed.

For scheduled operator actions, the long tier is specifically selected for transfers of operator authority; other scheduled actions use the standard tier. The operator timelock can exercise any role actually granted to it on the target, not merely actions colloquially described as operator work. Its permissions therefore need to be evaluated against actual role assignments.

An upgrade proposal fixes the proposed replacement and its associated setup instructions. A module's owner may still adopt materially different logic after the delay. The useful protection is review time and a veto opportunity, not elimination of governance trust.

Participant consideration: Changes to allocation or recovery rules can change who receives income or bears a shortfall. A change that prevents a future accounting problem does not automatically restore previously affected balances. Any migration or recovery arrangement has its own treatment of existing claims and access conditions; relabeling a tranche does not change those economic rights.

10.4 Pause and reopening

A market pause blocks its lending and collateral operations, repayment, accrual, and liquidation. A global pause additionally blocks market creation and flash loans. This is an operational pause, not a freeze of external collateral prices or all administrative actions.

On reopening, lazy synchronization advances accrual timestamps to the relevant unpause time. Interest during the excluded interval is not charged; interest between the last accrual and the pause can also be forfeited unless it was crystallized first. The design preserves an immediate pause path when accrual itself would fail.

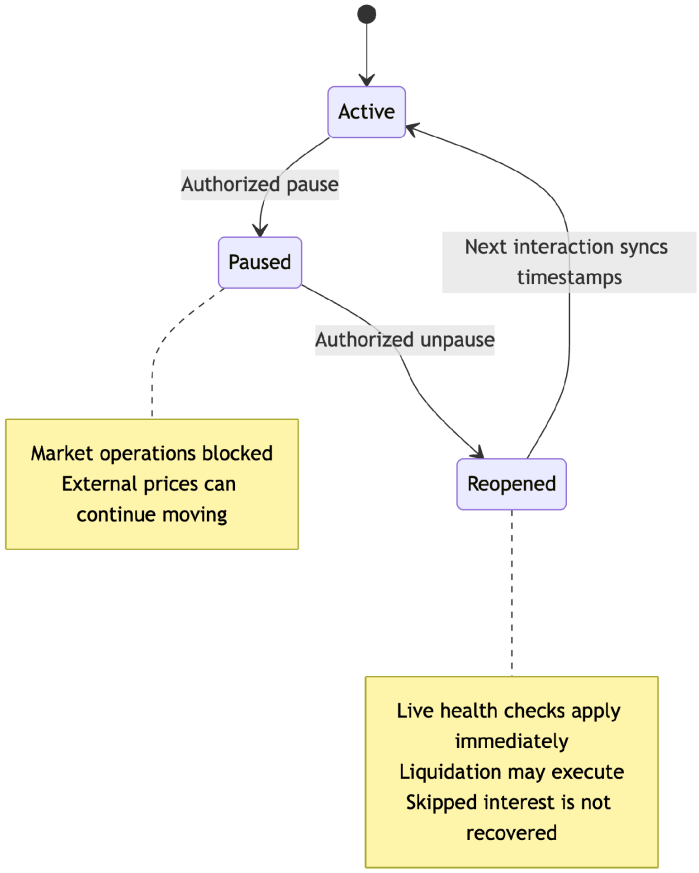


Figure 26 — Pause and reopening. The reviewed core has no separate built-in borrower grace state.

A pause can protect against acting on unreliable inputs, but it also stops borrowers from adding collateral or repaying through the paused market. Reopening policy is therefore economically consequential. A timelock or notification alone does not provide an exit guarantee when free supply or external redemption capacity is unavailable.

10.5 Hooks, exposure limits, and registries

Hooks are static checks: they can reject an operation but cannot mutate state through the hook call. The market flow-limit hook constrains supply and borrowing changes against a refreshed market baseline. This is a flow control over a window, not a permanent stock limit on total borrowing or a single collateral's exposure. Accrued interest is included in the measured totals and can consume allowance.

A supply-decrease restriction can slow withdrawals. That can provide response time, but it does so by limiting exits; it does not make borrowed assets liquid or allocate withdrawal capacity pro rata.

Repeated baseline refreshes can also permit continuing growth, so growth controls and absolute exposure budgets should be assessed separately.

