DHS

DECENTRALIZED WIFI SHARING

WHITE PAPER

DECENTRALIZED WIFI SHARING

CATALOG

1. EXECUTIVE SUMMARY

1.0 EXECUTIVE SUMMARY

The internet has changed how businesses operate and how consumers behave. Modern lifestyles have evolved to revolve around the internet. We use the internet to stay updated on the latest news, communicate with people, watch videos, play games, and look up directions. We can send data from one country to another in a matter of seconds, allowing business to be conducted from any corner of the world and information to go global in real time.

With the increasing reliance on internet for almost every aspect of our daily lives, Wi-Fi and mobile data have become a necessity. But despite the explosive growth and reliance on wireless connectivity, a portion of world's population are still unable to access internet. Not only that, even users with internet connectivity are restricted by data limits and borders, where users are penalized with high data overage fees and astronomical roaming fees. Even with the current state of free Wi-Fi hotspots, users are obstructed by annoying advertisements, signing in with personal information to access the free internet connectivity, and sometimes even risking getting their devices infected with malware.

DWS hopes to solve these problems through blockchain technology. DWS hopes to foster a global community of Wi-Fi owners, users, and advertisers through establishing Wi-Fi as a tradable asset, incentivized through DWS tokens.

DWS Protocol Foundation Limited (DWS Protocol), based in Singapore, was set up in 2018 to revolutionize the global Wi-Fi sharing ecosystem with blockchain technology. DWS hopes that through this, our community can make instantaneous and secure Wi-Fi connectivity accessible all over the world.

2. PROJECT BACKGROUND

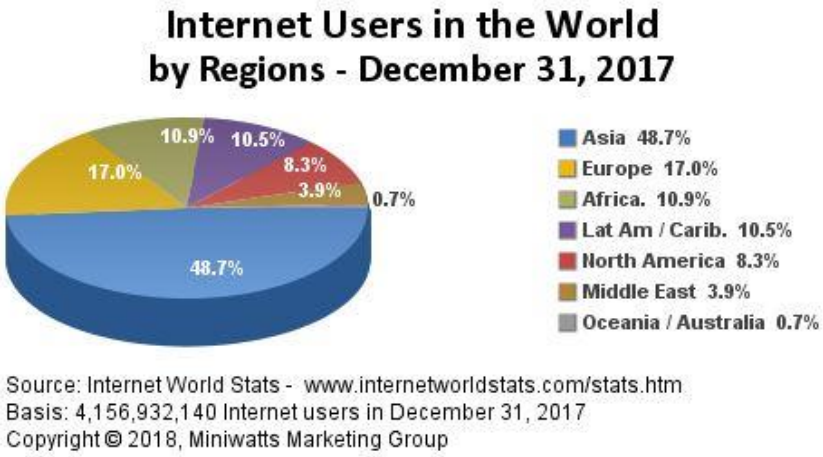
2.0 PROJECT BACKGROUND: WI-FI

Wi-Fi is a wireless networking technology which uses radio waves to provide network connectivity. In simpler terms, it is also known as the wireless connectivity that allows mobile phone, laptop, or tablet device to be connected to the internet wherever you are.

With a wireless transmitter or hub, devices can receive information from internet via Wi-Fi. A router transforms information into radio waves and emits it, creating a small area around itself. Devices will be able to receive these radio signals within the small area if they are fitted with the relevant technology or suitable wireless adapters. This small area is known as the Wireless Local Area Network (WLAN). As radio signals are not very strong, Wi-Fi signals do not travel very far.

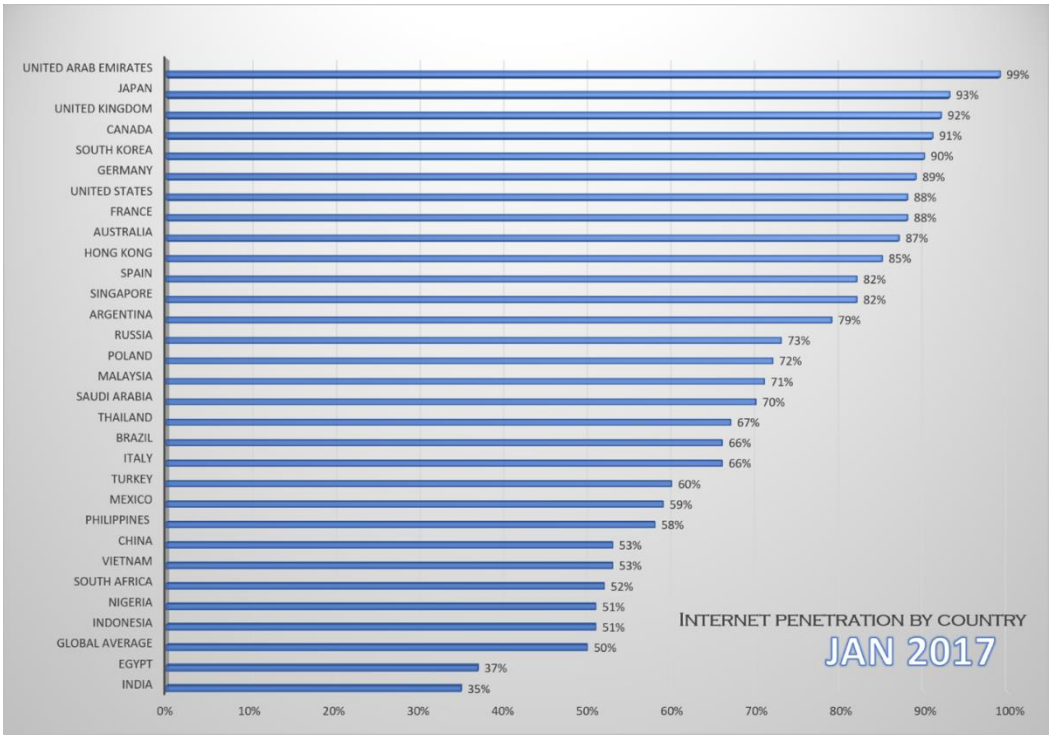
Mobile phone technology has advanced rapidly over the past few decades. With the invention of the smartphone, we are no longer bound to our computers when we want to access to the internet. Instead we can use our mobile phones to stay online anywhere and everywhere all the time.

With the rise of the internet of things, we are connected to the internet through countless gadgets we use for every aspect of our lives. But even as internet technology development surges forward, over four billion of the world's population still have no access to internet while those who have access to it are required to pay unreasonable fees for it.

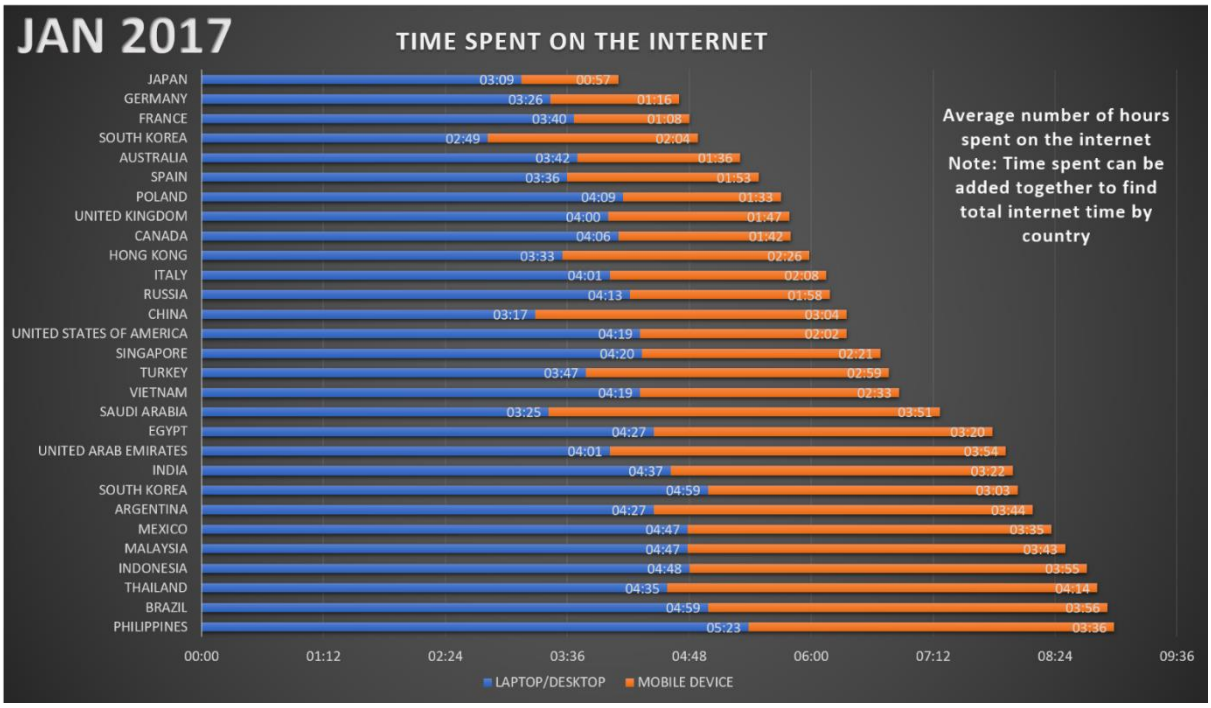


Based on the UN Report on Global Broadband Progress from September 2017, the world's internet users totaled 3.58 billion. Almost 50% of internet users come from Asia, making up a huge share of global internet users.

Therefore, Asia has a great demand for wireless connectivity. In Singapore, at least 82% of the population have access to the internet. Internet penetration is close to 100% in United Arab Emirates, which ranks number one. Internet penetration remains low on South Asia and Sub-Saharan Africa where fewer than one in three people have access to the internet.



The global average of internet penetration is at 50%, which means half of the world is still in the dark when it comes to internet connectivity. Japan, Canada, United Kingdom and South Korea have high internet penetration, with rates sitting above 90%. Seven countries are well above 80%.

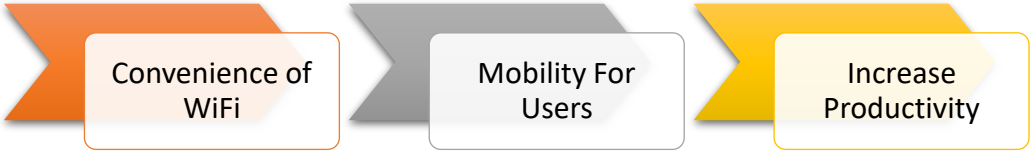


When it comes to the average number of hours spent on the internet, nine countries, mostly developing countries, spend more than eight hours on the internet each day. Internet use in these countries is primarily through laptop/desktop. The Philippines averaged the highest number of hours on the internet, with at least 5 hours on the laptop/desktop and three hours on the mobile phone. Brazil, Thailand, and Indonesia follow closely behind.

