Non-Fungible Tokens

A Brief Introduction and History

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Head of Research and Insights

Kendrick Lau

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Content

Executive Summary

Welcome to our first research piece on non-fungible tokens! We hope you enjoy learning about the amazing world of non-fungible tokens (NFTs).

Key Takeaways

◇ Non-fungible tokens combine the best traits of decentralized blockchain technology with non-fungible assets to create provably unique, provably scarce, and provably authentic tokens utilizing blockchain technology.

◇ NFTs are applicable in a wide range of use cases, including: collectibles, gaming, art, virtual assets, tokenizing real world assets. They also allow for a flexible way to store, control, and protect the information related to one's identity.

◇ Non-fungible tokens have had a long history, since 2012 with the introduction of colored coins built on the Bitcoin network. On Ethereum, the first NFT was CryptoPunks in 2017, followed soon thereafter by the CryptoKitties, the most successful and well-known NFT project ever.

◇ During the Ethereum boom of late 2017 and early 2018, NFT activity in CryptoKitties drove a huge spike in activity. When the market crashed in 2018, however, interest in NFTs was also impacted and stagnated until late 2020, when NFTs saw a resurgence.

◇ Despite its benefits, the adoption of NFTs is still low relative to the tens of millions of people who own cryptocurrencies worldwide. The roadblocks preventing mass adoption of NFTs are: inaccessibility, the newness of the technology, the volatility of transaction fees, difficulty to link real-world assets to NFTs, and regulation.

In addition to this Macro Report, we have also conducted a survey on our users' opinions on NFTs. You can read that report here.

Introduction

While the crypto community has been enthralled with DeFi, non-fungible tokens (NFTs) have been growing in popularity, slowly but surely. NFTs allow for digital scarcity and provable ownership of unique, one-of-a-kind assets. In this research piece, we will introduce you to non-fungible tokens and the different platforms where you can use and trade them.

What is Fungibility?

Before we delve into the intricacies of NFTs, it's worth looking at the difference between "fungible" and "non-fungible." A fungible item or token is, for all intents and purposes, interchangeable with another unit of the same thing.

For example, one Bitcoin is equal to another Bitcoin, just like one US dollar is equivalent to another US dollar. If you lend your friend a $10 note, you wouldn't need them to repay the loan with the same $10 note – any $10 note will do.

Things that are non-fungible, on the other hand, are not interchangeable with one another, and have unique properties that can make them radically different from one another, even though they may look similar.

There are many examples of non-fungible items in the real world, such as paintings, concert tickets, and so on. Although two paintings may look similar, they may have drastically different level of rarity. Similarly, front row tickets at a concert are much more valuable than tickets for the back row.

Fungible	Non-Fungible
$1 = $1	🐱 ≠ 🐱
⬧ = ⬧	Front Row ≠ Back Row
₿ = ₿	🏠 ≠ 🏠

Source: Crypto.com Research

What are Non-Fungible Tokens?

This brings us to non-fungible tokens (NFTs). What are they, and how are they different from non-fungible digital assets like domain names or Twitter handles? Non-fungible tokens are an extremely powerful kind of token that allows for a flexible way to represent non-fungible assets on a blockchain. Their main properties are:

- **Unique:** Non-fungible tokens contain within their code information that describes the properties of each token that make them different to others. A piece of digital art might have coded information about individual pixels, while tokenized in-game items might contain details that allow the game client to understand which item the player owns and its attributes.

- **Traceable:** Each NFT has a record of transactions on-chain, from when it was created, including every time it changed hands. This means each token can be verifiably authentic, and not a counterfeit – obviously a very important thing for owners and prospective buyers!

- **Rare:** In order for non-fungible tokens to be attractive for buyers, they should be provably scarce. This will ensure that assets remain desirable in the long run, and that supply does not outstrip demand.

- **Indivisible:** NFTs mostly cannot be transacted as fractions of a whole. Just like how one cannot purchase half of a concert ticket or trading card, non-fungible tokens cannot be split into smaller denominations.

