21SHARES

ISSUE 5 | FEBRUARY 2022

STATE OF CRYPTO

Our insights into Web 3,
The Future of The Internet.

State of Crypto

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Foreword

This report provides an in-depth overview of the state of the cryptoasset industry over the last few months — offering our view on the industry and a recap of the most important news items. In addition, we have included one of our research reports: Our investment thesis on Web 3, *The Internet of Value*.

The rise of crypto-native applications in the past year spanning from financial services, art, games, and music, has created a sub-economy composed of various sectors. We hope that our writing and research can guide you over the next few months by helping you understand the cryptoasset industry better.

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About Our Research

21Shares is a technology company, co-founded by Hany Rashwan and Ophelia Snyder, that creates financial on-ramps to invest, trade, and secure digital assets.

The Research team is a cross-functional department collaborating with the distribution, product, and engineering teams. Composed of professionals with over 8 years of experience in the cryptoasset industry, our team places education at the core of our industrial research. We provide data-driven, cutting-edge, unique insights into the crypto markets and macroeconomic factors likely to influence the state of this industry.

We stand by free and publicly accessible content; and strongly believe information asymmetry contradicts crypto ethos and philosophy. More than 10,000 investors read our research notes and reports every week, ranging from private banks, asset managers, professional traders, hedge funds, tier-1 media outlets, and regulators.

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Glossary

An **automated market maker (AMM)** is an automated decentralized exchange where trades are made against a pool of tokens called a liquidity pool. An algorithm regulates the values and prices of the tokens in the liquidity pool.

A **Blockchain** is an append-only, decentralised ledger that can be used to store data (such as transaction history) in a censorship-resistant way.

Bridges allow independent blockchains to communicate with each other for the transfer of assets or messages.

Cryptoassets are digital assets whose global transaction history is stored on a blockchain.

A **Crypto Exchange** is a platform that enables the exchange of crypto assets for other crypto assets or fiat currencies.

Decentralized Autonomous Organization (DAO) is an organization managed by members often using open source code and smart contracts, decisions are often voted upon by members and utilize a native token for participation.

A **decentralized exchange (DEX)** is a platform for buying, trading, and selling digital assets, directly and peer-to-peer on the blockchain without a centralized intermediary.

A **Digital Wallet** is a software that interacts with blockchains to facilitate the storage and transfer of crypto assets.

Ether (ETH) is the native cryptoasset of the Ethereum blockchain and is used to pay for the transaction and smart contracts fees on the network.

A **Halving Event** is when the number of new coins awarded to miners per block is cut in half every four years.

The **Hash Rate** is the combined number of computations (hashes) performed per second by all miners within a network.

Liquidity Mining is the process where traders provide assets to a specific pool often to earn trading fees or rewards.

Mining is a mechanism where individuals within a network solve computationally difficult proofs of work to confirm transactions and add new blocks to a blockchain.

A **non-fungible token (NFT)** is a unique cryptographic token which is not interchangeable with any related asset and can not be divided or altered.

On-chain refers to information and transactions that are executed and stored explicitly on a blockchain.

Proof of Stake (PoS) is a mechanism that selects block creators based on a participant's stake, such as the number of tokens they hold or how long they have participated on the network.

A Proof of Work (PoW) is a piece of data that is difficult to produce but easy for others to verify and satisfies certain requirements. They are often used in the consensus mechanisms of cryptoasset networks including Bitcoin.

A **Rollup** is an aggregation of transactions to be processed off chain before on-chain settlement and are often considered a throughput solution.

A **Smart Contract** is a digital code typically programmed onto a blockchain that enforces a previously agreed-upon transaction based on preset conditions.

Stablecoins are cryptoassets that aim to have similar volatility to widely-used fiat currencies like the US dollar.

Staking is the process of locking up tokens in order to verify transactions on the blockchain and earn rewards.

Total Value Locked (TVL) is a DeFi native metric that measures the cryptoassets or assets under management locked in decentralized finance (DeFi) application through the use of smart contracts.

Zero-Knowledge Proofs (ZKPs) is a cryptographic method that enables an individual to prove to a verifier that a certain asset or information exists without revealing details about the asset or information itself.

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Market Updates

Business

NEAR Foundation appointed ex-Circle executive **Marieke Flament** as CEO.

Polygon acquired Ethereum scaling startup **Mir** for $400 million.

Acala won the **first Polkadot Parachain auction** with $1.3 billion committed in DOT.

Crowdfunding platform **Kickstarter** announced plans to migrate to a decentralized platform built on the **Celo** blockchain.

Jack Dorsey stepped down as Twitter CEO to focus on his role in Square.

Coinbase acquired the team of crypto wallet provider BRD to help accelerate Web 3 adoption as well as provide deep expertise in self-custody.

Solana powered up Web 3 gaming projects with a $100 million funding deal.

Binance announced the launch of a $115 million crypto and blockchain initiative to develop the European crypto ecosystem.

FTX crypto exchange expanded to the Bahamas, after inking a major regulatory approval.

Twitter allowed Bitcoin tipping for users.

Visa made its first swipe on NFTs with the purchase of CryptoPunk 7610, one of 3,840 female punks, for around $150,000.

The B Word conference hosted by the Crypto Council for Innovation, ARK, Square, and crypto investment firm Paradigm took place online.

Investments

B.Protocol raised $2.2 million to backstop DeFi liquidations from 1kx, Spartan Group and Robot Ventures.

The token holders of two DAOs, **Rari Capital** and **Fei Protocol**, approved their multibillion-dollar merger, one of the biggest mergers in DeFi history.

Decentralized rendering engine, **Render Network**, raised $30 million from Multicoin, Alameda and the Solana Foundation to offer a decentralized alternative to Pixar's massive rendering farms.

Gear Technologies raised $12 million to boost slat-contract development on **Polkadot**.

Router Protocol raised $4.1 million to bridge EVM and non-EVM chains.

Burrata raised $7.75 million from **Stripe** and **Variant** to build its identity data bridge.

Three Arrows led a $4.3 million round for **Solice**, the Solana-based metaverse project aiming to compete with Decentraland and The Sandbox.

Talis raised $2.3 million to build NFT marketplace and more on Terra blockchain.

Snapshot Labs, a popular DAO voting platform, raised $4 million to expand the reach of its governance tools.

The Oasis Foundation launched a $160 million ecosystem fund, to finance early stage projects building on Oasis, with the support of a group of VC firms like Dragonfly Capital Partners, Draper Dragon Fund, and Jump Capital.

Pawnfi, an alternative-asset lender, raised $3 million in a funding round led by Digital Currency Group.

ConsenSys, the Ethereum-focused software company raised funding at a valuation of $3.2 billion

Hong Kong-based **Chiron Partners** launched a $50 million fund to support projects, especially "metaverse-linked" NFT platforms, building on top of the Terra ecosystem.

Niantic, Pokemon Go creator, announced plans to build a metaverse with a newly completed $300 million round from tech-focused investment manager **Coatue**, bringing the company's valuation to $9 billion.

Ardana, Cardano's stablecoin protocol, raised $10 million in a seed round led by CFund, Three Arrows Capital and Ascensive Assets.

The digital pet universe NFT game **Axie Infinity** raised $152 million in a Series B round led by **Andreessen Horowitz**.

Nigerian crypto exchange **Yellow Card** closed a $15 million Series A round led by Valar Ventures, Third Price, and Castle Island with noteworthy participation from Square, BlockFi, and Coinbase Ventures.

Solana raised $18 million for its DEX, **Orca**, in a Series A round led by Three Arrows Capital and Coinbase Ventures.

One River Digital, a crypto-focused hedge fund, raised $41 million from **Goldman Sachs** and **Coinbase**.

Regulations

The **Federal Reserve Board** released a paper that dissects Central Bank Digital Currencies (CBDCs) and lists down a handful of pros and cons based on the Fed's perspective.

Congressman Tom Emmer introduced a bill to ban the **Federal Reserve** from issuing a CBDC directly to the public, arguing that a CBDC issued by the Federal Reserve could be used as a surveillance tool.

China piloted its CBDC, the digital yuan, taking the Beijing Winter Olympics as a base to try it out on athletes and their coaches who are eligible to get wristbands that can be used to pay for goods and services at the games.

For unregistered swaps, **Polymarket** was fined $1.4 million by the CFTC and was given until January 14th to "wind down" all markets displayed on the platform that do not comply with the Commodity Exchange Act (CEA) and applicable CFTC regulations.

The US Committee on Banking, Housing, and Urban Affairs, met in an open session about stablecoins. Witnesses invited, which included Dante Disparte from Circle, discussed with representatives of the committee how stablecoins work, how they're used and the risks associated with them.

The **US House Committee for Financial Services** invited top executives of six major companies working in the crypto industry to testify at the Congress to discuss the challenges and benefits of financial innovation in the United States.

The **European Council** published the approved version of a 2020 proposal for regulation on Markets in Crypto-Assets (MiCA) to create a regulatory framework for the crypto-assets market that supports innovation and draws on the potential of cryptoassets in a way that preserves financial stability and protects investors.

The **directors of Sweden's financial services** and **environmental protection regulators** called for an EU-wide ban on proof of work crypto mining due to a significant uptick in renewable energy consumption used by bitcoin miners.

US President Joe Biden signed the **Infrastructure Bill**, aiming to collect up to $28 billion over a decade through more crypto taxation to finance improvements of roads, bridges, and transportation systems.

Local news reported that **Zimbabwe** is weighing options of adopting cryptocurrency as a legal tender and is consulting various stakeholders on the merits of the virtual currency.

Kazakhstan announced new laws limiting Bitcoin miners to 100 MW, in addition to a 1 MW limit on all newly authorized plants over two years, following major outages.

New Jersey sent out an order to **Celsius** to halt the offering and sale of its interest accounts in the state. **Texas**, in the meantime, booked a court hearing next February for the same reason.

Following threats by the SEC, **Coinbase** announced that it is abandoning Lend, a product they hadn't launched yet engineered to deliver high-interest returns on USDC.

El Salvador became the first country in the world to accept Bitcoin as a legal tender.

Cuba announced it will set rules to regulate and authorize the use of cryptocurrencies and determine how to license providers of related services within the Carribean island.

Binance faced a wave of clampdowns in the United Kingdom, Japan, and the Canadian province of Ontario.

Technology

Polygon disclosed a patched exploit that put 9 billion MATIC at risk.

Dfinity's Internet Computer opened the Ethereum bridge allowing Ethereum-based assets to natively exist on Internet Computer via the new bridge connecting the blockchains.

Norwegian browser developer **Opera** announced plans to support transactions in **Polygon**'s MATIC from Q1 2022.

Ethereum launches **Kintsugi public testnet** ahead of move to Proof of Stake, opening access to the new environment to a wider audience.

Fantom DeFi project **Grim Finance** exploited for $30 million, one of the largest hits that the Fantom blockchain experienced.

Messari launched its governance portal, "**Messari Governor**," a one-stop shop for managing decentralized projects.

Bitcoin's long-anticipated upgrade **Taproot** was activated, giving developers an expanded toolbox to work with as they continue to build on the network.

Uniswap announced in its FAQ section that it has made major changes in its terms of service as of 25 October. These include a blockchain-intelligence company, TRM Labs, conducting forensic research on wallet addresses for compliance purposes.

The **Solana** network experienced a major outage that kept investors' money locked for 17 hours, taking down SOL prices by 5.06%.

Polygon increased the minimum gas price for transactions on its network by 30x, in a hedge against spam transactions.

El Salvador started using volcanoes to power its Bitcoin mining facilities.

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Executive Summary

Web 3 is the third evolution of the Web; at the heart of the Web3 philosophy is to decentralize Internet infrastructure and technology while preserving individual privacy.

The brain drain from tech giants and traditional banks to Web 3 is unprecedented and fueled by the drive to build a better Internet ranging from financial services, e-commerce, media, music, and more.

We are right in the early innings of Web 3; Amazon's number of developers is twice as large as the global crypto developer headcount. Additionally, most infrastructure is still under development and significant progress, yet ready for worldwide production and mass adoption.

Ethereum is by far the most dominant settlement layer to build Web 3 apps processing over 1.2 million transactions daily and collecting ~ $10 billion in annualized revenue or 11x Bitcoin's total revenue worth ~$960 million. Ethereum's developer base grew by 42% in 2021. At the start of 2021, Ethereum accounted for 97% of the total market share in DeFi.

As of mid-January 2022, it dropped to 60%, but Ethereum remains 8x larger than Terra, the second-largest DeFi ecosystem amounting to ~$17 billion in TVL.

Other ecosystems entered the market as cheaper and faster alternatives. According to Electric Capital, Solana, NEAR, Binance Smart Chain, Avalanche, and Terra are growing faster than Ethereum did at similar points in its history.

As adoption continues to grow, Ethereum competitors will likely face network issues. More significant usage could cause outages and higher transaction fees. For example, Polygon, Solana, and Harmony already experience network outages due to spam transactions.

Most of Ethereum's competitors launched with insider ownership of around 40%, such as Solana, Avalanche, and Celo, while others approached the 60% mark like Flow.

Rollups and Sharding are currently the main solutions to securely scale blockchains to process millions of transactions per second in the long run while remaining decentralized, neutral, and trustless.

Ethereum is the epicenter of blockchain scalability solutions with the most comprehensive roadmap of which the R&D will likely benefit other ecosystems.

Polygon in the first half of 2022 will be the largest beneficiary of migrated Ethereum-based applications until other Layer 2 solutions mature. Crypto users' favorite apps will mostly be accessible on Polygon, as Ethereum has become unusable for day-to-day operations.

Interoperability protocols such as Cosmos and Polkadot will play a key role in this multi-chain future with the rise of new blockchains. It is hard to overstate how significant those technological breakthroughs are to build a robust infrastructure for Web 3. However, it's also important to note that these are complex technologies and will take time to materialize and mature ~ 2 - 3 years at least.

Terra, the second-largest DeFi ecosystem in the world ($14 billion), joined Cosmos in October. As such, Cosmos might continue to be miles ahead of Polkadot on the interoperability vertical.

Web 3 will need a robust infrastructure and fully-fledged decentralized app development platforms such as Pocket Network to avoid Web 3 applications falling prey to random outages and leaked data occurring on centralized services such as Infura.

Operating systems still represent one of the strongest censors in the Web 3 stack as Google, Apple, and Microsoft own this vertical. Therefore, alternative operating systems will be essential to keep an eye on this decade.

Decentralized Finance (DeFi): Daily trading volumes doubled in the last year to reach over $100 billion in December. Despite this, the lack of liquidity is still painfully evident when trading long-tail and pre-price discovery assets.

2021 was an exciting year for crypto-native derivatives: the growth of DeFi 2.0 through self-repaying loans, tokenized volatility, composable yield tranches, and staked derivatives.

The significance of Ethereum Name Service (ENS), as a protocol to provide the world's decentralized identity as a public good for Web 3 was finally realized in 2021. In the coming months, we can expect access to on-chain credit, public storage, messaging, and decentralized credentials to take a solid hold.

One of the most prominent narratives for 2022 is the growth of stablecoin adoption. We saw unparalleled growth in 2021, with the supply surging by 388%, from $29 billion to $140 billion. With regulators hovering over Tether for USDT and Circle, the company behind USDC, the demand for a decentralized stablecoin has never been more apparent.

The DeFi sector is not immune to hacks — particularly unaudited code. DeFi protocols have already seen a record number of exploits this year, totaling $680 million. The support of forensic research has been essential to retrieving funds. DeFi is still early in the adoption lifecycle, similar to the early years of crypto exchanges in 2011.

Goldman Sachs estimated that only 0.54% of cryptoasset transactions are related to illicit activities.

NFTs: The explosive resurgence and recognition of crypto-native art collections, music, and games (NFTs) have given a new face to this industry and attracted new cohorts of builders including illustrators, musicians, game developers, photographers, movie producers, fashion designers, and 3D artists. The number of daily NFT users, especially for art and collectibles, has increased significantly from 10,000 to over 40,000 in 2021.

The main issue NFTs create is exacerbating wealth inequality. Bots and blue-chip NFT owners such as Bored Apes are becoming the new accredited investors of this industry and are offered VIP access to the minting phase of upcoming NFT drops.

Play-to-earn games at the moment are DeFi applications in disguise. These games are generally more appealing to DeFi users who enjoy a gamified experience and not necessarily to full-hearted gaming fans. AAA games take several years to develop and might not launch in 2022.

Music NFTs will be one of the most engaging verticals. According to American musician and author, Mikel Jollett: “1,000,000 streams on Spotify nets $3,000. Of this, 84% goes to the label (if the artist is on a major, 50% if indie) and a whopping $480 goes to the artist”. With music NFTs, fans will own songs through royalty-backed NFTs.

Big Data: The data infrastructure is arguably one of the space’s most overlooked sectors.

Chainlink’s role has now evolved way beyond facilitating decentralized price feeds. The network’s growing repository of decentralized services has transformed it into a critical piece of the infrastructure layer that will be heavily responsible for the growth and evolution of the Web 3 stack.

Filecoin and Arweave encompass the decentralized storage industry and nourish a truly censorship-resistant layer underpinning the growth of the Web 3 ecosystem.

Regulation: Concerns about unclear definitions of financial terminologies like “securities,” have been the core of that discord, raising question marks on whether the SEC holds all the tools to handle decentralized financial (DeFi) products.

We gathered insights from a series of anonymous polls surveying allegedly people working in the US-based DeFi space. The findings were as follows. A little more than 75% of respondents perceive the regulatory environment in the US negatively, pushing nearly half of them to likely move headquarters abroad next year by more than 60% chance. The majority of the respondents were split between Switzerland and Canada as their next offshoring destinations.

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Introduction

2021 was nothing short of an eventful year, marked by countless defining moments marking innovation and wider adoption of cryptoassets. While 2020 was labeled as the year of institutional and corporate engagement and the dawn of Decentralized Finance (DeFi), the unprecedented interest in crypto last year onboarded a whole new wave of entrepreneurs and investors at a pace never seen before. Many leapfrogged Bitcoin and even Ethereum, typically the traditional entry points for new crypto users — to interact with the first generation of Web 3 applications.

"Blockchains also made possible the automation of traditional financial functions such as lending or trading. The first Ethereum apps to gain widespread adoption were decentralised finance (DeFi) apps like Compound, Maker and Uniswap. In DeFi, financial functions are handled by fully automated protocols that are owned and operated by decentralised communities instead of centralised companies." — Chris Dixon: general partner, a16z, and Packy McCormick: founder, Not Boring Capital

Summer 2021 was defined by a paradigm shift that some have coined "*Class of 2021: Web 3*". The explosive resurgence and recognition of crypto-native art collections, music, and games (NFTs) have given a new face to this industry and attracted a new cohort of builders, including illustrators, musicians, game developers, photographers, movie producers, fashion designers, and 3D artists. Most newcomers have one vision in common, to establish the 'creator economy" where Internet services are built to reward contributors and remove as many gatekeepers as possible.

One of the many reasons we are optimistic about the future of this space is not only due to the unparalleled inflows of venture capital support but also the industry's ability to crowdsource funds via talent networks and initiatives like Braintrust and Gitcoin. Another good indicator of this new era is the brain drain from tech giants to Web 3, fueled by the drive to build a better Internet ranging from financial services, e-commerce, media, music, and more.

We are right in the early innings of Web 3; Amazon's number of developers is twice as large as the global crypto developer headcount. Additionally, most infrastructure is still under development and significant progress, yet ready for global production and mass adoption. There is no better time to understand and prepare for the Web 3 revolution. This report serves as an overview of the Web 3 infrastructure and what the future holds.

