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What it Means to Decentralize the Web

A Study of the Implications and Feasibility of a Decentralized Web

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SUMMARY:

Although based on decentralized principles, the World Wide Web has become highly centralized with a few multinational tech corporations hosting and providing all of the services most people use the internet for. This has led to the unproportionate power some companies hold over the world's people and has wide consequences, not least is reduced integrity. As a response to this development, decentralized alternatives to these services are being developed and used, as well as a vision for an entirely new web (Web3). Federated social networks, blockchain technologies, dApps, and more are all components of a new decentralized web. However, these initiatives face threatening challenges - both technological and social ones. While these alternative solutions are a viable solution for some, none of them are in a stage where they can compete with the centralized architecture. Due to substandard UX design, poor performance, network effects, inherently reduced functionality and a tainted reputation, the decentralized web is far from as functional as the traditional web.

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1 Introduction

In 1989 Tim Berners-Lee submitted a proposal to his boss Mike Sendall for an information management system. After reading the proposal, Sendall wrote the famous words “*Vague, but exciting*” on the paper. This information management system came to be known as the World Wide Web (Webfoundation.org, 2022). Now, over three decades later, Berners-Lee is the head of Solid, a framework for developing decentralized applications. (Mansour et al., 2016) Berners-Lee is not alone in the mission to re-decentralize the web, decentralized applications (dApps) are being developed at an unprecedented pace (Wu, 2019), and are to some extent replacing traditional services. At the same time, emerging technologies are enabling Web3 to be realized, an idea of a decentralized web that aims to remove the intermediaries entirely.

When the internet was first introduced to the world, it was in its natural state decentralized. However, the way that the web is structured has changed dramatically since the birth of the internet. Fairly few large tech companies, such as Google, Microsoft, Amazon and Meta (formerly Facebook) have managed to control a significant portion of the internet's infrastructure and services (Vojíš et al., 2020). These companies have accumulated vast amounts of user data and have built sophisticated algorithms and technologies that make it difficult for smaller competitors to enter the market. As a result, they have been able to maintain their dominance while smaller companies struggle to compete. As the web has become more sophisticated, it has become more difficult for individuals and small companies to create and maintain websites and web applications. This has led to a reliance on large companies and centralized services to provide web hosting, content delivery, and other services (Raman et al., 2019). Furthermore, the rise of social media platforms has contributed to the centralization of the web. The social platforms under Meta (Facebook and Instagram) and Twitter have become the primary way that many people access and share content on the web. As a result, these platforms have unprecedented power to shape public discourse and influence the spread of information, and there is no governing body to ensure that this power is not abused (Barabas et al., 2017). Seeing as social media is the modern day arena for political debate and discussion, allowing privately owned companies to ban whoever they choose from the public discourse can be viewed as a democratic problem. Furthermore, more and more people are getting the majority of their news from social media (Pew Research Center, 2021), this means that these companies have to a large extent the ability to control what enters the public consciousness (Barabas et al., 2017).

As a counter reaction to this development, and as people start to realize the value of privacy and ownership over one's own data, the idea of a decentralized web emerged (Barabas et al., 2017). Decentralizing the web has never been thought of as a quick transition, no one owns the internet nor has the ability to alter it at such a fundamental level. Instead, decentralized, open source alternatives to established digital services have been gaining traction in recent years. Examples such as Mastodon, PeerTube, and Hubzilla have surfaced as replacements for Twitter, YouTube and Facebook (Raman et al., 2019). Utilizing a peer-to-peer architecture, these services can be hosted by anyone, effectively removing the large corporations out of the equation. These have been both praised and criticized, and questions about if these really can replace their traditional counterparts are vigorously debated.

Furthermore, the question if a decentralized web is technologically possible is highly debated. Of course, in order to understand the discourse surrounding the debate, the “decentralized web” must be defined. Surely a more decentralized web can be achieved - it is happening at the moment - but a fully decentralized web is another question altogether. Because of this distinction, a portion of this paper will be dedicated to the explicit attempt at building a new

decentralized iteration of the web known as Web3. What this would entail, the current state of it and its future potential will be explored.

1.1 The Problem

Barabas et al. (2017) argue that the web had to consolidate around a few curated service platforms, otherwise it would not have been able to become practical for everyday users. Now that the web is highly usable, the focus in regards to what development is wanted on the web has shifted for many. There is a large interest for a more decentralized web, or a decentralized alternative to our current web to be found online as showcased by the myriad articles, research papers and forums. What is often referred to, by these communities of enthusiasts, as *hype*, or excitement for the decentralized web seems to have been increasing since the inception of the idea (Gartner, 2020). New dApps are being built at an unprecedented pace (Wu, 2019), and new technologies such as blockchain networks give the impression that the technology might finally allow for the ostensibly utopian dream to be realized.

Fueling the excitement and enthusiasm is a growing concern for internet integrity and ownership of data (Zembruzki et al., 2022). Internet users are at a larger scale than ever becoming aware of the reality that multinational, billion dollar corporations are monetizing their personal data (Vojír et al., 2020). Simultaneously, it is becoming increasingly difficult to evade this reality due to the oligarchic nature of internet services such as Google or Facebook. While one always has the option of refusing to utilize these services, doing so would put one at a disadvantage, socially and economically. Not utilizing any form of social media means missing out invitations to events, or generally being out of the loop, especially for younger generations. Resisting the use of services such as Google or Bing would make an otherwise easy tasks, such as information finding, difficult. Refusing services powered by Amazon will most likely result in more expensive goods, and in many cases not attaining it. The comfort of a Chromecast, smart watch or home assistant would not be an option. The list of downsides to refusing the services of mega tech companies is extensive. Not least is the fact that in order to set up a website on the conventional web, it needs to be hosted on a server, and most people do not have access to the hardware or know-how in order to set it up. The vast majority of people will utilize Amazon's (AWS), Microsoft's (Azure) or Google's (GCS) affordable cloud solutions (Liu et al., 2017). The respective market share of “*The Big Three*” has been estimated at 22% for Amazon, 23% for Microsoft and 11% for Google, together accounting for 66% of worldwide cloud revenue (Dutta et al., 2019). Another component needed to contribute to the web is acquiring a domain name so that the site can be found, this too has been shown to be a highly consolidated market. The top five DNS (Domain Name Server) providers account for over 20% of all domains and the top one hundred account for 80% of the IPv4 domains (Zembruzki et al., 2022).

Furthermore, O'Reilly (2021) means that our current web (Web2) has become an environment where it is difficult for creators to gain visibility for their work. He says that “*What was once an open and generally free internet has become increasingly gated, with creators paying companies to publish their work and users paying companies for access to it.*” (O'Reilly 2021).

It cannot be disputed that the web is highly centralized. This has prompted many to search for an alternative. Given this reality, a decentralized web becomes a highly attractive solution: all of the useful services, none of the exploitation of the user. Murray et al. (2023) states that

“Web3 has the potential to undermine the business models of large, centralized platforms that follow predictable lifecycles”.

Strides are being made towards a decentralized web, particularly in way of decentralized apps (Wu, 2019). Still, central questions prove to be difficult to answer, such as if a fully equipped and functional decentralized web is feasible, or if decentralized alternatives to traditional services would be able to perform similarly to their respective counterparts.

There is more than optimism surrounding the concept of a decentralized web, the idea has attracted justified criticism by credible authors. This critique has been directed both at the technological feasibility of the project and at the idealistic goal itself (Diehl, 2021). Decentralized services have also proven to be difficult to launch (Barabas et al., 2017; Raman et al., 2019). The federated social networks Mastodon, today’s biggest decentralized competitor to traditional social media, is shown to not actually be very decentralized and is far from being on par in terms of performance (Raman et al., 2019).

While a decentralized web could provide a non-hierarchical platform on which censorship would be impossible, where everyone is the sole owner of one’s information and where the barrier or entry for any type of creator would be reduced; there is a case to be made about the spread of illegal and/or unethical content, crypto-scams and the vending of illegal or unethical items. In some cases, the sole question of performance has been enough to make tech enthusiasts pessimistic at the thought of a decentralized web. Because of excessive hype on the one hand, and overly critical tech commentators on the other hand it becomes difficult to assess the movement.

1.2 Purpose

The purpose of this study is to contribute with knowledge useful to decision makers in the context of the decentralized web by shining light on if efforts to develop it further is desirable.

1.3 Research Question

With this as background, our research question is as follows:

What would a more decentralized web entail, and how feasible is mainstream adaptation of a fully decentralized web?

1.4 Delimitations

We limit the scope of this essay to examining only the impact of the decentralized web on its users. In this paper, there will be no examination of the societal effects that a decentralized web could entail, nor will we examine the concept from a group-perspective.

Not only will the implications of the decentralized web be investigated, but to what extent the concept might be realized will also be explored. This paper will therefore also describe to what extent a fully decentralized web is feasible and any technical and non-technical limitations present.

1.5 Topics, Explanations and Definitions

1.5.1 *The Decentralized Web*

While there is no agreed upon definition of the decentralized web it can be said that it is a concept, in the same way that the world wide web (WWW) is a concept. The decentralized web that exists today comprises all of the decentralized services that are available, but the concept entails much more than what can be observed today. In many ways, the decentralized web offers decentralized alternatives to the traditional web (Web2), such as ENS instead of DNS, blockchain ledgers instead of centralized banks for making transactions or P2P online software such as federated social networks. However, it does also provide services that have no centralized equivalent, smart contracts is an example of that (O'Reilly 2021). Some of these technologies vary in what extent they are actually decentralized, for the purpose of this paper all advancements in online decentralization will be regarded as an extension of the decentralized web. It can be thought of as the part of the web that is decentralized, often accessible to interact with only through certain browsers or browser extensions. Raman et al. (2019) define it as *“an evolving concept, which encompasses technologies broadly aimed at providing greater transparency, openness, and democracy on the web”* (p. 217). Web3 refers specifically to the next generation of the internet that is being built using decentralized technologies such as blockchain, distributed computing, and peer-to-peer networking and is included in the term decentralized web. Web3 is explained in greater detail below.

1.5.2 *Web3*

Web3, sometimes referred to as Web3.0 is a concept based on the idea of building a new version of the internet utilizing blockchain technologies, thus making decentralization possible. The idea originates from the cryptocurrency community, being coined 2014 by Ethereum co-founder Gavin Wood and has been gaining traction in more recent years (Edelman, 2022). Web3 is often described as a natural step in the development of the internet from Web1 and Web2, the version of the internet that is currently dominating. In this context, Web1 refers to the early stages of the internet when the majority of the online content was made up of static pages, simply as a means of spreading information. Web2 is defined by a shift in paradigms, the internet was no longer just a means to deliver information to the user - now the user delivered information about itself. Large corporations were able to interact with users, collect their data, market and sell products through the web and not least capitalize on data collected from users by selling it to external parties (Murray et al. 2023). Smutný et al. (2020) summarizes the three iterations of the web in a sweeping yet effective way: *“assuming that Web1 revolutionized information and Web2 revolutionized interaction, Web3 has the potential to revolutionize agreements and value exchange.”*

Web3 can be regarded as a response to the shortcomings of our current day internet. Mainly, the critique is aimed at the increasing power large corporations hold and their inescapable presence. The core function of Web3 is to circumvent the otherwise inevitable Web2 feature that is the exchange of services for personal data. Web3 would allow anyone to consume these services without giving up information about oneself, in fact, it would remove the very corporations that monetize this personal data. Web3 is a concept, it is not, nor can it be owned. There are however organizations dedicated to funding Web3 initiatives, one such being the Web3 foundation (Web3 Foundation, 2023).

While cryptocurrency is heavily associated with Web3, they can exist without each other. Yet, in order to build a usable decentralized web, there must exist some sort of transaction method

for business to be conducted. Here is where the two intersect. As Tim O'Reilly, the man who popularized the terms open source and Web2, stated “*If Web3 is to become a general purpose financial system, or a general system for decentralized trust, it needs to develop robust interfaces with the real world, its legal systems, and the operating economy*” (O'Reilly 2021).

The following sections below all describe technologies that would have to be deployed for a fully usable decentralized web to exist, all of these play a central role in the development of Web3 and re-decentralization of the web as a whole. Web3 based services are being developed today and can be accessed via certain browsers such as Brave Browser or via browser extensions such as MetaMask.

1.5.3 *Blockchain*

The first implementation of a blockchain was described in *Bitcoin: A Peer-to-Peer Electronic Cash System*, a white paper for the first cryptocurrency Bitcoin released 2008 under the pseudonym Satoshi Nakamoto. The paper is available to read at bitcoin.org/bitcoin.pdf, but the true identity or identities of Satoshi Nakamoto is still unknown (Zarrin et al., 2021). It proposed a decentralized currency working based on a trustless system: The Blockchain. It is a decentralized and distributed ledger technology and it enables secure and transparent recording of transactions or data in a chronological and immutable manner (Zarrin et al., 2021). It consists of a series of interconnected blocks, each containing a set of transactions or data, and is maintained by a network of nodes that validate and agree on the state of the ledger through what is called consensus algorithms. The technology provides a secure and transparent method for recording and verifying transactions or data without relying on any central authority. Data recorded on a blockchain is encrypted, time-stamped, and distributed across multiple nodes within the network, making it resistant to tampering, fraud, and censorship (Di Pierro, 2017).

Each of the blocks are stored next to each other and contains the hash of the previous transaction, creating a chain. Transactions are pieces of information that contain details about a specific transaction and the time it occurred. These details can be represented as numerical values or strings in a computer system. A blockchain can be likened to a table with three columns, where each row represents a unique transaction. The first column stores the timestamp of the transaction, the second column stores the transaction details, and the third column stores a hash that is computed using the current transaction's details and the hash of the previous transaction. When a new transaction is added to the blockchain, the most recent hash is shared with all relevant parties. It is not necessary for every party to keep a complete copy of the entire transaction history; a few parties can suffice. This is because anyone can verify the integrity of the data by comparing it with the last hash, (Di Pierro, 2017) which ensures that the data has not been tampered with.

The blockchain technology in itself is fairly straightforward, a simple code example is given by Di Pierro in *What is the Blockchain?* (2017). It is in the implementation that the complicated technical procedures must take place, such as algorithms for data distribution, syncing nodes, efficient storage, querying or conflict resolutions. But at the core of these systems, a few lines of code make up the technology that makes it possible.

1.5.4 *DAO - Decentralized Autonomous Organization*

A DAO is precisely what its name suggests. Utilizing open source code and Smart Contracts a DAO is essentially a digital organization with no board, CEO nor managers. These organizations are programmed into existence and run on decentralized networks -

blockchains. Self-executing programs dictate the rules of the organization and these are voted upon, this means that there is no central authority. There is no predetermined way to set up a DAO, for instance, who gets voting rights can vary widely. Usually voting rights are granted to anyone holding the DAO's native token, and the power of influence is proportional to how much one owns (El Faqir et al., 2020). "Native tokens" can best be explained as the cryptocurrency equivalent of a company's stock. Some DAOs allow anyone to vote while others have other more specific rules. Whatever the configuration is, the process is always fully transparent (El Faqir et al., 2020).

DAOs are designed to enable decentralized and democratic governance, where stakeholders collectively participate in decision-making processes. They typically use mechanisms such as voting, consensus algorithms, and smart contracts to determine the direction and actions of the organization. DAOs can be used in various domains, including finance, governance, supply chain management, and more. DAOs are transparent, auditable, and resistant to censorship or manipulation, as their operations are recorded on a blockchain. They foster inclusivity by providing a platform for stakeholders to participate in decision-making and have a say in the organization's operations (El Faqir et al., 2020).

It must be remembered that DAOs do have drawbacks. The open source nature of a DAO is often credited to making it safer since everyone can inspect the code and report or fix bugs, however this is a double edged sword: malicious hackers can also inspect the code and exploit any potential vulnerability. Since the code can be copied, they may even test and perfect their attacks. This has happened more than once, most famously to an early DAO called *The DAO*, where the culprit managed to extract around 55 million dollars worth of the cryptocurrency Ethereum. This early setback prompted the Ethereum Foundation to, after several days of discussions, perform a so-called hard fork and return the stolen funds to their investors. This effectively created a split in the currency between Ethereum Classic (ETC) and Ethereum (ETH), saving the operation. The fork did however damage the concept of immutability of the ledger's past records (Meher et al., 2019). Another disadvantage is that the open source policy has a tradeoff, there can of course not exist business secrets.

Still, because of the many upsides to DAOs, many regard them as attractive alternatives to traditional organizations. They are collectively owned and controlled, trustless and open source, they cannot be shut down if enough instances host it and are resistant to governmental interference since there is no central authority (El Faqir et al., 2020).

1.5.5 *Smart Contracts*

Smart contracts are self-executing digital agreements that are encoded on a blockchain or other distributed ledger technologies. They are programs that automatically enforce and execute predefined actions without the need for intermediaries or any central authority. Because of this, they are transparent, immutable, and tamper-proof. Zheng et al. (2020) identify the chief benefits of smart contracts as 1) Reducing risks, 2) Cutting down administration and service costs and 3) Improving the efficiency of business processes.

As smart contracts are designed to facilitate transparency, and efficiency in digital transactions by eliminating the need for intermediaries; they are typically triggered by specific events or conditions. They automatically execute transactions or other actions based on predefined rules. This is the basis for what is known as a *trustless system* - no trust is needed. The phrase "*code is law*" sprung out of this concept, emphasizing that these systems will execute exactly what they are programmed to, and that this is a feature that cannot be

guaranteed in traditional contracts, companies or any other process where humans handle the executing of the task (Zheng et al., 2020).

Smart contracts are typically executed in a decentralized and consensus-driven manner, where multiple nodes in a network validate and agree on the outcome of the contract. This ensures that the execution of the contract is transparent, auditable, and resistant to censorship or manipulation (Zheng et al., 2020).

1.5.6 dApps - Decentralized Apps

Decentralized Applications are software applications that operate on a decentralized network, typically based on blockchain or other distributed ledger technologies, without the need for intermediaries or centralized authorities. dApps aim to provide transparent, secure, and autonomous applications that are governed by code and consensus among network participants, rather than relying on a single entity for control. They are designed to run on a peer-to-peer (P2P) network, where the users themselves host the application, eliminating the need for intermediaries. They are typically open-source, accessible to anyone with internet connectivity, and use smart contracts to automate processes and enforce rules. Typically, these are governed by DAOs or community-driven protocols, where decision-making and governance is distributed among network participants (Wu, 2019).

Like any other decentralized software, dApps benefit from the stability that comes with distributed hosting. There is no single point of failure, unlike centralized services.

There is a distinction to be made when it comes to dApps, not every decentralized service is technically a dApp. Mastodon, for instance, is not a dApp, even if it increases decentralization on the web. Rather, mastodon is a federated service (Barabas et al., 2017). dApps and federated services are both software systems used in the realm of distributed computing, but they have fundamental differences in their architecture and operation. Mainly, federated services are systems in which multiple entities or organizations collaborate to provide a unified service

1.5.7 DeFi - Decentralized Finance

According to Zetsche et al. (2020), DeFi can be understood as “*the decentralized provision of financial services through a mix of infrastructure, markets, technology, methods, and applications*”. In other words, DeFi refers to financial systems that operate on decentralized networks. These will typically be blockchain technologies and thus they can omit intermediaries or centralized authorities. DeFi aims to provide open, transparent, and permissionless financial services to users, enabling them to transact, save, invest, and access financial products and services in a peer-to-peer manner. It leverages smart contracts (see 1.5.4 *Smart Contracts*) to automate financial processes and eliminate the need for intermediaries. The same researchers suggest that DeFi technology has the potential to undermine traditional forms of finance, out-performing it in several ways.

1.5.8 P2P - Peer-to-Peer Architecture

Peer-to-Peer architecture is a distributed computing model where multiple nodes in a network collaborate and share resources, such as computing power, storage, and data, without relying on a central authority. In P2P networks, all participating nodes have equal capabilities and responsibilities, and they can act as both clients and servers, providing and consuming resources interchangeably. Concisely put: “*The term “peer-to-peer” refers to a class of*

systems and applications that employ distributed resources to perform a function in a decentralized manner.” (Milojicic, 2002). P2P architecture enables direct communication and interaction among peers in the network, without the need for intermediaries or central servers. Peers can initiate requests, provide services, and share resources with other peers in a decentralized manner. P2P networks can be classified into different types based on their organization, such as unstructured, structured, and hybrid P2P networks, each with its own characteristics and benefits.

