Xylume TestNet
Whitepaper

Abstract

Xylume TestNet (formerly XYL TestNet) is an innovative decentralized testing environment designed for high-performance, scalability, and secure transaction validation. Built on a **Directed Acyclic Graph (DAG)** structure, Xylume TestNet aims to eliminate bottlenecks found in traditional blockchains by enabling parallel transaction validation.

With the introduction of **Proof of Unspent Transaction eXploration (PoUTX)**, Xylume TestNet enhances transaction integrity by forming a series of validated transactions in the graph. The **parent-child relationship** between transactions, supported by the **'juice'** system (where the unspent output of a parent transaction is used as input for a child), strengthens security by linking transactions in a way that is resistant to double-spending and other attacks.

This method is faster, more efficient, and less resource-intensive compared to conventional blockchain approaches. As a result, the series of validated transactions naturally ensures that only valid transactions are included in the DAG. If a valid parent transaction is present in the DAG, then the child can be linked and validated, maintaining the integrity of the entire system.

Xylume TestNet features a dynamic gas model that ensures fair rewards for miners and validator nodes while preventing spam transactions. This system ensures low transaction fees, making it cost-effective for all network participants.

1. Introduction

Xylume TestNet is a high-performance decentralized crypto network built to simulate the core operations of Xylume's future mainnet.

The testnet integrates **advanced DAG** technology, **PoUTX-based validation**, **dynamic gas model**, and a **parent-child transaction flow with a 'juice' system**

to maximize security, speed, efficiency, and reliability. Unlike traditional blockchain systems, Xylume TestNet offers an innovative, stable, and high-throughput environment for developers to test the ecosystem safely and without financial risk, using free test tokens obtained through dedicated faucets.

2. Architecture

2.1. Directed Acyclic Graph (DAG)

In Xylume TestNet, transactions are structured using a **Directed Acyclic Graph (DAG)** rather than the linear chain structure of traditional blockchains.
This DAG-based system allows for multiple transactions to be validated simultaneously yet securely, eliminating the bottleneck caused by sequential block production in conventional blockchains. The DAG design allows Xylume TestNet to process transactions much faster and scale more efficiently as it grows.

2.2. Parent-Child Transaction Model

Xylume TestNet uses a **parent-child relationship** between transactions. Every transaction is either a parent, a child, or both, linking multiple transactions together in a hierarchical fashion. The parent-child model optimizes transaction validation and propagation speed across the network, making it possible to handle a higher volume of transactions with lower latency.
Each parent's unspent output can be referred as the **'juice'** to be used as input for the child transactions. The **parent-child relationship** ensures that each transaction's validity is maintained without introducing redundant validation steps. As a result, the network can scale seamlessly, processing large volumes of transactions without sacrificing performance.

2.3. Proof of Unspent Transaction eXploration (PoUTX)

Xylume TestNet implements **Proof of Unspent Transaction eXploration (PoUTX)** as its validation mechanism and 'mining'. This approach uses **Unspent Transaction Outputs (UTXO)** to verify transactions.
In PoUTX, miners find valid transactions with sufficient unspent outputs (juice) and submit the corresponding parents' hashes and the child transaction's hash to the node, which re-checks and validates the authenticity of the mined job. This ensures that no funds are double-spent, a series of valid transactions is formed

representing the flow of the coins, and that the transactions are legitimate, thereby maintaining network security.
PoUTX also facilitates a lightweight state dependency system, where each transaction only relies on the state of its direct parent transaction, making the network more efficient and resistant to attacks.

2.4. Gas and Tokenomics

Xylume TestNet incorporates a **dynamic gas model** to encourage efficient use of the network, and reward nodes and miners fairly for participation in the validation process. Each transaction consumes gas, which is paid in native Xylume (XYL) tokens.

- The base gas is calculated according to the network load:
  Base fee in XYL = 0.000069 + (0.000069 * (Current incoming TPS / 10000))

- The incoming TPS is calculated as the number of pending transactions divided by the time difference between the oldest and newest pending transactions:
  Incoming TPS = Number of pending transactions in mempool / (Timestamp of the oldest pending transaction in seconds - Timestamp of the latest pending transaction in seconds)

- The initial supply of XYL is **6,942,340 XYL**. The smallest unit of the native token is **wxei**, which is equal to **1e-18** of a XYL, thus the decimals of the XYL token is 18, similar to that of Ether.

