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Stamps Protocol

Leveraging the Power of Bitcoin with Stamps: Image Storage on the Blockchain

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Note to Readers: This PDF report contains hyperlinks to various reference sources and additional reading material for your convenience and further education. We have carefully selected these sources, believing them to be credible and genuine in their content. Please take advantage of these links to expand your understanding of the subject matter.

Summary

- Stamps is a blockchain protocol created by MikelnSpace that enables storing images on-chain on Bitcoin transaction outputs. It utilizes the Counterparty platform, a long-standing Bitcoin meta layer, to broadcast Stamping transactions to the Bitcoin Network.
- In addition, using a Counterparty transaction allows for creating a token directly linked to image data. This allows Stamps creators to trade these tokens within the existing Counterparty ecosystem.
- The stamping process involves writing image data to several multi-sig outputs on the Bitcoin Network. This makes them un-prunable and costly to create. Stamps are well-suited for creating pixel art as Non-fungible tokens (NFTs) or Semi-Fungible Tokens.
- The project has seen an ecosystem forming around it, with users creating over 31,186 stamps (including multiple editions). Since the project is still in its early stages, the infrastructure has yet to mature.
- In conclusion, like any project, Stamps faces risks and challenges that need to be mitigated and overcome as it progresses. So far, the project has demonstrated commendable achievements, and it will be interesting to see what the future holds for this innovative approach to immutable digital art.

Stamps Protocol

Protocol Overview

Stamps is a protocol for storing images on-chain on the blockchain. It was originally developed by MikelInSpace as a mechanism to store images on Bitcoin transaction outputs, it has spread over to other blockchains due to Stamps being a blockchain-agnostic protocol.

Storing images and other arbitrary content on the blockchain has been a known concept, but it was when the emergence of Non-fungible Tokens (NFTs) that it gained substantial attention. Networks like Ethereum spearheaded the movement, with other blockchains following suit, leading to remarkable growth in the NFT sector.

However, NFTs face several criticisms. The primary concern is that NFTs often point to content hosted on centralized or distributed databases (IPFS or Arweave) with weaker permanence guarantees. Additionally, NFTs subject to royalties are not considered to be truly permissionless.

A more robust method for storing arbitrary content would be to utilize the largest and most secure public blockchain network, Bitcoin. By having every Bitcoin node carry data related to images or other content types, one could achieve maximum security guarantees and the highest level of provenance. The most famous and contentious method involves using the OP_RETURN mechanism, which is subject to size limits due to historical reasons. The other way for storing content would be within witness data. However, data stored in this ways are prunable.

The Stamps Protocol was introduced to obviate these issues. The strategy employed by the Protocol, to overcome these limitations, involves embedding the Base64-formatted image data into transaction outputs on the Bitcoin Blockchain.

This report will mainly discuss Bitcoin Stamps, though Stamps are blockchain-agnostic and have also been replicated on other chains and the Bitcoin network (Doge Stamps using the Dogeparty as the platform and Named Bitcoin Stamps using the Counterparty as the platform).

What is Pruning?

Bitcoin nodes can be configured to run in the Pruned Mode to reduce the storage requirements. In the Pruned Mode, nodes will not maintain data unrelated to the UTXO set.

Fun Fact: The term "Stamps" was coined by MikelInSpace to highlight their dual nature. They are small, like traditional stamps, with a size of 24x24 pixels, and they are also "stamped" onto the blockchain. However, some informal discussions have proposed other meanings for the term, such as Secure Tradeable Art Made Persistent.

Technology

Stamps are assets created using [Counterparty Protocol](#) and feature files (such as image data) linked to these assets. The files are encoded into Bitcoin transactions (hence, Bitcoin Stamps), meaning the file data is embedded within the ScriptSig of a Bitcoin transaction. While the file types can vary (e.g., .png, .gif), the assets themselves can be any Counterparty asset type like numeric, named, or subassets (A Bitcoin Stamp must be a numerical asset). Any Counterparty issuance transaction with the prefix 'STAMP:' in its description field is considered a Stamp.

Counterparty: A Prelude

The [Counterparty Protocol](#), launched in 2014, is a layer that sits on top of the Bitcoin blockchain. Counterparty uses the [Bitcoin blockchain as a service](#) for the publication and timestamping of its messages. Bitcoin miners are paid a fee for registering Counterparty transactions in the Bitcoin blockchain. Its functionalities include enabling the creation of tokens and facilitating their trading and other functions. The Protocol aims to open the doors for innovation and advanced features that are impossible on the Bitcoin layer-1.

XCP functions as the currency used to pay for code execution on Counterparty. The total supply of XCP was created and distributed burning Bitcoins, known as "[Proof-of-Burn](#)." The currently available supply of total XCP is [2,595,168](#) coins. However, if Bitcoin can technically provide the required functionality, XCP is not used. [For example](#), in Bitcoin Stamps creation, XCP tokens are not used in any way; all that is used is Bitcoin.

Read more on Counterparty [here](#).

Unlike other Bitcoin NFT projects like Ordinals, which developed its enablers from scratch, Stamps leverage the existing Counterparty platform as its foundation. Since Stamps are Counterparty assets, it allows for trading these images utilizing existing Counterparty tooling. The early contributors to the Stamps protocol viewed this as a simplified bootstrapping mechanism rather than building it from scratch. Furthermore, the thought process was that Counterparty already has a community (albeit smaller than Ethereum or others) and existing tools that would eventually adapt and support Stamps.

How to mint Bitcoin Stamps?

Stamps utilize already existing Counterparty tools and some other mechanics to attain the desired properties:

- The binary content of an image is encoded to a base64 string.
- The base64 string is added to the intended transaction's Description Key. Adding the prefix " STAMP:" is important before the string.
- The transaction is broadcasted to the Bitcoin Network using the Counterparty Protocol.

