



The EWM Light Client

A Lightweight Solution to Scale the Verification of
Data in the Ethereum Wayback Machine.

Last updated: August 27, 2024

Abstract

The EWM Light Client is a new and pivotal component of the Covalent Network, designed to ensure the secure, decentralized verification of blockchain data, specifically within the Ethereum ecosystem. As part of the broader Ethereum Wayback Machine (EWM) initiative, the EWM Light Client enables users to participate in the network without needing to run full nodes, making the network more accessible and enhancing its decentralization. This client plays a crucial role in scaling the verification of proofs in the network and contributing to the long-term availability of Ethereum's transactional history.

1. Background

1.1 Evolution of Light Clients

Light clients have been a part of blockchain ecosystems since the early days of Bitcoin and Ethereum. Initially, full nodes were the primary method for participating in these networks, requiring users to download and store the entire blockchain. However, as blockchain networks grew, so did the resource demands for running full nodes. This led to the development of light clients—software that allows users to interact with the blockchain without needing to store the full history. Light clients rely on full nodes to provide the necessary data for transaction validation and network interaction, thus making participation more accessible. Over time, light clients have become crucial for maintaining network decentralization, however, they are more important than ever in the current state of the Ethereum ecosystem.

1.2 Motivation: Why the EWM Light Client?

As Ethereum scales through rollups and other Layer 2 solutions, the challenge of maintaining access to historical data becomes increasingly complex. The traditional method of running full nodes to validate and store blockchain data is resource-intensive and limits participation to those with significant technical infrastructure. The EWM Light Client addresses this by providing a lightweight, decentralized solution that scales the verification of data in the Ethereum Wayback Machine. By decentralizing validation and reducing the resource requirements, the EWM Light Client makes it possible for a wider range of participants to help maintain the blockchain's history, thus preserving its accessibility and trustworthiness.

1.3 The Ethereum Wayback Machine (EWM) Vision

The Ethereum Wayback Machine (EWM) is a Covalent initiative aimed at ensuring long-term access to Ethereum's historical transaction data. With the adoption of rollups and other scalability solutions, the EWM provides a decentralized, verifiable archive that maintains the

accessibility and integrity of this data. The EWM Light Client is central to this vision, scaling the decentralized verification of data in the network and thus preserving Ethereum's historical records.

1.4 The Need for Decentralized Validation

To realize the vision of the EWM, decentralized validation is essential. Ethereum is scaling through rollup-centric designs, which enhance scalability by moving data off-chain. However, as it does this, the risk of data centralization grows. This can lead to vulnerabilities like data manipulation or censorship by centralized entities. The EWM Light Client mitigates these risks by enabling a distributed network of participants to verify the existence and integrity of blockchain data.

2. EWM Light Client Overview

The EWM Light Client is a lightweight, resource-efficient software client. Unlike full nodes, which store the entire blockchain and perform all the tasks required to maintain the network, the EWM Light Client focuses solely on confirming the presence of data. It checks the existence and integrity of Block Specimens—snapshots of blockchain data—and ensures they meet the necessary cryptographic proofs before they are recorded in the Covalent Network. This approach allows a broader range of participants to engage in the validation process without needing extensive hardware or storage, contributing to a more decentralized and secure network.

2.1 How it Works

The EWM Light Client operates by validating Block Specimens, which are created by Block Specimen Producers (BSPs) in the Covalent Network. When a Block Specimen is generated, it is uploaded to a decentralized storage network (such as IPFS) and a corresponding proof is recorded on the EWM Proof Chain. The EWM Light Client receives validation tasks from the Job Scheduler, which allocates different Block Specimens to various clients for validation. The Light Client checks the Block Specimen against its cryptographic proofs to ensure data integrity. Once validated, the results are sent to the Collection Service and aggregated by the Bridge Agent, which then updates the Rewards Smart Contract.

The EWM Light Client is deeply integrated into the Covalent Network's architecture. It interacts with the Coordination Service/Scheduler to receive Block Specimens and communicates with the Collection Service to report the validation of data existence. The Proof Chain acts as a sequencer for the EWM ingestion pipeline, recording all activities to ensure transparency and verifiability across the network. By integrating with these components, the EWM Light Client contributes to the Covalent Network's mission of providing a decentralized, secure, and accessible archive of blockchain data, particularly for Ethereum. This integration also supports

the broader Ethereum ecosystem by ensuring that, even as the network scales, its historical data remains trustworthy and accessible.