Hany Rashwan, CEO at 21Shares
Ophelia Snyder, President at 21Shares
Eliézer Ndinga, Research Lead at 21Shares

Figure 1:
Global blockchain funding soars to reach $15B in first 9 months of 2021

Source:
CBInsights, design by 21Shares

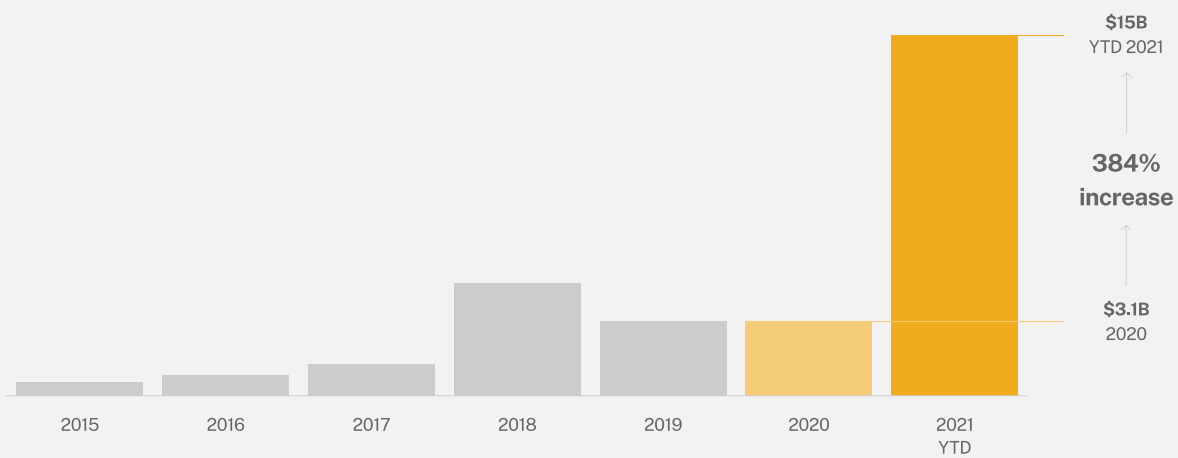
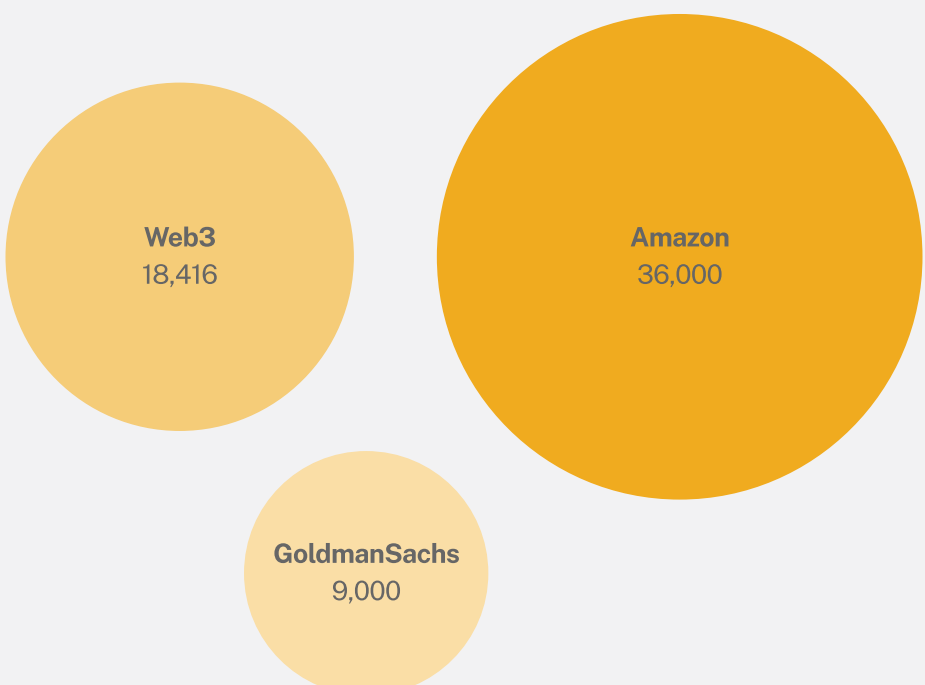


Figure 2:
Developers in Web 3 vs. developers at select companies

Source:
Electrical Capital, design by 21Shares



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The Web 3 Stack

Web 3 is the third evolution of the Web; at the heart of the Web3 philosophy is to decentralize Internet infrastructure and technology while preserving individual privacy. The roots of this movement date back to the mid-1970s. Public-key cryptography was launched when declining trust in the government grew after the Watergate scandal. At the time, cryptography was unscalable and was essentially used by governments and corporations across secure channels. The innovation behind Public-key cryptography ensured confidentiality and authentication of a message in open channels. The need for privacy in the digital age was a dominant topic in the early 1990s with the launch of CypherPunk's manifesto written by Eric Hughes and the rise of first-generation Web services launched on the Internet protocols suite, including the HyperText Transfer Protocol (HTTP) invented by Sir Tim Berners-Lee. This cryptographic breakthrough revolutionized email and e-commerce.

"*Privacy is necessary for an open society in the electronic age*." — Eric Hughes

In 2009, at the dawn of the Great Financial Crisis, Bitcoin became the brainchild of the CypherPunk movement. The first global network launched for disintermediating a central authority from clearing and settling payments while preventing digital replicas and counterfeiting. Fast forward to 2014, in the early innings of Ethereum, Gavin Wood, one of its co-founders, coined the term Web 3 in a manifesto titled "DApps: What Web 3.0 Looks Like".

The state of the Web we know today is often referred to as Web 2, where information is stored on centralized servers — owned and governed by large corporations such as Facebook, Google, and Amazon. Namely, a few entities control much of what happens on the Internet: The Cambridge Analytica data scandal, Facebook and Twitter shutting down their APIs to third-party apps are a few examples amongst many of how users and developers are at the mercy of those large companies.

However, before the launch of Bitcoin, one missing part of the whole Web innovation was a global protocol to agree on permissionless data.

"(...) prior to the Bitcoin Paper we literally didn't know how to have permissionless. Yes, we had distributed databases. And yes, we had federated databases. But all of those still had a small group of entities in charge (cf pretty much every financial network such as ACH or VISA). We didn't have a protocol for maintaining consensus – meaning agreeing on what's in the database – that would allow anyone to join the protocol (as well as anyone to leave)." — Albert Wenger.

Figure 4:
Web 1 vs Web 2 vs Web 3

Source:
Why Web 3 Matters by Chris Dixon,
design by 21Shares

Ethereum brought to life smart contracts and a new Turing-complete programming language broadening the scope of innovation with blockchain technology in Web 3. Today, Ethereum has built the world's largest developer ecosystem in the crypto space. Other blockchains have since launched but largely complement Ethereum's ecosystem and technology.

History indicates that technological breakthroughs were invented amidst public distrust but only took effect, pushing innovation forward a few years after. It is important to note that the Web 3 infrastructure has not reached escape velocity yet to attain its full potential. Given the current state of the whole Web 3 ecosystem, it is fair to admit that 2022 for Web 3 is comparable to what 2005 was for Web 2. This section focuses on the key component of the Web 3 infrastructure, from the blockchain base layer to the application layer.

Always refer to Figure 5 on the next page to follow the Web 3 Stack constituting the chapters covered in this magazine.

Web 1

~1990-2005

Read-only websites launched on open protocols. These protocols were decentralized and community governed. Value accrued to users and builders.

Web 2

~2005-2020

Interactive websites owned and controlled by centralized organizations. Value accrued to shareholders of the company.

Web 3

~2020-present

Interactive platforms decentralized and community-governed. Value will accrue to contributors and builders

Figure 5:
The Web 3 Stack

Source:
21Shares Research

	DeFi	NFTs	Identify	Data	Wallets	DAOs
Decentralized Applications (dApps) or Application Layer Web and mobile applications to access Web 3 products and services, or data.	Aave, USDC, Sushiswap, Uniswap	OpenSea, Rarible, Axie Infinity	Ethereum Name Service, Solana Name Service by Bonfida	Chainlink, Band Protocol, TheGraph	Ledger, Phantom, Metamask	Gitcoin
Blockchain Development Environments Developer tools to build decentralized applications (dApps), run tests and debug code.	Hardhat, Truffle					
Execution Blockchains or Layer 2 Blockchains specialized to execute transactions and information, batch them together and settle them at a later point in time on a settlement blockchain like Ethereum. Layer 2s help augment network capacity of settlement blockchains by orders of magnitude.	StarkWare, Arbitrum, Cartesi, Optimism, Loopring					
Use-Case-Specific Blockchains or Hybrid Layer Standalone blockshains built to serve a specific use case such as cloud storage, empower IoT devices, blockchain data availability, etc.	Arweave, Filecoin, Helium Network, Celestia, Sia.tech					
Settlement Blockchains or Layer 1 "Settlement Blockchains or Layer 1 Blockchains specialized to settle transactions and launch decentralized applications. The latter are sometimes dubbed smart-contract platforms. In this layer, blockchains also provide immutable data hosted on each node. Ethereum dubbed this use case 'sharding'. "	Terra, Binance, Tezos, Harmony, Ethereum					
Interoperability Blockchains or Layer 0 Networks specialized in inter blockchain connection.	Polkadot, Cosmos					
Internet Protocol Suite Protocols to transfer files, emails, and data over the internet.	HTTP, TCP/IP					
Operating Systems A system software managing computer hardware, software resources, and provides common services for computer programs.	iOS, Microsoft Windows, Linux					
Hardware Personal computers, smart phones, tablets, etc.	iPhone, Xiaomi, Samsung					

Bridges

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Settlement Blockchains (Layer 1)

Ethereum

Layer 1 (L1) blockchains specialize in settling transactions and launching Web 3 or decentralized applications. In this layer, blockchains also provide immutable data hosted on each network's server or node; Ethereum pioneered this use case called 'sharding.'

Most L1s rely on variants of Proof of Stake mechanisms for settlement and network security purposes. Ethereum is currently the only hybrid network running a Proof of Work (PoW) and a Proof of Stake (PoS) blockchain. This year, the Merge, the long-awaited network upgrade, will occur to completely switch to Proof of Stake and reduce 99% of the network's energy consumption away from PoW.

Ethereum is by far the most dominant settlement layer, processing over 1.2 million transactions daily and collecting ~ $10 billion in annualized revenue or 11x

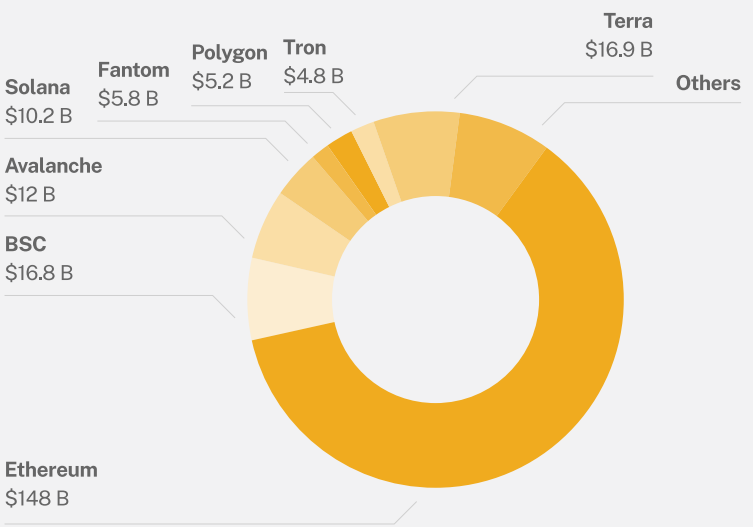


Figure 3:
Total Value Locked (TVL) by Layer 1 blockchains

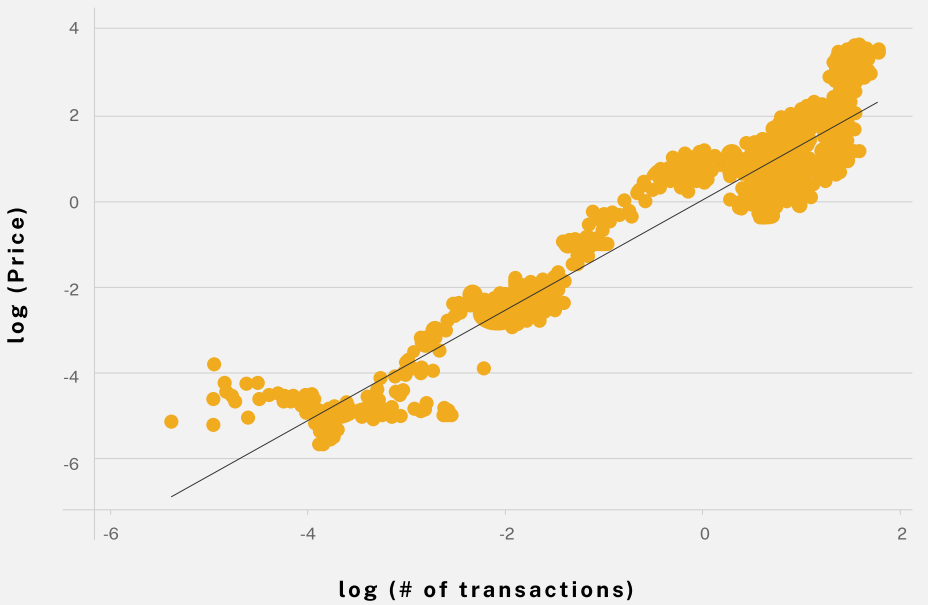
Source:
Coin98, design by 21Shares

Bitcoin's total revenue worth ~$960 million. Ethereum's developer base grew by 42% in 2021 and is the most vibrant and engaged developer platform in the world. As of writing, a total of $160 billion has been poured into Ethereum-based DeFi applications such as Curve, Aave, Uniswap, and MarkerDAO. At the start of 2021, Ethereum accounted for 97% of the total market share in DeFi. As of mid-January 2022, it dropped to 60% but Ethereum remains 8x larger than Terra, the second-largest DeFi ecosystem amounting to ~$17 billion in TVL. However, Ethereum has become the victim of its own success over the past year, leading to this sharp decline in market share. Growing network activity transpired into higher transaction fees, pricing out microtransactions, and day-to-day payments. The average cost on Ethereum is ~$46 per transaction, while the base layer processes 12 to 40 transactions per second, depending on the smart-contract complexity and the network usage.

Another important metric to gauge demand for Ether, though a lagging indicator — is the growth in the number of transactions against the price growth. Over the long run, there is a significant correlation between those two variables. For example, a 10% transaction growth implied a ~13% price growth. This shouldn't come as a surprise since developers and users need to pay in Ether to build and participate in the Ethereum economy. Therefore, a greater transaction count implies more demand for the underlying asset.

Figure 6:
Correlation of Ethereum's Transaction Growth and Price Growth

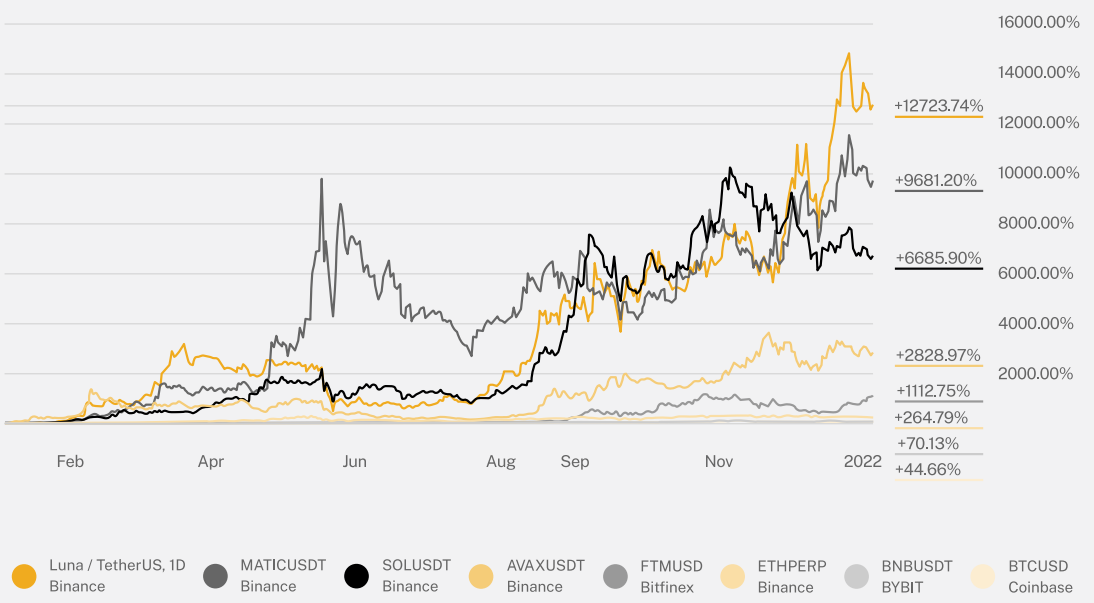
Source:
TaschaLabs, design by 21Shares



Ethereum Competitors

Figure 7:
The Rise of Layer 1s

Source:
TradingView, design by 21Shares



The escalating demand for Ethereum in hosting the array of newly launched NFT and DeFi projects has debilitated the blockchain and made it practically unserviceable for the average retail user. In effect has pivoted investors' interest towards the competing Layer 1 blockchains promising higher network speed and affordable transaction costs.

Other ecosystems entered the market as cheaper and faster alternatives. According to Electric Capital, Solana, NEAR, Binance Smart Chain, Avalanche, and Terra are growing faster than Ethereum did at similar points in its history. All of them outperformed Ether (ETH) over the past year as market participants and developers shifted their attention to those alternative Layer 1s: BNB (187.10%), Solana (4,446.10%), Terra (10,891.60%), Avalanche (886.80%) and Fantom (12,309.50%), see image below.

Figure 8:
Major L1s

Source:
21Shares, DefiLlama, CoinMetrics, Etherscan, FlipsideCrypto, Native Block Explorers, TheCelo

Total TVL by Q4 ($, Billion)	$240.24
Total TVL of Major L1s ($, Billion)	$209.57
Major L1 Dominance (%)	87.23%

	Assets Ticker	Ethereum ETH	Binance BNB	Solana SOL	Terra LUNA	Avalanche AVAX	Fantom FTM
Price	1-Year Performance	187.10%	1118.90%	4446.10%	10891.60%	886.80%	12309.50%
	TVL ($, Billion)	$146.50	$14.97	$9.95	$19.04	$11.23	$7.88
	TVL Quarterly Growth (%)	27.18%	-15.18%	-4.05%	113.45%	198.67%	408.39%
	TVL Dominance	60.98%	6.23%	4.14%	7.93%	4.67%	3.28%
TVL	Daily Transactions on Dec 31 (Milion)	1.11	6.31	178.15	0.36	10.97	0.85
	Annualized Revenue ($, Billion)	$1.20	$0.08	$0.0050	$0.0004	$0.0114	$0.0034
	Monthly Active Developers	4011	340	900	150	280	90
Capacity	Transactions per Second	15	73	2,965	4	324	10
	Transactions per Second with L2s	4,000	NA	NA	NA	NA	NA
	Transaction Fees ($)	$46.00	$0.01	$0.00	$0.07	$0.07	$0.03
	Transaction Fees with L2s ($)	$0.00	NA	NA	NA	NA	NA
	Number of Validators / Miners	200,000	21	1,104	130	228,000	46

*Number of bitcoin based on SlushPool data**
*Number of Ethereum validators based ETH 2.0**
*Luna transaction fees based on UST**
*Solana removed 11.365M SOL from the circulating supply**
*Every quarter, Binance commits to burning BNB, until 50% of the total BNB supply (approximately 100,000,000 BNB) is removed from circulation**
*All fees on Avalanche are burned**
*Fantom Active Validators**

L1s stratospheric performances boosted their reward/risk ratios measured with the Sortino ratio, which only measures per unit of downside volatility. This can provide a more real-world indication of the asset's desirability since most investors are primarily concerned with downside moves, as far as 'risk' goes. For example, LUNA recorded a Sortino ratio close to 10, while Ether's ratio is a little over 4. However, past performance is no guarantee of future results.

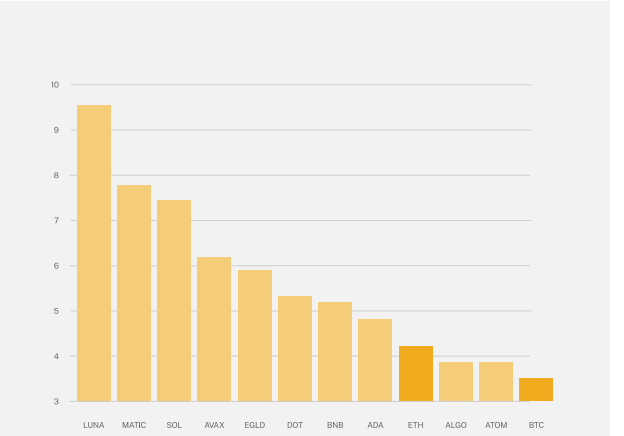


Figure 9:
Sortino Ratio for Major L1s

Source:
TaschaLabs, design by 21Shares

Bridges

2021 saw the rise of a key component of the Web 3 stack; a whole new market for specialized cross-chain transfer protocols or dubbed bridges.

A bridge allows market participants to transfer assets between two blockchains like from Ethereum to Solana. Today, most bridges typically achieve this by locking up an asset on one blockchain and minting the equivalent on the other blockchain. A burn function is actived to release the locked asset subsequently. It is essential to understand the different types of bridges that exist and the consequences of relying on the bridging infrastructure.

