REPORT

Define Rewarding Strategies

- project deliverable 4.4

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Summary The purpose of this deliverable is on the one side to analyse which is the best blockchain platform where to build the Helios Rewarding system and on the other side, to define the actions to be rewardable as well as the algorithm to calculate the number of tokens to be distributed for each of the users who contributes on top of Helios. In order to do so, an analysis of different rewarding systems used by some of the most popular decentralized social networks has been conducted. Furthermore, different types of blockchain (permissionless vs permissioned) are investigated. Last but not least, the Helios Reward System is defined taking into account use cases applicability.	
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Table of Content

List of Acronyms **4**

1 Introduction **5**

1.1 Helios Motivations 5
1.2 About this document 5

2 Traditional Social Media revenue model and Problem Overview **7**

3 Next-Generation Social Networks **9**

3.1 Steemit 9
3.2 Minds 11
3.3 Foresting 12
3.4 Appics 13
3.5 Other Social Networks 14

4 Selection of a Blockchain Platform **15**

4.1 Types of blockchain 15
4.2 Blockchain selection 17

5 Use Cases Applicability **23**

5.1 Use Case #A – Connecting People 23
5.2 Use Case #B – HELIOS Cultural HUB 25
5.3 Use Case #C – Citizen Journalism 27
5.4 Other Use Cases in the Helios Network 28

6 HELIOS: Rewarding Model **29**

6.1 Helios Multi-purpose Utility Token 29
6.2 Summary of Helios Token Requirements 30
6.3 Helios Token Distribution 31
6.4 Helios: Decentralized Rewarding and Rating Model 32
6.5 Utility of the Helios Token 36

7 Conclusions & Next Steps **37**

List of figures

Figure 1 - Alastria, a Public Permissioned Network 20
Figure 2 - Alastria's Network Architecture 20
Figure 3 - Distribution per sector of Blockmaker's Node 21
Figure 4- Alastria's Network 21
Figure 5- Alastria's System Requirements 22
Figure 6- Tokenomics Model 30
Figure 7 – General Scheme of Helios Rewarding System 33

List of tables

Table 1 – Comparison permissionless vs permissioned blockchain 16
Table 2 – Characteristics of some of the permissionless Blockchain's platforms 18
Table 3 – UC A Connecting People – Reward Incentives 23
Table 4 – UC B Helios Cultural Hub – Reward Incentives 25
Table 5 – UC C Citizen Journalism-Reward Incentives 27
Table 6 – Other Use Cases in Helios 28
Table 7 – Helios Token Distribution 32
Table 8– Score weight/rewardable action 33
Table 9– Variable's definition 34
Table 10 – Daily Token distribution according to active users and their contributions 35

List of Acronyms

Acronym	Description
BOSM	Blockchain Online Social Media
D	Deliverable
DOSN	Decentralized Online Social Networks
DPOS	Delegated Proof of Stake
IBFT	Istanbul Byzantine Fault Tolerance
IoT	Internet of Things
OSNs	Online Social Networks
PoS	Proof of Stake
PoW	Proof of Work
SBD	Steem Blockchain Dollars
SME	Small Medium Enterprise
SP	Steem Power
T	Task
VR	Virtual Reality

1 Introduction

HELIOS is a decentralized social media platform that addresses the dynamic nature of human communications in three dimensions: contextual, spatial and temporal.

As main differentiator's factors from other decentralized social networks that currently exist, Helios introduces novel concepts for social graph creation and management, which are grounded in trust and transparency and will enrich the value of the user's social networks.

Furthermore, HELIOS will include techniques such as decentralisation, context detection in IoT environment, real and virtual object networking, peer-to-peer based content streaming and validation.

1.1 Helios Motivations

The rapid and vast adoption of social media during the past two decades has changed the way we communicate in our daily life. A wide number of social network sites have popped up in recent years. Since then, several problems concerning centralization, censorship, lack of transparency, distribution of value, etc. have popped up around it.

Existing Online Social Networks (OSNs) are centralized. Such sites do not allow users much control over how their personal information is disseminated, which results in potential privacy problems. In fact, many of the current social networks are successful giving users the impression that they have full control over their data, but in reality, by accepting "privacy policies," they are transferring power to social networks to use their data in the way that they choose.

Additionally, OSNs fail to address user needs and expectations. Most of these sites have not into account that social needs vary over place and/or time. It can, therefore, be argued that current social networks do not see a social graph as a means to express and empower meaningful relationships, but purely as a content distribution channel.

These limitations of existing social networks are some of the reasons that have taken us to consider a decentralized framework for online social networking. Following this approach, HELIOS was born with the objective of creating a decentralized platform that provides users with control in three aspects: privacy, ownership and distribution of content. In addition, to solve the closed ecosystem stigma, by creating a basis for cooperation in social network services that follows the concepts of contextual integrity where users can share information according to their context or social sphere (for example, friends, work, studies, etc.) in the same way they do in the physical world.

1.2 About this document

The purpose of this document is to design and define a rewarding system that incentives and engages existing and potential users on the use of the HELIOS Platform.

The deliverable is structured in the following way: In Section 2 Problem Overview with traditional social networks is presented; Section 3 includes a detailed analysis of rewarding systems applied by some of the most popular DOSNs. In Section 4, a distributed ledger is proposed after investigating different blockchain platforms. Section 5 describes the Helios Use Cases and potential rewards applicability. Section 6 describes the Helios Reward System and a brief introduction to the Tokenomics and the utility of the Helios Tokens. Finally, Section 7, where conclusions and next steps are presented.

2 Traditional Social Media revenue model and Problem Overview

Current Online Social Networks (OSNs), such as Twitter, Facebook, or Instagram, are based on centralized platforms. During the last years, several issues have been arisen concerning, principally, the privacy of users' data in OSNs. Indeed, the rise and quick development of OSNs has led to two important phenomena: the user privacy disclosure and the rapid spread of information.

OSNs have become the epicentre through which individual privacy is violated. The last scandal concerning users' data is the well-known Cambridge Analytica scandal[1] erupted in early March 2018, when personal data of millions of Facebook users were acquired through a Facebook application called "This Is Your Digital Life".

In detail, the company had acquired and used personal data about Facebook users from an external researcher who had told Facebook he was collecting it for academic purposes.

The privacy issue was the main motivation to propose new solutions to overcome all the several problems of current OSNs[2][3]. Decentralized Online Social Networks (DOSNs) are Online Social Networks implemented by exploiting decentralized networks, such as P2P networks, that provide the decentralization of social services. Thanks to the decentralization, there is not a central entity able to manage users' data.

During the last ten years, several DOSNs have been proposed[4][5][6][7][8]. The first big project in this area is Diaspora[9], founded in 2010. Diaspora has been mainly proposed to overcome the privacy issue. The main characteristic of Diaspora is that is a federated Online Social Network, formed by independent and federated servers managed by individual users. Another important platform is Mastodon[10], which has reached more than 2M of users.

Diaspora and Mastodon are part of FeDiverse[11], a confederation of federated platforms able to communicate between them.

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1 https://www.theguardian.com/news/series/cambridge-analytica-files

2 Guidi, B., Conti, M., Passarella, A., & Ricci, L. (2018). Managing social contents in decentralized online social networks: a survey. *Online Social Networks and Media*, *7*, 12-29.

3 Datta, A., Buchegger, S., Vu, L. H., Strufe, T., & Rzadca, K. (2010). Decentralized online social networks. In *Handbook of social network technologies and applications* (pp. 349-378). Springer, Boston, MA.

4 Cutillo, L. A., Molva, R., & Strufe, T. (2009). Safebook: A privacy-preserving online social network leveraging on real-life trust. *IEEE Communications Magazine*, *47*(12), 94-101.

5 Graffi, K., Gross, C., Mukherjee, P., Kovacevic, A., & Steinmetz, R. (2010, August). LifeSocial. KOM: A P2P-based platform for secure online social networks. In *2010 IEEE Tenth International Conference on Peer-to-Peer Computing (P2P)* (pp. 1-2). IEEE.

6 Buchegger, S., Schiöberg, D., Vu, L. H., & Datta, A. (2009, March). PeerSoN: P2P social networking: early experiences and insights. In *Proceedings of the Second ACM EuroSys Workshop on Social Network Systems* (pp. 46-52).

7 Narendula, R., Papaioannou, T. G., & Aberer, K. (2011, August). My3: A highly-available P2P-based online social network. In *2011 IEEE International Conference on Peer-to-Peer Computing* (pp. 166-167). IEEE.

8 Guidi, B., Amft, T., De Salve, A., Graffi, K., & Ricci, L. (2016). DiDuSoNet: A P2P architecture for distributed Dunbar-based social networks. *Peer-to-Peer Networking and Applications*, *9*(6), 1177-1194.

