crypto.com

Bitcoin's Expanding Ecosystem: Layer-2, DeFi, NFT

April 2023

Research and Insights

Crypto.com Research and Insights Team

Published on 2 May 2023

RESEARCH DISCLAIMER

The information in this report is provided as general commentary by Crypto.com and its affiliates, and does not constitute any financial, investment, legal, tax, or any other advice. This report is not intended to offer or recommend any access to products and/or services. The views expressed herein are based solely on information available publicly, internal data, or information from other reliable sources believed to be true.

While we endeavour to publish and maintain accurate information, we do not guarantee the accuracy, completeness, or usefulness of any information in this report nor do we adopt nor endorse, nor are we responsible for, the accuracy or reliability of any information submitted by other parties. This report includes projections, forecasts, and other predictive statements that represent Crypto.com's assumptions and expectations in light of currently available information. Such projections and forecasts are made based on industry trends, circumstances, and factors involving risks, variables, and uncertainties. Opinions expressed herein are our current opinions as of the date appearing in this report only.

No representations or warranties have been made to the recipients as to the accuracy or completeness of the information, statements, opinions, or matters (express or implied) arising out of, contained in, or derived from this report or any omission from this document. All liability for any loss or damage of whatsoever kind (whether foreseeable or not) that may arise from any person acting on any information and opinions contained in this report or any information made available in connection with any further enquiries, notwithstanding any negligence, default, or lack of care, is disclaimed.

This report is not meant for public distribution. Reproduction or dissemination, directly or indirectly, of research data and reports of Crypto.com in any form is prohibited except with the written permission of Crypto.com. This report is not directed or intended for distribution to, or use by, any person or entity who is a citizen or resident of, or located in a jurisdiction, where such distribution or use would be contrary to applicable law or that would subject Crypto.com and/or its affiliates to any registration or licensing requirement.

The brands and the logos appearing in this report are registered trademarks of their respective owners.

Contents

Published on 2 May 2023

Key Takeaways

- Compared to Ethereum and other smart contract Layer-1 blockchains, Bitcoin is somewhat limited in terms of functionality and use cases. However, the durable and decentralised base layer of the Bitcoin network potentially serves as the foundation of a much wider range of economic activity. Indeed, Bitcoin-based protocols that bring scale and programmability on top of this base layer are in development, further expanding the Bitcoin ecosystem.

- Modifications to Bitcoin's core protocol take a long time to implement due to the development community's conservative approach to making changes. Thus, initiatives to expand the scalability and use cases of Bitcoin are mostly taking place outside of the base layer.

- The landscape of the latest projects that are building on top of Bitcoin is expanding beyond payments, and includes Layer-2 scaling solutions and key application categories like decentralised finance (DeFi) and non-fungible tokens (NFTs). Currently, the main Layer-2 solutions are Lightning Network, Liquid Network, Stacks, and Rootstock. Also highlighted are Bitcoin-based projects in DeFi, such as Sovryn, ALEX, Stackswap, and Lend at Hodl Hodl; and in NFTs, such as Ordinals, Bitcoin Stamps, and Bitcoin domain names.

- Although efforts to expand Bitcoin's use cases have been ongoing since 2012, levels of adoption are still relatively low to date. However, there are emerging catalysts that could potentially accelerate developments in the Bitcoin ecosystem, including infrastructure progress and developer incentives.

- Bitcoin will continue facing stiff competition from Ethereum and the multitude of alternative Layer-1 blockchains. These competing platforms were built for general-purpose applications since their inception, and their user experience currently remains superior to many Bitcoin-based solutions.

1. Introduction

What is Bitcoin? Since its inception, Bitcoin has navigated through a maze of narratives. It has been described as peer-to-peer (P2P) electronic cash (as envisioned in founder Satoshi Nakamoto's original white paper), digital gold, an uncorrelated financial asset, a store of value, and a global payment and settlement network, for example.

Compared to Ethereum and other smart contract-focused Layer-1 blockchains, Bitcoin is somewhat limited in terms of functionality and use cases. However, the durable and decentralised base layer of the Bitcoin network potentially serves as the foundation of a much wider range of economic activity. Indeed, Bitcoin-based protocols that bring scale and programmability on top of this base layer are in development, further expanding the Bitcoin ecosystem.

Bitcoin-Based Protocol Landscape Expanding

Modifications to Bitcoin's core protocol take a long time to implement due to the development community's conservative approach to making changes. This is to ensure that Bitcoin's core values of decentralisation, stability, and security are not compromised for more functionality. For instance, one of the most significant Bitcoin upgrades, Taproot, was proposed as early as 2018 but was not implemented until nearly four years later.

Thus, initiatives to expand the scalability and use cases of Bitcoin are mostly taking place outside of the base layer.

As shown in the timeline below, attempts to bring programmability and scalability to Bitcoin began as early as 2012. Efforts picked up again in 2018, when new Bitcoin-related protocols emerged and began deploying new technologies into production.