The basic components of most bridge designs include:

- **Monitoring** — through an oracle or validator
- **Messaging** — the transmission of information to the destination chain
- **Consensus** — agreement between the actors involved
- **Signing** — the need to cryptographically sign information sent

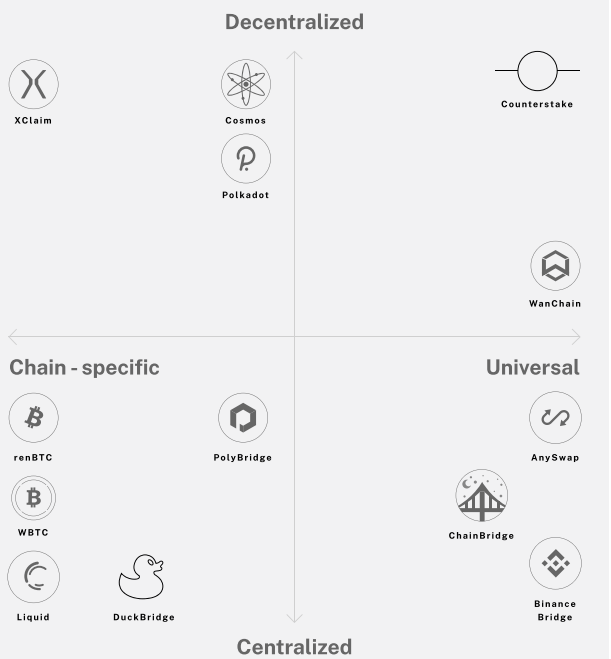
Not all bridges were made equal. Each bridge has its own benefit and drawbacks:

- **Asset type** — the transfer of liquidity often involves a wrapped asset or a protocol-specific derivative and not all bridges may support the same asset
- **Chain specific** — bridges between two blockchains is often limited
- **Application specific** — some bridges exist within the application layer to be used within the application
- **Generalized** — the transfer of information between multiple blockchains like Cosmos' IBC protocol

The real and more serious concerns for investors are latency, security, and decentralization. Decentralization is key to aligning with blockchain design's principles and ethics, protecting users' funds better, and removing token censorship. Trust assumptions, connectivity, and capital efficiency should also not be overlooked.

Figure 10:
Centralized vs Decentralized Bridges

Source:
21Shares



Bridge Types

Cross-chain bridges can be broadly categorized by their underlying security mechanism and fall into these categories:

- **Light-clients** with block relays-based bridges. Unlike a Merkle tree commitment, a light client does not verify all the transactions in the entire chain and relies on the assumption that the chain with the most PoW contains only valid transactions, removing the need for heavy computation. The security of this chain is based purely on the underlying two blockchains. L1 bi-directional bridges like Rainbow bridge from Near is an example.

- **Oracle-based bridges.** Wormhole is an example of an Oracle-based bridge where the trust lies in the oracle network rather than the blockchain and is powered by its own consensus mechanism.

- **Cross-Chain Liquidity bridges** are supported by the protocol's security model and are driven by their method of data availability, withdrawal integrity, and liveness. It is the responsibility of the protocol to provide incentives to support liquidity. Examples are Anyswap and Hop Protocol.

As we step into a multi-blockchain future, it is important to note that most Ethereum competitors have yet to be battle-tested. Ethereum's co-founder, Vitalik Buterin, warned about the risk of a cross-chain future due to potentially lucrative attack vectors on bridges.

"(*...) the more usage of cross-chain bridges and apps there is, the worse the problem becomes. No one will 51%*

Figure 11:
Bridge Types

Source:
@dberenzon, 21Shares

attack Ethereum just to steal 100 Solana-WETH (or, for that matter, 51% attack Solana just to steal 100 Ethereum-WSOL). But if there's 10 million ETH or SOL in the bridge, then the motivation to make an attack becomes much higher, and large pools may well coordinate to make the attack happen. So cross-chain activity has an anti-network-effect: while there's not much of it going on, it's pretty safe, but the more of it is happening, the more the risks go up."
— Vitalik Buterin

Here is a non-exhaustive list of issues alternative L1 blockchains could face in the future.

1. Expensive hardware requirements:
High validator requirements could hinder access to the entire history for most participants. Solana requires validators to get at least 128 GB in RAM to keep up with the state of the network. Hardware will undoubtedly become cheaper, which may play in their favor, but this presents an issue.

2. Network outages:
As adoption continues to grow, Ethereum competitors will likely face network issues. More significant usage could cause outages and higher transaction fees. By optimizing for low fees and censorship resistance, some Ethereum competitors have already suffered from spam and very low-quality transactions, such as Polygon, Solana, and Harmony. Solana went down 3 times in less than six months, one of which lasted for nearly 17 hours. Interestingly, low fees are both a blessing and a curse. It appeals to end-users but also threatens the network's latency. The Harmony team had to increase their network fees to mitigate spam attacks, while Polygon's network fees exceeded $0.50, up from fractions of a cent. In hindsight, a lot of what happens to those L1 chains is reminiscent of the early days of CryptoKitties, a 2017 non-fungible token (NFT) hit that clogged the Ethereum network. Researchers started to argue whether a target fee of $0.50 on a network would be ideal for preventing such woes to make spam attacks economically unappealing.

3. Code vulnerabilities:
Most L1s rely on novel technologies where codebase vulnerabilities, in some cases, could only be discovered and fathomable in hindsight, not in foresight. A double-spending bug in Polygon's Plasm bridge was identified in October 2021. The code related to a contract locks up to $1 billion worth of funds and is utilized when users move funds to and from the Polygon network. Fortunately, the existence of Polygon's bug bounty program on ImmuneFi helped identify and rectify the vulnerability before it could be exploited. Gerhard Wagner discovered the vulnerability that could have led to a string of attacks totaling approximately $850 million. It took 30 minutes for Polygon to begin fixing the issue. Wagner was subsequently awarded $2 million from the bug bounty program.

4. Centralization and Governance Wars:
Professor Scott Galloway at NYU Stern perfectly summarized19 the current state of smart-contract platforms and Web 3: " Web3 has different-colored hair, but the same DNA as earlier web paradigms, which decentralized services at an unprecedented scale to centralize wealth and influence at an unprecedented scale". The truth of the matter is that most of Ethereum's competitors launched with insider ownership, around 40%, such as Solana, Avalanche, and Celo. In comparison,

others approached the 60% mark like Flow, akin to the classic 80/20 insider/public ratio for tech companies about to IPO.

Most Proof of Stake blockchains have not yet gone through “civil wars” akin to Bitcoin vs. Bitcoin Cash or the Tezos’ scandal. Those networks may never go through significant disagreements on blockchain design and functionalities or governance. Still, their high Gini coefficient could backfire, especially when governance as a narrative will start to emerge and matter as much as environmental concerns.

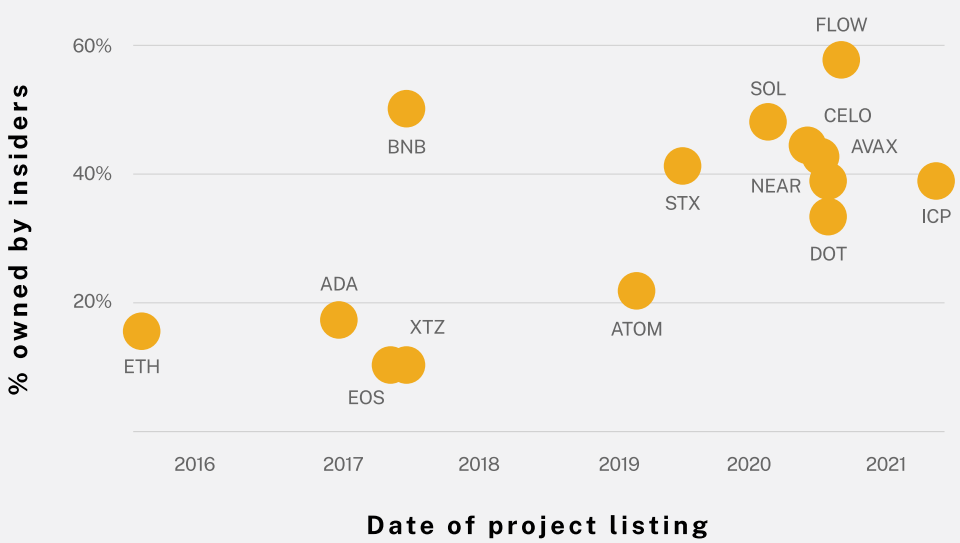


Figure 12: Insider Ownership Share At Launch

Source: Messari, design by 21Shares

The Ethereum Roadmap, Layer 2 Scaling Solutions and Interoperability Protocols:

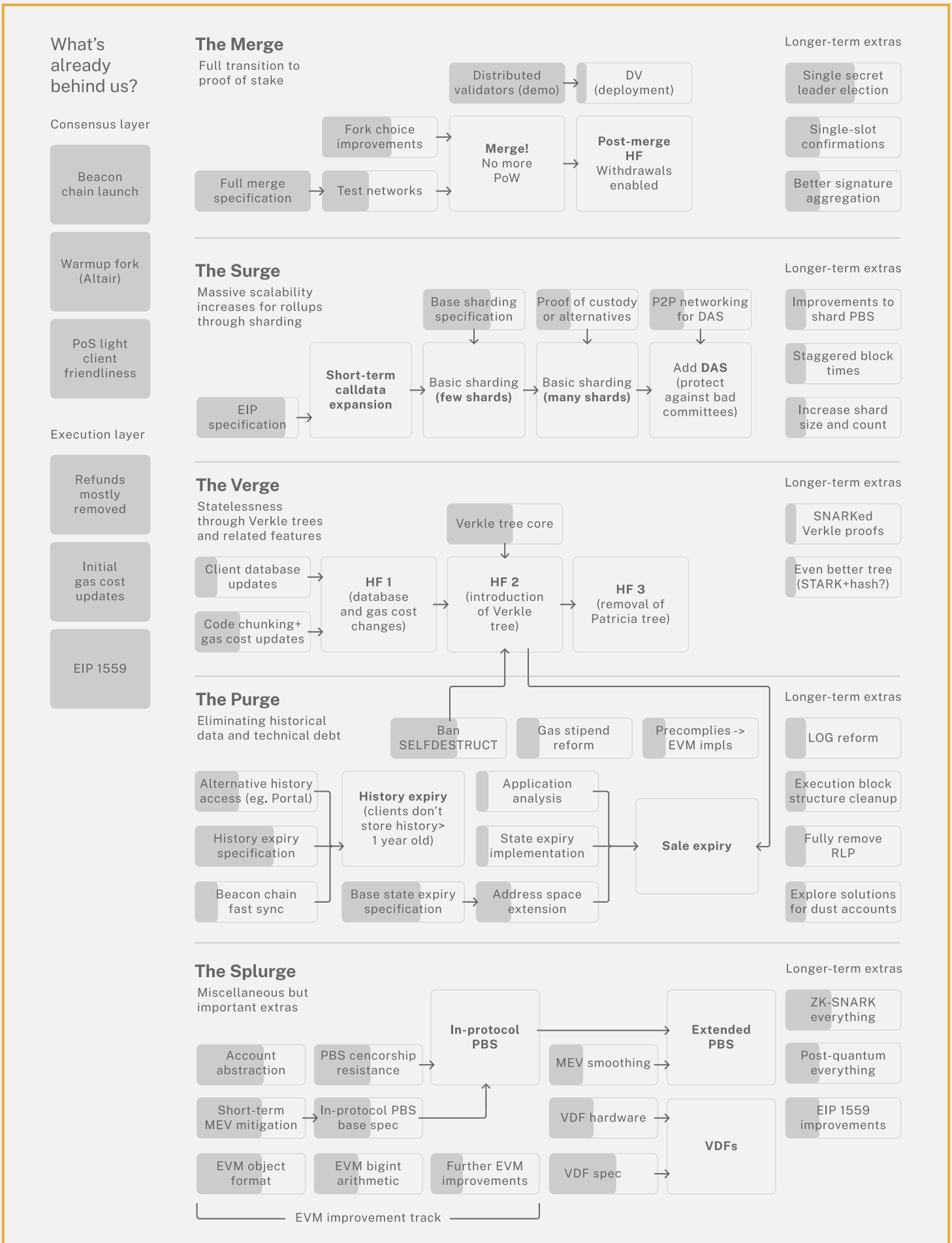
Ethereum is the epicenter of blockchain scalability solutions with the most comprehensive roadmap of which the R&D will likely benefit other ecosystems, namely its L1 competitors. In addition, interoperability protocols will play a vital role in this multi-blockchain future with the rise of new ecosystems. It is hard to overstate how significant those technological breakthroughs are to build a robust infrastructure for Web 3. However, it’s also important to note that these are complex technologies and will take time to materialize and mature.

The Ethereum Roadmap and Scaling Solutions

The Ethereum roadmap is divided into 5 periods:

- The Merge
- The Surge
- The Verge
- The Purge
- The Splurge

Figure 13: The Ethereum Roadmap *Source: Vitalik Buterin*



The Merge

First comes the migration to a Proof of Work to Proof of Stake environment. Thus far, the Ethereum core team has made significant progress towards the Merge with testing. The Beacon Chain, Ethereum's PoS blockchain, has proved itself and holds close to $30 billion. It is still uncertain how many client softwares will synchronize after the Merge, but according to Buterin, the Ethereum blockchain is currently 50% away from the Merge. After this point, the PoW blockchain will be terminated.

The Surge

Ethereum has become a scalability-centric ecosystem. Rollups and Sharding are currently the main solutions to securely scale blockchains to process millions of transactions per second in the long run while remaining decentralized, neutral, and trustless. Scaling solutions will be the main layer where applications will be integrated and built from the ground up.

1. **Zero-Knowledge (ZK) and Optimistic Rollups:** Two different methods of compressing (or "rolling-up") several Ethereum transactions into a single transaction settled on the Ethereum blockchain to improve scalability. Examples: Arbitrum, Aztec, Loopring, Metis, Optimism, StarkEx, StarkNet, zkSync, Polygon's Nightfall, Hermez & Miden.

Rollups are already significantly reducing fees for many Ethereum users. For example, optimistic rollups, including Optimism and Arbitrum, provide fees ~3 to 8x cheaper than the Ethereum base layer itself, and ZK rollups, which have better data compression and can avoid including signatures, have fees ~40 to 100x more affordable than the base layer. In addition, with the rise of the derivatives exchange, dYdX, StarkEX has been leading the Layer 2 race by orders of magnitude in cumulative transactions since May last year.

Limitations of rollups:

- **Expensive:** It's expensive to compute a zero-knowledge proof; some primitives of zero-knowledge proofs like ZK-SNARKS also require a trusted ceremony to generate the proofs, which could be compromised. There are alternatives like STARKs removing this trusted set-up. Costs and time for computing ZK proofs will decrease with software optimizations, Moore's Law, financial support for R&D, which we already see with crypto-native quadratic funding initiative on Gitcoin, including the ZK Tech Ecosystem Round.

- **Nascent technology:** Rollups are made of a nascent technology and will take time to mature, get battle tested and most importantly, live up to their full potential through community support, talents, large-scale application integration, and hackathons.

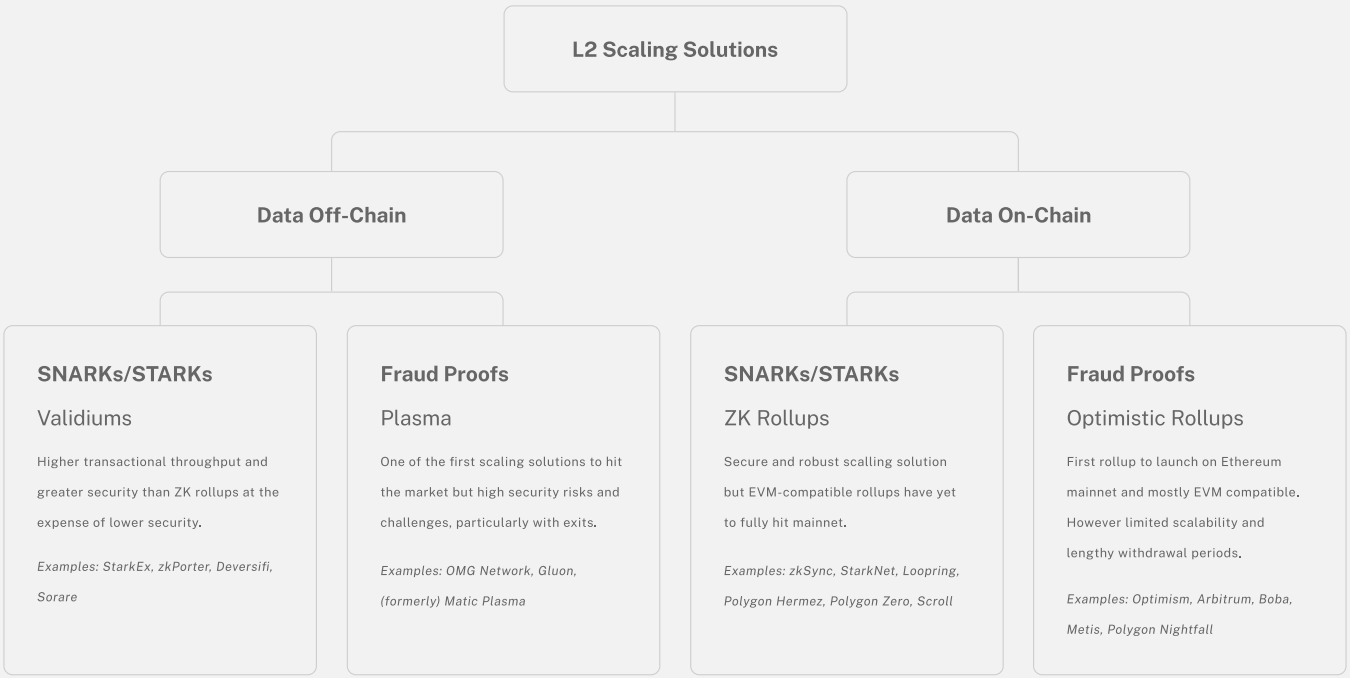
- **Backdoors and centralization:** According to Buterin, major rollups have backdoors and centralized sequencing. It's risky to commit an entire ecosystem to a single rollup. For example, Arbitrum had a network outage due to a hardware failure of its main sequencer.

Despite current limitations, there is a pragmatic path forward for rollups in the coming year:

- **Reduce costs for rollups** by 5x. There is an improvement proposal called EIP 4488, happening post-Merge, called "the calldata cost reduction". In the same vein, there is fractal scaling — additional

Figure 14:
L2 Scaling Solutions

Source:
Amber, design by 21Shares



application-specific layers needed for higher throughput on top of Layer 2 solutions at fraction of a gas, sometimes referred to as Layer 3. StarkWare indicated that this solution reduces gas fees by 1,000x.

- **Increase scalability** with a handful of shards, around 4.
- **Implement L2 interoperability** solutions like Hop, Connext, cBridge, Movr Network and innovations like dAMM introduced by StarkWare and Loopring.
- **Incentivize significantly more user adoption** with withdrawals to L2s from top exchanges such as Coinbase and Binance. The latter recently announced direct withdrawals to Arbitrum.
- **Diversify to the most secure Layer 1 blockchains.** Rollups will be chain-agnostic and integrated to the most secure and fast-moving ecosystems.

2. Sharding: a scalability effort that seeks to improve the ability of the Ethereum blockchain to handle a more significant number of transactions. Sharding is a process through which the Ethereum blockchain is "split" into sub-blockchains. This improvement makes it easier for different blocks of transactions to be processed simultaneously rather than sequentially.

Ethereum 2.0 Sharding can be understood as a multi-lane approach for a blockchain instead of a single-lane approach, as for Ethereum 1.0, Bitcoin, and others. There is an important distinction to make between latency and bandwidth.

1. Latency: how many seconds one has to wait for a transaction to settle

2. Bandwidth: how many transactions are settled per second

For rollups, none of what's implemented in the Surge phase improves latency. It is still a 12-second slot time that might move up to 16 seconds to handle sharding. The Surge mainly improves bandwidth. Ethereum today can handle 14 to 40 transactions per second (TPS). Today, rollups can process 1,500 to 4,000 TPS with proper compression. The combination of rollups and sharding can process 100K TPS. Namely, this is 4x the capacity of the Visa network capable of handling 24K TPS.

Alternative L1s will benefit from peer-reviewed research and developments for scaling Ethereum and other sharding technologies pioneered by Celestia primarily focused on scaling block verification with data availability proofs. Celestia is the first ever scale-out data availability-focused blockchain.

We believe Polygon in the first half of 2022 will be the largest beneficiary of migrated Ethereum-based applications until other Layer 2 solutions mature. Crypto users' favorite apps will mostly be accessible on Polygon, as Ethereum has become unusable for day-to-day operations. Some applications are already implemented such as Aave, Sushiswap, Uniswap and Royal.io. It will also be a critical year with such significant user traction for Polygon. As we mentioned previously, Polygon will likely be the victim of its own success translated into network outages and higher gas fees. The silver lining is the fact that Polygon acquired various Layer 2 solutions, which will be instrumental to scale its ecosystem.

Limitations of Sharding:

Ethereum will use quadratic sharding, which is limited by the fact a node must process:

1) a single shard and 2) the beacon chain.

If shards are too big, nodes can no longer process individual shards. If there are too many shards, nodes can no longer process the beacon chain, (ie, = the upper bound). Hence why, Shard size is not Shard count.

