Navigating DeFi: A User's Guide

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Blockchain: Building Trust in DeFi

- A Shared Digital Ledger: Records transactions securely and transparently.
- Key Features
 - Decentralized: No central authority, reducing risk.
 - Immutable: Records cannot be altered, ensuring reliability.
- Why Blockchain for DeFi?
 - Enables trustless transactions without intermediaries.
 - Powers programmable smart contracts for complex financial functions.

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Transaction Flow in Blockchains



The MEV Supply Chain

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Smart Contracts: The Logic of DeFi

- What are Smart Contracts?
 - Digital agreements written in code that live on a blockchain.
 - Execute automatically when specific conditions are met.
- Key Benefits
 - Trustless: Removes the need for middlemen, minimizing risk.
 - Immutable: Ensures agreements cannot be changed after deployment.
 - Transparent: The code is open for everyone to inspect.
- How Smart Contracts Drive DeFi
 - Lending & Borrowing: Enable peer-to-peer financial transactions.
 - Decentralized Exchanges: Facilitate direct token trading.
 - Asset Management: Automate complex investment strategies.

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Decentralized Finance (DeFi): A New Financial Landscape

- What is DeFi?
 - A blockchain-based financial ecosystem offering services without traditional banks or brokers.
 - Smart contracts automate financial services.
- Key Benefits
 - Open Access: Anyone with an internet connection can potentially participate.
 - Transparent: Rules and transactions are visible on the blockchain.
 - Programmable: Enables innovative and customizable financial products.
- Important Considerations
 - Smart Contract Risks: Code flaws can lead to loss of funds.
 - Regulatory Uncertainty: Laws are still developing.
 - Market Volatility: Cryptocurrency prices can fluctuate significantly.

Stablecoins

- Custodial (Centralized) Stablecoins (e.g., USDC, USDT): Backed by fiat or high-quality assets, requiring trust in a custodian.
- Over-Collateralized Stablecoins (e.g., DAI): Maintain peg using crypto collateral managed by smart contracts.
- Algorithmic Stablecoins (e.g., UST): Aim to maintain stability through supply adjustments without external collateral.

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USDC – A Regulated Digital Dollar

- Stablecoin pegged 1:1 to the US Dollar
- Issued by Circle, a regulated company
- Backed by cash and US Treasuries
- Audited monthly for reserve transparency
- Why use USDC?
 - Price stability within the crypto ecosystem
 - Trusted bridge between traditional finance and DeFi
 - Entry point for institutions and mainstream adoption

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MakerDAO and DAI Stablecoin

- DAI: A decentralized stablecoin pegged to the US dollar.
- Maker Protocol: The platform enabling DAI's creation and stability, governed by the MakerDAO community.
- How it Works
 - Collateralized Loans: Collateralized Loans: Users deposit crypto for DAI loans.
 - Over-collateralization: Ensures DAI's value exceeds the loan.
 - Liquidation: Protects the system by selling under-collateralized assets.
 - Peg Stability Module (PSM): Enables direct swaps between USDC and DAI to maintain the peg.
 - MKR Governance Token: Interest paid on DAI loans is used to buy and burn MKR, influencing protocol decisions.
 - DSR (Dai Savings Rate): DAI holders earn passive income from the system's interest generation.

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Maker Protocol



Asset Risk Assessment: DAI Exposure to Real World Assets

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Curve Finance and crvUSD

- crvUSD: A stablecoin pegged to the US dollar, issued by the Curve Finance platform.
- Collateral-Based Minting: Users deposit various crypto assets as collateral to mint crvUSD.
- LLAMMA: An algorithm that automates collateral management and liquidations, maintaining stability.
- Stabilizer and Monetary Policy: Mechanisms that actively adjust supply and demand to keep crvUSD pegged to the dollar.

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crvUSD



Introduction to the Principles and Architecture of Curve Stablecoin

PegKeeper

- When crvUSD price > 1 USD: mint new crvUSD without collateral and deposit it into the Curve Pool to increase the supply of crvUSD in the market.
- When crvUSD price < 1 USD: withdraw previously minted crvUSD from the Curve Pool and burn these crvUSD to reduce the supply of crvUSD in the market.

PegKeeper



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Ethena: Earn More on Your Savings with USDe

- Ethena: A DeFi platform offering higher potential savings yields.
- USDe: A stablecoin pegged to the US dollar, designed for minimal volatility using *delta-neutral* strategies.
- Key Benefits:
 - DeFi Powered: Taps into innovative yield strategies within the crypto ecosystem.
 - Independent: Operates outside of traditional banking systems
 - Designed for peg stability through delta-neutral hedging.
 - Accessible: Simplifies participation in DeFi earning opportunities.

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How it Works





Q: Will it work?

Ethena gitbook

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Credit in DeFi

DeFi credit protocols like Compound and Aave enable lending without traditional intermediaries:

- Liquidity Vaults: Lenders deposit tokens, earning interest. They receive tokens representing their deposit plus accrued interest.
- No Credit Checks: Loans are issued based on smart contracts, without individual assessments.
- Overcollateralization: Borrowers must deposit collateral exceeding the loan's value to protect lenders.
- Automated Liquidation: If collateral value drops below a threshold, it's automatically sold to repay the loan.

How is DeFi Lending Different from Traditional Lending?





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Flash Loans

Flash loans offer zero-collateral borrowing with the requirement to repay within the same blockchain transaction. Use cases include:

- Collateral Swaps: Change loan collateral.
- Arbitrage: Exploit asset price differences across DEXs.
- Liquidity Provision: Temporarily boost DEX liquidity.
- Potential for Manipulation: Flash loans can enable market manipulation schemes.

