

CHAPTER 1

Problems Solved by NFTs

Non-fungible tokens (NFTs) are digital assets that can come in the form of art, music, in-game items, videos, and more and seem to be everywhere these days. From art and music to tacos and toilet paper, these digital assets are selling like 17th-century exotic Dutch tulips – some for millions of dollars.

So, when you create something new, you should be rewarded for the effort in proportion to the value that you have created. For that to happen, we need to replicate the constraints of the physical world into the digital world. That is, we need to introduce scarcity, identify ownership, validate authenticity, trace back provenance, and enable the collection of royalties, which is the basis of this chapter.

Introduction

It is a truism to state that the rate of technological innovation has been accelerating at an unprecedented pace. A new technology not only solves a given set of problems, but also paves the way for the creation of new tools for the next generation of innovations. The most obvious example is the personal computer. When initially introduced, the PC was a gadget that helped you do the things that you already did, but do them more efficiently: type without having to deal with typewriters that needed paper

and ink and white-out liquids (and that broke down every once in a while); calculate without needing a calculator; create balance sheets without pencils, pens, paper, and rulers; learn without having to go to the library; or play games without having to go to the arcade.

But very quickly, the PC became a platform that enabled further innovation in its own right. High-level programming languages such as BASIC, FORTRAN, COBOL, and Pascal enabled anyone willing to learn them to write new software that delivered new solutions to existing problems. Such software (for instance, AutoCAD) enabled its users to experiment faster and with minimal cost. This enabled the creation of yet newer solutions, which then themselves became the next generation of innovation engines.

We are now well into the fifth decade since the introduction of that first generation of PCs in the late 1970s. Since then, we have seen several waves of innovation, each opening up new vistas of possibilities, along with the ecosystem of challenges that emerge as a result of the market's adoption of the products and solutions to which some of those possibilities converted: the Internet, the Web, Wi-Fi connectivity, cell phones, the cloud, smartphones, and the mobile apps that they run, and most recently social networks.

But what is new about this fifth decade is the reality that nearly everything that we do, day in and day out, at nearly every waking moment of our day (and even when we sleep, if we include devices that monitor and collect our vital signs during our slumber) involves us engaged in doing something with a digital device – whether a desktop, a laptop, a surface, a smartphone, a smart speaker, or a wearable device. We interact with our fellow human beings, buy our stuff, plan our trips, organize political movements, listen to our music, do our work, order our food, learn, play, and everything else imaginable, almost entirely in the digital world.

And indeed, we have come a long way since the days of Radio Shack's TRS-80, the Commodore PET, and the Atari 800, both in terms of the hardware, the software, and the plumbing that is enabling our world

to keep on turning. But what has remained nearly unaddressed in any meaningful way is the misalignment between several core attributes of the digital ecosystem and the fundamental pillars upon which our economic value chain delivery system rests.

Elemental to the digital world is near zero-cost and instant replication: I can replicate a file as many times as I want in no time and at virtually no cost. I can distribute those files in any way I wish. Those who receive those files can do likewise: they can replicate and distribute those files in any way they wish. In all of this, scarcity, ownership, authenticity, provenance, and royalties collection become either meaningless concepts or nearly impossible to establish. Until the time when wealth distribution no longer relies on labor (and no one is holding their breath for such a system to emerge any time soon), humanity must adopt a mechanism to enable the value exchanges on which our economy relies that works for our increasingly digital reality.

Scarcity

Scarcity refers to the concept of limited availability or a shortage of resources in relation to the demand for those resources. In economics, scarcity is a fundamental concept that affects the decisions individuals, businesses, and governments make about how to allocate resources effectively.

In the digital world, scarcity is often a problem, since digital goods can be easily reproduced without limit. This means that once an original digital asset is created, it can be copied infinitely, leading to a lack of scarcity and a corresponding decrease in value.

NFTs provide digital scarcity by creating unique, noninterchangeable digital assets. This means that each NFT is unique and cannot be replicated, which helps to establish its value. NFTs can be used to represent a variety of digital assets, including art, music, video games,

and more. For example, an artist can create a unique piece of digital art and sell it as an NFT, ensuring that there is only one authentic copy of that piece of art in existence. Yes, replicas will exist – just as they exist in the physical world – but unlike the physical world, the digital world can solve the problem of determining whether something is an original or a copy of that original.

