Deri V4: A Cross-Chain Decentralized Protocol of Derivatives

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Abstract
This whitepaper presents the innovations of Deri Protocol's 4th version (Deri V4), which is anchored around the Cross-Chain Decentralized Application (xDapp) model. Deri V4 aspires to transform decentralized finance by providing a universal decentralized derivative trading protocol, enhancing inclusivity and capital efficiency in the DeFi derivatives market. Its hallmark features include unparalleled flexibility across blockchains, consolidated liquidity, swifter execution, and an expansive range of symbol offerings. The xDapp-based architecture, consisting of a requesting interface and an executive engine, ensures Deri V4's seamless operation across multiple blockchains, promising a more integrated and dynamic DeFi ecosystem.

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1. Introduction

This whitepaper introduces the 4th version of Deri Protocol (Deri V4). The central feature of the V4 upgrade is the adoption of the Cross-Chain Decentralized Application (xDapp[4]) model, a pioneering development in the blockchain sphere that holds promise for redefining the decentralized finance landscape.

Our vision for Deri V4 is to construct an all-chain decentralized protocol for derivative trading, enhancing inclusivity, capital efficiency, and user experience in the DeFi derivatives market. By embracing the xDapp concept, we aim to achieve unprecedented scalability and versatility in our ecosystem, overcoming previous limitations and setting a new standard for decentralized derivatives trading.

The Promise of Deri V4
From the perspective of users (i.e. traders and liquidity providers), Deri V4 offers several notable advantages:

- **Flexibility of Network:** Deri V4 excels in providing traders with access to a wide range of blockchain networks. Traders can choose their preferred blockchain and enjoy a consistent trading experience, enabling them to focus on executing trades and staying ahead of the curve.

- **Consolidated Liquidity for Enhanced Trading:** By pooling liquidity from all supported networks, Deri Protocol ensures that traders have access to deeper and more robust markets. This consolidation reduces fragmentation and slippage, enabling traders to execute orders with greater efficiency and liquidity across multiple networks.

- **Faster Execution and Reduced Gas Costs:** Deri V4 employs a novel approach to enhance trading speed and reduce gas costs. By executing the main logic on Deri's Layer 3 infrastructure, the protocol significantly improves transaction processing times. Traders benefit from faster order execution and trade settlements, as well as reduced gas fees.

- **Expanded Symbol Offerings and More Option Strikes:** Deri V4 offers a broader range of symbols and a greater variety of strikes for Everlasting Options, allowing traders to tailor their strategies more precisely and explore a diverse array of trading opportunities.

Unchanged or Strengthened Features
Despite the introduction of exciting innovations, the following major features have either been retained or strengthened from previous versions:

- **External Custody:** External custody, introduced in Deri V3[*3*] to address the scalability issue of supporting multiple base tokens, has been implemented by storing user capital in a money market protocol, such as Compound, AAVE, or Venus. This mechanism has substantially optimized the scalability and capital efficiency of Deri V3 and will continue to do so for Deri V4. The external custody framework will be further optimized in Deri V4, as detailed later in this whitepaper.

- **Sharing liquidity across symbols:** Deri V3's unified DPMM[*3*] provides significant advantages by handling a variety of funding-fee-based perpetual derivatives within a single general-purpose trading pool. This approach enhances capital efficiency, as different types of derivatives can be traded against the same liquidity pool, simplifying speculation and risk management. The unified DPMM also facilitates the introduction of innovative derivative types. In Deri V4, the advantages of DPMM will be further expanded, as the new framework will enable the DPMM to support many more symbols than Deri V3 does.

- **Multiple base tokens:** Deri V4 continues to support multiple base tokens, with even greater flexibility due to an optimized external custody mechanism.

With Deri V4, we aim to take the "lego gameplay" of DeFi projects to new heights, further establishing our position as a leading player in the DeFi derivatives space. As always, we are committed to delivering an exceptional trading experience, bridging the gap between conventional finance and DeFi, and driving innovation in the decentralized derivatives markets.

In conclusion, Deri Protocol V4, as an xDapp, represents a pioneering approach to DeFi derivatives, showcasing the potential of cross-chain applications and contributing to the ongoing evolution of the DeFi arena.