Core has no economically configured market/tranche/borrower stock caps like those used for risk budgeting. Storage-width limits and collateral/free-supply checks are not substitutes for those caps. Vault caps can constrain managed portfolios, while direct supply and other vaults can still increase system-wide exposure.

Module and LLTV enablement is one-way in the core. Removing a module manager prevents future enablement actions for that account but does not disable existing modules. The adapter registry controls admission according to its owner and trusted factories. Registry trust should not be described as a guarantee of continuous runtime safety or automatic removal from every existing vault.

Economic assessment. The governance architecture combines rapid intervention with delayed changes to important permissions and policies. Its effectiveness depends on deployed roles, meaningful monitoring, and the liquidity available during the notice period. The report's positive assessment of the available controls is therefore conditional on deployment evidence rather than on contract names alone.

11 Economic scenarios and design suitability

Relevant to: Borrowers · LPs · Due diligence

11.1 Related borrowing opportunities with fragmented funding

Suppose several independent markets use the same funding asset but offer different collateral or leverage terms. One book can be funding-constrained while another holds idle assets. Under complete separation, suppliers or allocators must move capital before the constrained book can use it.

Lotus lets a senior borrower use unused junior funding within the same market. That reduces the need for explicit LP reallocation among eligible opportunities and lets LPs choose an exposure boundary. It is most useful when the direction of sharing matches the borrowers whom suppliers are prepared to fund.

The benefit is asymmetric. A junior borrower cannot consume arbitrary senior idle supply, and the sharing does not cross separate Lotus market identifiers. If demand exists only at the most junior index

while most capital sits senior, the same protections that narrow senior exposure preserve some fragmentation. Selective pooling improves a matching problem; it does not remove all mismatches.

11.2 Different leverage preferences

Borrowers can value different combinations of financing cost and collateral headroom. A borrower prioritizing a lower threshold exposure or different collateral may choose a different book from a return-maximizing recursive borrower. Lotus can support these choices inside one funding structure.

If one tranche offers the most attractive combination for a particular borrower objective, demand may concentrate there. Since junior borrower interest cannot flow upward, senior suppliers can then earn little Lotus interest despite abundant total borrowing. The recursive-borrowing calculation in Section 6 diagnoses that possibility, not proof that concentration is inevitable.

The benefit is differentiated access to shared funding. The distribution of activity across tranches remains dependent on borrower preferences and the returns available to suppliers.

11.3 Supplier rotation and pricing pressure

If junior suppliers withdraw and resupply senior, total market supply can stay constant while the backing available to junior borrowers falls. Junior free supply becomes tighter, and utilization-based pricing can rise, encouraging repayment. This permits market-driven pressure without changing an existing borrower's fixed LLTV.

For example, a feasible 20-unit withdrawal from T2 in the recurring example reduces junior free supply from 30 to 10. Resupplying those 20 units into T0 restores total market liquidity but does not restore the T1–T2 suffix. Junior borrowing remains constrained.

The adjustment is limited by available liquidity: suppliers cannot rotate already committed capital at will. Under heavy utilization, price signals can coexist with temporarily locked claims. Modeling rotation as an instantaneous reallocation of the whole market would overstate its stabilizing capacity.

11.4 Withdrawal order under stress

Consider two tranches with $S_0 = B_0 = 100$, $S_1 = 100$, and $B_1 = 0$. Both have free supply of 100. If the junior supplier withdraws first, senior free supply falls to zero. If the senior supplier withdraws first,

junior free supply falls to zero. Neither supplier has a reservation over that shared cash; the first completed withdrawal determines the liquidity left for the other.

First successful exit	Assets withdrawn	Free supply available to the other supplier afterward
Senior supplier	100	0
Junior supplier	100	0

Seniority gives a weaker liquidity constraint, not a reserved redemption queue. During a common rush to exit, transaction ordering and claim sizes matter. A vault's idle buffer can absorb some of that demand, but it cannot guarantee liquidity beyond the underlying positions and configured routing. A withdrawal queue within a vault, if offered, governs access among that vault's users; it does not by itself reserve Lotus liquidity against direct suppliers or new borrowing. Any additional priority arrangement also has its own waiting periods and access conditions.