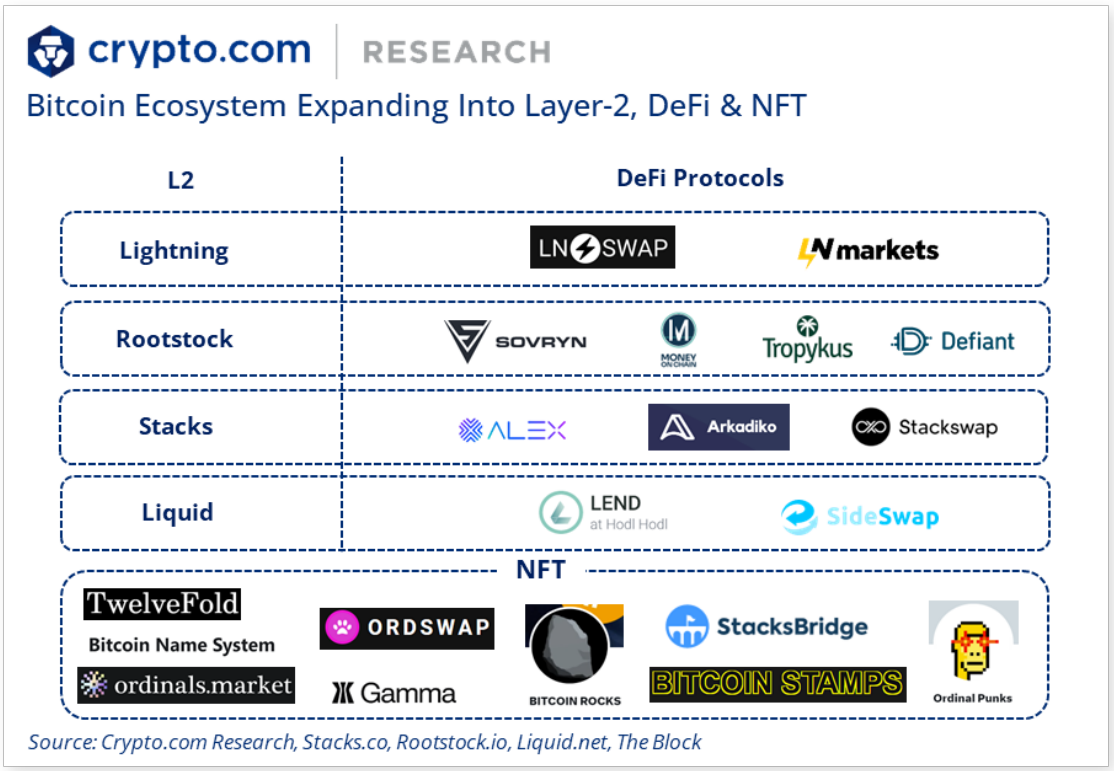
Bitcoin Development Timeline: Key Events crypto.com | RESEARCH

Date	Event
Dec 2012	Colored Coins proposed on Bitcoin
Jul 2013	Mastercoin launched as a protocol layer on top of Bitcoin
Jan 2014	Counterparty goes live
Jan 2018	Rootstock (RSK) mainnet launched

Oct 2018	First Lightning Network implementation goes live
Oct 2018	Liquid Network launched as Bitcoin sidechain
Sep 2020	Sovryn mainnet launched
Jan 2021	Stacks smart contracts launched on mainnet
Apr 2022	Taro (a protocol for asset issuance) announced on Bitcoin
Jan 2023	Ordinals protocol launched on Bitcoin

Sources: Crypto.com Research, The Block

The landscape of the latest projects that are building on top of Bitcoin is expanding beyond payments, and includes Layer-2 scaling solutions and key application categories like decentralised finance (DeFi) and non-fungible tokens (NFTs). Some of the scaling layers, such as Lightning Network, focus on payments, while others (e.g., Stacks, Rootstock) are general-purpose smart contract layers that enable different types of applications, such as those related to DeFi and NFTs, to be built.



Source: Crypto.com Research, Stacks.co, Rootstock.io, Liquid.net, The Block

2. Bitcoin Layer-2 and DeFi

As mentioned, due to the challenges of modifying Bitcoin's core protocol, Layer-2 scaling solutions are key to expanding the use cases and ecosystem for Bitcoin. Currently, the major Layer-2s are **Lightning Network, Rootstock (RSK), Stacks, and Liquid Network.**

