

# L33: Introduction to DeFi

## Module E: DeFi Ecosystem

Blockchain & Cryptocurrency

December 2025

- Define Decentralized Finance (DeFi) and its core principles
- Understand Total Value Locked (TVL) as a key metric
- Explore the DeFi technology stack
- Analyze composability and its implications
- Compare DeFi to Traditional Finance (TradFi)

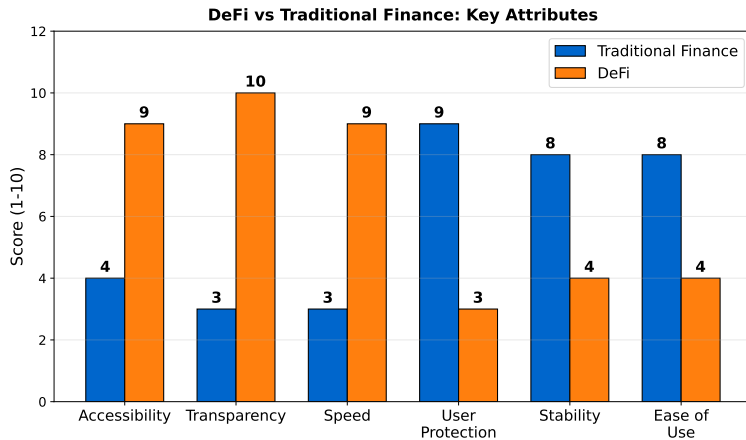
**Definition:** Decentralized Finance (DeFi) refers to financial services built on blockchain networks, operating without traditional intermediaries.

## Core Principles:

- **Permissionless:** Anyone can access without approval
- **Transparent:** All transactions visible on blockchain
- **Non-custodial:** Users control their own assets
- **Composable:** Protocols integrate seamlessly (money legos)
- **Programmable:** Smart contracts automate execution

**Vision:** Recreate traditional financial system with greater accessibility, transparency, and efficiency.

# DeFi vs. Traditional Finance



*DeFi excels in accessibility and transparency; TradFi offers stability and user protection*

## Traditional Finance (TradFi)

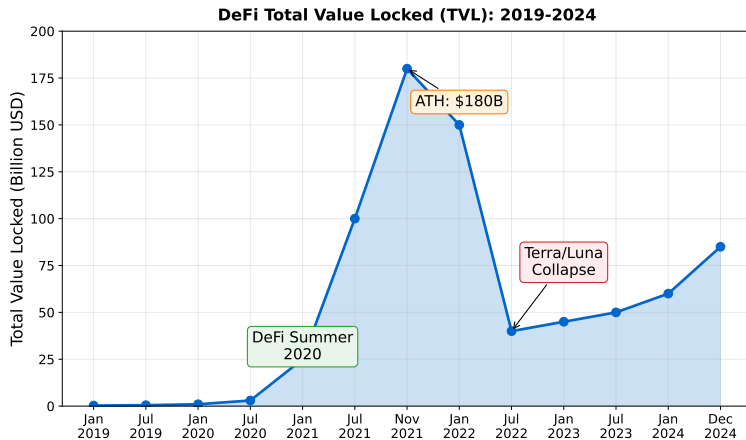
- Centralized intermediaries (banks)
- KYC/AML requirements
- Business hours, slow settlements
- Geographic restrictions
- High barriers to entry

## Decentralized Finance (DeFi)

- Smart contracts (no intermediaries)
- Pseudonymous (wallet addresses)
- 24/7 operation, instant settlement
- Global access
- Low barriers (internet + wallet)

**Trade-off:** DeFi offers accessibility and transparency but carries smart contract risks and regulatory uncertainty.

# The Rise of DeFi: TVL History



*DeFi Summer 2020 marked explosive growth; 2022 bear market saw major correction*

# Total Value Locked (TVL)

**Definition:** The total amount of assets deposited in DeFi protocols, measured in USD.

## What TVL Measures:

- Capital deployed across lending, DEXs, staking, derivatives
- Proxy for DeFi adoption and trust
- Indicator of liquidity depth

## Current State (Late 2024):

- Total DeFi TVL: \$85 billion (recovered from 2022 lows)
- Ethereum: 55% of TVL
- Layer 2s (Arbitrum, Base): 12% combined

