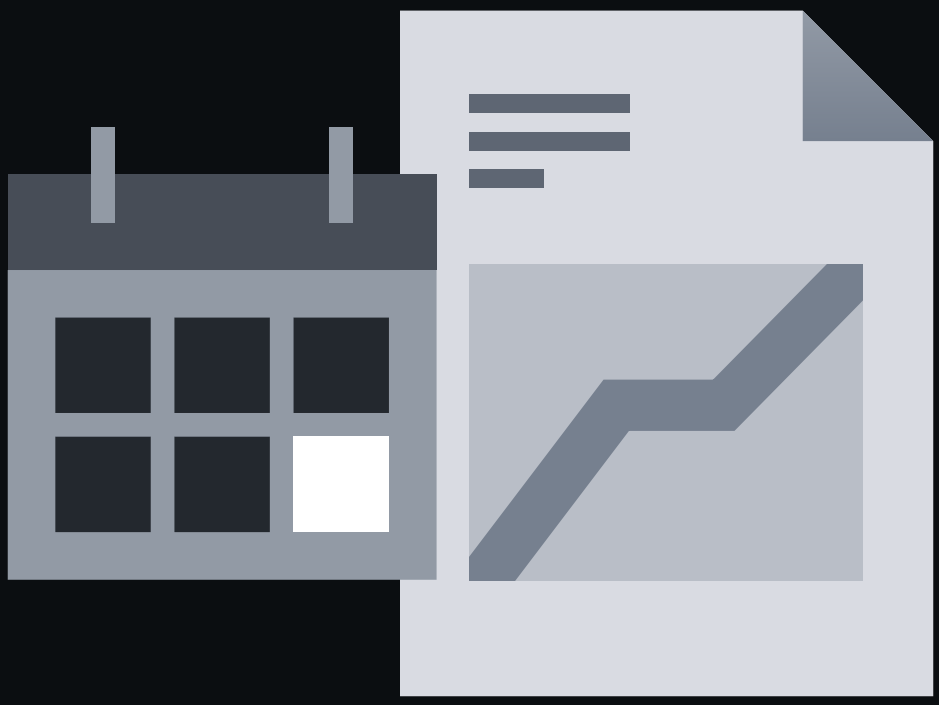
BINANCE RESEARCH

Full-Year 2023 & Themes for 2024

January 2024



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1 Key Takeaways

- The crypto market staged a significant turnaround in 2023 with a 109% increase in total market cap, fueled by substantial gains in Q1 and Q4. The surge in the final quarter was driven by the optimism around Bitcoin ETF approvals and anticipation of Bitcoin's upcoming halving. The broader financial environment, marked by resilient global GDP growth and moderated inflation rates, also contributed to a conducive environment for risk assets such as cryptocurrencies.

- Layer-1s ("L1s") had a strong 2023, with Bitcoin regaining its dominance, both in market capitalization and attention. Key narratives to follow include spot ETF flows, Bitcoin halving, continued Inscriptions / BRC-20 developments, and scaling solutions. We also take a close look at the top alt-L1s; Ethereum, BNB Chain, Solana, Avalanche, Cosmos, and a few others.

- Layer-2s ("L2s") had a notably eventful 2023, marked by a 321.3% increase in total value locked ("TVL") and 77.2% rise in L2 dominance, both year-to-date ("YTD"). While optimistic rollups retained over 80% market share, the L2 sector as a whole made significant strides, ranging from improved technology stacks to forming notable partnerships. EIP-4844, among a series of upcoming developments, are set to impact the progression of L2s further.

- Decentralized Finance ("DeFi") saw robust growth in 2023 with TVL rising 38.9% year-on-year ("YoY"). The remarkable ascent of liquid staking tokens ("LSTs") and LSTfi, the rising adoption of real-world assets, and the emergence of intent-centric architecture are notable developments that have contributed to growth of the sector.

- Despite a rebound in October 2023, the global stablecoin market capitalization saw a 5.2% decline YTD, accompanied by shifts in market dynamics. Centralized stablecoins continue to command 92% of the market, with Tether's USDT increasing its dominance to 70.6%, even as new entrants such as Collateralized Debt Position ("CDP") and LST-backed stablecoins emerged.

- Non-Fungible Tokens ("NFTs") rebounded impressively across Q4. December's volumes of US$1.7B was the highest of 2023, with Bitcoin NFTs showing the most impressive growth. The NFT marketplace wars has been another key theme, with the upcoming Blur-aligned L2, Blast, an interesting upcoming development. It will be important to see OpenSea's continued response to their dwindling market share numbers.

- Looking at on-chain metrics, there has been a resurgence in gaming activity going into the year-end. There were 12.6M weekly unique active wallets in the final week of the year, more than double the start of the year at 5.8M. 2024 is looking set to be an eventful year with the upcoming launches of several games by notable gaming giants.

- The launch of friend.tech in August 2023 catapulted SocialFi to the center of the dominant narrative. The success of friend.tech and its forks demonstrated the sector's potential and its appeal to creators by allowing them to monetize content. However, activity on SocialFi platforms has declined, and it remains to be seen if we will see a resurgence in interest going forward.

- Throughout 2023, Web3 projects attracted a total of 1173 investments, amassing a collective capital of US$9.0B. Of this, a substantial 36.5% was invested in infrastructure projects, followed by CeFi's 13.3% and DeFi's 8.6%. Despite the noticeable reduction in both investment volume and overall valuations in 2023, it is encouraging to see signs of market recovery and substantial capital being allocated towards building infrastructure.

- Moving into 2024, eight key themes are particularly exciting to us, and we anticipate significant progress in these areas throughout the year. These themes span various narratives and sectors, such as those related to the Bitcoin ecosystem, ownership economy applications, artificial intelligence ("AI"), real-world assets ("RWAs"), on-chain liquidity, institutional adoption, and more.

2 Overview

2023 marked a year of recovery for the crypto markets, with total crypto market capitalization rising by ~109%[(1)]. This impressive growth was driven by notable advances recorded in the first and fourth quarters of the year, which posted gains of 48.3% and 54.4% respectively. This resurgence is a stark contrast to a difficult 2022, when the market dipped by ~64%, driven by a series of destabilizing events such as the depegging of TerraUSD ("UST"), the bankruptcies of several lending institutions, and the fallout of FTX.

Figure 1: Total crypto market capitalization rose by 109% in 2023

Source: Coinmarketcap, Binance Research, as of December 31, 2023

Key to the strong performance in 2023 were several encouraging developments on the crypto landscape. Pivotal among these was the optimism generated by the spot Bitcoin ETFs, and the anticipation of the upcoming Bitcoin halving event. Apart from these crypto-related catalysts, a stronger macroeconomic landscape as exhibited by a resilient global GDP growth and slowing inflation rate, had also created a conducive environment for cryptocurrencies in 2023.

Despite the strong gains, 2023 was not without its share of challenges. In March, disruption in the banking sector spilled over into the crypto market, causing a temporary depegging of the USDC stablecoin. In August, traders incurred losses amounting to US$1B due to liquidations, fuelled by macroeconomic uncertainties related to China's economy and indications from the Federal Reserve that it was considering additional rate hikes. Remarkably, the crypto market demonstrated resilience, quickly recovering from these events and reclaimed its momentum with gains in the following months.

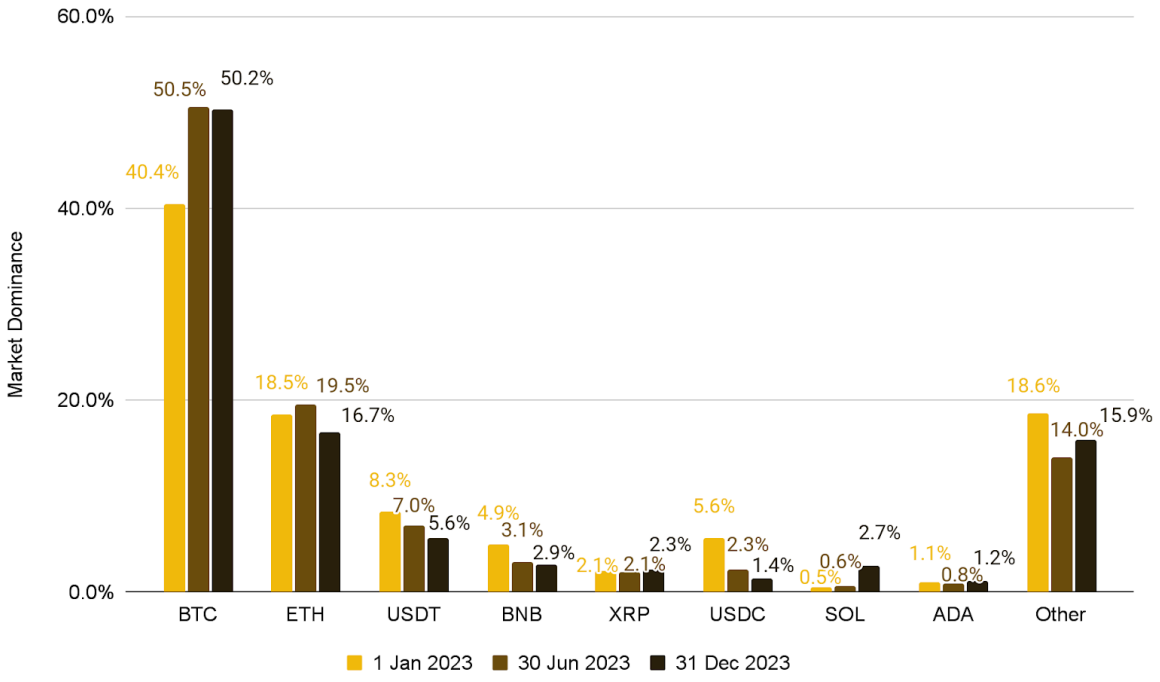
As we envisage the future of the crypto market, the lessons of 2023 underline the ability of the industry to adapt, innovate, and grow, even amidst challenges. The strong recovery of 2023 serves as the foundation for more breakthroughs, growth, and possibilities for the crypto space. In the latter part of this report, we spotlight several themes that we anticipate with interest in 2024.

3 The Layer-1 Landscape

3.1 Bitcoin

A very eventful year for Bitcoin, with **developments, including the advent of Ordinals, Inscriptions, and BRC-20 tokens, enabling a new era for Bitcoin to emerge in 2023.** While headlines over the last few years have often focused on smart contract behemoths like Ethereum, BNB Chain, and Solana, last year, Bitcoin did well to reclaim its place, both in the headlines and in market dominance. As we can see in Figure 2, through 2023, **Bitcoin increased its market dominance from 40.4% to 50.2%**, once again commanding over half of the total crypto market capitalization.

Figure 2: Bitcoin demonstrated a 24% increase in market dominance in 2023



Source: CoinMarketCap, Binance Research

When looking at the top crypto assets, Solana, Ripple, and Cardano showed increases in market dominance. However, the majority of other top assets declined. Combining this with the fact that the overall crypto market cap grew by over 109% across 2023[(1)], it would indicate that Bitcoin received an outsized amount of investment across this year, relative to alternative assets.

In this section, we explore some key Bitcoin metrics and how they have evolved this year. We then examine some of the primary narratives and developments that have underpinned these metrics and what we can expect as we head further into 2024.

Metrics

Figure 3: Bitcoin had a strong 2023

	1-Jan-23	30-Jun-23	31-Dec-23	% change
Financial				
Market Cap (US$B)	321.3	602.9	827.8	+158%
Trading Volume (US$B)	9.2	26.4	16.3	+77%
Network				
Transactions (7DMA)	246.1K	389.2K	557.0K	+126%
Active Addresses (7DMA)	879.1K	972.8K	800.1K	-9%
Average Tx Fee (US$, 7DMA)	1.2	2.9	18.4	1,433%
Lightning Network Capacity (US$M)	87.8	170.3	217.9	148%
Mining				
Hash Rate (EH/s, 7DMA)	253.1	356.5	508.8	101%
Mining Difficulty (T)	35.4	50.6	72.0	103%

Source: CoinMarketCap, The Block Data, Blockchain.com, Binance Research
7DMA = 7-day moving average

The strength of Bitcoin's year is clear in the metrics, with the majority of metrics displaying triple-digit growth. The network activity is very clearly impacted by Inscriptions and BRC-20s, and it is positive to see the continued growth of the Lightning Network to help

cater to new Bitcoin use cases. The solid growth in Bitcoin hash rate and mining difficulty, a measure of the increased numbers of resources being dedicated to Bitcoin mining, has also been impressive and continues to improve the network's resiliency.

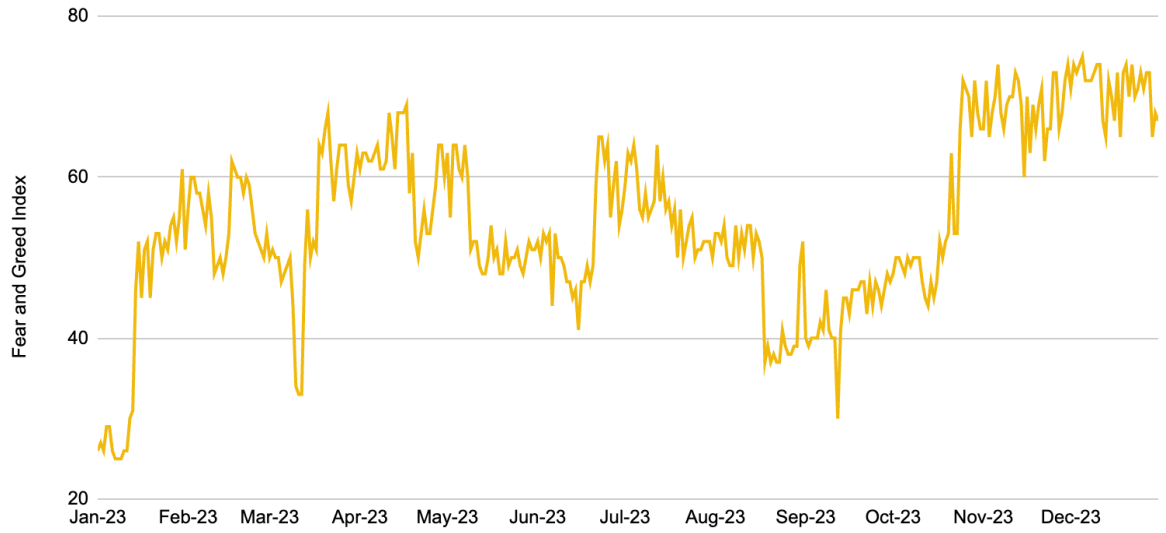
Sentiment Analysis

We can also consider Bitcoin sentiment analysis, which can offer valuable insights into the collective sentiment expressed by both market participants and the wider public towards Bitcoin.

One relevant metric is the Bitcoin Fear & Greed Index, a **widely-cited sentiment indicator that assesses market attitudes and investor psychology surrounding Bitcoin**. Ranging from 0 to 100, values below 50 indicate periods of 'fear,' while values above 50 indicate 'greed.' The index derives its values from various factors such as market dominance, trading volume, Google trends, social media sentiment, and price volatility, among others.

As we can see in Figure 4, this metric has exhibited fluctuations over the past year, but has shown a **consistent upward trend, climbing from the mid-20s to above 70**. While not a comprehensive measure, this **suggests an overall bullish sentiment towards Bitcoin throughout the year**, signifying a positive trend. Interestingly, the index displayed a **notable market surge around February (coinciding with the rise of Ordinals and Inscriptions)**, and only slipped back below 40 once since then, indicating a generally positive sentiment towards Bitcoin for a significant part of this year.

Figure 4: The Bitcoin Fear & Greed Index has increased over the last year



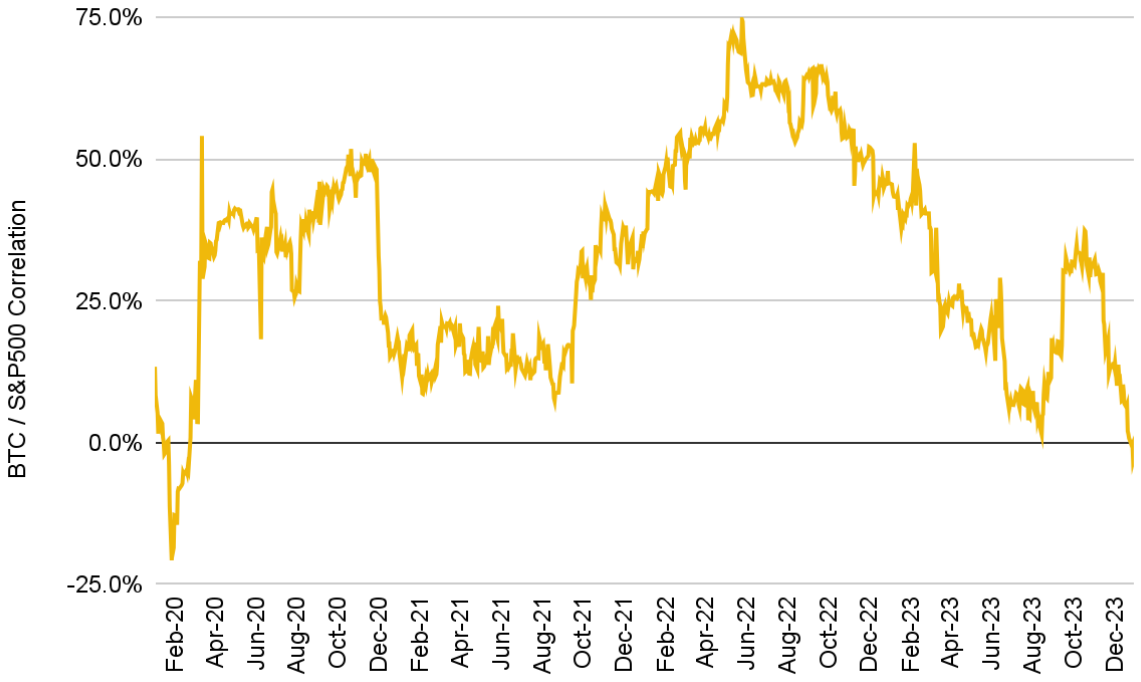
Source: Alternative.me, Binance Research, as of December 31, 2023

Correlation to Traditional Finance ("TradFi")

Bitcoin's relationship with TradFi markets has been consistently evolving. In the past, the correlation between Bitcoin and the S&P 500 fluctuated between -20% and 20%. However, in mid-2020, the correlation experienced a significant surge, eventually peaking at an unprecedented high of approximately 75% in May 2022. Notably, this increase coincided with global central banks initiating interest rate hikes.

Historically regarded as a potential diversification tool for investment portfolios due to its relatively independent price movements from traditional risk assets, Bitcoin's perception changed in 2022. Nevertheless, in 2023, the correlation reverted to its previous behavior. Currently, **Bitcoin's correlation with the S&P 500 is at its lowest in more than three years, rekindling the argument for Bitcoin as an effective portfolio diversifier.** The correlation declined from approximately 45% in January to a three-year low of roughly 0% in August, and currently hovers around 1%. This is in stark contrast with the 56% average observed throughout 2022.

Figure 5: Bitcoin's correlation with the S&P 500 is at its lowest in over three years and recently turned negative

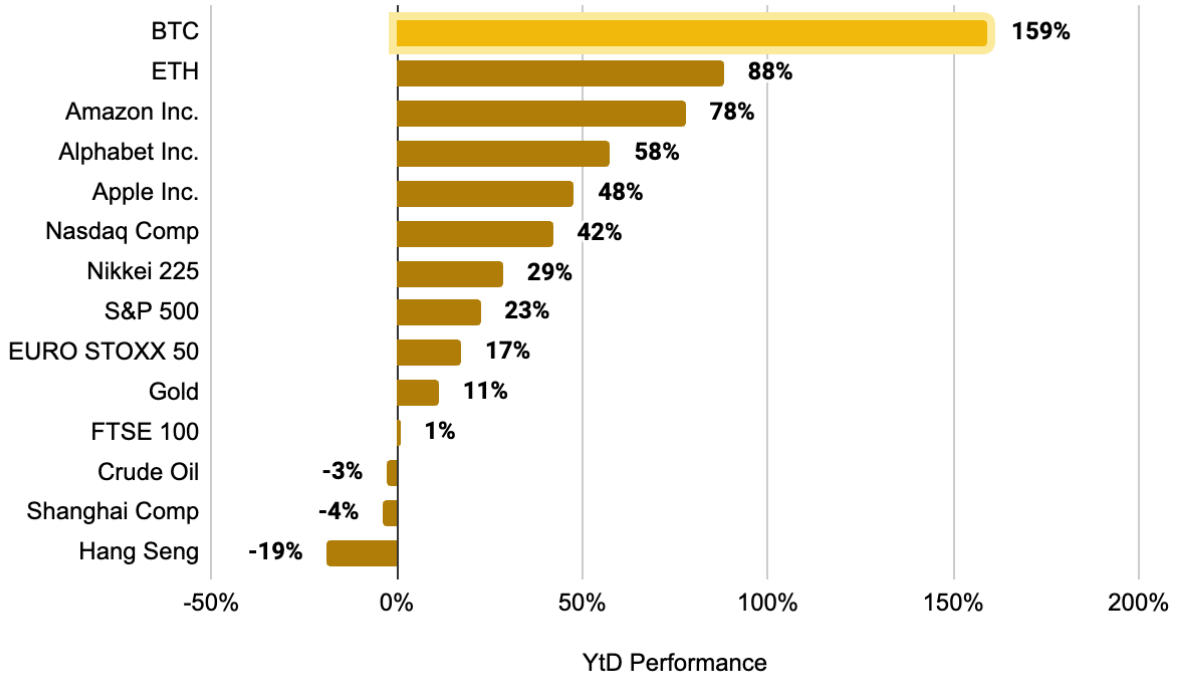


Source: Coin Metrics, Binance Research, as of December 31, 2023

Comparing Bitcoin's performance to other TradFi investments, Bitcoin comes out on top with its 159% gain across last year. $ETH gained 88%, while Alphabet and Amazon's stocks were the only other investments in our comparison group that were up over 50% last year. The major stock market indexes are much further behind, with many displaying single-digit returns while others are negative for the year. **Gold, the commonly touted Bitcoin alternative, rose only 11%, while crude oil was roughly flat.** This chart further

helps illustrate Bitcoin's potential diversification benefits and strong performance compared to a purely TradFi portfolio.

Figure 6: Bitcoin was the best performer in 2023 among a group of popular TradFi benchmarks



Source: Yahoo Finance, Binance Research, as of December 31, 2023

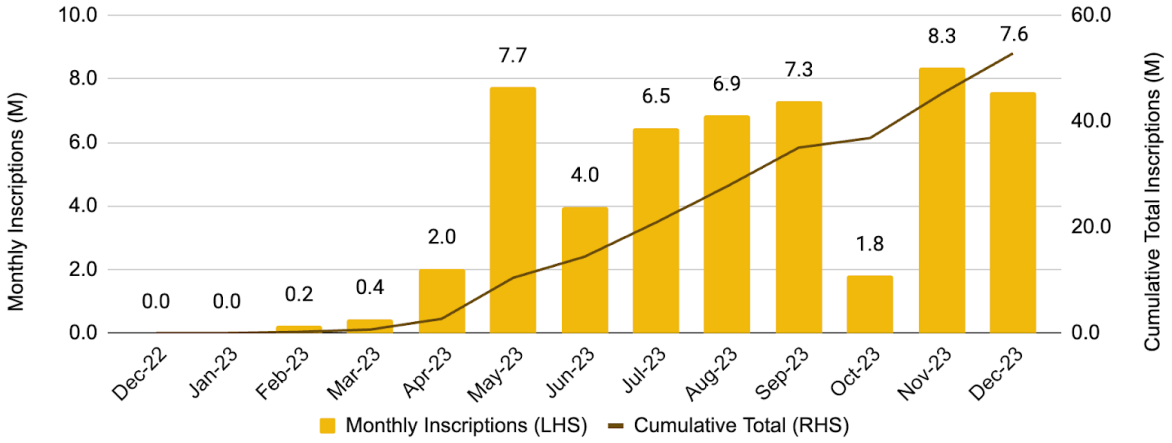
Ordinals, Inscriptions, and BRC-20s

One of the most significant developments for Bitcoin in 2023 was the advent of Ordinals and Inscriptions. Casey Rodarmor's "Ordinal Theory" enabled the **tracking of individual Satoshis (the smallest unit of Bitcoin), and ascribed a unique identifier to every single one. These individual Satoshis were then able to be "inscribed" with arbitrary content, e.g., text, images, videos, etc.** This created an "Inscription" or what soon became known as a Bitcoin NFT. For a more complete understanding, check out our report, "A New Era for Bitcoin?".

While initially, users were using this new technology to inscribe pictures and graphics into the Bitcoin chain, this soon changed with the addition of BRC-20s. First conceptualized in March 2023 by pseudonymous Crypto Twitter user domo[(2)], **BRC-20 is an experimental token standard that enables the deployment, minting, and transferring of fungible tokens on the Bitcoin blockchain**. Between BRC-20s and Inscriptions, both fungible and non-fungible tokens became part of the broader Bitcoin ecosystem. The idea behind BRC-20s is that JSON data (which is a text-based data format) can be inscribed onto individual sats via the Ordinal Protocol and create fungible tokens.

The first Inscription was minted in December 2022. While this number slowly increased, it was really when BRC-20s came about that minting volumes exploded. By early April, the number of Inscriptions had crossed 1M, with the month of May seeing a frenzy where this figure increased from around 2M to over 10M. In December, this number crossed the 50M mark. As of the time of writing, **there have been over 53M Inscriptions minted on the Bitcoin blockchain, generating over US$230M in fees**[3].

Figure 7: Total Bitcoin Inscriptions exceeded the 50M mark after the recent resurgence in minting volumes across November and December



Source: Dune Analytics (@dgtl_assets), Binance Research, as of December 31, 2023

In terms of the leading BRC-20 tokens, the **first token contract to be deployed was for the ORDI token**, which had a limit of 1K tokens per mint and a 21M maximum supply (in homage to Bitcoin's 21M maximum supply). ORDI remains the most successful and popular token, with listings on several prominent exchanges. **As of the time of writing, BRC-20 tokens have a combined market cap of over US$3.0B.**

Figure 8: The top five BRC-20 tokens by market cap

Logo	Ticker	Market Cap (US$M)	24H Volume (US$M)	Total Supply
	ORDI	1,497	526.6	21M
	SATS	1,420	71.9	2,100B
	rats	237	36.9	1,000B
	MUBI	154	22.9	950M

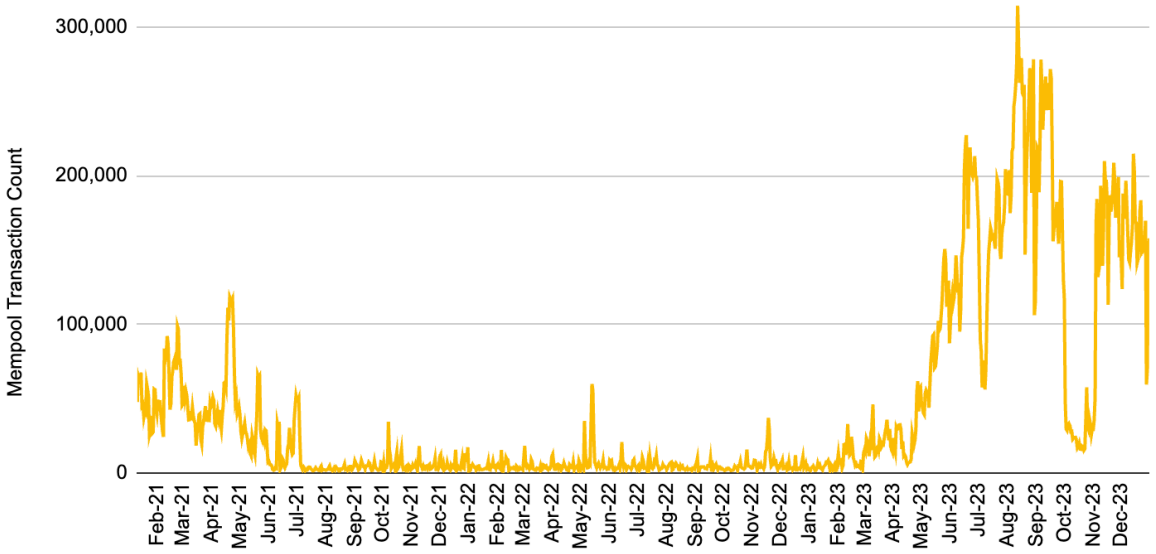
	TRAC	96	1.3	21M

Source: ordspace.org, Binance Research, as of January 9, 2023

Despite "BRC-20" being a play on Ethereum's "ERC-20" token standard, there are significant differences between the two. Most notably, BRC-20 tokens do not have any degree of smart contract compatibility and thus have relatively limited functionality. Furthermore, the market infrastructure for BRC-20s is far less developed. Naturally, this is a function of the lack of maturity in the BRC-20 token market when compared to ERC-20s, which have been around for many years. Check out our full report, "**BRC-20 Tokens: A Primer**", here.

Impacts

Figure 9: Bitcoin's mempool transaction count has been at all-time highs in 2023 following the activity generated by Inscriptions and BRC-20s



Source: Blockchain.com, Binance Research, as of December 31, 2023

Inscriptions, and BRC-20s have had a significant impact on various metrics of Bitcoin, such as average block size, mempool growth, and transaction fees. Many prominent community members welcomed the **increased fees in Bitcoin, recognizing its role in creating a more sustainable environment for miners**, who heavily rely on block rewards that diminish every four years (more detail here). However, some were critical, referring to the impact on peer-to-peer transactions in countries where Bitcoin serves as an alternative to local fiat systems. The important question raised was whether transactions, like sending US$10 to friends, must occur on the Bitcoin L1 network. This is exactly why the Lightning Network exists: for fast and cheap peer-to-peer payments.

Fees would also increase if Bitcoin reached a few million new users, so to blame Inscriptions and BRC-20s is largely illogical, as fees were bound to go up if mass adoption took hold. Instead, the focus should be on making it easier and more efficient to onboard onto the Lightning Network and to continue work on the L2 solutions for Bitcoin so that transactions can occur on a layer outside the Bitcoin L1.

In fact, the most noteworthy impact of this has been the **underlying excitement and innovation that Ordinals have generated** both within and outside the Bitcoin ecosystem. Numerous new builders have flocked to Bitcoin, many existing projects have shipping updates at a faster pace, and various new ideas are currently circulating within the Bitcoin community. The quick integration of Ordinals support from market incumbents like Xverse, Gamma, Leather (previously Hiro), alongside consistent product releases from Unisat are examples. Projects like **Liquidium**[4], which enable **borrowing and lending for Ordinals** are interesting, while the recent **US$7.5M raise**[5] **by Taproot Wizards**, an Ordinals-focused project based around a famous Bitcoin wizard meme is also worth mentioning. In terms of scalability, notable Bitcoin project, **Stacks, and their upcoming sBTC solution**[6] to create a decentralized, non-custodial, Bitcoin L2, is an interesting relevant development to follow.

While there has been consistent debate within the community regarding how these developments would affect Bitcoin's intended use as a form of hard money, ongoing innovation and development within the Bitcoin ecosystem have largely overshadowed these concerns. Ultimately, continuous innovation is necessary to create new and exciting use cases that can drive widespread adoption and it is exciting to see where Bitcoin can go next.

Spot ETF Discussion

The potential for a U.S.-regulated spot Bitcoin ETF has been a long-standing discussion, but significant strides were made in 2023. Notably, the resolution of the dispute between the U.S. SEC and Grayscale regarding the conversion of Grayscale Bitcoin Trust ("GBTC") into a spot Bitcoin ETF essentially concluded in favor of Grayscale. This led to a number of other players, including the likes of BlackRock, Fidelity, and Invesco, to also file spot Bitcoin ETF applications in recent months.

Currently, **there are 12 spot Bitcoin ETF applications undergoing review by the SEC, with the earliest final deadline set for this month and the latest in August 2024**. The market widely anticipates approval especially in light of the SEC's decision in the Grayscale case, and the consistent refiling and amendments that each applicant has been making to their ETF applications in order to maximize their chances for approval.

Post editing update

As widely expected, the **majority of these applications were approved by the SEC** on 10 January.

Figure 10: The final deadlines for the SEC to make a decision on Bitcoin spot ETFs occur in Q1-2024, starting in January

Final SEC Deadline	Company
10-Jan-2024	21Shares & ARK
14/15-Mar-2024	BlackRock, Fidelity, Bitwise, VanEck, Wisdomtree, Invesco & Galaxy
19-Mar-2024	Valkyrie
19-Apr-2024	Global X
30-May-2024	Hashdex, Franklin Templeton
Deadlines passed - in direct negotiations with the SEC	Grayscale

Source: Bloomberg, Binance Research

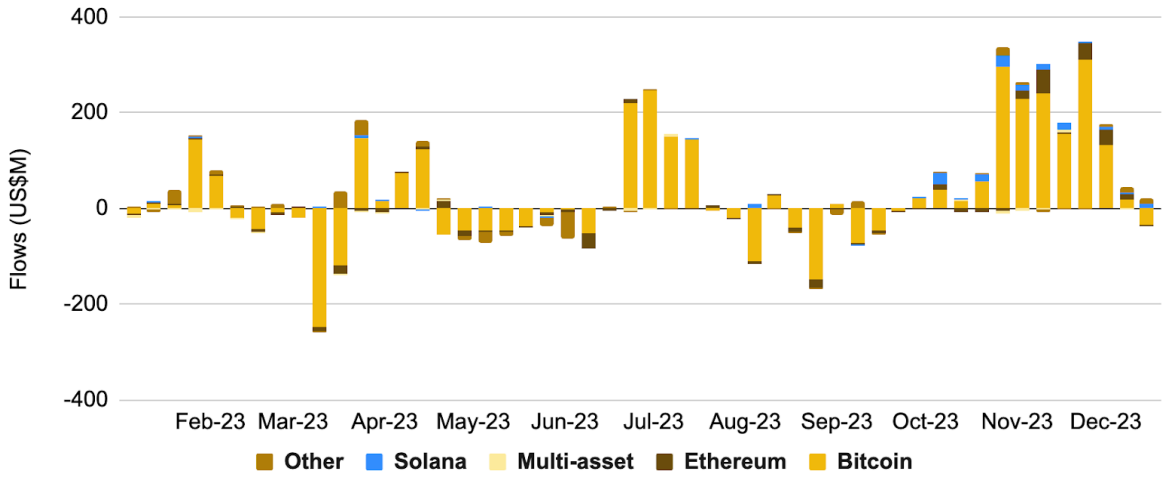
If approved, a spot Bitcoin ETF will tackle two primary drivers of Bitcoin adoption: **convenience / accessibility and mainstream acceptance.** Having the **spot ETF wrapper will provide many institutional investors with an easy, regulated, and widely-accepted way to add Bitcoin exposure** to their portfolios, as well as improve distribution. The stamp of global asset management giants like BlackRock, Fidelity, and Invesco, will **improve the perception of Bitcoin as a legitimate asset class, and help ease regulatory / compliance concerns for new investors**. This is expected to lead to a significant increase in inflows into Bitcoin, both from previously sidelined institutional investors, as well as, new retail investors who might previously have been wary.

A recent study[7] by Galaxy had a fairly conservative **estimate of US$14B of inflows at the end of Year 1 of a spot Bitcoin ETF**. In addition, we can consider the case study of the spot gold ETF. Specifically, the **first U.S. traded spot gold ETF launched in 2004**, prior to which it was very difficult to invest in gold. After the ETF launch, the **price of gold went up for seven years in a row**. This demonstrated the sizable market-mispricing of gold due to the lack of a suitable investment vehicle. While not directly comparable to Bitcoin, it is worth considering whether we might see similar moves in Bitcoin if a spot ETF does indeed get approved in the near future.

In fact, **recent crypto exchange-traded products ("ETP") data has demonstrated a sustained increase in inflows**. Although the majority of this data is retail-driven, the CoinShares team has also seen a rise in institutional interest. Furthermore, the rising inflows in crypto ETPs (which includes products like ProShares' Bitcoin futures ETF, Bitwise 10 Crypto Index, etc.) are also an **indication of increased investor interest in wanting**

crypto exposure in a more traditionally-regulated manner (versus using centralized or decentralized crypto-native exchanges). Digging deeper into CoinShares ETP data[8], we can see that **Bitcoin ETPs saw over US$1.9B in inflows last year, being the most popular asset by far (87% of all flows).** Additionally, total flows of US$2.3B were also the largest since 2017 and 2.7 times greater than the flows from 2022.

Figure 11: Global crypto ETP inflows have shown a marked increase since October, with Bitcoin the dominant asset by some way

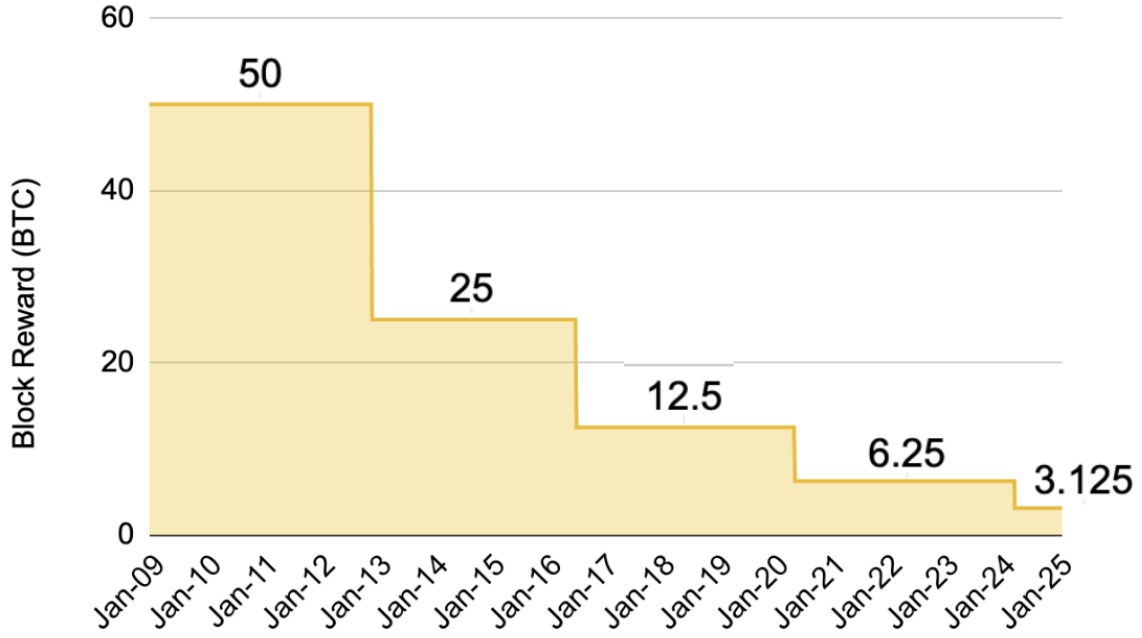


Source: CoinShares Digital Asset Fund Flows Weekly, Binance Research, as of December 18, 2023

Halving

Bitcoin miners are incentivized through two mechanisms: block rewards and transaction fees. The block rewards have traditionally accounted for the majority of miners' income, with transaction fees only recently showing increases in volume (after the launch of Ordinals). These block rewards are paid out for every newly mined block, which happens every 10 minutes on average, and are cut in half roughly every four years. The block rewards started at 50 BTC per block in 2009 when the Bitcoin blockchain first launched. Following halvings in 2012, 2016, and 2020, the block reward is currently 6.25 BTC per block. This number will halve to 3.125 BTC per block in April 2024.

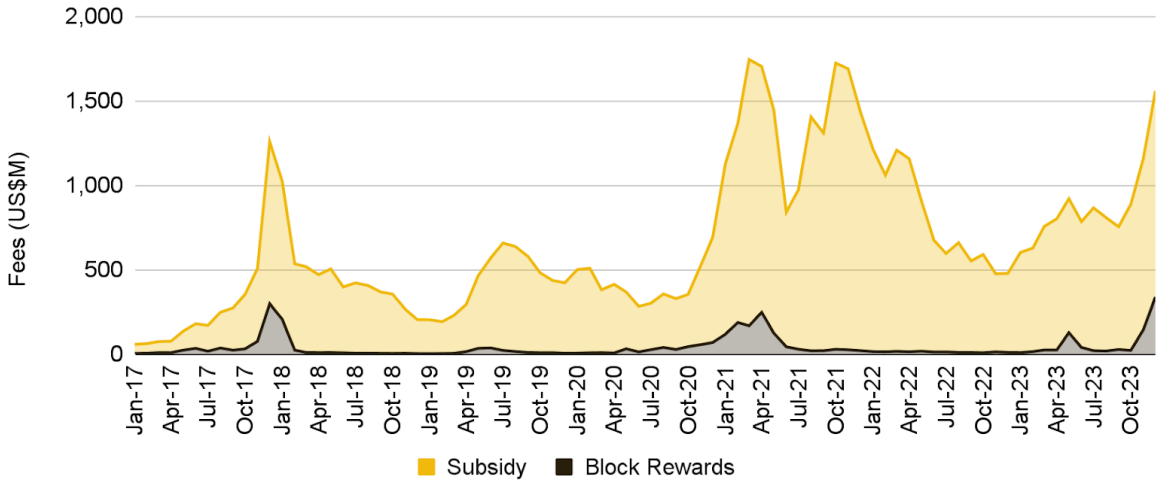
Figure 12: Bitcoin's mining reward is cut in half roughly every four years. The next halving is expected in April 2024.



Source: Binance Research

This discussion is increasingly **important as block rewards will eventually diminish to zero, meaning that Bitcoin's transaction fees will become the sole compensation for miners i.e. the security budget of Bitcoin**. Given the large historical difference between block rewards and transaction fees, the halving of block rewards will undoubtedly have a substantial impact on miner income. However, there are green shoots. As we can see in Figure 13, this year has seen two large bumps in transaction fee income (driven by Ordinals, and BRC-20 tokens). Although still small from a relative perspective, this is definitely a welcome addition to miner income and something that will become even more important next year following the Halving.

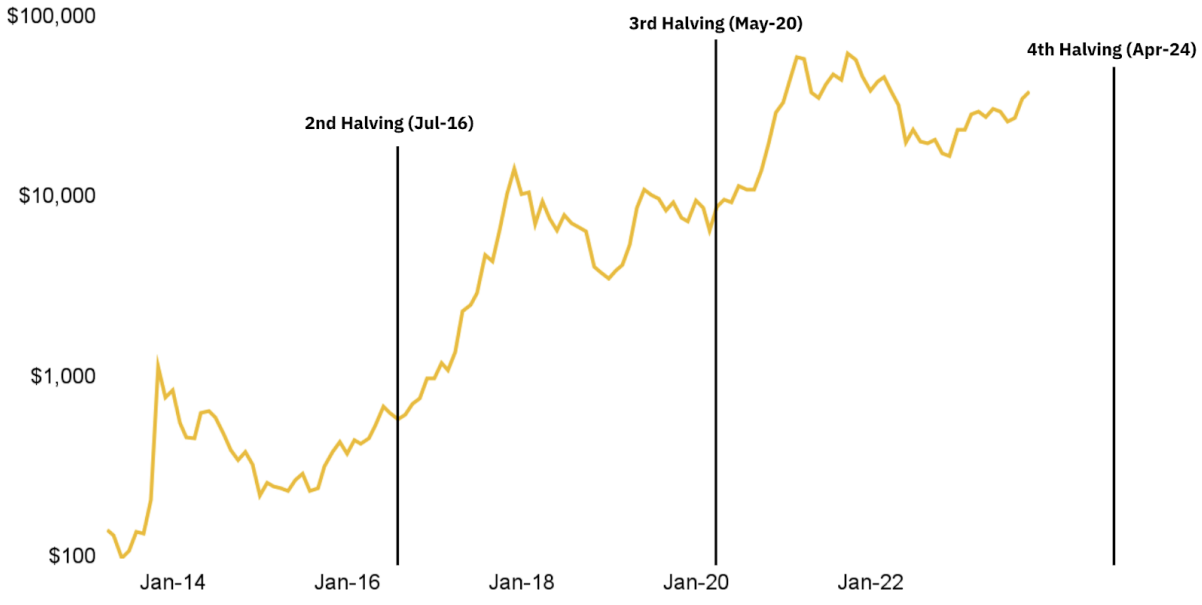
Figure 13: Bitcoin's annual security budget (block rewards + transaction fees) is largely composed of block rewards which are halved every four years and will eventually go to zero



Source: The Block data, Binance Research, as of December 31, 2023

Overall, the Halving essentially **creates further scarcity for Bitcoin, and reinforces the narrative of Bitcoin as digital gold**. Given Bitcoin is an asset with a fixed maximum supply of 21M coins, and the Halving reduces the rate at which new Bitcoin are created by 50%, basic economics would dictate that a rise in price is the natural next step. Historically, the event itself has been associated with heightened market volatility, although the overall crypto market has generally performed well in the year following the Halving.

