GEDEX: Cross-Chain DEX

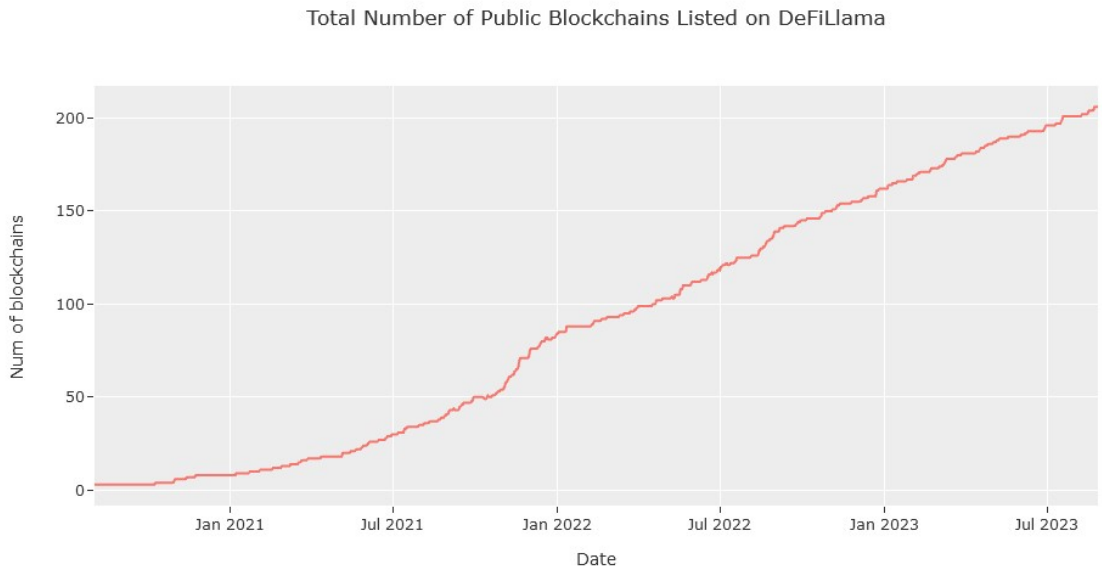
Litepaper, August 2023

info@gedex.nexus

***Abstract*— The future is multi-chain. However, there currently exists no solution for cross-chain trading that enables direct swaps of any asset pair across different chains, in a cost-effective and fully decentralized manner. In this paper, we introduce GEDEX, the first truly decentralized cross-chain DEX without impermanent loss.**

1. INTRODUCTION

The current trend in the cryptocurrency world points towards a multi-chain future, where interoperability, especially in the realm of decentralized finance (DeFi), is becoming increasingly important. One of the drivers of this trend is the growing number of blockchains, which is currently well over 200[1]. When we consider the ever-growing number of tokens and protocols of all types on each blockchain, it becomes evident that achieving higher levels of interoperability is no longer a mere option, but a necessity.