2.1 Advantages of Wi-Fi

The internet plays a large role in driving economic and job growth in developing economies and sustaining economic and job growth in developed countries. However, lack of Wi-Fi coverage restricts worker mobility. By increasing accessibility to internet anytime anywhere, users can remain connected to internet constantly, giving them more freedom of movement and economic opportunities. This creates a ripple of productivity as users are able to access and complete their required work.

Based on the statistic above, Singaporeans spend an average of four hours on internet via their laptop/desktop. This also shows that Singaporeans are spending more time on their laptop/desktop rather than their mobile phone.



Unlike wired networks, a sudden increase in the number of users would not require any additional wiring. This provides flexibility to users as well.

Wi-Fi functionality is easy to integrate into mobile computing devices and is now being used worldwide in devices such as PCs, laptops, cameras, printers, and more.

2.2 Increase in Market Demand

The global internet service provider industry (GISP), the main source behind Wi-Fi's spread across the world, is growing at breakneck pace. With the rapid advancements in technology, infrastructure, and services, multiple solutions for internet accessibility in our daily lives and businesses have emerged. These solutions have modified businesses operations and user behaviors.

The figure below shows just how rapidly GISP companies are growing. It also entails the centralization of Wi-Fi companies, as more business will go to these select GISP companies.

The diagrams below depict two growth trends. The first one is the growth trend of Wi-Fi, both for public and private Wi-Fi Network. The next graph extrapolates the growth of Global Internet Service Provider (GISP) companies in the next few years.

Diagram 1: Growing number of Public & Private Wi-Fi globally.

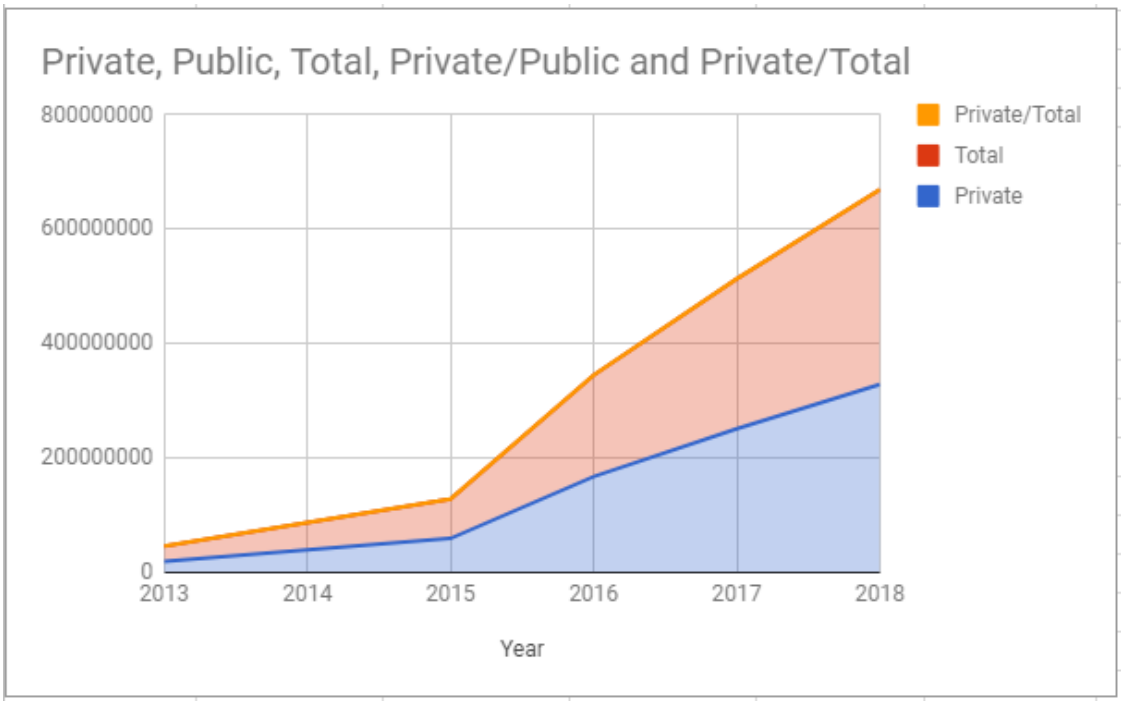
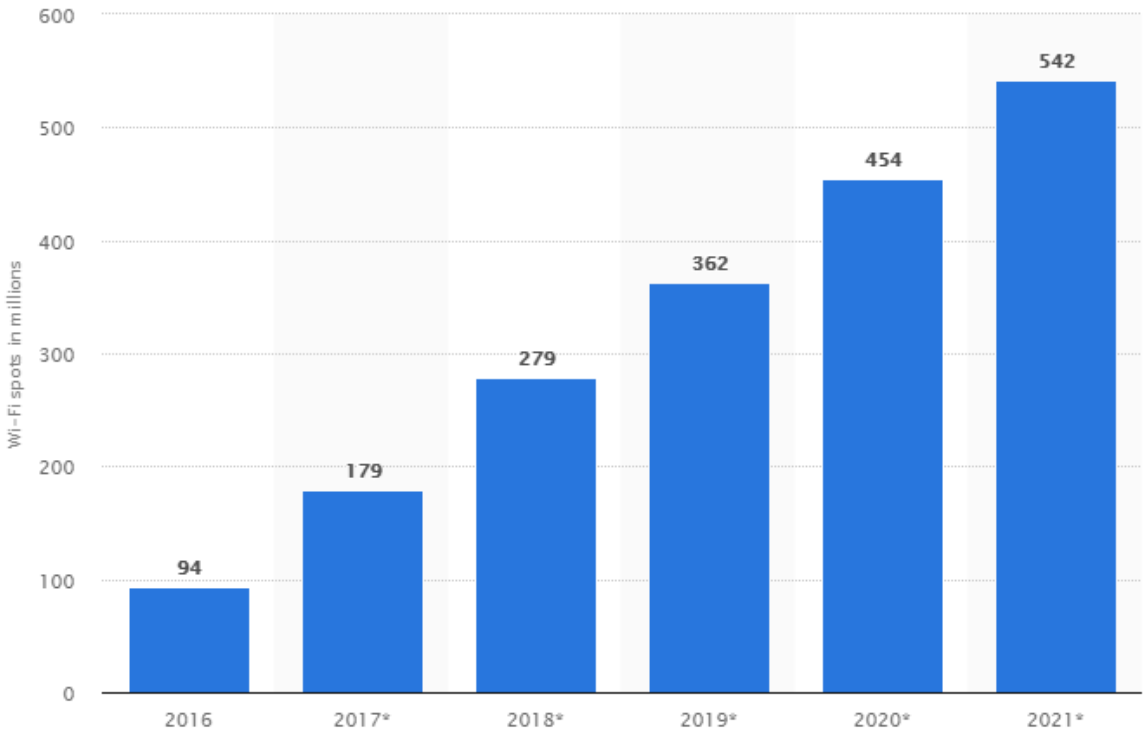


Diagram 2: Growing number of Global Internet Service Provider '000

In every corner of the world, Wi-Fi remains indispensable for users of mobile phones and portable electronic devices such as tablet and laptops. Even with advanced mobile data network connectivity, more and more users are relying on public hot-spot network for Wi-Fi. Today, there are roughly 279 million Wi-Fi hotspots available around the world. The graph below depicts that these numbers will continue to rise steadily. By the end of 2021, there will be an estimated total of over 542 million Wi-Fi hotspots all over the world.



3. CURRENT ISSUES

3.0 PROBLEMS & DISADVANTAGES OF WI-FI CURRENTLY

With the rising popularity of Wi-Fi connectivity and hotspots, there are many challenges that come from the centralized Wi-Fi provider model that exists currently.

Lack of Security:

When it comes to the internet, security is always at the forefront, with potential threats of data breach, viruses, and other threats. Full security is often difficult and challenging to achieve primarily because Wi-Fi connection is wireless in nature. It requires proper security authentication protocols and configurations. To combat this security issue, wireless networks may choose to utilize some of the various encryption technologies available. Some of the more commonly utilized encryption methods, however, are known to have weaknesses that a dedicated adversary can compromise

Limited Range:

The typical range of a common 802.11g Wi-Fi network with standard equipment is on the order of tens of meters. While this kind of range is sufficient for a typical home or small space, it will be insufficient for a larger space. In order for users to obtain additional range, repeaters or additional access points will have to be purchased and installed. This results in additional costs, which can quickly add up.

Reliability of Connection:

Like any radio frequency transmission, wireless networking signals are subject to a wide variety of interference, as well as complex propagation effects that are beyond the control of the network administrator.

Wi-Fi devices are fully functional when they are within the range of AP and receiving good signal strength. Wi-Fi access is limited to about 30 to 100 meters (i.e. 100 to 300 feet).

Limited Speed:

The speed on most wireless networks (typically 1-54 Mbps) is far slower than even the slowest common wired networks (100Mbps up to several Gbps).

Low Data Transfer Rate:

Data transfer rate decreases (to individual computer) when number of clients or computers connected with Wi-Fi network increases.

Resource Underutilization & Redundancy:

As predicted by www.ipass.com, the number of worldwide Wi-Fi hotspots is estimated to reach over 328 million by end of 2018, which means on average, every 23 people globally will share one Wi-Fi hotspot. This figure is expected to be much higher in developed regions. Considering the rapid development of 5G technology and market penetration of current 4G technology, each WI-FI router would be expected to have higher capacity to support a bigger user base and geographic coverage.

From a resource utilization perspective, this is a huge underutilization of Wi-Fi. 92.5% of global Wi-Fi hotspots belong to private households, with only 2-3% belonging to business locations. Professionals only spend 8-16 hours daily at home, half of which are for sleeping. Similarly, 50%-70% of the time, an office is empty. This results in hardware devices and data plan underutilization, during off-peak hours.

On the other hand, peak-hours at business locations may result in internet “traffic jams” due to high demand of data volume and speed. Thus private Wi-Fi subscribers would probably choose their data subscription based on the bottleneck during peak-hour, resulting in more unused Wi-Fi capacity during off-peak hours.

Therefore, we believe a more flexible and dynamic WI-FI network is necessary.

3.1 Challenges Faced by Wi-Fi Internet Users

Availability of Wi-Fi:

One of the most common challenges consumers face is a lack of open Wi-Fi networks available to connect to. For many places in the world, especially in developing countries, the availability of internet, let alone Wi-Fi, is scarce. Those that are available are usually private and locked, rendering them impossible to connect to.

Even in places with fast mobile Internet infrastructure such as LTE there are some common challenges: LTE Internet has limitations on the maximum tra-c, speed, and it is generally more expensive. For the average tourist or traveler, using LTE Internet in roaming is prohibitively expensive. And as such, they are the first group of people who are likely to search out for the free Wi-Fi hotspots.

Cost of Using Internet:

In the real world of centralized Wi-Fi network access and usage, cost will always be a disadvantage for users. Wi-Fi networks are usually offered by telecom companies who will pass the cost onto the users. Because Wi-Fi is so expensive, users tend to not share their Wi-Fi willingly.