Figure 14: Bitcoin's post-Halving has been generally strong, and Bitcoin has recorded a new all-time high price in each 4-year period between the halvings



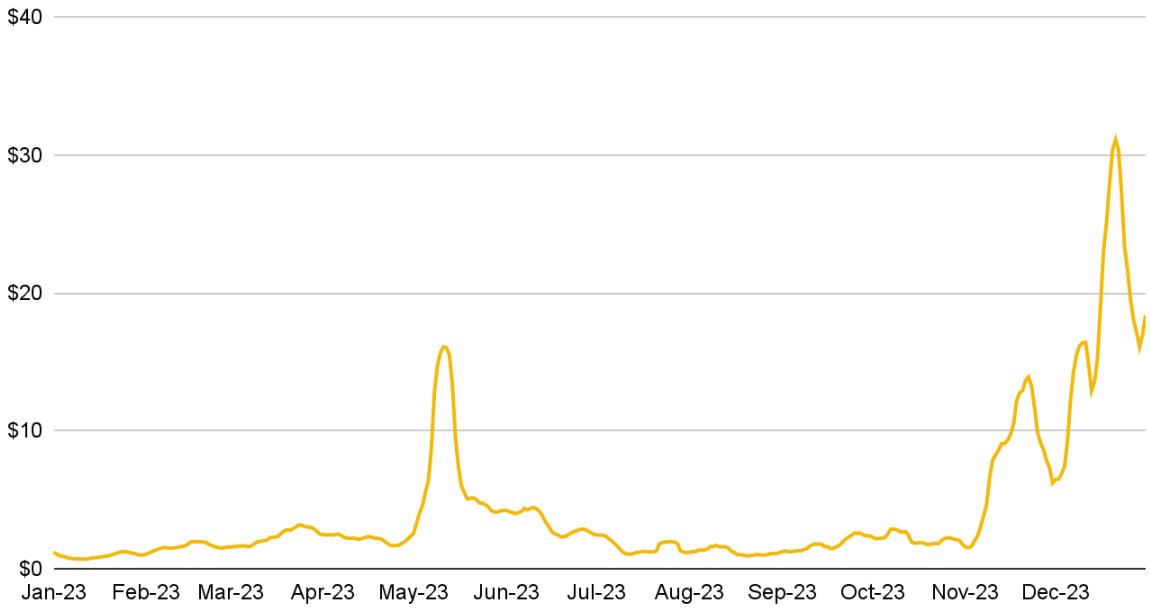
Source: CoinMarketCap, Binance Research, as of December 31, 2023

What Do We Expect Going Forward?

In a year full of innovation for Bitcoin, many ecosystem participants are expecting a similar path in the new year. Some of our expectations and things to watch for:

1. **Bitcoin L2s:** The **case for Bitcoin L2s has never been stronger**. Inscriptions and BRC-20s led to a very visible increase in Bitcoin's block size, mempool, and transaction fees, and many community members have been very critical of this chain congestion. While some have even called for the Bitcoin chain to be patched to prevent Inscriptions and BRC-20s, many others have received the uptick in chain usage very positively, particularly considering the positive impact on those securing the chain i.e., miners.

Figure 15: Average transaction fees on Bitcoin have trended upwards, with two notable spikes in the middle of BRC-20 mania



Source: The Block data, Binance Research, as of December 31, 2023

Ultimately, Bitcoin is a decentralized blockchain that is not centrally controlled by any one entity. Thus, the idea of simply patching the chain to prevent Inscriptions is unlikely to gather the required community support for it to be actioned. Furthermore, as previously stated, **similar fee spikes and congestion would occur if Bitcoin reached mass adoption and was able to attract just a few million more users**. Thus, the solution is clear - **Bitcoin L2s**.

The **Lightning Network** has made a great start and its continuous capacity growth is a great sign. Nonetheless, Lightning has its limitations and is not the perfect solution, so more work is needed here. **Lightspark's "enterprise-grade" solution[9] to onboard businesses onto the Lightning Network** is something interesting. Notable Bitcoin project, **Stacks, and their upcoming Nakamoto Release and sBTC**

solution[10] to create a decentralized, non-custodial, Bitcoin L2 is very relevant. With a testnet expected in Q1-2024, this is a very important development to follow. There is even the discussion of **Bitcoin's first ZK-rollup, with the Chainway Labs** [11] team working on a solution.

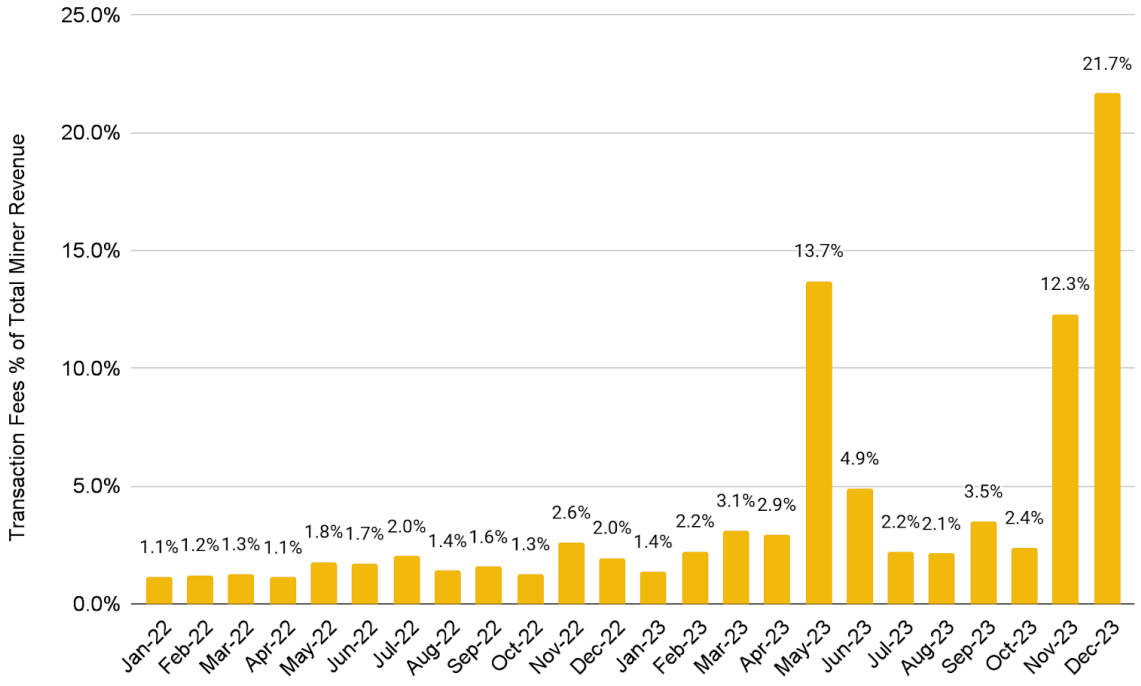
2. **Continued innovation Bitcoin use cases:** One thing that the past year has shown us is that **people want something to do with their Bitcoin**. Yes, there are undoubtedly those groups that are happy to leave Bitcoin in cold storage and let it accumulate value i.e., digital gold. However, there are also many in the Bitcoin community who want more. Perhaps the Bitcoin supporters who want some of the functionalities of the more expressive L1s, but with the iron-clad decentralized security of Bitcoin.

   The mania created by Ordinals, Inscriptions, and BRC-20s has shone a brighter light on these Bitcoin users and also attracted more to the community (including many new builders). **Bitcoin Frontier Fund's accelerator program** and its startups[12] might be interesting to look out. **ALEX**[13], who are **working on Bitcoin DeFi**, are also a company to keep an eye on, and recently announced the launch of their Bitcoin Oracle[14] to provide trusted indexing for BRC-20s. Lightning Labs' Taproot Assets[15], whose mainnet recently launched, is also worth noting. Although previously mentioned, we should again highlight, the underlying innovation, attention, and developer activity that Ordinals have brought to the Bitcoin ecosystem is perhaps their most important impact.

   "...the underlying innovation, attention, and developer activity that Ordinals have brought to the Bitcoin ecosystem is perhaps their most important impact."

   One other important factor to mention is the impact that these developments have had on **miner revenue**. As highlighted in the Halving section, Bitcoin's block rewards have historically been the primary component of miner revenue, with transaction fees making up a much smaller percentage. However, looking more closely at recent data from the last year, we can see **transaction fees have increased from an average of 1.6% of total miner rewards in 2022 to over 5.5% in 2023**. This also includes 13.7% in May and 12.3% in November. While we cannot conclude that this is exclusively due to Inscriptions and BRC-20s, we have relatively strong reason to think that a large part of this move has been due to these innovations within Bitcoin.

Figure 16: Bitcoin's transaction fees as a percentage of total miner revenue were over 370 times higher in 2023 than in 2022, on average



Source: The Block data, Binance Research, as of December 31, 2023

Remember, block rewards will eventually diminish to zero (and be halved in April 2024), but miners will still need to be paid to secure Bitcoin. Given transaction fees are going to have to make up for that loss in revenue, this recent trend of increasing fees can be seen as a very positive move. If **innovative use cases continue to develop for Bitcoin, and the chain can find more ways to create transaction fees for its miners, this will help solve one of the longest-standing issues that the Bitcoin community has been discussing for years.** It is clear that Ordinals have helped to unlock a sizable chunk of demand for Bitcoin's block space, and we look forward to seeing what new and exciting use cases can emerge in 2024 to keep compounding on this move.

3. **Spot ETF inflows:** As discussed in the Spot ETF section, the **deadlines for the SEC to approve a spot Bitcoin ETF are spread across the first half of 2024**. The number of amendments and refilings that the ETF issuers have done are indicative of constructive discussions with the SEC and are among the reasons that the market sees the approvals as imminent. With numerous **estimates of multi-billion dollar inflows into Bitcoin following the approval of a spot ETF**, it feels like such an approval might be one of the most significant events in Bitcoin's history (so far).

   One other angle to consider is how an ETF approval will create **structural demand for Bitcoin**. For instance, many traditional institutional investors, especially pension funds or endowments (those with higher risk-aversion), tend to slowly build up

positions over many months and years. What this involves is a regular buying cycle, perhaps every week or month, which helps create a regular and structural demand for the product. This is in contrast to "fast money" i.e., hedge funds or high-frequency traders, who might be trying to get in and out of positions on very short time horizons. The fact that the **spot ETF will help open up Bitcoin as an asset class to the more traditional investors**, and help create a structural demand, might lead to very positive moves and price support for Bitcoin, the likes that we only really see in traditional equity / bond markets.

3.2 The Other L1s

Overview

Figure 17: A summary of where things stand for the major L1s (as of FY 2023)

	Ethereum	BNB Chain	Solana	Tron	Avalanche
Financial					
Market Cap (US$B)	274.4	47.9	44.4	9.3	14.4
Trading Volume (US$M)	6,871	953.2	1,748	206.2	578.3
2023 Revenue (US$M)	2,041	17.7	14.2	1,003	65.3
Network					
Daily Txs (M)	1.1	6.7	23.7	4.1	1.1
Daily Active Addresses (K)	351.9	2,250	560.7	1,420	55.6
Average Tx Fee (US$)	3.8	0.09	0.006	n/a	0.01
Ecosystem					
Staked Supply	23.9%	14.2%	87.8%	50.3%	59.6%
Total Developers (as of Oct 1, 2023)	5.769	600	946	60	405
DeFi TVL (US$B)	28.7	3.5	1.4	8.1	0.9

Source: CoinMarketCap, Token Terminal, Artemis.xyz, Block Explorers, Flipsidecrypto.xyz, stakingrewards.com, Electric Capital, DeFi Llama, Binance Research. Data as of December 31, 2023.

When looking at the high-level metrics, it is clear that **Ethereum remains in a position of strength and leads on numerous fronts i**ncluding market cap, daily trading volume, yearly revenue, DeFi TVL, and total developers. **BNB Chain holds a respectable second place in many key metrics**, including daily transactions, and market cap, while leading in terms of daily active addresses. **Total developer numbers** are interesting to note, with Etheruem leading by a large margin, with BNB Chain, Solana, and Avalanche with comparable numbers, while Tron's developer community remains smaller.

Ethereum

As a very broad summary, Ethereum's story across 2023 has been an **amalgamation of liquid staking, L2s, and the modular thesis**. The year started with hotly anticipated **Shanghai Upgrade**, which enabled withdrawals of staked $ETH (that had previously been locked as Ethereum completed its transition from proof-of-work to proof-of-stake). Following the successful upgrade, **staking (particularly liquid staking) saw a notable uptick**. This, in turn, birthed the sub-sector of **LSTfi,** providing users with more ways to unlock yield on their staked $ETH. While all of this was happening, **Ethereum's L2 rollups grew significantly**, with numerous announcements and launches. A number of **zkEVMs launched** their mainnet, while the **leading optimistic rollups launched their L3 solutions** with the OP Stack, and Arbitrum Nitro.

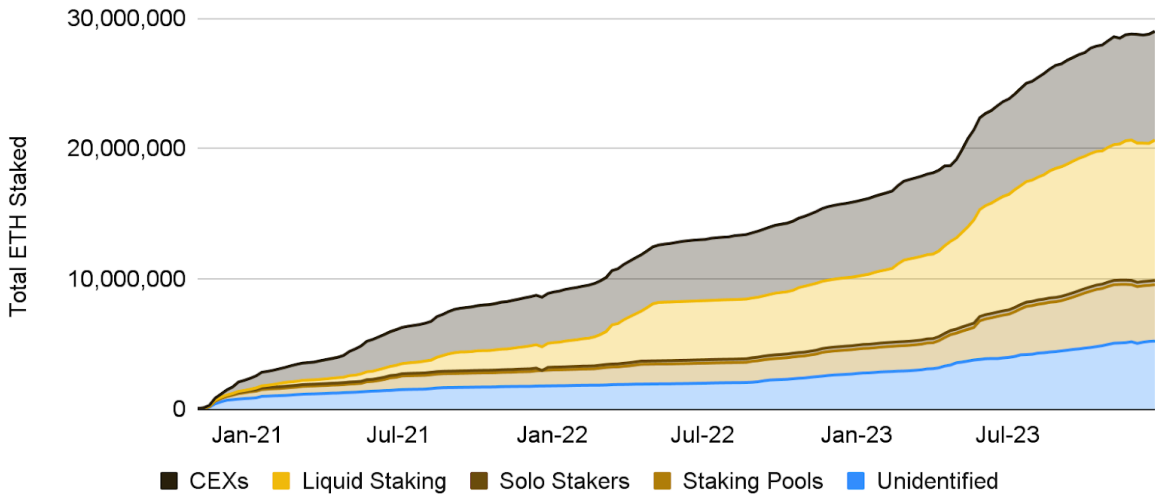
- **Liquid staking reaches new heights[16]:** Heading into 2023, one of the key stories was that of the Shanghai Upgrade unlocking staking $ETH (some of which had been locked since the Beacon Chain first launched in December 2020). While some were concerned that the unlock might be a source of volatility, in reality, **since the upgrade on April 12, there has been an inflow of over 9.4M $ETH into the staking contract**.

  Liquid staking protocols have taken in nearly 50% of this inflow, gaining over 5.5M $ETH across 2023. **Lido** has been a big winner, being the leading $ETH staker (**~32% of all staked $ETH is through Lido**) and the **top DeFi dApp** with over US$21B in TVL[17]. **Liquid staking is the most popular way to stake $ETH**, followed by centralized exchange ("CEX") staking. Clearly, users value the freedom to delegate the task of managing staking infrastructure to another party, while also benefiting from the liquidity provided by liquid staking tokens ("LSTs") like Lido's stETH, Rocket Pool's rETH, and Binance's BETH. Nonetheless, as seen in Figure 17, **Ethereum's staking ratio remains relatively low** and it'll be interesting to see how this number moves across 2024.

  The Stage 1 Mainnet launch of the highly anticipated restaking protocol, **EigenLayer**, was also a notable moment and one that has invited polarizing views across the Ethereum community. While many restaking it to be the natural progression of a developing L1, others are concerned about the potential consequences of the

rehypothecation of staked $ETH. EigenLayer has steadily expanded its restaking caps and **currently has over US$1.5B in TVL[18], with support for 9 different LSTs, in addition to native ETH restaking.**

Figure 18: Liquid staking commands ~37.1 of the total ETH staking market



Source: Dune Analytics (@hildobby), Binance Research, as of December 31, 2023

- **Emergence and initial growth of LSTfi:** LSTfi can be seen as **a marriage between liquid staking and DeFi,** and was one of the results of the Shanghai Upgrade supercharging the market for liquid staking. LSTfi protocols offer yield-generating opportunities for holders of LSTs. These include yield-trading protocols, indexing services, projects that allow users to mint stablecoins using their LSTs as collateral, etc. At this relatively early stage, the market is relatively concentrated among the top protocols, although we expect this to change as more new projects enter in the coming months. The **relatively low staked ETH percentage is a potential structural tailwind for this sector** (as outlined in Figure 17).

Figure 19: LSTfi TVL grew to over US$1.6B by the end of 2023

Source: Dune Analytics (@defimochi), Binance Research, as of December 31, 2023

- **Modular thesis grows:** the modular thesis was in full swing across 2023 with a number of key releases. As a refresher, the **modular blockchain thesis calls for unique, specialized layers to perform the four core functions of a blockchain (consensus, data availability, execution, and settlement), rather than one monolithic structure to do them all**. The idea is that, by separating the functions, different layers can specialize and become maximally efficient at their one role.

  Rollups (and other L2s) **specialize in the execution** function. In terms of announced and released rollups, the numbers are at an all-time high. In fact, 2023 very much represented the beginning of the L3 thesis, with the OP Stack, Arbitrum Nitro, zkSync Hyperstack, and others starting up and launching their platforms. **Rollup-as-a-service ("RaaS")** providers like Conduit further helping things along by providing developers with the option to deploy their own rollup more easily than ever before. **Shared & decentralized sequencing** has also been having its moment, with notable work being done by teams like Espresso, and Astria.

  The latest and one of the most highly anticipated modular networks, **Celestia**, which focuses on **data availability ("DA")** also recently launched its Mainnet Beta[19]. Competing DA layers, **Avail**[20] and **EigenDA**[21] are **expected to launch in 2024**.

- **Spot $ETH ETF:** Many of the major TradFi asset managers who filed for spot $BTC ETFs, have also filed for spot $ETH ETFs, including BlackRock and Fidelity. It will be interesting to see how these approvals go, particularly if the (widely expected) spot $BTC ETF gets approved in the near future.

Figure 20: A number of prominent TradFi asset managers have filed for spot $ETH ETFs

Final SEC Deadline	Company
May-2024	VanEck, 21Shares & ARK, Hashdex
Jun-2024	Grayscale Ethereum Trust Conversion
July-2024	Invesco & Galaxy
~Aug-2024	BlackRock, Fidelity

Source: Twitter (@JSeyff), Binance Research, as of December 11, 2023

BNB Chain

BNB Chain saw continued ecosystem growth, with the notable announcements of **BNB Greenfield**, a next-generation **data storage** platform, as well as **opBNB**, an **optimistic L2 for BNB Chain** based on the OP Stack. **DeFi** remains a bright spot, with BNB Chain's **US$3.5B+ total value locked ("TVL")**[22] firmly placing them as the third-largest chain for DeFi. Within DeFi, **PancakeSwap** continues to be the largest dApp, commanding over US$1.5B in TVL, with lending protocol, Venus, second-placed at ~US$990M.

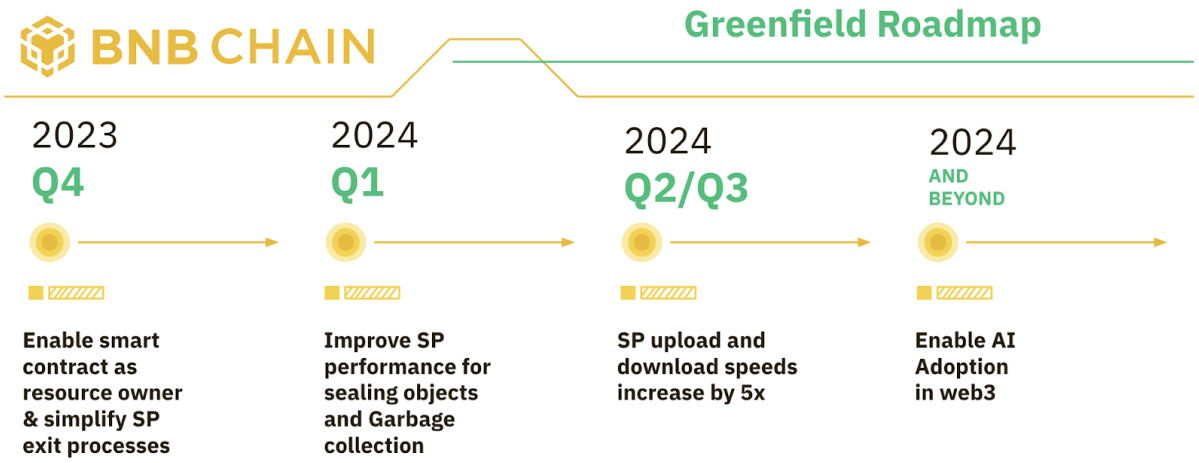
- **Focus on scalability with opBNB:** opBNB is an L2 solution that leverages Optimism's OP Stack (learn more here) to build an optimized scaling solution for BNB Chain. opBNB is **EVM-compatible**, capable of over 4K transactions per second ("TPS"), with an **average transaction fee of US$0.001**[23]. This combination makes opBNB potentially attractive to developers working on applications that require high-frequency microtransactions, e.g., gaming.
    - Since going live in September, opBNB has recorded **over 70M transactions across 900K+ daily active accounts**[24]. Leading dApps include NFPrompt, an AI-driven platform for creators, and social-learning focused, Hooked Protocol.

Figure 21: opBNB's daily active accounts hae been growing steadily with a notable spike in December, which was possibly related to the launch of BNB Chain inscriptions

Source: opbnbscan.com, Binance Research, as of December 31, 2023

- **Decentralized data storage with BNB Greenfield:** BNB Greenfield provides decentralized data storage infrastructure within the broader BNB Chain ecosystem. It is a **storage-oriented blockchain where users can create, store, and exchange data that they fully own.** With the use of a native cross-chain bridge, all of the data stored in BNB Greenfield can easily be transferred to BNB Smart Chain, where it can be used by BNB Chain dApps and any new BNB Greenfield dApps. **Use cases include website hosting, cloud storage, blockchain data storage, publishing, personal data markets,** etc.
    - More details can be found on the official website here. BNB Greenfield launched their **mainnet in Q4 2023** and have seen around 190 GB of storage[25] in the first few weeks after launch. They have also released a detailed whitepaper alongside an updated roadmap.

Figure 22: The recently launched BNB Greenfield roadmap



Source: BNB Chain website, Binance Research

Solana

Solana has been at the forefront of the market narrative in recent weeks and months. Despite having been deeply affected by some of the events of 2022, **Solana ended the year on a high** and native builders truly showed off their bear market work. For instance, consider the recent airdrops conducted by those like MEV-linked liquid staking provider, **Jito Network**, and oracle project, **Pyth Network**. This has coincided with a **rise in DeFi TVL**[26], which **rose by over 113%** in December to over US$1.4B by the end of 2023, more than any other major chain. Jupiter, a major DEX aggregator that ties the ecosystem together, has also started airdroppings its native token in the first of various rounds[27].

It also **seems that Solana's network outage issues**[28] **are behind it**. While in 2022 Solana saw a number of network outages, there was only one such incident in 2023 (early in the year in February). These incidents are expected to further reduce next year with the upcoming release of **Firedancer**[29], a new, independent, validator client. The benefit of Firedancer is **increased network reliability and resiliency,** i.e., if a bug takes down one of the clients, the network can remain running on the other. Additionally, **Firedancer aims to significantly bolster Solana's scalability** (Firedancer has processed 1M+ TPS in tests[30], much more than Solana's current average of ~4K[31]) and **reduce latency times**, which should help give Solana a performance boost.

- **Narrative changing:** The price of $SOL started 2023 under US$10, with the narrative around the chain heavily negative amid the FTX scandal. However, the year progressed well with developments like the launch of **Solana's Saga mobile** followed by rising activity and volumes in their DeFi ecosystem. Launches like **$BONK** also had a positive effect which compounded over time. The Solana narrative increasingly shifted away from the FTX overhang towards the work that Solana has continued to do through the BUIDL market of the last couple of years.

- **Airdrop Season:** Some of this work was most evident among the major **DeFi** projects of Solana, which kicked off a bit of an **airdrop season**. Such periods of time are especially important for L1 ecosystems as **loyal users get rewarded with funds, at least some of which are redeployed within the broader ecosystem**. E.g., users who received the $JITO and $PYTH drops most likely deployed some of their funds into other Solana projects, helping the ecosystem chug along. This so-called "**wealth effect**", i.e., the idea that consumers spend more as their wealth increases, is important and can be a significant tailwind for any ecosystem.

    - Closely related to the airdrop season are **points systems**. Teams like Jito aggregated **user activity to provide users with points**, which linked to their airdrop i.e. larger allocations for those users with more points. Other major DeFi projects like **MarginFi**, **Kamino Finance**, and **Parcl** have also implemented similar points systems. While not confirmed, many in the community think that these might be a factor in potential upcoming airdrops from these protocols. This has further helped generate user activity within Solana.

- **Saga:** Solana made a push toward Web3 hardware in 2023 and launched **Saga**[32], an **Android mobile phone that is tightly integrated with the Solana blockchain**. The phone focuses on easy and secure Web3 transactions and the management of digital assets such as tokens and NFTs. They also launched the **Solana Mobile Stack** ("SMS"), an open-source software toolkit for building Android applications that can interact with the Solana network.

    - While sales were initially not as strong as expected, things really picked up towards the end of the year. Firstly, the rise of **$BONK** created a lot of attention, with the memecoin rising over 3000% from ~US$41M in November to an all-time peak of over US$1.4B in early December. With **Saga owners eligible to claim 30M $BONK tokens, with the price rise, the airdrop became more valuable than the price of the phone,** leading to a surge in sales. Perhaps unsurprisingly, the Saga sold out[33] in mid-December.

    - Others such as Access Protocol and Honeyland have also already offered incentives to Saga users, with top projects like Solend[34] expected to continue the trend. Saga users also benefit from various other perks, including a **free 30 day trial[35] of Helium Mobile**, which is the crypto-powered 5G service built on the Helium Network, which also runs on Solana.

- **Solana dApps: DePin and Payments:**

    - Decentralized Physical Infrastructure ("DePin") is one of the most interesting innovations in the crypto world and something to keep a close eye on in the

coming year. **Solana has very much become the home of DePin, playing host to the likes of Helium, Render, Hivemapper, and others.** DePin forms part of the class of dApps that are seen as "only possible on Solana", owing to its localized fee markets and high throughput (relative to other major networks, which are largely EVM-based and may not be ideal for the intensive use cases seen on Solana). Things are progressing well, for example, **Hivemapper**, a community-powered, decentralized mapping service, has **already mapped over 10% of global roads**[36].

- Payments is another major use case that Solana is working on, with **Solana Pay**. 2023 saw a number of announcements, including a collaboration with **Visa**[37] to pilot USDC settlement, a partnership with e-commerce giant **Shopify**[38], as well as, the launch of tools like **TipLink**[39] which allows users to send crypto with a link and without any wallet requirements.

- **Tinydancer and Token-22:** A couple of other important developments to track are the upcoming launch of Tinydancer and the Token-22 token standard. **Tinydancer**[40] **will be the first light client for Solana** and is a response to the common criticism of Solana's expensive hardware requirements for validators. Tinydancer will help combat this by letting lower-cost verifiers check the work that **higher-cost validators are doing and improve network reliability. On the other hand, Token-22 is a new programmable token standard that aims to enable the development of new applications**, for example, collecting royalties on transfers and confidential payments. Token-22 is expected[41] to be released later this year.

Avalanche

Avalanche continued to progress on Subnets and corporate partnerships, especially within gaming and RWAs.

- **Subnet update:** Avalanche Subnets provide the ability to create app-specific blockchains for different use cases with their own customizable network parameters. The gaming-focused DeFi Kingdoms were the first to launch in 2022, and many others have since launched or are in the process of launching[42]. Examples include the first **central limit order book ("CLOB") DEX** built on a Subnet, **Dexalot**, and **e-sports NFT dApp, Loco Legends.** The Subnet with the most validators, 17[43], is the "Neobank for digital money[44]", **MELD**. Upcoming shoot-em-up game, Shrapnel, and Solert Games' Subnets are also notable mentions within the broader Subnet gaming universe.

Figure 23: The top Avalanche Subnets

Logo	Subnet	Validators
	Avalanche (C-Chain)	1702
	Avalanche (P-Chain)	1702
	Avalanche (X-Chain)	1702
	Meld	17
	Gunzilla	11
	Dexalot	10
	Shrapnel	10
	UPTN	10
	Solert Games	9
	Numbers EVM	9

Source: Avalanche, Binance Research, as of December 28, 2023

- **Evergreen Subnets:** The launch of Avalanche **Evergreen Subnets[45], a suite of deployments, customizations, and tooling designed for financial service-related use cases**, was an important development.
    - The first Evergreen product was Spruce[46] which was **used as a testnet by TradFi institutions, including T. Rowe Price Associates, Wisdom Tree, and, Wellington Management,** to evaluate the advantages of executing and settling trades on-chain. Most recently, Onyx by J.P. Morgan and Apollo Global partnered[47] under the Monetary Authority of Singapore's ("MAS") Project Guardian and used an Evergreen Subnet for their proof-of-concept.

- **Republic Note & Corporate Focus:** Investment firm, Republic, launched their new profit-sharing Republic Note[48] product on Avalanche. The **Note provides access to dividends accruing from investment profits from Republic's private equity portfolio**. It is also listed on Avalanche-powered trading platform, INX. Alongside partnerships with the likes of Shopify, KKR, AWS, Tencent Cloud, and others, we continue to see **Avalanche's focus on onboarding corporate clients**, especially those with a financial focus.

Cosmos

As a brief recap, the **Cosmos ecosystem is centered around the Cosmos Hub, which is an appchain secured by the $ATOM token**. A number of other appchains, referred to as "**Zones**," are connected to the Cosmos Hub and use the **Inter-Blockchain Communication** ("IBC") protocol to communicate and transfer data between one another. A "Hub" is essentially a Zone that facilitates communication with multiple other Zones. The Cosmos Hub was the first such Hub, however, many other Hubs exceed it in terms of activity[49]. Other leading Hubs include **Osmosis, Celestia, Axelar, and Injective**. At the time of writing this report, there are **83 activeIBC-enabled Zones** in the Cosmos ecosystem, with a **market cap of over ~US$43B**[50].

Figure 24: On-chain activity of the top five Cosmos appchains from the last 30 days

Logo	Name	IBC Volumes (US$M)	Total Txs (M)	Monthly Active Users (K)
	Osmosis	1,547	8.9	259.3
	Cosmos Hub	548.4	2.7	418.2
	Axelar	370.6	11.9	17.8
	Noble	307.1	0.1	5.2
	Celestia	295.3	6.5	440.8

Source: mapofzones.com, as of January 10, 2024

- **Replicated Security:** This was one of the most important narratives of 2023 for Cosmos and remains a crucial story to follow given its potential impact on the future of the ecosystem.

One of the key goals of large parts of the Cosmos community has been to establish the Cosmos Hub as a central network of economic security (and thereby find meaningful ways to accrue value to the $ATOM token). Cosmos took a meaningful step towards realizing this vision through **the launch of their shared security system, Replicated Security.** In a nutshell, "consumer chains" can benefit from the economic security of the Cosmos Hub and its validator set in exchange for fees. This helps newer and smaller chains bypass the need to bootstrap their own validator set, which is a costly and time-consuming process (and even then, they might not be able to match the security of the Cosmos Hub).

"In a nutshell, "consumer chains" can benefit from the economic security of the Cosmos Hub and its validator set in exchange for fees. This helps newer and smaller chains bypass the need to bootstrap their own validator set, which is a costly and time-consuming process..."

Neutron, a general-purpose, permissionless smart contract platform, became the **first project to launch as a consumer chain** in May last year[(51)]. **Liquid staking protocol Stride became the second.**

It is important to monitor how these chains progress. Liquid staking, particularly on Ethereum, has grown significantly in recent months, and thus, it will be interesting to see what level of growth Stride can bring to the Cosmos liquid staking market. No doubt we will also see more appchains deploy using the replicated security model.

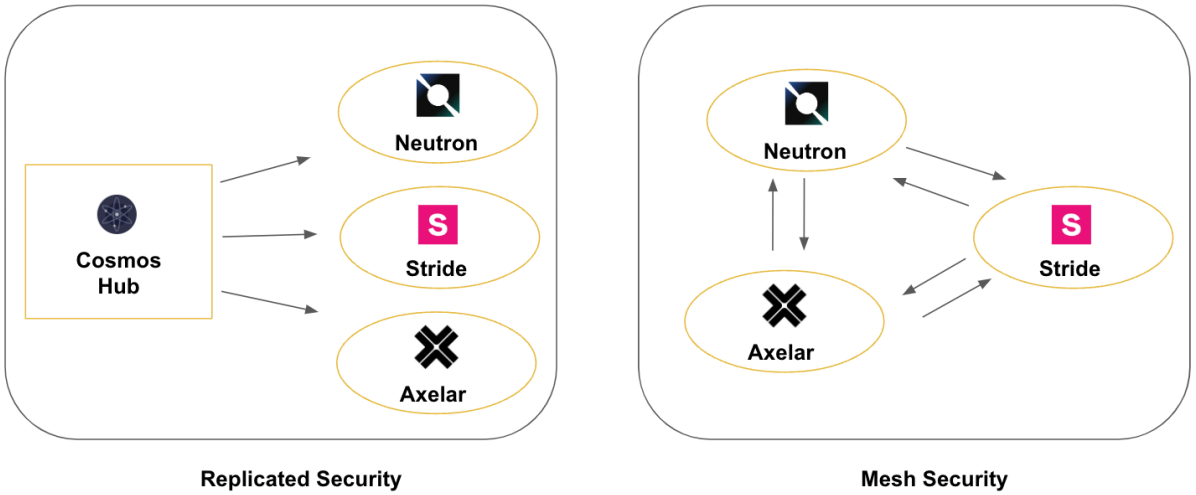
To learn more about Cosmos' Replicated Security and the types of models other chains are using to compete, check out our report, Modular Blockchains: The Race to Become the Top Security Provider.

- **Mesh Security:** Another shared security model that is currently being developed in the Cosmos ecosystem is Mesh Security. **Osmosis, a notable Cosmos appchain, is the project behind this model**, and it is working alongside others in the ecosystem, e.g., Axelar, the Akash Network, etc. Rather than a hub-and-spoke model, as with Replicated Security, Mesh Security essentially allows for bilateral and multilateral sharing of economic security between many different appchains. **Those that have staked tokens on one Cosmos appchain can restake those on another partner chain, thereby sharing security between appchains.**

  Mesh Security **targets appchains that are looking to augment their current level of economic security** rather than those that are looking to bootstrap an entire validator set (who might be better off using Replicated Security). **Many appchains already have significant validator overlap and thus already share some level of**

economic dependency; utilizing Mesh Security is a natural next step to further strengthening these relationships. Mesh Security is still in development, with the initial announcement having come in May 2023[52]. Expanding Mesh Security is even part of the Cosmos Hubs' 2024 roadmap.

Figure 25: While Replicated Security uses a hub-and-spoke, unilateral security model, Mesh Security is more focused on bilateral or multilateral security



Source: Binance Research

- **Celestia and dYdX Chain go live, Babylon Chain coming:** while we have seen a number of Cosmos projects perform well, we wanted to highlight a few of the most significant launches - anything to add on Cosmos Collaborative Finance?
    - **dYdX Chain**: Leading derivatives exchange dYdX finally launched **dydX v4 as a Cosmos appchain**, moving away from their previous Ethereum-based StarkEx L2 solution. The move was initially announced in 2022, with the customizability available for a Cosmos appchain a key driver for dYdX to consider the move. Since trading went live in November, dYdX Chain has already recorded **over US$5B[53] in trading volume**. Depending on how things continue for the derivatives giant, it will be interesting to observe whether we see more dApps migrate to their own appchains.
    - **Celestia**: Perhaps the most hotly anticipated launch of the year, **modular data availability ("DA") network**, Celestia, launched to great market fanfare on Halloween 2023. Having gone live with a number of integrations, Celestia has continued to announce more. All types of L3 chains, including **Arbitrum Orbit, Polygon CDK, and OP Stack chains can all integrate with Celestia as a DA layer**. In addition, all of the major RaaS platforms, including Conduit, Caldera, AltLayer, and many others, feature Celestia integrations. Market performance has also been positive, with the $TIA token rising nearly 450%

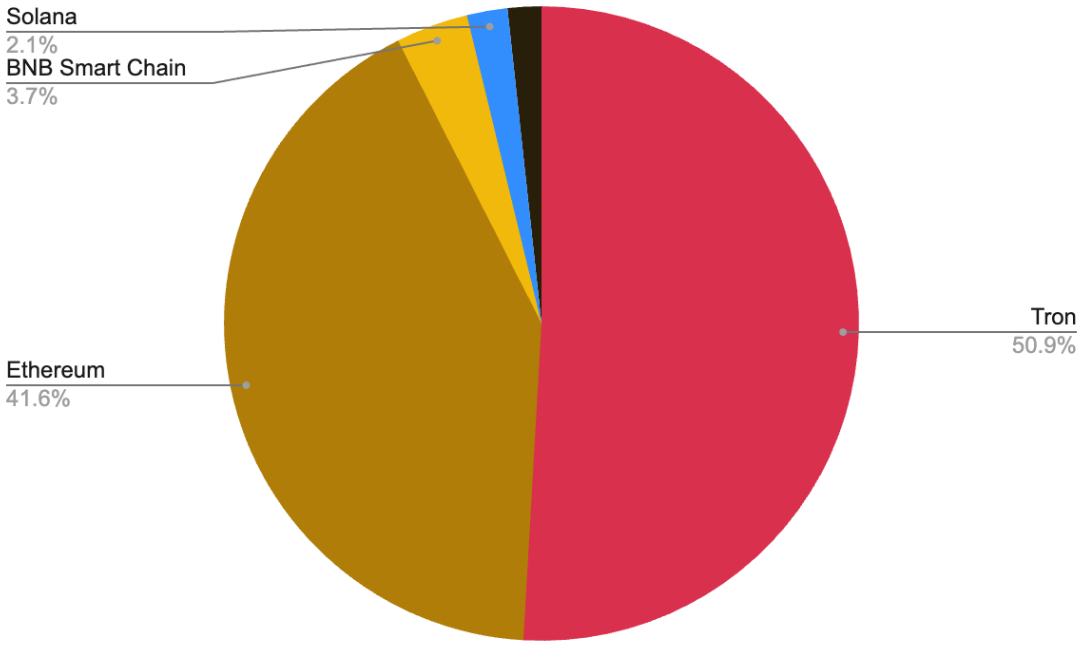
in market cap since launch. Given Celestia's mainnet came so late in the year, 2024 is really when we are likely to see Celestia gear up.

- **Babylon**: Babylon is a Cosmos project that aims to **leverage the security of Bitcoin to enhance the security of Cosmos appchains and other PoS chains**. Babylon has already integrated with 39 testnet chains, with a total market cap of over US$11.7B[54]. These include the majority of top Cosmos appchains, such as Osmosis, Injective, Akash, Sei, Stride, Evmos, and many more. Babylon also announced a US$18M funding round in December 2023, and a mainnet launch is expected this year. Given the hybrid model of Babylon, which combines PoS and PoW and then adds IBC for communication, we can view it as seeking to **leverage the best parts of Ethereum, Bitcoin, and Cosmos**. It is a promising new approach to blockchain design and we look forward to following it closely.

Others

- **Tron:** Tron continues to excel in the important niche of stablecoin settlement and remains the **most popular chain for $USDT issuance**. Specifically, over 50% of all $USDT is issued on Tron. Given $USDT is the largest and most popular stablecoin, this makes Tron the most popular L1 for stablecoin transactions.

Figure 26: Tron is the largest source of USDT supply across all blockchains



Source: DeFillama, Binance Research, as of December 31, 2023

- **TON:** The Open Network ("TON") has steadily grown in the last year and now its native Toncoin ($TON) trades inside the top 15 assets in the market.

- **TON x Telegram**: Announced in September, the partnership means that **Telegram will rely exclusively on TON as its web3 blockchain infrastructure**, and **TON Space**, a self-custodial web3 wallet, has been integrated for all of **Telegram's 800M monthly active users**. Additionally, TON projects and ecosystem partners will benefit from in-app promotion within Telegram and priority placement on their advertising platform.

- Most recently, we saw gaming / metaverse VC, **Animoca Brands**, announce[55] an investment into the TON Foundation and become the **largest validator** of the TON chain.

- **Ripple:** 2023 was good for Ripple, with the notable news of a **positive case ruling in their dispute with the U.S. SEC** (essentially declaring that $XRP, by itself, is not a security). They also launched a **CBDC platform** to help central banks, governments, and financial institutions in issuing their own digital currency. With the increased focus on CBDCs from governments around the world, this platform might become increasingly important through this year.

- **Cardano:** Cardano continued work on **scaling**, with development on Hydra and their upcoming **data-protection focused sidechain, Midnight** (which is currently in Devnet).

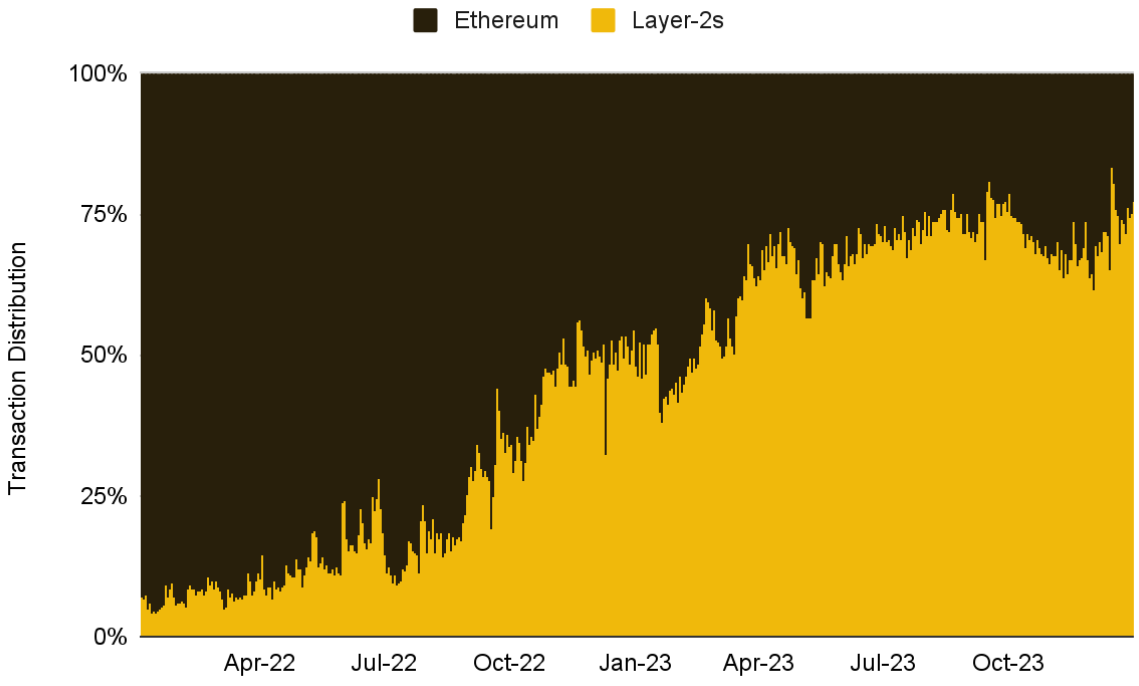
- **Aptos** and **Sui** both experienced a **renewance in energy in the recent market rally**. While both had well-anticipated initial launches with plenty of excitement, it has been a slow grind. Realistically, bootstrapping and creating a thriving L1 ecosystem takes time. The recent upwards move in Solana has sparked further interest in non-EVM based operating systems, which has benefited the Move-based Aptos and Sui.

