Khalifa Blockchain: An Ethical DeFi Optimised Layer-2 Blockchain Built on Setheum for DeFi Confidentiality, Interoperability and Scalability

Technical White Paper

MAY 2023

By

Muhammad-Jibril B.A. (Khalifa MBA)

Founder, Chief Architect, Grand Imam

Slixon Technologies | Setheum Labs| OpenWeb3 Foundation

Abstract

The intent of the Khalifa Subchain Network is to improve upon the concept of Ethical Web3 and Ethical DeFi, scalability, security, mass adoption, diversity, and most importantly ethics while preserving decentralisation and democratisation.

We see a lot of blockchains coming up, yet we haven't seen many that have either solved the trilemma or effectively found reasonable equilibrium in the trilemma thus achieving a decent level of scalability, increased network security and a decent level of decentralisation. Khalifa intends to be just that and more, with Khalifa, the Setheum Network intends to create an ecosystem for Ethical DeFi on the most scalable Blockchain Network in the World. We feel strongly towards Ethics and Morals to be applied to our native DeFi Protocols.

We see a lot of cryptocurrencies coming up everyday, but what we don't see is a cryptocurrency that is decentralised, secure, scalable and having the option for price stability at the same time, especially one without interest-based debt or having to be centralised by a physical reserve in a corporate bank, and one that is also properly governed, this is why we introduce Khalifa.

Introduction

Setheum achieves a decently high level of equilibrium in the trilemma by leveraging a Directed Acyclic Graph(DAG) to build the blockchain consensus, achieve instance finality, high throughput and subsecond blocktime while preserving network security and having a fairly decentralised network, Setheum's consensus system leans towards achieving high scalability and high security with an ethical, decent and equitably high level of decentralisation.

Setheum is EVM(Ethereum Virtual Machine) compatible for smart contracts to thrive on its super fast blockchain, the entire chain is upgradable and forkless enabling forkless upgrades as Setheum is built with the Substrate framework using the Rust programming language. Khalifa Suite powers the DeFi revolution on Setheum, being on the fastest public blockchain network in the world and leveraging all the benefits that come with being on Setheum, making it a DeFi optimised blockchain especially exceptional for DeFi applications and solutions.

Khalifa Subchain's DeFi Suite is also the DeFi powerhouse of the Setheum Network, providing all kinds of top notch DeFi protocols including an AMM DEX, payment gateway rail based on setheum's built-in payments modules, DEX aggregator, Decentralised Liquid Staking for for both Setheum SEE and Khalifa KHL and ethical zero-interest halal stablecoins that gives us the properties of both Fiat and Crypto with SlickUSD (USSD) and the Setter (SETR) using an Ethical Collateralized Debt Position (ECDP) mechanism that is over-Collateralized and multi-Collateralised and stable without compromising decentralisation or economic stability, offering zero-interest loans of stable cryptocurrencies that has scalable value and trust, setheum provides just that, backed by crypto assets with efficient zero-interest loans.

Table of Contents

Abstract **1**
Introduction **2**
Brief History **4**
Understanding The Blockchain **5**
Inspiration & Motivation 6
Setheum Network **6**
Khalifa Subchain 7
EPoS (Extended Proof of Stake) in Khalifa 7
Penalty and Slashing Mechanism in EPoS 8
Types of Staking Protocols in Khalifa 9
Khalifa Staking - Standard Staking vs Liquid Staking Comparison 10
Standard Staking in Khalifa 10
Liquid Staking in Khalifa 11
Staking Rewards in Khalifa 12
Ethics, Halalness, Randomness and Fairness in Khalifa's EPoS 12
Vesting in Setheum **13**
Wallet Recovery in Setheum **13**
Khalifa Suite: Powering Ethical DeFi Solutions **15**
Chain Properties **16**
Khalifa's EVM (Ethereum Virtual Machine) **16**
ECDP: Ethical Collateralised Debt Position **17**
The Ethics of ECDP, Stablecoins in Khalifa Suite 18
Types of ECDPs - Pegged and Unpegged 19
Comparison between Khalifa Stablecoins - Pegged/Unpegged 20
The ECDP Process 20
Comparison between Khalifa Stablecoins and Others 21
Risk Management in the ECDP 22
ECDP Liquidations 22
Liquidation Pools 23
Liquidation Swaps 23
Unpaid Debt 23
ECDP Risk Management Parameters 24
Pegged-ECDP Risk Management Parameters 24
Pegged ECDP Price Stability Mechanisms 25
Unpegged-ECDP Risk Management Parameters 25
Unpegged ECDP Price Stability Mechanisms 26
Khalifa Exchange 28
Aggregated Swap: Cross-Chain Swap DEX Aggregator 28
Spot Swap: Concentrated Liquidity AMM DEX 28
P2P Swap: Peer-to-Peer Atomic Swap DEX 29
Range Orders 29
Active Smart Liquidity Automated Market Maker (ASLAMM) 31
Liquidity Mining Incentives 31
Time Lock Vesting Protocol 31
Governance **32**
Roadmap **33**
Conclusion **35**
References and Further Reading **36**

Brief History

It all started in 1976, cryptographers Whitfield Diffie & Martin E. Hellman published their paper “New directions in cryptography”. David Chaum first proposed a protocol similar to Bitcoin in his thesis "Computer Systems Established, Maintained, and Trusted by Mutually Suspicious Groups.” in the year 1982. Then S. Even, O. Goldreich, and Y. Yacobi published “Electronic wallet” later in 1983. Furthermore, since then we’ve seen inventions in this field being introduced by some of the most brilliant minds around, this gradually builds up and leads to what we know today as the “Blockchain” In 1998 yet again, Nick Szabo introduced the design of a mechanism for a decentralised digital currency he called "Bit Gold". Though Bit Gold was never implemented, it has however been dubbed "the direct precursor to the Bitcoin architecture.” In Nick Szabo’s Bit Gold, a participant would dedicate computing power to solve cryptographic challenges (like puzzles). In the Bit Gold network, solved cryptographic hashes would go through a BFT (Byzantine Fault-Tolerant) public registry and be assigned to the public key of the participant/solver. Each solution would become part of the next challenge, creating a growing chain of new challenges. This provided the Bit Gold network with a method to verify and time-stamp new Bit Golds, because unless a majority of the validation participants agree to accept new hash solutions, they couldn’t start on the next challenge. When attempting to design a digital currency, challenges like the "double-spending" problem arise. Once data has been created, reproducing it would simply be a matter of copy and paste. Most digital currencies would solve the problem by advocating some control over to a central authority, which keeps track of the account balances. This was clearly an unacceptable solution for Nick Szabo, "I was trying to mimic as closely as possible in cyberspace the security and trust characteristics of gold, and chief among those is that it doesn’t depend on a trusted central authority,"said Szabo. The phrase and concept of "smart contracts" was also developed by Nick Szabo, with the goal of bringing what he calls the "highly evolved" practices of contract law to the design of trustless e-commerce protocols on the Internet. More papers were published to achieve fairly the same objective, a peer-to-peer trustless and secure electronic monetary equivalent. All these inventions were neglected and almost forgotten until when we needed them the most in the 2007-2008 financial crisis, what a crash, I had wish we saw the black swan coming earlier and took all preventive measures, but we just simply didn’t trust crypto, and now it’s proven us totally wrong, though it hurts to be wrong we have to admit we must transition to a better economic stability strategy. On the 7th of April 2008, MICHAEL NÜSKEN published “WORKSHOP e€ (ELECTRONIC MONEY).” In the same catastrophic 2008, Blockchain was invented by a person under the alias of “Satoshi Nakamoto”, to serve as the public transaction ledger of the cryptocurrency “Bitcoin”. The identity of Satoshi Nakamoto remains unknown till date. The invention of the blockchain for the bitcoin network, made it the first digital currency to solve the “double-spending” (where one could spend a unit of exchange more than once) problem without the need for a trusted centralised authority. The bitcoin design has inspired many other applications and blockchains that are public, transparent. The blockchain is considered as a type of payment rail. Late 2019, I proposed Setheum and its Subchain Khalifa to serve the underserved in this industry and introduce an ethical shari’ah compliant Blockchain and a group of protocols.

Understanding The Blockchain

The blockchain is a decentralised, electronic ledger made up of **blocks** used to record transactions across distributed nodes such that any recorded block cannot be altered retroactively, without the alteration of all the subsequent blocks. This enables the participants to verify and audit transactions independently. A blockchain's database is managed autonomously using a peer-to-peer network and a distributed timestamping server. They are authenticated collectively by participants with similar self-interests. The blockchain does away with having to trust a central authority or server, making it trustless and it is transparent to support auditing and ensuring readability.

- 1st Generation - Bitcoin (Cryptocurrency)

The 1st generation of the blockchain aimed at Cryptocurrency is the first implementation of distributed ledger technology (DLT). This allows financial transactions based on blockchain technology or DLT (for the sake of simplicity often seen as synonyms) to be executed with Bitcoin being the most prominent example in this segment. It is being used as A STORE OF VALUE, a digital payment system and can be seen as the enabler of an "Internet of Money".

- 2nd Generation - Ethereum (Smart Contracts)

Ethereum blockchain aims to execute 'Smart Contracts' to reduce the cost of verification, execution and fraud prevention. They are independent computer programs that automatically execute predefined conditions. A DApp can have frontend code and user interfaces written in any language that can make calls to its backend, like a traditional App. But a Dapp can have its frontend hosted on decentralised storages such as Ethereums Swarm. *[DApp = frontend + contracts* **(**running i.e. on Ethereum**)]**

- 3rd Generation and Web3.0 (leapfrog)

The 3rd generation blockchain revolves around the idea of interoperability and the 3 Ss namely **sustainability**, **scalability**, and **security**. This is where we see Proof of Stake implementations that are environmentally friendly and an alternative to the legacy "Proof of Work" for long-term environmental sustainability with works like Polkadot and Setheum. Here we see decentralised storage like Filecoin, IPFS, and Chia that use Storage Consensus mechanisms. Here we see state upgradability without forking like in Polkadot and **Setheum**, we see on-chain built-in DeFi systems like in the case of **Setheum** and its Subchain **Khalifa**. We also see layer 0 solutions like Polkadot and layer 2 solutions alongside many innovations in the blockchain and crypto space.

But, we haven't seen specific significant contributions to the Islamic Finance market in this space, little to no DeFi presence of the muslim community and those people alike that seek out for halal (permitted) zero-interest theologically acceptable DeFi protocols. This is why Setheum was completely rectified **via Khalifa** into the conclusive go-to DeFi network for people and communities alike that share my enthusiasm as well as those that share my concerns.