The same timing issue matters around visible impending losses. A supplier that exits before a loss is recognized removes the withdrawn capital from that write-down. Free supply bounds the permitted exit, and later allocation uses the remaining live balances. This makes transaction order relevant to both available liquidity and the distribution of subsequent losses. The repayment cooldown constrains eligible young borrowing positions; it does not reserve supplier capital for a committed first-loss period.

11.5 Collateral shocks and concentration

If collateral price gaps past the liquidation threshold, the difference between trigger and execution value determines how much collateral remains to settle debt. Increasing deposits can enable larger borrowing against the same collateral without improving its secondary-market depth. At scale, a similar percentage shock can require larger sales and produce worse execution.

The tranche structure changes which suppliers can bear that loss; it does not eliminate the loss. A junior supplier must assess senior borrower collateral as part of its exposure. Similarly, deploying several markets against the same collateral, oracle, or liquidation venue can reproduce portfolio-level concentration even when individual allocations look small.

In mixed-collateral markets, tranche order should be read with the full configuration. A lower LLTV against a thin or operationally restricted asset is not automatically safer than a higher LLTV against a

deeper and more reliably liquidated one. Suitable limits depend on stressed execution capacity and the time available to respond.

11.6 Pause during a market dislocation

Assume a market pauses because the oracle or chain is unreliable while external prices keep moving. During the pause, borrowers cannot improve positions through Lotus, and lenders cannot exit. On unpause, health is evaluated at the live price and liquidation can occur immediately.

Immediate reopening can help contain a genuine collateral shortfall, while reopening on an erroneous price can impose avoidable borrower losses. Delaying liquidation can give borrowers time to respond but can increase LP losses if prices continue falling. The current implementation leaves this trade-off to operational reopening decisions rather than implementing a separate recovery phase.

An economic assessment should therefore examine incident procedures alongside normal operating parameters. A pause button is useful only within a process that establishes when inputs are reliable enough for the market to resume.

11.7 Reserve income during low borrowing demand

A productive reserve can provide value independent of Lotus borrower demand. This may improve the usefulness of a loan asset when Lotus utilization is low, provided reserve income exceeds its costs, and the reserve remains suitable for liquidity needs.

That income has a different source and dependency set. Coinbase rewards can change or cease; a fund holding can retain value while redemption is delayed. A reserve yield assumption should therefore be varied independently from Lotus borrowing rates in scenario analysis. A product that remains functional at zero reserve income has a different resilience profile from one relying on that income to cover fixed costs or meet advertised returns.

11.8 Combined reserve and lending stress

Suppose the productive-debt reserve becomes temporarily difficult to redeem while collateral prices fall. Borrowers may need to obtain loan shares for repayment; liquidators may need funding in the same share; and LPs may seek underlying cash. These demands can collide even when each contract’s local accounting is correct.

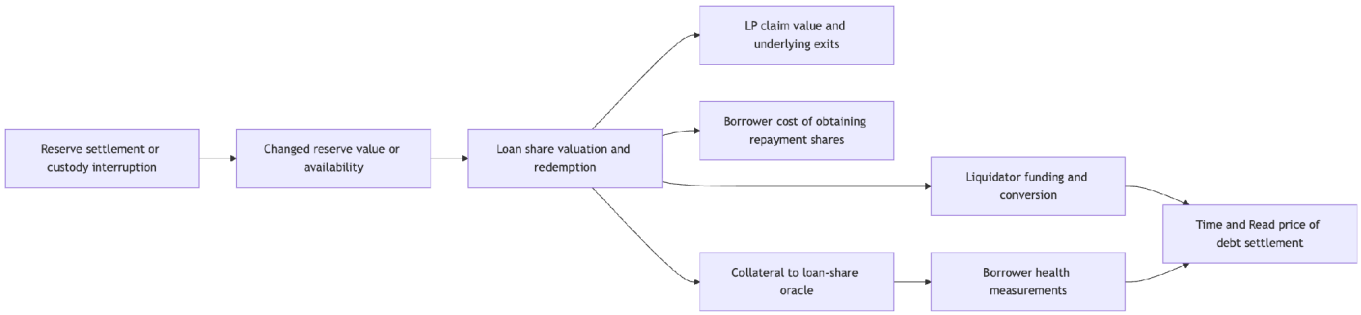


Figure 27 — Transmission of a reserve interruption. This is a dependency diagram, not a prediction that every arrow occurs in every incident.

