PLAAS

Supply Chain Research Architecture

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1. Abstract

Agro-virtual market uses information and communication technologies built for example on blockchain technology. The purpose is to create a next-generation environment for stakeholders, that facilitates agricultural products to be delivered to the market places in time. This platform is not a brokering facility rather a marketplace solution to enable stakeholders to trade effortlessly and directly between parties.

Plaas is a platform that enables the virtual market for agriculture that empowers the farmers of africa to seamlessly trade their animals and crops at market price, that will boost their income and it will increase the civilization in african countries, information provided by farmers to enrich the crops will help others to match the standards.

Plaas.io will use its own private blockchain POA, Proof of authority blockchain, POA will help performing validation and it has a very high TPS also its very secure, scalable and charge very less or negligible fee of a transaction.

Through this architecture we will focus on system architecture, blockchain consensus algorithm, module wise breakdown, enabling supply chain using smart contracts, process charts and flowcharts of a system to understand internal architecture and overview of a plaas platform.

2. What is PLAAS doing

- Overseeing Farm Inventory
- Enhancing Agricultural Supply Chains
- Modernizing Farm Management Software (FMS)
- AgTech IoT Optimization
- Fair Pricing
- Oversight and Payment of Agricultural Subsidies
- Community-Supported Agriculture
- Mobile Remittance for Small Farmers
- Incentivizing Sustainable Practices

3 Why PoA Blockchain ?

Introduction

PoA consensus is essentially an optimized Proof of Stake model that leverages identity as the form of stake rather than actually staking tokens. The identity is staked by a group of validators (authorities) that are pre-approved to validate transactions and blocks within the respective network. The group of validators is usually supposed to remain fairly small in order to ensure efficiency and manageable security of the network.

In this context, identity means the correspondence between a validator's personal identification on the platform with officially issued documentation for the same person, i.e.certainty that a validator is exactly who that person represents to be.

- To establish that their identity is true, the notaries, who already have their identity information freely accessible in the public domain, go through the formal on-chain identity verification. As public databases of licensed notaries and the POA Network verification DApps are independent from each other, forging information on eitherside will prevent a candidate from becoming a validator.
- After the initial distribution of licenses, an additional validator can be added through the voting process on the built-in Governance DApp. A majority of votes will be needed from validators to be accepted into the smart contract with a list of validators.

Characteristics :

The main characteristics of a PoA network are a low requirement of computational pow er, no requirement of communication between nodes to reach consensus, and continuity of the network is independent of the number of the available genuine nodes since they are pre-approved and verifiably trustable through cross verification in the public domain.

Example of PoA better than PoS or any other blockchain consensus for private blockchain setup

PoA is designed to be less computationally intensive than PoW models that require exp- ending electricity to solve algorithms, PoA removes a primary concern within the PoS model that although stakes between two parties may be equal, their value to each party may vary significantly depending upon their holdings.

Abhishek may have 1,000 XYZ tokens staked and Parth may also have 1,000 XYZ tokens staked, however, Abhishek has $10 million outside of his stake and Parth only has $10,0- 00 outside of his. Therefore, Parth is much more likely to be invested in the success of the XYZ network than Abhishek since his stake represents a substantially larger portion of his overall finances.

This implies that there are fundamental inequities among stakeholders and thus differing motives for network behavior. This results in a whole new set of vulnerabilities that don't exist in PoW as high stacked entities are incentivized to act in their own interests and not the interests of the network.

Some Important features and benefits of POA:

Radical Simplification of Consensus (Easy to understand, drives adoption)
More Reliable Block Generation (~5s/block)
Higher Transaction Throughput
No specialized hardware required (lower barrier of entry)
Energy efficient compared with PoW
Cheaper more efficient network (lower transactions costs)

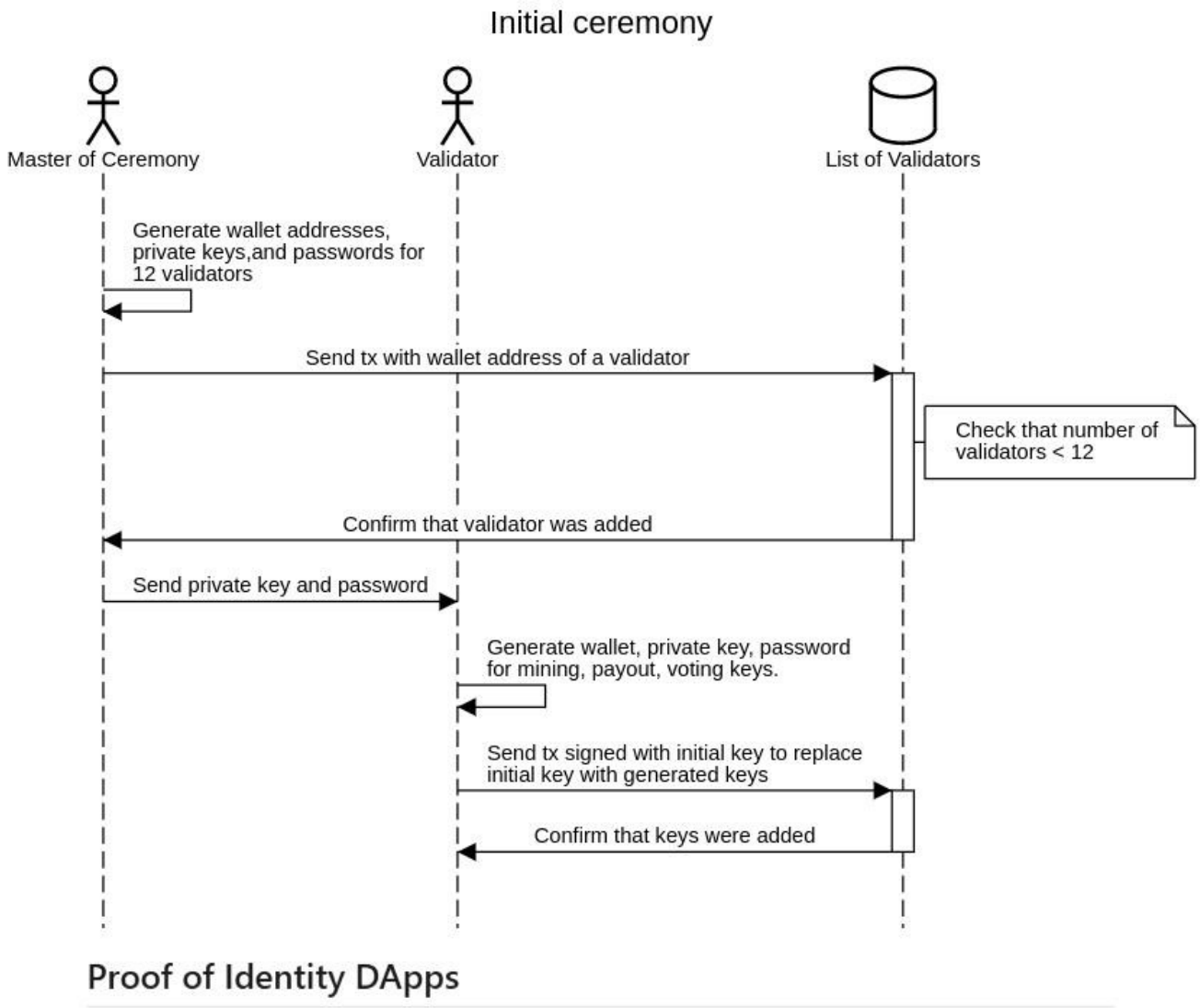
Requirements to become a validator

Their identities need to be formally identified on-chain with the ability to cross-reference these identities through reliable data available in the public domain (such as a public notary database).