Inspiration & Motivation

- The **Inspiration** behind Khalifa was initially to provide an alternative payment system to the current FinTech atmosphere. To create a system that is bipartisan and open to the public providing an easy to use remittance network that is also easy to onboard, attractive for day-to-day spending and transparent. Something I could build an ecommerce platform on and use as the main payment option and a bridge between traditional finance and cryptocurrency in both low-level and high-level endpoints, especially in the less developed and developing parts of the world. Then I built the system on the foundation and principles of Islamic Finance in the Shari'ah to make it halal (permissible) to all muslims and beneficial to all muslims and non-muslims alike.
- The **motivation** is to make it easier for the free-flow of capital internationally and intersystematically (interoperability between distinct systems/networks), to maximise capitalisation and economic growth under the umbrella of the Shari'ah, realising that this is the solution for many of the problems challenging communities around the world, inequality in capital distribution and discrepancies in the free flow of capital between equality of opportunities and systematic fairness in capital distribution and financial regulations. Equality of opportunities cannot be achieved without the free-flow of capital, while there is no systematic fairness in the distribution of capital there can be no free-flow of capital in the hands of the public. In Khalifa, the capital will be directed to the public for the public utility in the Khalifa economy through various mechanisms including staking, liquidity incentives, Khalifa Treasury, Grants and Bounty Program etc.

Setheum Network

Setheum is cloud optimised Web3 operating system, Interoperability Focal Point, and Communication System that resolves around the issues of the **Blockchain Trilemma**, enabling smart contracts, confidential hardware-level shared-security blockchains (**Subchains**), confidential computing, confidential smart contracts and intersystemic interoperability. Setheum is built with the **Substrate** modular interoperable blockchain framework. In Setheum, one can pay for transaction fees in any token currency powered by **KhalifaSwap** without having to hold Setheum's native token. Setheum implements a free and fair economic system that pursues equality of opportunity and the maximisation of public utility in the crypto-economy.

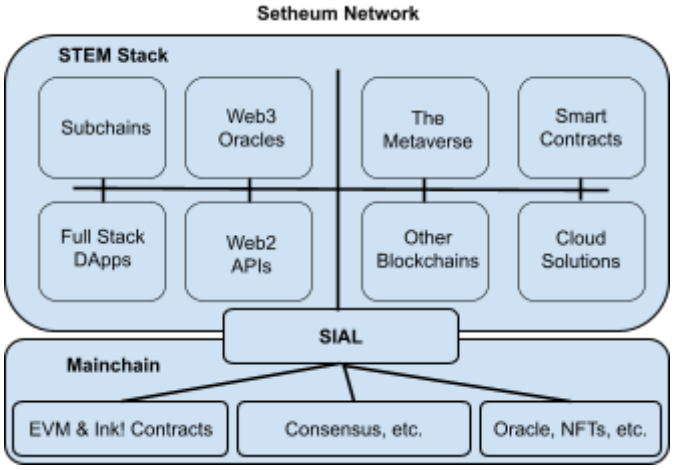

Fig-1: Setheum Network Architecture Abstraction

Khalifa Subchain

Khalifa is a DeFi optimised operating system, liquidity exchange provider, and financial system that resolves around the issues of interest, liquidity and stablecoin reliability issues mostly raised by centralised stablecoins by creating over-collateralised zero-interest stablecoin backed by pristine crypto assets and managed by the network's Shari'ah backed governance Council that helps provide zero-interest loans for all muslims and non-muslims alike. Khalifa is built as a Setheum's Subchain with Setheum's STEM SDK which is built with the Substrate modular interoperable blockchain SDK and is based on the novel Extended Proof of Stake (EPoS) consensus algorithm. In Setheum and Khalifa, one can pay for transaction fees in any token currency without having to hold Khalifa's native token. Khalifa implements a free and fair economic system that pursues equality of opportunity and the maximisation of public utility in the crypto-economy.

EPoS (Extended Proof of Stake) in Khalifa

The staking mechanism in Khalifa is EPoS (Extended Proof of Stake). EPoS is inspired by the NPoS(Nominated Proof of Stake) staking mechanism, and this mechanism advocates equality, randomness and fairness in the staking system in securing the network as well as earning staking rewards in the process. However, the main difference between EPoS and NPoS is that two(2) tokens are staked in EPoS and this introduces the `StakingQuota` parameter that is used to allocate a quota for stakers on a validator node, the `StakingQuota` is limited by the `SetterStake` of the node.

The problem with the staking algorithms today is that the rich get richer and the poor (well, you know what I mean. It basically is the best solution out there to counter inequality in the block production of a Blockchain Network such as Khalifa and block fees/rewards sharing/distribution methods on-chain. And the validators can earn the KHL tokens to pay for their service as validators that run and secure the network. Therefore, this qualifies as Halal. All protocols in Khalifa are halal (permissible in Islam).

Extended Proof Of Stake(EPoS) as the name implies - is an Extended mechanism that supports the staking of 2(two) `NativeCurrencies` which are the `KHL` and `SETR`. The `KHL` is the `PrimaryCurrency` while `SETR` is the `SecondaryCurrency`. The `PrimaryCurrency` is the main staking currency that is staked and earned by stakers (validators/nominators). The `SecondaryCurrency` is used to allocate a `StakingQuota` (similar to Setheum's CPoS `StakingQuota`), where each validator node is allocated a `StakingQuota` relative to its `SetterStake` (amount of `SETR` staked on the node).

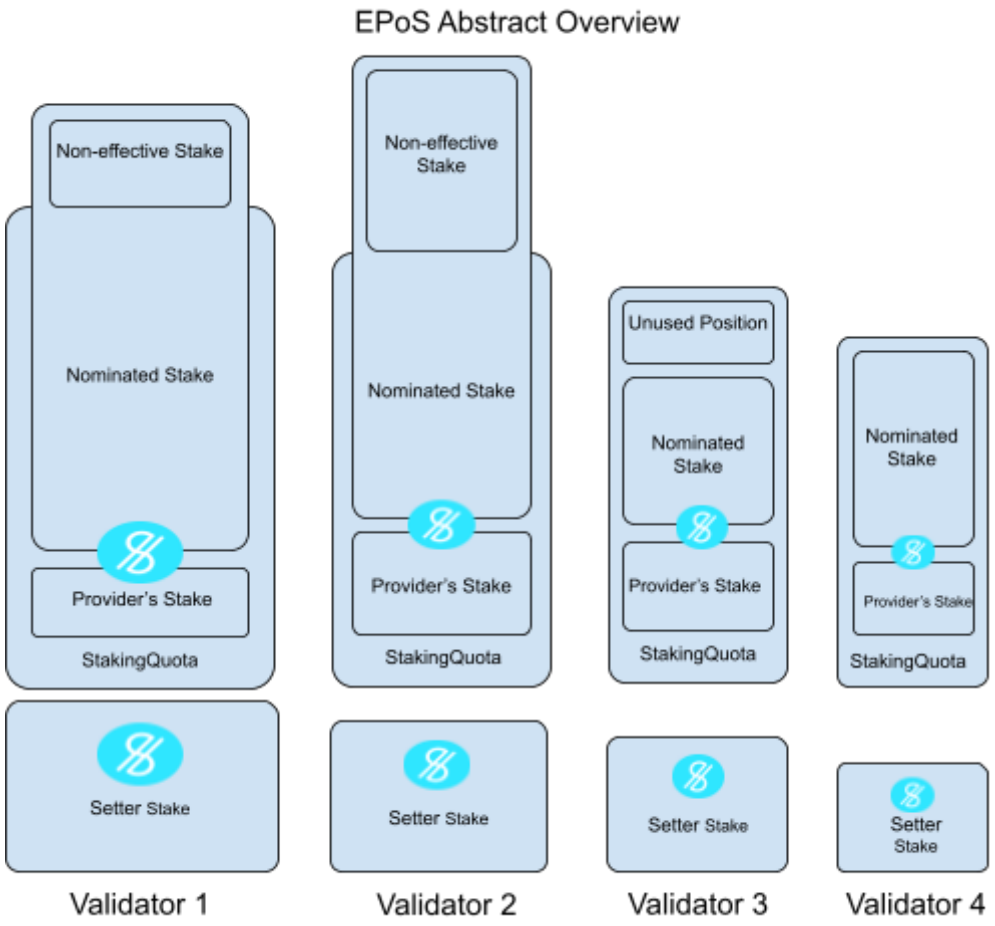

Fig-2: Abstract Overview of Khalifa's EPoS

Penalty and Slashing Mechanism in EPoS

Staked funds of unstable node validators or malicious nodes are slashed to incentivise stability, availability and reliability of nodes in the Khalifa Network.The slashing mechanism is set in place to ensure reliability and availability of network participants such that the consensus verifiers are assured, protected and a penalty is given in the form of slashing to the concerned validator(s).

The penalty includes slashing a portion of the validator's staked KHL tokens as well as removing the Verified identity Badge of the validator. The slashed amount is not burned right away but rather transferred to the network treasury, such that the slashed validator can appeal to get its funds returned within a certain period (ie. AppealPeriod), the slashed funds cannot be returned to the validator after the AppealPeriod has passed, thus stays in the Treasury. The formula for the SlashRatio is as follows:

$$\chi = Min\{\frac{3 \times [\rho - (\frac{n}{10} + 1)]}{n}, 1\} \times 0.07$$

where, n is the total amount of validator nodes, ρ is the amount of offline validator nodes, and χ is the SlashRatio.

Types of Staking Protocols in Khalifa

There are two types of Staking protocols in Khalifa, `StandardStaking` and `LiquidStaking`.

