L35: Uniswap Deep Dive

Module E: DeFi Ecosystem

Blockchain & Cryptocurrency

December 2025

Learning Objectives

- Trace Uniswap's evolution from V1 to V4
- Understand concentrated liquidity mechanics (V3)
- Analyze fee tier optimization
- Explore UNI token governance and the fee switch debate
- Case Study: Fee switch governance controversy

Uniswap: Origins

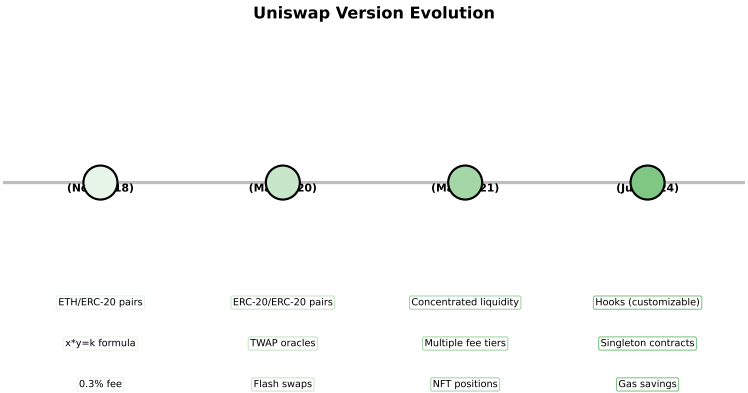
Created by: Hayden Adams (inspired by Vitalik Buterin's post)

Market Position (Dec 2024):

- Largest DEX by volume ($50B+ monthly)
- $5B TVL across all chains
- Deployed on Ethereum, Polygon, Arbitrum, Optimism, Base

Impact: Pioneered AMM model, inspired hundreds of forks.

Uniswap Version Evolution



Each version added significant innovation while maintaining core AMM principles

Uniswap V1 and V2

V1 (2018):

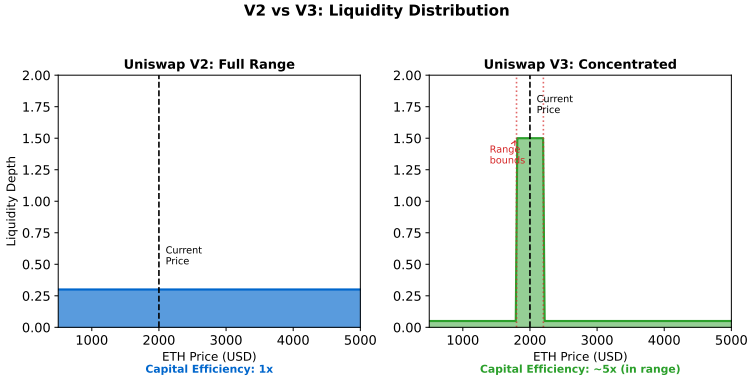
- ETH/ERC-20 pairs only, $x \cdot y = k$ formula
- 0.3% fee (100% to LPs)

V2 (2020) - Major Improvements:

- **ERC-20/ERC-20 pairs:** Direct trading without ETH
- **TWAP oracles:** Manipulation-resistant price feeds
- **Flash swaps:** Borrow tokens, repay in same tx
- **Protocol fee switch:** 0.05% potential fee (not activated)

Flash Swaps: Enable arbitrage without upfront capital.

Uniswap V3: Concentrated Liquidity



V3 concentrates liquidity in active trading ranges for higher efficiency

Concentrated Liquidity Explained

Revolutionary Concept: LPs choose specific price ranges for liquidity.

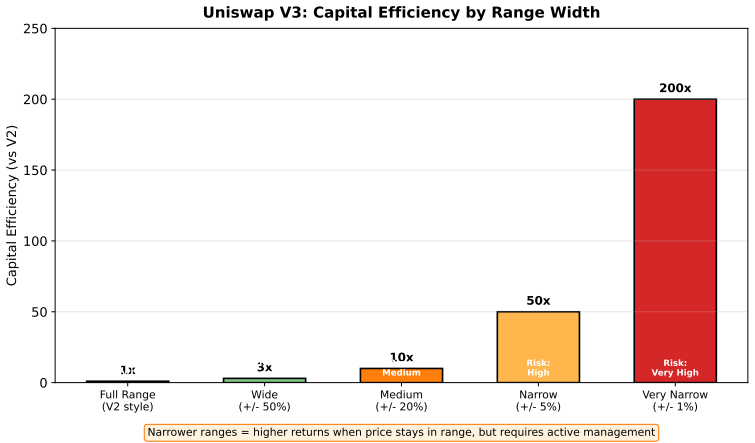
How It Works:

- Instead of infinite range, LP sets bounds (e.g., \$1,900-\$2,100)
- Liquidity only active within range
- Earns fees only when price in range

Example:

- LP deposits 1 ETH + 2,000 USDC with range \$1,900-\$2,100
- ETH = \$2,000: Position active, earns fees
- ETH = \$2,200: Position fully in USDC, no fees
- ETH = \$1,800: Position fully in ETH, no fees

Capital Efficiency by Range Width



Trade-off: Higher efficiency requires active management as price moves

Concentrated Liquidity: Management

Challenge: Price may exit your range, requiring rebalancing.

Strategies:

1. **Passive (Wide Range):** Low returns, minimal management
2. **Active (Narrow Range):** High returns if price stable, frequent rebalance
3. **Automated (Vault Services):** Gamma, Arrakis auto-rebalance for 0.1-0.5% fee

V3 LP Positions: Non-fungible (NFTs) - each position has custom range.
Impact: Less composable with other DeFi (wrapper protocols needed).