2. The xDapp Architecture: Interface and Engine

Central to Deri V4's revolutionary design is the adoption of the *xDapp* model[*4*]. Short for Cross-Chain Decentralized Application, xDapps represent a new breed of decentralized applications, architected to function across multiple blockchains. This development represents a significant leap forward from traditional Dapps, ushering in a new era of interoperability and integration within the blockchain ecosystem.

xDapp

The concept of xDapp, i.e. Cross-Chain Decentralized Application, is crucial to grasp the architectural evolution of the Deri Protocol in its fourth iteration. Distinct from traditional Dapps that are confined to a single blockchain, xDapps are engineered to operate seamlessly across a multitude of blockchains. Central to this architecture is the xData layer, a shared data repository that spans various blockchains, enabling xDapps to adopt a top-down, message-passing approach to development, as opposed to the traditional bottom-up world of Dapp development. Adhering to the Protocol-First

Design philosophy, xDapps prioritize the definition of high-level protocols, creating a blueprint to which all components must conform, moving the smart contract implementation to a subsequent stage. In essence, xDapps integrate multiple specialized components to deliver a unified, distributed, and decentralized user experience across a range of layer 1 or layer2 ecosystems. By harnessing this innovative xDapp architecture, Deri V4 stands to offer a host of benefits, which will be elaborated later in this paper.

2.1. *i-Chain and d-Chain*

The key innovation in Deri V4 lies in its architecture, which consists of two main components: a requesting interface and an executive engine, each implemented as a group of smart contracts. Think of the former as the front-end and the latter as the back-end of our architecture — but do not confuse the former with the webpage UI. They represent the contract-level interface and execution, respectively. This distinction between the requesting interface and the executive engine allows for the deployment of the two components on different blockchain networks. Importantly, the requesting interfaces are deployed across multiple blockchains (both layer 1s and layer 2s), enabling users to interact with Deri V4 from whichever major blockchain they prefer. This approach realizes the "all-chain strategy" (i.e., the *"x"* aspect of *xDapp*).

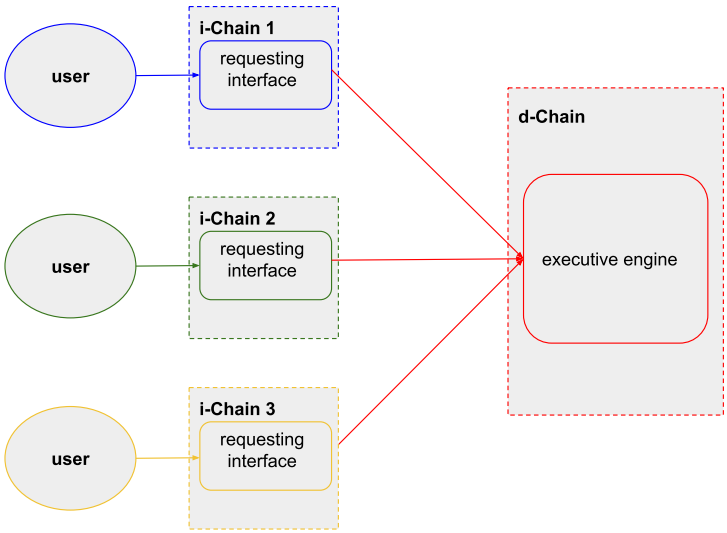

Figure 1.: While the executive engine is deployed on the singular *d-chain*, the requesting interface is deployed across multiple *i-chain*s.

As shown in Figure 1, the executive engine of Deri V4 is deployed on a dedicated blockchain, specifically an AppChain (application blockchain). This dedicated AppChain is termed *d-chain*, where *"d"* represents *Deri*. In contrast, the smart contracts for the requesting interface are deployed across various public blockchains such as Ethereum, Arbitrum, zkEVM, and BNBChain. A blockchain network that has the Deri requesting interface deployed is termed *i-chain*, with *"i"* signifying *interface*. In future discussions where the context is clear, we might use the terms *"i-chain"* and

"requesting interface" interchangeably[1]. Likewise, "d-chain" and "executive engine" will be used synonymously.

Figure 2 illustrates the Deri V4 architecture and the corresponding interacting procedure.