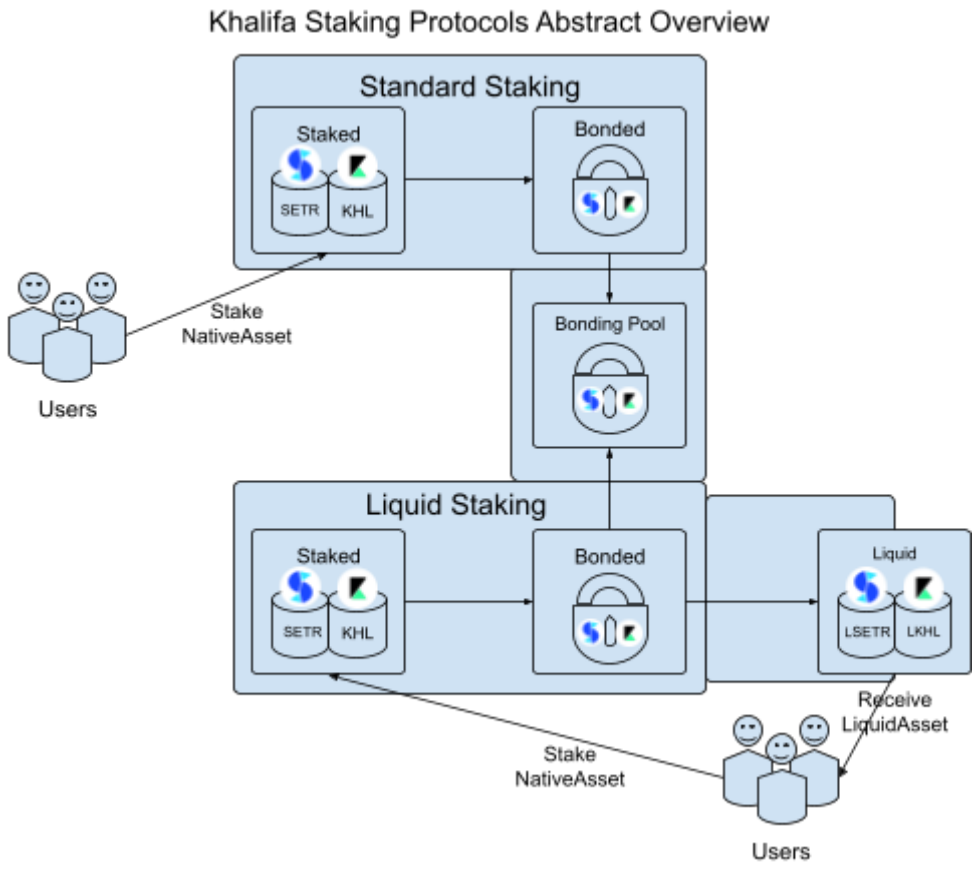

Fig-9: Khalifa Staking Protocols Abstract Overview

Khalifa Staking - Standard Staking vs Liquid Staking Comparison

✔️Criteria	Standard Staking	Liquid Staking
✔️Halal	✅	✅
✔️Native Protocol	✅	✅
✔️Main Staking Protocol	✅	❌
✔️Instant Unbond	❌	✅
✔️Liquid Assets ()f	❌	✅
✔️Staking Rewards	✅	✅
✔️Stake KHL	✅	✅
✔️Stake SETR	✅	✅
✔️Slashing	✅	✅
✔️MultiProvider Nomination	✅	✅
✔️On-Chain	✅	✅
✔️Decentralised	✅	✅
✔️Permissionless	✅	✅

Fig-10: Khalifa Staking Protocols Comparison Table (Standard Staking vs Liquid Staking)

Standard Staking in Khalifa

In Khalifa's Standard Staking protocol, stakers(validators/nominators) commit the KHL token or the SETR token or the recommended KHL-SETR pair for staking on the network therefore securing the Khalifa Network and earning staking rewards in return. The KHL is the main staking token, however the SETR is able to be staked alone or alongside KHL, the SETR staking is a way to increase a provider's StakingQuota so that more staked KHL could be part of the active-stake that earns staking rewards. A provider or even a nominator can stake SETR to increase the StakingQuota of a certain provider so that he/she can have space in the active-stake to stake more active KHL to earn more KHL in line with their inactive-stake making it part of the active-stake or to earn SETR rewards made via the quota allocated to the validator.

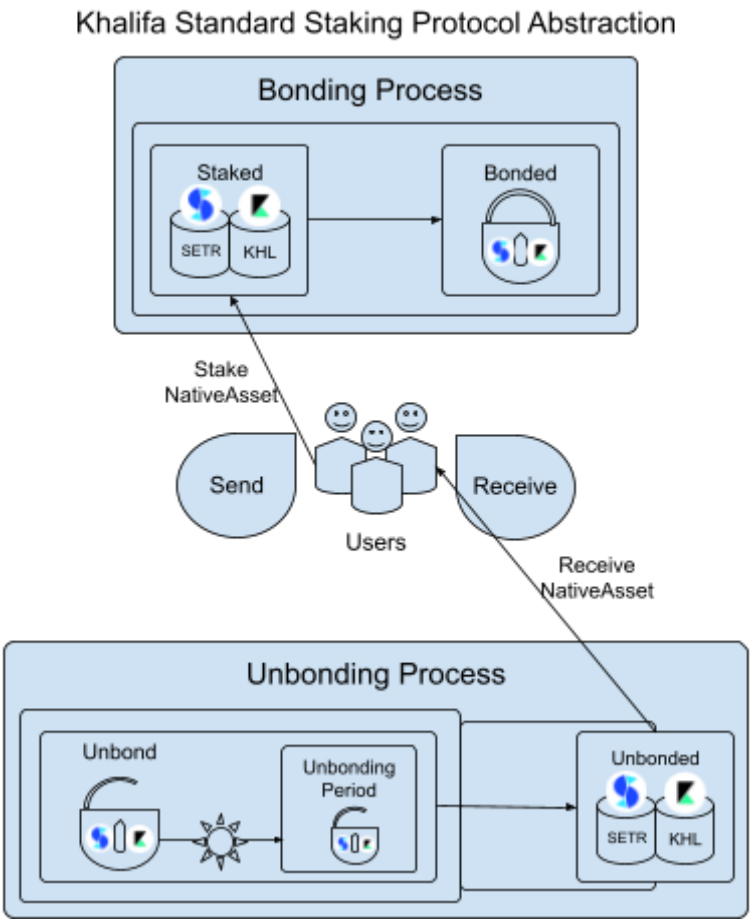

Fig-11: Khalifa Standard Staking Protocol Abstract Overview

Liquid Staking in Khalifa

Stake `KHL` and/or `SETR` while holding `LKHL (Liquid KHL)` and/or `LSETR (Liquid SETR)` for your market activity. When you stake a PoS chain's native currency, the token is locked in the system rendering it illiquid in order to secure the blockchain network. This is a very effective way to secure the network, however it is not efficient in terms of token economics, the more liquid the token is, the more efficient its market is. So what is the solution, here comes in Liquid Staking, as the name indicates, it is a way to stake tokens for securing the network while preserving the liquidity of the token in the market without compromising network security, but most liquid staking protocols out there are liable to compromising the security of the network, why, because they are not decentralised thus if they obtain the majority of the network tokens, these protocols can in fact be an attack vector for the network. In Ethereum 2.0 for example, the liquid staking protocol Lido finance makes for a good example of my point, it extremely centralises the network as we have seen that Lido finance controls over 1⁄3 of ETH staked in the network, and the ratio needed to be able to attack the network is 1⁄3, this makes the network prone to centralised attacks and censorship therefore making it more centralised. Khalifa's liquid staking protocol solves that, it is a native built-in decentralised protocol built on Setheum's `DAGESTAN` consensus engine, but separate from DAGESTAN, using DAGESTAN as its backbone.

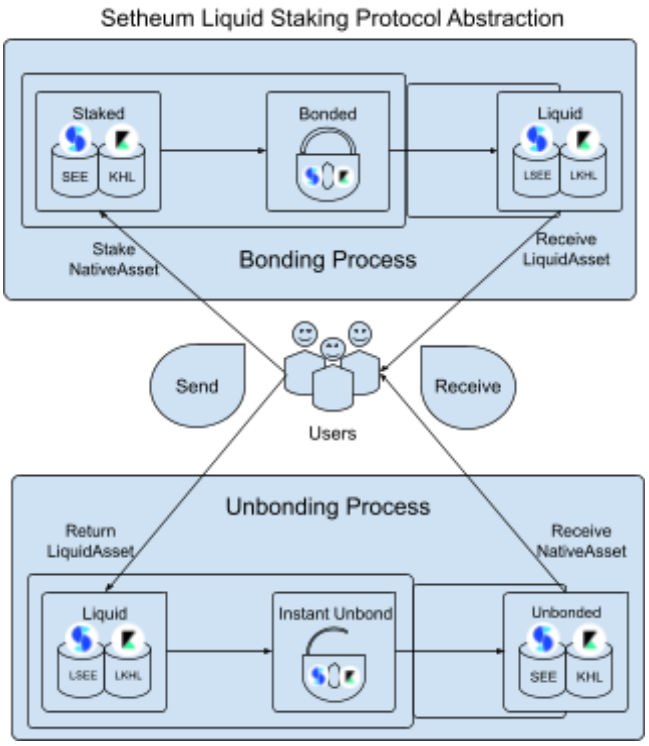

Fig-12: Khalifa's Liquid Staking Protocol Abstract Overview

Staking Rewards in Khalifa

A definite amount of rewards are paid out per payout period, validators, nominators and the treasury are rewarded from that reward pool of 1 Billion KHL, 10%(100 Million KHL) to the treasury, 90%(900 Million KHL) to the Validators and Nominators. There is a minimum stake amount of 1,000 KHL for nominators, and Validators have a hardware requirement and a minimum stake of 250,000 KHL. A payout period is made up of 24 hour long eras made up of 96 sessions of 15 minutes each, Nominators/Validators need to wait for the next era to initiate. The protocol allows any Khalifa Validator to take part and allows Nominators to choose which Validators they want to elect and stake with them.

Ethics, Halalness, Randomness and Fairness in Khalifa's EPoS

The EPoS (Extended Proof of Stake) that Khalifa uses does not distribute block rewards to the so-called winning blocks or elite validators that have the highest stake or the most powerful mining rig. It is halal from my understanding and it's my opinion and we say that everything is Halal unless there is an evidence that it is haram from the Qur'an, Sunnah, Ijma' of the Sahaba or the Tabi'een, or the Atba' tabi'een, or ijma' of the Salaf AsSaliheen, or ijma' of the Ulama, or from the logical deduction according to the principles of the purposes of Shari'ah, and Allah knows best. The Islamic Finance just happens to be the best option out there for best rewards and best long-term economic sustainability and reliability. Khalifa just happens to implement just that for everyone.

Vesting in Setheum

Vesting is very important to be implemented, the initial issuance of tokens are to be vested for certain allocations to protect the community in general. There are various mechanisms and options in Setheum's vesting protocol that range from native vesting to smart contract vesting, cliff vesting to linear vesting, fungible and non-fungible token vesting etc.

The parameters allow for three options regarding schedule types, cliff vesting, graded vesting, and linear vesting. LP tokens, ERC721 NFTs as well as ERC20s and various token standards covered by Sethem's MultiCurrency and MultiLocations Asset standards can be vested in the protocol.