Bitcoin Layer-2s crypto.com | RESEARCH

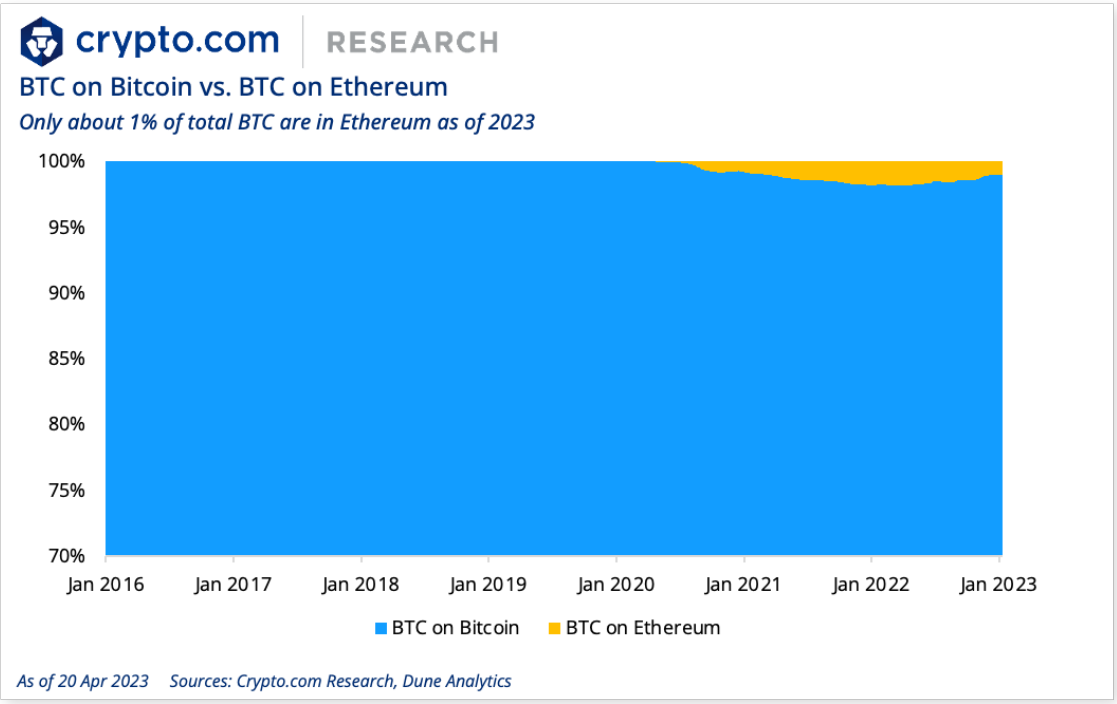
	Lightning Network	Stacks	Rootstock	Liquid
Native Token	N/A	STX	RBTC	L-BTC
Smart Contracts	No	Yes	Yes	Yes
Programming Language	Multiple programming languages	Clarity	Solidity	Simplicity
Consensus Mechanism	N/A	PoX	PoW *(Merged-mined with Bitcoin)*	Strong Federations
EVM-Compatible	No	No	Yes	No
Throughput (TPS)	Millions	~19 (Between Bitcoin and Ethereum's throughput)	10-20 (100 tps in test environment)	7-10
Finality	Near-instant	10 min	12 blocks confirmation (~6 min)–	2 blocks (~2 min)

Source: Crypto.com Research

The programmability of smart contracts in the Ethereum network drives much of the innovation in blockchain, including the majority of DeFi platforms today. However, Bitcoin has lagged behind the growth of DeFi ecosystems. But while full interoperability amongst blockchains remains an issue, solutions like **blockchain bridges** have helped to unlock new DeFi markets.

Blockchain bridges allow for the transfer of digital assets from one chain to another, issuing synthetic tokens that represent the originating asset from another blockchain in the process like WBTC and renBTC for example. These synthetic tokens can come in the form of Bitcoin-backed tokenised assets — for

example, a converted version of Bitcoin that can be used on other blockchains like Ethereum.



There are nearly US$5 billion worth of BTC bridged on Ethereum today, most of which are likely deployed and locked in DeFi platforms. This clearly demonstrates a pent-up user demand to utilise their Bitcoin in other ways and venues, including developing more Bitcoin-native DeFi applications. It is important to point out that there are drawbacks to tokenised BTC. For one, WBTC is held in custody by a centralised exchange (BitGo) and only institutions can mint it. Assets like WBTC also face the risk of de-pegging when there are disruptions in the ecosystem, which can cause users to lose their confidence in it or the pegged asset to lose its value.

Bitcoin is evolving, thanks to the introduction of innovations and upgrades within the network and its ecosystem — and the direction it's taking is mainly found beyond the base layer. The narrative around scaling solutions on Bitcoin is only starting to pick up, even though these solutions have existed for a few years now.

This report will cover the Bitcoin-based protocols that are bringing programmability and scalability to the network. It will examine the Lightning Network, Stacks, RSK, Liquid, and Bitcoin rollup projects, how they enable DeFi on Bitcoin, and what the next phase of growth for the network can look like.

Become a Crypto.com Private member and gain access to our full report on Bitcoin DeFi and Scaling Solutions.

2.1 Lightning Network

Lightning Network is a Layer-2 payment protocol built on top of the Bitcoin blockchain that enables near-instant payments via payment channels. It was designed as a scalability solution to Bitcoin: In an effort to reduce Bitcoin network congestion, Lightning Network uses payment channels to handle Bitcoin micropayments off-chain.

Through Lightning Network, a channel can be established between two parties who want to make a transaction, where the transaction made in that payment channel basically bypasses the main blockchain.