3. Technical Architecture

Key Components of the EWM Light Client

IPFS Pinner

- **Role:** The IPFS Pinner plays a critical role in the storage and accessibility of Block Specimens within the Covalent Network. It operates alongside the Geth node, continuously monitoring and capturing Block Specimens as they are generated.
- **Technical Details:** The IPFS Pinner is responsible for uploading these Block Specimens to the InterPlanetary File System (IPFS), a decentralized storage network. The metadata associated with each Block Specimen, which includes critical validation proofs, is then recorded on the Covalent Network's Proof Chain. This ensures that the Block Specimens are not only stored securely but also remain easily retrievable by other network participants who require access to historical data.

Job Scheduler

- **Role:** The Job Scheduler is the central system that allocates the tasks of verifying Block Specimens and their associated data chunks across numerous EWM Light Clients. It ensures an even distribution of work and optimizes the overall efficiency of the validation process. In the long term we plan to have this component be fully decentralized.
- **Technical Details:** The Job Scheduler acts as a gatekeeper within the Light Client architecture. This component is potentially stateless, meaning it does not retain data between sessions, thereby reducing the risk of bottlenecks or single points of failure. The Job Scheduler ensures that a large number of Light Clients are not assigned to validate the same block. This approach ensures efficient distribution of workload, prevents redundancy and enhances the scalability of the network while maintaining the integrity and timeliness of Block Specimen validation.

Light Client Software

- **Core Functionalities:** The EWM Light Client software is the backbone of the light client operations within the Covalent Network. It is responsible for performing the actual validation of Block Specimens, verifying the existence of data against the cryptographic proofs stored on the Proof Chain.
- **Architecture:** The Light Client is designed to operate with minimal resource consumption, making it accessible to a wide range of users. It communicates directly with the Job Scheduler to receive validation tasks and interacts with the Collection Service to submit validation results.

The software is modular, allowing for future updates and enhancements without disrupting ongoing operations. To keep the Light Client lightweight and efficient, Data Availability Sampling (DAS) is employed, allowing clients to sample small portions of data rather than downloading entire datasets. Additionally, the use of KZG commitments and padded Block Specimens ensures that the validation process is secure and that data integrity is maintained without overburdening the client.

Collection Service

- **Role:** The Collection Service is the aggregation point for all validation work performed by the Light Clients. It gathers the results of the validation processes and ensures they are processed correctly.
- **Mechanism:** The Collection Service operates through an API for proof submission, where Light Clients submit their validation results through an authorization layer API. This system allows for real-time aggregation of data, ensuring that all validations are accounted for before moving to the next phase of the workflow.

