PRODUCT CONCEPT

VolumeDynamicFeeHook

v2.4.0 · April 13, 2026

OBJECT	VolumeDynamicFeeHook (Uniswap v4 Hook)
VERSION	v2.4.0
DATE	April 13, 2026
STATUS	Final
REPOSITORY	github.com/Axel-DeFi/VolumeDynamicFeeHook
AUDIT	Completed · Critical: 0 / High: 0 / Medium: 0 / Low: 0
RUNTIME	EVM L1 / L2, Solidity ^0.8.26
HOOK ADDRESS	`0x2C3254Da...5044`
POOL ADDRESS	`0x226d6297...974c`
AUDIT REPORT	audit-v2.4.0-en.pdf

VolumeDynamicFeeHook is an automated pool fee adjustment mechanism that adapts the fee level to observed trading activity. Everything happens without price oracles and without manual intervention: the algorithm operates directly on the pool's own data.

1. THE PROBLEM: FIXED FEES LOSE TO THE MARKET

Traditional Uniswap pools operate with a fixed fee set at creation. This creates a structural problem for liquidity providers:

Quiet Market

Volume drops, but the fee remains high. Traders move to cheaper competing pools. Liquidity sits idle.

Hot Market

Volume surges, demand for liquidity is high — but the fee stays the same. The LP earns less at the moment of greatest value.

Manual Adjustment

Changing the fee requires migrating liquidity to a new pool. In practice, nobody does this in time.

> **Bottom line:** a liquidity provider with a fixed fee either loses flow during quiet periods or leaves money on the table during hot ones.

2. THE SOLUTION: AUTOMATIC ADAPTATION TO MARKET REGIMES

The hook measures trading volume and compares it to a smoothed historical value (EMA). Based on this comparison, the fee switches between three fixed regimes.

A — Quiet Market / FLOOR

Volume is below average for several periods in a row. The fee drops to the FLOOR regime. The pool becomes attractive to traders and restores flow.

B — Normal Market / CASH

Volume is close to the moving average. The fee is stable in the CASH working regime. The deadband absorbs minor fluctuations.

C — Hot Market / EXTREME

Volume is consistently above average. The fee transitions to the EXTREME regime. The provider monetizes high demand and earns more per trade.

Three Fee Regimes

FLOOR
0.04%
Minimum fee

CASH
0.25%
Working fee

EXTREME
0.90%
Elevated fee

The fee is always in exactly one of the three regimes.

3. DEFAULT COMPETITIVE POSITIONING

The fee levels of the three regimes are configured at deployment. The reference profile is calibrated so that the pool can compete with standard static Uniswap tiers in any market condition.

Hook Mode	Default Fee	Nearest Static Tier	Positioning
FLOOR	0.04%	0.05%	Slightly below standard → attracts traders in a quiet market
CASH	0.25%	0.30%	Better than standard → captures traffic from 0.3% fee pools
EXTREME	0.90%	1.00%	Near the top tier → monetizes genuine overheating

The values 0.04%, 0.25%, and 0.90% are a standard profile, not hard-coded parameters. The key point is that the pool is always slightly more favorable than standard static fee levels in V3 pools.

4. HOW THE HOOK DECIDES TO CHANGE REGIMES

The algorithm compares the closed period volume with the moving average. Transitions do not happen from any random spike — several additional filters are built into the mechanism:

Filter	Purpose	What It Means for LP
Absolute threshold	Volume must exceed a specified minimum	A random small spike will not raise the fee
Relative threshold	The ratio of closed period volume to EMA volume `closeVol / emaVol` must cross a threshold	Fee increase requires a real exceedance of the norm
Deadband	The threshold must be crossed with margin	Small fluctuations around the boundary do not trigger switches
Confirm series	Some transitions require multiple consecutive confirmations	A one-time spike does not move the pool to EXTREME
Hold protection	After entering a regime, a holding period applies	A temporary dip does not knock the pool out of its working regime
Emergency reset	During prolonged zero volume — automatic reset	A long pool pause returns it to the minimum fee regime

5. WHERE PREDICTABILITY COMES FROM

Despite its adaptiveness, the model is not arbitrary. Several structural properties make its behavior observable and verifiable:

- The fee is always in exactly one of three predefined regimes.
- Transitions between regimes occur only under formalized conditions described in the specification and verified by audit.
- The basis of calculation is exclusively the pool's own data, not an external price source.
- State changes occur only on swap — at the natural point in the pool's life cycle.
- For each closed period, an event with a reason code is emitted.