# TVL Calculation Example

## Hypothetical Lending Protocol:

### Deposits:

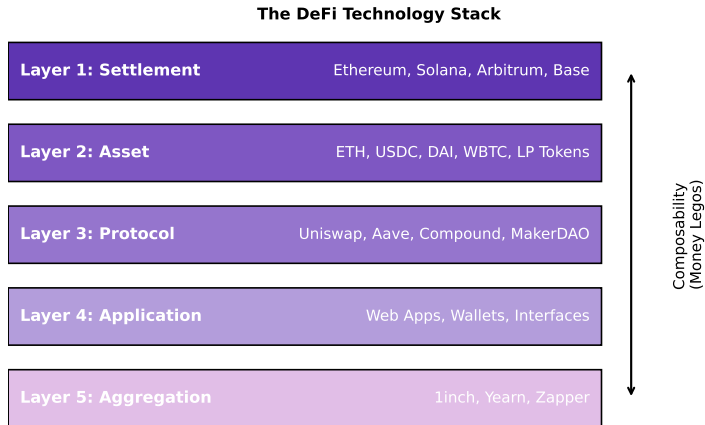
- 1,000 ETH at  $\$2,000/\text{ETH} = \$2,000,000$
- 500,000 USDC at  $\$1/\text{USDC} = \$500,000$
- 10 BTC at  $\$40,000/\text{BTC} = \$400,000$

### Total TVL:

$$\text{TVL} = \$2,000,000 + \$500,000 + \$400,000 = \$2,900,000$$

**Note:** TVL fluctuates with crypto prices; double-counting can inflate numbers.





*Composability allows protocols to build on each other like “money legos”*

## 1. Decentralized Exchanges (DEXs)

- Token swapping without intermediaries (Uniswap, Curve)

## 2. Lending & Borrowing

- Earn interest on deposits, borrow against collateral (Aave, Compound)

## 3. Stablecoins

- Price-stable cryptocurrencies (USDC, DAI)

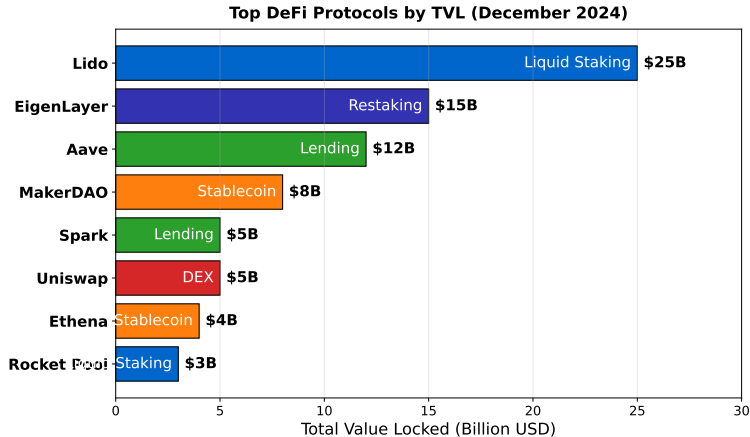
## 4. Derivatives

- Futures, options, synthetic assets (dYdX, GMX)

## 5. Yield Aggregators

- Automated yield optimization (Yearn Finance)

# Top DeFi Protocols by TVL



*Liquid staking (Lido) and restaking (EigenLayer) dominate; lending and DEXs follow*

**Definition:** DeFi protocols can interact seamlessly, allowing complex strategies by combining simple primitives.

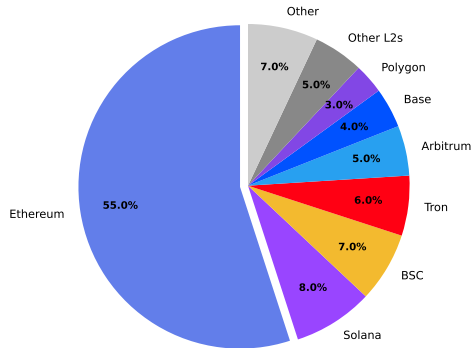
**Example Workflow:**

- 1 Deposit ETH in Aave, receive aETH (interest-bearing token)
- 2 Use aETH as collateral to borrow DAI
- 3 Swap DAI for USDC on Uniswap
- 4 Deposit USDC in Curve for yield farming

**Benefits:** Capital efficiency, innovation from combinations

**Risks:** Complexity increases attack surface, protocol failure can cascade

**DeFi TVL Distribution by Blockchain (Dec 2024)**



Ethereum maintains dominance; Layer 2s growing rapidly

*Ethereum dominates; L2s growing rapidly*

**Definition:** Bugs, exploits, or design flaws in smart contract code.

**Common Vulnerabilities:**

- Reentrancy attacks (famous: DAO hack 2016)
- Oracle manipulation
- Front-running and MEV exploitation
- Access control failures

