



# Crypto Outlook 2023



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# Foreword

“There are decades where nothing happens, and there are weeks where decades happen”, said Lenin. And in the cryptoassets sector, time seems to be going faster than elsewhere.

2022 was hardly an exception. From euphoria to collapse, from success to fraud, from innovation to regulation, topics for analysis are not lacking.

A year ago, we wrote that 2022 would be marked by governments’ interest in Bitcoin. Russia’s invasion of Ukraine precipitated and anchored the trend. Along with other cryptos, Bitcoin has allowed to raise nearly €100 million in donations to Ukraine, while providing Ukrainian citizens with a way to safeguard their savings, even transport it outside the borders. Bitcoin came under the spotlight again after it was banned by the Taliban regime in Afghanistan, while critics paradoxically continue to denounce its use for the purpose of terrorist financing.

Moreover, the main topics in 2022 will very likely continue to drive the debate in 2023: NFT, scalability, decentralised finance on Ethereum, etc. This report provides avenues for thought and analysis on each of the verticals, both in terms of technical infrastructure and market trends.

Importantly, it is also worth mentioning that the momentum around permissioned or private blockchains seems to be losing steam. 2022 was notably marked by the end of iconic consortia such as B3i, or projects such as those of Maersk and IBM relating to traceability, based on these technologies whose added value seems difficult to capture.

Lastly, the past year was an eloquent reminder of the risks associated with the rapid development of an ecosystem. In this respect, we cannot ignore the major event that has disrupted the crypto space : the

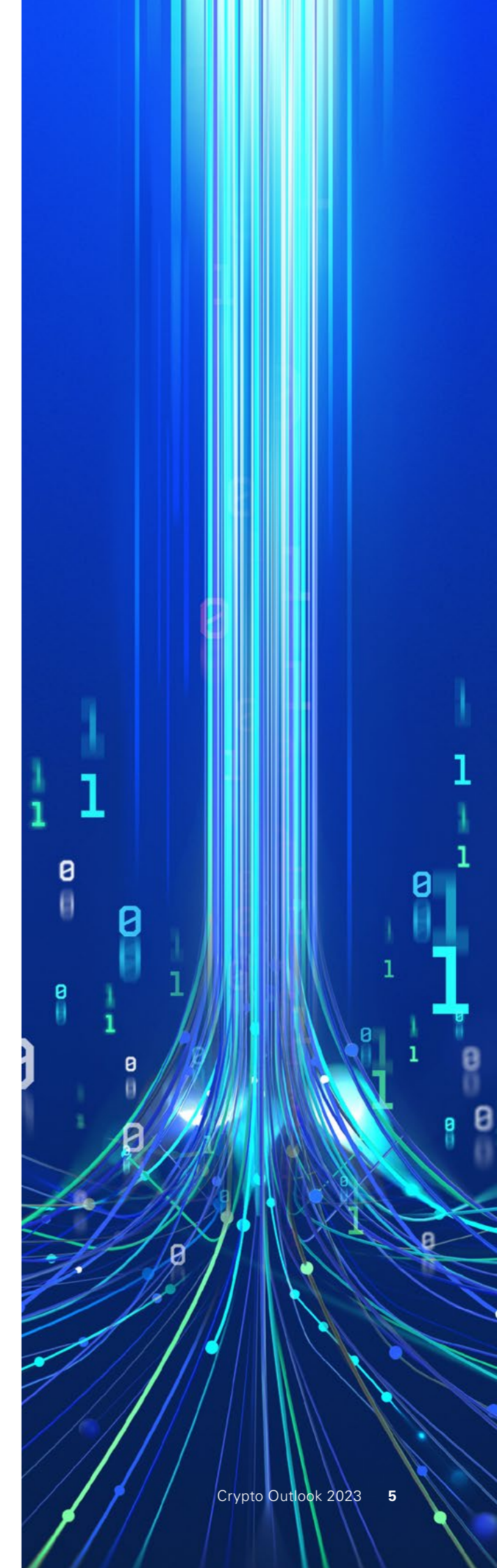
collapse of the centralised exchange platform FTX. “Never in my career have I seen such a complete failure of corporate controls and such a complete absence of trustworthy financial information as occurred here”, „compromised systems integrity and faulty regulatory oversight”, were the words of John J. Ray, the new CEO of FTX appointed to manage the situation and who previously supervised Enron’s bankruptcy. The sudden collapse of this major crypto player, with a domino effect that is probably not over yet, raises questions in many respects: entrepreneurs, investors, regulators, media and politics, and more generally the ecosystem that is developing around these technologies. Introspection is needed to understand how such a situation could occur and what lessons can be learned from it.

However, we must remember that this is a case of alleged fraud, not of calling into question the technology. In this regard, we should welcome the reaction of the European authorities (ESMA, DG Fisma, etc.), which, during a hearing of the European Parliament’s Committee on Economic and Monetary Affairs, sent a clear message: the FTX case is not specific to cryptoassets, and the MiCA text does not need to be urgently amended. The various participants also recalled that the rules relating to the solicitation of European consumers by foreign companies will be strict and that international harmonisation would be the next area of work.

Should we therefore expect an irreversible cataclysm for cryptos in the coming year? Or will this crisis of confidence be, as JP Morgan said, a painful step backwards that could act as a positive catalyst, giving cryptos a second wind? Unlike the European Union, where the regulatory framework seems to be established thanks to the MiCA regulation, the definitions in the United States are still not set in stone. At the end of November, CFTC president Rostin Benham said that

the only cryptocurrency to be considered a ‘commodity’ should be Bitcoin. This would potentially put all others under the supervision of the SEC as ‘securities’, with potentially very significant consequences for an ecosystem that is still under development.

2023 is therefore set to be an exciting and crucial year. But above all, it is likely to put traditional financial players back at the centre of the playing field, as they could benefit from this crisis of confidence and use their expertise to catch up the relative lag versus the pure crypto players. The uncertain macroeconomic environment, inflation, the key rate hikes by the main central banks, as well as the geopolitical tensions complicate the development of players and solutions. In this context, more than ever, risk management, knowledge of the sector, technologies, and the financial challenges will be key assets to define a winning strategy. Our team will continue to share its experience and knowledge with customers wishing to explore the potential of these technological and financial innovations.



# Executive Summary

This report provides a summary of events in the crypto sector in 2022 and presents the analyses of KPMG experts on the Crypto Outlook for 2023, through eight verticals: Bitcoin, Ethereum, alternative blockchains (layer 1), scalability solutions (layer 2), decentralised finance (DeFi), NFTs, metaverses and decentralised storage.

## Bitcoin

- For companies, particularly European companies, **Bitcoin's technological and strategic potential is still misassessed.**
- **It is in countries in crisis, such as Ukraine or Lebanon, that Bitcoin mainly demonstrates its value proposition.** Its safe haven properties are more visible in circumstances where the local banking system is unreliable.
- **However, Bitcoin's volatility is still high,** in light of its limited history.
- **Technological innovation continues** on the Bitcoin infrastructure, with the **prospect of the arrival of stablecoins on the network,** enabling the Lightning Network to compete with traditional payment systems.
- ESG criticisms against Bitcoin are still curbing its adoption by companies. However, in reality, **the Bitcoin network can serve as an economic buffer for wasted energy. The geo-independence of miners even represents an advantage for the energy transition,** since mining could improve the profitability of investments in renewables. In 2023, the public discourse concerning Bitcoin's environmental footprint could see a reversal.

## Ethereum

- **Ethereum remains the benchmark programmable blockchain,** and its technical development is ongoing.
- **From an operational point of view, the "Merge" was a success, with no interruption of the infrastructure.** Furthermore, the new consensus method (Proof-of-Stake) provides Ethereum with a model that is more easily perceived as eco-compatible.
- **Further updates will be needed,** to control the risks arising from the functioning of Ethereum.

## Alternative blockchains

- **Choosing the right blockchain infrastructure is a key condition** for the success of a crypto project.
- **All programmable blockchains alternative to Ethereum are not equal** and several parameters must be taken into account (TVL, cybersecurity, adoption, scalability, decentralisation, etc.)
- Most alternative blockchains underperformed in 2022 and **a multi-chain ecosystem seems less and less likely.**
- **Ethereum, still the dominant platform, has become the standard as a 'settlement layer'** for layer 2 scalability solutions (rollups).

## Scalability solutions (layer 2)

- **The rollups, scalability solutions built on Ethereum, are of paramount importance for any crypto project targeting the general public.**
- There are different types of rollups. **Today, two main categories stand out: the Optimistic Rollups (OR) and the ZK-Rollups (ZKR).**
- **The choice of the best rollup for a crypto project depends on the prerequisites specific to each initiative.**

## Decentralised Finance (DeFi)

- **The self-custody and transparency features of DeFi enabled this industry to be resilient** in the face of the tumultuous events of 2022 in the crypto sector (failures, drop in prices, etc.).
- Given the dominance of centralised stablecoins with a fiat currency collateral, DeFi applications are looking for an uncensorable and decentralised alternative, but are faced with a dilemma. Indeed, there are **two possible strategies and neither really stands out yet: increasing hybridisation with traditional finance, or fully detachment from it.**
- DeFi still has **many avenues for improvement,** for example in terms of the cybersecurity of smart contracts. However, **this vertical remains one of the most attractive to follow in the crypto ecosystem.**

## NFTs

- In a bear market, NFTs followed the trend. However, this difficult context **makes it easier to identify promising projects with real added value.**

- **Various industries (luxury, gaming, etc.) continue to position themselves on this market** and develop strategic thought processes around the use of NFTs.
- Technological innovation enables the emergence of new use cases, particularly in connection with digital identities and **decentralised social networks.**

## Metaverses

- 2022 was marked by the development of 'metaverse' projects, surfing on a **disproportionate marketing trend** and for the most part **ignoring the added value of crypto and blockchain technologies,** by limiting themselves to the creation of online virtual worlds.
- **Some initiatives have nevertheless been successful and suggest real use,** particularly in terms of customer engagement.
- The challenges posed by metaverses require **long-term strategic positioning,** on the condition that the limitations and opportunities involved in these technologies are kept in perspective..

## Stockage décentralisé

- Decentralised storage solutions can represent **an alternative to the Cloud and central databases** for many use cases, including with no direct link to NFTs.
- Existing technologies **are still lacking maturity** (particularly in terms of cybersecurity) and **currently remain difficult to access** for the general public. Nevertheless, their **potential and growth prospects are promising.**
- Companies can begin to understand the stakes of decentralised storage and launch experiments in this area.

# Highlights of 2022

Western Europe<sup>1</sup> was the world's largest crypto market in 2022: individuals and companies combined traded **\$1.3 trillion in value** in crypto over the year and captured **21.9% of global volume**<sup>2</sup>. The Ethereum and Bitcoin networks record **1.08 million and 258 thousand transactions per day**<sup>3</sup>, and it is estimated that more than **320 million users (in the world) hold cryptoassets**<sup>4</sup>. These statistics demonstrate growing adoption within the crypto ecosystem. Nevertheless, in one year, **the market capitalisation, all cryptos combined, fell from \$3,000 billion to \$961 billion**<sup>5</sup>. Understanding this context therefore requires an analysis of the fundamental trends in the various verticals (DeFi<sup>6</sup>, infrastructures, NFTs, etc.). However, before sharing our views and our outlook for 2023, it is important to look back at the news of the past year, which has been full of announcements and twists.

## The context: a bear market that is not slowing down innovation

In an environment diametrically opposed to the euphoria of 2021, the cryptoassets market is about to close **a bear market year**. Valued to date at \$17,120 and \$1,280<sup>7</sup> respectively, **Bitcoin and Ether prices are down 75% from their records, and decentralised finance has seen its TVL** ("Total Value Locked", or the total value processed by a blockchain network) reduced to a quarter, all channels combined<sup>8</sup>. However, the crisis in the crypto ecosystem could also have positive effects. Retrospectively, this represents **a test for the industry and allows us to sort between** the truly innovative initiatives and the more opportunistic projects

with a fragile value proposition.

**The Terra blockchain crash** in May exemplifies this phenomenon with the decorrelation between the value of the TerraUSD stablecoin and that of its collateral, the dollar (depeg); the failure of the Anchor protocol and Interpol's issue of a red notice for Terra founder Do Kwon. **This event opened the way for a major clean-up within the ecosystem**. The ensuing contagion and loss of confidence triggered the downfall of protocols and more traditional companies such as Celsius and Three Arrows Capital. Later, announcements of layoffs by Crypto.com, BlockFi, Kraken and Coinbase – among many others – show that the industry as a whole has been affected. A crisis of confidence is generally caused by irrational business models and flawed tokenomics<sup>9</sup>, and this one will last until crypto players can prove their ability to withstand negative market reversals.

Conversely, decentralised finance (DeFi) was able to take advantage of the environment to come out stronger. Indeed, as with the choice of certain protocols<sup>10</sup> to prohibit the use of UST as collateral for loans, **the principle of transparency and the risk-based approach of DeFi have been highlighted**. As we learned from the collapse of the FTT token and the opacity of synergies between the central exchange FTX and the trading firm Alameda Research, the CeFi (centralized finance) market still faces insolvency risks. Since many players such as Blockfi, Crypto.com, Genesis and Coinhouse were exposed to FTX, this event once again places the transparency and decentralisation of DeFi in a favourable light. In response, platforms such as Binance have chosen to regularly provide **'proofs of**

1 Central, Northern & Western Europe (CNWE), 21 countries – scale taken from Chainalysis's 2022 Global Crypto Adoption Index.

2 „2022 Global Crypto Adoption Index Report. Published on 14/09/2022

3 The Block Data's "Transaction Count" chart.As at 20/11/2022

4 <https://triple-a.io/crypto-ownership-data/>

5 [CoinGecko's Global Cryptocurrency Market Cap as at 09/11/2021 and 2022](#)

6 DeFi - Decentralised Finance

7 [Data from CoinMarketCap as at 01/12/2022](#)

8 [Data from DefiLlama as at 18/11/2022](#)

9 Tokenomics - Combination of Token and Economics, characterises all the parameters of token creation for the proper functioning of a project

10 For example, Aave and Compound

**reserve**, according to a good practice already applied by the Kraken exchange<sup>11</sup>.

In addition, the general gloomy market environment is reflected in the investments. Since the first half of the year, the amount of investments has decreased across all verticals. However, despite the downward trend, investments remained high overall in 2022 (total of \$28.5 billion in Q1, Q2 and Q3)<sup>12</sup>. While there is no shortage of funds, investors appear to be more demanding in terms of value propositions and technological fundamentals<sup>13</sup>. As a result, important round tables continue to take place around innovative and high-potential projects, such as the DeFi protocol Morpho (\$18m raised<sup>14</sup>) and scalability solutions (see section “Ethereum layer 2: a promise become reality”) of the company Starkware (\$100m raised<sup>15</sup>). Moreover, **2022 did not prevent institutional investors from creating new Web3 investment funds**. Sequoia Capital<sup>16</sup> and Eurazeo<sup>17</sup>, for example, deployed \$600 million and \$100 million, respectively, to generate their own sector funds. Although the demise of FTX triggered a healthy challenge of the due diligence<sup>18</sup> needed for investors, and despite a record nearly 2-year low in November<sup>19</sup>, the amounts invested in the crypto sector by venture capital funds in 2022 decreased less than for other verticals in the tech sector (-22% vs. -52%<sup>20</sup>).

## Fundamental market trends, from finance to NFTs

First, it is important to note the **growing interest in crypto services within the traditional financial sector**. Earlier this year, Californian bank Silvergate announced it was acquiring the technological bricks of Meta’s Diem project<sup>21</sup>, and its competitor BNY Mellon participated in the \$550 million fund raising of digital asset custodian Fireblocks<sup>22</sup>. In view of the strategic stakes represented by crypto services, **neo-banks and fintechs have also become interested in the subject**: Revolut, Lydia, Trade Republic and Paypal now offer cryptoasset services. Brazilian neo-bank Nubank, valued at \$23 billion with 65 million users<sup>23</sup>, recorded an inflow of 1.8 million users into its crypto exchange service offering in 2 months<sup>24</sup>. This dynamic on the crypto market, initiated by US and Asian financial institutions<sup>25</sup>, is the response to **growing demand from businesses and individuals** that is now also spreading in the European continent. As an illustration, during the summer, several French banks announced partnerships with specialists in cryptoasset custody solutions. Societe Generale (via its subsidiary Forge) and BNP Paribas chose technology provider Metaco, while Crédit Agricole (via CACEIS) partnered with Taurus. These announcements only concern the custody of ‘security tokens’, i.e. traditional securities circulating on a blockchain in the form of tokens; however, they allow banks to take their first steps in the cryptoasset custody business.