9 https://diasporafoundation.org/

10 https://mastodon.social/about

11 https://fediverse.party/

However, decentralization techniques have been radically changed during the last few years. Indeed, the decentralization of OSNs has seen the rise of Blockchain-based Online Social Media (BOSMs)[12]. These platforms give more importance to the content by providing rewarding systems and removing the problems of privacy and fake news through the blockchain technology.

During the last years, the amount of content creation through social media has grown rapidly. Every single day, we consume and create content ranging from articles to videos, images, etc. from a wide number of social media platforms such as Facebook, Twitter, YouTube and so on. However, most of these social networks fail in providing a fair and transparent rewarding system.

[12] Guidi, B. (2020). When Blockchain meets Online Social Networks. *Pervasive and Mobile Computing*, 101131.

3 Next-Generation Social Networks

On the following subsections, we analyse current rewarding systems applied BOSNs, in particular, Steemit and Minds as the two most popular decentralized social platforms, each with over one million registered users.

3.1 Steemit

Steemit[13] is a social media platform where everyone can receive a reward for creating and curating content, in the form of the Steem cryptocurrency[14]. Today, Steemit is the most well-known Blockchain-based OSM with more than 1 million users[15].

In contrast to the majority of the blockchain-based platforms, Steemit is born as the killer application of Steem. Steem is a permissionless blockchain, founded by Ned Scott and Daniel Larimer, which differs from Bitcoin and Ethereum because it has been created to natively support social applications.

Other two big differences are:

1. There are three different kinds of currency units: STEEM, VEST, and STEEM Blockchain Dollars (SBD).
2. There is a set of transactions that can be executed, each of which has a specific social meaning, in contrast to other common blockchains where the transaction types are few. As for now, there are tens of different transaction types on Steem.

The three currencies have different usage and different meaning. The most intuitive one is the STEEM, which represent the liquid currency of the platform that is the currency that is normally exchanged between users. STEEM can either be stored for future payments or can be used to make a long-term investment on the platform. This long-term investment consists of turning (part of) the STEEM one holds in VESTs with an operation called "power-up". The number of VESTs one holds shows how much commitment or investment he/she has on the platform. VESTs cannot be traded among users, and moreover, they can be traded back to STEEMs but this conversion, called "power-down" requires some time. In fact, the power-down process requires a total of 13 weeks to complete, independently on how much VEST is being powered down, but each week a portion (1/13) of the requested VESTs is converted back to STEEMs.

Per se, owning VESTs over STEEMs is a disadvantage; therefore the developers added two key features. Within the user interface provided by Steemit, the amount of VEST owned cannot be checked, but instead, the so-called "STEEM Power" (SP) is presented.

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[13] https://steemit.com

[14] *Kiayias, A., Livshits, B., Mosteiro, A. M., & Litos, O. S. T. (2018). A puff of steem: Security analysis of decentralized content curation. arXiv preprint arXiv:1810.01719.*

[15] *Li, C., & Palanisamy, B. (2019, June). Incentivized Blockchain-based Social Media Platforms: A Case Study of Steemit. In Proceedings of the 10th ACM Conference on Web Science (pp. 145-154).*

The SP of a user is the amount of STEEM that the VEST of that user is worth at a given time; in other words, the SP of a user is the amount of STEEM the user would get if he/she would power-down all his/her VESTs.

SP is much easier to understand from an end-user point of view: since 1 unit of STEEM is equivalent to 1 SP one can easily understand how much currency is "liquid" (available for transfer) and how much is invested in the platform as VEST.

Finally, to introduce some market stability, and to make the whole economy also accessible for people outside the platform, a third currency was introduced: the SBD.

It is, economically, more stable because the exchange rate is always kept close to 1 USD, and to deny possible speculations with it, the conversion from SBD to STEEM is executed 3.5 days after its request, while converting from STEEM to SBD is possible only through the internal market.

The main concept of Steemit is that the community should be recognized for the value it adds. Indeed, the platform is based on three important principles, as emerged from the white paper of Steemit. The most important key principle is that who contributes with content should receive payment or debt from the venture. The second principle is that all forms of capital are equally valuable, and the third is that the community creates value which is useful for the members of the community.

The blockchain Steem is built upon Graphene[16], which is able to sustain over 1000 transactions per second on a distributed test network. Steem uses the Delegated Proof of Stake (DPoS)[17], and it does not have miner, but witnesses to produce blocks. Block production is done in rounds, and for each round, 21 witnesses are selected to create and sign blocks of transactions. The 21 witnesses are shuffled every round to prevent one witness from constantly ignoring blocks produced by the same witness placed before[18]. Any witness who misses a block and has not produced in the last 24 hours will be disabled until its block signing key will be updated. A witness who is not able or does not want to produce blocks can set its block signing key to the null public key, and it will no longer be scheduled.

Whenever content is created, it can be modified only up to 7 days after its creation. After this time span, the content is finalized, it cannot be edited anymore, and the rewards for the creator and the curators are effectively computed and awarded.

Users have two options on how to get the rewards: Power up 100%, or 50%/50%.

In the first case, all the STEEM value of the reward is powered up and granted to the user as VESTs. In the latter case, which is the default one, half of the reward is powered up while the other half is granted as liquid currency (a combination of STEEM and SBD).

Users can also decide to decline the pay-out for a specific content they created and receive no rewards for being curators of that content. The reward for content is not fully

[16] *https://objectcomputing.com/resources/publications/sett/march-2017-graphene-an-open-source-blockchain*
[17] *Larimer, D. (2017). Dpos consensus algorithm-the missing white paper.*
[18] *https://steem.com/steem-whitepaper.pdf*

awarded to the creator, but a share is awarded also to the curators of that content, and to become a curator of content it is sufficient to upvote that content. Ordinarily, 50% of the rewards go to the author and 50% is granted to the curators, however, if a curator has upvoted content within 5 minutes of its creation, a fraction of its reward is returned to the reward pool of that content.

The total pay-out of content is based on the SP of the curators (the users that upvoted) and by how much *voting power* they decide to give to their vote, but the reward granted to each curator is based also on the voting position: being the first curator pays better.

Users of the platform can also decide to *downvote* a content, which decreases its value. In case of a downvote, no curation reward is awarded.

A peculiarity of the Steemit community is that users are divided into categories based on their amount of VEST:

- *Redfish*: They are the newly registered users on the network, with less than 1 million VEST (1 MV).
- *Minnow*: Are users that begin to have some involvement in the platform and have at least 1 MV, but less than 10 MV.
- *Dolphin*: This category contains users with a VEST amount between 10 MV and 100 MV. These users have some influence within the network and their 100% vote is worth at least 0.1$.
- *Orca*: Some of the most influential users of the network, with an amount of VEST between 100 MV and 1 GV (1 billion VEST); their votes have a value greater than or equal to 1$.
- *Whale*: They are the most influential users of the network, with more than 1 GV. Their vote is worth at least 10$, which is why they often grant it only upon payment.

The inequality of this classification is one of the most important criticisms made of Steemit.

3.2 Minds

Minds[19][20] is a free, encrypted, and reward-based social networking platform based on Ethereum, and launched in 2015. Minds has been developed as a blockchain application with the intent to face the censorship problem. Indeed, content is free, without the risk to be censored or subverted. As for the other Blockchain Social Media, the blockchain technology guarantees the decentralization by excluding the single point of failure, and the immutability property helps to face the censorship. Today, Minds has over 1.5 million registered users.

Minds rewards users for their activities on the site. In particular, the current rewarding system has been proposed in 2018, and the tokens, called Points, are built upon the Ethereum ERC-20 standard. Each action on the site is worth a different number of points. These points are then added up to the daily contribution total and the total amount of tokens are given by the User Contribution Score divided by the Total Network Score.

[19] Guidi, B. (2020). When Blockchain meets Online Social Networks. *Pervasive and Mobile Computing*, 101131.
[20] https://www.minds.com/

If the contribution of a user consists of a considerable amount of actions on a slow day, the user gets more tokens than he/she would by contributing the same amount on a busy day. Points can be exchanged for additional exposure on your content, to have a guaranteed number of views (1point = 1 view). Specifically, the daily accumulated points are converted as followings:

- 1 point for 1 upvote
- 2 points for 1 comment on your posts
- 4 points for a subscriber or shared
- 10 points for an invitation using a referral code (new user)
- 2 points for every time you check-in

Furthermore, users may 'wire' points to other users/channels as a tip, or to pay for a premium subscription, to exclusive content and unlock rewards. Minds Wire is the P2P payment system that enables users to exchange their Points and USD for exclusive content, premium content, and rewards.

A characteristic of Minds is that users can choose between OnChain and OffChain transactions to mitigate the latency and cost of on-chain payments and transactions. OnChain transactions benefit from being published and secured on the public blockchain, while OffChain transactions benefit from speed and no transaction fees.
OffChain tokens are stored on the Minds servers and can be used just as Points are used. OnChain tokens, in contrast, are stored on the Ethereum public blockchain and are accessible outside of Minds.

