



EXECUTIVE PRODUCT SUMMARY

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Opportunity

Blockchain technology in a short duration has garnered intense interest for multiple use cases in Governments as well as private sector. Most of the Fortune 500 Companies and world's largest financial institutions has embraced Blockchain to improve their existing business processes. We have observed multi billion dollars of money been spent in building Blockchain powered applications and yet the mainstream adoption is very much limited. We see that immediate jump taken by Blockchain technology leap frogged the focus upon the most important aspect – The infrastructure.

Technology infrastructure plays a significant role while building a scalable platform. The infrastructure must provide a sufficient level of flexibility for developers to choose and adopt core protocols for the platform while designing it. Also, the infrastructure must empower an application to allow high performance during its runtime execution. While discussing specifically about building blockchain platforms, such an infrastructure is required to allow multi-tiered networks and inter-blockchain communication, all while ensuring the entire ecosystem is trust-free and the data integrity is maintained at its best.



Introduction

Auxesis Group founded in 2014, pioneer in building enterprise Blockchain solutions and is one of The Top 100 Most Influential Blockchain Organisation globally. Auxesis started Auxledger project internally in 2017, with the idea of implementing blockchain network for one of the world's largest democratic country and to act as a value chain for the country's economy, enabling trust, transparency and efficiency in various business processes. During its operation, with the support of the Indian state governments, Auxledger team has onboarded a population of over 53 Million users on its government operated blockchain network. The blockchain network was designed with the highest technical standards and with an in-built ability of executing robust smart contracts and deploying mass scale networks.

The team at Auxledger further overviewed hundreds of implementations made across the globe using Auxledger and other platform to come up with a comprehensive platform which would be require to power tomorrow's decentralise internet. Concluding from our research, among numerous

enhancements, we found three key elements which is a deciding criteria while building Blockchain for mainstream adoption.

- **Performance:** The ability for Blockchain networks and distributed applications to match up with today's world speed requirements. Sending information's and processing transactions at a real time speed.
- **Customisability:** The flexibility offered by a platform to be customised as per the business and developers need. Allowing designing of a private/public Blockchain network with a full control to adapt different protocols.
- **Interoperability:** Blockchain networks with different protocols and different sizes should be able to communicate with each other in a trust-free manner. A communication protocol which sets a global standard to communicate between networks without compromising on data integrity.



Solution

Keeping the mainstream adoption of Blockchain and challenges in existing infrastructure in mind, Auxledger team devised a platform and technology infrastructure to overcome the requirements of performance, customisability and interoperability. The proposed solution included building a number of communication protocols, bridging methodology while on same time leveraging some of the best open source protocols and codes written by the Blockchain fraternity. The key pillars of Auxledger ecosystem are described below:

1. **Microservices Oriented Design Architecture**

Auxledger technology architecture has been designed with the micro-services principles in mind. Protocols available in the form of microservices allows creation of customised public or private Blockchain networks while publishers has the ability to choose consensus mechanism, governance, issuance and participation in network. Team at Auxledger also believes that most of these protocols are yet to be designed and will happen faster with the wider adoption of technology in enterprises. Keeping same in mind, we have allowed horizontal scalability in the platform ensuring community can build and deploy new protocols in the Auxledger ecosystem.

2. **AuxViom - LLVM Improved Virtual Machine**

Auxviom is a variant of LLVM specialized to execute smart contracts on the blockchain. Its design, definition and implementation has been done at the highest mathematical standards, following a semantics-first approach with verification of smart contracts as a major objective. Specifically, we have defined the formal syntax and semantics of Auxviom using the K framework, which in return gives us an executable reference model in addition to a series of program analysis tools, including a program verifier. Unlike Ethereum Virtual Machine, which is a stack-based machine, Auxviom is proposed to be designed as a register-based machine, like LLVM. It has an unbounded number of registers and also supports unbounded integers.



3. Multi-tiered Blockchain Networks

Auxledger introduces the concept of multi-tier blockchain architecture design, where multiple networks are able to be deployed upon a single network and further maintaining full network consensus and data integrity of all networks are maintained at any tier. Tiering of networks allow different chains to remain in-sync while ensuring restriction of no private information from one chain is flowing to another chain. AuxNet - the enterprise public network is the genesis implementation of Auxledger infrastructure acting as a source of truth for all networks that will be tiering on top of it

4. AuxNet - Enterprise Public Network

Auxnet is the genesis implementation of Auxledger infrastructure and thus acts as zeroth tier blockchain implementation. It is an open blockchain network, built with enterprise grade security, privacy and scalability. Auxnet is built to perform the role of the “heart” in the Auxledger ecosystem, capable to fulfil the requirements that have been listed in the multi-tier blockchain network architecture. As a public blockchain network, Auxnet, is built with the design goals of **(1)** Act as an infrastructure to build powerful DApps interacting with multiple networks and services. **(2)** Powering organizations to deploy a hybrid blockchain network on top of Auxnet. **(3)** Providing a sustainable network through robust and sustainable economic incentivization. **(4)** Acting as a source of consensus for all networks deployed in the ecosystem and regulating them.

