Wireless Internet Service Provider Tokens ($WISP)
Blockchain-Based Internet Service Incentive

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Abstract

The Internet is a fundamental infrastructure for modern life. However, large cable companies have failed to deliver their promised internet service, especially in underserved and rural areas. Wireless internet service providers (WISPs) have brought some light in bridging the service gap in the last few years. However, many WISPs struggle to scale due to limited access to infrastructure, lack of funding, and difficulty in recruiting. Considering all the existing problems in the market, we propose a blockchain-based incentive program that aligns the interest of internet service users, infrastructure providers, franchisee partners, and wireless internet service providers through the $WISP token ecosystem.

1. Value proposition

Wireless Internet Service Provider token ($WISP) will provide an incentive model to grow better internet service solutions in rural and underserved markets. Multiple benefits apply to each party.

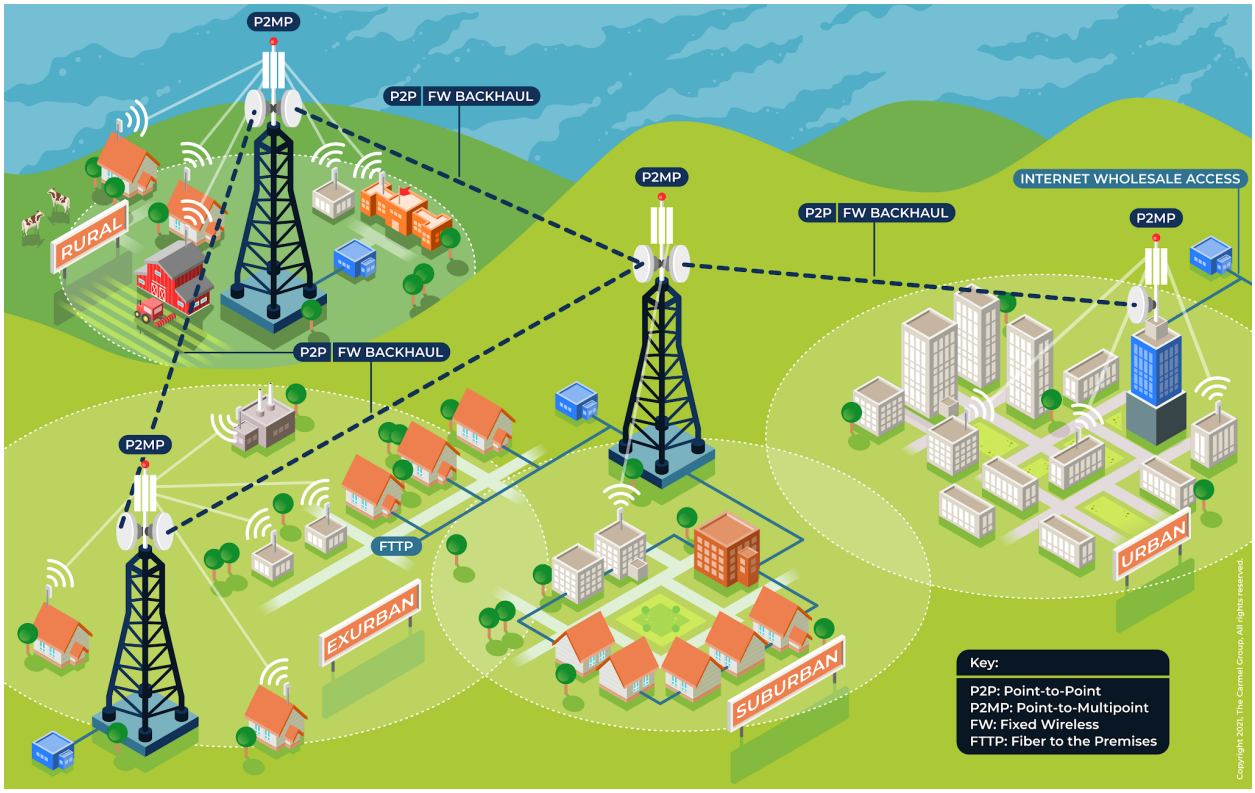
- Internet service user: more transparent internet billing and usage information, better privacy protection, flexible contract, more affordable rates than most ISPs currently provide, token rewards for being a loyal customer.
- Point of Presence (POP), tower, or infrastructure provider: earn a reward when providing connections to end-users.
- Franchisee Partner: shared cost and support expertise from an existing WISP company, and token rewards from the served area.
- Wireless Internet Service Provider (WISP): capital to scale, smart billing contracts, flexibility for partnership, and low transaction costs.

