

# UTXO Stack: The Decentralized Liquidity Staking Layer for Hybrid Lightning Network

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**Abstract:** The Bitcoin Lightning Network (LN) is a well-designed payment channel system with inherent advantages that could drive the mass adoption of cryptocurrency. However, a series of limitations—including liquidity issues, onboarding barriers, and the lack of stablecoin support—are still hindering its further development. To address these shortcomings, we at UTXO Stack, positioned as the liquidity staking layer for the Lightning Network, propose a comprehensive infrastructure to significantly boost the network’s liquidity. Our solution is based on the Lightning Network and Fiber Network (FN, a Lightning Network implementation on Nervos CKB), connecting them together to create a larger and more robust hybrid network that also introduces stablecoins into this ecosystem. Additionally, we will incentivize liquidity in Lightning Network channels through liquidity mining reward campaigns, with the goal of bootstrapping liquidity for stablecoin routing nodes. Over time, the incentives will gradually decrease, allowing the nodes to transition to generating income through regular transaction fees. Collectively, these efforts will strengthen the Lightning Network and allow it to fully realize its potential.

## 1 Lightning Network’s Advantages and Limitations

The Lightning Network (LN) offers several key advantages that position it as a promising solution for scaling cryptocurrency payments and driving broader adoption:

1. **Instant Finality:** LN enables transactions to be completed almost instantly because they occur in off-chain channels. Payments on LN settle in seconds, providing users with real-time finality.
2. **Unlimited Throughput:** LN utilizes payment channels, which significantly enhance transaction throughput. Theoretically, TPS (transactions per second) within these channels is unlimited, as payments across different channels do not interfere with each other.
3. **Privacy Preserving:** Since payments happen off-chain in private payment channels, they do not require public broadcasting on the main blockchain, reducing the exposure of sensitive data and protecting user privacy.
4. **Faster and Cheaper:** Even when compared to traditional payment systems (like those used in Web2), LN still holds the advantage of faster transaction speeds and lower fees.

Some argue that using a high-performance chain like Tron for on-chain payments could replace the role of LN, but what they overlook is that as long as it's an on-chain solution, it requires synchronizing and confirming transactions across multiple nodes, which inevitably creates performance bottlenecks. This limits scalability and imposes a cap on the maximum TPS and finality latency.

In contrast, LN operates off-chain, and its parallel processing capabilities allow it to achieve transaction throughput that can even surpass that of centralized systems. In fact, beyond TPS, LN outperforms on-chain payments in the following areas:

- LN doesn't require a separate token for gas fees.
- LN is ideal for small, high-frequency payments.
- LN provides instant transaction finality.
- LN operates off-chain, offering better privacy protection.
- LN is compatible with regulatory frameworks, allowing for more user scenarios to expand.

Feature	Lightning Network	On-Chain	Centralized
Processing Method	Channel (off-chain, peer-to-peer)	Blockchain	Third-party intermediaries
Speed	Instant	Slow	Fast
Fees	Low	High	Variable
Frequent Payments	Ideal	Not suitable	Suitable
Privacy	High	Low	Medium
Finality	Instant	Uncertain	Final once confirmed
Regulatory Compatibility	Flexible	Limited	High
Performance in Congestion	Scalable	Slow and expensive	Platform dependent
Stablecoin Support	No stablecoin support	Yes	Yes
Liquidity	Liquidity challenges	N/A	Managed by platform
Onboarding Barrier	High	High	Low but KYC required

Table 1: Comparison Chart: Lightning Network vs. On-Chain & Centralized Systems

However, LN also has its own set of limitations:

### 1. Lack of Stablecoin Support

- *No Stablecoins on LN*: Currently, Bitcoin is the primary currency circulating within LN. This presents a challenge because Bitcoin's price volatility may deter users who want stability for daily transactions. To make LN more attractive for everyday commerce, the introduction of stablecoin is becoming increasingly necessary.