An example of an NFT that has achieved significant value is the CryptoPunks collection. CryptoPunks are a series of 10,000 unique digital characters that were created on the Ethereum blockchain. Each CryptoPunk is one of a kind, and some of them have sold for millions of dollars.

Another example is the digital artist Beeple, who sold a single NFT artwork for \$69 million at a Christie's auction in March 2021. This sale demonstrated the potential value of unique, noninterchangeable digital assets and the ability of NFTs to create scarcity in the digital world.

A third example is the NBA Top Shot, a blockchain-based platform that allows users to buy, sell, and trade NFTs in the form of video highlights of NBA basketball games. Each highlight is a unique NFT, and the scarcity of each highlight is ensured by the limited number of moments available for each game. The popularity of NBA Top Shot has exploded, with some moments selling for hundreds of thousands of dollars.

And one more is Decentraland, a virtual reality platform built on the Ethereum blockchain that allows users to buy, sell, and trade virtual land parcels as NFTs. Each land parcel is unique and cannot be replicated, creating scarcity in the virtual world. Users can use their land parcels to build virtual experiences, such as games, art galleries, and more, and monetize their creations by selling them as NFTs. The value of each land parcel is determined by its location, size, and the content that is built on it.

Ownership

Ownership refers to the legal and ethical right of an individual or entity to claim control and possession of a tangible or intangible asset. Traditionally, ownership has been associated with physical objects such as a house, a car, or a piece of land. In the digital world, however, ownership often refers to the ability to control and claim ownership of digital assets, such as images, videos, music, podcasts, software, and other types of digital content.

The digital world has brought about many challenges in regard to ownership. Unlike physical assets, digital assets can be easily replicated, shared, and distributed. This has made it difficult for individuals and businesses to claim ownership of their digital assets and control how they are used and distributed. The ease of digital reproduction has also led to issues of copyright infringement and intellectual property theft, making it challenging for artists and creators to monetize their work and protect their rights.

NFTs have emerged as a solution to the problem of ownership in the digital world. By creating a one-of-a-kind token for a specific digital asset, NFTs not only allow for the creation of digital scarcity, but also unique ownership of digital assets.

NFTs solve the problem of ownership in the digital world by providing a way to prove ownership and authenticity of digital assets. NFTs provide a way for artists, musicians, and creators to sell and monetize their digital creations as unique, one-of-a-kind assets. NFTs also provide a way for collectors to claim ownership of digital collectibles, such as trading cards, limited-edition collectibles, and rare in-game items.

Here are five examples of how NFTs solve the problem of ownership in the digital world:

Digital Art: NFTs allow artists to prove ownership and authenticity of their digital artwork, providing a way to sell and trade their digital creations as unique, one-of-a-kind assets. For example, the artist Beeple

sold a digital artwork called “Everydays: The First 5000 Days” for \$69 million as an NFT.

Collectibles: NFTs allow collectors to claim ownership of digital collectibles, such as trading cards, limited-edition items, and rare in-game items. For example, the NBA has created NBA Top Shot, a platform for buying and selling digital collectibles in the form of NFTs.

Music: NFTs provide a way for musicians and music producers to claim ownership of their music, sell unique experiences, and control the distribution of their music. For example, the musician Grimes sold an NFT collection that included unreleased music and art for nearly \$6 million.

Virtual real estate: NFTs allow for ownership of virtual real estate in online games and virtual worlds, providing a way for players to own and trade virtual assets. For example, the virtual world Decentraland allows players to buy and sell virtual land as NFTs.

Domain names: NFTs allow for the ownership and transfer of domain names, providing a way for individuals and businesses to claim and sell unique domain names as one-of-a-kind assets. For example, the domain name “eth.com” was sold for \$2 million as an NFT.

