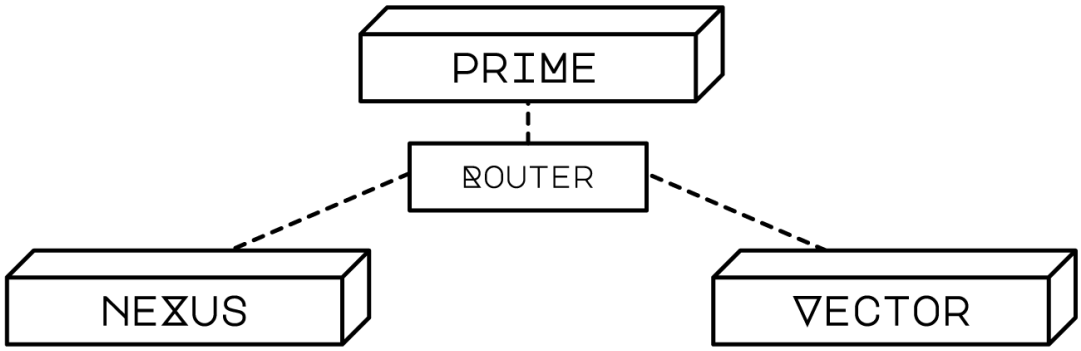
Architecture of Apex Fusion

Apex Fusion is there to serve as a network infrastructure that is not only robust but also finely tuned to the needs of all users, leveraging state-of-the-art battle-tested technology for network nodes and supporting a decentralized network architecture. This is done using the Fusion ecosystem 3-chain architecture - **Prime Chain**, **Vector Chain**, and **Nexus Chain**.



The Prime Chain implements the Ouroboros consensus protocol, and serves as a L1 blockchain offering security and decentralization to the ecosystem. Scalability within

the ecosystem will be provided via internally bridged L2s using both UTXO (Vector chain) and EVM side chains (Nexus chain), with more chains to follow. Such architecture allows for the mitigation of the blockchain trilemma. This setup supports the use APEX as the native token for transaction fee payments and other operations across the entire ecosystem, with the possibility for its effortless bridging accross the Fusion family of blockchains.

Apex Fusion takes a proactive approach to security by incentivizing node distribution across various independent data centers to avoid having the majority of the network's reliance on a single centralized third-party providers. This ensures that the network is not reliant on a single infrastructure provider, boosting its resilience and complying with the ethos of decentralization.

By seamlessly integrating the UTXO and account-based (EVM) models, we achieve the security guarantees, native asset capabilities and the robust staking platform of the Ouroboros Consensus Protocol with the user-oriented and developer-friendly capabilities of EVM-based smart contracts.

In addition to this, Fusion blockchains fueled by Apex and supported tokens (like ERC20 tokens) will be connected with other external networks via designated bridges, such as general message-passing protocols (such as Axelar, Chainport or Chainlink's CCIP). This will allow seamless communication and asset transfers between diverse array of blockchains.

For more information on the Apex Fusion architecture, please read the Apex Fusion Litepaper.

Prime Chain

The Prime Chain is the Layer 1 (L1) blockchain within the Fusion ecosystem serving as the foundational decentralized base layer by providing stability and security for the entire ecosystem.

The Prime chain will be maintained by a decentralized network of validators using the latest implementation of the Ouroboros Proof-of-Stake consensus protocol, based on

a proven and secure e-UTXO accounting method. This not only ensures energy efficiency but also enhances network security through liquid staking.

The Prime Chain serves as the liquid staking consensus mechanism for the multi-chain architecture providing liquid staking benefits to both the UTXO (Vector) and EVM (Nexus) side chains. Validators on the Prime chain are responsible for creating blocks and processing transactions, incentivized by staking rewards in the form of APEX tokens.

The Prime Chain is the exclusive issuer of APEX tokens, meaning that it is the only source of inflation withing the Fusion ecosystem. The predominant transactions on the network will involve the use of liquid staking.