**Mitigation:**

- Professional audits (Trail of Bits, OpenZeppelin)
- Bug bounties, formal verification
- Time-locks and multi-sig governance

**Challenge:** Smart contracts can't natively access off-chain data (e.g., ETH price).

## **Solution: Oracles**

- Third-party services that feed external data on-chain
- Example: Chainlink (decentralized oracle network)

## **Oracle Types:**

- **Centralized:** Single trusted source (fast but risky)
- **Decentralized:** Multiple providers aggregated (Chainlink)
- **On-chain:** Data derived from blockchain state (Uniswap TWAP)

**Risk:** Oracle manipulation can drain DeFi protocols (flash loan attacks).

## Permissionless Access:

- No identity verification, no geographic restrictions
- Only need: internet connection + crypto wallet
- Benefits: Financial inclusion, censorship resistance

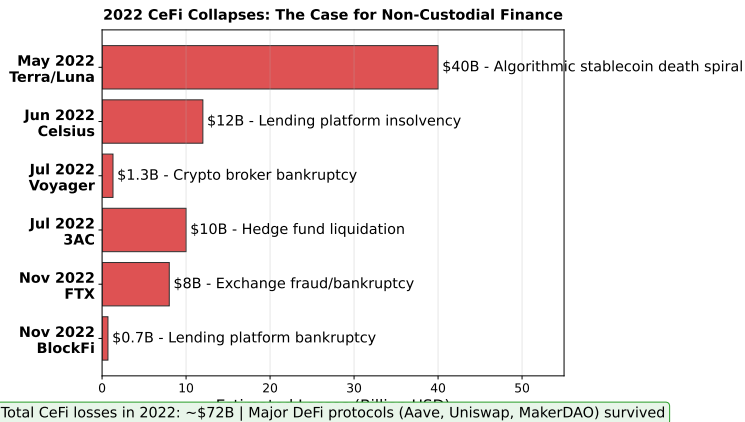
## Non-Custodial Finance:

- You hold private keys, smart contract holds funds during interaction
- No third party can freeze or seize
- **Positive:** True ownership, no counterparty risk
- **Negative:** No recovery if you lose keys

**Mantra:** Not your keys, not your coins.



# 2022 CeFi Collapses: The Case for DeFi



*CeFi custodial risk exposed; DeFi protocols like Aave and Uniswap operated normally*

**Centralized Crypto Platforms:** Coinbase, Binance, BlockFi, Celsius

## CeFi Advantages

- User-friendly interfaces
- Customer support
- Fiat on/off ramps

## CeFi Risks

- Custodial (platform holds assets)
- Counterparty risk (FTX collapse)
- Can freeze accounts

**2022 Lesson:** Multiple CeFi platforms collapsed (Celsius, FTX), highlighting custodial risk. DeFi protocols survived.

## What is Restaking?

- Reusing staked ETH to secure additional networks/services
- Introduced by EigenLayer (major growth 2024)

## How It Works:

- 1 Stake ETH with Ethereum validators (earn 3-4% APY)
- 2 Opt-in to restaking via EigenLayer
- 3 Earn extra yield from securing additional services (AVS)

## Impact:

- \$15B+ TVL in EigenLayer by late 2024
- Liquid Restaking Tokens (LRTs): eETH, rsETH, ezETH
- Criticism: Added systemic risk, complexity

## Emerging Trends:

- **Real-World Assets (RWA):** Tokenizing bonds, real estate
- **Undercollateralized Lending:** Credit scoring on-chain
- **Cross-Chain DeFi:** Seamless interaction across blockchains
- **Institutional Adoption:** Banks exploring DeFi rails
- **Regulation:** Clearer frameworks emerging (MiCA in EU)

## Long-Term Vision:

- DeFi as backend infrastructure for TradFi
- 24/7 settlement for global finance
- Financial inclusion for billions

## Key Takeaways:

- DeFi recreates financial services on blockchain: permissionless, transparent, non-custodial
- TVL measures capital deployed ( \$85B in late 2024)
- Composability enables innovation but increases complexity
- Smart contract risk and oracle manipulation are key concerns
- Restaking (EigenLayer) emerged as major 2024 innovation
- Ethereum dominates but L2s capturing increasing share

**Next Lecture:** AMM Mechanics - How automated market makers work.

- ① How does TVL differ from traditional finance metrics like AUM?
- ② Why is composability both a strength and a risk in DeFi?
- ③ What are the trade-offs between DeFi and CeFi for retail users?
- ④ How do oracles solve the external data problem, and what risks remain?
- ⑤ What regulatory challenges does DeFi face in the next 5 years?