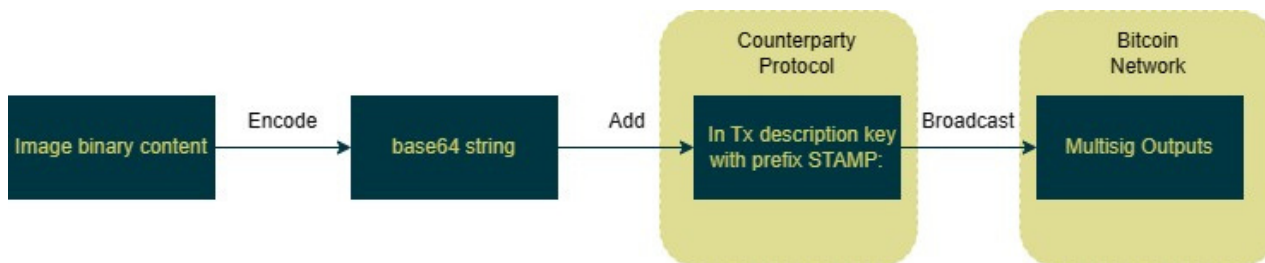
The prefix STAMP: can be immediately followed by three file data formats as per [CIP26](#):

- base64_data
- MIME-Type;base64_data
- data:MIME-Type;base64;base64_data

It is possible for users to encode multiple files within a single Stamp transaction.

Due to the length of the string, the Counterparty protocol, by default, sends the data in chunks as bare multi-sig outputs (UTXOs) on Bitcoin Network. Consequently, these data are not prunable since they form part of the UTXO set. On the contrary, OP_RETURN and witness data are easy to filter out, and a pruned node would not hold them.

Figure 01: The Stamps Minting Process



Illustrated by SQRR Research

Several tools are available for minting Stamps, with the [Stampchain Stamp Minting Utility](#) being the most economical. Another option is to use any Counterparty wallet that supports Stamps creation. CounterWallet is a popular service due to the absence of any limitation on the description field's length.

Interested readers can find a step-by-step guide on minting Stamps using CounterWallet [here](#).

In addition, several rules must be followed when creating Bitcoin Stamps:

- They must be numerical assets.
- They can be made from numerical assets that were not previously stamps.
- They cannot be duplicated on the same asset.
- The image data must be in either jpg, png, gif, or webP format and encoded in base64.

Stamps are ideal for pixel art (e.g., PFPs) due to cost constraints that impose certain 'canvas' limits. Stamp assets suggested canvas limits include having a 24×24 pixel size and an 8-color-depth PNG or GIF format.

Bare Multi-sig Outputs

On the Bitcoin Network, the file data for Stamps are stored using multi-sig outputs. These outputs contain UTXOs, or spendable Satoshi balances (BTC dust used in the transaction) held in several 1-of-3 multi-sig Bitcoin addresses. This multi-sig encoding happens when a Counterparty message is 81 bytes or longer. For example, the [Bitcoin Stamp No. 2](#) (Counterparty Asset: [A3121984346241143000](#)) broadcast is encoded in [this transaction](#), which outputs five multi-sig scripts. The creator sends 7,800 Satoshis to each of these scripts. Although each script contains three addresses, only the third address (a pubkey in hexa decimal form and can be converted to address using [this tool](#)) can claim these Satoshis, and the first two addresses have the Counterparty message. (Note that the 7800 Satoshis is the default multisig_dust_size for Counterparty and hence the CounterWallet).

With this approach, the artist or creator of the Stamp possesses the spendable key, permitting them to spend the transaction outputs. If this occurs, the art would be present

in the transaction data but not in the UTXO set. However, the community argued that this might compromise the unique selling point of Stamps — the non-prunability of art. A suggested solution to this issue involved assigning the outputs to a burn address, preventing the creator from spending the outputs.

The screenshot displays a Bitcoin transaction interface. At the top, it shows a timestamp of 2023-03-09 11:09 (1 month ago), a fee of 21,360 sat (\$4.65), and features like SegWit, Taproot, and RBF. The 'Inputs & Outputs' section shows one input of 0.00500000 BTC from address 16ty9iygA4N1uW8Tu7ssGV5SeHscAAXjXP. This input is split into six outputs, each labeled 'UNKNOWN Multisig 1 of 3' with a value of 0.00007800 BTC. A bracket groups these six outputs as 'Multi-sig Outputs (UTXOs)'. Below them is a 'Change Output' of 0.00439640 BTC. A detailed view of one output shows its script, script signature, and previous output script. Annotations include 'Creator pubkey' pointing to a hex string, 'Image data' pointing to a script element, and 'Spensible Output' pointing to the output's value.

Source: Mempool.Space ([transaction](#))

Key Burn

The developers recently introduced burn addresses in an [update](#). This feature, called Key Burn, includes two burn addresses that minting services can use to send Bitcoin dust. When Satoshis are sent to burn addresses, artists cannot spend them. As a result, the art will remain in the UTXO set forever.

Despite progress, there are concerns within the community regarding the declaration of burn addresses. Some worry that this may signal to Bitcoin nodes that the unspent transaction outputs (UTXOs) associated with the burn address can be pruned in the future.

Cost Item	CounterWallet	Minting Tool	Reduction %
Mining Fee	3,691 Sats	3,691 Sats	NA
Output Script 1	7,800 Sats	796 Sats	-90%
Output Script 2	7,800 Sats	796 Sats	-90%
Output Script 3	7,800 Sats	796 Sats	-90%
Output Script 4	7,800 Sats	796 Sats	-90%
Service Fee		546 Sats	
Total	34,891 Sats	7,421 Sats	-79%

Secondary Market

Users have various options to trade Stamp tokens, which include the following methods:

Counterparty Dispensers: Creators can mint their Counterparty assets and make them accessible through Dispensers. The asset for sale will have a set selling price, and the buyer can send the price to receive the asset from the Dispenser. (Dispensers are conceptually similar to vending machines)

Over-the-Counter (OTC): It's challenging to obtain information on over-the-counter (OTC) activity, but it may be a more efficient trading method as the trading infrastructure is still in development.

Counterparty DEX (XCPDEX): It is technically possible to trade Stamps on Counterparty DEX, but the explorer does not display any significant activity for any asset. Check XCPDEX stat [here](#).