This type of architecture has been widely used in various applications, such as file sharing, content distribution, communication, and computation. Examples of P2P protocols include BitTorrent for file sharing, Bitcoin for cryptocurrency transactions, and Skype for voice over IP (VoIP) communication (Milojicic, 2002).

2 Literature Review

There are several directions to move towards within the context of the decentralized web, there are more philosophical areas where authors such as Bruce Schneier are heavily referenced in conjunction with terms such as “Cloud feudalism”. This is a term used to describe a situation in which a few large technology companies have gained significant control over the cloud computing infrastructure that supports much of the modern internet (Liu et al., 2017). Another direction is heavily technical, there is a plethora of technical papers detailing peer-to-peer architecture applied to various technologies and services. While some of these do hold some relevance in this essay, the main focus will be on the papers creating discourse around fairly practical aspects of digital decentralization, and its associated effects.

Many authors, including Vojř et al. (2020) have described the effort to decentralize the web as rather an effort to re-decentralize the web. What is meant by this is that the internet was not originally set up in such a fashion that only few owned the data of many - it happened over time (Barabas et al., 2017; Liu et al., 2017; Raman et al., 2020). Eloquently put: *“Although the World Wide Web (or web) is a decentralized network of interconnected documents, highly centralized ecosystem dominated by a few supranational companies has developed on top of these foundations.”* (p. 107, Vojř et al., 2020) With this in mind, Raman et al. focus their attention at highlighting properties that create natural pressures towards re-centralisation. As these researchers show, as a decentralized alternative web service grows, it seems that centralization naturally occurs. By investigating the case of Mastodon, a decentralized social media platform, they found that 10% of the hosting instances host almost half of the users. Even with a peer-to-peer infrastructure, it seems high degrees of centralization do emerge spontaneously. Bratton (2016) argues that search engines are “centers of power” as they act as a gateway to web content, which determines the likelihood of a user visiting a webpage. For instance, research shows that users tend to visit webpages presented on the first page of search results, usually even in the first half (Ledford, 2008). This concentration of power is also evident in social networks such as Facebook, where algorithms dictate the media content that appears on a user's home page, influencing the content that users consume. This is sometimes known as the *“dictatorship of algorithms”* that offers personalized content (Vojř et al., 2020).

There is also an abundance of academic papers detailing a specific effort to, among other things, decentralize the web, known as Web3. This is an explicit effort to not as much change the way the internet works as it is an effort to provide an alternative web. Murray et al. 2023 provide valuable information on the topic in their article about how firms can prepare for the change. It is in this realm that topics such as DAOs, Blockchain and Cryptocurrencies become important to understand as they are highly interconnected to the project. All of these topics are in turn sources for yet more academic writings, and subject to research in their own regard. Some of these have relevance in this paper.

Web3, being a tangible project which can be explored and tested by anyone, has attracted the attention of not only scholars but also the tech industry as well as tech enthusiasts. As a result, there has been a recent surge of non-academic articles, tech journal news reports, blog posts, videos and other resources on this topic. Some of these are produced by credible and knowledgeable authors and will be taken into account in this paper. One example of such an instance is an article written by software engineer, author and cryptocurrency critic Stephen

Diehl (2021), detailing all of the ways Web3 might only be a technologically unachievable dream.

Whether or not within the context of Web3 or the broader cause of digital decentralization, decentralized applications or dApps play a crucial role. By everyday people, the internet is used primarily to access helpful platforms allowing for chat, email, digital social interactions and more. It then stands to reason that for the web to become decentralized, so must these functions (O'Reilly, 2021). This is the function that dApps serve. For the web to be truly decentralized, these must be found and accessed through other search engines than Google or Bing, since these, just like every other established digital service, are centrally hosted on the servers of tech conglomerates. By this logic it becomes evident that browsers, search engines, chat platforms, image sharing platforms to name a few must have a dApp equivalent in order for a decentralized web to be useful. Because of this, literature covered in this paper will occasionally deal with specific dApps or federated networks such as Mastodon (Raman et al., 2019) or search engines (Bratton, 2016).

2.1 The Rise, Dangers and Benefits of the Centralized Web and Challenges in Re-Decentralization

Out of MIT Media Lab, a research laboratory at the Massachusetts Institute of Technology, Barabas et al. (2017) seeks to explore the topic of decentralization in the context of the web. Several services and technologies are examined, namely: Freedom Box, Diaspora and Mastodon as well as Blockstack, IPFS, Solid, Appcoins and Steemit. These technologies are all meant to provide solutions to further spread the decentralized web, for instance, Blockstack enables personal identities and IPFS enables decentralized data storage. These researchers suggest that apex threats to the project of re-decentralizing the web are user and developer adoption, security, monetization (incentives) and resisting market consolidation. A key takeaway is that the heavily centralized internet of today is, in fact, built atop distributed peer-to-peer protocols such as HTTP and SMTP. This in itself evidently did not lead to a decentralized system, rather a system featuring a few service providers surfaced (Barabas et al. 2017). A clear demonstration of this can be seen in the distribution of online advertising dollars, the idea is that this data will roughly correspond to the distribution of viewership on the internet. A 2016 report shows that 85 cents of every new dollar spent on online advertising went to either Facebook (now Meta) or Google (New York Times, 2017). This demonstrates that structurally decentralized architecture does not necessarily equate to decentralized, competitive markets.

Barabas (2017), Liu et al. (2017), Raman (2019) and Vojř (2020) et al. all recognize that centralization (and market consolidation) often yields benefits in terms of usability, efficiency and performance but that these gains come at a cost, namely control and freedom.

Furthermore, four risks are identified by Barabas et al. (2017) with our current day web: 1) Top-down, Direct Censorship, 2) Curatorial Bias / Indirect Censorship, 3) Abuse of Curatorial Power and 4) Exclusion. The first risk of direct censorship is not a hypothetical scenario that the researchers are foreboding, it does occur. The example mentioned by Barabas et al. (2017) is from 2016 when Facebook prevented users in Thailand from viewing satirical pages mocking the king and the Thai royal family. Nothing can in reality be done about this since social media corporations like any other corporate entity must comply with local laws and regulations in order to stay in business. This applies even concerning free speech. Curatorial

bias or indirect censorship is more subtle but not less worrisome, they argue. What is meant by this term is an unintentional censorship created by the automated algorithms designed to maximize likes and user-retention. These algorithms dictate what people see in their feed, what they find when they search within the platform and thus effectively what gets coverage. Abuse of curatorial power refers to intentional, arbitrary removal of content from the platform by the platform. This is something Facebook was accused of doing, although it is still unclear whether the allegations are true. Exclusion, like the above mentioned risks, is current and non-hypothetical and aims to describe how exclusion from social media is de facto exclusion from the political debate. This fact, combined with the fact that it is impossible to moderate networks of this size at a detailed level creates a threat to democracy (Barabas et al., 2017; Liu et al., 2017). This inability to moderate has created opportunities for political groups to remove posts and texts and even ban journalists or people with converging views from the platform (Barabas et al., 2017).

These risks are all the more serious because of the fact that people cannot really change social media platforms as a response, there is no real competition. There exists so few alternatives that the best response the public can give when these service providers abuse their power, undermine democracy or exercise censorship is to voice their complaint. Since the decentralized alternatives are still so inferior in terms of user friendliness, (Raman et al., 2019; Murray et al., 2023) it would be naive to hope for the public to adopt them as a response to misuse of power from the side of the tech corporations (Barabas et al., 2017).

Diaspora is ultimately a failed attempt at a decentralized social network, the reasons behind its failure is discussed extensively by Barabas et al. (2017). The factors explaining why it never took off are not specific to this service, rather they apply to any decentralized service. It is speculated that the most difficult challenge is that the vast majority of people simply do not want increased digital privacy if it comes at any cost or additional effort (Barabas et al., 2017). Another one is that existing mega-platforms benefit from network effects, this is very difficult for new competitors to overcome (Raman et al., 2019).

Mastodon is the strongest competitor to any conventional social media network (Barabas, 2017; Raman et al., 2020). However, it has been shown that its relative success can in part be explained by not only the unusually high level of user friendliness. Three of its five largest hosting instances are located in Japan and provide the service to 60% of Mastodon users. Pawoo.net is the largest instance and was set up by Pixiv, a Japanese company that invites its users to create and share art characterized by strong sexual themes. One subcommunity creates what is known as “lolicon” (Shorthand for Lolita complex), a form of anime imagery that portrays children in sexual situations, sometimes explicitly graphic. In Japan, these types of drawn images do not fall under child pornography as they are not photographs, making them legal there. Nonetheless, Twitter guidelines do not allow for this content to be shared and thus banned these accounts from the platform. This mass-banning sparked the community to migrate to Mastodon where they could continue unregulated (Barabas, 2017). While this might increase Mastodon's user base in the short term, it is not far-fetched to assume that it might very well worsen the reputation of the social platform and make potential users more suspicious and less prone to adopting it.

2.1.1 Social implications of a Re-decentralized Web

Vojříř and Smutny (2020) approach the concept of a decentralized web as a parallel alternative to the internet. They too recognize that the internet was built atop of decentralized principles but that widespread centralization has occurred over time. The web that dominates today is one in which a few big tech companies monetize the data of their users. Quoting the WWW

Foundation (2018), they state that although the web is, in technical terms, a decentralized network “billions of people experience the World Wide Web through a small handful of huge companies”.

In this context, the effort to re-decentralize the web can be understood as an effort to return to the original ideas of what the web was supposed to be: an open space for anyone to post or share their content, and freely decide what happens to their own data (Vojíř et al., 2020).

The extent of the power a few companies hold over society is explained in multiple ways. Vojíř et al. (2020) put great emphasis on the power of search engines since they are privately owned and to a large extent dictate what people find and see on the web, much like Bratton (2016). Utilizing a study by Ledford (2008), it can be shown that a vast majority of Google search clicks happen on the first half of the first page. This exemplifies what is known as the dictatorship of algorithms. Companies like Google or Meta can to an incredible extent decide what people see on the web, and what they do not see. It should be noted that this must not be a malicious or even intentional act for it to have a great effect (Vojíř et al., 2020).

The problematization is not viewed by Vojíř et al. (2020) as the consolidation itself, in fact, the centralization made the web more usable. The problem is the concentrated power a few corporate entities hold. This is, yet again, exemplified by the scandal of 2016 where a US presidential election was influenced by a campaign created by the company Cambridge Analytica. Another example is from 2010 when Google discontinued offering their service to China. The younger generations (the *digital natives*) in particular seem to be aware that their right to use personal data is limited in favor of multinational services. From the service providers perspective, this is their income - it is a fair deal. It is stipulated that the largest disadvantage to this business model is the lack of transparency that comes with it. Users have no way of knowing how their data is used, where or what third parties are involved (Vojíř et al. 2020).

2.1.2 Technical Hindrances to a Re-decentralized Web

In terms of technical challenges of the re-decentralized web, the many hindrances that stood in the way seem to be solved at an increasing pace (Wu, 2019; Vojíř et al., 2020). Authentication of users can be overcome by blockchain-based technologies, DAuth protocol based on Ethereum is one example. The challenge of decentralized data storage and sharing among users persists. Users typically want a way to share their data in a manner that enables their friends to conveniently access and retrieve the information. Semantic web technologies such as RDF and Linked Data offer potential solutions to meet these requirements, and some decentralized social networks have already implemented these technologies (Vojíř et al., 2020).

Stephen Diehl (2021) voices concerns about blockchain’s ability to scale and the cost of decentralized networks compared to centralized ones. This is expanded upon under 2.3.3 *Inherent Problems*.

2.2 Decentralization through Social Networks and Challenges They Entail

In a paper titled *Challenges in the Decentralised Web: The Mastodon Case* Raman et al. (2019) discusses the challenges associated with decentralization in the context of the

decentralized social media platform Mastodon. Mastodon is the current leading federated social media platform that allows users to host their own servers, forming a network of interconnected instances. Here the decentralized web is understood as *“an evolving concept, which encompasses technologies broadly aimed at providing greater transparency, openness, and democracy on the web”* (Raman et al., 2019). Decentralized web platforms are prescribed the purpose of spreading data among independent instances and in doing so making privacy-intrusive data mining difficult. This also makes data ownership transparent and it increases the robustness of the entire system in face of legal, regulatory or technical attacks. Federated services like Mastodon or the earlier (failed) (Barabas, 2017) Diaspora introduce two key innovations. 1) The decomposition of their service into independent instances that anybody can bootstrap. 2) The ability to federate, that is, utilize decentralized protocols in order to allow interaction between instances and thereby creating a potentially global service (Raman et al., 2019).

Mastodon instances (servers with the Mastodon software installed) work similarly to Twitter, users can register accounts and post “toots”, as well as “boost” others’ toots. This is the Mastodon equivalent of reposting a tweet. Important to understand is that these instances can not only work in isolation, meaning that they allow locally registered users to follow each other, but they can also federate. By “federate” it is meant that users registered on one instance may follow users registered to another instance (Raman et al., 2019).

Utilizing a monitoring service, Raman et al. (2019) was able to collect approximately half a billion data points through an API over a period of 15 months. The team created a multi-threaded crawler to compile all of the toots from all the available instances, parallelising this across 10 threads on 7 machines to speed up the process. This generated 67 million toots, published by 239 thousand unique users. Not every toot could be collected since some networks are private and other block crawling software. In the same fashion, followers and following lists for users were scraped and added to the dataset. The aim was to understand these instances, their nature and how they are deployed. They also wanted to examine how the uncoordinated administrators of these instances change the behaviors of the system. Common between federated services is the ability for instance administrators to enforce custom rules, and for users to choose what instances suit them. This means that in a federated social network, each instance may have a different set of policies. The researcher looked at 697 instances, out of these, 17.5% had no regulation at all - the rest disallowed at least one activity. The few instances with no regulation also had few users, as they were prone to spam bots.

Social, technical and economic aspects are brought up by Raman et al. (2019) that might hinder the further development of the decentralized web. The natural pressure for re-centralization is a central theme, and this is in line with the research by Barabas et al. (2017) The biggest threats according to the Raman et al. (2019) are 1) To what extent systems can securely scale-up, 2) Detection of wide-area malicious activity and 3) Protection from data loss during instance outages or failures. Upon analyzing the collected data, four main findings are presented, three of which relate to spontaneously occurring pressures for centralization. The findings are:

- 1) Mastodon enjoys active participation from both administrators and users.
- 2) There are user-driven pressures towards centralisation
- 3) There are infrastructure-driven pressures towards centralisation
- 4) There are content-driven pressures towards centralisation

When examining Mastodon, Raman et al. (2019) divided instances into two categories, open and closed. The open ones are instances that anyone can register on whereas the closed instances require an explicit invite. Here it can be observed that for both categories, the top 5% of all instances host 90.6% of the users. Similar patterns are seen in toot generation and in what countries the instances are hosted: 89.1% of all toots are located on instances in Japan, the US, and France. The three largest hosters of instances. Moreover, only 10% of instances host almost one half of the all users, and for some categories of content this number is even more concentrated. This is consistent with the findings of Barabas et al. (2020).

Raman et al. (2019) put more emphasis on the topic of availability. Mastodon is examined and compared to Twitter when it was the same age as Mastodon. Twitter, known to have low availability in its early days, still easily outperforms Mastodon. It is shown that 11% of instances are inaccessible over half of the time and that, contrary to the researchers hypothesis, outages also occur on the most popular instances. Mastodon has a staggering unavailability rate of 10.95% compared to early Twitter's 1.25%. At the same time, outages in just 10 instances can remove almost half of all toots. Combining this with the knowledge that outages are common on Mastodon, one can appreciate how much worse this decentralized network performs in this regard. The researchers argue that if these issues remain ignored, the decentralized web runs the risk of converging into a semi-centralised system.

2.3 The Broader Picture

2.3.1 *How the Web Became Centralized and Subsequent Consequences*

Previous researchers agree upon the fact that the web was indeed built upon decentralized principles and open standards such as URIs and URLs, HTTP, HTML, but that it had to become centralized in order for it to be usable to the public. (Liu et al., 2017; Barabas et al., 2020; Raman et al., 2019) This consolidation of firms made the web convenient for individuals, but it came at the expense of their data and it relies on trust based systems. Because of this, the effort to decentralize the web is often called an effort to re-decentralize the web. The concept of the decentralized web is thought of in different ways, sometimes as an extension of the web, sometimes as an alternative or a parallel web. Taking a stance in this regard is not vital, the decentralized web is in all cases the collection of decentralized services and software that can be accessed by anyone and that runs in a P2P fashion (i.e is not centrally controlled).

The consolidation of tech firms have had serious consequences. Barabas (2017) and Vojř (2020) both argue that the centralized web poses threats to our democracy. This happens in several ways, both in the explicit exclusion of people from certain platforms and in a process called the dictatorship of algorithms where engaging content is served to users, potentially filtering out other important content. Another issue is the single point of failure that is created, maybe best demonstrated by the 2016 and 2019 DDoS attacks against two DNS servers. (Zembruzki et al., 2022) More ideological problems are the lack of transparency from service providers as to what data they are collecting and who they are selling it to (Barabas et al., 2017) as well as their unproportionate uncontrolled power. They have an unchecked ability to sway public discourse. This power includes the ability to arbitrarily censor content as well as ban anyone from the platform (Barabas et al., 2017).

2.3.2 Forces for Centralization

In several ways, there seems to exist natural pressures for centralization. These pressures are user-driven, content-driven, architecturally driven (Raman et al., 2019) and economically driven (Liu et al., 2017; Barabas et al., 2017). There are both social and technical pressures to centralize.

A clear example of these forces are demonstrated by Mastodon. Raman et al. (2019) showed that even in an explicit attempt to create a decentralized social network - it became fairly centralized. A simple behavioral reason for this is that there simply are more people who want to consume the service than there are people interested in hosting instances of it. It would be naive to assume that Mastodon would be alone in this problem. These researchers suspect that decentralized social networks might run into issues trying to scale-up in a secure manner without centralization. The same problem arises when it comes to detecting malicious activity and protecting the user in the case of an outage (Raman et al. 2019).

A content driven force for centralization observed in Mastodon is that some accounts became popular, and the content that they produced was consumed by many. This too is a social force for centralization, and it drives high volumes of traffic to few instances. (Raman et al., 2019) Liu et al., (2017) share the view that the forces for centralization often are not of technical nature, however, they propose rather that “*centralization is frequently driven by economies of scale*”, suggesting that the capitalist system itself creates pressures to centralize. This is very much in line with the conclusions drawn by Barabas et al. (2017) who argue that the business model of these tech firms is based on centralization: they utilize target advertisement based on user data. This business model proved to be hugely successful and thus furthered consolidation in the market.

2.3.3 Inherent Problems

Decentralized architecture has disadvantages. At the cost of a censorship resistant platform comes an inability to remove unwanted content such as hate speech or CSAM-content. Federated networks can be moderated within the instances, but no one can moderate the entire network. (Raman et al., 2019) And fully decentralized dApps are arguably worse off in this regard (Diel, 2021).

Some Web2 features cannot be replicated in Web3. Any system that is blockchain based has the limitation that information stored is append-only and immutable, this is at the core of blockchain technology. The consequence of this is that, for the most part, data deletion cannot be done or becomes very complex, by design (Diehl, 2021). This has several implications. As new business models are created, questions arise about who will have custody of our private data and who will have access to it, there is no technical solution that gets around these questions. Another inherent issue brought up by Diehl (2021) with the decentralized web and Web3 in particular gets at the heart of the idea. The lack of a central authority makes it impossible to restore accounts or passwords. If anyone forgets a password, their account is lost forever and every bit of data or (crypto-) money stored within it too. In the same way, spam bots or unwanted content cannot be removed.