Second, **TradFi (traditional finance) and DeFi (decentralised finance) are no longer at opposing ends and hybridisation is about to begin**. In early Novem-



ber, US bank JP Morgan completed its first transaction on Polygon using a permissioned version of the DeFi protocol Aave, called Aave Arc, launched in early 2022. The Chainproof project is also worth mentioning, initiated by the insurance company Sompo, which offers coverage against protocol hacks on DeFi. The adoption of DeFi is largely driven by stablecoins, which have been the centre of a lot of talk this year. Last October, Tether announced the removal of commercial paper from its reserves<sup>26</sup>. Earlier in the year, the drop in the decentralised stablecoin TerraUSD (UST) confirmed that algorithmic stablecoins are, at best, experimental projects. As a result, **stablecoins with 100% cash collateral, managed by a centralised intermediary, are opening the way to DeFi for corporates**. In 2022, stablecoins confirmed their fundamental place in the crypto ecosystem. Early April 2022 marked the record for total capitalisation of stablecoins<sup>27</sup> and saw the birth of many new tokens, including the Euro Coin (EU-ROC) issued by Circle, the US company also behind the USD Coin (USDC).

Third, **the NFT industry is slowing but remains an important innovation theatre**. Despite a 97% drop<sup>28</sup> in volumes compared to January 2022, the NFT

market, which is cross-industry (particularly B2C), is growing steadily in terms of available solutions and use cases offered. The use of NFTs as a customer loyalty and engagement tool is in vogue in luxury, with partnerships such as the one between Arianee and Yves Saint Laurent Beauté, or the DG Family Boxes of Dolce & Gabbana. In retail, Nike stands out through its initiatives. Its new subsidiary RTFKT, dedicated to Web3<sup>29</sup>, notably had many projects in 2022. In addition, the Beaverton brand announced in mid-November the launch of its new Web3 platform SWOOSH. However, there is **uncertainty hovering over the NFT market, as initiatives do not always result in the expected adoption**. For example, Coinbase’s NFT marketplace, launched last May, counted only around a hundred transactions on the day of its official launch<sup>30</sup>, while a month earlier 4 million people were registered on the waiting list<sup>31</sup>.

Retrospectively, the lack of interest for NFTs in the second half of the year proved beneficial. Indeed, the **sluggish market favoured innovation and highlighted the key success criteria for an NFT**, namely digital scarcity and usefulness. The success of the CryptoSnoos collection issued by the Reddit social network on

11 “proofs of reserve” prove the existence of cryptoassets on ‘on-chain’ addresses belonging to exchange platforms. However, they do not offer any guarantee concerning the financial transactions that trading platforms can carry out on the basis of these assets (loans, collateralisation, etc.). This is why the role of auditors remains essential in this regard.

12 [The Block Research – Blockchain Venture Funding](#)

13 [3Q22 VC Market Update. Summary | by Richard Galvin | Oct, 2022 | Medium](#)

14 [Morpho Labs lève 18 millions de dollars pour développer son protocole de lending innovant \(cryptoast.fr\)](#)

15 [StarkWare Reaches \\$8B Valuation Following Latest \\$100M Funding Round \(coindesk.com\)](#)

16 [Sequoia Capital va créer un fonds de 600 millions de dollars dédié aux cryptomonnaies \(cryptoast.fr\)](#)

17 [TBW #31 : Encore un nouveau fonds Web3 \(thebigwhale.io\)](#)

18 *Due diligence* - A set of procedures carried out to analyse the financial, legal and tax status of the counterparty concerned

19 [VC Monthly Report: Financing Amount in Nov. was only \\$840M, another record low \(substack.com\)](#)

20 [3Q22 VC Market Update. Summary | by Richard Galvin | Oct, 2022 | Medium](#). Data at the end of Q3 2022 compared to the previous year.

21 [Cryptomonnaie : le projet Diem, de Meta, revendu à une banque américaine \(usine-digitale.fr\)](#)

22 [Le spécialiste du crypto-custody Fireblocks lève 550M\\$ - Coins.fr](#)

23 [NuBank Revenue and Usage Statistics \(2022\) - Business of Apps](#)

24 [Cryptos au Brésil : 1,8 million de clients séduits par cette néo-banque en à peine 2 mois - Journal du Coin](#)

25 In 2018, Japanese Nomura and US Fidelity launched crypto custody services

26 [Press release of the Tether foundation - 13 October 2022](#)

27 [Total Stablecoins Marketcap – DefiLlama](#)

28 [NFT Trading Volumes Collapse 97% From 2022 Peak - Bloomberg](#)

29 [Rachat de RTFKT par l'entreprise Nike - Forbes](#)

30 [Chiffres au lancement de la plateforme Coinbase NFT](#)

31 [Coinbase NFT Marketplace Already Has 4M People On The Waitlist \(nftevening.com\)](#)

the Polygon blockchain is the perfect example. Thanks to a simplified user experience<sup>32</sup> and capitalising on an already very strong community spirit among its users, Reddit has registered nearly 3 million Reddit Vault portfolios with a sales volume of more than \$11 million<sup>33</sup>. As with the other verticals of the ecosystem, **2022 therefore represents a test year** during which users and companies were able to somehow separate the wheat from the chaff. Like Reddit's strategy, **the market has valued projects that use NFTs as a "community" technology vehicle.** This trend is also confirmed with the emergence of the first **decentralised social networks**, in particular thanks to the technology proposed by **Lens Protocol** (opened to the public last May). In response to the creation of these applications, Web2 social networks are adapting and investing the building blocks of Web3. Instagram issues NFTs on Polygon<sup>34</sup>, Tiktok does the same on Ethereum via the StarkEx infrastructure<sup>35</sup> (see section *"Ethereum layer 2: a promise become reality"*) and, since its acquisition by Elon Musk in late October, various rumours have been circulating about Twitter's involvement in Web3.

Lastly, the metaverse sector has followed the general trend and institutional investments have continued despite the context. In July, the company "Improbable" raised \$150 million<sup>36</sup> for its Msquared interoperability project and many companies – all industries combined – invested in land in the Sandbox Metaverse (Carrefour, Gucci, AXA Assurance, HSBC), for example. However, the indecision on this market remains strong and the value proposition of the metaverses remains to be determined. Indeed, **confusion between virtual worlds, virtual reality and the crypto metaverses persists.** In crypto metaverses such as Decentraland, **any developer can create an application on a public blockchain, and any user can acquire assets and interact with other bricks of the ecosystem.** These technologies make the metaverse a new commercial venue and are therefore important to justify business investment and evaluate the offer of each project. For example, Epic Games raised \$2 billion in July<sup>37</sup>. However, like its main Fortnite universe, this company only offers a "closed" and centralised virtual experience that cannot be qualified as a metaverse. The launch of new crypto metaverses such as Otherside and Illuvium

in 2022, on the other hand, proves that this market is still growing. Initiatives multiply and Web3 users are increasingly discerning the purely media intentions from investments with a concrete value proposition (e.g. Australian Open on Decentraland, see section *"Metaverses: just a trend or a real technological break?"*)

## The democratisation of interfaces: access to cryptos is becoming increasingly easier

**Centralised exchanges ("CEXs") have gradually engaged in all verticals** and now provide diverse services to their clients. For example, Coinbase and Kraken joined Binance by respectively launching the beta versions of their NFT platforms. Moreover, it is interesting to observe the **evolution of the offer of CEXs for institutional investors.** In July, Coinbase and Blackrock signed a partnership to enable institutional investors to gain exposure to cryptoassets<sup>38</sup>. Since 2019, **the majority of Coinbase volumes are generated by companies**, and this trend has only increased in 2022 (76% in Q1 2022 and 83% in Q3 2022)<sup>39</sup>.

Furthermore, in 2022, **self-hosted ("non-custodial") wallets also improved their services** in terms of interoperability and especially UX, with interfaces that allow users to visualize new tokens or directly view their NFTs on all blockchains. Last November, the company Consensus announced its new Metamask Bridge offering, which will benefit from a bridge aggregator<sup>40</sup> directly in the Metamask wallet. Wallet aggregators such as Zapper, Debank, Zerion, or more recently Metamask and DefiLlama, offer a unique interface to track and manage one's entire activity on Web3 across all blockchains. In addition, aggregators are seeking to diversify their services by offering a social dimension, illustrated by the decentralised messaging project Debank Hi.

As such, we are seeing **a democratisation of the Web3 infrastructure and a lowering of barriers to entry.** However, the cybersecurity of the ecosystem

remains a significant area for improvement. On 28 June 2022 we published a report<sup>41</sup> on the current situation with respect to the ecosystem's vulnerabilities. We mentioned **a lack of experts capable of conducting smart contract audits around the world**, as well as a total value of \$1.2 billion in hacks against DeFi protocols in Q1 2022 alone. At the beginning of August, Chainalysis estimated that bridge attacks represented 69% of total funds stolen so far in 2022<sup>42</sup>, notably with attacks on Poly Network (\$611m)<sup>43</sup> and Wormhole (\$326m)<sup>44</sup>.

## Infrastructures that are evolving to strengthen the pillars of the crypto ecosystem

In addition to the market movements, which are often more publicised, the fundamentals of the crypto ecosystem continued to develop in 2022.

On the Ethereum side, the **"Merge"** update, already theorised in 2014 by Vitalik Buterin (founder of Ethereum) and awaited for years, was successfully completed on 15 September. It consisted of a **change in Ethereum's consensus mechanism**, from 'proof-of-work' (PoW) to 'proof-of-stake' (PoS). This new consensus mechanism allows any player holding 32 Ethers (\$40,960 at the price on 1 December) to "stake" or sequester them in the Ethereum network, and thereby receive compensation as network validator. Thus, with a **theoretical 99% reduction in the energy consumed** by the network consensus mechanism<sup>45</sup>, Ethereum can eliminate the main argument used against it by competing infrastructures (Polygon, BNB

Chain, Tezos, etc.). This change also makes it possible to promote its adoption by large companies that are exposed to the criticism related to CSR requirements. Moreover, following the **"Merge," Ethereum's monetary policy has become less inflationary, even deflationary**, in periods of intense traffic on the network.<sup>46</sup> The proof-of-stake on Ethereum ensures an annual rate of return of around 5% for the staking of 15 million<sup>47</sup> ETH at the time of writing this report. Since its application, this new consensus mechanism has driven the emergence of a **new industry: that of "staking", with unprecedented business opportunities.** Some companies, such as EDF, through its subsidiary Exaion, have announced that they are investing in this industry by deploying their own nodes<sup>48</sup>. However, in the future, the majority of players are likely to go through centralised exchange platforms such as Coinbase (13.6% of ETHs staked) or decentralised staking protocols such as Lido (29.7% of staked ETHs)<sup>49</sup>, which are also directly accessible via the main self-custody solutions for cryptos (Fireblocks, Ledger Enterprise, etc.). **This creates risks of recentralisation**, which should be monitored in 2023.

These risks are **especially significant in light of the sanctions imposed on 8 August 2022 by OFAC**<sup>50</sup> against the Tornado Cash protocol, accused of favouring cryptocurrency movements for money laundering purposes<sup>51</sup>. In the days following the announcement by the US authorities, **this decision triggered a real cascade effect** within the Ethereum ecosystem. For example, this sanction motivated the stablecoin issuer Circle to blacklist those addresses<sup>52</sup> having interacted with Tornado Cash. Similarly, it led decentralised protocols such as DyDx to censor certain addresses<sup>53</sup>. Following the announcement of OFAC's sanctions, widely exceeding US jurisdiction, a developer of Tornado

32 "User experience": Reddit has invisibilised crypto terms, supports customers with simple user paths and has optimised the front-end by integrating its own Reddit Vault wallet into Reddit

33 [Reddit Collectible Avatars \(dune.com\)](https://dune.com)

34 [Meta choisit Polygon pour permettre la création de NFT sur Instagram \(cryptoast.fr\)](https://cryptoast.fr)

35 [TikTok launches first creator-led NFT collection | TikTok Newsroom](https://tiktok.com)

36 [Improbable lève 150 millions de dollars pour développer l'interopérabilité des metaverses \(cryptoast.fr\)](https://cryptoast.fr)

37 [Le studio Epic Games lève 2 milliards de dollars pour bâtir un metaverse \(cryptoast.fr\)](https://cryptoast.fr)

38 [Coinbase selected by BlackRock: provide Aladdin clients access to crypto trading and custody via Coinbase](https://theblock.co)

39 [Coinbase's Volume by Customer Segment \(theblock.co\)](https://theblock.co)

40 Bridge - A smart contract that allows you to transfer value from one blockchain to another

41 [Cybersecurity for Blockchains and Cryptos 2022 - KPMG France \(home.kpmg\)](https://home.kpmg.com)

42 [Cross-Chain Bridge Hacks Emerge as Top Security Risk \(chainalysis.com\)](https://chainalysis.com)

43 [Rekt - Poly Network - REKT](https://rekt.com)

44 [Rekt - Wormhole - REKT](https://rekt.com)

45 [Ethereum Energy Consumption Index - Digiconomist](https://digiconomist.com)

46 <https://ultrasound.money>. This is possible because the destruction of outstanding tokens (in times of network congestion) is greater than the issue of new ethers to compensate the block validators. Indeed, in PoS, the costs to bear to become a validator are lower than the costs paid by miners in PoW. The level of yield required to ensure the decentralisation of the network is therefore lower in PoS compared to the PoW.

47 [Open Source Ethereum Blockchain Explorer - beaconcha.in - 2022](https://beaconcha.in)

48 [EXCLUSIF : EDF gère plus de 150 noeuds Ethereum \(thebigwhale.io\)](https://thebigwhale.io)

49 [Beacon Chain Deposits | Etherscan](https://etherscan.io)

50 OFAC - Office of Foreign Assets Control

51 Generally, blockchains are only very marginally used for illicit activities, as network transparency does not allow for concealing illegal transactions. However, the so-called "mixer" protocols like as Tornado Cash are able to increase the level of confidentiality of transactions, by concealing the link between the payer and the recipient of the payment.

52 [Circle freezes blacklisted Tornado Cash smart contract addresses \(cointelegraph.com\)](https://cointelegraph.com)

53 [La plateforme de trading dYdX gèle les comptes des clients ayant interagi avec Tornado Cash \(cryptoast.fr\)](https://cryptoast.fr)

Cash was even arrested<sup>54</sup> in the Netherlands for simply writing on-chain code. For information, according to a Chainalysis report, 72% of the transactions processed by Tornado Cash have completely legal purposes<sup>55</sup>.

Despite some difficulties due to the evolution of its network, **Ethereum remains the major leader in the “layer 1” programmable blockchain market**, with 57.56% of TVL all chains combined<sup>56</sup>. In comparison, the majority of alternative blockchains (three examples of which are provided below) are struggling to gain credibility and attract users.

- The **collapse of the Terra blockchain** last May illustrates the failure of a non-resilient value proposition in a context of falling prices.
- **Solana’s 7 service outages**<sup>57</sup> over the year as well as its links with FTX and Alameda Research<sup>58</sup> cast doubt on the future of this infrastructure.
- **The BNB Chain (formerly Binance Smart Chain) was stopped arbitrarily** on 7 October<sup>59</sup> by the 26 validators of the chain (versus more than 400,000 for Ethereum). As a reminder, this voluntary shutdown is intrinsically contrary to the theoretical properties of a blockchain. The smaller the number of validators in a blockchain, the more it is subject to censorship and goes against the fundamental principles of decentralisation and security.

However, it should be noted that **not all blockchains are equal** and that there are exceptions, such as Polygon, whose Foundation raised \$450 million in February<sup>60</sup> and attracted numerous new projects in 2022 (e.g. Instagram’s NFTs<sup>61</sup>); or Cosmos, which evolved remarkably during the year (see section “*Alternative blockchains to Ethereum: many competitors, but few*

*winners*”) and thus attracted protocols such as Dydx<sup>62</sup>, originally developed on Starkex, a scalability solution built on Ethereum.