### 2. Liquidity Issues

- *Lack of Liquidity in the Network*: Liquidity is crucial for LN, as it requires sufficient funds in payment channels to effectively route transactions. According to the latest data from Mempool <sup>1</sup>, LN has a total of over 18,000 nodes, nearly 48,000 payment channels, and channel liquidity of approximate 5,276 BTC. However, from the perspective of being a large-scale payment system, the liquidity is insufficient, and all these metrics need to increase significantly to meet the demands of mass adoption.

<sup>1</sup><https://mempool.space/lightning>

- *Inefficient Liquidity Management*: In LN, node operators must constantly balance liquidity across their channels. If there are no funds on your side of the channel, you won't be able to send payments; if all the funds are on your side, you won't be able to receive payments. Current liquidity management solutions are not efficient enough.

### 3. Onboarding Barrier

- *High Onboarding Costs*: Another significant hurdle for widespread adoption of LN is the cost of setting up channels. The initial onboarding fee can be as much as \$1.5 (with a feerate as low as 3 sat/vByte), or potentially even higher depending on network conditions.
- *Bitcoin's Limited Throughput*: Due to the limited throughput of Bitcoin, it cannot serve a large number of users. For example, if 10% of the global population used LN and each person opened and closed a channel once per year, it would require 0.7 billion \* 2 transactions in total. This results in an average TPS of  $0.7B * 2 / 365 / 24 / 3600 = 44$ , which is approximately 6 times the current TPS of the Bitcoin network.

## 2 UTXO Stack's Comprehensive Infrastructure

As the liquidity staking layer for the LN, UTXO Stack has introduced a comprehensive infrastructure designed to enhance the network's liquidity and further support its development. This infrastructure includes the Hybrid Lightning Network (Hybrid LN), Decentralized Liquidity Staking Pool (DLSP), swapping nodes, a wallet, and a peer-to-peer (P2P) payment SDK.

### 2.1 The Hybrid Lightning Network

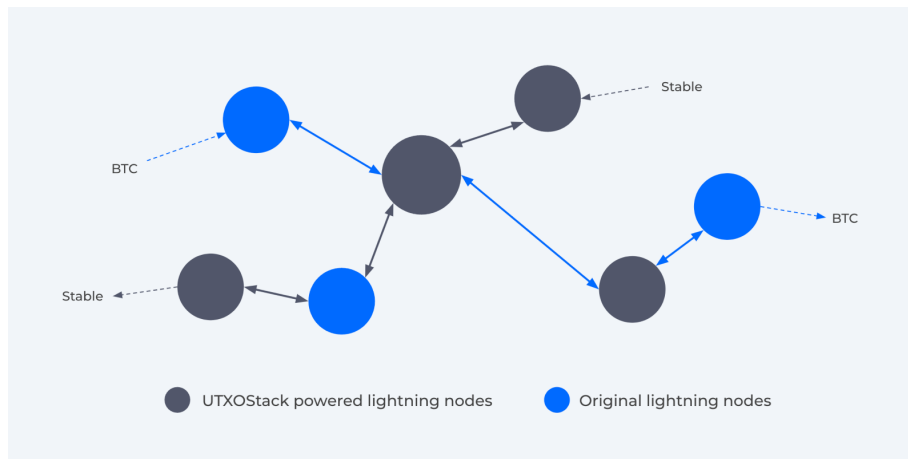


Figure 1: Diagram of the Hybrid Lightning Network

It is crucial to emphasize that our solution is built on both the LN and the FN. In fact, FN and LN can be seamlessly interconnected, allowing payment paths to be established within a larger and more robust hybrid network.

The primary function of such a hybrid network is to enable the introduction of stablecoins into the LN. The FN leverages the Turing-complete capabilities of the CKB blockchain to natively support user-defined assets. For example, stablecoin assets based on the RGB++ protocol <sup>2</sup> can be issued on the Bitcoin chain, then transferred to the CKB chain using the functionality of bridgeless cross-chain leap, and finally enter FN and LN, since they are seamlessly interconnected.

Moreover, using HTLC (Hash Time-Locked Contracts) and PTLC (Point Time-Locked Contracts) technologies, edge nodes, which act as intermediaries between these two networks, enable atomic swap of assets between them. Through this process, assets like BTC and stablecoins (e.g., USDI) can be exchanged seamlessly across both networks, ensuring that transactions are either fully completed or entirely rolled back. For instance, a BTC payment can be received on the LN side of an edge node and then transferred out from the FN side with an equivalent value in stablecoin, continuing to route through the FN until it reaches the recipient.