2. Introduction

The Internet is a fundamental infrastructure for modern living, working, and economic growth. Since the Covid-19 pandemic, people's reliance on the internet has increased even more. "As of January 2021, there were 4.66 billion active internet users worldwide - 59.5 percent of the global population. Of this total, 92.6 percent (4.32 billion) accessed the internet via mobile devices". [1]

In the US, the majority of internet service is provided by large cable companies like AT&T, Xfinity, Spectrum, Cox, Verizon. The high upfront capital cost has been a huge barrier for small companies to enter the competition. Unfortunately, the result of lack of disruption to those big corporations acting as quasi monopolies is poor or no coverage in rural areas and terrible customer service for everyone. As people continue to move out of cities and move into more rural areas due to the pandemic and remote working, the need for high-speed and low-cost internet in rural areas has been greater than ever. However, the digital divide between urban and rural areas remains significant.

Fortunately, wireless internet service providers (WISPs) provide great alternatives for many less populated areas where cables are too expensive to reach or not practical to reach like on a lake, or in forests. "WISPs typically rely upon a direct, line-of-sight connection from the access point (normally on top of a tower or tall landmass) to the roof of your home", which is a lot easier to set up than cable and provides very good speeds when access points are within 3-5 miles from where you live. [2]. Figure 1 shows how wired ISP (internet service providers, aka cable companies) vs WISP are being used.



Data source: https://www.wispa.org/what_is_a_wisp.php

Figure 1: Typical Fixed Wireless Network Architecture

Despite the growth in WISPs in the last decade, most WISPs stay in small local areas where the founders live. Many WISPs struggle to scale to large sparse areas and raise capital to expand. This paper will review the challenges current WISPs have and outline a new solution that creates a transparent blockchain-based marketplace for internet service users, infrastructure providers, franchisees, and existing WISP companies.

2.1. General challenges

"Building broadband infrastructure involves market assessment, planning, technology choices, funding, permitting, site acquisition, construction, customer acquisition, maintenance and repair, and customer service."[3] From the study with multiple WISPs in the market, common challenges are: access to high-speed fiber backhaul, vertical infrastructure, access to funding, and resources to hire and train qualified technicians.

2.1.1. High-speed fiber backhaul

Last-mile connectivity is only as good as upstream connectivity. In rural areas, the biggest challenge is the lack of proximity and access to regional fiber, assuming it exists. The U.S. has millions of

miles of fiber weaving across the country like interstate highways, but for data. [4] However, fiber line is very expensive to build, from between $8,500 and $10,000 per mile for a 12-strand single-mode fiber optic to $20,000 and $30,000 per mile for a 96-strand single-mode fiber optic. [5] Therefore, most fiber lines only go through cities and populated areas. Not all rural areas or areas that need to be served have fiber lines nearby or easy to access.

2.1.2. Vertical infrastructure

"Microwave backhaul and fixed wireless access (FWA) can cover the greatest distance with the highest throughput when they have clear line-of-site which generally means they need to be mounted to some form of vertical infrastructure and/or on top of hills. Towers can be reused (on-going rent) or built (upfront capital), but because rural business cases are very cost-sensitive, it is important to take advantage of existing vertical infrastructure whenever possible, including water towers, church steeples, barns, and small towers built for precision agriculture telematics."[4] To find the cost-effective "towers" or high points, WISPs often have to chase owners for approval. If the owner is a city or county, e.g. for a municipal water tower, it can take a long time for the approval to be granted.

2.1.3. Funding

Developing a WISP in a new site will need upfront capital for infrastructure and equipment, ranging from $50,000 to a few hundred thousand dollars. On top of that, there are ongoing operation costs like rent, marketing, installation labor, software subscriptions, etc. However, the upfront capital takes up the majority of the cost. Many WISPs are family-run small operations and "do not have large cash balances, fixed assets that can be collateralized for a loan, or sufficient accounts receivable to justify factoring." [4] While the federal government has various programs to help fund rural expansion, many WISPs "felt like they would not meet the qualification criteria, such as providing a bank letter of credit, and could not effectively support the ongoing reporting requirements." Also, many WISPs just don't have the manpower and expertise to go through the tedious government application paperwork.

2.1.4. Recruiting and training

Since WISP needs some local presence for installation, tech support, etc, it can be very challenging to find the right people when expanding to a new area where founders do not live. Technicians need some basic radio knowledge and cannot be afraid of heights, for installing devices on roofs, towers, etc. Without excellent connections or incentives, it takes time to hire and train people, especially in the current labor market.