With regard to scalability solutions or so-called ‘layer 2’ infrastructures, 2022 also saw very significant developments. In particular, the growing adoption of ‘rollups’ (see section “*Ethereum layer 2: a promise become reality*”) confirms the dominance of the modular blockchain model, based on the separation of different technical functions (data availability, processing of operations and consensus mechanisms to ensure alignment between members of the decentralised network), contrary to the traditional, more monolithic paradigm. Some projects such as Celestia, which raised 55 million on 20 October<sup>63</sup>, even make this new paradigm a business model, offering a layer 1 blockchain with a natively modular architecture. **The layer 2 market in 2022 was notably dominated by Arbitrum and Optimism**, which account for 62% and 34.9%<sup>64</sup> of the total layer 2 crypto TVL, respectively, while their mainnets were only launched in May<sup>65</sup> and December<sup>66</sup> 2021, respectively. Arbitrum is now fifth in the ranking of all blockchains combined, ahead of Avalanche and Solana in terms of TVL (2.24% of total TVL, all chains combined)<sup>67</sup>. **Some applications are now developing natively on L2s**, such as GMX (trading) on Arbitrum and Illuvium (gaming-metaverse) on ImmutableX, in turn built on layer 2 StarkEx. Lastly, **the adoption of these layer 2 blockchains opens the door to new technological innovations for 2023**, in particular with regard to wallets with ‘account abstraction’<sup>68</sup> and the mobile ‘hardware signer’ on Braavos<sup>69</sup>.

Parallel to the development of new infrastructures, particularly within the Ethereum ecosystem, **2022 definitively closed the debate on private DLT technologies**. The list of projects built on these bases, and

54 [Arrest of Crypto Privacy Mixer Tornado Cash Developer Draws Dutch Community Protest \(coindesk.com\)](#)

55 [OFAC Sanctions Popular Ethereum Mixer Tornado Cash for Laundering Crypto Stolen by North Korea’s Lazarus Group - Chainalysis](#)

56 [All Chains TVL - DefiLlama as at 28/11/2022](#)

57 [Solana Status - Incident History](#)

58 [Solana : le projet finalement exposé à FTX, SOL tombe en disgrâce - BeinCrypto France](#)

59 [Binance : Hack géant sur la BSC ? La blockchain à l’arrêt - Journal du Coin](#)

60 [La solution de seconde couche Polygon \(MATIC\) lève 450 millions de dollars \(cryptoast.fr\)](#)

61 [Meta to Let Users Mint and Sell Polygon-Powered NFTs on Instagram — Polygon | Blog](#)

62 [Announcing dYdX Chain](#)

63 [Crypto : Celestia annonce une levée de fonds de \\$55 millions \(coinacademy.fr\)](#)

64 [Rollup TVL - DefiLlama](#)

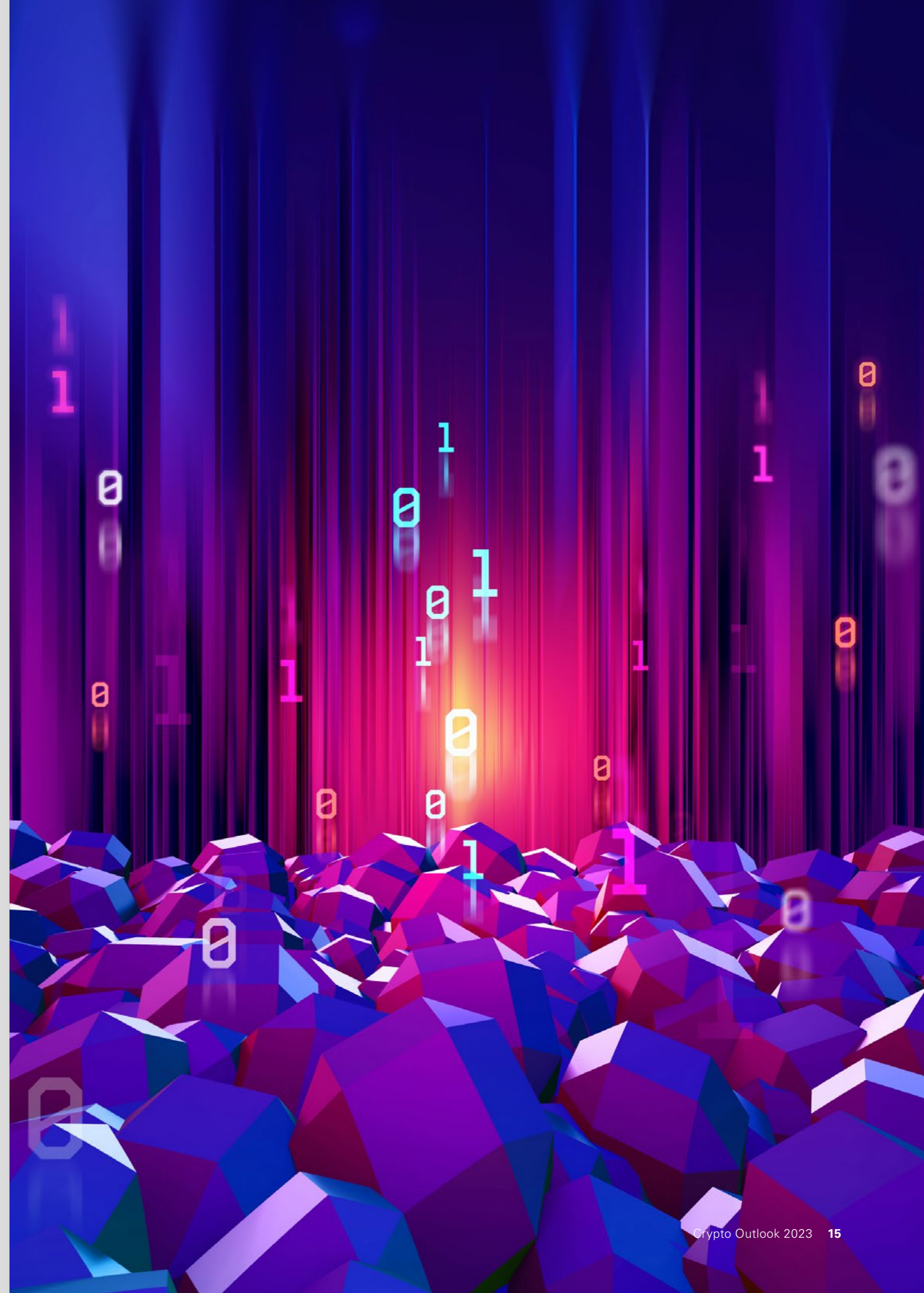
65 [What is Arbitrum? • Layer 2 on Ethereum • Benzinga](#)

66 [What is Optimism \(OP\) Layer-2 Blockchain? \(coindcx.com\)](#)

67 [All Chains TVL - DefiLlama](#)

68 Account abstraction allows a smart contract to be the first-level account that pays fees and initiates the execution of transactions.

69 The first physical wallet (hardware) on mobile that uses secure smartphone enclaves: [Braavos - StarkNet Wallet](#) : “*Braavos new Hardware Signer capability is a game changer*”





having ultimately failed, grew further over the past year. For example, the consortium of B3i insurers initiated in 2016, which announced at the end of July 2022 the cessation of its activity<sup>70</sup>, or the Maersk traceability project in collaboration with IBM, which ended at the end of November<sup>71</sup>. Despite the residual use of private blockchains such as Hyperledger Fabric, Quorum and Corda, **this change in conviction within the industry demonstrates the evolution and maturity of the market.** New initiatives now prefer to break with the trend and directly opt for a public blockchain, with the option of a layer of control introduced at the application level, rather than the infrastructure. Traditional players that have built use cases on private blockchains are now investing in public blockchains, in order to take advantage of the current liquidity and already existing uses and technical tools. For example, the DeFi experiment of JP Morgan (creator of the Quorum infrastructure) on the Polygon blockchain<sup>72</sup> in November is an important signal.

Lastly, in view of the rapid development of Web3, **the question of decentralisation is also emerging, and increasingly so, with regard of data storage and management.** Indeed, despite the adoption of blockchain technology, the traditional centralised method of hosting data creates **significant risks of censorship.** On 9 May 2022, the Youtube platform, for example, banned the online information channel Bankless and thus blocked access to more than 10,000 hours of crypto and Web3 content overnight<sup>73</sup>. Such data vulnerability is an Achilles heel for a Web3 ecosystem built on the values of decentralisation, immutability and transparency. However, as blockchains are not intended to store data, a growing number of players are currently working on the development of alternative solutions. The IPFS network and its WEB3. Storage application overlay, which provides attractive UX features, thus continue to broaden their usage, like rival Arweave, which will soon be used by Meta to store the metadata of the NFTs issued by Instagram on the Polygon blockchain<sup>74</sup>. This is a vertical still with low maturity, but that will be interesting to monitor in 2023 (see section “Decentralised storage: high potential under the radar”).

## Harmonisation of the jurisdiction and competition of the European crypto industry

2022 was also full in terms of progress and announcements from a regulatory point of view, particularly at the European level. At the end of June 2022, **two provisional agreements on cryptoassets were reached between the French Presidency of the European Council and the European Parliament**, on the **MiCA (Market in Crypto-Assets) Regulation and TFR (Transfer of Funds Regulation)**. On 10 October 2022, these texts were approved by the Committee on Economic and Monetary Affairs. Both texts must now be translated into all EU languages and submitted to a final vote by Parliament in preparation for publication in the Official Journal in early 2023. Industry players will then have between 12 and 18 months to comply. **These texts will therefore not enter into force before 2024.**

**The MiCA regulation provides a framework for all cryptoasset services at the European level.** For this purpose, a new CASP (Crypto Asset Services Provider) regime, based on the French PSAN (*Prestataire de Services sur Actifs Numériques*) system has been put in place. Through this CASP status, this regulation aims to harmonise the legal framework governing European companies in the crypto industry. During 2022, the MiCA regulation evolved significantly in view of the complexity of the topic. In the end, MiCA excluded Decentralised Finance (DeFi) from its scope and does not regulate all NFTs in the same way, independently of the underlying asset. MiCA's relative proportionality is reflected in the approach to environmental issues and demonstrates the **willingness of regulators to understand and gradually regulate these technologies.** Indeed, while the threat of the ban on Bitcoin's proof of work<sup>75</sup> hovered over Europe at the beginning of the year, regulators finally opted for ESG transparency requirements. CASPs must now detail the environmental footprint of the various services they will provide to the authorities and their clients.

Despite these advances, **disagreements persist** between ecosystem players and regulators. First of all,

a real question of scope arises. The resulting stakes are very high and players in the ecosystem are **still vulnerable to new adaptations to the precise scope of regulatory exemptions**, particularly for NFTs. The second major noteworthy point is the framework for stablecoins, which is very strict and inspired by the traditional finance industry. Following the collapse of the stablecoin UST on the Terra blockchain, **regulators decided to house all stablecoins under the same brand**, regardless of their architecture. This choice goes against the exemption granted to DeFi and is a major constraint for new entrants and European players. In particular, a clause in the MiCA regulation allows the ECB to have a veto right against any stablecoin that could potentially affect the stability of the eurozone<sup>76</sup>. This regime reflects the EU's great distrust of private players wishing to issue stablecoins and will probably favour the issue of stablecoins by traditional banking institutions. Like the Euro Coin (EUROC) issued by Circle, the adoption of a euro stablecoin issued by an American consortium represents a real risk for sovereignty.

**The TFR reinforces the KYC obligations of CASPs** and requires them to monitor their users' transactions. For the CASPs, **this means collecting, storing and communicating users' private information to the authorities for the exchange of any value.** This 'travel rule', inspired by traditional finance, applies regardless of the amount of the transaction between two CASPs, from the €1,000 threshold between a CASP and a Metamask-type self-hosted portfolio, and does not apply to transactions between two self-hosted portfolios. It aims in particular to strengthen anti-money laundering and combating the financing of terrorism (AML/CFT) measures. However, it also raises important points. First, the TFR requires CASPs that deal with self-hosted portfolios to recover the identity of the owner of this 'self-hosted wallet'. However, there is currently no technical solution for exchanging such information between a self-hosted portfolio and a CASP. Moreover, **just like a traditional physical wallet, a self-hosted digital wallet is by nature not intended to develop a KYC file.** Secondly, the TFR also raises the issue of competitiveness. Indeed, this almost systematic 'travel rule' for CASPs **favours large-scale players to the detriment of small ones.** While large players will be able to easily comply by developing tools internally, small businesses will have to partner with solutions developed by some of their direct competitors (i.e. Coinbase TRUST).

These two European regulations therefore have positive consequences for the ecosystem. First of all, **Europe is giving itself appeal by showing the world its avant-garde legal stance on the subject.**

The uniformity and regulatory clarity offered by this framework on the European market are real advantages. What's more, there is a strong chance that, while trying to be more attractive, **the rest of the world will use the MiCA & TFR as inspiration for their regulation.**

**However, these regulations must also leave room for innovation** in order to enable European players to remain competitive in the race for sovereignty on Web3. Indeed, regulating the crypto industry as a traditional financial industry, not as a brand-new industry, could **significantly impact its ability to build the crypto market of tomorrow.** This trend towards alignment with financial regulations is a difficult shift to negotiate for new European crypto players, which are thus facing significant constraints. First, **these regulations tend to favour the traditional financial industry.** While the 'travel rule' applies to all transactions between two CASPs, the threshold is €1000 for transactions between two traditional financial institutions (e.g. banks). Secondly, **these regulations could trigger reverse solicitation of the European market.** The heavy requirements for European players could generate asymmetry in competition with foreign players. There is no travel rule yet outside the eurozone and a foreign player not registered as a CASP could still address the European market as long as it does not directly solicit it from a commercial point of view. **These measures therefore do not necessarily support new players in the development of a European crypto market, and risk giving the advantage to the development of international competition.**

Lastly, France was able to benefit from this by acting as a model for Europe with its PACTE law and its PSAN status. This advantageous positioning for France is reflected in well-equipped companies and professional groups such as the association for the development of digital assets ADAN (*Association pour le Développement des Actifs Numériques*).

70 [B3i : le « consortium blockchain » des assureurs dit stop | Silicon](#)

71 [Maersk, IBM discontinue shipping blockchain platform | Reuters](#)

72 [JPMorgan \(JPM\) Had Its First Live Trade on Public Blockchain Polygon - Bloomberg](#)

73 [Bankless Crypto Channel Banned From YouTube \(coindesk.com\)](#) : YouTube then said it was an error and restored the Bankless account. However, this episode marked minds by exposing the need for an alternative in terms of data storage and online content.

74 [Instagram - Arweave \(AR\) sélectionné par Meta pour le stockage de ses NFTs - CryptoActu](#)

75 [Today's EU MiCA vote could ban exchanges from listing proof of work crypto assets \(cryptoslate.com\)](#)

76 [MiCA – EU reaches agreement on the crypto-assets regulation \(cliffordchance.com\)](#)

## The inertia of the ecosystem's flagship

Bitcoin remains the subject of much debate in 2022, the outcome of which is not yet unanimous in the eyes of public opinion. However, given the disproportionate media attention on other topics, such as the metaverses, the absence of Bitcoin in this summary of 2022 highlights could have passed almost unnoticed. In reality, **Bitcoin continues to be the fundamental pillar of the crypto ecosystem, due to its value proposition and more than a decade of existence.** At the end of the year, Bitcoin is the 28th highest valued asset in the world in terms of market capitalisation (\$318bn)<sup>77</sup>; a bitcoin unit is valued at \$17,120<sup>78</sup>, and the network has more than 19 million bitcoins mined out of 21 million<sup>79</sup>.

The complicated geopolitical context of 2022 has consolidated Bitcoin's value proposition. First, **the war in Ukraine highlighted the usefulness of Bitcoin as an alternative medium of exchange.** For many Ukrainians who suddenly found themselves without access to their bank accounts, or had to flee their country in an emergency, Bitcoin's lack of borders and uncensorable nature proved to be very practical<sup>80</sup>. Second, due to its deflationary model and limited units in circulation, Bitcoin is used as a hoarding tool in countries like Turkey<sup>81</sup> that have undergone an extreme devaluation of their national currency. Of course, Bitcoin's performance as a safe haven asset is to be nuanced, given the decline in its price in 2022. It is nonetheless still a **young asset that is consolidating.**

In addition, Bitcoin's financial performance should be viewed in light of its technological performance in 2022. Despite a decline between November and December, the network's 'hashrate'<sup>82</sup> increased<sup>83</sup>, demonstrating a higher level of infrastructure security. Furthermore, its adoption continues, and the network records 260,000 transactions per day<sup>84</sup> with more than

990,000 active addresses per week<sup>85</sup> at the end of November – roughly the same as at the all-time high in November 2021. This demonstrates that, despite lower returns, and a disadvantageous geopolitical context for miners with the rise in energy prices, **Bitcoin's technological fundamentals are resilient.** 2022 is also synonymous with the structuring of the Lightning Network (see section *"Bitcoin: a continuing trend, with some ups and downs"*), with initiatives such as Lightspark (launched by the former CEO of Libra, David Marcus) to support companies wanting to use this infrastructure, on the one hand, and on the other hand the arrival of the Taro protocol, which will soon allow the issue of assets such as stablecoins on the Bitcoin blockchain.

