Puffer UniFi Litepaper

Bringing Ethereum Together

The Puffer Team

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Introduction

In pursuit of Ethereum's rollup-centric roadmap, the winner-takes-most dynamics of L2s results in a negative-sum game that fragments the ecosystem and prevents Ethereum from reaching its full potential.

Puffer's **UniFi** is a Based Rollup designed to address Ethereum's fragmentation, drive value back into the L1, and facilitate credibly neutral transaction sequencing—all while maintaining a user experience conducive to mass adoption.

UniFi leverages based sequencing on the L1 and integrates preconfirmations from Puffer's natively restaked validators. This architecture allows UniFi to quickly scale from a single centralized sequencer to tens of thousands of decentralized sequencers while delivering the fast and cheap transactions expected by rollup users. Through synchronous composability, transactions on UniFi can interact directly with other based rollups, eliminating the need for bridges and offering users the experience of a unified L1.

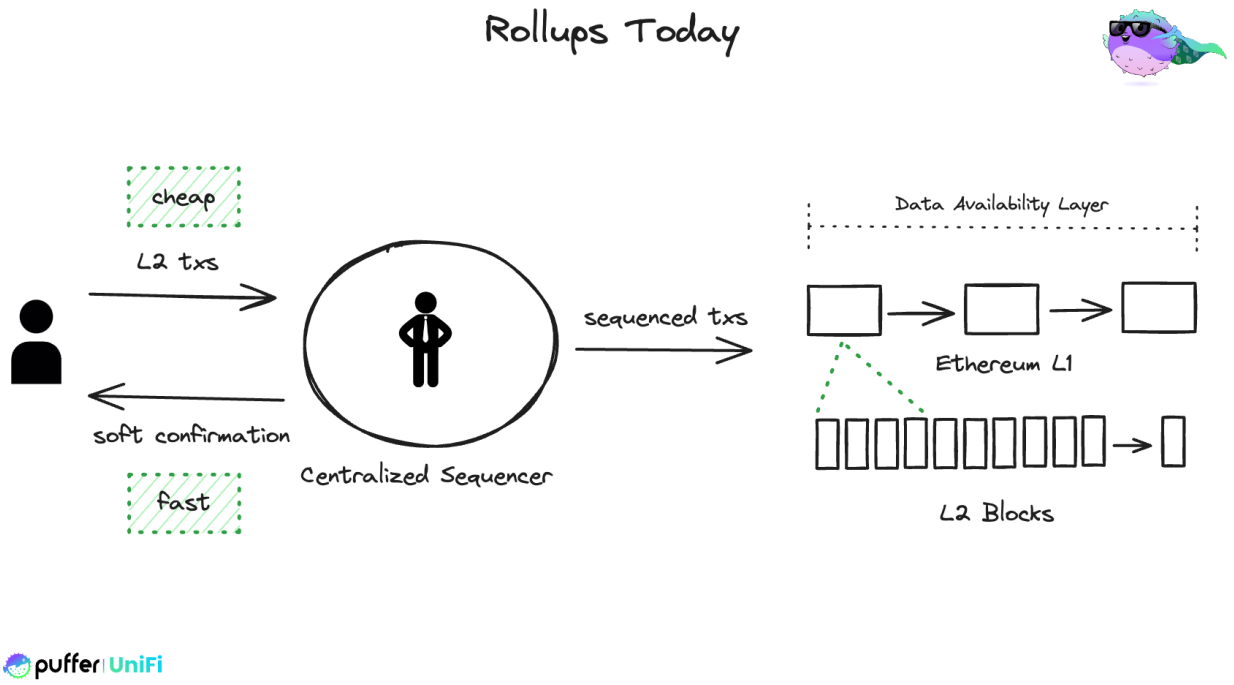
Additionally, UniFi's architecture enables "native yield" through Puffer's Liquid Restaking Token, pufETH and the addition of unifiETH. Users who stake pufETH to join UniFi share a yield with the Puffer preconfers, enabling gasless transactions and enhancing overall user experience.