The appropriate reading is that productive debt expands the opportunity set and the system boundary together. It can generate additional income, but an economic review must follow the loan asset through custody, valuation, and liquidation use rather than stopping at its ERC4626 interface.

12 LP considerations and assessment conclusions

Relevant to: LPs · Borrowers · Due diligence

12.1 What an LP is choosing

An allocation selects more than a headline APY. It selects borrower origins, a share of their realized income and losses, a liquidity position within the market, and any vault or reserve dependencies introduced by the access route. Seniority narrows some credit exposure; it does not remove all collateral, liquidity, administrative, or loan-asset risk.

LP consideration	Meaning for the position	Relevant sections
Eligible borrower set	Own tranche and more senior borrower origins	3, 5
Source of return	Allocated borrower interest and, where applicable, loan-asset reserve value	5, 6, 9

LP consideration	Meaning for the position	Relevant sections
Withdrawal availability	Own claim bounded by free supply, gates, routing, and any underlying redemption	4, 8, 11
Loss sharing	State-dependent cascade rather than a fixed junior attachment point	5
Capital concentration	Actual borrower and common-dependency exposures, not only adapter IDs	8, 10, 11
Parameter changes	Governed rates, module logic, hooks, fees, and vault policies	6, 10
External integration	Custody, entitlement, settlement, pricing, and access conditions	9

For borrowers, the choice combines the buffered borrowing limit, expected rate behavior, funding availability, the plain-LLTV liquidation threshold, and repayment cooldown conditions. When loan shares appreciate, the cost of replacing borrowed shares also matters. Opt-in pre-liquidation authorizes collateral sales within a defined band and remains subject to the buffered residual-health requirement and repayment checks.

12.2 Supported conclusions

The assessment supports the following conclusions, subject to the stated token and module assumptions. Lotus enforces a directional envelope for liquidity and loss exposure; it independently verifies that risk-engine free supply does not exceed its physical accounting ceiling; it conserves allocated interest and realized bad debt; and its ordinary action paths use conservative share conversions. Its modular design supports multiple rate and liquidation policies without embedding custody accounting in each rate engine.

The vault integrations support managed allocation, exposure identifiers, and explicit withdrawal routing. Productive adapters separate unbooked receipts, booked exposure, and released income, while requiring observable settlement evidence for the quantities they book. These are meaningful controls, but their scope is local: they do not prove remote pending claims, legal attribution, or continuous external redemption.

The bundled engines use live balances for both interest and loss allocation. Their loss split preserves cumulative backing for remaining debt when the initial cumulative backing constraints hold. This is a property of the bundled allocation formula; the core separately enforces output direction, per-tranche bounds, and conservation. Section 5.5 assesses supplier ownership and the conditional empty-terminal-tranche case.

12.3 Conditions and economic limitations

Assessment item	Economic characteristic	Implication for participants
Directional supplier exposure and liquidity sharing	Defined by the market rules	Supports selective pooling as the core proposition
Seniority as a fixed junior first-loss guarantee	Not the implemented policy	Product descriptions must use the actual exposure and weighting rules
Allocation and supplier ownership	Live weights allocate assets; shares establish claims, with unconditional terminal weight	Assess terminal carry, share ownership, and fees together as described in Section 5.5
Post-loss backing and liquidation execution	The bundled loss formula preserves initially valid cumulative backing	Check the enabled engine, collateral execution, token behavior, and external liquidity separately
Borrower defenses during stress	Buffered borrowing limits and age-dependent repayment restrictions apply	Young, nonexempt borrowers can be blocked from

Assessment item	Economic characteristic	Implication for participants
		repayment and pre-liquidation during a cooldown
Ordered risk and price ladder	Configuration-dependent	Index alone is insufficient evidence of relative economic risk
Withdrawal priority	No senior reservation; exits depend on transaction order	Free supply should be disclosed as current capacity, not an entitlement to future cash
Governance protection	Available contracts; production role configuration unverified	Timelock and guardian claims require deployed evidence
Venue integration suitability	Conditional on custody, settlement, feeds, permissions, and terms	No blanket equivalence between tokenized value and cash liquidity

These conditions depend on the market state and configuration. Live funding contribution, shareholder claims, withdrawal capacity, and loss-absorption capacity measure different aspects of a position. Assess their interaction under withdrawals, changing borrowing demand, and collateral shocks. The code-level availability of repayment for sufficiently aged positions does not establish the profitability of using them to influence loss sharing; that question requires a current reproduction and quantified costs.