3. Decentralization & Network Architecture

3.1. Node Discovery and Connectivity

Decentralization is achieved through the **P2P node system** integrated into Xylume TestNet. Nodes communicate using **socket-based communication**, where each node has one sender component, and a receiver component for each connected node.
A new node initiates a connection to other nodes by listening to (the sender of) each node in a thread. The nodes connect back and listen to the sender/server of the new node. Nodes can be discovered through an officially and automatically

maintained list, which ensures only healthy nodes are shown on the list, avoiding performance decrease due to slow or faulty nodes. This architecture maintains the decentralized nature of the testnet while optimizing connectivity for nodes across the network.

3.2. Distributed Consensus

Xylume TestNet is built on a **distributed consensus** system, where all nodes are involved in validating transactions through the PoUTX mechanism. This ensures that no single participant can dominate the network, and the testnet remains resilient to centralization or attacks.
Each mined transaction is broadcasted to all connected nodes, which themselves revalidate the transaction and responds to the source node (node which sent the transaction to other nodes) about its decision on the validity of the transaction. The nodes add the transaction to their own DAG upon successful validation. The transaction is added to the source node's DAG, irrespective of majority agreement or disagreement. Although this may lead to desynchronization with the majority of the network, this protects against Sybil attacks, as majority disagreement is only possible if there is a mismatch between the validation rules & code of the majority and the node, which may be a result of malicious modifications to the source code of the node(s). There is no intent of synchronization with malicious or rogue nodes.

4. Security and Integrity

4.1. Cryptographic Security

Xylume TestNet leverages cryptographic techniques to ensure the integrity of transactions. Each transaction is digitally signed using the sender's private key, ensuring authenticity.
Furthermore, PoUTX prevents double-spending by requiring proof of unspent outputs before any new transaction can be added to the network.
To enhance security and efficiency, Xylume TestNet employs **BLAKE2b** as its primary hashing algorithm for its **high-speed performance, strong cryptographic resistance, and reduced computational overhead** compared to other cryptographic hash functions like SHA-256.

4.2. Resistance to Attacks

Xylume TestNet is highly resistant to common attacks, such as **51% attacks**, **Sybil attacks** and **double-spending**.
The DAG structure and PoUTX consensus mechanism ensure that no single entity can control the network, while the parent-child transaction relationships ensure that invalid transactions are easily identified and rejected.
Unlike traditional blockchain networks, where a single entity controlling **51% of the hashrate** can rewrite history, Xylume TestNet prevents such attacks through multiple security mechanisms:

- **DAG-Based Structure (Not Chain-Based Mining)** – Transactions reference past valid transactions, preventing attackers from reorganizing the network. There is no longest-chain rule to exploit.

- **Parent-Child Validation & Juice Rule** – Invalid transactions will not be referenced by honest nodes, preventing malicious forks or conflicting transactions from being accepted.

- **Dynamic Gas Model** – Inspired by **EIP-1559**, this model increases fees for excessive transactions, discouraging spam and resource exhaustion attacks.

- **No Automatic Trust in New Peers** – Nodes rely on verified transaction history. A peer must reference valid prior transactions in the DAG to get a transaction accepted across other nodes in the network, making Sybil attacks harder to execute.

Conclusion

Xylume TestNet represents a significant evolution in decentralized ecosystems, providing a cutting-edge platform for developers and users to explore the future of DAG-based transactional ledgers.
By incorporating **DAG technology**, **PoUTX**, **dynamic gas mechanisms**, **EVM-Compatibility**, and much more, Xylume TestNet sets a standard for scalability, security, performance and decentralization in cryptocurrency networks.
The testnet is designed to facilitate testing and development without the risk of using real assets, making it the perfect platform for developers to experiment with, as well as for testing of new features for the Xylume ecosystem.