- **Programmability:** Like all traditional digital assets and tokens built on smart contract blockchains, NFTs are fully programmable. CryptoKitties and Axie Infinity have breeding mechanics coded directly into their tokens. Even more functionality is possible.

In other words, NFTs combine the best traits of decentralized blockchain technology with non-fungible assets. Unlike regular digital assets that are issued and regulated by centralized entities, which can be taken from you at any time, it is possible to truly own and control your own NFTs.

Use Cases

As you can imagine, NFTs can be extremely powerful since they can represent literally any asset, digital or real. Below are just some uses for NFTs:

	Collectibles	With the likes of CryptoKitties and CryptoPunks, we have seen that NFTs can be used to create incredibly desirable new kind of digital collectibles. More traditional collectors' items such as baseball cards and stamps are also being tokenized.
	Gaming	Tradeable in-game items are also one potential use case for NFTs. So far, we have seen most implementations revolve around turn-based battle or trading card games like Axie Infinity or Gods Unchained. With NFTs, however, games such as Fortnite or CS:GO with vibrant item economies may one day support on-chain item trading!
	Art	With the launch of the art marketplace Rarible and their yield farming incentive program, tradeable digital art has become a hot topic. NFTs allow artists to monetize their artwork and protect their copyright. NFTs also allow artists to receive royalties every time their creations change hands.
	Virtual Assets	The Ethereum Name Service and Unstoppable Domains have turned .eth and .crypto domain names into NFTs, which can then be traded. Real estate in virtual worlds Decentraland and Cryptovoxels have also been tokenized into NFTs.
	Real-World Assets	One of the original imagined purposes for NFTs was to tokenize real-world assets that can then be traded. OpenLaw created a system to trade real estate using the ERC-721 token standard, and Nike last year also patented a system to tokenize shoes.
	Identity	With NFTs, users would be better able to protect and control their personal information, like medical histories, birth certificates, and more.

Source: Crypto.com Research

History of Non-Fungible Tokens

Non-fungible tokens have been around for longer than you might think. After Bitcoin's founding in 2009 and the initial explosion in token types such as Litecoin, Ripple, and so on, many people were looking to innovate on blockchain technology to create newer, more powerful tokens. In this section, we will walk you through a brief history of NFTs.

Colored Coins

The earliest predecessors of non-fungible tokens were arguably colored coins, which were first formulated in a blog post by Yoni Assia in March 2012. These were very small units of Bitcoin which were "colored" with specific attributes coded into metadata using Bitcoin's scripting language. In this way, units as small as one satoshi (0.00000001 BTC) could represent any asset you can imagine, be it a dollar, shares in a company, a house, or digital collectibles.

Although the concept of colored coins was very promising and potentially powerful, they had major flaws and roadblocks:

1. The Bitcoin network didn't officially support colored coins. Hence, it was up to wallet providers to recognize the existence of colored coins.

2. The minimum transaction size for a Bitcoin transaction back then was patched to be 5,430 satoshis (0.000543 BTC), which was much too large for the implementation of colored coins.

3. Colored coins allowed for not just the creation of NFTs, but *any asset*. Hence, the creation of Ethereum's ERC-20 token standard in 2015 took away much of the purpose of colored coins, since ERC-20 are much more flexible (see our Token Standards article on Crypto.com University). Meanwhile, platforms such as Counterparty took over colored coins' NFT function.

As such, colored coins slowly fizzled and died out. Coinprism, the first wallet to support colored coins, shut down in 2018, citing regulatory pressure and the inflexibility and relative sluggishness of the Bitcoin network.

Counterparty.io

Counterparty was founded in 2014, building on the idea of colored coins to issue non-fungible and semi-fungible tokens. Counterparty's founders understood that Bitcoin did not support the features that would allow for the creation of a robust asset creation and trading platform.