12.4 Overall assessment

Lotus provides a useful framework for selectively sharing liquidity among related lending opportunities. Its strongest economic feature is the ability to choose an exposure boundary while retaining access to eligible shared funding. This can support differentiated borrowing terms and managed capital allocation without requiring every opportunity to operate as a fully separate pool.

Those advantages are strongest when the tranche order reflects a clear underwriting policy, rates account for borrower incentives, and exposure remains compatible with collateral and reserve liquidity. They are weaker when borrower demand concentrates outside the supplied exposure set, when LPs

require unconditional liquidity, or when the product is presented as a conventional senior/subordinated security.

Lotus combines directional funding, live allocation weights, and bounded module outputs with configuration-dependent pricing and borrower controls. Its suitability depends on matching borrower exposure, collateral execution, repayment restrictions, and managed-asset liquidity to participants' needs. Assess a particular offering using its deployed roles and parameters, enabled modules, and operating arrangements alongside the lending mechanics.

13 Assessment scope and supplementary mechanics

Relevant to: Due diligence; ★ for supporting mechanics

13.1 Assessment scope and assumptions

This assessment considers Lotus's lending and allocation rules, illustrative economic scenarios, the available governance arrangements, and the external dependencies of productive reserve assets. Public primary sources support the venue descriptions and terms. Management representations are distinguished from independently verified arrangements.

We did not independently establish production ownership, oracle configuration, counterparty agreements, or current venue permissions for a particular Lotus production offering. The descriptions therefore explain the reviewed arrangements without certifying a final operational setup. Actual roles, terms, limits, and liquidity need to be confirmed for the product in which a reader participates.

The WisdomTree control assessment incorporates the dated 8 September role review and management descriptions considered through 14 September. The observations concern administrative capabilities and possible consequences, not an allegation of an incident or an estimate of current residual loss probability. The reported cold/MPC controls were not independently validated through signing policy, recovery, or operational testing. That evidence supports identifying an administrative dependency; it does not support asserting an unprotected single-person key or a fully verified multi-party control system.

Core conclusions assume tokens transfer the requested quantities without fee-on-transfer or silent rebasing effects and that token callbacks do not violate the integration's interaction assumptions. Oracle-dependent conclusions assume appropriate collateral/loan-token units, correct decimal composition, and timely, economically meaningful prices. Lotus's generic oracle interface and the narrow staleness wrapper do not themselves establish those properties. Callback composition, token issuers, external wrappers, and upgradeable liquidation modules remain part of the trust boundary.

13.2 ★ Interest accrual and flash-loan flows

Interest accrues lazily, generally before balance-changing lending actions. The core checks each returned borrower-interest amount against a maximum-rate envelope and validates that all supply interest is funded by current or more senior borrower interest. Rates are per-second WAD values and use a three-term Taylor compounding approximation. Calling frequency and state changes can affect realized outcomes; a simple annualized parameter is not an exact, guaranteed APY.