Regarding the technical limitations of the decentralized web, Diehl (2021) argues that blockchain networks cannot scale without becoming the centralized systems they were built to replace. Raman et al. are cautiously pessimistic when it comes to the scaling of federated social networks, stating that it is uncertain if they can scale-up in a secure way.

Furthering his pessimistic view of Web3, Diehl (2021) argues that blockchain systems are far more expensive to maintain than centralized solutions. This is “*the bandwidth problem*” and the main point is that centralized systems will always be able to serve data to customers more efficiently than decentralized solutions. Decentralized networks also suffer from a user experience issue (Barabas 2017). Since anyone can join, security measures must be put in place. Because of the decentralized structure, this responsibility is put on the user who has to manage a key or passphrase. It is incredibly difficult, according to Barabas et al. (2017), to develop decentralized programs that are both cryptographically secure and easy to use. However, they do state that it is possible in some cases, proven by the encrypted messaging service Signal, still most dApps do not succeed in this endeavor.

2.3.4 Performance and Usability

Web3 suffers from substandard UX (Murray et al., 2023; Barabas 2017), however there is nothing to suggest that these issues could not be solved. The user experience in general, however, is not likely to ever be able to match the one of web2 because of the previously mentioned inherent issues. Federated services are also not on par with centralized ones, shown by Raman et al. (2019). Comparing Mastodon with Twitter when it was the age Mastodon is now reveals that the decentralized service has a much higher inaccessibility rate, instances (small and large) suffer from outages frequently.

2.3.5 Is the Web3 Hype Justified?

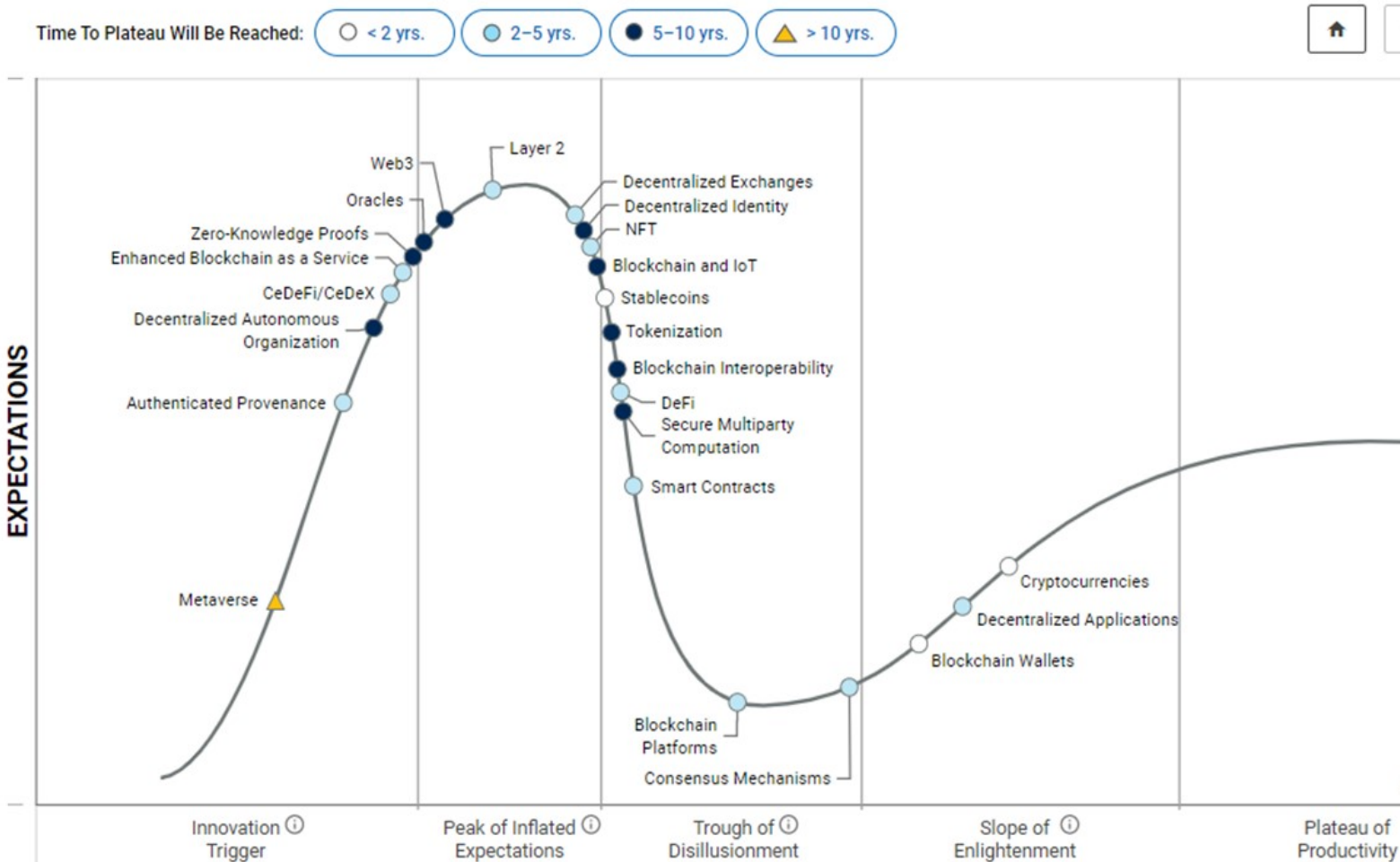


Figure 2.1 - Gartner Hype Cycle for Blockchain and Web3 (Gartner, 2020)

The Gartner Hype Cycle is a model developed by Gartner, it places different technologies in one of five stages and is meant to show maturity, adoption, and social application of these. By looking at where a technology is placed, one can get an idea of the maturity of the technology.

Here, Web3 technologies (and Web3 as a concept itself) are charted along the model. The Y-axis shows the current expectations of the technologies (i.e the hype) and the X-axis is divided into five stages of maturity: Innovation Trigger, Peak of Inflated Expectations, Trough of Disillusionment, Slope of Enlightenment and Plateau of Productivity.

In an article by Litan (2020), it is argued that while some Web3 Technologies are proving themselves helpful like Blockchain wallets, dApps and Cryptocurrencies (far right), Web3 as a whole is estimated by Gartner to be at the peak of the hype cycle, meaning that its usefulness and potential is probably overestimated. The world has yet to see any “killer apps” except for cryptocurrency trading (Litan, 2020).

Web3 technologies vary greatly in their maturity levels, DAOs are still in the first phase while smart contracts are well on their way down from their peak. No technology has reached the final phase, Plateau of Productivity, yet, hinting that there still is untapped potential in the technology. Litan (2020) is still optimistic that Web3 technologies will prove themselves useful, Web3 scam-tainted reputation is brought into light and Litan likens the situation with what could be observed in the early days of the WWW.

2.3.6 Feasibility of a Fully Decentralized Web and its Current State

Researchers vary in their optimism for if a decentralized web is feasible, Raman et al. (2020) puts emphasis on the fact that it might simply converge to a semi-centralized system. Other scholars mean that it might just remain a project for enthusiasts and never go mainstream. Vojir (2020) et al. provides the perspective that the decentralized web might only be looked at as a complement to the current web - still it is argued that these decentralized solutions will continue to be developed and used in the future. They state that the re-decentralization of the web could reshape the sociotechnical structures of the internet, but that users would have to change their behavior for this development to take place. As of today, most people do seem to be content giving away their data and watching ads in exchange for utilizing the services that these companies provide. Barabas et al. (2017) are highly pessimistic. According to their analysis, social and economic forces that regulate our behavior limit the strides made in decentralization of the web.

Murray et al. (2023) adds to the conversation by stating that the current state of Web3 still resembles Web2 to a high degree, just slightly worse. This despite all of the development that is taking place. It is also noted that most basic functions of the web such as email, chat or social media have no real Web3 equivalent. All of these things are needed if Web3 is ever to become mainstream.

Taken together, no author seems to be convinced that a mainstream decentralized web will emerge. Tim O’Riley, who popularized the term Web2 states *“I love the idealism of the Web3 vision, but we’ve been there before. During my career, we have gone through several cycles of decentralization and recentralization”* (O’Reilly 2021). That said, the degree of progress expected to be made in the field is high, although it differs somewhat.

3 Method

3.1 Choice of Methods

In this study, method triangulation is employed to provide a more comprehensive understanding of the potential implications of a more decentralized web structure. Method triangulation involves the use of multiple methods or data sources to enhance the credibility and validity of the research findings (Oates, 2022). In our case, we combined an extensive literature review with qualitative interviews to gather both theoretical and empirical insights into the subject. The rationale behind using method triangulation is to overcome the limitations of relying on a single method, as each method has its strengths and weaknesses. By combining different methods, we aimed to produce more robust and reliable results, enhancing the overall quality of the study. For the literature review, we examined relevant articles and literature to create a comprehensive understanding of the current state of research and development in decentralized web technologies. This helped us build a solid theoretical foundation for our investigation.

In addition to the literature review, we conducted qualitative interviews with selected experts in the field. The major advantages of using this approach were as following:

- **Depth and richness of data:** Interviews provide in-depth, detailed, and nuanced information about the respondents' opinions, experiences, and insights (Oates, 2022). This allowed us to explore the complexities of the subject matter and uncover new perspectives that might not have been available in the existing literature.
- **Flexibility:** Interviews, particularly semi-structured interviews, allow for a certain level of flexibility in the conversation (Oates, 2022). This enabled us to probe deeper into the topic, ask follow-up questions, and adapt the questioning to the specific context of the respondent, resulting in more relevant and context-specific data.
- **Capturing personal experiences and perspectives:** Interviews gave respondents the opportunity to express their views, thoughts, and feelings in their own words. This helped us to better understand the motivations, values, and beliefs of the respondents, which was critical in interpreting the implications of a decentralized web.

By employing method triangulation with a combination of literature review and qualitative interviews, our study provides a thorough, nuanced, and comprehensive investigation into the potential implications of a more decentralized web structure, enriching the understanding of the subject matter from multiple perspectives.

3.2 Literature Selection

In the literature selection process, we aimed to create a comprehensive understanding of the current state of research and development in decentralized web technologies. Our goals for the literature review were to gain a deeper understanding of the subject matter, to identify gaps in existing research that needed to be addressed, and to formulate our research question (Oates, 2022).

To achieve these goals, we conducted a thorough search for relevant articles, reports, and other sources, examining the existing knowledge around decentralized web technologies such as blockchains, decentralized autonomous organizations (DAOs), smart contracts, decentralized finance (DeFi), and peer-to-peer architecture (P2P). Our search for relevant sources was conducted using academic search engines like Google Scholar and LubSearch to ensure that the articles we used were credible and pertinent to our research topic. To further evaluate the sources, we focused on peer-reviewed articles and considered factors such as publication date, the reputation of the authors and publisher, and the methodology used.

The literature review played a crucial role in our study, as it allowed us to establish a solid theoretical foundation upon which we could base our research. By identifying gaps in the existing literature and formulating our research question, we were able to tailor our study to address these unanswered questions and contribute to the overall body of knowledge on the subject of decentralized web technologies and their potential implications.

3.3 Interviews

3.3.1 Selection of Respondents

Regarding the selection of respondents for the study we sought to interview experts with a diverse range of knowledge in and experience in the subject. The aim here was to create a broad and complete picture of the field as a whole and therefore we sought to gather insights from professionals in various domains within the framework of the decentralized web and achieve a well-rounded understanding of the subject matter from multiple perspectives.

We developed several criteria for the selection of respondents to be interviewed, which are as follows:

- **Expertise:** Respondents should have demonstrated expertise in one or more areas related to decentralized web technologies, such as computer science, cryptography, network engineering, or software development. This could be evidenced by their professional experience, academic qualifications, or published work.
- **Diversity of perspectives:** We aimed to include respondents from various domains, such as developers, researchers, policymakers, and industry professionals, to ensure a comprehensive understanding of the subject matter from multiple perspectives.
- **Practical experience:** Respondents should have direct, hands-on experience with decentralized web technologies or applications, either through the development, implementation, or use of such technologies.

- Relevance to the research question: The respondents' expertise and experience should be directly relevant to the specific research questions we aimed to address in our study.

By using these criteria for selecting respondents, we ensured a diverse and knowledgeable pool of participants that could provide valuable insights into our research questions and contribute to a well-rounded understanding of the subject from various angles.

3.3.2 Interview Methodology

A semi-structured approach for the interviews was chosen as the data collection method for this study, as it offers a balance between structure and flexibility. This approach allows for a deeper exploration of the opinions, experiences, and insights of the participants (Oates, 2022) regarding the potential benefits of decentralized web apps. The flexibility of this interview format allowed us to probe deeper into the topic, it also allowed us to ask spontaneous follow-up questions that led to answers that were very relevant to this paper. We also occasionally asked the interviewees the very open question if they had anything to add to the topic which also generated insightful responses. For the purpose of this paper, the interviews are used as an explorative tool, rather than used for “checking” further strengthening our choice of a semi-structured approach as our interview method (Oates, 2022). Another benefit that we utilized was the ability to ask the questions in a natural order, if the respondent naturally leaned into a topic, we asked the question relating to that next. This way, a more natural conversation could appear, making it easier for the interviewee to reflect and talk freely. We also skipped over questions that were fully answered in previous questions, for instance their opinion on the general UX design of decentralized solutions were often extensively answered before we asked the explicit question.

The semi-structured approach will also supply us with richer and more detailed data compared to a structured or survey-based approach, and might also provide us with valuable insight into the subject that we might have overlooked when going through the previous research. The open-ended format of this type of interview can also help us adapt to the context of the respondent and make it more context-specific. Every respondent comes from a different perspective with different experiences and it will show in their answers, the context of their answers will help us understand the value and meaning of said answers.

Potential problems with this approach might be bias and subjectivity (Oates, 2022). As we go through the previous research we will inevitably become biased in the matter to some extent and this could influence how we ask the questions to the respondents. This could in turn inadvertently influence the participants' responses, thus introducing bias into the data. Furthermore, the data collected with this method is subjective in nature and there is no way to be sure that the answers we collect are the whole truth of the matter. But as we thread unknown territory we have concluded that this approach will take us the closest to answering our research questions.

3.3.3 Formulation of the Questions

The interview questions are formulated to explore various aspects of the decentralized web, focusing on its advantages, disadvantages, practical implementations, technical limitations, and potential impacts on users of decentralized applications. These questions were chosen to ensure a comprehensive understanding of the participants' perspectives on the topic.

Our interview subjects are widely different in opinions and expertise within the decentralized web. Because of this, the questions are tailored to the respondents' area of expertise in order to get the most out of each interview. Four people were interviewed:

- 1) A founder of a DAO
- 2) An experienced user of Web3 services
- 3) A Web3 service developer
- 4) Technical Education Lead at Web3 Foundation

Each interview started with an introduction of us and the topic and aim of this paper. After that, our goal was to encourage as much response as possible from the respondents with minimal interference from us.

The questions asked to them are as follows:

DAO Founder:

These questions aim to understand the motivation, role, and challenges faced by the founder of a DAO. They touch upon the technical aspects, user data management, and the barriers faced by new participants. The goal is to gain insights into the purpose and functioning of DAOs in the context of Web3.

1. What is your background in this field?
2. What is your role within [The DAO that the interviewee founded]?
3. What was the motivation for founding/joining the DAO and its purpose?
4. What do you believe is the role of DAOs in the design and development of Web3?
5. Have you encountered any specific technical difficulties during the development of the DAO?
6. Is any user data saved? And if so, how do you work to ensure integrity and security for it?
7. From your own experience with the DAO, what are the biggest barriers for new participants, and do you have any strategies to make it easier for them?

Web3 User:

These questions are designed to explore the user's perspective on decentralized applications. They cover the user's experience with various apps, the benefits and drawbacks they perceive, and their concerns about privacy and data ownership. The objective is to understand the factors that drive users to adopt decentralized apps and the challenges they face while using them.

1. How did you hear about decentralized apps and what got you interested in using them?
2. Which app(s) do you use and what are their features?
3. What are the biggest benefits for you when using decentralized apps versus their centralized counterparts?
4. Have you encountered any obstacles/difficulties/drawbacks in using decentralized apps?
5. Are you concerned about privacy/ownership of data and how do you feel these apps provide that?
6. What do you think about UX in decentralized apps, are there areas that can be improved?

7. Do you have an example of an app that you think has had a positive impact in any sector/community
8. In your opinion, what are the biggest barriers to the widespread adoption of decentralized apps?

Web3 Developer:

These questions target the developer's point of view on the decentralization movement, its goals, and potential impacts on privacy and security. They also delve into the technical and social limitations of implementing decentralized technology and the long-term effects on individual users. This helps understand the factors that motivate developers to work on decentralized projects and their vision for the future of the decentralized web.

1. What is your background in the field of decentralization/web3, how did you get involved in it and what motivates you?
2. In your capacity to have been aware of the decentralization movement from an early stage, what do you see as the goals of the decentralization movement, and has your own view of it evolved or changed over time?
3. Are you concerned about privacy/ownership of data and do you feel that decentralization can assist with this at a level that you are satisfied with?
4. Do you have an example that you think demonstrates well how decentralization (app/technology) has led to a positive impact for a community/individual/industry?
5. Which types of decentralized apps or platforms do you think have the most potential for a positive impact on individual users' privacy and security?
6. Do you think that individuals' online behavior and habits are changing as a result of a decentralized web?
7. Do you see any major obstacles to the widespread implementation of decentralized technology? Technical or social limitations?
8. Looking into the future, what do you see as the most significant long-term effects of decentralized technology on the individual?
9. Are you yourself working on some kind of project within the framework of decentralization that you would like to tell us about?

Technical Education Lead at the Web3 Foundation:

The selected questions aim to comprehensively probe the developer's perspective on the rise and evolution of the decentralization movement. They touch on both the goals of the Web3 Foundation and its vision for the future of decentralized web technologies, encapsulating the potential impacts on privacy, security, and individual data ownership. The intent is to glean valuable insights into the developer's motivations for entering this field, what inspires them, and the professional trajectory that led them to the Web3 Foundation.

1. What is your background in the field of decentralization that inspired you to work in the field of decentralized web technologies and join the Web3 Foundation?
2. What are the primary goals and objectives of the Web3 Foundation in promoting the adoption of decentralized technologies? And do you think that the goals of the movement have shifted or evolved over time?
3. In your opinion, what are the most significant challenges and obstacles to the widespread adoption of decentralized technologies?
4. In your opinion, what are the most significant advantages and challenges that a more decentralized web structure presents for users, developers, and businesses?

5. What are the most promising use cases or applications of decentralized technologies that you think will have a significant impact in the near future?
6. What resources or tools does the Web3 Foundation offer to help developers build and deploy decentralized applications?
7. How do you see the landscape of decentralized web technologies evolving over the next 5-10 years?
8. Are there any specific areas of research or technical challenges that you believe are particularly important for the Web3 Foundation to address in the near future?
9. What are the most common misconceptions or knowledge gaps you encounter among developers or other stakeholders when it comes to understanding decentralized technologies and their potential applications?
10. What potential implications do you foresee for privacy, security, and data ownership with the widespread adoption of decentralized web technologies?
11. From your experience, what are the most effective strategies for overcoming barriers to the adoption of decentralized web technologies and fostering widespread use?

3.3.4 Respondents References Coding

When referencing anything said by our respondents in-text, the references will be made in this manner:

Title	Reference name	Duration of interview
DAO Founder	R1	39 min
Web3 user	R2	23 min
Web3 Developer and early user	R3	31 min
Technical Education Lead at Web3 Foundation	R4	30 min

Table 3.1: Respondent Coding

3.3.5 Ethical considerations

Before each interview, we sought informed verbal consent from every participant. This consent indicated their understanding and agreement to be a part of the study, and also their approval for the interviews to be audio-recorded for subsequent transcription and analysis. To protect participant anonymity, we carefully modified the interview transcripts. Any identifying information such as names, affiliations, or other potentially identifying details were replaced with generic descriptions within brackets, such as [Name] or [University]. This ensures participants cannot be directly or indirectly identified through the transcripts (Oates, 2022).