Rigid Billing Process:

Most operators charge individual Wi-Fi service subscribers on a monthly/yearly fixed base fee plus incremental charge model. The monthly cost of residential Wi-Fi Broadband Service in the world ranges from few USD dollars to hundreds of USD, with an estimated average of 30-40 USD monthly. Telecom operators spend a substantial amount of their budget on building billing systems and customer services systems to settle utility bills. Due to the technical limitations and cost involved in maintaining and updating the system, the billing system lacks sufficient flexibility for an on-demand billing approach.

No Option of Earning While Having Wi-Fi:

In the current situation, there are no incentives for Wi-Fi network owners and users to share their Wi-Fi. This is one of the major reasons why most Wi-Fi network remains private and locked.

Poor User Experience in Public Wi-Fi Services:

Wi-Fi access isn't always as straightforward as arriving in a location and getting online. According to a survey conducted by www.ipass.com, nearly seven out of ten mobile professionals (68 percent) say that they have decided against using a Wi-Fi hotspot service simply because the registration process was overly frustrating or time-consuming. Given the importance of Wi-Fi connectivity, this could have a significant impact on worker productivity in the short and long term. The numbers bear this out. Nearly 20 percent of mobile professionals estimate they miss more than three hours of working time a week not being able connect to the internet—that's 156 hours a year, nearly a full working month. Perhaps it's no surprise, therefore, that nearly half of respondents said that they would be more likely to join a prospective employer if they offered global Wi-Fi access as a perk for all employees.

4. INTRODUCING BLOCKCHAIN

4.0 INTRODUCING BLOCKCHAIN TECHNOLOGY –

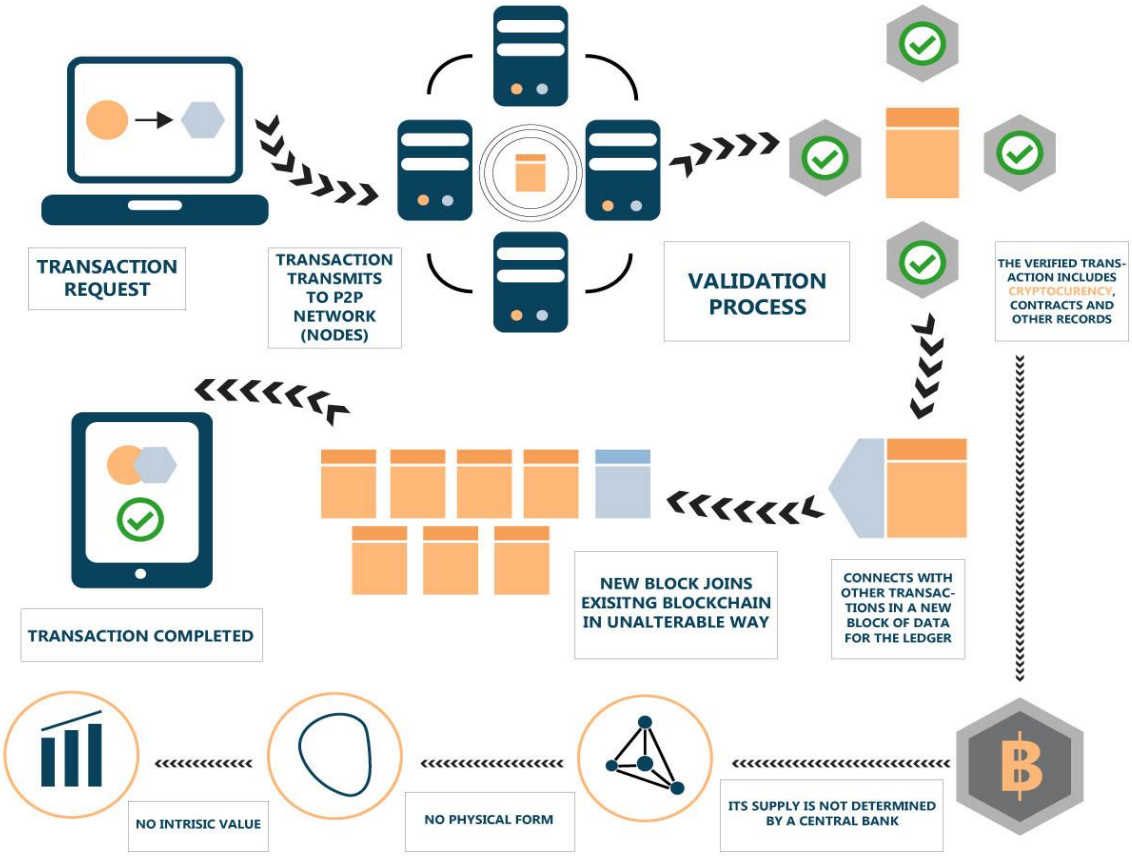
HOW WILL WI-FI BE ENHANCED BY BLOCKCHAIN

A blockchain is a digital ledger of transactions of database that record virtual financial transaction known as cryptocurrency. Blockchain technology has created a system that allows digital information to be distributed in virtual digital currency, originally devised for Bitcoin. The tech community has been looking for more potential uses for this technology. Information held on blockchain are shared, the public can view information, and no centralized version of information exists; it is hosted by millions of computers simultaneously and data is transparent and easily accessed by anyone on the internet.

The technology of blockchain durability is identical to the internet, by storing massive amounts data of information across its network, the blockchain cannot simply be controlled by one single entity.

While bitcoin was invented in 2008, the technology of blockchain has operated without any significant disruption or failure.

A decentralized technology system is made up of a global network of computers that jointly manage the digital database that records cryptocurrency transaction, with no central authority meaning the entire system operates on peer to peer basis.



4.1 Advantages of Blockchain

The use of blockchain by enterprises and consumers could benefit everyone; unlike banks that monitor transactions with traditional currencies, blockchain allows for the free transfer of cryptocurrencies. This data is interlinked by a network of computers, owned and run by the users themselves.

Blockchain offers the benefit of traceability and cost-effectiveness. When it comes to Supply Chain Management, blockchain can be used to track the movement, origin, and quantity of goods. In terms of a B2P ecosystem, the processing system renders ownership, transfer and production process, and payments transparent.

Blockchain assists with quality assurance. Records leave a highly traceable audit trail, guaranteeing the accuracy of records. If a mistake has been made, the blockchain system is able to easily trace and identify the mistake to its origin, making it easier for business to carry out investigations and take the necessary actions. This ease of tracing accountability deters human error and the tampering of data.

Drafting traditional business contracts can be time consuming; it is often a bottleneck for the growth of a business, especially for big firms that constantly communicate with others on a regular basis. With blockchain technology, smart contracts allow agreements to be automatically validated, signed, and enforced without the need of an advocate or intermediary.

Peer to peer (P2P) global transactions enable fast, secure, and efficient transfer of funds across the world. P2P transactions such as PayPal process international payments usually for a small transaction fee. Other P2P payment platform services may have limitation such as location restrictions and minimum or maximum transfer amounts. The use of Blockchain and cryptocurrency allows users to transfer and make payments without any restrictions.

4.2 How Blockchain Will Benefit WI-FI

Many issues facing Wi-Fi can be solved by implementing a blockchain platform system to share Wi-Fi, through the use of a decentralized Wi-Fi network system based on private, mostly residential, routers. Hosts can share excess broadband capacity with outside guests to earn cryptocurrency.

Furthermore, internet users may also be able to access Wi-Fi for free by viewing a short advertisement. For each ad response, the advertiser will pay the owner of the Wi-Fi router directly.

How It Works:

Guest User – Connect to open Wi-Fi hotspot, and either (a) pay the Wi-Fi router owner on an on-demand basis and settle the payment automatically via a smart contract set by the router owner or (b) read an ad banner or watch an advertisement to use the internet for free.

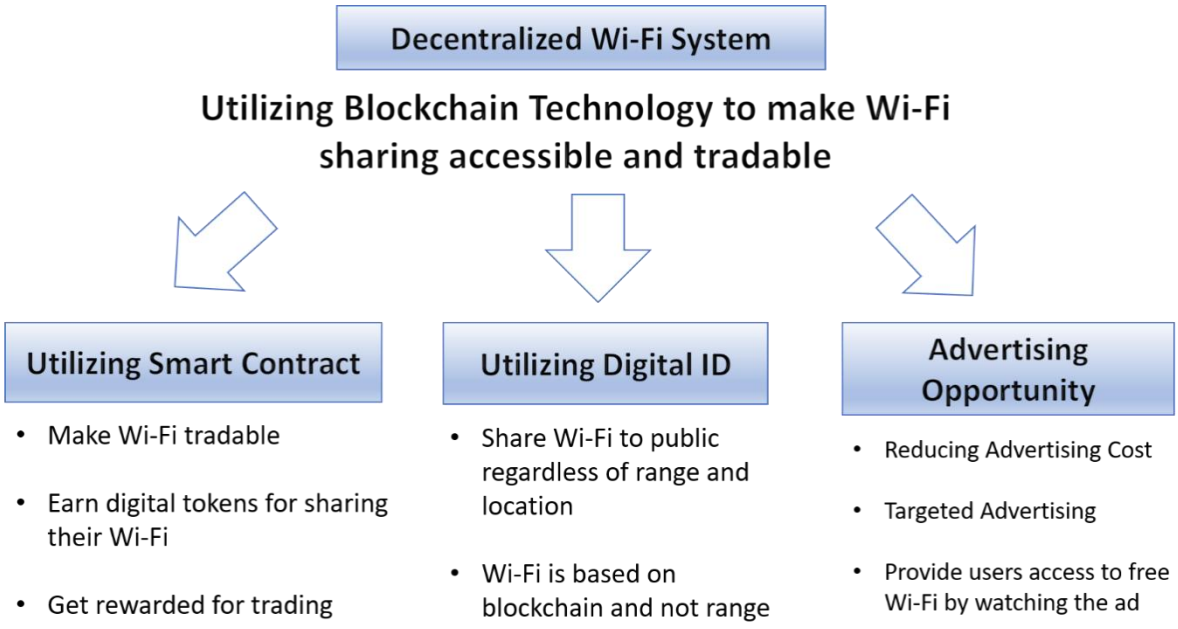
Owner of Wi-Fi Router – Utilize your excess Wi-Fi capacity to earn tokens from advertisers and guest users for opening up your Wi-Fi network to the public.

Advertiser – Expand your advertising reach and increase the accuracy of your ad targeting through a decentralized network of Wi-Fi owners and pay them directly for ad responses.

Blockchain technology provides fast and economical transactions between parties to ensure clear agreements by utilizing smart contract technology, while advertisements shown are also traceable and targeted with the use of blockchain technology.

5. About DWS

5.0 DWS NETWORK STRUCTURE BASED ON BLOCKCHAIN



DWS Protocol is based on blockchain for the network core layer. In the protocol, DWS will utilize a hybrid model multi-layer blockchain consisting of its own DWS-Chain and partnering public chains such as QLC Chain and Neo.