Other methods: There are alternative ways to trade Counterparty assets besides the methods Stamps currently uses. One example is bridging Counterparty assets to Ethereum through Emblem Vault. An alternative choice would be to utilize the Hiro Wallet. The team is currently in talks with Token.Art, and OrdinalWallet to explore potential partnerships.

Counterparty-aware Wallets: CounterWallet and FreeWallet are the main Counterparty-aware wallets that can facilitate the management of Stamps (including peer-to-peer trading). Although these wallets are currently available, the user experience may not be optimal and could improve. It is also noted that FreeWallet does not facilitate key burn.

Competitive Landscape

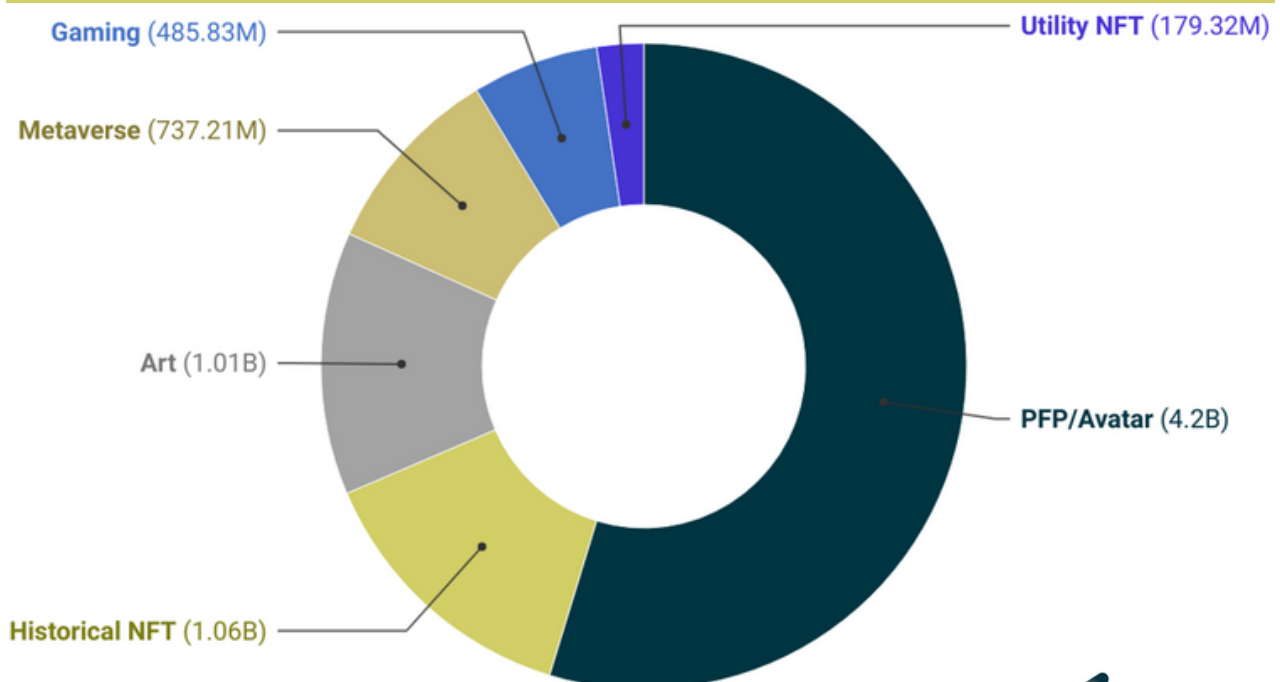
NFTs and Markets

Bitcoin Art (or NFTs) has been around before the term NFTs became popular in the Ethereum ecosystem and beyond. However, the Bitcoin Art sphere has experienced fluctuations due to various reasons, such as ideological, philosophical, technical, and political debates within the community. These debates mainly stem from the belief that the Bitcoin network and its transactions should not be utilized for alternative use cases. An example of this is the '[OP_Return wars](#)' that occurred in 2014. Unlike Ethereum and other networks with specific functionality developed for NFT and other use cases, the Bitcoin network was not optimized for alternative use cases from a technical standpoint. Consequently, Bitcoin NFTs (art) have garnered a smaller audience than other NFT ecosystems on Ethereum and similar platforms. Nonetheless, Bitcoin art has made a unique and Bitcoin-centric cultural impact.

The team at Ordinals has created a comprehensive summary of NFT Archeology with helpful references, which can be found on their [website](#).

To understand the NFT market, let's look at some key statistics from Ethereum NFT markets. According to NFTPriceFloor, there are currently 710 collections with a total market cap of around \$6.1 billion. The top five collections make up 42% of this market cap. The most popular category is PFP/Avatar, with a market cap of approximately \$4.2 billion across 344 collections. Ethereum NFTs are actively traded on various marketplaces, with CryptoPunks having a trading volume of USD 604.65 million in the 90 days ending on May 17, 2023. High-ranking collections also have significantly higher floor prices.

Figure 02: Ethereum NFT Market Cap by Categories



Source: SQR Research. Data: [NftPriceFloor](#). Data as of 17 May 2023. Created with [Datawrapper](#). Note: Some collections belong to multiple categories.

As the Bitcoin Artifacts (NFTs) ecosystem expands, it remains to be seen if it will continue to offer the same utilities as we have seen in other Networks or develop new ones beyond its current functions of creating and trading digital artifacts.

Competition

Stamps Protocol and Ordinals, a Bitcoin artifacts protocol, compete but not in a hostile manner. The project is distinguishing itself from the competition as a solution that provides data permanence on the blockchain. Hence, its key selling proposition is 'Unprunable UTXO Art.' This means that it also distinguishes itself from other Counterparty art solutions that use OP_RETURN space for storing data. Both witness data (which Ordinals use) and OP_RETURN data are susceptible to pruning since they do not form part of the UTXO set.

Future Plans

The project's development does not follow a preset roadmap. Instead, it evolves through community discussions and feedback.