Authenticity

Authenticity is a concept that has been widely discussed in various fields, including art, literature, and philosophy. At its core, authenticity refers to the quality of being genuine, real, or true to oneself or an original source. In the digital world, authenticity is a critical issue that has emerged due to the ease of creating, copying, and sharing digital content. This has led to a proliferation of fake or counterfeit digital content, making it challenging to distinguish between what is genuine and what is not. In recent years, the emergence of NFTs has revolutionized the way authenticity is perceived and managed in the digital world.

NFTs are digital tokens that are used to represent ownership of a unique or rare asset or piece of content. NFTs are designed to solve the problem of authenticity in the digital world by providing a unique and tamper-proof record of ownership that cannot be duplicated or replicated.

Here are five examples that illustrate how NFTs are solving the problem of authenticity in the digital world:

Digital art: In the past, digital artists have struggled to prove ownership of their work and receive proper compensation for their creations. With NFTs, digital artists can create unique tokens for each of their pieces of work, providing a secure record of ownership that cannot be duplicated or replicated.

Music: NFTs are also being used in the music industry to provide a secure record of ownership for rare or exclusive music tracks. NFTs can be used to represent ownership of the original recording, providing an opportunity for artists to monetize their work and control its distribution.

Gaming: In the gaming industry, NFTs are being used to represent ownership of in-game items and virtual assets. Players can buy and sell NFTs for rare or exclusive items, providing a secure record of authentic ownership and creating a new market for digital collectibles.

Sports: NFTs are also being used in the sports industry to represent ownership of rare or exclusive memorabilia, such as game-worn jerseys or autographed items. NFTs provide a secure and verifiable record of ownership, allowing fans to buy and sell unique sports memorabilia in a transparent and secure marketplace.

Real estate: NFTs are also being used in the real estate industry to represent ownership of unique or exclusive properties. NFTs can be used to provide a secure and tamper-proof record of ownership, making it easier for buyers and sellers to transfer ownership of high-value properties.

Provenance

Provenance refers to the history of ownership and custody of a particular object or artifact, including its origin, the chain of custody, and any changes that may have occurred over time. In the world of art, for example, provenance is used to establish the authenticity, ownership, and history of a work of art, which is critical in determining its value. In the digital world, provenance refers to the history of ownership and changes made to a digital asset, such as a document, image, or video. It is essential in determining the authenticity, integrity, and ownership of a digital asset, which is becoming increasingly important as digital assets become more valuable and ubiquitous.

The problem of provenance in the digital world arises because digital assets are easy to replicate and manipulate, and it is difficult to establish the originality and ownership of a digital asset. This makes it easy for people to create and distribute fake or altered digital assets, which can be used for fraudulent purposes, such as identity theft, intellectual property theft, and financial fraud. In addition, it is difficult to track the ownership and history of a digital asset, which can lead to disputes over ownership and control.

NFTs have emerged as a solution to the problem of provenance in the digital world. NFTs are unique digital tokens that represent ownership of a particular digital asset, such as an image, video, or music file. Each NFT is unique and cannot be replicated or duplicated, which means that it is easy to establish the originality and ownership of a digital asset. NFTs are stored on a blockchain, which is a distributed ledger that records all transactions and changes to the ownership of a digital asset. This makes it easy to track the ownership and history of a digital asset, which can be used to establish its provenance.

Here are five examples of how NFTs solve the problem of provenance in the digital world:

Art: NFTs have become popular in the art world, where they are used to establish the ownership and provenance of digital art. NFTs can be used to verify the authenticity of a digital art piece, and the blockchain can be used to track its ownership and any changes made to it over time. For example, the artist Beeple sold a digital artwork for \$69 million in March 2021, and the NFT used to represent the artwork established the ownership and authenticity of the piece.

Music: NFTs can be used to establish the ownership and provenance of music files, which are often subject to piracy and intellectual property theft. NFTs can be used to verify the ownership of a music file, and the blockchain can be used to track its usage and any changes made to it over time. For example, Kings of Leon became the first band to release an album as an NFT in March 2021, which established the ownership and authenticity of the album.

Gaming: NFTs are becoming popular in the gaming industry, where they can be used to establish the ownership and provenance of in-game assets, such as virtual real estate, characters, and items. NFTs can be used to verify the ownership of an in-game asset, and the blockchain can be used to track its usage and any changes made to it over time. For example, the game Axie Infinity allows players to own and trade NFTs representing in-game assets, which establishes the ownership and authenticity of the assets.