In 2015, the mobile game Spells of Genesis became the first to issue in-game assets onto any blockchain, doing so through Counterparty. The platform saw further success in 2016 as the popular trading card game Force of Will issued cards on Counterparty. At the time, Force of Will was the fourth most popular trading card game in North America, behind household names such as Magic: The Gathering, Pokémon, and Yu-Gi-Oh.

Although blockchain-based in-game assets would continue to see use, the biggest innovation came in 2016 when people began issuing limited edition Rare Pepes on Counterparty, based on the popular and at times controversial meme character Pepe the Frog. Of course, the idea of a "rare" online picture is absurd since they can easily be copied, but people had been discussing the notion since 2015.

Rare Pepes Represent Meme Power and Digital Scarcity

Source: Rare Pepe Directory

Although you may be tempted to dismiss Rare Pepe cards as silly, in actuality they serve as a powerful demonstration of the human desire to own something that is rare and has some commonly perceived aesthetic or collectible value, a combination which allowed Rare Pepes to become an instant sensation. Rare Pepes can sell for thousands of dollars, with the pinnacle being a landmark digital art auction in 2019, where an ultra-rare, one-of-a-kind Homer Simpson Pepe (pictured above) sold for $38,500.

CryptoPunks

With Rare Pepes providing a recipe for success, John Watkinson and Matt Hall in June 2017 created CryptoPunks – algorithmically-generated, 24x24 pixel characters that live on the Ethereum blockchain. Only 10,000 characters with unique appearances were created. The CryptoPunks founders allowed anyone to claim the Punks for free – needless to say, all 10,000 were quickly claimed.

Every CryptoPunks is Unique in Appearance
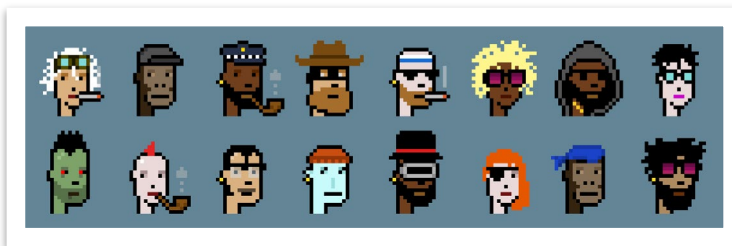
Source: CryptoPunks

Different Punk types and attributes have different rarities, and certain combinations of rare or desirable traits can be tremendously valuable. For example, ape-types are the second rarest. The most expensive Punk ever, an Ape Punk with a Hoodie, sold for 150 ETH (US$71,403) just this month!

Types and Attributes Combine to Create Unique Punks

Punk Types

Attribute	#	Avail	Avg Sale ❶	Cheapest ❶	More Examples
Alien	9	0	0		
Ape	24	3	77.33Ξ	250Ξ	
Zombie	88	2	41.80Ξ	46.90Ξ	
Female	3840	210	3.82Ξ	3.30Ξ	
Male	6039	392	2.96Ξ	3.25Ξ	

Attributes

Attribute	#	Avail	Avg Sale ❶	Cheapest ❶	More Examples
Beanie	44	4	27.02Ξ	49Ξ	
Choker	48	0	20.81Ξ		
Pilot Helmet	54	3	12.66Ξ	65Ξ	

Source: CryptoPunks

Although CryptoPunks were already viral sensation when they first launched, lately they have really been catching the attention of the NFT community. As the earliest "true NFT" launched on Ethereum, many are beginning to treat Punk ownership as a badge of honor, almost as a status symbol demonstrating that the owner is a "true OG" of the crypto world. Over the past three months, CryptoPunks realized prices have skyrocketed to thousands of dollars.