AMMs: The Heart of Decentralized Exchanges (DEXs)

- What are AMMs?
 - Algorithms that power decentralized exchanges (DEXs).
 - Replace traditional order books with liquidity pools.
 - Use mathematical formulas to determine asset prices.
- How AMMs Work
 - Users provide liquidity (crypto assets) to pools.
 - Traders swap directly with the pool's assets.
 - Prices are determined by the ratio of assets within the pool.
- Key Benefits
 - Permissionless: Anyone can trade or provide liquidity.
 - Automated: No middlemen or order books needed.
 - Always Available: 24/7 trading, regardless of market conditions.

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Uniswap v2 / Balancer

- Uniswap v2
 - Best For: Basic swaps of popular tokens (ETH, WBTC, stablecoins, etc.)
 - Key Feature: Simplicity and wide asset support, ideal for beginners.
- Balancer
 - Best For: More flexibility in liquidity pools and trading less common assets.
 - Key Features:
 - Customizable pool weights (not just 50/50)
 - Supports multiple assets per pool

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Uniswap v2: The Constant Product Market Maker

- The Constant Product Rule: xy = L
- How it works: Trading changes the token ratio in the pool while maintaining overall liquidity, determining prices.



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Uniswap v3: Advanced Trading & Capital Efficiency

- Best For: Liquidity providers willing to actively manage positions for maximum returns.
- Key Feature: Concentrated Liquidity
 - Users provide liquidity within specific price ranges.
 - Enables limit-order-like trades.
 - Increases capital efficiency and potential higher earnings for LPs.

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Virtual Liquidity



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Liquidity is "additive"



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Liquidity Distribution



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Uniswap v3 Position Value



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Curve StableSwap: The Stablecoin Exchange Specialist

- Best For: Swapping between stablecoins (like USDC, DAI, USDT) with minimal slippage and extremely low fees.
- Key Features:
 - A unique algorithm optimized for assets designed to maintain a 1:1 value ratio.
 - Large liquidity pools further reduce slippage, enabling efficient trades of significant amounts.

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Curve AMM



Understanding the Curve AMM

Challenges for AMM

- Adverse Selection: Traders exploit price discrepancies due to AMM pricing mechanisms, leading to losses for liquidity providers.
- Smart Contract Risk: AMM code vulnerabilities can be exploited by hackers.
- Front-running: Bots can manipulate trades by placing orders ahead of others, profiting from the price impact.

Solution: Auction-based Models!

Next-Gen DEX: Intent-based Mechanisms

- What is Intent?
 - Programmatic trade rules specifying conditions for asset trading.
 - e.g., Buy 1 ETH only if price drops below \$1500 within 24 hours.
- Solvers: Optimal Aggregation
 - Systems, sometimes involving competitive bidding, that execute trades according to Intent when market conditions allow.
- Examples: UniswapX, CowSwap

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DeFi Asset Management: Unlock Automation

- What is DeFi Asset Management?
 - Smart contracts automate and streamline investment strategies, maximizing returns.
 - Replaces the need for human fund managers with pre-programmed actions.
- Key Strategies:
 - Yield Farming: Moves assets across protocols to chase the highest yields.
 - Liquidity Provision: Earning fees for supplying tokens to DEXs.
 - Index-like Vaults: Single deposit offers diversification across assets.
 - Automated Rebalancing: Maintains your target asset allocation over time.

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Yearn ETH Vault

YEARNETHVAULT

CURRENT STRATEGY



What are Yearn Vaults? ETH Vault Explained

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Yearn yETH: Optimized Staking Returns

- What is yETH?
 - A token representing a basket of *Ethereum Liquid Staking Derivatives (LSDs)*.
 - Designed for the best risk-adjusted returns on your staked ETH.
 - Earn yield and participate in governance by staking yETH to mint st-yETH.
- How it Works
 - Deposit: Exchange LSDs (like stETH, rETH) for yETH.
 - Earn: yETH's value grows from combined staking rewards across the LSDs.
 - Manage: st-yETH holders vote to optimize the pool's LSD mix for yield and risk.
 - Withdraw: Option to withdraw specific LSDs or yETH anytime.

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OETH: A Yield-Enhanced Version of stETH

- What is OETH?
 - OETH is a yield-bearing version of staked ETH (stETH).
 - It utilizes smart contract to automatically generate returns on your ETH holdings.
- How it Works
 - Deposit stETH and receive OETH in return.
 - OETH employs diverse yield strategies across DeFi protocols to maximize returns.
 - OETH's value constantly increases as yield is earned.
 - Sedeem oETH to receive your ETH plus accumulated yield.
- Key Benefits
 - Effortless Yield: Earn higher returns without manual yield strategy management.
 - Liquidity: OETH can be used in other DeFi protocols (as collateral, in liquidity pools, etc.), unlocking further possibilities.

My Research Projects

- Stochastic Models for AMM Pricing
 - Developed models linking AMM price discrepancies w.r.t. a reference market
 - $\bullet \ \ \mathsf{Spread} \Leftrightarrow \mathsf{Fee} \ \mathsf{tier}$
- Liquidity Distribution Dynamics (Ongoing)
 - Using SPDE to study liquidity flows in Uniswap v3.
- Optimal Liquidity Provision (Ongoing)
 - Crafting strategies for optimal liquidity management.

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No Arbitrage Region



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Thank You!

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Reference

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- Uniswap V3 New Era Of AMMs?
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- Asset Risk Assessment: Origin Ether (OETH)

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