- **Native Vesting:** This category of vesting is carried out fully on the protocol's pallet and governed by the General Council;
- **Time Lock Vesting:** This category of vesting is carried out via the protocol's pallet and deployed as smart contracts, they are not upgradeable unlike native vesting. Anyone can deploy their own Time Lock Vesting Schedules.
- **Transferable Vesting:** This class of vesting allows for transferability of vesting schedules from one beneficiary to another. It is not in the form of tokens but replaces the `owner` with the `new_owner`.
- **Non-Transferrable Vesting:** This class of vesting does not allow for transferability of vesting schedules.
- **Cliff Vesting:** This type of schedule gets vested all at once at a specific timestamp (`vesting_period`).
- **Graded Vesting:** This type of schedule gets vested in grades of varying ratios over a specific period of time where tokens are vested in varying configurable ratios every `vesting_period`.
- **Linear Vesting:** This type of schedule gets vested gradually in a linear progressive over a specific period of time where tokens are vested in equal amounts every `vesting_period`.

Wallet Recovery in Setheum

We have seen a multiple of times when people or organisations lose access to their crypto assets either by forgetting their hardware wallet passcodes or losing its whereabouts, and many different other examples that go from the simplest of mistakes to very complex problems that all lead to losing access to valuable assets. Some people lose their life's work to this class of problems, some lose all their savings, others lose all their investments or their hope and interest in this industry and seem to get confused worrying if this revolution has failed them or if they have failed it or both. A lot of us are guilty of this, many people went under and many people went extreme, but we are still here aren't we.

This is why CEXs(centralised exchanges) have helped in onboarding most of the people coming into the industry and retaining most of them, CEXs can provide easy key management options and wallet recovery methods for their users. This is why CEXs also provide these custodial services not just to retail investors, family offices and newbies but also to institutional investors like banks, VCs and hedge funds.

DeFi(Decentralised Finance) cannot reach mass adoption to the scale of centralised options without solving this class of problem, the wallet recovery problem. Thanks to the substrate framework and the talented team, contributors and ecosystem behind its development, we can now approach and ***solve the wallet recovery problem***. Setheum enables you to assign a list of contacts as wallet addresses to allow you to recover your wallet via these contacts ie. family, friends, colleagues. This is especially crucial when a person passes away for his/her family to be able to recover their wealth, or when a person loses his/her private keys thus cannot access their wealth, or even when an organisation loses access to their assets. Setheum provides the solutions for its users in all three scenarios.

- **Personal Wallet Recovery:** Could be a single wallet or a multiple of wallets controlled by a single proxy wallet.
- **Next of Kin Wallet Recovery:** Could be a single wallet or a multiple of wallets controlled by a single proxy wallet. Could be recovered by a single signature contact/wallet or by a multisig wallet (controlled by a list of member signatures).
- **Organisational Wallet Recovery:** Or rather ***Multisig Wallet Recovery*** is a wallet controlled by a set of signatures/members all with their own accounts/addresses. Could be recovered by a single signature contact/wallet or by another multisig wallet (it is recommended to have it be controlled by a different list of member signatures/wallets that have different private keys from the ones used to control the wallet meant to be recovered, and ***avoid cyclic recovery to avoid losing chances of recovery***).

Khalifa Suite: Powering Ethical DeFi Solutions

This is Setheum's DeFi Hub built on Setheum, it s native to Khalifa Subchain and Setheum Mainchain. Khalifa Suite is a platform of a suite of DeFi protocols powering Ethical DeFi solutions in the Setheum ecosystem. Khalifa Suite provides a range of protocols from a Liquid Staking protocol to Zero-Interest Stablecoins to a cross-chain DEX aggregator and Smart Liquidity Manager as listed:

1. **Liquid Staking:** Stake KHL and/or SETR while holding LKHL (Liquid KHL) and/or LSETR (Liquid SETR).
2. **Decentralised Zero-Interest Ethical CDP Stablecoins:** Get Shari'ah Compliant Zero-Interest over-Collateralised Stablecoins backed by multiple cryptocurrencies from Khalifa's *ECDP (Ethical Collateralized Debt Position) protocol*.
3. **ECDP Liquidation Pools:** Provide liquidity to liquidation pools to get access to assets during liquidations at liquidation premium and help keep a healthy ECDP system.
4. **Concentrated Liquidity AMM DEX:** Trade, farm yield and provide liquidity on Khalifa's *Automated Market Maker Decentralised Exchange*.
5. **Cross-Chain Swap DEX Aggregator:** Trade with best prices and cheapest fees with near instant finality on multiple cross-chain exchanges as one to enable cross-chain swaps via Khalifa's DEX aggregator between Setheum and other networks.
6. **Limit Orders on DEX:** Trade limit orders on Khalifa's *Automated Market Maker Decentralised Exchange*.
7. **Active Smart Liquidity Automated Market Maker (ASLAMM):** Provides a Smart Active Concentrated Liquidity protocol on the *Concentrated Liquidity AMM DEX* protocol in Khalifa.
8. **Liquidity Mining Incentives:** Mine Liquidity Incentives as an LP(Liquidity Provider) on Khalifa's *Automated Market Maker Decentralised Exchange*.
9. **Time Lock Vesting Protocol:** Provides time locking and vesting for various types of tokens including native assets, ERC20s, NFTs, NFT LP tokens, and fungible LP tokens (for ASLAMM Liquidity Mining). This protocol supports time locking of assets as well as asset vesting schedules. The time locks and vesting schedules are deployed on the SEVM as smart contracts and can be used by anyone. This protocol is very different from the "***native vesting protocol"*** that can only be used via on-chain governance and is limited to a certain threshold of vesting schedules where the "***time lock vesting protocol"*** has no such limitations.
10. **Khalifa TWAP Oracle:** Time Weighted Average Price Oracle for on-chain price feeds.
11. **Setheum Oracle:** An on-chain multi-oracle message feed system primarily for price feed oracles.

Chain Properties

Network	**Khalifa**
Native Asset/Currency	KHL
EVM Chain ID	2580
SIAL Chain ID	1
Primary Asset Initial Supply	2,000,000,000 (2B) KHL
Finality	0.2 Sec. (200 Millisec.)
BlockTime	0.2 Sec. (200 Millisec.)
MaxBlockSize	5 MB
BlockHashCount	2,400 (8 Mins.)
Session	1200 (4 Mins.)
Era	360 Sessions (24 Hrs.)
Annual Inflation	200 Million KHL
Min. Validator Bond	50,000 KHL (to be lowered as we grow)
Min. Nominator Bond	200 KHL (to be lowered as we grow)

Khalifa’s EVM (Ethereum Virtual Machine)

The Khalifa EVM (**KEVM**) enables Solidity smart contracts to be deployed on the Setheum blockchain with minimum changes. It also offers many distinct features such as "**multicurrency gas**" (paying fees in any tokens other than Khalifa’s native token), smart-contract access to All the built-in DeFi protocols and an **on-chain automatic scheduler** that enables use cases like subscription and recurring payments, **microgas** (paying very miniscule gas fees) etc. Khalifa leverages Setheum’s EVM modules to enable EVM compatibility on the Khalifa Subchain.

ECDP: Ethical Collateralized Debt Position

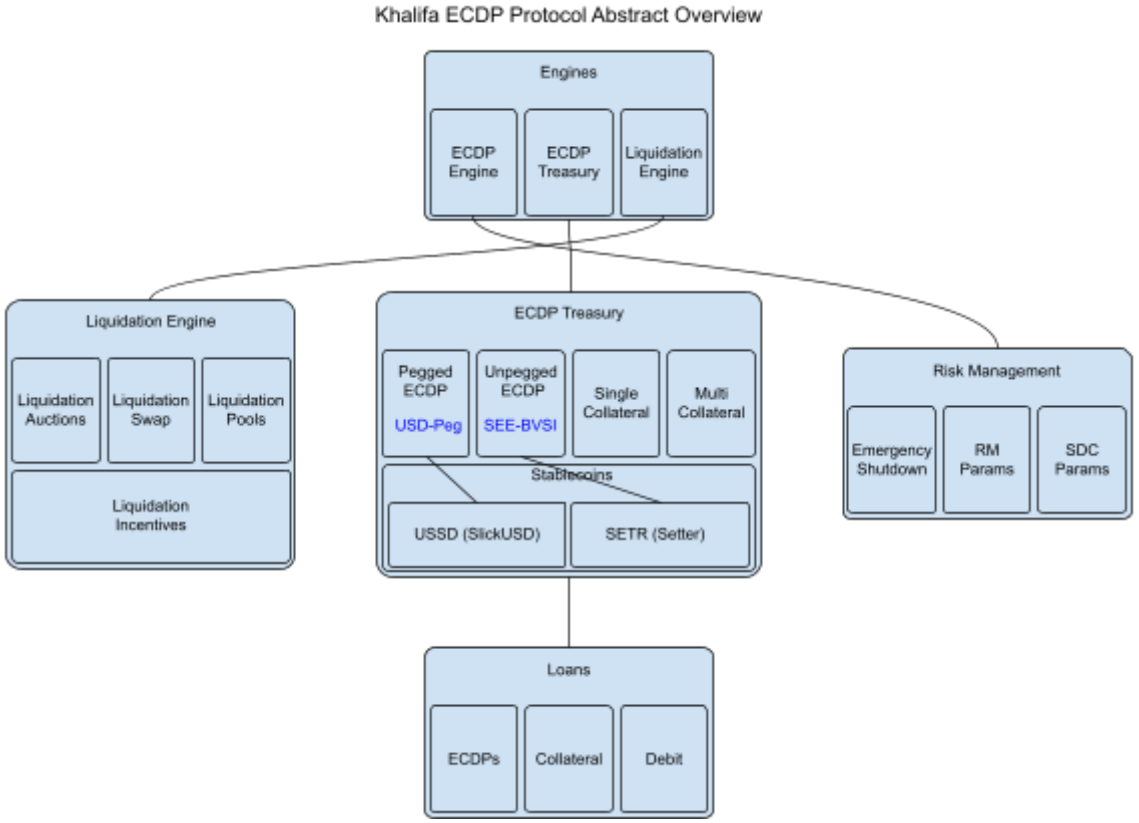

Fig-11: Khalifa ECDP Protocol Abstract Overview

Get Shari'ah Compliant Zero-Interest over-Collateralised Stablecoins backed by multiple cryptocurrencies from Khalifa's ***ECDP (Ethical Collateralised Debt Position) protocol***. Inspired by MakerDAO Protocol, the CDP (Collateralised Debt Position) protocol on Ethereum, the Setheum's **"ECDP" (Ethical Collateralised Debt Position)** has zero interest rates, zero stability fees, and zero-liquidation-penalty, and is fully halal and Collateralised. This differentiates ECDP from a traditional CDP Protocol, making it halal. And it is ***Multi-Collateral.*** Just reserve some collateral to mint some **ECDP asset**, when returning the loan just return exactly what was loaned and unreserve the collateral with no fees and no interest. This lets the muslim world also participate in the industry and take part in trading and yield making strategies that are within their dome of principles, for me this is a game changer that I wished was there for me, therefore I am building it for people like me who need it but haven't been given the chance to be pleased by it, and also non-muslims that want to break-free from the interest-based alternatives to a more efficient system based on truth, fairness and equality. Every currency issued through the ECDP Protocol is backed in excess by a cryptocurrency and is stabilised through the Protocol - a flexible dynamic system of **"ECDPs" (Ethical Collateralised Debt Positions)**, on-chain governance and incentivized key actors. The ECDP loans system design in Khalifa is inspired by the first decentralised stablecoin MakerDAO protocol (in the case of pegged stablecoins) and RAI stablecoin protocol (in the case of unpegged stablecoins), which has become the DeFi building block in the Ethereum ecosystem.