4 The Layer-2 World

4.1 Market Overview

Saying that the Layer-2 ("L2") sector merely 'came into its own' in 2023 would be a significant understatement. In reality, L2s emerged as **one of the fastest-growing sectors** of the year, **firmly establishing their product-market fit**, with overall **total value locked ("TVL") increasing by over 321.3% year-to-date ("YTD")**[56]. This remarkable growth has led to the summer of 2023 even being **dubbed the 'L2 Summer'**. Indeed, the occurrence of several notable developments this year has made the L2 space lay strong foundations and take **significant strides towards the roll-up centric vision**. The **increase in L2 dominance to 77.2%** serves as a testament to this year's progress. With a number of catalysts on the horizon, the momentum of the L2 sector shows no signs of slowing down, making it a particularly exciting area to watch.

Figure 27: L2 dominance in daily transaction volumes reached a notable high in 2023, now accounting for over 77.2% of transactions compared to Ethereum



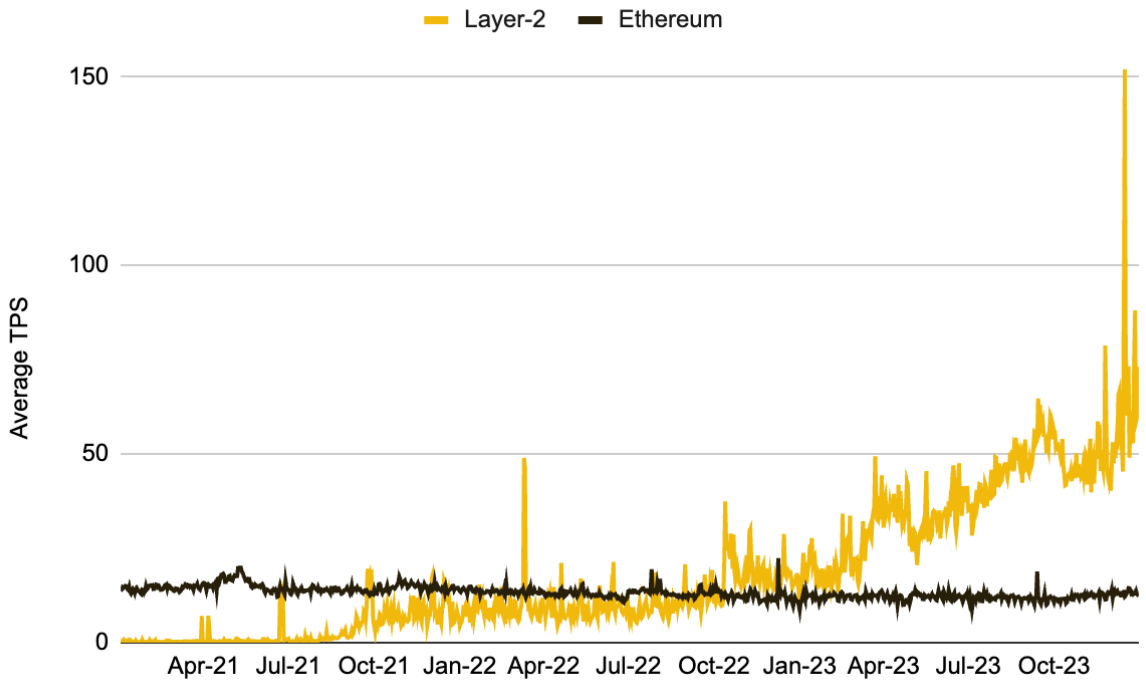
Source: Dune Analytics (@21co), Binance Research, as of December 31, 2023

L2s have now developed significantly more robust ecosystems, attracting a diverse array of developers and users. This growth has been propelled by the **advancements in L2 technology stacks** as well as the **abstraction of functionality into specialized layers**; a

trend in line with the modular blockchain thesis[57]. The **emergence of rollup-as-a-service ("RaaS") providers**, aimed at **simplifying the creation of custom L2 networks**, has further accelerated this trend. These developments have not only made it **easier for developers to build with L2s** but have also **enriched the tools available** to them. This progress is directly linked to the ability of several high-performance L2s to **efficiently handle the surge in transaction volumes**.

Throughout the year, there has been a **consistent increase in average L2 transactions per second ("TPS")**, positioning these networks as **more attractive than Ethereum for high-throughput dApps**. By the end of 2023, **L2s achieved an average TPS of 73.2, in contrast to Ethereum's average of 12.3**. Another key metric is the 'L2 scaling factor', a term coined by L2Beat[58]. This factor measures the increase in transactions settled on Ethereum attributable to L2 solutions. For the last seven days (as of January 5, 2024), this number stood at 6.27x, indicating that **transactions on Ethereum were 6.27 times higher than what would have been feasible without L2s**. Interestingly, despite the growth of L2s, they **primarily siphoned activity from Alternative Layer-1s ("Alt L1s") rather than detracting significantly from the Ethereum mainnet**, which seems to have maintained a relatively stable level of transaction activity.

Figure 28: Throughout 2023, L2s consistently achieved a higher average TPS than Ethereum, with a notable peak of 152.0 in December

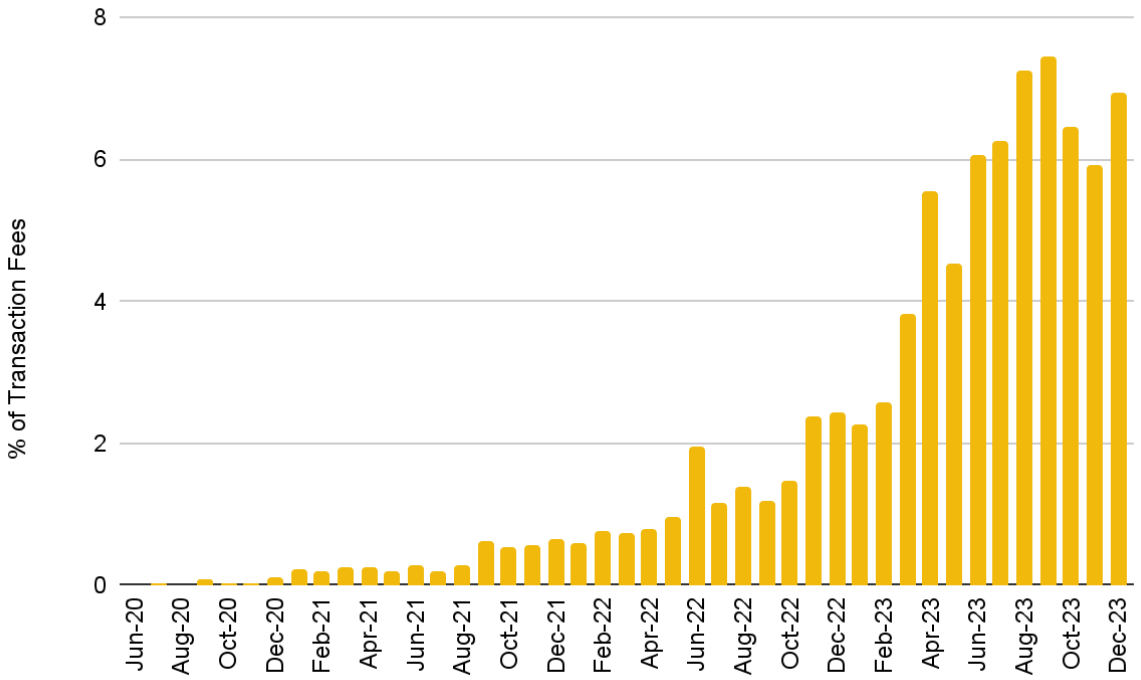


Source: l2beat.com, Binance Research, as of December 31, 2023

An analysis of gas expenditure for posting L2 data to the Ethereum mainnet also reveals a strong upward trend. This indicates the **rising influence of L2s for transactions ultimately settling on Ethereum**. L2s have certainly **carved out their own market segment** and today are **viable ecosystems for a diverse range of decentralized applications ("dApps") to**

seamlessly deploy, function, and flourish. The growing number of users is also evident, with **daily active addresses on L2s increasing to over 500K**, indicating a **63.6% dominance over Ethereum**[59]. This paves the way for the much-anticipated scalability upgrades, which are projected to substantially elevate the usability of L2 solutions[60].

Figure 29: The proportion of transaction fees paid by L2s on Ethereum has consistently trended upwards, rising more than threefold this year

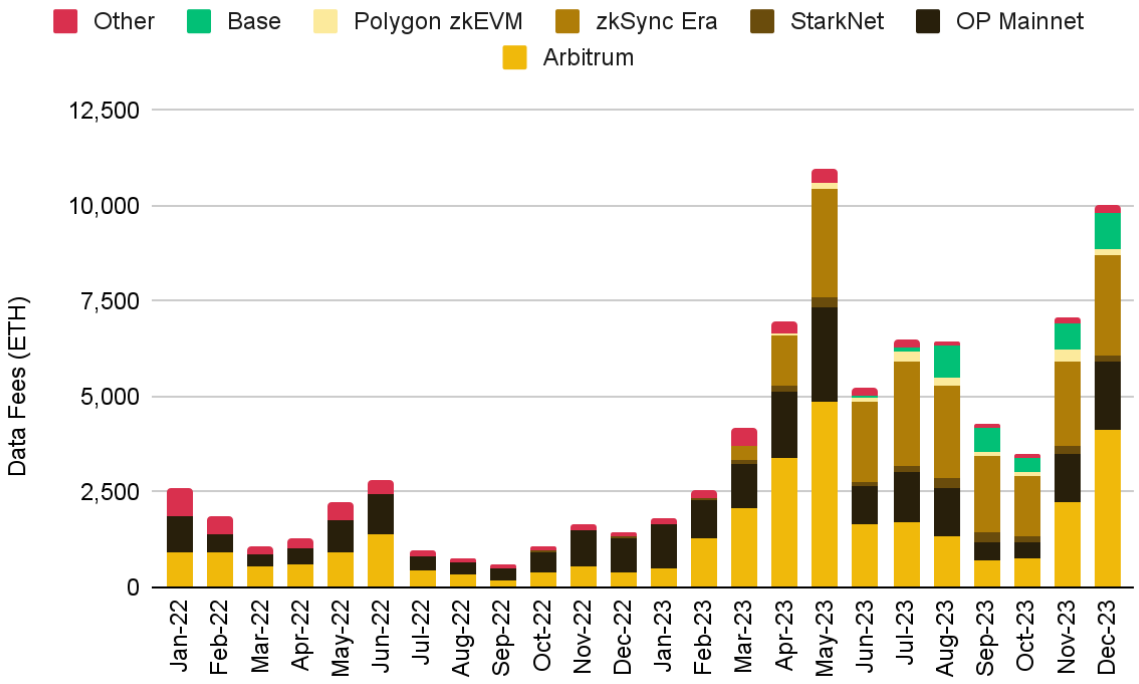


Source: The Block, Binance Research, as of December 31, 2023

Another data point that provides a strong conviction to this trend is that **Ethereum L2 data publishing fees have seen a dramatic 453.8% YTD increase**. The month of May, in particular, marked a **record high with these fees reaching 10.6K ETH for the first time**. Data fees serve as a key metric of L2 network activity, reflecting the cost of posting data back to the Ethereum mainnet. Hence, **the peak in data fees represents an important milestone** for the L2 ecosystem and a growing trend toward its underlying adoption.

While part of these impressive figures can be attributed to the growing number of L2s now operating in the space, we also saw **individual L2s record substantial growth**. Arbitrum and Optimism are prime examples of this and frequently lead in fee generation. However, after only launching in March 2023, it was zkSync Era that captured the spotlight. **zkSync Era has been consistently averaging over 2.2K ETH in monthly data fees, occasionally outperforming its Optimistic counterparts**. This is certainly a notable development for zero-knowledge Ethereum Virtual Machines ("zkEVMs") and zkSync Era in particular, considering the historical dominance of optimistic rollups in fee collections.

Figure 30: Ethereum L2 mainnet data publishing fees skyrocketed to record highs in 2023, increasing by over 453.8% YTD

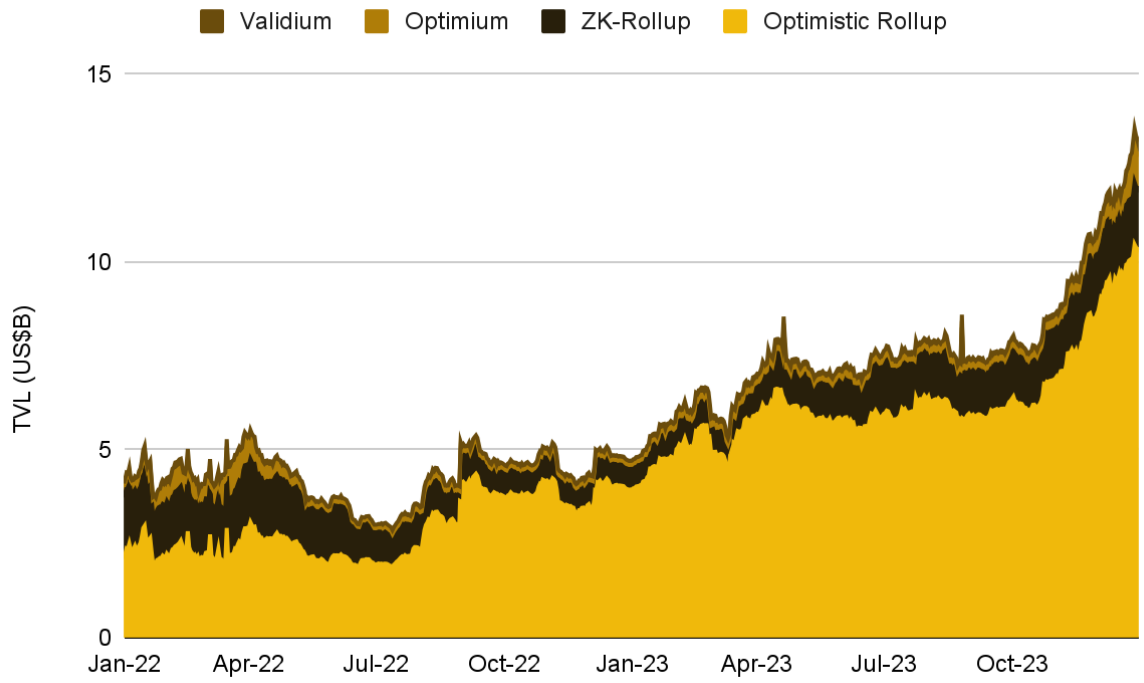


Source: The Block, Binance Research, as of December 31, 2023

Analyzing the wider market composition of the L2 sector reveals that **rollup technologies continue to dominate** and remain the preferred choice for both developers and users. **Optimistic and zero-knowledge ("ZK") rollups are the top two by market share, collectively accounting for over 90% of the market.** The remaining portion is split between **optimium and validium solutions,** holding TVL figures of **US$1.5B and US$388.8M, respectively**[61].

Optimiums and validiums distinguish themselves with their use of off-chain Data Availability ("DA"), presenting a cost-effective alternative to rollups[62]. This strategy circumvents the higher costs associated with posting transaction data on-chain, though it does come with a **tradeoff in security**. Despite this, optimiums and validiums haven't matched the same level of market penetration as rollups. **Market trends over the past year indicate a strong preference for rollups**, with the difference in costs yet to be sufficiently impactful enough to offset their use.

Figure 31: TVL across L2s are significantly up for the year, with rollup technologies, especially optimistic, continuing to assert their dominance in market share



Source: Dune Analytics (@21co), Binance Research, as of December 31, 2023

With TVL across every type of L2 up this year, **a significant portion has accrued toward optimistic rollups**, which hold the **largest share of TVL, accounting for over 80%**. They remain the **most viable and battle-tested scaling solution** in the market, **hosting a wide selection of native dApps** that have **effectively engaged users**. While their early-mover advantage has been significant, **optimistic rollups have also maintained their strong lead in the face of growing competition from other rollups**, especially following the debut of the first zkEVMs this year[63].

The two leading optimistic rollups in Arbitrum and Optimism have continued to **ship high-value products that yield strong business outcomes**. By capitalizing on their robust technology stacks, **both rollups have successfully carved out new market opportunities** for themselves. A prime example is OP Stack and Base, which has risen to become the fourth largest L2 in the ecosystem.

Figure 32: Optimistic rollups continue to capture a substantial portion of the market, exceeding 80%

Logo	Name	Type	Market Share (%)	Max Daily TPS	TVL (US$B)
	Arbitrum One	Optimistic	47.66	58.97 *(Dec 2023)*	9.61

	OP Mainnet	Optimistic	31.09	10.43 *(Jul 2023)*	6.27
	Metis Andromeda	Optimium	3.19	1.25 *(Mar 2022)*	0.64
	Base	Optimistic	3.11	21.29 *(Sep 2023)*	0.63
	Manta Pacific	Optimium	2.90	5.88 *(Dec 2023)*	0.59
	zkSync Era	Zero-Knowledge	2.85	62.07 *(Dec 2023)*	0.58
	Mantle	Optimium	1.28	25.47 *(Dec 2023)*	0.26
	ImmutableX	Validium	1.03	39.35 *(Mar 2022)*	0.21
	Linea	Zero-Knowledge	0.92	14.92 *(Dec 2023)*	0.19
	StarkNet	Zero-Knowledge	0.72	10.21 *(Nov 2023)*	0.15
	Polygon zkEVM	Zero-Knowledge	0.63	1.41 *(Aug 2023)*	0.13
	Scroll	Zero-Knowledge	0.28	5.03 *(Aug 2023)*	0.06
	Ethereum	Base Layer	N/A	22.37 *(Dec 2022)*	N/A

Please note: The table only considers a selection of active Layer-2 projects
Source: l2beat.com, l2fees.info, Binance Research, as of December 31, 2023

The **launch of the first zkEVMs this year marked a significant step forward**, bringing a new dimension to the market. To recap, zkEVMs offer **improved compatibility**, addressing earlier limitations related to EVM support and smart contract execution. Starting with **zkSync Era and Polygon zkEVM** in March, followed by **Linea**, and **Scroll** later in the year. **StarkNet**, another pioneer of ZK-tech, also has a ZK-rollup in production, with the **Kakarot zkEVM bringing EVM-compatibility** to the StarkNet technology. **Taiko** is another upcoming zkEVM expected to launch early next year.

Although ZK-rollups offer distinct advantages, they are **yet to make a substantial dent in the market share dominated by optimistic rollups**; by the end of 2023, **the collective TVL of ZK L2s only reach US$1.7B**. Their **transaction fees and realized TPS have not shown meaningful improvements** but this could change in the future as ZK-based technology matures[64].

Interestingly, December 2023 marked a substantial growth spurt for optimium solutions, notably closing the market share gap with ZK-rollups, although there are questions about the durability of this trend. Both **Metis Andromeda and Manta Pacific saw boosts in their TVLs to US$644M and US$585M, respectively**. This growth was primarily fueled by the allure of **native yield offerings**, along with **ecosystem incentives** and **speculation of airdrops**, all coinciding with a general upswing in crypto markets. In particular, Manta Pacific's **'New Paradigm' reflects the broader trend towards native yield L2s[65], similar to Blast, which amassed over US$1B in TVL**[66]. Blast is an upcoming L2 designed to **automatically generate yield** for ETH and stablecoin depositors on its network. Mantle Network, while not matching this growth, also ventured into native yield products with the Mantle Liquid Staking Protocol[67]. Ultimately, considering this growth may be attributable to time-bound or yield-driven factors rather than the underlying L2 technology, **the long-term stickiness and competitiveness of this growth remain to be seen**.

Ultimately, L2 differentiation strategies have been varied, ranging from distinct execution environments like StarkNet's CairoVM and flexible tooling like Arbitrum Stylus, to retail-oriented projects like friend.tech on Base and the recent native yield trend in Optimiums and Blast. This **spectrum of strategies reflects the distinct paths** taken in the space, with **certain L2s initially prioritizing technology, while others emphasize business development efforts.** However, given L2s inherently share similar mission statements, we are seeing an **increase in overlapping strategies**, indicating a move towards market saturation. As these L2 projects continue to mature, this **overlapping is expected to drive the sector towards eventual consolidation**.

4.2 Optimistic Landscape

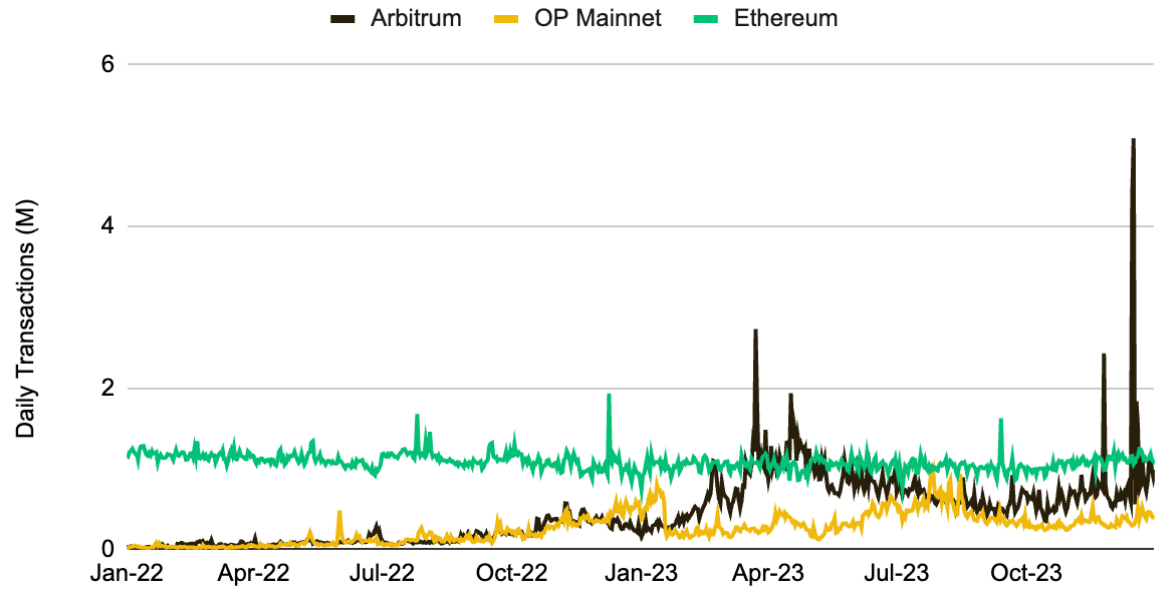
Arbitrum

Arbitrum has had a successful 2023, strengthening its foothold not just in the L2 landscape but across the entire blockchain ecosystem. In a year that saw several new entrants, Arbitrum continues to **boast the highest TVL, capturing a significant 47.7% of the L2 market share**. Echoing this success on a wider scale, DeFiLlama ranks Arbitrum as the **fourth largest in TVL across all blockchains**[68]. Alongside OP Mainnet, **Arbitrum forms one of the 'big two'** in the space, leading in several key metrics. It records the **highest transaction volume among L2s** and is the **largest consumer of Ethereum gas this year**[69].

Comparing Arbitrum with OP Mainnet, which serves as an ideal benchmark given its competitive proximity, both started the year closely aligned in key operational metrics. Yet, as 2023 unfolded, **Arbitrum not only surpassed OP Mainnet but also widened its lead**, despite OP Mainnet's growth. **Arbitrum averaged 148.7K daily active addresses, significantly more than OP Mainnet's 70.9K**[70]. In terms of daily transactions, **Arbitrum handled over 1.1M, outstripping OP Mainnet's 0.4M**.

However, it's important to note that some of the peak figures seen in December were influenced by the **inscriptions frenzy extending to other EVM-compatible chains**[71]. Nevertheless, even when these anomalies are set aside, Arbitrum maintained average daily transactions of 0.7M. In fact, throughout 2023, there were several instances of **Arbitrum's transaction counts even surpassing that of Ethereum**.

Figure 33: After surpassing OP Mainnet earlier this year, Arbitrum has consistently processed a higher number of daily transactions



Source: Artemis, Binance Research, as of December 31, 2023

A notable moment for Arbitrum occurred in March 2023 with the launch of its airdrop, a significant milestone as it joined the ranks of the few in the sector with its own native token[72]. Since then, the **$ARB token has reached a market cap of over US$2B**[73]. What's particularly striking is that post-airdrop, both transaction counts and other key metrics have consistently remained high. As depicted in Figure 33 above, **Arbitrum's daily transaction counts reached unprecedented heights post-March 2023, and these figures have since stabilized at these higher levels**. This trend indicates the **strong and sustained utilization of the chain**.

Current market data clearly positions Arbitrum as the preferred optimistic rollup for users. This is certainly an advantageous position, especially in light of the forthcoming catalysts in the rollup space like Ethereum's Dencun upgrade. Indeed, Arbitrum's rise this year can be attributed to several factors, including **new product innovations**, **targeted user engagement campaigns**, and an **expanding dApp ecosystem**, among others.

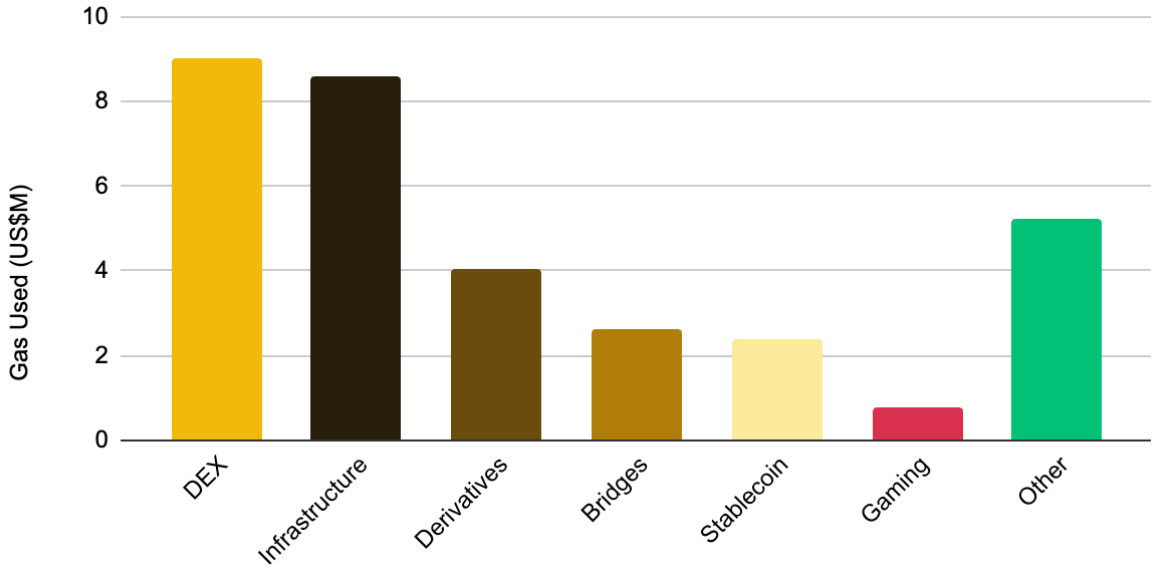
- **Arbitrum Orbit:** Orbit emerges as a flagship product for Arbitrum this year, encapsulating their **vision for the next generation of rollups**. It offers an **extensible framework that enables developers to spin up new Layer-3 ("L3s")** settling on either Arbitrum One or Arbitrum Nova, thus effectively **functioning as an L3-as-a-service provider**. Interestingly, **Arbitrum differentiates IP between L2 and L3 deployments**. While the Arbitrum DAO retains IP rights for the creation of L2s, **Orbit facilitates the permissionless creation of L3s**, granting developers more autonomy. Building upon this, developers engaged with Orbit gain **full access to the Arbitrum Nitro stack**. This access allows for flexibility in **configuring privacy settings, permissions, and fees** for their L3 networks. Additionally, developers can **customize their stack to specific needs**, **plug into various data providers**, and **utilize Arbitrum tooling such as Stylus**, a novel programming environment that supports languages like Rust, C, and C++. Stylus is still in testnet but is poised to offer developers a **powerful new way to build on Arbitrum**.

  Another notable aspect of L3s on Arbitrum is the **fee payment to Arbitrum sequencers**. This not only **generates economic benefits from open-source code** but also establishes a **sustainable value accrual mechanism** for the $ARB token. Though in its early stages, Orbit is mainnet ready[74] and has begun to draw interest from several projects such as Polychain Monsters, Xai and Deri Protocol[75].

For more reading on this topic, check out our previous report, The Layer-2 Evolution: Superchains, L3s, and More.

- **DeFi and Infrastructure drive network growth:** As per Figure 34, **Decentralized Finance ("DeFi"),** particularly **Decentralized Exchanges ("DEXes")** and **Derivatives**, represents the **largest gas-consuming sector on Arbitrum**. This trend underscores Arbitrum's **growing influence in the DEX and Derivatives markets**. Arbitrum hosts a significant number of derivatives protocols, positioning it as a preferred chain for this sector, thanks to its favorable transaction execution. In fact, the **highest contributor to Arbitrum TVL is the Derivatives platform GMX, boasting US$554.4M**[76]. At the same time, **Infrastructure has played a key role**, with contributions from LayerZero being notable in injecting liquidity into the L2[77].

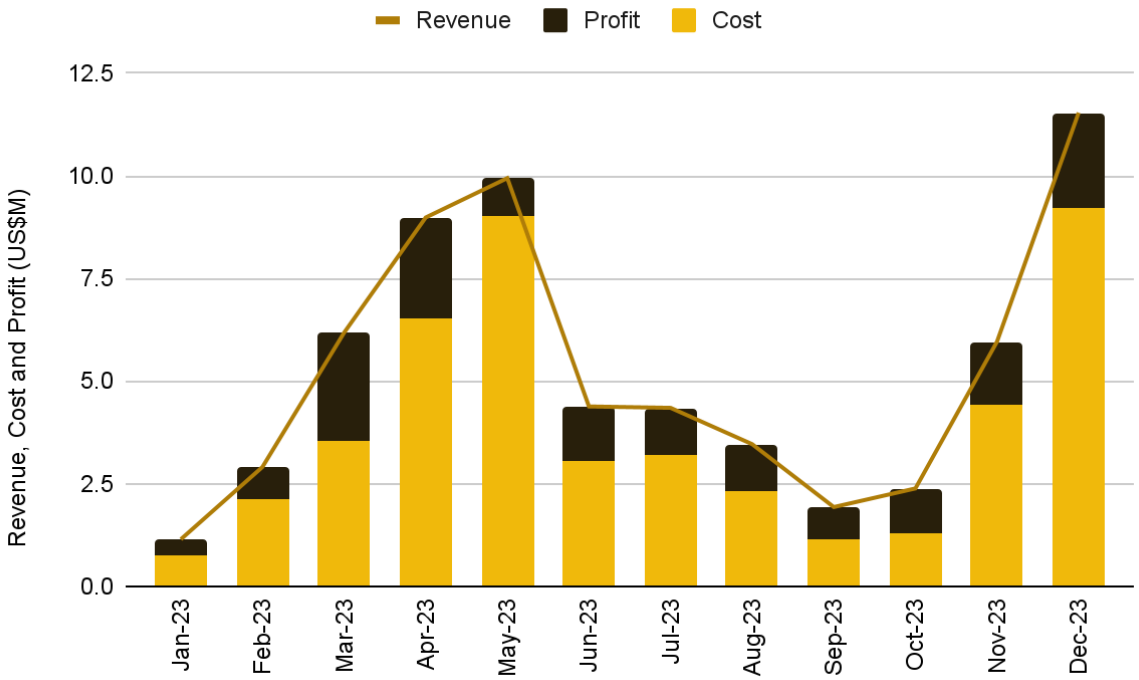
Figure 34: DeFi sectors such as DEXes and Derivatives were the top gas-consuming projects on Arbitrum in the last 365-day period, together accumulating over US$13.1M



Source: Token Terminal, Binance Research, as of January 5, 2024

An important aspect of the L2 economic model is its **ability to create sustainable cash flows**. The gas consumption and transaction activities produced from these sector projects have notably contributed to Arbitrum's fee collections and, consequently, its overall earnings. In 2023, **Arbitrum's treasury benefitted from sequencer profits amounting to US$16.6M**. This figure, representing the gross on-chain profits, is derived from the difference between the fee revenue from L2 users and the fee expenses paid to the base layer. These profits, accruing to the treasury, are **earmarked for reinvestment, fueling future growth initiatives on Arbitrum**.

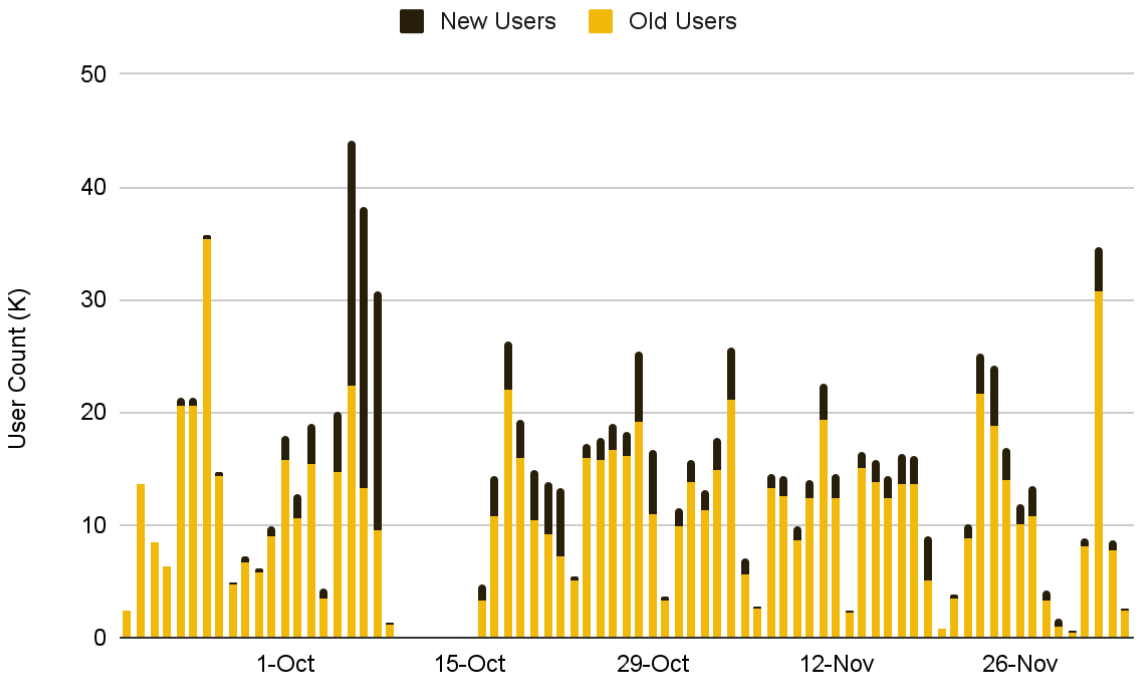
Figure 35: Arbitrum realized earnings exceeded US$16M in 2023



Source: Token Terminal, Binance Research, as of December 31, 2023

- **Arbitrum Odyssey:** In a bid to both retain and expand its user base, we saw Arbitrum relaunch its Odyssey campaign[78]. This **seven-week initiative** enabled participants to engage with **13 leading Arbitrum protocols and communities,** and to **earn 16 NFT badges** through a variety of tasks. Analysis of the campaign's participants reveals that the **majority, totalling 221k**[79]**, were existing users,** whereas **newcomers amounted to 96k**. This distribution underscores that a substantial part of the campaign's **success relied on the active involvement of Arbitrum's existing user community**, demonstrating their **sustained engagement and interest in the L2's developments**.

Figure 36: A significant portion of the Arbitrum Odyssey campaign engagement came from existing Arbitrum users



Source: Flipside (Masi), Binance Research, as of December 31, 2023

- **Short-Term Incentive Program ("STIP"):** In another strategic move, Arbitrum **allocated up to 50M ARB tokens across 30 projects** to encourage their development and utilization on the network[80]. **Perpetual-based protocols emerged as the primary beneficiaries, receiving 44% of the total grants, while DEXes secured the second largest share with 15%.** Unsurprisingly, given the impact of derivatives on Arbitrum's network activity, **GMX was the top grantee from STIP, receiving 12M ARB**[81]. As a result of STIP, projects have been utilizing the ARB incentives to **stimulate user activity** through methods like **fee rebates**, **prizes** or **action-based rewards**.

  Following the initial grant distribution, the Arbitrum DAO **approved a one-time 21.4M ARB 'backfund' for 26 projects** that were overlooked in the first round. The largest allocation in this subsequent round was **4.5M ARB to another derivatives-based protocol in Gains Network**[82]. **Other significant grants went to Stargate, Synapse, and Wormhole**, indicating that aside from DEXes and derivatives, Arbitrum has a focus on **developing composable dApps** and **ensuring the interoperability of its network**.

OP Mainnet

Optimism's OP Mainnet, as the second major optimistic rollup in the space, **boasts over US$6.3B in TVL** and **holds a substantial 31.1% market share** among Ethereum L2 solutions. The **OP Stack has been a focal point of Optimism's strategy** this year, contributing greatly to its traction and the **realization of its Superchain vision**. With the emergence of several new L2s this year, many have been developed using Optimism's OP Stack, testament to its status as a preferred, easy-to-deploy rollup solution. **The widespread adoption of OP Stack effectively positions Optimism as having created a 'build-an-L2' supermarket**[83].

Additional key developments for Optimism include **migrating their flagship L2 rollup to Bedrock**, which brought about operational and user experience improvements, **executing further rounds of retroactive public goods funding**, and **carrying out the third OP airdrop**[84].

- **OP Stack:** The OP Stack is a **standardized and open-source development stack** that **powers OP Mainnet** and **facilitates the creation of a network of interoperable, coordinated L2 chains**. It promotes **permissionless L2 creation**, allowing developers to build modular chains with contributions from OP Mainnet, Base, and other OP Stack developers. This model, offering open-source access for unrestricted L2 development, stands in **stark contrast to Arbitrum's approach** with Orbit, which requires DAO approval for using its IP to create L2s.

  A highlight for Optimism this year was the **launch of various OP Stack chains**, each showcasing impressive transaction volumes and unique address metrics[85]. The spectrum ranged from **general-purpose L2s** like Base and Mode to more **specialized chains** such as Zora Network and DeBank Chain. Its attractiveness to projects stems from its **market readiness** and **technical compatibility**. Key **integrations with dedicated RaaS providers like Conduit have streamlined the deployment process** on the OP Stack, thereby encouraging the creation of more rollups[86]. Additionally, the **Bedrock upgrade has reduced transaction and smart contract deployment fees**, further lowering entry barriers and enhancing the OP Stack's allure for developers.

Figure 37: Several chains are building on OP Stack, collectively accumulating impressive metrics in both transactions and unique addresses

Logo	Name	Type	Cumulative Transactions (M)	Cumulative Unique Addresses (M)
	OP Mainnet	General-Purpose	158.7	12.7
	Base	General-Purpose	83.0	59.3
	Zora Network	NFT	18.8	1.8
	Public Goods Network	General-Purpose / Public Goods	8.2	0.1
	Mode (Developer Mainnet)	General Purpose	2.2	0.005
	DeBank Chain (Testnet)	SocialFi	8.3	0.08
	Ancient8 Chain (Testnet)	Gaming	7.5	0.06

Source: Block explorers, as of January 5, 2024

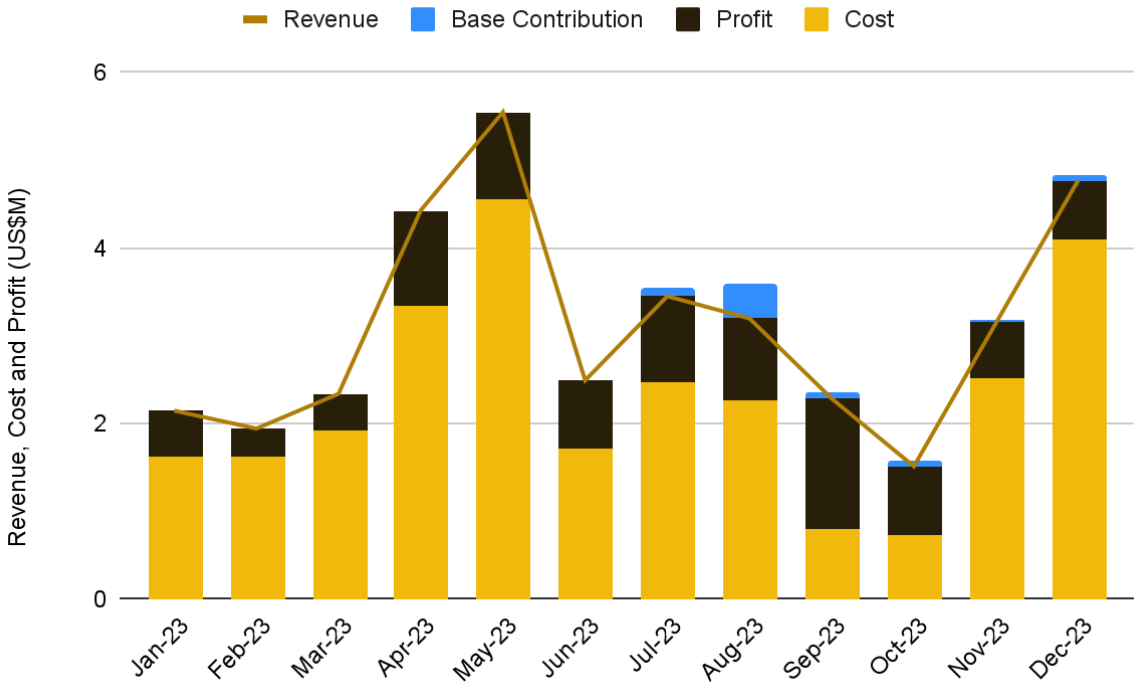
- **Realization of the Superchain thesis:** As an **unified network of chains built using the OP Stack**, the ultimate goal of the Superchain is to bring **seamless interoperability between OP Chains, integrating shared aspects like security, bridging, governance, upgrades, and communication**[87]. Network effects from this, especially if some OP Chains rely on OP Mainnet to bootstrap liquidity, may yield increasing on-chain activity for OP Mainnet. **The Superchain has gained significant momentum this year, bolstered by the OP Stack's successful onboarding of several L2s**. Specifically, the emergence and launch of **Base has been instrumental in advancing OP Mainnet's 'Superchain' narrative**, making it an increasingly relevant and discussed topic in the ecosystem.

  Base's endorsement, for instance, signifies a strong alignment, given its **grant of 2.75% of OP token's supply in return for 2.5% revenue or 15% of profit** (whichever is higher). This arrangement with Optimism effectively underscores a comprehensive **partnership in technical, financial, and social dimensions, adhering to the law of chains**. Base's profit sharing not only solidifies the

Superchain thesis but also allows **OP Mainnet to backpack off of Base's future growth**. Ultimately, this **profit-sharing model reduces Optimism's reliance on its own mainnet for growth**, presenting a more collaborative growth approach[88].

Yet, the **situation may differ for other OP Stack chains**. As various chains within the Superchain come to fruition, there's a **risk of a cannibalistic effect**, potentially **diverting liquidity away from OP Mainnet**. Chains like Zora and Public Goods Network, having opted for OP Stack as their foundational architecture, have not yet announced any profit contributions to OP Mainnet. This dynamic warrants close observation as we move into the new year. Watching the Superchain evolve, it will be intriguing to see **how governance and incentives are balanced between protocols on OP Mainnet and those within the broader Superchain network**.

Figure 38: Optimism generated over US$10.3M in profits this year, with Base contributing over 13% to the total on-chain profits since its launch in July



Please note: Token incentives are not included in the stated figures
Source: Token Terminal, Binance Research, as of December 31, 2023

- **Retroactive Public Goods Funding ("RetroPGF"):** Optimism has placed a strong **emphasis on fostering the development of on-chain public goods**, with their innovative RetroPGF model, which **rewards creators and supporters of public goods**, gaining traction once more this year. Specifically, two more rounds of RetroPGF were progressed: **the second round distributed 10M OP tokens to 195 unique projects[89], while the third round allocated 30M OP tokens**[90].

Governance at Optimism involves a **partnership between the Optimism Foundation and the Optimism Collective**. The Foundation, acting as the Collective's steward, also manages the sole sequencer. Since launching its mainnet, the **Optimism Foundation has dedicated all sequencer revenues, received in ETH, to fund RetroPGF**. As plans for technical decentralization advance, they are expected to significantly influence such initiatives going forward.