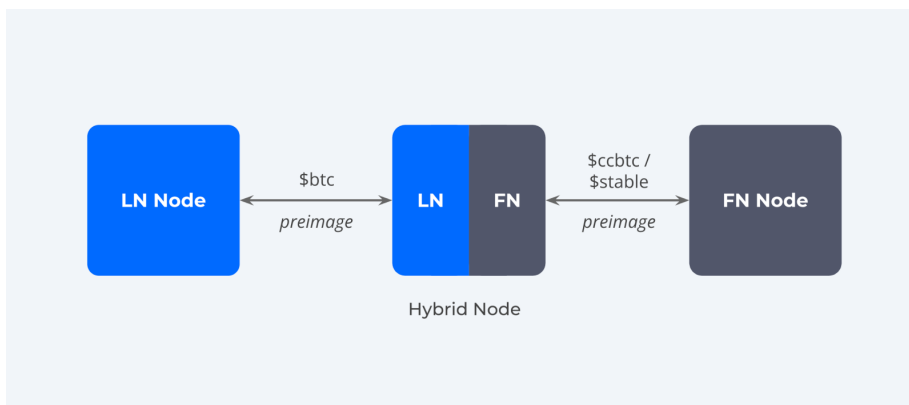


Figure 2: Edge nodes act as intermediaries between the two networks

Overall, the benefits of the Hybrid LN can be summarized into three key points:

First, it introduces stablecoins into LN, effectively solves the problem of the LN's lack of stablecoin support.

Second, the introduction of edge nodes integrates both networks, creating a hybrid system where the increased number of nodes significantly enhances network connectivity.

Finally, UTXO Stack, as a liquidity staking layer, boosts the Hybrid LN's liquidity. The liquidity injected into FN nodes by the DLSP can freely enter the LN through cross-channel atomic swaps (details follow).

## 2.2 Decentralized Liquidity Staking Pool (DLSP)

DLSP allows users to lend various assets, such as ccBTC, stablecoins, and CKB, to a shared liquidity pool. This liquidity is then rented out to the Hybrid LN.

Through a token-gated governance mechanism, a selection of nodes are chosen to join the DLSP network. These nodes obtain liquidity from the DLSP and provide routing service for both LN and FN users. The yield generated by these nodes comes from a portion of the fees paid by users for

<sup>2</sup><https://github.com/utxostack/RGBPlusPlus-design/blob/main/docs/light-paper-en.md>

their services. The majority of the yield is returned to the pool, serving as dividend income for users who have staked in the DLSP.

This stable income offered by the DLSP can attract more capital into LN and FN, facilitating growth in the number of nodes, channels, and channel capacity within the networks. As a result, the user experience of LN and FN will improve, and it will attract even more users, leading to increased transaction volumes, higher fee revenue for routing nodes, and further incentives for individuals to contribute liquidity to the DLSP. Ultimately, this creates a positive cycle for LN and FN, driving continuous growth and adoption.

Thanks to the Turing-complete programmability of CKB, DLSP is a system based on smart contracts. It is decentralized, non-custodial, and does not rely on multi-signature setups. It leverages smart contracts to manage the flow of funds: liquidity from the pool can only be provided to channels, and liquidity within the channels can only be withdrawn back into the pool.