Lightning Network: Transaction Speed Comparison crypto.com | RESEARCH

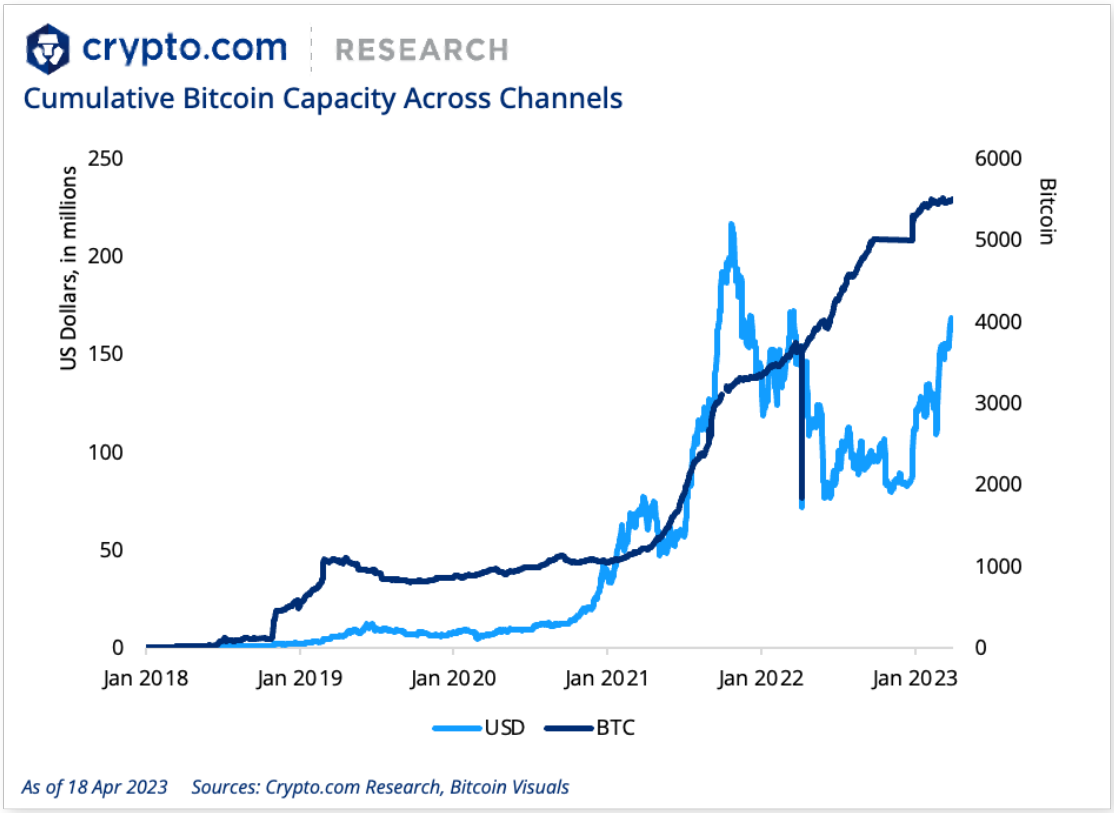
	Visa	Rollup *(Ethereum)*	Lightning Network *(Bitcoin)*
Speed	3–5 seconds (including risks of chargebacks)	~14 seconds	Immediate
Transaction cost	~$0.20	~$0.01 to $2	$0 to several cents
Throughput (per second)	65,000	500–5,000	1,000,000

Sources: Crypto.com Research, Bitcoin Magazine

By taking execution off Bitcoin's base layer, Lightning Network allows users to utilise BTC for low value transactions, such as purchasing a cup of coffee, which can be impractical directly on Bitcoin's base layer, where fees on individual transactions have historically been high (peaking at ~US$60 in April 2021).

With Lightning Network, users do not need to wait for the expected 10-minute block time for most merchants to consider their transactions final. Increased scalability and lower transaction fees allow for a better user experience and potentially give rise to entirely new use cases (e.g., micropayments).

Since its mainnet launched to production in 2018, Lightning Network has seen slow growth over the subsequent years, but started to pick up around late 2021. Over the past year, the amount of BTC sent to the Lightning Network has consistently grown, reaching a record high of nearly 5,500 as of writing.



2.2 Rootstock (RSK)

First introduced in 2014 by IOV Labs, Rootstock (RSK) is a smart contract platform connected to the Bitcoin blockchain through sidechain technology. The total value locked (TVL) in the RSK network peaked in 2022, and currently sits at around US$88 million.

Rootstock aims to bring functionality to Bitcoin in the form of a Turing-complete and Ethereum Virtual Machine (EVM)-compatible sidechain. It uses **smartBTC (RBTC)**, which is issued against BTC locked on Bitcoin and used to pay transaction fees on Rootstock. Similar to Liquid Network, Rootstock uses the concept of **peg-in and peg-out bridging.** Rootstock's Powpeg Federation is responsible for issuing RBTC on Rootstock for every BTC deposited in the Rootstock network by users.

Rootstock is secured through **merge mining** with Bitcoin, meaning that Bitcoin miners have the option to simultaneously mine Rootstock blocks along with Bitcoin blocks. As Rootstock does not have a separate native asset, it cannot offer block subsidies to miners — instead, miners are compensated with transaction fees generated on Rootstock.

Below we highlight a key Bitcoin-based DeFi project that is built on Rootstock:

Sovryn

Sovryn (SOV) is a DeFi platform that offers several products, including loans on Bitcoin (and Bitcoin-based stablecoins), a decentralised exchange (DEX) for swaps and with Spot/Margin trading, yield farming, and staking. It has ~US$52.4 million in TVL (at time of writing). Sovryn also has an overcollateralised Bitcoin-backed stablecoin called Sovryn Dollar (DLLR), which has a 1:1 peg with the value of USD and is composed of a diversified basket of other exclusively Bitcoin-backed stablecoins.

