



FOODWARE

Foodware: A Blockchain-Powered Food Distribution Network.

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1.0 Abstract

“Food” is a utility that fuels the human engine. Its systems have connected several civilizations via the adaptation and adoption of food culture. It is indeed a unique gift of nature as it is older than man’s existence. Its essentiality cannot be exaggerated as it is a medium that spreads love, peace, unity, and positivity. This essential need is always served with love from our families.

To our Sadness, this Commodity is turning into a financial Exploitation and manipulation medium instead of being improved for a better and more sustainable society. Agriculture, Transportation, Marketing, and availability play roles in global food distribution (Supply Chain).

There are tons of inconsistencies in the system due to profit-driven approaches to solving global food problems, and these constraints are currently hitting the continent of Africa hard despite its large expanse of farmable land.

Considering the adage "It is easier to make than to mend." we decided to create a regenerative and sustainable Ecosystem of Consumers, Vendors, Farmers, and Riders powered by Blockchain - The Foodware Network.

1.1 Introduction

We want to discuss the technologies and techniques used to build the Foodware Network.

Cryptocurrencies are just a single use case of Blockchain/Distributed Ledger Technology. Our use case of blockchain is specific to the Real-World application of this technology in Food distribution through a more decentralized, regenerative, and sustainable system known as the Foodware Network.

The Foodware Network is a DePIN Network built with a SHA Function Cluster/Algorithm for Secure Messaging and the Solana Blockchain through Smart Contracts for Transactions and Authentications.

In Section 2, we talk about The Network and its technology specifications.

We explain the three On-chain Reward Mechanisms used to incentivize Contributors, Content Creators, and Riders in Section 3.

We leave information about the two Tokens in the Foodware Network in Section 4.

2.0 The Foodware Network

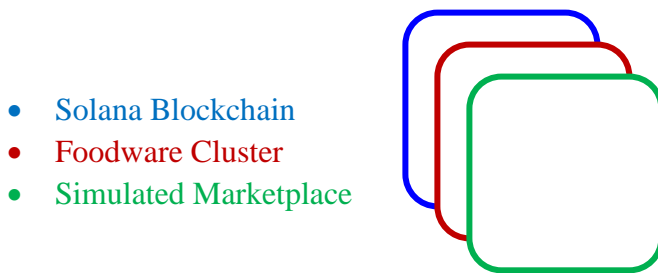
The Foodware Network is a Simulated Real-Life Food Marketplace built on a DePIN Network of Transport Vehicles, and it completes and tracks the movement of food from farm/store to plate with the help of its Layered Network System. Primarily, Foodware has three integral components; A Simulated Marketplace (Web2 Software), A Proof-of-Authentication Cluster (Middleware), and Asset Router Solana Programs (DLT Software).

- The Simulated Marketplace allows users (Buyers and Sellers) to choose & upload product specifics, bargain, use Marketplace Services, and buy/sell Products.

- The PoA Cluster is a Secure Messaging Software for distributing Encrypted Information among Consumers, Vendors/Farmers, and Riders. It uses a Verification Model known as Proof-of-Authentication to ascertain whether or not Riders have received and delivered the purchased products.
- Asset Routers are Solana Programs (Smart Contracts) used to hold funds as an Escrow, distribute rewards, and perform other programable functions. The Asset Routers and Solana Blockchain serve as Foodware Network's Value Layer for Programmability of Money.

The Figure below is an illustrative view of the three integral components of the Foodware Network;

Figure 1: The Foodware Network Technologies at a Glance.



From Section 2 to Section 4, we will mention the terms Token A and Token B. For clarity purposes, Token A has no monetary value, while Token B has monetary use.

The Cluster, Asset Routers, and a Decentralized Content Incentivization Model are touched on here.

2.1 The Foodware Cluster

This Cluster is a Database oracle that distributes messages across a Network that comprises Confirmers (Consumers), Verifiers (Vendors), Authenticators (Riders), and Routers (Solana Programs). This process gives birth to an encrypted Possession Verification Mechanism called Proof-of-Authentication.