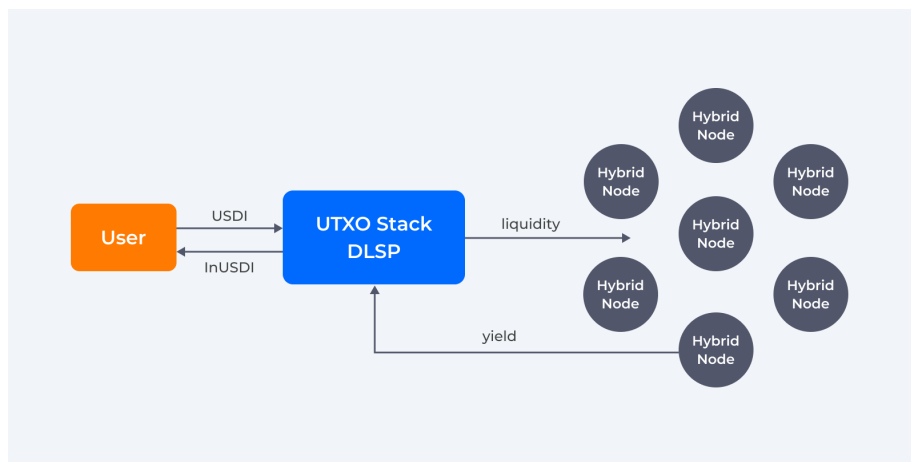


Figure 3: The DLSP model creates a positive feedback loop

Next, we will explain how the DLSP significantly enhances the liquidity of the LN from three key perspectives: Liquid Staking Derivatives (LSD) for Lightning, Automated Liquidity Management, and Zero-cost Channel Opening, thereby addressing the LN's limitations.

### 2.2.1 LSD for Lightning: DLSP fully unlocks asset liquidity

The liquidity assets injected into the DLSP, including ccBTC, CKB, and USDI, are used to generate staking certificates on a 1:1 basis, known as liquidity tokens—such as lnBTC, lnCKB, and lnUSDI. The minting and burning of liquidity tokens are controlled by smart contracts. By holding these liquidity tokens, users not only earn passive interest automatically but also retain the liquidity of their assets. This allows them to continue participating in DeFi, re-staking, and other economic activities, effectively unlocking the full liquidity potential of their assets.

This mechanism is quite similar to the liquidity mining model that emerged during DeFi summer. In this model, liquidity providers are incentivized by the ability to maintain asset liquidity while earning rewards. Additionally, the DLSP mechanism also parallels the LSD model seen in Ethereum PoS mining, where users can stake their assets while still retaining liquidity through derivatives,

allowing them to continue participating in other DeFi activities.

DLSP aims to use this new paradigm to maximize asset efficiency while incentivizing participation, ultimately enhancing the LN's liquidity and growth.

### 2.2.2 Automated Liquidity Management: DLSP improves efficiency for node operators

Typically, an LN routing node requires \$10,000 or more in liquidity, and node operators charge a fee of 0.05-0.1% on transactions they route. Currently, liquidity for LN is usually provided by the node operators themselves or through liquidity leasing. The former requires the node operator to have a large amount of disposable funds, while the latter is inefficient and comes with many limitations.

Current liquidity leasing methods are all peer-to-peer. For example, a merchant establishes a channel with a large, well-funded node and rents a certain amount of liquidity to increase its inbound capacity. The demand matching between the parties involved in the leasing process is not efficient.

In contrast, DLSP's liquidity management is aggregated and automated, where participants pool their funds, and liquidity is then borrowed from this pool. To draw an analogy with exchanges: existing liquidity leasing is like an order-book model, whereas the DLSP approach functions more like an Automated Market Maker (AMM). DLSP can use automated pricing algorithms to offer higher liquidity and a more streamlined process for liquidity demanders. At the same time, it provides liquidity providers with continuous earning opportunities.

Overall, DLSP effectively addresses the liquidity issues faced by the LN, namely liquidity shortages and inefficient liquidity management.