Figure 15:
The Ethereum ZK Rollup Ecosystem

Source:
Amber, design by 21Shares

Rollup	Apps	Wallets	Vailidium / Volition	Infrastracture
Loopring	Maker	dYdX	Wallet Connect	Ramp
Polygon Zero	Paraswap	zkPorter	imToken	Syscoin
Aztec	StarkVote	DeversiFi	Argent	Infura
zkSync	zk.Link	sorare	Ledger	The Graph

The Verge

Democratize access to the validity of the Ethereum blockchain to everyone with Verkle tree — a way to reduce data compression vs. Merkle tree by a factor of ~6 to 8.

"*Verkle trees are a powerful upgrade to Merkle proofs that allow for much smaller proof sizes. Instead of needing to provide all "sister nodes" at each level, the prover need only provide a single proof that proves all parent-child relationships between all commitments along the paths from each leaf node to the root. This allows proof sizes to decrease by a factor of ~6-8 compared to ideal Merkle trees, and by a factor of over 20-30 compared to the hexary Patricia trees that Ethereum uses today*" — Vitalik Buterin

The Purge

The Purge simplifies the design of the Ethereum blockchain. Nodes will no longer need to download the entire history since the genesis. Instead, they will go to third-party protocols like TheGraph or block explorers, including Etherscan, should they want the complete history of the Ethereum blockchain.

Every node will store a certain percentage of the ledger. There are third-party protocols like TheGraph, which are a great archetype and technology that applications have started to switch to, as it's faster and more convenient. Ethereum will integrate state expiry where data that has been dormant for more than a year will be moved to the history tree and will need to be retrieved on TheGraph, Etherscan, etc.

The Splurge

This phase could happen in the next 5 years. The main upgrade is to simplify smart contracts and make the Ethereum blockchain more resilient post-quantum signature algorithms with a new standard called ERC 4337 or *account abstraction*. You can find the proposal in the Reference page.

Before delving into the Application Layer next, we are closing this chapter with a few possible pathways recommended by Buterin for other Layer 1 blockchains and one last word on blockchain interoperability.

How can Ethereum competitors become more resilient?

Alternative blockchains should consider decentralizing block verification to dilute the power of a central block producer to prevent them from doing anything against the community. Here are a few examples:

- **Diversify client softwares.** In an ideal world, no client should host more than 33% of the network. If each individual client is below this percentage, it reduces the risk that a bug found in a client would impact the network. This also applies to ETH 2.0 such as Prysm, one of Ethereum's client softwares, which has close to 70% of the market share.
- **Add a second tier of staking** with low requirements to distribute block validation.
- **Introduce fraud proofs or validity proofs** via ZK-SNARKs to let anyone cheaply verify block validity.
- **Let anyone check block availability** on-chain with data availability sampling akin to Celestia or Sharding.
- **Implement secondary transaction channels** as an alternative way to get transactions included.

Interoperability Protocols

Cosmos and Polkadot will be ecosystems to closely monitor this year. Terra, the second largest DeFi ecosystem in the world, joined Cosmos in October, as such Cosmos might continue to be miles ahead of Polkadot on the interoperability vertical.

As the "metaverse" booms in business, interoperability solutions will be an important component for Web 3 applications, especially in DeFi, as we'll discuss in the next chapter.

State of Crypto

The Application Layer

According to ReportLinker, the global cloud computing market size is expected to grow from $445.3 billion in 2021 to $947.3 billion by 2026, at a Compound Annual Growth Rate (CAGR) of 16.3% during the forecast period. We covered in the previous section the utmost importance for the Web 3 infrastructure to scale and inter-communicate in a decentralized and neutral manner to at least millions of transactions per second to onboard billions of people this decade. Assuming Ethereum and other Layer 1 blockchains grow as fast as the global cloud computing market, they could be processing 900 million transactions a day in the next decade.

Web 3 will need a robust infrastructure and fully-fledged decentralized app development platforms such as Pocket Network to avoid Web 3 applications falling prey to random outages and leaked data occurring on centralized services such as Infura. Such outages are an issue, primarily when most apps rely on a single service and can't operate when users need it the most.

"*350K developers use Infura for accessing Ethereum, IPFs, and Layer 2 networks. Infura provides the critical infrastructure behind major DeFi players such as Uniswap, MakerDAO, and the world's most popular decentralized wallet, MetaMask*."

Finally, operating systems still represent one of the strongest censors in the Web 3 stack as Google, Apple, and Microsoft own this vertical. Therefore, alternative operating systems will be essential to keep an eye on this decade.

We believe the most fascinating innovation will be crypto-native applications, fostered and sustained by communities. In some ways, Facebook, Instagram, Substack, and Twitter disrupted the media and communication industries. On the other hand, in the Web 1 and Web 2 eras, the New York Times and the Wall Street Journal were not innovators. This bottom-up disrupting pattern will prevail in crypto and by orders of magnitude with open source software and incentive mechanisms to align stakeholders of a network and reward contributors.

Clayton Christensen, the late American academic and arguably the most influential management thinker of his time popularized the theory of *Disruptive Innovation* in his book "The Innovator's Dilemma." *Disruptive Innovation* describes a process by which a product or service initially takes root in simple applications at the bottom of a market — typically by being less expensive and more accessible — and then relentlessly moves upmarket, eventually displacing established competitors.

DeFi, NFTs, and the data infrastructure are vital sectors to monitor for 2022.

Figure 16:
Total Value Locked (USD) in DeFi

Source:
DefiPulse, design by 21Shares

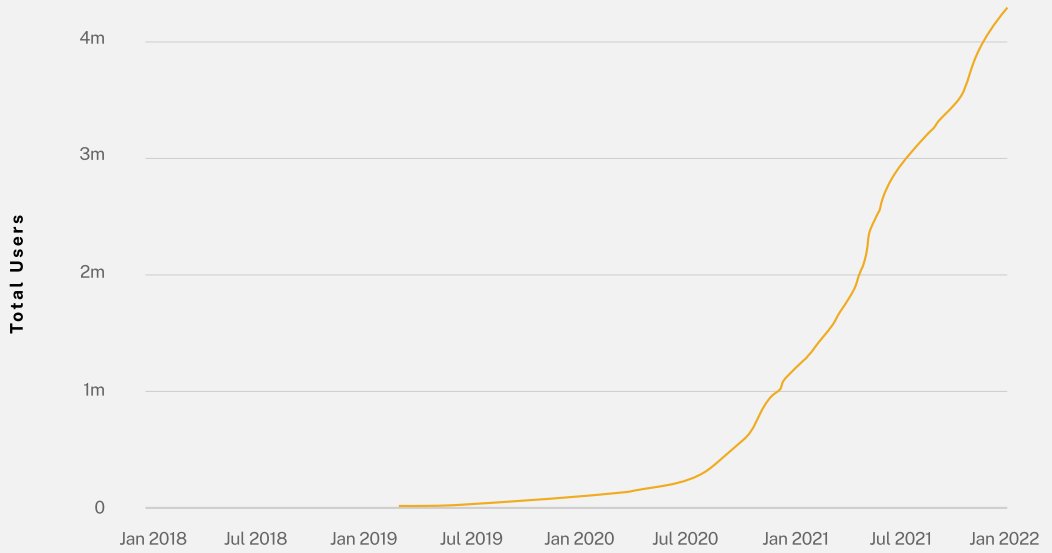
Decentralized Finance (DeFi)

The number of Ethereum addresses interacting with DeFi protocols crossed 4 million in 2021, an almost 200% increase since the start of the year. DeFi verticals serving these users extend across money markets, derivatives, yield aggregation, portfolio management, and exchanges — disrupting and democratizing everything traditional finance had to offer. In the last year, we've seen all the low-hanging fruits of DeFi picked, iterated, and bifurcated across every possible chain, casually demonstrating the power of open-source code. In this rush, the record-breaking capital inflow was locked into DeFi this year, upwards of $100 billion. Considered the edge of DeFi innovation only last year, protocols are often referred to as DeFi blue chips.

The increasing Institutional interest has been one of the greatest drivers of DeFi this year. Although ConsenSys published its DeFi Report acknowledging the rise of institutional interest, PWC reports 47% of traditional hedge fund managers are looking at investing in crypto. ConsenSys also released MetaMask Institutional to facilitate institutional interactions, while the leading money market app, Aave ($12 billion in TVL), launched Aave Arc to serve institutions in a regulated environment. As we see greater institutional utilization of DeFi and scaling investments, we need better, broader, all-encompassing solutions – not only for the user but for the overall operational and capital efficiency of the entire DeFi ecosystem.

Figure 17:
Total DeFi Users Overtime

Source:
Dune Analytics @rchen8, design by 21Shares



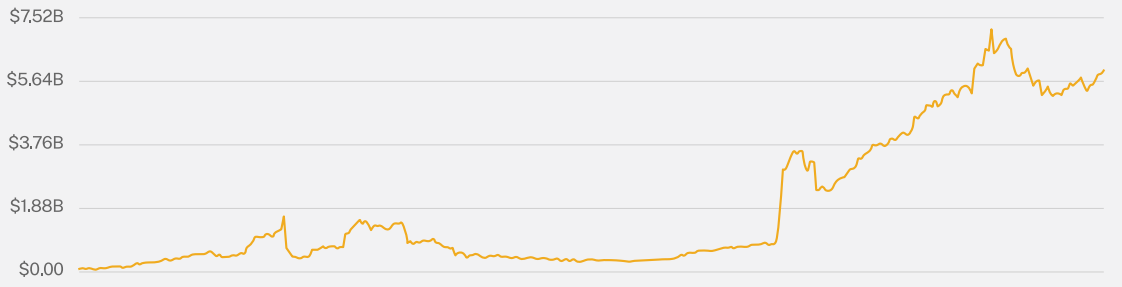
Bridging and Multi-chain futures

2021 saw the rise of Layer 1s, 2s and with them, a whole new market for bridging protocols and an 89% MoM increase in TVL for this category in October. These blockchain bridges will become an even more vital part of DeFi infrastructure, interoperability, and scalability as we step into a multi-chain future. TVL on Layer 2s is over $6 billion, with Arbitrum, dYdX, and Loopring leading. As mentioned before, users' real and more serious concerns are latency, security, and decentralization.

The current solutions offered by third-party cross-chain liquidity bridges leave users to trust the protocol's security assumptions, essentially forcing developers and users to depend on a single bridge and its supported version of wrapped assets. For applications building on top of cross-chain liquidity bridges, this puts them at unnecessary risk if they suffer from vulnerability, congestion, poorly distributed liquidity, or reliability issues. Not only will this reduce the application security to that of the underlying bridge, but investors are also at the mercy of its fees, support gestures, broken APIs, and rate limits. For example, on January 17th this year, Multichain (previously Anyswap), a leading cross-chain bridge, announced the discovery of a critical vulnerability affecting 6 cross-chain tokens reported by security firm Dedaub and fixed by the Multi-chain team.

Figure 18:
Total TVL By Layer 2s
From Jan 5, 2021 to Jan 4, 2021

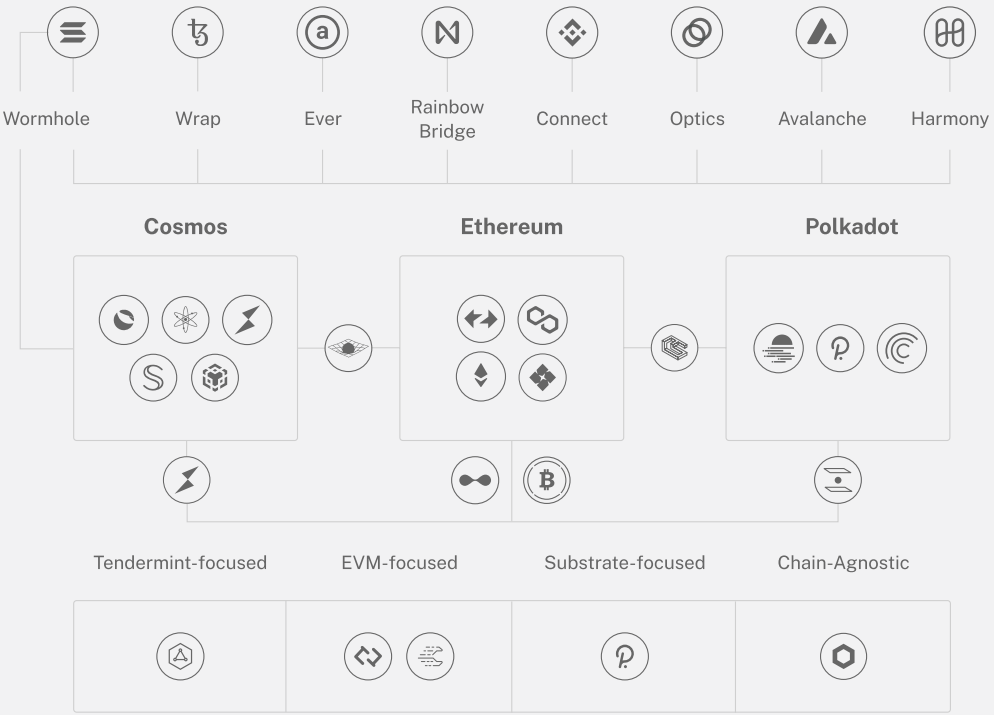
Source:
L2 Beat, design by 21Shares



No. Name	TVL	7d Change	Market share	Purpose	Technology
1. Arbitrum	$2.81B	+15.89%	46.81%	Universal	Optimistic Rollup
2. dydX	$975M	-0.04%	16.20%	Exchange	ZK Rollup
3. Loopring	$543M	-0.52%	9.03%	Exchange	ZK Rollup
4. Boba Network	$481M	-5.32%	8.00%	Universal	Optimistic Rollup
5. Optimism	$465M	+6.39%	7.74%	Universal	Optimistic Rollup
6. Metis Andromeda	$296M	+71.50%	4.93%	Universal	Optimistic Rollup
7. ImmutableX	$127M	-2.81%	2.12%	NFT, Exchange	Validium
8. ZKSwap V2	$119M	-2.84%	1.99%	Payments, Exchange	ZK Rollup
9. DeversiFi	$75.48M	-0.32%	1.25%	Exchange	Validium
10. zkSync	$72.60M	+2.08%	1.21%	Payments	ZK Rollup

Figure 19:
Total TVL By Layer 2s

Source:
@dberenzon, 21Shares



The panel at Solana's Breakpoint in 2021 framed the future of cross-chain bridges and the transfer layer perfectly. As the web of bridges expands across chains, trust between bridges will become even more evident. Soon bridging integration will exist on the application layer, and perception of risk will have to be managed by developers unseen to the average user. We have already seen this with applications like Lido and their staked products on Solana and Terra. In this way, the success of bridges will be those that serve as a tool and allow flexible functionality for composability. It has even been suggested to enable yield generation on bridge-locked tokens, further increasing capital efficiency.

A multichain future expects the exchange of native assets across chains and moves away from the current fragmentation of wrapped asset types. Solutions like interoperability protocols, such as Cosmos or Polkadot, may soon be one of the key projects to realize this reality. The ideal UX in the future would involve one where the desired asset is transparently swapped across chains but seamless to the user.

Liquidity Infrastructure

Decentralized Exchange (DEX) daily trading volumes doubled in the last year to reach over $100 billion in December. Despite this, the lack of liquidity is still painfully evident when trading long-tail and pre-price discovery assets. Large trades in low liquidity pools experience severe price impact and slippage. As a more significant number of DEXs emerge across Layer 1s and cross-chain solutions mature and scale, we see the flow of capital enabled by bridging infrastructure but, at the same time, hindered by the thinning of liquidity across chains.

Uniswap V3 was a revolutionary piece of DeFi infrastructure that helped alleviate the lack of liquidity, which launched on the Ethereum mainnet in mid-2021. It was created to provide greater capital efficiency by placing concentrated liquidity around the current market price. Not only did it enable a rise in capital efficiency by 4,000x, but it also allowed liquidity providers with higher returns on their capital. However, the most significant downside of concentrated liquidity is hyper impermanent loss. A recent study showed that 50% of Uni V3 LP providers made a loss. Vaults automating active liquidity provision from Visor finance, Unipilot, and Lixir allow to deploy assets in pools on Uniswap V3 with fee optimization, market-making strategies, and options to reinvest fees. The launch of Uniswap V3 on Polygon will significantly alleviate the costs associated with resetting price ranges, but L2 automated liquidity via smart vaults is yet to be launched. We can most definitely expect to see this in Q1 of 2022.

Several projects on the horizon may provide a sustainable solution to liquidity management and build the future of liquidity infrastructure. In a piece released by Paradigm written by Dave White, Dan Robinson, and Hayden Adams, Time-Weighted Average Market Maker (TWAMM) was introduced. This could be one of the imminent solutions implemented in DeFi, potentially using Flashbots RPC or a privacy-centric Layer 2 like Aztec to circumvent attack vectors such as information leakage and sandwiching. Chain-specific DEX aggregators were another welcomed solution to the lack of depth in liquidity. This was preceded by cross-chain liquidity aggregators that took DEX aggregation to the next level, further reducing the friction for cross-chain arbitrage and cross-chain flash loans. Finally, the launch of Evmos and Gravity bridge will grant Terra more connectivity to both the Cosmos Hub and Ethereum.

One general caution to projects attempting to bring liquidity to new token pairs via unreliable market makers is their unethical wash trading, frontrunning, and spoofing. The next generation of solutions should provide a frictionless experience for the DeFi user trading across chains, it would aggregate automated smart liquidity vaults across multiple AMMs on the backend. To take this one step further, smart contracts could automate liquidity allocation to pools across chains with the highest demand of trading volume. These tools could then facilitate cross-chain market making for the next wave of DeFi investors.

On top of the current DeFi infrastructure, it will also be exciting to see innovative DeFi liquidity composability, interoperability solutions, and more secure, stable bridges. With greater capital efficiency in liquidity mining, protocols can build more sustainably without allocating a large portion of their token supply to incentivize liquidity mining rewards.

Onchain identities and Onchain credit

The significance of Ethereum Name Service (ENS), the protocol providing the world's decentralized identity as a public good for Web 3, was finally realized this year, years in the making. Of course, the concept of self-sovereign identification systems on the blockchain through decentralized Identifiers (DIDs) is not new. Still, ENS provides a very personable and relatable way for Ethereum users to develop their on-chain identity — exceeding the use cases of IP and email addresses. You can even set your NFT as your avatar.

The success of ENS is greatly attributed to a solid community, demonstrating how powerful that can be. It is even more impressive they were able to attain this without approaching any exchange support, market makers or raising any funding other than grants from the Ethereum Foundation.

The future access to decentralized finance applications in urban transport apps, healthcare, and car insurance will see the use of DID to authorize sign-ins with zero-knowledge proofs to verify your data cryptographically. With ZK proofs, personal information such as driving licenses, credit card details, and health records could be used to sign in, transact and obtain services without handing personal data to Google, Apple, or Facebook. For example, days after Facebook rebranded its corporate name to Meta, an Australian artist found herself blocked, with seemingly no recourse, from an account documenting nearly a decade of her life and work with the handle "metaverse." Such events would never happen to an ENS owner unless they disclose their private key.

The use of on-chain transaction history to assign user profiles is starting to manifest, with xDefi even structuring access to their IDO on Miso based on trading scores. Decentralized trading platforms such as dYdX or KuCoin now deploy their trading incentives based on their trader's liquidation history. DIDs can provide protocols to distinguish market segments benefitting their most loyal users. Alchemix Finance, a self-repaying loan protocol, hinted at the functionality of delegating your credit to those deemed worthy. Protocols like Spectral are also working on using on-chain data, including transaction history, liquidation history, amounts owed and repaid, and length of credit history to calculate on-chain credit scores.

In the coming months, with the development of DIDs we can expect access to on-chain credit, public storage, messaging, and decentralized credentials to take a solid hold. In addition, Ethereum name sign-in will become the new norm in 2022, with protocols like Spruce paving the way.

DeFi-Native Derivatives

2021 was an exciting year for DeFi derivatives. First, we saw the growth of DeFi 2.0 through self-repaying loans, tokenized volatility, composable yield tranches, and staked derivatives. Even more innovative derivatives came from protocols like Tracer DAO; their leveraged tokens brought on an exciting new wave of delta-neutral strategies. Low-risk strategies like these are needed for DeFi to scale and attract greater user adoption in an otherwise drastically volatile market.