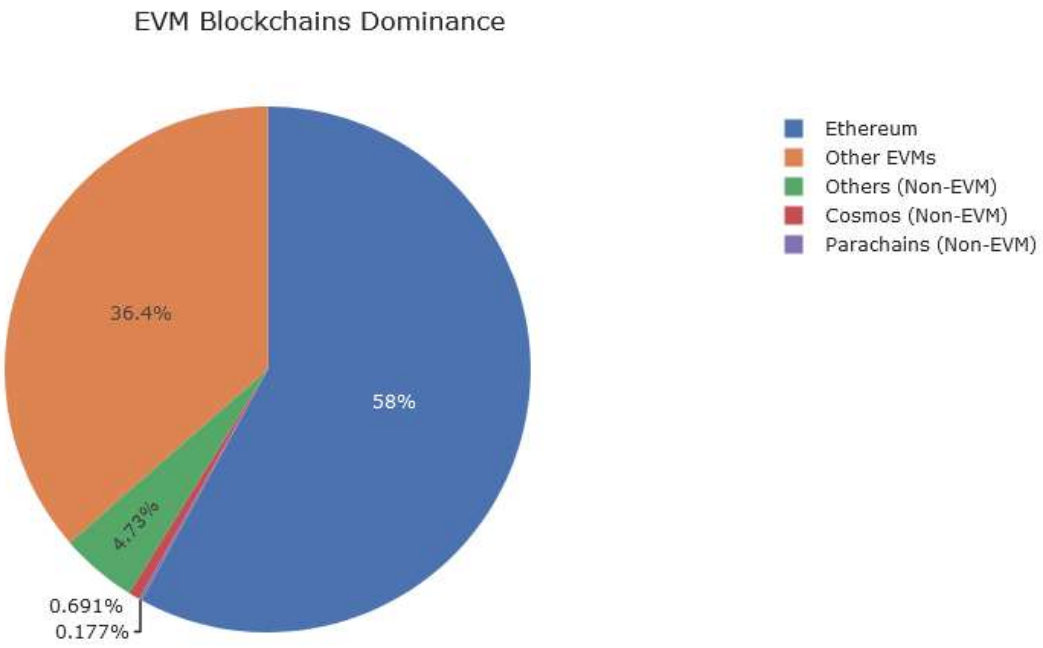


Adding to this landscape, it's notable that almost 60% of all existing blockchains classified as smart contract platforms adopt the Ethereum Virtual Machine (EVM). This speaks to the dominance of Ethereum's technological infrastructure and the widespread adoption of its programming language, Solidity. Standardization has historically been key in the evolution of computing systems, promoting robust and sustainable technical

[1] Source data from DefiLlama (https://defillama.com/chains)

development. Just as HTML and JavaScript were pivotal for web development and Python gained traction in the realm of data science, EVM and Solidity have quickly emerged as the de facto standards for Web3 development.

A central force amplifying the relevance of these standards is the 'network effect', an indispensable principle that underpins the value of these technological ecosystems. In this context, Ethereum boasts a remarkable triple network effect, established across its user base, developer community, and application ecosystem. This cumulative effect reinforces Ethereum's preeminent position within the cryptocurrency landscape, making its ecosystem the best option for the development of new crypto applications, especially in the field of decentralized finance.



Further evidence of this trend toward multi-chain interoperability lies in the rapid proliferation of traditional bridges and the more recent Arbitrary Message Bridges (AMBs). These bridges serve as essential connectors between different blockchain networks, allowing the seamless transfer of not only assets, but also information thanks to the introduction of AMBs. A sample of the momentum of these solutions is that the volume of transactions through these bridges has reached an average of $411 million[2] per day in recent months. This is particularly remarkable given that it occurs in the midst of a bear market, with overall trading volumes on both centralized exchanges (CEX) and decentralized exchanges (DEX) hitting a three-year low. The volume of transactions facilitated by the DEXs has remained at an average of $2.7 billions[3] per day during the

[2] Source data from DefiLlama (https://defillama.com/bridges)
[3] Source data from DefiLlama API (https://api.llama.fi/overview/dexs)

same period, which means that traffic through the bridges has now achieved a scale equivalent to 15% of the total DEX trading volume across all chains.

These volumes, witnessed both on DEXs and bridges, while certainly impressive, pale in comparison to the spot trading volume observed on centralized exchanges, which has maintained an average of around $50 billion[4] per day over the past 12 months. This volume comparison reveals that trading across decentralized exchanges constitutes just approximately 5% of the trading magnitude observed on their centralized counterparts. This indicates that, despite the substantial efforts made in the past five years to develop decentralized solutions, they may not yet be competitive enough against traditional trading options. The question remains: Why?

2. EXISTING SOLUTIONS

While the aspiration for multi-chain interoperability is clear, the practical realization of seamless cross-chain trading has faced a number of obstacles. Various solutions have emerged to address this challenge, each with its own set of advantages and limitations.

Centralized Exchanges

CEXs were among the first solutions to facilitate cryptocurrency trading, offering simplicity, speed, and access to a wide range of trading pairs, making them attractive to both novice and experienced traders. However, CEXs require users to trust the exchange to maintain the integrity of their assets and execute trades fairly, raises concerns about user privacy and anonymity, and conflicts with the decentralized ethos of blockchain.

[4] Source data from Coingecko (https://www.coingecko.com/en/exchanges)

Decentralized Exchanges and Bridges

Cross-chain swaps, the process of exchanging two tokens on different chains, typically involve a series of steps. This process can be intricate, requiring several transactions and approvals. Depending on the availability of the assets on the bridge, the process might involve up to two swaps on decentralized exchanges (one on the source chain for a bridgeable asset and another on the destination chain for the desired asset), the bridge transaction, and corresponding approvals.

In the worst case, this could mean signing six blockchain transactions across three different applications. This intricate process comes with a high cost in terms of gas, time, and protocol fees, potentially exceeding 1% of the traded amount. Given the cumulative costs involved, it's understandable that the market share of decentralized solutions remains considerably lower compared to the trading volume on centralized exchanges.

Atomic Swaps

Another prominent strategy is the use of atomic swaps, a mechanism that allows direct peer-to-peer exchanges of native assets from different blockchains. Atomic swaps guarantee that both parties to the transaction occur simultaneously or that neither occurs, thus eliminating counterparty risk.