Eligibility to becoming a validator must be difficult to obtain in order to ensure the long-term prospective position of the validator is one of clear incentives, both financially and reputationally, to remain an honest validator.

There must be complete uniformity in the process for establishing validators.

Initial ceremony is a required procedure to start a new network based on POA ideas of independent validators.



Proof of Identity DApps

Role of a validator

A Validator is an independent individual who stakes their identity and is entrusted to maintain a node on the network that validates transactions and commits new blocks to the blockchain.

Responsibilities

A Validator has both technical and social responsibilities both of which are important for the health, performance and security of the network.

Technical Responsibilities

Ensure node is secure by practicing safe key management.
Maintain node requisite software version.
Monitor node to ensure its availability and participation in consensus.
Monitor network in general and communicate with other Validators, network entities if problems arise.

Social Responsibilities:

Participate in on-chain Governance of the network
Governance is a collection of DApps where ballots are proposed and voted on by existing Validators to manage the network. The Ballot types include:

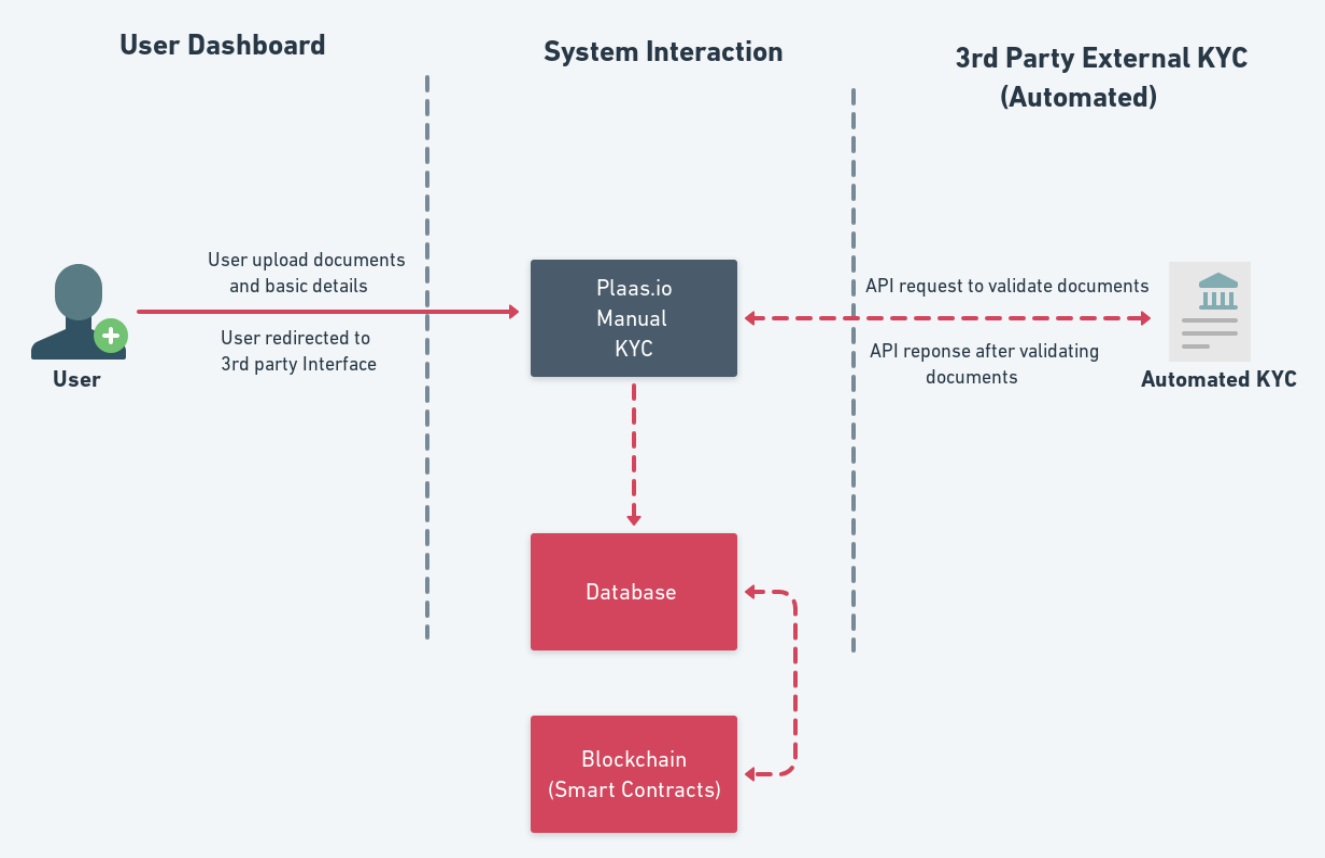
- Adding new Validators
- Removing Validators, i.e. for compromising security of network, malicious behavior, non-participation in Governance

4 KYC manual or Automatic

KYC is required for each farmer to know their identity on a platform, KYC will be required for each entity on a platform farmers, govt entities, validators will need to go for different KYC process while registering as a validator, they need to proof their identity, for now we will only talk about buyer and sellers, information providers.

We can either choose manual or automated kyc on a platform for farmers to join, that will contain basic steps through which each user will go through to identify themselves on a platform.

Interaction Diagram of a user and Admin with manual KYC module



Technical Responsibilities

1. Users will Sign up using E-mail id / Phone number with OTP based verification ~ Sign up as a farmer or sign up using social networking sites.

2. Users will first upload documents to the platform and complete its KYC.

3. Admin will receive a notification on an app whenever a new user will join the platform to approve kyc of users on a platform.

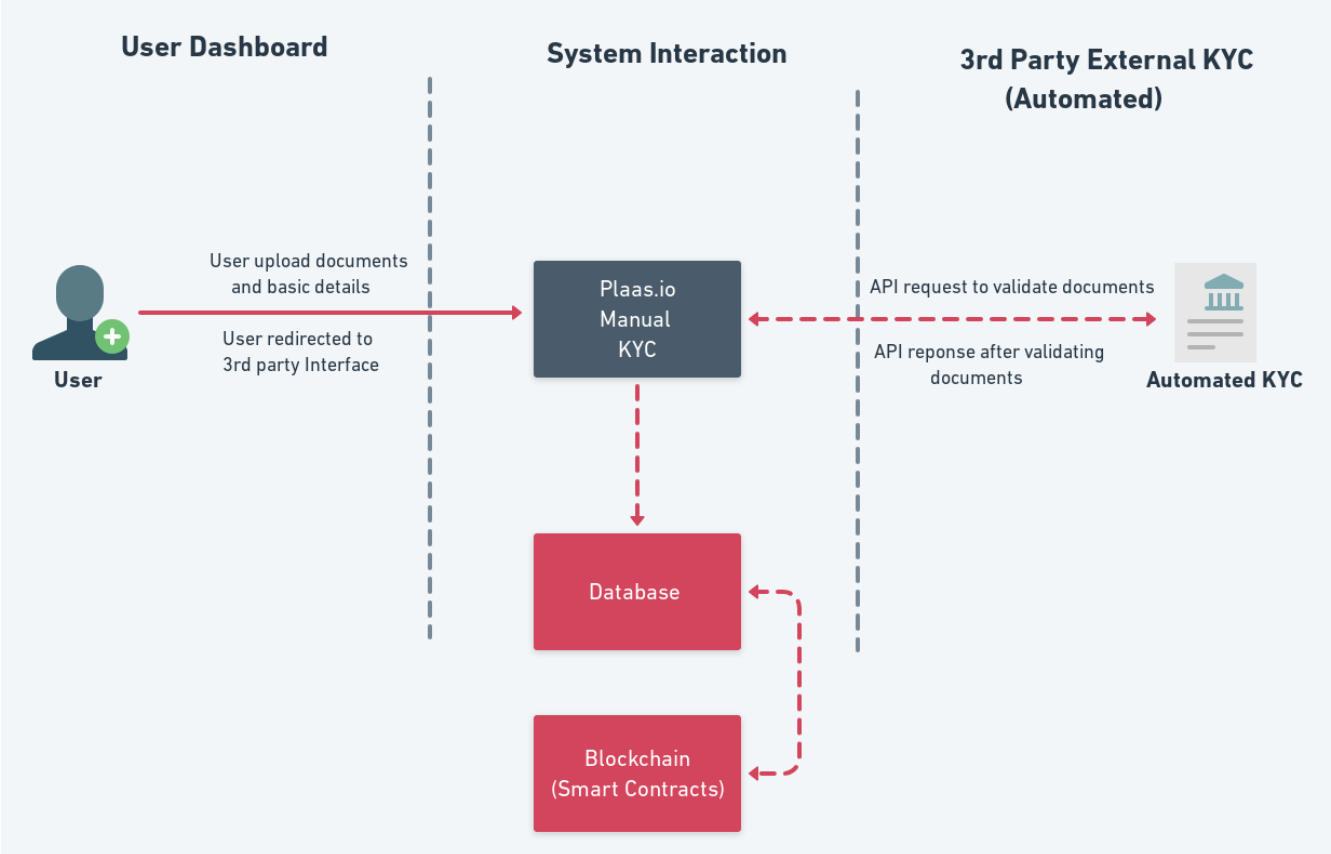
4. Admin will have multiple options to handle kyc (Approve, decline, hold, ask for more documents).