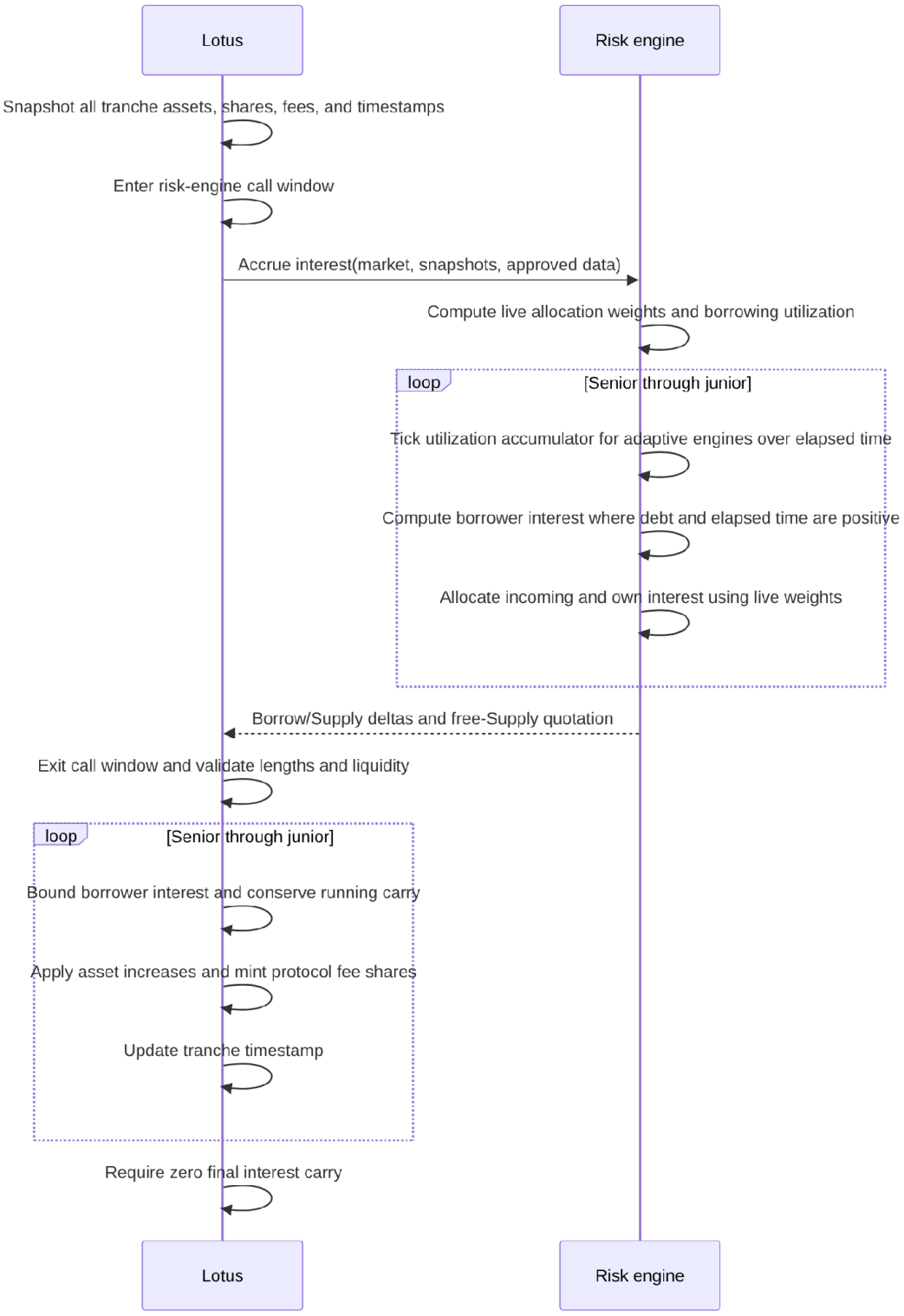


Figure 28 — Full-market accrual.

The narrow call-window guard restricts state-changing core reentry while the engine is returning deltas. It does not justify a blanket statement that every core function is globally nonreentrant; callbacks are deliberately used for composable operations, and flash loans have their own settlement requirements.