Lastly, we will use the findings from this research responsibly. We aim to ensure the findings contribute positively to the body of knowledge on decentralization, without compromising the privacy or well-being of any participant involved. We will also strive to provide an accurate representation of the participants' views, without distortion or misinterpretation.

3.4 Processing of the Empirical Data

3.4.1 *Thematic Analysis*

To analyze the qualitative data collected from the interviews, we employed a thematic analysis approach. This method allowed us to identify, analyze, and report patterns or themes within the data (Oates, 2022). The thematic analysis provides a flexible and useful research tool to derive a detailed and nuanced understanding from the collected data.

The process of thematic analysis consists of six steps: familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report (Oates, 2022). We first transcribed the interviews and read through the transcripts multiple times to familiarize ourselves with the data. Next, we coded the data, which involved identifying meaningful patterns and assigning labels to these patterns. We then grouped the codes into potential themes and reviewed these themes to ensure they accurately represented the data. Finally, we refined and named the themes, which were used to structure our findings and analysis.

3.4.2 *Reliability and Validity*

The people interviewed for this study were carefully chosen after a thorough examination of their expertise in the field of decentralized web technologies. The data collection used provided the research with in-depth knowledge from the participants who all had different backgrounds in the field, ensuring that our data was representative of a range of perspectives on the topic. Triangulations were also used to combine different data sources such as the qualitative data from the interviews with the literature review to make sure that our findings were derived from multiple sources and perspectives (Oates, 2022).

It is important to note that this study is based on a limited number of interviewees. The study is based on four participants, and may not capture the full range of perspectives and experiences in the field of decentralization and the results should be seen as indications of what reality looks like, not necessarily the whole truth. The interviewees, in the capacity of being experts in their respective areas, are likely subject to having a somewhat positive bias towards the concept of decentralization. We try to mitigate this bias by choosing participants from various backgrounds in an attempt to capture a diverse range of opinions and experiences as suggested by Oates (2022).

It's also worth noting that the field of decentralization is evolving rapidly, this fast-paced development may result in some of our findings becoming outdated and less relevant as time moves on.

4 Empirical Evidence

This chapter presents the empirical data gathered through the interviews with four key individuals deeply involved in the field of decentralized web technologies. They offer a range of perspectives based on their unique, individual experiences and roles within the industry, providing valuable insight into the field's current state and potential future. The intent is to offer a comprehensive and nuanced picture of the current landscape of decentralized technologies and the challenges and opportunities they present, and what trajectories they might follow in the future. The empirical evidence presented in this chapter will be further discussed and contextualized in the next chapter.

4.1 Empirical Themes

We use an inductive approach to create a framework for coding our data gathered from the interviews. The categories used are those we observed in the transcribed material; this approach was chosen to let us have completely open minds and let the data speak to us (Oates, 2022) so that we could capture insights and perspectives that may not have been covered in the literature review. The reasoning behind this was that the topic we research is disputed with many loose ends and by using an inductive approach we gain the tools for a more explorative way of conducting our research. The themes we identified from the interviews were mentioned by every interviewee multiple times and therefore we consider them a valuable addition to the purpose of our research. The respondents' opinions are compiled and sorted after the identified themes.

The themes present in the empirical data are the following:

Code	Category	Content
CC	Centralization and its consequences	Privacy concerns, Trust in central authorities, Threats to democracy, Single points of failure, Monopoly
FDD	Forces driving decentralization	Advantages of decentralized technologies, User- and ethically driven forces, economic forces, Drivers, Triggers
CD	Challenges in decentralized platforms	Scalability, Security, Content moderation, Prevention of malicious activities, technical limitations,
UX	User experience and usability	Performance and reliability, Adaptability, ease of use and lack of knowledge
FF	Feasibility and future of the decentralized web	Mainstream adoption potential, Role of decentralized web, development of Web3 alternatives to current platforms

Table 4.1: Empirical Themes Coding

4.2 Centralization and its Consequences

The theme of "Centralization and its Consequences" unveils a shared sentiment among four prominent figures in the decentralization field. Each individual, with their unique experiences, alludes to inherent flaws within centralized systems. The consensus among the four revolves around the inherent issues of centralization, notably its tendency towards inefficiency, corruption, and a lack of justice, primarily due to the monopolistic practices of dominant entities. Moreover, their narratives shed light on the numerous challenges that centralization poses, especially in terms of knowledge distribution, data ownership, freedom, and exploitation of creators.

R1, as a founder of a decentralized autonomous organization, active within the decentralized space called "decentralized science," shared their views on why they had chosen to take this unconventional approach to doing business. R1's insight from being active within the field of biotechnical science is that there are inherent problems with inefficiency, corruption, and injustice within the centralized structure.

R1 states that the grants system used to finance research fails in the process of distributing the grants in a fair way where it is needed. R1 also states that they are disappointed with how immaterial rights are being handled in most of the world, where the researchers often do not own their research and where the taxpayers pay for the research without getting anything back without paying even more to access the finished results of said research. R1 names journals as an example of this, often tax-financed but still locked behind a paywall if you need access to them (R1-4).

R1 says that knowledge should be democratized, which is not the case of how it is today. According to R1, there is a big problem with the creation of monopolies where a few centralized structures get a lot of the power, where the more significant a structure is, the slower it becomes, it leads to a hindrance for competitors to enter the field, which in turn leads to less innovation. This is something R1 has noticed not only in biotech but in all parts of society, whether state level, art, philosophy, politics, or the industry (R1-5).

R1 also sees a problem with the lack of transparency within centralized structures, and they give the example of Elon Musk and Tesla, where Elon has absolute power to make any next move with the company without giving the stakeholders any chance to be able to anticipate how it will play out (R1-5).

R2 has a problematic outlook on the ownership of data and centralized platforms. R2 states, "*The situation we have today with Google and Facebook owning everyone's data, I think, is a bad situation, but it is unclear how to get out of it.*" (R2-6). According to R2, today's monopoly comes with a so-called "lock-in effect" where everybody is driven to use one of the few alternatives that dominate the market of the web 2. Even though many are against it, there are just no viable alternatives (R2-4). Furthermore, R2 states that the power those industry giants possess comes with some drawbacks on an idealistic plane. They provide the example of Meta (formerly Facebook), who took over an Instagram user's 'Metaverse' handle in conjunction with the company name change, stating that such an incident would not be possible with a decentralized alternative. (R2-5).

R3 tells us that they got into the field of decentralization because of a belief in total freedom of the internet. R3 says that we were free to do anything on the web except make payments for a long time. There we had to use a bank as an intermediate.

R3 also expresses concern about the importance of accessing your personal data, which has been tough through Web2. However, it has become a little easier after the introduction of GDPR (R3-3). R3, though, has some concern about EU directions also. They mention the proposition called “Chat control”, a new law that will oblige all service providers to go through all messages sent on the internet (R3-10). Overall, R3 is displeased with how Web2 is run today (R3-3).

R4 says that there exist inherent problem with corruption and injustice with how the centralized nature of Web 2 is operating today, and says that: “*Currently the landscape of the internet is in such a way that the creators are being exploited, if you look at the revenue of Google, Instagram, and Facebook, you see that it is all based of the content of what the users are creating.*” (R4-2). R4 gives another example of how they personally got taken advantage of as a creator on a Web2 platform: “*I was a photographer when I was in grad school. I took beautiful pictures of Buffalo and Vermont, then when I uploaded them to the stock photo site, they charged 10 dollars for my photos and would give me 10 cents.*”. R2 states that this example shows how much money intermediates extract from creators and customers just by being the monopoly (R4-2).

4.3 Forces Driving Decentralization

The theme "Forces Driving Decentralization" captures a shared sentiment across four diverse perspectives in the decentralization field. Their responses underscore the potential for individual sovereignty over data and personal content, further enhancing the appeal of decentralized systems. In broad strokes, these perspectives emphasize the opportunities for innovation, equity, and user control in decentralized ecosystems, painting a compelling picture of a future shaped by decentralization.

One primary motivator for decentralization for R1 is to change the business landscape, and the DAO they are active within works as a decentralized alternative to a traditional company, where it serves as a coordination mechanism to accomplish things within the framework of Web3 where it can help with coordinate projects on a global scale (R1-5). R1 states that one key difference between the DAO compared to a traditional company is how the decision-making power is distributed. In contrast, the DAO is comprised of a flatter hierarchy and a community-based approach (R1-3). The goal is to create an organization that will continue to work toward its purpose even without the original creators. It succeeds with this by distributing the power over all the contributing members, where everybody can put forward, spearhead, and lead a proposal. This enables the members to have the power to make different decisions and lead different processes on their own (R1-3), which in turn leads to several advantages compared to a more traditional approach.

One of these advantages is that by using a more democratic decision-making process, the DAO is “maximizing its entropy,” leading to more diverse and unexpected solutions and reducing the risk of poor decisions made by a small group of people since a large group of people vets the decisions with a diverse range of perspectives (R1-4).

The enhanced power of the members also leads to a thing R1 calls “collective intelligence,” where the greater diversity, perspective, and ideas of the members lead to a greater collective intelligence than could be achieved by a smaller group of people (R1-4).

Another positive outcome from working decentralized that R1 noticed is called emergence, meaning that “the whole is greater than the sum of its parts,” leading to properties or outcomes that a single participant could not achieve. R1 states that it can be about potent network effects attracting influential and influential individuals to your organization. It can also be about getting the tools and resources to source more significant projects that would not be possible with a smaller group (R1-4).

This also leads to the following advantage, which R1 calls “Skin in the game,” which means that by letting members own a part of each project in the DAO, they have an incitement to see it through, thus making them more willing to open up their network of contact or contribute with their expertise for each project. The member will contribute more favorably if they actually get something back, which they do by owning a part of the organization. In other words, they have skin in the game (R1-4).

R1 states that for all of this to work, the DAO also operates under full transparency by being governed by code, which is open source and accessible to everyone. This is called “code is law.” R1 states that the advantage of this is that everybody can see how the organization is governed, its goals, and how the rules are set. This means that people interested in joining the organization always know exactly what they are getting into when joining or working for the DAO, which hinders unpredictable events or prevents people from being cheated (R1-5).

In short, R1 states that the DAO contributes with a decentralized alternative to a traditional company, which opens up the opportunity for people to cooperate in an aligned way with a clear economic incentive. This also leads to a powerful network effect which R1 states are an essential part of doing business (R1-7).

R2 identifies some unique functionalities offered by decentralized apps not present in the centralized counterparts as driving forces for decentralization. For example, R2 talks about a social media platform called “Lens Protocol,” a platform designed to retain one’s social graph while being able to change the front end, thus eliminating the need to stay on a specific platform and therefore eliminating lock-in effects (R2-4).

Another decentralized service R2 says is superior to its centralized counterpart is the “Ethereum Name Service” (ENS), an equivalent to the “Domain Name System” (DNS). ENS allows users to link their wallet to a unique ENS name. Furthermore, the ENS name is protected. Thus nobody can acquire it from its owner, as the example with Meta stated above (R2-5).

Additionally, R2 mentions how decentralized platforms can support fundraising for public goods without intermediaries taking a cut, as in the case of Gitcoin grants (R2-9). This functionality can empower communities and has a positive societal impact, which is another driving force toward decentralization.

Lastly, the desire for improved data ownership is a strong motivator for users to explore decentralized apps (R2-6). While R2 is not particularly concerned about privacy, they acknowledge the importance of data ownership and control over personal information, something that decentralized systems can offer better than centralized platforms.

R3 describes his quest for total freedom on the internet and how decentralization could help achieve this vision. He talks about a concept called “code of law,” which could be used to organize cross-border digital organizations that would be a decentralized equivalent to today’s stock companies (R3-2).

R3 also says that decentralized technologies could be used for the greater good of humanity. One example he uses is the project called “Proof of humanity”. The project was used as a means to spread resources cross-border to people in need, like a method of universal basic income. R3 liked the idea but said something was missing for the project to work correctly (R3-5).

According to R4, the main driver and goal of his organization is to give the users on the internet more sovereignty over their data, their identity, and their fair share of the revenue generated by their content. All this will be possible by cutting out the intermediate, which is possible through the means of decentralization (R4-2). Regarding the example R4 shared about his time as a photographer, he compared the situation in a Web3 context, where he stated that if a customer paid 1.02 dollar for one of his pictures, he would instead get 1 dollar. The two extra cents would be used to maintain the network (R4-2).

R4 emphasized the importance of being transparent and open source, where his organization keeps all of its code open for anyone to see to promote openness about their goals and guidelines.

R4 also mentions the principle of “trustlessness” as a significant advantage of decentralized systems. He explains, “If you know how the code works when a condition is met, you know it will execute your transactions. That is the biggest advantage here, nobody has a kill switch, nobody can stop things from happening, and you can have it running 24/7, you are eliminating those entities in between.” (R4-6). R4 calls this phenomenon “code is law”.

Another advantage R4 says is the potential for preserving privacy in a decentralized web, which gives users more sovereignty.

R4 also mentions that the decentralized web works with incentive models, where the actors involved on the platforms have incentives for involvement.

R4 says there are many promising technologies in the Web 3 toolkit, one of which is called NFTs. He says there is a misconception about how they are used in the mainstream way today. They, for example, can be used to keep track of royalties. R4 says:” If you mint your music as NFTs and if someone plays that music through a Web3 platform, you get revenue for each play automatically through the network. This is, for example, an incentive for an artist to use the network.” (R4-8).

4.4 Challenges in Decentralized Platforms

Transitioning to decentralized platforms presents several challenges, as stated by all respondents. Technically, it involves issues with transaction handling and privacy. Economically, there's a struggle to create sustainable models and viable incentive systems. Socially, user behavior can change due to the anonymity provided, potentially leading to misuse. Also, complex interfaces may hinder user experience and adoption. Lastly, governance in a decentralized context remains a significant challenge. Despite these issues, the potential for innovation and freedom offered by decentralized platforms is substantial.

Even though R1 states that deploying and DAO is relatively straightforward, the question remains whether their current method of deployment is the best one. This is due to the fast-paced nature of technology and the constant emergence of new theories and methods (R1-6). R1 also states that there are other areas within decentralization that hit technical

roadblocks for today, such as stable decentralized finance products and zero-knowledge applications. However, this is something other than what their DAO is dealing with (R1-6).

R2 identifies several technical challenges that could arise when using decentralized platforms. In the early days of interacting with these apps, R2 was experiencing issues with transactions ending up in “limbo” due to insufficient “gas” fees, leading to double payments (R2-7). However, the issue has since been mitigated by introducing newer technologies like layer 2. R2 also says there have been some challenges in handling transactions on the networks. For example, the Ethereum network up until last year (2022) used a concept called “proof of work,” which now has since switched to a concept called “proof of stake” because the strain on the network would otherwise have gotten too big to handle. R2 also says there are other concepts like “Layer 2,” as mentioned earlier (R2-8).

Finally, R2 acknowledges that despite the advantages of decentralized platforms, they are also attractive to individuals with malicious intent who want to act without any regulatory oversight (R2-10), something that has been hard to prevent in a decentralized environment.

Although R3 expresses satisfaction with how far some economic aspects in some chains have gotten, they also say there is a big problem with centralization within decentralization today (R3-3). Furthermore, R3 speaks about how many half-finished projects are built in a hype cycle that often gets stuck in a semi-decentralized state (R3-4) and is unsure how many of those projects will proceed when they are fundamentally unstable (R3-4).

Regarding this, R3 also mentions a fundamental problem with incitement for decentralization to survive. There has to exist a working economic mechanism for the platforms to survive, something that is lacking today (R3-9). R3 tells us that we still do not know how to build efficient ways of building decentralized apps that make money. One part of it is that it is tough to create decentralized ownership. The way people are trying to solve this is through DAOs, but R3 states that they still cannot compete with the ads-driven revenue that is on the web today (R3-9) as it is hard to make people pay for content they used to get for free through ads.

Another issue R3 brings up is that in platforms like Ethereum, it is relatively easy to track people's addresses. Although privacy solutions exist, users who start moving towards these solutions risk being flagged as suspicious by exchanges they interact with or by tax authorities. R3 also mentions the trade-off between privacy and convenience, where people tend not to use privacy tools like coin mixers unless they really need to due to the associated cost and risk.

Another problem with decentralized technologies that R3 speaks about is the behavioral changes in people that follow the anonymity that decentralized technologies provide. R3 thinks that people's behavior changes when they do not need to show their real identity and that that change can lead to a project created for their own personal gain, like cash grabs and scams. Something prevalent in the field of decentralization as a whole.

Lastly, R3 mentioned that cycles of innovation, adoption, and hype that are characteristic of the crypto world could lead to instability and unpredictability, making it difficult for sustainable projects to survive (R3-12).

R4 brings up the challenge of building a user-friendly interface in the Web3 world. R4 mentions how existing interfaces may not be as smooth or intuitive as Web2 interfaces, which could create a barrier for users transitioning from Web2 to Web3. For example, there is no seamless user experience where you need to remember long codes or phrases to access your

keys, or your keys can get stolen, and you then lose everything they contain. R4 thinks this is a fundamental user problem and a hindrance to mass adoption, something which is clear when even people proficient in technology get taken aback when they talk about it (R4-4).

R4 mentions that the biggest problem used to be other technical issues, such as blockchain performance and scaling problems. However, those problems are a thing of the past due to a thing called sharding. This is a new technology that their company employs and is alone on implementing right now, where a central blockchain can support a lot of different blockchains running on top of it. The blockchains on top are called shards and run in parallel to each other, giving the central blockchain a collective performance from every shard (R4-5).

One thing R4 does think is a technical challenge right now is the question about governance. R4 says that most decentralized systems today are run through DAOs and that the movement lacks understanding of how to conduct governance over those systems in the best way. However, R4 also states that centralization exists within the world of decentralization today, and it is unclear where the balance between centralized and decentralized entities should be (R4-9).

Blockchains are also subject to technical limitations that do not exist in centralized alternatives, according to R4. These limitations can be that resources are limited due to the nature of decentralized architecture, where a lot of information is being replicated. This means that decentralized platforms need very efficient code to run well (R4-10).

Finally, R4 says that many blockchains are having trouble with the unpredictability of costs. R4 uses the Ethereum blockchains as an example: “If you subscribe to Ethereum’s model, you have no predictability of how much things are going to cost, the gas fee in Ethereum is very variable if you are a developer that is trying to develop an application for Ethereum, there is no way for you to predict the operation cost for the next year or the next quarter”. However, according to R4, there are other blockchains not suffering from this problem (R4-11).

4.5 User Experience and Usability

Decentralized platforms face significant challenges in terms of user experience and usability despite their promise of enhanced privacy and control. All respondents seem to agree on some key problem areas, such as negative perceptions of the field of decentralization, which is often associated with scams or illegal activity. The respondents also identified the knowledge gap as a key barrier, where users struggle to understand the unique characteristics of these platforms, including economic aspects like handling digital wallets. Additionally, they note that the user experience currently falls short compared to more familiar, centralized services. Therefore, education and improving the user interface are therefore seen as crucial for encouraging broader adoption of decentralized platforms.

Due to R1, one of the significant hurdles for people to use decentralized alternatives is to get them to understand its value and why they should use it. This becomes an even more significant barrier with a still lacking user experience compared to the centralized mainstream alternatives (R1-7). R1 says, for example, that people lack knowledge of how to use a decentralized web's economic means. They do not know how to use a wallet or how to transfer funds into it. Regarding the DAO, R1 experienced that one significant barrier to entry was that people lacked trust in the value of the tokens used to compensate the members for their work due to its speculative nature. R1 also said that some members have some problems

with different technical solutions used in conjunction with working with the DAO. The example used is using the program called Discord for communication.

R2 admits that the user experience differs greatly from what they are used to on Web2 platforms. R2 says that you only need one account or wallet for all Web3 activity (R2-1) but that it was a small hurdle to overcome the first time they created one (R2-2). For the moment, the usability and user experience could be better, which is a problem for first-time users trying to get on board, R2 says (R2-10).

