BRIDGEPOOL

NEAR Rainbow Bridge Hackathon

@TechnologyAS 30.09.2020

Abstract: Bridgepool is a cross-chain liquidity pool that is designed to enable low-friction automated transactions between EVM compatible blockchains. This implementation is specifically designed as a complement to the NEAR Rainbow Bridge.

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Introduction: Bridgepool is a protocol for automated token exchange between the Ethereum network and the NEAR network, uses the NEAR Rainbow Bridge (NRB) as the basis of its operation. It is designed around gas efficiency, maximisation of liquidity across chains and transparent operation. It is intended to be used as both a tool for maximizing liquidity and for gas price arbitration. This document outlines the core mechanics and technical details for Bridgepool.

Motivation: The rapidly expanding DeFi segment has come to dominate Ethereum network usage, raising gas prices to an extent that many of the previous network users are priced out and are increasingly looking to alternative chains for their activities. Many of these EVM-compatible chains allow for all of the functionality of Ethereum but often with much lower gas fees and a corresponding reduction in overall security. In order to use these alternative chains however the user must first purchase a token on Ethereum and send it to the alternative chain using a one-way bridge, incurring two or more transaction fees on Ethereum. This may happen once or multiple times in either or both directions depending upon how much the user requires to move their funds between chains.

The proposition of Bridgepool is to make a smart contract cross-chain liquidity pool that will allow users to A) deposit ERC-20 tokens from Ethereum or NEAR chains into a shared liquidity pool, and redeem these ERC-20 tokens on either chain at any time; and B) the NEAR Bridgepool can interact with AMMs on either chain to allow an alternative routing for trades to occur cross-chain and in a frictionless manner. When used in this manner the Bridgepool either requires the user to have sufficient collateral across the chains to facilitate the transfer or charges a small liquidity provision fee.

Providing Liquidity: Adding liquidity requires depositing ERC-20 tokens into the Bridgepool contract for that token. As liquidity is added to the pool a pool auto-balancing mechanism automatically sends a percentage to the pool contract on the opposite chain, thereby keeping the pool split nominally 50/50 between chains. Liquidity tokens are minted to track the relative proportion of total reserves that each liquidity provider has contributed. They are highly divisible and can be burned at any time to return a proportional share of the market's liquidity to the provider. The liquidity provider can choose to what chain the liquidity tokens are sent and as they are to ERC-20 standard they can be transferred across chain at a later date; in this way Bridgepool liquidity-provider tokens (BLP tokens) can be used as a proxy for either the ERC-20 token on either chain.

Contract Autobalancing: The Bridgepool contract that is deployed on both chains has an auto-balancing function and an exchange rate function that enables pool liquidity to be withdrawn on either chain without prompting a liquidity crisis. This function comprises of two parts designed to work in conjunction with natural market arbitrage opportunities to maintain a balance. The first part comprises of an automatic auto-balancing on addition or removal of liquidity, and the second part comprises of a variable exchange rate between nominally identical tokens across chains.

Liquidity Balancing: For example, on deposition of a token on either chain the smart contract automatically sends a proportion (nominally 50% but can be more or less depending upon the balance of the pools, and the location of the BLP tokens) across the bridge to the corresponding contract. In this way the contract is likely to meet the demand for redemption of BLP tokens under the majority of circumstances.

Exchange Rate: As the two tokens in the contract are both notionally the same then they are notionally of equal value, and the target exchange rate is always 1:1. However, if the contract enters into a set of circumstances where demand on one chain is threatening the ability of the pool to service all redemption events then the exchange rate mechanism will allow this value to move away from 1:1 along a bonding curve. This should provide a sufficient arbitrage opportunity for market participants to add tokens to the undercollateralized chain or move BLP tokens to the overcollateralized chain. This point at which this happens will depend upon the position on the bonding curve and the respective chain gas fees.

Chainstate Reconciliation: As Bridgepool relies upon two equivalent smart contracts (one for each chain) then changes to a pool on one network also need to be applied to the pool on the alternative network. For instance, if liquidity is added to the NEAR Bridgepool on the Ethereum network then the smart contract must both broadcast the change in overall liquidity and also the sum of NEAR being transferred between chains + the updated exchange rate as part of the auto-balancing mechanism. Therefore any addition/removal of liquidity will required corresponding gas fees on the network in which the contract interaction occurred.