5. Once a user's kyc is approved data will be stored on the blockchain.

6. User can update their KYC documents anytime after joining platform

7. Admin approval is required after any update on kyc documentation

Interaction Diagram of a user and 3rd party automated document validator with Automated KYC module of Plaas platform



Steps for the Automatic KYC

1. Users will Sign up using E-mail id / Phone number with OTP based verification ~ Signup as a farmer or sign up using social networking sites.

2. Users need to undergo kyc process to explore Plaas platform

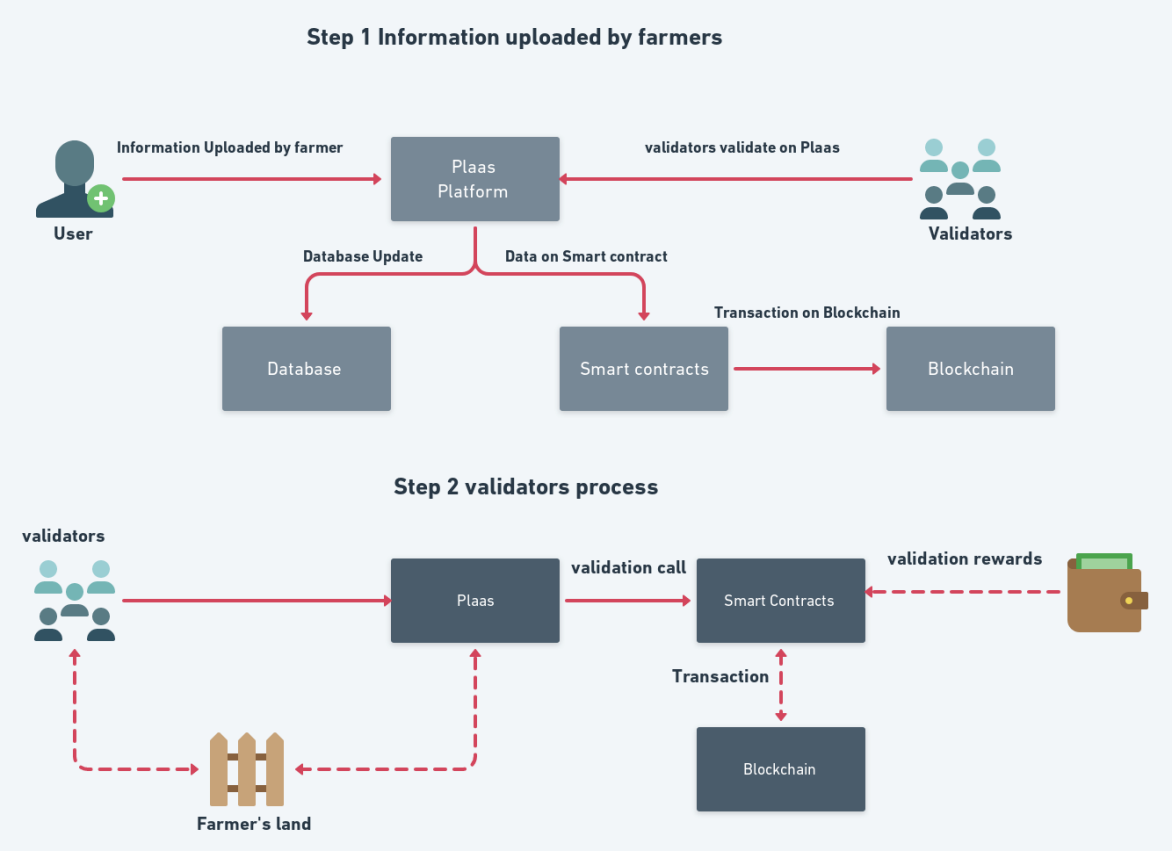
3. Users will be redirected to a 3rd party interface to upload documents and submit details.

4. Once a 3rd party app accepts the kyc documents and validates it (1 Sec -30 minutes) 3rd party app will send a response to plaas platform.

5. Users will then allow to access the platform

5. User Interaction with Plaas platform

Farmers play an important role in building plaas platform, also plaas platform is user friendly to engage non tech users on a platform we have minimise the complex blockchain technology and make it user friendly to farmers.