3. Our approach: blockchain-based incentive program

Traditional nationwide ISPs often have monopoly advantages, yet cable companies are some of the "most hated companies in America" according to Consumer Reports. Why? Poor customer service, under-delivered internet speed, routine price hikes, hidden fees, untrustworthy sales representatives, the list goes on and on… WISPs come along and help bridge the gaps ISPs ignore, yet many struggle to scale due to limited access to infrastructure, lack of funding, and difficulty in recruiting. Considering all the existing problems in the market, we propose a new approach: incentive-based cash flow economics for WISPs leveraging blockchain technology.

A new unit of exchange, the $WISP token, is introduced to the WISP company. The use of a deflationary token dramatically changed the dynamics of the WISP's system. $WISP is a token for the decentralized service exchange. $WISP connects internet users, infrastructure providers, the WISP

company, and potential partners or franchisees, creating a more efficient marketplace. The token is derived from internet service use.

When users pay for internet service, the fee essentially consists of the cost of fiber/tower/high building space rental (aka infrastructure cost), radio/router devices installed for each customer, and labor, maintenance, service provided by WISP companies. A large portion of the customer's monthly bill to the internet provider is just a bypass since the ISP has to use it to pay for infrastructure and hardware costs. In the traditional model, WISPs have to put down the capital to get the backhaul connection to the fiber line and rent expensive towers upfront before any customer starts paying. WISPs normally wait until several customers are interested in getting internet service, before being able to open a market because too few customers will not break even on the cost or take a very long time to get the capital return. Often the wait time may result in losing some of the initial customers who need the service because they choose other services. There can also be marketing costs involved once the infrastructure is set up in a location as the WISP will want to have additional customers in the area sign up to increase profit and returns.

3.1. Smart contracts to leverage future cash flow

What if we can alleviate some of the upfront capital burdens by leveraging future cash flow? Instead of paying all backhaul and tower costs in cash upfront, a WISP can leverage some existing assets like real estate or cryptos to get a decentralized finance (Defi) loan from those infrastructure providers with an asset as collateral and promise payment from future cash flow in smart contracts. The low transaction costs from NEAR made cheap microtransactions possible. Every time each customer pays, the payment (likely portion of the payment) will directly go to the infrastructure provider per written smart contracts. Some AI anomaly detection algorithms can be built in the contract, which triggers a warning or collateral liquidation when cash flow is significantly reduced and no payment from the WISP to make up the difference. See Figure 5 for a simplified cash flow process. This will not completely erase the upfront capital but likely will make the barrier much lower.
(PS: Negotiation with tower or fiber companies to get in the ecosystem and doing cash flow "loans" would likely have a higher chance to succeed when there is some momentum from an individual user or small company adoptions. By then, those big companies might see the power of the $WISP token and fear of being left out.)

