# The surge of non-fungible tokens and its implications for digital ownership from an Internet governance perspective

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This work explores the recent rise of non-fungible tokens – and blockchain technology in general – which has brought into question traditional perceptions on property rights and decentralized organization in the digital age, with significant implications for the future of Internet Governance. To this end, the article starts with the story and evolution of non-fungible tokens within the context of blockchain technology. Particular attention is given to some of the events that happened in the year 2021 that triggered the surge of public interest in these tokens. Afterward, we touch upon current issues of digital ownership and non-fungible tokens, as well as the potential solution offered by distributed ledger technologies such as blockchain. Then, we comment on the main characteristics of blockchain regulation (primarily in Europe) and decentralized governance. Finally, we inquire into the current efforts and possible effects related to Internet Governance in terms of decentralization, taking into account all of the previous aspects.

Digital ownership – Blockchain – Decentralized autonomous organization – Web3

## 1. Introduction

A non-fungible token (NFT) is a unique identifier recorded in a distributed ledger (typically a blockchain) that could be used to certify the authenticity and ownership of both tangible and intangible assets. NFT applications have existed for several years now, but recently there has been a sudden increased interest due to several high-profile acquisitions of digital assets in, among others, the domains of arts, collectibles, gaming, and sports. This surge has in turn sparked a frenzy in NFT marketplaces, in which users transfer the ownership of digital objects, usually by means of cryptocurrency transactions, in what some observers call an *NFT rush* reminiscent of a gold fever[1]. Nevertheless, there remains much

uncertainty regarding the legal recognition on this so-called *ownership* of digital assets via NFTs, as well as other related legal aspects such as regulation and governance. These issues are further exacerbated by the frenetic development of the underlying blockchain technology.

In essence, blockchain technology is an approach to implement a distributed ledger as a decentralized immutable list of records spread over a peer-to-peer network without the need of a trusted authority. It was first introduced in 2009 by a person or group of persons known by the pseudonym of Satoshi Nakamoto, along with Bitcoin[2] – the first successful decentralized electronic cash system based on cryptography. Since its introduction, blockchain has been perceived as a disruptive technology due to its poten-

tial to transform not only financial systems, but also society itself[3]. Internet Governance (IG) is a case in point. The Internet is commonly thought of as decentralized, albeit this is not really the case; it is better described as a sociotechnical system with distributed arrangements – both in terms of technology and governance[4]. Thus, it is not surprising that the decentralized sociotechnical constructs of the blockchain ecosystem, in terms of governance by the infrastructure (achieved via automated protocols) and governance of the infrastructure (managed by its community), have piqued the interest of IG scholars as a potential way to achieve better individual autonomy and collective self-organization for the Internet[5].

Today, distributed ledger technology (DLT) has diversified and many other implementations have sprung to tackle some of the shortcomings of Bitcoin, although blockchain technology continues to be by far the most commonly used approach. Arguably, the most successful of these alternatives is Ethereum, which was released in 2015 and became widely used thanks to the versatility of its smart contracts, i.e., transaction protocols that automatically execute, control, and document an agreement without the need of a trusted intermediator[6]. In fact, in Ethereum NFTs are implemented as smart contract interfaces that follow specific community standards called Ethereum Request for Comments (ERC), namely ERC-721 and ERC-1155[7]. Incidentally, this collaborative standardization system – common to the blockchain ecosystem – is inspired on the Request for Comments (RFC) of the Internet Engineering Task Force (IETF).

This work thus provides an overview of the NFT phenomenon and the regulation and governance of cryptoassets, with the hope of stimulating the debate concerning the implications for an Internet Governance that could go towards building a decentralized digital ownership.

## 2. The surge of non-fungible tokens

Non-fungible tokens represent units of data stored on a ledger that – unlike fungible tokens such as cryptocurrencies – are not mutually interchangeable, as each token is unique and distinct, and which can be associated with digital or real-world assets. The idea of creating unique tokens to represent assets on a blockchain emerged a few years after the release of Bitcoin, but due to the latter's design as a system of interchange of tokens (i.e., cryptocurrency), the first efforts were often rudimentary and did not gain widespread use[8]. It was thanks to the more generalizable smart contracts of Ethereum that NFTs gained traction. Even today, NFT marketplaces on the Ethereum blockchain, together with many cryptocurrencies, represent the majority of the cryptoasset ecosystem in terms of volume and value of transactions[9].