R3 expresses concern that many people fail to see the value in using decentralized platforms. Pointing out that many users prefer the convenience of centralized platforms, even if it means surrendering their personal information and overpaying with monetary means for a more private, decentralized experience. This, R3 believes, is a significant hurdle for the adoption of decentralized platforms.

A problem with the user experience, according to R4, is that the field has a bit of “bad optics”, and that words like crypto or blockchains are automatically tagged with scams. R4 uses the following example of this: *“I was at the South by Southwest conference in Austin. It is a big technology convention with like 100 000 people attending. When we mentioned Web3 or crypto, the people got taken aback, but when you showed them the decentralized technology with the nodes, they were very fascinated. So I think that the general perception of the people is the biggest roadblock right now.”*

R4 also says that another significant roadblock for users is the lack of knowledge in understanding decentralized technology. R4 says: *“Take the example of democracy. If everybody knew their rights and how the system works, it would be really hard to manipulate them to do something that you wanted to do, and people would make informed decisions”*. Here is the problem with the knowledge gap toward Web3, people do not understand its value, and this is a significant roadblock to mass adoption. R4 also says that if people get educated on the matter, they would be pleased to switch over to decentralized alternatives (R4-4).

R4 states that their organization works hard to foster an open environment for people to easily build their own decentralized applications using the organization’s framework. Everything is free, open source, and modular to cater to adaptability and promote knowledge in the field (R4-7). To reinforce this further, the organization also runs a curriculum masters program on blockchain technology.

4.6 Feasibility and Future of the Decentralized Web

The respondents' views were both optimistic and pessimistic on the topic of the feasibility of mainstream adaptation of the decentralized web. Some stated that decentralized technology has the potential to shape a more equitable and transparent society in the near future. However, the respondents also pointed out some significant roadblocks to mass adoption. One such obstacle is the perceived lack of purpose and incitement in many existing projects. Another barrier to adoption is the current user experience, which is still less mature than traditional web applications. However, respondents expressed hope that this would improve over time. One respondent likened the current state of the decentralized web to the early days of the internet, predicting that valuable applications would emerge incrementally. The respondents also raised concerns about the volatility and hype surrounding the cryptocurrency and blockchain space. They warned that this could dilute the movement's original intent and

discourage genuine innovators. Despite these challenges, the overall sentiment was hopeful. The respondents envisaged significant improvements in the usability of decentralized platforms within the next few years, driven by advances in technology and growing awareness of the value of decentralization. In conclusion, the future of the decentralized web is filled with promise but also fraught with challenges. As the technology matures and user experience improves, it's likely that we'll see a gradual shift towards more decentralized platforms. However, to accelerate this process, it's crucial to address the current barriers to adoption.

Overall, R1 has a positive outlook on the future of a decentralized society. R1 calls Web3 the community-owned future and emphasizes how the technical solutions that come with decentralization will help build a more fair and transparent world (R1-5). R1 says that the role of a DAO is equivalent to a traditional organization but in the Web3 framework (R1-5). Furthermore, the DAO they are active within is already up and running and working as intended, which helps to remove the traditional hierarchical structures, which R1 says the members are negatively disposed towards (R1-3). Science is very risky, according to R1, which makes it a perfect field to decentralize due to the nature of how a DAO works and its way of crowdfunding projects that its members believe in (R1-4).

R1 also states that some of the technical solutions of decentralization will help to remove intermediaries. The example he uses is the use of NFTs to easily exchange patents without the need for an expensive lawyer (R1-4).

Although R1 has an overall positive outlook on the future of decentralization, they also state that there are some roadblocks to mass adoption. The field is suffering from a lot of solutions being created without having a real problem to solve. R1 uses the term "bloats" to describe those projects without a purpose and suggests that for the decentralized web to be feasible and meaningful, the focus needs to shift towards identifying problems and then using blockchain to solve them. Otherwise, this will hinder people from understanding the value of using decentralized technologies (R1-6).

Overall, R2 does not see decentralized applications mature enough for widespread adoption. However, they talk positively about the ideas, such as the social media platform Lens, and say they hope to see it come to bloom one day (R2-4) as the technical solutions improve each year (R2-8).

One big problem for mainstream adoption, R2 state is that there is a big problem with the branding today as the permissionless state of decentralized platforms attracts a lot of scammers and illegal activity, which is a big hinder to user acceptance due to regular people not wanting to be associated to that kind of usage (R2-10). Although, R2 claims that there are already a lot of platforms running decentralized technologies right now, without calling themselves Web 3 technologies because of the bad branding. One example of this is Reddit avatars, which are NFTs situated on a blockchain but call themselves collectibles. This is a trend R2 believes is going to get all more common.

R3, a seasoned developer in the realm of cryptocurrency and decentralization, discusses the complexities and potential hurdles within this evolving field. R3 underscores that much of the existing technology is nascent, and there is a critical need for adequate financing and incentive models to maintain and advance long-term projects.

R3 points to the initiative "Proof of Humanity" as a case in point. While the concept was novel and held potential, R3 raises questions about its sustainability, primarily due to a lack of robust mechanisms for maintaining value in the tokens distributed to its users (R3-5).

R3 expresses optimism for the future usability of decentralized platforms, predicting significant improvements within 5-10 years. However, they identify the current lack of incentive structures as a significant roadblock to developing and adopting these platforms (R3-5). For the field to truly thrive, R3 stresses the importance of overcoming this issue (R3-9).

R3 also addresses the volatile nature of the crypto movement, marked by recurring hype cycles that attract diverse stakeholders with differing motivations. This volatility, R3 suggests, dilutes the movement's original intent and drives away the real innovators. While some participants are motivated by idealism and a desire to contribute to the development of the field, others are primarily drawn by the potential for economic gain (R3-12).

Despite R3s reservations about the current trajectory of the crypto movement, they remain actively involved in developing decentralized applications. R3 expresses hope that there are still like-minded individuals within the movement and that, despite its challenges, the movement will eventually succeed in realizing its original goals (R3-10).

R4 possesses a positive outlook on the future of decentralized web technologies. They strongly relate to the vision and need for fair and equal web platforms and say that we will get there incrementally with each successful project launched (R4-2). R4 compares the state of the field with the internet bubble in the late 90's, where the really useful applications that we take for granted today rose from the masses (R4-3). R4 also says that they recently overcame a major roadblock with scaling within blockchains and that they are already starting to see some interesting decentralized applications like social media platforms that require a high-frequency interaction, something previously impossible to implement (R4-4).

R4 says, *“I will actually say that we think in the timeframe of 3 years. So we are gonna see a wave of useful applications being usable, along with being useful. At that point, people don't even need to be aware that their applications are being powered by blockchain technology or have a Web3 architecture”*. R4 stated that this would lead to applications with real-world use cases within the framework of Web3 and an evolution of the landscape where people are adopting the new technology (R4-8).

According to R4, this will be especially useful for the creator's economy, and predicts a lot of creators will move over to Web 3 within the next three years.

R4 says that through predictable pricing models that some blockchains provide, we are now also going to see a lot of exciting applications coming up and a lot more adoptions in terms of enterprises moving over to the Web 3 model (R4-11).

At the heart of R4s views is the belief that efficiency is a powerful driver of adoption. They are convinced that as Web3 technology becomes more efficient and user-friendly, it will inevitably draw a greater number of users and creators, thus realizing the vision of a fair, decentralized internet.

5 Discussion

In the discussion section of our research paper our findings are reflected upon and critical analysis of these are made. First, we summarize the key points of what we discovered to set a context for the rest of the discussion. The following headings are meant to reflect the most relevant topics and findings aggregated from both the literature and the interviews conducted. Technical and non-technical challenges in the decentralized web will be described, however, it must be noted that this divide is fairly trivial as the two are highly interconnected. Technical challenges often arise because of a lack of incentive which of course is a non-technical issue.

There is also the difference between the further decentralization of the web and Web3, the first encompasses all aspects of decentralization online (such as federated networks or other P2P services) while the latter only addresses blockchain-based technologies and platforms accessible via certain browsers or browser extensions. These will all be treated under the decentralized web umbrella term and thus be discussed simultaneously in the discussion.

5.1 Advantages and Disadvantages of the Decentralized Web

The advantages of decentralized web services and Web3 are many and overlap, however, they are idealistically oriented and do not reflect the wants or needs of everyone. For enthusiasts, these might easily be worth all of the costs associated with them. For others, the advantages might not be worth any sort of downgrade, in which case the services will not be adopted.

The primary attractiveness the decentralized web has is derived from its ability to offer ownership of one's own data, non-interference from government, censorship-proof systems and that no corporations may affect public discourse (no dictatorship of algorithms). Potential democracy problems can be avoided and the power does not lie in the hands of the company supplying the service, there is none. A trivial yet powerful example of this was brought up by Respondent 2: when Meta launched the Metaverse, they took a user's Instagram handle because it happened to be "Metaverse". Instead of discussing this with the owner of the account, or buying the handle from her, they simply took it because they could (R1) (The New York Times, 2021). This strikes at the essence of the movement, the decentralized web would even the playing field for everyone and make these types of actions impossible.

In decentralized systems, there is no single point of failure (Zembruzki et al., 2022). While this is a clear advantage of decentralized systems, it cannot be said with certainty that a decentralized web would be less vulnerable to failures, outages or attacks. Raman et al. (2019) showed that, taken together, content was unavailable more frequently on Mastodon compared to Twitter. While large tech companies enjoy centralized control over a platform, the servers are typically spread out all over the world, making them resistant to attacks aimed at a central point of failure. Furthermore, large tech corporations are highly incentivised to minimize downtime if any sort of failure occurs, every minute of downtime is a lost opportunity for revenue. Meanwhile, private instance administrators are not as incentivised to respond quickly to failures, outages or attacks since there is no monetary loss involved. Taken together, what looks to be an advantage of the decentralized web is oftentimes a downside.

Blockchain technology (dApps) costs money to use (R3), in Web3 where corporations cannot collect payment in terms of user data - the user pays directly. There must also exist some sort of cost to using Web3, otherwise it would get flooded by spam and bots created by

anonymous users. This is not a general rule for P2P software in general however, for instance federated networks like Mastodon gets around the issue by introducing instance-specific rules.

That Web3 comes with a performance downgrade and low user-friendliness is supported in both the literature (Murray et al., 2023) and by every interview subject in this study (R1, R2, R3, R4). Even in the most optimistic of scenarios, where matters of UX and performance has been resolved, adopting decentralized solutions, whether it be dApps, federated social networks, Web3 technologies or something else, will entail some sort of downgrade simply because decentralized architecture does not allow for certain *quality-of-life* functionalities.

Privacy is a complicated issue. On Web3, someone's identity cannot be fully established (R1). However, every transaction is stored on the blockchain and can theoretically be viewed by anyone who chooses to do so via services such as Etherscan (R1). One does certainly have increased privacy in the way that service providers cannot sell one's data to third parties, no central authority exists and therefore cannot collect user data in the first place.

5.2 Technical Challenges

Apps running on decentralized web technologies are still relatively new and face many technical challenges. In its current state, Web3 cannot compete with the established web. Murray et al. (2023) points out that most of the internet's critical functions such as chat, email and social media have no serious competitor. Where there exists dApp-alternatives, they are in broad terms always at least slightly worse than their established counterparts. The fact that they attract less users is on its own an undeniable downside (R2). The same can be said about federated networks (Raman et al., 2019).

Federated services seem to struggle to establish themselves (Murray et al., 2023). Diaspora, the previously most popular federated social network failed and Mastodon is facing grave technical challenges. Availability might be the most severe one. In theory, a decentralized system should be more reliable since it eliminates the single point of failure, this does not seem to be the case, certainly not with Mastodon. Interestingly enough, one could argue that it is precisely because of how centralized Mastodon is, that makes it less reliable than fully centralized services such as Twitter. This is due to the fact that the administrators of the instances have low incentives to quickly respond to an outage whereas tech corporations are highly incentivized to minimize downtime because of the risk of monetary loss. Because of how few instances host so much of the content on Mastodon, an outage will result in a larger loss of availability and that is why its lack of decentralization makes it less reliable.

As stated by all persons interviewed in this study, user experience is one of the key areas where decentralized technologies are lacking compared to the centralized services used today, this highlights the need to address technical challenges.

5.2.1 Scalability

Strides have been made in this regard to scalability for a long time, with technologies such as IPFS that allows for decentralized file storage (Barabas et al., 2017). Still, one of the main concerns about technical challenges faced by decentralized web platforms today is this scalability problem (Murray et al., 2023; Diehl, 2021). If the decentralized services are to be seen as alternatives to the services we use to day they need to be able to handle a growing user base with the increased traffic and data storage requirement it bring, without

compromising performance, a challenge faced by blockchain-based system, which is central to many decentralized applications today (Diehl, 2021). This is because the current blockchain implementations have a limited transaction throughput making it difficult for the systems using this technology to handle the massive user base and traffic of the centralized platforms we use today. This is evident in the examination of Mastodon, where the researchers found that scalability is one of the biggest threats to the further development of the decentralized web (Raman et al., 2019). If decentralized technology does not overcome the scalability problem, the decentralized services it offers will struggle to handle increased traffic and data storage requirements that come with becoming a more mainstream alternative to the centralized services used today.

Notably, R4 brings into light new technologies that might well make Diehl's (2021) criticism outdated. *"Previously it used to be the blockchain's performance but with the advancements of blockchain technology we now have scaling solutions, this is not a problem anymore"* (R4), it is explained that the process is called Sharding and that the only "fully sharded" blockchain as of now is Polkadot. This provides a compelling argument that the most dire technical challenge of Web3 might be in the process of being solved.

5.2.2 User Experience

There exists a clear consensus that the user experience is lacking in Web3 solutions, both in the literature and from all respondents (Barabas et al. 2017; Murray et al. 2023; R1, R2, R3, R4). Within the broader term User experience (UX) exists UI, user interface. The UI of Web3 technologies is not a threat to widespread adoption of Web3, it can be improved and implemented with ease just like in Web2 solutions. There are, however, UX issues that are not as easily solved. The user journey is, by design, hard to make seamless (R4). These problems arise from the inherent problems decentralized architecture presents. An example of this is the passphrase required by the user to use the Ethereum blockchain (R4). R4 states that *"we don't have products that give a seamless user experience right now"*. According to R4, this is a *"fundamental user experience problem"* and *"a big hindrance to mass adoption"*.

One still has to be fairly technically knowledgeable to utilize Web3 platforms. R1 states that a lot of people do not know how to set up a crypto wallet, transfer ETH to the wallet or understand the role of DAOs nor the value of tokens as opposed to money. These are all barriers of entry for Web3. This is strengthened by the fact that R2, the early user, tells us that his way into the Web3 sphere was through a friend who helped him with some technical necessities, such as setting up a wallet. This brought the barrier of entry down for him and enabled him to join (R2). R2 also tells us that the UX has gotten considerably better since he started using Web3 services. Some severe bugs are fully patched (R2) and projects such as Layer 2 (R2) and Blockstack (Barabas et al. 2017) are making Web3 an easier place to navigate.

Despite the progress being made, many believe that because of these inherent problems, Web3 might never be able to compete with Web2 in terms of UX (Murray et al., 2023). The question remains if the user journey can become *just seamless enough* for regular people to enter hassle-free.

5.3 Challenges of Non-Technical Nature

The majority of the challenges the decentralized web faces are not technical. These include natural pressures for centralization, that decentralized services have a propensity to acquire bad reputations, a generally low quality user experience, decentralized social networks struggle to establish themselves due to network effects (R3) and that the decentralized web as a concept does not seem generate much interest by the public (R4).

5.3.1 *Re-centralization*

In more than one sense it can be said that there exists a natural force for centralization on the web:

Natural Centralization in Peer-to-Peer Hosting: As seen in the case of Mastodon, peer-to-peer architecture is not an instant solution for achieving decentralization. The study by Raman et al. (2019) showed that 10% of the users hosted for more than half of the users of the platform. This is not a technical limitation, rather a behavioral law, fewer people will be interested in hosting a service than just using it.

Content-driven Centralization: The content generated by any social media network can become popular, or viral. When this happens in a federated network with multiple instances, some instances will draw more traffic to them than others (Raman et al., 2019). This creates a more lively social network where more content is created and can become viral again, continuing a cycle of centralization.

Centralization is Functional: A centralized system inherently has functionality that decentralized systems cannot attain, or will have struggle reaching. A good example if this is the simple task of resetting passwords (Diehl, 2021). Forgetting a Web3 password can be detrimental, the only way to get access to one's crypto wallet is via a password. This creates a scenario where losing a password could be very costly. Worse still is having the password leaked or stolen as there is no solution if it occurs (R4), even with technologies such as Blockstack (Barabas et al., 2017).

Economic Forces for Centralization: The centralized business model has proven to be widely successful and it has allowed users to interact with services for free. The income stream generated by these companies is often not money collected from the users, rather it comes from selling data generated by them, and by employing targeted ads (Barabas et al., 2017; Liu et al., 2017). This of course does benefit the user, as long as they are willing to give up the right to their data.

5.3.2 *“Bad Optics”*

“I think that the general perception of the people is the biggest roadblock right now” says R4, when asked about the biggest hurdle for Web3 to attain mainstream adaptation..

Web3 seems to suffer from a bad reputation (R1, R2, R3, R4; Murray et al., 2023), the crypto community has seen a surge in scams, and various schemes in recent years (Litan 2020). Web3 platforms, being blockchain based, are often perceived as a scammer's paradise where shady business can thrive. “Bounty hunters” is a term used in the Web3 context to describe people with no interest in the original cause of Web3 but who have entered the sphere for the sole purpose of making money (R1).

Other decentralized services are also vulnerable to this decrease in reputation since decentralized software often becomes the go-to place for criminal activity. The software does not have to be blockchain-based for this to occur, any system where users can easily be anonymous and interact is susceptible to this.

R2 believes that if Web3 is to take off, it must not be branded as Web3. There are several applications of Web3 technologies that are used simply because they are useful, R2 tells us that many Reddit users are unaware that the profile avatars one can have are actually NFTs and can be sold and traded on Web3. It may well be that the easiest way for Web3 to spread and grow in popularity is through the discovery of small useful applications nested in an otherwise Web2 interface.

Keeping in mind that R4 is inclined to have a positive outlook on Web3, being employed by the Web3 Foundation, he does air some interesting counterpoints worth taking into account. R4 looks at the time when the World Wide Web was invented (the era of Web1) and points out that the same could be said about the internet back then. Now we would all agree that the web is more than a place scammers reside, but when the WWW was new, this was a commonly voiced concern. What is meant is that people looking to take advantage of others will always be drawn to new playing fields, this does not mean that the arena is bad itself and hopefully it will sort itself out just like the WWW did. This is the same argument brought forward by Gartner (Litan, 2020).

“..just the way like it was with the internet bubble, where all this new technology led to some scams but in the end it led to companies like Facebook or Google and other services that we use today and take for granted” (R4).

R4 calls this the issue of “bad optics”, no matter how noble the cause is, the view of the public seems to be suspicious. A conference in Austin called South by Southwest is recalled. When speaking at the conference, R4 remembers how using the words “Web3” or “crypto” triggered negative emotions, but upon showing the architecture of decentralized software and its benefits, people were fascinated.

5.3.3 Attracting and Retaining Users

As pointed out by Barabas et al. (2017) it is not enough for a technology to be technologically feasible for it to be adapted by the public. The decentralized web, whether it is Web3 or any other iteration, and the services it hosts must be user friendly and intuitive. This is a great challenge since the very essence of decentralization removes certain functionalities that users have grown accustomed to have.

Social networks face difficulties establishing themselves due to network effects, people decide to join social networks because their friends are already on them. Typically, centralization is crucial to the success of a given social network because the social network must reach a critical mass of users. At the same time, network effects are a barrier of entry for competitors (Barabas et al., 2017; Vojříř et al., 2020). It is noteworthy that none of the people interviewed for this study used any form of decentralized social media, despite all being highly invested in the decentralization of the web. Web3 initiatives to get around this does exist, (R3) but has yet to have a breakthrough. R3 tells us about Lens Protocol, a decentralized initiative which aims to remove network effects or lock-in effects of social media by acting as the foundation on top of which social network frontends can be built and by doing this keep one’s friends no matter what frontend is used.