Basic Functionality: If a user intends to utilise both primary chain (Ethereum) and alternative chain (NEAR) for multiple transactions both on and between chains they might find gas fees a significant consideration. Bridgepool will allow the user to deposit ERC-20 tokens on either chain for a proportional share that bridgepool. This share is evidenced by a certain number of BLP tokens which may at a later date be redeemed for ERC-20 tokens on either network. In this scenario the user would be more inclined to add tokens to the bridgepool when gas fees are low on the depositing network on the basis that the BLP tokens could later be redeemed on the alternative network avoiding potentially raised gas fees.

In this scenario if the user chooses to have all of their BLP tokens sent to their address on the alternative network this might have the effect of upsetting the ratio of tokens/BLP tokens on each side of the pool, and the auto-balancing mechanism would adjust the exchange rate to incentivize users to move BLP tokens to the other chain, either by sending them as ERC-20 standard tokens or by depositing on the undercollateralized side.

Advanced Functionality: If a user intends to transact between token A (e.g. WETH) and token B (e.g. OMG) via one of the Ethereum based AMMs (e.g. Uniswap) they must interact with the exchange contract for that token and accept the transaction rate determined by the AMM bonding curve. It is however anticipated that in the near future there will be similar AMMs on alternative chains such as NEAR that may offer different provisions of liquidity and, under dynamic market conditions, different transaction rates. Bridgepool is intended to offer a solution to maximizing liquidity across chains and to enable complex multi-step transactions to occur seamlessly, and with price certainty, finality and resistance to front-running. The mechanism it uses to achieve this is as follows:

1. The user deposits into the bridgepool, their funds are allocated into the pool across chains according by the autobalancing function and their BLP tokens are sent to the address on the user-selected chain. The user may ultimately have deposits in many different token bridgepools across the NEAR/Ethereum chain pairing.

2. The user visits the Bridgepool DEX aggregator on the chain they are using (in this example Ethereum Main Net) and selects the tokens they wish to transact (in this example WETH/OMG), prompting a rate of exchange from the aggregator showing the various AMM exchange contract rates. The Bridgepool client can then assess this rate of exchange against the rates offered on the NEAR based AMM and highlight potential trade routings that might offer more favourable rates considering the additional gas fees required to take the more circuitous route.

3. Should the user choose to accept a cross-chain trade routing (this assumes the exchange rate savings outweigh the additional gas fees) then the following steps are taken on execution of the trade:

i) the user accepts the trade on Bridgepool aggregator (WETH/OMG) using the cross-chain routing and their corresponding slippage allowance. There is also the option to select which network the OMG tokens are required to end up on, and an option to select whether the spent liquidity should be replaced.

ii) Bridgepool redeems a sufficient proportion of their NEAR-based BLP tokens to cover the trade (this could redeem one or more NEAR-based ERC20 tokens).

iii) Bridgepool executes a trade between the redeemed ERC20 token and OMG.

iv) Optional: Bridgepool sends the OMG across the Rainbow bridge to the Ethereum address if so requested by the user.

v) Optional: If the spent liquidity is to be replaced then Bridgepool buys a corresponding amount of the previously redeemed ERC20 token on the Ethereum network and supplies it to the BLP. Alternatively if there is a functioning secondary market for BLP tokens the Bridgepool can simply repurchase the BLP tokens.

Further Considerations: To incentivise greater use of bridgepools between NEAR, Ethereum and other EVM-compatible chains there could be the ability for users to harness the liquidity in these pools without becoming a liquidity provider. This would incur a small fee for the user which would be added to the liquidity pool, ultimately rewarding the liquidity provider. The Bridgepool DEX aggregator could suggest trade routes which went through tokens or chains which the user did not possess and the smart contract functionality could both use and replenish the liquidity without any requirement for the user to purchase alternative tokens or to leave the network on which they are operating.

i) the user accepts the trade on Bridgepool aggregator (WETH/OMG) using the cross-chain routing and their corresponding slippage allowance.

ii) Bridgepool redeems a sufficient proportion of the NEAR-based WETH pool to cover the trade, and adds the user's WETH to the Ethereum side of the pool including the small liquidity fee.
iii) Bridgepool executes a trade between the redeemed WETH and OMG on the NEAR based AMM.

iv) Optional: Bridgepool sends the OMG across the Rainbow bridge to the Ethereum address if so requested by the user.