This hybrid model of multi-layer blockchain serves two primary functions. First, the blockchain stores records and details of transactions between asset (router) owners and users on a ledger, and secondly, the blockchain also deploys and executes smart contracts.

A DWS Chain **smart contract** is an algorithmic contract deployed between asset (router) owner and users. This smart contract will establish the trade rules and also automatically generates and executes transactions through it.

DWS Protocol will consider using a third-party public chain network such as Neo for telecom asset registration.

This setup will allow a user to access the router owner's Wi-Fi via DWS protocol without the need to personally know who the router owner is. The user simply has to pay the router owner

in tokens via DWS based on the length of time they are connected. Thus, this is termed trading. These trading terms will be written into a smart contract which automatically executes terms of the smart contract through the DWS platform without any manual intervention.

5.1 Asset Level: Utilizing Digital Asset & Digital ID

With the rapid development of internet, electronics, and computers, online commerce has grown tremendously, giving birth to many business and trading opportunities online. However, the trading rules online are mostly governed on a domestic level where rules breakers or offenders are punished according to each individual country's law. When trade happens on a global level between individual parties who don't know each other, how can both parties trust each other if both parties don't know who the other person is, or which country's law will be followed if an agreement is broken? How do we find the person who broke the agreement? This is a big problem for global Wi-Fi sharing.

To address this, DWS Protocol will drawing on NEO Smart Economy platform resources. DWS Protocol will integrate the Digital Asset, Digital Identity, and Smart Contract functionalities, utilizing the NEO platform as a top-level partner on a level 1 blockchain partnership. DWS will also integrate future NEO features such as cross-chain protocol, quantum-resistant cryptography, a distributed storage protocol, and a secure communication protocol.

NEO Smart Economy is the next generation of trade, where trade agreements are written in programming code using a Smart Contract. The Smart Contract is stored in a decentralized immutable Blockchain and will be executed precisely to the terms of the trading agreement, and precisely at the time agreed upon. This allows for an economy where two or even thousands of parties can agree on a contract without the need to trust each other. The Smart Contract will always execute according to the defined terms laid out in the contract.

Digital Assets

The main objective of NEO is to enable a Smart Economy. To achieve this, NEO's technology allows digitizing any real asset into digital assets. Digital assets are programmable assets that exist in the form of electronic data.

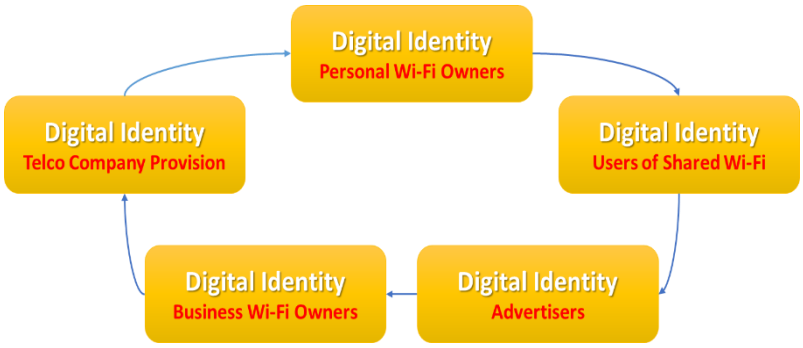
In DWS Protocol scenario, the real asset that we are referring to would be telecom company provisions such as mobile data & broadband, home/personal owners Wi-Fi router, business owners Wi-Fi routers, or personal mobile data.

In theory and in real-life, this means that any physical asset can be constituted as a digital asset on the NEO Blockchain, where ownership of that asset can be split, shared, and distributed among any number of owners or users. With Smart Contracts, this also means that trading of digital assets can be done almost instantaneously and without the need to trust any other party.

Digital Identity

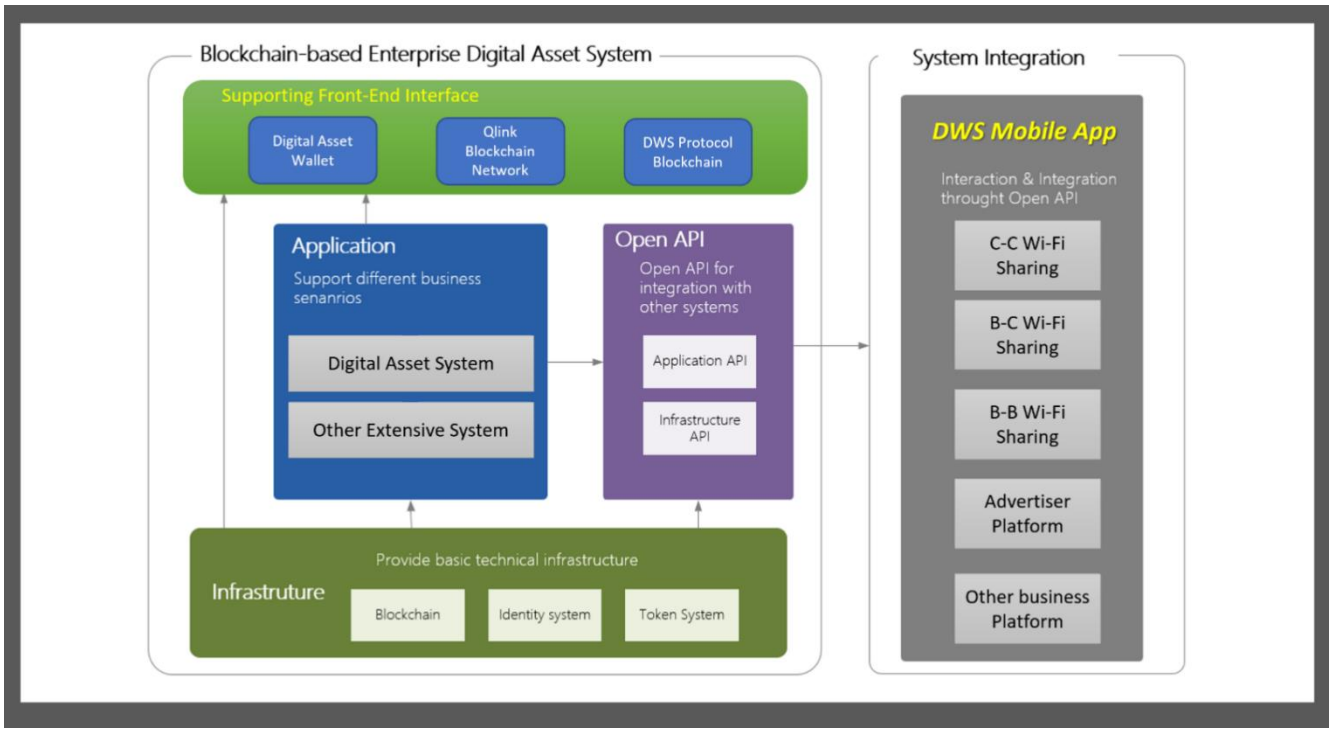
By enabling Wi-Fi trading through decentralized digital assets, the next step for DWS Protocol is to enable users (traders) to open trading rules. Having trading rules means users want to know who they are trading with. This is where NEO's digital identity support comes in, the basis for DWS and NEO partnership.

Individuals and institutions can be given their own digital identity. Participants in the market can choose to only trade with parties who have a confirmed digital identity. With digital identity, it also allows our institutions and governments to support the trading rules and ensure that the trade is fair to all parties involved. Moreover, any schemes to abuse trading deals can still be punished according to applicable law, since participants can be identified.



Together with NEO Smart Economy, DWS Protocol will allow real assets to be digitized and traded with certainty using clear and transparent trading rules in Smart Contracts and traceable and verified Digital Identities.

The full DWS & NEO Smart Economy partnership platform will look like this:



5.2 Service Level: Infrastructure of DWS PROTOCOL

The entire DWS Protocol framework will allow for the development of the DWS D-App, whose main feature is to give users Wi-Fi Access with the secondary aim of advertising content distribution for advertisers.

By giving users access to Wi-Fi, DWS will provide a Wi-Fi sharing service through its DWS mobile application. In addition, DWS will also provide content distribution for advertising purpose for advertisers.

DWS Protocol will partner with third party public chain network QLC Chain to create a measurable and tradable Wi-Fi sharing ecosystem.

Measurable in this instance means that data usage from each individual user can be measured based on the amount of Wi-Fi data they use.

Tradable here means charging users based on the measured data usage.

In doing this, DWS Protocol will create a decentralized global Wi-Fi sharing network with a P2P login. Prior to the launch of the DWS Chain, the P2P login will be authenticated on the Public Chain and use a Delegated Byzantine Fault Tolerance (dBFT) consensus algorithm by NEO.

5.2.1 Implementation of decentralized Wi-Fi sharing (For sharers / Router owner)

DWS Protocol will allow the sharing of Wi-Fi from various point angles be it personal or

homeowners' Wi-Fi routers, business owners' Wi-Fi routers, or personal mobile data owners. Typically, Wi-Fi (Routers) owners will purchase internet broadband plans from telecom providers as a package with very limited or almost no option to pay-per-usage. Even if there is the option, the cost will be exorbitant. The cheaper alternative is to sign up a broadband

package. In the case that Wi-Fi owners do not use up all the broadband in the month, the owner will still have to pay the same amount on the bill.

With DWS Protocol, Wi-Fi owners can share and trade their Wi-Fi with public users on a per-usage basis and fully take advantage of their broadband plan, with several trading methods to choose from.

To make this possible, DWS Protocol will enable the sharing registration of Wi-Fi hotspots through the DWS Mobile application in the form of a digital asset on the third party public chain. In doing so, Wi-Fi sharers and router owners will receive DWS tokens as payment for allowing access to the hotspot through the execution of a smart contract.

5.2.2 Enabling a Dynamic Pricing Strategy for Wi-Fi / Router owner

DWS Protocol and app will allow Wi-Fi owners to set their own dynamic pricing on their own terms. The Wi-Fi owners will be able to set their rules through the smart contract, which all Wi-Fi users can view and agree on.

With DWS dynamic pricing strategy, we can create an “on-demand” basis to cater to different categories of Wi-Fi owners with difference needs.

Category A: Personal Wi-Fi or Home Wi-Fi owners

Home Wi-Fi owners could set different pricing for Wi-Fi sharing based on different time of the day. In the day time. on a weekday, when home-owners are out for work, they can set a lower pricing structure. They can then set a higher pricing structure on evenings and weekends as they would be using Wi-Fi as well.

Category B: Business Wi-Fi owners

Small business such as a café can also set their own pricing structures based on an on-demand approach. For example, during periods of low customer traffic, café owners can set prices lower or even provide token rewards for users to dine in and use the Wi-Fi. This can also potentially bring additional business to café owners.

Category C: Big business or Public Places

Big organizations such as offices, buildings, shopping malls or public places could also set their pricing based on an on-demand pricing structure or set their own rules based on high peak periods and off peak periods.