3.3 Foresting

FORESTING[21][22] is a new Blockchain-based Social Media consisting of the social media "FORESTING", the digital banking services for participants, "FORESTING Bank" and the "FORESTING Lab" to support the community and content creators[23]. The system, like all the other platforms presented before, is principally focused to reward valuable content and to guarantee content authenticity.

FORESTING relies on blockchain to deliver and reward valuable content by using a distributed consensus protocol. In FORESTING, users can benefit economically just by getting ‘Likes', called PICK, through the blockchain. PICK counts should be used wisely as each user is given 24 PICKs a day. By clicking PICK, a user can increase the value of his/her favourite contents. Charging time is 1 PICK per hour. Users can also tap “Shooting” to donate to their favourite contents and content providers. This feature is one of the ways to directly support other users and can be sent with a message.

The rewarding system of the platform is based on how active users are. Content creators receive Berry rewards based on how many PICKs (votes) they collect. The system uses the FORESTING Interaction (FI) index to evaluate the entirety of each user’s activeness

[21] Guidi, B. (2020). When Blockchain meets Online Social Networks. *Pervasive and Mobile Computing*, 101131.
[22] https://foresting.io/
[23] https://cdn.foresting.io/pdf/whitepaper/FORESTING_Whitepaper_Eng_Ver.1.0.pdf?ver0.2

and the reactions they receive for their contents. The user's level increases based on the FI index, and Berrys are rewarded according to the level the users reach. In short, the higher the level a user reaches, the greater the benefits the user receives. FORESTING Network is based on the PTON Token. Users do not receive PTON for their social activity. Indeed, they collect Berrys which is a point obtained in Foresting by PICKing others' contents, being PICKed by others, and receiving Shooting. Berrys can be exchanged for PTON. The rewarding system provides 50% of the value to the creator of content, the 25% to the curators, and the last 26% to all the participants.

The purpose of FORESTING Bank is to support financial services required by users. Indeed, users can contribute to the platform through a variety of activities, and the contribution is computed by using a new contribution assessment model presented by FORESTING Bank.

The FORESTING Lab is an offline collaborative space for users which is accessible to any participant of the FORESTING Network. This space provides a place for users to create good quality content to provide support for content creation.

The initial FORESTING system is built on the Ethereum blockchain, and all the activities are recorded on it. If a malicious user posts too much, or goes beyond the limits of the activity that the blockchain can serve, the service may become paralyzed. For this reason, the number of posts that an individual can produce is limited.

One of the main goals of FORESTING is improving the performance of the PoS consensus algorithm by minimizing the discarded blocks that appear while creating blocks via stake. It also boosts the synchronization speed and throughput rate among nodes by minimizing the generated blocks by delayed nodes.

3.4 Appics

APPICS is one of the first Smart Media Tokens (SMT) on the STEEM Blockchain. An SMT is a native digital asset on the Steem blockchain that can be quickly launched by anyone to help monetize content, like Ethereum's ERC-20. Similar to Steemit, it introduces a new-generation social media inside a single mobile application.

APPICS utilizes the power of social media influence by integrating brand content into the ecosystem. Each user can decide how much power they want to "like" content with. A full-power "like" will add a large amount of reward to any content. The specific amount of reward depends on the amount of APPICS power the user is holding.
APPICS proposes categories, and each category has a representative, who is an expert in their field that has built a reputation and audience on other social media platforms. The expert of a category will be able to judge content, give advice and act as a moderator which can filter valuable content.

3.5 Other Social Networks

Heartbout

Heartbout[24] is also part of the next generation of social networks, where users are rewarded for their activity in the form of HB cryptocurrency. HBs an ERC20 token issued on Ethereum. On this social network, ordinary likes and dislikes are replaced by a hot and cold heart respectively.

Heartbout introduces the concept of Heart power which is mainly an indicator of how powerful is the vote at a given moment. The greater the power, the greater the reward in HB. After each 10'th vote, power is reduced by 0.2. The recovery of 0.2 power occurs every 9.6 hours. The maximum power is 1, and the minimum is 0. In addition, the reward is distributed taken the sequence number of the hot heart in the publication. The issued tokens are distributed as rewards to the author, miners, and voters. The author receives 65% of the issued tokens. The reward for reacting to the publication with a hot heart is 15%.

SocialX

SocialX[25], launched in 2018, is a community-driven social media platform allowing users to publish pictures and video content. Following, the same idea than other decentralized social media, on Social X, users have available a daily limited amount of superlikes and disliked based on the number of followers they have. Normal likes serve only to show appreciation to users while dislikes are used to identify spam, low-quality content or inappropriate content.

Sapien

Sapien, launched in 2016 Rewards are distributed by a voting process that it is called Charges. Charges are a daily allocation of votes assigned to users based on their Sapien Staking Tier. The higher the Staking Tier, the more Charges you receive per day. The more Charges a post receives, the more SPN Rewards that post will receive. There is a direct correlation. The user or post that receives the most Charges in a day will also receive the most SPN Rewards that day. In order to encourage stability of the SPN token and the curation of valuable content, SPN tokens must be staked to access social platform features at least for a period of 1 year[26].

[24] https://heartbout.com/Presentation.pdf
[25] https://socialx.network
[26] https://www.sapien.network/static/pdf/SPNv1_4.pdf

4 Selection of a Blockchain Platform

Since Bitcoin's introduction, the possibilities around applicability and potential of blockchain have attracted worldwide attention. As the market around blockchain continues to grow, a wide range of blockchain networks appeared during the past years.

With the aim of identifying the most appropriate blockchain, it is of special importance to understand the pros & cons of permisionless and permissioned blockchains.
Moreover, when evaluating the blockchain platform where to build the Helios Reward module, the following points are also of special relevance:

- Development Status of the platform
- Languages that the platform supports
- Popularity
- Consensus protocol
- Whether the platform supports smart contracts or not
- Scalability needed

4.1 Types of blockchain

Permissionless blockchain. On this model, the blockchain is kept open to the public, meaning that everybody can read, write and validate transactions without permission. Popular blockchains such as Bitcoin, Ethereum, Litecoin, Dash, among others fall under this category.

The decision-making process is normally done by one of several decentralized consensus algorithms, such as Proof of Work (PoW) or Proof of Stake (PoS). Bitcoin and Ethereum, for example, use PoW and in order to achieve consensus, a computational challenging mathematical problem must be solved. The process is known as mining and the nodes in the networks are known as miners. Once the solution has been solved by a miner, the block can be broadcasted to the network and all the other miners can verify the solution is correct. Mining requires highly specialized computer hardware and a large amount of energy and resources spent. As a consequence, there is a poor degree of scalability in terms of transactions per second and high costs associated. In networks like Bitcoin or Ethereum, the transacting identities are anonymous so the task of the system is to achieve with an adequate level of trust that the transactions are valid and that each party will comply with its duties. This is a very difficult task to perform in these conditions, and this is mainly the reason for the poor throughput observed in those public permissionless networks.

Due to the disadvantages associated with PoW, Ethereum is planning to leverage PoS with a new version called "Ethereum 2.0". Unlike PoW, PoS is based on the token ownership of participants.
The main idea behind Ethereum 2.0[27] is to solve scalability problems while maintaining the decentralization of the protocol. Some changes that will be introduced on this version are:

1) Proof-of-stake consensus mechanism over Proof-of-work.

[27] https://docs.ethhub.io/ethereum-roadmap/ethereum-2.0/eth-2.0-phases/

2) Sharding refers to partitioning a large database into smaller so each node is responsible to validate the information related to its partition rather than processing and storing the entire network's transactional load.

Despite the scalability problems on a permissionless blockchain, security and transparency are better addressed than on permissioned blockchain. All the transactions and blocks are broadcast, verified and recorded among all participants in a decentralized peer-to-peer network. This process ensures that the whole system is immutable, stable and resistant as long as more than half of the computing resources remain honest[28].

Permissioned blockchain. As opposite to permissionless blockchain, on this type of blockchain, users need approval by a trusted authority to join the network. By doing so, it addresses some of the drawbacks of public blockchains, such as the scalability. However, it also sacrifices some of the potential benefits (e.g., decentralized transactions, a wide distribution of the ledger, and a truly decentralized environment without any intermediaries[29])

In private consortiums, the entities transacting have well-known identities, and they are subject to compliance with the law and to regulation. That means that there are lower requirements on "Trustless" because system trust can be complemented via external mechanisms to the blockchain network[30].