Figure 20:
Sign in — Web 1 vs Web 2 vs Web 3

Source:
ConsenSys, design by 21Shares

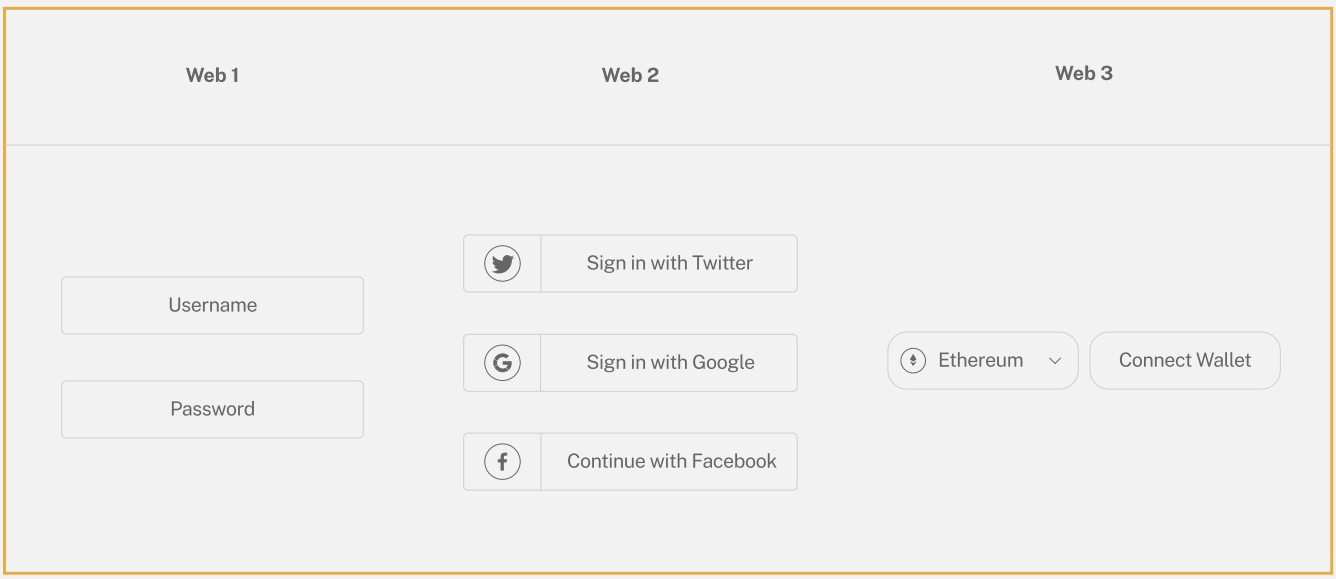
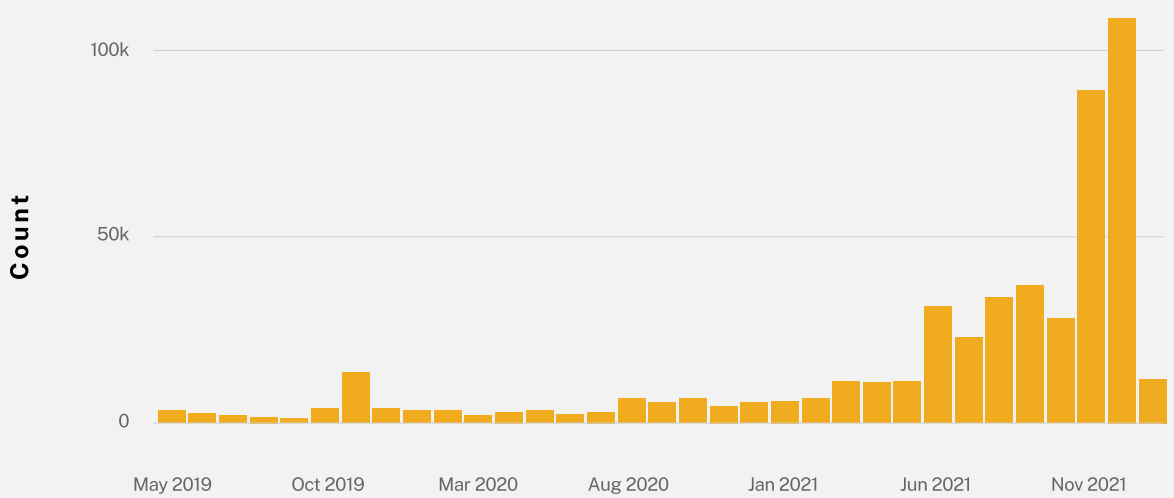


Figure 21:
ENS Monthly Registration

Source:
Dune Analytics @makato, design by 21Shares



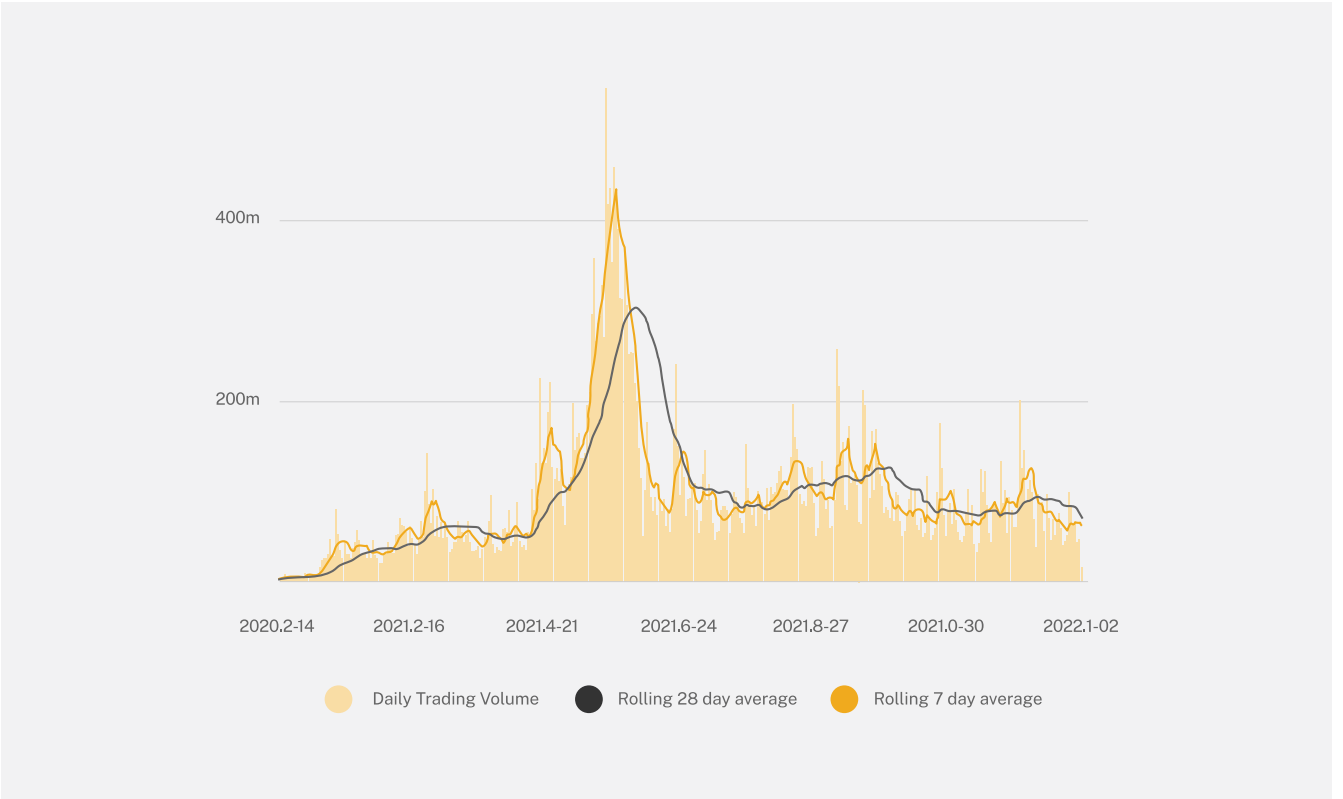
Last year also saw a steady increase in users trading perpetuals on decentralized exchanges like dYdX and Perpetual Protocol. Despite this, the perpetual swaps market has yet to recover from its all-time high trading volumes from May 2021. Protocols like Ribbon Finance and StakeDao now offer structured products with covered call-and-put selling strategies providing fixed income. These vaults demonstrate how DeFi composability can help distill complex strategies with simplified front ends and meet user demand for low maintenance strategies.

Building on this demand, Opyn recently announced the launch of a new DeFi primitive – Squeeth. The instrument is an evolution of everlasting options which will enable hedging strategies for non-linear impermanent loss for liquidity providers on Uniswap v3. In addition, power perpetual also provides a way to consolidate liquidity with a single market instrument in current fragmented liquidity markets.

With the launch of Squeeth — Opyn announced *The Crab Strategy*, a contract that will automate rebalancing to ensure delta neutrality - allowing users to deposit ETH to earn yield with little maintenance. It will also be fascinating to see other new low-maintenance DeFi primitives that will begin to transpire as structured products. The latter can potentially give way to more sustainable yield patterns and provide safe havens for risk-averse investors and market makers.

Figure 22:
Perpetual Swaps, Daily Trading Volume by dYdX

Source:
Dune Analytics @ily0ff, design by 21Shares



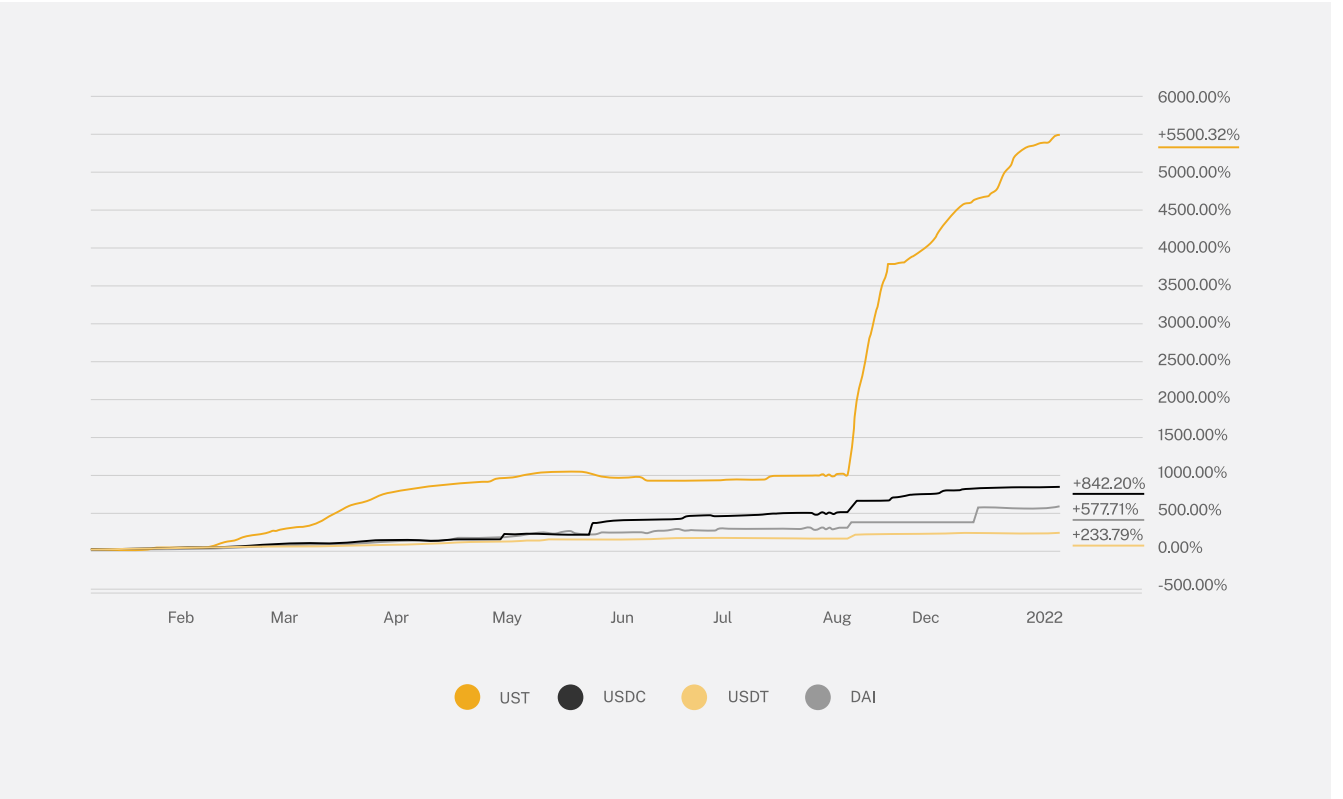
Stablecoin adoption

Perhaps one of the most prominent narratives for 2022 is the growth of stablecoin adoption. We saw unparalleled development in 2021, with the supply surging by 388%, from $29 billion to $140 billion. This was partly attributed to two phenomena. First, the growth of the derivatives marke settled in stablecoins, and second, the attractive stablecoin yields in DeFi. With regulators hovering over Tether for USDT and Circle, the company behind USDC, the demand for a decentralized stablecoin has never been more apparent.

This demand was demonstrated by UST's growth in market cap, as it far outpaced its competitors in the second half of 2021. Driving UST market cap in Q4 of 2021 was two of Terra's proposals, 133 and 134, which called for 88.67 million LUNA to be burned to mint UST. Part of the UST will fund Terra's insurance protocol, Ozone. TerraForm Lab's strategy over the next year is to drive UST adoption through all verticals, particularly outside of its ecosystem, casting a much wider net for its Total Addressable Market. Regulator risk is a concern with any protocol which uses synthetic fiat currencies. Monetary sovereignty has been a consistent topic of discussion in the last few years. As the regulatory landscape matures in the next year, the sector hopes to see greater certainty for the future of stablecoin adoption.

Figure 23:
Stablecoins Market Cap

Source:
TradingView, design by 21Shares



DeFi Security

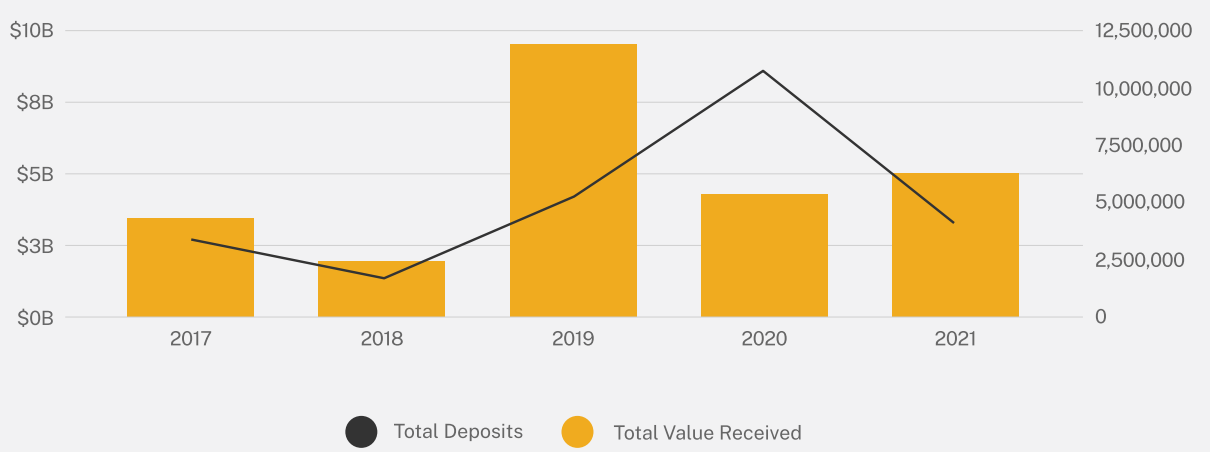
The DeFi sector is not immune to hacks, particularly unaudited code. Although, the reliability of cross-chain bridges is consistently tested for vulnerabilities, DeFi protocols have already seen a record number of exploits in 2021 totaling $680 million, several of which are attributed to cross-chain liquidity platforms. The largest hack to date, costing investors $600 million, was an attack on Poly Network, an interoperability network for trading assets. The silver lining is that blockchains' flow of funds is transparent and, therefore, easier for law enforcement agencies and the community to track and identify the digital trail of attackers. In addition, the support of the crypto community and forensic research has been essential as, in many cases, hackers returned a portion of the stolen funds. This is a reminder that DeFi is still early in the adoption lifecycle, similar to the early years of crypto exchanges in 2011. More importantly, projects need to strengthen their security practices, such as launching bug bounties and battle testing their products in real-world conditions for an extended period. This mind-blowing figure is 2.7x greater than the previous year's high of $319 million in Q2. According to Rekt, $1.3 billion was stolen in 2021 alone.

Money laundering strategies haven't changed drastically despite the increase of funds leaving investment scams. Most crypto sent from scam addresses ends up in mainstream centralized exchanges or mixers like Tornado Cash to obfuscate digital trails. In DeFi, rug pulls have dominated the ecosystem with 37% of all scam revenue in 2021 vs. 1% in 2020. Among the most notable scams was the Turkish centralized exchange Thodex where users lost over $2 billion, and Anubis Dao, which lost $58.3 million. DeFi security, as a result, has perhaps also never been allowed to shine brighter with the rise of blockchain forensic companies like Peckshield and TRM labs. Prolific whitehats like Samczsun have also repetitively saved the day by working with protocols to rectify vulnerabilities so that developers can learn from bugs or hacks.

The growth of DeFi composability and complexity paired with developers' relatively low level of experience in the space can only mean that smart-contract risks won't likely be fully mitigated in the near future. Web 3 bug bounty programs will therefore play a crucial part. Platforms like Immunefi provide a means for bugs to be reported

Figure 24: Total Yearly Cryptocurrency Value Received by Investment Scams 2017-2021

Source: Chainalysis, design by 21Shares



responsibly. The platform has paid out over $10 million in bounties and averted $20 billion in vulnerabilities to date.

While these figures may seem alarming; it is important to gain perspective. Goldman Sachs estimated that only 0.54% of cryptoasset transactions are related to illicit activities. Education is perhaps the most effective way to combat scams; understanding reliable resources and healthy security practices is crucial for new users.

DeFi Ethics

The development of DeFi this year also brought together an incredible community. The nature of transparent blockchain activity has allowed the community to police itself against bad actors. Divergence Ventures in the Ribbon Finance airdrop debacle is an example that gathered significant attention; despite the return of funds, it fueled the growing discontent of misbehaving market makers and venture capital firms.

As the space matures, better frameworks for environmental, social, and governance practices relevant to DeFi need to evolve. A16z presents an operational policy agenda that encapsulates this framework incredibly well. In the context of security, to pursue jurisdictional harmonization, standard setting for protocols and regulatory sandboxes and safe harbors. For inclusion, to ensure equitable access to resources and information by leveraging the strengths of Web 3 technology. Finally, with efficiency, to establish a strategy for digital infrastructure and align with sustainability objectives and, at the same time, unlock the full potential for DAOs.

Much discussion and emphasis have been put on whether the DAO structures are appropriate in all contexts, particularly grassroots communities. In many examples last year, we saw that simply starting a DAO and airdropping governance tokens will not materialize quality communities or empower well-educated long-term decision making. Delegate structures may be a proven solution to this, mitigating disorganization and driving a sense of stewardship for community leaders. This includes voting power for those who provide the most value and utility to the protocol. Greater thought needs to be put into token distribution mechanisms and fair launches, as this will forever define its degree of decentralization and integrity of governance.

Regardless of which side you may be on or whether you are even sold on what Web 3 promises, it is clear there is a call for founders and teams to build transparently. Involving communities early in the product cycle, promoting open, inclusive means of communication, and encouraging participation for better governance are all motions of affirmation for the vision of what Web 3 is trying to achieve. Greater decentralization on the blockchain infrastructure front also needs to be realized; running a node must be made multiple times more attainable.

It is important to realize that decentralization is an ideal, grand spectrum in the current realm of Web 3. It may not be as decentralized as many claims for it to be, but it is a constant working progress.

State of Crypto

Non-Fungible Tokens (NFTs)

The big story of this decade will likely be Web 3 as the largest beneficiary of the "Great Resignation" currently happening in the US. Miners and companies are no longer the only groups able to make a primary or secondary income in this industry. The explosive resurgence and recognition of crypto-native art collections, music, and games (NFTs) have given a new face to this industry and attracted new cohorts of builders, including illustrators, musicians, game developers, photographers, movie producers, fashion designers, and 3D artists.

NFTs have made the crypto industry a lot more approachable than in previous years. Despite the hype around art NFTs or "JPEGs", the underlying technology that they offer will be an integral part of the infrastructure of Web 3. NFTs will undoubtedly be the major catalyst to cross the chasm towards mainstream adoption in crypto. NFTs entail an immense disruptive power by providing a unique digital certificate, unlocking opportunities for new business models while shifting power and ownership back to users.

Even though the concept of NFTs is not new, 2021 was unquestionably the year they took off and made mainstream attention. NFT was even coined as Collins Dictionary's word of the year in 2021. Breaking news headlines in 2021 included Beeple's $69 million mega sale, the rise of the Bored Ape Yacht Club, OpenSea making over $14 billion in sales, Visa buying a CryptoPunk and much more. The number of daily NFT users, especially for art and collectibles, has increased significantly from 10,000 to over 40,000 in 2021. However, when comparing this to the number of total crypto users — circa 200 million or even to the global number of internet users, 4.88 billion, we can assert that we are still in the early innings.