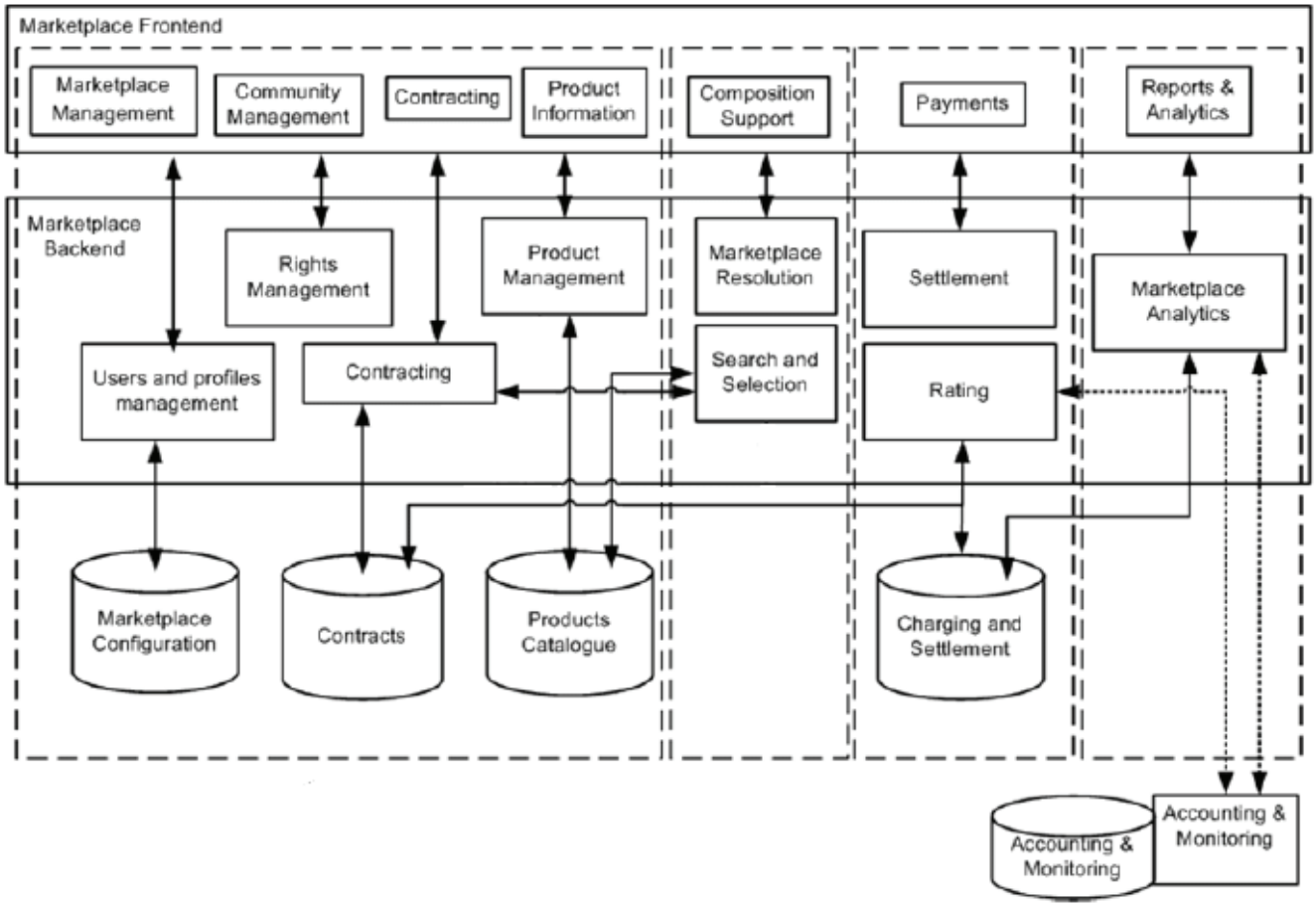


Steps for the information upload and validation

1. After KYC has been approved farmers can explore all the features of a platform
2. Farmers are required to fill a form to upload all the documents, images, information with references related to their farm, crops, animals, inventories, techniques.
3. Each information will be encrypted in smart contracts/databases and will be available in public domain after validators validate the information to blockchain.
4. Validators will participate in validating information and they will be rewarded with a plaas token based on a formula of computing the amount of info and it is also based on time/value.
5. Once the information has been validated and a transaction has been sent to the blockchain the information will be public and other users can access the authentic information on a platform.

6 Marketplace Plaas Platform

High level architecture of a marketplace

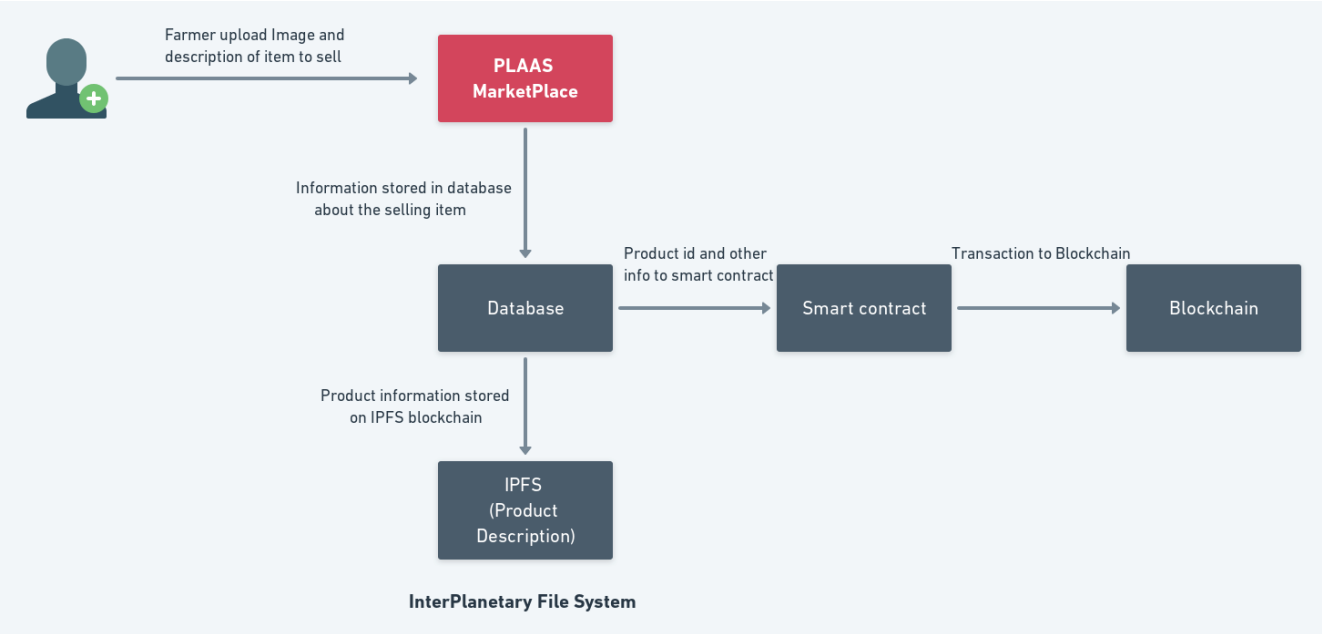


Marketplaces allow farmers to put their items in front of thousands of other farmers and buyers, this will help them to get the right price for their item based on market price.

By introducing agriculture marketplace on blockchain we will achieve following things