There are multiple topics of interest and potential future plans from ongoing conversations. It is worth noting that not all of these plans are guaranteed to be implemented, as their feasibility is dependent on community feedback. Additionally, new plans may arise as time progresses. For example, with the rapid popularity witnessed by the BRC-20 experiment in the Ordinals community, Stamps contributors have recently introduced the [SRC-20 Token Specification](#).

Tentative Future Implementations

Firstly, as already discussed in this report, there is a plan to develop a pathway for partial output redemption of older Stamps. Secondly, the developers also plan to mark all three states of Stamps, i) Key Available: Outputs Unspent; ii) Key Available: Outputs Spent; iii) Key Burned: Outputs Can't Be Spent. Additionally, the development team is considering implementing a feature that allows artists to burn keys of Stamps they minted in the early stages of the project.

The developers are also planning to introduce artist names associated with addresses.

There are additional plans that have not yet been announced. These implementations will only be revealed to the public after they have been put into action.

Team and Advisors

The project's core team, led by [MikelInSpace](#), is small and only composed of a few developers. Both Mike and [Moonblink](#) actively contribute to the project's GitHub page. Mike often requests assistance on Telegram to implement new features he has in mind.

Transparency

Stamps Protocol is an open-source project that solicits feedback from the community, and the contributions to its [GitHub](#) repositories are handled exclusively by the core team.

However, it is noted that Stamps Protocol only proposes a method to store data on the Bitcoin blockchain and utilize the existing tools on the Counterparty protocol to achieve this. Therefore, Stamp Protocol does not have its own codebase as such; but rather relies on tried and tested Counterparty transactions.

Counterparty is an open-source project that has been in existence since 2014. Its protocol specification and software are accessible for examination and collaboration on [GitHub](#). According to publicly available information, multiple Bitcoin security experts have officially reviewed its software.

Governance and Legal Structures

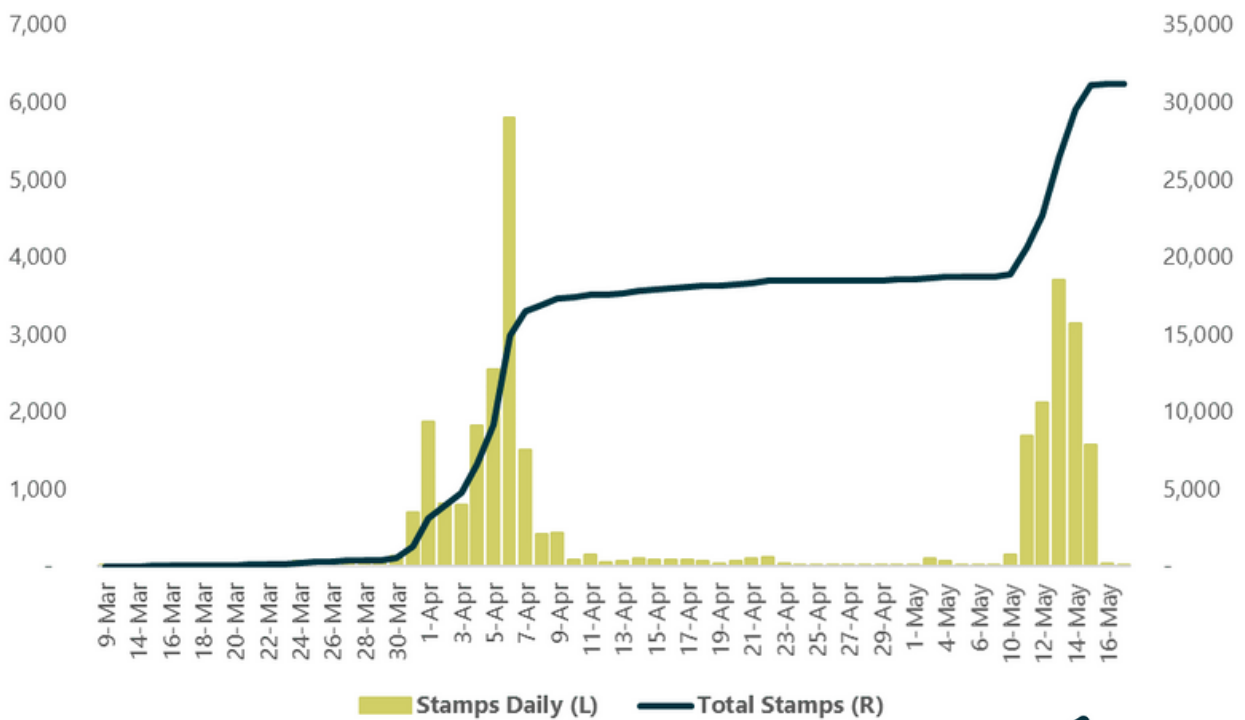
The project has no formal legal structure but is a community-contributed effort.

Traction

Stamp creation began in March 2023, and the total number of Bitcoin Stamps minted has exceeded 31,100 since then (this statistic only accounts for Bitcoin Stamps). However, the number of Stamps created has plateaued after peaking in the first week of April 2023. It is worth noting that since the implementation of the SRC-20 Token Spec, there has been an uptick in the number of mints per day.

Out of all the mints that have been made, around 32% of them belong to the 10,000 StamPunks. It is worth mentioning that even though there are 31,186 Stamps, some of them come in editions such as 1/1, 1/10, and 1/100.