Furthermore, **the value of Bitcoin as an uncensorable exchange system was strengthened in 2022.** While just over a year ago China was banning bitcoin transactions, it was Afghanistan's turn to ban this asset in September 2022. These decisions can be explained by the **decentralised and transparent nature of the Bitcoin network**, which is not readily compatible with the intentions of these States to keep control over internal monetary flows. As a result, 2022 opposed Bitcoin to the various CBDC (Central Bank Digital Currency) projects. The Chinese government has already broadened the use of the digital Yuan across much of its territory<sup>86</sup>, and Nigeria has launched eNaira in response to the growing interest of the population for cryptoassets. Seen as a threat by the Nigerian government, cryptoassets nevertheless recorded a 35% adoption rate by the Nigerian adult population<sup>87</sup>, while the eNaira has not exceeded 0.5%<sup>88</sup> since its launch.

International institutions for their part are still reticent towards this digital asset; the IMF, for example, which last January asked El Salvador to stop using Bitcoin as a legal currency. Despite this, El Salvador's president Nayib Bukele recently announced a DCA policy<sup>89</sup> on Bitcoin<sup>90</sup>, and intends to offer, through his new national Bitcoin office (ONBTC), low-rate bitcoin loans for small

and micro-enterprises in the country<sup>91</sup>. Furthermore, the Minister of the Economy of El Salvador submitted a draft bill at the end of November that would pave the way for so-called 'Volcano bonds' or 'Bitcoin bonds'<sup>92</sup>. This new and controversial type of government bond issue would represent an alternative method of financing, and its outcome, whether positive or negative, could create a precedent for other emerging countries.

77 [Infinite Market Cap \(8marketcap.com\)](#)

78 [Cours de Bitcoin, graphique de BTC et capitalisation boursière | CoinGecko](#)

79 [How Many Bitcoins Are There? \(Circulating Supply - Live\) \(buybitcoinworldwide.com\)](#)

80 [Post | LinkedIn](#) – Philipp Sandner

81 [TRY/EUR 0,0516 \(▲0,000011 %\) | Google Finance](#)

82 Hash Rate - Key security measure on a blockchain network governed by a proof-of-work consensus. The higher the hashrate (calculation) of the network, the higher its security and overall resistance to attacks.

83 [Blockchain.com | Charts - Total Hash Rate \(TH/s\)](#)

84 [Transactions per Day \(transactionfee.info\)](#)

85 [Number of Active Addresses \(7DMA\) \(theblock.co\)](#)

86 [La Chine étend son yuan numérique à quatre nouvelles provinces \(siecledigital.fr\)](#)

87 [Nigerians Pile Into Bitcoin, Crypto: KuCoin Report - Bitcoin Magazine](#)

88 [eNaira struggles with 0.5% adoption rate amid Nigeria's high ranking in crypto use | Pulse Nigeria](#)

89 DCA – Dollar-Cost Averaging: Buying an asset at regular intervals to protect against its volatility

90 [Le président du Salvador va acheter un bitcoin par jour dès vendredi \(bfmtv.com\)](#)

91 [Le Salvador proposera des prêts à taux bas en Bitcoin \(BTC\) pour les petites entreprises \(cryptoast.fr\)](#)

92 [Crypto Outlook 2022 - KPMG France \(home.kpmg\) \(cf. p. 14\)](#)

# Outlook for 2023

## Bitcoin: a continuing trend, with some ups and downs

The adoption of cryptocurrencies continues, for both individuals and businesses, with a variety of use cases ranging from NFTs to decentralised finance, from staking to payment. However, **companies, particularly in Europe, remain very wary of Bitcoin.**

### Bitcoin in a system in crisis

Inflationary economic environment, geopolitical conflicts, probable recession and energy crisis are all key factors that echo the context of the emergence of Bitcoin. As a reminder, Bitcoin was designed in a period of financial instability following the subprime crisis in 2008. 2022 therefore represents a real scenario for Bitcoin's value propositions.

On the economic front, we are now witnessing a major return of inflation. Countries most affected include Lebanon and Turkey, as well as Western States, with a global average of around 8.8%<sup>93</sup>. According to our estimates, more than 2.3 billion people are living under double-digit inflation. The expansionary monetary policies of recent years, exacerbated by the pandemic, have had a negative impact on one of the main value propositions of official currencies, namely the ability to transport value over time. **Bitcoin, with its limited quantity of 21 million units and deflationary monetary creation model, has recreated a scarcity system and can be seen as a tool for long-term value reserve.** However, this feature as a value reserve struggled to be asserted in 2022, with the liquidity contraction on the markets and the subsequent 65% drop in the value of Bitcoin since 1 January. **Bitcoin is still a young and volatile asset.** This is why it struggles to keep its promise as a value reserve and as an anti-fragile asset.

Nevertheless, even with a significant loss of value, Bitcoin is having major success in some countries, such as Lebanon, which is in a situation of hyperinflation, where the national currency has lost more value and confidence. Bitcoin is seen as a viable alternative to preserve value because of 158% inflation on the local currency<sup>94</sup>. In a reality in which banks are preventing residents from withdrawing their funds, Lebanese people have

massively turned to cryptos<sup>95</sup>, which cannot be blocked by institutions. **It is within crisis systems that Bitcoin and cryptocurrencies most easily demonstrate their value proposition, making it possible to secure and exchange value peer-to-peer without a trusted intermediary.** Moreover, with a return of inflation in Western countries, Bitcoin's value preservation proposition is also finding new appeal, as the population is seeing its savings drastically devalued in a short time.

### Bitcoin: an international currency?

2022 was also marked by a particularly difficult geopolitical context, notably due to the outbreak of the war in Ukraine. This conflict has reshuffled the maps of international trade and brought monetary issues back into the debate. In this context, Bitcoin and cryptocurrencies, as currencies without borders and uncensorable, enjoyed success. They made it easy to transfer value internationally with, for example, donation campaigns to Ukraine in the amount of \$100 million<sup>96</sup>. However, at the monetary level, geopolitical instability especially benefited the dollar, which was used more as a safe haven currency against other currencies.

This geopolitical context is therefore weighing on fiat currencies and impacting the power synergies between these sovereign currencies. We note the attempts to shift global dynamics, with, for example, Saudi Arabia opening up the possibility of accepting the yuan for oil trade, which was almost exclusively in dollars<sup>97</sup>. **With increasing competition among currencies, Bitcoin could see its place grow internationally, as a cross-border means of payment and as a neutral and inalienable currency.**

### A galvanisation of Bitcoin fundamentals

In terms of its fundamentals, Bitcoin continues to grow and strengthen. In recent years, **several updates have been made to the network to improve its scalability, enabling new features to be added without compromising security.** Indeed, Bitcoin has evolved significantly since its creation, as the majority of the network now uses the latest updates. As such, 85% of transactions follow the specifications of the SegWit update to benefit from more scalability (+61%) and fees reduced by 40%<sup>98</sup>. With regard to the latest innovations, the Taproot update, which arrived at the end of 2021, expands the field of possibilities on Bitcoin remarkably.

93 [World Economic Outlook \(October 2022\) - Inflation rate, average consumer prices \(imf.org\)](#)

94 [Lebanon Inflation Rate 2022 | Consumer Price Index | Take-profit.org](#)

95 [In bankrupt Lebanon, locals mine bitcoin and buy groceries with tether \(cnbc.com\)](#)

96 [Guerre en Ukraine : ce que les dons en bitcoins et cryptomonnaie ont vraiment permis d'acheter - Journal du Coin](#)

97 [L'Arabie saoudite envisage d'accepter les yuans des Chinois pour son pétrole - l'Opinion \(lopinion.fr\)](#)

98 [Bitcoin, where do we stand? A technical point of view | Next.js Blog Example with Markdown \(blockchain-partner.fr\)](#)

In particular, Taro, a protocol under development based on Taproot, should soon permit the creation and exchange of stablecoins on Bitcoin and the Lightning Network. As a reminder, the Lightning Network is a network built on top of Bitcoin in order to be able to perform routine operations more easily, with faster transactions and at negligible cost. The network is still far from its final version, but its potential is huge as it is based on Bitcoin's properties and security in order to exchange value without an intermediary. However, although the Lightning Network enables a true payment system to be built, the exchange of value is now only made in bitcoin, which impedes the use of the network for everyday payments. As shown by the significant weight of stablecoins in the total capitalisation of cryptos (\$145 billion)<sup>99</sup>, the need for a stable standard behind the currency of exchange for retail payments is paramount. This is also reflected in the uses, such as in Lebanon, where stablecoins are used for daily payments and bitcoin as a long-term savings vehicle<sup>100</sup>. **The arrival of stablecoins on Bitcoin and the Lightning Network with Taro could be a catalyst for the adoption of Bitcoin as a payment system.**

#### Mining: an opportunity for the energy transition

Despite the decline in prices in the markets, Bitcoin's security continues to strengthen thanks to the increase in work provided by miners, having even reached a new record last November with 273 Th/s.<sup>101</sup> As a reminder, the hash rate (TeraHash/second) reflects the computing capacity deployed on a blockchain network using a proof-of-work (PoW) consensus method. The Hashrate<sup>102</sup> makes it possible to assess the security level of a PoW blockchain and the confidence of miners in the infrastructure.<sup>103</sup>

Since Ethereum's transition to a proof-of-stake consensus method (the "Merge"), **Bitcoin remains one of the only crypto currencies<sup>104</sup> based on a proof-of-work consensus** and corresponds to almost all of the mining power deployed worldwide in the crypto ecosystem, which makes it the regular target of criticism related to its energy consumption and its perceived environmental footprint.

However, 2022 may have represented a change in perception of the opportunity that Bitcoin constitutes for the energy and ecological transition.

First, **according to various sources, around 40% (University of Cambridge, 2020)<sup>105</sup> and 60% (Bitcoin Mining Council, 2022)<sup>106</sup> of energy used for mining comes from renewable sources.** A recent study, including for the first time the data of miners operating outside the main networks ('off-grid'<sup>107</sup>), resulted in a low point of 52.2% zero-emission energy<sup>108</sup>. If Bitcoin miners are substantially turning to these energy sources, it is because they are encouraged to do so economically. As the first line of spending for a bitcoin miner is the electricity bill, miners are constantly looking for cheap energy sources around the world. This naturally often leads them to renewable energies, **as production surplus and the unused extra capacity of power plants (e.g. hydropower) provide access to very low prices.** This is all the more true in a time of soaring fossil fuel prices.

**One of the major advantages of mining is its geo-independence**, allowing miners to have mobility in the locations of their choice with regard to the source of energy production. Unlike all other industries, mining is not required to settle close to a given resource, a consumption or employment basin,

logistics platform, etc. It can operate from mobile, containerisable equipment, with low labour intensity. Only constraint: access to an Internet connection, but the quality of which can be average (satellite, for example). Conversely, a data centre often requires access to high-performance networks with guaranteed availability, such as fibre optics.

Miners can then move according to an economic logic, being encouraged to find the cheapest energy source without taking into account its global location. In many cases, the cheapest energy sources are at the level of underexploited power plants, in particular renewables<sup>109</sup>, which are poorly connected to the grid or generate a surplus of energy<sup>110</sup>. It is estimated that 52.8% of Bitcoin mining is off-grid, i.e. the majority of computing power<sup>111</sup>.

With its capacity to consume large amounts of energy, **mining can therefore even help to finance investments in renewable energy facilities**, in exchange for preferential access to this low-cost surplus of energy, as is the case in the vicinity of the iconic Niagara falls<sup>112</sup>.

However, this off-grid energy used by miners does not only come from renewable energies (solar, wind and hydraulic). Many off-grid sites produce under-exploited amounts of energy, having a catastrophic environmental impact. For example, many oil companies emit into the air the gas (methane) that they released during oil extraction. These practices are far from anecdotal: in 2021, United Nations spokesperson Inger Andersen, Executive Director of UNEP, stated that "cutting methane emissions is the best way to slow climate change over the next 25 years"<sup>113</sup>.

However, in the absence of an economically viable solution, oil producers continue the same practices, or, in a quarter of the cases, according to the International Energy Agency, they simply burn the gas in order to transform it into CO<sub>2</sub><sup>114</sup>, which has a less catastrophic impact on the environment than methane. Oil producers are not the only emitters of methane for which

the geographical distance from electricity networks prevents the recovery of this natural gas: agricultural farms, in particular cow farms, or open landfills, are other examples. In this regard, 2022 marked the beginning of awareness by the various stakeholders and the public authorities of the economic and ecological opportunity that Bitcoin mining represents. In the United States, for example, mining farms use the energy from associated gas that is unused for physical or economic reasons<sup>115</sup>. This is what the company Crusoe does, for example, which raised \$350m in October<sup>116</sup>. According to the University of Cambridge<sup>117</sup> and the International Energy Agency<sup>118</sup>, the Bitcoin network could be powered close to 8 times using just the recoverable energy of associated gas from oil extraction, which otherwise would be burned or released into the atmosphere<sup>119</sup>.

Moreover, while access to energy production capacity is a competitive advantage for miners, requiring considerable energy and capitalising on the intermittence of renewable energies, the converse is also verified: **Bitcoin mining allows producers to make renewable energy production units profitable that are otherwise not economically viable** due to lack of demand<sup>120</sup>, or a lack of adequate distribution network. Therefore, Bitcoin mining can be useful for network managers in order to smooth the electricity demand curve. When there is no demand, mining takes over in order to make renewable facilities profitable, while at peak consumption, miners are able to be extremely responsive, and switch off their machines in order to erase their network demand.

99 [Principaux stablecoins par capitalisation boursière | CoinGecko](#)

100 <https://www.cnn.com/2022/11/05/in-bankrupt-lebanon-locals-mine-bitcoin-and-buy-groceries-with-tether.html>

101 [Blockchain.com | Charts - Total Hash Rate \(TH/s\)](#)

102 Miners in the network are in mathematical competition to validate transactions by creating new blocks. A mathematical calculation must be resolved to acquire the right to add a new block to the chain, in exchange for a yield

103 In the short term, we can expect a likely relative decline in this hash rate in absolute terms, as the computing power that can be mobilised is strongly linked to the price. With prices falling over the long term, miners are forced to stop their operations, which are becoming unprofitable. The fact that the rate continues to rise in the weeks following a drastic drop in prices nevertheless reflects a strong long-term commitment of miners.

104 The others are marginal cryptos from a market point of view, such as Litecoin or Monero

105 [2021-ccaf-3rd-global-cryptoasset-benchmarking-study.pdf \(cam.ac.uk\)](#) (cf. page 11)

106 [Bitcoin mining electricity mix increased to 59.5% sustainable in Q2 2022 - Bitcoin Mining Council](#)

107 The electrical grid represents all the infrastructure used to transport electricity from production centres to electricity consumers. The energy in this network is called 'on-grid' if it corresponds to the energy quota produced that meets society's energy needs, as a whole. Energy outside this network is called 'off-grid' and corresponds to all extra energy capacity, which the network infrastructure does not consume directly and which is either stored or wasted.

108 <https://batcoinz.com/a-more-complete-picture-of-bitcoins-energy-usage/>

109 renewable energies

110 [2021\\_03\\_bitcoin\\_and\\_environment\\_benichou\\_published\\_2.pdf \(dropbox.com\)](#)

111 <https://batcoinz.com/a-more-complete-picture-of-bitcoins-energy-usage/>

112 [Bitcoin Miners Tap Hydropower as Environmental Criticism Grows \(wsj.com\)](#)

113 [Progress on methane emissions by energy companies, but numbers still don't add up: UNEP | UN News](#)

114 <https://www.iea.org/commentaries/putting-gas-flaring-in-the-spotlight>

115 [messari-report-crypto-theses-for-2022.pdf](#)

116 [Flared-Gas Bitcoin Miner Crusoe Energy Raises \\$350M Series C \(coindesk.com\)](#)

117 [Cambridge Bitcoin Electricity Consumption Index \(CBECI\) \(ccaf.io\)](#)

118 [Putting gas flaring in the spotlight – Analysis - IEA](#)

119 In other words 'gas flaring'

120 Direct Monitoring of Energy Resources - [Electricity Maps | Real-time carbon intensity of electricity consumed](#) (interesting to observe supply and demand for non-manageable renewables)

### Mining in Texas: a case study leading the way

This situation is particularly remarkable in the United States. In a September 2022 report, the White House mentioned the potential of bitcoin mining as a tool for stabilising its electricity grid<sup>121</sup>. Beyond theory, the State of Texas, benefiting from the exodus generated by the Chinese ban on mining, is already seeing the practical benefits. According to Senator Ted Cruz, representative of the second richest state in the country<sup>122</sup>, Texas considers that the local boom in Bitcoin mining plays “a significant role in strengthening and hardening the resiliency of the grid”<sup>123</sup>.