Every Network Member has a Unique hash key (UHK) for identification and communication on the PoA DePIN. The Cluster has a list of all the UHKs, and each UHK has a role (Confirmers, Verifiers, and Authenticators).

1. Verifiers add products they offer to the Simulated Marketplace.
2. A Confirmer chooses products it intends to acquire from the Simulated Marketplace and creates a list with these products and their Verifier's UHK.
3. The Confirmer sends the list to the Cluster, who will wait for payment confirmation from the Escrow contract before broadcasting it to the Authenticator Network.

4. The Payment to the Escrow Contract will contain the Confirmers UHK, the Order ID, service fee, and transportation charges.
5. After the payment to the Escrow Contract, it sends the Transportation charge to the Rider Contract with the order ID attached to it before the Confirmer's list is broadcasted to the Authenticator Network by the Cluster. Verifiers of the products receive fragmented copies of the list.
6. An Authenticator will send a transaction to the Rider Contract hashed with the Order ID to receive the necessary details in the Confirmer's list.
7. The Cluster sends the requested details to the Authenticator after confirmation.
8. For every product the Authenticator receives from a verifier on the list, it sends an Authentication message to the Cluster.
9. The Cluster will request verification messages from the verifiers upon Authentication message receipt. Authenticated and verified products make up the Order's Payout instruction to the Escrow Contract.
10. After the Authenticator delivers the product to the Confirmer, it sends a product-delivered authentication message to the Cluster.
11. The Cluster will request a Confirmation message from the Confirmer.
12. Having received the confirmation message, the Cluster instructs the Rider contract to deliver the Transaction Charge to the Authenticator.
13. The Charge is sent to the Authenticator by the Rider Contract.
14. The Cluster instructs the Escrow Contracts to pay the Verifiers of the cleared products and refund the Confirmer what is left.
15. The Escrow Contract makes batched payments to all the Verifiers that have cleared products after the Authentication process.
16. The Remaining funds allocated to uncleared products are sent to the Confirmer instantly.

2.1.1 Note

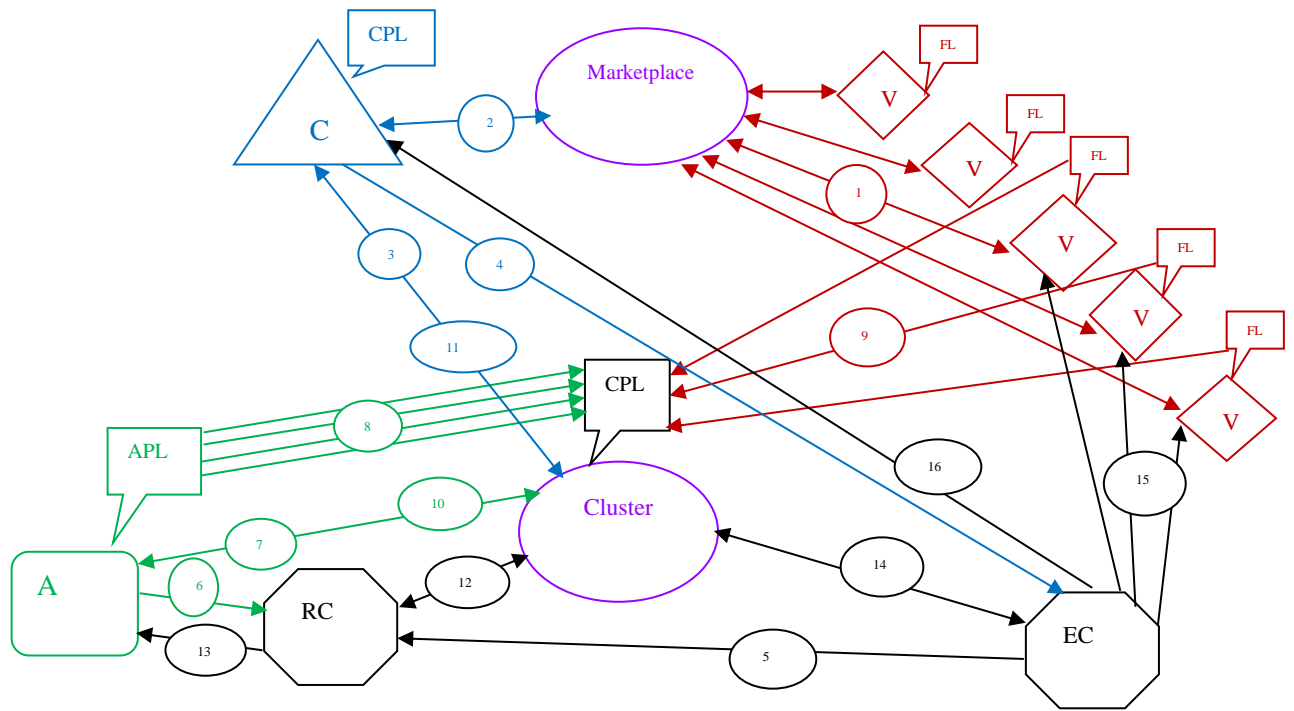
It is always Authentication before Verification and never the other way around. If Authentication and Verification are not on a product it is not added to payment instructions that the Cluster will give to the Escrow Contract.