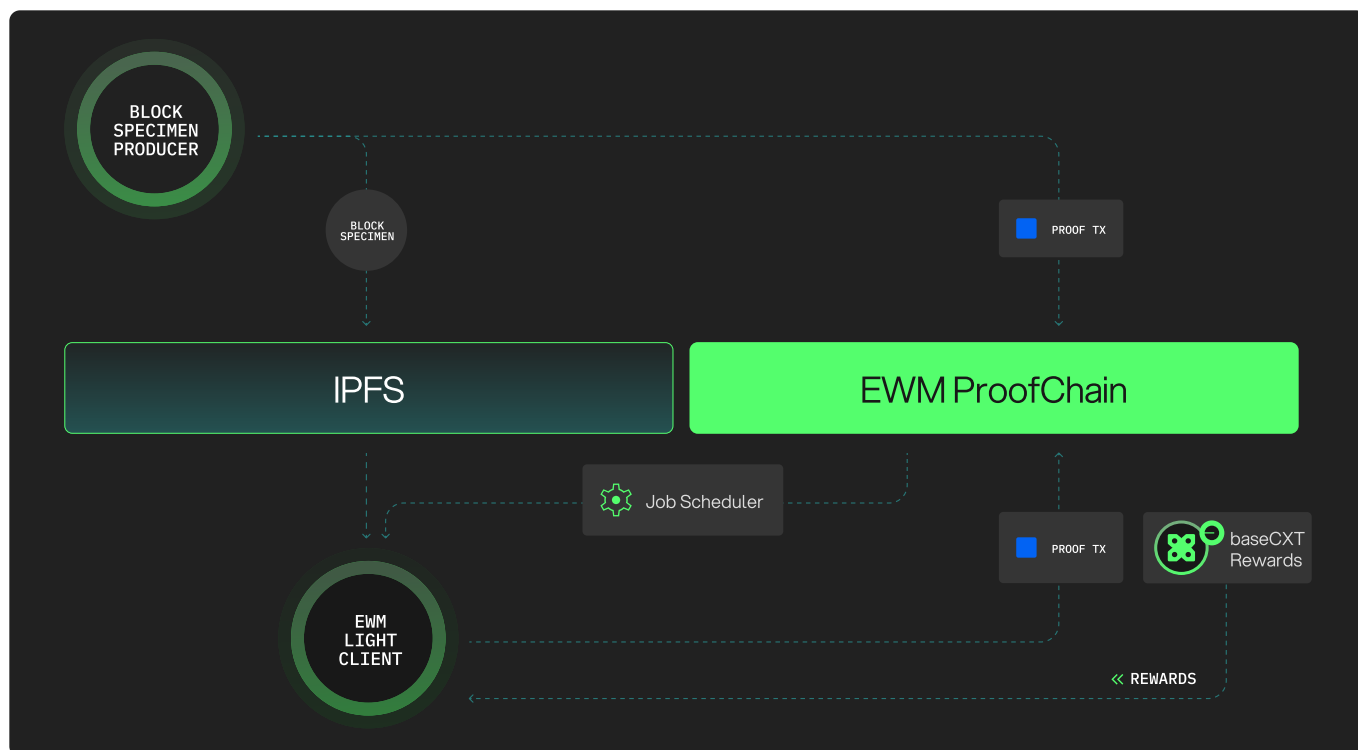
Bridge Agent

- **Functionality:** The Bridge Agent acts as the intermediary that consolidates the validation work completed by the Light Clients at the end of each epoch. It plays a crucial role in ensuring that the results of the validation are accurately reflected in the Covalent Network's economic and governance models.
- **Role in Rewards Distribution:** The Bridge Agent aggregates the validation data and updates the Rewards Smart Contract accordingly. This ensures that participants are fairly compensated for their contributions to the network based on the quality and quantity of their validation work. The Bridge Agent operates automatically, minimizing the potential for errors in reward calculation.

Rewards Smart Contract

- **Interface:** The Rewards Smart Contract is the final component in the validation and reward distribution process. It interacts with the Bridge Agent to receive updates on the validation work performed by Light Clients.
- **Reward Distribution Process:** The contract calculates the rewards due to each Light Client based on their contribution and the rules defined within the Covalent Network. It then distributes CXT tokens to the Light Clients as compensation for their work. This process is transparent and auditable, ensuring that all participants can verify the fairness of the reward system.