- **Path toward decentralization:** Optimism's roadmap for the upcoming year outlines various **steps toward achieving technical decentralization**[91]. These measures include **implementing a fault-proof system**, **introducing additional sequencers** who are expected to receive a share of the network's sequencer transaction fees, **transitioning control to the Optimism Collective**, and **progressively relinquishing control over upgrade keys**. However, decentralizing a protocol can be challenging and comes with its own set of risks, particularly if done hastily. It is likely that this transition will be carried out in a phased approach. Having operated in a centralized manner for two years, **2024 may be the year we see Optimism take concrete steps towards decentralization**, approaching a **Stage 1 classification**.

For detailed insights into Optimism and the OP Stack, we recommend reviewing our report, The OP Stack: What's New?

Base

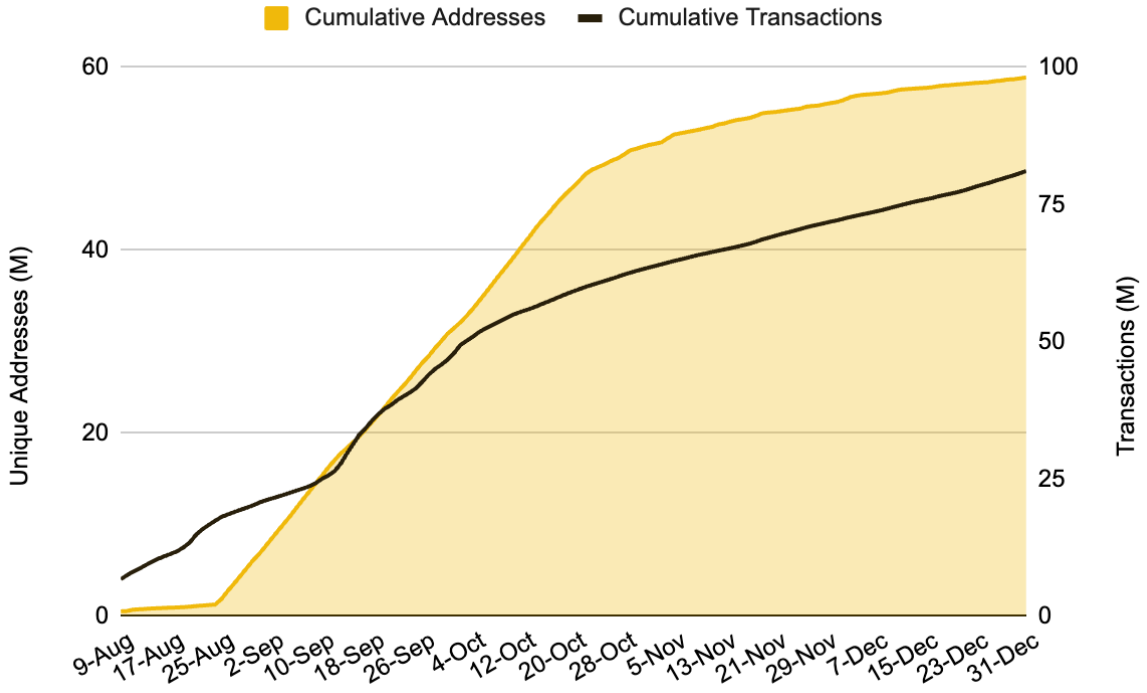
Base, Coinbase's native L2 solution, was **among the first OP Stack L2s** announced in February 2023 and launched its public mainnet on August 9[92]. Designed to offer a **frictionless entry point into on-chain activities**, Base represents Coinbase's effort to **more thoroughly immerse its users within the broader crypto economy**. This move is indicative of a wider shift among CEXes, increasingly venturing into Ethereum and the L2 space to boost non-trading revenue sources.

Base **benefits from its association with Coinbase**, unlocking a number of synergies such as **quick fiat on-ramps, access to Coinbase users, and support from Coinbase Ventures' ecosystem fund**. This mutual benefit is actually bidirectional; transacting on Base may often require the utilization of other exchange products, effectively transforming the L2 into a user acquisition tool. Given Coinbase's retail-heavy user base, Base's future growth will be heavily dependent on **introducing dApps that resonate with Coinbase's typical users**.

As a general-purpose L2 and the most popular OP Stack chain after OP Mainnet, **Base boasts a TVL of US$628M, making it the fourth-largest in the sector by TVL**. Base's launch was particularly successful and accompanied by a series of noteworthy events that not only boosted liquidity but also laid important groundwork for the L2. For instance, '**Onchain Summer**', a month-long launch event, coincided with Base's mainnet and featured NFT mints in **collaboration with partners like Coca-Cola**. The event witnessed **over 700K mints from more than 268K unique wallets across 75 collections**[93]. Base

also **debuted with over 100 dApps**, with **friend.tech being a significant catalyst**. To date, Base's ecosystem has continued to grow, with **cumulative transactions surpassing 81M**.

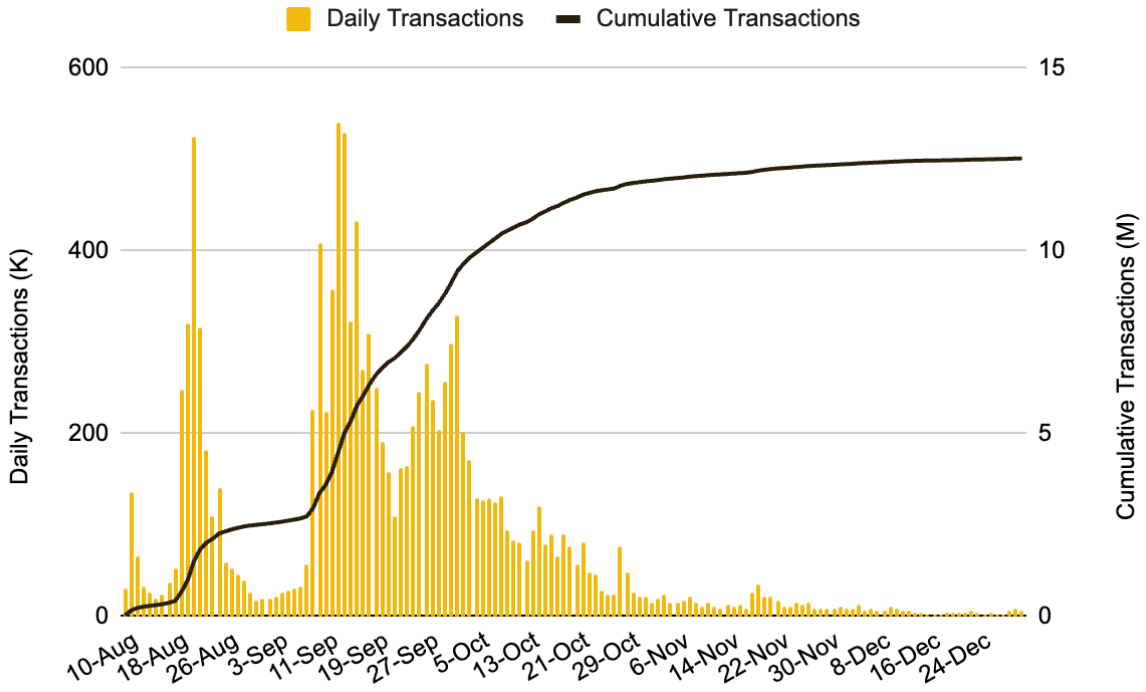
Figure 39: Since its mainnet launch, Base has experienced a marked rise in user and transaction metrics, though this growth has begun to taper off post October



Source: Base block explorer, Binance Research, as of December 31, 2023

- **Friend.tech catalyzing growth:** friend.tech is a **Twitter (or X)-linked mobile app that enables users to trade tokenized 'Keys'** associated with other users' profiles, termed as 'Subjects.' As a SocialFi platform, friend.tech was crucial in boosting Base's early success post-launch. Since its August 10 debut, **friend.tech has amassed over $26.6M in fees, across 12.5M transactions**[94]. However, **transaction volumes and underlying hype has died down since**, and a **focus on attracting non-crypto personalities** is likely to be key for growth going forward. Ultimately, friend.tech demonstrated the **importance of engaging dApps**, especially those **designed to cater to retail users**, such as SocialFi, **during initial phases of L2 adoption**[95]. As a result, it's possible that we see other L2s employ similar strategies in onboarding such dApps to stimulate growth.

Figure 40: After the initial buzz in August and September, friend.tech experienced a significant decline in daily transactions for the remainder of 2023



Source: Dune Analytics (@cryptokoryo), Binance Research, as of December 31, 2023

- **Collaboration with Optimism: The results of Base's partnership with Optimism offer a glimpse of what the Superchain may hold in the future**. One of the significant outcomes was undoubtedly the **bi-directional economic agreement**. Under this arrangement, **the Optimism Collective receives a share of revenue, while Base stands to earn up to 118M OP tokens over the next six years**[96]. As one of the leading rollups, Base has also become a part of the **second core development team of OP Stack**[97] and is **committed to contributing to the development of the ecosystem**. A notable example of this was Base's release of Pessimism, an open-source monitoring system designed to enhance the security of OP Stack and other EVM-compatible chains. The team's forthcoming focus revolves around providing comprehensive coverage for the native OP Stack bridge.

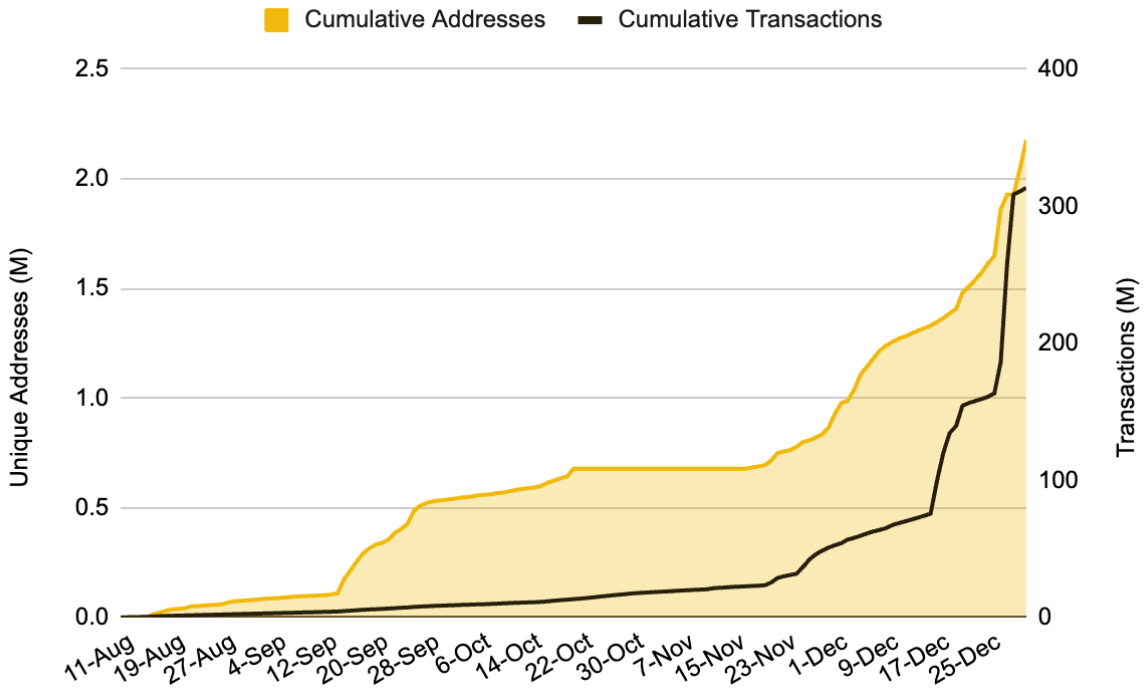
opBNB

opBNB is another emerging optimistic rollup that utilizes the OP Stack but **designed specifically for the BNB Chain**. opBNB is EVM-compatible and aims to achieve **over 4K TPS and transaction fees lower than US$0.001**. This represents a significant improvement over BNB Chain, which currently registers approximately 54.3 TPS with transaction fees around US$0.09[98]. At these levels, opBNB is poised to significantly **outperform even the most high-performing L2 solutions**, as we saw earlier in Figure 32. While still in its early days, **opBNB has attracted over US$29.2M in bridged assets**, **reflecting a 660.3% growth** since its public mainnet launch[99]. Impressively, by the end of

2023, opBNB had **processed more than 313.4M transactions across 2.2M unique active addresses**.

Fundamentally, opBNB is set to play an important role in enhancing BNB Chain's throughput. It achieves this by **introducing a middle layer referred to as 'SharedPool'**, which **optimizes caching efficiency** and **expedites database operations**. Presently, opBNB is home to several notable projects including NFPrompt, an AI-driven platform for creators, and Hooked Protocol, emphasizing social learning[100]. Given its association with BNB Chain, **opBNB is ideally positioned to support high-throughput dApps such as gaming**.

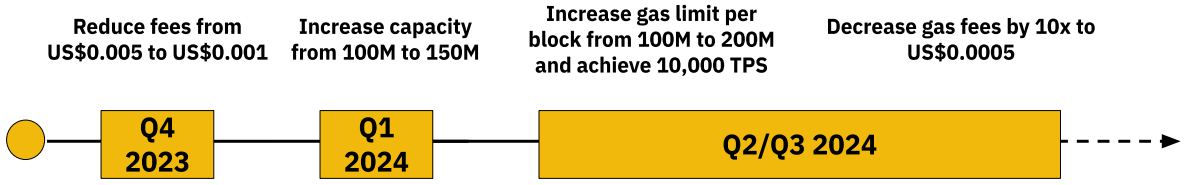
Figure 41: As the year drew to a close, opBNB recorded over 313.4M transactions across 2.2M unique active addresses



Source: opBNB block explorer, Binance Research, as of December 31, 2023

Furthermore, opBNB boasts an **ambitious and fast-paced** roadmap with exciting prospects on the horizon, structured around key themes of **High Performance** and **Low Cost**, **AppChain Architecture**, and **Community Collaboration**. Some of the upcoming milestones include the introduction of **multiple node types (Archive, Full, and Fast)** catering to a variety of user and developer requirements, a notable **block capacity increase from 100M/second to 150M/second**, and the **implementation of scalable DA with reduced costs** on BNB Smart Chain and Greenfield.

Figure 42: opBNB sets an ambitious goal of reaching a staggering 10K TPS while simultaneously reducing transaction costs to one-tenth of their current levels



Source: opBNB Documentations, Binance Research, as of December 31, 2023

By **incorporating optimistic rollup capabilities into its already extensive product suite**, BNB Chain **strengthens its position as an 'ecosystem of blockchains'**, offering developers access to a wide range of tools and technologies. As the **exclusive L2 solution for BNB Chain**, where **scalability challenges are not as pertinent** as compared to Ethereum, opBNB also enjoys a unique advantage to **grow at a sustainable and organic pace**. In the upcoming year, opBNB is poised to further expand its footprint, with more dApps expected to join the network.

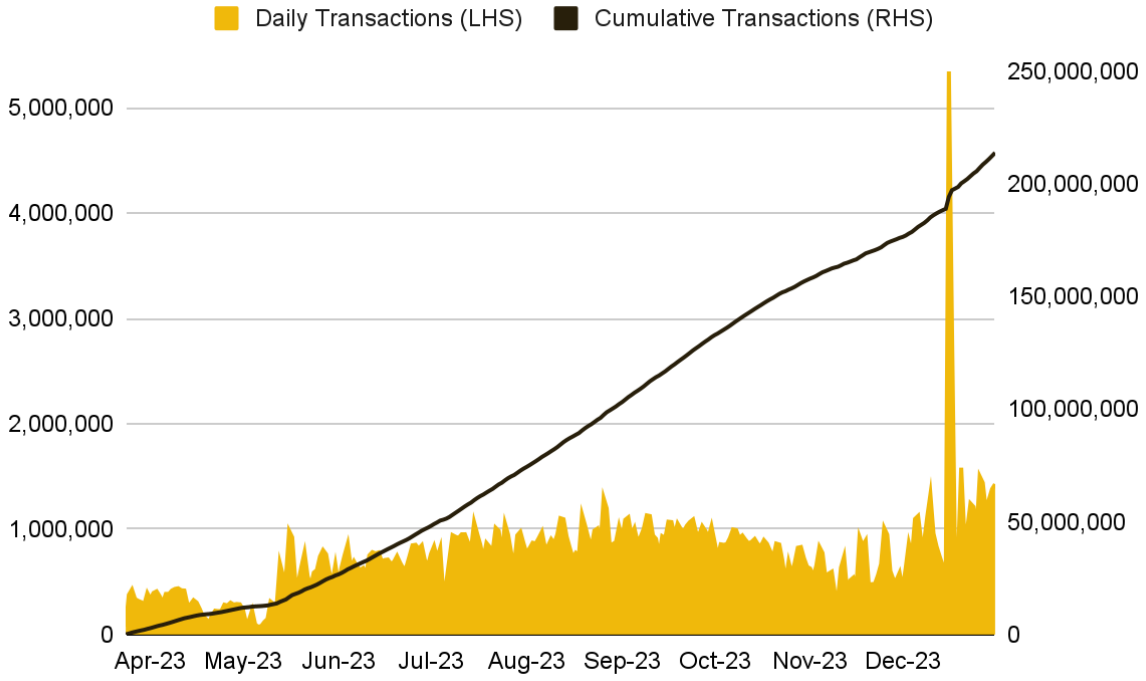
4.3 Zero-Knowledge ("ZK") Landscape

zkSync Era

zkSync Era achieved a significant milestone earlier this year as the **first zkEVM solution to launch on mainnet**. Its debut on March 24, 2023[101], received a positive market response, and today, it **boasts over US$575M in TVL** and has **processed more than 213.8M transactions**, the highest among zkEVMs. In a remarkably short time frame, zkSync Era also **surpassed both OP Mainnet and Arbitrum as the largest fee payer to Ethereum for data publishing fees** during certain months of the year. Given the strong position of optimistic rollups in the market, these data points showcase the traction that zkSync Era has managed to generate this year.

zkSync Era experienced a steady increase in daily transactions throughout the year, culminating in a **notable peak of 5.3M on December 16, 2023**, primarily driven by inscriptions-based activity[102]. This transaction spike pushed zkSync Era to achieve a **maximum daily TPS of 62.1**, which is also the **highest recorded among L2s to date**[103]. Although there were partial outages during this period, the increased inscriptions-based load offered valuable insights into zkSync Era's scalability potential.

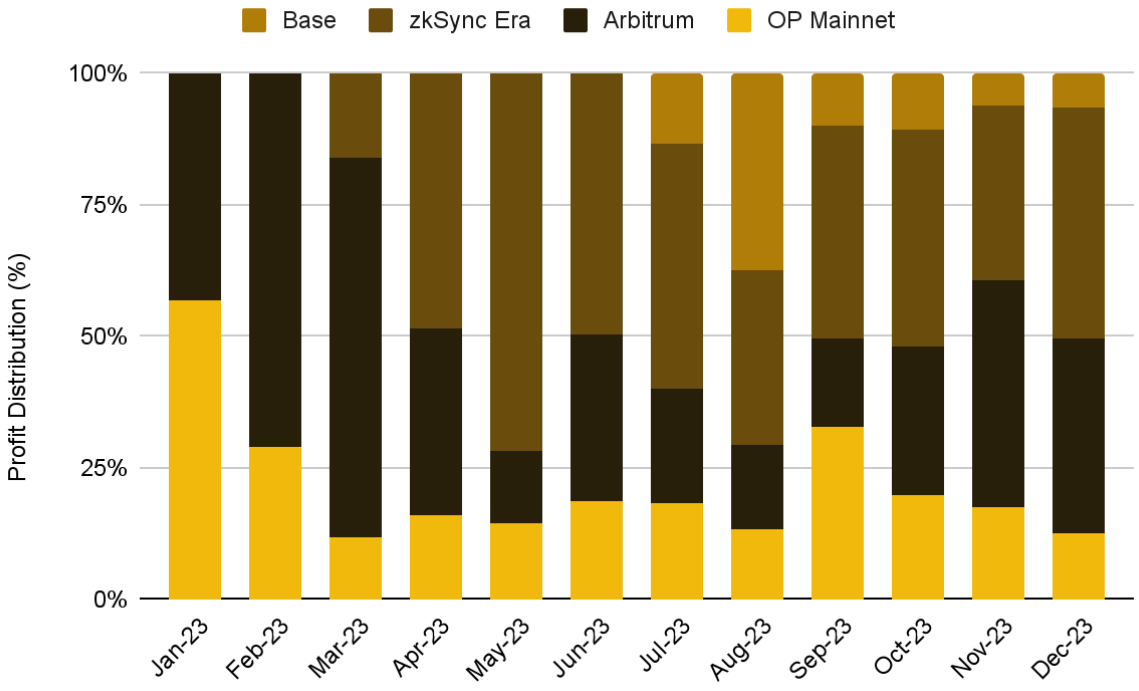
Figure 43: Having successfully processed 213.8M transactions, zkSync Era has exhibited the highest level of activity among all other zkEVMs in 2023



Source: Dune Analytics (@matterlabs), Binance Research, as of 31 December, 2023

Despite its impressive transaction activity, it cannot be ignored that zkSync Era has attracted the attention of airdrop farmers. The L2 is also **yet to match the same level of TVL it achieved earlier in the year**, peaking at approximately US$735M in July 2023[104]. An interesting observation is that **among the top 8 protocols ranked by TVL on zkSync Era, all of them happen to be DEXes**[105]. While it is natural to expect these applications to lead the TVL race, **the lack of diversity indicates that the zkSync Era's ecosystem is still nascent**. Thus, it will be interesting to observe how zkSync Era sustains its adoption growth, attracts liquidity, and expands its user base going forward. Nevertheless, the most impressive metric as a result of its increased usage is perhaps that zkSync Era is the **most profitable L2 this year**, having **generated in excess of US$22.6M**.

Figure 44: In 2023, zkSync Era ranked among the highest in terms of on-chain profits, exceeding US$22.6M



Please note: Token incentives are not included in the stated figures
Source: Token Terminal, Binance Research, as of 31 December, 2023

- **ZK Stack:** In keeping with the prevailing trend among L2s, zkSync released its own modular rollup development framework, the ZK Stack. The ZK Stack has a **permissive licensing model**, enabling anyone to deploy rollups on zkSync Era, Ethereum, or other zkSync Hyperchains. Similar to Optimism's Superhcian, **zkSync Hyperchains will launch through a shared L1 bridge**, acting as a governance hub for all Hyperchains and providing a shared message-passing layer between rollups. Projects on ZK Stack also **benefit from zkSync's native account abstraction**, which offers several flexibilities including how users pay for transaction fees.

Early adopters of the ZK Stack include GRVT, Tradable and Cronos zkEVM, which is also the first live public testnet[106]. Encouraging the widespread adoption of the ZK Stack is undoubtedly beneficial for zkSync. By **cultivating a community of rollups built on the ZK Stack**, the L2 is able to **expand its developer ecosystem**. Moreover, projects like Cronos zkEVM are likely to extend its portfolio of Cronos dApps, in turn boosting both activity and liquidity for the zkSync Hyperchain ecosystem. In parallel, **establishing a robust grants program or a retroactive public goods funding system may be the next logical step** for zkSync to further develop the ecosystem. The announcement of the **first cohort of RaaS providers, including Ankr, Luganodes, and Zeeve**, will certainly help in providing the **necessary infrastructure to support the growth of Hyperchains**[107]**.**

Additionally, Matter Labs' **new prover system, Boojum**, is poised to play a key role in the success of ZK Stack. Boojum **improves prover performance** and **reduces hardware requirements**, which in turn **lowers proving costs** and **makes prover decentralization more feasible**. Consequently, this enables **enhanced interoperability between Hyperchains**, especially as adoption of the ZK Stack scales further.

To learn more about zkSync Era and their wider product suite, check out our report from earlier in the year, The zkEVM World: An Overview of zkSync.

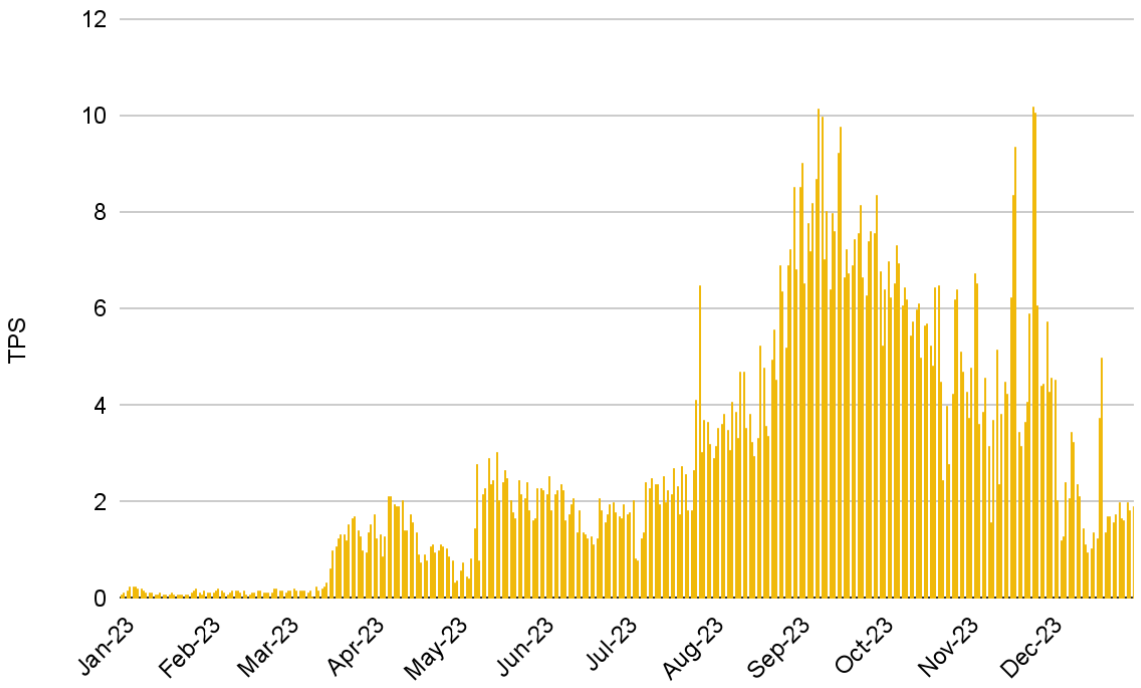
StarkNet

StarkNet is a permissionless ZK-Rollup on Ethereum that uses the **Cairo programming language and Cairo Virtual Machine**, both **optimized for STARK proofs**; a design that has the StarkWare team betting on StarkNet becoming the most performant ZK-Rollup. Despite not capturing as much attention as other L2s, StarkNet has seen steady growth, **reaching a TVL of US$146M**. Notable developments this year include the **deployment of StarkNet's Quantum Leap upgrades**, the **introduction of StarkNet Appchains**, the **Devonomics Pilot Program**, and the **announcement of the STRK token distribution plan**. With more throughput and latency improvements to come as part of its roadmap, including a path toward decentralization, it will be interesting to see whether these updates eventually translate towards increasing network activity.

- **StarkNet Appchains:** Earlier this year, StarkNet unveiled its **appchain framework, with Paradigm's Paradex as the first appchain**, providing affirmation of the StarkNet stack[108]. This StarkNet stack comprises a **set of software tools that enable developers to create customized appchains optimized for specific applications**. Key elements of the stack include **STARK proofs**, the **Cairo programming language**, and **native Account Abstraction**. StarkNet places a lot of importance on decentralization and its stack is expected to continue evolving going forward.

- **Quantum Leap and TPS:** As one of the major upgrades of the year, **Quantum Leap aims to increase StarkNet's TPS to at least 100 and reduce the time required to confirm and include a transaction**, known as 'time-to-inclusion'. This improvement is part of a **planned series of upgrades, with v0.12.0 and v0.12.1 having been released** earlier in the year on 12 July and 21 August, respectively. Given StarkNet's **max daily TPS previously recorded at 10.21, sustaining 100 TPS would mark a substantial improvement** and outshine its major competitors. While StarkNet's average TPS has increased since the initial deployment of Quantum Leap, it remains to be seen if StarkNet can reach and maintain its targeted TPS over time. To see this play out, more adoption of the network is likely to be required first.

Figure 45: Since deploying its Quantum Leap upgrade, StarkNet average daily TPS has increased from 1.03 to 4.74 this year



Source: Token Terminal, Binance Research, as of 31 December, 2023

- **STRK Token:** The Starknet Foundation outlined its plan to **distribute over 1.8B STRK to drive network adoption**[109]. Central to this is a Provisions Committee, who will **distribute 900M STRK in a phased manner to reward past and future user and community contributions**. The Foundation is also planning user rebates to subsidize or refund transaction costs, with a second committee **distributing 900M STRK to cover user transaction fees**. Finally, a third group, the 'DeFi Committee', will allocate an initial **50M to boost activity and liquidity for DeFi protocols**.

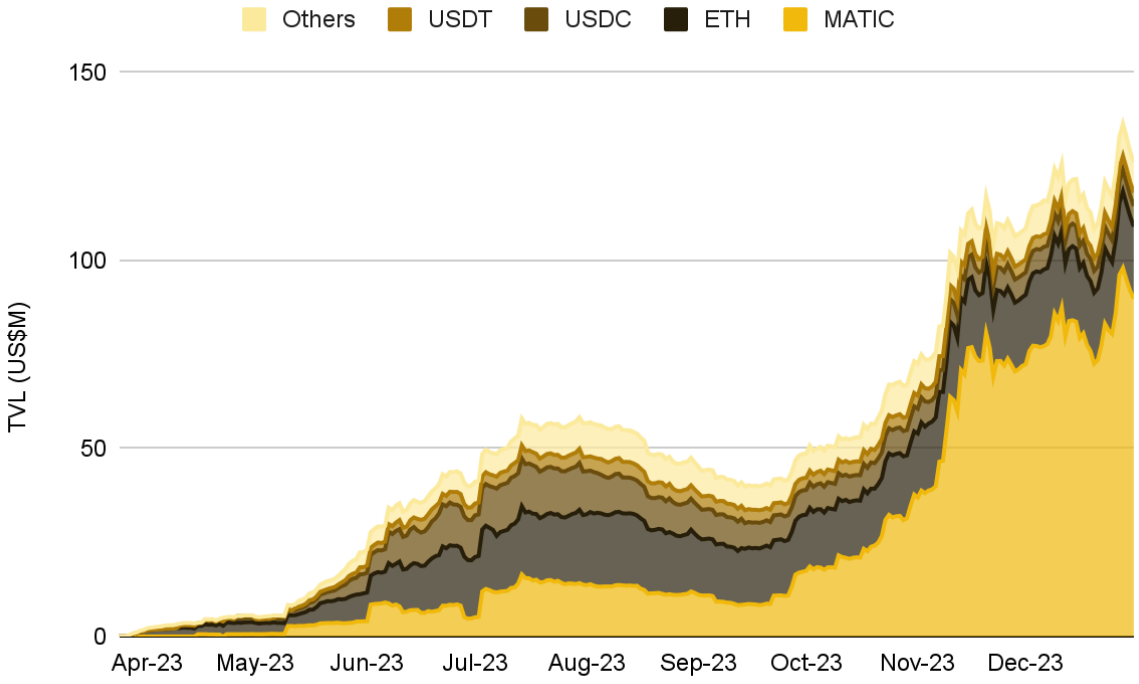
  It has previously been detailed that a **total of 10B STRK tokens would be issued**[110]. Among these, **50% will be retained by the organization**, while the **remainder allocated to core developers, ecosystem contributors, and the**

community. Considering the success of $OP and $ARB in boosting adoption for OP Mainnet and Arbitrum, it's plausible that StarkNet achieves similar results through a well-executed airdrop.

Polygon zkEVM

This year saw Polygon make notable strides in the ZK space. Central to this progress is Polygon zkEVM, the **core zkEVM rollup solution within Polygon's diverse product suite**. Since launching in March 2023, the initial growth of Polygon zkEVM was relatively slower compared to its peers in the zkEVM space. However, the **latter part of the year did bring an uptick in growth**, with the L2's **TVL surpassing US$128M and depositor count exceeding 100K**[111]. Although its figures are still modest in comparison to the cohort of competitors also launched this year, **as a zkEVM, Polygon stands out for its higher Ethereum equivalence**. This makes it a more conducive environment for deploying Ethereum dApps.

Figure 46: Despite its slow start, Polygon zkEVM's TVL witnessed a notable uptick towards the end of 2023, now reaching over US$128M



Source: Dune Analytics (@Marcov), Binance Research, as of December 31, 2023

Polygon zkEVM's growth this year has been influenced by diverse partnerships with players like Celer Network, Synapse, Balancer, Uniswap, and Chainlink. These collaborations, along with the **introduction of the Polygon Bridge to zkEVM**[112], have greatly enhanced ecosystem connectivity. Another key advancement was the **Dragon Fruit upgrade**, a major post-mainnet enhancement including **support for the PUSH0 Ethereum opcode**.

In a broader context, as **Polygon transitions to Polygon 2.0 with a focus on its new ZK-powered tech stack**, wider ecosystem developments are likely to benefit Polygon zkEVM. The **relaunch of Polygon Village**, backed by a significant **grant program of over 110M MATIC**, is aimed at supporting founders and stimulating ecosystem growth. With **strong synergies present between its range of ZK-based products**, the successful rollout of Polygon 2.0 along with the continued adoption of Polygon zkEVM and Polygon CDK will be increasingly critical for Polygon as we progress into the new year.

- **Polygon 2.0:** Polygon 2.0 represents a key milestone in Polygon's evolution, positioning itself as the **'Value Layer of the Internet'**. It brings significant **enhancements in architecture, tokenomics, governance**, and marks the **transition of the Polygon PoS chain to a zkEVM Validium**. This shift towards a ZK-centric ecosystem means every Polygon chain will be a ZK L2, making **Polygon zkEVM and zkEVM Validium central to a new super network of L2s**. Polygon's new POL token **extends beyond the original MATIC token's utility** and covers everything being built on the expanding ecosystem, including restaking. **Validators in Polygon 2.0 are set to assume expanded responsibilities** for network security, interoperability, and staking.

  Ultimately, the ecosystem's focus on ZK tech signals a positive future for Polygon zkEVM. This is not to say that it will become the premier Polygon chain, but it makes Polygon zkEVM and related developments worth paying close attention to. The two networks, **Polygon zkEVM and zkEVM Validium, are set to coexist and complement each other**[113]**,** serving the following use cases:

  - **Polygon zkEVM:** Offers the **highest level of security** (both ZK proofs and transaction data are sent to Ethereum), with the **tradeoff of slightly higher fees and limited throughput**. It is a **great fit for dApps processing high value transactions and where security is the priority**, i.e. DeFi.

  - **zkEVM Validium (Upgraded Polygon PoS):** Offers very **high scalability and low fees**, with the **tradeoff of storing transaction data locally instead of on Ethereum**. It would be a **great fit for dApps that have high transaction volume and require low transaction fees**, e.g. Web3 gaming and social.

- **Polygon CDK:** The launch of Polygon CDK aligns with the emerging trend of modular rollup ecosystems this year. Polygon CDK, a suite of open-source tools, **simplifies the development and deployment of ZK-powered L2s on Ethereum**, succeeding the discontinued Polygon Edge[114]. Notably, each individual Polygon chain can offer **customized roles and rewards for its validators**, who can also choose to validate multiple chains at once to compound their rewards. As more L2s join the ecosystem, validators and POL stakers stand to gain from increased fees.

For Polygon 2.0's success, **drawing projects to build with the CDK will be beneficial**, ultimately contributing to the ecosystem's value accrual and sustainability. Polygon CDK's **appeal lies in its customizability**, further amplified with its recent **integration of Celestia's out-of-the-box DA layer**[115]. Implementation providers like Gelato's RaaS should also help to drive adoption[116]. Notable projects utilizing the CDK include ImmutableX, Astar, Canto, and OKX's X1. Looking ahead, L2s developed with the Polygon CDK will be **interoperable within a broader web of ZK-powered L2s**, creating a single unified pool of liquidity.

- **Polygon Miden:** Polygon Miden is an upcoming ZK-rollup, but with very different design priorities. As opposed to being EVM-equivalent, like Polygon zkEVM, **Miden does not rely on the Ethereum Virtual Machine and instead utilizes the Miden Virtual Machine**, written in Rust. This unique approach **allows developers to build dApps with high throughput and enhanced privacy** using modern smart contract languages like Rust. Hence, Miden paves the way for **creating dApps that are currently challenging or impractical to build on account-based systems** like Ethereum.

Linea

Earlier this year, blockchain development firm Consensys released the highly anticipated Linea zkEVM on the mainnet[117]. Since its launch, Linea has quickly gained traction, **amassing a TVL of US$186M**. Though still early days, Linea has forged notable partnerships and initiated ecosystem campaigns like DeFi Voyage to kickstart its growth. **Linea's affiliation with Consensys has also been particularly advantageous**, enabling the L2 to **tap into other Consensys-owned products** like MetaMask, as well as developer tools in Infura, Diligence and Hyperledger Besu.

- **DeFi Voyage:** Partnering with Intract, a Web3 quest platform, and MetaMask Learn, Linea launched its first major campaign **in a bid to attract new users post mainnet launch**. DeFi Voyage was designed to incentivize users to explore and engage with various dApps on the Linea network in exchange for earning non-transferrable soulbound tokens.

  After running its course of six weeks, the campaign proved to be generally successful for Linea[118]. While a portion of this success may be attributed to the speculation of an airdrop, Linea's **TVL increased by an impressive 133.7%, starting just shy of US$80M**[119]**.** Post-campaign, the TVL has remained fairly stable, but there's a significant **drop in daily network activity, affecting both active addresses and transaction counts**. While such declines may be expected after ecosystem wide campaigns, it remains to be seen whether Linea is able to sustain its growth in TVL going forward.

Figure 47: DeFi Voyage initially boosted Linea's network activity from 78.6K to a peak of over 1.2M, but since completion, daily transactions regressed to prior levels

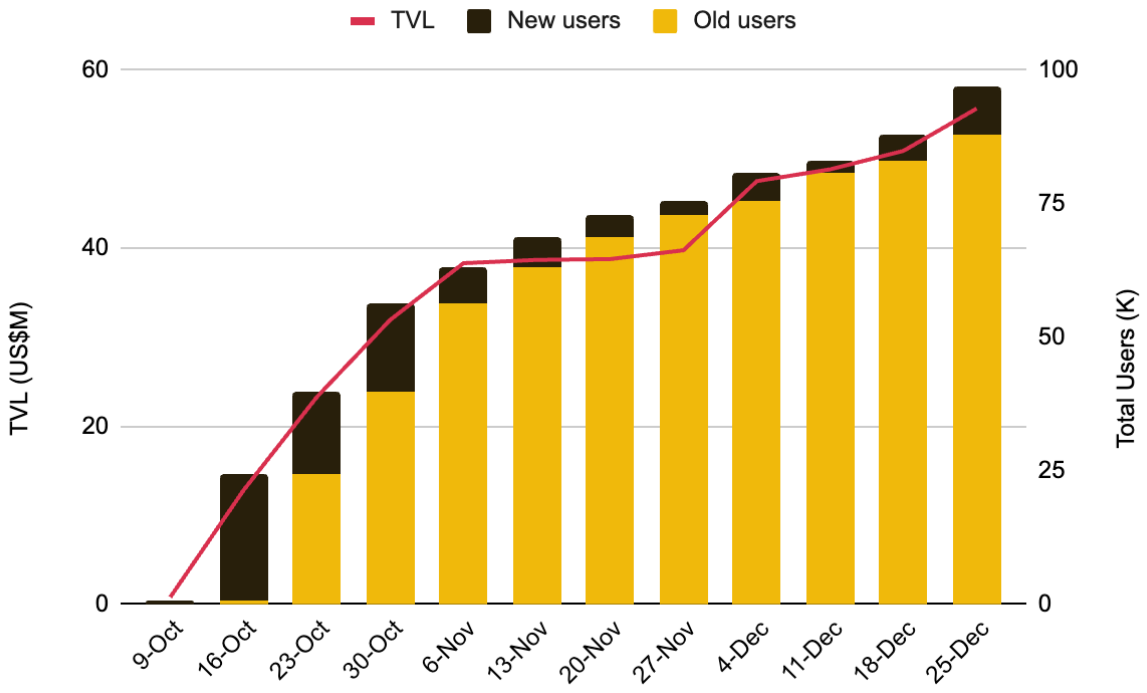
Source: Artemis, Binance Research, as of December 31, 2023

Scroll

After more than two years of rigorous development, Scroll unveiled its mainnet on October 17th, joining the growing list of zkEVMs introduced this year. **As a type-2 zkEVM, Scroll seamlessly integrates with Ethereum at the bytecode level, simplifying deployment for existing infrastructures and dApps.** Scroll's strategic approach has distinctly stood out from its competitors. **Rather than vying for the first-mover advantage**, the team **prioritized building a more EVM-equivalent product**, drawing upon their deep contributions in Ethereum L1 and zkSNARK research[120].

However, in the increasingly fragmented L2 landscape, technological innovation is not the sole factor for gaining market share. This is particularly true given the overlaps with other zkEVMs also aiming for a closer alignment with Ethereum. For Scroll, the real test will be to **effectively expand its ecosystem**, a task that involves **onboarding a diverse range of projects and users**, essential for building a sustainable network. Nevertheless, Scroll has shown early signs of growth since launch. It has seen its **TVL grow to US$55.7M**, with a **weekly user influx averaging 7,856**. **DEXes have been important in this upsurge**, with protocols like Ambient, SyncSwap and Zebra being the highest contributors to Scroll's TVL[121].

Figure 48: Following its mainnet launch, Scroll has accumulated US$55.7M in TVL and attracted more than 96K users



Source: L2Beat, Flipside (tkvresearch), Binance Research, as of December 31, 2023

Taiko

Taiko is **building towards a Type-1 zkEVM**, which can also be thought of as **complete Ethereum equivalence**. A Type-1 zkEVM solution offers unparalleled compatibility with Ethereum and a fluid developer experience, albeit with some compromises in performance. Despite the ambitious nature of this goal in the near term, the team have made significant strides, with **multiple testnets having been launched throughout the year**[122]. Their latest, the Jólnir testnet (Alpha-5), went live in September. As we proceed closer to Taiko's **intended mainnet launch in 2024**, it will be interesting to follow the first Type 1 zkEVM's trajectory closely.

4.4 Developments To Watch

- **Dencun upgrade and EIP-4844:** Ethereum's Dencun hardfork, slated for Q1 2024, comprises several upgrades poised to bring material changes to the largest L1. Specifically, the **spotlight is on EIP-4844 (Proto-Danksharding)**, which emerges as a **potential catalyst for the L2 space** given that it **enhances both the economic viability and scalability of rollups**. EIP-4844 seeks to **reduce the operational costs** of rollups by **introducing a new transaction type in 'blob-carraying transactions'**, directly addressing the critical scaling bottlenecks of Data Availability.

  Blobs present a **more cost-effective solution compared to the current calldata space** used by rollups to post data on the Ethereum mainnet, with the **potential to cut costs by 80-90%**. Such a reduction in fees is likely to stimulate increased transaction activity. This increase in activity could, in turn, raise execution costs, potentially leading to greater overall profits for L2s. While there are many other moving pieces to consider, **EIP-4844 certainly merits close attention**.

  For a more in-depth reading, refer to our earlier report, Ethereum: Beyond The Merge.

- **Rollups-as-a-Service ("RaaS"):** Rollups are increasingly being **recognized for their versatility in addition to their scaling capabilities**. Indeed, major L2 networks are now introducing technologies that **enable developers to launch their own rollups**, offering dApps a **customizable execution layer with abundant block space**, albeit **at the cost of some decentralization and security**. Solutions like Arbitrum's Orbit chains, Optimism's OP Stack chains, zkSync's Hyperchains, and Polygon CDK are becoming focal points in the next generation of rollup technology. This shift has spurred the **rise of RaaS providers as a sub-sector within L2s**.

  RaaS providers offer a **spectrum of services,** from **rollup management to no-code deployment options**, enabling developers to easily launch and maintain their rollups. Notable projects in the RaaS space include Conduit, AltLayer, Caldera, and Gelato, all of which are **forming active partnerships with many newly launched or upcoming rollups**. With a surge in rollup adoption anticipated in the coming year, RaaS solutions are **positioned to capitalize on this growth**.

  For more information on this topic, check out our previous report, The Rollups-as-a-Service Primer.