Putting this all together, users who transact on UniFi can expect 100ms preconfirmations and gasless transactions, while tapping into a unified liquidity and app layer. From a wider lens, UniFi seeks to drive long-term sustainability and value into Ethereum's base layer by allowing sequencing fees to flow back to block proposers.

Realizing this vision requires reaching a Schelling point where the based rollup ecosystem's network effects are sufficiently large to attract the next prospective user and developer. UniFi is Puffer's flagship rollup aimed to catalyze a cohesive based app-chain ecosystem and foster a positive-sum environment where dApps and liquidity are unified across Ethereum.

Background

Ethereum's Rollup-Centric Roadmap



For the past several years, Ethereum has pursued a rollup-centric roadmap to address scalability challenges. This strategy focuses on optimizing the network's throughput by shifting transaction execution from the L1 to L2 rollups. In this paradigm, multiple parallel L2 solutions can process transactions swiftly and cost-effectively before settling them on the Ethereum L1.

By leveraging L2 rollups, Ethereum enhances its collective throughput beyond the capacity of the L1 alone. This architectural approach not only boosts transaction speed and reduces costs but also lays the groundwork for broader scalability innovations across the Ethereum ecosystem.

Key advantages of this roadmap include:

- **Tech Accelerationism**: Offloading execution to L2s allows Ethereum L1 upgrades to proceed cautiously, promoting safety, while L2s can rapidly innovate. This has spurred advancements in proving systems (validity and fraud proofs), execution environments (EVM/zkEVMs/SVM), and introduced additional scaling solutions (Layer 3s).
- **dApp Unlocks**: Fast transaction confirmations and reduced gas fees improve user experience and enable new applications in Social Finance (SoFi) and Game Finance (GameFi) that require low latency.

- **Competition**: The proliferation of L2 solutions fosters competition among rollup providers across technology, developer relations, and business development, driving innovation and improving service offerings.
- **Moat**: Ethereum L1 can maintain specifications that prioritize decentralization (e.g., lower hardware requirements for node operation), while L2s compete effectively with alt L1s in terms of scalability.

Challenges With The Roadmap

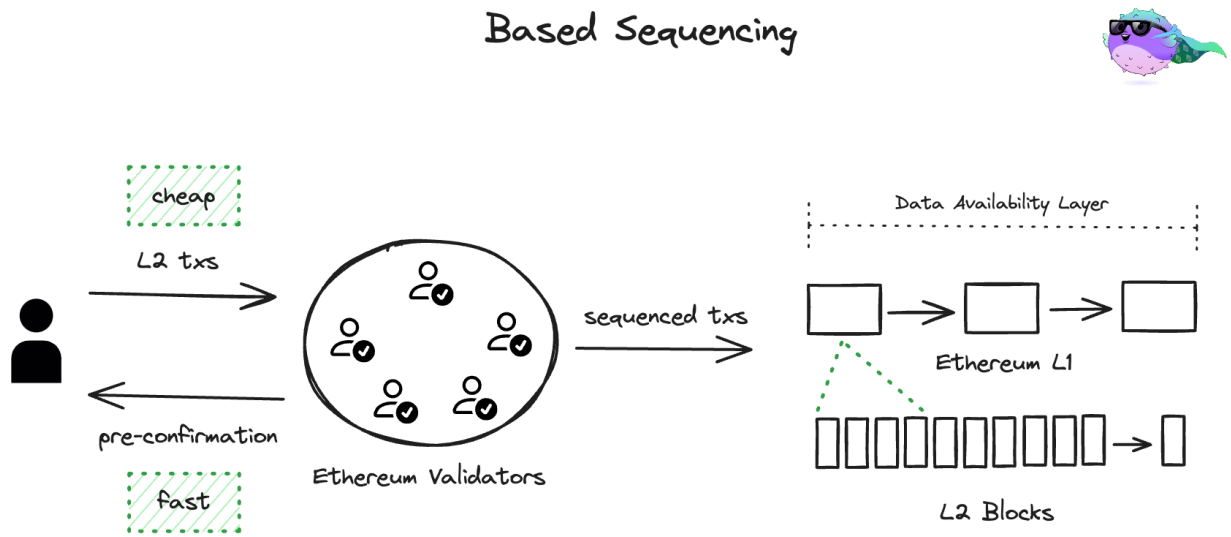
Despite its advantages, Ethereum's rollup-centric roadmap faces several challenges that left unresolved can hurt its longterm success:

- **Fragmentation is a negative sum game**: Ethereum's current L2 landscape suffers from liquidity fragmentation due to winner-takes-most dynamics, which favor L2 solutions with the highest liquidity. According to Metcalfe's Law, competing for liquidity is not merely a zero-sum game but actually a negative-sum game for the L2s and the broader Ethereum ecosystem.
- **Entrepreneurial friction**: The proliferation of L2s force dApp developers to choose which rollup to build on. This decision-making process adds complexity and uncertainty for developers. It is not straightforward to hedge by deploying on multiple rollups as it introduces additional costs, like operational costs for oracles, marketing costs to reach different users, and costs to incentivize new liquidity.
- **User friction:** Existing rollups lack synchronous composability, preventing seamless interaction with contracts on other rollups. Users must decide where to park their assets, and transferring assets between different rollups is slow, expensive, and carries significant security risks through bridges.
- **Possibility of rent extraction**: Centralized sequencers, which are the status quo in current L2 implementations, have the potential to extract rent from users in via toxic MEV. A rollup with large network effects and vendor lock-in could subject its users to this.
- **Value flow out of Ether:** Upgrades such as EIP-4844 have reduced data availability costs on Ethereum L1, lowering fees paid by rollups to L1. While this makes rollup operations cheaper, it also results in more Ether being issued

than burned. This imbalance threatens Ethereum L1's economic security as a reliable settlement layer over the long term.

These challenges highlight the complexities and potential risks associated with Ethereum's current trajectory. While rollups clearly solve many of the most important issues Ethereum has faced, care must be taken to ensure they are economically aligned with a healthy future for Ethereum. Failure to do so can result in Ethereum not reaching its full potential, and allow alt L1s to capture market share.

Based Rollups



A **Based Rollup**, also known as an L1-sequenced rollup, is an alternative design that is compatible with the rollup-centric roadmap.

Based rollups derive their sequencing directly from Ethereum validators on the L1, meaning a based rollup allows L1 validators to decide the ordering of their rollup transactions in the L1 blocks they propose. By shifting these responsibilities, rollup users no longer have to trust a centralized sequencer to deliver transactions, rather they can tap into Ethereum's decentralized validator set for a more reliable and credibly neutral transport layer.

Based rollups have advantages over non-based rollups and offers solutions to some of Ethereum's pain-points.

Advantages of Based Rollups

- **Liveness Guarantees**: Based rollups inherit the robust liveness guarantees of the L1. Validators include based rollup blocks in L1 blocks, ensuring that transactions are processed and confirmed with the same reliability as transactions on the Ethereum L1 itself. On a non-based rollup, the recovery time if a centralized sequencer goes offline or censors may be very long, in which case users must resort to an L1 "escape hatch." In a based rollup, users only need to wait for the next block proposer for their transaction to be included.
- **Simplicity and Security**: Based rollups inherit the security and decentralization of Ethereum L1 since they reuse the underlying validator stack and PBS infrastructure. This reduces the complexity of the protocol compared to centralized sequencing or shared sequencing via an external consensus mechanism. This simplicity not only reduces potential vulnerabilities but also minimizes development costs and speeds up time-to-market.
- **Economic Alignment**: MEV originating from transactions in based rollups flows to Ethereum L1 through validators. The result is more value captured back into Ether, helping strengthen Ethereum's economic security and therefore its value as a settlement layer.
- **Synchronous Composability:** Based rollups offer synchronous composability, due to the fact that at any given block, a single validator has monopoly rights to sequence multiple based rollups at once. This feature allows users to interact with smart contracts across different based rollups within the same transaction. This capability eliminates delays, additional costs, and the security risks associated with using bridges.