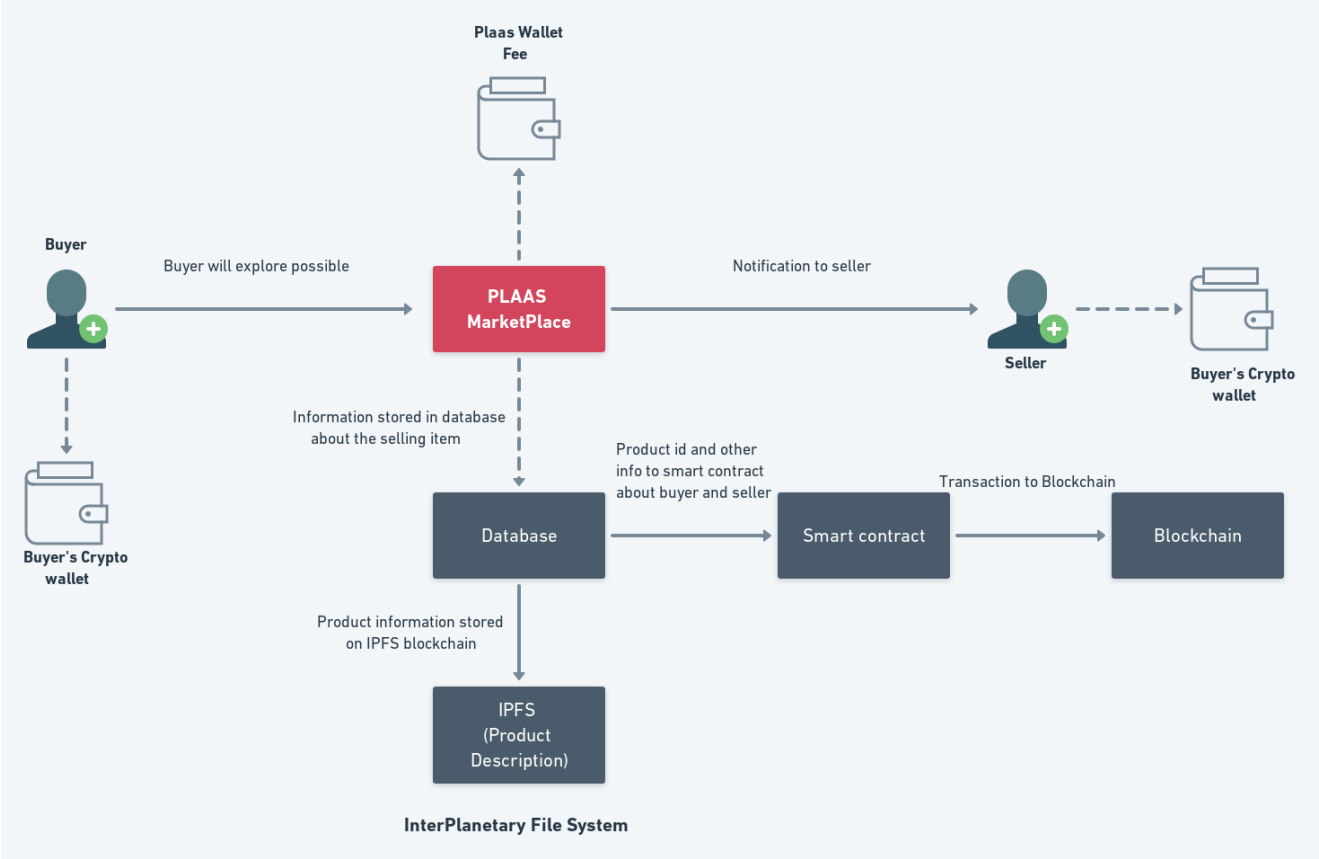
- Transparency. Direct transactions between farmers and industry/retail.
- Fairtrade. Redistribution of value in food supply chain.
- User Friendly. Reduce costs to buyers without losing reliability.
- Food Traceability.

Farmers activity to sell item on Plaas Platform



- Farmers upload images or descriptions based on the item and other attributes related to the item they want to sell on the marketplace.
- Item will be stored in database
- Item data will be then transferred to IPFS
- Smart contracts will uphold the transaction details of ipfs (HASH)
- Transaction will be registered on blockchain

Buyers activity to Buy item on Plaas Platform



- Buyer Explore all the possible opportunities on PLAAS platform
- When Buyer buys an item on plaas platform, the buyer will sign a transaction and send it to the blockchain.
- Databases will be updated and smart contracts as well with accurate info of buyer and seller.
- ESCROW contract will be used to trade between buyer and seller till both the parties close the deals.

7 Use of Plaas Token on Plaas Platform

- Plaas is a ERC20 token
- Plass is a utility token
- Plaas token will be listed on multiple exchange
- Plaas token can be buy at Plaas platform as well in exchange of any other crypto or fiat
- Plaas token will be used as a currency on a plaas platform
- Plaas token will act as a fuel for transaction on blockchain
- Plaas token will be held in plaas crypto wallet
- Buyer and seller use plaas for any engagement on a platform
- Validators will be rewarded with plaas
- Future contracts on plaas platform
- Insurance of crops and items

8. Plaas Wallet

A cryptocurrency wallet is a secure digital wallet used to store, send, and receive digital currency. Most coins have an official wallet.

If plaas opt for a private blockchain then plaas will have its official wallet or it can be built on the top ethereum blockchain wallet or can use existing wallets.

Private blockchain setup will allow you to add custom RPC url to blockchain wallet and use it on any existing wallet (Metamask)

Wallets are used to store, receive and send plaas tokens on a plaas platform.

Metamask wallet can be used as a wallet to uphold the plaas token, it is secure and comes up with chrome extension and mobile wallet other than metamask, plaas can build its own wallet for users to uphold a currency on plaas platform.

MetaMask generates passwords and keys on your device, so only you have access to your accounts and data. You always choose what to share and what to keep private.

Plaas platform can easily build its own wallet for platform use, along with the fact that users can opt for other online and physical wallets, as well.

9 Database design and schema

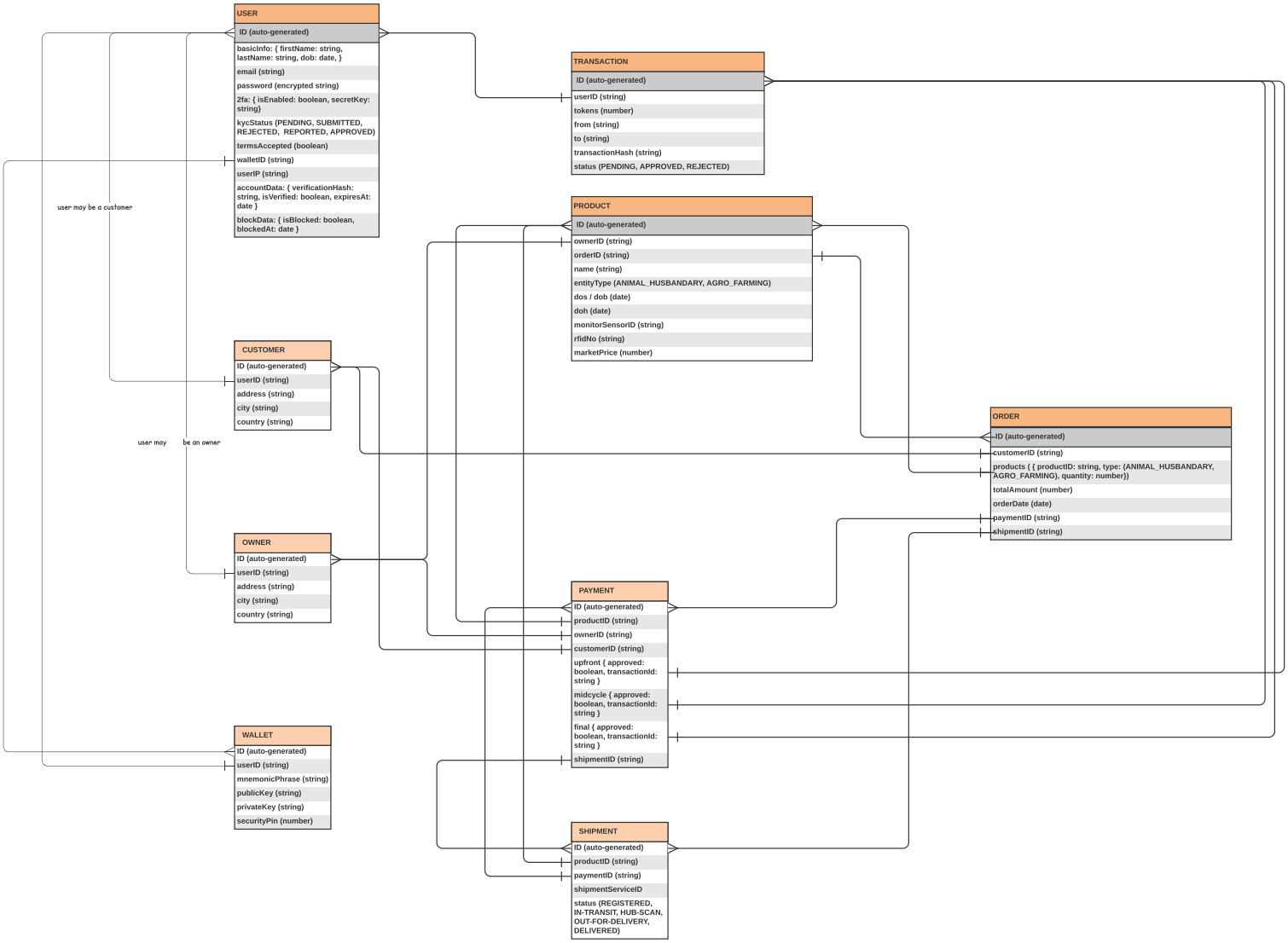
Data modelling

A cryptocurrency wallet is a secure digital wallet used to store, send, and receive digital currency, Most coins have an official wallet.