DWS Protocol provides an **automatic solution** through smart contract price settings based on different requirements. This ensures Wi-Fi owners have the power to set their own pricing structure.

Most importantly, DWS Protocol will also provide the option for Wi-Fi owners to determine and limit the amount of data bandwidth/speed so as to ensure optimal Wi-Fi experience and help owners not exceed their internet broadband plan limit.

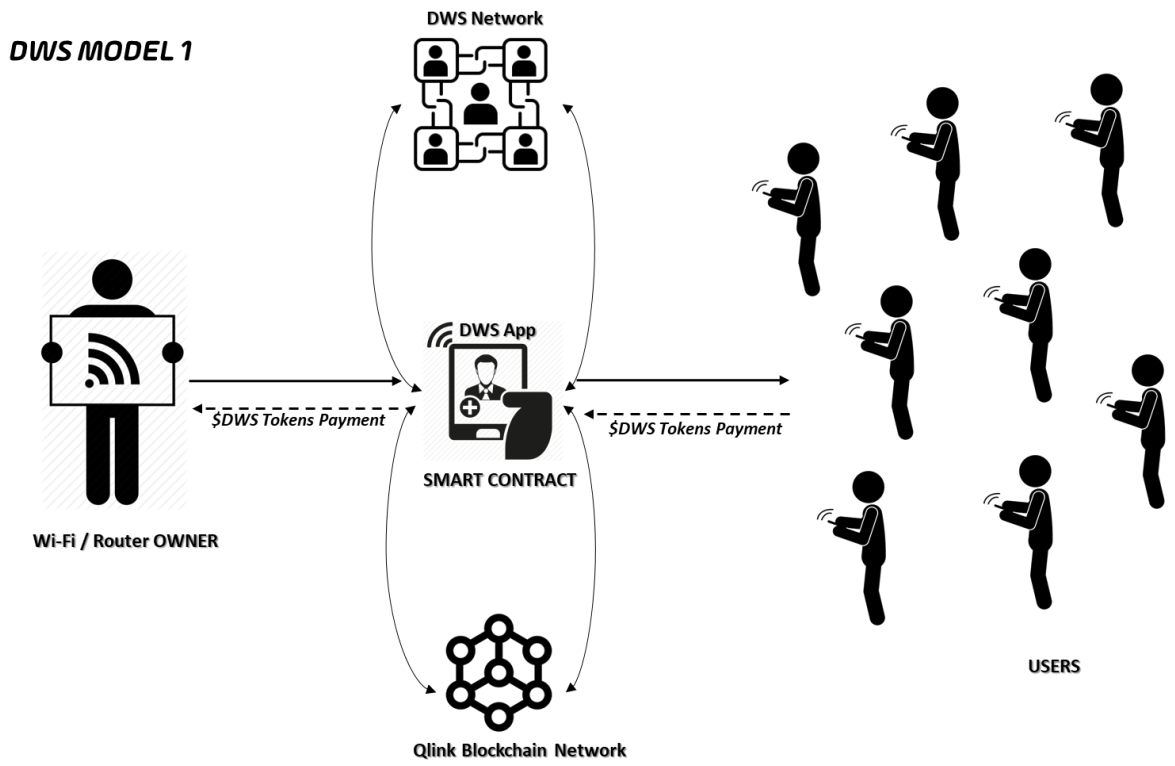
5.2.3 Implementation of decentralized Wi-Fi sharing (For users)

When a DWS Wi-Fi owner shares a new Wi-Fi hotspot for the first time, it will be registered as a digital asset by DWS on the third party public chain. Some of the registration information will include the GPS address of the Wi-Fi hotspot, IP address, MAC address, internet speed test report, SSID, and other associated information. Encrypted password will be kept to the Wi-Fi with sharer/router owner and not on the public chain.

Once a new Wi-Fi hotspot has been successfully registered on the DWS Chain, Wi-Fi will become available to all DWS users.

Users can log in to the DWS mobile app to find a list of all nearby Wi-Fi hotspots. Users can then view the rules and pricing based on the Wi-Fi owner smart contract to decide if they wish to tap in and use the Wi-Fi.

DWS Protocol features will also provide a FEEDBACK mechanism for users to rate and provide feedback on the quality of the Wi-Fi. These ratings will then be pegged to the Wi-Fi owner and the consolidated ratings will be made visible to the Wi-Fi owner's profile. This will serve as a guide to other users in choosing their Wi-Fi provider. This will also give Wi-Fi owners the opportunity to constantly improve the quality of their Wi-Fi.



Business Model: The DWS Tokens and Paying using DWS Tokens.

With DWS Protocol, we will create a shared economy that not only provides a business model to Wi-Fi owners, but also to the shared user as well.

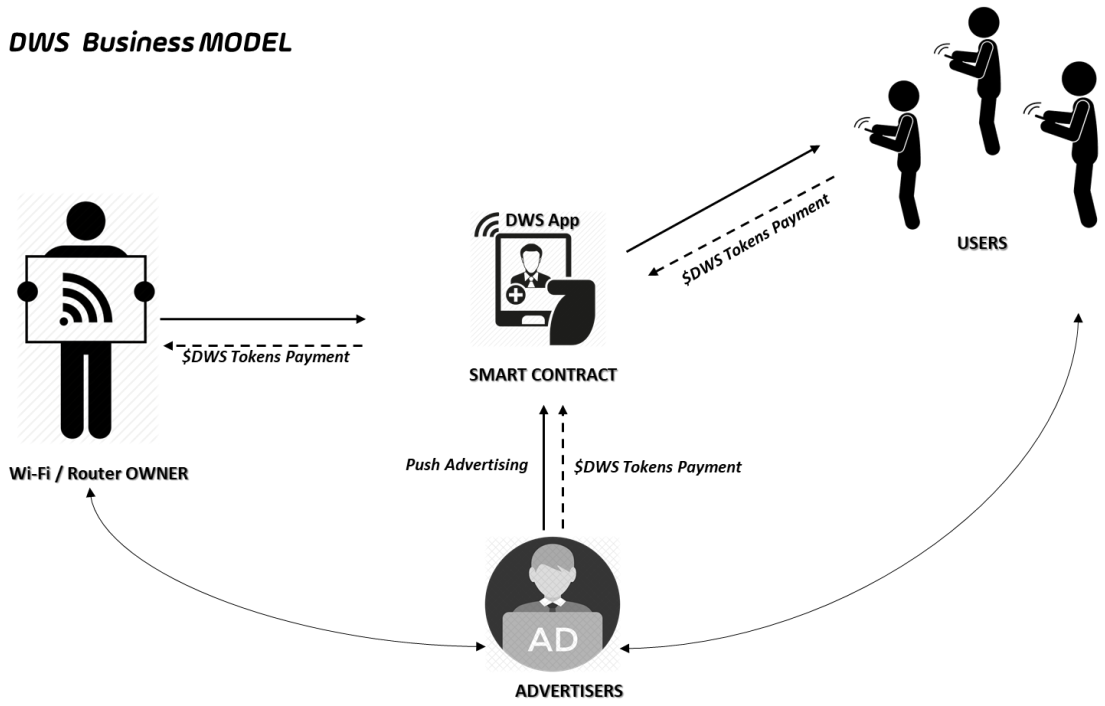
All business models are carried out through digital asset tokens called DWS. DWS tokens will be used to pay for accessing Wi-Fi from router owners. Wi-Fi/router owners can utilize the DWS automatic solution platform to create a smart contract that charges a usage fee in DWS to users who would like access to their connection. Furthermore, DWS Protocol infrastructure will precisely measure the amount of data used, not only based on length of time used, but based on the actual data consumption of each user. Wi-Fi users will be informed clearly on the consumption amount and will pay the Wi-Fi owners in DWS tokens.

DWS Business Models:

Wi-Fi Sharers and Users: Users directly pay Wi-Fi owners for sharing their Wi-Fi based on smart contract terms.

View Wi-Fi Owner's Ads for Wi-Fi Access: Wi-Fi/router owner may choose is to provide free Wi-Fi in exchange for ad views. This is especially useful for owners of businesses like cafés or beauty parlors. Instead of paying exorbitant advertising fees, business Wi-Fi owners can broadcast their personal ad for users to view in exchange for free Wi-Fi access.

Advertiser Integration: Incorporate advertising and content distribution from third party advertisers as another way of monetizing Wi-Fi. This provides users with free Wi-Fi service. External parties or businesses who would like to broadcast their ads could pay the Wi-Fi owners and in return, Wi-Fi owners can provide public users with free Wi-Fi.



5.3 Mobile Content Sharing On the Decentralized Network System for Advertisers

Apart from sharing Wi-Fi function, DWS Protocol will be able to allow advertisers to pay for network access as a feature. In this case, we look at what challenges that traditional advertisers are facing.

Lack of information:

One main issue advertisers face is the lack of information about their target audience. Advertisers often incur unnecessary advertising costs as they are unable to specifically execute audience targeting, running bootless errand advertising campaigns to the wrong audiences. This not only increases the cost of campaigning, but also reduces advertising effectiveness, severely affecting the conversion or ROI of advertising budgets. This is usually the case when campaigning for a niche product having a clear-cut target audience.

There are however several internet tools such as search engines optimization (SEO) and social media optimization (SMO) that can support advertisers in targeting their audiences. However, their targeting parameters are very limited. Adding to this, the cost of running these tools is not insignificant. Many advertisers feel that these tools seldom bring ROI and are ineffective.

Limited access to tracking KPIs:

It is currently almost impossible to reliably track the efficiency and return on investment (ROI) of an advertising campaign. Advertisers are not able to gather or obtain the relevant key performance indicators (KPIs) such as who has viewed the ad, when it was viewed, and ad impression numbers. This greatly complicates the adjustment process if the advertising campaign does not produce the expected result. Owners of advertising media often intentionally overstate the statistical impressions data to charge more, since they know that the advertiser have no means to check the validity of the information

Content creation is a major part of on the internet; users connected to the internet tend to engage with content that they are interested in or are amused by, such as browsing Social Media feeds, getting caught in the latest Twitter tweets, communicating with friends via texts, watching movies and videos, reading e-books, and a whole host of online activities. The use of mobile data has a cost; telecom companies simply cannot provide free data. Consumers may choose to wait or look for open free Wi-FI hotspot or opt against using the service. DWS features a solution that will allow content providers to prepay for data usage, allowing users to enjoy online content in a non-Wi-Fi environment without the need to pay for mobile data cost.