By enabling synchronous composability, based rollups effectively address the issue of fragmentation in the Ethereum ecosystem. In a scenario where every rollup adopts the based sequencing approach, Ethereum can transition to a positive-sum game environment. This shift fosters shared network effects among

based rollups, promoting healthy competition based on user experience, technological innovation, and other metrics beyond liquidity alone.

In essence, widespread adoption of based rollups could lead Ethereum towards a future where the rollup ecosystem thrives on collaborative growth and innovation, benefiting the entire Ethereum community.

Limitations of Based Rollups

Based rollups, while advantageous in many respects, face challenges related to soft confirmations. Soft confirmations refer to the ability for a rollup user to reliably know that their transaction will successfully reach the L1. These soft confirmations are crucial for ensuring snappy response times (e.g., around 100ms), which are essential for applications like GameFi.

Technical Challenge: Unlike centralized sequencers, which serve as centralized points where users can reliably obtain promises for transaction submission to L1, based rollups face a different challenge. Being inherently decentralized, based rollups do not have a specific centralized entity or target from which users can easily acquire soft confirmations from. Instead, they rely on Ethereum validators for sequencing, which adheres to 12-second block production times, resulting in minimum confirmation times of 12 seconds.

In summary, while based rollups offer significant advantages in terms of composability, decentralization, and economic alignment with Ethereum's Layer 1, the challenge of providing soft confirmations is a critical hurdle. Addressing this challenge is essential for based rollups to deliver a compelling user experience and achieve meaningful adoption within the Ethereum ecosystem.

Preconfirmations

Preconfirmations (preconfs) offer a substantial improvement over traditional soft confirmations. Typically, rollup users receive soft confirmations from centralized sequencers, which can sometimes fail to include a transaction despite promising to do so. Preconfs, on the other hand, provide stronger assurances from Ethereum validators who are in line to propose blocks. If preconfers fail to fulfill their promises, they face penalties such as slashing, ensuring a higher degree of

reliability. This mechanism gives users greater confidence that their transactions will indeed be included in the Ethereum L1 state.

By integrating preconfs with based sequencing, based rollups can deliver a user experience comparable to that of centralized sequencers, offering 100ms confirmation times with robust assurances of inclusion and enhanced liveness guarantees. This integration allows based rollups to retain all their inherent benefits while addressing their most critical flaw. Ultimately, it brings the ecosystem closer to resolving Ethereum's fragmentation problem and promotes a more unified and efficient rollup ecosystem.

UniFi: A Step Towards Healing Ethereum's Fragmentation

UniFi is Puffer's flagship based rollup, marking the inaugural step towards building a unified ecosystem. Its primary goal is to enhance user experience, facilitating the onboarding of the next billion users, while addressing Ethereum's fragmentation and ensuring long-term sustainability.

UniFi is the first of many synchronously composable based app-chains to come, each bringing more value to each other and users as they share liquidity and allow for seamless interoperability. This positive sum game has the potential to revolutionize the rollup market, positioning Ethereum for a sustainable future.