CryptoPunks Average Price per Transaction
### CryptoPunks are selling for a pretty penny as traders seek collectibles
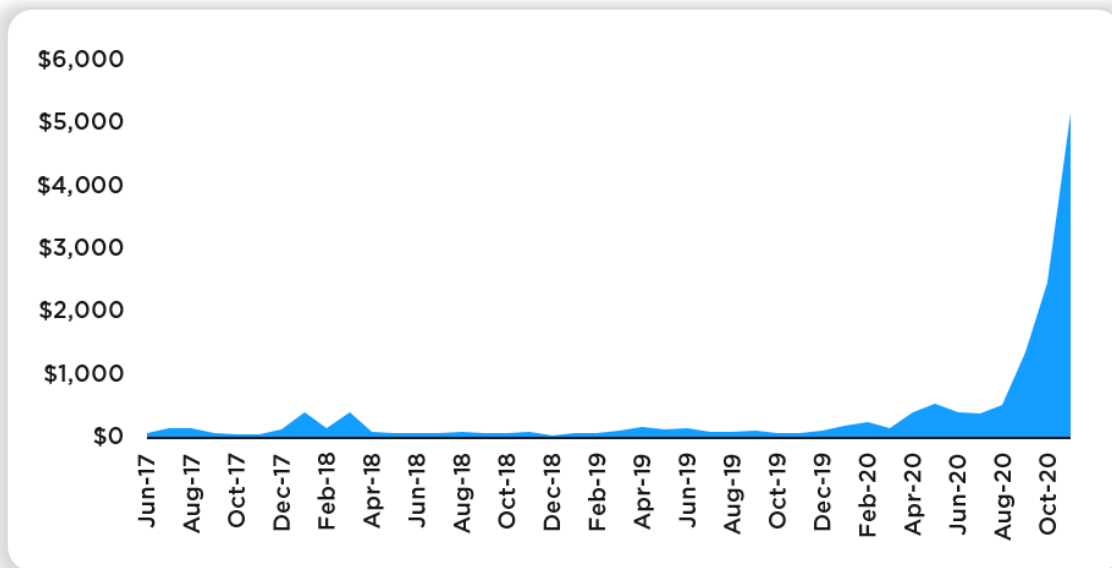
As of October 31, 2020
Source: Nonfungible.com, Crypto.com Research

Since CryptoPunks was created before the invention of the ERC-721 non-fungible token standard, the founders had to use a modified version of the ERC-20 token for the Punks (token address). Nevertheless, CryptoPunks served as the inspiration the ERC-721 standard, paving the way for the truly viral NFT sensation to come: CryptoKitties.

CryptoKitties

CryptoKitties was founded in October 2017. It was a virtual game that allowed players to breed, raise, and trade virtual cats with unique genomes that influence their appearances. Released in the midst of the crypto boom of late 2017, CryptoKitties soon began to rise exponentially in value, with one CryptoKitty even fetching 600 ETH (US$172k at the time). The project made appearances on mainstream media everywhere, including the likes of CNN, CNBC, and the Financial Times.