- **Rollup decentralization and security:** Rollups are vital to Ethereum's technical roadmap and are **increasingly subject to the Ethereum community's strict decentralization and security standards**. As per Vitalik Buterin's framework, they are still in the **early stages of decentralization** and **rely on certain 'training wheels'**. For example, most rollups have, so far, found it convenient, user-friendly, and cost-effective to **run their own sole, centralized sequencers**. However, with the maturation and growth of the rollup space in 2023, the view is starting to shift towards **decentralizing sequencers** and **improving trustlessness**. While Arbitrum is currently the furthest along this trend, most rollups have **incorporated sequencer decentralization into their roadmaps**. Concurrently, **shared sequencer solutions like Espresso, Astria and Radius have emerged**, aiming to extend decentralization to an arbitrary number of rollups.

  Zooming out, it's evident that each rollup is **shedding its 'training wheels' at a varied pace**. To reach the coveted Stage 2 category in Vitalik's taxonomy, rollups' focus areas range from: **implementing validity or fraud proofs**, **expanding the pool of operators for validation and sequencing**, and ultimately, transitioning to a more decentralized model by **relinquishing admin privileges and distributing control through governance**.

  For additional reading on decentralized sequencers, check out our previous report, Ethereum's Rollups are Centralized. A Look Into Decentralized Sequencers.

- **Zero-knowledge ("ZK") technology:** Beyond zkEVMs, **several significant advancements are shaping the landscape of ZK-based technology**. Leading this are **ZK co-processors**, which allow dApps to **offload data-intensive and costly computations off-chain**. This not only enables dApps to **maintain low gas costs** for users, but also lets them **run more complicated functions and computation**, **improving the overall user experience**. The key advantage of this approach is the **retention of Ethereum's full security** for dApps, even with some processes off-chain. ZK co-processors are thus set to **unlock a new generation of Web3 dApps**, with use cases ranging from on-chain gaming, DeFi loyalty programs, variable incentive programs, digital identity, KYC, and more.

  Adding to this, there are efforts to create dedicated infrastructure layers **making ZK development more integrated and streamlined**. The Succinct protocol serves as an example of this, providing a **collaborative platform for developers to explore and build with ZK-technology**. As the capabilities of ZK-technology continue to evolve, its adoption and impact across the crypto industry are expected to become increasingly apparent and widespread.

5 Decentralized Finance

5.1 The Big Picture

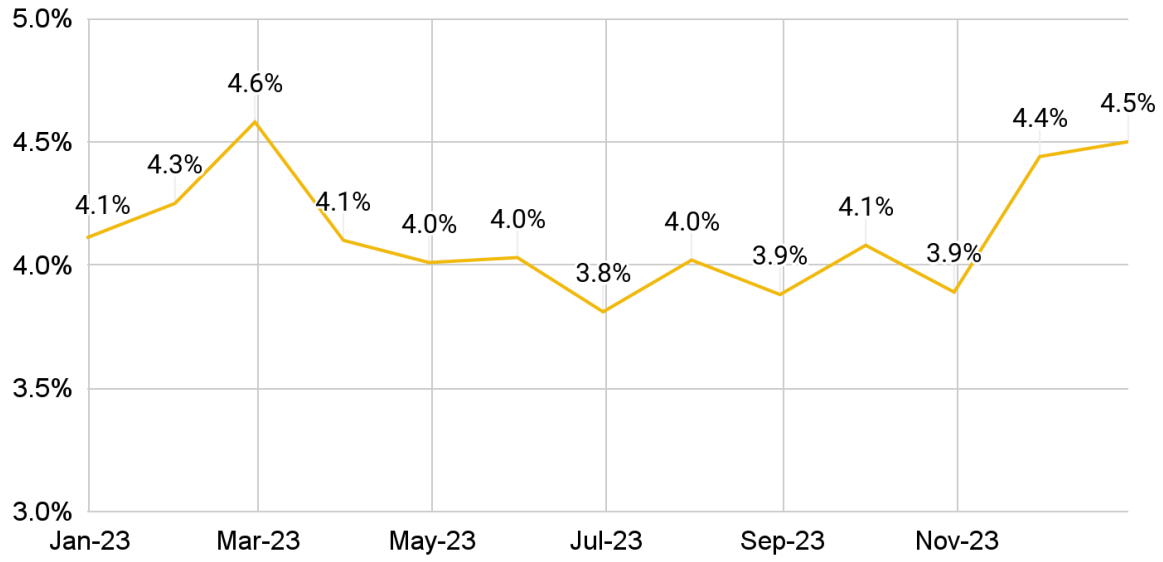
The decentralized finance ("DeFi") market witnessed substantial growth in 2023, driven by a broad market rally in the latter part of the year. DeFi TVL rose by 38.9% and stood at US$53.4B at the end of the year. The continued commitment of substantial capital, amounting to billions of dollars within a wide array of DeFi protocols, attests to the sector's pivotal role within the digital asset industry.

Figure 49: DeFi TVL increased by 38.9% in 2023

Source: DeFi Llama, as of December 31, 2023

Additionally, it is not just on-chain metrics such as TVL that have seen positive growth. **DeFi-related token prices also witnessed a notable recovery at above-trend growth.** Referring to Figure 50, DeFi's market dominance increased from 4.1% at the start of the year to 4.5% at the end of the year. This implies that DeFi tokens have grown at a more rapid pace than the wider crypto market, which is a positive indicator for the sector.

Figure 50: DeFi dominance increased by 0.4% (absolute terms) in 2023

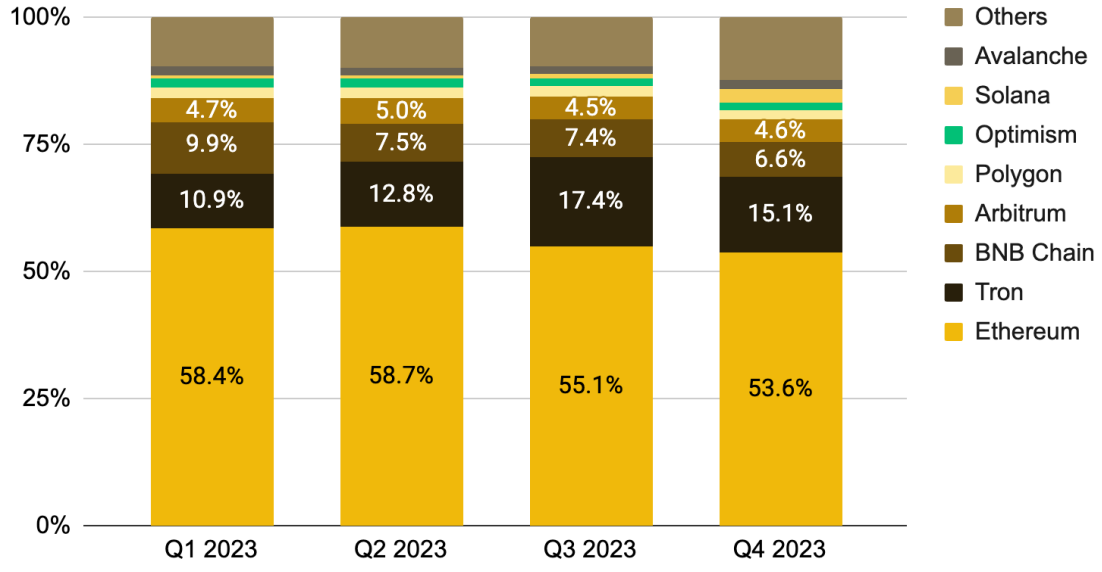


Source: The Block, as of December 31, 2023

Looking at the distribution of TVL by chains, it is clear that **Ethereum remains the dominant leader by a large margin**. This is unsurprising, as most DeFi activity still occurs on Ethereum, which has a large diversity of dApps.

Tron was a notable gainer for the year, with its market share rising from 10.9% at the end of Q1 to 15.1% by the end of the year. This growth was largely driven by an increase in TVL in JustLend, the largest DeFi protocol on Tron, which specializes in lending. However, utilization (total borrowed/total supply) of the protocol is very low, at less than 2%[123].

Figure 51: Ethereum maintained its dominance in DeFi



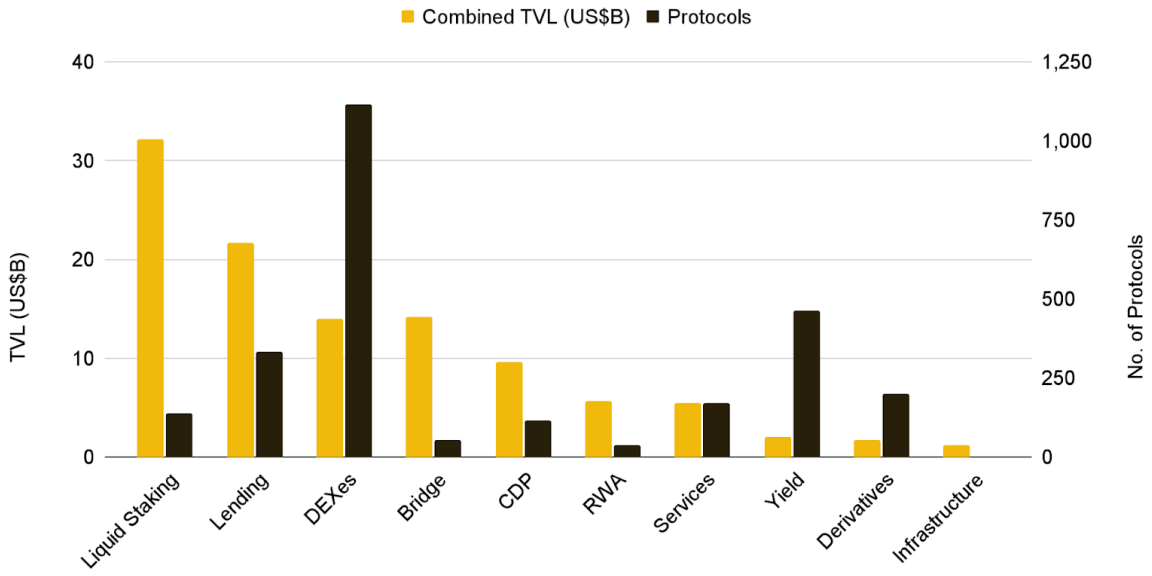
Source: DeFi Llama, as of December 31, 2023

Another notable mention is **Solana, which has seen DeFi TVL increase from 210.5M to 1.4B, attributed to a surge in the price of SOL**. While Solana's current TVL remains substantially lower than its all-time high of over US$10B at its peak in 2021, TVL has increased sixfold from its year-to-date lows, making it one of the fastest-growing chains in DeFi in U.S. dollar terms this year. However, TVL in SOL terms is down 34%, highlighting the challenge that faces Solana in encouraging capital flows to DeFi. We have seen airdrop programs by projects like Pyth[124] and Jupiter[125], and it remains to be seen if anticipation of potentially more airdrops would drive DeFi on Solana.

5.2 DeFi by Sub-Sectors

Liquid staking protocols overtook decentralized exchanges ("DEXes") and lending protocols to emerge as the top DeFi sub-sector by TVL in 2023. DEXes have fallen from the top place to the third in 2023 based on this metric. Nonetheless, DEXes remain the largest sub-sector, with over 1,000 protocols, indicative of the size and importance of this space.

Figure 52: Top sectors in DeFi by TVL and number of protocols



Source: DeFi Llama, as of December 31, 2023

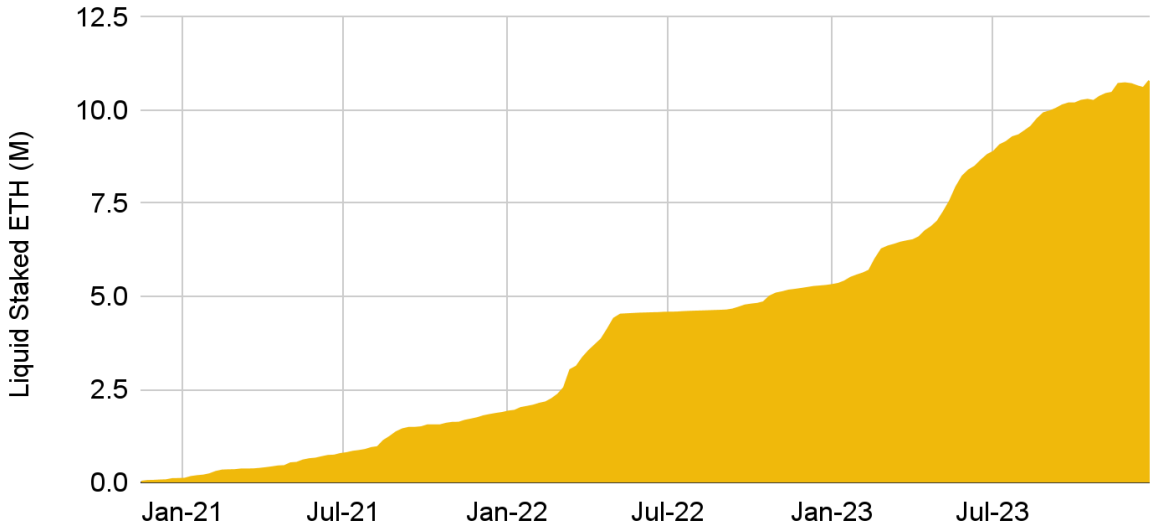
In this section, we cover the latest developments in liquid staking, lending, and DEXes.

Liquid Staking

The successful transition of Ethereum to Proof of Stake ("PoS") and the subsequent enablement of staked ETH withdrawals after the Shapella upgrade have contributed to a

massive growth in staking. Correspondingly, we have also seen significant growth in liquid staking tokens ("LSTs").

Figure 53: ETH in liquid staking protocols have grown significantly



Source: Dune Analytics (@hildobby), as of December 31, 2023

LSTs are tokens issued by liquid staking platforms (e.g., stETH, rETH, etc.). There are considerable technical difficulties and capital requirements to run a solo node, which may not be suitable for everyone. As such, **liquid staking protocols allow more users to participate in the staking process with lower barriers to entry** while also retaining the liquidity of staked assets. This retention of liquidity is achieved by issuing a liquid staking token for users of the protocol, which can then be used to participate in the broader crypto ecosystem.

LSTs can be rebasing or reward-bearing tokens. Holders of rebasing tokens such as stETH experience a change in balance as token supply changes in accordance with staking rewards or slashing penalties. Conversely, reward-bearing tokens reflect accrued yields through changes in token values instead of changes in balances.

Figure 54: Liquid staking providers in the Ethereum ecosystem

	Lido	RocketPool	Frax	Binance	Coinbase
Token	stETH, wstETH	rETH	frxETH, sfrxETH	BETH, WBETH	cbETH
Mechanism	Rebasing (stETH) / Reward - Bearing (wstETH)	Reward - Bearing	Reward - Bearing	Rebasing (BETH) / Reward - Bearing (WBETH)	Reward - Bearing

Fees	10%	14%	10%	10%	25%

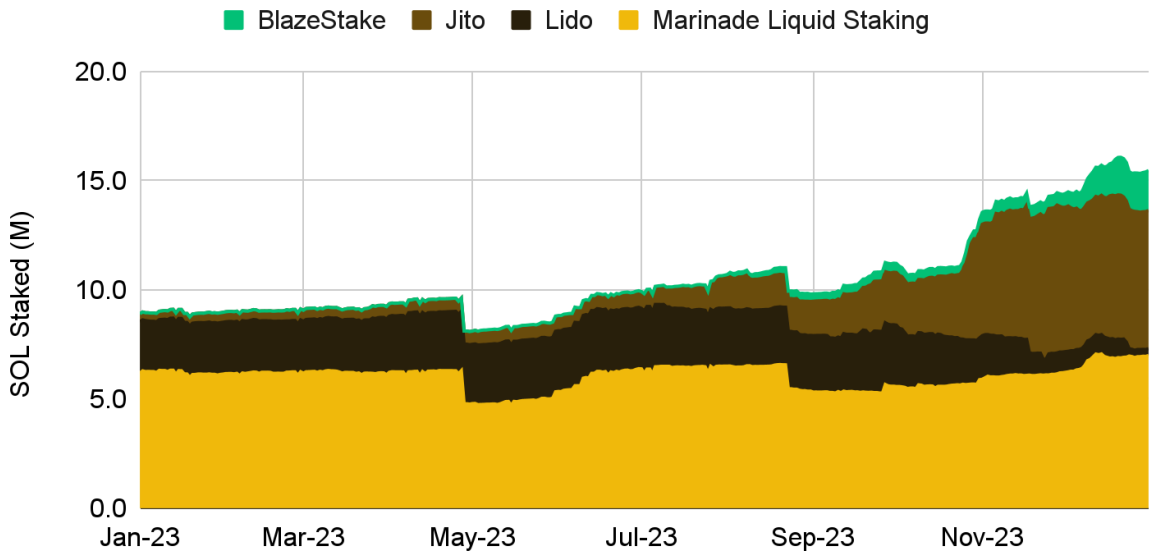
Source: Projects' Websites, DeFi Llama, as of December 31, 2023

Notice that, apart from DeFi protocols such as Lido, RocketPool, and Frax, centralized exchanges such as Binance and Coinbase also provide liquid staking services for their users. In fact, Binance and Coinbase are among the top 5 entities in terms of the amount of ETH staked[126]. Similar to other LSTs, WBETH and cbETH can also be used in a variety of DeFi protocols.

Solana's Liquid Staking Growth

While liquid staking is not something new to the Solana community (Marinade's mSOL went live in August 2021), liquid staking protocols on Solana have seen a surge in TVL in recent months. Jito has been a key driver, with TVL on the protocol increasing by 1660% in 2023. Activity on Jito in recent months has been driven by its JTO airdrop and its points campaign to incentivize staking.

Figure 55: SOL staked on liquid staking protocols has spiked



Source: DeFi Llama, as of December 31, 2023

Despite increased activity on Solana's liquid staking protocols, Lido is sunsetting its Solana staking operations following a vote by Lido DAO members in October 2023[127].New users will not be able to stake SOL on Lido; its website front-end will not support unstaking from February 2024 onward. Nonetheless, referring to Figure 55, there has not been a huge impact on the overall ecosystem. It seems that users have migrated to other competitors, with Jito being the greatest beneficiary.

Looking ahead, the liquid-staking landscape on Solana still has significant room for growth. **While over 70% of eligible Solana is staked, only less than 4% of that is in liquid staking protocols**[128].

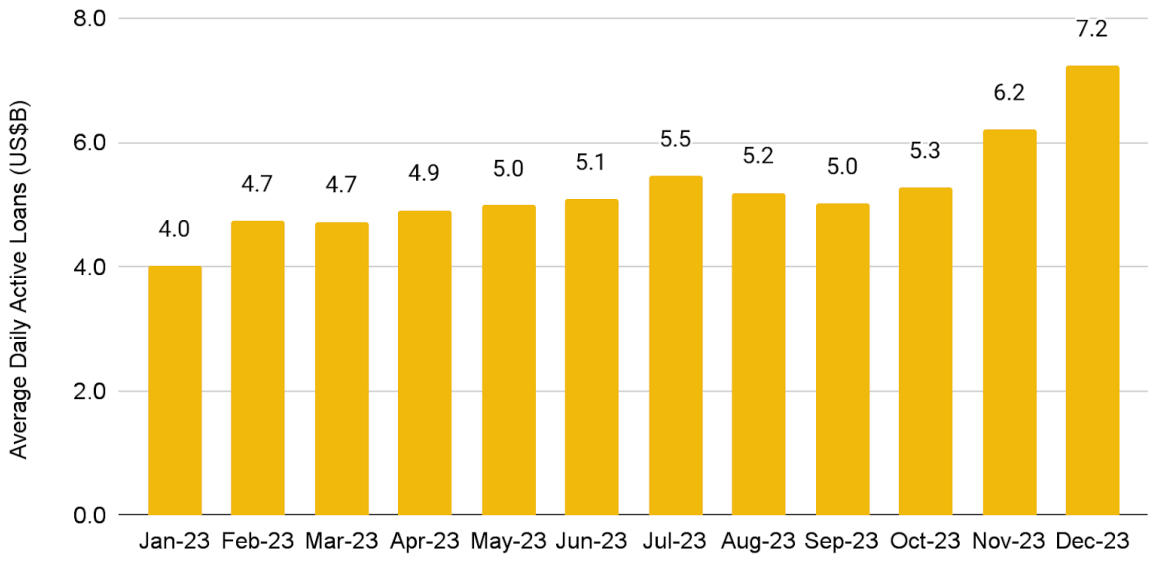
Lending

Lending is a vital component of DeFi, with a TVL of US$21.6B. Notably, the sector has overtaken DEXes this year to claim the number two spot by TVL. **A large contributor has been the increase in TVL by JustLend, a lending protocol on Tron.** In 2023 alone, JustLend experienced a surge in TVL from US$2.7B to US$6.4B, representing an increase of 139%. It has surpassed Aave to be the largest lending protocol by TVL.

However, it is important to note that TVL by itself may not be the most representative metric for lending protocols as it does not account for actual lending activity. **Despite JustLend's sizable TVL, actual demand for lending on the protocol is relatively low.** Comparing the amount borrowed to the available supply, the utilization of the protocol is less than 2%[129]. This indicates that most of the capital on the platform is idle and is not loaned out.

Looking at the sector as a whole, the average value of active loans has been on the rise, and the sector has benefited from renewed market activity. Specifically, the monthly average value of active loans in the top protocols increased by 89% year-on-year in December and has been on a general uptrend throughout 2023.

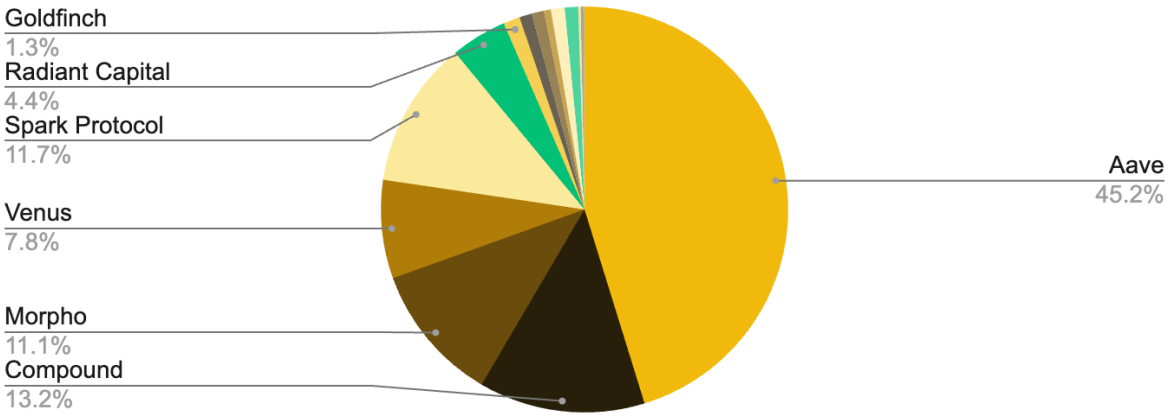
Figure 56: Average daily active loans has increased since the start of the year



Source: Token Terminal, as of December 31, 2023
Projects covered: Aave, Compound, Morpho, Venus, Radiant Capital, Spark Protocol, Goldfinch, Maple Finance, Sonne Finance, BENQI, Gearbox, BendDAO, TrueFi, Euler, Fraxlend, Silo Finance

In this regard, Aave stands out as the leader with the highest amount of active loans in the lending space, accounting for slightly less than half of the total active loans in December 2023.

Figure 57: Aave is the dominant leader by amount of active loans



Source: Token Terminal, as of December 31, 2023
Projects covered: Aave, Compound, Morpho, Venus, Radiant Capital, Spark Protocol, Goldfinch, Maple Finance, Sonne Finance, BENQI, Gearbox, BendDAO, TrueFi, Euler

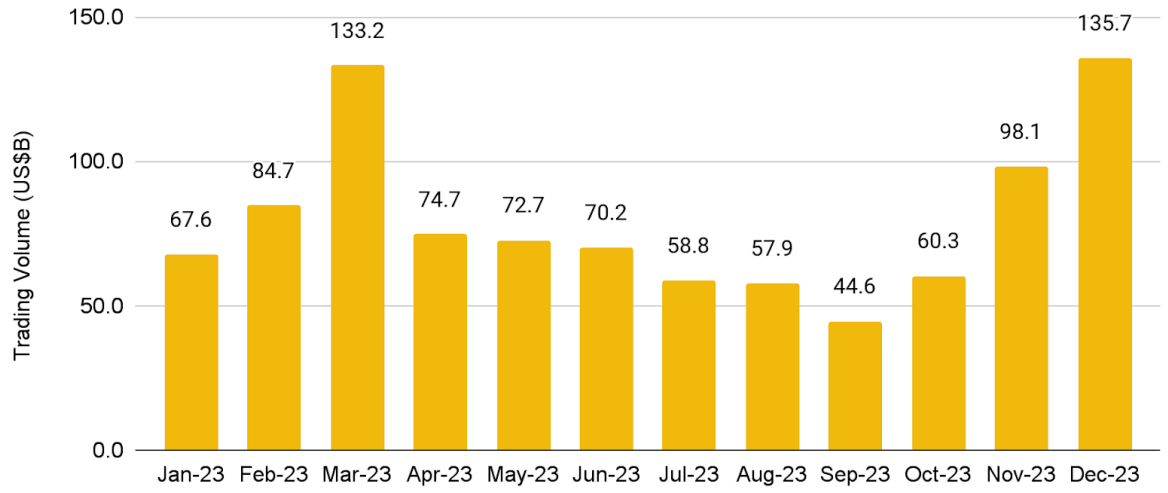
Notably, Spark Protocol, which launched only in May this year, has risen up the leaderboard rapidly and is now one of the top lending protocols by TVL (#4 on DeFi Llama) and by average value of active loans (#6 on Token Terminal). Spark Protocol is a lending protocol that offers DeFi loans by obtaining liquidity directly from Maker. Users can deposit DAI and earn the DAI Savings Rate ("DSR"), which is currently at 5%. Activity has been driven by Spark's upcoming airdrop program as well as the initiation of the Enhanced DAI Savings Rate ("EDSR"), which stimulated the growth of DAI.

Lending continues to be a key part of DeFi and has witnessed sustained growth throughout the year. An interesting area of development relates to real-world asset lending, which we cover here.

Decentralized Exchanges ("DEXes")

DEXes recorded over US$958B in trading volume in 2023. Apart from a spike in March contributed by USDC's depeg and regulatory concerns about centralized exchanges ("CEXes")[130], trading volume on DEXes was generally on a downtrend for the first three quarters of the year. The fourth quarter marked a significant turnaround as trading activity rebounded alongside improved market sentiment.

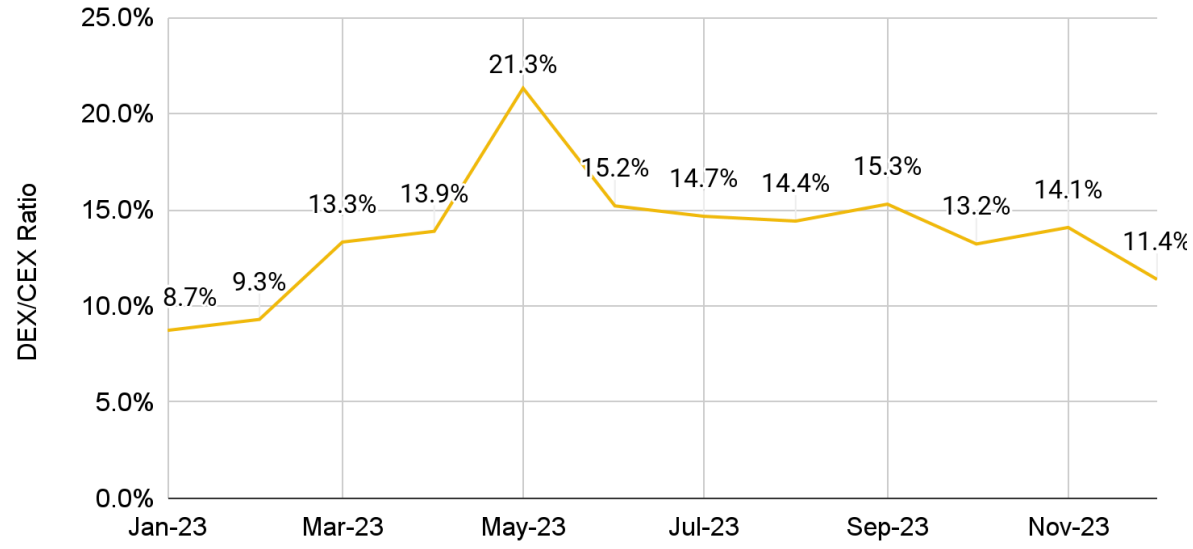
Figure 58: Over US$958B was traded on DEXes in 2023



Source: DeFi Llama, as of December 31, 2023

While centralized exchanges continue to command the lion's share of total trading volume, **DEXes have seen a remarkable increase in activity throughout 2023**. The DEX/CEX ratio, which measures the trading volume of DEXes relative to CEXes, hit its all-time peak in May 2023 at 21.3%, far exceeding its previous high of 16.8% in January 2022. On average, the monthly DEX/CEX ratio in 2023 was 13.7%, an increase from 11.4% in 2022.

Figure 59: Average DEX/CEX ratio was 13.7% in 2023

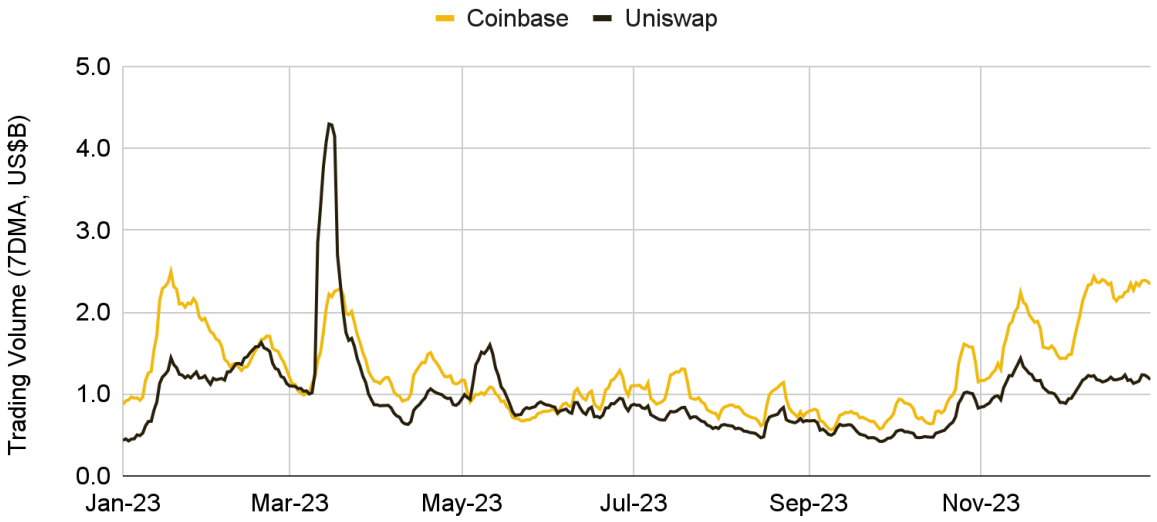


Source: The Block, as of December 31, 2023

This can be attributed to several drivers, such as continued product innovations, a proportionately large share of crypto-native participants in the current environment, and concerns over regulatory developments affecting centralized exchanges.

Notably, **trading volume on Uniswap overtook that on Coinbase for the first time in the first quarter of 2023**, when Uniswap recorded US$155B in trading volume as compared to US$145B for Coinbase[131]. While the seven-day moving average trading volume of Coinbase remains higher than Uniswap most of the time in recent months, the disparity was not significantly wide for most of the year and paints a plausible future where DEXes overtake CEXes in trading activity.

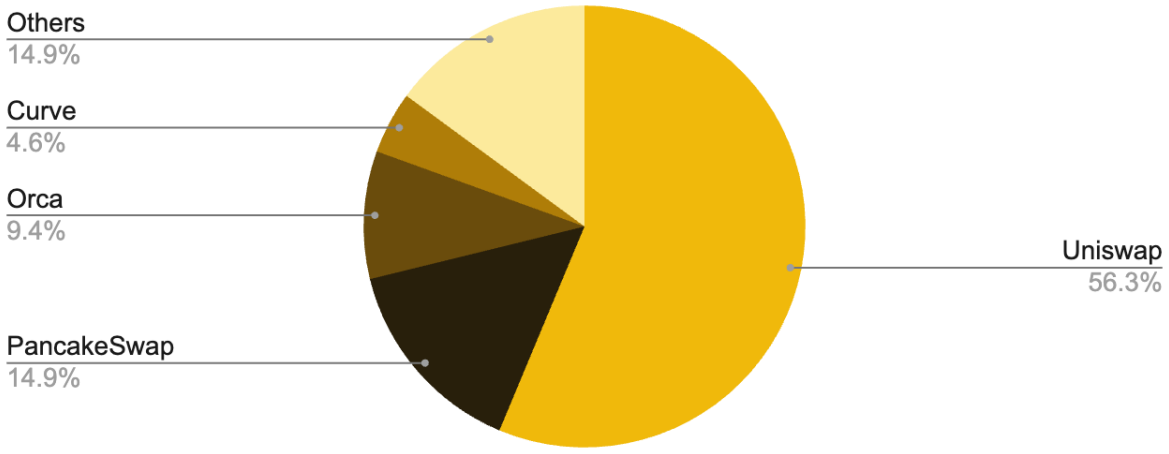
Figure 60: Trading volume of Coinbase and Uniswap were comparable for most part of 2023



Source: The Block, as of December 31, 2023

Looking at the competitive landscape, Uniswap remains the largest DEX by trading volume, with 56.3% market share in December 2023. Key developments for the year include Uniswap's v4 announcement and the launch of UniswapX. As a Dutch auction-based trading protocol for routing and aggregating liquidity, UniswapX's launch marks Uniswap's entrance into the intent-based landscape. It aims to provide a better experience for users by aggregating liquidity sources, swapping without network costs, and protecting against MEV attacks[132].

Figure 61: Market share by trading volume in December 2023



Source: The Block, as of December 31, 2023

The launch and adoption of Uniswap v4 is worth monitoring, especially if it successfully manages to attract a diverse set of traders by introducing more complex order types, such as time-weighted average price ("TWAP") and limit orders. With its enhanced customizability, Uniswap v4 could enable project teams to build on top of Uniswap's secure and liquid base, thereby transforming Uniswap into a foundational layer for future automated market makers ("AMMs"). Additionally, the nature of Uniswap v4 showcases the increasing shift towards open-source and public infrastructure. Note that the launch of v4 will only take place after the release of EIP-1153 and transient storage in the next Ethereum hard fork[133].

PancakeSwap cemented its spot in second place and ended the year with 14.9% market share. It remains the most popular DEX on BNB Chain and is currently available on 9 different blockchains. Notably, **PancakeSwap has proven to be successful in its multi-chain expansion, coming in the top 3 on most of the chains in terms of trading volume**[134]. Other notable developments include the transition of PancakeSwap's native CAKE token to a deflationary model following several initiatives, as well as the extension of PancakeSwap into the blockchain gaming industry through the launch of the PancakeSwap Gaming Marketplace.

5.3 DeFi Narratives

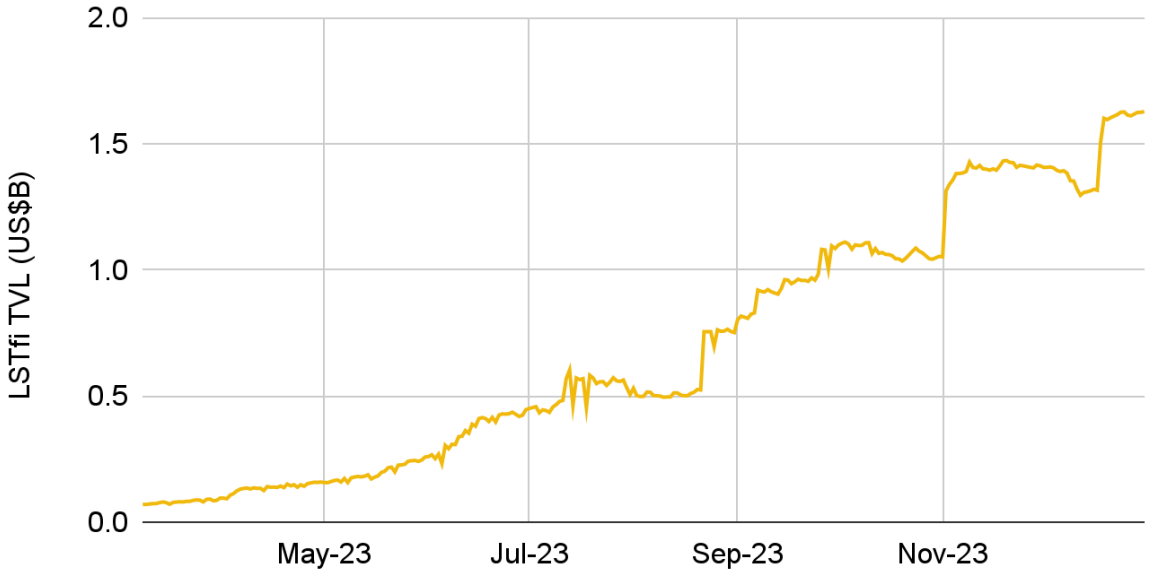
As we navigate through the ever-evolving landscape of DeFi, it's key to understand prevailing trends and narratives. These are the catalysts that have driven adoption, fueled interest, and powered use cases in the DeFi ecosystem. We have highlighted three developments in this section.

LSTfi

LSTfi refers to DeFi protocols built on top of liquid staking derivatives. By offering additional yield-generating opportunities, LSTfi protocols allow LST holders to put their assets to work and maximize yield.

LSTfi protocols have experienced a rapid increase in TVL over the past year, benefiting from the adoption of liquid staking. As the narrative gained steam, **cumulative TVL in top LSTfi protocols crossed the US$1.6B mark and has increased by 1119%** since Ethereum's Shapella Upgrade on April 12.

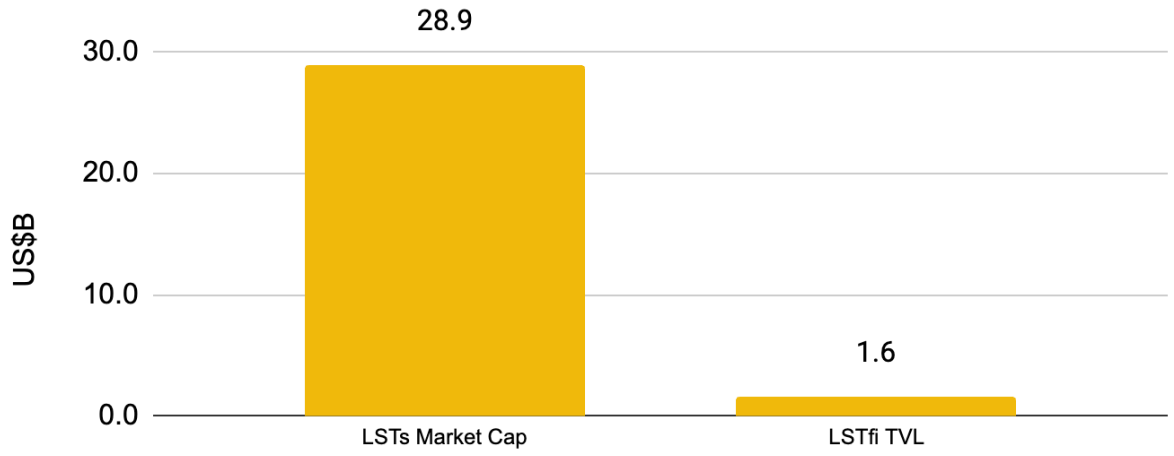
Figure 62: LSTfi TVL has been on the rise



Source: Dune Analytics (@defimochi), as of December 31, 2023

The growth of LSTfi protocols has benefited from the structural tailwind of an increase in staked ETH post-Shapella. With greater participation in staking, liquid staking adoption has also risen. Naturally, holders of LSTs have also looked towards LSTfi protocols to generate additional yield. Such growth is unsurprising, considering there are over US$28.9B in LSTs on Ethereum and a TVL of only around US$1.6B in LSTfi protocols, representing a penetration rate of approximately 6%. While some LSD holders may have reservations about using LSTfi protocols and it would be practically impossible to achieve 100% penetration, **a low single-digit penetration represents large headroom for growth**.

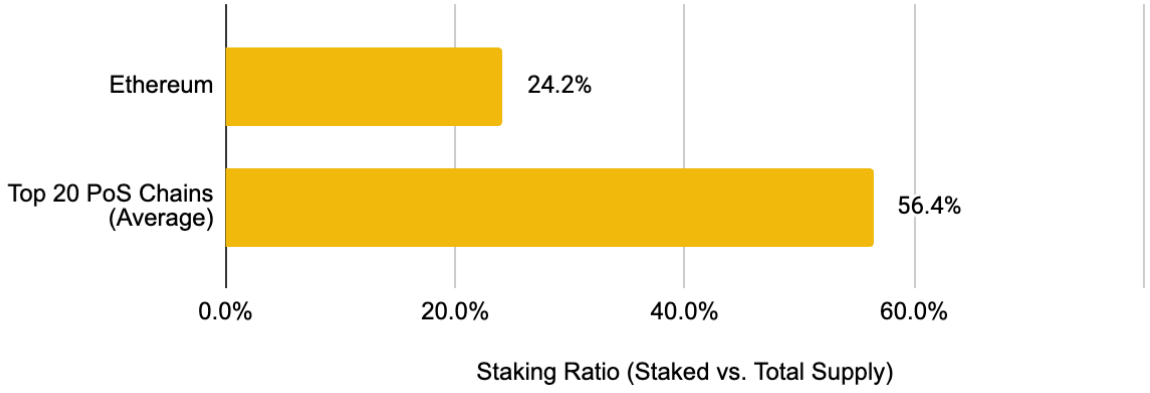
Figure 63: LSTfi has barely scratched the surface when evaluating against the total addressable market



Source: Dune Analytics (@eliasimos, @defimochi), as of December 7, 2023

The growth of staked ETH also represents a structural tailwind for the sector. The **staking ratio has increased from less than 15% pre-Shapella to more than 23% today**, and more than 9.3M ETH has been staked since the Shapella upgrade[135]. Despite this, the **staking ratio of ETH is still significantly lower than the average of 56.4% of the top 20 proof-of-stake chains**, indicating further growth potential. If the staking ratio does increase, the influx of staked ETH would serve as a positive catalyst and structural tailwind for LST and LSTfi protocols.

Figure 64: ETH's low staking ratio exhibits significant potential for growth



Source: Staking Rewards, as of December 31, 2023

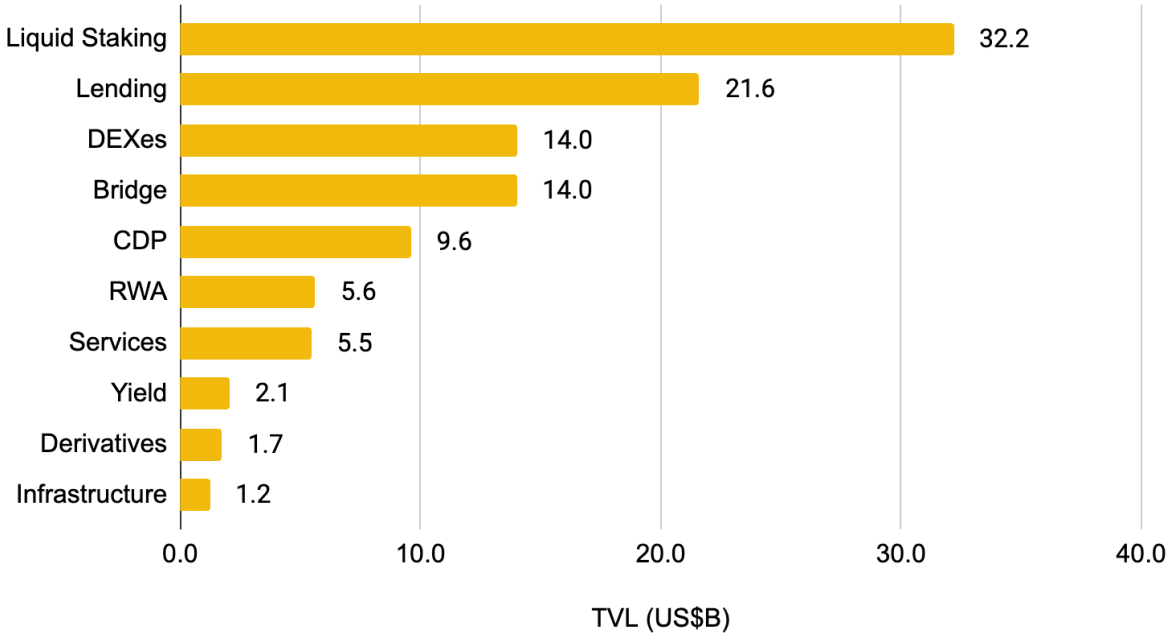
As the sector continues to grow, it will be exciting to observe further innovations and to monitor the adoption of LSDfi. That said, it is crucial to note that LSTfi is a relatively young market, and as with all emerging technologies, one should be aware of the risks involved in interacting with such projects.