The most successful model for monetization of social publishing platforms is advertising (Barabas et al., 2017). Most users do seem content with the trade of being shown advertisements in exchange for free use of the platform. Attracting these users might just be a futile task, there must exist some sort of concern for integrity issues in order for anyone to abandon Web2 (R4).

R4 tells us that the problem with Web3 is that people have to really understand it to appreciate it. Clearly, people are fine with using centralized services and letting their data be used in any way the provider sees fit. R4 argues that in order for mass adoption of Web3 to take place, people must be educated on its benefits.

5.4 Regulatory and Legal Challenges

Apps running on decentralized web technologies may face regulatory and legal challenges, particularly in areas such as data privacy and intellectual property. One issue is that of moderation of content (Raman et al., 2019; Diehl, 2021). With no central authority, there is no one to remove hate speech, CSAM-content or other unwanted content. This of course is an ethical question as well as a legal one. Barabas et al. (2017) suggest that a hybrid solution might be the best approach, taking away somewhat at the decentralized nature of the system in order to be able to moderate. They suggest a structure similar to Reddit, where each sub-forum has its custom rules and moderators. This structure resembles that of Mastodon.

R4 too speculates that some decentralization might have to be sacrificed in favor of a safe and legal digital space, and that it might just be a matter of striking the right balance. The governance of Web3 is still a gray area, R4 is transparent with the fact that more *“understanding and analysis and research into how to do proper governance”* is needed in Web3.

5.5 Use Cases and Applications

Both the literature and the respondents generally express optimism for future use cases of Web3 technologies and decentralized architecture as a whole. Litan (2020) believes that many new use cases will be found despite his assessment that the hype surrounding Web3 is reaching its peak. R4 shares this view, telling us that more applications will certainly be found. R4 particularly thinks that NFT technology is misunderstood and underutilized, telling us that one can make many more things than JPGs non-fungible tokens, such as music for instance. R2 believes that blockchain technologies will prove useful outside of the Web3 sphere and show up in otherwise Web2 interfaces, like it did on Reddit.

6 Conclusion

The web as it is today (Web2) is not challenged. The most ambitious attempt at a working decentralized web is Web3, which will remain a complement to Web2 for the foreseeable future. Strides are being made at an impressive pace, yet the usability and performance of the services that it offers are still infantile. A centralized web comes with certain benefits, these range from high web and app performance, free storage and personalized feeds and advertisement. In those instances where a decentralized alternative can be compared to its traditional counterpart, the alternative service has yet to meet the same standard. It is evident that switching from traditional services to decentralized ones does entail performance and convenience downgrades for the user. With the benefits of web-centralization in mind, still it does pose some risks, such as reduced competition, loss of privacy, and the potential for censorship and control of information by few large corporate entities.

Recent breakthroughs seem to challenge the idea that Blockchain systems cannot scale without becoming the centralized systems they were designed to replace, the world has yet to see how well this actually works however. Furthermore, some technical issues remain to be fully addressed such as the bandwidth problem, and the fact that Web3 it is far more costly than what we have today.

Reliability is an issue in federated services. In theory, decentralization should increase reliability in hosting, Yet, because of how centralized some federated networks are, they end up being less reliable than their fully centralized counterparts. This is, we suspect, because of how non incentivised instance admins might be in relation to highly incentivized mega-platform employees.

Technological advancements have paved the way for Web3 technologies, and a fully decentralized web seems to be on the verge of existence. What stands in the way for Web3 to take off seems not to be the technical aspects, rather it is behavioral ones. Web3 suffer from the crypto-world's tainted reputation as a marketplace for scammer, furthermore decentralized technologies naturally attract shady actors seeking to evade authorities, governments or regulated platforms - this phenomenon further worsens the reputation of dApps and other decentralized services as safe havens for criminals. Because of this, it is difficult to establish a good public face outward for these services.

Furthermore, there seems to exist a natural force of centralization. It is helpful to remember that our current web is running on decentralized principles and technologies (HTTP, HTML). This alone did not stop it from becoming highly centralized. We draw the conclusion that because of naturally occurring pressures to re-centralize, a high level of decentralization of the web might not be a realistic future. Even with a peer-to-peer infrastructure, high degrees of centralization does seem to emerge spontaneously. Even in explicit efforts to escape centralization it seems it does appear nonetheless, Mastodon being the primary example.

Another non-technical hindrance to the emergence of the decentralized web is that the vast majority of people simply do not want to trade the comfort that comes with centralized service providers. Even if some people mean that they do care about ownership of data and privacy - most do not care enough to be willing to take the downgrade in performance and usability to make the switch from centralized platforms. The benefits provided by the decentralized web are mainly ideological which is a hindrance to mainstream adoption. The user experience is one of the central components standing in the way of Web3 gaining in popularity, its UX has improved greatly and nothing suggests that it will not keep improving. Yet, there exists a

built-in limit because of its decentralized nature, this suggests that Web3 might never quite reach the UX or convenience levels of Web2. Despite the existence of inherently impossible functionalities, it cannot be said that the barrier of entry cannot become low enough where mass adoption can occur.

Legal and regulatory challenges pose non-trivial threats to the existence of a decentralized web. A censorship resistant architecture comes at the cost of the possibility to share illegal and immoral content, as have already been observed in decentralized social networks.

Federated services provide a middle ground in the decentralization of the web, they are not fully as decentralized as dApps running on blockchains but they solve problems that Web3 seems to struggle with. In a federated network, moderation is easier. One problem with them is that they seem to be extremely vulnerable to the natural forces for centralization detailed above.

Realizing the full potential of the decentralized web, if possible, would require overcoming a number of technical, social, and economic challenges, such as developing user-friendly interfaces, building scalable and reliable infrastructure, and addressing the issues of governance and incentive alignment. It is telling that even the strongest advocates for Web3 that were interviewed were open with the limitations of the system. As of today, many of the vital functions expected on the web do not have a Web3 equivalent, which would have to be the case if mass adoption is to occur. Of course, the decentralized web would not serve as an end-all solution to all internet related issues, such as privacy or ownership of data.

Appendix

Interview 1

JB = Jakob Borglund

TS = Torsten Strömberg

R = Respondent - Founder of a DAO

Speaker		Code
JB	Vad har du för bakgrund inom området?	
R1 1	<p>Jag har faktiskt ingen akademisk bakgrund inom området, min bakgrund är syntetisk biologi, bioteknik, studerade det i Lund, har lite forskningserfarenhet. När det kommer till blockkedja och krypto så är bakgrunden där att själv ha läst om det och försökt lära mig om olika projekt och målet där var att själv investera i dessa olika projekt. Tanken var att om jag ska investera inom dessa projekt så vill jag veta vad dessa projekt faktiskt gör och vad för nytta de tillför så jag åtminstone kan rättfärdiga min investering.</p> <p>Det leder ju till en viss fördjupning av ämnet. När man först börjar läsa om det så tänker man ju 'Vad är det här? Vad är DeFi? Vad är ett smart contract? Men ju mer man fördjupar sig, ju mer övertygad blir man och ju mer lär man sig hur man kan tillämpa dessa olika i olika områden. Så ja, bara av ha utsatts av de här olika begreppen. Jag följer folk på twitter som pratar om dom, olika influencers, olika människor som förespråkar denna teknologin så kan man också hålla sig uppdaterad om olika trender och så vidare. Det är min erfarenhet av det.</p>	
JB	Okej så det var egenintresse som fick dig involverad i det?	
R1 2	<p>Precis och det jag oftast hör och det som gäller för mig också är att, you know, vi alla vill tjäna pengar, vi alla är ute efter att göra bra investeringar och bitcoin och etherium är enligt mig sådana möjligheter. Det är också extremt risky, men som en yngre individ så kan man ta de riskerna. Dock i den resan så lär man sig om de här sakerna, och det börjar bli spännande och då tänker man själv " jag kanske själv kan göra någonting med det här" och det ledde mig in på att börja arbeta med på en heltidsnivå där jag faktiskt har en inkomst av att arbeta med det. Det var bara ren coincidence att det skedde.</p>	FDD
JB	Vad är din roll inom [DAO:en] bio (som original grower)	

R1 3	<p>OG kallar vi det, det är en kulturell grej. I blockkedja, vi snackar ju om decentralisering och hela det och det leder ju också till att man ser annorlunda på de traditionella hierarkier från web2 där man har en tydlig hierarki, man har en chef man har olika lager. I blockkedjajävärlden, i web3, försöker man skapa en mer platt hierarki, en platt struktur och de första stegen i att skapa den strukturen är att tänka på nytt om den kultur man har, det språket man använder sig av när man skapar grunden i [DAO:en]. Jag gör till exempel saker som en CEO hade gjort i ett traditionellt företag men jag säger inte till folk att jag är CEO, jag säger att jag är core founder eller jag är core member. Men däremot om någon kallar mig för CEO till exempel eller founder, då säger jag inte emot det, för det har med att folk i den här industrin sätter inte titlar på sig själva utan de tjänar sina titlar baserat på hur folk identifierar dom. När jag pratar med en investerare, då kallar jag mig till exempel för grundare för att kunna prata deras språk, medans när jag talar till allmänheten eller resten av communityt så kallar jag mig själv för core member. Så det är ett nytt sätt att arbeta på och en grej i web3 är att man nästan gör narr av det traditionella titlarna och skapar ett nytt språk i hur man definierar de här sakerna. Så det finns inget färdig template för hur du ska strukturera en web3 organisation, vissa strukturerar dom som traditionella företag, vissa strukturerar dom med målet att decentralisera så mycket som möjligt där beslutsfattande (decision-making-power) sker med tokens, där tokensen används för att rösta på olika förändringar i organisationen, det kan vara tex "hur ska vi använda vårt treachery", "vem ska vi välja till styrelsen", "Vem ska vi välja som grundrepresentanten för den här delen för organisationen" och sådana saker. Man kommer alltså med en mer community approach där communityt är en del av byggarna/deltagarna.</p>	FDD, FF
TS	Är det också communityt som ger förslagen man kan rösta på eller vem kommer med förslagen?	
R1 4	<p>Både och. I [DAO:en] har vi som mål att maximera decentralisering. Målet är att någon gång i framtiden kunna ta bort oss själva från ekvationen och organisationen fortsätts drivas och gör det den ska göra. Så vad vi gör är att vi låter vem som helst komma med förslag en så kallad governance proposal, det är typ som ett parlament där de individuella medlemmarna kan komma med ett förslag, en lagstiftning, en lagförändring och så vidare. och då kan de spearheada, de kan leda den processen och skapa ett narrativ, övertyga, lobbya för det för att få det igenom. Det är den sortens struktur vi vill skapa i [DAO:en] där vi enablar medlemmarna att själva bli ledare och leda olika processer, beslut, initiativ, riktningar och så vidare. Vi vill att folk ska komma och säga, "jag vill ändra den här riktningen till det här för att det är bättre". Då säger vi "okej då röstar vi om det, och så kör vi på det". Day to day activity, alltså operational saker, där har vi ett core team, jag och de 3 andra grundarna. Men när det kommer till större saker, till exempel att spendera mer än 20 tusen dollar så krävs det en governance</p>	FDD, FF

	vote, där folk med tokens röstar.	
TS	Vad var motivationen till att grunda/gå med i en DAO, i kontrast till någon annan slag organisation.	
R1 4	<p>Innan jag kom in i det här spacet, typ 2021, jag satt på en bar med någon som jag känner via mitt jobbnätverk. Hon berättade att det fanns folk i discordgrupper som sysslade med biologi och blockkedjor, jag gick in där och hittade något som heter decentralized science, DISI, det handlar om hur vi kan förbättra forskningsfältet, vetenskap generellt, hur kan vi göra en mer demokratiserad, rättvis och där fokuset är mer på att faktist utveckla teknologier som möjliggör bättre förhållanden för människor istället för att finansiera finansiera forskning som är väldigt incremental. Problemet inom forskning idag är att samma forskare får samma grants varje år, peer review systemet är riktigt dåligt, du får ingenting för att peer reviewa och du lägger ju en massa tid på att läsa igenom andra forskares papers. samtidigt angående immateriella rättigheter. Sverige är det enda undantaget i världen där forskaren äger sin data, medans i resten av världen så äger universitetet datan. Ett annat problem är att vi som skattebetalare, vi betalar skatt, pengarna går till universiteten, men sen går inte den teknologin som tillbaka till folk, utan vi måste betala för att komma åt den teknologin, och vi måste oftast betala höga summor. Journaler till exempel, där du måste betala mycket pengar för att komma åt vissa artiklar. Så kunskap är alltså inte demokratiserad vilken den borde vara. Där kan man ju själv svara på frågan om varför det här behöver förändras. DISI försöker då lösa dom här problemen inom forskning, och det kan vara genom att hitta nya sätt att finansiera forskning med hjälp av blockkedja, det kan vara tex crowdfunding, eller att sätta immateriella rättigheter i en NFT. Det man gör då är att man sätter in ett fysiskt kontrakt i en NFT vilket möjliggör att tex jag och du kan exchangea ip, patent och så vidare jättefort genom blockkedjan istället för att vi skulle ha en advokat som ska göra en massa pappersarbete åt oss och som vi behöver betala en massa pengar. Nu kan vi automatisera den processen, och i och med att det är en NFT och att du äger din egna wallet, så äger du också de immateriella rättigheterna i NFTn. Så jag hittade detta universumet och tänkte att ingen här sysslar ju med syntetisk biologi, det finns jättemycket potential att lösa olika miljöproblem med syntetisk biologi och jag märkte också att de flesta inom blockkedjor och DISI har en stor passion för att lösa globala problem och att lösa globala problem i ett kontext inom blockkedja, i det ekosystemet är mycket lättare eftersom det är väldigt enkelt att skapa ett community och att fundraisa, det finns så mycket kapital och forskning är extremt risky, och folk inom blockkedja är också väldigt risk-prone, alltså de är villiga att ta risker. Så att foundrasia för sådana här riskfyllda initiatives såsom att finansiera forskning är väldigt bra, det finns alltså goda förutsättningar och folk här är väldigt grymma på att skapa awareness, att skapa hype och kombinera det med att applicera det på något riktigt vettigt som till exempel</p>	FDD, CC, FF

	<p>forskning som verkligen kan förändra människors liv, där har du en kombination som verkligen kan göra impact på en större skala. När du har en DAO, med tokens, de tokensen kan tjänas in av contributors, de kan tjänas in av folk som allokerar kapital, dom blir ju delägare av din DAO och kan vara med i beslutsfattandet, det är en skillnad mot traditionella företag, där har du board members, men det är begränsat, vem som helst kan inte bli en board member, utan dom måste hieratiskt väljas in, medans i en DAO där har du möjligheten för faktiskt maximal entropi och när du har maximal entropi kan allting hända. Men du kan också använda dig av collective intelligence, typ som myror, som helt autonomously bygger sina myrstackar, sina bon utan att ha en central ledare och när du har sådana decentraliserade strukturer uppstår ett fenomen som kallas för emergence, och emergence är de nya propertisen som dyker upp när folk arbetar på ett decentraliserat sätt. Det kan tex vara att du har väldigt starka nätverkseffekter som leder till att inflytelserika individer kommer in till din organisation, till din DAO, det kan också vara att du har möjligheten att sourca riktigt grymma projekt som du finansierar som du inte hade kunnat sourca naturligt som en liten grupp. Det finns också ett begrepp som kallas för "skin in the game" som betyder "om jag äger tokens i ett projekt, då har jag skin in the game eftersom att jag då har ett direkt intresse att se där här projektet lyckas" och om jag har vissa färdigheter, till exempel vissa nätverkskontakter som kommer jag att ha ett större incitament att öppna upp mitt nätverk eller bidra med mina erfarenheter för just detta ändamålet som DAO:n försöker att åstadkomma. Detta leder till att fler människor kan komma in, fler människor kan bidra på ett gynnsamt sätt där de faktiskt får tillbaka någonting, det de får tillbaka är ett ägandeskap i nätverket, för du har ju tokens och de här tokensen delas upp på ett visst sätt baserat på hur mycket folk bidrar och hur mycket folk investerar, det är ett fenomen vi inte har sett ännu i digitala verksamheter, i digital communities, det är det DAO:s skapar, möjligheten för fler människor att sammarbeta med ett tydligt ekonomiskt incitament.</p>	
TS	Enligt dig, vad har DAO:s för roll i utvecklingen av web3?	
R1	Hur definierar ni web3?	
TS	Utvecklandet av ett decentraliserat alternativ till det vi kallar för web2.	
R1 5	<p>Det är en del av web3, det är en del av hela den delen av ekosystemet som använder blockkedjan som technology stack. Jag ser det som web3 är the community owned future. Som vi ser idag så finns det vissa problem med att skapa monopol. Det finns problem med att vissa centraliserade strukturer får jättemycket inflytande för då får vi mindre innovation, för att ju större en struktur är desto långsammare är den. Ju mer dominas den har, ju mer kommer den stoppa för nya spelare att komma in, nya competitors, och detta bromsar ner innovation. På en teknologisk nivå, på en politisk</p>	FF, FDD, CC

	<p>nivå, på en statnivå, på en filosofinivå, konst, allt möjligt, det är ett fenomen vi ser i alla pelare i livet och det som gör folk optimistiska med web3 är att man kan decentralisera makt på ett sånt sätt att man inte kan fuska kring det och allt börjar med att “code is law”, du kan inte argumentera med kod, du kan inte övertyga kod att göra en viss grej för kod funkar logiskt, och ju mer saker som vi kan göra logiskt, ju mer förutsägbara blir dom. Då kan jag som spelare veta att innan jag går med i ett spel, whatever om det är ett företag, ett community så kan jag veta hur reglerna funkar och att jag inte kommer bli fucked, ingen kommer använda min data, allt kommer vara tydligt, jag kan själv bekräfta det genom att kolla på koden. Som det ser ut idag så kan jag tex inte veta vad Elon Musk tänker innan jag investerar i Tesla. Så det är att skapa transparency i framtiden, där varje individ kan bli mindre manipulerad av systemet som bygger på vinst eller förlust. Så community owned future och user owned internet. Idag ägs internet av några olika jättar, där du inte äger din data, de äger den och tjänar pengar på den. För mig är DAO:s en koordinationsmekanism för att utföra saker i ett web3 ramverk. Om du vill skapa ett företag i web3 så kan du använda dig av DAO:s för att inkludera din community mer, om du har något väldigt ambitiöst ändamål som du vet att du inte kan göra själv på en lokal skala så kan DAOs hjälpa att göra det på en global skala.</p>	
TS	Så alltså som en ekvivalent till traditionella företag inom web3?	
R1	Precis.	
JB	Har du stött på någon teknisk svårighet under DAO:ns utveckling?	
R1 6	<p>Nä inte tekniskt, det vi gör är inte så avancerat, när det kommer till att deploya en DAO. Det är ganska straight forward att deploya då det är så många som gjort det tidigare, däremot är det svårt att veta om det här är det optimala sättet att göra det på. För att nya saker utvecklas hela tiden, så det gäller att hänga med i utvecklingen och implementera nya teorier för hur man ska styra en DAO. Däremot finns det tekniska svårigheter att skapa stabila DEFI produkter som tex stable coins som inte är centraliserade, det är ett svårt tekniskt hinder. Det finns innovationer, som tex CEKA zero knowledge där du utan att se någons data kunna veta om det dom säger är sant eller falskt med hjälp av krypteringsteknologi. Vi tillämpar själva inte sådana saker utan de är folk som håller på med mer avancerade saker på en experimentell nivå. Problemet som blockkedjan har idag är att det är jättemånga lösningar som letar efter problem, istället för att först identifiera problem och sedan hitta lösningar med hjälp av blockkedja. Problemet med hela fältet just nu är att folk utvecklar saker utan att designa problemspacet, detta leder oftast till att folk frågar sig “ varför behöver du ens blockkedja för att lösa detta problemet?”. Detta leder till att hela industrin får mycket bloats, med projekt utan syfte. I många fall blir dessa projekt “self referential”, det betyder att tex att du skapar ett program för att få ett annat</p>	CD, FF, UX,