Why Puffer

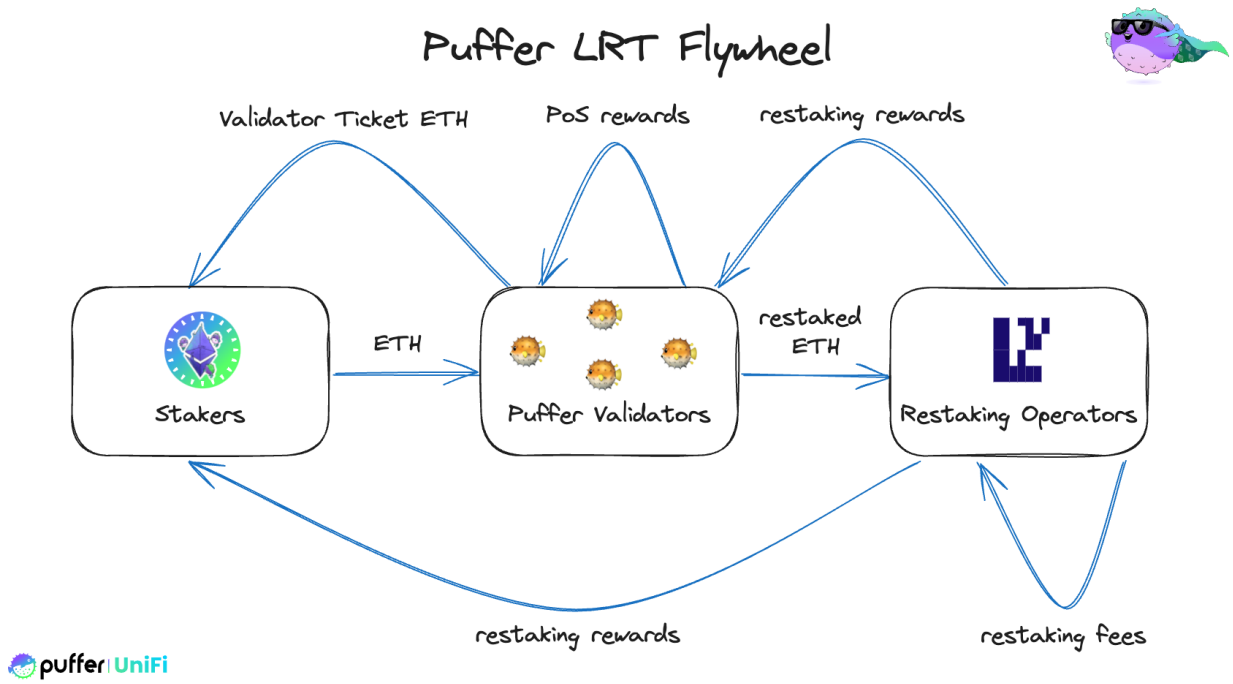
Puffer is primed to introduce UniFi and based app-chains to Ethereum. Since its inception, Puffer has been committed to researching and developing innovative technical solutions to advance the Ethereum roadmap, with the primary goal of preserving its decentralization. This culminated as the first permissionless liquid restaking protocol, which introduced two important mechanisms to the industry, anti-slashers and Validator Tickets. These advancement enable trustless and

permissionless validating, while significantly reducing the barrier to entry, allowing for greater participation from home validators. Additionally, Puffer was built with support for native restaking, unlocking revenue opportunities for home validators through restaking use cases like preconfs.

How Puffer Works

Puffer's Liquid Restaking Token (LRT), pufETH, generates yield via the sale of Validator Tickets. Node Operators purchase Validator Tickets to rent validator keys, allowing them to earn staking rewards and transaction fees while contributing to Ethereum's validation process. The sale of Validator Tickets drives staking revenue for pufETH. Validator Tickets are related to Execution Tickets on Ethereum's roadmap, which can play a crucial role in the endgame for preconfs.