Data modeling helps in the visual representation of data and enforces business rules, regulatory compliances, and government policies on the data. Data Models ensure consistency in naming conventions, default values, semantics, security while ensuring quality of the data.

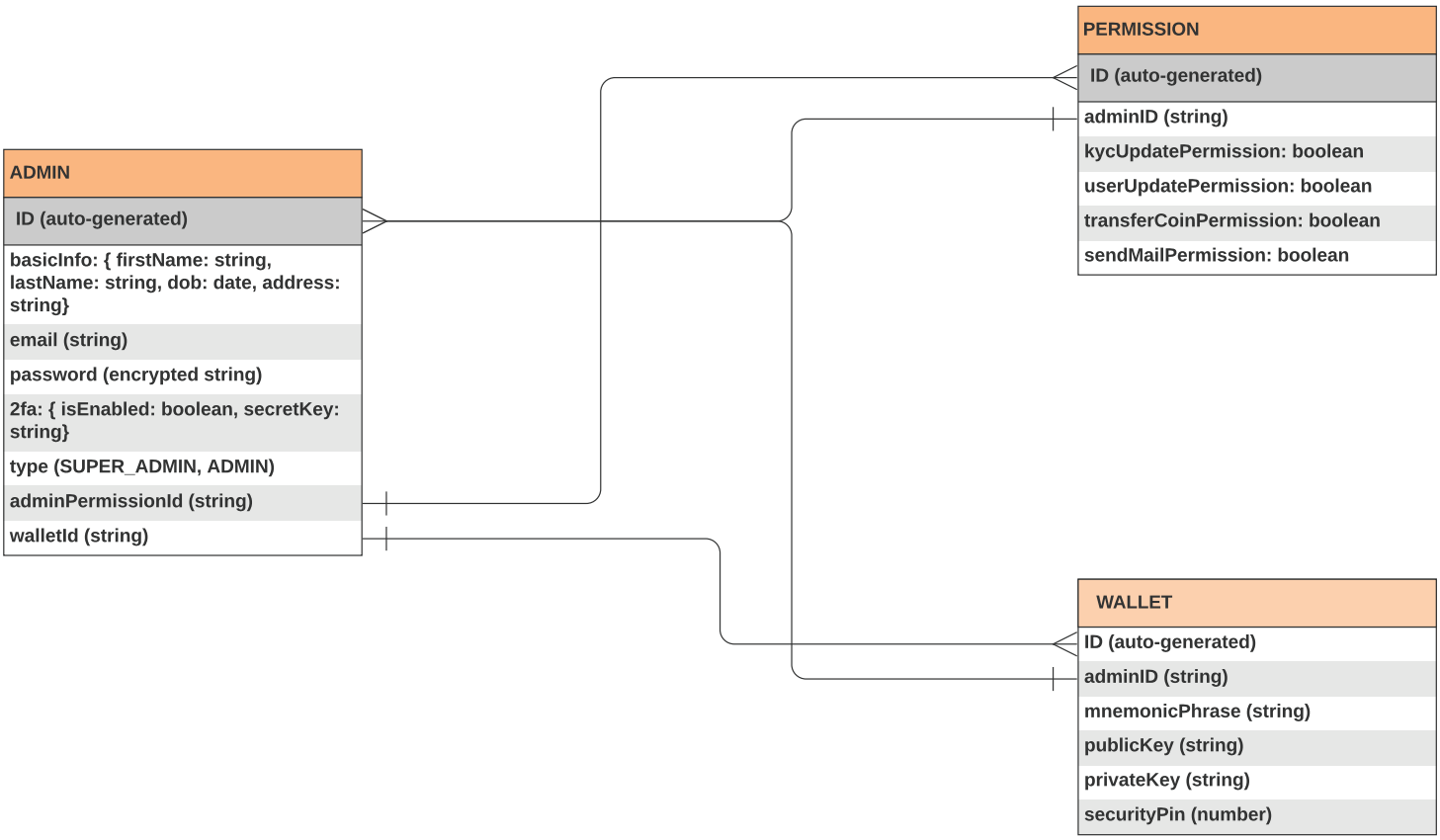
Data modelling in supply chain management platforms places a vital role to enhance the process of traceability to work seamlessly in accordance with blockchain.

Plaas User Database overview



doh - date of harvesting
dos - date of sowing
doh - date of harvesting
rfidNo - animal data analysis
monitorSensorID - plant data analysis
shipmentServiceID - id of shipment from the shipping company
upfront - 50%
midcycle - 25%
final - 25%

Plaas Admin Database Overview



kycUpdatePermission : admin can update kyc status of a user
userUpdatePermission: admin can verify / block a user
transferCoinPermission: admin can transfer plaas coin to user
sendMailPermission: admin can send mail to user

10. Risk analysis and management

10.1 Introduction

Risk Analysis and Management is a key project management practice to ensure that the least number of surprises occur while your project is underway. While we can never predict the future with certainty, we can apply a simple and streamlined risk management process to predict the uncertainties in the projects and minimize the occurrence or impact of these uncertainties. This improves the chance of successful project completion and reduces the consequences of those risks.

Risk analysis and management should not be done only in the phase of development but also evaluated and analysed when the project is production ready in the form of competitors analysis. It highlights that effective and early risk identification and management secures the achievement of project objectives, leading to reduced rework costs.

The organization-mandated risk management framework is reviewed and tailored to define the project risk management plan when the project is initiated. The risk management plan includes two basic definitions:

- List of possible risk sources and categories
- Risk reduction and action plan

If these two factors we can identify we can reduce chances of failure of projects including other external factors.

10.2 Risk Analysis

Risk analysis involves examining how project outcomes and objectives might change due to the impact of the risk event.

Once the risks are identified, they are analysed to identify the qualitative and quantitative impact of risk on the project so that appropriate steps can be taken to mitigate them.

10.3 Probability of Risk Occurrence

After identifying and analyzing all the risk sources, all the identified risk should be categorised in probabilities factors listed below.

High probability – (80 % ≤ x ≤ 100%)

Medium-high probability – (60 % ≤ x < 80%)

Medium-Low probability – (30 % ≤ x < 60%)

Low probability (0 % < x < 30%)

10.4 Risk Impact

Risk impact should also be calculated before starting any project, calculating risk impacts is good practise and should be categorised in high, medium and low category to plan on risk response accordingly.

a. High – Catastrophic (Rating A – 100)
b. Medium – Critical (Rating B – 50)
c. Low – Marginal (Rating C – 10)

10.5 Risk management

Risk management is becoming the most challenging aspect of managing software projects. While we can never predict the future with certainty, we can apply a simple and streamlin ed risk management process to predict the uncertainties in the projects and minimize the occurrence or impact of these uncertainties.