CryptoKitties: The First Non-Fungible Token Hit
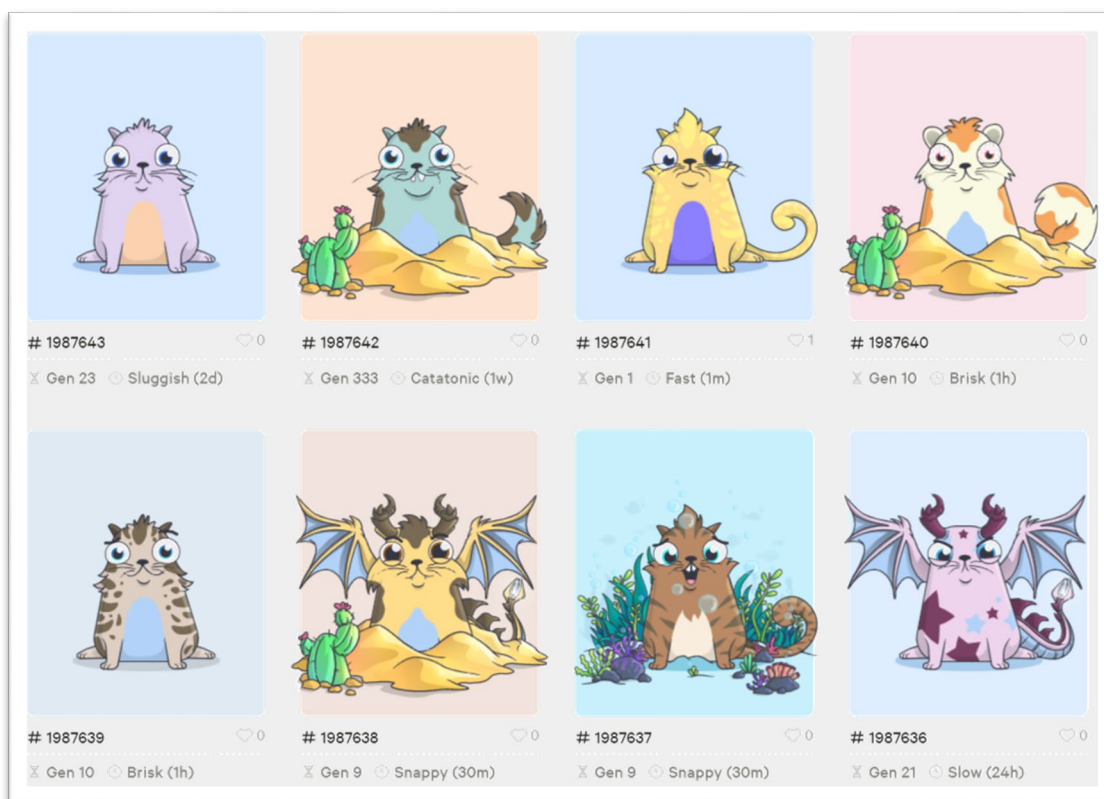
Source: CryptoKitties

Today, the activity in CryptoKitties has abated somewhat, falling in volume of tokens traded over the past week to 13th place according to NonFungible.com, but we cannot overstate the impact that CryptoKitties has had on the NFT landscape – the project is still ranked #1 in all-time volume traded, with over $38 million worth of CryptoKitties having been transacted since 2017.

Top Projects in NFTs

Since 2017, many projects have sprung up in NFTs. According to The Block Research, there are at least 73 NFT platforms today – we list some of the most prominent ones below:

	Collectibles	CryptoPunks: Collectible characters that were algorithmically generated, created by Larva Labs. Avastars: Users can mint and collect avatars Meme: Farming tokens which can be used to redeem limited edition collectible NFTs
	Gaming	Axie Infinity: Collect, raise, and breed Axies to take into battle CryptoKitties: Purchase, breed, trade, and collect unique digital cats Sorare: Fantasy football game where users can collect, trade, and field player cards
	Virtual World	Decentraland: Virtual world based in Ethereum, where users can trade virtual real estate Cryptovoxels: Buy land in this virtual world, build stores and art galleries, and host events
	Domain Names	Ethereum Name Service: Register a named .eth domain to receive payments Unstoppable Domains: Platform to register blockchain domains for your crypto wallets
	Marketplaces	SuperRare: Marketplace for digital art Rarible: Marketplace for digital collectibles. Trade on Rarible to farm RARI token OpenSea: P2P marketplace for all NFTs
	DeFi	Aavegotchi: Own and trade avatars backed by interest-bearing tokens representing loans on DeFi lending platform Aave NFTfi: Use NFTs as collateral for a loan

Roadblocks to Mass Adoption

It is clear that non-fungible tokens are extremely powerful and hold immense promise for their future application. After all, they are exceptionally flexible instruments, and appeal to an innate human desire to own rare and unique items. The uses cases are endless, limited only by developers' imaginations.

Despite this potential, however, it is hard to argue against the fact that NFTs are still extremely niche. NonFungible estimates that the number of active addresses belonging to active users of NFT Dapps is around 70,000. Although this number has more than tripled since 2018 and doubled since the beginning of the year, 70,000 is still a far cry from the 71 million crypto owners globally, by our estimation (the methodology for our Crypto Adoption Index can be found here).