In particular, two crucial projects marked the dawn of NFTs on Ethereum: CryptoPunks and CryptoKitties. CryptoPunks are a limited edition of uniquely generated character images; the project was launched in 2017 and is the inspiration for ERC-721[10]. CryptoKitties, released later in the same year, is a marketplace for collectibles in the form of unique virtual cats that are algorithmically *bred*[11]. The project was among the first to adopt ERC-721, and it became so popular that it slowed down the Ethereum blockchain with its kitty-related transactions[12]. The project's popularity also reached mainstream media, increasing the public awareness on NFTs, albeit moderately. In fact, safe for a few instances, interest diminished in the following couple of years after the virtual kitty hype had subsided.

In the year 2021, however, there were several high-profile sales of digital assets across a wide range of sectors that significantly increased public interest on NFTs. Probably the sector of digital arts has been the most affected by the rise of NFTs[13], especially with the sale of the piece *Everydays: The first 5000 days* for US $69M by Beeple, pseudonym of digital artist Michael Winkelmann[14]. Relevant NFT sales in more mainstream sectors include a dunk highlight of basketball player LeBron James sold for US$200K within NBA's *Top Shot* marketplace[15], and rapper Eminem's sale of a collection of digital objects related to his musical career for US$1.8M[16]. Interestingly, several significant sales were also made on digital Internet memorabilia, such as the first ever tweet[17], the source code of the initial implementation of the World Wide Web[18], and the *Doge* meme figuring a bewildered Shiba dog[19].

Consequently many artists, businesses, and organizations in the realm of intellectual property started to pay more attention to the potential of NFTs as a source of revenue. Furthermore, the apparent ease with which individuals became rich overnight with NFTs attracted the collective imagination of laypeople; even teenagers with little to no professional experience seemed to be earning significant amounts of money through the sale of NFTs[20]. A prominent example is the case of twelve-year-old Benyamin Ahmed, who made more than £290K with his pixel art collection, called *Weird Whales*; one should not ignore, however, that his father is a professional software developer for financial institutions[21]. In addition, as the year advanced, more educational mate-
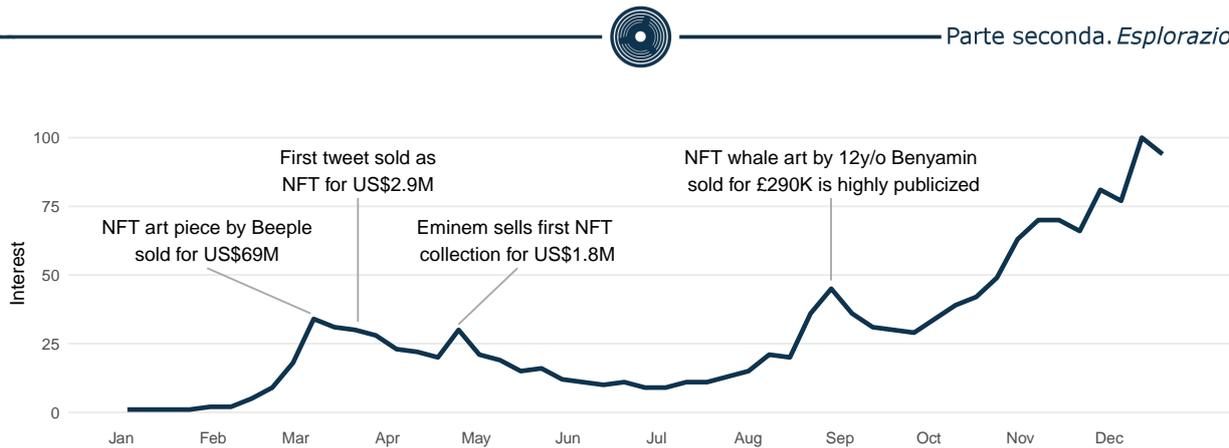
Figure 1: *Global search interest on the term* NFT *for the year 2021, according to Google Trends. Interest over time is scaled on a range of 0 to 100 (peak popularity for the term in the given period)*

rial on the subject, as well as various marketplaces and applications, were made available, further increasing the interest on NFTs by the general public. This growth can be clearly seen in the global trend of Google searches for the term *NFT* for the year 2021, as illustrated in Figure 1.