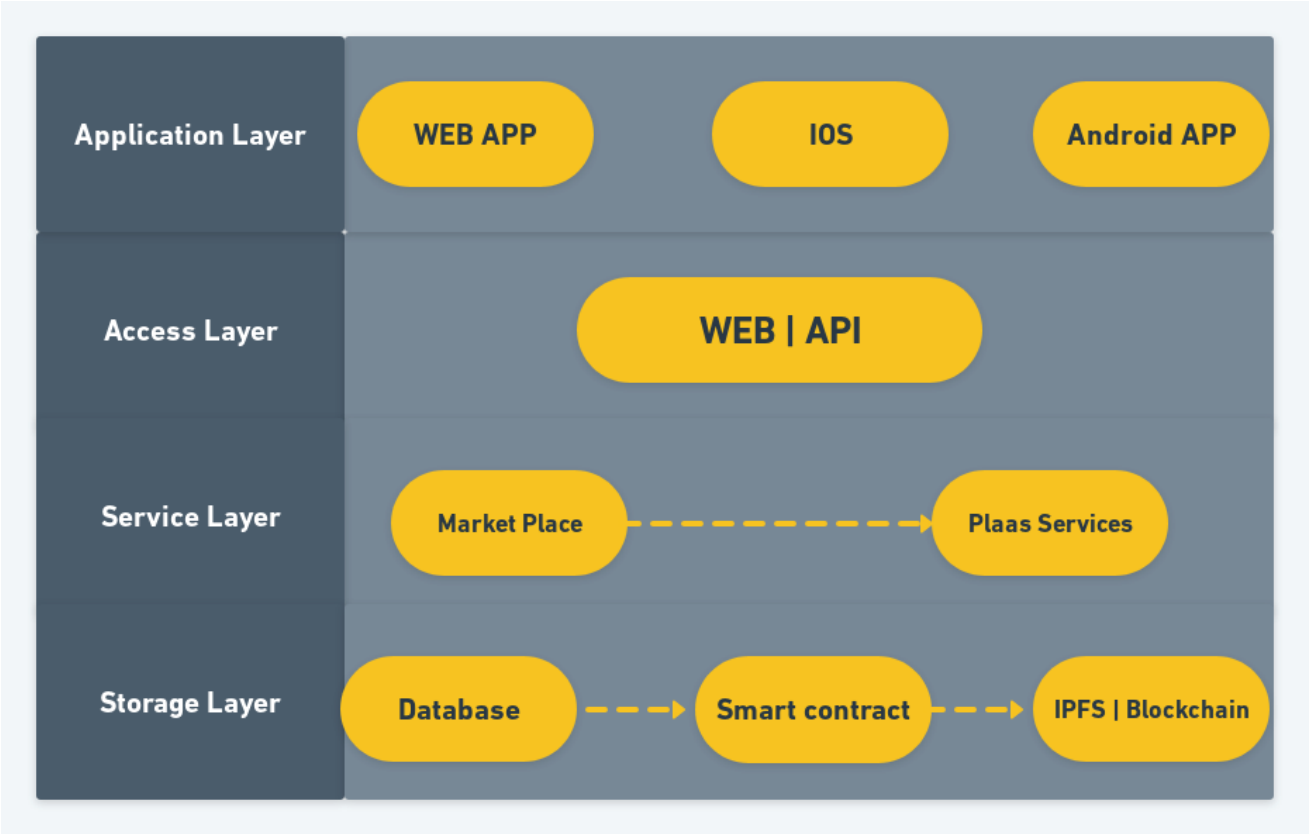
Risk management not only helps in avoiding crisis situations but also aids in remembering and learning from past mistakes. This improves the chance of successful project completion and reduces the consequences of those risks.

Also risk management is not a one time process, risk management should be a continuous process. Each and every, small or large projects should analyse all risk associated with the project and take proper action to control risk.

11. Plaas Features Offering

- Fully capable agriculture supply chain: Transparency and Traceability solution
- Farmers can share information on Plaas platform
- Farmers will also incentivised on platform
- Validators will validate information and rewarded
- APIs to get response from RFID sys and store on blockchain with authentication
- Architecture marketplace for buyers and seller to trade on Plaas
- Admin Panel to govern and manage Plaas
- Futures contract that allowed farmers crowdfund in advance for shares for profits
- User panel to trade and incentivised on plaas platform
- Manage KYC (manual and Automated)
- Admin manage Validators
- Plaas secure wallet
- User friendly UI
- Customised graphs and statistics
- Node validators

12. System internal Architecture



Application Layer

It is also known as Client layer also known as a top most layer. By using this layer we can access the web pages. The main functionality of this layer is to communicate with the Access layer. This layer passes the information which is given by the user in terms of keyboard actions, mouse clicks to the Access layer.

This layer helps users to interact with business logic of exchange in the form of UI/UX and users will be able to send or get details using the application layer.

Access Layer

Access layer works as a mediator between application layer and service layer, this layer is not open to the user and passes the information/data from and to the service layer to apply core or business logic on data to process further.

Service layer

Service layer is very important for marketplace all the order on marketplace is executed at service layer and pass the information to storage layer to execute the order and to execute the transaction via wallet and submit to blockchain

Storage Layer

The data is stored in this layer. the service layer communicates with the storage layer to retrieve the data. It contains methods that connect the database and performs required action e.g.: insert, update, delete etc.

13 Entities involved in Plaas with approach for Supply Chain

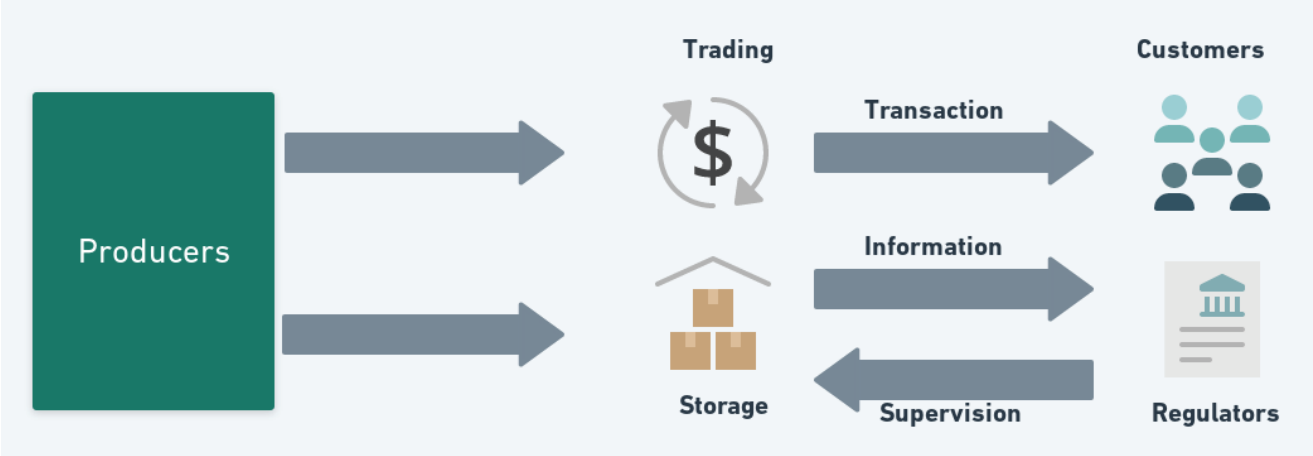
1. Farmer – a producer who can communicate about his production to the world by an app on his smartphone. When there is no such possibility, he/she can go to the nearest education center and trade from there if they don't have a smartphone or education.

2. Storage – a network of storages and trusted places where products can be checked and securely stored. Elevators for grain have to be placed across the country to offer ease of access. Each of the storage has to be equipped with labs or certification offices which will allow the product to be sold. They determine its quality and if a product is traceable, they start it using RFID or blockchain.

3. Buyers – registered organizations capable to buy products and get them from the storages.

4. Logistic – if needed organization which will allow product delivery.

5. Trading platform – a virtual place of the trade with easy access to everybody.



A blockchain-based web & mobile virtual Agri marketplace designed with farmers needs to be a solution to assure proper transparency. In this case, the platform seeks to provide a transparent, open and trustworthy space for smallholder farmers and buyers to negotiate fair prices and deals. This platform helps to connect smallholder farmers to markets and creates a virtual, app-based network that allows farmers to interact with traders and other buyers.