Interaction with the EWM Ecosystem



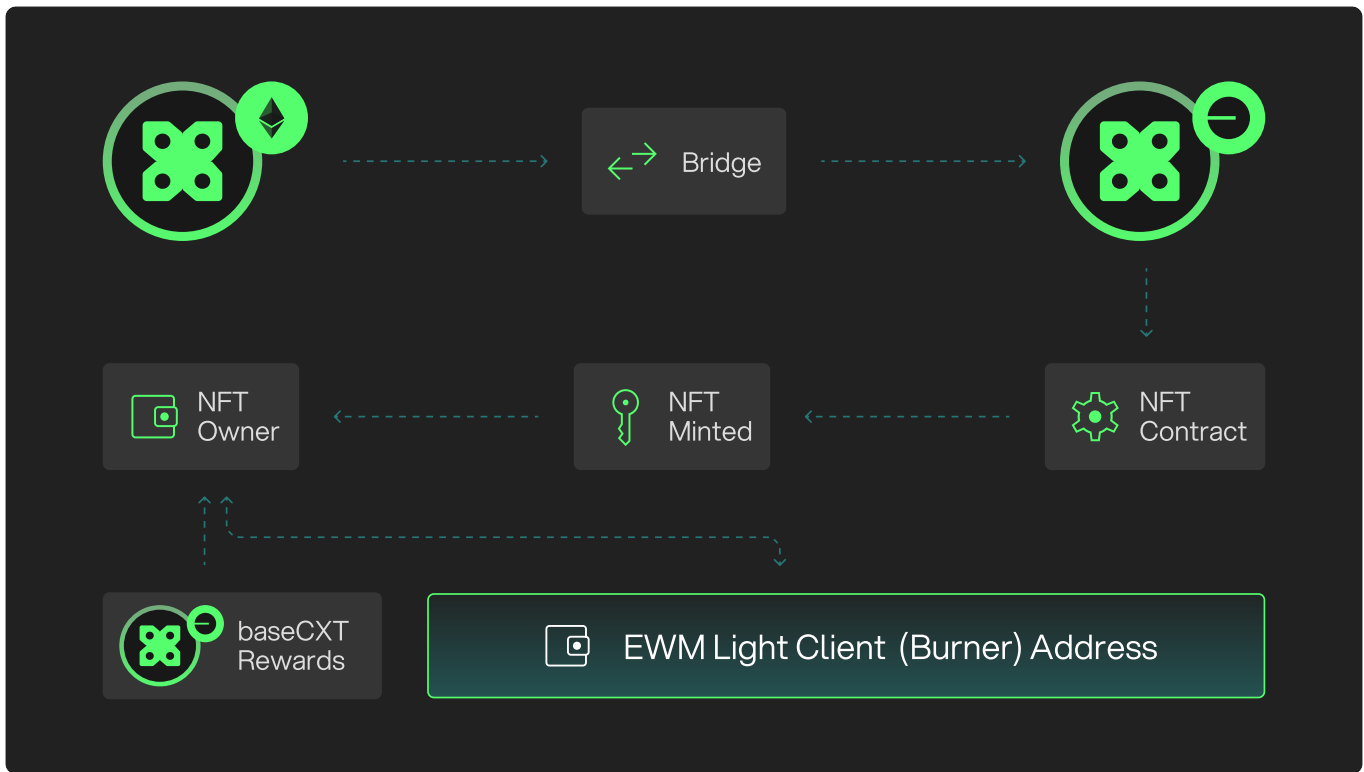
Data Flow

- 1. From Block Specimens to Validation:** The process begins with the Block Specimen Producer (BSP) capturing blockchain data and creating Block Specimens, which are then stored on IPFS. The Job Scheduler assigns these Block Specimens to various Light Clients for validation. Once validated, the results are collected by the Collection Service and aggregated by the Bridge Agent, which updates the Rewards Smart Contract.
- 2. Validation to Reward Distribution:** After the Bridge Agent updates the Rewards Smart Contract, the contract calculates the rewards based on the validation work and distributes baseCXT tokens (CXT on Base) to the Light Clients. This ensures a continuous and reliable flow of data through the network, from initial data capture to final reward distribution.

Security and Proofs

- 1. Cryptographic Proofs:** Security is a cornerstone of the EWM Light Client's architecture. Each Block Specimen is accompanied by cryptographic proofs. These proofs serve as verifiable evidence that the data has been processed and validated correctly.
- 2. Integrity Assurance:** The EWM Light Client uses these cryptographic proofs to ensure the integrity of the data it processes. By cross-referencing the proofs with the data it validates, the Light Client can guarantee that the data is accurate and trustworthy. This system of decentralized validation, combined with the use of cryptographic proofs, protects the Covalent Network from data tampering and ensures the reliability of the historical blockchain data it provides.

The User Flow



When the EWM Light Client goes live on mainnet, participants will access the software through soulbound NFTs that grant the license to run light client instances. Below is the step-by-step breakdown of the user flow:

- 1. Whitelist Process:** Participants will first submit their public wallet address to the Covalent team during the testnet phase. This address will be used to receive an NFT that will grant them access to run an EWM Light Client on mainnet.
- 2. Base CXT:** Before operating a Light Client, will need to accumulate baseCXT (Base CXT). The minimum amount required to run a single Light Client is 5000 baseCXT, scaling up depending on how many Light Client instances a participant intends to operate. Participants can bridge their CXT tokens to Base or acquire baseCXT directly on the L2 network.
- 3. Deposit CXT and Claim NFT:** After gathering sufficient baseCXT, participants will deposit their tokens into a claim contract, specifying how many Light Clients they plan to operate. This deposit determines the number of soulbound NFTs they will receive. These NFTs will be non-transferable and are tied to specific instances of the Light Client software. The number of NFTs that can be purchased will be capped based on the whitelist and predefined limits on maximum purchases per address.
- 4. NFT Mint:** Once the participants are verified, we'll mint NFTs to the respective addresses. These NFTs represent the locked (staked) baseCXT the participants have deposited to run the EWM Light Client and will be airdropped to participants' wallets.