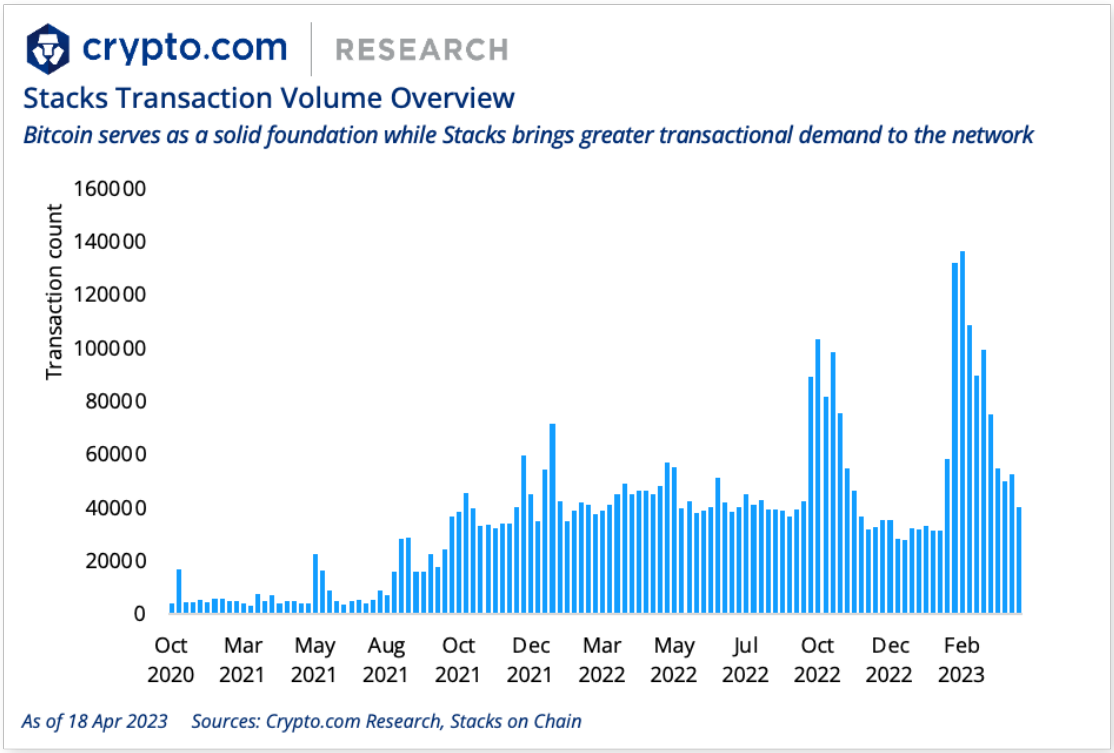
2.3 Stacks

Stacks (STX) is a smart contract Layer-2 blockchain linked to the Bitcoin base layer by its consensus mechanism that spans the two chains, called **Proof of Transfer**

(PoX). This enables Stacks to leverage Bitcoin's security, and Stacks apps to use Bitcoin's state. Bitcoin acts as the secure and robust base layer for Stacks, where all transactions are settled. Stacks adds complex apps and smart contracts, which can interact with Bitcoin state so users can have an app that uses Bitcoin as its currency.

PoX is an extension of the Proof of Burn (PoB) consensus mechanism, where miners compete by 'burning' (destroying) a Proof of Work (PoW) cryptocurrency as a proxy for computing resources.

Like with PoB, PoX uses the PoW cryptocurrency of an established blockchain to secure a new blockchain. However, unlike with PoB, rather than burning the cryptocurrency, miners transfer the committed cryptocurrency to other participants in the network. This allows network participants to secure the PoX cryptocurrency network and earn a reward in the base cryptocurrency. **Thus, PoX blockchains are anchored on their chosen PoW chain. Stacks uses Bitcoin as its anchor chain.**



Below we highlight some DeFi projects built on Stacks:

ALEX

ALEX (ALEX) is a DeFi platform offering a DEX that combines order book and Automated Market Maker (AMM), fixed and variable rate lending/borrowing of

Bitcoin, and leveraged products, such as margin swaps and yield farming. The platform also has a launchpad for other projects to launch tokens to meet their financing needs through liquidity bootstrapping pools. ALEX has ~US$23.8 million in TVL (at time of writing).