Tokenization of Real-World Assets

Real-world assets ("RWAs") represent tangible and intangible assets in the physical world (e.g., real estate, bonds, commodities, etc.). **The tokenization of RWAs allows us to bring these off-chain assets onto the blockchain**, thereby opening a new realm of possibilities regarding composability and potential use cases.

Today, **RWAs represent the sixth-largest sector in DeFi** based on protocols tracked by DeFi Llama, having risen rapidly from 13th place at the end of Q2. Contributors include the launch of stUSDT in July and the increasing RWA exposure for MakerDAO.

Figure 65: RWAs is the sixth-largest sector in DeFi



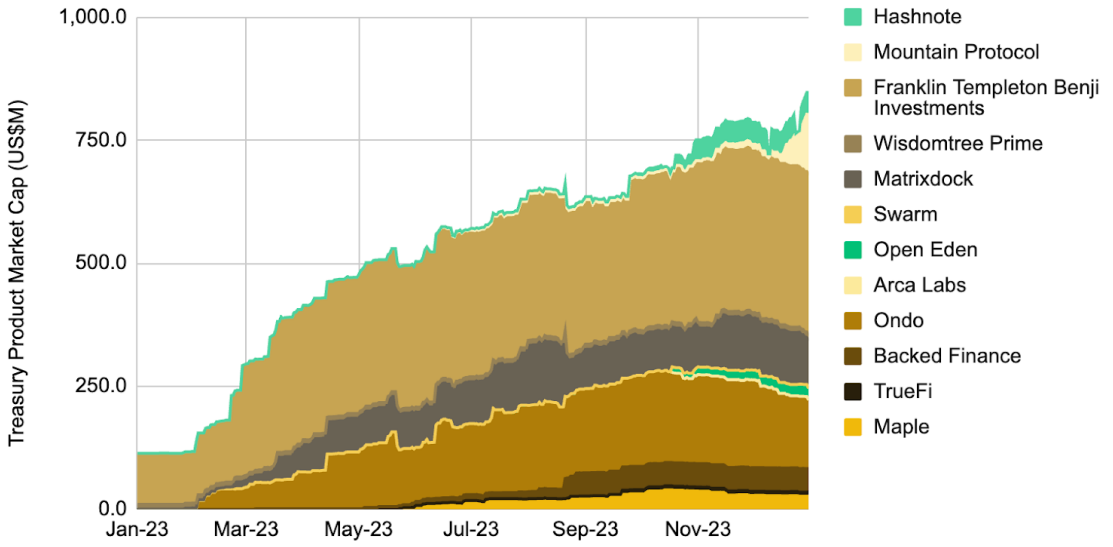
Source: DeFi Llama, as of December 31, 2023

Note that the data above is likely understated as not all protocols have been captured, and data in certain instances may not be readily available when tokenization happens on private blockchains. Nonetheless, the rise in the ranks of RWAs as a sector is a testament to the increasing adoption of RWA protocols.

A bright spot within the RWA space in recent months has been tokenized U.S. Treasuries. U.S. Treasuries refer to sovereign debt issued by the U.S. government and have been widely considered a benchmark for risk-free assets in traditional financial markets. The elevated yields of treasuries make them an attractive asset class.

Demonstrating the utility of RWAs, **investors today can take advantage of real-world yields by investing in tokenized treasuries without leaving the blockchain**. In fact, the tokenized treasury market is worth roughly US$846M today, meaning that investors are effectively lending that amount to the U.S. government at around 5.2% APY[136].

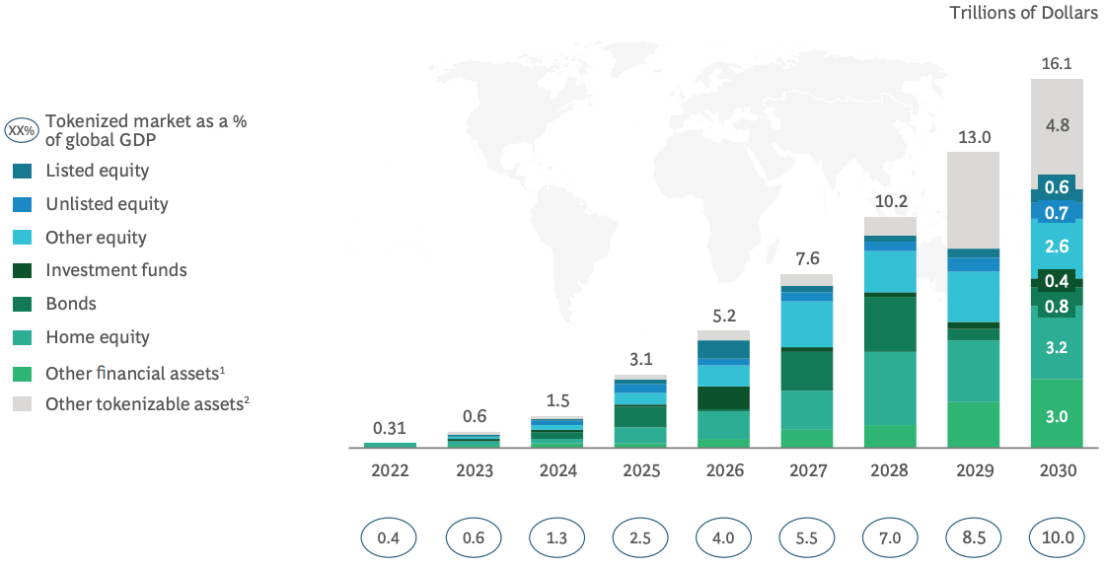
Figure 66: The tokenized U.S. Treasury market is worth US$846M



Source: rwa.xyz, as of December 31, 2023

Looking ahead, tokenized assets are estimated to be a US$16 trillion market by 2030[137]. This would make up 10% of global GDP by the decade's end, a significant increase from US$310B in 2022. This estimate includes on-chain asset tokenization (more relevant to the blockchain industry) and traditional asset fractionalization (e.g., exchange-traded funds, real estate investment trusts). Considering the potential market size, even capturing a small percentage of the market would be a boon for the blockchain industry.

Figure 67: The tokenization of illiquid assets is estimated to be a US$16T business opportunity by 2030



Source: Boston Consulting Group

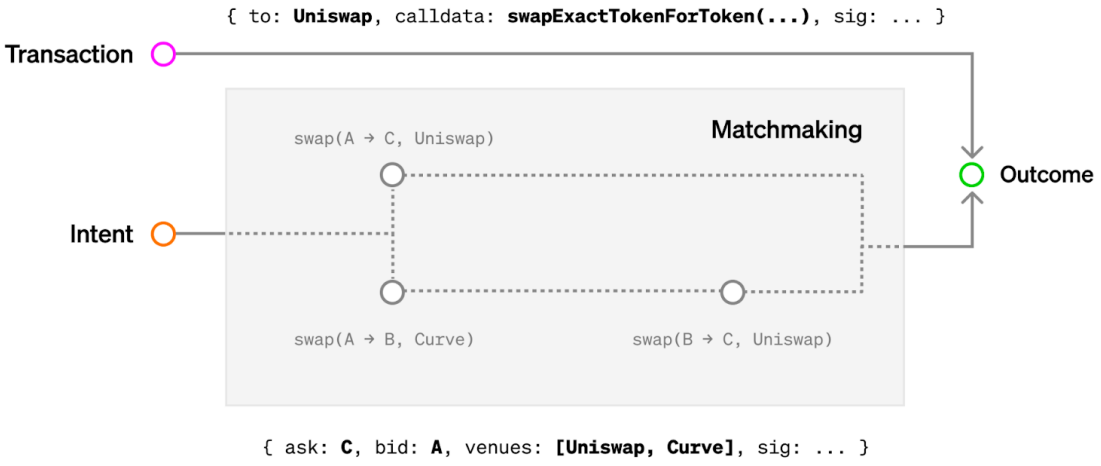
For more details on how some protocols have integrated RWAs, check out our previous report, Real-World Assets: State of the Market.

Intent-Centric Architecture

Intents have recently gained prominence as a solution to the challenges encountered by users in the current Web3 paradigm. For starters, engaging with current Web3 systems can be a complex and time-consuming task, especially for those not well-versed in such technologies. To interact with blockchains, users are required to navigate fragmented infrastructures to piece together an execution route. Such complexity often leads to a suboptimal user experience ("UX"), is prone to errors, and paves the way for potential exploitation of MEV by more sophisticated actors.

As a result, intents emerged as a solution to overcome these challenges, with the aim of simplifying Web3 interactions for users. But what exactly are intents? **Intents are signed messages that enable users to express what they want to achieve on-chain, while third-party actors, known as solvers, handle the technical details to make it happen.** At their core, intents comprise a set of declarative constraints; users delegate transaction creation to solvers, who choose the best computational path on their behalf, all while retaining full control over their assets. **In layman's terms, intents allow users to focus on their end goals – the "what" – without being bogged down by the specific steps – the "how" – to realize those goals.**

Figure 68: The shift from a transaction-based interaction to an intent-based approach removes additional barriers for users



Source: Paradigm

There are several intent-specific applications emerging today, unlocking a broad spectrum of industry use cases. A few notable examples are highlighted below:

- **Limit orders and batch auctions:** Limit orders function as partial transactions. Solvers compete to find the ideal combination of counterparties, potentially across multiple DEX pools, to secure the optimal routing and price for users.

- **Smart orders:** Users can define specific execution conditions for their swaps and use intents to place various bids customized to their needs.
- **Automated actions:** Automate the execution of various actions. For instance, users might choose to dollar-cost average into a token or auto-rebalance their portfolios, either within a set range or at a predetermined time.
- **Cross-chain bridging:** Bridging can pose a significant UX challenge for users. By specifying preferences and risk thresholds, users can delegate and let solvers handle the process.
- **Crowdfunding:** Using intents, users are able to conditionally pledge funds, committing only when a project hits predefined milestones. A case in point is GitCoin Matching Funds, where users pre-commit donations to winning projects even before they're chosen.
- **Peer-to-Peer ("P2P"):** By declaring intents, users can transact directly with others, eliminating the need for intermediaries and achieving better pricing. In the context of lending, lenders define their conditions, like desired collateral types and rates. Should a borrower repay early and the lender want to continue lending, solvers can match the lender with another suitable counterparty.
- **Security screening:** Utilize intents to restrict interactions to smart contracts that provide verifiable proofs, such as confirmation of approval by whitelisted audit teams.

For more information, read our previous report, Demystifying the Intent-Centric Thesis.

6 Stablecoins

6.1 Market Review

Despite a recent uptick since October, **the stablecoin market has overall contracted** this year. Currently, the market cap of stablecoins stands at approximately US$130.6B, a **modest decline of 5.2% year-to-date ("YTD")** from the US$137.8B recorded at the start of 2023. Stablecoins, primarily **functioning as a source of dollar liquidity** for financing crypto exposure, are often **indicative of the broader health and dynamics of crypto markets**. Hence, the observed decline is largely a **reflection of the general downturn in markets**, which has affected both liquidity and trading volumes. Other factors contributing to this trend include the shifting regulatory landscape, higher interest rate environment, the discontinuation of Binance USD ("BUSD"), and the lingering residual effects from events like the FTX fallout in November 2022 and the U.S. regional banking crisis in March 2023.

At the same time, the total crypto market cap has grown, leading to a **decline in the dominance of stablecoins**, which has **fallen from 17.3% of the total crypto market cap to 7.8%**. In a market where **short-term U.S. bond yields have been steadily rising** and nearing 5%, **the opportunity cost for investors holding stablecoins rises**, incentivizing many to move their assets off-chain. Nevertheless, stablecoins continue to play an important role in the future of digital money and are imperative for the wider adoption of cryptocurrencies. As the significance of stablecoins increases, the need for comprehensive and clear regulation becomes more pressing, emerging as a key theme going forward.

Figure 69: Albeit an October uptick, the global stablecoin market declined in 2023

Source: DeFiLlama, Binance Research, as of December 31, 2023

Tether's USDT and Circle's USDC remain the top two stablecoins by market cap, although there have been **noticeable changes with the overall market composition** this year. In particular, Tether's USDT has strongly consolidated its market position, with **USDT's market cap rising from US$66.2B at the start of the year to over US$91.8B**, thereby **increasing its share of the stablecoin market to a staggering 70.2%**. This dominance of USDT became more pronounced in the wake of Paxos discontinuing the issuance of BUSD[138]. The **reduction in USDC's market cap from US$44.1B to US$24.0B** has also played a role in steering the market's preference towards USDT.

In response to market shifts, **MakerDAO's DAI has now firmly established itself as the third largest stablecoin** by market cap, a position further reinforced by the attractive yields offered by the Dai Savings Rate ("DSR"). Meanwhile, **new entrants such as TrueUSD ("TUSD") and First Digital USD ("FDUSD") have emerged**, successfully capitalizing on market opportunities and **collectively capturing 3.1% of the global stablecoin market share**. Their growth was initially boosted by Binance's zero-fee trading promotions for TUSD[139] and subsequently FDUSD[140], highlighting the influence of centralized exchanges ("CEXes") and such initiatives on stablecoin distribution. While a large portion of consumers seeking alternatives to BUSD has gravitated towards USDT, **TUSD and FDUSD have seen rising market caps, now being notable presences in the sector.**

Figure 70: USDT has stood out as the main beneficiary in the midst of significant shifts seen in the overall market composition during 2023

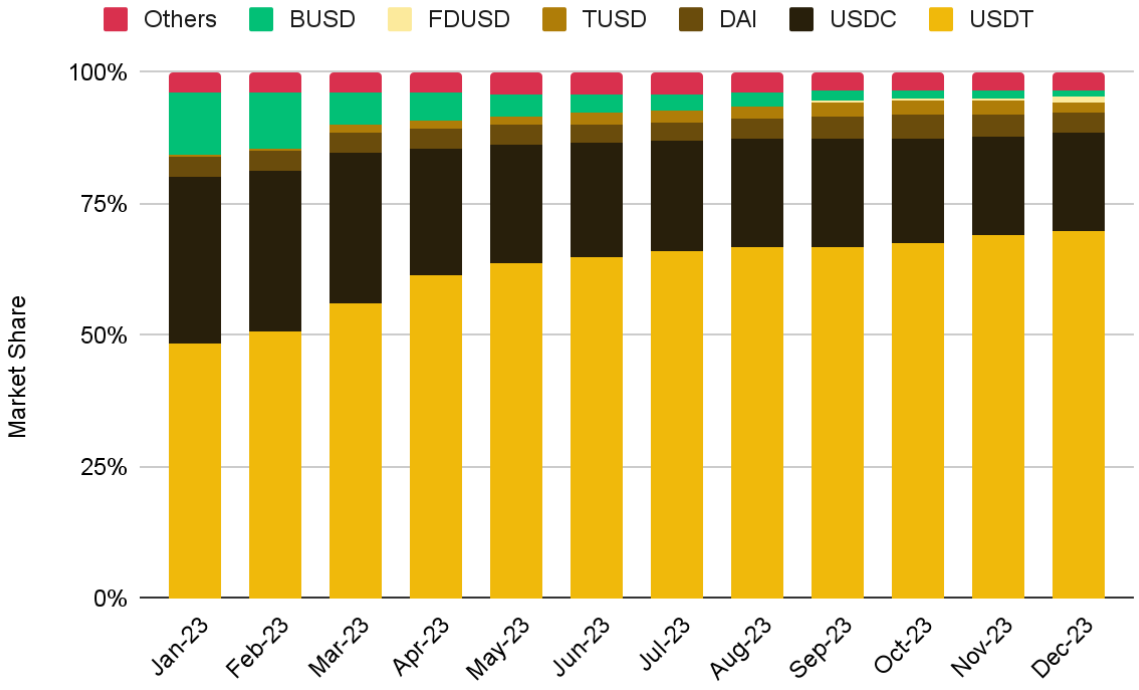
Stablecoin	Market Cap (US$B)		Market Share (%)		Volume (US$B)	
	Dec-23	YTD	Dec-23	YTD	Dec-23	YTD
USDT	91.8	38.5	70.2	46.1	33.2	192.3
USDC	24.0	-45.6	18.4	-42.6	3.6	197.9
DAI	5.2	2.5	4.0	8.1	0.2	173.4
TUSD	2.3	201.4	1.7	217.8	0.2	672.4
FDUSD	1.8	N/A	1.4	N/A	1.8	N/A
BUSD	1.0	-93.9	0.8	-93.6	0.1	-97.6
USDD	0.7	0.1	0.5	5.6	0.0*	196.2
FRAX	0.6	-36.3	0.5	-32.9	0.0*	52.8
Others	3.2	-1.1	2.5	4.3		

**The figure is denominated in billions and may not necessarily have an absolute value of 0.0.*
Source: CoinMarketCap, DeFiLlama, Binance Research, as of December 31, 2023

Centralized stablecoins remain the cornerstone of the industry, constituting over 90% of the total stablecoin market. Today, most stablecoins gaining traction employ some degree of centralization, whether completely or within a hybrid framework that intertwines elements of centralization and decentralization. The **presence of high-yield** has prompted stablecoins such as DAI and Frax Finance's FRAX to **shift towards more centralized holdings, like U.S. Treasury bills, to capture this value**[141]. Consequently, both have strategically positioned their protocols to provide returns on par with the U.S. Treasury bills, attracting investors in search of stable yields.

Furthermore, **consumers continue to place a high emphasis on the counterparty risks** associated with the stablecoins they transact in. The **preference is increasingly shifting towards centralized options**, attributed to their **ease of use**, **scalability**, and **broader acceptance on CEXes and in payment systems**. Although centralized stablecoins are expected to maintain their market dominance for the foreseeable future, the year has witnessed the **emergence of new players**, including **collateralized debt position ("CDP")** stablecoins and those **backed by liquid staking tokens ("LSTs")**. This trend is observable **not just in the wide array of stablecoin types**, ranging from fiat-backed to crypto-backed, but also in the **diversity of issuers that spans from traditional financial institutions to modern payment companies**[142].

Figure 71: Centralized stablecoins remain the favored choice, commanding more than 92% of the market share



Source: DeFiLlama, Binance Research, as of December 31, 2023

While **newer decentralized models are a key aspect of decentralized Finance ("DeFi")**, they have so far **struggled to make inroads in a market dominated by established stablecoin providers**. Decentralized stablecoins have carved a niche within the on-chain

ecosystem though their adoption is primarily driven by yield-based opportunities. In comparison, **major players like USDT not only hold significant market shares but also provide substantial liquidity and are deeply ingrained in DeFi products**. For instance, deep liquidity pools like those of USDT, USDC, and DAI (e.g., Curve's 3-pool) continue to entrench liquidity in favor of these established stablecoins.

Furthermore, **traditional issuers have markedly earned more trust** from the broader crypto user base, which is a **vital factor in determining liquidity placement for stablecoins.** This trust factor is something that the major stablecoins are inadvertently capitalizing on to **sustain their market dominance**. On the other hand, these newer models **carry distinct risk profiles** and are **contending with a perceived market sentiment shaped by prior events**. Hence, it remains to be seen whether emerging decentralized stablecoins are able to catch up in the long-term - 2024 is certainly going to be an important year ahead for them. Demonstrating **stability in maintaining their peg** and **improving usability for adoption** in both on- and off-chain applications will be crucial.

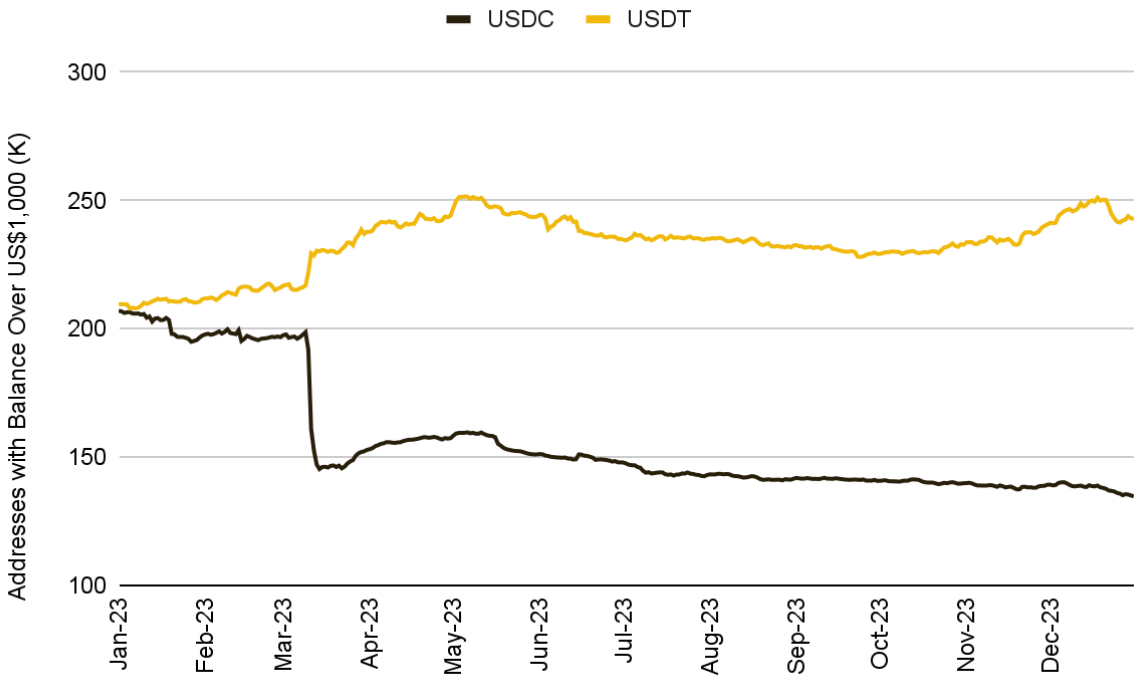
6.2 Major Players

Tether's USDT

USDT has significantly consolidated its dominance in the stablecoin market this year. The numbers speak for themselves: its **market share rose from 48.1% at the start of 2023 to a commanding 70.2% in December**, while its **daily volumes reached US$33.2B**, far surpassing its competitors. This remarkable growth has effectively reshaped the balance of power among the prior major trio of USDT, USDC, and BUSD. In a high interest rate environment, **Tether's rising market share has also been financially advantageous**. USDT's nearly US$1B in quarterly earnings and its US$3.2B in excess reserves[143], which includes a significant Bitcoin holding, indicate a solid fiscal standing. This sets the stage for them to expand their reserves further, providing a strong foundation for their continued development and growth.

Concurrently, **USDT has expanded its user base globally and in developing countries**[144], particularly in the **aftermath of a toughening U.S. regulatory landscape**. As crypto operations increasingly migrate to offshore[145] settings to avoid regulatory risk, USDT has found itself in a favorable position. This becomes even **more pronounced considering the challenges encountered by crypto-friendly U.S. regional banks** like Silicon Valley Bank ("SVB"), Signature, and Silvergate earlier this year. Users seeking to bypass uncertainties associated with U.S. bank affiliated stablecoins have found USDT an increasingly appealing option. A clear indicator of this shift is the **growing disparity in the number of USDT and USDC wallets holding balances over US$1,000**.

Figure 72: Wallets holding over US$1,000 in USDT increased by 15.9% YTD, while those with USDC balances saw a 33.0% decline in the same period

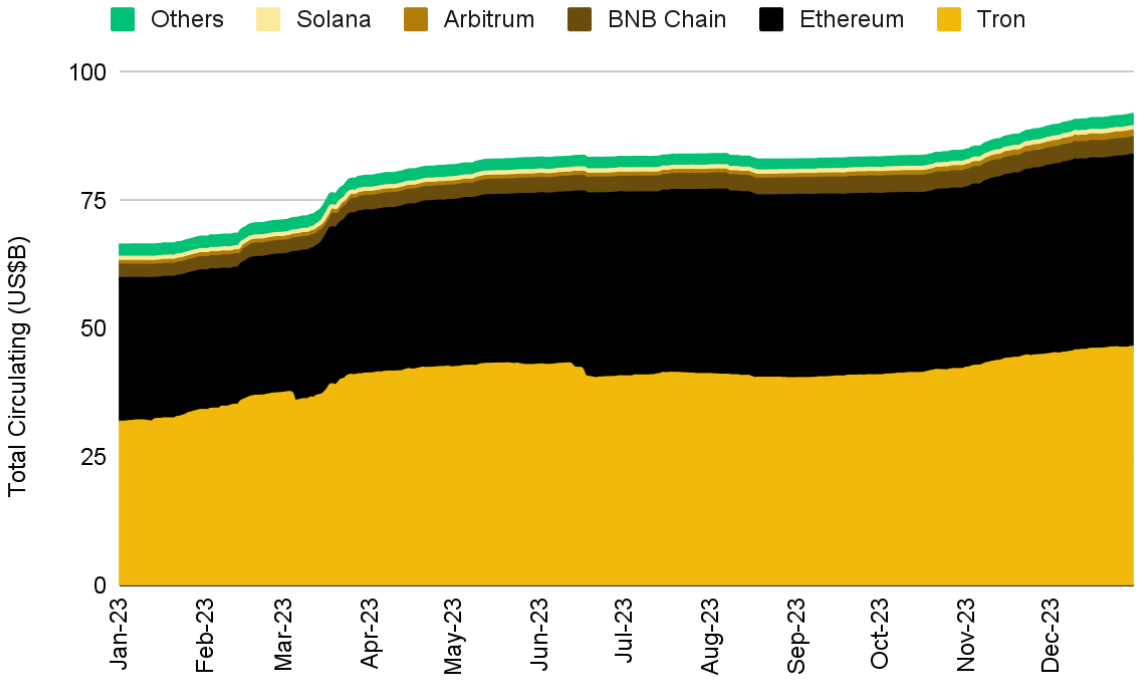


Source: The Block, Binance Research, as of December 31, 2023

- **Growth on Tron:** **USDT on Tron has established itself as the leading crypto payment network**, even **surpassing Ethereum in terms of stablecoin volumes** at certain periods this year. **USDT supply on Tron has increased to US$46.3B**, accounting for approximately **94.1% of the network's total stablecoin market cap**. This growth has been significantly influenced by Tether's relationship with Tron on payments outside the U.S., particularly in regions such as Latin America, Europe and Africa.

  A key factor in Tron's dominance in the USDT market is attributed to several developments **improving stablecoin usability on the network**. These enhancements have primarily been driven by **major wallet and payment infrastructure providers**, with BitGo being a prominent example[146]. Tron's strategy to position itself as a prime network for non-custodial USDT storage has been largely welcomed, as evidenced by the observable uptick in USDT holdings on the network. Thanks to its **monopolistic standing**, USDT is **well-positioned to capitalize on any future growth or innovations** that come out of Tron's stablecoin ecosystem.

Figure 73: With a circulating supply of US$46.3B at the close of 2023, Tron emerged as the largest holder of USDT on its network



Source: DeFiLlama, Binance Research, as of December 31, 2023

Circle's USDC

At its peak, USDC's market value once reached US$55.2B, positioning it just behind USDT. However, its **market share has now shrunk to 18.4%**, eroding much of the progress made in 2022. This decline can be attributed to a **shifting regulatory landscape** and **this year's banking crisis alongside a temporary de-pegging event**, which dealt a significant blow to its reputation - a crucial factor for stablecoin consumers[147].

A bright spot for USDC amidst these setbacks is its **enduring prominence in DeFi activities**. This is especially apparent in DEXes, CDP, and money market borrowings, where USDC continues to play a leading role. Even with a significant decline in market share, there are talks of Circle eyeing a public listing in 2024[148]. Indeed, the company's **business has been boosted by rising interest rates**, and it has been **strategizing for international expansion**, with targets including Japan and Brazil[149]. Looking ahead, **as the U.S. moves towards clearer regulatory frameworks for stablecoins** and crypto in general, there is **potential for a resurgence in momentum among U.S.-based stablecoin issuers like USDC**.

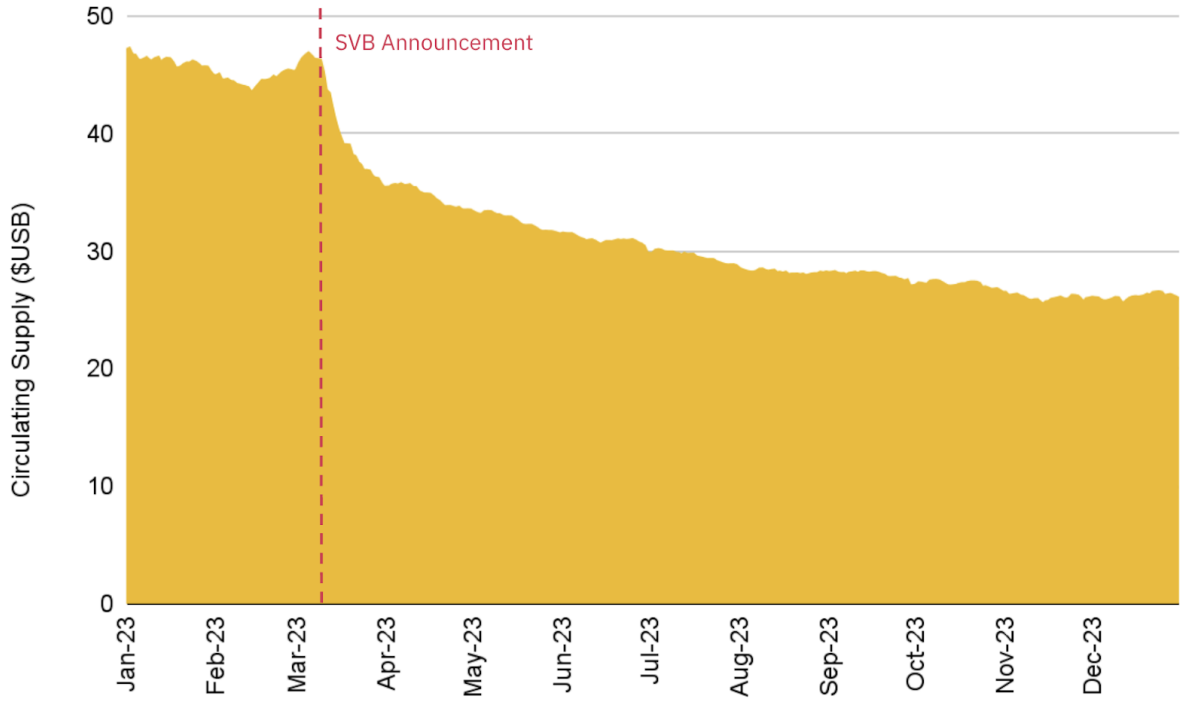
- **USDC's year of challenges:** The downturn for USDC began with the **collapse of SVB**, a major banking partner for several firms, including Circle, which cast USDC into the spotlight. Circle's **US$3.3B in reserve deposits at SVB** triggered **concerns about USDC's capital reserves and its assured dollar collateralization**[150]. This uncertainty **precipitated a temporary depeg of USDC**, where its price fell to

US$0.88 on several exchanges, and in some instances, even to as low as US$0.80[151].

Although USDC eventually restored its peg, this **short-lived instability had far-reaching implications on market sentiment**, contributing to USDC's decreasing market share over the year. In fact, USDC saw a considerable drop in market share during this period, **decreasing from 31.1% at the start of March to about 24.5% a month later.** This incident highlighted the critical need for thorough scrutiny of the reserves of centralized stablecoin issuers, who were once believed to be impervious to depegging events.

Since then, USDC has seen a **continued decrease in both its overall supply and market share**. Leading stablecoin providers like **DAI and FRAX have also scaled back their reliance on USDC** for collateral[152]. USDC's sustained decline is likely influenced by its **US-centric nature**, especially compared to global stablecoins like USDT. With U.S. users now having access to **higher-yielding treasuries**, this preference may have led to a **more pronounced outflow from USDC**. The uncertain domestic regulatory environment has also not been conducive to its growth.

Figure 74: USDC has seen a considerable loss in market share this year, with its circulating supply falling by 45.0% YTD



Source: Artemis, Binance Research, as of December 31, 2023

MakerDAO's DAI

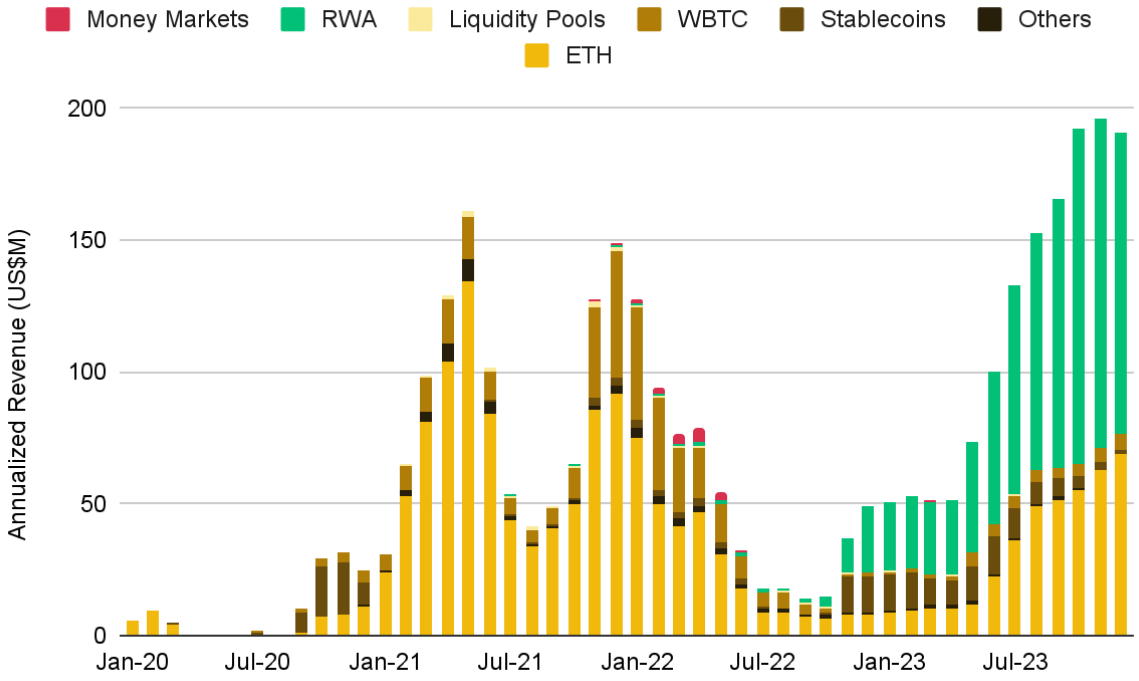
MakerDAO, as one of the largest DeFi protocols, has steered DAI to become the leading decentralized collateral-backed stablecoin. With a **market cap of US$5.2B**, DAI has climbed to the **third-largest position in the stablecoin market**, edging out BUSD earlier in the year. This represents a **significant 2023 milestone**, underscoring **DAI's resilience in a market typically dominated by centralized fiat-backed stablecoins**. In addition to **benefiting from the shifts in market share among existing players**, DAI's success can be attributed to its **growing presence in the real-world asset ("RWA") space**, **competitive yield offerings**, and **increased on-chain usability**.

In light of the SVB crisis and the ensuing regulatory scrutiny on centralized stablecoins, there's been a **noticeable shift towards diversifying reserves**, a strategy DAI has adeptly embraced this year. The need for this became clear when **USDC's depegging caused DAI to briefly dip to US$0.897**[153], as USDC made up a large proportion of DAI's collateral at that time[154]. In a move to mitigate similar risks in the future, **DAI has reduced its reliance on USDC, turning instead to assets like U.S. Treasury securities**[155]. This strategic shift not only **spreads risk and increases yield** but also highlights MakerDAO's commitment to adaptable, market-driven solutions. What's more, the **higher yield from treasuries** has **helped fund increased interest rates for the DSR**, playing an important role in sustaining DAI's market share this year.

- **Tokenization of RWAs:** With rising interest rates, **U.S. Treasury yields have steadily risen**, now **comfortably exceeding those in DeFi**. To **capitalize on the higher TradFi market yields**, stablecoin issuers are **allocating parts of their reserves into TradFi instruments**. As one of the frontrunners in the tokenization of RWAs, **MakerDAO's treasury has been able to reap the benefits** from the increasing yields.

  Currently, MakerDAO holds over **US$2.5B in RWA exposure**, which ends up **yielding more than half of its revenue**[156]. This is a result of MakerDAO's strategic shift towards **financing RWA-backed initiatives with DAI loans**, a move aimed at **generating additional revenue in the current high-interest rate climate**. Given the notable yield difference between DeFi and TradFi, it seems probable that more stablecoin protocols will explore RWA integration, aiming to increase their treasury revenues and the attractiveness of their stablecoins to holders.

Figure 75: With significant contributions from RWAs, MakerDAO is in touching distance of generating US$200M in annualized revenues



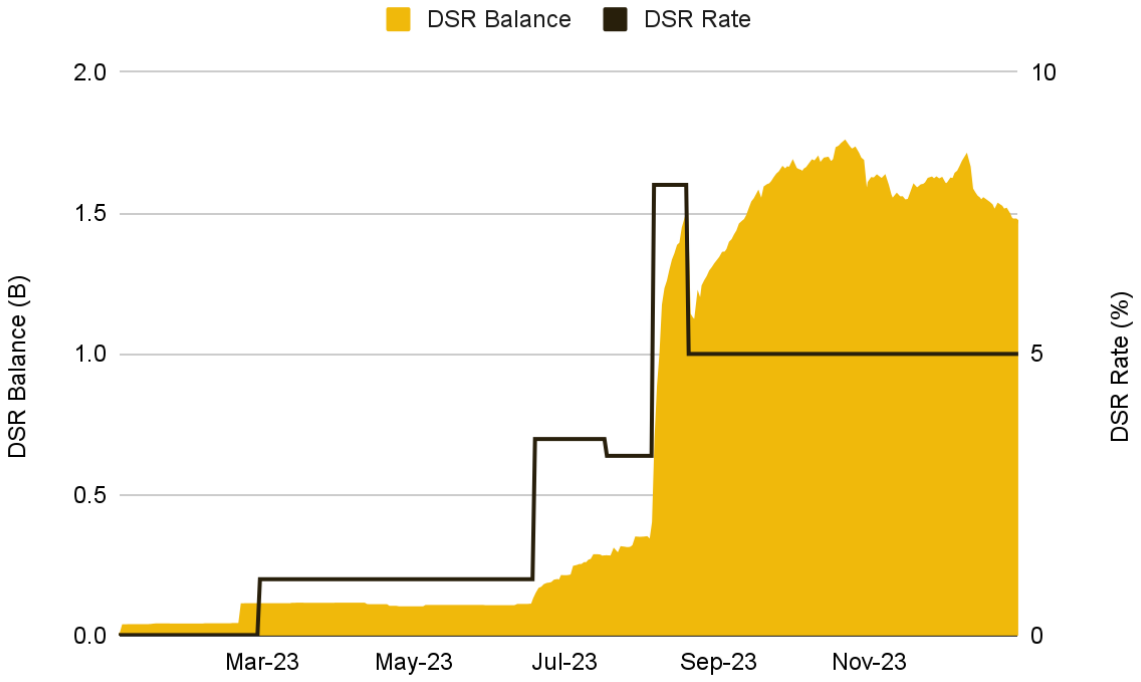
Source: Dune Analytics (@jasperprime), Binance Research, as of December 31, 2023

- **Enhanced DAI Savings Rate ("EDSR"):** On August 7 this year, **MakerDAO introduced the EDSR, a mechanism designed to temporarily boost the standard DAI Savings Rate using a multiplier.** This multiplier is determined by the proportion of DAI held in the DAI Savings Contract compared to the total DAI supply. The DSR was **initially increased from 3.19% to 8%**, aiming to **encourage more deposits into the DSR contract** and effectively position DAI as one of the highest-yield stablecoins. The impact of EDSR was notably positive, as evidenced by a substantial **rise in the amount of DAI deposited, moving from 0.3B to 1.5B** in a short space of time. At the time, this **represented a significant 38.1% of the total DAI supply**, demonstrating the **effective use of interest-bearing mechanisms to stimulate demand for DAI**[157].

  However, this high rate was short-lived. A new proposal was quickly enacted to **lower the DSR from 8% to 5%**. The rationale behind this reduction was to **maintain the system's sustainability** and to **ensure that its benefits were evenly distributed among DAI holders**, rather than disproportionately favoring those with larger amounts of capital[158]. This adjustment helped stabilize the DSR, aligning with the goal of providing sustained yields; it's important to remember that **the DSR increase had direct financial implications for MakerDAO**, especially as it was utilizing its revenue to fund these customer acquisition costs. Ultimately, it can be said that **MakerDAO has effectively democratized access to U.S. Treasury yields**, offering savers a **compelling 5% on-chain interest rate alternative**. This not only

boosted demand for DAI but also **accelerated the adoption of MakerDAO's Spark lending protocol**.

Figure 76: MakerDAO's strategy with the DSR has positively impacted the demand for DAI, leading to a culmination of 1.8B in deposits at its peak



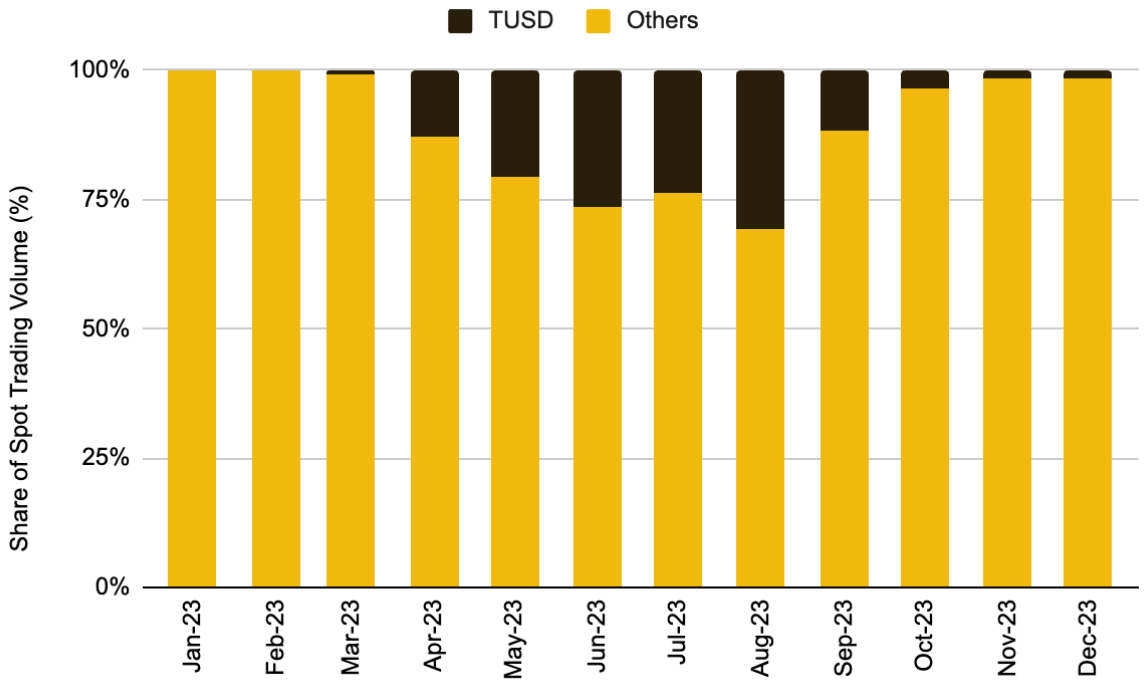
Source: Dune Analytics (steakhouse), Binance Research, as of December 31, 2023

Techteryx's TUSD

Following the discontinuation of BUSD, TUSD was able to capitalize on the situation and gain traction among users this year. With an **impressive YTD market value increase of 201.4%**, TUSD has demonstrated notable growth. The adoption of **TUSD gained momentum when Binance removed maker fees** on all TUSD pairs while reintroducing fees on notable BTC pairs, with the exception of BTC/TUSD.