6. PERIODS OF INACTIVITY

The hook updates its state lazily — only when a new swap arrives. If there has been no trading activity in the pool for a long time, the next swap may trigger an Idle reset. In this case, the regime returns to FLOOR, the accumulated smoothed history is cleared, and a new period begins from scratch.

For the LP this means: a prolonged pause does not lead to an old trading context being "frozen" indefinitely. After a long silence, the pool starts calculation anew from the base regime.

7. HOOK FEE AND HOW IT DIFFERS FROM LP FEE

In addition to liquidity provider fees, the contract has a separate fee — Hook Fee. This is not a replacement for LP Fee and not a redistribution of already accrued LP Fee. Hook Fee is accrued through a separate accounting circuit and can range from 0% to 10% of the fee amount. Hook Fee is included in the exchange price and does not affect liquidity provider returns.

- Hard upper limit — 10% (immutable, fixed at the contract level).
- Percentage changes go through a 48-hour `timelock` with transparent notification.
- Hook Fee does not reduce LP Fee for liquidity providers.

8. WHAT CAN BE CHANGED AFTER LAUNCH

The hook is not fully immutable. After launch, the owner retains administrative paths, separated by type and constrained by execution rules.

What Changes	What It Means for LP
Regime fees FLOOR / CASH / EXTREME	Changing predefined levels of the three regimes, not an arbitrary value
Transition logic parameters	Algorithm sensitivity to volume changes
Time parameters	Some changes may involve a safe statistics reset
Hook Fee percentage	Dedicated administrative path with a 48-hour `timelock` delay
Minimum counted swap (telemetry)	Affects the volume observation model, not swap execution

9. LP FUND SAFETY

Based on the technical concept and a separate security audit (`v2.4.0`, commit `61fde88`, April 12, 2026): the contract contains no vulnerabilities threatening liquidity provider funds.

The hook has no direct access to LP positions and LP funds within `PoolManager`.

What the Audit Confirmed

Property	Audit Confirmation
Hook has no access to LP positions	LP funds are stored in `PoolManager` outside the hook; direct losses through the hook are impossible
`rescueToken()` does not withdraw pool currencies	The function explicitly blocks `poolCurrency0` and `poolCurrency1`
Hook Fee claim path is protected	Implemented using the CEI pattern; reentrancy blocked by `onlyPoolManager`
Owner cannot extract LP funds	Administrative functions provide no path to liquidity provider funds
No critical or high vulnerabilities	Critical: 0 / High: 0 / Medium: 0 / Low: 0

The current architecture provides no technical path for the hook to steal LP funds or block the standard withdrawal of liquidity from the pool.

This conclusion specifically applies to LP fund access. Economic, operational, and configuration risks remain and are discussed separately in section 10.

10. RESIDUAL RISKS

Risk	Description	What Limits It
Stablecoin depeg	The hook counts volume at face value, without an external price correction	Reliable asset selection, limited regimes, emergency floor
Artificial volume splitting	On cheap networks, volume can be split into trades around the threshold	Minimum counted swap threshold, calibration, monitoring
Artificial volume inflation	Economically motivated trades may attempt to shift the regime	Confirm logic, hold, deadband, anomaly monitoring
Owner / governance risk	The owner retains rights to change parameters	Pause-only operations, `timelock` for Hook Fee, multisig recommended

11. WHAT THE LP GETS IN THE END

From the LP's perspective, this hook is not a "black box" but a controller with predefined logic:

- uses only the pool's own data — no external oracles, which significantly reduces the attack surface;
- operates within three clear fee regimes;
- leaves an observable event trail with reason codes;
- allows limited administrative control through clearly described paths;
- separates LP Fee from Hook Fee in both meaning and accounting;
- has no technical ability to access LP funds — confirmed by audit.

The pool fee is not set once and forever, but is managed by the hook's algorithm, which adapts to the trading flow within the pool itself while remaining sufficiently formalized for external verification.