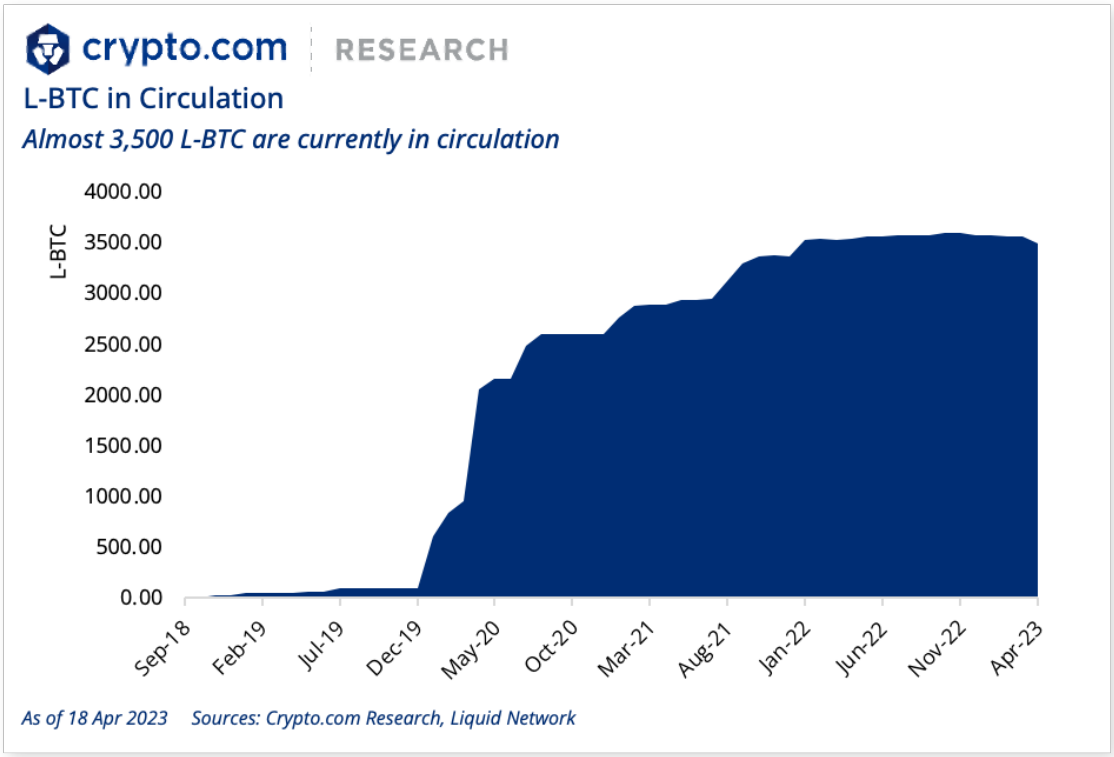
Stackswap

Stackswap is another DeFi platform offering products that enable users to exchange and launch tokens, mint and trade NFTs, and borrow algorithmic stable cryptocurrencies on the Bitcoin network. It is also the first permissionless DEX to run on the Bitcoin layer by utilising the Stacks protocol. Stackswap supports the traditional functions of a DEX, such as token trading through swaps and liquidity mining, and has introduced advanced features. These include issuing project tokens through its dedicated Launchpad, and creating trading pools and token compensation programs. Stackswap currently has ~US$183,000 in TVL (at time of writing).

2.4 Liquid Network

The idea for Liquid Network was proposed in 2015, but it wasn't launched into production by Blockstream, its major development organisation, until October 2018. It is a sidechain of Bitcoin that allows users of the Liquid Network to move Bitcoin between the two networks with a two-way peg.

Currently, Liquid Network is a federated network managed by the Liquid Federation, which is composed of different members, including crypto exchanges, trading desks, and infrastructure companies. Bitcoin used in the Liquid Network is referred to as **L-BTC,** and each L-BTC has a verifiably equivalent amount of BTC secured by certain Liquid Federation entities, called functionaries.



Below we highlight a DeFi project built on Liquid Network:

Lend at Hodl Hodl

Lend at Hodl Hodl is a peer-to-peer (P2P), non-custodial lending platform. Users can lend or borrow cryptocurrencies without selling their Bitcoin, using it as collateral instead. The platform allows customers to find an offer to either lend or borrow specified amounts of cryptocurrencies for a specified interest rate within a specified period of time. No third parties are involved, and no verification is required to lend or borrow. The platform aims to ensure safety by providing a unique multisig escrow for every contract created.

3. NFTs

Bitcoin NFTs have gained considerable popularity and traction since the launch of the Ordinals protocol in January 2023, which allows for minting NFTs directly onto the Bitcoin blockchain. Since then, the number of Ordinals inscriptions on the Bitcoin network has exceeded 1 million.

Traditionally, it is more difficult to mint NFTs on Bitcoin compared to other blockchains like Ethereum. This is due to the limited smart contract functionality

on the Bitcoin base layer, as well as the lack of a token standard for NFTs, such as the ERC-721 token standard on Ethereum.

Become a Crypto.com Private member. Gain access to our full report, NFTs in the Bitcoin Ecosystem, and many more.

Below we highlight Bitcoin-based NFT projects:

Ordinals

Bitcoin Ordinals NFTs are **minted on Bitcoin's base layer** using the Ordinal theory through the Ordinals protocol, which was developed by Casey Rodarmor. The aim of Ordinal theory is to give each Satoshi an individual identity, allowing them to be tracked, transferred, and imbued with individual meanings through inscriptions. This allows one Satoshi to be different from another, hence non-fungible.

The main advantage of Ordinals NFTs, as compared to other NFTs, is that the entire metadata is contained on the Bitcoin blockchain. This is viewed by many as having an increased level of immutability.

In contrast, for many NFT collections, the actual image file of the art is typically stored off-chain, and the metadata just includes a link to the image file. This implies that the artwork can potentially be altered by third parties if it is not stored on the blockchain.