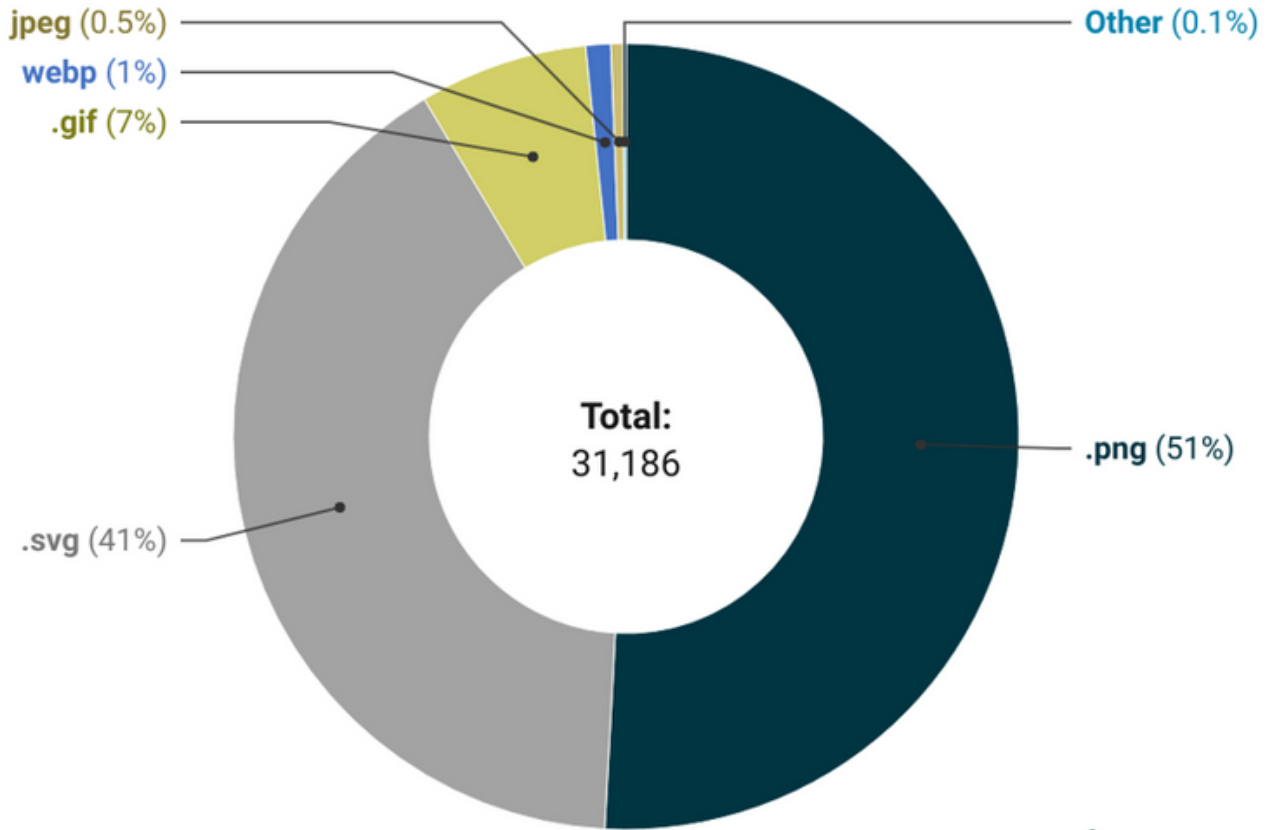
Figure 03: Total Bitcoin Stamps Minted



Source: SQRR Research. Data: stampchain.io. Data as of 17 May 2023.

Currently, Stamps have a limited range of acceptable file formats. The image data must be in JPG, PNG, GIF, or WebP format, but some Stamps have used SVG, BMP, or other formats. Of all the stamps created, 50.87% are in PNG format, 40.55% are in SVG format, and only 8.46% are in GIF, JPG, and WebP formats. The remaining types comprise less than 1% of the total stamps created.

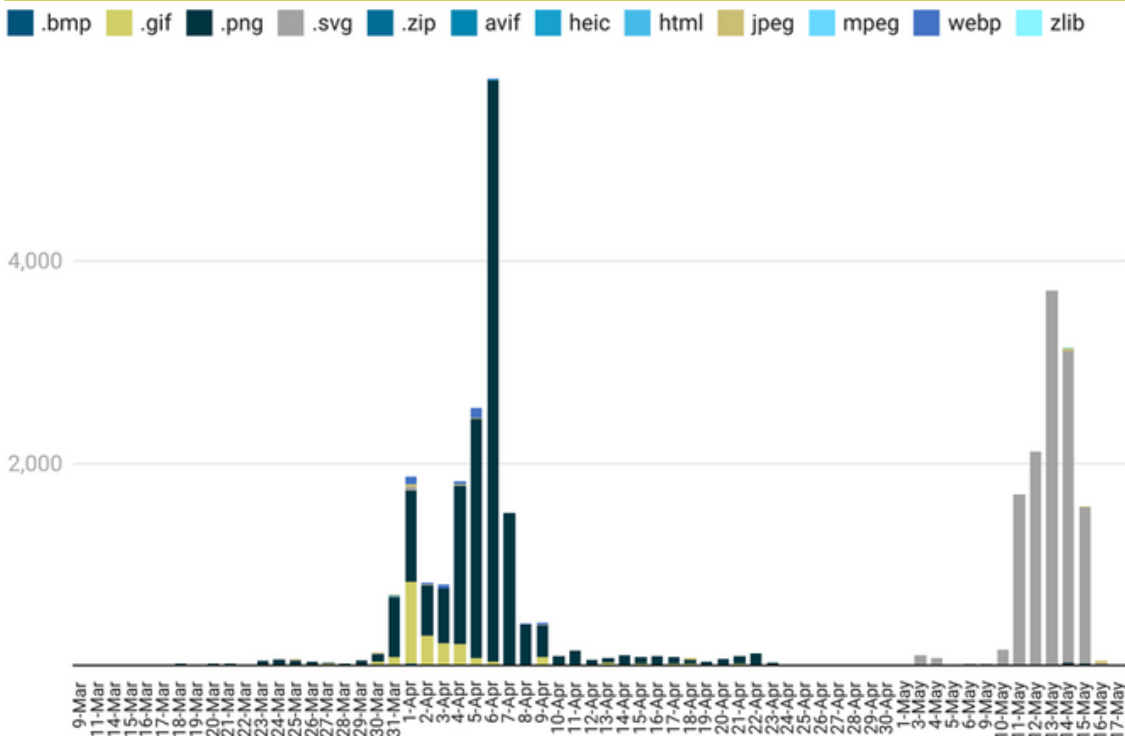
Figure 04: Bitcoin Stamps by Type



Source: SQRR Research. Data: stampchain.io. Created with: Datawrapper. Data as of 17 May 2023.