Unlike in Ethereum, where an external liquidator is required to monitor and close dangerous positions, which is by and large due to limitations in Ethereum, the **ECDP** Protocol is able to use the substrate Off-chain Worker (an automatic scheduler unique to parity's Substrate) to automate the process and inherently increases the security and stability of the stable currency.

The Ethics of ECDP, Stablecoins in Khalifa Suite

As we already know, price-stable cryptocurrencies combine the best of both worlds, both fiat currencies and cryptocurrencies like Bitcoin, but not many have a clear plan for the usability let alone the adoption of such a currency. Cryptocurrencies and stablecoins in particular, were designed as a direct result of shortcomings in financial markets and in the global economy – lack of capacity for cross-border payments, high transaction fees, opacity on banking systems, investor risks, market hours and exchange limitations, etc. And since the value of a currency is driven by its network effects, a successfully progressive new digital currency needs to maximise adoption in order to be useful. Creating just another stablecoin is not enough, the "use case" is what matters more. Are there any practical use cases apart from trading in exchanges, airdrops and staking? There is high demand for decentralised, price-stable currencies that should be both fiat-pegged and absolutely cryptonomic in nature, eliminating fiat's inflation fracas and bitcoin's volatile nature. And when it succeeds, then it will have a significant impact as one of the best use cases for cryptocurrencies and a dam of market liquidity. Khalifa Ethical DeFi Suite makes that balance of truthful trustless equilibrium between fiat currencies and cryptocurrencies.

Khalifa is building a concept we call **"ECDP" (Ethical Collateralised Debt Position)** to issue a multi-stablecoins with multi-collateral cryptocurrency backing, and also maintains its decentralised nature while also avoiding extreme price volatility and hyperinflation. Khalifa's ECDPs combine the benefits of assets like Bitcoin, Ethereum, while providing the price stability of stablecoins, creating features that maximise the better of both ecosystems. The price-volatility of cryptocurrencies is a well-studied problem by both academics and market observers (see for instance, Liu and Tsyvinski, 2018, Makarov and Schoar, 2018).

Most cryptocurrencies, including Bitcoin, have a predetermined issuance schedule that, together with a strong speculative demand, contributes to wild fluctuations in price. Bitcoin's extreme price volatility is a major roadblock towards its adoption as a medium of exchange or store of value. Intuitively, nobody wants to pay with a currency that has the potential to double in value in a few days, or wants to be paid in a currency if its value can significantly decline before the transaction is settled. But other cryptocurrencies that have infinite supply also have speculations as to how they can sustain hyperinflation in the long run, what happens to their PPP (Purchasing Power Parity) when their always infinitely increasing supply is a matter of concern.

So we need a balance right in the middle, and a mechanism to curb both volatility and inflation, in order to harness the economic stability of cryptocurrencies - their best day to day use cases hide behind the curtains of economic stability.. Khalifa gets rid of that curtain, for God says let there be light, so then why do we prevent it from reaching us even though we're in the dark. The problems of high volatility are aggravated when the transaction requires more time, i.e; for deferred payments such as mortgages or employment contracts, as volatility would severely disadvantage one side of the contract, making the usage of existing digital currencies in these settings prohibitively expensive.

At the core of how the Khalifa Suite solves these issues is the idea that a cryptocurrency with a collateral backed supply would maintain a stable price, retaining all the censorship resistance of Bitcoin, and making it viable for use in everyday transactions just like the fiat. However, price-stability is not sufficient for the wide adoption of a currency.

Currencies inherently have strong network effects: a customer is unlikely to switch over to a new currency unless a critical mass of merchants are ready to accept it, but at the same time, merchants have no reason to invest resources and educate staff to accept a new currency unless there is significant customer demand for it. For this reason, Bitcoin's adoption in the payments space has been limited to small businesses whose owners are personally invested in cryptocurrencies. That is, the Khalifa Suite with its equanimity in fostering stability and propping adoption in the Khalifa Suite of Protocols, represents an eloquent complement to 'Fiat currencies' and 'Cryptocurrencies' as means of payment and stores of value.

Types of ECDPs - Pegged and Unpegged

There are two types of ECDPs(Ethical Collateralised Debt Positions) namely pegged and unpegged ECDPs. Below are the two types of ECDPs and their comparisons.

- **Pegged ECDP:** A pegged ECDP is based on a stablecoin that is pegged to another asset, eg. USD. The USSD (Slick USD) is a type of pegged ECDP stablecoin. The pegged ECDP is valued at a 1:1 against its peg by the ECDP protocol, having a stable ratio with its peg.
- **Unpegged ECDP:** An unpegged ECDP is also based on a stablecoin that is not pegged to any other asset, however it is a stablecoin that maintains its stability relative to the BVSI(Blunt Volatility Scale Index) of its collateral (a currency whose value is redeemable in the accepted collateral with the stable asset).

  The Unpegged ECDP is stabilised by a blunted volatility index mechanism we call ***BVSI(Blunt Volatility Scale Index)*** *which mirrors the volatility in value of its basket of currencies but in a very blunt manner such that it stays relatively stable and only moves the price a few basis points giving it the features of a floating but stable currency*.

Comparison between Khalifa Stablecoins - Pegged/Unpegged

Criteria	Unpegged (SETR)	Pegged (USSD)
✔️**Multicollateralised**	❌	✅
✔️**OverCollateralised**	✅	✅
✔️**Debt-based System**	✅	✅
✔️**Zero-Interest Debt**	✅	✅
✔️**1 USD Peg**	❌	✅
✔️**Unpegged**	✅	❌
✔️**PID Controller**	✅	❌
✔️**Liquidation Protection**	✅	✅

The ECDP Process

- **Depositing Collateral:** The user creates an ECDP by depositing one of the accepted collaterals.
- **Borrowing Stablecoin and Opening ECDP:** The user requests and borrows the desired asset(USSD or SETR) according to the collateral parameters set by governance based on the chosen and collateral.
- **Paying back :** To close an ECDP, the user pays back the borrowed asset, with no-interest of course, and no stability fees, they need to deposit enough to pay back the outstanding debt in their ECDP, with zero-interest policy, there is no need to pay a stability fee or any accumulated interest whatsoever.
- **Closing the ECDP:** After the protocol receives the outstanding asset debt, the ECDP becomes debt-free, and then the ECDP holder can retrieve their collateral, the ECDP is then closed by the protocol.

Comparison between Khalifa Stablecoins and Others

Criteria	USSD	SETR	RAI	SAI	DAI	UST	Centralised (USDT, USDC)
✔️MultiCollateralised	✅	❌	❌	❌	✅	❌	❗
✔️OverCollateralised	✅	✅	✅	✅	✅	❌	❌
✔️Crypto Backed	✅	✅	✅	✅	✅	❌	❌
✔️Not Algorithmically backed	✅	✅	✅	✅	✅	❌	✅
✔️1 USD Peg	✅	❌	❌	✅	✅	✅	✅
✔️Unpegged	❌	✅	✅	❌	❌	❌	❌
✔️No Critical Centralised Point	✅	✅	✅	✅	❌	❌	❌
✔️Transparent System	✅	✅	✅	✅	✅	✅	❌
✔️Decentralised System	✅	✅	✅	✅	✅	✅	❌
✔️BVSI Based System	❌	✅	✅	❌	❌	❌	❌
✔️Halal System	✅	✅	❌	❌	❌	❌	❌
✔️Debt-based System	✅	✅	✅	✅	✅	❌	❌
✔️Zero-Interest Debt	✅	✅	❌	❌	❌	❌	❌
✔️PID Controller	❌	✅	✅	❌	❌	❌	❌
✔️Risk Management System	✅	✅	✅	✅	✅	❌	❗
✔️Liquidation Protection	✅	✅	✅	❌	❌	❌	❗
✔️Multi-Strategy Liquidation	✅	✅	❌	❌	❌	❌	❌
✔️Emergency Shutdown	✅	✅	❌	✅	✅	❌	❌
✔️Safe Unwind (Safe BankRun)	✅	✅	✅	✅	✅	❌	❌

Risk Management in the ECDP

The Financial Council has governance rights and responsibilities for managing risks of the ECDP protocol in the Khalifa DeFi Suite, including authorising risk parameters adjustments (manual and/or scheduled). Multiple asset types with distinct risk profiles are accepted as collaterals for ECDPs, therefore, all risk parameters of the ECDPs and liquidation parameters are separately set up across various collaterals and are to be adjusted on the Protocol through on-chain governance by the Financial Council. More collaterals could be added through runtime upgrades by system governance.