- 5. Running the EWM Light Client:** The EWM Light Client software is open-source and publicly available for download. While anyone can technically run the software, only participants who complete the whitelist, baseCXT deposit, and NFT claiming process will be eligible to earn rewards for running Light Clients. Participants will assign burner addresses to the licenses, creating a one-to-one relationship between each NFT and a burner address that will operate the light client. Each NFT corresponds to one Light Client instance, which ensures the network remains secure.
- 6. Earning and Redeeming Rewards:** As Light Clients are operated, rewards will be earned based on the data validation work performed. The reward manager will aggregate rewards across all light client instances and NFT IDs. Participants can redeem their CXT rewards by calling the “redeemRewards” function from the wallet that holds the NFTs. This clears their reward balance and transfers the rewards to the NFT owner’s wallet from the NFT reward pool.

4. Benefits and Use Cases

4.1 For Node Operators

The EWM Light Client offers significant incentives and benefits for node operators who choose to participate in the Covalent Network, especially for those who may not have the technical infrastructure to support a full node. Operators of the EWM Light Client can earn rewards in the form of CXT tokens at an APY of up to 25%. The decentralized nature of the EWM Light Client ensures that node operators contribute to the network's security and integrity, while also benefiting from the financial incentives provided through the Rewards Smart Contract. This model not only encourages participation but also promotes the long-term sustainability of the network.

4.2 For the Covalent Network

The introduction of the EWM Light Client significantly enhances the Covalent Network’s decentralization, scalability, and reliability. By enabling a larger number of participants to engage in the network’s validation process, the light client reduces the risk of centralization and improves the overall security of the network. This increased participation also enhances the network’s scalability, as the workload is distributed more evenly across a broader set of nodes. The EWM Light Client’s role in scaling proof verification ensures that the Covalent Network remains a trusted source of blockchain information, supporting a wide range of applications and use cases across the Ethereum ecosystem and beyond.

5. Roadmap and Future Development

Phase 1 - Devnet

The initial deployment phase, known as the Devnet phase, commenced on August 14, 2024. During this phase, a core group of participants, primarily Covalent employees, are tasked with running the EWM Light Client. The primary goals of this phase are to test the basic functionality of the light client, ensure that the IPFS Pinner modifications are working correctly, and identify any potential issues that could affect the subsequent phases. The Devnet phase is crucial for laying the groundwork for broader adoption in the testnet and mainnet phases. Successful completion of this phase will demonstrate the viability of the light client and pave the way for its broader release.

Phase 2 - Testnet

The testnet phase, scheduled to begin in September 2024, is designed to expand the deployment of the EWM Light Client to a larger group of participants, including community members and early adopters. During this phase, additional components such as the Job Scheduler, Collection Service, and Light Client software will be activated. Participants in the testnet will receive rewards in the form of bonus multipliers on their mainnet yield, from running the client on mainnet. This phase will focus on stress-testing the network, refining the reward distribution mechanisms, and ensuring that the light client operates efficiently under more extensive network conditions. The testnet phase is expected to last 4-6 weeks, providing ample time to gather feedback and make necessary adjustments before the mainnet launch.

Phase 3 - Mainnet

The mainnet phase, slated for launch in November 2024, marks the final deployment of the EWM Light Client. By this stage, all six key components, including the Bridge Agent and Rewards Smart Contract, will be fully operational. The mainnet phase will be open to all participants, with a 5000 CXT stake required to operate a light client. This phase is designed to ensure that the EWM Light Client can function at scale, supporting the Covalent Network's broader goals of decentralization, security, and long-term data availability. The mainnet launch will also feature tiered participation in the form of "seasons", where participants will be onboarded in tiers and receive different NFTs depending on the season they join.