2.1.2 Rewards

At the end of an hour, all the Authenticators that completed Orders in that period get rewarded with Token B. Verifiers receive a Token A deposit along with their payment according to the R rate, and Confirmers that use Token B to buy products will also receive Token A according to the rate R.

Below is a diagrammatic representative of the logic above, in the diagram C - Confirmer, V - Verifiers, EC - Escrow Contract, RC - Rider Contract, A – Authenticator, CPL – Confirmer Product List, APL – Authenticator Product List, FL – Fragmented List;

Figure 2: The Foodware Network Proof-of-Authentication System.



The above illustration is an order of 5 products made by a Confirmer, and they are from 5 different Verifiers. Assuming that the Authenticator did not authenticate a product and one verifier forgot to verify its item before the Product List Confirmation. We explain the outcome in the diagram above.

2.2 The Asset Routers

The Asset Routers are Solana Programs (Smart Contracts) that listen and send messages to the Cluster. The instructions given by the Cluster help them to issue payments to users. This process makes them and the Solana Blockchain our value layer where all funds (Stablecoin & Crypto) are programmed. The Foodware Network has four unique contracts namely the Escrow Contract, the Crowdfund Contract, the Rider Contract, and the Content Reward Contract. The Foodware Network will start with the Escrow and Rider Contracts. Solana Programs are programable with Rust, an efficient and error-proof distributed ledger technology programming language. The Smart Contracts allow us to ensure a decentralized distribution of digitalized money, making our DePIN Network open to anyone.