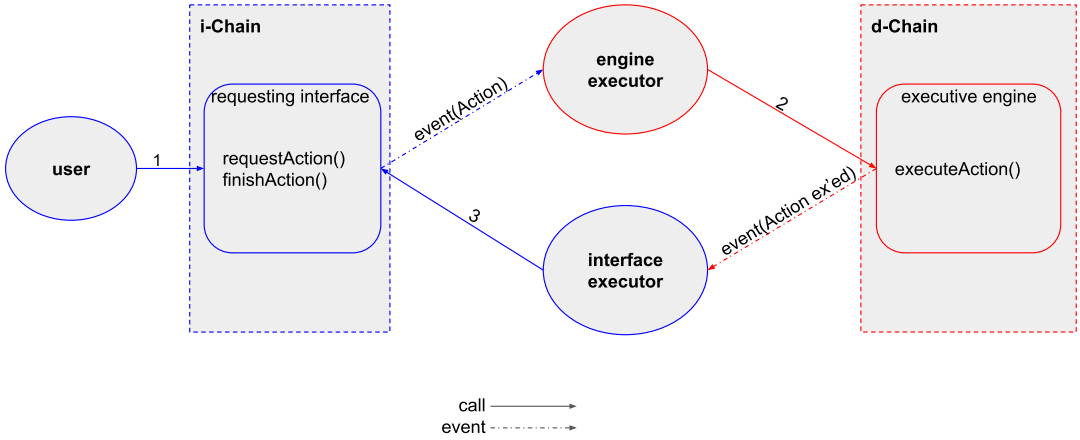

Figure 2.: Standard procedure for an *Action* executed in Deri V4. An *Action* can encompass operations such as trading, adding or removing margin, adding or removing liquidity, or liquidation. The entire procedure is delineated in 5 steps.

When users interact with Deri V4, they send an *Action* request to the *i-chain* (the requesting interface). This *Action* might be a trader placing an order, depositing or withdrawing margin, or a liquidity provider adding or removing liquidity. This request is subsequently relayed to the *d-chain* (the executive engine) for processing. The full procedure for executing an *Action* encompasses three steps, as depicted in Figure 2:

(1) A user requests an *Action* on *i-chain*
(2) The engine executor captures the *Action* request (an event emitted by *i-chain*) and executes the *Action* on *d-chain*
(3) The interface executor captures the *"Action executed"* event emitted from *d-chain* and finishes the *Action* on *d-chain*

It's important to recognize that not all *Actions* necessitate progressing through all three steps. For instance, concluding a trade typically requires only the first two steps.

[1]However, it's worth noting that *"i-chain"* could refer either to the actual blockchain or to the group of Deri smart contracts running on that blockchain.

2.2. *Capital Efficiency and Unified Liquidity with xDapp*

Through the implementation of the xDapp architecture, Deri V4 addresses the pervasive challenge of liquidity fragmentation, which is prevalent in numerous DeFi protocols. With this revamped architecture, liquidity from various blockchain networks converges into one centralized pool, advancing capital efficiency and granting traders superior liquidity access.

Within Deri V4, irrespective of the particular blockchain network in use, all liquidity providers feed into a singular, consolidated pool. This pool then serves all traders, regardless of their chosen blockchain. This marks a significant departure from Deri V3, where liquidity pools across distinct blockchain networks operated independently, leading to fragmentation. Consequently, Deri V4 offers a more substantial liquidity pool, enhancing the trading experience for users.

Deri V4 leverages the cross-chain capabilities of xDapps, creating a conduit for liquidity between disparate blockchains. This broadens the array of assets deployable within the Deri ecosystem, thereby heightening capital efficiency. By assimilating this cross-chain feature, Deri V4 widens its service ambit, allowing users spanning various blockchain networks to engage with the protocol. This broader inclusiveness is poised to draw a multifaceted user community, bolstering a resilient and dynamic DeFi ecosystem.

Even with its advanced cross-chain capabilities, Deri V4 steadfastly upholds its foundational DeFi tenets. Persisting as a suite of smart contracts on the blockchain, it guarantees that risk exposure transactions remain on-chain, transparent, and uncompromised. Deri V4 continues its support for major derivative instruments, including Perpetual Futures, Everlasting Options, Power Perpetuals, and Gamma Swap, while broadening the derivatives' reach across an expanded spectrum of blockchain platforms.

3. Architectural Changes

3.1. *Position Handling*

Distinct from previous versions, Deri V4 allows an address to hold an arbitrary number of pTokens. Each pToken can encapsulate multiple positions. When initiating a trade, a trader must specify the pToken from which the trade will originate, be it an existing pToken or a new one.