6. Economic Model and Incentives

6.1 Staking and Rewards

The EWM Light Client is integral to the Covalent Network's decentralized validation process, and participation in this process is incentivized through a staking and rewards mechanism. To become an EWM Light Client operator, participants are required to stake a minimum of 5000 CXT tokens. This staking requirement serves as a security measure, ensuring that operators have a vested interest in the network's integrity and are disincentivized from acting maliciously.

In return for their participation, light client operators are rewarded with CXT tokens based on the volume and accuracy of their validation work. The rewards are calculated and distributed through the Rewards Smart Contract, which aggregates the validation results submitted by the light clients and allocates rewards accordingly. The reward structure is designed to be tiered, meaning that operators who consistently contribute high-quality validation work can earn higher rewards. This system not only incentivizes participation but also encourages operators to maintain high standards of accuracy and reliability in their work.

6.2 CXT Token Integration

The CXT token plays a central role within the EWM Light Client framework, serving as the primary medium of exchange for transactions, rewards, and governance. Operators use CXT tokens to stake their participation in the network, which grants them the right to validate Block Specimens and earn rewards.

Beyond its utility in transactions and rewards, the CXT token also plays a role in network governance. Token holders have the ability to participate in decision-making processes that affect the future development of the Covalent Network, including updates to the EWM Light Client protocol, changes to the staking and rewards structure, and the introduction of new features. This governance model ensures that the network remains decentralized and that the interests of its participants are adequately represented.

6.3 Economic Impact

The introduction of the EWM Light Client significantly enhances the utility of the CXT token and contributes to the overall value of the Covalent Network. By lowering the barriers to participation in the network's validation process, the light client increases the number of active participants, which in turn drives demand for CXT tokens. This increased demand is further amplified by the staking requirements and the use of CXT tokens as rewards.

As more participants join the network and more data is validated and stored, the Covalent Network becomes a more valuable resource for developers, enterprises, and other stakeholders who rely on accurate and accessible blockchain data. This increased utility not only strengthens the CXT token's value proposition but also enhances the network's resilience and scalability. In the long term, the widespread adoption of the EWM Light Client and the broader Covalent Network is expected to drive significant growth in the utility of CXT, as the token becomes an essential component of a decentralized, data-rich blockchain ecosystem.

7. How to Get Involved

There are many opportunities to become an EWM Light Client operator. Detailed setup instructions and participation guidelines will be shared upon the launch of the testnet in September, 2024.

Participation in the testnet phase will automatically add users to a whitelist for the mainnet phase, and make them eligible for rewards for early participation. Once mainnet is live in November, participants can sign up for different seasons of the campaign.

Throughout the entire rollout of the EWM Light Client, the Covalent team will be hosting meetups around the world to onboard anyone who wants to run a Light Client. These meetups can be found listed on the EWM Light Client landing page on the Covalent website. Stay informed by joining the Covalent Telegram channel for updates and following the official account on Twitter.

8. Conclusion

The EWM Light Client represents a significant advancement in the Covalent Network, and the first major step in solving long term data availability, ensuring historical data remains available for an infinite amount of use cases. By providing a lightweight, accessible solution for validating Block Specimens, the EWM Light Client enhances the decentralization and scalability of the overall Network. This tool is crucial for supporting Ethereum as it continues to scale, ensuring that everyone can trust the historical records of the blockchain.

As the EWM Light Client prepares for its public release, now is the perfect time to get involved. Whether you're a developer, node operator, or blockchain enthusiast, your participation in the upcoming testnet and mainnet phases will be invaluable. By joining the Covalent community and contributing to the success of the EWM Light Client, you'll be playing a key role in shaping the future of Ethereum.

About Covalent


Covalent is the leading modular data infrastructure layer dedicated to solving major challenges in blockchain and AI, including verifiability, decentralized AI inference, and Long-Term Data Availability. Its large reservoir of structured, verifiable data enhances decentralized training and inference, reducing the risk of manipulated or biased AI models. Additionally, the Covalent Network's Ethereum Wayback Machine ensures secure, decentralized access to Ethereum's transaction data. Trusted by over 3,000 leading organizations, Covalent powers AI, DeFi, GameFi, and more with unfettered access to on-chain data from over 200 blockchains.



Modular Data Infrastructure for AI.

 @Covalent_HQ

 [covalenthq.com/telegram](https://t.me/covalenthq)

 [covalenthq.com/discord](https://discord.com/invite/covalenthq)

 covalenthq.com