5. Hybrid Tendermint POS Consensus

AuxNet public network utilises a hybrid tendermint based consensus protocol. Nodes holding AuxChips participate in the consensus process governed by an enhanced mechanism, The consensus is first achieved in form of small groups represented by the master node. Further, these master nodes follow a consensus process among themselves to decide a node which will get the chance to propose a new block. The probability of a node to be chosen to propose a block depends upon the amount of AuxChips hold by a particular node. Further, the rating system incorporated in the network regulates the probability of a node to propose the next block.



6. Self-Regulating Economy Model

Auxledger ecosystem utilises 2 token based methodology to regulate the token economy better and more effectively. AuxChips, the administrative token in Auxledger ecosystem is fixed in supply and created in a 1-time process. AuxChips allows holders to participate in AuxNet consensus and mine AuxGas, deploy public/private chain on top of AuxNet and allows network governance related voting rights. AuxGas, on the other hand is fuel of AuxNet, which gets utilised for doing computation/ storage, simple or interchain transactions, contract updates etc. AuxNet is to be deployed with 300 Million AuxGas created in advance and distributed in proportion to the AuxChips holders. Further AuxGas can be mined by participating in the AuxNet consensus process. Auxledger introduces a self-regulating economy algorithm where network adjusts the block mining reward depending upon the network's real requirement.

7. Hybrid Blockchain Network Capability

Auxledger's unique ability to tier an organisation's private Blockchain network to the public Blockchain network, AuxNet. This ensures that newly deployed network enjoys the best ability of a private network with high performance and data protection while Merkle proof sent to the public network keeps the network's data trust free across the Auxledger ecosystem.

8. Privacy Preserving Smart Contracts

Auxledger ecosystem aims to enable enterprise blockchain solutions where data privacy is of utmost importance. Here we are proposing a tested framework enhanced upon the usability of Auxledger ecosystem. Using Enigma's secure multi-party computation (sMPC or MPC), data queries are computed in a distributed way, without a trusted third party. Data is split between different nodes and they compute functions together without leaking information to other nodes. The on-chain privacy and contractual security is based upon Hawk model. On-chain privacy stipulates that transactional privacy can be provided against the public unless the contractual parties themselves voluntarily disclose information.



9. Interoperability & Cross-chain Assets Swap

Interoperability in Auxledger ecosystem is defined as a trust-less method to exchange native assets of different subnets. This transaction can also be followed and resulted into execution of a smart contract in their specific networks, resulting the change of other states data. This function allows any connected blockchain networks to exchange assets, contracts and permissions. Further, team at Auxledger is also building bridges to communicate Auxledger based networks to other public Blockchain networks such as Ethereum, Ripple and Neo.

Company Capability

The team at Auxledger consists of Blockchain Engineers, Researchers & Scientists driven by the motivation of building Blockchain of the future. Auxledger team has deployed some of the World's largest enterprise Blockchain network including for the State Government of India which has today over 53 Millions users onboarded over the network. Across the year, company has made dozens of deployments for its partners and companies which includes HPE, IBM, KPMG, NITI Aayog among multiple Blockchain innovation start-ups like Cashaa to build their solution.



Roadmap

PHASE I Orion

Status **COMPLETED** Completion Date Q3, 2019

- Fault Tolerant Virtual Machine
 - Network synchronization and data portability
 - Plug-in based architecture module
 - Ethereum Virtual Machine compatibility
 - Integrated asset management system
 - Easy private Blockchain network deployment
- Accomplishments: Onboarded
- 53 Million+ Population
 - South Asian Enterprises
 - Indian Government Bodies
 - Partners: HPE, IBM, KPMG

Go to [Live Auxledger Explorer](#)



Q4
2017

Almagest PHASE

Status **COMPLETED** Completion Date JULY 2018

- With experiences of deploying dozens of networks for enterprises, the team researched and released an introductory paper of a new generation Blockchain infrastructure, focused on:
- Enterprise grade fault tolerant, high performance virtual machine
- Customizable framework enabling enterprises to deploy blockchain under their business guidelines
- Enabling data integrity and interoperability among multiple private & public networks
- Enterprise public network supporting business ready DApps

Read [Technical Introduction Paper](#)



Q3
2018

PHASE II Draco

- Enterprise public network launch
- Hybrid Tendermint DPOS Consensus
- Multi token economy governance
- Self-regulating economy model
- Privacy Preserving Smart Contracts
- Transactional & Contract Development
- Secure wallet and asset management

Status **ONGOING** Completion Date Q3, 2019

PHASE III Cetus

- Auxledger Virtual Machine implementing higher degree of fault tolerance
- CLI enabled SDK and API's for networks tiering
- Microservices oriented Blockchain protocol pool base
- Horizontally scalable architecture for new protocol development
- Enabling community contribution protocol repository

Status **PLANNED** Completion Date Q2, 2020

PHASE IV Hydra

- Full scale AVM supporting multi language scripting & defensive contract techniques
- Decentralize tiered network consensus protocol
- Interoperability across networks and interchain transactions
- Bridge consensus to interface with heterogeneous networks
- GUI enabled SDK for networks & protocol customization

Status **PLANNED** Completion Date Q4, 2020

Q3 2019

Q2 2020

Q4 2020





Conclusion

With higher penetration and more adoption of Blockchain across the world motivated us to build a packaged platform solution for enterprises. Auxledger in its current version is solving the requirements of enterprises in a much effective manner and had led to major implementations by some of the world's largest Government and Enterprises. The current solution being built by Auxledger aims to act as an infrastructure for tomorrow's decentralise internet.