Amid the rise in popularity of Ordinals NFTs, there have been sales exceeding $100,000, even during the bear market. In addition, the total transaction fees for Ordinals NFT inscriptions have surged and exceeded 176.46 BTC, or approximately US$5.19 million (as of 18 April 2023). Top Ordinals projects include **Ordinal Punks** and **Yuga Labs's TwelveFold.**

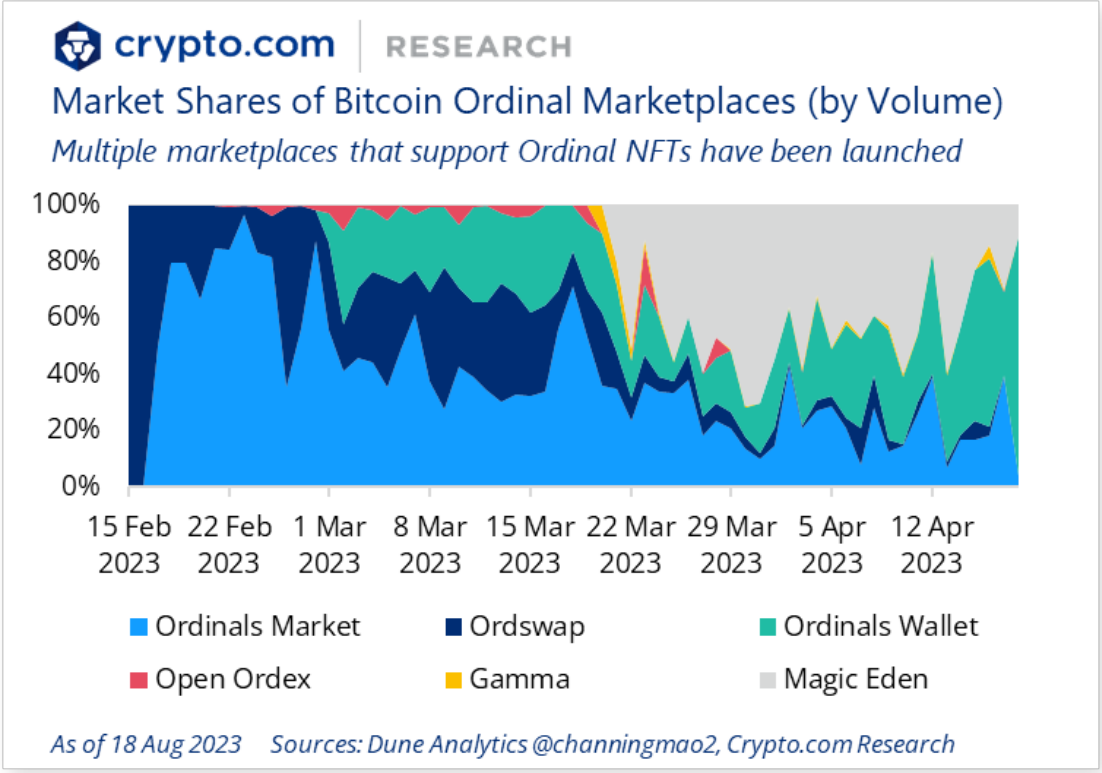
Top Bitcoin NFT Sales crypto.com | RESEARCH

Collection	Sale Price (BTC)	Sale Price (USD)	Date of Sale	Image
Ordinal Punks	11.5 BTC	$249,000	10 Feb 2023	
Ordinal Rocks	9.8 BTC	$213,800	10 Feb 2023	

Ordinal Punks	9.5 BTC	$221,300	8 Feb 2023	
Ordinal Loops	7.2 BTC	$154,800	11 Feb 2023	
TwelveFold	7.1 BTC	$158,800	5 Mar 2023	
Ordinal Punks	6.3 BTC	$149,900	16 Feb 2023	

As of 13 Apr 2023 *Sources: Bitcoin.com, Galaxy Research, TwelveFold, Crypto.com Research*

One of the largest Ordinals marketplaces that dominated the Bitcoin NFT trading scene in the early months was Ordinals Market, which enables the trading of Bitcoin inscriptions on the Ethereum blockchain using Ethereum vaults developed by Emblem Vault.



Bitcoin Stamps

The STAMPS (Secure Tradeable Art Maintained Securely) protocol is a recent development that proposes a different method of embedding image data onto the Bitcoin base layer, as compared to the Ordinals protocol.

Bitcoin Stamps are also considered 'semi-fungible', as they can be issued as '1 of 1' or '1 of many' digital assets. This makes it similar to the Ethereum ERC-1155 multi-token standard.

Bitcoin Stamps have shown considerable growth. Since launching on 7 March 2023, 8,300 Stamps have been minted, as opposed to fewer than 500 Ordinals in the same time frame.

StacksBridge

StacksBridge, currently in development, is a cross-chain NFT transfer service aiming to enable NFT holders the ability to move their NFTs between the Ethereum blockchain and the **Stacks** blockchain. StacksBridge is being developed by the team behind Ethereum-based NFT profile picture project Satoshibles.

Gamma

Gamma is a Bitcoin-based NFT marketplace and platform for Web3 social identity. It started out as an open marketplace for Bitcoin-secured NFTs on the **Stacks** network, but now also supports users to view their Ordinals NFTs, as well as Ethereum NFTs.