This platform is expected to help farmers market their produce in a better way, get market-related information and facilitate better price discovery through efficient, transparent and competitive marketing platforms withaccess to a large number of buyers from within and outside their location through transparent auction processes or direct buy with smart contracts as an escrow.

On the other hand, trading in the electronic platform would benefit the farmers, as they can sell their crops to buyers anywhere in the country. Similarly, buyers, including large traders, processors and exporters would also be benefited, as they can undertake online trading from anywhere in the country. They do not need to depend on middlemen for trading to take place.

14. Technology and techniques

Backend : Nodejs

Frontend : Reactjs, vue.js

Blockchain Protocol : POA consensus Algorithm/public blockchain

Blockchain Language : Golang, C++

Wallet : web3.js

External wallet : Metamask

Smart contracts : Solidity

Trading engine : Nodejs

Token support : ERC20

15. Modules with Timeline

Modules :

1. **UI and UX:-**

Description: This module includes designing the UI with designing tools and writing the corresponding html and css. This section also includes user experience requirement gathering from client and implementation.

Admin dashboard, Trading screen, User profile

2. Admin

Description: This module contains both backend and frontend integration for admin dashboard.

2.1 Admin Authentication

- Login with email
- Google Captcha
- 2FA Integration
- Password Recovery

2.2 Manage smart contracts

- Deploy token smart contracts
- Deploy escrow contracts
- Deploy info based contracts
- Interact with smart contracts
- Future contracts
- Insurance of crops and items on smart contracts

2.3 Manage fee wallets, fee structure and incentive program

- Add fee wallet to collect fees
- Change fee wallet
- Change fee structure
- Add incentive program of native tokens
- Insurance platform

2.4 Manage users

- Verify KYC (if manual)
- Invite new users
- Block users
- View full transaction history of users (open/closed/executed orders)
- All statistics of particular user

2.5 Customised graph and statistic

- Interactive graphs
- Bar charts and statistics

2.6 Manage validators and storage

- Add/ remove validators
- Add inventory/storage place

3.Trading screen (traders/users/Farmers and buyers)

Description: This module contains both backend and frontend integration for admin dashboard.

3.1 Trader/Users Authentication

- Signup
- Login
- Google Captcha
- 2FA Integration
- Profile updation

3.2 KYC Integration (manual or third party)

3.3 product list/Item list

- product table (market price, volume, 24 hrs change)

3.4 (market place)

- Product item
- Buy /Sell Order book
- incentivised

3.5 Create and Integrate wallets (metamask,trezor etc)

- Integrate all wallets
- Select wallet
- Select account
- Change wallet
- Change account

3.6 Trading engine

- Optimised trading engine with security

3.7 Create order offline

- Create buy/sell order

3.8 Modify/Cancel offer

- Cancel existing order
- Modify existing order

3.9 Graphs and analytics

- Customised graphs

3.10 Information upload

- Farmers incentivised for info

3.11 Validators

- Add/ remove validators
- Node setup
- Validation
- Reward sharing

4. Testing

- Manual Testing
- Unit Testing
- Coverage Report
- Penetration Testing
- Alpha testing
- Beta testing

Time (Weeks)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	✓	✓														
2.1			✓													
2.2			✓	✓	✓											
2.3					✓	✓										
2.4					✓	✓	✓									
2.5								✓	✓	✓						
2.6								✓	✓	✓						
2.7								✓	✓	✓						
2.8										✓	✓	✓				
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3.6										✓	✓	✓	✓			
3.7											✓	✓	✓			
3.8											✓	✓	✓			
3.9											✓	✓	✓			
4.0													✓	✓	✓	✓

16. Insurance on Plaas Blockchain

Crop/Item Insurance

In agriculture, smart contracts have unique implementations in the form of helping farmers insure their crops and claim damages with insurance companies. Normally, it is a painfully slow and burdensome process, both on the side of the grower and the company that insures them.

Unpredictable weather anomalies make it difficult to correctly estimate and quickly report the exact losses they cause. This leaves room for fraud and makes the process an operational nightmare.

Through setting up tailored smart blockchain contracts, the damage claim can be triggered via changes to weather conditions that meet certain criteria, easing the process for farmers and insurers.

Through setting up tailored smart blockchain contracts, the damage claim can be triggered via changes to weather conditions that meet certain criteria, easing the process for farmers and insurers.

Smart contracts will play a crucial role in insurance, all the external environmental details will be triggered to contracts through oracles, all the claims will be settled on blockchain via smart contracts.

Achievements using insurance on blockchain

- Fraud Prevention: Detecting Fraudulent Claims
- Expediting Policy Creation and Claims Processing
- Streamlining Routine Interactions
- Risk Prevention
- On-Demand Insurance
- Property and Casualty Insurance
- Reinsurance
- Microinsurance
- Peer-to-Peer Insurance
- Parametric insurance

We need to set up an agent for dealing on smart contracts and based on environmental factors it will be seed on blockchain initially later on to settle a claim agent will verify the details and settle a claim on smart contracts and blockchain.

17. Summary and competitor analysis

Summary

Plaas Platform is a product for farmers and agriculture traders that will be built on the top of blockchain using smart contracts, ipfs. Plaas is empowering small farmers and traders by using emerging technology.

Plaas has been coming up with a user friendly application that will enable farmers to upload information relevant to enhancing farming skills, information about items (Animals). Farmers can also opt for future contract based on the predictions and taking data input from some last years about weather condition and other environmental factors, farmers can possibly claim to have a reasonable amount of crop and that can be traded before, we will use escrow contracts for this only a few percentage will be delivered to farmers initially.

Plaas will have it's marketplace on plaas platform to enable trades between buyer and sellers using plaas token only this will increase the liquidity of plaas token, Plaas will use its own token on plaas platform user can buy plaas token using fiat and crypto on plaas platform and also with any exchange or decentralised exchange

Plaas will have its own app where users can sign up with minimum requirements and create their profiles on the platform and upload information about farming and items on plaas platform, validators will validate the information and will be rewarded.
Plaas is also enabling insurance of crops and items on the plaas platform for the farmers using smart contacts that will enable transparency in claim settlement and its very fast process that will help farmers and it's very risk efficient.

Competitor Analysis

Based on the competitor analysis we have found that plaas should focus on the user friendly interactive app and should minimize the complex blockchain transactions, node setup and wallet integration for users, there should be an interactive ui with simple and decent design that will help farmers to interact with the app easily and hassle free.

We found that other platform are very hard to use for non tech persons and farmers are not very handy with apps and smartphones, plaas should focus on basic UI interactive section that farmers can adopt and use easily along with that with new user on plaas should provide a user guide to explore the platform to make farmers comfortable on app.

What plaas should do to come up with different approach from competitors

- Plaas should bring together all stakeholders in the agricultural supply chain, allow them to make better-informed decisions, eliminate unnecessary paper work and dockets, reduce supply chain inefficiency and risk, open markets and increase their bottom line, and make all on one easy-to-use platform.
- Advance secure wallet with simple user interface to use
- Low transaction cost
- High TPS
- Transparency of transaction on blockchain
- Hassle free contract creation and interaction
- Artificial intelligence platform for crop quality prediction
- Platform should be compatible with low internet speed as well
- Interactive notifications of items and crops on platforms uploaded by farmers and better user interface for traders.
- Fast trading engine

PLAAS FARMERS MANAGEMENT SYSTEM