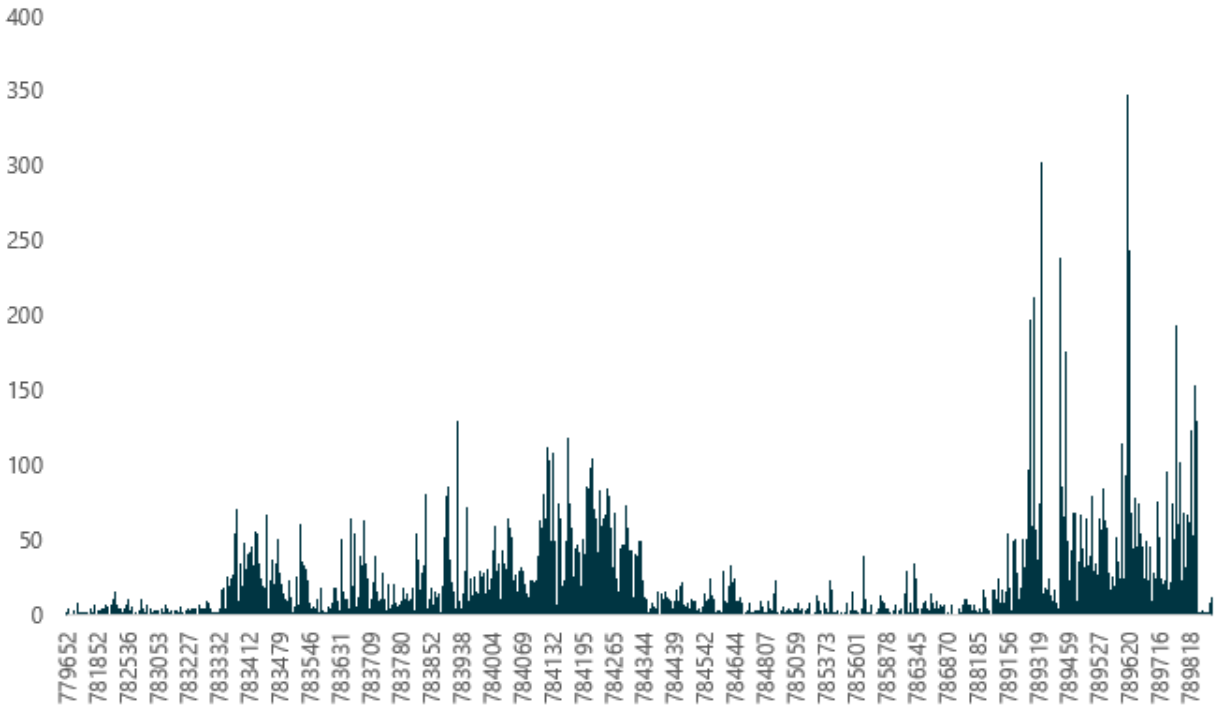
Over time, creators appear to adhere to the permitted file formats.

Figure 05: Bitcoin Stamps by Type (overtime)



Source: SQRR Research. Data: stampchain.io. Created with: Datawrapper. Data as of 17 May 2023.

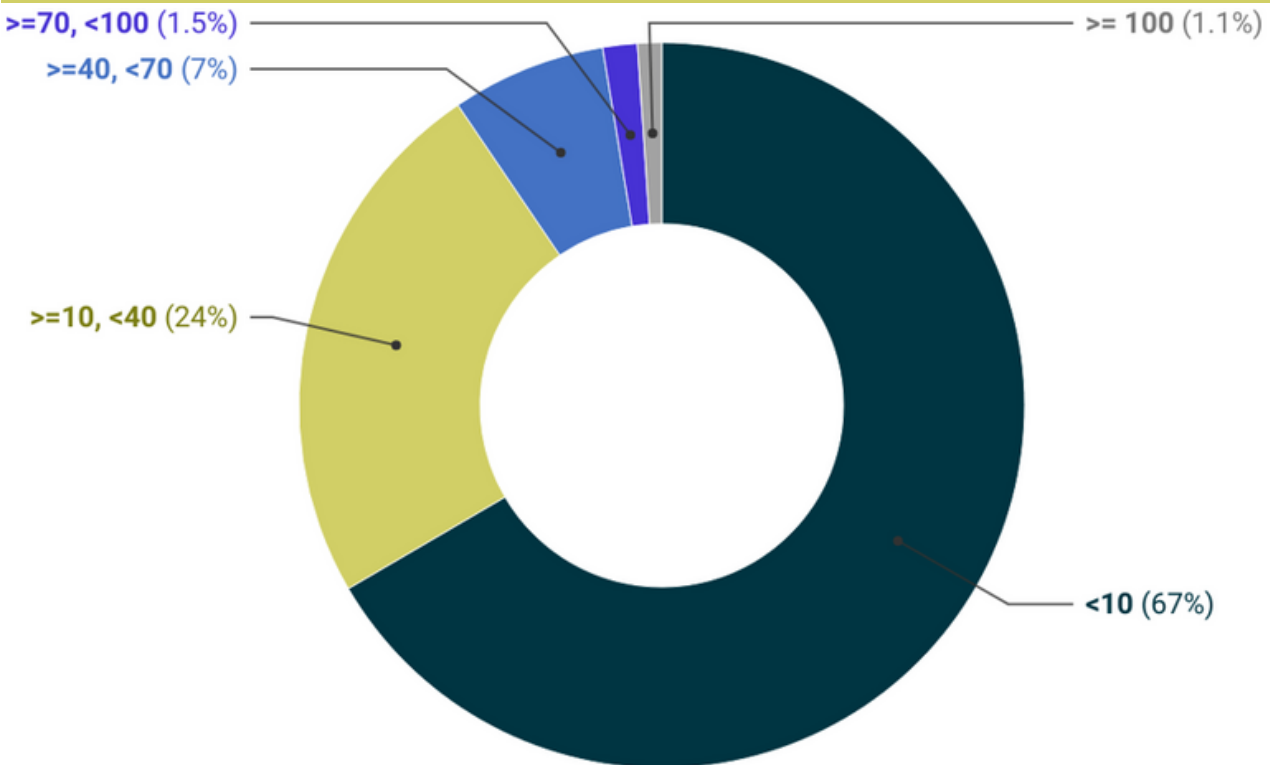
Figure 06: Number of Stamps by Block



Source: SQRR Research. Data: stampchain.io. Data as of 17 May 2023.