The Prime Chain will implement the InFusion mechanism, used by the Apex Fusion Foundation to fund projects by delegating and saturating nodes using the ISPOs (initial stake pool offerings) process. The InFusion mechanism ensures that the delegated APEX remain within the Apex Fusion Foundation. Grants and InFusion generated funding dedicated to projects developing the ecosystem will be issued on the Prime Chain. In addition to this, the initial deployment of new technologies and features be done on the Prime Chain before they are integrated into 2nd layers or connected chains.

Governance on the Prime chain will be conducted through a decentralized voting mechanism, where token holders have the power to vote on proposals for changes and improvements to the network. This will ensure that the development of the chain aligns with the interests of the community.

Vector Chain

The Vector chain is a Layer 2 (L2) blockchain within the Apex Fusion ecosystem, designed to extend the capabilities of the Prime chain. It utilizes the latest Ouroboros Proof-of-Stake consensus protocol, however it is designed to handle specific functionalities and applications that require higher transaction throughput and lower latency.

The Vector chain will be maintained by a permissioned set of validators. It supports dApps based on the Cardano ecosystem. Unlike the foundational Prime chain, the Vector chain has lower transaction fees, and the block times are smaller, which increase throughput. It is built for projects requiring rapid settlement in DeFi or real time interactions in DeFi and gaming domains for UTXO. This chain might host smart contracts that are optimized for specific applications, such as gaming, micro-payments, or real-time data processing, which benefit from the lower latency and higher throughput.

The primary objective of the Vector chain is to enhance the scalability of the Apex Fusion ecosystem. Vector is built to interact seamlessly not only with the Prime chain but also with other Layer 2 solutions like the Nexus chain, facilitating efficient asset and data transfer across the ecosystem.

Nexus chain

The Nexus network functions as a Layer 2 (L2) EVM chain designed to facilitate the integration of EVM-based decentralized applications (dApps) and services, providing the benefit of low transaction fees. This efficiency is achieved through an advanced EVM L2 scaling infrastructure, which leverages existing open-source implementations such as Polygon EVM.

The network's stability and security are ensured by a permissioned set of validators who manage and maintain the blockchain.

Within this network, the APEX token is adapted to operate as an ETH-equivalent native token, conforming to the account-based system characteristic of EVM chains. This design allows for seamless interaction and compatibility with a wide range of EVM-based applications and services, enhancing the overall functionality and utility of the Nexus network.

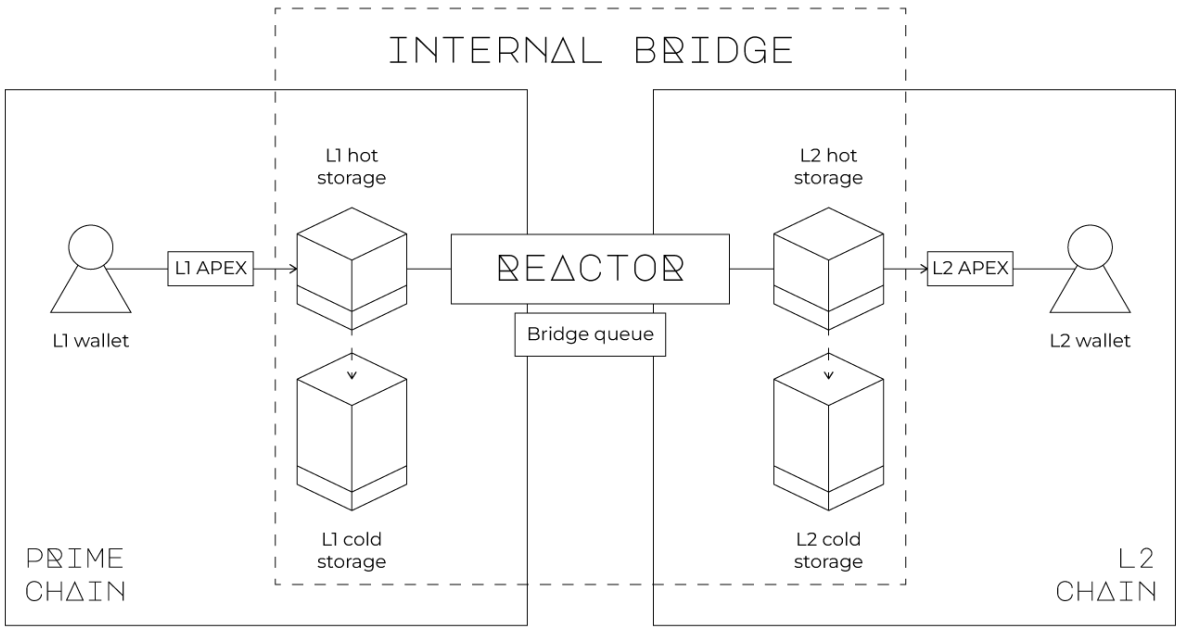
The Nexus chains' focus is providing an environment conducive to decentralized finance (DeFi) applications.