As a summary, in Table 1, we present the main pros and cons of the two types of blockchain:

Table 1 – Comparison permissionless vs permissioned blockchain

	Permissionless	Permissioned
Pros	- Massively distributed - Good level of security - Transparent	- Scalable and faster solution - Low energy consumption - Low transactions costs - Clearly defined governance structures. - Access controls.
Cons	- Most of the permissionless Blockchains works on the principle of Proof-of-Work, meaning that it requires the consumption of a lot of resources. - Lack of speed & efficiency - Not so cost-effective. - Hard to maintain. - Decentralization can be questionable depending on the	- Permissioned network is as good as the member's integrity. - Not fully decentralized, less transparent. - Vulnerable to hacks and manipulation. - Less anonymous.

[28] https://www.eublockchainforum.eu/sites/default/files/research paper/an_overview_of_blockchain_scalability_interoperability_and_sustainability.pdf
[29] https://www2.deloitte.com/content/dam/Deloitte/us/Documents/audit/us-audit-blockchain-technology-and-its-potential-impact-on-the-audit-and-assurance-profession.pdf
[30] https://coinstelegram.com/2018/12/15/benefits-and-drawbacks-of-permissioned-blockchains/

consensus used.

In terms of compliance with GDPR, according to the study of “Blockchain and the General Data Protection Regulation”, a study written by Dr Michèle Finck, it cannot be concluded whether blockchain is compatible or not with EU data protection law. Each distributed ledger and use case must be assessed in a case-by-case analysis. Nevertheless, it is easier to design permissioned blockchain in a manner that it is compatible with GDPR than permissionless networks. Main reasons are because of its access control policies and governance structure. Participants in permissioned are known to another so there is a control over which actors have access to personal data[31].

4.2 Blockchain selection

The challenge is that there is not a proven solution that can deliver the scale, decentralization and security needed to support billions of people and transactions across the globe through a permissionless network. This is the scalability trilemma; a term coined by Vitalik Buterin[32] (founder of Ethereum) from what he raised the fact that you can only have two out of decentralization, scalability or security.

According to the whitepaper of Steem, supported by statistics from Reddit, in 2015 Reddit’s 8.7 million users generated an average of 23 comments per second, with an average of 83 comments per year per user. There were 73 million top-level posts, for an average of 2 new posts per second. There were about 7 billion upvotes creating an average voting rate of 220 votes per second. All told, if Reddit were operating on a blockchain it would require an average of 250 transactions per second[33]. If we consider Facebook, with over 2,38 billion monthly active users[34] in 2019, the number of transactions per second to be supported would require a higher outcome of scalability.

Therefore, bringing on mind that Helios could be the next generation of decentralized social networks with a high number of users registered, the Consortium has decided to go for a permissioned blockchain, in order to achieve better throughput but at the same time keeping minimum standards regarding security and decentralization.
When choosing the appropriated platform where to build the Helios Rewarding Module, from a range of multiple permissioned blockchains it is important to take into consideration the following requirements:

- The Blockchain Platform selected must support Smart Contracts to leverage decentralized applications

[31] https://www.europarl.europa.eu/RegData/etudes/STUD/2019/634445/EPRS_STU(2019)634445_EN.pdf
[32] https://github.com/ethereum/wiki/wiki/sharding-faq
[33] https://steem.com/SteemWhitePaper.pdf
[34] https://www.socialmediatoday.com/news/facebook-reaches-238-billion-users-beats-revenue-estimates-in-latest-upda/553403/

- High efficiency and transaction throughput. Capable of processing over 100 transactions per second.
- Diversity of validator nodes has to be maximized to ensure minimum levels of decentralization.
- The blockchain selected should have an optimum number of validator nodes in order to provide a major level of safety and decentralization. Minimum 21 validator nodes.
- Low or null transactions costs for validation purposes through pilots.
- Cryptocurrency may need to be supported in the future.

On the following table, the consortium has analysed mainly permissioned blockchains to see which one could be more suitable for a project like Helios. Blockchains such as Ripple, R3 Corda or Stellar have been excluded from the analysis due that they are mainly focused on the financial industry. The current characteristics of Ethereum as permissionless blockchain are included in order to have a deeper understanding of the performance obtained on permissioned blockchains.

Table 2 – Characteristics of some of the permissionless Blockchain's platforms

	Ethereum	**Steem**	**NEO**	**NEM**	**Tron**	**EOS**	**Quorum**
Launched	2015	2016	2014	2015	2017	2018	2017
Currency	Ether	Steem	NEO	XEM	TRX	EOS	-
Languages	Solidity	C++	C#, Javascript, Java, Python, and Go	Java (soon C++)	Java	C++, WASM	Java & Kotlin
Consensus	PoW / PoS*	DPoS	PoS	PoI	DPoS	DPoS	Istanbul BFT and Raft-based model
Transaction Cost	0.0023 ETH (avg.) / 0,39$	Free (only bandwidth cost)	0.001 GAS for low priority	0.05 XEM per 10,000 XEM transferred, but it capped at 1.25 XEM .	Yes, bandwidth and energy (simple transaction, energy-free but smart contract and Dapps need a bit	Partially Free (Use CPU, RAM)	Depends (if it is built over a private infrastructure)

					energy)		
Block's Time	20s	3s	15-25s	1m	15s	0,5s	50ms
Transaction Speed	15/s	>10000/s	1000/s-10000/s	>4000/s	>2000/s	>3000/s	>1000/s
Smart Contract	Yes	No	Yes	Yes	Yes	Yes	Yes

In order to ensure maximum capabilities for the Helios Project to reward users for their actions within Helios APPS, the consortium has decided to use Alastria blockchain infrastructure for the following reasons:

- Based on Quorum (which is based on Ethereum).
- Mix benefits from permissioned and semi-public blockchain models.
- Allows Smart contracts and DApps
- It's permissioned, so every participant node has to be identified before it can participate in the network.
- A more efficient consensus algorithm, enabling higher performance and scalability.
- Transaction finality in one block, enabling legal validity of executed transactions (>1000 tx/s).
- Implements legal identities of all participants.
- As for now null transaction cost by being a member of the Alastria Consortium. Worldline is currently a member through an annual membership fee.

Alastria

Alastria is a non-profit association that promotes the Digital Economy. It was launched as the Lyra Network in May 2017 and formalized as a non-profit organization in October that year. It is composed of more than 426 partners. Among them, 46% are SMEs, 15% Large Companies and 39% Institutions (Public Administrations and Universities)[35].

As it can be seen on the following figure, Alastria is neither a public-permissionless network nor a private consortium. It shares some of the properties of both types of networks. Alastria's current network is built on Quorum (Ethereum-based architecture).

[35] https://alastria.io/en/

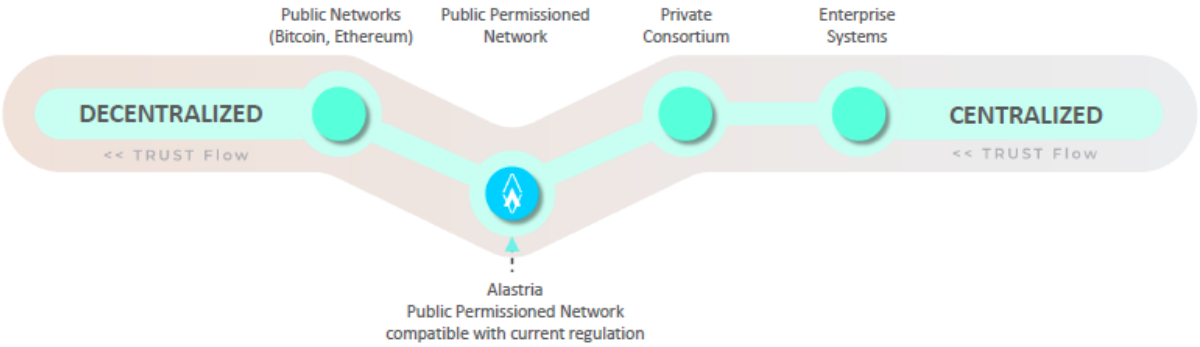

Figure 1 - Alastria, a Public Permissioned Network

In this network, three types of nodes can be displayed[36]:

- **Validators**: Responsible for generating neutrality and reliability when generating blocks. They are in charge of executing the IBFT consensus algorithm.
- **Bootnodes:** Responsible of the network's nodes permissions. Visible to every type of node.
- **Regular:** Responsible for accepting, verifying and delivering transactions to validators.