However, atomic swaps face their own challenges. The liquidity requirement on both sides of the trade and the limited number of supported blockchains may limit its usability. In addition, the technical complexity of orchestrating exchanges at the protocol level between different blockchains has hindered the widespread adoption of atomic swaps.

Thorchain

THORChain (2020) is a decentralized liquidity protocol that enables users to swap assets across various blockchain networks. Unlike traditional decentralized exchanges (DEXs) that operate within a single blockchain network, THORChain enables native swaps without the need for wrapped or pegged tokens. It operates as an independent Layer 1 built on the Cosmos SDK. The protocol's drawback lies in the complexity of adding new blockchains, requiring significant development effort. Additionally, the asset listing process isn't permissionless but rather centralized, limiting available trading options. Regarding fees, these vary depending on the size of the trade in relation to the available liquidity, so they can be quite high in some cases, although they usually range between 0.5% and 1%.

Aggregators

A growing trend in the DeFi space is the rise of aggregators, which improve the user experience by leveraging existing DeFi protocols. Unlike the solutions discussed earlier, aggregators operate at the application level rather than on the blockchain itself. They simplify cross-chain trading by automating the search for optimal routes across DEXs and bridges.

Aggregators don't tackle the core challenges of high costs and inefficiencies associated with cross-chain trading. Instead, they enhance the overall user experience by reducing the complexities involved in manually conducting these transactions, making the process more accessible and intuitive for users.

Examples of these solutions can be found in protocols such as DoDo, Squid, and the recently introduced Uniswap X.

After analyzing the range of existing cross-chain solutions, it becomes clear that each approach presents its own blend of advantages and limitations. None of the current solutions allow for the exchange (swap) of assets between different chains in a fully decentralized, permissionless and single-step manner. DEXs like Uniswap allow for decentralized exchanges but only within the same chain and to exchange assets from different chains requires the use of a bridge and multiple swaps on the origin and destination chain, with high cost and complexity. Thorchain allows for the decentralized exchange of native assets from different chains, but the number of assets is limited and requires team implementation (it is not permissionless). Aggregators simplify the user experience, but don't deal with the underlying inefficiencies, thus keeping costs high. Finally, there are centralized solutions, which are more economical but are not decentralized or permissionless and require trust in a third party.

Amidst of these considerations, a new player emerges that aims to redefine the landscape of cross-chain trading: GEDEX. This novel solution introduces mechanisms to address the challenges faced by existing methods. In the next section, we will delve into the features of GEDEX, which allow it to overcome the limitations of current cross-chain trading solutions.

3. GEDEX

After reviewing existing cross-chain decentralized solutions, two main challenges stand out: complexity and cost. While recent solutions such as aggregators address the complexity, the underlying costs of interfacing with multiple protocols remain unaddressed.

The complexity of cross-chain trading arises from the need to perform multiple transactions on different DEXs and bridges. The high fees arise mainly from trading volatile assets in DEXs, as a result of trying to compensate liquidity providers for the impermanent loss, a challenge that has persisted in decentralized finance for years.

Another alternative that has gained ground recently to reduce costs is the use of stablecoins as a bridging asset. Recent projects like Squid or Stargate are proof of this. Using stablecoins as a bridging asset eliminates impermanent loss and reduces the compensation needed for liquidity providers, resulting in lower fees However, this solution is limited to stablecoin trading and does not address trading different assets on different chains.

In the midst of these challenges, GEDEX emerges as an innovative solution to improve the cross-chain trading landscape. With a clear understanding of the existing complexity and cost issues, GEDEX aims to revolutionize the DeFi sector by directly addressing these obstacles:

Streamlined Cross-Chain Trading

GEDEX's innovative approach focuses on simplifying cross-chain trading by eliminating the need for transactions and interactions between different protocols. By enabling direct cross-chain asset exchange in a single transaction, GEDEX does away with the convoluted, multi-step processes that plague current solutions. This streamlined process solves both the complexity issues, improving the user experience as a result, and a significant part of the cost issues, by performing the entire exchange process internally in a single step.

Impermanent Loss Compensation

Impermanent loss poses a major challenge on decentralized exchanges. GEDEX employs a concentrated liquidity architecture and advanced automated market making (AMM) algorithms to counter impermanent loss. Liquidity providers can deposit a single asset instead of a pair of assets, while innovations we've introduced to the AMM algorithm and liquidity management system take care of offsetting potential losses from asset price volatility.