Nexus is built to interact seamlessly not only with the Prime chain but also with other Layer 2 solutions like the Vector chain, facilitating efficient asset and data transfer across the ecosystem.

Reactor Bridge

The Reactor Bridge is a crucial component within the Apex Fusion ecosystem, enabling seamless interoperability between the 3-chain Fusion ecosystem. It allows for the secure and efficient transfer of assets and data within the Apex Fusion network. It may be used to connect other networks in the future, but it is primarily designed to bridge APEX tokens minted on the Prime Chain. This bridging functionality allows users to utilize their APEX tokens on the chain best optimized for their particular use case, and ensuring a cohesive and interconnected blockchain environment.

The bridging is achieved by locking the tokens on the source blockchain, and releasing an equivalent amount of tokens on the destination blockchain. In order to accomplish this in a secure and trustworthy manner, the locked APEX tokens will be held at a multisig address controlled by the bridge validators.



Since bridging is achieved by locking/releasing mechanism, at any given moment, there must be a balance between locked tokens on L1 blockchain and released tokens on L2 blockchains. This means that the amount of locked tokens on the L1 blockchain must be equal to the sum of unlocked tokens on the L2 blockchains.

The bridge operates in a decentralized manner, leveraging smart contracts and cryptographic protocols to ensure the security and integrity of cross-chain transactions. The Reactor Bridge employs a network of validators responsible for verifying and approving cross-chain transactions.

Workflow

Deposit and withdrawal processes operate similarly, so 'source' and 'destination' chains will be used instead of 'L1' and 'L2' chains.

1. **Bridging Initiation**: The sender starts the bridging process by creating a transaction on the source chain. The input will be a UTXO from the sender's address, covering fees and the funds to be bridged. These funds will be locked in a multisig address controlled by the bridge. Transaction metadata will include necessary details like the destination address, chain ID, amount, etc.

2. **Detection of Bridging Transactions**: Each validator operates an off-chain component (oracle) to monitor bridging requests by observing transactions on the source chain that produce output UTXOs related to the bridge's multisig address.

3. **Witnessing Bridging Transactions**: Each oracle submits the transaction to the bridge blockchain to verify it has observed the bridging request.

4. **Confirmation of Bridging Transactions**: When a quorum of validator oracle votes is reached to confirm a transaction, it is considered valid and ready to be included in a batch.

5. **Batching Transactions**: Confirmed transactions are stored on the bridge blockchain until it's time to create a new batch. A batch is a UTXO transaction that will be executed on the destination blockchain. It can be created when

enough transactions are confirmed or when the maximum time limit between batches is reached.

6. **Batch Confirmation**: To submit the batch to the destination blockchain, it must be confirmed by the quorum of bridge validators. Validators confirm the batch by signing it with their private keys that control the multisig address on the destination blockchain.

7. **Batch Submission**: The batch transaction is submitted to the destination blockchain, where the bridging funds are unlocked from the bridge-controlled multisig address and transferred to the specified destination addresses.

The APEX utility token is the native cryptocurrency central to the Apex Fusion ecosystem, fueling the Ouroboros Consensus mechanism and enabling seamless interaction between the Fusion blockchains, protocols, bridges, and decentralized applications. Learn more about it in APEX Token section.