ECDP Liquidations

Liquidations in the ECDP protocol are there to help keep the system healthy. There are several types of Liquidation Methods available. How are these methods chosen by the `LiquidationEngine`, the methods are chosen based on the abstraction of the algorithm below:

```
fn liquidation_engine(collateral: Collateral, debit: Debit) -> LiquidationMethod {
   if collateralization_ratio > liquidation_ratio {
      // collateral is safe
      LiquidationMethod::None
   } else if collateralization_ratio <= liquidation_ratio
            && collateral.is_listed_in_liquidation_pool() {
             if get_swap_amount(collateral, debit) <
             liquidation_pool_premium * collateral.amount() {
              let slippage = (swap_rate - get_market_rate(collateral))
                 / get_market_rate(collateral);
              if slippage <= acceptable_slippage &&  get_swap_amount(collateral, debit) <
                 liquidation_pool_premium * collateral.amount() {
                       // liquidate using the swap liquidation on DEX
                       LiquidationMethod::LiquidationSwap
              } else if slippage >= acceptable_slippage &&
                 get_swap_amount(collateral, debit) <
                 liquidation_pool_premium * collateral.amount()
                 && liquidation_pool_liquidity >= debit.amount() {
                       // liquidate using the swap liquidation on DEX
                       LiquidationMethod::LiquidationSwap
                }
             }
   } else if collateralization_ratio <= liquidation_ratio
            && collateral.is_listed_in_liquidation_pool()
            && liquidation_pool_liquidity >= debit.amount() {
            // liquidate using the liquidation pool
             LiquidationMethod::LiquidationPool
   } else {
      // liquidate using the auction
      LiquidationMethod::Auction
   }
}
```

In simple words; If the collateralization ratio is greater than the liquidation ratio, it indicates that the collateral is safe, and thus the function returns LiquidationMethod::None. If the debt is unsafe and the collateral has a liquidation pool, the function proceeds with the liquidation process where if the buy-back is cheaper via `LiquidationSwap` than on a `LiquidationPool` and the slippage is acceptable, then it proceeds with the swap liquidation method. Else if the buy-back is cheaper via `LiquidationSwap` than on a `LiquidationPool` and the slippage is unacceptable and there is enough liquidity available in the liquidation pool, it proceeds to use the `LiquidationSwap` method. Else if the collateral has a liquidation pool and there is enough liquidity available in the pool for that liquidation, the `LiquidationEngine` then decides to use the `LiquidationPool` method to liquidate the assets. Else, the `LiquidationEngine` uses the `LiquidationAuction` to liquidate.

Liquidation Pools

The ECDP Liquidation Pools are there to help in asset liquidations in the ECDP Protocol. The `LiquidationPool` is a decentralised money pot that holds pooled funds in the form of the debit stablecoin from `LiquidationProviders` (LPs), the funds are then accessible to the ECDP protocol to automatically swap with collateral that is meant to be liquidated. The `LiquidationPool` has a preset premium called the `LiquidationPoolPremium` that is a discount for selling the collateral to the `LiquidationProviders` (LPs). The `LiquidationPool` operates quite similar to a DEX's `LiquidityPool` in the sense that the premium earned by LPs is shared proportional to an LPs ownership in percentage relative to the total funds at any given time. `MultiCollateral` Stablecoins have multiple `LiquidationPools`, one for each collateral, while `SingleCollateral` Stablecoins have a `LiquidationPool` that is used to liquidate the `SingleCollateral`. There are also incentive rewards for `LiquidationProviders` (LPs) to incentivise liquidity provision to the `LiquidationPool`.

Liquidation Swaps

ECDP liquidations can be done via a `liquidation-swap` if slippage is within the range of `AcceptableSlippage`, it is basically a method to swap the collateral on the built-in DEX in Khalifa DeFi for buying back the stablecoin which is paid back into the system to burn it out of existence.

Unpaid Debt

Unpaid debt is considered as the outstanding debit that could not be bought back at a point in time during times of extreme market conditions. It is recorded in the system as excess debt that is paid back later via collateral liquidations, the collateral that is not able to be sold during this period will be collected by the `ECDPTreasure` for later liquidation, the outstanding debit is recorded in the system as debt to be repaid with later liquidation(s).

ECDP Risk Management Parameters

The Risk Management Parameters are set in place to manage risk in the system to keep a healthy ECDP system. Market conditions affect the state of these parameters, therefore the params can be updated as per collateral volatility, stablecoin demand & supply, they can be set to low or high thresholds to fit market needs and collaterals can be removed and added all by on-chain Governance.

Pegged-ECDP Risk Management Parameters

- **`MinCollateralRatio`:** The minimum collateral to debt ratio needed to issue debt.
- **`LiquidationRatio`:** The collateral to debt ratio at which the debt is unsafe and liquidated.
- **`HardDebtCeiling`:** The maximum total amount of debt issuance under a specific collateral type. It is never exceeded once it is reached, it can however also be updated by governance.
- **`SoftDebtCeiling`:** The soft cap amount of total debt issuance under a specific collateral. It can be exceeded by debt whereby the debt is above the **`SoftDebtCeiling`**. Once it is reached, more debt can be issued but only adhering to the **`SDC`**/**`SoftDebtCeiling`** parameters, which are:

  * **`SDCCollateralRatio`**: Often greater than usual (ie. 250%);

  * **`SDCLiquidationRatio`**: Often greater than usual (ie. 170%)

  * **`SDCCollateralAsset`**: Can only get loans with one collateral (ie. `SETR`), this is always **`SEE`** in **`SETR`** Unpegged ECDP protocol;

  * **`SDCMaxLoanAmount`** The maximum amount of loan that can be borrowed to an account during the **`SDCPeriod`**:

  * **`SDCPeriod`:** is the time period when the `SoftDebtCeiling` in the system has been reached or exceeded.

#	Collateral	Min Collateral Ratio	Liquidation Ratio	Hard Debt Ceiling	Soft Debt Ceiling	SDC Collateral *(Only One Currency)*	SDC Collateral Ratio	SDC Liquidation Ratio	SDC Max Loan Amount
1	SEE	200%	120%	$30M	$25M	SETR	250%	170%	$19K
2	KHL	200%	120%	$25M	$20M	``	``	``	``
3	BTC	180%	120%	$38M	$35M	``	``	``	``
4	ETH	180%	120%	$33M	$30M	``	``	``	``
5	BNB	180%	120%	$37M	$30M	``	``	``	``

Fig-22. Example of inserted Pegged ECDP Risk Management Parameters

Pegged ECDP Price Stability Mechanisms

The **USSD** is designed to peg to the US Dollar at a ratio of 1:1 that the Network aims to maintain the value of one **SlickUSD (USSD)** approximately to one US Dollar at all times. Our strong peg to US Dollar is achieved through a risk management mechanism in the **SlickUSD** Protocol, together with council governance, the DEX and the Price Feed Oracles.

- **When SlickUSD > $1:**
    1. **Governance** would **increase the** `SoftDebtCeiling` to support and encourage more debt issuance which results in more supply which brings down demand, therefore pulling back the price to its $1 peg.
    2. **Governance** could also **increase the** `HardDebtCeiling` to enable, support and encourage more debt issuance which results in more supply which brings down demand, therefore pulling back the price to its $1 peg.
    3. **Arbitrageurs** would use the opportunity to move the price back to its peg.
- **When SlickUSD < $1:**
    1. **Governance** would also **reduce the** `SoftDebtCeiling` to discourage more debt issuance by making it smaller, slower and more expensive, which results in more buying which in turn props up demand, therefore pushing the price back to its $1 peg.
    2. **Governance** would also **reduce the** `HardDebtCeiling` to discourage and ultimately/eventually disallow more debt issuance which results in more buying which in turn props up demand, therefore pushing the price back to its $1 peg.
    3. **Arbitrageurs** would use the opportunity to move the price back to its peg.

Unpegged-ECDP Risk Management Parameters

- **`LVSICollateral`:** The collateral asset that backs the stablecoin. It is the index that the stablecoin mirrors and is Collateralised by. It is the LVSI (Low Volatility Stable Index) tracking the price movement of the collateral and blunting down its volatility into relatively stable low volatility price movements. The `LVSICollateral` of **SETR** is **SEE**.
- **`MinCollateralRatio`:** The minimum collateral to debt ratio needed to issue debt.
- **`LiquidationRatio`:** The collateral to debt ratio at which the debt is unsafe and liquidated.
- **`RedemptionRate`:** The rate at which the stablecoin is being devalued or revalued against the collateral which results in changing the `RedemptionPrice`. It is expressed as a percentage per year and can be either positive or negative depending on whether the `MarketPrice` is above/below the `RedemptionPrice`. A positive `RedemptionRate` means that **SETR** is being revalued and its `RedemptionPrice` is **increasing over time**. A negative `RedemptionRate` means that **SETR** is being devalued and its `RedemptionPrice` is **decreasing over time**. It is determined by the **PID Controller**, the algorithm that adjusts the rate based on the deviation between the `MarketPrice` and the `RedemptionPrice`.

- **RedemptionPrice:** The price that the protocol targets for the stablecoin to be valued on the open market. It is the internal price of `SETR that the system tries to match with the market price. It is used to mint the stablecoin against its collateral and to redeem collateral from the ECDP. The RedemptionPrice is meant to almost always float as it does not target a peg.
- **HardDebtCeiling:** The maximum total amount of debt issuance under a specific collateral type. It is never exceeded once it is reached, it can however also be updated by governance.
- **SoftDebtCeiling:** The soft cap amount of total debt issuance under a specific collateral. It can be exceeded by debt whereby the debt is above the SoftDebtCeiling. Once it is reached, more debt can be issued but only adhering to the SDC/SoftDebtCeiling parameters, which are:

  * **SDCCollateralRatio**: Often greater than usual (ie. 250%);

  * **SDCLiquidationRatio**: Often greater than usual (ie. 170%)

  * **SDCMaxLoanAmount:** The maximum amount of loan that can be borrowed to an account during the SDCPeriod.

  * **SDCPeriod:** is the time period when the SoftDebtCeiling in the system has been reached or exceeded.

LVSI Collateral	Min Collateral Ratio	Liquidation Ratio	Redemption Rate	Redemption Price	Hard Debt Ceiling	Soft Debt Ceiling	SDC Collateral Ratio	SDC Liquidation Ratio	SDC Max Loan Amount
SEE	200%	120%	5%	$2.58	$30M	$25M	250%	140%	$7,000

Fig-22. Example of inserted Unpegged ECDP Risk Management Parameters

Unpegged ECDP Price Stability Mechanisms

The **SETR** is designed to be unpegged and relatively stable. The stability of the Setter is achieved through a PID Controller, a risk management mechanism in the **Setter** Protocol, together with council governance, the DEX and the Price Feed Oracles.

The **Setter (SETR)** uses a variant of a PID (Proportional Integral Derivative) controller as a means for maintaining market price stability. It makes use of a proportional term (***P***), an integral term (***I***) and a derivative term (***D***) for influencing the future values of a time series. The PID controller works by continuously measuring the error between the **MarketPrice** and the **RedemptionPrice** and then adjusting the **RedemptionRate** to reduce this error. The proportional term (***P***) is responsible for reducing the current error, while the integral term (***I***) is responsible for reducing past errors and the derivative term (***D***) is responsible for predicting future errors.

- **When SETR `MarketPrice` > `RedemptionPrice`:**
    1. The **PID Controller** would make debt inexpensive by **decreasing the** `RedemptionRate` which in turn encourages minting more debit to keep supply and demand in equilibrium by propping up supply, thus bringing down the `MarketPrice` back to the `RedemptionPrice`.
    2. **Governance** would **increase the** `SoftDebtCeiling` to support and encourage more debt issuance which results in more supply which brings down demand by propping up supply, therefore pulling back the `MarketPrice` to the `RedemptionPrice`.
    3. **Governance** could also **increase the** `HardDebtCeiling` to enable, support and encourage more debt issuance which results in more supply which brings down demand, therefore pulling back the `MarketPrice` to the `RedemptionPrice`.
    4. **Arbitrageurs** would use the opportunity to push the `MarketPrice` down to the `RedemptionPrice`. They are incentivised to mint `SETR` and immediately sell it for profit in the open market.