2.3 The Crowdfund Contract

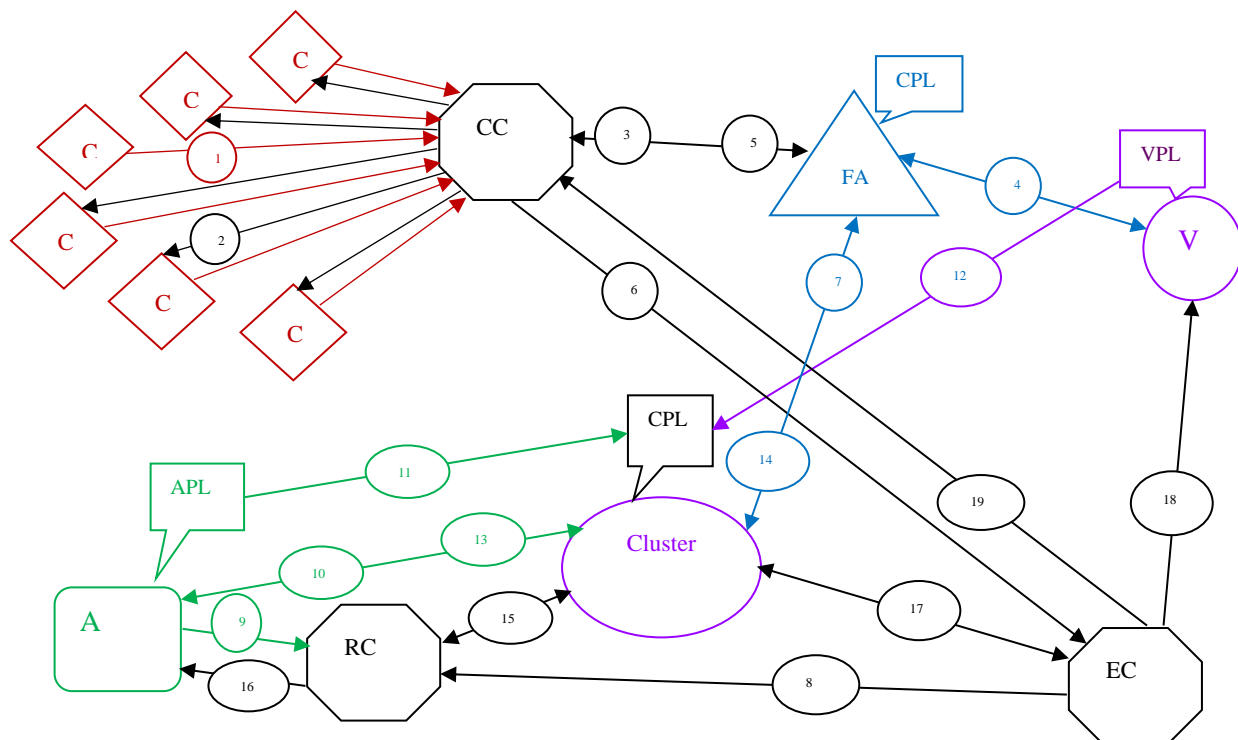
The Rider and Escrow Contract offers users product purchase convenience, but we have a category of users from our research who want more value for their money. Building on the concept of research and procurement, we decided to offer a DAO-like Food Product Procurement Crowdfund. This Crowdfund allows users to vote for and procure products in large quantities (recommended

products are Rice, Beans, and other not-easily perishables). The Crowdfund is a Solana Program where users contribute money to acquire certain food products for themselves.

1. Users on the Simulated Marketplace vote with Token B in our Governance Portal for a New product to be on the Crowdfund's Product List, and the voting lasts for two weeks.
2. Voted Food Products are added to the Crowdfund's registry, and Crowdfunds for the items get introduced in the next Contribution rounds a week later.
3. When a food product Crowdfund is up, Contributors (Users) will add funds to it according to the quantity of the item they require, and this contribution lasts for a week. A Soft Cap/Hard Cap of contribution is needed for the collective procurement to pull through. If the funds contributed don't reach the Soft Cap after one week, all contributions in the food product Crowdfund are refunded. If Contributions hit the Hard Cap before the end of a week, the Food Product Crowdfund ends.
4. After it sends a Product list message to the Foodware Cluster through Foodware's Admin Panel and deposits its transportation charge to the Rider Contract, the PoA process starts according to Subsection 2.1.
5. Our Admin Panel makes the confirmation Messages because Crowdfund Logistics is one of Our Customized Services. Foodware will also provide all information on Confirmer's Product List, and the Products are delivered to a predetermined pick-up Station unless the Contributors have booked for Home delivery. Home Delivery will cost an added transportation charge.

In the below diagram, C – Contributor, FA – Foodware Admin, VPL – Verifier Product List, and every other abbreviation are the same as in the diagram in Section 2.1.

Figure 3: The DAO-like Contract's Interaction with the DePIN Network System.