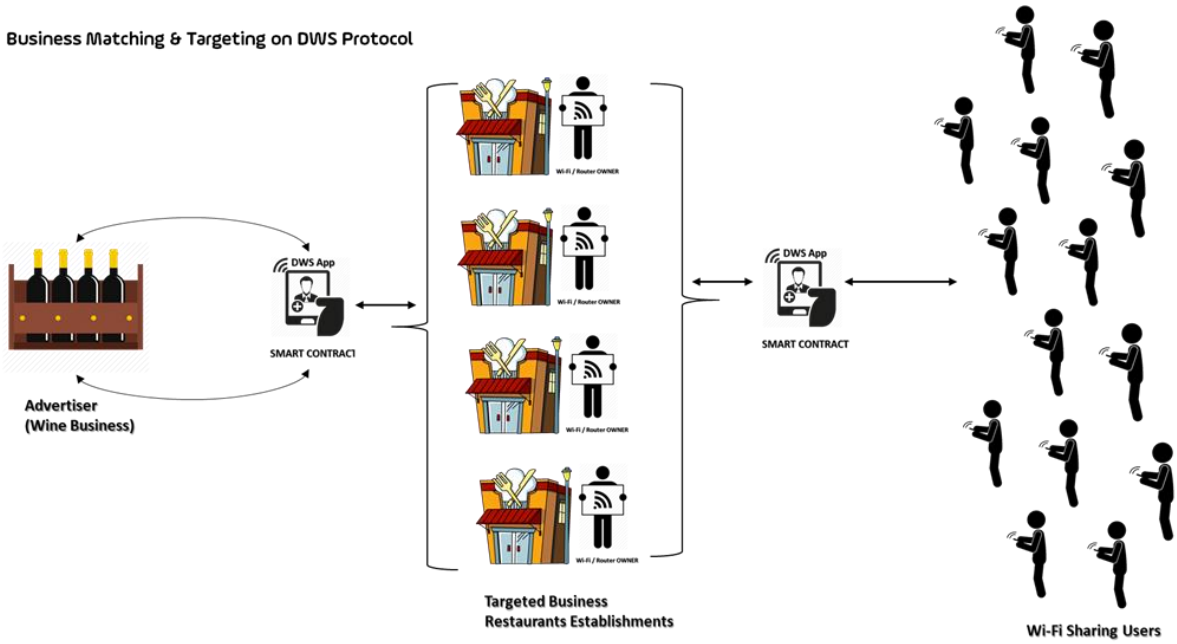
Currently, mobile network operating systems cannot accurately identify specific user content engagement activity. This means they cannot provide customized content for the user. DWS features a function that can identify and analyze advertising content to curate a customized content feed based on user interest. Telecom companies can engage in the transaction of content to improve their overall profits, content providers will be able to benefit from detailed and accurate distribution, and users will be able to have free access to sponsored content. This DWS feature will innovate changes in the traditional subscription and advertisement based business model and generate new business opportunities.

DWS features two advertising integration models:

- **The Content Provider**: Creative content owners who innovate, design, and create advertising content register their content on DWS and send out ads to everyone, paying users to view their ads and Wi-Fi owners to host their ads. They can also be Wi-Fi owners who provide Wi-Fi in exchange for users viewing their ads.
- **Business Matching.** Advertisers can choose to target specific audiences through DWS Protocol, which compiles their ads and curates advertising content for Wi-Fi users to view, maximizing advertiser marketing budgets.

DWS Protocol business matching would allow advertisers to better target the sector their product is developed for, which is more effective and cost efficient for their business. For example, a wine or liquor manufacturer company can utilize the DWS business matching service to only advertise in select industries such as restaurants, bars, and nightlife. By

targeting specific industries, audiences are more likely to be receptive to the advertisement, leading to higher conversion and ROI.



The Process for Advertisers & Volume of Ads

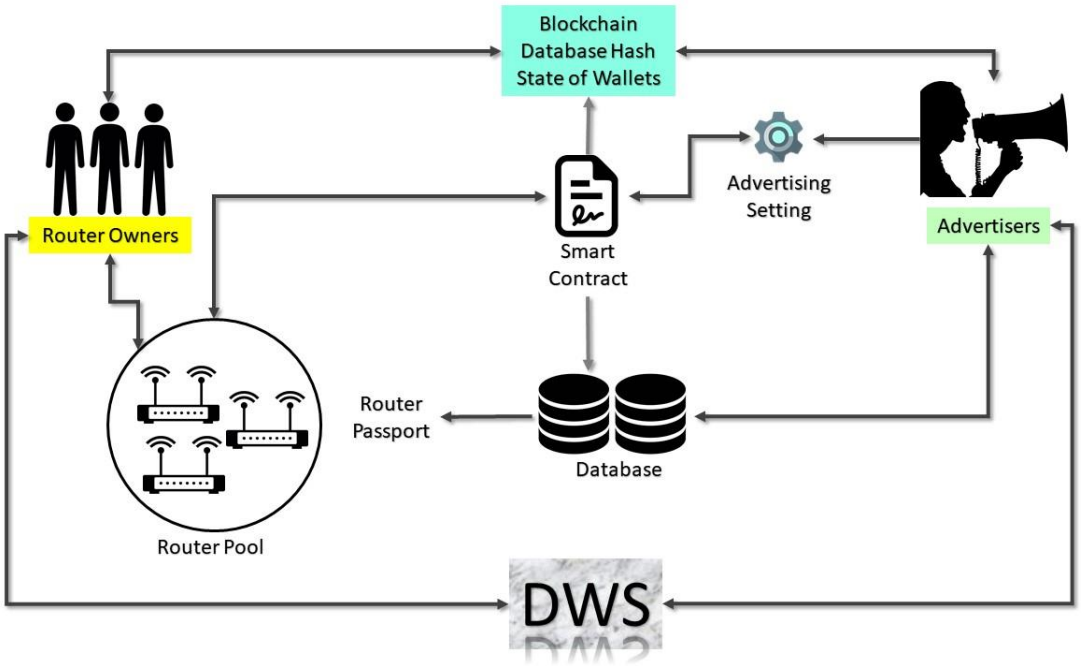
Operations are processed in project data centers – a distributed network available for our advertisers or businesses. The transaction will be confirmed via several NODES that allow for quick processing.

The DWS system is capable of processing high volumes of advertising transactions per second.

As the high-load input/output operations do not depend on the blockchain component, the system has no problems with scalability and DWS blockchain speed.

One entry in the blockchain contains information on one transaction. The number of transactions equals the number of advertising campaigns. The distributed database on the DWS Platform contains information on targeting (geo, router coordinates, number of users, age, interests, etc.) in relation to the previous advertising campaigns and their conversion, which is systematized so that these materials can be easily found and processed. The database updates automatically and is complemented by information from new advertising campaigns.

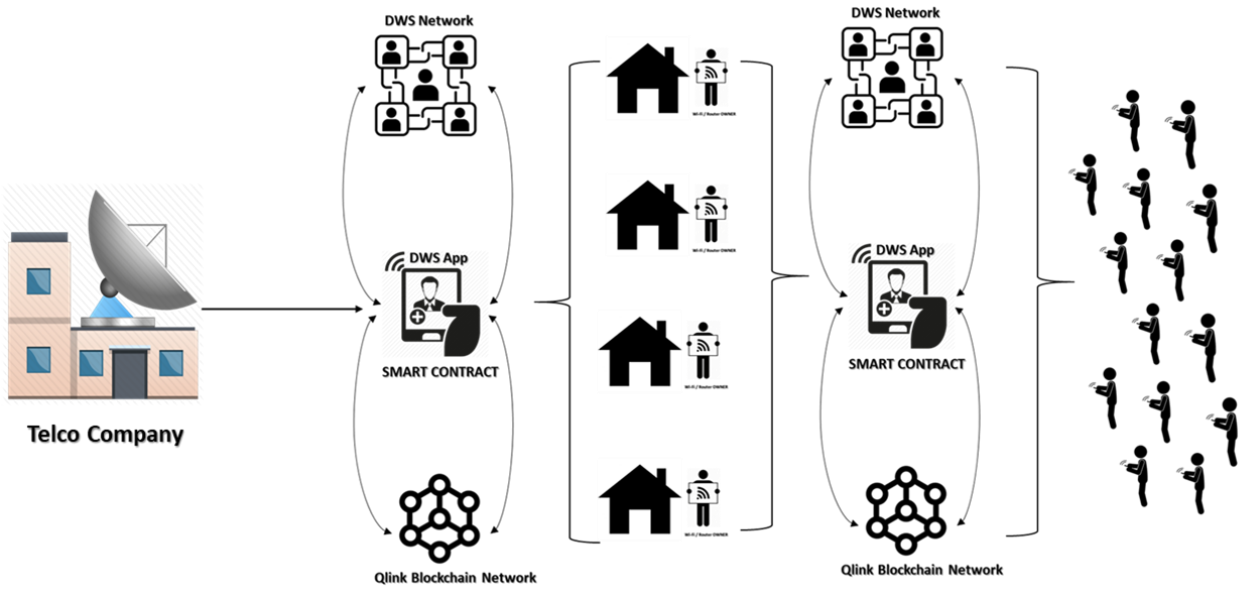
The database hash is linked to each router to ensure advertisers receive updates and reliable information on the conversion of the completed advertising campaigns. Advertisers view all this using the graphical interface where the settings and parameters of their advertising campaigns can be adjusted.

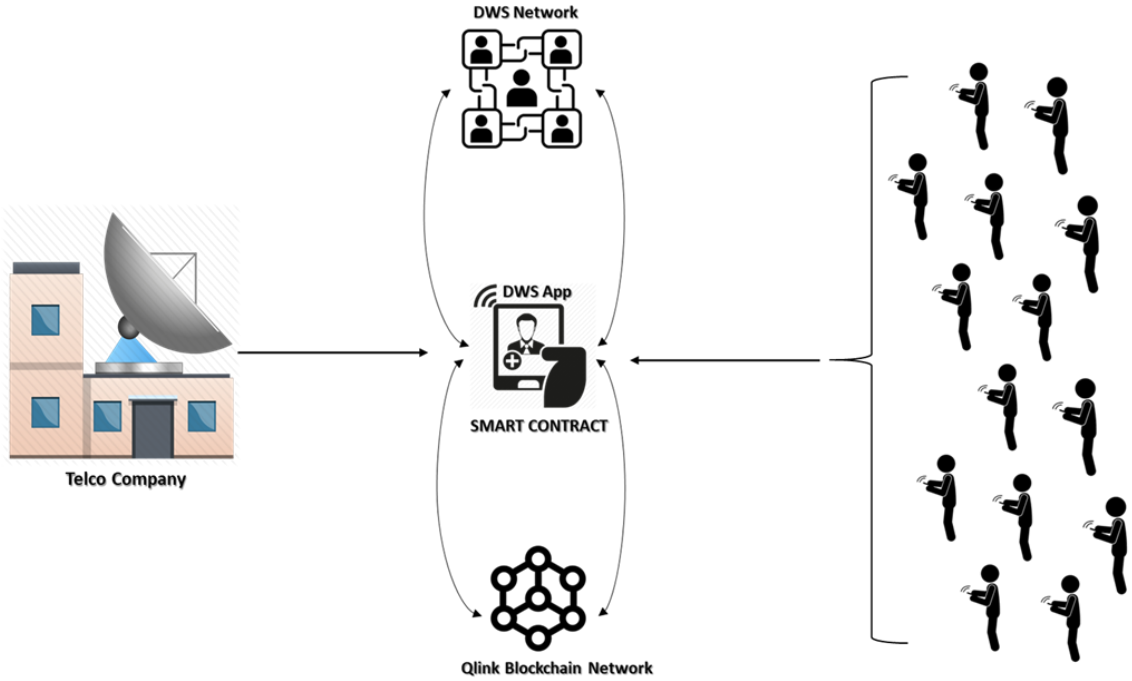


5.4 Exploring Integration with Telecom

In the later stages of DWS Protocol development, DWS will utilize its partnership with QLC Chain to allow integration of telecom companies (Internet provider) into DWS Protocol so as to also allow telecom companies to offer Wi-Fi sharing directly to users on the DWS app.