### 2.2.3 Zero-cost Channel Opening: DLSP advances funds to help users onboard

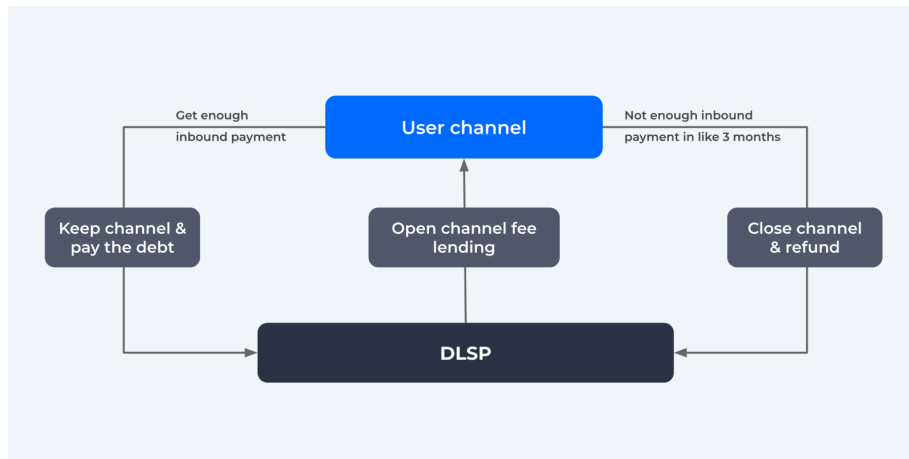


Figure 4: DLSP enables users to open channels without financial burden

One major barrier for users entering the LN is the upfront cost of opening and funding channels. The DLSP leverages CKB's smart contract functionality to introduce a zero-cost channel opening model for users, where funds are advanced initially by the DLSP and charges are applied later.

When a user opens a payment channel, they get setup fee rent funded by the DLSP. If they receive enough inbound payments later, they can maintain the channel and pay back any fee or liquidity advances. However, if the user doesn't receive sufficient inbound payments within a given period (e.g., three weeks), the channel will be closed, and any remaining funds will be refunded back to the DLSP.

This model simplifies onboarding for new users by ensuring they have the necessary liquidity to receive payments without upfront costs, ultimately lowering the barriers to using the LN.

In summary, as previously discussed, the three major limitations of the LN now have targeted solutions. The list of these solutions is as follows:

LN Limitations	Our Solutions
1. Lack of Stablecoin Support	The Introduction of Stablecoin through the Hybrid LN
2. Liquidity Issues	LSD for Lightning, Automated Liquidity Management
3. Onboarding Barrier	Zero-cost Channel Opening

Table 2: LN Limitations and Solutions

## 2.3 Decentralized Swapping Nodes

In the Hybrid LN, decentralized asset exchange can be facilitated through swapping nodes, which function similarly to edge nodes. These swapping nodes offer multiple asset channels, such as BTC, stablecoin, CKB and ccBTC, enabling seamless cross-asset exchanges. By integrating oracles, these nodes can provide users with accurate price feeds and reliable asset conversion services.

Such a network of swapping nodes enables decentralized, trustless exchanges between Bitcoin and stablecoins, while also providing a trading platform for RGB++ assets.

## 2.4 Wallet

JoyID<sup>3</sup> is a crypto wallet integrated with Passkey technology, which adds an extra layer of security. It supports both LN and FN, offering fast and efficient transactions. In addition, JoyID will also introduce stablecoin payment, allowing users to make payments with stablecoins directly within the wallet.

Meanwhile, JoyID will incorporate the UTXO Stack staking protocol, enabling users to effortlessly stake BTC, CKB, and stablecoins into the DLSP to boost liquidity on the LN. Thanks to JoyID's user-friendly experience, staking is simplified and accessible.

Currently, JoyID has over 800,000 users. With its strong combination of features—including security, ease of use, and multi-chain support—JoyID will further empower stablecoin payments on the LN.

## 2.5 P2P Payment SDK

The P2P Payment SDK is designed to be seamlessly embedded into Web2 applications, enabling frictionless, high-frequency micropayments on a global scale. By integrating this SDK, developers can transform existing Web2 services to support P2P payments without requiring complex infrastructure changes. This allows for real-time, low-fee transactions that can be used in various

<sup>3</sup><https://joy.id>

applications such as content monetization, in-app purchases, and subscription services. With the UTXO Stack behind it, the SDK leverages the scalability of the LN, ensuring that payments are fast and efficient, even in high-volume scenarios.