Collectibles, Avatars and Digital Art

Currently, NFTs are in the general population still mainly known for expensive JPEGs, digital art, and overhyped avatar projects. The best example was the rise of CryptoPunks early last year. In an auction conducted by Sotheby's in June 2021, a "Covid alien" CryptoPunk 7523 was sold for a staggering $11.7 million.

Companies including Nike, Microsoft, Twitter, McDonalds, Ubisoft, Budweiser, Marvel, Shopify, and many more have already announced their plans to leverage NFTs for future projects. For instance, Adidas launched its first NFT in partnership with the renowned Bored Ape Yacht Club (BAYC). This NFT drop showcased what's possible with blockchain technology. This instance makes NFTs a receipt and proof of ownership to redeem Adidas unique physical goods, which will be available in early 2022 and includes a hoodie, a tracksuit worn by the Bored Ape, and more upcoming digital experiences. We believe that this

trend will continue into 2022, and we'll see more major brands partnering with renowned NFT projects. NFTs represent an immense opportunity for smaller artists to capitalize on their work. They will bootstrap their projects and be the direct beneficiaries of their doings without any middleman taking the majority of their profits.

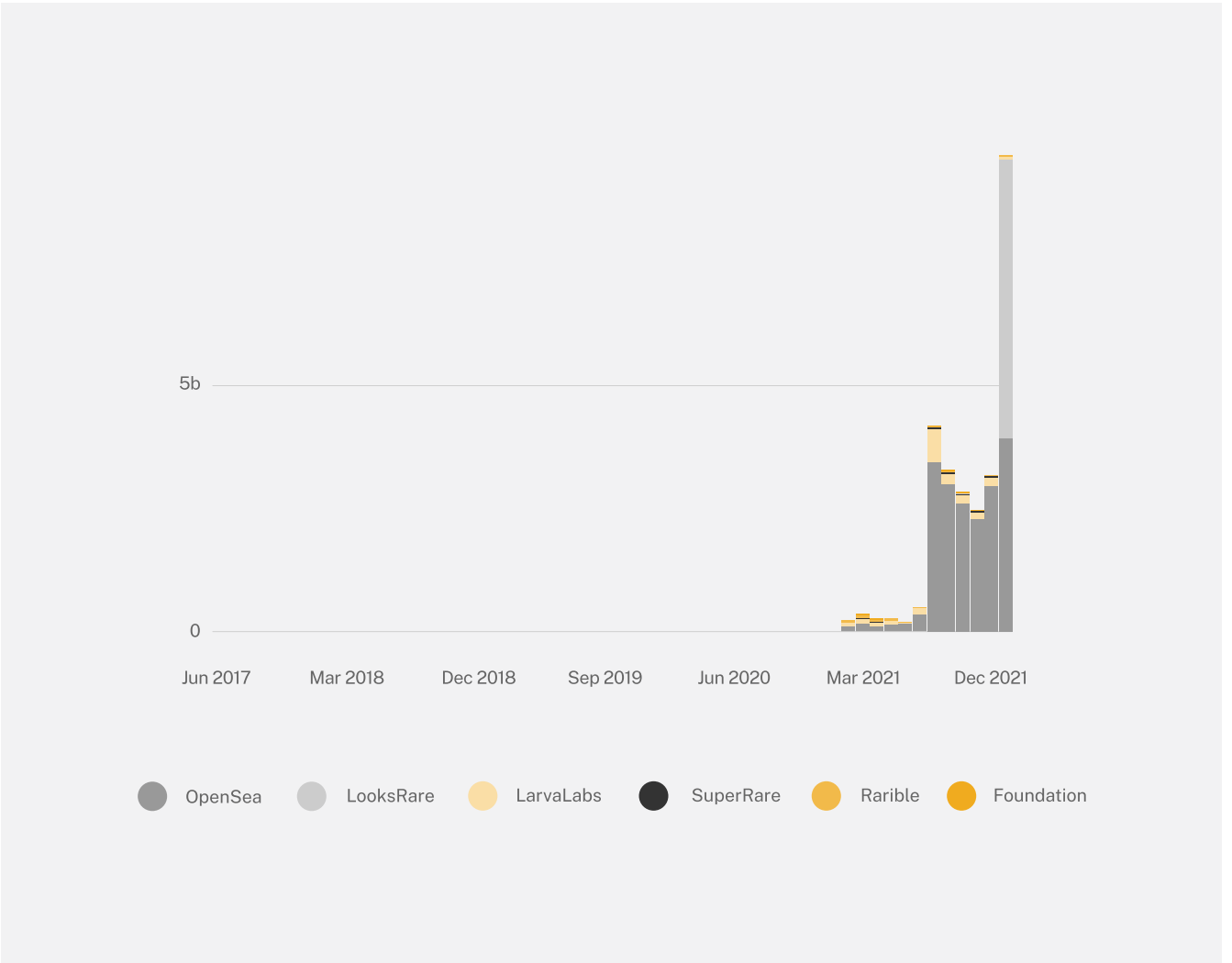
It's essential to note that the main issue NFTs create is exacerbating wealth inequality — specifically for accessing collections in the primary market or at the minting phase akin to the seed-stage of startups only open to a specific class of investors. Bots and blue-chip NFT owners such as Bored Apes are becoming the new accredited investors of this industry and are offered VIP access to the minting phase of upcoming NFT drops. Crypto has been the best real-world case study to prove that talent is everywhere, and so are opportunities. It will be critical for the future of this vertical not to recreate the barriers that made this movement possible. Artists providing fair access to the primary market will most likely benefit from a strong and sticky community over time.

Marketplaces

The biggest NFT marketplace, OpenSea, enjoyed similar growth as the NFT sector itself last year. The platform's sales numbers reached a staggering $14 billion at the end of 2021. While OpenSea might have a first-mover advantage, other platforms could capture market share in the next year. The recent rise of the decentralized marketplace LooksRare is the first evidence for our thesis. By off-loading tokens via an airdrop eligible for all OpenSea power users, LooksRare was able to attract a massive user base in a short period. In the last 30 days, the decentralized marketplace showed a higher trading volume than its main competitor, OpenSea, with $4.72 billion vs. $3.81 billion. There is a growing opinion by users and NFT collectors that OpenSea turned its back on them in favor of investors. Many believe that without its historically strong community backing, OpenSea would not have been the thriving platform today. The crypto community held high hopes for OpenSea's token airdrop, an increasingly common practice among crypto projects, giving back control and value to their users. In addition, the recent freeze of 16 NFTs that were reportedly stolen has raised some centralization concerns among the community. Lastly, with Coinbase planning to release its NFT marketplace this year, giving over 70 million users access to NFTs, we believe the market dominance of OpenSea will continue to decrease.

Figure 25:
NFTs USD Volume

Source:
Dune Analytics @hildobby, design by 21Shares



Gaming

Crypto-native games like Axie Infinity, with over $4 billion in market value, experienced exponential growth last year. Crypto games could win over many players, especially through sophisticated tokenomics. For example, in the Philippines, the potential income with the play-to-earn model from Axie Infinity has been higher than the national minimum wage.

Play-to-earn games at the moment are DeFi applications in disguise. On the one hand, it broadens the scope of DeFi users. On the other hand, it could drive casino-like addictions to such games — especially when the incentives are not to play but to make money. In the future, we could see more complex DeFi primitives such as perps or automated option strategies incorporated

into various games. There's an opportunity to make DeFi more fun and accessible. And, most importantly, a lot more understandable through games. This use case has potential, especially if a given game can build user-friendly dashboard and tools. We see the first generations of blockchain games utilizing the play-to-earn model, and DeFi Kingdoms is the archetype of a DeFi game.

However, these games are generally more appealing to DeFi users who enjoy a gamified experience and not necessarily to full-hearted gaming fans. Most of the games' graphics look like the first generation of Super Nintendo or Playstation 1 video games but hold a significant upside given their accessibility internationally.

Many games have already adopted various in-game purchases and microtransactions in recent years. Free-to-play games that rely on these streams have become increasingly popular, but many gamers remain skeptical. In the past, the success of a video game was determined by the actual quantity of physical copies sold. Gaming companies could generate additional revenue streams by selling merchandise or accessories. With the rise of Web 2.0, we saw new business models popping up — including downloadable content, DLCs, and microtransactions.

An example would be Electronic Arts (EA) selling physical or digital copies of their sports games and additional revenue with in-game purchases. Ultimate Team (known as UT) is a game that allows players to create teams with any players from any league and play online to earn coins for stronger players or packs with random players. These packs can also be bought with real money and were responsible for more than $1.5 billion in sales last year. The problem is that once the season is over and a new version of the game is released, in-game assets become worthless, and players need to start all over again.

Fortunately, a newer monetization strategy is on the horizon. The current rise of Web 3 has begun to alter the Internet, including the gaming landscape, by bringing blockchains, cryptocurrencies, and non-fungible tokens (NFTs) into the mix. NFTs, in their most basic form, are digital, verifiable certificates that can be linked to almost anything, including in-game objects. As a result, every costume, avatar, virtual land, and everything else in-game may be converted into an NFT, making them unique, valuable, and most importantly, tradable. In theory, they could be transferred between games and resold to other players on secondary markets. As a result, gamers don't have to spend significant amounts on items that will disappear once gamers lose interest or if the game ceases to exist. Time and money spent resemble investments rather than a sunk cost. Of course, the game's creators could still offer a similar range of potential in-game purchases. Still, they could do so at a lower price, one they wouldn't consider in the current model, to generate additional revenue by running in-game markets and P2P trading, charging a small fee on each transaction. This would also incentivize the developers to keep their in-game economy alive by constantly improving experiences and in-game assets. Those improvements will usher in a new era of gaming, one that will benefit both creators and players.

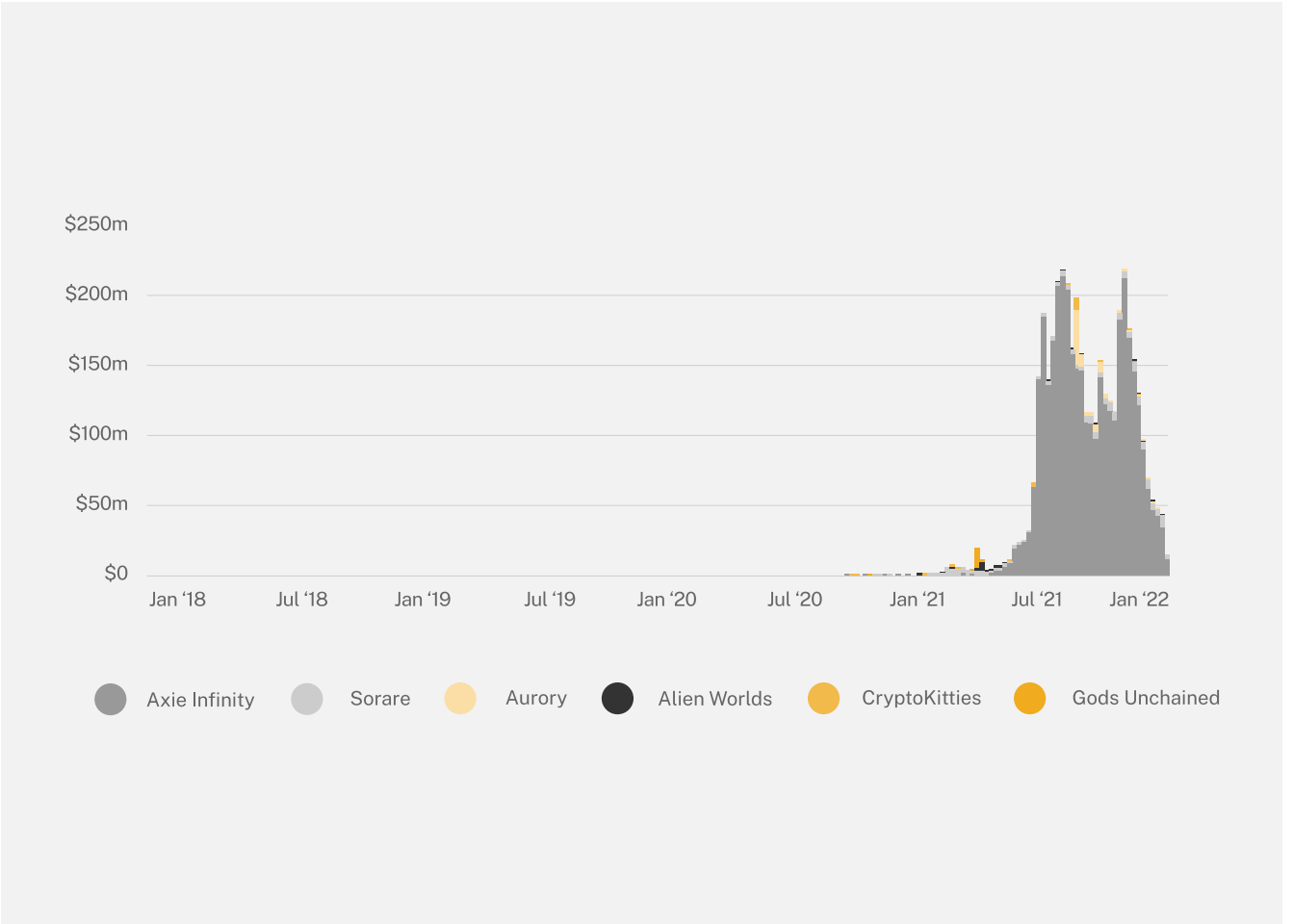
As for AAA games, we don't believe we'll see any fully-fledged blockchain games to be released in 2022. These games take several years to develop. Another challenge remains blockchains' speed and potential scalability to cope with millions of gamers. What we could see throughout the year are smaller implementations of the first in-game NFT capabilities, and most certainly, we'll see several takeovers of smaller crypto gaming companies by big game makers and major investments in the crypto gaming sector in 2023. This also reflects the current investment landscape in the NFT gaming area: for

example, a16z invested 150 million US dollars in Mythical Games, an NFT gaming platform. Enjin announced a $100 million Metaverse fund, Solana Ventures, FTX, and Lightspeed set up a $100 million gaming fund.

However, the current sentiment in the gaming community is somewhat skeptical. For example, tech and gaming firms like Ubisoft, Discord, and Mozilla have held off NFT launches due to this market sentiment. Many perceive digital scarcity as an unnecessary innovation that brings the worst of capitalism to the open Internet. It's especially interesting for Discord, the pillar for Web 3 and NFT enthusiast toolkit, while also serving a broader user base for gamers — which perceive NFTs as a continuation of the monetization nightmare micro-transactions have inflicted on gaming titles. In conclusion, we believe gaming will be a major narrative in crypto and NFTs specifically. However, mainstream adoption will only be achieved when the play-to-earn (or better play-AND-earn) tokenomics of crypto-native games, well-thought-through NFT implementations, and the gaming experience of AAA games converge.

Figure 26:
Gaming NFT Trade Volume

Source:
CryptoSlam and TheBlock, design by 21Shares



Metaverse

Another buzzword in 2021 was the "Metaverse." Although there is no clear definition for the word Metaverse, its vision entails a collection of virtual worlds parallel to our physical world, designed to foster social interaction. It can be described as a new iteration of the internet, where people meet, play, collaborate or even work together. It combines different technology components, including blockchain, NFTs, DeFi, gaming, augmented reality (AR), and virtual reality.

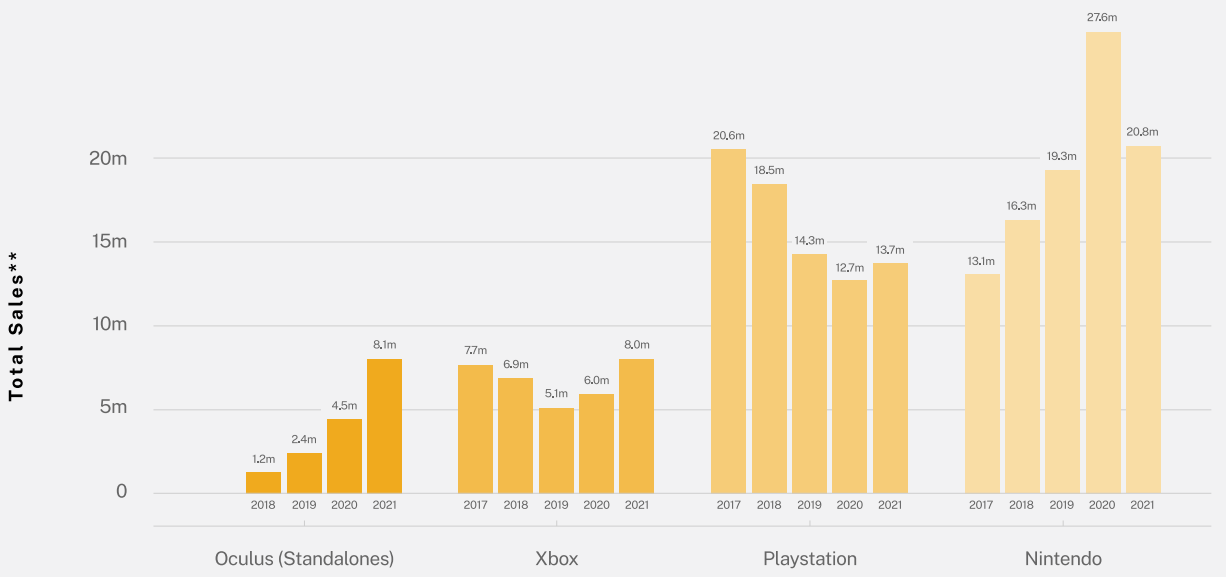
Even though it's also a term that has been used for some time, it gained mainstream awareness through Facebook rebranding to Meta. The rebranding refers to focusing on the next generation of social networking in virtual reality. In addition, the firm announced its intentions to support NFTs in the context of selling goods and services in the virtual world.

Crypto-native virtual-reality applications have been in the spotlight as investors seek alternatives to Facebook. According to Statista, the global augmented reality (AR), virtual reality (VR), and mixed reality (MR) market is expected to reach 30.7 billion U.S. dollars in 2021, rising to close to 300 billion U.S. dollars by 2024. Ethereum-based virtual games such as the Sandbox (ticker: SAND) and Decentraland (ticker: MANA), where players can play, build, own, and monetize their virtual experiences — rose by more than 156,000% and 39,000% in 2021. Both applications have a combined market cap of $7.7 billion. We can anticipate both applications and the Metaverse sector to keep up with this adoption rate and awareness as users continue to distrust Facebook. On the flip side, Facebook has the competitive advantage of owning Oculus virtual reality hardware. In 2014, Facebook announced the acquisition of this leader in immersive virtual reality technology for a total of approximately $2 billion. The paradox between software and hardware in the VR and AR sectors will be essential to monitor as this sector moves towards mainstream adoption and beyond gaming, such as health care and the airline industries. The bull case scenario for Facebook / Meta is that by owning Oculus, it might become the largest beneficiary of the adoption of the Metaverse sector as users will likely be using more immersion VR goggles significantly in the future. Meta could win the VR/AR hardware race but not necessarily succeed in the application/software category. While its virtual space will be available to billions, due to distrust placed in Facebook, users will most likely divert to crypto-native applications like Sandbox and Decentraland. So either Facebook will make those virtual crypto spaces available on Oculus alongside its in-house application or take the opposite direction. Embracing decentralized VR and AR applications on Oculus will be one of the most important moves for Facebook / Meta to reinvent itself.

Besides Meta, several companies have already expressed their plans to dive into the Metaverse by cooperating with existing projects or building their own from scratch. In 2022, more brands, especially shoe manufacturers and apparel companies, will leverage the Metaverse and NFTs to display items and physically deliver pieces to NFT members. Adidas and Nike are the leading brands on that front.

Figure 27:
Console Sales by Brand by Year

Source:
Design by 21Shares



** **Xbox**, **Playstation** and **Nintendo's** sales data are scraped from https://www.vgchartz.com/tools/hw_date.php. VGChartz estimates their sales through retail sampling and country trends, and they claim their predictions are within 10% of actuals.*

*** As the mobile app is necessary for onboarding, I measure **Oculus** "sales" through **Mobile App Downloads**. Likely an underestimation as it does not include users who upgraded, users own multiple Oculus devices, not all sales convert to onboards, and Black Friday sales have yet to be activated on Christmas. Zuck has stated that Oculus has sold 10m in Quest 2's alone.*

Social Tokens and Music NFTs

Another megatrend that we expect in 2022 could be triggered by so-called social tokens (or fan tokens) and music NFTs. Content creators, artists, singers, writers, and social media influencers, are the genuine stars and income generators for media companies and record labels, yet they are frequently underpaid. A third entity, such as Instagram, Youtube, or Universal, mediates the interaction between creators and fans by sharing income and aesthetic control. Social tokens and NFTs may fundamentally undermine this long-standing arrangement by directly paying creators for their work. Football fans could, for example, have a say in the choice of jerseys for the new season, or rising singers could let their fans participate in their success through royalties.