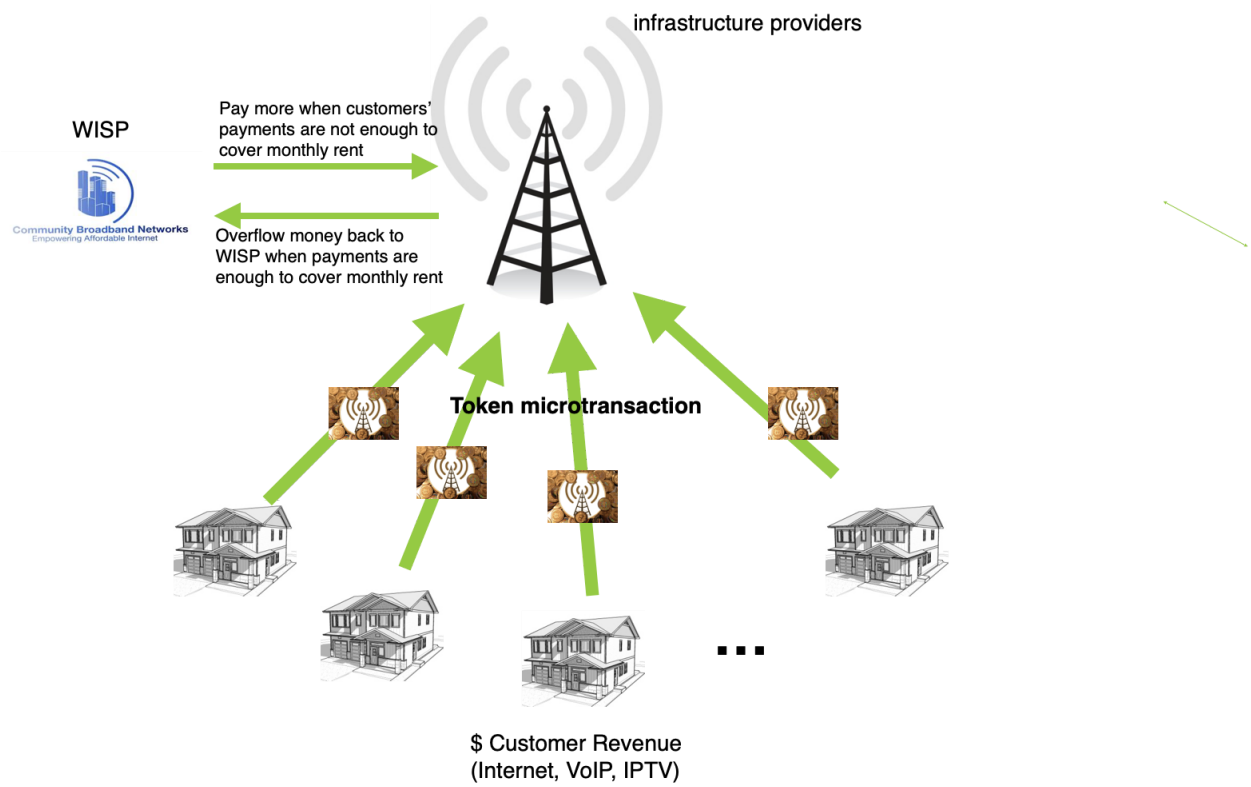


Figure 5: Cash flow payment process

3.2. Smart pricing

When the WISP just starts at a location, it is normally because some people in that area are very interested in the service but the total number of customers is low. Since the fixed capital cost is the same no matter how many customers the WISP has (assuming no more additional backhaul is needed even when user numbers grow, in this case, and variable costs like a router for each added new customer is the same), the cost per user customer is very high when there are few customers in the area and exponentially going down as the customer base grows. In the traditional billing to the customer, the customer is paying a fixed amount (or just goes up over time!) every month regardless of how many people are on the network. This is easy for marketing and billing accounting but may not be the more efficient way to run a business. Since in the beginning, the service cost is very high, if we charge for a higher price and gradually go down in price as more customers get on board, the break-even point for offering service can be a lot lower. The total profit (total revenue minus total cost) is also higher since WISP will start to make money earlier. The price drop as more users sign in to the service can be compensated by the reduction in marketing cost. See Figure 6 for a simplified illustration.

Note:

- *This graph does not consider the initial equipment installation cost at the customer site, which is a fixed one-time cost and does not change the overall shape of the graph.*
- *Cost of a customer not considering marketing cost. If marketing cost is added, the cost per customer function will change from the convex function (concave up) to a more concave function (concave down), since more marketing effort is needed to expand the network, which makes breakeven customer numbers even larger when using fixed pricing.*

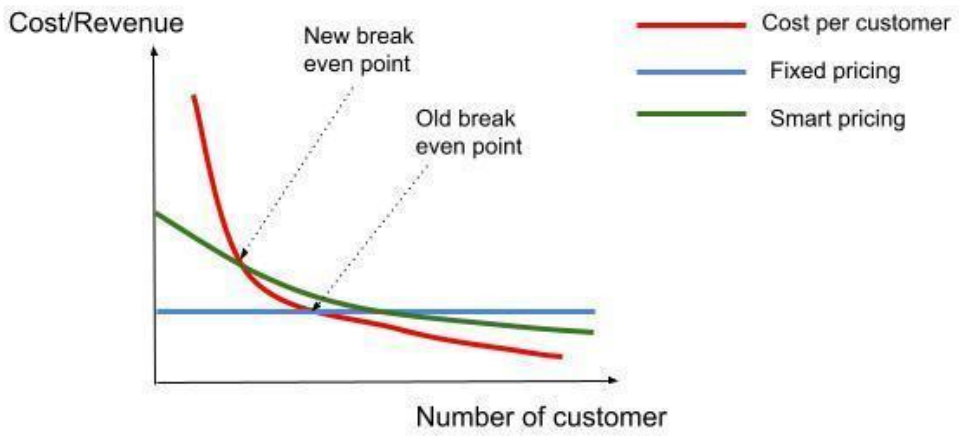


Figure 6: Cost/Revenue vs Number of customers relationship

You might argue this pricing mechanism penalizes early adopters and is bad for expansion. However, this is not always true if combined with other mechanisms. Firstly, the people who want to get service in the very beginning typically have a huge need for the service. For example, someone who lives in the middle of the forest has only low-speed DSL service and is still paying $80/month. If a WISP can offer 100MB download and upload speed, this user will more than likely jump in the service even if the price is $80/month or more. In summary, early adopters have higher pricing points and are less sensitive to price compared with the service itself.