An analysis of Stamps distribution in Bitcoin blocks reveals that the maximum number of Stamps in a single block was 348. Of 2,342 blocks containing Stamps, 67% had fewer than 10 Stamps, while only 1% had more than 100 Stamps in them.

Figure 07: Percent of Blocks with Stamps (in Slabs)

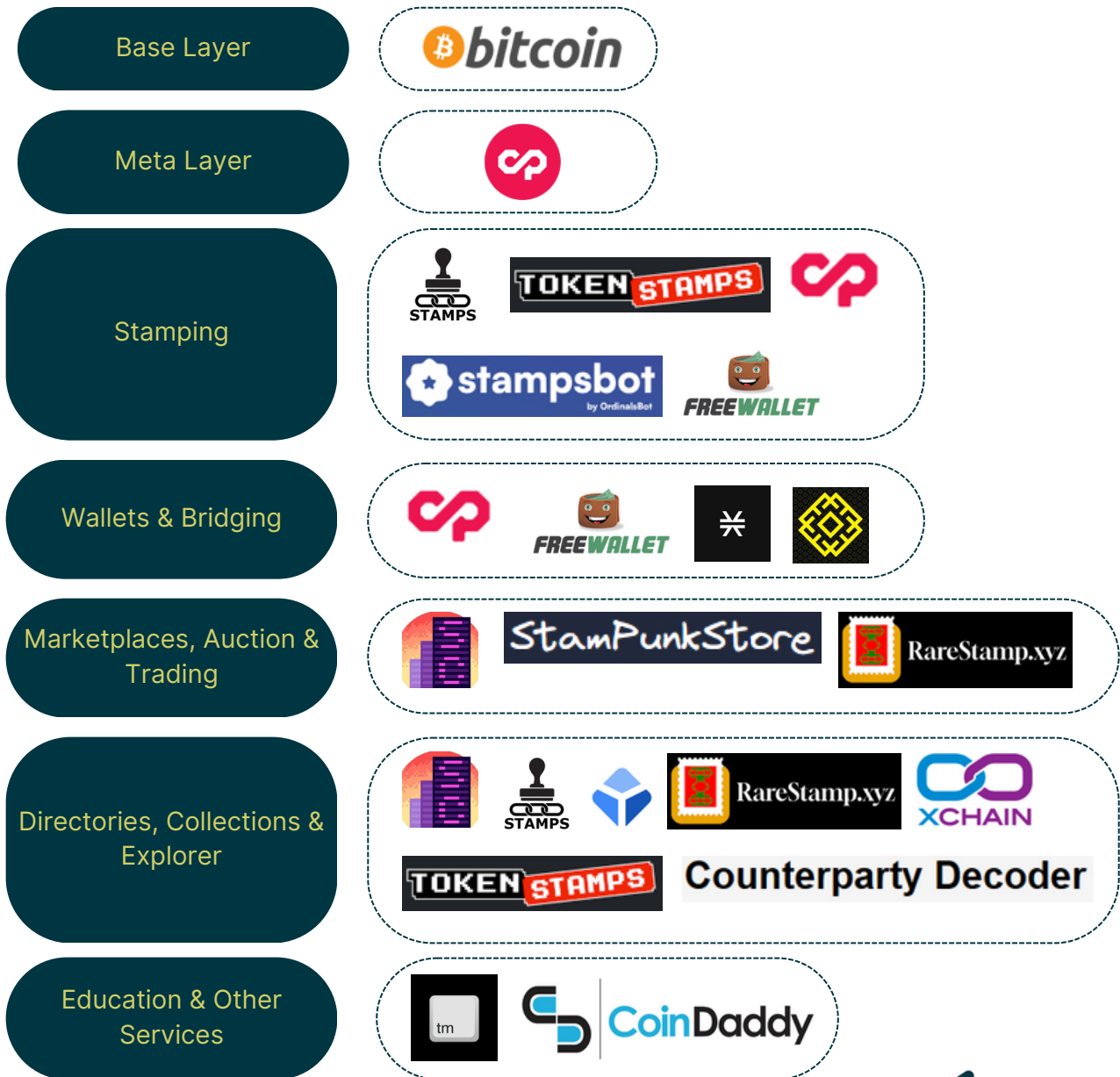


Source: SQRR Research. Data: stampchain.io. Created with: Datawrapper. Data as of 17 May 2023.

Recently, transaction fees have climbed significantly, pushing the cost of minting Stamps higher. Given that Stamps are using more expensive non-witness space for storing data, this increase is a concern for minters and partly explains the drop in daily mints.

Notably, the Stamp Protocol is gradually attracting participants to its ecosystem.

Figure 08: Bitcoin Stamps Ecosystem



Funding Status

The community backs this project and has not sought funding from investors.

The core team created the **Stamps Development Fund (SDF)** in response to a request from a patron. Any funds sent to this address will be utilized to ensure the project's sustainability and enhance the Protocol. The team also appreciates any donations that can help further the project and advance the Protocol.

As of May 17, 2023, the wallet address ([bc1qe5sz3mt4a3e57n8e39pprval4qe0xdrkzew203](https://blockchain.info/address/bc1qe5sz3mt4a3e57n8e39pprval4qe0xdrkzew203)) belonging to the SDF had received approximately 0.23478383 BTC (equivalent to USD 6,983.27) in contributions. The wallet's remaining balance is approximately 0.13271678 BTC (USD 3,558.54) as of the date.