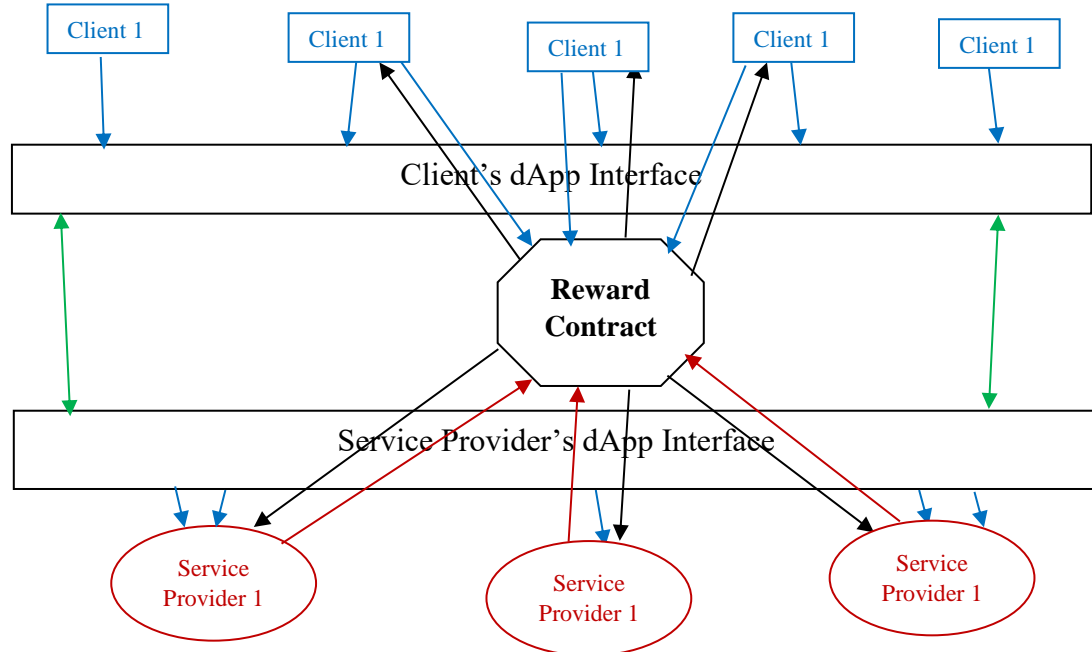
2.4 The Food Education System

This Subsection dives deep into the Decentralized design behind the Network's Food Education Content Reward System. This system has four components, the Client, dApp Interface, Reward Contract, and Service Providers.

- The Client views video content on the dApp Interface
- The Service Providers upload video content to the dApp Interface
- The dApp Interface Routes Token A from a Client's Wallet to a Service Provider's Wallet for every video content viewed.
- The Reward Contract Changes Token A to Token B for Service Providers as Content Rewards at a fixed rate of $1000 \times 2^{(n)}:1$, where n is an hourly incremental constant. It also sells Token A to Clients for Token B or Stablecoin at a fixed rate S , which is exchangeable every 24 Hours. The daily amount of Token B withdrawal with Token A from the Reward Contract Y gets halved every four years.
- For every Content viewed by a Client, the Service Provider of that Content is sent Z Amount of Token A from the Client's account as Content Incentives.
- The Reward Contract has a Fixed Reserve of Token B used to reward Service Providers.

Below is an illustration of the system, explaining how Clients interact with Service Providers

Figure 4: The Food Education's Content Reward Mechanism



- Blue lines are Client deposit transactions either to the Reward Contract for Token A or a deposit of Z amount of Token A to the Service Providers.

- Black lines are Reward Contract deposit transactions to Clients for their Token B or Stable according to the S rate or Token B deposit to Service Providers for their Token A according to the exchange rate $1:1000 \times 2^{(n)}$.
- Red lines are Token A deposit transactions to the Reward contracts from the Service Provider for Token B according to the exchange rate $1000 \times 2^{(n)}:1$.
- Green lines represent a continuous content upload from Service Providers and continuous content view by Clients. It also represents the routing of Z amount of Token A to the rightful Service Provider.

3.0 Reward Mechanisms

This Section discusses decentralized reward mechanisms employed by Foodware to incentivize ecosystem participants, the Formulas behind the mechanisms, and their distribution across Years, Weeks, Days, and Hours. We discuss the three mechanisms below.