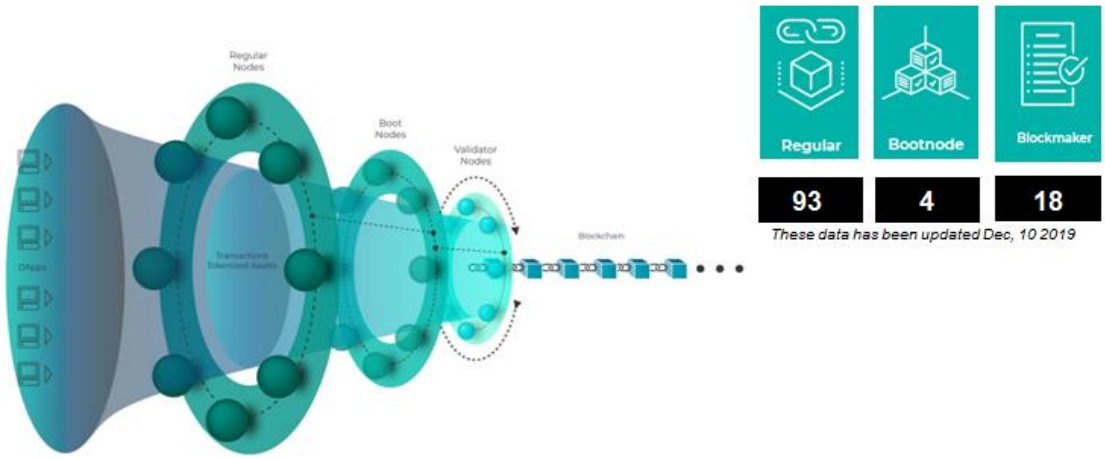

Figure 2 - Alastria's Network Architecture

In terms of distribution per sector of current Blockmaker's Node[37], the following figure depicts that there is an optimum distribution between sectors, avoiding centralization from a specific domain.

[36] https://medium.com/babel-go2chain/setting-in-motion-a-regular-node-in-the-telsius-network-of-alastria-c2d67b8369c7
[37] https://alastria.io/en/directorio-de-negocios/alastria_categoria/blockmaker-validador/

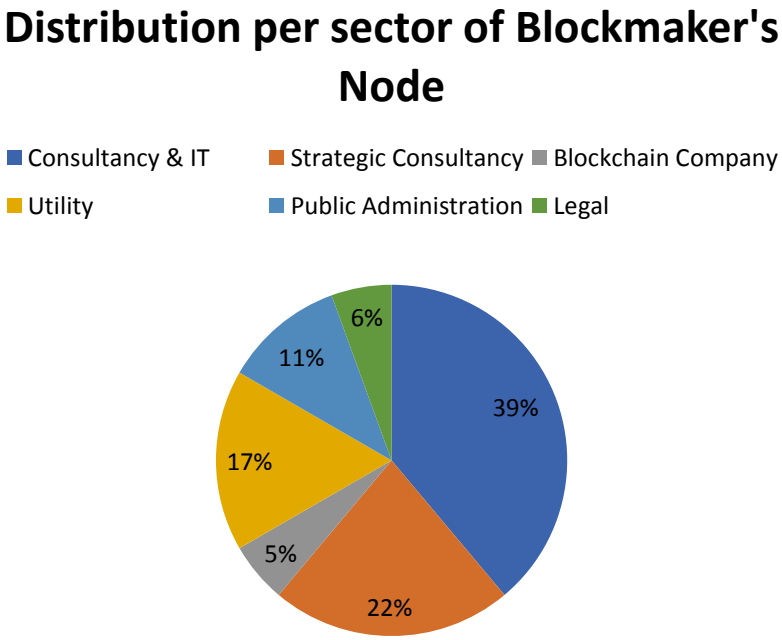

Figure 3 - Distribution per sector of Blockmaker's Node

The current implementation of Quorum in Alastria uses the Istanbul BFT (IBFT) consensus algorithm. On this type of consensus protocol, each block requires multiple rounds of voting by the set of validators to arrive at a mutual agreement, which is recorded as a collection of signatures on the block content. Byzantine fault tolerance assumes that there can be adversary nodes on the network. The network can still operate and reach consensus in the presence of the adversary nodes. This is because IBFT can tolerate up to a third of all the nodes in the network being faulty, or n=3f+1, where n is the total number of nodes and f is the number of faulty nodes[38] .

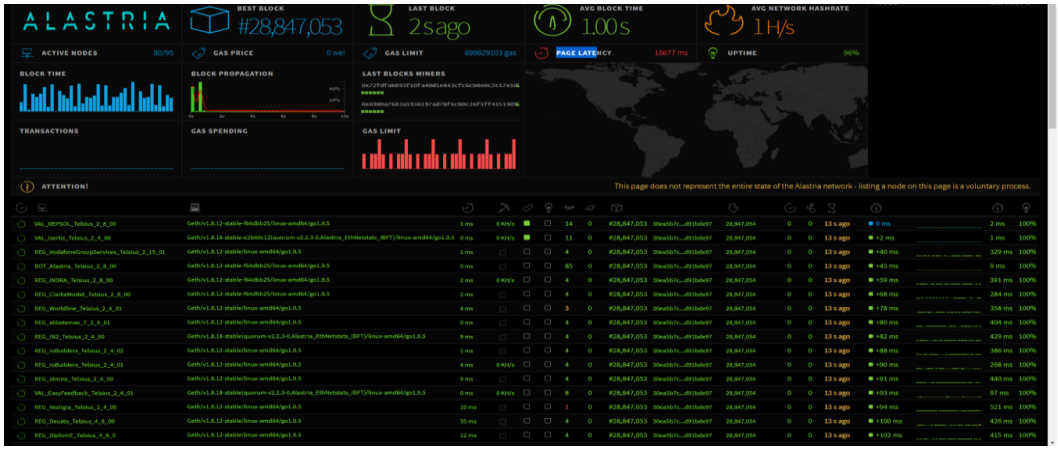

Figure 4- Alastria's Network

38 https://docs.chainstack.com/blockchains/quorum#ibft

In terms of requirements to set a node the following computer specifications are needed:

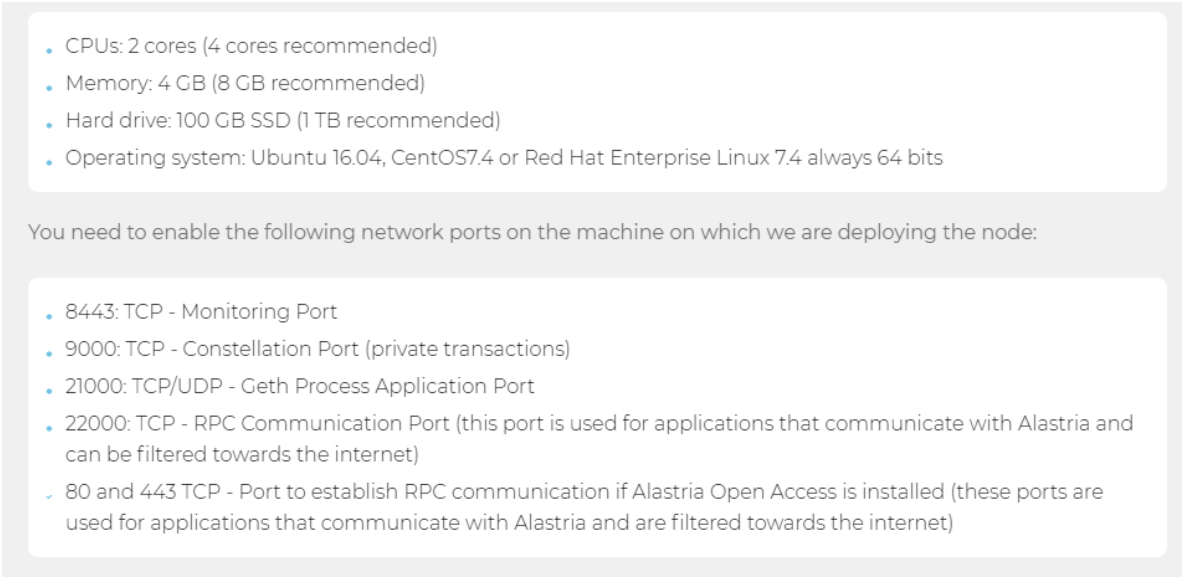

Figure 5- Alastria's System Requirements

For further information check the GitHub page of Alastria[39]

39 https://github.com/alastria/alastria-platform/blob/master/en/Alastria-Core-Technical-Platform.md#alastria-core-technical-platform

5 Use Cases Applicability

For the analysis of the rewardable actions on Helios, input from D2.6 User-Centric Design has been necessary for mapping each use case with actions subject to be a candidate for rewarding. Additionally, D8.2 Exploitation plan dealing with tokenization and D2.5 Commercial Exploitation Requirements Gathering Initial Version as initial tokenization opportunities identification have been taken into consideration for the token utility.

5.1 Use Case #A – Connecting People

Helios offers the opportunity to engage with new people, practice new activities or gain knowledge about a certain topic. It is used by people with common interests such as business people, retirees, students, co-workers, singles, etc.