Universelle, who manages RareStamp.xyz, a crucial component of the Bitcoin Stamps ecosystem, is a beneficiary of the project's funding. Universelle received 0.032 BTC to cover the increasing hosting expenses.

Community and Social Media

Stamps Protocol has gathered a small but highly active community.

Channel	Remarks
Twitter	<p>Although Stamp Protocol is not on Twitter, MikelnSpace is a prolific Twitter user with frequent posts and 18k followers.</p> <p>Stampchain.io's official Twitter account was launched in April, but it currently has a small following.</p> <p>There are two Twitter handles for Counterparty: CounterpartyXCP and Counterparty NFT. The former has 29.9k followers, while the latter has 12.3k followers.</p>
Telegram	<p>The BitcoinStamps Telegram channel is a valuable resource for the community, providing information, updates, and education. Notably, MikelnSpace is an active contributor to the discussions on the channel. Despite its value, the channel currently has ~2,666 members.</p>
Discord	<p>A group of community members manages the Stampcord Discord channel, although it is not official. Presently, there are 556 members in the channel.</p>

Risks and Challenges

As with any new blockchain project, Stamps encounters various challenges and risks. Additionally, there are some risks, particularly because the project is based on Bitcoin Network.

Currently, the project is at a crucial stage in its life cycle. The Protocol is undergoing updates and new concepts are being tested. Additionally, the infrastructure required is still in its early stages and needs to be proven over time. As the project progresses, these challenges will gradually decrease. It is noteworthy that several popular names in the industry have shown support for the Protocol by integrating it.

The Counterparty protocol has had its share of successes and setbacks over time. Counterparty is relatively small compared to larger ecosystems, which means that the Stamps project may have a smaller market to target. This raises questions about the project's potential for growth. However, no other project on Counterparty has gained as much momentum as quickly as Stamps has. In addition, the Counterparty community has been very supportive of Stamps, with two CIPs ([CIP 26 Defining the Stamp Protocol](#) and [CIP 27 for STAMP Filesystem](#)) already introduced in its support.

The Stamps Protocol utilizes non-witness space, which is more costly, leading to higher stamping fees. This can be problematic as elevated transaction fees within the Bitcoin network may impede stamping activity.

In Bitcoin, a consensus rule limits the number of Sigops that can appear in a block. Sigops refer to script opcodes that perform signature checks like OP_CHECKSIG, OP_CHECKSIGVERIFY, OP_CHECKMULTISIG, and OP_CHECKMULTISIGVERIFY. A valid block can not exceed 80,000 Sigops (approx. 1 Sigop per 50 bytes of block data). A Stamp minting transaction contains several multi-sig outputs that contain the opcode OP_CHECKMULTISIG. Consequently, Stamp transactions are at a disadvantage in the Mempool and could take longer to confirm.

Finally, there is a split within the Bitcoin community regarding the allocation of block space. Some believe it should be used for purposes other than transactions, such as data storage. It is unclear if this disagreement will have a negative impact on the Stamps Protocol, but it could present a challenge if Stamp transactions are labeled as "Spam" and filtered out.

Tokenomics

The Stamps Protocol does not have a requirement for the use of any token to complete tasks. Creators and solutions associated with Stamps are free to charge fees in BTC for their services.

Furthermore, the project team has received financial assistance from the community thus far, and this pattern will probably persist in the future.

Key Terms

Term	Brief Explainer
Base64	Base64 is a way of encoding binary data (such as images, documents, etc.) into a text-based format that can be easily transmitted over the internet. It is commonly used in email, electronic documents, and other web applications.
CIP	<u>Counterparty Improvement Proposal</u> is a design document providing information to the Counterparty community, or describing a new feature for Counterparty or its processes or environment.
Floor Price	The lowest price for collection items, rather than the average item price, and is updated in real-time. (Source: <u>OpenSea</u>).
Image Binary Content	The binary content of an image refers to the data used to represent the image, usually in the form of bits.
PFP	The letters stand for Profile Picture. A PFP NFT is a digital token or artwork designed to be displayed as a person's social media profile picture. (Source: <u>nftnow</u>).
UTXO	Bitcoin Unspent Transaction Output (UTXO) is a type of transaction that is used in the Bitcoin network. It is an output from a previous transaction that has not been spent yet and can be used as an input for a new transaction. UTXOs are used to track ownership of bitcoins and ensure that users are only spending what they own.

Provide Feedback

We value your feedback and strive to enhance our content and offerings based on your suggestions. Let us know what you enjoyed about this report and if there is anything we may have overlooked. We're eager to receive feedback and encourage you to share your thoughts with us at research@sqrr.xyz. Additionally, please stay tune for our regular update reports, which we aim to publish in the future to keep our audience well-informed and engaged on this Protocol.

Thank you, Stamps Team, for taking the time to review the draft of this report. Your efforts are greatly appreciated.

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Contributors to This Report



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Tharanga is a highly experienced financial services and blockchain professional with over a decade of experience in the industry. He holds an MSc in Blockchain and Digital Currency from the esteemed University of Nicosia, an MSc in Applied Finance from the University of Sri J'Pura, and a BBA in Accounting & Finance from the University of Ruhuna. He also holds a Post Graduate Diploma in Treasury and Forex Management from ICFAI University in India.

He has previously held senior roles as the Head of Research at D-Core and as CIO at an Asset Manager. Moreover, his experience in Investment Banking adds practical insights into innovative solutions that leverage blockchain technology. He leverages his knowledge and experience to examine trends, assess risks, and uncover new opportunities.

Tharanga's data-driven and results-oriented approach complement our team's research methodology.



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Data



dgtl_assets is an enthusiastic individual who enjoys diving deep into the world of blockchain data and is continuously striving to master the art of blockchain data analysis. Possessing a curious mind, dgtl_assets finds particular interest in the newly emerging Bitcoin Artifacts phenomenon. With dedication and passion, dgtl_assets actively explores various aspects of this intriguing domain to develop and share deeper insights and knowledge with the broader community.