Music NFTs will be one of the most engaging verticals where artists can control their fate. According to American musician and author Mikel Jollett: "1,000,000 streams on Spotify nets $3,000. Of this, 84% goes to the label (if the artist is on a major, 50% if indie), and a whopping $480 goes to the artist". With music NFTs, fans will own songs through royalty-backed NFTs. In addition, musicians can upload songs on censorship-free platforms like Audius or tokenize their videos on Glass Protocol. The fanbase can even support artists through decentralized record-label such as Good Karma DAO. The best example was the release of Ultraviolet in February 2021. Famous producer and DJ 3LAU experienced one of the most incredible NFT moments of the year. A collection of 33 different NFTs, Ultraviolet brought 3LAU $11.7 million throughout a three-day auction.

NFTs are here to stay and will continue to disrupt various industries and business models. For example, even though art and collectibles made up 90% of NFT sales last year, we believe gaming will significantly increase its NFT market share in 2022. On the regulatory side, we might see some crackdowns on NFT projects and their promoters, especially NFTs that could be classified as unregistered securities and outright scams like pyramid schemes advertised on social media channels like TikTok or Instagram. However, the silver lining is that NFTs will be an integral part of the Web 3 infrastructure.

State of Crypto

Data Infrastructure

The data infrastructure industry is arguably one of the space's most overlooked sectors. Blockchains are inherently constrained by their designs to do two things:

1. Disconnected from the outside world, they can't access off-chain data.

2. Under the traditional blockchain's sequential design, data extraction becomes a grueling process.

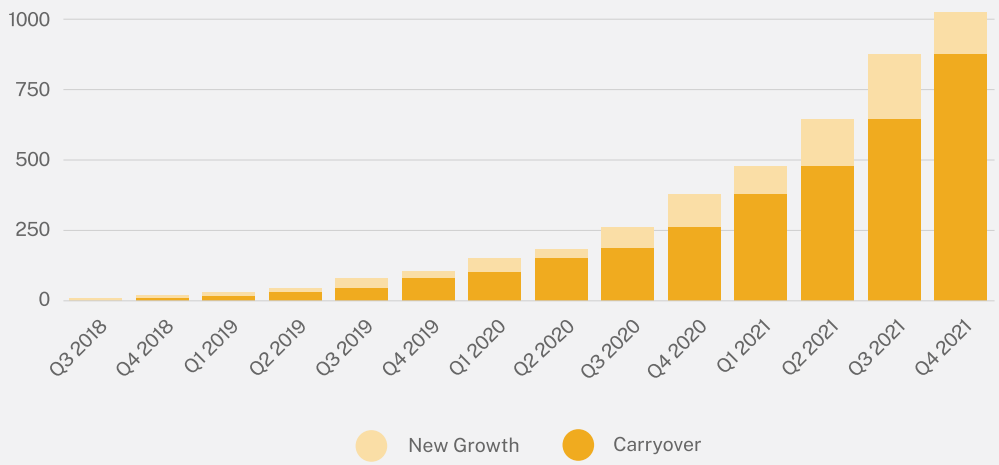
Alternative 3rd party solutions have emerged in blockchain explorers such as Etherscan and PolygonScan. However, relying on the aforementioned centralized parties raises the risk of trusting that the data is left untampered with, which is antithetical to the ethos and objectives of decentralization. That said, two specific projects have embarked on their journey to filling in the gap felt by the technology's design limitations:

1. Chainlink

2. The Graph protocol

Figure 28:
1,000+ Projects in The Chainlink Ecosystem

Source:
Twitter, design by 21Shares



Chainlink began by offering its now-industrially-recognized price and data feeds that helped with onboarding critical points such as asset prices, weather forecasts, FX rates, or IoT data. The sourcing of high-quality data by its decentralized oracle network (DON) helped kick start Ethereum's first DeFi rally in the summer of 2020. After that, the network's data and price feed virtually became ancillary to powering the DeFi sector framing the derivatives, money market, asset management protocols. Chainlink now boasts more than 1,000 integrations across the crypto space while onboarding roughly 1.3 million data points delivered by the network's node operators and spanning across 7 blockchains and L2 solutions.

Nevertheless, the network has embarked on an impressive journey of growth and adoption over 2021 to transform Chainlink's DONs into a proper blockchain agnostic middleware.

- They introduced **VRF** for on-chain cryptographically-guaranteed randomness, a feature adopted by the NFT project - Bored Ape Yacht club - where BAYC holders randomly received the Mutant Serum NFTs, to cite an example.

- Then came **FSS**, where the DON network was recast as an oversight committee effectively monitoring the mempool and ordering its queued transactions in a first-come-first-serve manner. An implementation meant to alleviate front-running and market manipulation (MEV standing for Maximal Extractable Value).

- Chainlink's **keeper** beta was subsequently introduced to provide a highly-reliable and cost-efficient substructure for automating particular smart contract functions such as yield harvesting and debt-repayment strategies found in Alchemix, which requires external input for execution. Finally, with the emanation of the multi-chain ecosystem over the last year, Chainlink decided to release the final piece of the puzzle that will enable the blooming of this new paradigm.

- Chainlink's CCIP can be best understood as a modular framework that helps create customizable bridges inept at transferring native tokens and programmable commands from one chain to the other. A case in point is Celsuis's announcement on its commitment to adopting the CCIP framework to leverage services found exclusively on different chains and allowing access to funds across what can now be interpreted as a communicative layer of blockchains. A simple illustration can be the transfer of assets from chain x to chain y, to have it locked in a particular smart contract's vault for a yield strategy. Bridges funds can then be withdrawn back to the original chain once a certain threshold has been met, such as a price level or an epoch's end.

Looking ahead, the excitement behind CCIP is justifiable as the landscape for interoperability is still far from reaching maturity by the layer 0 blockchains working on it. For example, Polkadot's auctions only went live late last year, with only six projects securing their bid as parachains, meaning that it'll take a while before we witness the protocol's full saturation. On the other hand, Cosmos only has a slew of protocols fully integrated with the network's IBC. This gap presents an opportunity for the network to accrue significant value from the crypto space as Chainlink's DONs unprecedented network effect only second to BTC & ETH, which helped it secure $80B of total value in the process. This achievement endorses Chainlink as a provably high-performant trusted contender that can take on the role of facilitating interoperability.

Chainlink's staking is also finally slated to be released this year. The rationale is influenced by the network's most prominent DONs' recently achieved ability to sustain their oracle operations without the need for the network's endowment. This progress was evident by the fact that Chainlink's team had stopped selling six weeks ago, effectively terminating the subsidization process adopted since the network's inception. Further, the rise of Ethereum's competitors has also provided economic means to monetize their services over the past year since it's not as costly to operate and transact on the alternative L1s.

All in all, Chainlink's role has now evolved way beyond facilitating data delivery. Instead, the network's growing repository of decentralized services has transformed into a critical piece of the infrastructure layer that will be heavily responsible for the growth and evolution of the Web 3 stack. As a result, Chainlink offers the Web 3 ecosystem a trust-minimized infrastructure that is expected to unlock unforeseen capabilities and innovation across its sphere.

The Graph

The Graph is a querying layer abstracted on top of public networks, designed to index blockchain data and organize it into a digestible format on a database-like scheme (PostgreSQL). Despite the protocol's initial exclusive focus on the Ethereum and IPFS ecosystems, it has extended its support to NEAR, Solana, Polkadot, and Celo. Decentralization in The Graph's model translates to the absence of centralized arbitrators that ultimately have a say on deprioritizing links, censoring requested data points, or even keeping tabs on the protocol's history and what users consume.

The Graph's impressive growth over the past year - as exemplified above - has been integral particularly to the DeFi and NFT industries as complex new applications building modularly on other smart contracts required access to the relevant data points located on the first generation of DeFi dApps. This can be seen as Uniswap, Sushiswap, Compound, Maker, Synethix, and Curve were just a fraction of the most queried subgraphs, where

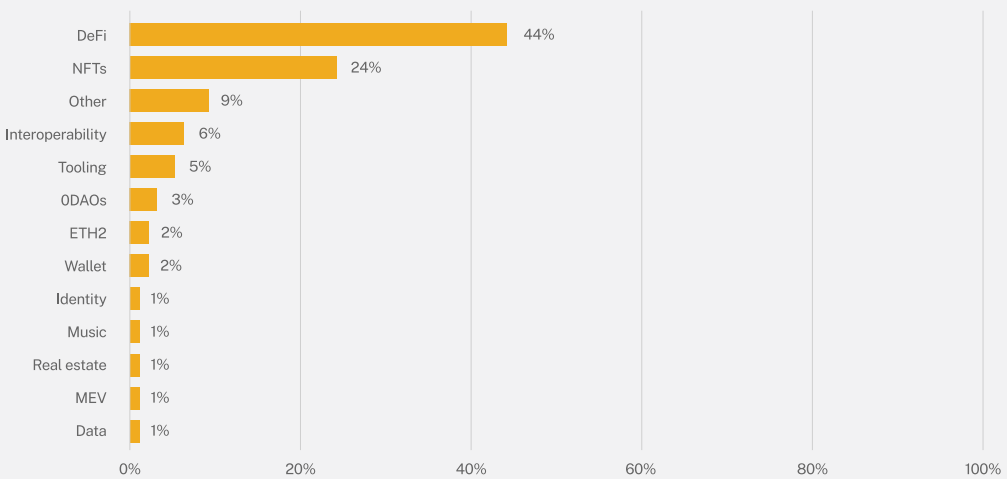


Figure 29:
Subgraphs by Vertical

Source:
The Graph

the indexed data is stored. As a result, the network now boasts an expanding sweep of 30 thousand Subgraphs spanning over 26 different blockchain networks.

Subgraphs, in short, are various indices utilized to store the indexed data in question. They appear in the form of open APIs, making it openly accessible for individuals or smart contracts to access their underlying data. A simple lookout for some of the most commonly queried subgraphs, such as Uniswap and Compound, would yield critical data points such as the liquidity, trading volume, and total volume over 24 hours for all token pairs. These are essential feeds that dApps need to leverage to build complex financial instruments or decentralized applications that rely on the constant streamlining of data. The appeal of The Graph's decentralized critical infrastructure can be felt when assessing the growth of queries per day as it reaches almost 2B fetches. That, in addition to the swelling volume on both The Graph's original centralized hosted service that antedated before the protocol's decentralized network launch in December 2020, gauged at ~21 MoM, 569% YoY.

The Graph protocol will be expected to integrate its solutions into various ecosystems: Layer 1 and 0 blockchains, nascent DeFi and NFT ecosystems, Cosmos' Tendermint, and other data-oriented networks such as Arweave. Furthermore, the protocol's value should similarly be realized towards the Metaverse vertical, as virtual worlds operating in silos are essentially what this new technological paradigm is trying to overcome. Hence, gaining access to smart-contract data hosted on the multiplicities of existing blockchains will be integral to formulating the interoperable immersive experience extending beyond these multiverse worlds' walled gardens.

The Graph is also anticipated to be turned to if EIP 4444 gets adopted. The proposed upgrade suggests that the network will require less historical data to sync up to the nodes. However, for dApps still looking to leverage historical data, the querying protocol could help facilitate this by indexing data from the genesis. Thus, The Graph protocol plays an indispensable role in enabling data's ease of accessibility, which is imperative in nurturing the composability of Web 3 ecosystems.

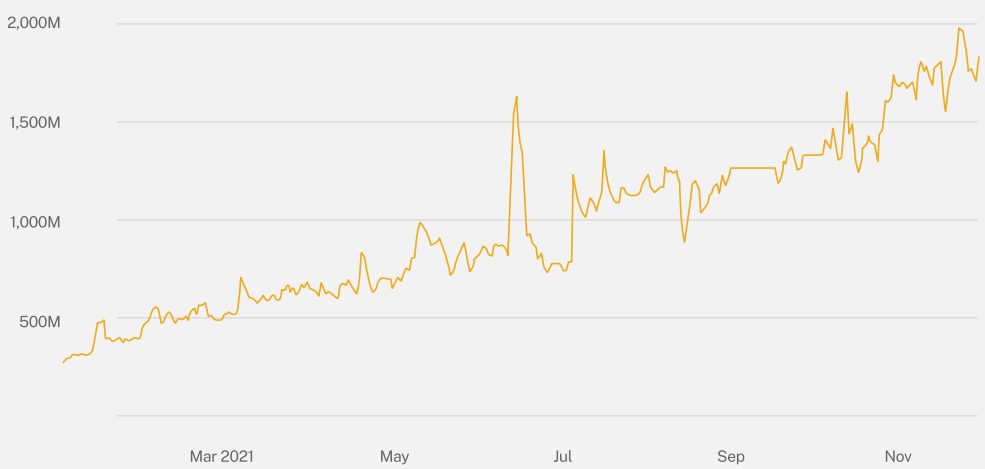


Figure 30: Daily Queries

Source: The Graph

Data Storage Sector

The Graph is a querying layer abstracted on public networks, designed to index blockchain data and organize it. Over this past year, the explosive growth witnessed across the crypto stratosphere has shed light on the need for decentralized storage solutions that serve the same functionality as AWS or Microsoft Azure. The increasing demand was highlighted because some of the world's renowned NFT projects - such as Beeple's crossroad on NiftyGateway - emerged throughout 2021 were hosted on centralized servers such as the services mentioned earlier. This opens up the door to data tampering and raises security concerns that data could be lost due to a single point of failure. As a result, a decent number of NFT platforms refrain from storing their media on-chain and instead opt for only storing the metadata, as it has been costly to deploy on top of Ethereum.

The predicament extends beyond the NFT space when realizing that one of the more prominent DeFi platforms, dYdX, went offline due to an AWS outage. To all the intents and purposes of forging a new paradigm where digitized assets can be truly owned, this shortcoming would indeed impair the holy grail of what the Web 3 industry is trying to achieve.

Finally, the explosion of alternative Layer 1 networks devised to sacrifice decentralization for speed stipulated that the newer players would produce exuberant amounts of data compared to the first generation of blockchains. A case in point is that Algorand's entire blockchain history is appraised at almost 2 TB split between main, beta, and testnet amassed over two years instead of Bitcoin's 375 GB bundled over 11 years. Another is Solana's estimates at almost a petabyte (1000 TB), which deems it practically unviable to expect nodes to store this data locally.

May that be the case, a slew of decentralized storage protocols have emerged over the past years, presenting a solution to the industry's shortcomings. They are split into two principal categories.

- First are the contract-based solutions that require periodic subscription payments to continue hosting the files, where there is a handful on the market, such as Filecoin, Storj, OPCT, and Sia.

- Secondly comes the pay-once store-forever incentive-based model pioneered solely by the Arweave protocol.

For abbreviation, the two prominent solutions with the most traction, Filecoin and Arweave, will be touched upon in this brief breakdown.

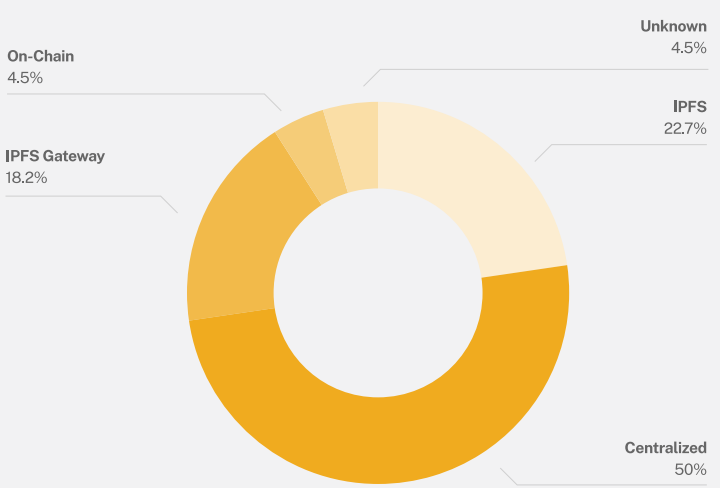


Figure 31:
Metadata URLs

Source:
twitter @pencilfip, design by 21Shares

Filecoin

Filecoin can be best described as a decentralized storage system that capacitates individuals and users to rent out spare hard disks on a P2P basis for storing data. The innovative protocol deployed on top of the IPFS network enables monetizing the abundance of spare storage. It redefines data ownership and provides a reasonably censorship-resistant mechanism for storing data complemented by setting consumers' terms and price times replication duration to be stored. It can also be sometimes delineated as an incentivization layer on top of the IPFS network, which, unlike Filecoin, offers no impetus towards its adoption.

The Filecoin blockchain handles all transactions about data management, which takes in agreements, storage miners, retrieval miners. To ensure the proper operability of the network and its participants' truthful execution, the network employs two novel ZK-SNARK-based consensus mechanisms to guarantee that the data is being stored and preserved as necessitated.

First comes proof-of-replication, where nodes prove to users that their data has been replicated to the committed storage, followed by proof-of-spacetime, where storage nodes sporadically demonstrate that the data is being stored as promised. Finally, users hoping to upload and retrieve files are expected to pay retrieval and storage miners in FIL.

Filecoin has welcomed many players over the past year. Following the inauguration of Nft.storage platform, several NFT platforms opted in to integrate Filecoin's services into their operations, such as OpenSea, Makerspace, Jigstack, Dapper Labs, and Curio, resulting in the accumulation of roughly 7.7M hosted NFTs. In addition, flow blockchain adopted Filecoin for its NFT storage capability.

The network should expect to accommodate an expanding ecosystem of dApps as FVM was just released last November, allowing developers to deploy Rust and Solidity codes. However, Filecoin doesn't seem to possess the financial capital to compete against centralized counterparts on costs over the long term. This is occasioned by the high barrier to entry for miners who are recommended to procure high-end hardware, deeming the network unscalable. In addition, they can't continue to offer lower prices than Amazon, for example, since they can't effectively continue to subsidize the cost of storage service purchasers by issuing FIL - as they did in the project's early stage. Due to supply dilution, the issuance will affect the asset's price accordingly, which means this trend will be short-lived.

Another potential risk to this type of contract-based service is that nodes aren't incentivized to replicate as much data as possible, as is the case with Arweave's protocol. The protocol's tokenomics and consensus mechanism only encourage nodes to upload and retrieve data as solicited but do not induce them to duplicate random copies of old data blocks. This, in turn, means that files stored for a long time are at risk of deletion if no one is requesting their retrieval or if a node shuts its operations, as was the case with Steve Aoki and DeadMau5's blue-chip NFTs collection that shortly went offline despite being stored on IPFS.

Thus, it can be argued that the Filecoin network, at best, is embracing the ethos of crypto due to its censorship-resistance nature and ideology, but not actually for lowering the competitive costs found in the current Web 2 landscape over a longer time horizon..

Figure 32:
A Comparison Among Different Types of Decentralized Storage Protocols

Source:
Footprint_DeFi, design by 21Shares

	Arweave	Filecoin	BitTorrent	Siacoin
Proof Type	SPoRA	PoRep+PosT	DPoS	PoW
Max supply	66,000,000	2,000,000,000	Not Available	Not Available
Supply issuance	Capped supply/inflationary	Capped supply/ highly inflationary	Capped supply/ highly inflationary	Not capped supply/inflationary
Token utility	Store files permanently on the Arweave permaweb	Store, distribute and retrieve information	File hosts get BTT tokens as rewards to keep files available on the network	Renters use SC tokens to buy storage from hosts, hosts deposit SC in file contracts as collateral
Storage cost	Pay once store forever	Pay-as-you-go recurring cost	One time payment low cost	Pay as you go recurring cost
Application	Over 360 hosted DApps	File storage client and platform wallet and others	Desktop, web and Android client	CDN and file sharing platform, could storage, media streaming and others
Working use cases	Web app hosting, file storage, backups for DeFi, censorship resistance	File storage	Peer-to-peer file, sharing as torrent	File storage, media streaming, decentralized CDN, cloud storage
Investors	a16z, 1kx, USV, coinbase Ventures, Multicoin Capital	Sequoia Capital, a16z, Digital Currency Group, USV, Winklevoss Capital	Acquired by TRON, IEO on Binance	Dragonfly Capital Partners, Fenbushi Capital, SVAngel

Arweave

Arweave is a decentralized data storage protocol that provides an economically sustainable mechanism for storing data permanently. Companies or individuals needing to store their data for continuity can leverage the distributed network to find nodes with spare hard disk capacity for reserving it in exchange for an economic stimulus in the form of indemnified AR tokens. Users are slated to pay ~$10 per GB for permanent storage in its current setup. Even though it's marginally costlier than Google Drive or AWS, Arweave's offering for perpetuity makes it cheaper over the longer term since users pay upfront for permanent storage. The calculations into the current service valuation were rooted primarily in Moore's law style for declining storage costs. The system factors in the worst of assumptions as it estimates that the costs will reduce by 0.5% annually when in reality, it has been declining by roughly 30% on a YoY basis.