Not all interest is positive though. There are many detractors of NFTs, more so with how many nascent and established applications are plagued by software bugs, disappointing quality of service, and are fertile ground for abuse[22]. For example, Ubisoft, one of the most important videogame publishers in the world, met widespread backlash regarding the introduction of a NFT marketplace of in-game digital items, which was perceived as a cash grab and restrictive initiative[23]. Similar opinions are prevalent with regards to newcomer start-ups and established corporations that are heftily building marketplaces and other applications to take advantage of the rising interest and investments in NFTs.

Arguably, however, the world of arts is the most divided on the subject, in which despite the promises and eagerness of improved control and riches by and for artists, dissenting voices decry the nascent business practices and perceptions around NFT art[24]. There is for instance the preoccupation about the changing relations between digital and physical art with the legal ramifications of the sale of real-world art pieces as NFTs[25]. Above all, fundamental questions remain unanswered regarding the ownership of NFTs and the assets that they represent, as succinctly expressed by art historian D. Joselit: «The NFT is a social contract that values property over material experience. That contract can be broken»[26].

## 3. Digital ownership

Many buyers on NFT marketplaces are lured by the very promise of *owning* the assets these represent[27].

Ironically, at the present time the *ownership* of such assets, especially in digital form, is mostly intrinsic to the given DLT platform, and its recognition outside of this platform is not guaranteed[28]. Moreover, there is no general consensus on what is being owned after an NFT transaction: only the token itself, the token and the object it represents, both plus any related copyright, all or none of the above?[29] The answer to this question differs not only on a platform basis, but also case by case. In brief, at the moment of writing we are in a legal *no man's land* with respect to ownership and NFTs.

In very broad terms, ownership can be described as the set of exclusive rights over property, usually classified as tangible (e.g., real estate, chattel) or intangible (e.g., intellectual property, digital objects). In general, property rights are recognized as fundamental in most nations, with some form of property law being inscribed in the constitutional or charter texts of many jurisdictions[30]. The concept of ownership, however, has changed and continues to change over time according to the mores of society, e.g., owning persons as property, that is slavery, was once perfectly legal in most of the world, but nowadays is outlawed in every country; and technological innovations, e.g., digital media now allow perfect copies of works at almost zero cost. This last characteristic of digital objects is of prime importance[31], given that the concepts of rivalry (impossible simultaneous use) and scarcity (limited availability) applied to pre-digital kinds of property are less well-defined, which has caused much debate regarding the rights of buyers, creators, and distributors of digital assets, with the former often losing many expected privileges associated with ownership.

According to Perzanowski and Schultz, most efforts to limit ownership rights of buyers in the digital economy have been undertaken in the name of

reinforcing the intellectual property (IP) rights of creators, with the reasoning that this would provide better economic incentives for the creation of new inventions and works of expression[32]. The two most prominent examples of this phenomenon are the licensing of goods and digital rights management (DRM) technology. There is an increasing shift towards licensing digital content to the detriment of ownership, in which the creators (or most likely the distributors) of the content retain its rights, contrary to the expectation of most buyers. An infamous example involves the e-book reading platform Kindle of Amazon, in which books have been remotely deleted from users' devices, as Amazon states that its content is licensed, not sold, despite deceptive language on its platform such as buttons that show "Buy" or "Purchase"[33]. Concerning DRM, another infamous example is the installation of a piece of software by Sony with special privileges on the computers of buyers of its musical CDs – unbeknownst to them – in order to prevent copying, which became a scandal in terms of consumer security and privacy[34]. It is not wonder then that the NFT promise of true ownership of digital assets is alluring to most people, despite the current uncertainties.

Furthermore, DLT has also given rise to new interpretations on the very concept of property. For instance, a particularly thought-provoking interpretation by J.A.T. Fairfield considers property as pure information (e.g., who owns what, when, how, etc.); in other words, «property is the law of lists and ledgers»[35]. This property-as-information view contrasts with traditional property theory. In particular, it goes against the use of tangibility as a way to classify assets in legal contexts, building on the argument by J.M. Moringiello that such a classification places paramount importance on physicality and ignores general property principles, such as rivalry and scarcity, for which tangibility is frequently used in courts as a faulty proxy[36]. Instead, property law could be viewed as an information system that records transferable, scarce, rival, persistent and sharply delineated objects. For instance, Internet domain names – a core theme of IG – are an often-used example to illustrate the inadequacies of the traditional property language to digital assets: they are not scarce yet they are rivalrous.