Each pToken manages its individual positions and collateral. Within a pToken, the cross-margin collateral mode is consistently applied: the *Required Margin* of the pToken is the aggregate *Required Margin* of all its contained positions. The protocol verifies the following margin prerequisites for trade execution or pToken liquidation:

- Execute a trade: require(Dynamic Effective Balance $>$ Initial Margin)
- Liquidate a pToken: require(Dynamic Effective Balance $<$ Maintenance Margin)

In the preceding year, we introduced a "lite mode" on our website, facilitating trade via the isolated margin mode. Instead of altering the protocol, the lite mode and its isolated margin were introduced atop Deri Protocol V3 as an additional dApp. In contrast, Deri V4 natively supports both cross-margin and isolated-margin modes. This is accomplished using the innovative pToken mechanism. Notably, pTokens function differently in Pro and Lite modes:

- **Pro mode (cross margin):**
  - All positions are held in a single multi-position pToken.
  - Only one pToken exists per address.

- **Lite mode (isolated margin):**
  - A single pToken holds one position.
  - Each new position prompts the creation of a dedicated pToken.

3.2. *Base Token Support*

Deri V4 continues to support an array of base tokens. Thus, tokens like stablecoins, ETH, or WBTC can serve as base tokens, aiding liquidity provision for LPs or as collateral for traders. However, Deri V4 no longer accommodates a mix of these base tokens. Users must choose, for example, between USDC and ETH, not both. This modification predominantly impacts traders:

- An LP must opt for a singular base token type for liquidity addition. If they wish to employ a combination of base tokens (e.g., ETH and USDC), they may do so using separate addresses for each base token.
- A trader can employ only one type of base token as margin. Combining, say, ETH and USDC, is no longer feasible—a necessary compromise.

3.3. *B0 Insufficient Scenarios*

Given that liquidity spans all the *i-chains*, a user might endeavor to withdraw more funds than available reserves on the solicited *i-chain*. In such cases, IOU tokens are issued, redeemable later. Liquidity rebalancing is initiated post IOU issuance:

- A backend process determines the optimal cross-chain path and elects the *i-chain* from which liquidity will be sourced, favoring chains with surplus liquidity.
- Cross-chain transfers are effected through either official routes like CCTP[*5*] or third-party bridge solutions such as Celer cBridge[*6*].

3.4. *Hard Decoupling of* i-Chain

Integrating a new *i-chain* is relatively direct. Procedural elimination of an *i-chain* is also planned, albeit rare. This segment addresses the challenging scenario of unexpected *i-chain* removals or "hard decouplings." Such events typically arise if an *i-chain* abruptly crashes with bleak prospects of recovery. For instance, a hypothetical adoption of the Terra blockchain as an *i-chain*, coupled with its collapse in May 2022, would instigate a hard decoupling. However, temporary outages aren't treated as hard decouplings.

During a hard decoupling, our primary concern is the potential ripple effects on the broader Deri V4 network, rather than the immediate fate of LPs and traders on the affected *i-chain*. Three primary impacts emerge:

- The total PnL apportioned to the affected *i-chain* (denoted as A) remains unsettled.
- The PnL generated by traders on this *i-chain* (denoted as B) is also unsettled.
- The liquidity removal from this *i-chain* incurs a penalty (represented as P). Typically, an LP would bear this during liquidity unstaking, but that's not viable in a hard decoupling scenario.

Thus, the value $(A - B + P)$ is settled as an *"Extraordinary Item"*.

4. Summary

In essence, Deri Protocol V4 marks the dawn of a revolutionary phase in decentralized finance. Leveraging the prowess and adaptability of the xDapp model, it seeks to redefine the traditional limitations and bottlenecks that plagued earlier DeFi paradigms. Our approach amalgamates multiple blockchain networks, aggregates liquidity, and refines trading processes. More than just evolving a protocol, we're setting the compass for the future trajectory of DeFi derivatives. Our core principles stand unwavering: decentralization, transparency, inclusivity, and unmatched efficiency. As the financial sphere perpetually morphs and matures, Deri V4 is geared to steer, sculpt, and demarcate the forthcoming epochs of decentralized derivative arenas.

Acknowledgements

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References

(1) *"The Derivative Exchange Protocol"*
(2) *"Deri V2: The Derivative Exchange Protocol with Extreme Capital Efficiency"*
(3) *"Deri Protocol V3: The Evolution of Capital Efficiency"*
(4) *"An Introduction to xDapps"*
(5) *"Cross-Chain Transfer Protocol"*
(6) *"Celer cBridge"*