3.1 Decentralized Product Subsidy Mechanism

This Subsection will discuss how we intend to use Token B to incentivize those that Contribute Funds to the Crowdfund of specific food products with Token B. Generally, Foodware will have a list of food products that users can contribute to their funds in the Crowdfund and bulk purchase. Our vision is to create an ecosystem where Token B is used to buy and pay for everything, so this mechanism both helps to subsidize the product price and ensures that Token B is in high demand.

Crowdfunding lasts a Week, after which the target products in each Crowdfund are bought, and delivered to the Contributors according to their quota in the Crowdfund. Every week, M amount of Token B subsidizes the food product price for them, meaning they pay less than others will pay per unit food item. We will distribute the Food Product Subsidy as if everyone will use Token B, so every unit of the product needed for the Crowdfund to end is subsidized. Also, $M = W/N$, where W is the Subsidy per Week per Epoch, and N is the number of Products open for contributions on the Crowdfund. The Subsidy System holds 100 Million Tokens divided equally across 10 Epochs. Below is a Table that states the Subsidy distribution in Weeks and Years.

Epoch	Subsidy per Week	Subsidy per Year	Epoch in Weeks	Epoch in Years	Subsidy per Epoch
1	131,072	6,815,744	~ 76.2940	~ 1.47	10,000,000
2	65,536	3,407,872	~ 152.5879	~ 2.93	10,000,000
3	32,768	1,703,936	~ 305.1758	~ 5.85	10,000,000
4	16,384	851,968	~ 610.3516	~ 11.71	10,000,000
5	8,192	425,984	~ 1,220.7031	~ 23.49	10,000,000
6	4,096	212,992	~ 2,441.4062	~ 46.99	10,000,000
7	2,048	106,496	~ 4,882.8125	~ 93.98	10,000,000
8	1,024	53,248	~ 9,765.6250	~ 187.95	10,000,000
9	512	26,624	~ 19,531.2500	~ 375.60	10,000,000
10	256	13,312	~ 39,062.5000	~ 751.20	10,000,000
Total			~ 78,048.7061	~ 1,501.17	100,000,000

Table 1: The Food Product Subsidy Distribution Table

According to this Table, we will be able to subsidize products for ~ 1,501.17 Years, which will be subsequently increased by collecting 2/10 of the Crowdfund fees and withholding unredeemed Token B Subsidy in every Crowdfunding round when all funds contributed are not

in Token B. This method will extend the number of epochs over time with the Subsidy per Week halving proceeding into the additional epochs.

3.2 Content Creation Reward Mechanism

This Subsection uses all the constants in Section 2.3 to derive a Sustainable yet deflationary mechanism to distribute Content Rewards through Token B to Service Providers.

We believe that in Section 2.3 the following values were introduced as parameters in the Reward System:

Constant Token Exchange rate for A/B $\cong 1000 \times 2^{(n)}$:1, where n is an hourly incremental constant.

Maximum Daily Token B Withdrawal from Reward Contract = Y, halved every four years.

Token A Content Incentive per Content viewed = Z.

Token A withdrawal rate from Reward Contract = S, which is withdrawable once every 24 hours.

We want n to increment hourly such that the Token Exchange rate doubles at the end of every 8766 hours (1 year). So, $n = (X/8766)$, Where X is the current number of hours elapsed since $n = 0$. Meaning initial rate will be $1000 \times 2^{(0)}$:1 = 1000:1, where $n = 0, 1, 2, 3, 4, 5, 6, \dots$, and $X = 0, 1, 2, 3, 4, 5, \dots$

Let $Y = K/2^a$, where $a = 0, 1, 2, 3, 4, 5, \dots$, and the constant 'a' increment by one every four years. K is the initial value of Y when $a = 0$.