	<p>program att fungera, att etherium går så bra är för att du kan använda etherium för att få andra saker att fungera men de här andra sakerna har egentligen inte en så stor impact utan är spekulativa saker som folk bygger som sedan inte funkar, den enda vinnaren här är etherium för att du behöver det för att utföra transaktioner och så vidare, och alla saker som bygger på ETH refererar bara tillbaka till varandra, där ett projekt tillämpar ett annat projekt som tillämpar ett annat projekt osv och sen går du full circle utan att ha faktiskt skapat något av värde, det kan vara coolt men, som tex på 70 talet när man utvecklade kvantdatorer så fanns det ingen tillämplig för det. Men hela industrin utvecklade verktyg för att möjliggöra kvantcomputation utan att någon fattade vad syftet var, men nu börjar syftet komma fram. Så jag tror att det är den fasen krypto är i just nu , vi vet inte vad tillämpningen är men alla är optimistiska att vi kommer hitta tillämpningarna, på både gott och ont.</p>	
JB	<p>Ur egen erfarenhet, finns det några trösklar för nya deltagare att arbeta med DAO och tillämpar ni någon strategi för att överkomma detta?</p>	
R1	<p>En tröskel är till exempel Discord, en web2 lösning som vi använder för att kommunicera, många är inte vana vid att använda den programvaran.</p>	UX
JB	<p>Så alltså tekniska lösningar som folk inte är vana vid?</p>	
R1 7	<p>Ja alltså user experience är fortfarande dålig. Många vet till exempel inte hur man sätter upp en wallet, många vet inte hur man för över eth till en wallet, en annan barrier to entry är att folk inte fattar grejen med en DAO och därmed inte ser någon anledning för att bidra, en annan tröskel är också att få folk att se värdet att arbeta för tokens och inte pengar, i ett tidigt stadie. I ett tidigt skede hade vi inte funding för att kompensera contributors, så det vi gjorde då och vad vi fortfarande gör är att kompensera med framtida tokens, och dessa token kommer ju att ha ett exponentiellt värde om projektet fungerar för de kommer ju launcha 10x priset som de tjänar in det på. Men de medlemmarna som kommer in och bidrar på ett meningsfullt sätt, för dem handlar det nödvändigt vis inte om att tjäna tokens utan mer om de möjligheter som de får och de människorna de träffar och det nätverket de bygger, entreprenörskap är väldigt nätverksbaserat, den som vinner entreprenörsspelet är den som har störst nätverk och känner flest investerare, och genom att komma in i [DAO:en]:s ekosystem så kan du hitta dessa individerna, och dessa individerna är aligned till att hjälpa varandra, så det finns ett extern värde som är beyond a monetary value och det är nätverkseffekten, som det inte går att sätta ett pris på men som vi försöker promota. Det finns två olika individer: det finns bounty hunter som bara kommer in för att ett ändamål som bara kommer in för att tjäna pengar och så finns det real contributor som är med för the long term goal.</p>	UX, FDD,

TS	I ert fall, hur fungerar DAO:n, hur sparas user data?	
R1	Vi sparar ingen user data.	
TS	Är det något som DAO:s gör alls?	
R1	Folks transaktioner är ju public, du kan hitta dem med tex Etherscan. Det finns en katalog med alla transaktioner. Där kan du extrahera data men det är väldigt svårt att pinpointa den till identitet. Vi har indirekt folks data via vår air table tex. Om du appliar för founding på vår sida så sparas din data i vårt airtable eller om du fyller i din information som contributor så kommer din information sparas för vi behöver det för att återkoppla till dig, men du kan vilken stund som helst be oss att radera din data och då gör vi det. Folk är medvetna om hur deras data används.	UX

Interview 2

JB = Jakob Borglund

TS = Torsten Strömberg

R = Respondent - Web3 user

Speaker		Code
JB	Hur fick du höra om decentraliserade appar och vad gav dig intresse till att använda dessa?	
R2 1	<p>Det var en svår fråga men om jag skulle säga en sak så skulle det vara genom vänner, men sen är det ju att man börjar läsa på och sätta sig in i det och då lär man sig mer om det. Så det är nog vanligt att det blir ett rabbithole liksom, men det börjar väl i att det är vänner som snackar om det, det är oftast så man leds in på det. Intresset kom när jag skapade en wallet för att lära mig om det, jag la väldigt osignifikanta summor pengar för att kunna leka runt, klicka runt och så för det skiljer sig väldigt mycket från hur den vanliga webben fungerar, man behöver inte göra ett konto överallt utan man har ju bara ett konto en gång.</p> <p>Sen var det också en vän som uppmuntrade mig att göra just det, han sa att jag kunde swisha honom så förde han över till min wallet så jag kunde leka runt med den.</p>	FDD
TS	Så han drog ner den tekniska barriären för dig så att det blev lättare att komma in i den världen?	
R2 2	Precis, han gjorde transaktionerna för min wallet så jag slapp det, det kan vara en liten hurdle.	UX
JB	Vilken/vilka appar använder du och vad är deras funktioner?	
R2 3	<p>Den första appen jag använde var ENS names, ENS står för ethereum domain systems, som motsvarar DNS fast det är decentraliserat, där kan man köpa ett namn som är på blockkedjan kopplat till en adress och sen kan man använda det som ett användarnamn. Så om man t.ex ska föra över pengar till en wallet så är det många daps som supportar att man bara skriver in ENS namnet så man inte behöver ha koll på den långa adressen till walleten.</p> <p>Jag klickade runt och såg att namnet [Respondentens namn] var ledigt, då tänkte jag att jag köper den adressen, då fick jag adressen [Respondentens namn].eth, den förnyar jag för att det är kul att ha den unika ENS adressen.</p>	FF
JB	Använder du ingen social decentraliserad app?	

R2 4	Inte riktigt, jag har en som heter Lens, eller Lens protokoll. Det är en slags plattform som man ska kunna bygga andra sociala plattformar ovanpå. Ens social graph är på Lens protokollet och det innebär att folk kan göra olika frontends till det, så om man då t.ex skulle vilja byta från motsvarande Facebook till Twitter kan man göra det och behålla sin social graph, ideén är att det inte ska ha samma lock-in-effekt som t.ex Facebook, där alla är för att alla är där fast ingen vill vara där egentligen. Med Lens har man den sociala grafen på ett lager och frontend på ett annat. Jag har inte använt appen men hoppas på att den ska bli något. Could be one day.	FF, FDD, CC
TS	Vad är de största fördelarna för dig när du använder decentraliserade appar gentemot dess centraliserade motparter?	
R2 5	Om man tex jämför den decentraliserade motsvarigheten till DNS, ENS. En DNS kan peka på en IP- adress men den kan ju inte peka på en wallet, det finns ingen centraliserad motsvarighet till ENS där adressen kan peka på ett bankkonto eller IBAN eller liknande. Så det är lite svårt att jämföra, men det finns idealistiska fördelar, mitt ENS namn är tex skyddat, ingen kan ta det ifrån mig. Det finns till exempel fallet när Facebook skulle göra sin Metaverse-grej så fanns det en Instagram användare som hade Metaverse som sin handle och då tog Facebook det namnet, de bara stängde ner hennes konto och tog det. Det hade inte gått att göra när det är decentraliserat. Så blir det när det är centraliserade appar. Men jag har ju köpt någon vanlig domän också och jag är inte rädd att någon kommer ta den från mig, så det blir mer på ett idealistiskt plan.	FF, CC, FDD
TS	Är du mån om privacy / ownership of data och hur upplever du att dessa appar tillhandahåller det?	
R2 6	Jag är inte så mån om min privacy, det går att kolla upp min ENS och det går att kolla upp alla mina transaktioner, jag har två olika wallets, ingen hemlig wallet som jag försöker ha gapad mot det publika, det går att göra via en tornadocache eller liknande, men jag har inte varit så privat för jag bryr mig inte så mycket om det. Men ownership of data tycker jag är bra, situationen vi har idag med att Google och Facebook äger allas data tycker jag är en dålig situation men det är oklart hur man ska ta sig ur det. Jag tycker dock att det skett mycket bra på EU- nivå där det varit mycket bra ändringar, man har till exempel rätt att "be forgotten", man kan be Meta om att de ska ta bort allt om en och så måste de göra det. Det är bra, ett sätt att lösa problemen på. Och att man kan hämta ut all sin data, man kan säga till google att jag vill ha all min location history och så måste de ge dig det och sådana grejer. Jag tror att man även i webb 2 kan lagstifta sig ganska långt.	CC, FF

JB	Har du stött på några hinder/svårigheter/drawbacks i användningen av decentraliserade appar? exempel?	
R2 7	När jag började hålla på med det så hade jag några problem. När man göra olika saker så betalar man en gas fee, och om då inte har tillräckligt, så kunde transaktionen hamna i limbo och då kunde det ske att man betalade dubbelt, men det har blivit mycket bättre nu. Det var en riktigt dåligt UX men det är inte så längre, med tekniker som layer 2 och så vidare.	UX,
JB	Vad betalar man för?	
R2 8	Det måste finnas någon sorts kostnad för att förhindra spam, annars hade nätverket kunnat cloggats. Det man betalar för är de som validerar att transaktionerna går igenom. Innan september förra året så var hela etherium "proof of work" så då betalade man miners, men nu har hela nätverket bytt till proof of stakes, så nu går en del av fee'sen som staking reward till de som stakear och upprätthåller säkerheten på nätverket medans en del av det bara bränns upp, och det för att belastningen på nätverket annars blivit för stor. Hur det funkar på layer 2 är lite annorlunda, det är att en del av transaktionerna inte göra direkt på nätverket utan på ett annat layer och då kan man optimera transaktions avgifterna, man kan jämföra det med: Om jag gör en banköverföring till dig så kommer pengarna fram direkt, men egentligen gör det inte det, utan i slutet av dagen så settlar alla bankerna och batchar ihop alla transaktioner och så funkar layer 2, man förutsätter att transaktionen gick bra och så batcher man ihop den och settlar med jämna mellanrum, och så får man ner kostnaden mot att skicka varje transaktion för sig.	UX, CD,
JB	Har du något exempel på någon app som du tycker har haft en positiv påverkan inom någon sektor/ community	
R2 9	Det bästa exemplet är enligt mig Gitcoin grants, Gitcoin är en organisation som raisar funds till att finansiera saker som är för public good, det kan vara vad som helst, det är som en kickstarter plattform, förutom att man inte förväntar sig att få något tillbaka. På plattformen kan en massa organisationer poola ihop pengar för att stötta projekt. Det finns då inga mellanhänder som tex i en centraliserad motsvarighet som patreon som då tar en cut. Gitcoin har smarta sätt att sprida finansiering mellan de olika organisationerna som vill bli finansierade, man kan både donera direkt till en organisation i Gitcoin eller till Gitcoin själv och då hamnar all dessa funds i en gemensam pool som sedan distribueras ut på ett smart sätt på alla dessa organisationer genom en grej som kallas för quadratic funding. Så det är ju ett bra exempel där organisationer kan bli finansierade som inte annars hade kunnat finansieras genom ett decentraliserat sätt.	FF, FDD

TS	Enligt dig, vad är de största barriärerna till en utbredd användning av decentraliserade appar	
R2 10	<p>Det är usability, det är för dålig UX, det är för svårt att ta sig ombord, sen tror jag också att det är ett stort problem med branding. Decentralisering drar ju åt sig mycket scammers och det har ett dåligt brand nu. Jag funderar om det går hand i hand med att det är permissionless och att vem som helst kan göra vad som helst utan att det behöver vara en bank emellan, det är perfekt för någon som behöver vara shady, lika mycket som det är för någon ärlig som bara inte vill ha en bank som mellanhand. Det märks på de saker som är "web3 iga" nu och som används de kallar inte sig för web3. Ett exempel är avatrar på reddit, de är på blockchain, men de kallas inte för NFT utan de kallas för collectibles, för att NFT har så dåligt brand. Dom kan man tex sälja på open seas, de är web3 men brandar sig inte så.</p> <p>Jag tror att web3 användningen kommer öka men att ingen kommer kalla det för web3, utan det kommer smyga sig på.</p>	UX, CD, FF

Interview 3

JB = Jakob Borglund

TS = Torsten Strömberg

R = Respondent - Web3 developer and early user

Speaker		Code
JB	Vad är din bakgrund inom området decentralisering/web3, hur blev du involverad i det och vad är det som motiverar dig?	
R3 1	<p>Min bakgrund var att jag var jätteintresserad av datorer, och jätteintresserad av opensourcebitarna och den sfären. Jag hängde med andra som tyckte att det var fett med open source, det fanns lite olika communities på internet som var hypade av det och andra aktuella rabbitholes på nätet.</p> <p>Någonstans där dök krypto upp, bitcoin dök upp en eller två gånger runt 2011. Jag kikade lite på det och blev intresserad. På bitcoinforumet då var det tre slags personer, nördarna som var inne på kodbiten, liberterianerna som var politiskt intresserade och den tredje typen som ville köpa och sälja knark, och även personer som överlappade dessa tre typer. Jag kommer mer från tech hållet, kanske smått politiskt. Det var så det började för mig, mycket av pitchen då var att: Vi har ett internet som är öppet och fritt där vi kan göra allt utom betalningar, där tog friheten slut, där behövde man bank och ett mastercard eller paypal. Det var därför jag började med detta.</p>	FDD, CC

JB	Ur din egenskap av att ha varit medveten om decentraliseringrörelsen från ett tidigt skede, vad är enligt dig målen med decentraliseringrörelsen och har din egen bild av den utvecklats eller förändrats över tid?	
R3 2	Absolut, i tidigt skede var det mer att man var frihetsrebell, att vi måste kunna göra detta på ett fritt sätt, men det problemet löstes, redan några år innan etherium skapades så fanns det en öppen marknadsplats där man kunde skicka saker med bitcoin, inte för att det var så många som gjorde det, men det funkade. Sen så hände det lite mer grejer, runt 2014, 2015 när ideérna kring etherium började dyka upp och första gången man fick höra om en DAP (decentralized application) eller DAO (decentralized autonomous organisation) och då tyckte jag det var coolt. Tidigare var det att är folk som gör betalningar, ganska basic, folk kommer göra det för att köpa knark och jag visste inte om krypto grejen skulle hålla i sig och om det skulle användas till andra saker eller att folk skulle ta det seriöst, visst fanns digital goal grejen men det var ändå osäkert. DAC och DAO gjorde allt mer seriöst, det kom tillsammans med att folk började prata om smart kontrakt på riktigt och då kunde man tex skriva program som kördes independently på en värdsdator och om du försvinner och din dator försvinner så kan du relya på att din kod att fortsätta att köras. Det var en major grej, vi har liksom aktiebolag och så om man skulle leva som ett litet land med sina polare och startat ett bolag, men om man är en massa randoms på internet, om man vill ha en form av bolag som inte passar in i de klassiska mallarna som man har för bolag i olika länder, hur gör vi detta natively på internet. Det var något som gjorde mig intresserad, särskilt om man kunde force en slags code of law med smarta kontrakt.	CD, FDD, FF
TS	Är du mån om privacy / ownership of data och upplever du att decentralisering kan bidra med det på en nivå som du är nöjd med?	
R3 3	Det beror lite på om vad pratar för slags decentralisering, om man pratar om kryptodecentraliseringen som etherium är så skulle jag säga att jag är ganska nöjd med hur decentraliserat det i sig är, man har kommit ganska långt i den finansiella decentraliseringen, iallafall nu när terra och alla sådana chains har kollapsat, men de som är riktigt decentraliserade har överlevt. Sen är jag inte nöjd med många andra saker som inte riktigt är decentraliserade som att vi fortfarande använder en massa tjänster där datan är på en annan server av oklar anledning bortsett från att de ska kunna göra (? 06:33) av det. Det är den här typiska icke decentraliseringen vi har idag som jag tyvärr inte tror att krypto kommer att kunna hjälpa till med för det finns där ingen naturlig överlapp där idag. Sen kan vi prata om sociala nätverk och den biten men jag är jättemaxi när det kommer till att hålla all din data lokalt eller ifall kunna ha access till all ens data lokalt, men det har lite att göra med mina andra intressen med quantified self och sånt, jag vill ha all data om mig själv, oavsett vem som håller i den datan. Det var oerhört svårt innan GDPR och har blivit lite lättare efter GDPR men	CD, FF, FDD, CC

	det är fortfarande krångligt. Sånt har jag alltid varit nyfiken och intresserad av rent tekniskt. Det är både ja och nej, jag är nöjd på ett tekniskt plan med ethereum, halvnöjd med bitcoin men mindre nöjd med många andra småprojekt som sprids runt som är halvfärdiga. Jag är mycket missnöjd med hur web2 ser ut, hur data situationen ser ut och så vidare.	
JB	Är det så att det skapas en massa projekt där många gått under nyligen?	
R3 4	Ja, det finns ju en massa projekt som har gått under, vissa projekt som gått under på grund av för att de varit fundamentalt ostabila, och många som gått under för de var byggda i en hype cycle, de var mitt i tåget och så stannade tåget och då stannade de också. När man bygger projekt kan det vara ganska svårt att vara fullt decentraliserings maxi från dag ett och tänka att vi ska inte släppa någonting förrän vi är helt decentraliserade, det händer sällan utan det börjar ofta med något försiktigt där man ofta har något verktyg för att kunna ta admin keysen för att undoa fel som kan hända och sen steg efter steg bygga bort dom i takt att man blir mer confident i systemet. De systemen fastnar ofta i något mellanland när de inte lyckas gå hela vägen, där det alltid finns en grupp som har kontroll över allt.	CD,
JB	Har du något exempel som du tycker visar bra på hur decentralisering (app/teknik) har lett till en positiv inverkan för ett community/individer/industri, när det kommer till privacy och security?	
R3 5	Lite svårt att svara på det. Det finns en massa projekt som är i ett slags pre - moget stadie som skulle kunna vara jättehäftiga grejer om 5-10 år om man hittar en annan mekanism för att finansiera eller underhålla dem. Det är svår fråga att svara på för det finns väldigt många halvbra svar och jag är inte så nöjd med de halvbra svaren. Ett projekt som jag tycker var bra under förra cykeln men som dött lite denna cykeln var "proof of humanity". Där var ideén att man skapar en profil och skickar lite information till en decentraliserad court på 3,4,5 personer där de validerade det du skickade in och du har en profil som är levande så länge du renewade den en gång per 12 månader. Så länge du hade en aktiv profil fick du en token i timmen där den tokenen skulle vara värt någonting och vara en slags ubi(universal basic income), frågan är då, hur uppehåller man ett värde på en token som ges ut till en massa personer en gång i timmen? Då krävs det ju att någon på andra sidan köper upp värden på tokenen. När projektet började så fick man 50 cent i timmen, sen får nätverket 10 000, 100 000 medlemmar och så helt plötslig ges det iväg miljoner dollar om dagen och då så sjunker snabbt värdet på tokenen som ges ut och rör sig mot noll. Idag har jag väl några tusen sådana tokens och de är väl värda 100 spänn. Men de var en häftig ide och om någon skulle ta det seriöst och för att bygga en cross border system sprida rikedom. I slutändan blev det att de som brydde sig mest	FDD, FF,