Secondly, we can provide more rewards for customers who get in early through the $WISP token system. The longer customers have the service and less user base is in the market, the more token rewards they get. The $WISP token can later be used toward bill payment and data credit offered by the service provider. Also as an early adopter, if the customer refers additional people to join the network, the customer will receive more tokens as others join through the WISP's affiliate marketing program.

Once we have a decent user base size to cover the fixed cost, the cost per customer can go down dramatically therefore the price can gradually go down as well which is what all customers want. Lower internet bills as the user base grows also incentivises existing customers to market the service to more people, and expand the network. The self-promoting marketing and user growth form a positive feedback loop and significant marketing costs can be saved.

3.3. Transparent billing

Since customers are paying with smart pricing and smart contracts specify how much is going to infrastructure providers and other 3rd parties, there is no way to use hidden fees or false claims to scam the customers. If a provider cannot deliver the quality of internet it promised, billing credit will automatically be issued to customers through smart contracts. Lastly, smart pricing systems will promote lower prices as service continues and the network grows, as opposed to cable companies who frequently increase billing after the contract period.

3.4. Talent pool

Finding good employees is always challenging, especially since Covid. When a WISP expands to a new area, it will likely need some local people to help with installation, customer support, PR to reach out to the community, etc.

Local talents get NFT certification after going through skill training. Then every time a job is being performed, an NFT will be added to the employee's wallet. This provides a trackable "experience" history with feedback directly from customers, which cannot be sugar-coated. The employees can easily show their experience to future employers upon leaving the position. Employees have options to be paid in Fiat currency or token or a mix of both.

Full-time employees can take a long time to hire and train. A pool of temp workers or handymen (contractors for short) available from the local area can reduce the response time and help foster the idea of a locally owned network. Contractors can earn tokens and NFTs per-job base. Therefore WISPs can easily identify the skill levels of contractors, which alleviates the unknown and unreliable problem of hiring contractors.

3.5. Reward metrics

$WISP tokens can be earned by participating in the $WISP ecosystem and each party has different ways to earn rewards. The factors that affect reward metrics are listed below.

- Internet service users:
    - Service duration.
    - The number of customers being served in the area.
    - Payment history. Percent of total days being late for payment, percent of payment bounce, etc.
    - Number of referrals
- Infrastructure provider:
    - The number of days providing service to the network.
    - The number of connections to end-users.
    - Connection quality. Downtime, signal interference, etc.
- Franchisees or partners:
    - Size of areas being served.
    - Payment from users in the serviced area.
    - Quality of service.
- WISP:
    - Payment from internet service users.
    - Franchise fees.
    - Feature development that can serve users, franchisees better.

3.6. General use case

The $WISP token will, at least in the early stages, specifically tie to wireless internet service and its partners. However, in the future, the system might be able to apply to many internet providers or even capital-intensive businesses overall. Imagine installing solar panels or wind turbines with zero down and using future electricity generation to automatically pay back the equipment provider through smart contracts. Or a traditional manufacturing company can "finance" equipment from future sales as each part (a portion of the sales price) being sold is gradually paying back the equipment provider directly. An equipment provider can take some assets from the manufacturer as collateral. If the manufacturer is not

selling parts as planned (with exceptions of certain conditions), smart contracts will trigger sales of a certain asset. Using our $WISP business model, many small companies will be able to get into capital-intensive businesses where the business incentives are initially low and the barrier of entry is high.

4. Tokenomics

$WISP token is a deflationary ERC20 utility token. $WISP token can be used to pay for internet service, data credit, TV service, phone service, get priority in customer service, and discounts in hardware like routers, TV boxes, etc. under WISP's network (for now; future state can have more networks be eligible for service), and governance voting power on the $WISP network. By staking the $WISP token, the capital will be used on more infrastructure development (aka running a node in the network like building a tower, setting up a backhaul fiber connection), which in turn generate more revenue (and more token reward) for the network. The reward will be split among stakeholders based on the amount they stake. Staking APY currently targets 10%-20%.

Customers can earn $WISP tokens by using the WISP service (and other partnered ISPs in the future). Owners who have access to towers, tall buildings, or infrastructure needed by WISP for expanding network coverage can earn additional token rewards. Franchisees who want to run a local network to expand WISP service can mint their tokens with a portion going to WISP central to pay for the support. Tokens are transferable, tradable, and redeemable.

4.1. Token launch summary

Our goal is to raise a minimum of $600,000 USD for seed capital. The following numbers are the best effort estimate as of March 1, 2022.