Traditionally, telecom companies offer broadband data plans to Wi-Fi (router) owners. These Wi-Fi owners will then share their Wi-Fi to users through the DWS app platform. With the next generation DWS Protocol, we can allow telecom companies to directly offer public users the option to “pay-per-use” in public spaces such as on the road, in parks, at the beach etc. where individual Wi-Fi owners are not present. This will create an even bigger sharing economy via blockchain technology.




DWS Network
DWS App
SMART CONTRACT
Telco Company
Qlink Blockchain Network

5.5 Technical Considerations & Blockchain Partnerships

DWS's decentralized WI-FI Sharing System will partner with QLC Chain as a supporting blockchain platform for network management technicalities. DWS will partner with NEO for the adoption of NEO blockchain platform in management of Digital Identity, dBFS Consensus Algorithm and Delegated Byzantine Fault Tolerance.

5.5.1 Public Chain with QLC Chain

The QLC Chain is a network transmission public chain powered by decentralized blockchain technology. The functionality of QLC Chain includes network device management on blockchain and decentralized arrangement in network and content addressing, network billing management, network firewall, and network content search.

QLC Chain connects with Linux Neutron to create a virtual network, contribute contents, establish routing capacity, ensure security, and carry out network addressing management.

The QLC Chain categorizes four types of network nodes:

- ✓ **NAT Node**: Network Address Translation Node
- ✓ **Routing Node**: Routing forwarding node based on content keyword/DHT/Router table
- ✓ **Content Node**: A node with saved content, which provides content based on retrieval requests from other nodes within the network
- ✓ **Security Node:** Performs firewall function and enacts security domain access rule

5.5.2 Asynchronous Ledger Technology

QLC Chain utilizes Asynchronous Ledger Technology specialized in network communications to create a network public chain. Asynchronous Ledger Technology is a blockchain ledger technology that provides high flow capacity in network transmission nodes. The technology will support the billing and operating functions of four network nodes.

The core of Asynchronous Ledger Technology includes the following steps:

1. Overlay a hash-addressing-based mesh network above physical network, or called the node electoral process for ledger validation
2. All nodes comply with Account Balance Mechanism, not the UTXO (Unspent Transaction Output) Mechanism. Account Balance Mechanism enables every node to have its individual account balance and a local ledger for the balance of entire network.
3. Every node signs in the local ledger with private key generated by Elliptic-curve Cryptography. The signature is irrevocable.
4. Entire network nodes are fragmented via OSPF/BGP. Each network fragmentation forms its own distributed consensus and the network consensus is confirmed twice through border gateway among various fragments.
5. The local ledger of every node is validated by Shannon Consensus, powered by QLC Chain. Generally, Step One is adequate to reach Shannon Consensus. However, the following hacking behaviors will raise Shannon Consensus validation in entire network nodes within subject fragmentation range:
    a. Fork attack derived from Double Spending
    b. 51% hashrate attack
    c. Sybil attack
    d. Broadcast storm attack

5.5.3 Shannon Consensus of QLC Chain

The Shannon Consensus of QLC Chain is designed as the following:

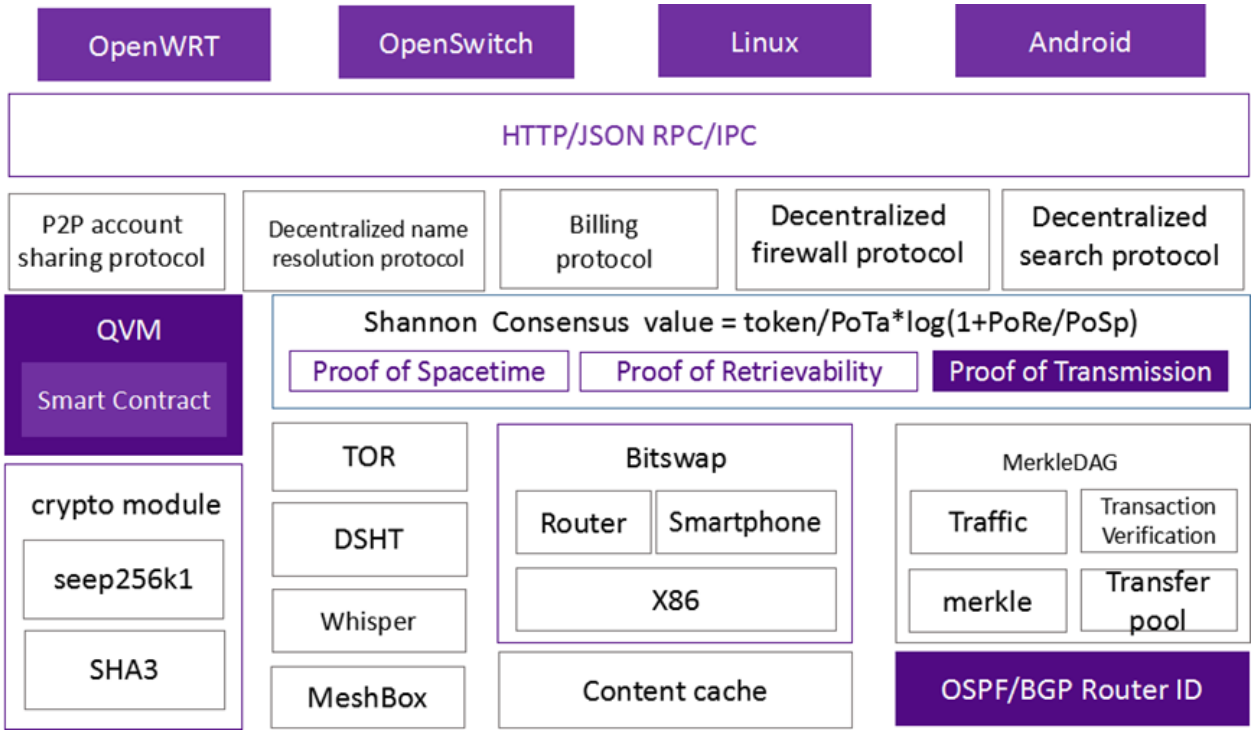
With the usage of the unit workload of PoS as the stake coefficient in the consensus, represented by the following formula:

*Stake = token/(PoTa*log(1+PoRe/PoSp)*

The solution of HASH function for obtaining the right of recording the ledger should satisfy:

*SHA3(previous block hash, nonce, time stamp, Merkel tree root) < target * stake*

The QLC Chain Structure based on Linux Neutron is showed below:



With the enhanced design of Asynchronous Ledger of QLC Chain, the simulated transaction per second (TPS) in QLC Chain can reach 8000 – 10000, with no obvious deterioration in system efficiency. In addition, it ensures the security of the decentralized network. These advantages are better than the current PoW and PoS consensus.

5.5.4 Developing Digital Identity System with NEO

DWS will explore integration of NEO's native identity layer, NeoID for the development of DWS's digital identity system.

Digital identity refers to the identity information of individuals, organizations, and other entities that exist in digital form. The latest digital identity system is based on the PKI (Public Key Infrastructure) X.509 standard. NEO will implement a set of X.509 compatible digital

identity standards. This set of digital identity standards, in addition to compatible X.509 level certificate issuance models, will also support Web of Trust point-to-point certificate issuance model. NEO'S digital identity verification includes the use of facial features, fingerprint, voice, SMS, and other multi-factor authentication methods. At the same time, NEO will also use blockchain to replace the Online Certificate Status Protocol (OCSP) to manage and record the X.509 Certificate Revocation List (CRL).

Digital Identity is a core module in DWS's system to allow users to make online transactions secure and seamless while keeping private data secure. This enables data to be utilized in an anonymously, securely, and autonomously, as well as make data monetization user friendly for functions like targeted advertising.

5.5.5 dBFS Consensus Algorithm

The best-known consensus mechanisms are Proof of Work (e.g. Bitcoin) and Proof of Stake (e.g. Ethereum). Neo proposes an improvement by using Delegated Byzantine Fault Tolerance (dBFT) as its consensus mechanism.

The Byzantine Generals' Problem occurs anytime we try to determine the TRUE outcome of a vote. Imagine 9 Generals for the Byzantine Empire have encircled the city of Rome with their armies. In order to successfully take Rome the generals must attack or strategically retreat in unison. If any general acts opposite the consensus decision, then the armies will be routed and defeated. The decision to attack or retreat is put to a daily vote and whichever option receives >50% of the vote is what the generals agree to do. Since each General is commanding their army in separate geographic locations around the city they utilize courier's to carry their vote to the other generals.