Table 3 – UC A Connecting People – Reward Incentives

USE CASE B – HELIOS CULTURAL HUB			
Action	**Description**	**Reward**	**Type**
Helios Download	The user downloads the Platform from a repository. It contains different applications, such as 'Helios People'.	⊗	
Helios Minimum Set-up	The user installs Helios in an Android operated device. Setting up is started. Helios auto-sets up.	⊗	
Personal Profile	Helios builds a personal profile from the data available at the user's device. It is transferred transparently.	✓	Collect token rewards by user onboarding
Helios Activation	Users activate Helios by turning it on. Before the activation, the user decides which data will be shared. After the activation, allowed activities can be registered by Helios.	✓	Collect token rewards by joining the network
Helios Learning	Helios learns from the user's routine. Some places are equipped with smart sensors. GPS location and other data can be shared with the user's permission.	⊗	
'Helios People' Enabled	The user enables the application 'Helios People' from the platform. Once it is enabled, the user can activate it in order to search for possible contacts (also people with the app-enabled).	⊗	
Data Feed	The users are able to introduce complementary information in their profiles preferences in order to narrow the search.	✓	Collect token rewards by user onboarding

'Helios People' Search	The app starts searching for connections according to coincident preferences and routine's similarities in the context.		
'Helios People' Match	The app identifies a second user that matches with the first one in terms of routines and preferential interests in the context.		
Connection Suggested	The user receives a suggestion for the connection with a possible new contact in the context. Possible pop-up.		
Connection Accepted	The user accepts the connection in this specific context. Now both users are able to start a private chat or a public forum in this context		Collect token rewards by connecting with new users
Private Chat	The users start talking in a private chat. Only the two can read the conversation.		
Public Chat Forum (1)	The users decide to move their conversation to a public chat (a forum for this context). They open a forum on a topic that is a shared interest.		
Forum New Users (1)	Other users access and participate in the forum conversation. They belong to the same context. The forum can be a possible pop-up for them		
Forum Commercial User	A commercial user enters the forum. The context and the topic make the connection. This user promotes special commercial activities to individual users in Helios.		
Consumption in Helios	The user accepts a consumer offer launched in the forum. Helios displays a module for payment and downloading of tickets.		Spend token rewards in buying services
Forum New Users (2)	Other users access and participate in the forum conversation. They belong to the same context. The forum can be a possible pop-up for them.		
Group Chat	Users can display a private chat for more than two people. It is the option when a conversation involves more than one user but they don't want to make it public		
Meet up Event	Users in the forum propose a collective physical meeting. Date, time and meeting point is set up through Helios. The meet up can be a pop-up for other users in the context		Collect token rewards by contributing with new content

Public Chat Forum (2)	The users continue their conversation through the forum. The conversation is fed with the experience of the meetup event.	⊗	
Community increases	New users can get incorporated to the forum and to the meetup events.	✓	Collect token rewards by expanding the network
New Context Networks	After the community increases, new context networks can appear. Possible pop-ups for the users.	⊗	

5.2 Use Case #B – HELIOS Cultural HUB

On this Use Case, Helios works as a social network that connects people based on attendance to cultural events such as museums, libraries or galleries, for instance, triggered by beacons or geo-fence areas within these shared spaces. In order to provide a better user experience and additional functionalities to be considered as a value-added for using Helios Social Network, augmented and immersive experience are provided. Additionally to an interactive map where users will be able to see displayed all the information at a glance about cultural places and events update.

Table 4 – UC B Helios Cultural Hub – Reward Incentives

USE CASE B – HELIOS CULTURAL HUB			
Action	**Description**	**Reward**	**Type**
Helios Download	The user downloads the Platform from a repository. It contains different applications, such as 'Helios People'.	⊗	
Helios Minimum Set-up	The user installs Helios in an Android operated device. Setting up is started. Helios auto-sets up.	⊗	
Personal Profile	Helios builds a personal profile from the data available at the user's device. It is transferred transparently.	✓	Collect token rewards by user onboarding
Helios Activation	Users activate Helios by turning it on. Before the activation, the user decides which data will be shared. After the activation, allowed activities can be registered by Helios	✓	Collect token rewards by joining the network
Helios Learning	Helios learns from the user's routine. Some places are equipped with smart sensors. GPS location and other data can be shared with the user's permission.	✓	Collect token rewards by check-in in a specific location
Helios Notification	Active users can receive a notification (pop-up) about a new contextual network related to their interests.	⊗	
Private Chat	The users start talking in a private chat. Only the two can read the conversation.	⊗	

Active Ad-hoc Network	Users are detected by the ad-hoc network and they receive a welcome notification. A new context appears in their devices. Users have to accept privacy settings (location, activity).		Collect token rewards by joining an ad-hoc network
Content Sharing	Users receive information about the particular context. Some downloads and links are available to users.		
Premium Content	Users receive information about content extensions, provided as "premium content". They have to pay for accessing this content.		Spend reward tokens by accessing premium content
Ad-hoc Content	A beacon in the smart environment shares specific explanations of the content. The content is marked as "read".		
Helios Notification	Users can receive a notification (pop-up) about a new AR layer for content.		
AR Content	AR content is displayed through the user's device.		
Public Chat-Forum	The users can evaluate the content in a public chat (a forum for this context).		Collect reward tokens by providing feedback
Sentiment Analysis	Helios makes a sentiment analysis of the comments. The emotional score of the content is updated.		
Helios Match	The app identifies a second user that matches with the first one in terms of preferential interests and comments in the context.		
Connection Suggested	The user receives a suggestion for the connection with a possible new contact in the context. Possible pop-up.		
Connection Accepted	The user accepts the connection in this specific context. Now both users are able to start a private chat or a public forum in this context.		Collect token rewards by connecting with new users
Private Chat	The users start talking in a private chat. Only the two can read the conversation.		
Group Chat	Users can display a private chat for more than two people. It is the option when a conversation involves more than one user but they don't want to make it public.		
Content Sharing	Users share information from a particular context. Some downloads and links are available to users.		Collect token rewards by sharing content
Sentiment Analysis	Helios makes a sentiment analysis of the interaction. The emotional score is applied to their level of trust.		
VR Connection Pop-up	The user receives a suggestion for the connection through VR in the context. Possible pop-up.		
VR connection on	The user accepts the connection in this specific context. Now users can interact through VR in this context.		

VR interaction	The user is able to access the environment in VR format through the connection between devices.	

5.3 Use Case #C – Citizen Journalism

On this use case, both professional journalist and citizens can publish data (text, image, videos) and access to collect information of a specific event. This use case includes concepts such as “Trust Score” and Quality Score” to avoid fake news and quality-related. Part of Helios contextual network is already established from former editions of the same event. Within the network, users can chat, share content and make video-calls.

Table 5 – UC C Citizen Journalism-Reward Incentives

USE CASE C – CITIZEN JOURNALISM			
Action	**Description**	**Reward**	
Helios Download	The user downloads the Platform from a repository. It contains different applications, such as 'Helios People'.		Collect token rewards for joining the network
Helios Minimum Set-up	The user installs Helios in an Android operated device. Setting up is started. Helios auto-sets up.		
Personal Profile	Helios builds a personal profile from the data available at the user's device. It is transferred transparently.		Collect token rewards by user onboarding
Helios Activation	Users activate Helios. Before the activation, the user decides which data will be shared. After the activation, allowed activities can be registered by Helios.		Collect token rewards for joining the network
Helios Learning	Helios learns from the user's device. Some places are equipped with smart sensors. GPS location and other data can be shared with the user's permission.		Collect token rewards by check-in in a specific location
Active Ad-hoc network	Users are detected by the ad-hoc network and they receive a welcome notification. A new context appears in their devices. Users have to accept privacy settings (location, activity).		Collect token rewards for joining an ad-hoc network
Broadcasting	Users broadcast the event so other users can watch it through streaming in Helios		Collect token rewards by creating new content
Content Sharing	Users share information from a particular context. Some downloads and links are available to users		Collect token rewards by sharing new content
Helios Notification	Users can receive a notification (pop-up) about a new broadcasted event.		
Broadcasting Consum	Broadcasting content is displayed through other user's device.		Spend reward tokens to access content

Public Chat Forum	The users can evaluate the content in a public chat (a forum for this context).		Collect reward tokens by providing feedback
Forum New Users	Other users access and participate in the forum conversation. They belong to the same context. The forum can be a possible pop-up for them.		
Media Archive Uploading	Users can produce, edit and upload content to a media archive.		Collect token rewards by creating new content
Helios Tracking	Helios learns from user's devices. Some users are equipped with smart sensors. GPS location and other data can be shared with the user's permission.		Collect token rewards by accessing tracking sensors
Premium Content	Users receive information about content extensions, provided as "premium content". They have to pay for accessing this content.		Spend reward tokens to access content
Helios Alarm	Users can activate an alarm message. Helios can convert these messages into emergency notifications.		