On the flip side, **TUSD has also encountered its own share of regulatory hurdles**, particularly with one of its providers, Prime Trust. The Nevada Financial Institutions Division ("NFID") ordered Prime Trust to suspend deposits and withdrawals[159], resulting in a **temporary halt in TUSD minting and subsequently impacting market sentiment**. Following this, Binance's introduction of **favorable fees for other stablecoins like FDUSD**, along with the **imposition of taker fees on the BTC/TUSD pair[160], has slowed TUSD's growth** in the latter part of the year. Its market cap has **declined from US$3.4B to US$2.3B since October.**

Figure 77: TUSD initially saw strong growth and made a notable impact on Binance spot volume, but this has tapered off since October



Source: The Block, Binance Research, as of December 31, 2023

6.3 Emerging Categories

Collateralized Debt Position ("CDP")

CDP stablecoins are **loan agreements grounded in smart contracts**, where users deposit assets like ETH as collateral to **receive a loan denominated in stablecoins**. This setup **enables users to unlock liquidity in their crypto holdings** without actually selling them. Curve's crvUSD and Aave's GHO are notable CDP stablecoins to have launched this year. Having only been operational for less than a year, both crvUSD and GHO are expected to grow well beyond their current circulating supplies.

- **Curve's crvUSD:** Launched earlier this year, crvUSD is Curve's native stablecoin that introduces **capital-efficient CDPs using a custom AMM for liquidations**. Its **standout feature is its novel liquidation mechanism** known as the **Lending Liquidation AMM Algorithm ("LLAMMA")**. This model employs what is known as **'soft liquidations'** and appeals to users who seek a **smoother liquidation process**. Conceived to enhance Curve's product ecosystem, crvUSD aims to **create a synergistic effect on protocol activity**. By offering crvUSD, Curve seeks to attract additional liquidity providers, boost trading volumes in its pools, and generate fees for both the protocol and vote-escrowed CRV ("veCRV") holders

Despite a dip in activity, likely linked to the reentrancy vulnerability identified in late July, crvUSD has maintained a steady upward trajectory throughout the year, though this growth has moderated since October. **crvUSD debt has risen to US$102.5M, and its TVL to US$181.7M**, yet the count of **crvUSD holders remains relatively modest, around 1.1K**[161]. There is certainly more room for growth and **converting crvUSD's TVL into tangible revenue represents a significant opportunity** for Curve. However, the **observed volatility in crvUSD's borrowing rates may deter potential users** so this would need to be sorted first.

Figure 78: crvUSD debt has steadily risen in 2023, currently standing at US$102.5M

Source: Dune Analytics (@Marcov), Binance Research, as of December 31, 2023

- **Aave's GHO:** The rollout of GHO **marks a pivotal strategic move for Aave** this year. While it operates similarly to crvUSD, a unique feature of GHO is that the **collateral deposited into Aave remains productive**, consistently generating yield. This effectively helps to **lower the cost of borrowing for GHO loan users**. Fundamentally GHO offers multiple advantages to its stakeholders: the Aave DAO profits from the new revenue stream created by GHO, stkAAVE holders enjoy discounted borrowing rates for GHO, and Aave itself can expand its influence and reach with this new product.

  However, GHO's growth has been modest, with only **34.7M GHO in circulation**, though interestingly **there are nearly 1K GHO holders**[162]. While not entirely uncommon for newer decentralized stablecoins, **GHO has mostly traded below its peg since inception**[163]. To address this, Aave has passed several proposals, including the **'GHO Stability Module'**, aimed at refining GHO's design[164]. Although GHO's overcollateralization mitigates immediate concerns, these measures are

crucial for its **long-term stability and success, providing reassurances and market intervention capabilities** in case of significant peg deviations.

LST-Backed

The **transition of Ethereum to Proof-of-Stake ("PoS")** and the **introduction of staked ETH withdrawals** have significantly **fueled the growth of LSTs** such as stETH, rETH, WBETH, among others. Coinciding with this surge in LSTs and interest in LSTfi, 2023 witnessed the **rise of LST-backed stablecoins like eUSD by Lybra and mkUSD by Prisma**. These stablecoins are **overcollateralized by LSTs**, offering holders the **dual benefits of earning intrinsic yields while maintaining the essential properties of stablecoins**.

Currently, the **growth of ETH staking serves as a tailwind for LST-backed stablecoins**. As the amount of ETH staked increases, the total addressable market for these stablecoins should correspondingly rise. That said, it is important for these stablecoins to **integrate widely across the DeFi ecosystem**, and **accept more forms of LST collateral** to drive further adoption.

- **Lybra's eUSD:** Lybra, a DeFi protocol, **enables the minting of its interest-bearing stablecoin**, eUSD, through collateral deposits such as ETH or stETH. The allure of eUSD lies in its design: **98.5% of the staking rewards from the LST collateral are converted to eUSD** and **proportionally distributed among eUSD holders**. This feature positions eUSD as an appealing option for income-seeking investors, allowing them to **capture a base yield simply by holding the stablecoin**.

  In its early stages, particularly during May and June, eUSD saw a substantial increase in its circulating supply, likely driven by **early adopters** and **coinciding with a heightened interest in LSTfi.** Building on this phase, Lybra progressed to launch **Lybra V2, featuring improvements to its stablecoin offerings**. Notably, Lybra V2 brought to life an **Omnichain version of eUSD, named pegged eUSD ("peUSD")**, which encapsulates eUSD's underlying DeFi utility and expands its application across various DeFi platforms. Moreover, the updated version **accommodates a broader array of LSTs as collateral**, providing greater versatility for both users and borrowers of eUSD. Presently, the **combined circulation of eUSD and peUSD stands at 151.5M**[165]. With several prospective expansions and functional enhancements slated for 2024, the Lybra ecosystem merits close observation going forward.

- **Prisma's mkUSD:** Prisma's mkUSD is another player in this market, capitalizing on the surging popularity of LSTs. Since its inception in September, **mkUSD has expanded its circulation to over 162.3M**, ranking it as the 13th largest stablecoin globally[166]. Though, its rapid and non-steady growth does raise questions about the organic and sustainable nature of this expansion. Functionally similar to Lybra's eUSD, mkUSD emerges as a direct competitor. **To enhance its competitiveness and bootstrap protocol growth, Prisma has adopted the ve-token model**, popularized

by Curve, incentivizing particular user actions. For instance, **mkUSD will be incentivized on Curve and Convex Finance**, creating a capital-efficient cycle where users can earn trading fees, CRV, CVX, and PRISMA, in addition to their Ethereum staking rewards[167].

As this sector continues to evolve, we expect to see market consolidation and the emergence of novel innovations that differentiate each protocol. The future competitiveness of these stablecoins will likely hinge on their stability and the ability to unlock new use cases for users across DeFi.

Centralized

The notable **successes of leading incumbent centralized stablecoins**, particularly from a financial standpoint, have naturally paved the way for new entrants in this space. First **Digital's FDUSD and PayPal's PYUSD stand out** as centralized solutions that have gained a significant market share in a short period of time. Remarkably, despite launching later than other emerging decentralized models, both stablecoins have outstripped them in market cap. This underscores the **prevailing trend of centralized stablecoin dominance** and highlights the **benefits of integrating with centralized liquidity sources**.

- **First Digital's FDUSD:** FDUSD, issued by FD121 Limited under the First Digital Labs brand in Hong Kong, entered the market in June 2023. Designed to be **fully backed by cash and cash-equivalent assets**, FDUSD has **quickly gained traction amidst the shifting market landscape of centralized stablecoins**. This rise was particularly evident following the phase-out of BUSD.

  FDUSD's daily trading volumes and market cap experienced a sharp increase in early August after Binance announced **zero maker and taker fees on BTC/FDUSD spot and margin trading pairs** for a limited period. This move **propelled FDUSD's market cap to US$1.8B**, positioning it as the 5th largest stablecoin. Looking ahead, the broader market adoption of FDUSD, including **integration by other CEXes** and its **growing presence in the DeFi sector**, remains a key aspect to watch.

- **Paypal's PYUSD:** PayPal's launch of PYUSD marked a significant move by a major fintech company, highlighting the **rising importance of stablecoins in global payment networks**. Issued by Paxos, PYUSD is fully backed by U.S. dollar deposits, Treasuries, and similar cash equivalents. With a **circulating supply of 234.1M**, it has **quickly ascended to become the 11th largest stablecoin**.

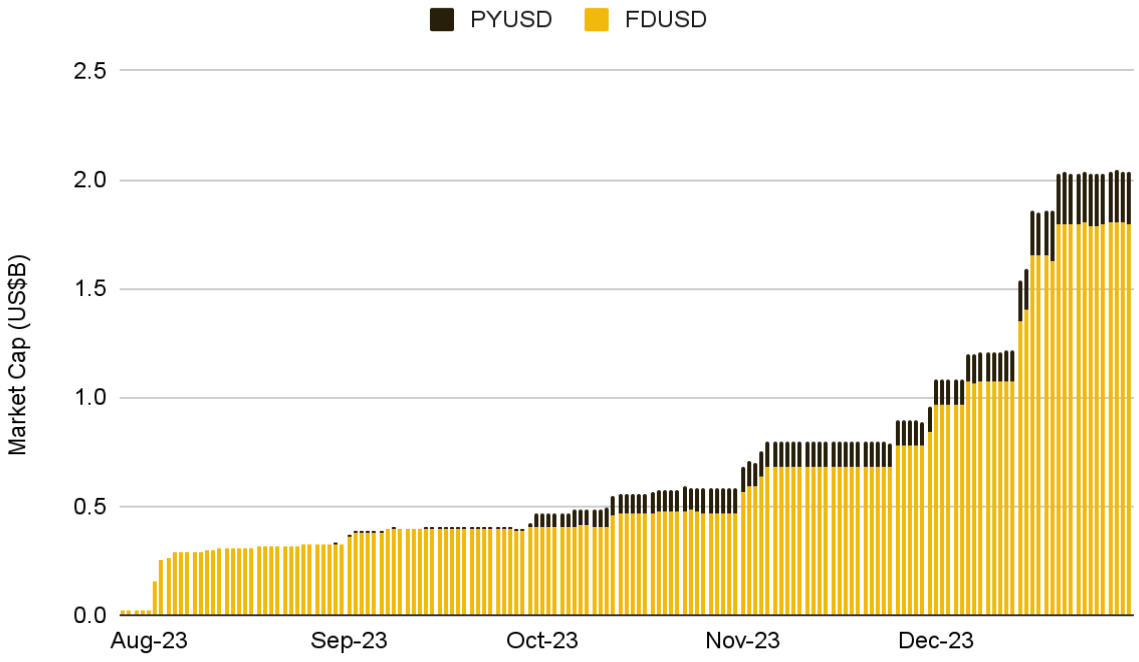
  The decision of a fintech giant like PayPal to enter the stablecoin space is certainly interesting. **Stablecoins now process over tenfold the volume of PayPal**, putting them on par with existing financial systems[168]. This makes them increasingly hard to overlook, especially from a financial perspective. In high-interest rate environments, **stablecoins emerge as a highly attractive business proposition**,

allowing fintechs like PayPal to **capitalize more effectively on their yield potential**. Unlike traditional PayPal balances, stablecoins are **'stickier'** and offer **more composable use cases across DeFi and payment systems**. This encourages users to **maintain larger collateral balances**, which in turn **leads to higher interest income** for the issuer[169].

From a design perspective, PYUSD's model, **mirroring other centralized stablecoins**, provides **little incentive for crypto natives to switch**. Yet, PayPal's expansive reach, with **over 428M active accounts globally**[170], gives it a distinct advantage. If successfully leveraged, PYUSD could **onboard several non-crypto users**, creating a **trickle-down effect** on the industry. Although presently limited to eligible U.S. accounts, PayPal's **strong presence in payments positions PYUSD well** for wider distribution and adoption, as shown by the **Venmo integration**[171]. Looking ahead, PayPal is likely to **explore further off-chain integrations** to enhance PYUSD's utility, potentially including **incentives on their main platform**, like reduced merchant fees.

The growing interest in stablecoins, as seen with PayPal's entry, may lead **other fintechs and neobanks to look toward stablecoins** as a **new unlock for their businesses**. This would also be advantageous for users. Currently all payment apps in a region utilize the **same monetary standard but they aren't interoperable**. The wider adoption of **stablecoins as a standard across multiple apps** enables **easier transactions** between them, **broadening the scope of digital payments**.

Figure 79: In a relatively short period, the market caps of emerging centralized stablecoins like FDUSD and PYUSD have risen to US$1.8B and US$0.2B, respectively



Source: DeFiLlama, Binance Research, as of December 31, 2023

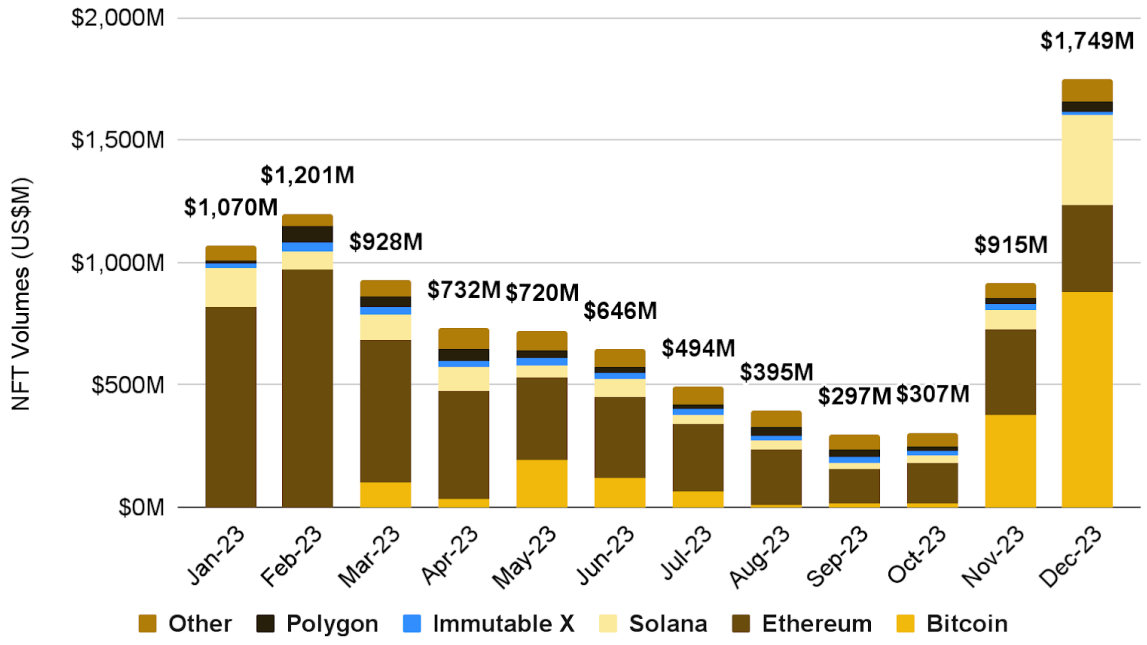
For a deeper dive, check out our report, Emerging Stablecoins: Latest Developments.

7 The Non-Fungible Token World

7.1 Macro View

2023 was an interesting year for non-fungible tokens ("NFTs"), where we saw activity and excitement for the asset class dwindle between March and September, before rebounding with strength in Q4. Specifically, **trading volumes for the top 15 chains by volume** initially peaked in February at over US$1.2B, before a seven-month downtrend, which broke in October and showed a **significant resurgence in November**. This resurgence became somewhat supercharged, with a **mammoth upward move in December**, breaking the volume record for the whole of 2023.

Figure 80: NFT volumes broke a seven-month downtrend in October, before a strong bounce in November and December



Source: CryptoSlam!, Binance Research, as of December 31, 2023

In terms of the top chains for NFTs, **Etheruem maintains a sizable lead in all-time sales** (nearly 10x more than the second-placed chain) and was the most popular chain across the majority of the year. However, 2023 brought a new player into the NFT world; **Bitcoin**. Last year, we saw the popularization of Ordinal Theory, a method to identify each individual Satoshi (the smallest unit of a Bitcoin) and "inscribe" them with arbitrary data, e.g., pictures, videos, text, etc. This essentially birthed the Bitcoin NFT (also referred to as an Ordinal or Inscription). We say essentially because although projects like Colored Coins[172]

and Counterparty[173] originally bought NFTs to Bitcoin earlier, however, these did not gain much traction due to the nascency of the NFT market in the early 2010s.

In **March 2023, we saw the first Ordinal-driven frenzy in the Bitcoin NFT market**, something we can observe in the volume metrics in Figure 80. Later on in March, we saw the **birth of BRC-20 tokens**. This was a new token standard and used Ordinal Theory to inscribe text onto individual Satoshis to bring fungible tokens to Bitcoin. This meant that, for the first time ever, **Bitcoin had both fungible and non-fungible tokens** ("NFTs"). While not strictly NFTs, BRC-20 sales were still seen as part of the Bitcoin NFT market, and thus impacted Bitcoin NFT volumes. We can see the impact through May and June, and a particularly large bounce in November and December. Bitcoin NFTs and surrounding infrastructure continue to be one of the hottest narratives going into the new year.

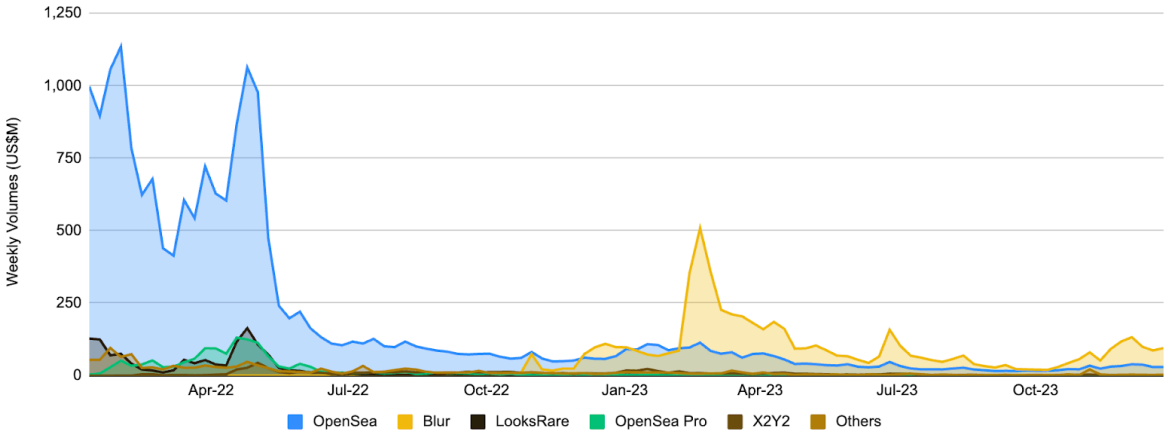
Solana NFTs have also been doing well, benefitting from the positive momentum towards the chain in recent months. **December's NFT sales**[174] of over US$366M were the **highest for over two years** and significantly higher than the year average of ~US$70M. Leading Solana NFT marketplace, Tensor, plays a key role in the ecosystem, and even has a native NFT collection, Tensorians. Notable ecosystem project, Backpack, who are the team behind Backpack Wallet and Backpack Exchange also have a leading Solana NFT collection, Mad Lads.

7.2 NFT Marketplaces

One of the key themes of the NFT market of 2023 was of **NFT marketplace wars**. OpenSea, an undeniable early leader, faced serious competition from newer entrant, Blur, who helped redefine the market. Blur's focus on pro-trading changed the meta of the NFT market, with OpenSea's responses and own innovations being some of the most interesting storylines of the year.

Looking specifically at volumes across the market, it is evident that **OpenSea was a dominant leader through the rise of the NFT market in 2021 and also in 2022**, with a very clear change across 2023. Although other marketplaces such as **LooksRare** and **X2Y2** launched in 2022 and used **vampire attacks to incentivize adoption,** they were not able to take any significant share away from OpenSea. Only **Blur** has been able to do this, and is now firmly in the leading spot (at least by volumes).

Figure 81: While OpenSea dominated volumes across 2021 and 2022, Blur has made significant strides and hosted the majority of 2023 NFT volumes



Source: Dune Analytics (@hildobby), Binance Research, as of December 31, 2023

OpenSea

While it was a tough year for OpenSea in terms of competition, there were also some notable developments:

- **Dwindling market share:** OpenSea went from **~85% share of total NFT volumes in January 2022 to ~41% in January 2023, before ending the year under 23%**[175]. A large part of this was driven by the entry of Blur and direct back-and-forth battle between the two. As we mentioned, while LooksRare and X2Y2 tried to do the same in 2022, they were unable to get anywhere close to the amount of traction that Blur has gotten. Add to this the news of recent layoffs of over 50%[176] of the company and a softer outlook from VCs, and we can see why 2023 was a challenging year for OpenSea.

- **New product launches:** To maintain pressure and their position, OpenSea continued to innovate across the year, with numerous new product launches. **OpenSea Pro** saw the launch of their **NFT marketplace aggregator** also aiming to target the "power user community". This was borne out of OpenSea's acquisition of leading aggregator, Gem, whose revitalized v2 went on to become OpenSea Pro.

  OpenSea Deals was launched in July 2023, allowing **peer-to-peer NFT swapping**, while **OpenSea Studio** gave creators the ability to create, launch, and manage their own collections in a **no-code** environment. Their launch of **Seaport** introduced a robust set of **decentralized NFT marketplace smart contracts**. Clearly, **OpenSea is not happy to go away silently and are undoubtedly attempting to fight for their place**. Whether their continued perseverance will allow them to reach their previous level of dominance is difficult to ascertain, but ultimately, the increased competition does create a better environment for users and the broader NFT market, which we should see as a net positive.

- **Potential future opportunities:** OpenSea has at least two very clear cards left to play in their growth as an NFT marketplace; launching a **token** and launching a **L2**. The $BLUR token and its staggered, multi-round airdrop launch, has created a huge amount of attention for the company, and attracted many new users to their platform. No doubt OpenSea has observed this as a potential option and might very well try something similar in the future. Similarly, the **launch of an NFT-centric L2 might also create a level of attention for OpenSea**, alongside providing scalability / cost benefits for its users. With the launch of Zora in 2023, as well as the upcoming mainnet of Blur-linked L2, Blast, this might become an increasingly popular option this year.

- **OpenSea 2.0:** Alongside the recent announcement of significant layoffs at the company, CEO Devin Finzer also announced their OpenSea 2.0 vision. 2.0 will represent "**a big upgrade**" to their product "...including the **underlying technology, reliability, speed, quality, & experience.**". They are also hoping to get better direct connections with their users following the downsizing. This will be an important story to follow as this year unfolds and we look forward to hearing more details.

Blur

Blur has been a major attention-grabber since their launch, and dominated NFT-related narratives across 2023.

- **Product differentiation:** Blur made the effort to focus on "**pro-traders**", and introduced a number of features for this. This includes **NFT-floor sweeping across multiple marketplaces, advanced tools for better NFT sniping, sophisticated portfolio analytics, a sleek, trading-oriented user interface**, among other features. This is in addition to their action surrounding minimized royalty fees and token incentives, all of which has worked together to help take Blur to the next level.

Figure 82: Blur has been very clear in their marketing. Even Googling them clearly shows their target market

Source: Google search

- **$BLUR token:** The launch of $BLUR, as part of a multiple rounds of airdrops (referred to as Seasons), has been an important factor in Blur's growth. The **strategy of staggering the release of the token through numerous rounds of token**

incentives has been particularly useful as it has essentially forced users to continue using the platform. While we cannot say whether all of these users will be sticky, when combined with the differentiated and unique product, it is likely that at least some of these users will continue to use Blur even after token incentives conclude.

Additionally, for many investors, **$BLUR is thought of as a proxy for NFT market exposure without buying individual NFTs**. This can be useful for a wider base of investors who are interested in NFTs. but not as much as to buy pieces for individual collections. For these investors, the $BLUR token is a great solution and remains essentially the only such option for NFT market exposure.

- **Blast L2:** The recent announcement of Blast, an **Ethereum optimistic L2 built by the same team as Blur and led by its founder, Pacman**, has been an interesting development. Blast describes themselves as the "first L2 with native yield" and **rewards users with yield on the $ETH and stablecoins** that they have bridged to the L2. Blast generates this through participating in $ETH staking, which it then passes onto users. Any stablecoins that users bridge is deposited into protocols like MakerDAO, wth yield being passed back to them via USDB, Blast's auto-rebasing stablecoin.

  Blast launched a one-way bridge for users to deposit funds and start earning yield and Blast points and has been able to attract **over US$1B in TVL across 80K+ users[177] ahead of a February mainnet launch**. The interaction between Blast and Blur, if any, will be an interesting story to follow, especially given Blur's focus on pro-trading and the scalability and cost benefits that an L2 can provide.

Tensor

Tensor is a leading NFT marketplace on Solana and saw a strong level of success and growth across 2023, displacing Magic Eden as the top Solana NFT marketplace. Q4-2023 was particularly notable with Tensor performing well as the Solana narrative grew.

Tensor has a sleek trading interface, similar to Blur, and also has a similar trading-oriented feel to it.

- **Market share growth:** Tensor grew significantly[178] in 2023, from under 1% of the market and under US$100K in volume in January 2023 to over US$5M in volume and 62% of the Solana NFT volume by the end of the year.

- **Points systems:** Tensor, like many Solana projects, have also incorporated a points program. Users can earn points for trading, listing NFTs, and referring other users. Users can also stake Tensor's native NFTs, Tensorians, to earn extra points.

Others

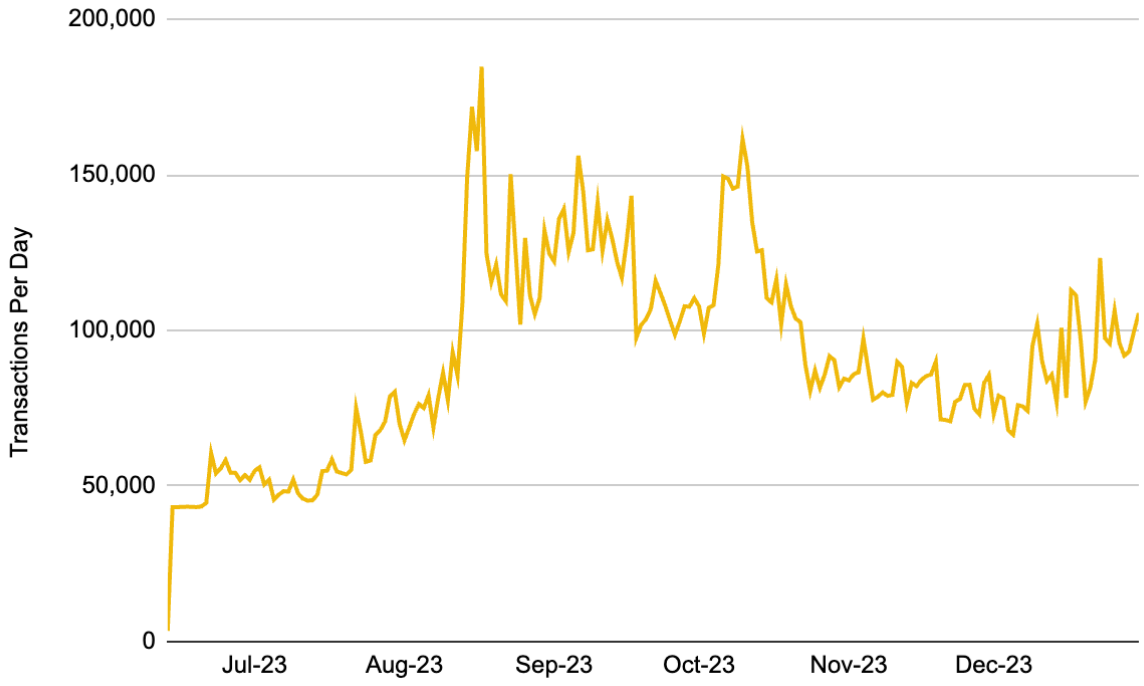
- **Magic Eden:** Magic Eden, which has been operating since 2021, is active across Solana, Polygon, and Bitcoin NFT markets. Notably, Magic Eden was **one of the first major NFT marketplaces to add functionality for Bitcoin NFTs**, very soon after the start of the initial Ordinals frenzy. Given they did this very early in the lifecycle of Ordinals, it helped them take some of these newer Bitcoin NFT users, adding a new dimension to their product suite.

  Magic Eden also announced[179] a **partnership with Yuga Labs**, the company behind Bored Ape Yacht Club, CryptoPunks[180], Meebits, Otherside, and other collections. They are set to launch the **Magic Eden ETH NFT Marketplace which will honor creator royalties**, which have been largely minimized since the launch of the newer wave of marketplaces like Blur, Looksrare, and X2Y2.

- **Zora:** Zora is an NFT protocol and marketplace that helps creators to create, and trade NFTs. Zora is one of the first NFT marketplaces to launch on its own chain, and operates the **Zora Network, an OP Stack L2 chain**. This means that transactions on Zora are generally cheaper and quicker than on platforms that use the Ethereum L1. This provides NFT traders with a better experience, while their **Protocol Rewards** scheme provides creators with revenue generation methods.

  You can learn more about Zora Network and other OP Stack L2 chains in our recent report, The OP Stack: What's New?

Figure 83: Zora Network has been seeing between 50-100K transactions per day in recent months



Source: Zora Network block explorer, Binance Research, as of December 31, 2023

7.3 Key Themes to Watch

1. Product Innovation

The narrative around NFTs has been lackluster in the last few months, and the era of simple profile-picture NFTs ("PFPs") is likely a relic of the last cycle rather than the future of NFTs. In this next cycle, it is vital for collections and creators to **innovate** and tackle the market from a number of angles to help **win back some of the NFT negativity that has been commonplace among the mainstream media outlets in the last year**. One example we can think of is **Pudgy Penguins**[181], who added to their NFT collection by initially launching a set of **physical toys**, which is now available in over 2,000 Walmarts across the US. Their latest move is to launch an **on-chain game, called Pudgy World**, with integrations to both their NFT and their physical toys. The game will launch on **zkSync in Q1** and help merge their "physical and digital worlds into one."

Figure 84: Pudgy Penguins has a range of products in addition to their NFTs

Source: pudgypenguins.com

2. NFT Perpetuals

One thing that the rise of Blur and Tensor has shown us is that there is a viable audience for "pro-trading" NFTs with sleek interfaces. The token markets have extremely hot perpetual ("perps") markets, but NFT perps are yet to reach a similar level. Current market incumbents include **Sujiko**, who launched mainnet in Q4 2023[182], and **nftperp** who are currently in testnet and recently announced a US$3M Series A round[183].

3. The Majors

CryptoPunks and **Bored Apes** continue to dominate the charts, although the sentiment on Twitter would have you believe that Punks have seemingly held their value a bit more (despite Yuga Labs owning both collections). **Pudgy Penguins,** as previously mentioned, have done well to add brand awareness among the masses, also raising a **US$9M round** in the process. **DeGods** made Crypto Twitter headlines a few times when moving their DeGods collection from Solana and their y00ts collections to Polygon. **Azuki** released Elementals which were met with some criticism, while Doodles said that they were "no longer a NFT project".

Figure 85: The top collections (by market cap) have performed well in the last 90 days

Collection		Price Floor ($)	90D Price Move	Supply	Market Cap ($M)
	CryptoPunks	120,725	70.6%	10,000	1,200.1
	BAYC	56,390	42.1%	10,000	564.6
	Autoglyphs	559,015	110.6%	512	284.5
	Pudgy Penguins	24,448	212.4%	8,888	214.5
	MAYC	11,015	43.9%	19,485	212.7
	Chromie Squiggle	17,886	20.4%	9,994	177.5
	Fidenza	165,021	111.4%	999	163.9
	Azuki	16,206	147.9%	10,000	166.6
	The Sandbox	735	98.3%	166,197	113.5

	The Captainz	9,006	83.1%	9,999	89.5

Source: nftpricefloor.com, Binance Research, as of December 31, 2023

4. Marketplace Mania

What's next? Blur changed the NFT trading market over the last year and OpenSea suffered despite the numerous strategic changes. As previously discussed (here), **OpenSea still has the intrigue of a potential token or L2 remaining**, both of which can have a material effect on their market standing. **Blur has Blast coming in Q1 so given they are ahead on both the token and the L2**, it will be interesting to see if they can continue to execute. Solana's NFT market is still growing fast and has much room to grow so the battle between Tensor, Magic Eden, and any smaller or newer players will be important to watch. The **potential for M&A,** for example, what we have just seen with **Etherscan and Solscan**, might also become more common as well-funded Ethereum startups might look to get exposure to Solana. Whether we see this M&A in marketplaces or elsewhere in the space is difficult to say, but infrastructure projects (e.g., like block explorers and marketplaces) might make attractive targets.

5. Bitcoin NFTs

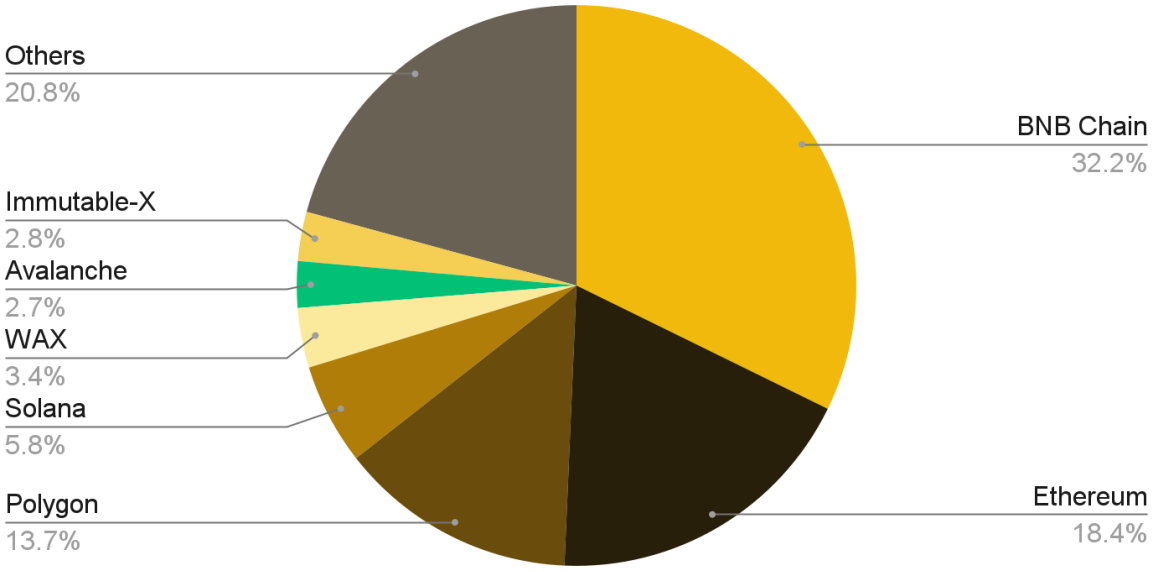
Ordinals, Inscriptions, BRC-20 tokens, all took the market by surprise across last year, reaching unprecedented levels of interest. It will be interesting to see if this market can be sustained and level of interest can exist in the medium term. While we have discussed this market in more detail earlier in the report, it is important to highlight again that Bitcoin NFTs are an intriguing and interesting part of the market, and remain very closely watched.

8 Gaming and Social

8.1 Gaming

The gaming landscape is led by the top three blockchains. **More than 64% of games are built on BNB Chain, Ethereum, and Polygon.** Given the large number of on-chain transactions for games, blockchains that have lower gas fees have a competitive advantage.

Figure 86: BNB Chain, Ethereum, and Polygon lead the blockchain gaming market

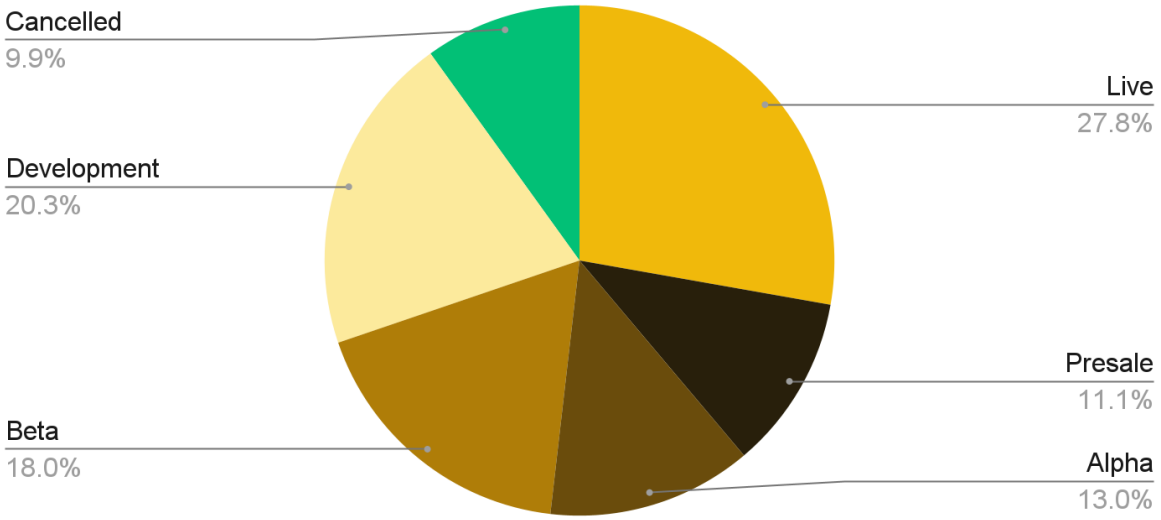


Source: PlaytoEarn.net, as of December 31, 2023

What about the status of game development? The blockchain gaming industry has often been criticized for its lack of quality games and subpar gameplay. However, **it is key to understand that AAA games take years to develop, even for the largest traditional gaming studios with decades of game-making experience.** Short development cycles are not effective enough to build AAA games. Rather, developers that focus on long-term growth over short-term results may have a better shot at developing quality games.

Currently, only 27.8% of all blockchain gaming projects are live, while the rest are still in different stages of development. This timeline makes sense, given that the bulk of the funding was received in the past 1-2 years and that more games should be launched over the next couple years.

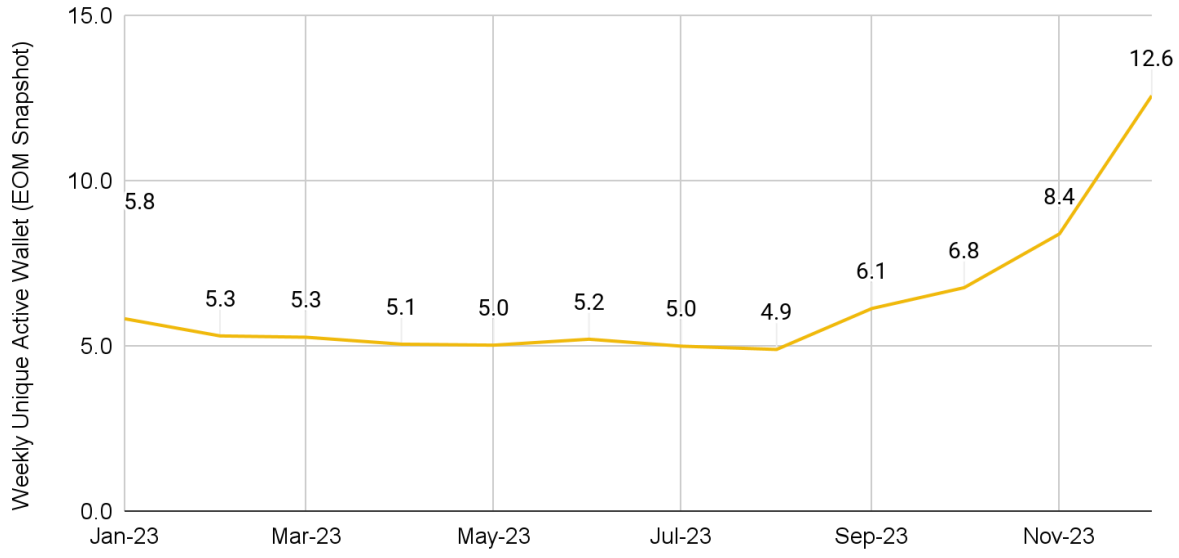
Figure 87: 27.6% of games are live today



Source: PlaytoEarn.net, as of December 31, 2023

Looking at on-chain metrics, **there has been a resurgence in gaming activity going into the year-end.** Following a relatively quiet period in the first three quarters of 2023, weekly unique active wallets based on end-of-month snapshots saw a rapid increase in the final few months of the year. It ended the final week of December with 12.6M weekly unique active wallets. This is a positive sign for the sector and is a proxy indicator of more gamers on-chain. Note that this data only represents on-chain activity, and given that not all actions on games require interactions with the blockchain, this data understates actual gaming activity.

Figure 88: Weekly unique active wallets have increased significantly

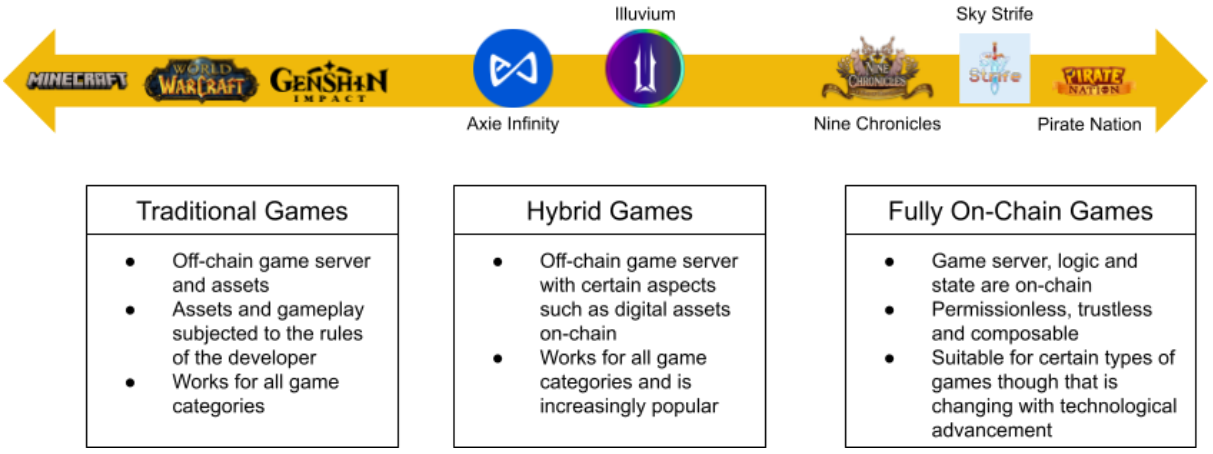


Source: DappRadar, as of December 31, 2023

Highlight: Fully On-Chain Games

Fully on-chain games refer to those where game logic and state are stored on-chain, along with several other characteristics[184]. By providing benefits such as immutability and game permanence, composability and interoperability, true ownership of digital assets, and community governance, fully on-chain games represent an area that holds much promise for the future of blockchain gaming.

Figure 89: Game spectrum with increasing appetite for on-chain gaming

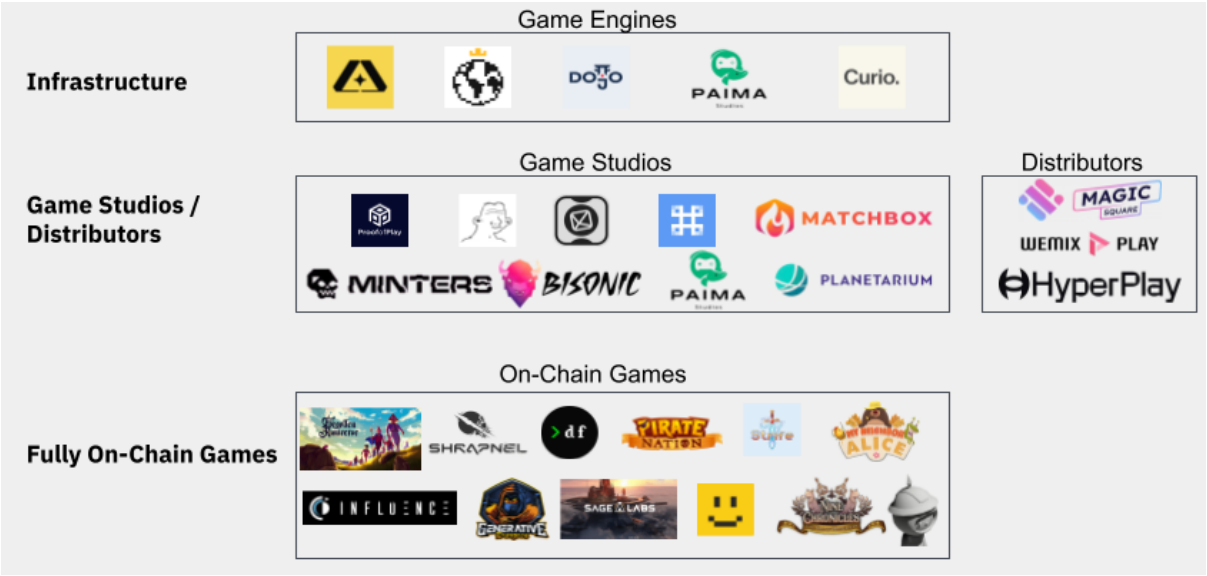


Source: Binance Research

Over the years, we have seen steady advancements and developments in blockchain gaming, bringing us many steps closer to a diverse ecosystem of fully on-chain games. From the launch of the first widely recognized blockchain game, CryptoKitties, in 2017, to the release of Axie Infinity in 2018 which introduced on-chain NFT assets and the play-to-earn narrative, all the way to the release of the Loot Project that tested the novel idea of a community-driven blockchain gaming world in 2021, these developments have laid the foundation for the development of on-chain games.