This analogy goes well with the perception alluded before of DLT as a sociotechnical construct akin to a worldwide distributed and decentralized information system, in a similar vein as the Internet. And, by the same token, the novel governance approaches in the blockchain ecosystem are influencing and being influenced by current IG practices.

Nevertheless, inadequate regulation risks being an obstacle for such digital governance transformation. That is not to say that governments around the world are ignoring the societal ramifications of DLT and cryptoassets in general, quite the contrary.

## 4. Blockchain regulation and governance

Several national and supranational governments have already begun to delineate or implement regulations on blockchain technology. For instance, the European Commission has started an initiative to create a legal and regulatory framework for blockchain technology, particularly in the context of financial applications[37]. In the United States, most of the regulation has been driven by the Securities and Exchange Commission (SEC), in particular with respect to the issue of deciding if cryptocurrencies are securities or not. In a landmark consideration, SEC chairman Jay Clayton stated at the end of 2017 that cryptocurrencies function as securities, thus these should be regulated as such[38]. This statement gave way to the recognition of cryptocurrencies as legal in the United States, but subject to more stringent regulations in line with other assets considered to be securities. Most other countries around the world implicitly or explicitly allow and tolerate the use of cryptocurrencies. Yet others, such as China, Russia, and Colombia, have taken a much more restrictive approach, explicitly deeming Bitcoin-like cryptocurrencies as illegal. And, at the other end of the spectrum, El Salvador, in a 2021 initiative that many experts consider highly risky, became the first country to recognize Bitcoin as legal tender[39].

Despite the many legal strategies and guidances adapted around the globe, most DLT regulation and government-backed initiatives have focused on fungible assets used as financial instruments. At the moment of writing there are fewer instances in which DLT is being regulated with respect to non-financial applications. For example, blockchain technology is explicitly mentioned as a key area for investment in the recently announced plan of the European Commission for digital transformation, called Path to the Digital Decade[40]. This plan also recognizes the potential of DLT for the future of a digital society, as demonstrated by the European Blockchain Services Infrastructure (EBSI) to deliver decentralized cross-border services for public administrators[41]. Nonetheless, at the moment of writing EBSI is still experimental and it only supports four use cases: identity, educational credentials, document traceability, and trusted data sharing for customs and tax authori-

ties. Tokenization of property via NFT or a similar mechanism is not yet within the scope of the project.

NFTs pose, however, related yet different legal conundrums which remain unresolved. In addition, the technology evolves so rapidly that the emerging regulations are already partially obsolete before they are even enacted. For instance, in September 2020 the EC published the final version of the impact assessment regarding a proposal for a regulation of markets in cryptoassets[42], in which there is no mention of the use of tokens as a means to manage property rights. As a matter of fact, the document recognizes that there is no official categorization of cryptoassets in use inside and outside the EU; moreover, the classification used therein does not take into account non-fungible cryptoassets.

Further complicating regulation of blockchain technology is the use and rapid evolution of a distributed and decentralized self-organization peculiar to the blockchain ecosystem. Such kind of organization is called a decentralized autonomous organization (DAO). In a DAO, a blockchain-based system enables people to coordinate and govern themselves by means of a set of self-executing rules (e.g., smart contracts) deployed on a public blockchain, effectively having a decentralized governance[43]. In this vision, there are two main governance structures: governance by the infrastructure and governance of the infrastructure[44]. The first, governance by the infrastructure, also called "on-chain" governance, refers to hard-coded rules embedded in a technological system (e.g., a blockchain), which includes both endogenous and exogenous rules that come from within or are imposed outside the reference community. The second, governance of the infrastructure, also called "off-chain" governance, refers to all the forces that subsist outside the technological system, but nevertheless influence its development and operations, with rules operating at the social or institutional level. These rules and procedures are not automatically executed, and a third-party authority might be necessary for enforcement or oversight. As with the first structure, there are rules of endogenous (e.g., social norms, customs) and exogenous (e.g., laws) nature. The concepts behind a DAO have also been identified on a more regulation-base perspective as two approaches called *Code of Law* (conventional law produced and enforced by national legal systems) and *Code as Law* (smart contracts on the blockchain)[45]. In either case, DAOs represent a novel approach for governance, which are starting to influence the governing approaches of many organizations, including IG.