This political statement was supplemented by a report by the Texan electricity grid manager, the Electric Reliability Council of Texas (ERCOT), which supports Bitcoin

mining as a profitable catalyst for off-grid energy, and the flexibility of this system that can be put on hold in the event of extreme energy needs<sup>124</sup> (i.e. bad weather). Despite the only recent emergence of the mining industry in Texas, ERCOT estimates that this industry is set to provide a reservoir of 1.7GW this year, which can be mobilised during peak winter demand, i.e. 2.5% of the maximum expected load. This is more than all battery (0.9 GW), wind (1.5 GW) or hydroelectricity (0.4 GW) storage, which is considerable. The Texas case study is likely to inspire others. We see it, among others, as **a non-negligible first sign of the change in perception of Bitcoin’s environmental impact**, with its opportunities for the ecological transition being increasingly recognised.

# Key takeaways

For companies, particularly European companies, **Bitcoin’s technological and strategic potential is still misassessed.**

**It is in countries in crisis, such as Ukraine or Lebanon, that Bitcoin mainly demonstrates its value proposition.**

Its safe haven properties are more visible in circumstances where the local banking system is unreliable

**However, Bitcoin’s volatility is still high,** in light of its limited history

In a difficult geopolitical context, Bitcoin offers a **cross-border means of payment and a neutral and inalienable currency.**

**Technological innovation continues** on the Bitcoin infrastructure, with the **prospect of the arrival of stablecoins on the network**, enabling the Lightning Network to compete with traditional payment systems.

ESG criticisms against Bitcoin are still curbing its adoption by companies. However, in reality, **the Bitcoin network can serve as an economic buffer for wasted energy. The geo-independence of miners even represents an advantage for the energy transition**, since mining could improve the profitability of investments in renewables<sup>125</sup>.

121 [09-2022-Crypto-Assets-and-Climate-Report.pdf \(whitehouse.gov\)](https://www.whitehouse.gov/wp-content/uploads/2022/09/09-2022-Crypto-Assets-and-Climate-Report.pdf)

122 Per total GDP [Richest States 2022 \(worldpopulationreview.com\)](https://www.worldpopulationreview.com/richest-states-2022/)

123 [Bullish on Bitcoin, US Senator Ted Cruz wants Texas to be a crypto oasis \(cointelegraph.com\)](https://www.cointelegraph.com/news/bullish-on-bitcoin-us-senator-ted-cruz-wants-texas-to-be-a-crypto-oasis)

124 Original source - [https://www.ercot.com/files/docs/2022/11/29/SARA\\_Winter2022-23.pdf](https://www.ercot.com/files/docs/2022/11/29/SARA_Winter2022-23.pdf) unavailable to date/Alternative source - (1) MAGS .....on Twitter: „ERCOT’s new study shows that Bitcoin miners are providing a benefit to the Texas grid <https://t.co/XcwCXqwl28>” /Twitter

125 renewable energies

## Ethereum: an infrastructure under perpetual development, between new risks and opportunities

With \$23.57 billion in value locked in its smart contracts (57.56% of all programmable blockchains)<sup>126</sup>, 213.8 million unique addresses<sup>127</sup>, around 605 decentralised applications and the largest ecosystem of developers on Web3, **Ethereum remains the benchmark infrastructure** for new crypto projects. However, the perpetual improvement of this technology involves both opportunities and risks. This is why, in order to best capitalise on the features offered by Ethereum, **companies wanting to launch crypto initiatives must closely monitor the evolution of this blockchain.**

**After the Merge, further updates are expected on Ethereum**

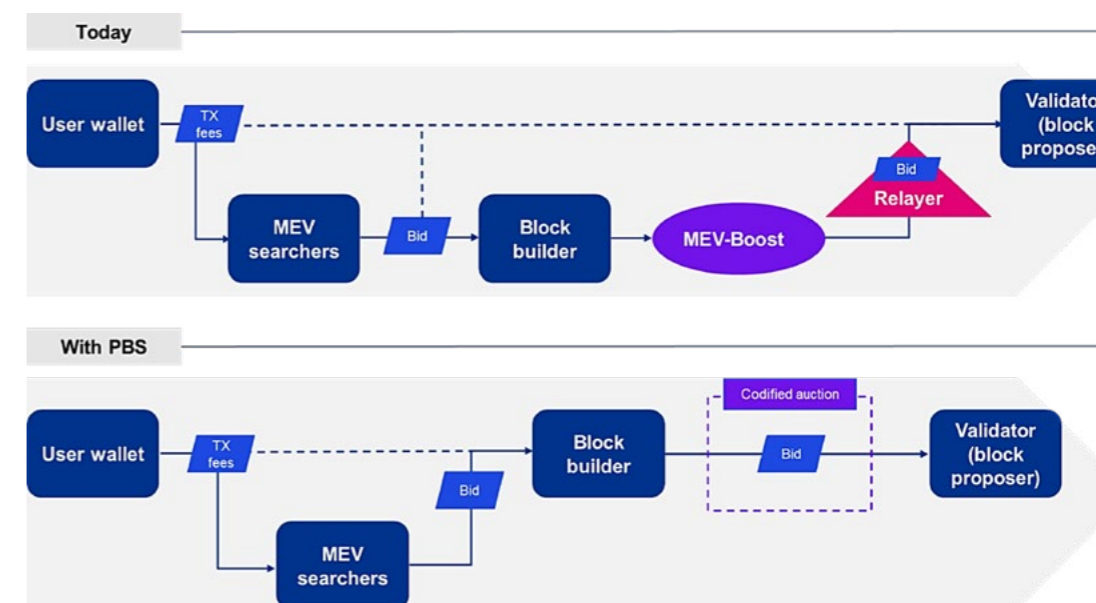
**The Merge**, the transition from a proof-of-work consensus method to a proof-of-stake method, **was conclusive**: the transition caused no subsequent interruption of service or accident. This allowed Ethereum to switch over to a **model that is easily perceived as eco-compatible** because less energy-consuming, without any interruption of on-chain activity<sup>128</sup>. Furthermore, proof-of-stake will boost the development of a new industry: that of ‘staking’, or the deposit of Ethers cryptocurrencies directly into the Ethereum chain, in order to participate in maintaining the decentralised register in exchange for passive income<sup>129</sup>.

**However, the roadmap is still long** and many updates are expected in the coming months and years to complete the development of Ethereum. By way of illustration, its creator, Vitalik Buterin, announced in July 2022 that “only 40%”<sup>130</sup> of the network’s functionalities were already in their final version. **In order to control the risks arising from the functioning of this blockchain, additional technological components are necessary**, the integration of which is expected as soon as possible.

For example, a large semi-OTC market has been created around the challenges posed by the Maximal Extractable Value (MEV). The MEV refers to a privilege of the validators who, as creators of new blocks, are able to view the list of all pending transactions that have not yet been entered in the blockchain, called the ‘mempool’. By reading this mempool, validators can be the first to identify market opportunities. For example, if a pending transaction is likely to change the price of an asset on a trading platform, a validator may add a trade on their own behalf to the following block in the blockchain, in order to benefit from an arbitrage opportunity.

Since January 2020, \$677 million has been ‘extracted’ via the MEV on Ethereum<sup>131</sup>. In the future, the functions for creating the block on the one hand, and validating it on the other, will be assigned each time to different players in the network: this mechanism is called the Proposer-Builder Separation (PBS). This will give rise to an auction system so that everyone can take advantage of the opportunities that arise from adding specific transactions to the blocks certified by the validators. In other words, the PBS will make it possible to decentralise the privilege that the validators have, with a gain in terms of the fairness and transparency of the system. At present, pending an update that will incorporate the PBS into Ethereum, an auction mechanism already exists. Nevertheless, it is managed entirely off-chain<sup>132</sup>, with a risk of centralisation around the programmes that manage the auction system, called relayers (see image below).

Figure 1 : **Illustration of how the MEV market works (now and in the future with PBS) by KPMG**



### Proof-of-stake involves centralisation risks

**A subsequent risk of centralisation for Ethereum stems from the proof-of-stake consensus method itself.** Indeed, while proof-of-work, still used by Bitcoin, secures a blockchain through access to energy, proof-of-stake secures Ethereum – and many other blockchains – through access to money. Yet, money is more easily controllable and tends to concentrate in fewer hands than access to energy.

**This risk of centralisation has come under even greater debate in the ecosystem following the sanctions announced in August by OFAC<sup>133</sup>** against the Tornado Cash protocol. While mining pools in Bitcoin simply bring together independent miners, connected via a network and free at any time to leave the alliance and/or move from one geographical area to another, platforms such as Coinbase (11.6% of the total stake in Ethereum<sup>134</sup>) are companies regulated and established in a specific jurisdiction – often, to date, in the United States. They could therefore be obliged to comply with the decisions of the US authorities if the latter decide to target not only on-chain addresses that interact with sanctioned protocols (e.g. Tornado Cash), but also validators certifying blocks that contain “sanctioned” transactions.

### Ethereum rightly remains the benchmark for all crypto projects

**Although the risks presented must be taken into consideration by companies, to date they are not such to call into question Ethereum’s role in the crypto ecosystem**, for two main reasons.

First, in terms of sanctions, OFAC has not taken any initiative against validators: while MEV ‘relayers’ have mostly chosen not to take into account blacklisted transactions<sup>135</sup>, the latter still have their place on Ethereum, although sometimes with a few blocks of delay<sup>136</sup>. Beyond the diverging views on the relevance of the sanctions against Tornado Cash, it is important that **Ethereum preserves its agnostic and permissionless character at the infrastructure level. A layer of control**, with KYC and compliance with the regulator’s directives, **can easily be added at the application level**, so that market participants use an open and decentralised infrastructure while complying with the restrictions imposed on them.

126 [All Chains TVL - DefiLlama](#) on 28/11/2022

127 [Ethereum Cumulative Unique Addresses \(ycharts.com\)](#) on 28/11/2022

128 ‘On-chain’ refers to transactions carried out directly on the blockchain register, and definitively recorded on the blockchain, in a distributed manner.

129 For more details, see the DeFi section

130 Statement by Vitalik Buterin at the EthCC event in Paris, July 2022.

131 [MEV Explore \(flashbots.net\)](#) on 28/11/2022

132 The information is not processed directly by Ethereum

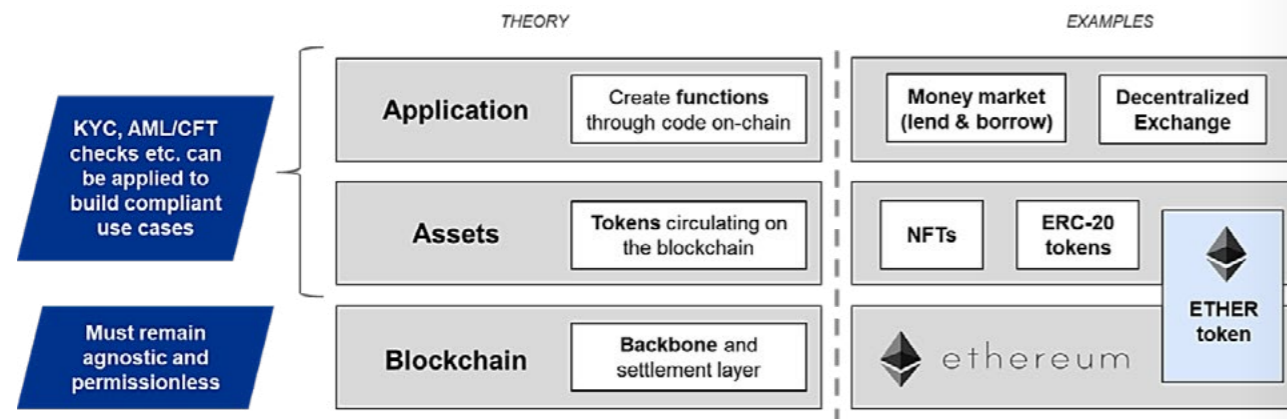
133 OFAC – Office of Foreign Assets Control

134 [Rated Network Explorer](#) On 28/11/2022

135 [MEV Watch](#) on 28/11/2022

136 For further information: [Relax, Ethereum Isn’t Censored - by Donovan Choy - Bankless \(banklesshq.com\)](#)

Figure 2 :  
Illustration of KPMG's vision of KYC/AML-CFT controls on public blockchain



Second, Ethereum's roadmap is certainly very ambitious, but **Ethereum developers seem to have shown that they are able to deliver successful updates more and more rapidly**. For example, while the Merge took place in September, another important update is set to be made in 2023<sup>137</sup>, providing Ethereum with the 'Protodanksharding' system. 'Protodanksharding' represents a preliminary version of 'Danksharding'<sup>138</sup>, a governance mechanism that enables significant improvement in network scalability. In particular, Protodanksharding consists of adding a new type of transaction, designed *ad hoc* for layer 2 technologies known as 'rollups': the 'blob-carrying transaction', allowing a large amount of data to be registered in the blockchain, at a lower cost and more efficiently.

Furthermore, **in the long term, Ethereum will notably cover the 'settlement layer' role, while applications will be built more on layer 2 technologies, such as rollups**, allowing better scalability while benefiting from the level of security and decentralisation of the primary network, Ethereum.

**In conclusion, Ethereum is rightly still the benchmark** for companies wishing to launch new crypto projects. We expect the crypto ecosystem to continue to grow in 2023 based on this infrastructure. This is why companies need to prioritise an analysis of the risks and opportunities involved in the ongoing evolution of Ethereum, in order to identify attractive use cases and position themselves in a growing market.

# Key takeaways

**Ethereum is rightly still the benchmark programmable blockchain, and its technical development is ongoing.**

**The "Merge" was a success** and the new consensus method (Proof-of-Stake) provides Ethereum with a model that is more easily perceived as eco-compatible.

**Further updates will be required** to control the risks arising from the functioning of Ethereum, particularly in terms of the centralisation of the infrastructure.

137 [Jesse Pollak \(jesse.xyz\) sur Twitter : „1/ Quick post-@EFDevcon update on EIP4844 \(10-100x cheaper rollups\). TL;DR the effort came in with a bunch of momentum, ran multiple high impact working sessions during the conference, identified a few small spec changes, and is moving full speed ahead on implementation.“ /Twitter](#)

138 Danksharding will be made possible by Data Availability Sampling and the Proposer-Builder Separation. Data Availability Sampling (DAS) is a mathematical method to verify that data sets are available and correct without checking all the data one by one. For further information: [The Hitchhiker's Guide to Ethereum - Delphi Digital](#)

## Alternative blockchains to Ethereum: many competitors, but few winners

### The importance of the choice of the right blockchain infrastructure

From our experience at KPMG, **companies pay particular attention – and rightly so – to the opportunities offered by cryptos in terms of use cases. Conversely, they sometimes minimise the choice of the underlying infrastructure**, as if there was little difference from one blockchain to the other. Although this perception is understandable given the technicality

of the subject, a well-developed use case could fail if it has a poor technical basis. Like for a journey, it is not enough just to choose the right destination, the means of transport must also be efficient and reliable. As Bitcoin's value proposition is minimalistic<sup>139</sup>, most companies favour programmable blockchains in order to build their projects, requiring smart contracts to manage complex features. Until the beginning of 2021, the choice of which blockchain to use was natural: Ethereum was the only viable option and concentrated more than 95% of the circulating value on all programmable infrastructures (Total Value Locked or TVL, see charts below). Today, although Ethereum remains largely dominant, many competitors have emerged.

Of course, **the criteria to be taken into account when choosing a blockchain far exceed the simple**

**measure of the TVL.** Above all, the level of **cyber security** of the infrastructure must be examined. Second, **performance in terms of scalability** (the capacity to scale up, notably in terms of transactions per second) is a key element for any project that targets a broad audience and requires the processing of a large number of transactions. In addition, a blockchain is only attractive if it displays a good **level of adoption**, which is estimated – among other things – by the number of applications built on the chain, or the number of existing unique addresses. Lastly, **the purpose of a blockchain lies in its decentralisation**, which allows for a truly neutral and uncensorable infrastructure<sup>140</sup>: for crypto use cases, if the infrastructure is controlled by a handful of players, its added value can be limited or even zero.