Today's on-chain gaming landscape can be broken down into several categories with each playing a pivotal role in advancing the growth of fully on-chain games. The ecosystem has grown steadily and there is an increasing number of on-chain games on the market today.

Figure 90: Landscape of Gaming



Source: Binance Research. Note that this is not an exhaustive representation of the ecosystem.

With less than 10% of blockchain games being fully on-chain games[185], it is evident that there is still a long way to go. Challenges related to technical constraints, user experiences, and a fragmented ecosystem are areas that developers and project teams are actively tackling.

Nonetheless, as we look ahead, we are optimistic of the outlook of on-chain games. The potential for a more interoperable ecosystem of games and assets, as well as an immersive gaming experience characterized by a deep integration of blockchain technology paints a promising future for the growth of this space.

Highlight: Gaming Giants Dive into Blockchain

It is not news that major gaming companies have entered the blockchain game industry. However, 2024 looks set to be an eventful year for blockchain gaming with the upcoming launches of several games by notable game publishers. We have summarized a few of such examples in the table below

Figure 91: Examples of blockchain gaming ventures by traditional game publishers

	Krafton	Nexon	Sega	Square Enix	Ubisoft
Notable Intellectual Property ("IP")	PUBG: Battlegrounds	MapleStory	Sonic the Hedgehog	Final Fantasy	Assassin's Creed
Blockchain Game	OVERDARE	MapleStory Universe	The Battle of the Three	Symbiogenesis	Champions Tactics™

			Kingdoms		Grimoria Chronicles
Release Date (Estimated)	1H 2024	2024	2024	December 21, 2023	2024

Source: Company websites, Binance Research

Krafton: OVERDARE

- OVERDARE is a NFT-driven metaverse game
- The game will introduce a Create-to-Earn ("C2E") system where users can buy and own digital assets created by content creators within the metaverse
- OVERDARE will be using Settlus as the blockchain for NFT licensing, and creators can earn revenue in the form of USDC

Nexon: MapleStory Universe

- MapleStory Universe is a NFT-centered, blockchain-based gaming ecosystem that is built based on Nexon's most widely recognized IP - Maplestory
- The MapleStory Universe encompasses four different experiences that includes MapleStory N, MapleStory N Mobile, MapleStory N Worlds, and the MapleStory SDK
- MapleStory Universe will leverage on NFT interoperability to connect gaming worlds and decentralize the ability to generate items

Sega: The Battle of the Three Kingdoms

- The Battle of Three Kingdoms is a NFT trading card game based on the Sangokushi Taisen IP
- The NFTs can be purchased, sold, and traded in the in-game marketplace.
- NFT holders may also benefit from rewards such as card packs and unique tokens

Square Enix: Symbiogenesis

- Symbiogenesis is an NFT-based game and has been described to be a "Narrative-unlocked NFT entertainment"
- There will be 10,000 NFT characters, each with a unique design, and various races and professions
- NFT holders will benefit from in-game utility such as points and rewards, and can use them as profile pictures

Ubisoft: Champions Tactics™ Grimoria Chronicles

- Champions Tactics™ Grimoria Chronicles is a NFT-centric player vs. player tactical role-playing game ("RPG")
- Players will collect legendary champions, assemble their teams, and battle with other players in a world called "Grimoire"

- A free mint for the game's "Warlords" NFT series was conducted on December 18, 2023, and will give holders access to a future mint of playable characters

The entrance of major gaming publishers into blockchain gaming is a positive development and indicates a recognition of the value behind blockchain games. **The investments, resources, talents, and IPs that come along with such ventures is a driving force for the development of AAA games** that will help attract more gamers and take blockchain gaming to the next level.

8.2 Social

By leveraging blockchain technology, web3 social applications enable and enhance traits such as decentralization, composability, and ownership. As compared to traditional social media platforms, **web3 social offers a greater degree of user-owned content and prioritizes censorship resistance**.

Friend.tech Frenzy Fuels SocialFi's Surge

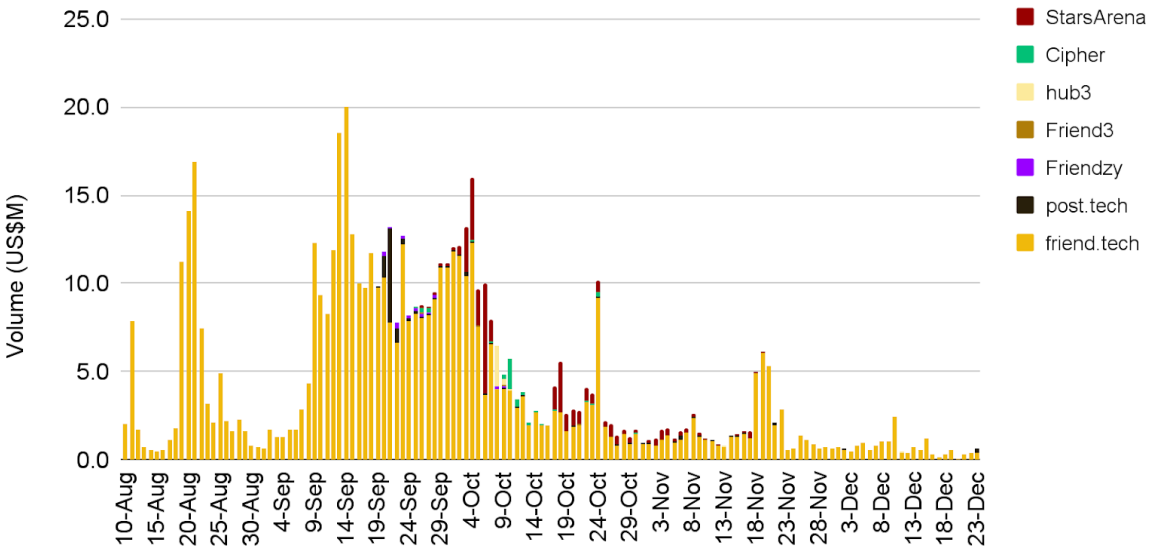
2023 saw the rapid growth of SocialFi, driven by the launch of friend.tech and its forks. Friend.tech, which launched on Base, allows users to tokenize and trade X (formerly Twitter) profiles. A 10% fee applies to all trades, 5% of which goes to the "Subject," i.e., the profile being traded, while the remaining 5% goes to the protocol. By buying a "Key," i.e., the tokenized version of a X profile, the user would gain access to a private chat with the Subject.

Friend.tech's initial success in onboarding creators was contributed by its ability to enable them to monetize content and generate value from social connections and community involvement. Additionally, the financialization element of the platform also helped drive community engagement as users looked to trade keys for profit, and increased activity to maximize points in anticipation of a potential airdrop.

There has since been several forks of friend.tech as others look to replicate the success of it on other chains. Examples include Stars Arena on Avalanche, Friendzy and hub3 on Solana, post.tech on Arbitrum, and Friend3 on BNB Chain.

However, following a strong start, **activity on SocialFi platforms has generally fallen across the board as interest waned.** As evident from the decline in daily trading volume across several SocialFi platforms, trading activity has been on a downtrend since October. At its peak in September, daily trading volume hit US$20M but was largely below the US1M mark throughout December. Friend.tech continues to account for the majority of trading volume.

Figure 92: Trading volume of SocialFi platforms has declined



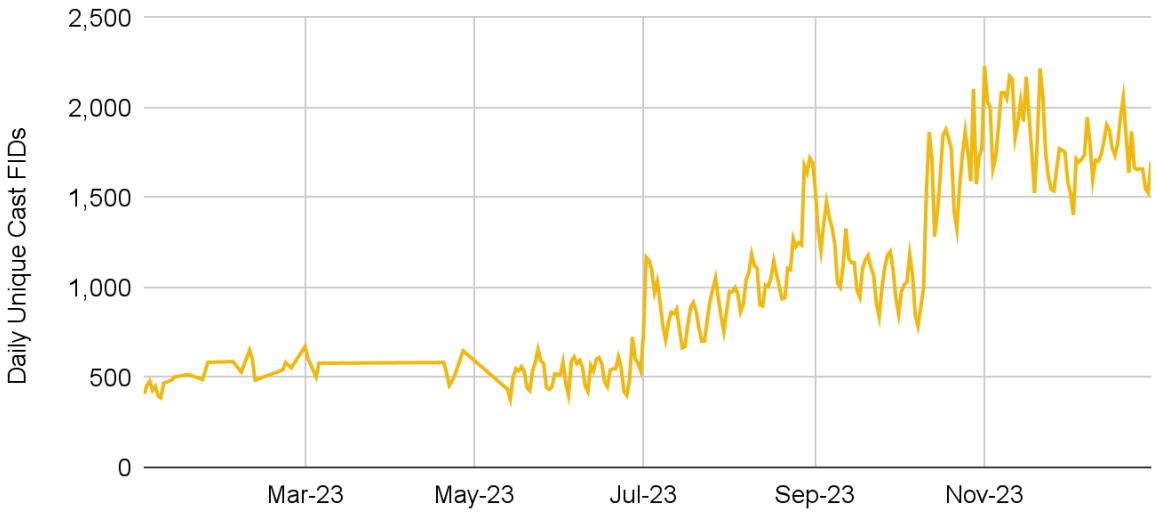
Source: Dune Analytics (@cryptokoryo), as of December 31, 2023

It remains to be seen whether SocialFi platforms and in particular, friend.tech will experience a resurgence in interest and activity. **A potential ace up friend.tech's sleeve could be its point system, especially with speculation regarding a possible future token airdrop.** Regardless, friend.tech's novel approach to monetization and community engagement is refreshing and could serve as a case study for teams looking to build the next generation of decentralized social dApps.

Farcaster's Permissionless Transition Catalyzes Growth

Farcaster transitioned to a permissionless model in October 2023, thereby opening registration to all users and making the platform accessible to more users. Prior to this, Farcaster was by invite-only. Since the migration to OP mainnet and the transition to a permissionless model, Farcaster has witnessed a resurgence in user activity.

Figure 93: Number of unique casts FIDs increased post-transition



Source: Dune Analytics (@pixelhack), Binance Research, as of December 31, 2023

Unique daily active users which have interacted with Farcaster in the form of "casts", which represent public and text messages from a user, have increased following the transition to a permissionless model. This followed a period of declining activity in September before making new highs in November. At the time of writing in December, in the past 30 days, there was an average of 7.3K casts and 20.6K reactions per day[186].The increase in activity has also been driven by the migration to OP mainnet, which makes sign ups more affordable.

With 47K registered users on Farcaster, web3 social undoubtedly still has a long way to go before reaching the scale of existing social media giants like X which has reportedly more than 300 million users[187]. Nonetheless, **having control over one's social graph, censorship resistance, and composability are compelling value propositions that differentiates web3 social protocols** from their web2 counterparts. While they may not necessarily be traits that every user is concerned about, web3 social protocols like Farcaster offer an attractive alternative to existing web2 platforms.

Lens' V2 Ushers in Profile-Based Paradigm Shift

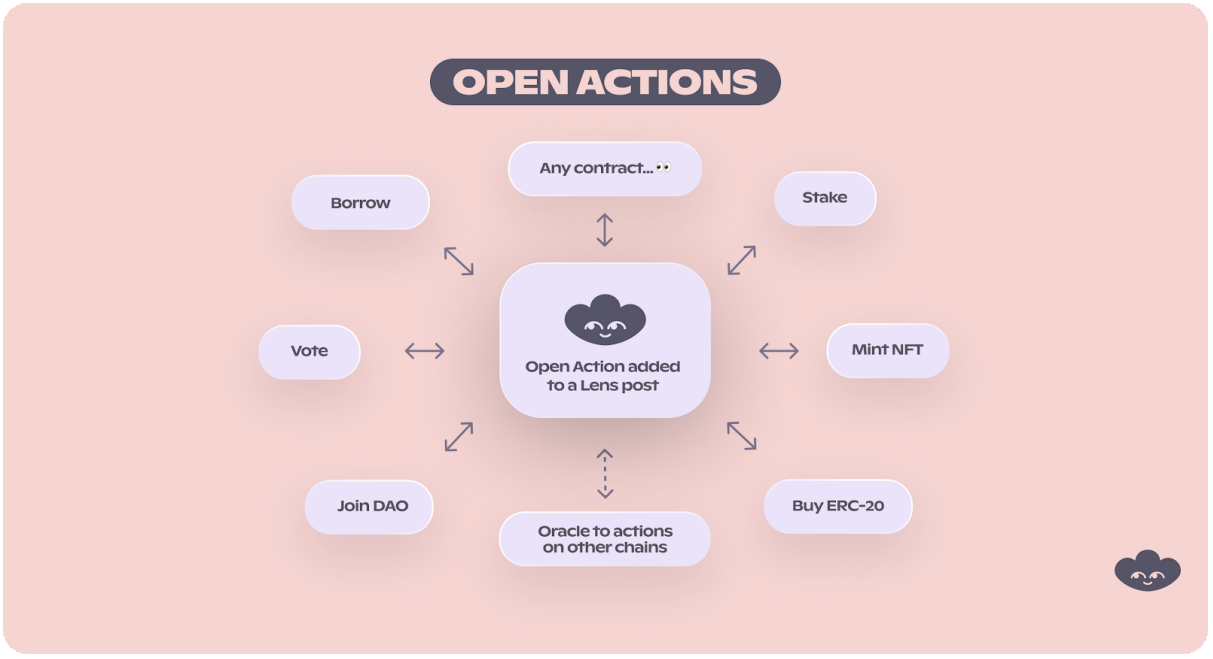
Lens v2 went live on mainnet in November 2023, with a focus on providing more control to builders and users. The upgrade results in activities and interactions that are profile-based instead of address-based, thereby improving developer experience by excluding wallet-based actions.

Notably, Lens V2 integrated ERC-6551, allowing profiles to act as wallets. This allows profiles to forge their own social connections and create new avenues for monetization, given that value from "mints" and "collects" can be directly accrued to profiles instead of to their owner's address. An example provided by Lens is that a CryptoKitty can own a Lens

profile, follow other CryptoKitties and publish content, resulting in the creation of its own value chain.

Additionally, Lens V2 has enhanced composability through the introduction of “Open Actions”. This essentially allows Lens applications to execute external actions directly on Lens, creating a better user experience as users do not need to leave the Lens ecosystem to execute such actions. An example of this is to allow users to click “mint” on a Lens post to mint an NFT via the OpenSea contract directly on Lens. In this way, Lens is able to increase composability and provide developers with a flexible tool to create more user experiences.

Figure 94: Open Actions enable developers to incorporate external smart contract operations directly into Lens



Source: Lens Protocol

The V2 upgrade has brought about more interactions centered around profiles, and gave users more flexibility and control over their social media experiences. Such a user-centric approach sets the stage in shaping the future of decentralized social, and paves the way for creators to explore new opportunities fueled by blockchain technology.

Putting It All Together

Web3 social presents a promising alternative to existing social media platforms. Users benefit from greater degree of control, potential monetization opportunities, and higher composability.

The rapid growth of friend.tech exhibited the huge interest in SocialFi and a willingness to try out novel applications that marry the elements of community engagement and monetization. While the subsequent decline in activity showcased the difficulty in

sustaining traction, friend.tech has nonetheless provided a blueprint for new teams to build upon. It will be interesting to watch how the space evolves over the next year.

Early decentralized social protocols like Farcaster and Lens have also continued building new features that are key for long-term growth. Their focus on decentralization and composability provides the foundation for a new era of community engagement and interaction. We are undoubtedly still in early stages of development for web3 social and there is still a long way to go in terms of achieving mass adoption. Nonetheless, the fundamental benefits provided by a user-centric and censorship-resistant social landscape fuel our optimism for the future.

9 Fundraising Activity & Institutional Adoption

9.1 Fundraising Activity

2023 observed a noticeable downturn in venture capital investments within the Web3-focused projects, with a significant reduction in funding compared to 2022. **The total capital raised by the top 10 projects in 2022 was US$5,870M, while in 2023 this figure dropped to US$1,780M, marking a 70% decline.** The disparity was stark, as even the lowest-funded project among the 2022's top 10 secured more capital than the highest-funded project in 2023. This decrease aligns with the broader market trend, as the crypto market didn't start to recover from its bearish phase until late 2023.

However, **2023 still saw some significant investments, particularly in infrastructure projects focusing on cross-chain interoperability solutions and financial services**, including exchanges, mining services, and wallet providers. Notably, most of the significant funding occurred in the latter half of the year, with six out of the 10 largest fundraises happening in this period. Among these, Phoenix Group, a Bitcoin mining service provider, and Ramp, a non-custodial payment infrastructure company, led the pack with US$370M and US$300M in amount raised, respectively.

Figure 95: Top 10 raises by Web3-focused projects

Project	Amount raised	Date	About
Phoenix Group	US$370M	11/21	Phoenix Group manages 725MW across global mining facilities, with a presence spanning Canada, North America, CIS, and the UAE. Services provided encompass mining, hosting, and cooling, alongside investments in web3 technologies and regulated digital asset exchanges. It has recently added systematic trading to its diverse portfolio of businesses.
Ramp	US$300M	8/23	Ramp is a non-custodial, full-stack payment infrastructure that allows users to buy crypto without leaving their dApp or wallet.
Wormhole	US$225M	11/29	Wormhole is a decentralized, universal message-passing protocol that enables developers and users of cross chain applications to leverage the advantages of multiple ecosystems.
Swan	US$165M	12/7	Swan is a Bitcoin financial services firm on a

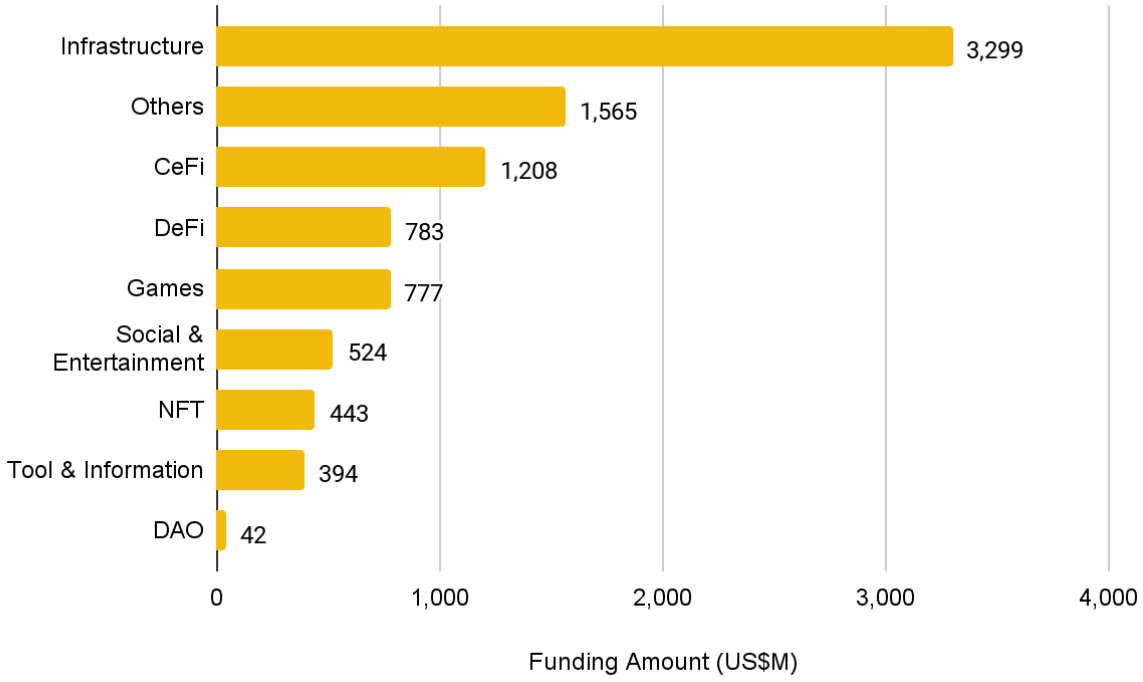
Project	Amount raised	Date	About
			mission to help people stack Bitcoin, for the long term, in every investment vehicle possible.
LINE NEXT	US$140M	12/13	LINE NEXT is a venture dedicated to developing and expanding the global NFT ecosystem. LINE NEXT aims to revolutionize the NFT experience for companies, creators, and users.
Blockstream	US$125M	01/24	Blockstream, a crypto infrastructure company, raised US$125M to expand its bitcoin mining facilities to meet the rising demand for large-scale hosting services.
LayerZero	US$120M	04/04	The Series B funding round of US$120M for LayerZero Labs is intended for growth initiatives such as hiring and expanding the company's presence in the APAC region.
Worldcoin	US$115M	05/25	Crypto ID project Worldcoin has raised US$115M in a Series C round. The capital aims to help accelerate research, development, and growth efforts on the project and showcase World App, the crypto wallet for the ecosystem.
Blockchain.com	US$110M	11/15	Blockchain.com is a digital asset platform that provides crypto exchange, blockchain explorer, and crypto wallet services. It also offers a range of solutions for institutions, such as asset trusteeship and loans.
Arkon Energy	US$110M	12/22	Arkon is a fully renewable data center infrastructure company that uses excess renewable power to run Bitcoin mining operations.

Source: ROOTDATA, Binance Research, as of December 31, 2023

During the first half of 2023, we observed that the VC investment trends within the blockchain ecosystem were experiencing a notable shift of focus. While CeFi was the primary investment focus in 2020 and 2021, the spotlight turned to infrastructure projects from 2022 through the first of half 2023. By the end of 2023, it was evident that infrastructure continued to dominate as the sector with the most VC interest.

Throughout 2023, **Web3 projects attracted a total of 1173 investments, amassing a collective capital of US$9.0B.** Of this, a substantial 36.5% was invested in infrastructure projects, followed by CeFi's 13.3% and DeFi's 8.6%. On the lower end of the investment spectrum was Decentralized Autonomous Organization ("DAO"), which saw the least amount of capital invested, accounting for a mere 0.47% of total investments.

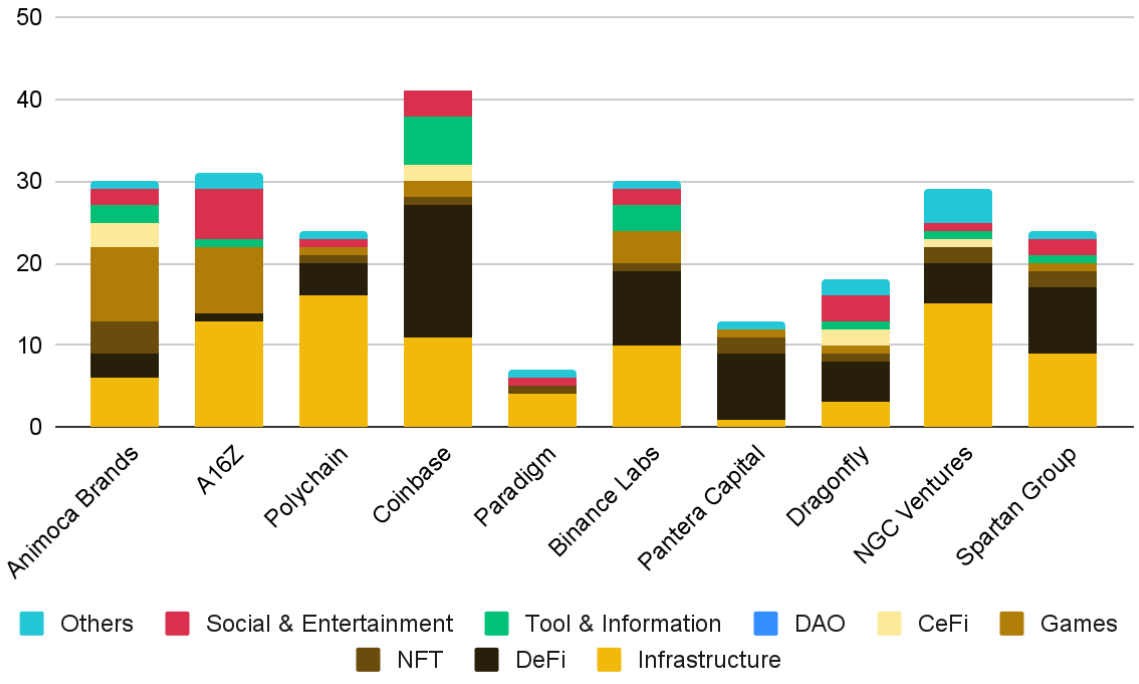
Figure 96: Infrastructure captured a substantial 38% of total invested capital in 2023



Source: ROOTDATA, Binance Research, as of December 31, 2023

Analysis of investment patterns from some of the leading funds in the space reveals a similar trend.

Figure 97: Infrastructure, DeFi, and Gaming are the most invested sectors of top VCs



Source: ROOTDATA, Binance Research, as of December 31, 2023

Data from ROOTDATA shows that these top funds invested in a total of 247 projects over 2023. These investments were predominantly focused on infrastructure, DeFi, and gaming, which comprised 35%, 23%, and 11% of the total deals, respectively. Notably, none of these funds ventured into DAO investment, corroborating the earlier observation of minimal investment activity in the sector.

Despite the noticeable reduction in both investment volume and overall valuations in 2023, it is encouraging to see signs of market recovery and substantial capital being allocated towards building infrastructure - a sector vital for the mass adoption of blockchain and cryptocurrency. **Moving into 2024, it would not be surprising to see an uptick in investment activities. This anticipated growth is not only due to the low base period from the previous year but also driven by the increasingly bullish sentiment permeating the market**. We remain optimistic for 2024 and will continue to track the capital flow.

9.2 Institutional Adoption

In 2023, the crypto market achieved significant strides in adoption, with notable involvements from major Web2 companies and TradFi institutions. These entities have shown growing interest in blockchain technology, forming partnerships with Web3 projects or integrating digital asset products/solutions into their operations and services. Below we highlight some key examples of these collaborations and explore two pivotal milestones of the year: the coming of spot Bitcoin ETFs and the adoption of cross-chain interoperability solutions

Note that the mention of specific projects does not constitute an endorsement or recommendation by Binance. Instead, the projects cited are merely used for the purposes of demonstrating the examples of digital asset adoption. Additional due diligence should be taken to better understand the projects and associated risks.

Growing Presence

In the past year, the crypto industry has seen a marked increase in visibility, gradually capturing public attention.

Collaborations between Web2 and Web 3

Several pioneering companies have taken the initiative, actively embracing the blockchain technology:

- In February, electronic giant Bosch teamed up with Fetch.ai to launch the Fetch.ai Foundation, developing Web3 technology for practical applications in areas such as mobility, industry, and consumers. This initiative aims to foster industry-wide Web3 adoption through a decentralized governance approach.

- Microsoft was reportedly testing a built-in Ethereum-based Web3 wallet in its Edge browser in March, representing Microsoft's strategic move to integrate decentralized solutions into its platform.
- In May, Alibaba Cloud, the cloud computing arm of Chinese tech giant Alibaba, developed a metaverse launchpad called Cloudverse on the Avalanche network. This project is designed to offer business end-to-end solutions for their own metaverse products.
- Amazon partnered with VeChain, an enterprise-grade Layer 1 blockchain, in the Amazon Cloud Technology Development Partner Program to promote a green and sustainable future for tech companies in June.
- On July 11, cross-chain interoperability protocol Axelar announced its partnership with Microsoft Azure to develop a blockchain-based tool that will simplify the connection between businesses, users, and dApps across Azure's platform.
- In September, Visa expanded its stablecoin payment capabilities by integrating the Solana blockchain to enhance the efficiency of the firm's cross-border transactions. This move positions Visa as one of the first major financial institutions to utilize Solana for large-scale settlements.
- On November 9, leading gaming studio Ubisoft announced its collaboration with blockchain gaming firm Immutable. This collaboration aims to blend high-quality mainstream gaming development with Web3 functions, leveraging Immutable's expertise in blockchain infrastructure.
- IBM introduced its new digital assets cold storage solution Hyper Protect Offline Signing Orchestrator ("OSO") on December 5. The OSO system automates transaction processes and uses air-gapped storage containers to minimize human interaction and errors.

Adoption by TradFi institutions

We also saw TradFi institutions and government entities exploring the potential of blockchain technology and crypto use cases:

- UBS Asset Management launched its first live pilot of a tokenized money market fund on the Ethereum network. This will enable UBS Asset Management to test various fund activities , including subscriptions and redemptions, on-chain. Additionally, UBS plans to execute more live pilot use cases in the future, exploring different investment strategies with a broader set of partners.
- The Reserve Bank of Zimbabwe ("RBZ") introduced a gold-backed digital token called Zimbabwe Gold ("ZIG") as a payment method. ZIG tokens can be stored in e-gold wallet or e-gold cards and are tradable for peer-to-peer and business

transactions. The purpose of issuing ZIG is to encourage local investors to invest in national assets instead of US dollars.

- Circle, the issuer of USDC, formed a partnership with Tokyo-based financial services firm SBI Holdings to boost the circulation of USDC in Japan. This partnership aims to transform Japan's financial landscape by integrating USDC and Web3 services, aligning with the recent revisions of Japan's Payment Services Act, which are expected to stimulate the country's transition towards a Web3 economy.
- In December, the Swiss city of Lugano officially started accepting Bitcoin and Tether as payment options for municipal taxes and other community fees. This initiative is part of Lugano's Plan B project, in collaboration with Tether, to leverage blockchain technology for transforming the city's financial system and enhancing the local adoption of cryptocurrency.

Spot Bitcoin ETFs

The narrative of "Institutions are coming" has always been one of the most captivating in the market. In 2023, this narrative edged closer than ever to become reality, with over 10 financial institutions having filed for spot Bitcoin exchange-traded funds ("ETFs"). **As of January 10, 2024, the U.S. Securities and Exchange Commission has approved the first wave of applications for spot Bitcoin ETFs**. This development marks a critical juncture for the crypto industry. The launch of spot Bitcoin ETFs would not only catalyze billions of capital inflows to the industry but also serves as a major endorsement of Bitcoin's legitimacy as an asset class.

Approved spot Bitcoin ETFs at the time of writing:

- Grayscale Bitcoin Trust, Ticker: GBTC
- ARK 21Shares Bitcoin ETF, Ticker: ARKB
- iShares Bitcoin Trust, Ticker: IBIT
- Bitwise Bitcoin ETP Trust, Ticker: BITB
- VanEck Bitcoin Trust, Ticker: HODL
- Wisdomtree Bitcoin Trust, Ticker: BTCW
- Invesco Galaxy Bitcoin ETF, Ticker: BTCO
- Fidelity Wise Origin Bitcoin Trust, Ticket: FBTC
- Valkyrie Bitcoin Fund, Ticker: BRRR
- Franklin Bitcoin ETF, Ticker: EZBC

Cross-Chain Interoperability Solutions

Cross-chain interoperability solutions emerged as a key sector with significant potential for future institutional adoption, particularly noted by the increasing experimentation from various TradFi institutions. These protocols enable an efficient and secure way to facilitate interconnectivity across different blockchains. Therefore, they play a pivotal role in TradFi institutions' blockchain applications, which often involve a combination of public and permissioned blockchains. For more information about how cross-chain messaging works, check out our report "Decoding Cross-Chain Interoperability."

Axelar & LayerZero

- Axelar is a Proof-of-Stake ("PoS") network that acts as a communication layer for dApps to interact across both the EVM and Cosmos ecosystems, enabling the transfer of tokens, smart contract calls, and general messaging.
- LayerZero is an omnichain interoperability protocol engineered for secure and reliable transfer between its supported networks.
- Onyx by J.P. Morgan and Apollo Asset Management formed a partnership to explore the feasibility of cross-chain portfolio management using on-chain tokenized funds and smart contracts, with Axelar and LayerZero were selected as the interoperability infrastructure providers, indicating recognition from respected TradFi institutions.
- This case study sends a strong signal, underscoring the important role cross-chain messaging protocols are set to play in TradFi institutions' future adoption.

Chainlink CCIP

- Launched in its Early Access phase in July 2023, CCIP is Chainlink's latest venture into the interoperability domain. It leverages Chainlink's Decentralized Oracle Networks ("DONs") to form a triple-network cross-chain interoperability architecture, facilitating the transferring of arbitrary data, tokens, or a combination of both.
- Australia and New Zealand Banking Group Limited ("ANZ") collaborated with Chainlink Labs to explore a cross-chain settlement solution utilizing CCIP, with a detailed report being published on September 29, 2023.
- CCIP was utilized as the backend infrastructure in the trial, allowing a customer to use an ANZ-issued New Zealand dollar stablecoin to buy tokenized Australian asset NFTs, priced in a different stablecoin on another blockchain.
- The successful results demonstrate the feasibility of using cross-chain interoperability solutions to optimize TradFi's integrations with blockchain

technology, such as the transfer of value from banks to public chains or atomic cross-chain settlement.

These examples showcase the growing adoption of blockchain technology among Web2 tech companies and financial institutions.

We believe 2024 may see an accelerated crypto adoption, fueled by the uptick in market sentiment, institutional flow, and upcoming events like Bitcoin Halving. These factors are likely to propel renewed attention for crypto in the public's eye, drawing a fresh wave of interest and participants to the market.

The involvement of tech giants like Google and Microsoft, along with major financial institutions such as BlackRock, highlights the undeniable potential and growing acceptance of blockchain technology and cryptocurrency. This trend of adoption among prominent entities suggests that more organizations may enter the space, keen on not being left behind in a rapidly growing industry - signaling we are a substantial step closer to digital assets' mass adoption.

10 Themes for 2024

Looking ahead, we are delighted to see the market's remarkable performance in the past year and are thrilled about the following themes for 2024:

- **Bitcoin narratives stay at the forefront:** Throughout 2023, Bitcoin remained a focal point, fueled by various narratives like Ordinals/BRC-20s, the approval of spot Bitcoin ETFs, and the 2024 halving. **Ordinals and BRC-20s** marked a 0 to 1 innovation in Bitcoin's evolution, introducing the deployment, minting, and transferring of fungible tokens on the Bitcoin network for the first time. These tokens also quickly became the preferred instruments for speculators seeking to capture the extra returns in addition to just holding Bitcoin. Meanwhile, the recently approved **spot ETFs** potentially introduces a source of substantial liquidity into the crypto market and signifies mainstream recognition of Bitcoin as a legitimate asset.

  Moving into 2024, these dynamics are likely to persist. The SEC's final decisions are here and likely to be positive. Historically, the crypto market has shown robust performance in the year following a **halving** event. Consequently, the recent spot ETF approvals and the optimism leading up to the April halving could trigger significant market volatility. Morvoer, should Bitcoin's price surge in response to these events, we could witness even more dramatic price fluctuations in Ordinals and BRC-20s due to their smaller market capitalizations and memecoin-like attributes. However, it's also anticipated that the Ordinals and BRC-20s ecosystems will undergo further developments. Most notably, the introduction of more **Bitcoin scaling solutions, such as Stacks' sBTC**, will be an interesting development to watch and will help enhance Bitcoin functionality.

- **Ownership economy applications gain further traction:** Blockchain technology empowers users to reclaim sovereignty over resources that are traditionally dominated by large entities. This includes personal data, creative content, and computation resources. For example, centralized storage services may require users to give up control over their data, exposing them to risks such as privacy breaches and the vulnerabilities of single points of failure. In response, various projects are exploring alternative solutions that grant users greater control over their assets and information. Two notable areas in this regard are **decentralized physical network infrastructure ("DePin") and decentralized social media ("DeSoc").**

  Although the concepts of DePin and DeSoc have been around for some time, they only started gaining significant traction in 2023. This shift can be attributed to factors like the maturation of infrastructure development, increased awareness, and a growing user base in crypto. For DeSoc, Friend.tech was the major growth driver in 2023, generating significant revenue that rivals some top protocols. Friend.tech

exemplifies the potential of decentralizing social media, enabling users to monetize their creations without the limitations imposed by centralized platforms. In 2024, we may see similar applications exploring various forms of social media, including music, video, and written content.

DePin, meanwhile, emerged as a popular narrative towards the end of 2023. These protocols are viewed as having high growth potential due to their extensive total addressable market and their ability to scale rapidly through bottom-up growth strategies. In 2024, we could witness accelerated adoption of both DePin and DeSoc projects, tapping into their potential for growth and market penetration.

- **Artificial intelligence ("AI") integration increases:** Since OpenAI's ChatGPT sparked intense traction for AI applications globally in 2023, **AI x Crypto has become one of the major narratives over recent months**, with a multitude of projects continuing to emerge. We believe the integration of artificial intelligence with crypto is an area poised for growth. While it is **still in the early stages** of development, integrating AI in the crypto ecosystem opens up a realm of possibilities regarding potential use cases and offers alternatives to existing solutions.

  Projects incorporating AI have already begun to offer services like **trade automation, predictive analytics, generative art, data analytics, and DAO operations**. Moving forward, more use cases are yet to be discovered. For instance, training AI models requires extensive data input, necessitating significant resources, often limiting this activity to tech giants. This results in decreased transparency and siloed development. However, by utilizing decentralized storage for data management, we can achieve greater transparency and security. This democratizes the AI model training process, allowing broader participation, which could lead to a surge in innovation and development in the field.

- **Real-world assets ("RWAs") grow:** The tokenization of RWAs presents a strong use case for blockchain technology. By bringing off-chain assets onto the blockchain, RWA tokenization allows for greater transparency, increased efficiency, and a new realm of possibilities regarding composability and potential use cases.

  Going into 2024, we expect **RWAs to benefit from the tailwinds of elevated interest rates**. Specifically, tokenized treasuries are likely to remain a bright spot given that they present an alternative and attractive source of yield for crypto investors. Additionally, **alongside the accelerated institutional adoption of RWAs, developments in related infrastructures such as decentralized identity, oracles, and interoperability solutions are also expected to gain momentum**. These elements are crucial for the establishment of a comprehensive RWA ecosystem. As more institutions delve into the tokenization of RWAs, the advancement of these supporting infrastructures is likely to follow suit.

- **On-chain liquidity landscape thrives:** Liquidity is fundamental to the on-chain ecosystem, especially for DeFi, and has evolved significantly since the introduction of Uniswap's Automated Market Maker model. This evolution has given rise to **multi-faceted liquidity models** supporting various on-chain activities, including token swaps, derivatives trading, and yield management.

  As the market gradually gains momentum, an **increase in the scale of on-chain liquidity and financial activities is expected.** Two noteworthy categories to track are **liquidity management and Request for Quote ("RFQ") systems**. Uniswap V3's popularization of Concentrated Liquidity Market Maker ("CLMM") addressed capital inefficiencies. Yet, challenges like Impermanent Loss ("IL") and Just-In-Time ("JIT") liquidity, which demand active position management to mitigate, still pose difficulties for less experienced participants. This has led to the emergence of liquidity protocols that use various strategies to optimize positions for CLMM liquidity providers. Currently, Uniswap V3 alone has a TVL of US$2.4B, but the combined value managed by these liquidity management protocols is only US$400M. This disparity highlights the growth potential, especially with the upcoming Uniswap V4, which could introduce more advanced liquidity optimization functions.

  RFQ systems, exemplified by projects like Uniswap X, CoW Swap, and 1nch Fusion, facilitate the matching between traders and market makers, often utilizing mechanisms like Dutch Auction to ensure competitive pricing. Advantages of the RFQ model include competitive pricing, MEV-proofing, zero slippage, and gas-less order processing. With ongoing advancements in on-chain trading infrastructure, the adoption of this efficient model is likely to increase.

- **Institutional adoption accelerates:** 2023 saw the arrival of institutions, and we can anticipate even more joining the crypto space. The **entrance of reputable traditional asset management giants such as BlackRock and Fidelity into crypto during the bear market in the past year is a testament to their belief** in the long-term potential of the industry.

  As we approach the Bitcoin halving and observe the positive headlines surrounding spot Bitcoin ETF applications, we can expect increased coverage of the crypto space in 2024. This would motivate more institutions to deepen their understanding of the technology and figure out how they can participate in the growth of crypto.

- **Security remains paramount:** Security plays a paramount role in building and maintaining user trust within the crypto industry, enabling it to realize its full potential. Past exploits have served as valuable lessons, prompting the industry to refine its processes and fortify its defenses.

  Over US$1B was lost to DeFi exploits in 2023, based on data from DeFiLlama. While this represents a significant improvement compared to the approximately US$3.28B hacked in 2022, every dollar lost remains one too many.

Considering the importance of security, we **anticipate continued emphasis in this area in 2024**. This focus may manifest in various forms, such as product innovations, educational initiatives, and enhancements in user experiences, to name a few.

- **Account abstraction gains importance:** To onboard the next billion users and accelerate blockchain adoption, **accessibility** and **inclusivity** are key. In the ideal world, users should find it easy to utilize decentralized applications and conduct any on-chain activity without difficulty. In reality, there is much more room for improvement. For instance, the majority of trades still occur on centralized exchanges ("CEX"). Even at their peak in May 2023, decentralized exchanges accounted for just 20% of the total CEX trading volumes.

  Several innovations keep us excited about the future. Account abstraction, for example, has facilitated the **creation of smart contract wallets with enhanced usability and features like social recovery**, which significantly enhances the overall user experience. Given the strong competition among wallet providers, it would not surprise us to see rapid developments here that could further reduce the friction of using Web3 wallets.

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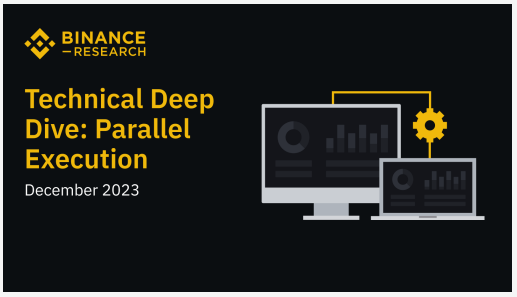

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About Binance Research

Binance Research is the research arm of Binance, the world's leading cryptocurrency exchange. The team is committed to delivering objective, independent, and comprehensive analysis and aims to be the thought leader in the crypto space. Our analysts publish insightful thought pieces regularly on research topics, including but not limited to the crypto ecosystem, blockchain technologies, and the latest market themes.

Jie Xuan Chua

Macro Researcher

Jie Xuan ("JX") is currently working for Binance as a Macro Researcher. Prior to joining Binance, he worked as a Global Investment Specialist with J.P. Morgan and had prior Equity Research experience at various fund houses. JX is a CFA charterholder. He has been involved in the cryptocurrency space since 2017.

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Moulik is a Macro Researcher at Binance, having been involved in the cryptocurrency space since 2017. Prior to joining Binance, he had experience spanning cross-functional roles in Web3 and Silicon Valley-based tech companies. With a background in co-founding start-ups and a BSc in Economics from the London School of Economics & Political Science ("LSE"), Moulik brings a comprehensive perspective to the industry.

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Shivam is currently working for Binance as Macro Researcher. Prior to joining Binance, he worked as an Investment Banking Associate / Analyst at Bank of America on the Debt Capital Markets desk, specializing in European Financial Institutions. Shivam holds a BSc in Economics from the London School of Economics & Political Science (“LSE”) and has been involved in the cryptocurrency space since 2017.

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Brian is currently working for Binance as a Macro Research intern. Prior to joining Binance, he worked as a DeFi researcher at a financial service startup and a Web3 education organization. He holds a Master of Finance degree from the University of California, Irvine (“UCI”), and has been involved in the cryptocurrency space since 2021.

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