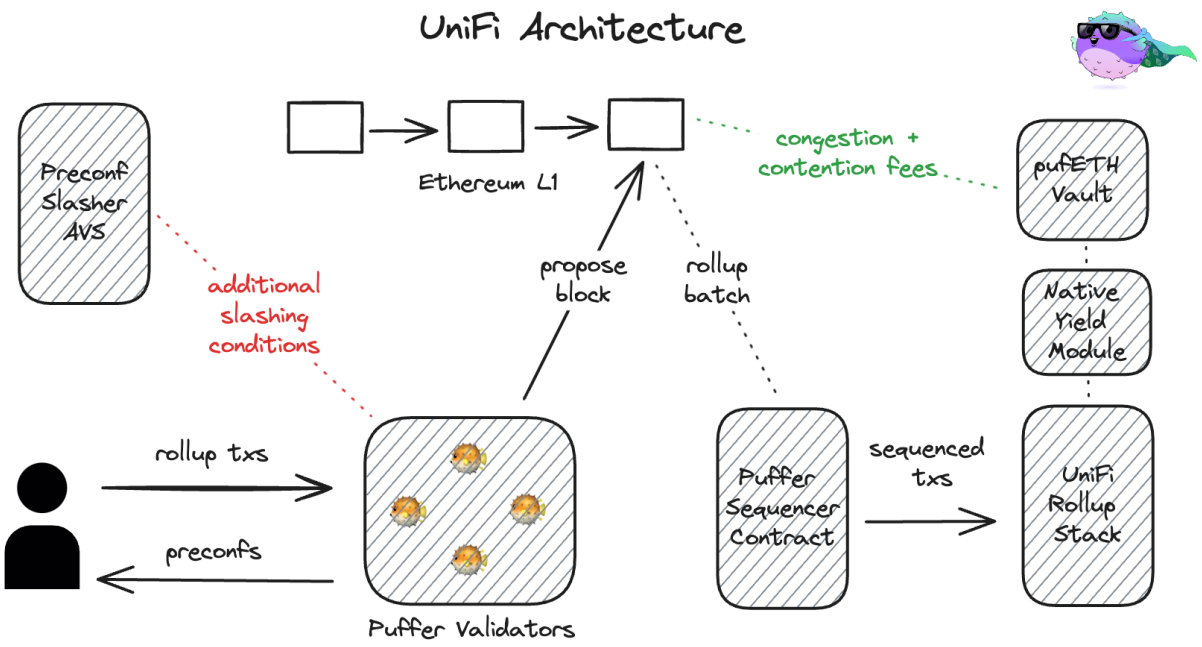
Puffer Protocol requires the use of anti-slashers, which are mechanisms that prevent validator equivocation, helping to protect staked Ether and stabilize Ethereum's consensus. Anti-slashers will be adopted in the future to prevent Puffer validators from reneging on their preconfs.



Additionally, Puffer validators have opted into additional slashing conditions through restaking, preparing them to participate in preconfs. The revenue

generated from preconfs and based rollup sequencing further incentivizes validator participation, aligning with Puffer's mission to onboard more permissionless validators.

Architectural Overview



UniFi's architecture allows it to scale quickly from a single centralized sequencer to tens of thousands of decentralized sequencers by leveraging Puffer's validator set. UniFi is designed to seamlessly integrate preconfs into its based rollup stack, ensuring efficient transaction processing and enhanced user experience. Here's a breakdown of the architecture:

1. Users submit their rollup transactions, which are then handled by the Puffer Validators. These validators provide preconfs, ensuring users know that their transactions will be included in the Ethereum L1 state.
2. Puffer validators are restaked with additional slashing conditions to ensure reliability, receive rollup transactions from users and issue preconfs. These validators are prepared to include transactions in the L1 blocks.
3. Preconf Slasher AVS enforces additional slashing conditions on validators, disincentivizing reneging on preconf promises.

4. Puffer validators propose blocks to the Ethereum L1. These blocks include the sequenced rollup batches that were preconfirmed.
5. The Puffer Sequencer Contract accepts the batched transactions, advancing the rollup's safe head.
6. The pufETH Vault collects congestion and contention fees generated from the rollup transactions. These fees contribute to the yield for pufETH holders, and back to UniFi users through native yield.

unifiETH - The Universal Gas Token

Native Yield

The concept of native yield empowers rollup users to earn income on assets locked within the rollup's native bridge, addressing the opportunity cost where native ETH remains unproductive. This approach acknowledges that native yield comes with varying degrees of risk across a spectrum and the implementation seeks to minimize this risk.