Uniswap V3: Fee Tiers

Innovation: Multiple fee tiers for same pair.

Fee Tier	Use Case	Examples
0.01%	Stablecoins	USDC/USDT, DAI/USDC
0.05%	Correlated assets	ETH/stETH
0.30%	Standard pairs	ETH/USDC
1.00%	Exotic/volatile	Low-liquidity tokens

Rationale: Stablecoins need low fees to attract volume; volatile pairs need higher fees to compensate IL.

Uniswap V4 (2024): Hooks

Key Innovation: Customizable pool behavior via hooks.

What are Hooks?

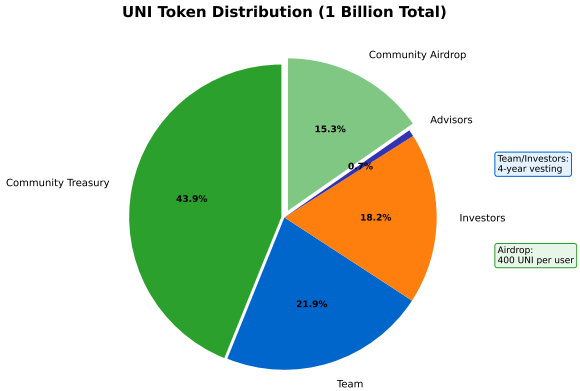
- Smart contracts executing at specific points in trade lifecycle
- Before/after swap, before/after adding liquidity
- Add custom logic without forking Uniswap

Example Use Cases:

- Dynamic fees based on volatility
- On-chain limit orders, TWAP execution
- Auto-rebalancing liquidity, MEV protection

Singleton Contract: All pools in one contract (gas savings).

UNI Token Distribution



Community received 60% (airdrop + treasury); team/investors 40% with 4-year vesting

UNI Token: Governance

Launch: September 2020 (400 UNI airdropped to every user)

Governance Rights:

- Vote on protocol upgrades
- Treasury allocation ($5B+ in assets)
- Fee switch activation (controversial)
- Cross-chain deployment approvals

Voting: 1 UNI = 1 vote (can delegate)
Thresholds: 2.5M UNI to propose, 40M quorum

Current Utility: Governance only - no direct fee revenue (yet).

The Fee Switch Debate

Current State: 0.3% fee goes 100% to LPs
Potential: Protocol can redirect 0.05% to UNI holders

Arguments For:

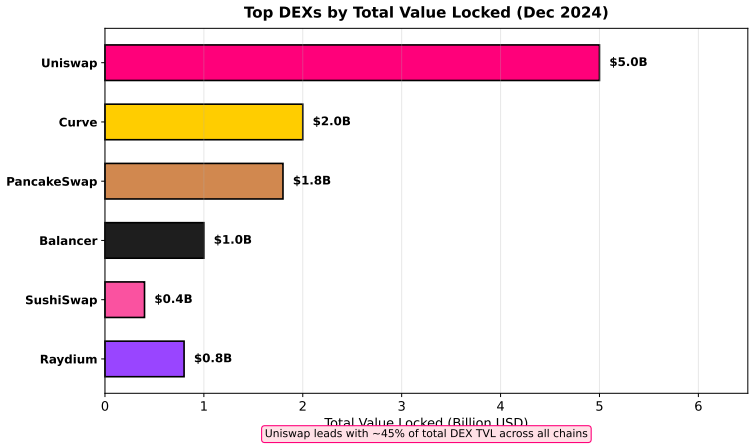
- Value accrual for UNI token
- Sustainable protocol development revenue

Arguments Against:

- Reduces LP returns (may lose liquidity)
- Regulatory risk (UNI could be deemed security)
- Current model working well

Status (Dec 2024): Fee switch remains off; delayed indefinitely.

DEX Market Comparison



Uniswap maintains market leadership through innovation and brand recognition

Uniswap's Multi-Chain Strategy

Deployments (Dec 2024):

- Ethereum (L1), Polygon, Arbitrum, Optimism, Base, BNB Chain

Benefits:

- Lower gas fees on L2s (10-100x cheaper)
- Access different user bases
- Maintain dominance across ecosystems

Challenge: Liquidity fragmentation across chains.

Uniswap's Moat: Brand recognition, deepest liquidity, innovation leadership.

Regulatory Challenges

SEC Wells Notice (April 2024):

- Allegations: Operating unregistered securities exchange
- Response: Protocol is decentralized; Labs just builds software

Legal Arguments:

- Protocol vs. Interface distinction
- Smart contracts are speech (First Amendment)
- Users choose tokens, not Uniswap

Potential Outcomes:

- Settlement, lawsuit, or favorable ruling
- Precedent-setting for all DeFi

Status: Ongoing litigation (Dec 2024).

Summary

Key Takeaways:

- Uniswap evolved from V1 (simple AMM) to V4 (customizable hooks)
- V3 concentrated liquidity: 10-200x capital efficiency
- Fee tiers: 0.01% (stables) to 1% (exotic)
- UNI governs protocol but lacks direct cash flow
- Fee switch debate: value vs. LP retention vs. regulation
- Multi-chain expansion maintains market dominance

Next Lecture: Lab - Testnet Swap (hands-on Uniswap experience).

Questions for Reflection

1. How does concentrated liquidity improve capital efficiency?
2. Why might activating the fee switch harm Uniswap's position?
3. What are the trade-offs of NFT-based LP positions in V3?
4. How do hooks in V4 enable new DeFi primitives?
5. Should Uniswap prioritize decentralization or regulatory compliance?