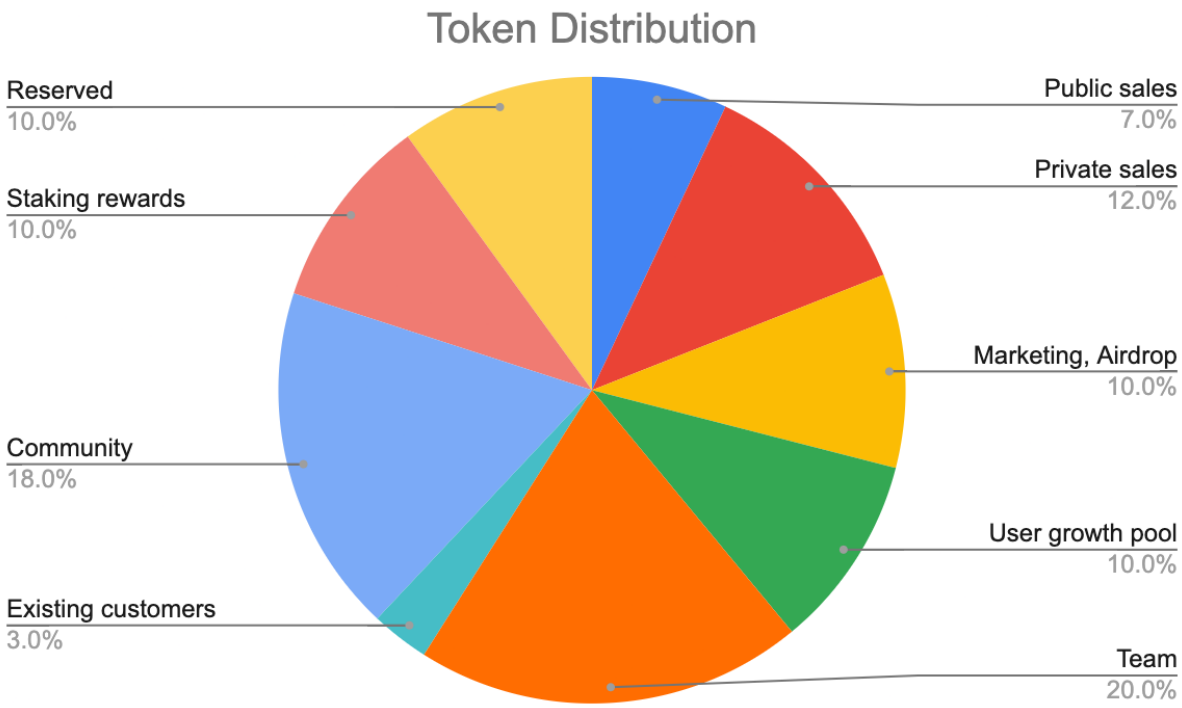
- Total supply: 100 million $WISP
- Maximum supply: 1 billion $WISP *
- Circulating supply: NA
- Exchange rate: 1 $WISP = 0.1 USD equivalent to token (convert to $ETH at time of purchase, this may change with ETH exchange rates. 1 $ETH = 30,000 $WISP, This was decided by taking a 60-day weighted average of the price of ETH when the sale started.
- Launch date: Q4 2022
- Token contract address: TBD (Published through various channels 48hrs before crowdsale launch date).

* As the network scales, we will need to flow more tokens into the ecosystem. These tokens will either come through franchisees, acquisitions, airdrops, or other future token allocation methods.

4.2. Token vesting schedule

Wallet	**Supply Number**	**Percent (%)**	**Lock-up Period**
Public sales	5,000,000	5	10% TGE, monthly vest over 6 month
Private sales	14,000,000	14	6 month cliff, monthly unlock over 1 year

Marketing, Airdrop	10,000,000	10	3 months cliff, monthly unlock over 1 year
User growth pool	10,000,000	15	8 months cliff, monthly unlock over 2 years
Team	20,000,000	20	12 months cliff, monthly vest over 2 years
Existing customers	3,000,000	3	3 months cliff, monthly vest over 1 year
Community	13,000,000	13	9 months cliff, monthly unlock over 1 year
Staking rewards	10,000,000	10	2 month cliff
Reserved	10,000,000	10	Varies
Total supply	100,000,000	100	