	<p>om dessa tokens var folk från fattigare länder ,mycket sydamerika som brydde sig om de här pengarna då de betydde mycket mer för dom, det var ett sånt community som byggdes ut och det hade kunnat vara ett sätt att sprida pengar till folk som behövde det men det skulle behövas något mer för att idén skulle funka.</p>	
TS	<p>Vilka typer av decentraliserade appar eller plattformar har enligt dig mest potential till positiv inverkan på enskilda användares integritet och säkerhet.</p>	
R3 6	<p>Jag ser att det är lite problematiskt med etherium med hur lätt det är att spåra folks adresser, det finns privacy lösningar men om man börjar röra sig mot de privacy lösningarna är det risk att man snabbt flaggas som en suspekt person av exchanges man interagerar med eller skatteverket. Det har alltid varit snack om att man ska ha privacy och det har funnits coinmixer och allt möjligt man hade kunnat använda men i praktiken så får man alltid ge upp någon procent när man ska göra sånt för det finns en risk med att vara mixer. Så folk gör inte det förutom om man verkligen behöver det, och om man verkligen behöver det så är man kanske kriminell.</p> <p>Det har gett människor integritet i den bemärkelsen att de kan göra saker utan att ha någons tillåtelse och utan att banken skriver till dig "hej nu vill vi ha kundkännedom om dig och vi spärrar ditt konto tills vi har kundkännedom om dig", jag vet inte om det är nödvändiga regler man borde ha i kryptovärden också men det känns ganska störigt och onödigt om man vet att man inte håller på med en massa fuffens. Det är mycket man hade kunnat göra där. Men om någon skulle vilja rota i dina grejer så blir det enklare om du har alla dina grejer på en blockchain än om du hade dom på din bank, men det är lite frihet under ansvar.</p>	CD, CC,
TS	<p>Det är ett stort problem vi märkt av under detta arbete, när man får göra hur man vill så dras det konstiga typer till det och därför har väl hela krypto-ryktet blivit besudlat.</p>	
R3 7	<p>Ja detta är typiskt beskrivningen av hela hype cykeln, Nu har den varit igenom tre gånger. I början är det bara en massa nissar som vill testa ny teknik, de vill lära sig, sen går det lite tid, priset börjar ticka upp lite och då kommer vissa in som vill vara med för priset, och då blir allt en NFT mania, hype cycle bubble, det följer ett mönster.</p> <p>Det börjar med nördarna, sen blir det coolt av vara nörd, sen kommer en massa psykopater som copycats vad de andra gjorde utan av att vara intresserade av tekniken från början och då blir det bara en konstig bubbla där de originella intressenterna flytt bort eller blandats ut med resten. (paul grayham essay)</p>	FDD

JB	Tror du att individers beteende och vanor online förändras som ett resultat till en decentraliserad webb?	
R3 8	Jag tror att folks beteenden har ändrats, iallafall en viss grupp beteenden. Lite av detta kom från 4chan-hållet med att folk vill vara anon (anonymous) där man har online identiteter som är bortkopplade från ens riktiga identiteter. När man decentraliserar saker och allt plötslig är på internet och man inte har personliga face to face kopplingar så avsäger sig folk sina riktiga identiteter och tar istället krypto alias på twitter liksom, sen startar de projekt som rör sig om riktiga pengar och då undrar man vem som egentligen driver dessa projekten egentligen? Ibland så driver de jättebra projekt och ibland driver de cashgrabs. När folk ges friheten att avsäga sig sin riktiga identitet så förändrar det folks beteenden.	CC
TS	Ser du några större hinder för en utbredd implementering av decentraliserad teknik? Tekniska eller sociala begränsningar?	
R3 9	Nej, det riktiga problemet här handlar om incitament, om man vill ha en decentraliserad web så måste det vara en web som har ett incitament att överleva, och för att överleva måste man ha assets. Man kan alltid bygga något i en hype cycle och hoppas på att de pengarna ska räcka. Om man vill att någon ska bygga en riktig decentraliserad webb och inte bara en massa random finansiella små projekt på ethereum eller cashgrabs, då måste det finnas incitament för att göra det och det är lite svårt att bygga något som är decentraliserat och som tjänar pengar, för vem ska äga det, hur ska man decentralisera ett ägande om man vill ha en true public goods style. Det var lite det som var tanken med DAOs och DACs där de skulle kunna driva sådana här projekt, men webben lever fortfarande idag på ads och affiliate länkar till amazon. 2016/2017 försökte vi bygga ett projekt som hette Thankful, hela ideén med Thankful var att man installerar en liten grej i sin webbläsare, och när man surfar runt på internet på alla creators och alla youtubers, alla bloggar osv, så samlar vi in tiden man spenderar på dom och sen vid slutet av månaden så föreslog vi "du har spenderat så här mycket tid på dessa olika sajterna, vi har gjort en fördelning hur mycket du kanske vill donera till varje person" och så hade vi länkar till direkt donationer till creators utan några mellanhänder. Vi släppte detta men ingen var intresserad, det dog. Det var då vi insåg att problemet fanns, att man vill ha folk som skapar gratis content, det är svårt att få folk att betala när de inte måste betala och det är svårt att inte tjäna pengar på gratis sidor om man inte vill ha ads, that's life.	FDD, CD, FF
JB	Om du ser in i framtiden, vad ser du som de mest betydande långsiktiga effekterna av decentraliserad teknik på individen?	

R3 10	<p>Jag hoppas att på sikt så kommer detta vara ett slags startskott för en större push för decentralisering, det kan vara så små grejer som att folk får mer ägande över sin data eller att vi lyckas eliminera mellanhänder som är redundanta. Till exempel det här med Eus förslag om chatcontroll där alla service providers ska gå igenom allas meddelanden efter olagligheter, det kan ju många känna att det skulle vara positivt om man inte skulle kunna göra det.</p> <p>Jag är lite tveksam till att den riktningen som många i kryptovärden pushar är den riktningen som kommer att leda dit. Jag är inte superoptimistisk, men jag bygger ju ändå sådana grejer så jag får väl hoppas att det finns lite andra som tänker och tycker likadant.</p>	FDD, CC,
TS	Arbetar du själv med något slags projekt inom ramen för decentralisering? Något du vill berätta om?	
R3 11	Ja, vi byggde ju tex projektet som jag berättade om tidigare. Idag är jag maintainer för ett library som integrerar med uniswap via python, det har jag maintainat i några år nu. Annars har jag hållit mig utanför sedan luna-implosionen.	
JB	Något annat du vill berätta om?	
R3 12	<p>Ett mönster jag sett är att det är en stor divide mellan folk som är i krypto för decentraliseringen / self ownership of data och folk som är där för det finansiella av det. Den dividnen är uppenbar. Det finns många människor som är i krypto i ovilja för det tekniska fältet de är i har blivit krypto-infested. Tex programmeringsspråk som tidigare hade en ganska stor fanbase som ansågs progressive, leftist och sedan började deras programmeringsspråk plötsligt användas till krypto. Det har varit lite culture clashes när saker blir över finansierade.</p> <p>En grej jag märkt är att många som var med tidigt var de som ville göra saker bättre, många av dom har tjänat så mycket pengar nu och nu blivit mer passiva, tappat motivationen och tagit en passenger seat för att de inte pallar med allt craziness som händer nu, de vill inte vara affiliated med alla scams. Det är typisk peak bull market effekt, och sedan är det väldigt jobbigt att starta projekt när bearmarketen har börjat, halvägs igenom bearmarketen så börjar väl folk jobba på projekt igen, det är väl snart, vi får se. Sedan har vi hela den legala situationen i USA där css springer efter folk höger och vänster, men det är en annan story.</p>	FDD,

Interview 4

JB = Jakob Borglund

TS = Torsten Strömberg

R = Respondent - Technical educator at Web3 Foundation

Speaker		Code
JB	What is your background in the field of decentralization and what inspired you to work in the field of decentralized web technologies and join the Web3 Foundation?	
R4 1	I did my Ph.D. in computer science in the US, at [An american university], I've been a teaching professor for 3 years in [Another american university], then I moved here and have been with Web3 Foundation for 2 years. My Ph.D. was in Artificial intelligence, I was working with computer vision. I was teaching it and I was very fascinated by the whole decentralization technology. During covid, I had enough time to sit at home and read about what's happening in the space of Web 3 and Ethereum. I've felt that during my grad school that I learned enough about this system and I knew that Ethereum's architecture does not really scale. I then looked at blockchains that were addressing those challenges. That's when I stumbled on Polkadot and when I looked at Polkadot architecture I was very fascinated by the technology they were creating. Web3 foundation is to polkadot, what Ethereum foundations are to Ethereum. Web3 Foundations had a job offer as a technical educator. At that point there where nobody that was an expert, I had to be someone that could understand complex topics and be able to explain them to the general public in a way they could understand, so I applied for the job and I got it and since then I've been working as a technical educator at Web3.	CC, FF
JB	What are the primary goals and objectives of the Web3 Foundation in promoting the adoption of decentralized technologies?	
R4 2	Polkadot is a flagship project, but we have a vision. Web3 foundation itself was founded by Gavin Wood, the co-founder of Ethereum, he wrote the yellow paper for Ethereum. He coined the term Web3 and his vision was that: Currently the landscape of the internet is in such a way that the creators are being exploited, if you look at the revenue of Google, Instagram, and Facebook, you see that it's all based of the content of what the users are creating. So Web3 is revisoning the whole landscape, where	FDD, CC, FF

	<p>we give the user sovereignty over their data, their identity, and their fair share of the revenue that is being generated by their content. Those are the primary goals of the Web3 foundation and Web3 in general. The way we achieve it is by project to project, so each project follows its own unique model but everybody is using blockchain technology for a reason, because it lets you implement all the goals of Web3, without any central party. That's the vision, and I strongly relate to that vision. I keep giving this example: I was a photographer when I was in grad school, I took beautiful pictures of Buffalo and Vermont, then when I uploaded them to the stock photo site, they charged 10 dollars for my photos and would give me 10 cents. So with the open marketplace that comes with Web3, I would get 1 dollar, and the person that pays would pay 1 dollar and 2 cents, and the 2 extra cents would go into maintaining the network. A win-win if you are able to eliminate the central authorities out there who are able to generate so much revenue just by being the monopoly.</p>	
<p>TS</p>	<p>Do you think that the goals of the movement have shifted or evolved over time?</p>	
<p>R4 3</p>	<p>That's the thing, you start with a grand vision, and then everybody wants to get a piece of what's there, or the hype that's created. If you would look at the Web3 foundations grants program, it's all open, we are on Github, all of the reviews are open, and all our grants are open. You will see that we clearly keep track of the goals and the progress of the projects that we founded. So the vision itself of the Web3 foundation hasn't changed, we are still funding projects that are going to help us realize the vision of creating a Web3 space where you don't have a central authority hogging all the resources. Given that this is what Web3 is, there's always going to exist hype or scams, just the way like it was with the internet bubble, where all this new technology led to some scams but in the end it led to companies like Facebook or Google and other services that we use today and take for granted. Right now I think that most of the core projects in the Web3 are still working and developing with the original vision in their mind, there are always people that want to take advantage of the landscape, and that's why you keep hearing those stories.</p>	<p>FDD, CD</p>
<p>JB</p>	<p>In your opinion, what are the most significant challenges and obstacles to the widespread adoption of decentralized technologies?</p>	

<p>R4 4</p>	<p>First of all, we have a bit of “bad optics”, crypto, blockchains, or any of those words are tagged with scams. It showed up when for example when I was at South by Southwest conference in Austin, it's a big art technology convention with like 100 000 people attending. When we mentioned Web3 or crypto the people got taken aback, but when you show them the decentralized technology with the nodes, they are very fascinated. So I think that the general perception of the people is the biggest roadblock right now. And the other thing is the user experience, we don't have products that give a seamless user experience right now, so if your want to be part of the Web3 space you need to remember those 24 words or 12 words with are the phrases that give you access to the public private key, you can lose them and when you lose them you lose everything, it can get stolen and there's nobody that you can go to to get it back, so there's a fundamental user experience problem out there. That's a big hindrance to mass adoption, people that I know are decentralized educated, they get very stressed out when you ask them about how to use the keys and so forth. Also, a lot of people don't really understand the technology, take the example of democracy, if everybody knew their rights and how the system works, it would be really hard to manipulate them to do something that you wanted to do, and people would take informed decisions. I have seen that in Switzerland, where I'm working right now, there is a direct democracy, everybody gets to read through that big booklet that they receive and then make informed choices. The problem with Web3 is that people have to really understand it to appreciate it. So for an end-user, they don't care what the app is running on, clearly, nobody cares. The majority of the user that is using Instagram, they are happy to put their content there they don't care how their data gets used, but if u tell them and educated them that there's a better way of doing all this, you could get the incentives to be using Web3 technology, they would be very happy to switch over. So we need to provide the user experience that is seamless, it's almost like a heist to get people over to Web3. So user experience is the biggest hurdle to mass adoption right now. Previously it used to be the blockchain's performance but with the advancements of blockchain technology we now have scaling solutions, this is not a problem anymore. We now see interesting applications like social media or similar that requires a high-frequency interaction with the blockchain, now blockchains are able to support such interactions.</p>	<p>CD, UX, FF</p>
<p>TS</p>	<p>This is a fairly new technology?</p>	

R4 5	Yes so, it's called sharding. Think about it like a computer, back then we only had a single CPU, now we have multicores, parallel programming, multiple threads, and so forth. The same can apply to blockchains as well, how do you run different processes, and different shards which are all with consensus with each other? Polkadot is the first fully sharded blockchain in production out there, we are running 40-50 different blockchains on top of Polkadot, all those are called individual shards and each one has its own performance and the collective performance of the whole chain is like 50 blockchains running in parallel.	FF
TS	In your opinion, what are the most significant advantages and challenges that a more decentralized web structure presents for users, developers, and businesses?	
R4 6	The biggest advantage here is that you sort of interact with the system in a trustless way. Trustless is the keyword. Most often you have to rely on somebody or some entity to get the work done and that's how you gain trust in them and then you start using that service. But having everything working as a part of code, where you can actually look at the code and see what's happening in the background, you trust in the code, "code is law", there are no surprises there. If you know how the code works, when a condition is met you know that it will execute your transactions, that's the biggest advantage here, nobody has a kill switch, nobody can stop things from happening, and you can have it running 24/7, you are eliminating those entities in between. Another advantage is that you have the ability to preserve your privacy if you want to, so there's a lot of sovereignty on the user end. And there are incentive models, where every actor on the network is incentives for the participation one way or the other. All of these advantages put together make Web3 very appealing and communities are willing to experiment with it. At the moment, as I mentioned, user experience is a challenge, once that hurdle is crossed, people will see the actual benefits of Web3.	FDD, FF
TS	What resources or tools does the Web3 Foundation offer to help developers build and deploy decentralized applications?	
R4 7	We have what's called a Substrate blockchains building framework, this blockchain building framework, if you use it, you don't need to build it on Polkadot, you can build it in an hour if you download the code, you compile it on your machine, and in 10 minutes you have a blockchain	FF

	<p>running. We give a lot of customizability there, Substrate is very modular, if you are not happy with certain modules that we provide, you can write your own modules or update existing ones or swap them out for other modules out there. Every single blockchain that we are calling “para chain” on Polkadot is built using Substrate. There are also other chains, one successful of them is called LF0 which is built using Substrate as well but they swapped the contents of the layers of substrate, and they built their own model. If you are aware of Polygon, one of the Polygon co-founders recently started a project that is built on Substrate, Project Avail. So web3 foundation originally founded the development of the Substrate blockchain that is used as a building framework, its open source, and anybody can use it to get started with blockchain development very quickly and then I should also highlight the open source stack that we founded and developed, it's in the Polkadot wiki. It's an open-source stack, where you can see every aspect of Web3, all the projects that we founded. One of our requirements for a founding project is that if you receive funding from us, you have to make your code open source or public. The wiki shows those projects and the state of those projects.</p>	
<p>JB</p>	<p>How do you see the landscape of decentralized web technologies evolving over the next 5-10 years?</p>	
<p>R4 8</p>	<p>I will actually say that we think in the timeframe of 3 years. So we are gonna see a wave of useful applications being usable, along with being useful. At that point, people don't even need to be aware that their applications are being powered by blockchain technology or have a Web3 architecture. We are hoping to see some real-world use cases that align with the vision of Web3. Right now there is a lot of hype, the hype is surrounding around NFT, gaming, or Metaverse. I'm not downplaying the importance of NFTs, they are at the core non fungible tokens, they could be anything, they could be a patent, or they could be intellectual property. We are looking at this technology in the wrong direction if we think that NFTs are just like jpegs or images, they could be so much more, the reason that they right now are just jpegs is that this is what most of the blockchains can easily support, but once we have blockchains technology supporting complex types of NFTs, that can keep track of royalties, for intense if you mint your music as NFTs and if someone plays that music through a Web3 platform, you get revenue for each play automatically through the network, this is, for example, an incentive for an artist to use the network. So you're gonna see this landscape evolving, you're gonna</p>	<p>FF, FDD</p>

	see people adopting, especially it's great for the creators economy, in the next 3 years you're gonna see a lot of creators moving to Web3 avenues.	
TS	Are there any specific areas of research or technical challenges that you believe are particularly important for the Web3 Foundation to address in the near future?	
R4 9	Yes, we need more research in the governance aspect of Web3, because most of the Web3 systems are operated through decentralized autonomous organizations, we need more understanding and analysis and research into how to do proper governance in Web3. When we talk about decentralization we are talking about how we want to move away from centralization but centralization exists in the framework of Web3 too, the important thing is: How do we move away from being a very centralized entity to being a decentralized entity, to strike a balance somewhere. I think that the Web3 focus is that, the first thing is to fund projects that will improve user experience, and the other is projects that are going to enable better governance. There's also a Polkadot pioneer surprise, a bounty, for zero knowledge research, so zero-knowledge proofs, implementing them at scale with a good performance, it's a technological challenge, so Web3 foundation and Polkadot are looking forward to founding those initiatives and making that technology available on blockchains so that we can improve a lot of privacy-preserving solutions on blockchain.	FF, CD, UX
JB	What are the most common misconceptions or knowledge gaps you encounter among developers or other stakeholders when it comes to understanding decentralized technologies and their potential applications?	
R4 10	For a regular developer, take for an example a full-stack developer. One of the main knowledge gaps is the understanding how many moving parts there are in Web3, and understanding why things are the way they are right now. So let's say a full stack developer that has amazing javascript experience and knows how to host solutions on the cloud, wants to do something on Web3 and wants to deploy an application which is called a dApp. Then they have a range of blockchains to choose from, what blockchains should they choose for deploying their application, once they choose a specific blockchain, that blockchain has its own special developer framework, just the way Polkadot has Substrate. They will have to learn that and understand the limitations. Another knowledge gap is that in Web 2 the resources are unlimited, but in Web 3 the resources are very	CD, UX, FF

	<p>constrained because you are working on a decentralized architecture where a lot of things are replicated and redundant. So you need to write very efficient code, that is why a lot of people are learning a programming language like Rust, a very memory-safe and efficient language. They often learn those things the hard way. When they come here to write and applications, they hit all these hurdles and they learn to understand all those moving parts, and then they can deploy successful applications. That's why we are running the Polkadot blockchain academy, it's an open invite for all Web 2 developers out there, to learn about blockchains, not just the technical aspects but what's the game theory behind incentivization, the background of blockchains technology, governance, interoperability, and more. It's a curriculum master program, it's giving you a good starting point of where we think is the knowledge gaps for someone that is a developer that wants to develop in Web3.</p>	
<p>TS</p>	<p>From your experience, what are the most effective strategies for overcoming barriers to the adoption of decentralized web technologies and fostering widespread use?</p>	
<p>R4 11</p>	<p>I can talk about what the majority of the applications are tackling for major challenges right now. If you subscribe to Etheriums model, you have no predictability of how much things are going to cost, the gas fee in Ethereum is very variable if you are a developer that is trying to develop an application for Ethereum, there's no way for you to predict the operation cost for the next year or the next quarter, so it's important that you look at other models as well.</p> <p>Polkadot gives you the predictability for at least 2 years and is also the lease period for a parachain. During that period, the people deploying dApps have a direct throughput with the Polkadot blockchains, they don't have to pay any fees for the chain, and that gives them a lot of foresight of how much things are going to cost and you will find very interesting applications coming up, companies that can operate with predictable price models. I think that once that is addressed, that barriers, we are going to see a lot more adoptions, in terms like enterprise, enterprises that are moving on to the Web3 model. Web3 people tend to say that everybody is evil and that everybody wants to extort money from you, capitalism, but I would say, given an option for an efficient model, everybody chooses that efficient model. Bringing that efficiency to Web3 is going to get more adoption.</p>	<p>CD, FF</p>

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