Arweave makes use of a blockchain-derivative database known as **blockweave**, where newly produced blocks reference previous blocks in addition to an ancient and randomly selected block (recall block). This is designed to incentivize nodes to replicate as much old data as possible to earn the rewards. Arweave's modus operandi for invoking this type of incentivization relies on the **SPoRA** consensus mechanism. In short, the probability that miners are chosen for block generation depends on their ability to reference the old called block and their speed of accessibility. An integral feature for rapid data retrieval meanwhile fending off concerns of lazy centralization as data is encouraged to be stored locally rather than at defunct data centers. Finally, Arweave appropriates Bittorrent's underlying principles by adopting a scoring system based on the speed of transaction transmission and relaying blocks while enabling peers to de-rank each other on underperformance or dishonesty - dubbed **wildfire**.

Last September saw Arweave launch what is inferred as an L2 scalability solution named **bundles**. Transactions within this proposed model are initially sent off-chain, grouped, and eventually sent back to the main chain in a 'bundled' transaction. The improvements resulted in an impressively scaled-out performance where 47 GB of data was sent in one go promptly following the solution's mainnet launch.

Finally, the pinnacle layer built on top of the Arweave network for serving the network's users, acting uniformly as the existing conventional web, and one that is built on top of the blockweave structure, is the permaweb. In a nutshell, it can be described as a serverless web layer capable of hosting a wide array of web pages, combined with computational-heavy smart contracts built by SmartWeave. It is the protocol's groundwork for standardizing the creation of dApps on top of the network.

Arweave's remarkable technological stack has promoted several key players from within the crypto space and outside its boundaries to utilize its distinguished permanent storage technology. For one, the internet archive partnered with the protocol to record torrents of their historical data onto the permanent network. In addition, a medium-like website dubbed mirror.xyz has also launched on top of Arweave, prompting permanent storage of written content while enabling its monetization as content can be resold as NFTs. Since

the storage occurs on Arweave's permanent network, a long history of ownership is supplied, bringing about the yielding of royalties for its redistribution. Furthermore, few stablecoin issuers have resorted to publishing their financial audits on the permaweb to sidestep the trust issues previously aimed at Tether. Likewise, NFT projects deployed on top of Solana have also been known to leverage Arweave to permanently store their media and its attached metadata due to the convenient process that Metaplex offers. And finally, Arweave's list of partners has expanded beyond supporting Solana as its preliminary storage solution for its petabyte worth of on-chain data to now include Cosmos, NEAR, Avalanche, and Polkadot — all on the back of Kyve network's collaboration.

Drawing things to a close, Filecoin and Arweave's development present some of the critical work provided by the decentralized storage industry towards nourishing a truly censorship-resistant layer underpinning the growth of the Web 3 ecosystem. We barely scratched the NFT sector's potential with immulatable storage solutions.

This in fact, emphasizes a higher need for permanent storage solutions. It would be counterintuitive for users to find out their precious in-game items or uploaded tracks, yielding them royalties, have been lost due to the delicacy of hosting on centralized servers prone to censoring or shutting down at any time. Simultaneously, the innovation happening at the base layer isn't expected to end anytime soon, meaning a myriad of L1s focused on scalability and speed will continue to emerge, meanwhile generating disproportionate amounts of data as a function of improved block space and transaction throughput. These will stand in dire need of decentralized storage solutions to store their historical data.

Figure 33:
Current Decentralized Storage in TB (left) vs Current Market Cap (right) Arweave is less than 0.1% of total decentralized storage

Source:
Filecoin.io, Storjshare.io, Siastats.info, Viewblock.io, CoinGecko, design by 21Shares

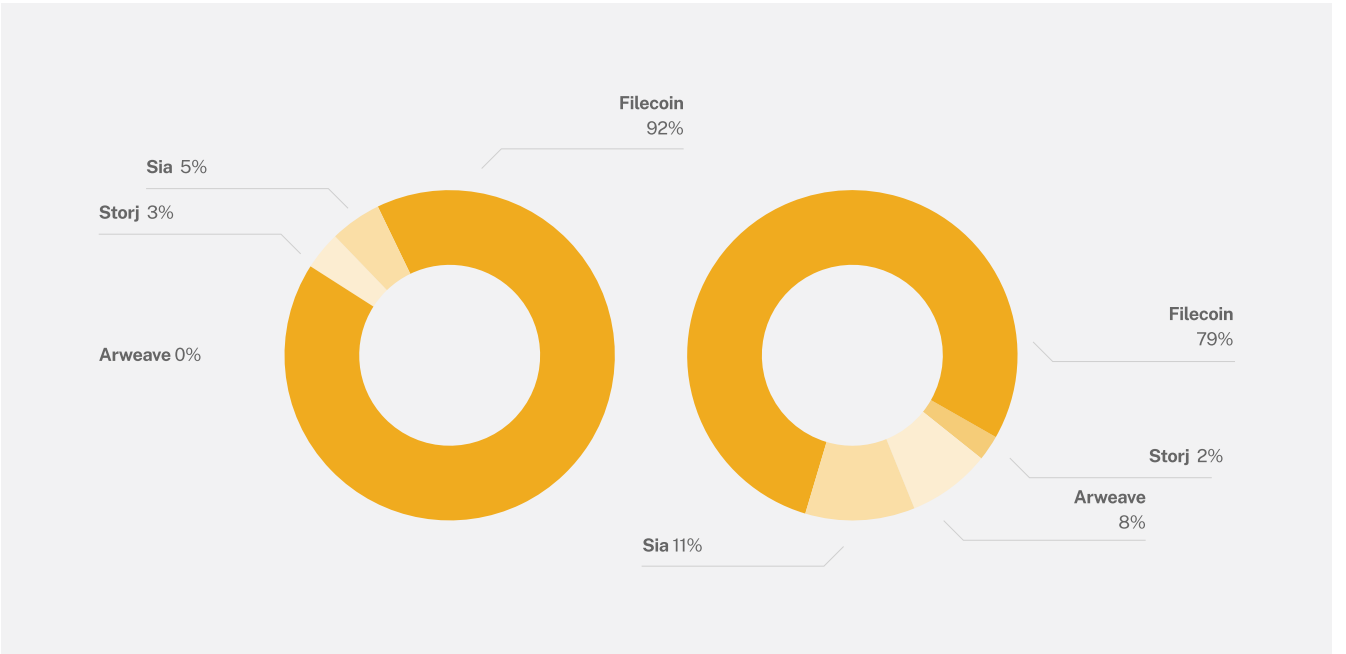


Figure 34:
Total Weave Size

Source:
Arweave, design by 21Shares

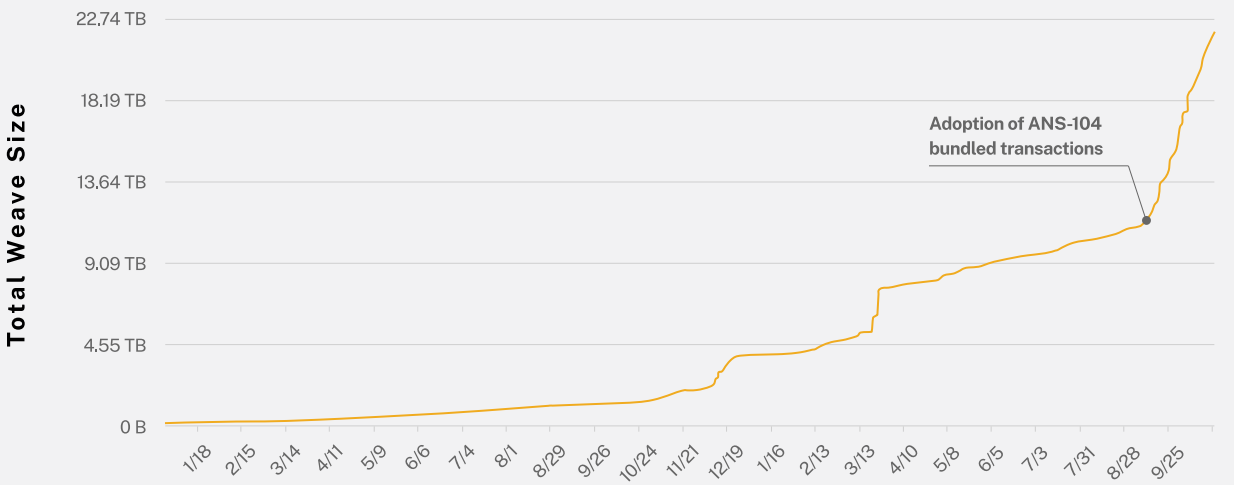
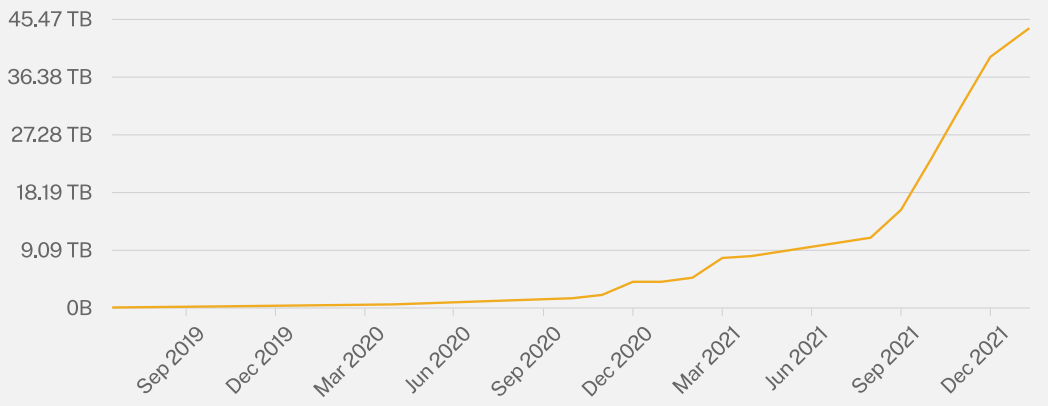


Figure 35:
Total Weave Size Chart

Source:
Arweave, design by 21Shares



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Regulation

We will conclude this publication with our views on regulations, which will likely impact Web 3's pace of adoption.

Concerns about unclear definitions of financial terminologies like "securities" have been the core of that discord, raising question marks on whether the SEC holds all the tools to handle decentralized financial (DeFi) products.

With the motive of protecting investors against fraud, SEC's Chairman Gary Gensler has an iron fist. "I do really fear that we'll keep bringing these enforcement cases, but there's going to be a problem," Gensler told Washington Post's David Ignatius in a livestream right after his testimony before the Senate. "There's going to be a problem on lending platforms or trading platforms. And frankly, when that happens, I think a lot of people are going to get hurt."

What's a security and what isn't?

In 1946, the US Supreme Court received a lawsuit filed by the SEC against a Florida-based citrus company run by William John Howey for not registering any statements to the SEC, thereby violating the Securities Act of 1933. To finance the future developments of his company, Howey sold real estate contracts that gave investors the right to claim profits of the produce tended to and marketed by Howey's enterprise but left no right to the land or to the crop harvested.

To solve the case, the court had to identify the components of a security or an investment contract. It found that an "investment contract" exists when four prongs are fulfilled: an investment of money in a joint enterprise with a reasonable expectation of profits to be derived from the efforts of others.

This conclusion reached by the Supreme Court in 1946 is what is known now as the "Howey test" and has been applied to any contract, scheme, or transaction, even if they don't resemble typical securities. Under the Howey test, form is disregarded for substance, and the emphasis is on economic reality. The Supreme Court has further explained that the term security "embodies a flexible rather than a static principle" to meet the "variable schemes devised by those who seek the use of the money of others on the promise of profits."

Applying the Howey test on digital assets, the first three prongs are easily met, while the fourth creates a blocker. The "efforts of others" represented by the workers in the citrus farms and the Bitcoin miners, for instance, don't seem to compare.

In a conversation with Perianne Boring, president of the Chamber of Digital Commerce, we understand that she is not a fan of the Howey Test. Her primary rhetoric is that the Howey Test was not created with the digital age in mind, having been created almost 80 years ago, decades before the dot-com bubble.

The Chamber of Digital Commerce is an American advocacy group that promotes the emerging industry behind blockchain technology, Bitcoin, digital currencies, and digital assets. In 2019, the Chamber published a statement that condemned the SEC for publishing a framework for "Investment Contract" analysis of digital assets. The verbose guidance was meant to help market participants to be able to identify the investment contracts in their products. Instead, its numerous criteria and little to no reference to which carry more weight than others if triggered make the guidance difficult for practitioners to use with confidence. The Chamber's statement stands relevant three years later, especially now with the SEC's crackdown on cryptocurrencies like Ripple.

"*We are urging the SEC to issue proposed rulemaking on SEC Commissioner Hester Peirce's safe harbor for digital tokens proposal,*" Boring says in a conversation with our researchers. Peirce, also known by the crypto community as "*Crypto Mom*", released a public statement[98] in April proposing amendments to her "*Token Safe Harbor*" originally published in February 2020.

If Peirce's proposal is adopted, crypto companies would be given a grace period of three years to launch their projects before being asked by federal securities laws. Companies would have the time to assess whether their projects meet the criteria to be considered "*decentralized*" or "*functional*." If a project meets neither requirement, they have a few months to become compliant and register their products with the SEC as a security.

But Peirce's Token Safe Harbor isn't a lonely effort to fix the regulatory approach towards crypto and DeFi. The Token Taxonomy Act was drafted by Congressman Warren Davidson and Director of Government Relations at Blockchain Association Ron Hammond, who first introduced the bill in 2018. The Token Taxonomy Act aims to amend the Securities Act of 1933 and the Securities Exchange Act of 1934 and establish more clarity for businesses, consumers, and regulators operating in the growing US blockchain ecosystem. The Act also directs the SEC to enact certain regulatory changes regarding digital units secured through public-key cryptography. The bill specifies that digital tokens are not securities for regulatory purposes and provides for the tax treatment of virtual currencies by excluding from gross income any gains from virtual currency transactions up to $600. It wants to adjust taxation of virtual currencies held in individual retirement accounts, to create a tax exemption for exchanges of one virtual currency for another, to create a de minimis exemption from taxation for gains realized from the sale or exchange of virtual currency for other than cash, and for other purposes.

In December, media reports revealed that Wyoming Senator Cynthia Lummis is preparing to lobby for new legislation to build a new crypto regulatory body in 2022. One of Bitcoin's most vocal supporters on Capitol Hill, Lummis wants to reach a middle ground where regulators and the crypto community meet. It was reported that the legislation would create a new regulatory body, overseen by the CFTC and the SEC. The bill would also regulate stablecoins, establish crypto tax laws, and create consumer protections. If passed, this would mark Congress's first attempts at creating rules broad enough to absorb the crypto space, with its developments and scalability.

Fear of a 100 Billion Dollar Industry Down the Brain Drain

"*I believe that a lighter touch of regulatory approach is what's called for here,*" Senator Daines told Gensler during his testimony before the Senate. "O*ver-regulating this young emerging industry could drive jobs, innovation overseas in the global race which we should all agree on would be a very bad outcome.*"

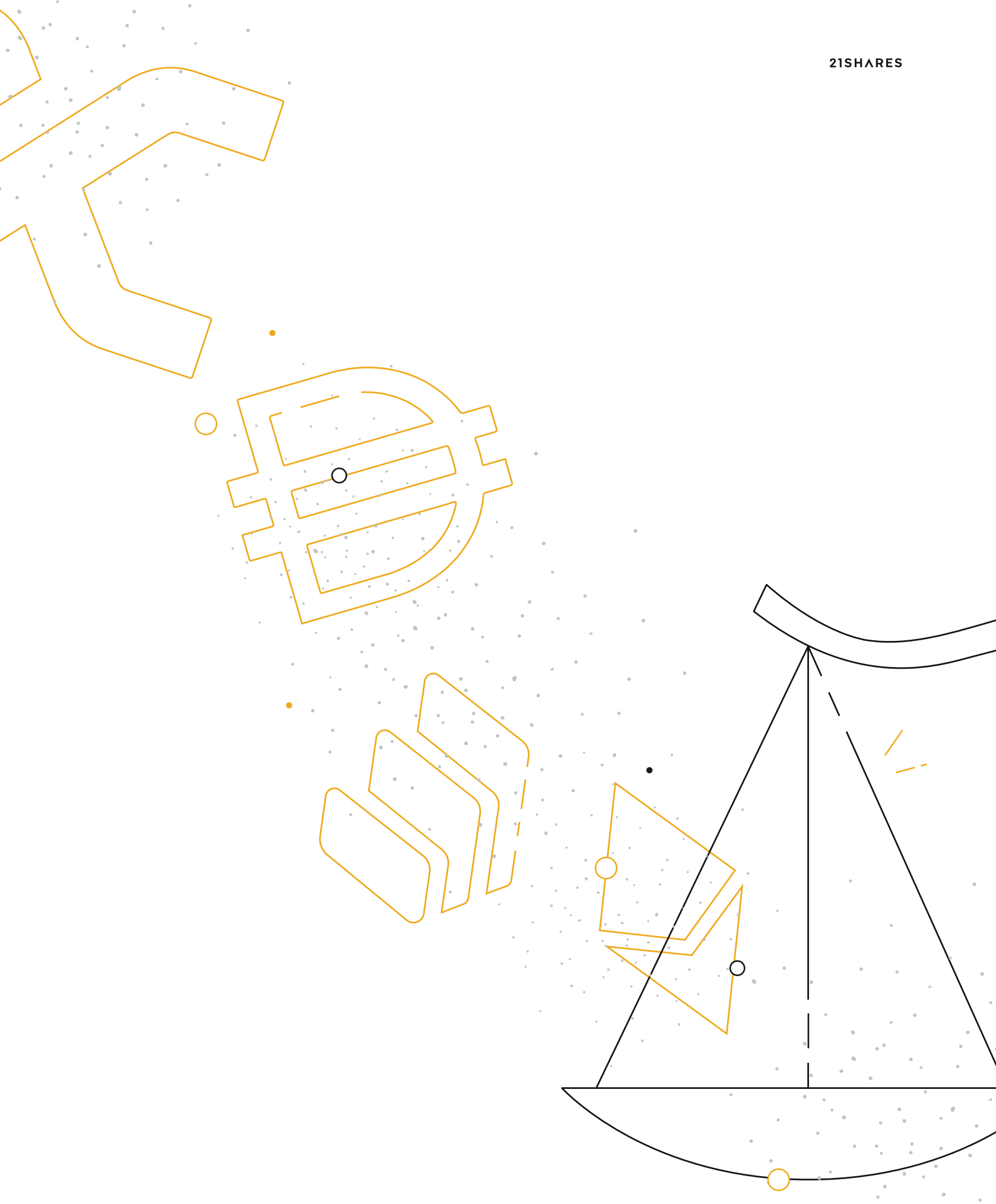
In our previous writings, our thesis reiterated that the regulatory clampdowns on the crypto space in one country would make its crypto workforce resort to another. We've gathered insights from a series of anonymous polls surveying allegedly people working in the US-based DeFi space to materialize our premise.

The findings were as follows. A little more than 75% of respondents perceive the regulatory environment in the US negatively, pushing nearly half of them to likely move headquarters abroad next year by more than 60% chance. The majority of the respondents were split between Switzerland and Canada as their next offshoring destinations. The latter comes as no surprise as both countries have friendly provisions towards the crypto community; they do not tax cryptocurrency holders or traders, to begin with.

"*The lack of regulatory clarity from the SEC and their troubling guidance through enforcement approach is driving business and innovation overseas,*" says Boring, who has seen many crypto companies choosing to move their businesses out of the US and not even allowing US citizens to have access to their products. "*Last time I was in New York, I had a law firm tell me a good part of their time was focused on helping US businesses move out of the US;*" she adds. "*Most of which involve digital assets.*"

As mentioned in our previous issue, DeFi founders could face prosecution if they were found running projects that aren't fully decentralized. Although big players are in jeopardy, new companies in the space will be thrown under the bus. The early stages of DeFi projects start partially centralized until they scale and float fully into the metaverse of decentralization. As they stand, the regulations do not fully absorb that matter.

On the whole, it is a given that the crypto market needs a higher level of regulator clarity for the industry to thrive and eventually fuse into a more comprehensive financial system. Protecting retail investors from frauds and scams while quelling crypto for cybercrime and tax evasion is the only way forward for this technology to gain the credibility and trust it needs to consolidate as an industry. However, considering how embryonic this space is, it is of the utmost importance that regulators keep an open mind and dialogue better to understand some of the sophisticated innovations of Web 3.



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Conclusion

This thesis has outlined the latent potential in Web 3 as an emerging industry. We believe that crypto will continue to present one of the most lucrative investment opportunities over the next decade as it continues to disrupt traditional internet services ranging from financial services, e-commerce, art, games and cloud storage.

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This report provides an in-depth overview of the state of the cryptoasset industry over the last few months — offering our own view on the industry and a recap of the most important news items. In addition, we have included one of our research reports: Our investment thesis on Web 3, The Internet of Value.

The rise of crypto-native applications in the past year spanning from financial services, art, games, and music has created a sub-economy, with its own sectors. We hope that our writing and research can guide you over the next few months by helping you understand the cryptoasset industry better.

State of Crypto Report by
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