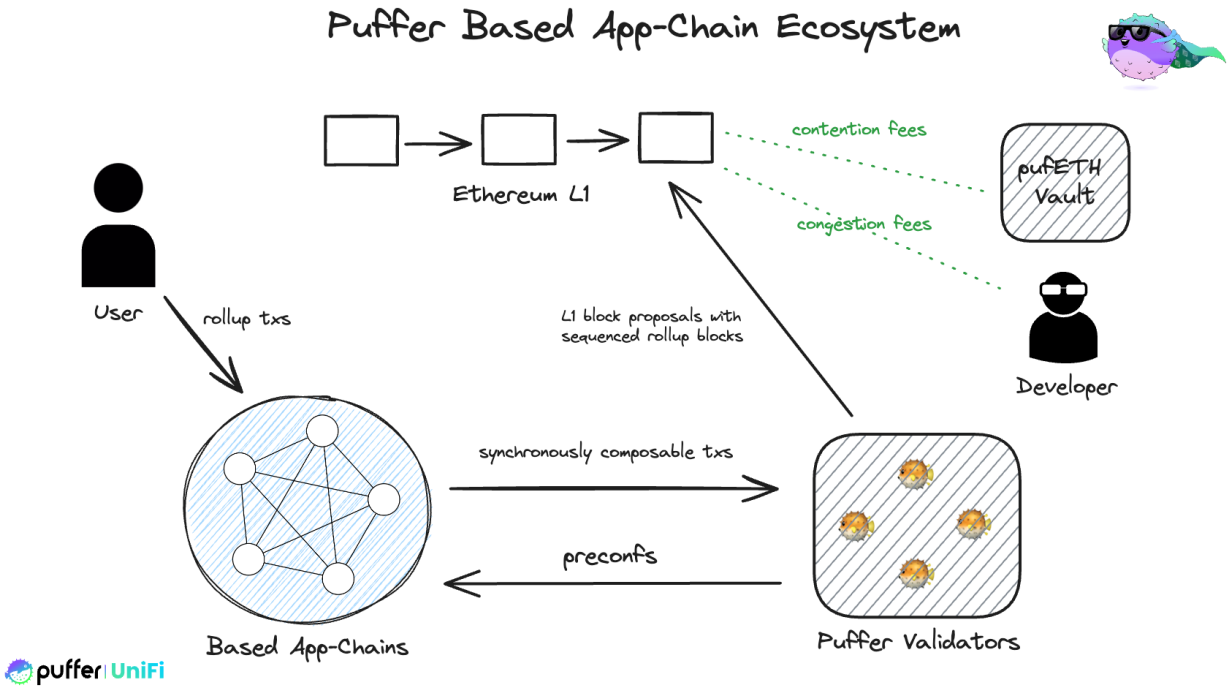
Role of unifiETH in the UniFi Ecosystem

unifiETH serves as the universal gas token within the UniFi ecosystem, designed to generate rewards through pufETH and employ market-risk-free strategies determined by the DAO. Market-risk-free in this context implies strategies with endogenous risks, such as lending protocols where validator slashing acts as the liquidation condition, benefiting from Puffer's anti-slasher mechanisms. This contrasts with strategies vulnerable to exogenous risk factors like Ether price fluctuations leading to liquidations.

Unlocking Potential

Native yield enables sustainable use cases such as gasless transactions, which carry significant implications for both web2 and web3. In web2, users are accustomed to free internet services subsidized by ads. Transitioning to web3, where users must pay for services, introduces friction in user adoption. unifiETH mitigates this by subsidizing costs without invasive ads, thereby unlocking new, user-friendly use cases across the ecosystem.