### 3 Use Cases

The DLSP model introduces a variety of innovative use cases, enhancing the functionality and versatility of the LN:

1. **Liquidity Lending for Lightning Service Providers.** In addition to creating liquidity for the LN, DLSP can also provide support for existing liquidity service infrastructure, such as Lightning Service Providers (LSPs)—entities that facilitate various liquidity and network services on the LN for users and businesses. DLSP can provide liquidity lending services for LSPs, enabling them to efficiently manage and optimize liquidity. For LSPs, renting liquidity from DLSP will be a more efficient and cost-effective solution compared to other ways.
2. **Decentralized Swaps Among Bitcoin, Wrapped Bitcoin and Stablecoins.** The Hybrid LN facilitates decentralized, trustless swaps between Bitcoin and wrapped Bitcoin, as well as stablecoins. The key technology enabling this is cross-network atomic swaps, which ensure seamless and secure exchanges between assets on two different networks.
3. **LN Payment Accounts for AI Agents.** DLSP can facilitate the creation of LN payment accounts for AI agents. Permissionless, instant, and high-performance payment capabilities are critical for AI agents, making the LN an ideal choice for micropayment solutions. Moreover, DLSP perfectly meets the liquidity demands of AI agents, ensuring seamless onboarding.
4. **Composability with on-chain DeFi stack.** The DLSP’s liquidity tokens can be seamlessly integrated with on-chain DeFi protocols. Users who stake their assets in the LN through DLSP receive these liquidity tokens, which can then be used as collateral in lending protocols, traded in DEXs, or utilized in yield farming strategies. This composability creates a powerful synergy between LN staking and DeFi, allowing users to maximize their capital efficiency by simultaneously earning LN routing fees and participating in DeFi opportunities.

### 4 Tokenomics

UTXO Stack will issue a utility token based on the RGB++ protocol with the following uses:

- Early incentives: Tokens will be used to incentivize nodes, liquidity providers, and overall network activity during the early stages.
- Liquidity collateral: Nodes must stake a certain percentage of the token to access liquidity from the pool.
- Penalty for inactivity: If a node is found to be inactive, its liquidity will be forcibly withdrawn, and its token stake will be forfeited as a penalty.
- Revenue sharing: 80% of the node’s transaction fee revenue will be returned to the pool and distributed as dividends to holders of liquidity tokens.



- Fee distribution: The remaining 20% of the fees will be split, with 50% allocated as node revenue and the other 50% going towards protocol income.
- Voting on asset types: Token holders can vote on which assets are allowed to enter the DLSP.
- Community governance: Token holders can participate in the governance of the community and help shape future decisions.

Besides, UTXO Stack will launch a liquidity mining reward campaign, which will also be the first airdrop within the LN ecosystem. A portion of the tokens will be allocated as airdrop rewards to incentivize various participants in the ecosystem. This includes end users, node operators, and liquidity providers of both LN and FN. This airdrop is designed to boost liquidity and network growth, particularly by incentivizing staking of stablecoins to bootstrap a stablecoin payment network within the LN ecosystem. Over time, the incentives will gradually taper off, allowing nodes to shift towards generating revenue through standard transaction fees.

## 5 The Vision

UTXO Stack serves as the liquidity staking layer for the LN. By providing a complete liquidity infrastructure, UTXO Stack will significantly enhance the liquidity of the LN, taking its adoption to the next level.

UTXO Stack envisions a decentralized peer-to-peer (P2P) economy powered by robust off-chain infrastructure. In this ecosystem, individuals and entities will seamlessly serve each other with fair incentives, fostering collaboration without reliance on centralized intermediaries, just like how the DLSP allows individuals to contribute liquidity to the pool to meet the liquidity needs of the LN while earning a reasonable return.

UTXO Stack aims to support next-generation stablecoin payments, driving mass adoption by creating a payment system that is scalable, efficient, and user-friendly. This vision also aligns with the idea of Web5, combining the familiar applications of Web2 with the unique, decentralized features of Web3.

We will support Web2 developers in integrating the UTXO Stack to enable Web5 upgrades, transforming everyday devices like computers and smartphones into network service nodes. Users will be able to pay for services on a per-use basis through the LN. Potential use cases include CDN, storage, GPU computing, and bandwidth sharing. This also opens the door to new business models, such as pay-per-view video platforms that require no subscriptions or prepayments, or time-based billing for one-on-one services like psychological consultations. These innovative models provide more flexibility and efficiency in service delivery, fully unleashing the LN's potential and driving the mass adoption of cryptocurrency.

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