### For most alternative blockchains to Ethereum, an appraisal revealing poor results

In the panorama of the many blockchains offering an alternative to Ethereum, none really came out a winner of the past year. Even without referring to the noisy collapse of the Terra blockchain in May 2022, **Solana has experienced several service interruptions** over the last 12 months<sup>141</sup>, for example, seriously calling into question its reliability. Furthermore, **Binance Smart Chain (BNB) has shown that it cannot be considered a real blockchain**, since its limited number of validators (26<sup>142</sup> vs. 488,620 for Ethereum<sup>143</sup>) allowed to shut down the chain arbitrarily in the framework of a cyberattack on 7 October 2022<sup>144</sup>. An infrastructure such as the BNB Chain, managed by around twenty players and intrinsically linked to the giant Binance, can theoretically be adapted to the hosting of certain applications, depending on the prerequisites and preferences of the project owners. However, it cannot be seen as a true, decentralised and trustless alternative to traditional centralised IT systems.

Despite the still modest TVL, only Polygon blockchain is an exception, with a mixed or even positive track record, given its good technical performance and its progress in terms of adoption. **Polygon has been**

**chosen by large-scale projects**, such as Lens Protocol (decentralised social networks, see section “*NFTs: a market that has lost momentum but confirms the underlying trends*”) as well as Instagram's NFT initiative<sup>145</sup>. **However, Polygon's technical teams seem to be aware of the limitations that this infrastructure could experience in terms of scalability**, if transaction volumes were to rise suddenly. This is why Polygon's strategic roadmap is now centred around **layer 2 scalability solutions, such as Polygon zk-EVM**<sup>146</sup> (see section “*Ethereum layer 2: a promise become reality*”).

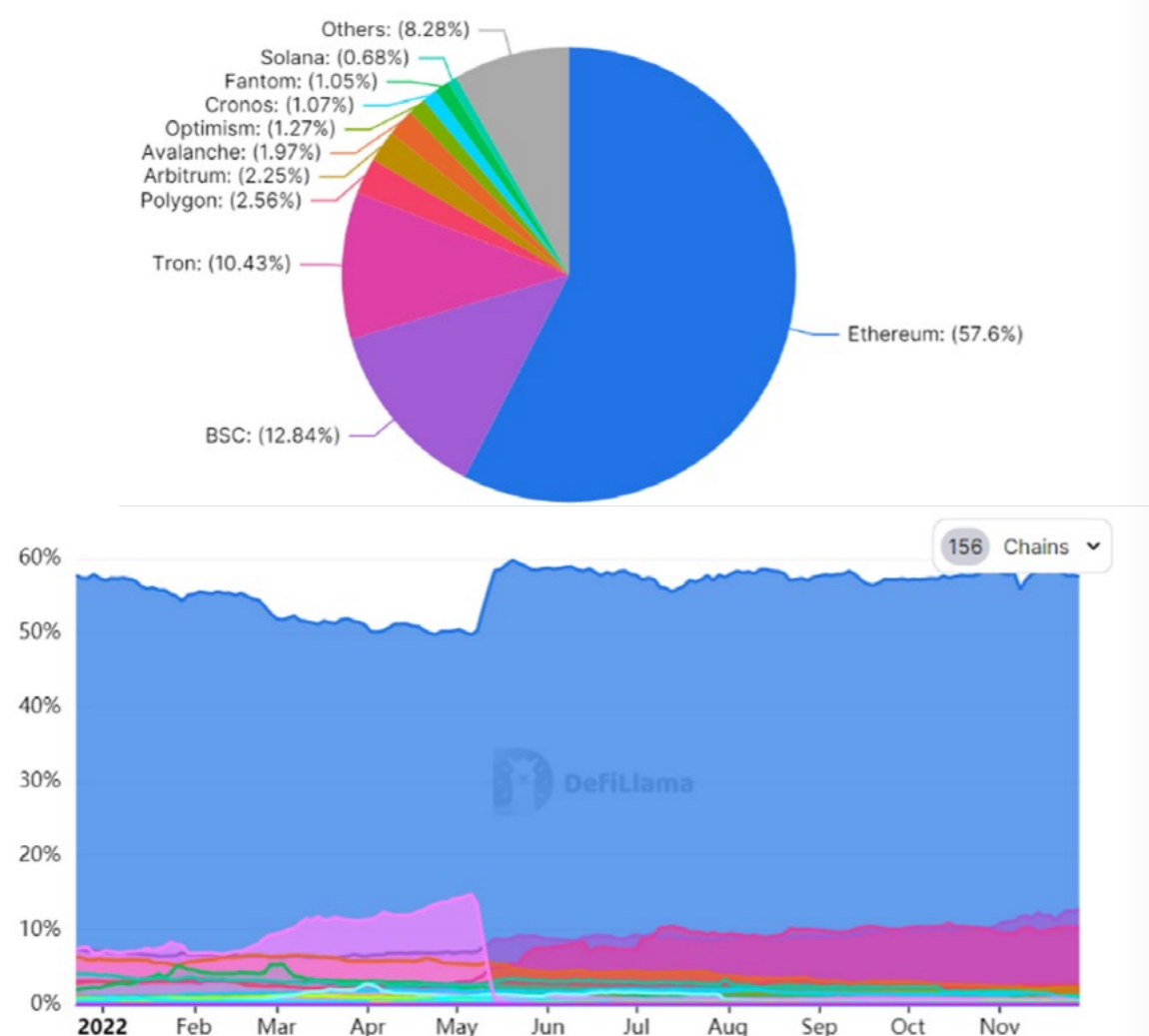
**Lastly, we remain sceptical overall about the prospect of a multi-chain ecosystem**, consisting of a large number of blockchains that coexist and can connect with each other via bridges. These bridges, which allow the exchange of value across different infrastructures, can take various forms<sup>147</sup>; however, in many cases, systems connecting separate blockchains are managed centrally by an intermediary, representing an important single point of failure and a target for cyberattacks. For example, the Wormhole bridge between Solana and Ethereum was attacked in February 2022, with a loss of \$326 million<sup>148</sup>.

### Cosmos: an attractive competitor but not yet proven

**Among alternative blockchains, one of the most attractive from a technological point of view is Cosmos**, whose value proposition differs from Ethereum and could ultimately justify the coexistence of the two infrastructures.

Cosmos was designed not as a simple chain but as an ecosystem, making it possible to easily create a multitude of blockchains through an SDK (software development kit) and an open source consensus algorithm called Tendermint. These blockchains, built on similar technical pillars and connected via a network of outposts, are supposed to be natively interoperable and able to communicate via the Inter-Blockchain Communication (IBC) protocol.

Figure 3 : Percentages of total value locked (TVL) in all programmable blockchains. On the left, position at 28/11/2022. On the right, change in distribution over time over the year. Source: DeFiLlama



139 Bitcoin essentially enables the transfer and safe storage of value without intermediaries, almost cost-free and with very short processing delays, on a global scale. However, to date, the deployment of smart contracts on Bitcoin is very limited, which hampers the construction of complex applications (decentralised finance, NFTs, etc.)

140 For the possibilities of adding a control layer at the application level (vs. the infrastructure level), in order to comply with regulatory constraints and perform a KYC, see section “*Ethereum Roadmap*”.

141 [Solana Status - Uptime History](#)

142 [BSCTrace - BNB Smart Chain \(BSC\) Blockchain Explorer](#) data as at 01/12/2022

143 [Validators - Open Source Ethereum Blockchain Explorer - beaconcha.in - 2022](#), data as at 28/11/2022

144 [BNB Chain's Cross-Chain Bridge Exploit Explained | Nansen](#)

145 [Meta to Let Users Mint and Sell Polygon-Powered NFTs on Instagram — Polygon | Blog](#)

146 The Polygon zk-EVM testnet was launched in October 2022 and the mainnet is expected in H1 2023

147 <https://techstories.blockchainpartner.fr/articles/bridges>

148 Rapport KPMG “Cybersecurity for Blockchain and Cryptos 2022”, [Cybersecurity for Blockchains and Cryptos 2022 - KPMG France \(home.kpmg\)](#)



In the Cosmos vision<sup>149</sup>, each major crypto application would create its own ‘appchain’ (blockchain for an application), which can rent validators to the primary Cosmos blockchain (‘Cosmos Hub’) to ensure a sufficient level of security. The modalities of remuneration at the benefit of ATOM token holders are being discussed and voted on in the Cosmos community<sup>150</sup>. Moreover, holders of ATOM tokens, in addition to depositing their tokens in the Cosmos Hub to secure the chain – in exchange for a yield – could use for reinvestment a derivative token representing their deposits, thanks to a ‘liquid staking’ mechanism.

Apart from these technical details, **the concept of ‘appchain’ is the key element in understanding Cosmos’s value proposition**. It is an attractive feature for applications wanting to have a customised infrastructure built according to their needs, without too much complexity. This is why, for example, the trading platform DydX announced in June 2022 its migration from a layer 2 solution on Ethereum, StarkEx, to a proprietary appchain in the Cosmos ecosystem.

**However, appchains present two main drawbacks:**

- First, **the splitting of the ecosystem could hinder the composability** of the applications, i.e. the possibility of combining different services automatically. The ease of connecting the different appchains, allowing them to communicate and thus ensure true interoperability, remains largely to be proven.
- Second, **the flexibility offered to the applications, which can create their own appchains, could involve more risks than opportunities**. Indeed, the collapse of the Terra blockchain, whose unstable design was the result of the malleability of Cosmos SDK, has proven that the design of a blockchain requires very fine work and precautions that cannot be neglected.

**Network effects strengthen Ethereum’s leadership in layer 1**

**A final factor makes the success of alternative blockchains unlikely: network effects.** Indeed, **Ethereum has already taken a very significant lead** over

all its competitors in terms of adoption and development. Passing Ethereum looks like a difficult target for Cosmos, in our view, and the latter’s coverage in the specialised media seems disproportionate to its TVL performance, adoption etc. This is also true for Celestia, a new blockchain with innovative design – combining the concept of appchains with the technology of rollups<sup>151</sup> – expected to be launched in 2023.

In our vision, tomorrow’s applications will probably not be built on layer 1 blockchains, but rather on layer 2 scalability solutions such as rollups (see *section “Ethereum layer 2: a promise become reality”*). Rollups ensure much better scalability performance, because they process transactions off-chain. However, the off-chain processing of transactions requires a layer 1 blockchain that is more decentralised than the rollups, to record evidence of the proper execution of transactions. This role of settlement layer on layer 1 is already performed by Ethereum and no other blockchain seems to be able to position itself as a competitor. With one exception: Bitcoin, provided that a technology solution is developed in this sense.

To make the best choices in the face of issues with high technical complexity, **companies must consider all infrastructure options**. In this regard, the subsidies that foundations attached to minor blockchains may offer should not have too much of an influence on a company’s choice. The resulting risk would not only be to see its crypto project fail, but also to undermine its reputation as an innovative player.

<sup>149</sup> We refer here to the Cosmos 2.0 design as described in the public documentation and in the context of the Cosmoverse event (September 2022). [Whitepaper - Resources - Cosmos Network](#) + [New Move of Cosmos: It All Starts with Interchain | by Huobi Research | Huobi Research | Sep, 2022 | Medium](#)

<sup>150</sup> The proposition “ATOM 2.0: a new vision for Cosmos Hub” was rejected in an on-chain vote on 14 November 2022. [IPROPOSAL #82|VOTE ON-CHAIN| ATOM 2.0: A new vision for Cosmos Hub - Hub Proposals / Signaling/ Text - Cosmos Hub Forum](#)

<sup>151</sup> In addition to the features of Data Availability Sampling and validity proofs natively provided for in the infrastructure code, in order to offer guarantees both in terms of scalability and composability. For further information: <https://members.delphidigital.io/reports/pay-attention-to-celestia>

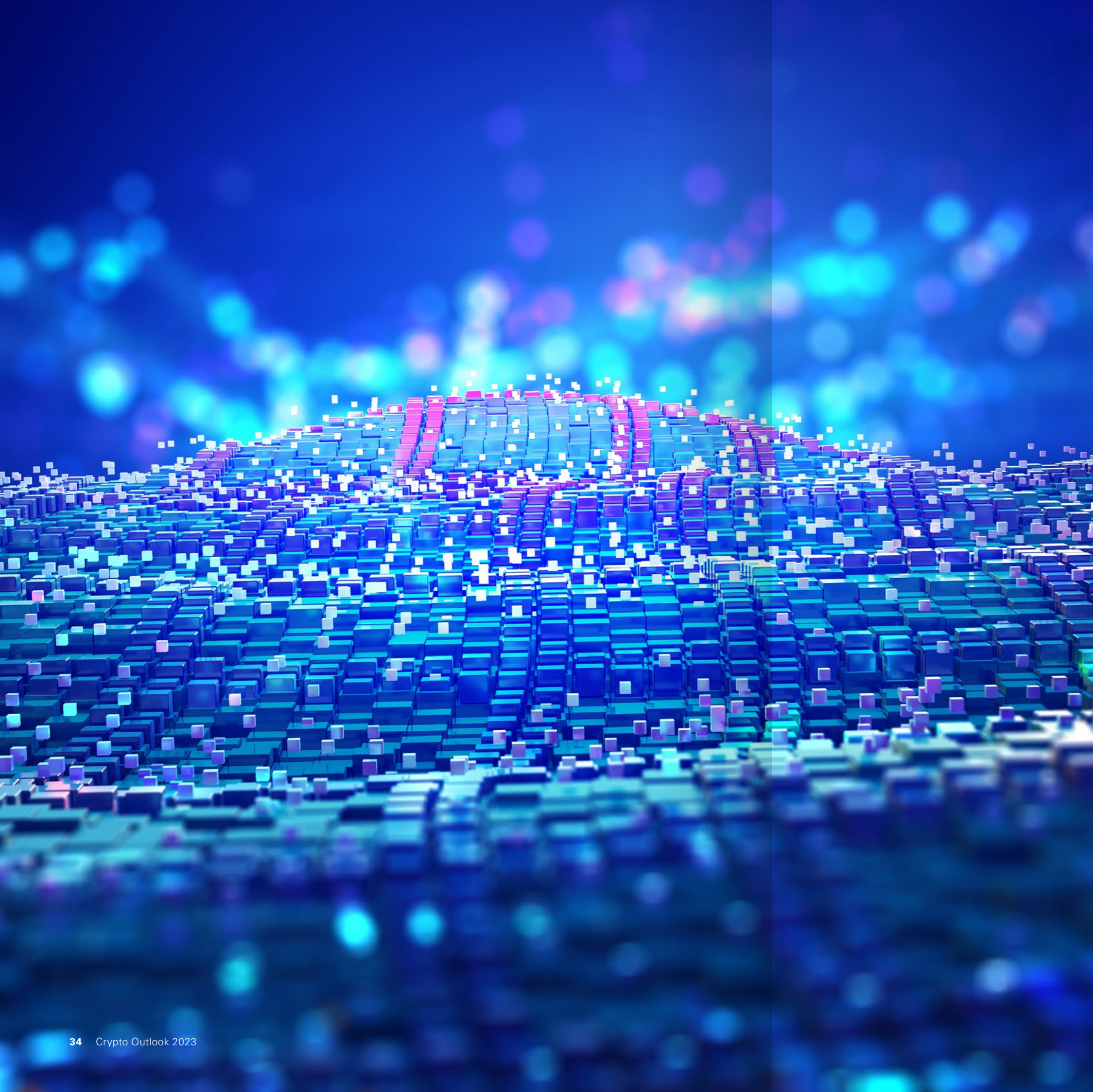
# Key takeaways

**Choosing the right blockchain infrastructure is a key condition for the success of a crypto project.**

**All programmable blockchains alternative to Ethereum are not equal** and several parameters must be taken into account (TVL, cybersecurity, adoption, scalability, decentralisation, etc).

Most alternative blockchains underperformed in 2022 and **a multi-chain ecosystem seems less and less likely.**

**Ethereum, still the dominant programmable blockchain, has become the standard as a ‘settlement layer’** for layer 2 scalability solutions (rollups).



## Ethereum layer 2: a promise become reality

### The purpose and functioning of rollups

The limits in terms of the scalability of layer 1 (L1) blockchains, such as Ethereum, are no longer debated in the crypto ecosystem<sup>152</sup>. We had addressed this issue already in our report *Crypto Outlook 2022*<sup>153</sup>, while introducing the concept of **scalability solutions or layer 2 (L2) technologies**. This concept is **of paramount importance for any company wishing to build a crypto project addressed to the general public** and thus needing to process transactions almost instantaneously and at minimal cost.

In particular, the **rollups, i.e. the type of layer 2 most used to date, support off-chain transactions**<sup>154</sup>. Thus, the technical constraints of blockchains, in terms of the direct processing of transactions, are bypassed. However, **the rollups inherit, to some extent, the decentralisation and security properties of the underlying blockchain (generally Ethereum), as they regularly record evidence of the proper execution of transactions on layer 2**.