- **When SETR `MarketPrice` < `RedemptionPrice`:**
    1. The **PID Controller** would make debt expensive by **increasing the** `RedemptionRate`, discouraging the minting of debit to keep supply and demand in equilibrium and prop up the `MarketPrice` to the `RedemptionPrice`.
    2. **Governance** would also **reduce the** `SoftDebtCeiling` to discourage more debt issuance by making it smaller, slower and more expensive, which in turn increases demand while decreasing supply, therefore pulling up the `MarketPrice` to the `RedemptionPrice`.
    3. **Governance** would also **reduce the** `HardDebtCeiling` to discourage and ultimately/eventually disallow more debt issuance which results in less supply which in turn props up demand, therefore pulling the `MarketPrice` up to the `RedemptionPrice`.
    4. **Arbitrageurs** would use the opportunity to pull the `MarketPrice` up to the `RedemptionPrice`. They are incentivised to buy `SETR` from the open market and immediately pay back their outstanding debt for profit.

Khalifa Exchange

AMM DEX: Automated Market Maker Decentralised Exchange

The Khalifa Exchange has a variety of products on its radar from an Aggregated DEX to Spot Swap, Conditional Orders, Automated Liquidity etc.

Aggregated Swap: Cross-Chain Swap DEX Aggregator

Trade with best prices and cheapest fees with near instant finality on multiple exchanges as one via Khalifa's DEX aggregator. It allows users to swap cryptocurrencies across different blockchain networks. This allows users to take advantage of the different features and benefits of various blockchain networks, without the need to trust a centralised third party to hold their assets.

The DEX aggregator works by connecting to multiple DEXs that are built on different blockchain networks. This allows it to access a wide range of liquidity sources, which can be combined and optimised to offer users the best possible prices for their trades.

The DEX aggregator also uses smart contracts on multiple EVM compatible chains to facilitate the cross-chain swaps. These smart contracts are automatically executed when a user initiates a trade, and they ensure that the assets are transferred securely and without the need for a trusted third party.

Overall, Khalifa's cross-chain swap DEX aggregator offers a convenient and secure way for users to swap cryptocurrencies across different blockchain networks. It provides access to a wide range of liquidity sources and allows users to take advantage of the unique features and benefits of different blockchain networks.

Spot Swap: Concentrated Liquidity AMM DEX

Inspired by Uniswap V3, Khalifa Exchange has a built-in Decentralised Exchange called "Khalifa Swap". Uniswap V3 introduced a new feature called concentrated liquidity, which allows liquidity providers to provide custom amounts of liquidity in selected price ranges. This allows liquidity providers to adjust their exposure and capital efficiency, and it expands the design space for automated liquidity provision.

The concentrated liquidity mechanism allows users to provide liquidity to specific price ranges on the DEX, rather than spreading it thin across the entire liquidity pool at all price ranges. This allows them to tailor their liquidity to specific assets and price ranges, and it enables them to adjust their exposure to the market.

It also allows users to approximate any static automated market maker (AMM) by using a custom liquidity provision strategy involving multiple positions. This allows users to create unique liquidity fingerprints corresponding to different AMMs, which can be visualised as a curve in "tick space."

P2P Swap: Peer-to-Peer Atomic Swap DEX

The p2p Swap or Atomic Swap in the Khalifa Exchange is a direct decentralised escrow system for atomic peer-to-peer token swaps. It does not provide a market for p2p swaps, rather it provides a platform on which any two parties can swap their cryptocurrency (coins, fungible and non-fungible tokens, LP Tokens etc.) in a direct and trustless manner, both parties involved in the swap need to share a secret key for a swap to take place, then the system automatically atomically swaps the assets in escrow. Here is a list of what it does and what it doesn't do:

✔️#	✅ DOES	❌ DOES NOT
✔️1	P2P Exchange Atomic Swaps (Help you swap with your chosen peer)	Doesn't support P2P Exchange Market to help you find peers to swap with
✔️2	Have support in the SDK for developers (You can use the SDK to build your own extra services that are not natively supported, such as Dispute Resolution)	Doesn't natively support Dispute Resolution
✔️3	Multi-Currency and Multi-Standard (You can use the SDK to develop solutions that support fiat and/or any tokenized non-crypto assets)	Doesn't natively support fiat or any non-crypto asset swaps
✔️4	`SpotAtomicSwap` for immediate spot swap of `TokenA` and `TokenB`	Doesn't give you a wallet on the protocol
✔️5	`VestedAtomicSwap` for vested swaps that adds a `VestingSchedule` to `TokenA` to be swapped for spot `TokenB` (ie. Vested Token Sale Swaps for presale/private sale investors)	Doesn't keep your escrow funds on the protocol, but rather locks it in your account (your wallet address)
✔️6	`MintableVestedAtomicSwap` for vested swaps that issue the `TokenA` to be swapped with `TokenB` (ie. Smart SAFT Contract Swaps for private investors)	Does't provide any form of legal or written SAFT contracts whatsoever
✔️7	Allows for setting `VestingSchedule` on both types of Vested Atomic Swaps	Does not allow for changing/updating `VestingSchedule` on any/both types of Vested Atomic Swaps

Fig-24. The DOs and DON'Ts of the Khalifa Exchange P2P Atomic Swap Protocol

Range Orders

Uniswap v3 Range Orders are a type of liquidity provision that can approximate limit orders by providing a single asset within a specific price range. Unlike traditional limit orders, Range Orders generate fees while the order is being filled and may not be executed if the price crosses the range and then reverses. Range Orders are useful for executing large trades with low slippage and high capital efficiency. Range Orders also allow liquidity providers to concentrate their capital within custom price ranges, providing greater amounts of liquidity at desired prices.

There are various types of **Range Orders** that can be made on Khalifa Exchange, here are the main four types of Range Orders that can be made on Khalifa Exchange:

- **Take-Profit Orders:** These are range orders that allow a liquidity provider to sell one asset for another when the price reaches a certain level above the current spot price. For example, a liquidity provider can provide KHL at a price of 258 SETR / KHL and have the order filled when the spot price crosses their position.
- **Buy Limit Orders:** These are range orders that allow a liquidity provider to buy one asset for another when the price drops to a certain level below the current spot price. For example, a liquidity provider can provide SETR at a price of 200 SETR / KHL and have the order filled when the spot price of KHL drops past their position.
- **Stop-Loss Orders:** These are range orders that allow a liquidity provider to sell one asset for another when the price drops below a certain level. For example, a liquidity provider can provide KHL at a price of 200 SETR / KHL and have the order filled when the spot price crosses their position.
- **Sell Limit Orders:** These are range orders that allow a liquidity provider to buy one asset for another when the price rises above a certain level. For example, a liquidity provider can provide SETR at a price of 258 SETR / KHL and have the order filled when the spot price of KHL rises past their position.

These types of range orders are possible because Khalifa Exchange separates the two paired assets in a given pool above and below the spot price, with the higher price asset available above the spot price and the lower-priced asset below.

However, there are some limitations and risks associated with range orders, such as:

- Range orders may not be executed if the price crosses the range and then reverses before the target asset is withdrawn.
- Range orders may incur impermanent loss if the price moves significantly away from the range.

There are various types and strategies of **Range Orders** that can be made on Khalifa Exchange, let's take **Limit Orders** for example; Users can trade limit orders on Khalifa's Automated Market Maker Decentralised Exchange. Limit orders allow users to specify the price at which they are willing to buy or sell a particular asset. With a limit order, the trader specifies the exact price at which they want to buy or sell a particular asset, and their order will only be filled if the market price reaches that level.

For example, let's say that a trader wants to buy BTC, but they only want to pay $35,000 per BTC. They could place a buy limit order at $35,000, and their order would only be filled if the market price of BTC drops to $35,000 or lower. If the market price doesn't reach $35,000, the trader's order will not be filled, and they will not buy any BTC.

On the other hand, let's say that a trader wants to sell SEE, but they only want to receive $1,500 per SEE. They could place a sell limit order at $1,500, and their order would only be filled if the market price of SEE rises to $1,500 or higher. If the market price doesn't reach $1,500, the trader's order will not be filled, and they will not sell any SEE.

Active Smart Liquidity Automated Market Maker (ASLAMM)

ASLAMM provides a Smart Active Concentrated Liquidity protocol on the Concentrated Liquidity AMM DEX protocol to the Setheum ecosystem. It allows users to deposit their funds into smart vaults that are managed by ASLAMM Reactors, which are algorithms that adjust the price ranges and fees of the liquidity positions according to market conditions. This way, users can benefit from optimal capital efficiency and fee generation on Khalifa Exchange without having to manually monitor and update their positions.

Liquidity Mining Incentives

The Khalifa Swap has an incentive layer that rewards LPs who lock their LP tokens, these incentives are multi-pool, multi-currency. These rewards are given to users who provide liquidity (ie. Liquidity Providers) to the DEX's liquidity pools. These incentives can be in various cryptocurrencies, such as SEE, BTC, ETH, etc. The purpose of liquidity mining incentives is to encourage users to contribute liquidity to the DEX, which helps to improve the liquidity and depth of the liquidity pools.
Liquidity mining incentives are important for DEXs for several reasons. First, they help to attract more users to the DEX, which increases the overall liquidity and depth of the liquidity pools. Second, they help to create a virtuous cycle of liquidity, where more liquidity attracts more users, which in turn attracts more liquidity, which in turn attracts more users and more fees, and so on. Third, they help to ensure that the DEX remains competitive and attractive to users, compared to other DEXs or CEXs.

Time Lock Vesting Protocol

This category of vesting is carried out via the protocol’s pallet and deployed as smart contracts, they are not upgradeable unlike native vesting. Anyone can deploy their own Time Lock Vesting Schedules. This is a Time Locking protocol for Khalifa DeFi Suite LP tokens on Khalifa’s Automated Market Maker Decentralised Exchange. The LP (Liquidity Provider) Time Lock Protocol allows liquidity providers to lock their assets in a liquidity pool for a specified period of time. This can help to increase the liquidity and stability of the liquidity pool, as it ensures that projects/teams/LPs have a long-term commitment to the pool. In a typical LP Time Lock Protocol, liquidity providers deposit their assets in a liquidity pool, and they specify a time period for which they want to lock their assets. During this time, the liquidity providers cannot withdraw their assets from the pool, but they can continue to earn rewards for providing liquidity to the pool. Once the time lock period ends, the liquidity providers can withdraw their assets from the pool, along with any rewards they have earned. The LP Time Lock Protocol is a useful mechanism for increasing the liquidity and stability of liquidity pools on DEXs. By allowing liquidity providers to lock their assets for a specified period of time, the protocol can help to ensure that liquidity remains consistent and stable over time.