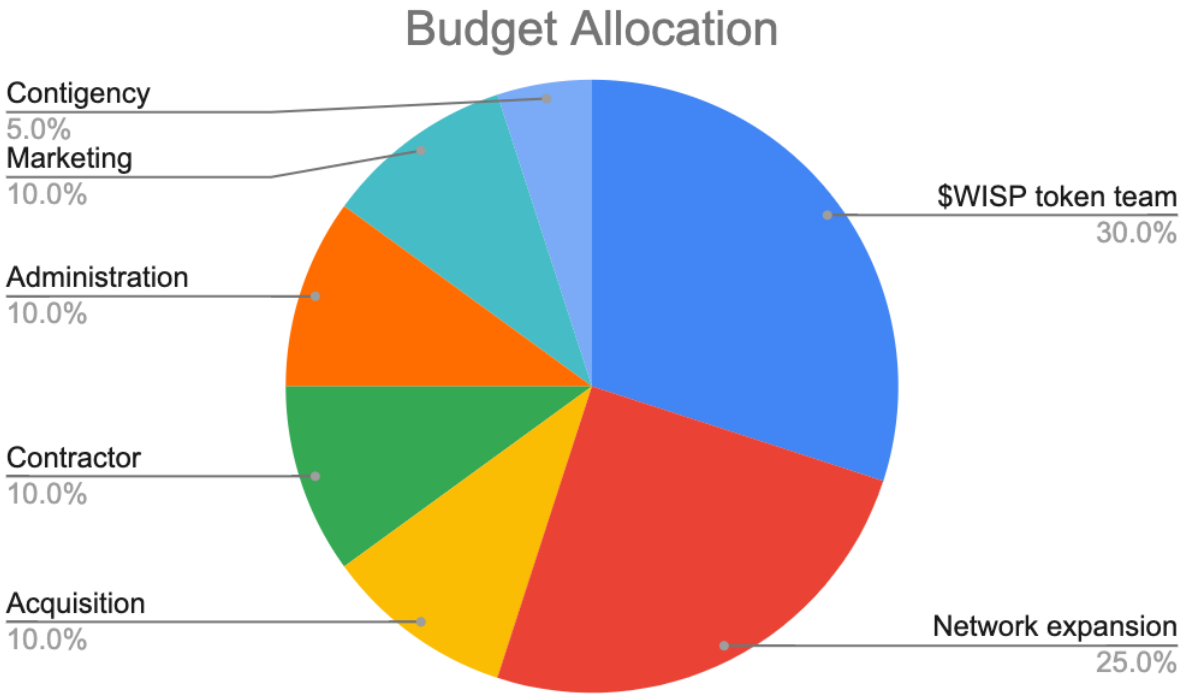
4.3. User growth pool

- Existing WISP customers can get their tokens by connecting their wallets to the app and claiming their tokens.
- Early adopters to the partnered WISP service within the user growth period can earn a sign-on bonus token.
- $WISP received as a bonus reward can only be used within the $WISP ecosystem for value-added services.

- Any token not being used in the user growth pool will be rolled over to the general user pool after the expiration date.

4.4 Budget allocation:

- $WISP token team: 30%. Develop the token integration to WISP's existing network. Add developers, designers. Fees for the token to add on exchanges, transaction cost. Application and website design.
- Network expansion: 25%. Growth capital for equipment, labor for install, real estate for crucial tower or operation location.
- Acquisition: 10%. Acquire other small WISPs as the team sees fit.
- Administration: 10%. Legal, accounting, security, paperwork, call center, CRM subscriptions.
- Marketing: 10%. Expanding the awareness and adoption of wireless internet service and the $WISP ecosystem among consumers, infrastructure providers, potential franchisees, and partners.
- Contractor. 10%. 3rd party providers offering network topology consulting, installation, software development, PR, partnership, etc.
- Contingency: 5%. Set aside for any unforeseen costs.



5. Roadmap:

- 2021 Q4: Market research and whitepaper.
- 2022 Q1:
    - Idea validation.
    - Seed funding.
- 2022 Q2:

    - Wallet and token integration to current customers on Devnet. Token reward amount being calculated by $WISP reward matrix.
    - Smart contract for wireless service.
    - Test parallel web3 application with existing web2 portal in one location.
- 2022 Q3:
    - Expand token utilities. Accept token for data credit, wifi credit, governance voting power.
    - Migrate web3 features to Testnet.
- 2022 Q4 and beyond:
    - Form $WISP DAO to make decisions on expansion plans.
    - Franchisee playbook. Set up training, equipment spec, shared central functions, token reward structure.
    - Expand token utilities through partnership and integration.
    - Integrate with hardware companies like radio and router providers.
    - Launch $WISP token on exchanges.