In addition, the rollups have been natively designed to meet requirements that, at the beginning of Bitcoin (2009) and Ethereum (2015), had not yet emerged as priorities. For example, most layer 2 protocols natively integrate account abstraction features, allowing for the separation of the concepts of key<sup>155</sup>, on the one hand, and wallet on the other. This notably creates opportunities to improve the user experience. Indeed, on Ethereum, in the event of loss of access to an account, recovery solutions require the use of a service supplementary to the infrastructure. Conversely, some rollups, such as Starknet, incorporates this feature by design, directly in the protocol.

<sup>152</sup> Especially as sharding, a technology allowing Ethereum to process more operations in less time, was excluded from the Merge update and postponed in the form of 'Protodanksharding' (see section "*Ethereum: an infrastructure under perpetual development, between new risks and opportunities*").

<sup>153</sup> [Crypto Outlook 2022 - KPMG France \(home.kpmg\), Chapter 3](#)

<sup>154</sup> Outside the blockchain

<sup>155</sup> Cryptographic/signature key

## Different types of rollups:

### Optimistic vs. Zero-knowledge proof

While tomorrow's crypto projects are likely to be built on rollups, **the challenge for companies is to choose the best layer 2 solution** from among the many budding ones. Currently, two sub-categories of rollups stand out on the market: Optimistic Rollups (OR) and ZK-Rollups (ZKR), where 'Optimistic' and 'ZK' (Zero Knowledge) refer to the different ways of verifying the proof recorded on the layer 1 infrastructure.

### 1. Optimistic Rollups (OR)

**The Optimistic Rollups are the first generation of rollups to have reached a substantial level of adoption.** Among the ORs, two main competitors share the majority of the market: Arbitrum on the one hand, and Optimism on the other. Thanks in part to the success of the GMX trading platform, Arbitrum reached 282,000 active users per week (on average) as at 31 October 2022<sup>156</sup>, with a TVL<sup>157</sup> of \$922.7 million<sup>158</sup>. Optimism, lagging slightly, recorded a TVL of \$502m<sup>159</sup> and 30,000 active users per day in October 2022<sup>160</sup>.

The functioning of ORs is relatively simple. As with all rollups, wallets must initially be fed with cryptocurrencies from layer 1 Ethereum. This transfer is done via a bridge, i.e. a smart contract allowing the connection between two infrastructures. Once the liquidity is obtained on the layer 2, the user can operate freely. On a regular basis, the L2 records on Ethereum evidence of execution of transactions at secondary layer level, namely the status of balances in the wallets on L2. This evidence is 'optimistically' considered to always be

correct. However, it is possible to submit fraud proof within seven days of the publication of the evidence on L1. This involves a 'verifier' programme, which, by analysing the full history of the evidence recorded on the blockchain, is capable of demonstrating that evidence does not reflect the correct status of the balances in layer 2, and therefore must be considered false. As a result of this process, the evidence is invalidated without altering the functioning of the layer 1. In OR theory, everyone can install and manage a 'verifier' programme<sup>161</sup>.

**In addition to being ahead in terms of adoption, compared to their competitor ZKR, the major advantage of ORs is their degree of compatibility (or even technical equivalence<sup>162</sup>) with Ethereum.** In other words, OR technology adopts the same specifications as Ethereum and allows, for example, the use of the same programming language, Solidity. This notion of compatibility, which may seem abstract, is in fact very concrete, in that it makes it possible, for example, to deploy on Arbitrum or Optimism applications that currently exist on Ethereum, by means of a simple "copy-paste" of the smart contract code.

Conversely, **the functioning of ORs involves a key drawback. When we want to send liquidity from L2 to L1, over the bridge, there is a waiting time of about seven days between the validation of the transaction and the actual sending of the funds.** This waiting period, designed as a security measure, corresponds to the time during which it is possible to submit the proof of fraud in relation to the status of the balances on layer 2.

### 2. ZK-Rollups (ZKR)

**The functioning of ZKRs is similar to that of ORs, with one major exception: the proof recorded on layer 1 is continuously verified** and, therefore, certified in real time. **These checks use a cryptographic method called 'zero knowledge proof' (ZKP)<sup>163</sup>,** which makes it possible to corroborate the validity of the proof without revealing its content. While this may seem almost magical, in reality it is only mathematics. ZKP techniques have been developed since the 80s<sup>164</sup> and have now reached a high level of sophistication, with many applications in the crypto domain in particular.

**Verification of proof using ZKP techniques eliminates the seven-day time limit for withdrawing funds** from L2 to L1. **Conversely, it requires very high computing power** and is difficult to perform on the basis of Ethereum's ('virtual machine') technology. This is why **ZKR's first projects, launched by the Israeli-American company Starkware, use a different virtual machine and programming language (called 'Cairo') from Ethereum, which limits compatibility** between the two infrastructures.

Starkware's first product, StarkEx, has been in production for more than a year. It is a silo (replicable) infrastructure designed to host a specific service that does not require interaction with other applications on blockchain. StarkEx is already used by major crypto projects such as Sorare<sup>165</sup> (fantasy sport based on NFT), ImmutableX (NFT platform) and DydX<sup>166</sup> (crypto trading). At the end of 2022, these three aggregate applications total the same number of transactions as Ethereum, with just over 30m<sup>167</sup> in one month, i.e. a scaling of 100% (or 2x).

In addition, Starkware's second product, Starknet, is a true L2 blockchain, launched as an alpha version in May 2022<sup>168</sup>.

156 [Arbitrum Activity Accelerates After the Nitro Upgrade - Delphi Digital](#)

157 Total Value Locked: money supply managed by the smart contracts deployed on the chain.

158 [Arbitrum TVL - DefiLlama](#) on 28/11/2022

159 [Optimism TVL - DefiLlama](#) on 28/11/2022

160 [Ethereum L2 Optimism Sees 500% Growth in Active Users Since July - Tokenist](#)

161 This system forms the basis for the functioning of both Arbitrum ([A Gentle Introduction to Arbitrum | Arbitrum Documentation Center \(offchainlabs.com\)](#)) and Optimism ([Rollup Protocol | Optimism Docs](#)). However, since the two protocols are still relatively recent, the practice does not fully correspond to theory. On Arbitrum, to manage a verifier, it is necessary to be approved by Arbitrum itself ([Arbitrum One - L2BEAT](#)). On Optimism, to date, there is no evidence of fraud, since the system is being radically updated ([Protocol specs | Optimism Docs](#) + [CAN-NON: Introducing Cannon | by Optimism | Optimism PBC Blog | Medium](#))

162 [Introducing EVM Equivalence. Or, Ethereum All the Way Down: How We... | by Optimism | Optimism PBC Blog | Medium](#)

163 [Zero-knowledge proofs | ethereum.org](#)

164 [people.csail.mit.edu/silvio/Selected\\_Scientific\\_Papers/Proof\\_Systems/The\\_Knowledge\\_Complexity\\_Of\\_Interactive\\_Proof\\_Systems.pdf](#)

165 Sorare could eventually migrate to an "L3" infrastructure, consisting of a StarkEx silo based on an L2 blockchain such as StarkNet (see next paragraph). For further information: [Fractal Scaling: From L2 to L3. It's layers all the way down | by StarkWare | StarkWare | Medium](#)

166 DydX announced in June 2022 the migration to an appchain of the Cosmos ecosystem (see section "Alternative Blockchains to Ethereum: many competitors, but few winners")

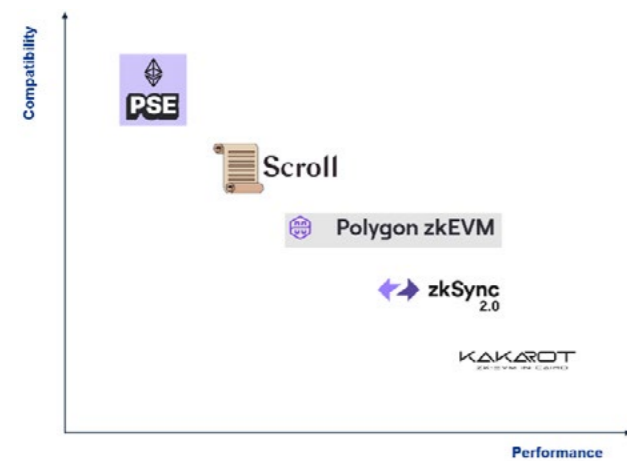
167 L2beat

168 [StarkNet Overview \(dune.com\)](#)

## Zk-EVM: the best of both worlds?

In order to compete with Starkware products, **the enthusiasm over solutions to build zk-rollups on the Ethereum Virtual Machine (EVM) is very strong.** However, as demonstrated by Vitalik Buterin, the founder of Ethereum, in its taxonomy of “zk-EVM” experiments<sup>169</sup>, **the trade-off between compatibility (with Ethereum) and performance (particularly in terms of generating proof) cannot be circumvented.** This is why each zk-EVM project chooses a different balance between these two variables.

Figure 4 :  
**Indicative illustration of the positioning of major zk-EVM projects in terms of the compatibility/performance trade-off. Source: KPMG based on the taxonomy of Vitalik Buterin<sup>170</sup>**



In terms of roadmap, **the most advanced projects are zkSync 2.0**, for which the main network (mainnet) is already online and is expected to be open to the public at the end of 2022<sup>171</sup>, **and Polygon zkEVM**, currently in testnet, which scheduled to launch its mainnet in the first quarter of 2023<sup>172</sup>. Then there is Scroll, for which the pre-alpha testnet was published in October 2022 and the mainnet is expected in 2023.

169 [The different types of ZK-EVMs \(eth.limo\)](#)

170 *Ibidem*. NB1: in the Vitalik taxonomy, Polygon zk-EVM is located at the same point on the chart as Scroll. #2: Moreover, Kakarot is not mentioned in Vitalik's paper. Sources for Kakarot: <https://twitter.com/i/spaces/1eaKbrDEddqKX?s=20> et [https://twitter.com/Ox\\_stoun/status/1577294576154513408?s=20&t=hR-RBPc8\\_a5sCdLWWhDD2Jg](https://twitter.com/Ox_stoun/status/1577294576154513408?s=20&t=hR-RBPc8_a5sCdLWWhDD2Jg).

NB3: The collocation of the projects in the diagram is approximate and the list of initiatives taken into account cannot be seen as exhaustive.

171 As a reminder, this report was drafted in early December 2022.

172 [The Zero-Knowledge Landscape: Part 2 - by tolks - Page One \(substack.com\)](#)

173 [Polygon Launches zkEVM Testnet — Defi Projects Uniswap, Lens, Aave Join Testing – Technology Bitcoin News, Aave Community Members Vote to Deploy on zkSync v2 Testnet \(coindesk.com\), Uniswap Votes to Launch V3 on zkSync - The Defiant](#)

174 [Arbitrum Nova - Ultra-low transaction costs with high security.](#)

Large-scale applications such as Uniswap and Aave (decentralised finance) have already been deployed on the zkSync 2.0 and Polygon zkEVM<sup>173</sup> testnets, attesting to the growing interest in these emerging infrastructures.

## In sum, what is the best L2 for a crypto project?

**There is no clear answer to this question**, for two main reasons:

- Firstly, because the **state of advancement of the various L2 projects varies greatly**. Just compare the Arbitrum (OR) statistics with the zk-EVM blockchain roadmap.
- Secondly, because **different rollups could end up coexisting**. If each infrastructure has a particular value proposition, with its advantages and disadvantages, **the choice of companies will likely be guided by the use case in question**. For example, the new Arbitrum Nova technology, which has a good performance in terms of scalability, but is based on a compromise in terms of on-chain transparency and decentralisation<sup>174</sup>, is particularly suited to projects in gaming or decentralised social networks. While remaining attentive to the development of ZKR solutions, with great innovative potential, we expect a diversification of rollups and adoption by companies according to preferences and needs.

# Key takeaways

**The rollups, scalability solutions built on Ethereum, are of paramount importance for any crypto project targeting the general public.**

There are different types of rollups. **Today, two main categories stand out: the Optimistic Rollups (OR) and the ZK-Rollups (ZKR).** The former are ahead on the market, due in particular to the growth of Arbitrum. However, ZKR appear to have high potential given the underlying technology fundamentals.

**The choice of the best rollup for a crypto project depends on the prerequisites specific to each initiative.**

## Decentralised Finance: a growing and increasingly complex ecosystem

Despite a tumultuous year for the crypto sector in terms of asset valuation, **Decentralised Finance (DeFi) continues to evolve and prove its relative resilience.** The DefiLlama site reported a drop in TVL (Total Value Locked, the total value circulating in DeFi agglomerating all chains) at the end of 2022: \$44bn against \$166bn at end-2021<sup>175</sup>. However, by taking the value of this TVL in ETH and not in dollars, it remains generally stable, or even slightly higher for protocols such as MakerDAO or Uniswap, thus putting the drop in dollars into perspective.

The intrinsic features of DeFi, such as **self-custody, transparency and composability, are fundamental.** The FTX scandal at the end of the year highlights these virtues, while **the institutionalisation of DeFi has only just begun,** with the announcement, of a public blockchain test for JP Morgan, as well as the developments of Aave Arc offering liquidity pools dedicated to institutional players.

### More resilient than ever? DeFi could be part of the solution to the shortcomings of CeFi

Periods of sharp price declines, in particular driven by the fall of centralized players such as Celsius, 3AC or FTX, coupled with ecosystem explosions such as Terra/Luna highlight that **the main DeFi protocols have a rather functional system for liquidating borrowing (or leveraged) positions**

At the time of the bankruptcies of these **centralised players (Celsius, FTX, etc.),** we note the speed of the decision to unwind positions on protocols such as AAVE or Compound firstly, before the loans between centralised players, given that the collateral is automatically liquidated in DeFi.

It appears that **decentralised finance remains more than ever a part of the solution to the problem posed by the bankruptcies of centralised players.**

The non-custodial<sup>176</sup> nature, the transparency arising from the execution of transactions directly on the

blockchain, as well as the self-executing code (smart contract), are important in stress situations on the markets. Proof of reserves is the essence of a functional decentralised application if the smart contract does not contain flaws, and the oracles<sup>177</sup> are decentralised like those of Chainlink to prevent any manipulation.

### A solid basis and improved by composability

The offer of decentralised finance applications is expanding around protocols that provide foundations for other applications.

The following quintet still dominates with (ordered by total value locked at the end of 2022<sup>178</sup>):

- **MakerDAO (6.9bn):** Protocol to create the stablecoin DAI with dollar parity and using crypto as collateral
- **Lido (6.1bn):** Protocol allowing staking on Ethereum and offering a liquid version of the investment, the stETH, re-usable and therefore composable in DeFi
- **AAVE (46bn):** Dominant lending and borrowing market
- **Curve (3.8bn):** Decentralised trading platform specific to assets of the same value (stablecoin, ETH-stETH, USDC-USDT, etc.)
- **Uniswap (3.7bn):** Decentralised trading platform for all types of cryptoassets

**Chainlink dominates the oracles market** with its network that feeds numerous applications with asset price data of all kinds (crypto prices, commodities, fiat currencies, etc.). Participants in Chainlink's network include traditional companies such as Deutsche Telekom or crypto-specific players. Chainlink is expected to continue to develop Chainlink's development is expected to continue in 2023, with more traditional players involved given the criticality of the oracle network and the capacity to increase competency in companies this way. In total, **Chainlink has secured flows since 2020 for a total value of \$6,500 billion**<sup>179</sup>.

**Many applications are emerging, built on the pillars of MakerDAO, Lido, Aave, etc.** For example, Morpho

(\$0.27 billion in TVL<sup>180</sup>), built on top of Aave or Compound, optimises the connection between the lender and the borrower. The result is to offer a more attractive interest rate for them by offering specific liquidity pools and a peer-to-peer system. As such, Morpho is remarkable with respect to the amount raised from investors in July 2022 (\$18 million). To illustrate the composability, Aave relies on Chainlink data, and Morpho is grafted on top of Aave.

### The quest for 'decentralised' stablecoin and the line between hybridisation and automation

**The asset of the non-crypto world<sup>181</sup> most widely used in the DeFi ecosystem remains the stablecoin dollar,** serving both as a reserve asset and a means of payment. Stablecoins with USD-denominated collateral (USDT, USDC and BUSD in particular) now account for \$134bn<sup>182</sup>. **DeFi thus makes it possible to use 'censurable' tokens** because it is subject as they are subject to the jurisdictions of the countries in which the issuers are located. The DAI comes fourth in the ranking with a system based on crypto collateral with a total capitalisation of \$5.8bn<sup>183</sup>, but nearly 50% of USDC collateral can therefore be frozen by court decision.