By addressing the issues of complexity and cost, GEDEX aims to redefine the user experience of cross-chain trading in the DeFi space. A user-friendly, efficient, and profitable platform will likely encourage greater adoption and usage, contributing to the growth of decentralized trading volumes compared to those of centralized exchanges. GEDEX mechanisms have the potential to create a more seamless, accessible and

efficient cross-chain trading environment, enhancing the value proposition of decentralized finance as a whole.

3.1 Features

GEDEX departs from the fragmented liquidity model popularized by Uniswap (Adams, 2018; Adams et al., 2020, 2021), opting instead for the concentrated liquidity model proposed by Bancor (Hertzog et al., 2018; Loesch & Hindman, 2020) and also adopted by ThorChain, which offers distinct advantages:

- **One-Side Liquidity**: Unlike fragmented liquidity systems, concentrated liquidity models empower liquidity providers to contribute a single asset to a pool, eliminating the need for dual asset deposits.
- **Supressed Impermanent Loss**: Concentrated liquidity DEXs centralize swaps against a single asset, enabling diverse strategies to offset impermanent loss for liquidity providers.
- **Lower Fees and Gas Cost**: GEDEX streamlines swaps, eliminating the need for multiple intermediate steps prevalent in fragmented liquidity DEXs. This leads to substantial gas and fee savings for users, improving efficiency.
- **Cross-Chain Swaps**: Leveraging the protocol's multi-chain architecture and concentrated liquidity model, GEDEX introduces cross-chain exchanges that allow any pair of assets on different EVM chains to be exchanged in a single step. This feature simplifies decentralized cross-chain trading to a level not seen before, setting a new standard for interoperability in DeFi.
- **Permissionless Pools:** One challenge of liquidity-concentrated DEXs in comparison to fragmented counterparts like Uniswap is the requirement for an approval process to list assets for security reasons. To address this, GEDEX adopts an innovative approach. It employs a hybrid system, allowing any token to be listed without prior approval by manually providing the required amount of GDX tokens to create the liquidity pool, akin to Uniswap-style pools. This solution allows anyone to add their token to the liquidity network without assuming undue risk, while simultaneously generating demand for the GDX token.
- **Hooks:** GEDEX is composable with existing protocols. Any existing DEX can use our protocol as a cross-chain router, giving its users a seamless cross-chain experience while retaining trading fees.
- **Reduced Slippage**: GEDEX can also reduce slippage thanks to its design. While a fragmented liquidity DEX would require 2n pools for n traded assets, our system

necessitates only n pools. This consolidation provides deeper liquidity and subsequently reduces slippage, notably benefiting traders.

- **Lower Deployment Cost**: Unlike Uniswap, where new liquidity pairs demand the creation of new contracts, GEDEX's integrated architecture significantly diminishes this cost. In Uniswap, each new pair entailed substantial gas costs (often exceeding $1,000 during high network congestion), but the concentrated liquidity model reduces this by requiring only one pool per asset. GEDEX takes this a step further by eliminating deployment costs entirely.
- **Built-in Price Oracle**: GEDEX incorporates an advanced internal oracle system that surpasses existing alternatives in terms of both security and precision. This powerful oracle technology enhances the DEX's reliability and accuracy, contributing to the creation of a more robust and secure DeFi ecosystem.

In summary, GEDEX's innovative approach addresses the complexity and cost challenges that are prevalent in today's cross-chain trading solutions. By streamlining the trading process, compensating for impermanent losses, and introducing a variety of additional features, GEDEX aims to redefine the landscape of decentralized finance by achieving a more fluid and efficient trading environment.

4. CONCLUSION

We have introduced GEDEX, a decentralized exchange that allows direct swaps between EVM chains while effectively addressing the problem of impermanent loss.

As we have seen, existing solutions for cross-chain exchanges often require trade-offs between decentralization, simplicity, and cost. Recent successful solutions have chosen to address the complexity challenge without fully mitigating the underlying cost issues (aggregators), or turn to the use of stablecoins to reduce costs but without allowing the exchange of assets. Other solutions like Thorchain simplify the process and have intermediate costs, but lack full decentralization and have limitations on the number of assets supported. To the best of our knowledge, there is currently no solution with the comprehensive features that GEDEX offers.

In conclusion, it is crucial to emphasize the significant opportunity presented by the absence of suitable multi-chain decentralized trading solutions at a time when the narrative around rollups is gaining momentum and a multitude of new Ethereum Layer 2 solutions are being developed and launched. Add to this that even during a bear market an average daily trading volume of $50 billion is maintained. This outlook underscores the need for innovative platforms like GEDEX, which have the potential to play a pivotal

role in shaping the future of decentralized finance by providing seamless and efficient cross-chain trading while addressing existing challenges.

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