5.4 Other Use Cases in the Helios Network

Table 6 – Other Use Cases in Helios

OTHER USE CASES IN THE HELIOS NETWORK			
Action	**Description**	**Reward**	
Platform feedback	Users report bugs and platform vulnerabilities to platform managers		Collect token rewards for contributing to the network
New features	Uses provide ideas on new platform features		Collect token rewards for contributing to the network
Coding	Developers participate in the implementation of new features in an open-source ecosystem		Collect token rewards for contributing to the network
Platform governance	Users participate in the decision making about platform roadmap and features implementation		Spend token as a right to vote
Early adopters	Users participating in A/B tests and/or new features early tests		Collect token rewards for contributing to the network

6 HELIOS: Rewarding Model

The primary challenge in designing the Helios rewarding protocol is to score the contributions to the network according to their subjective value. Moreover, the protocol must be impermeable to intentional manipulations for profit, as any misuse of the rewarding model could make users lose confidence in the fairness of the protocol and the network itself.

Helios rewarding model will leverage on the Helios token as a fundamental unit of account for rewards in the Helios network. It will enable micropayments for the access to different kind of network services (premium content, unblocking of new features, sponsored service consumption, etc.). Helios utility token will be blockchain-based and will offer the following characteristics:

- Near-instant settlements between actors
- Zero fees for transactions made with Helios token
- Multi-purpose utility for its expenditure and use
- Decentralized accountability

Helios users will collect Helios tokens eligible for reward-valuable actions in the network and contributions to the content creation. This deliverable will describe this rewardable actions and contributions and how these will be translated into the corresponding Helios token by the rewarding module.

For that, when designing the algorithm for rewarding on Helios Actions, the consortium has taken into consideration the following points:

- Token functioning should not be complex. It is important to keep the algorithm understandable by the average number of Helios users. The concept of a decentralized social network is quite new and therefore, in order to be widely accepted by the user community, it needs to be kept simple and well defined.
- The reward algorithm should be defined in a fair way for every single user of Helios.

6.1 Helios Multi-purpose Utility Token

The Helios multi-purpose utility token will be released and used within the Helios ecosystem for all network members as a reward in exchange for their valuable actions and contributions to the Helios platform. For its definition, a Tokenomics model framework has been designed to cover the main building blocks in the creation of a new utility token:

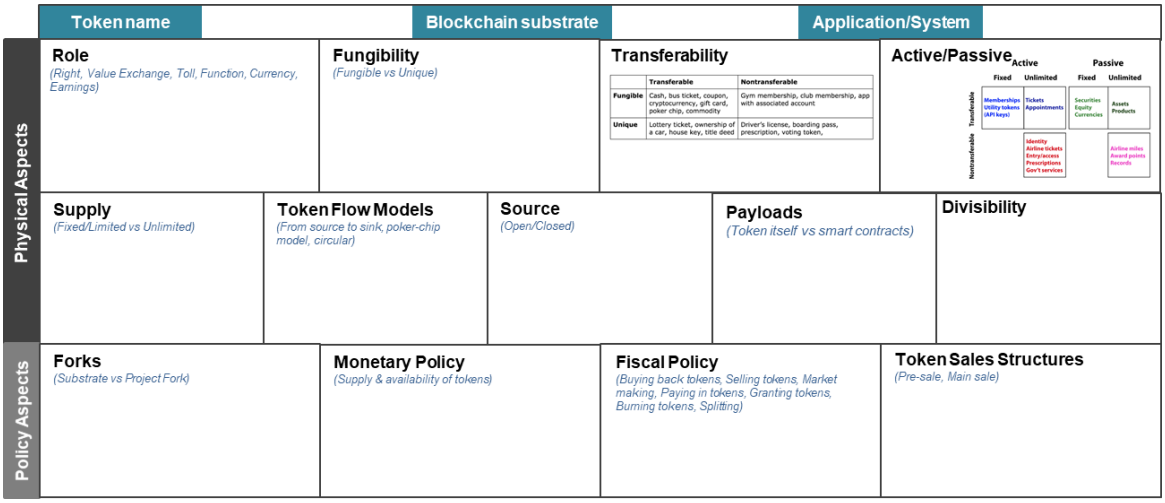

Figure 6- Tokenomics Model

- **Token Name**

The utility crypto-asset has been initially named **Helios token (HLO).**

- **Blockchain substrate**

This is the blockchain (or another "carrier" software) on which the token is issued and transacted. The blockchain substrate chosen for Helios is Quorum, an open-source blockchain platform (based on Ethereum) that combines the innovation of the public Ethereum community with enhancements to support enterprise needs. The role of the blockchain substrate is to ensure the security and validity of the token

- **Application/System**

The token may exist on a particular blockchain like Quorum, but it will only valid in a certain system or application (Helios network) and will not interoperate with other systems or applications.

6.2 Summary of Helios Token Requirements

The Helios rewarding token is defined as a utility incentive granted to Helios users for their activity and contribution in the network that might be used to access premium content or third-party services offered in the different use cases. A detailed Tokenomics study around this crypto token will take place at Deliverable D8.4 Exploitation Mid Term Report where all the physical aspects (supply model, flow model, divisibility, transferability, fungibility, utility and purpose) and policy aspects (monetary policy, fiscal policy, sales structure) will be discussed.

Hereafter, we provide the main characteristics that a utility token used as network incentive for users may have and the initial rules of thumb for its distribution to be used as requirement inputs for the tokenomics design exercise:

- The Helios token for rewards and incentives is tied to a service usage (i.e. access to premium content, unblocking premium features, payment for 3rd party services in the platform) and it is exclusive for Helios users.
- The reward token provides also a governance action for voting on a consensus related to the future platform features and roadmap.
- The token is provided to users after a proven value-adding contribution or action to the network (sharing or disclosing valuable data, content, etc.).
- In the future (out of the scope of this initial implementation), the Helios token can result in a monetizable reward if brought to exchange crypto-markets for other crypto-tokens or fiat money.
- Buying/Selling actions (i.e. users contributing with content, 3rd parties adding contextual services and products and other users willing to buy them) is part of the business model. The value of the Helios token is inherently tied to offer/supply market mechanisms.
- 3rd party developers and service providers are encouraged to generate new products and services to attach to the particular contexts of each use case.
- Helios tokens are required to run a smart contract for their transactional management. An oracle to the off-chain world is required as an API.
- Helios token is defined as a utility token according to its characteristics and purpose (access to platform services).
- The Helios network does not initially require gas to run the smart contracts. It operates over the Alastria network (based on Quorum), a public, permissioned blockchain that has no gas-based transactions.
- The Helios token is not required to join the Helios network. On the contrary, a small quantity is given for free to newcomers just for downloading, installing and providing some of their personal information to enrich the contextual data for the rest of users.
- The token is provided to users under limited circumstances (rewardable actions) that will vary depending on the weight of importance of each action (i.e. sharing content has more incentives than upvoting).
- There is a limited number of tokens that are mined in a rewarding period (initially set to a daily basis). This number will depend on the number of contributors in a day in relation to the total number of users in Helios.
- The token can actively be used as a payment unit to access network services and content. The value of this access will be determined by offer-supply mechanisms.
- The Helios token does not autonomously distribute profits nor other benefits to token holders.
- The Helios token is defined as a deflationary token (a maximum volume of 100Million Helios will be minted).

6.3 Helios Token Distribution

The following table depicts the main factors and parameters conforming the definition of the Helios token:

Table 7 – Helios Token Distribution

Parameter	Description
Maximum Circulating Supply	100 Million HLO
Initial Token Distribution	5% Community Development 5% Development Team 5% Early adopters & advisors 5% Future reserves 80% Token Reward Pool (escrow)
Rewarding Period for mining	1 day (every 24 hours or 86.400 blocks)
Max. number of tokens in Reward Pool	80 Million HLO
Block creation	Every second (Alastria Quorum)

6.4 Helios: Decentralized Rewarding and Rating Model

The main function of the decentralized reward system is to incentivize Helios users in the use of the platform. Users will be able to collect this incentive, in the form of a fungible token, and will be able to spend it for benefits within the platform (access to premium features, access to premium content, access to external services).

Why a decentralized (blockchain-based) reward system?