Bitcoin Domain Names

Similar to Ethereum domain names, such as Ethereum Name Service (ENS), there are also Bitcoin domain names which provide similar functionalities. The **Stacks** solution provides a .BTC domain name as a decentralised web identity and human-readable wallet address scheme. The main features of Bitcoin domain names by Stacks blockchain are as follows:

- The domain names are registered using a Stacks smart contract that is funded with Bitcoin.
- With this smart contract, a decentralised name registry is implemented, and the owner's identity is kept private while using decentralised domain names.
- By submitting a transaction to the Bitcoin Name System (BNS) smart contract on the Stacks chain, .BTC domain names can be registered instantly, creating a pair of corresponding Bitcoin and Stacks addresses.
- Each .BTC name's ownership is represented in a hash of the Bitcoin blockchain. Currently, domains cost 2 STX (approximately $1.60 at the time of writing) and need to be renewed every five years.

4. Fundraising Landscape

Blockstream, Lightning Labs, Hiro Systems (the firm behind Stacks), and Trust Machines are amongst the most well-funded organisations in the Bitcoin ecosystem that have recently raised capital. Fundraising by these firms picked up considerably in late 2021 and into 2022 — recent funding rounds surpassed aggregate funding raised in prior years.

Bitcoin-Focused Fundraising

crypto.com | RESEARCH

Organisation	Date	Round	US$M	Select Investors
Blockstream	Nov 2014	Seed	21.0	Khosla Ventures, Real Ventures
(Founded in 2014, a provider of blockchain technologies, and at the forefront of work in cryptography and distributed systems)	Jul 2015	Ext. Seed	Not known	Acequia Capital
	Feb 2016	Series A	57.0	Horizon Ventures
	Nov 2017	Funding	11.0	Digital Garage
	Aug 2021	Series B	210.0	Baillie Gifford, Bitfinex
	Jan 2023	Funding	175.0	Kingsway Capital
Total Funds Raised			**475.0**	
Lightning Labs	Mar 2018	Seed	2.5	Digital Currency Group, The Hive
(Develops software that powers the Lightning Network)	Feb 2020	Series A	10.0	Craft Ventures, Slow Ventures
	Apr 2022	Series B	70.0	Valor Equity Partners, Baillie Gifford
Total Funds Raised			**82.5**	
RSK Labs	Jan 2016	Angel	0.4	Coinsillium
(The company behind Rootstock)	Mar 2016	Seed	1.0	Digital Currency Group
	Mar 2017	Ext. Seed	2.4	Digital Finance Group
	May 2017	Funding	3.5	Bitfury, Bitmain
Total Funds Raised			**7.3**	
Mastercoin (Now Omni, a company that is building an open-source, decentralised asset platform on Bitcoin)	Jul 2013	Crowd-funding	0.5	
Total Funds Raised			**0.5**	
Hiro Systems	Dec 2017	Reg D	47.5	Union Square Ventures, Foundation Capital

(The company behind Stacks)	Sep 2019	Reg A+	23.0	Union Square Ventures
Total Funds Raised			**70.5**	
Trust Machines (Mission is to build the largest ecosystem of Bitcoin applications, taking a layer-agnostic approach)	Feb 2022	Funding	150.0	Union Square Ventures, Breyer Capital
Total Funds Raised			**150.0**	

Sources: Crypto.com Research, The Block

5. Conclusion

Although efforts to expand Bitcoin's use cases have been continuing since 2012, levels of adoption are still relatively low to date. However, there are some catalysts emerging that could potentially accelerate developments in the Bitcoin ecosystem.

For example, Bitcoin-focused organisations have been making progress in building Bitcoin-based infrastructure — as this accelerates, it should encourage more applications to be built. Recent examples include Lightning Labs announcing asset issuance on Lightning Network and a BTC collateralised stablecoin. Trust Machines's US$150 million fundraising builds on the recent success of Stacks in making Bitcoin a platform for Web3 applications. Moreover, Jack Dorsey's Block (formerly known as Square) is developing a Bitcoin-focused decentralised exchange.

In the Layer-2 space, Mintlayer is an upcoming scaling solution in development, while newly formed ZeroSync Association is aiming to bring zero-knowledge proofs to Bitcoin and recently announced a partnership with Blockstream. ZeroSync Association has received sponsorship from crypto investment firm Geometry Research and StarkWare Industries, the software company behind Layer-2 Ethereum zero-knowledge rollup scaling system StarkNet.

Also, financial incentives aimed at developers and users recently have been launched. Last year, Stacks Foundation, Digital Currency Group, GSR, and others announced 'Bitcoin Odyssey', a grant programme with US$165 million in funding focused on making Bitcoin the go-to blockchain for decentralised applications (dapps). Meanwhile, Mintlayer has launched a US$4 million grants initiative to entice developers and projects.

Bitcoin will still face stiff competition from Ethereum and the multitude of alternative Layer-1 blockchains. These competing platforms were built for general-purpose applications since their inception, and their user experience currently remains superior to many Bitcoin-based solutions.

References

The Block Research. “Bitcoin: Beyond the Base Layer.” *The Block.co*, https://www.theblock.co/post/153283/bitcoin-beyond-the-base-layer-commissioned-by-trust-machines/. Accessed 25 April 2023.

Crypto.com Research. “Bitcoin DeFi and Scaling Solutions.” *Crypto.com*, https://www.crypto.com/vip/report/signin/1/. Accessed 25 April 2023.

Crypto.com Research. “NFTs in the Bitcoin Ecosystem.” *Crypto.com*, https://www.crypto.com/vip/report/signin/1/. Accessed 25 April 2023.

e. contact@crypto.com

Published on 2 May 2023