Setting initial rates to be 1000:1, $Y = K$, we observe the following figures and behavior in Table 2 below:

Time Elapsed	X	$1000 \times 2^{(X/8766)}$	Years	Y
0	0	1000	1	K
12 Hours	12	~ 1000.9493	2	K
1 Day	24	~ 1001.8995	4	K/2
1 Week	168	~ 1013.3728	8	K/4
4 Weeks	674	~ 1054.7404	12	K/8
1/2 Year	4,383	~ 1414.2136	16	K/16
1 Year	8,766	2000	20	K/32
2 Years	17,532	4000	24	K/64
3 Years	26,298	8000	28	K/128
4 Years	35,064	16,000	32	K/256

Table 2: Withdrawal Rate and Withdrawal Amount Deflationary Table

The Value Z will be made known when the DePIN Network goes live, and it will be a value that Clients can readily part with or buy from the Reward Contract at the S rate for viewing Contents. S rate and the K Constant are also unknown for now.

The Rationale behind the deflationary mechanism is that as the DePIN Network grows, the value of Token B will increase, and more Content Creators will enter the Ecosystem. To accommodate them and the fixed Supply allocated to this Content Creation System, we employed a double deflationary formula that reduces the withdrawal rate and daily withdrawal amount over time.

3.3 Order Mining Reward Mechanism

In the DePIN Network, Authenticators receive Token B for continued participation and delivery service to the Platform. This Section discusses how the DePIN Network rewards them through the Order Mining Mechanism.

100 Million Token B was allocated to this incentivization and we divided the order Mining Rewards into 10 Epochs holding 10 Million units each. We decided to reward Riders (Authenticators) who complete delivery orders within an hour with the rewards. The amount of rewards per hour reduces as we go down the Epochs. Hourly Rewards for Riders start at 2048 Token B and are halved as we transcend across epochs. The table below shows the Epoch distribution in rewards and time.

Epoch	Reward Per Hour	Reward Per Day	Reward per Week	Reward per Year	Epoch in Hours	Epoch in Days	Epoch in Weeks	Epoch in Years	Rewards Per Epoch
1	2048	49,152	344,064	17,915,968	~ 4882.8	~ 203.45	~ 29.064	~ 0.5582	10,000,000
2	1024	24,576	172,032	8,957,952	~ 9765.6	~ 406.9	~ 58.129	~ 1.117	10,000,000
3	512	12,288	86,016	4,478,976	~ 19531.2	~ 813.8	~ 116.257	~ 2.235	10,000,000
4	256	6,144	43,008	2,239,488	~ 39062.5	~ 1627.6	~ 232.515	~ 4.475	10,000,000
5	128	3,072	21,504	1,119,744	~ 78125	~ 3255.2	~ 465.030	~ 8.942	10,000,000
6	64	1,536	10,752	559,872	~ 156250	~ 6510.4	~ 930.060	~ 17.885	10,000,000
7	32	768	5,376	279,936	~ 312500	~ 13020.8	~ 1860.119	~ 35.770	10,000,000
8	16	384	2,688	139,968	~ 625000	~ 26041.7	~ 3720.238	~ 71.540	10,000,000
9	8	192	1,344	69,984	~ 1250000	~ 52083.3	~ 7440.476	~ 143.080	10,000,000
10	4	96	672	34,944	~ 2500000	~ 104166.7	~ 14880.952	~ 286.161	10,000,000
Total					~ 2506258.5	~ 209128.0	~ 29892.840	~ 571.723	100,000,000

Table 3: Order Mining Rewards Distribution Table

From the table above, the total rewards will incentivize Riders 24 Hours daily for ~ 571.723 Years before Courier fees will be the only source of income for them on the DePIN Network. Every hour with no completed orders, the Rider Contract burns the rewards for that moment. This process allows the Authenticators to trust and continually use the Foodware Network till it is strong enough to function without incentivizing them.

4.0 Tokens & Utilities

Here, we discuss the intended use of our Tokens and their Tokenomics. We want to draw notice that Token A is called *FoodGas Token*, and Token B is called *Foodware Coin*. These are the Crypto Assets to be issued by Foodware at Launch. Further utilities will be created for these assets either by Foodware Logistics Technologies or by Foodware Coin Development Foundation.