6. Competitive analysis:

6.1. Helium

"Helium is a decentralized telecommunications network that uses LoRaWAN technology to connect Internet of Things (IoT) devices to the internet. Also known as The People's Network, Helium has reached a tremendous milestone of over 150,000 hotspots deployed globally in just over two years. This marks it as the largest contiguous wireless network owned by its participants, not a single company." [6]

Helium has been a wireless company focused on the IoT network for 8 years and only added the crypto features to add incentive to adoption in 2018. Since they started Helium token ($HNT), the number of Hotspot in the Helium network has exploded. Miners make money from hosting hotspots which at the same time provide coverage for the IoT network. The hardware business is generally hard to grow due to capital and fixed costs, however, Helium showed us a new way to grow the network with the right user incentives. Helium has been attracting large partners like DISH, FREEDOMFI, and GIGSKY into its 5G ecosystem, which helps its expansion tremendously.

However, Helium is focused on the IoT network, which has small packages on transmission and low requirements for speed and throughput. Due to limited storage size on Hotspots and Routers, full blockchain cannot be stored on each device as the size grows and each block is limited to 1MB for now to avoid synchronization and halting issues on the network. Also since Helium is using their blockchain through proof of coverage, there is some maintenance and overhead involved. $WISP token is for internet service providers and leveraging the existing scalable L1 blockchain. $WISP token can be used as data credit similar to an IoT company paying to use the Helium network per data package except in the $WISP system the data size is way bigger and wireless service is from radio signals.

"Helium showed how effectively hardware businesses could bootstrap expensive two-sided marketplaces with the right user economics." [7] However, not everything needs to be decentralized on the chain. Centralized service is efficient when the data is large and needs to be accessed a lot. Decentralized service is good for small, high-value, censorship resistance transactions. We can add token incentives to existing wireless internet service and use a combination of web2 and web3 protocols to expand our business.

6.2. W-WIFI

W-WIFI offers high-speed connection in collaboration with KMT's network and blockchain's decentralized infrastructure with the $WIFI token. KTM is an internet service company in South Korea. Their website says "The W-WIFI network is a blockchain-based wireless mesh network that enables smart devices to connect anywhere in the world. Based on the mobile hotspot network (MHN) model, decentralized internet access can be provided to users at home or on-the-go."[8] However, there are no details on their project on the website. Reading through its poorly written, confusing whitepaper, it looks more like W-WIFI partnered with KTM and issued a $WIFI token to raise money. They want to collect all the user data KTM can access as an internet provider and sell it to advertisers.

We don't see W-WIFI as a viable competitor as it is now, but good to know other ISPs are getting on the blockchain and tokenization trend.

6.3. Other WISPs

Most WISPs we found are very small and local and many are family-run to support the area the founders live in. So far we haven't seen any WISPs have any functional web3 features or even token launch. However, with blockchain and web3 going mainstream, there will be WISPs shifting towards it. Ryan Selkis mentioned "Andrena and Althea (pre-tokens!) are tackling the internet service provider layer by enabling communities to set up hotspots and antennas that bring internet access to nearby towns" in Crypto Theses for 2022. I haven't seen any crypto movement from Andrena but Althea has some big activities. [9]

Besides expanding wireless service to Warner Valley in southeastern Oregon or the hillsides of northeastern California and multiple rural areas, “Althea’s decentralized structure enables users to participate in hosting infrastructure and earning revenue, leveraging a community’s existing assets, and making it possible to build to the furthest frontier. ” Althea plans on building their own blockchain in 2022, “creating a decentralized, secure, and reliable platform for Althea’s pay-per-forward bandwidth market.” [10] Althea blockchain aims to “not only support the metering and billing aspects of Althea’s networks but also explore new models of lending and funding infrastructure with fiber infrastructure” [9], similar to what we are doing. Looks like Althea is a bit ahead of us with their blockchain initiative but internet service is a big field that can have multiple players. There are hundreds of thousand cities in the US alone let alone all the developing countries and underserved regions. The plan and momentum from Althea does align well with the incentive model outlined by $WISP token.

6.4. Other national ISP

Big nationwide internet providers like AT&T, Xfinity, Spectrum, Cox, Verizon will continue to play a big role in the internet service market in the foreseeable future. However, due to the high breakeven point on their operations, we don't think they will compete with us in rural areas any time soon.

7. Conclusion

We have proposed a blockchain-based incentive program for WISPs using $WISP tokens. Limited access to infrastructure can be solved by using Smart contracts to leverage future cash flow; Lack of funding can be solved by smart pricing; Difficulty in recruiting can be solved by building a local talent pool. Furthermore, smart contracts and transparent billing resolves the chance of internet providers playing games with price hikes, hidden fees, and under-delivered service.

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