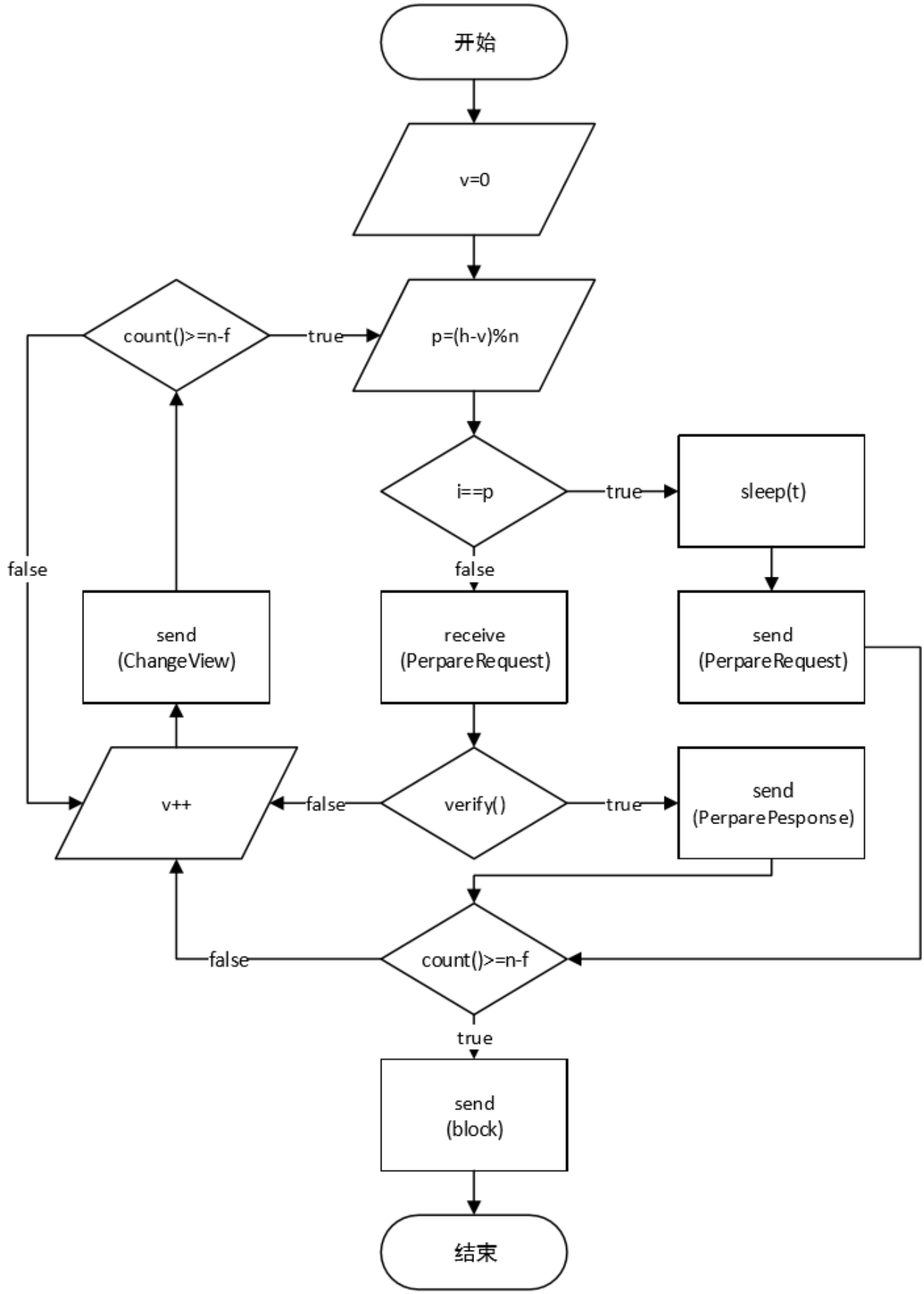
This system has inherent flaws. First, any number of the Byzantine Generals could be bribed by the Romans to betray the Byzantine army; these would be Traitorous Generals. Second, any general could make an inappropriate decision as to whether they should attack or retreat; these are Improperly Functioning Generals. Third, the couriers carrying the votes of the generals could be bribed by the Romans to alter the votes in a traitorous way. And fourth, the couriers could fail to deliver their message or deliver the wrong message.

The Byzantine Generals' scenario is an analogy for the problem faced by distributed computing systems: How do we reach consensus when faced with untrustworthy and malfunctioning actors that threaten to destabilize the ecosystem?

5.5.6 Delegated Byzantine Fault Tolerance

Numerous protocols have been developed to solve the Byzantine Generals' Problem. Hyperledger, for instance, uses Practical Byzantine Fault Tolerance in its Proof of Work algorithm. Neo, on the other hand, implements Delegated Byzantine Fault Tolerance to solve the Byzantine Generals' Problem. The Neo creators chose this protocol because it allows for better scaling and performance when compared to currently existing solutions.

Scalability is a major issue for any blockchain. As the number of transactions and network size increase, the blockchain must be able to scale proportionally. If it cannot scale to keep up with demand, then transactions will be delayed or never processed at all. We saw this issue recently with the Bitcoin scaling debate the SegWit2x update that threatened to fork the blockchain.


开始
v=0
count()>=n-f
true
p=(h-v)%n
i==p
true
sleep(t)
false
false
send
(ChangeView)
receive
(PerpareRequest)
send
(PerpareRequest)
v++
false
verify()
true
send
(PerparePesponse)
false
count()>=n-f
true
send
(block)
结束

5.6 Smart Contract Pseudocode

```
public static Object Main(string operation, params object[] args)
    {
        // Contract transaction, ie assest deposit/withdrawl transaction (operation == signature)
        if (Runtime.Trigger == TriggerType.Verification)
        {
            TransactionOutput senderObject = GetSenderObject(GetSenderObjects());
            byte[] contributorSH = senderObject.ScriptHash;

            if (IsContributorSH(contributorSH))
            {
                // Getting Requested TX value
                BigInteger withdrawRequested = senderObject.Value / 100000000;

                // Getting pre approved withdraw value for contributorSH
                BigInteger withdrawHold = StorageGet(contributorSH.AsString(), "withdrawHold").AsBigInteger();

                // This should always be 0
                BigInteger balance = withdrawRequested - withdrawHold;
```

```
            if (balance == 0)
            {
                return true;
            }
        }
    }

    // Invocation transaction
    else if (Runtime.Trigger == TriggerType.Application)
    {
        Runtime.Notify("TriggerType.Application");
        // Operation Permissions:
        //     Creator:       CreateFund, DeleteFund
        //             Contributor:          DepositFunds,   GetFundParameter,   ReachedGoal,
ReachedEndTime, IsRefundActive, GetContributorInfo, CheckContributorOwed

        // CREATOR //
        // CREATE FUND
        if (operation == "CreateFund")
        {
            // Checks we have all arg inputs
            if (args.Length != 6) return false;
```

return CreateFund((byte[])args[0], (string)args[1], (byte[])args[2], (byte[])args[3], (BigInteger)args[4], (BigInteger)args[5]);

}

// CONTRIBUTOR //

// GET FUND PARAMETER: (fid, param)

if (operation == "GetFundParameter") return GetFundParameter((string)args[0], (string)args[1]);

// DEPOSIT FUNDS: (fid, asset, contributorSH)

if (operation == "DepositFunds") return DepositFunds((string)args[0], (byte[])args[1], (byte[])args[2]);

//if (operation == "DepositFunds") return GetFundParameter((string)args[0], (string)args[1]);

// REACHED GOAL QUERY: (fid)

if (operation == "ReachedGoal") return ReachedGoal((string)args[0]);

// REACHED END TIME QUERY: (fid)

if (operation == "ReachedEndTime") return ReachedEndTime((string)args[0]);

// IS REFUND ACTIVE: (fid)

if (operation == "IsRefundActive") return IsRefundActive((string)args[0]);

// CONTRIBUTOR INFO: (fid, GetContributorInfo, key)

```
            if (operation == "GetContributorInfo") return GetContributorInfo((string)args[0], (byte[])args[1], (string)args[2]);


            // GET FUNDS FROM CONTRIBUTOR: (GetContributorInfo)
            if (operation == "GetFundsFromContributorSH") return GetFundsFromContributorSH((byte[])args[0]);


            // SUBMIT WITHDRAW REQUEST
            if (operation == "WithdrawFundsRequest") return WithdrawFundsRequest((string)args[0], (byte[])args[1], (BigInteger)args[2]);


            // SUBMIT WITHDRAW REQUEST RESET
            if (operation == "WithdrawRequestReset") return WithdrawRequestReset((byte[])args[0]);


        }


        return false;
    }
```

6. TOKEN

6.0 DWS PROTOCOL TOKEN – DWS

The native digital cryptographically-secured token of DWS PROTOCOL (**DWS**) is a major component of the ecosystem on DWS and is designed to be used solely on the DWS network. The Ticker Symbol will be DWS. DWS will initially be issued as ERC20 standard digital tokens on the Ethereum Blockchain.

DWS is the basic unit of account in the DWS PROTOCOL network, and DWS would be used for the payment of all fees for usage of the DWS network. Users of the DWS network would be required to obtain DWS. DWS is a non-refundable functional utility token. The goal of introducing DWS is to provide a convenient and secure mode of payment and settlement between participants who interact within the ecosystem on DWS. DWS does not in any way represent any shareholding, participation, right, title, or interest in the Company, its affiliates, or any other company, enterprise or undertaking, nor will DWS entitle token holders to any promise of fees, revenue, profits or investment returns, and are not intended to constitute securities in Singapore or any relevant jurisdiction. DWS may only be utilized on DWS NETWORK, and ownership of DWS carries no rights, express or implied, other than the right to use DWS as a means to enable usage of and interaction with DWS NETWORK. In fact, the project to develop DWS NETWORK would fail if all DWS holders simply held onto their DWS and did nothing with it. DWS are designed to be consumed, and that is the goal of the DWS token sale.

In particular, you understand and accept that DWS:

(a) Is non-refundable and cannot be exchanged for cash (or its equivalent value in any other virtual currency) or any payment obligation by the Company or any affiliate;

(b) does not represent or confer on the token holder any right of any form with respect to the Company (or any of its affiliates) or its revenues or assets, including without limitation any right to receive future revenue, shares, ownership right or stake, share or security, any voting, distribution, redemption, liquidation, proprietary (including all forms of intellectual property), or other financial or legal rights or equivalent rights, or intellectual property rights or any other form of participation in or relating to DWS NETWORK, the Company, the Distributor and/or their service providers;

(c) is not intended to be a representation of money (including electronic money), security, commodity, bond, debt instrument or any other kind of financial instrument or investment;

(d) is not a loan to the Company or any of its affiliates, is not intended to represent a debt owed by the Company or any of its affiliates, and there is no expectation of profit; and

(e) Does not provide the token holder with any ownership or other interest in the Company or any of its affiliates.

6.1 Token Specs

- Total DWS tokens: 500,000,000
- DWS token is ERC20
- Token Sale accepts: ETH

6.2 Token Distribution

- DWS Foundation: 40%
- Public Token Sale: 60%

7. PARTNERSHIPS

7.0 PARTNERSHIP

QLC CHAIN

QLC CHAIN DEDICATES TO BUILD THE NEXT GENERATION OF NETWORK AND EMPOWER EVERYONE TO OPERATE THEIR OWN NETWORK WHILE BENEFIT FROM IT. THE QLC CHAIN IS A PUBLIC CHAIN FOR MOBILE NETWORK INDUSTRY. QLC CHAIN'S MISSION IS TO BRING PEOPLE ONLINE THROUGH A SIMPLER, MORE PLEASANT, AND MORE SECURED WAY WITH FULL TRANSPARENCY.

SWIFT WI-FI OFFERS NEARBY WI-FI HOTSPOT OPTIONS, WHICH INCLUDE FREE WI-FI HOTSPOTS AND THE PASSWORDS SHARED BY USERS ALL AROUND THE WORLD. SWIFT WI-FI - FREE WI-FI HOTSPOT IS NOT ONLY A FREE WI-FI SHARING APP BUT ALSO A WI-FI MASTER (WI-FI OPTIMIZATION TOOL), WHICH CAN IMPROVE WI-FI PERFORMANCE, OPTIMIZE WI-FI CONNECTION BY CONNECTING TO THE OPTIMAL SIGNAL.

END

DECENTRALIZED WIFI SHARING