Real estate: NFTs can be used to establish the ownership and provenance of real estate assets, such as property deeds and contracts. NFTs can be used to verify the ownership of a real estate asset, and the blockchain can be used to track its ownership and any changes made to it over time.

Sports memorabilia: NFTs can be used to establish the ownership and provenance of sports memorabilia, such as trading cards, jerseys,

and equipment. NFTs can be used to verify the authenticity of a sports memorabilia item, and the blockchain can be used to track its ownership and any changes made to it over time. For example, the National Basketball Association (NBA) has partnered with a company called NBA Top Shot to sell NFTs representing digital collectibles, such as game highlights and player cards, which establish the ownership and authenticity of the collectibles.

Royalties

Royalties are a form of payment made to the owner of an intellectual property right, typically in exchange for the use of that right. In the context of music, for example, royalties are paid to songwriters and publishers when their music is used in a variety of ways, such as when it is played on the radio, streamed online, or included in a movie or TV show.

In the digital world, the concept of royalties is equally important, if not more so. With the rise of digital media, it has become easier than ever for people to create and distribute their own content, whether it be music, videos, images, or other forms of digital art. However, this ease of distribution has also created new challenges for creators, who must now contend with issues like piracy, unauthorized use of their work, and difficulty in tracking and enforcing their intellectual property rights.

One way that creators can address these challenges is by using NFTs. NFTs are a type of digital asset that are stored on a blockchain, a decentralized ledger that records transactions in a secure and transparent way. When someone buys an NFT, they are essentially buying a unique digital token that represents ownership of a particular piece of content, such as a song, video, or artwork.

NFTs are designed to solve a number of problems that have long plagued the world of digital content, including the issue of royalties. Because NFTs are stored on a blockchain, they allow creators to establish ownership of their work in a way that is transparent and easily verifiable. This means that if someone wants to use a piece of content that is associated with an NFT, they will need to obtain permission from the owner and pay any required royalties.

To illustrate the concept of royalties and how NFTs can help solve the problem, let's look at five different examples:

Music: A musician creates a new song and releases it on a streaming platform like Spotify. Because the song is associated with an NFT, the musician can ensure that they receive a share of the revenue generated from streams of the song, even if it is added to playlists or used in other contexts without their direct involvement.

Art: An artist creates a digital artwork and sells it as an NFT. Because the ownership of the artwork is recorded on a blockchain, the artist can ensure that they receive a portion of any subsequent sales of the artwork, even if it is sold or traded multiple times.

Video games: A game developer creates a new video game and distributes it through an online platform like Steam. By associating the game with an NFT, the developer can ensure that they receive a share of the revenue generated by the game, even if it is sold or distributed through other channels.

Photography: A photographer takes a stunning photograph and licenses it for use on a website or in a magazine. By using an NFT to establish

ownership of the photograph, the photographer can ensure that they receive a royalty payment for each use of the photograph, whether it is used once or multiple times.

Writing: An author writes a new book and self-publishes it on a platform like Amazon. By associating the book with an NFT, the author can ensure that they receive a share of the revenue generated by sales of the book, even if it is sold or distributed through other channels.

Summary

In this chapter we discussed the rapid pace of technological innovation and its impact on various aspects of our lives. We highlighted how information technology has evolved from providing mere tools to do specific things for us to platforms that drive further innovations. The chapter emphasizes that the present era is characterized by pervasive digital engagement in almost every aspect of our lives. Despite this digital transformation, we identify a misalignment between the core attributes of the digital ecosystem and traditional economic value chains. Five critical attributes of the digital world are addressed: scarcity, ownership, authenticity, provenance, and royalties. The chapter delves into the significance of these attributes, discusses the challenges posed by the digital realm, and introduces non-fungible tokens (NFTs) as a solution that addresses these challenges. It examines how NFTs provide digital scarcity, unique ownership, authenticity verification, and provenance tracking and facilitate royalty payments in the digital domain. The introduction sets the stage for exploring the role of NFTs in reshaping the way we perceive and interact with digital assets.