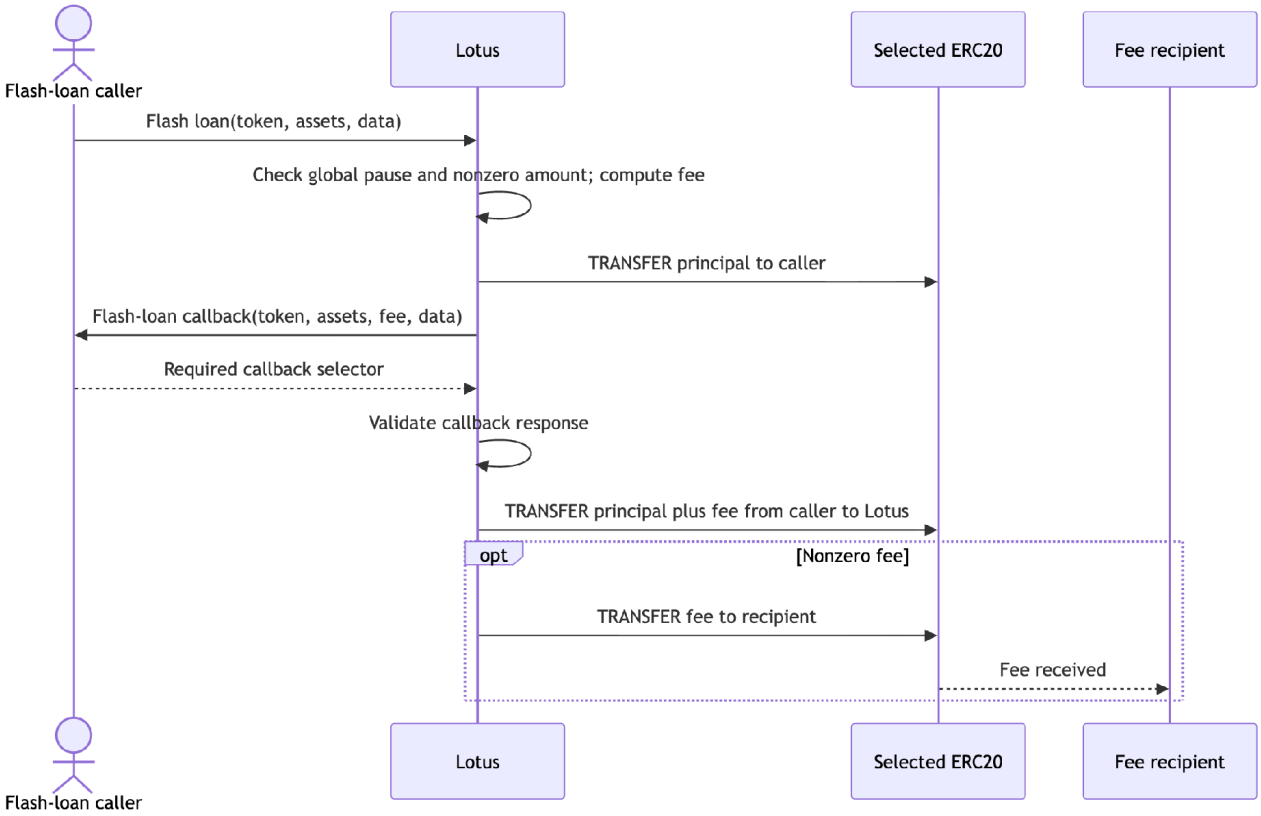


Figure 29 — Flash loan. Flash loans do not create a tranche borrower position and are blocked by global, rather than per-market, pause state.

13.3 Notation

Symbol or term	Meaning
$i, n-1$	Tranche index and most junior index
S_i, B_i	Live supplied and borrowed loan-token assets.
N_j	Nonnegative net assets of the suffix beginning at j
F_i	Physical free-supply ceiling for tranche i
G_i	Gross supplied assets in tranche i and all junior tranches
`J_i`	Strictly junior net supply: the nonnegative sum of supplied assets less borrowed assets below tranche i
w_i	Cascade allocation weight
LLTV	Liquidation loan-to-value threshold
`borrowLtvBuffer`	Global WAD fraction reducing LLTV for borrowing and collateral withdrawal
Effective borrowing LLTV	Downward-rounded `LLTV × (1 - borrowLtvBuffer)`
`borrowTs`	Share-weighted borrowing timestamp, rounded upward toward the current time
`MIN_BORROW_DURATION`	Minimum position age required during an active repayment cooldown, unless the borrower is exempt
LTV	Actual debt divided by collateral value
Supply shares	Claim on a tranche's accounted supply assets

Symbol or term	Meaning
Borrow shares	Units of a borrower’s tranche debt
Booked exposure	Recorded venue value used for allocation reconciliation
Drip	Delayed recognition of already booked reward value
Claimable cash	Settled assets available for a supported deallocation, subject to other checks
Pending request	External create/redeem exposure awaiting reconciliation