How does one explain the fact that adoption is still relatively low for a technology that seems so promising? We explore these roadblocks below:

Inaccessibility	The most popular uses for NFTs are collectibles, art, and gaming. Although the market for these kinds of assets should naturally be very large, the fact is that NFTs are limited mainly to relatively veteran crypto users familiar who know how to use Dapps. In other words, not all collectors, art enthusiasts, and gamers are crypto traders.
Novel Technology	The technology behind NFTs is only a few years old, having been created in their current form a few years ago. The understanding around these assets is still very poor, leading many to question NFT's safety and authenticity. This likely means that current adopters of NFT technology are still well within the early adopter, niche user demographic.
Transaction Fees	As NFTs live mostly on the Ethereum blockchain today, creating and transacting NFTs can depend highly on the network activity at any given moment. During the height of the DeFi craze in September as Uniswap launched their token and yield farming incentive, gas prices reached a staggering 1000 gwei.

Difficult Real-World Linkage	Even if NFTs can represent real world assets, actually guaranteeing a NFT holders' claim to ownership on a real asset can be tough. For example, how can a user be sure that a NFT supposedly linked to a real-world asset actually guarantees him the ownership of a physical item? In order to achieve this, real world companies will have to issue their own NFTs or partner with crypto companies to achieve this. It is also questionable whether NFTs would confer any benefits over a traditional database.
Regulation	Due to NFTs ability to be used to represent real world assets, NFT projects run the risk of these tokens being considered securities and catching the attention of regulators. This can be a deterrent to developers who might be on the fence about building new NFTs.

Source: Crypto.com Research

These roadblocks are anything but trivial, but we are seeing hopeful signs that the industry is beginning to address them. To address the user-unfriendliness of NFTs, blockchain-based games are beginning to rethink their approach to the user experience.

From our perspective, we believe NFTs will have achieved mass adoption if there are millions of users interacting with NFTs without even being aware of these tokens' existence – in other words, a seamless user experience. However, we should note, as the founder of Opensea does in this piece, that "abstracting away the blockchain," although an interesting concept, ultimately are less attractive to the more hardcore community that comprise the early adopters that make up the NFT community today.

Addressing the other roadblocks, on the other hand, is a matter of time. For real-world linkages, we are seeing more and more companies beginning to adopt NFT technology, in industries such as auction houses, consumer products, real estate, and more.

Summary

In conclusion, although we have seen promising signs of life within the NFT space, there is still a long way to go before this novel application of blockchain technology reaches mass adoption. The technology has definitely come a long way since its inception in 2012, but it will undoubtedly take some more time before it is proven that NFTs are more than just an ultra-niche sector for early adopters to play in.

Key Takeaways

- Non-fungible tokens combine the best traits of decentralized blockchain technology with non-fungible assets to create provably unique, provably scarce, and provably authentic tokens utilizing blockchain technology.

- NFTs are applicable in a wide range of use cases, including: collectibles, gaming, art, virtual assets, tokenizing real world assets. They also allow for a flexible way to store, control, and protect the information related to one's identity.

- Non-fungible tokens have had a long history, since 2012 with the introduction of colored coins built on the Bitcoin network. Since then, NFTs have primarily moved to Ethereum, where non-fungible token standards such as ERC-721 and ERC-1155 can be minted and traded easily and seamlessly.

- The first NFT collectibles that really took off in popularity were Rare Pepes. This was followed by CryptoPunks, and then arguably the most successful and well-known NFT project ever, CryptoKitties.

- During the Ethereum boom of late 2017 and early 2018, NFT activity in CryptoKitties drove a huge spike in activity. When the market crashed in 2018, however, interest in NFTs was also impacted and stagnated until late 2020, when NFTs saw a resurgence.

- Despite this, the adoption of NFTs is still low relative to the tens of millions of people who own cryptocurrencies worldwide. The roadblocks preventing mass adoption of NFTs are: inaccessibility, the newness of the technology, the volatility of transaction fees, difficulty to link real-world assets to NFTs, and regulation.

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e. contact@crypto.com