Puffer's Based App-Chain Ecosystem



Based sequencing enables synchronous composability with other based rollups, effectively dismantling the barriers between them. In this setting, if a dApp significantly drives transaction fees on a general-purpose rollup, there's incentive to break away and create an app-specific chain, allowing them to directly capture this value themself. The future equilibrium will likely result in many app-specific chains and few general purpose rollups.

Puffer is spearheading this shift first by launching UniFi and then making it easy for any developer to launch their own based app-chain. Importantly, each app chain is interoperable, inherits the security and decentralization of Ethereum, and contributes its long term sustainability.

Developer Benefits

Aligned Incentives: The economic model of based app-chains incentivizes developers by allowing them to capture the fees their applications generate, directly linking ecosystem success with individual developer success.

Reduced Operational Complexity: By eliminating the need for a centralized sequencer, developers reduce their operational burden and technical overhead, simplifying chain management.

Positive Sum: Deploying on a based app-chain allows your application to benefit from every new chain added to the ecosystem, magnifying reach and impact without additional deployments.

Seamless Interoperability: App-chains in the UniFi ecosystem are designed to interoperate smoothly, enabling transactions and interactions across chains without the need for cumbersome and risky bridging solutions.

Less Decision-Making: The risk of betting on the success of a single general purpose rollup is mitigated, allowing developers to focus on innovation rather than platform risks.

Ease of Deployment: Launching a based app-chain is streamlined to be as straightforward as deploying a smart contract, significantly lowering the barrier to entry for new developers.

User Benefits

Users of Puffer-based app-chains will enjoy a user experience comparable to existing rollups, characterized by rapid confirmations typically within 100 milliseconds and cost-effective transactions facilitated by off-chain execution. However, based rollups enhance this experience with stronger assurances of transaction inclusion through preconfs. They also provide improved liveness guarantees by eliminating dependence on a single sequencer. Despite the distribution of liquidity and contracts across the ecosystem, the composability of app-chains ensures that users perceive them as operating seamlessly like a unified chain.

Case Study

Imagine a SoFi application considering deployment within the Ethereum ecosystem. Here are three deployment options and their implications:

1. **Deploy as a Normal App-Chain:**

Upside: Potential to capture congestion fees if the application gains popularity.

Challenges: Fragmentation limits access to liquidity and applications on other rollups. The app-chain must independently build its user base and cannot

leverage users from other chains. Integrating DeFi protocols for users blurs the lines of what an app-chain is and requires incentivizing liquidity.

2. **Deploy to a General Purpose Rollup:**

Benefits: Shares users and liquidity with other applications on the rollup, fostering a positive-sum game within the rollup.

Drawbacks: Congestion on the rollup may lead to higher transaction costs for SoFi app users. If the app itself causes the chain's congestion, the developers or app do not capture congestion fees.

3. **Deploy as a Puffer Based App-Chain:**

Benefits: Offers a "Goldilocks zone" combining benefits of general purpose rollups—shared users, liquidity, and contracts—while enabling developers and apps to capture congestion fees.

Unlocks: Native yield allows the app-chain to subsidize usage allowing for gas-less transactions. The SoFi project can compete with web2 UX with the benefits of web3.

Conclusion

UniFi is more than just a based rollup; it's a vital part of a broader initiative aimed at enhancing Ethereum's long-term sustainability. Based sequencing can significantly restore value capture to Ethereum's Layer 1.

UniFi opens the door to an ecosystem of based app-chains designed to shift Ethereum's rollup market dynamics towards a collaborative, positive-sum environment. This alignment supports the network's long-term health and viability.

As we continue to develop and expand the UniFi ecosystem, we invite developers, users, and enthusiasts to join us on this transformative journey. Our goal is for the based ecosystem to reach a tipping point—a critical mass where choosing based rollups becomes the standard. This will help channel sustained value back to Ethereum, benefiting the entire blockchain community.