## 5. Towards decentralized Internet property

The Internet Governance Forum (IGF), the main group for policy dialogue on governance of the Internet, has paid particular attention to blockchain technology for the last few years. In this regard, the IGF dynamic coalition on blockchain technology was born[46], and later consolidated as the Coalition of Automated Legal Applications (COALA)[47]. The coalition is comprised of leading academics, lawyers, economists, protocol architects, technologists, and entrepreneurs who work on blockchain-based legal and technical frameworks, standards and applications alongside governance policies that enable innovation and evolution of systems and networks. Indeed, P. De Filippi, one of the leading figures in blockchain governance and a founding member of COALA, «recommends that public and private institutions adopt some of the technological guarantees provided by blockchain technology to increase public confidence and trust. Governments can play a leading role in that regard, using regulation to promote the use of blockchain-based for regulatory compliance, and encourage the adoption of common global standards and shared international blockchain-based infrastructures for public services»[48].

COALA has published many documents regarding the impact of blockchain governance and the impact and regulation of DAOs. In addition, the coalition has also created a group that works on intellectual property, called COALA-IP, with the goal of establishing free, open, and easy-to-use methods of recording attribution and related metadata about works, assigning or licensing rights, mediating disputes, and authenticating claims by others[49]. This is a promising step forward in the autonomous management of IP in a decentralized manner, albeit IP does not comprehend all of property law. Besides, the coalition initiative started before the surge of NFTs. Nevertheless, these emerging solutions within the blockchain ecosystem will have a great influence on the future of property rights on the Internet. In fact, NFTs are already being used in new standards that implement a completely decentralized paradigm to some of the core technologies that both defined the Internet and gave way to IG.

Among these solutions we find two in particular: Ethereum Name Service (ENS) and the Interplanetary File System (IPFS). ENS complements and competes at the same time with the current Domain Name System (DNS). It allows to map the long cryptographic addresses of the accounts and smart contracts on the blockchain to more human-readable

names, and recently a compatibility with DNS was added to map traditional domain names in a decentralized manner within the Ethereum blockchain[50]. Users can buy and manage ENS domains as NFTs, which allows a decentralized ownership of the domains, as opposed to the more hierarchical and centralized nature of DNS. As with digital objects in other domains, NFTs for ENS domains have also been subject to an increased interest, with the unwelcome consequence of domain name squatting[51]. On the other hand, IPFS is a distributed and decentralized peer-to-peer hypermedia protocol[52]. It was created by Juan Benet, who is also a COALA contributor. It is the most common technology to store the asset associated with the NFT, which is embedded as a link address within the token metadata that points to a file on IPFS. Incidentally, ENS domains can point to IPFS addresses, which improves the usability and storage resilience of NFTs. Both are projects that follow a DAO approach for governance, and demonstrate how the current Internet could evolve to integrate a decentralized autonomous property system.

Furthermore, ENS and IPFS are also already functioning examples of the rapidly increasing digital token economy, which is converging toward what many people call Web3, a potential decentralized and token-based iteration of the Web[53]. In this vision, the retrospectively called Web 1.0 refers to an iteration in which most users were consumers of static-only content; Web 2.0 refers to a more participatory or social iteration, characterized by the emphasis in dynamic and user-generated content[54]; and Web3 would thus be an iteration based on DLT available to all users, who could not only consume and generate content, but also execute smart contracts on a peer-to-peer basis. Confusingly enough, the decentralized Web3 is distinct from the similarly named but older Web 3.0, an implementation of the semantic Web envisioned and promoted by Tim Berners-Lee since the beginning of the century[55]. The main idea behind the semantic Web is that data in it is described in a formal language, which can be processed by intelligent agent systems on behalf of humans.

It should be noted, however, that these "numeric versions" are just labels to describe a related set of changes within the Web ecosystem. Indeed, the Web could be described as an ever evolving set of technologies and practices to share information over the Internet. The dynamism touted in Web 2.0 is expected in most websites, but not necessary in many others; and several of the capabilities of the semantic Web are already available via standardized metadata and linked data, albeit its full potential has not been yet realized as originally envisioned. With regards to the decentralized Web3, we are starting to see the integration of token economics such as NFTs into some of the most mainstream social media platforms. A first example concerns Twitter, which now allows to set NFT profile pictures, distinguished by their hexagonal shape; however, these must be bought as ERC-721 and ERC-1155 tokens on marketplaces unrelated to Twitter[56]. A second and more adventurous example regards Reddit, which has started to sell NFT avatars called CryptoSnoos (Reddit's mascot is named Snoo), in collaboration with the OpenSea marketplace[57].