- An incentive system that is not dependent on a central issuer and has rules agreed by participants
- A censorship-free and transparent incentive system

The following figure shows the general scheme of the rewarding system:

- A user of the Helios network performs an action on the network that may be a candidate to be rewardable (according to system rules)
- The rewarding module manages the associated rules and incentives, confirms the rewardable action and applies the transfer of the corresponding tokens to the user's wallet
- The reward wallet accumulates such tokens as a balance of points that the user can use for other uses as if it were an internal currency of the system

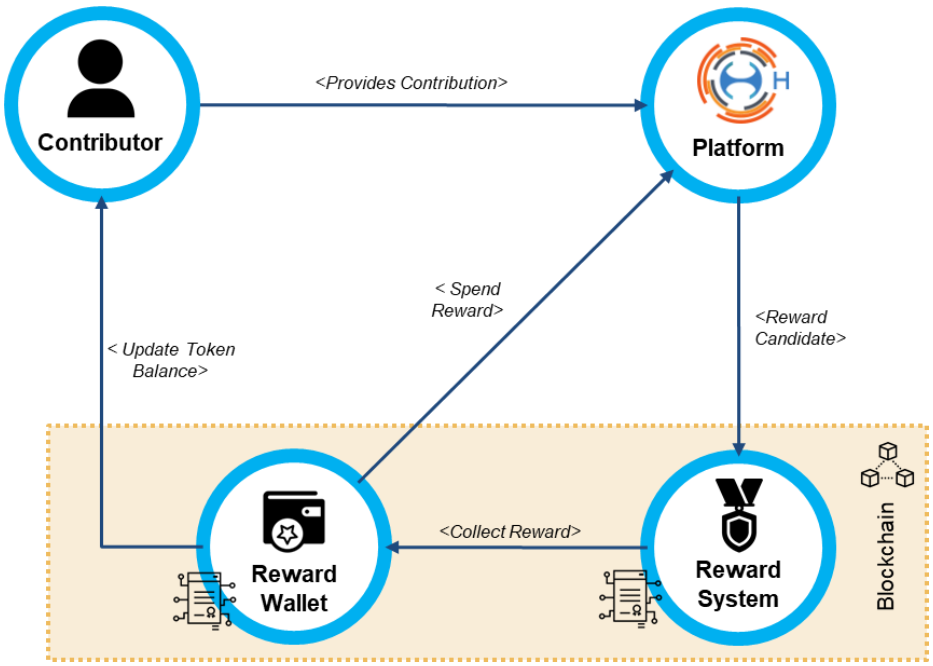

Figure 7 – General Scheme of Helios Rewarding System

As users contribute with valuable content or performing some of the identified rewardable actions on the network, they will earn Helios tokens rewards that will be directly linked to their relevance as a contributor on the Helios network. All rewards will initially transact via the Quorum Network through smart contracts.

A predetermined number of Helios tokens, based on the total daily activity directly linked with rewarding actions, will be issued at the end of each day as a **Daily Reward Pool**. An **individual's daily contribution will be determined by how much they contributed to the network that day relative to the entire community.** This percentage will then be applied to the Daily Reward Pool to determine everyone's daily token grants.

The following table outlines the scoring weight applied to each rewardable action to determine user contribution and relevance to the network:

Table 8– Score weight/rewardable action

Contribution	Weighted score
Early Adopters	50 (only once)
Join the network	10 (only once)
Profile Registration	Max 10 (only once)
Likes/Upvotes	1
Share content	2
Check-in	2
Content Views	5

Creating new content	10
Join ad-hoc network	3
Development	Manually reviewed

Hereafter, we present the main factors defined for the rewarding algorithms:

Table 9– Variable's definition

Symbol	Definition
N	Total number of users in the Helios network
$User_i$	i-th User, being 1≤ i ≤ N
R_i	Total number of Rewardable action of $User_i$
R^j_i	j-th Rewardable Action performed by $User_i$, 1≤ i ≤N, being j one of the identified rewardable actions (like, share, check-in, views, etc.)
W_j	Weight function for R^j, being j one of the identified rewardable actions (like share, check-in, views, etc.)
$Balance_i$	Balance of Helios tokens for $User_i$ at a particular moment
$Relevance_i$	Relevance factor determined by the contribution of $User_i$ related to the entire community in the rewarding period
RP	Rewarding Period determines the time Helios Network generates a reward, mining from its Reward Pool
HLO_{RP}	Total amount of Helios Token generated at each RP (rewarding period)
HLO_i	Amount of Helios tokens that $User_i$ earns at each RP (Rewarding Period) that is added to $Balance_i$
$Contribution_i$	Contribution in Helios of $User_i$
$Contributors$	Users with a non-zero $Contribution_i$ in a Rewarding Period

The total contribution of a user in the Helios network for a Reward Period (initially set to 1 day) is the following:

$$Contribution_i = \sum_{j=1}^{Ri} R_i^j \; x \; W_j$$

The Relevance of this user is related to the whole contribution performed by the rest of the users in the network for a Reward Period:

$$Relevance_i = \frac{Contribution_i}{\sum_{j=1}^{N} Contribution_j}$$

The number of tokens available for distribution to contributors in each Rewarding Period (reward mining) is based on a pre-set calculation but it also depends on the number of active users contributing to the network.

$$HLO_{RP} = \sum_{j=1}^{N} Contribution_j \times \frac{Contributors}{N}$$

Finally, the amount of Helios tokens that are transferred to each user's wallet depend on the token production (reward mining) generated every Rewarding Period by Helios in the following way:

$$HLO_i = HLO_{RP} \; x \; Relevance_i$$

The following table depicts an example of token supply according to contributions and active users (assumption N = 10.000 total users in the Helios network and 10 Contribution points in average per user):

Table 10 – Daily Token distribution according to active users and their contributions

Active Users (Contributors)	Average Contribution /day	Total Contribution	Helios Token minted by day	Avg. Tokens/ Contributor	Contribution Avg Value (HLO tokens)
0	0	0	0	0	0
1	10	10	0,001	0,001	0,0001
5	10	50	0,025	0,005	0,0005
10	10	100	0,1	0,01	0,001
100	10	1000	10	0,1	0,01
500	10	5000	250	0,5	0,05

750	10	7500	562,5	0,75	0,075
1000	10	10000	1000	1	0,1
2500	10	25000	6250	2,5	0,25
5000	10	50000	25000	5	0,5
7500	10	75000	56250	7,5	0,75
10000	10	100000	100000	10	1

Under this linear model, there is no fixed token minting on a daily basis but the emission is proportional to the active contribution in the network. Higher active participation is rewarded with higher pay-outs in tokens.

6.5 Utility of the Helios Token

Helios users will collect Helios rewarding tokens through the performance of activities and actions that are tagged as rewardable (see above Reward incentives for each use case). These tokens will be collected in their mobile applications within a wallet module that will store the balance of tokens and the capability to transfer a partial or total amount in exchange of benefits accessible to each use case. These accessible benefits will be defined at Deliverable D8.4 Exploitation Mid Term Report for each of the use cases but hereafter we describe initial token utilities that will be defined within the scope of the different contexts and use cases where this token may be spent:

- Access to premium content
- Access to external services as a discount on the final price
- Content promotion
- Promotional campaigns for external services
- Platform development governance (voting on new features and product roadmap)

The collection of Helios token has been initially defined as an assignment of tokens regarding the activity and contribution of a user in the network but it is not the only way to get Helios tokens. We can imagine situations in which the access to certain content or services may request an effort in incentives that can be hard to accomplish for most users (i.e. Use Case C, where no proactive users or content providers that are willing to access premium content, too). In the Tokenomics exercise, we will determine the characteristics of the Helios token to be collateralized with Euros and allow users to buy pre-paid Helios cards that may increase the balance of tokens in their wallets. This initial off-chain payment can be done in Euros that will be blocked in an escrow account in exchange for Helios tokens (i.e. pre-paid cards will display a QR code that will trigger the transfer to the wallet after scanning it with the use case application).

7 Conclusions & Next Steps

This deliverable (named D4.4 “Rewarding Strategies”) identified the rewardable actions to be considered on each of the three use cases that will validate Helios Results and defined how these actions are translated into the corresponding Helios token by the Rewarding Module.

For the definition of the Rewarding Module, deliverable D2.5 “Commercial Exploitation Requirements Gathering”, D2.6 “User-Centric Design Gathering” and D8.2 “Exploitation Plan” have been crucial for the identification of the corresponding rewardable actions as well as for tokenization purposes.

In this deliverable, different blockchain platforms have been analysed with the aim of identifying the most appropriate and convenient blockchain where to build the Rewarding Module for a project such as Helios. Having studied the wide range of blockchain platforms and its characteristics, the consortium has decided to go for a public permissioned blockchain, specifically Quorum, as scalability is fundamental if we consider that Helios could be the next generation of social networks.

Additionally, rewarding algorithms used on some of the most famous BOSNs such as Steemit and Minds have been analysed with the purpose of identifying limitations and opportunities to improve user perception in regards to a fair and transparent rewarding algorithm, keeping the algorithm understandable by the average number of Helios users.

Finally, a tokenomics model framework has been designed to cover the main building blocks in the creation of a new utility token. An extended detailed version of the tokenomics framework will be provided within deliverable D8.4 Exploitation mid Term Report, where the utility will be defined within the scope of the different contexts and use cases where the Helios token may be spent.

As next steps, from M15 to M18, the rewarding module will be developed and implemented. An API will be provided to ensure integration with Helios Use Cases for accessing the blockchain and smart contracts.