4.1 Foodware Coin

Foodware Coin is the Native Token of the Foodware Network. It serves as a product and services payment medium on the Food Marketplace. The Asset is used to incentivize Riders (Authenticators) on the Logistics DePIN Network as Order Mining Rewards, Content Creators (Service Providers) on the Food Education Platform as Content Creation Rewards, and Foodware Coin Contributors on the Crowdfund as Decentralized Product Subsidy.

Foodware Coin has a Total Supply of 1 Billion Units and is native to the Solana Blockchain. Below are its allocation specifics:

- Decentralized Product Subsidy - 100 Million (10%)
- Content Creation Rewards - 100 Million (10%)
- Order Mining Rewards - 100 Million (10%)
- Foodware Logistics Technologies - 200 Million (20%)
- Foodware Coin Development Foundation - 200 Million (20%)
- Ecosystem Fund - 100 Million (10%)
- Zero Hunger Fund - 100 Million (10%)
- Investors - 50 Million (5%)
- Founders - 50 Million (5%).

4.2 FoodGas Token

FoodGas Token is the Reward Token of the Foodware Network and is rewarded to Consumers (Confirmers) and Farmers/Vendors (Verifiers) for participating in the DePIN Network. It has no monetary value, but with Stablecoin or Foodware Coin at a fixed rate S , one can get it as discussed in Sections 2.3 and 3.2. It has an infinite Supply and is utilized only on the Foodware Network. It has two uses listed below:

- Decentralized Discount System: Consumers use FoodGas Tokens as Cashback Discount Vouchers on the Marketplace. Vendors use FoodGas Tokens as Proof-of-Sales volume to enjoy Commission Cutbacks on their Products.
- Food and Agricultural Education Content: Consumers and Vendors/Farmers can also use their FoodGas Tokens to access Educational Content of their interest as each Video will cost Z amount of FoodGas Tokens.

4.3 Why Solana

In this Subsection, we discuss our Network's DLT choice - Solana.

- Solana is a High-performance blockchain with a computational speed of 65,000 TPS and an Average transaction completion time of 0.52 seconds, making it suitable for our consumer App use case.
- Most Solana Smart Contracts are in Rust, an error-free and user-friendly language compared to C and C++. Solana has open-source libraries that Developers can refer to, thus making the development process easy.
- Solana Transaction fees are low compared to top EVM Chains, making it a prospect for Real-World Consumer Smart Contracts.
- Solana is highly interoperable with other Chains, especially EVMs with Neon Blockchain and Wormhole GMP Protocol. These protocols make a future Cross-Chain product integration possible.
- Solana increases in efficiency as its users and transactions increase, and with the introduction of the Firedancer Validator, we are sure that the Blockchain is indeed Scalable.

5.0 Conclusion

So far, we have explained how the systems will operate and how Blockchain and Cryptocurrency will ensure the security, longevity, and health of the Network through programmable money, near-instant transaction finality, Decentralized Authentication, and incentivization.

Foodware is a Disruptive Approach to the Real-World Application and Use of Distributed Ledger Technology and the first of its kind. We are Judiciously Connecting.

5.1 Appreciation

We thank our Parents for the Gift of Education, without which we wouldn't have gotten thus far. We want to Appreciate the Solana Foundation, Super Team Nigeria, and Solana Community FUTO for the opportunities, help, and support so far. They were pivotal to our migration from the Xahau Ledger to the Solana Blockchain. We appreciate every free thinker out there and their effort in making their society a better place.

5.2 Disclaimers

This Whitepaper is for informative and educative purposes only, and in no way should it be taken as financial advice. Foodware Logistics Technologies will not take responsibility for any losses due to wrong investment. Cryptocurrencies are volatile assets. We advise you to do proper research before making any investment.

Owning our Token doesn't give shares or authority in Foodware Logistics Technologies. Foodware reserves the right to make changes to this Document for a reason and no reason.

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