All of the above existing NFT functionalities offer a glimpse of decentralized Internet property. In the present, we can easily imagine a user that buys their CryptoSnoo avatar on Reddit, sets it as profile picture on Twitter, while also connecting their account on both platforms to an ENS domain pointing to their personal webpage hosted on IPFS; all of which gives the user the perception of *owning* their digital self-representation on the Internet. In the future, some scholars and enthusiasts imagine a much more immersive and intertwined digital ownership via NFTs in the so called Metaverse[58], an envisioned ecosystem of virtual reality worlds navigable via avatars[59]. Nevertheless, in order to realize such vision – even if only partially – many sociotechnical issues must be resolved, such as legal recognition and regulation, decentralized organization, and standards and protocols, just to name a few of those treated herein. Consequently, I believe that IG on the subject is of the utmost importance, and I hope that Internet stakeholders beyond COALA and the IGF in general will pay closer attention to its development.

## 6. Conclusion

Digital ownership is on the verge of a revolution with the arrival and surge of NFTs. However, at the present moment it is more likely that we are living in an NFT economic bubble that might burst in a not so distant future. My hope is that stakeholders on the realm of IG will be able to see beyond these hectic times and pay closer attention to the novel mechanisms and possibilities that a decentralized approach to digital property might entail. Who knows? Perhaps this is the way in which property will work in the much exalted and vilified future Metaverse... or not. In any case, what is certain is that the concept of ownership will continue to evolve with new technologies and changing mores, as NFTs attest, thus IG stakeholders must be prepared and aid in this transformation. In the end, this is but a small

contribution on the discussion regarding the subject, intended to stimulate more scholarly debate on these pressing issues.

## Notes

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[2] Given its profound impact, it should be noted that the original white paper by S. Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System*, is surprisingly brief at only nine pages (including code examples and references).

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[6] For a comprehensive description of Ethereum, I recommend the book by A.M. Antonopoulos, G. Wood, *Mastering ethereum: building smart contracts and dapps*, O'reilly Media, 2018.

[7] The first blockchain NFT standard began as the Ethereum Improvement Proposal EIP-721, which was later accepted and specified as ERC-721. Incidentally, in ERC-721 an alternative name for a NFT is *deed*. However, this standard and previous standards were limited to a single token type, thus ERC-1155 was created to manage multiple token types in a single smart contract, be it fungible (ERC-20) or non-fungible tokens.

[8] Many consider *colored coins* to be the spiritual precursors of current NFTs. These are *marked* Bitcoin tokens that represent a real-world value asset. Due to the limitations of the Bitcoin scripting language, colored coins fell in disuse in favor of the more sophisticated NFTs.

[9] Ethereum NFT marketplaces also manifest high cointegration and significant causal short-run connections among themselves. See A. Lennart, *Non-fungible token (NFT) markets on the Ethereum blockchain: Temporal development, cointegration and interrelations*, 2021.

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**La crescita degli NFT ("gettoni non fungibili") e le implicazioni per i diritti della proprietà digitale nel contesto della governance di Internet**

**Riassunto**: Il presente lavoro esplora la recente crescita dei *gettoni non fungibili* (NFT, *non-fungible tokens*) – e della tecnologia blockchain in generale – che hanno messo in discussione la tradizionale percezione dei diritti di proprietà e l'organizzazione decentralizzata nell'era digitale, con rilevanti implicazioni sul futuro della governance di Internet. A tale scopo, il saggio inizia con l'esaminare la storia e l'evoluzione dei NFT nel contesto della tecnologia blockchain. Particolare attenzione è prestata ad alcuni dei più importanti eventi relativi agli NFT, verificatesi nell'anno 2021, che hanno provocato una vera e propria ondata di crescente interesse da parte dell'opinione pubblica e degli utenti. Il saggio prosegue con l'esaminare le questioni più importanti legate alla proprietà digitale e agli NFT, così come le potenziali soluzioni offerte dalle tecnologie dei registri distribuiti quale blockchain. Dopodiché, sono prese in esame le principali caratteristiche dell'attuale normativa sulla tecnologia blockchain (principalmente quella europea) e le nozioni di governance decentralizzata. Infine, sono esaminate le iniziative in corso e i possibili effetti della decentralizzazione sul futuro della governance di Internet prendendo in considerazione tutti gli aspetti analizzati.

**Parole chiave**: Proprietà digitale – Blockchain – Organizzazione autonoma decentralizzata – Web3

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