Governance

Governance is the way rules, norms and actions are structured, sustained, regulated and held accountable. Khalifa has a multicameral governance system with several avenues/chambers to pass proposals just like the Setheum Mainchain. Decisions in Khalifa are enacted on-chain and are autonomous & binding. Khalifa and Setheum each have various on-chain governance chambers. The primary chamber is “the Shura Council”, it comprises a set of accounts. There is a Technical Committee for deciding on technical governance (e.g. runtime upgrades), and other councils explained below. There are 3 Chambers / Councils of the Khalifa Governance, all are as follows:

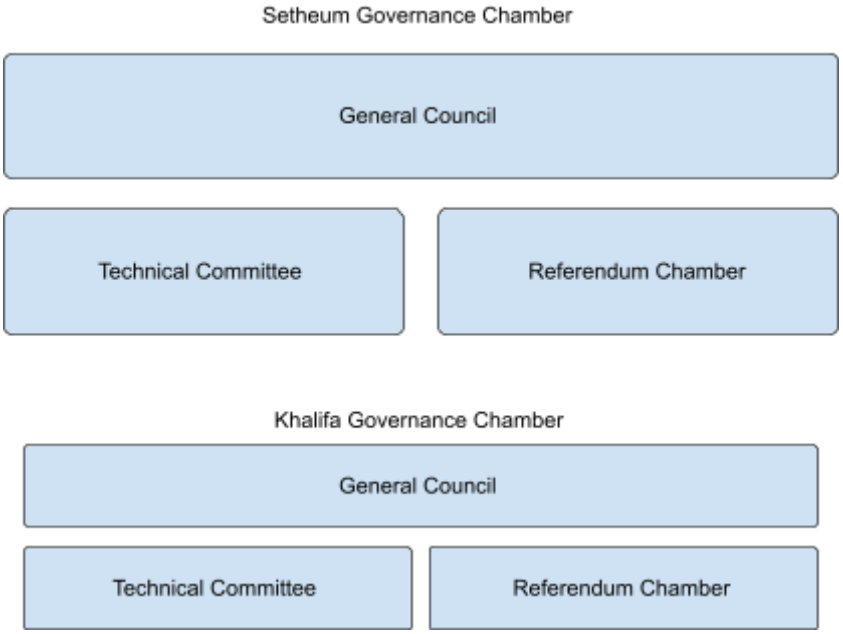

Fig-13: Setheum & Khalifa Governance Overview

1. **General Council:** General governance like approving runtime upgrades, it also elects Technical Committee members.
2. **Technical Committee:** They will be the **Committee** in charge of the governance of the Technical aspects of the Network like bug fixes and maintaining open source projects for example. The **Committee Members** are elected by the General Council.
3. **Referendum Chamber:** Simply enables democracy to allow all native token holders to participate in governance by voting on referendums. It is basically a **DAO (Decentralised Autonomous Organisation)** that governs a set of parameters that are put in place by the General Council. The **Council** proposes an on-chain update on those `parameters` then the **Chamber** votes on the proposal(s). Native token holders can also submit proposals to the **General Council**, the proposal is then voted on by the **Council Members**, if the proposal passes then it is forwarded to the **Referendum Chamber** as a public referendum to be voted on by the native token holders. The proposals are restricted to the `GovernanceParameters` of the **DAO/Chamber**.

Roadmap

Launching of the Khalifa Blockchain will take a Phased approach, with **Madinah Testnet** launching in the **Phase-0** on **Damascus, Mainnet Genesis** of **Khalifa Subchain** launching in the **Phase-1** with core modules, and the Khalifa Suite **DeFi protocols** launching in the **Phase-2** and **Phase-3.**

Setheum GitHub Repo Milestones Link:

https://github.com/Setheum-Labs/Setheum/milestones

Khalifa GitHub Repo Milestones Link:

https://github.com/Khalifa-Blockchain/Khalifa/milestones

- [x] ~~Architecture - Infrastructure Research and Design~~
- [x] ~~Architecture -Token Economics Research and Design~~
- [x] ~~Architecture -Whitepaper~~
- [x] ~~Project Website Development~~
- [x] ~~Project Documentation~~
- [x] ~~Initiate Community Social Media Accounts~~
- [x] ~~Setup the Infrastructure~~
- [x] ~~Build and test the Blockchain (Devnet)~~
- [x] ~~Build Multi-Currency Native Support~~
- [x] ~~Build native built-in DEX Protocol~~
- [x] ~~Build multi-currency flexible gas fee support~~
- [x] ~~Build CDP Stablecoin Protocol~~
- [x] ~~SEVM - Build SetEVM, an EVM layer for smart contracts~~
- [x] ~~SEVM - Precompiles and Predeploy Contracts~~
- [x] ~~SEVM - Build Setters.JS APIs, SDKs & developer libraries for EVM~~
- [x] ~~Build native support for NFTs~~
- [x] ~~Build Setheum.JS APIs, SDKs & developer libraries~~
- [x] ~~Liquidity Mining Incentive Protocol~~
- [x] ~~Build Launchpad Crowdsales MVP~~
- [x] ~~Khalifa Stablecoins - Update CDP protocol to ECDP protocol~~
- [x] ~~Khalifa Stablecoins - Pegged ECDP protocol~~
- [x] ~~Native Vesting Protocol~~
- [ ] Khalifa Stablecoins - Unpegged ECDP protocol
- [ ] Khalifa Liquid - Build Liquid Staking protocol
- [ ] Khalifa Exchange - Update DEX Swap protocol to extended v3 design

- [ ] Khalifa Exchange - Build DEX Aggregator protocol
- [ ] Khalifa Exchange - Build Limit Order protocol
- [ ] Oracles - TWAP Oracle Protocol
- [ ] ASLAMM Active Liquidity Protocol
- [ ] ECDP Liquidation Pools
- [ ] Update Liquidity Mining to support ASLAMM and Liquidation Pools
- [ ] Time Lock Vesting Protocol
- [ ] Publish Khalifa-JS based on Setheum-JS
- [ ] Launch Airdrop Event
- [ ] Phase-0 Launch **Madinah** Testnet on Setheum's **Damascus** Testnet
- [ ] Phase-1 Launch **Khalifa Subchain** Mainnet
- [ ] Phase-2 Launch the **DeFi Suite of protocols** on Mainnet
- [ ] Enable Governance

Conclusion

Khalifa has a unique approach to the problems facing the space and provides opportunities that incentivize adoption and usability and most importantly because it helps make Ethical Web3 and DeFi available to anyone and everyone. Setheum has amazing investment opportunities with astonishing usability. Setheum is the brainchild of a cluster of ideas and challenges that inspire the founding of it. And so with the expected level of equilibrium, security, decentralisation, scalability, efficiency, diversity and adoption. Khalifa subchain, is set to implement the neom of finance in the Web3 Ecosystem extending hands to the halal consumer market and the Islamic Finance and Ethical Finance community by developing a wide range of Islamically permissible Web3 and DeFi products and services on the Setheum Network such as SlickUSD(USSD) and Setter(SETR) which is a zero-interest ECDP based crypto-collateralised stablecoin protocols, Khalifa also provides an Ethereum compatible smart-contracts layer (EVM), an on-chain built-in Decentralised Exchange (DEX), Liquidity Incentives etc.

References and Further Reading

1. Muhammad-Jibril B.A. (Khalifa MBA), *Setheum Network: A Secure Confidential And Interoperable Decentralised Cloud Compute And Storage Network With A Layer-2 Infrastructure for Subchains and Smart Contracts | Technical White Paper - v15*, [online] Available: https://github.com/Setheum-Labs/Setheum-Labs-White-Papers/
2. S. Nakamoto, *Bitcoin: A peer-to-peer electronic cash system*, 2008, [online] Available: https://bitcoin.org/bitcoin.pdf.
3. The Maker Protocol Whitepaper | Feb 2020, <https://makerdao.com/en/whitepaper>
4. Hayden Adams, Noah Zinsmeister, and Dan Robinson. 2020. Uniswap v2 Core. Retrieved Feb 24, 2021 from https://uniswap.org/whitepaper.pdfG. Wood, "Ethereum: A secure decentralised generalised transaction ledger", *Ethereum Project Yellow Paper*, 2014.
5. V. Buterin, *On public and private blockchains*, 2015, [online] Available: https://blog.ethereum.org/2015/08/07/on-public-and-private-blockchains/.
6. Jack Fransham, Parity Substrate, Polkadot, What is Substrate?, July 09, 2018, <https://www.parity.io/blog/what-is-substrate>
7. Alfonso Cevallos, Overview of NPOS, <https://research.web3.foundation/en/latest/polkadot/NPoS/1.%20Overview.html>
8. Jack Fransham, Polkadot Network - Medium, Never Fork Again, Nov 28, 2018, <https://medium.com/polkadot-network/never-fork-again-438c5e985cd8>
9. Schoenmaker, Dirk, 2013. "Governance of International Banking: The Financial Trilemma," OUP Catalogue, Oxford University Press, number 9780199971596.
10. MoneyAndBanking.com, The Other Trilemma: Governing Global Finance, July 24, 2017, <https://www.moneyandbanking.com/commentary/2017/7/23/the-other-trilemma-governing-global-finance>
11. Stephan Cummings, Altcoin Magazine, The Capital - Medium, The Four Blockchain Generations, Feb 2, 2019, <https://medium.com/the-capital/the-four-blockchain-generations-5627ef666f3b>
12. Ibrahim Abu Sammy, Is Proof of Stake like Riba?, Published in Jamaa, Medium Publication, <https://medium.com/ummati/is-proof-of-stake-like-riba-f9ad17c391a6>
13. Range Orders | Uniswap. <https://docs.uniswap.org/concepts/protocol/range-orders>.
14. Introducing Uniswap v3. <https://blog.uniswap.org/uniswap-v3>.
15. On-chain range orders using Uniswap V3 | by Peteris Erins - Medium. <https://medium.com/auditless/on-chain-range-orders-using-uniswap-v3-7a49e480ce5>
16. Executing Large Trades with Range Orders on Uniswap v3. <https://medium.com/@alexnezlobin/executing-large-trades-with-range-orders-on-uniswap-v3-a4a5e4debb67>