Two events of the year revived the debate about the effective decentralisation desired by the various DeFi players:

- OFAC's decision to condemn the use of a mixer<sup>184</sup> like Tornado Cash, and the repercussions for the stablecoins that can be censored.
- The collapse of the UST, with its algorithmic model without collateral and unsustainable over time, on the Terra blockchain, fortunately not linked to Ethereum regarding systemic risk.

**This quest for decentralised stablecoin attracts various protocols that see the creation of a stablecoin as an opportunity to generate additional income, as well as to make protocols and capital more efficient in their uses.** In 2023, Aave is expected to offer the stablecoin GHO<sup>185</sup>, which can be borrowed by users depositing the capital with an interest rate (including a yield paid on the deposit). Curve, with less

clarity on the model and modalities, has also announced that it is working to issue its own stablecoin.

As such, the DeFi ecosystem has the choice of two directions, bridging 2022 and 2023: **either increasing hybridisation with traditional finance,** particularly in light of more attractive interest rates; **or a more sinuous and still unclear path,** aiming to completely detach from any censorship or link (peg) to the dollar.

MakerDAO illustrates this hesitation, as the protocol seems to be caught between the two trends. Two contradictory governance votes took place at the end of the year, between a long-term vision (carried by the co-founder Rune Christensen) aiming to no longer depend on RWA (Real World Assets, financial securities and drawdown rights on a line of credit) and get rid of the link to the dollar<sup>186</sup>, and the contradictory investment of \$1.6 billion<sup>187</sup> in USDC via Coinbase to generate a 1.5% return on this collateral.

### Emerging ecosystems specific to L2 chains

**The emergence of L2s** (see section "Ethereum layer 2: a promise become reality") **makes it possible to consider DeFi applications with more users given the moderate fees offered** with, at the end of 2022, three networks (Arbitrum, Optimism and Zksync 1.0) reporting transfer and exchange transactions for less than 10 cents. Moreover, these costs are set to decrease by a factor of 10, even 100, with a new update of Ethereum in the coming years (see section "Ethereum: an infrastructure under perpetual development, between new risks and opportunities").

On these L2 networks, we note **that DeFi functionalities are even more economically accessible. Consequently, applications and ecosystems specific to these chains are appearing.** An example of this is GMX on Arbitrum, a decentralised perpetual trading platform, or Dopex, that can create vehicles to automate the use of options to generate yield. Thus, at the end of 2022 Arbitrum saw its DeFi ecosystem reach a number of transactions, compared with Ethereum, with a remarkable ratio of 60%<sup>188</sup>. Moreover, GMX is interesting in that it illustrates the 'real yield' principle, with the ability to share part of

175 [DefiLlama - DeFi Dashboard](#)

176 Non-custodial - self-hosted, meaning that there is no intermediary

177 Service allowing the injection of data outside Blockchain, see next paragraph and presentation of Chainlink

178 [DefiLlama - DeFi Dashboard](#), end November 2022

179 [Decentralized Data Feeds | Chainlink](#) (aggregate of all the flows of DeFi applications using this network of oracles)

180 [Analytics | Morpho](#) as at 25/11/2022

181 Otherwise known as Real World Assets

182 [stablecoins.wtf - Crypto Stablecoin Dashboard & Resources](#)

183 [Dai Stats](#)

184 Service used to mix flows and provide (relative) confidentiality in exchanges

185 For "Ghost", as Aave means ghost in Finnish

186 [MakerDAO Splits in Two Over Founder's 'Endgame' Proposal - Decrypt](#)

187 [Maker Governance - Ratification Poll for Coinbase USDC Institutional Rewards \(MIP81\) - October 10, 2022 \(makerdao.com\)](#)

188 [L2BEAT - The state of the layer two ecosystem](#)

the income with the holders of GMX tokens (governance token) or GLP tokens (index token representing the platform's reserves). To date, more than 150k addresses have interacted with these services<sup>189</sup>. This narrative faces obvious legal considerations on the qualification of tokens but suggests that **governance tokens could become more meaningful through the ability to capture an economic flow**. In the same way as DYDX on Starkex (before the migration to Cosmos), Perp Protocol (on Optimism) or GMX are **alternatives to platforms such as FTX**. Rollups (see section "Ethereum layer 2: a promise become reality") could push centralised exchange platforms to rely on DeFi protocols as an on-chain 'back-end' technique for trading. **This would provide transparency on trading and reserves, thanks to the natural auditability of on-chain flows**. The proof of reserves of customer deposits could then be anchored every hour in Ethereum L1. These developments will take a few more years but point to still undetected potential confidence through the properties of DeFi.

**Weaknesses remain in DeFi to date, but solutions are emerging on the horizon**

Although decentralised finance, which is still young, is far from being fully scaled, this vertical of blockchain applications nonetheless remains **one of the most vibrant sectors, after elimination of several weaknesses** that do not constitute an unreachable horizon:

- **Foundation bricks that are still relatively immature**, such as Automated Market Makers, which favour 'arbitrageurs' to the detriment of liquidity providers (with around 50%<sup>190</sup> of liquidity providers loss-making on Uniswap's V3).
- **Still significant technical flaws in the applications despite numerous audits**, proof of which

- **Still non-existent regulations make the development of DeFi difficult at the institutional market level**. As a reminder, the European MiCA regulation, which will enter into effect in 2024, does not directly concern DeFi. A second version, a "MiCA 2.0", has already been publicly announced for this purpose.
- **Yields that are too low** (around 1% to 2% for stablecoin in DeFi) while US treasury bills are between 4% and 5% for a one-year horizon with less risk (considering the technical smart contract risks inherent to DeFi).
- **Governance tokens with an inflationary economic model** and too weak to anticipate an appreciation of these assets.

In conclusion, decentralised finance is gradually becoming one of the most relevant and attractive sub-sectors to follow in the crypto ecosystem. **The promise to offer financial services of all kinds (lending, borrowing, trading, liquid staking, etc.) with transparency, self-custody and reduced transaction fees seems to be fundamental considering the events of 2022**. The promises of composability offered by well-anchored applications, coupled with new applications that optimise them, offer a development to follow. **The progress of Aave Arc, among many other DeFi protocols enabling the addition of KYC controls, as well as Ethereum's Merge update are in line with the direction of an institutionalisation of the sector**, in anticipation of the regulation.

189 [GMX Everything Dashboard \(Avax and Arbitrum\) \(dune.com\) / Dopex \(dune.com\) / GMX analytics](#)  
 190 [Microsoft Word - Impermanent Loss in Uniswap v3.docx \(arxiv.org\)](#)  
 191 [Cybersecurity for Blockchains and Cryptos 2022 - KPMG France \(home.kpmg\)](#)

# Key takeaways

**The self-custody and transparency features of DeFi enabled this industry to be resilient in the face of the tumultuous events of 2022.**

The composability of DeFi applications around pillar protocols, such as Uniswap, MakerDAO or Aave, is an attractive and promising feature for the development of DeFi.

Given the dominance of centralised stablecoins collateralised in fiat currency, DeFi applications are looking for an uncensorable and decentralised alternative. **There are two possible strategies and none of them really stands out: hybridisation with traditional finance, or fully detached from it.**

DeFi protocols are beginning **to be developed natively on layer 2 blockchains.**

DeFi still has **many avenues for improvement**, for example in terms of the cybersecurity of smart contracts. Nevertheless, **this vertical remains one of the most attractive to follow in the crypto ecosystem.**

## NFTs: a market that has lost momentum but confirms the underlying trends

**Despite a boom in NFTs (Non-Fungible Tokens) in the first quarter of 2022**, with a weekly global trading volume of nearly \$6billion<sup>192</sup> in January, **the current situation shows a significant contrast**. In a complex macroeconomic environment affecting all asset classes, the NFT market has also been logically impacted. However, it should be remembered that we are only in the early stages of the opportunities offered by these assets and that **the adoption of cryptos, both for individuals and businesses, continues to grow**. It is therefore necessary as we embark on 2023 to summarise the current landscape and determine the underlying trends of the NFT market.

### A declining market but that brings new challenges for companies

With a **drop of nearly 90% in trading volume** since the first quarter of 2022, it is impossible to ignore the disproportionate magnitude of the NFT wave in H1 2022. **However, the number of users of NFT platforms has continued to grow** in H2 2022. For example, OpenSea had more than 2.3<sup>193</sup> million users at the end of 2022, confirming the interest in these technologies. Indeed, **2022 was also marked by unprecedented positioning of many companies** on the NFT market, across all sectors, in order to meet growing demand.

Although some initiatives have not yet seen the expected returns and appear to be more of a media stunt, they have revealed deeper internal issues. Indeed, the relatively rapid and generally outsourced experimenting of projects related to NFTs has led **to the urgent need to understand and master many aspects of crypto topics**. From the challenges of storing and securing cryptoassets, to **the management of cybersecurity or legal risks**, the need to develop skills and increasingly internalise resources has been increasingly felt. These experiments, mainly in the art and collectibles segments of NFTs, have enabled several players to look into **more complex use cases**, using both fungible and non-fungible tokens. These include the

possibility of generating interest for its cryptoassets, launching projects related to decentralized autonomous organisations (DAOs<sup>194</sup>), and access to decentralised borrowing and lending platforms. Nevertheless, the regulatory uncertainty persists regarding the qualification of NFTs, which were notably excluded from the MiCA regulation<sup>195</sup> in Europe (see section “*A harmonisation of the jurisdiction and competition of the European crypto industry*”), the main issue of which remains the end-purpose (financial asset? work of art? online gaming tool?) and not the technological support, which itself is neutral.

### Some initiatives stand out and reveal many opportunities

In a declining market in which the reputation and visibility of NFTs have been significantly impacted, some projects stand out from others and continue to disrupt the sector. Most of the serious projects also confirm the dominance of the Ethereum network. Here are a few examples:

**Nike and RTFKT:** The acquisition in December 2021 of the start-up RTFKT, launched in 2020 and specialising in the creation of virtual footwear and accessories under NFTs, has enabled the US giant to become one of the pioneer brands in Web3. By offering a ‘phygital’<sup>196</sup> offer linking NFTs and real objects, Nike has not only created demand from a pre-existing community but has also reached a new and younger target. With its CloneX avatar collection launched through 20,000 NFTs, **Nike was able to generate a total of \$185 million<sup>197</sup>** in just a few months (including \$92 million in royalties<sup>198</sup>). A profitable and strategic positioning demonstrating the interest and commitment of consumers to Web3. Lastly, we have seen the creation of **unprecedented synergies between different sectors**, as illustrated by the recent partnership between RTFKT and Rimowa, a luxury luggage brand belonging to the LVMH group.

**Sorare:** With more than **2 million players<sup>199</sup>** to date and **170,000 owners<sup>200</sup>** of paying cards (**+126%** vs 2021), the French unicorn offering a mix of multisport fantasy games and cards to be collected in the form of NFTs, continues its rapid development. Thanks in part to the use of the **StarkEx** layer 2 scalability solution (see the section “*Ethereum layer 2: a promise become reality*”), developed by Starkware, Sorare offers an experience perceived as more intuitive, faster and with no transaction fees for the final player. Users also have the possibility to monetise their game time based on their performance. This company is also pursuing its **international development** with its recent partnerships in the United States, notably with the NBA (basketball) and the MLB (baseball).

**Tiffany:** Although it represents just one initiative among many in the luxury sector, Tiffany demonstrates the relevance of an offer combining NFTs and physical objects, while preserving the values of luxury: rarity and authenticity. In a partnership with the famous NFT Cryptopunk collection, the LVMH brand created a series of exclusive pendants reserved for the holders of these NFTs, a first in the sector. **In just 20 minutes, Tiffany generated more than \$12.6 million<sup>201</sup>**, while attracting and uniting a younger, natively digital and previously non-consumer community. An innovative way to strengthen its brand image, indirectly, through NFTs.

Figure 5:  
Illustration of NBA NFT cards according to the different levels of scarcity by Sorare



192 The Block, NFT Marketplace Monthly Volume, [Marketplaces \(theblockresearch.com\)](https://www.theblockresearch.com/)

193 [OpenSea | DappRadar](https://dappradar.com/)

194 DAO - Decentralized Autonomous Organization

195 Markets in Crypto Assets

196 Phygital: A brand strategy based on both a physical (objects) and digital (web) experience.

197 [NFT Brand Case Study \(dune.com\)](https://dune.com/)

198 Nike receives 5% royalties on each sale made on the secondary market

199 [Sorare teams up with NBA for a new NFT fantasy basketball game | TechCrunch](https://techcrunch.com/2022/01/12/sorare-teams-up-with-nba-for-a-new-nft-fantasy-basketball-game/)

200 [NFT Dashboard / CryptoSlam!](https://cryptoslam.com/nft-dashboard/)

201

## NFTs are becoming part of the video landscape

Finally, while the wave of NFTs has been materialised by the over-mediatisation of their speculative nature, real value-added use cases are developing rapidly, for example in **the entertainment sector, especially in video games**. While the famous play-to-earn<sup>202</sup> Axie Infinity highlighted prototypes of partnerships between cryptoassets and video games, the wave quickly died down, with a sharp drop in the number of users, as a result of a shaky economic model. More generally, the price of NFTs on certain games remains a key obstacle for their adoption and sustainability. However, we are gradually seeing **a clean-up of the market**, as well as the promotion of an economic model that is more focused on **play-to-own**<sup>203</sup>. Many ambitious projects are under development, in a sector with **massive financial leverage** (nearly \$10 billion invested to date<sup>204</sup>).

Among them, **Illuvium** is attracting growing interest from users (**\$72 million**<sup>205</sup> in land sales last June), with various games expected to be launched in the coming months. Built on the L2 solution **Immutable X**<sup>206</sup> (see section “Ethereum layer 2: a promise become reality”), Illuvium promises an innovative, intuitive gaming experience with no transaction fees, while preserving the dimension of ownership and portability of the underlying digital assets (crypto, NFT).

Social media and NFTs: a future marriage in perspective?

In addition to the ongoing development of projects in the gaming sector, we are also witnessing a rise in solutions related to **identity management and on-chain communities**. In fact, **it is possible to encapsulate any type of data linked to social interactions in NFTs**, with advantages in terms of **portability** as well as **user control** over their data, generally centralised in the hands of a few players (GAFAM, etc.). Many use cases are appearing, such as the issuance of identification elements attesting a user’s activity on a given blockchain. This is what the Sismo project<sup>207</sup> proposes for example, with its certificates in the form of badges.

**Lens Protocol offers a solution to create decentralised social networks**, that is composable and interoperable. Unlike traditional social networks, Lens makes it possible to switch from one application to an-

other with a single profile (address of a digital wallet), while keeping ownership of data, the shared content and the social interactions generated. A new source of content monetisation is also emerging for users (artists, developers, influencers, etc.), based on this technology.

Similarly, the initiative of the social network **Reddit**, through the launch of NFTs in the form of customisable avatars, illustrates **the interest of Web2 players in Web3**, as well as the key role UX plays in the adoption of these new standards. We note the unprecedented approach that Reddit has chosen by removing many barriers to entry, both in its communication and in the user experience. With more than 3 million accounts created for the purchase of these avatars, it will be interesting to monitor the progress of Reddit’s projects in connection with NFTs, as well as the usefulness that will be associated with these digital assets for the benefit of the user community.

Finally, **new standards** are emerging, such as the ‘soulbound’ tokens that make possible to create non-transferable tokens, an essential technical component when it comes to personal data (identity, certificates, etc.). Although some questions persist, including the **degree of accountability** of users regarding data management and security, more and more solutions are emerging.

# Key takeaways

In a declining market, NFTs logically followed this trend. However, this complex context **makes it possible to better identify promising projects with real added value.**

**Various industries (luxury, gaming, etc.) continue to position themselves on this market** and develop strategic thought processes around the use of NFTs.

Technological innovation enables the emergence of new use cases, particularly in connection with digital identities and **decentralised social networks.**

202 Play-to-earn (P2E) is a new horizon for players to earn real income from their online business, capitalising on the rise of NFTs.

203 Play-to-own: a concept that promotes the notion of ownership and sovereignty of digital assets, while having the ability to monetise playing time.

204 KPMG internal source

205 [Illuvium Raises \\$72M From Land Sale Despite GameFi Bear Market - The Defiant](#)

206 Scalability solution developed by Starkware

207 [SISMO - Own your identities](#)



## Metaverses: simple trend or real technological breakthrough?

A misunderstood concept with too high expectations. More than a year after Facebook's transition to Meta, metaverses have attracted strong corporate interest, reflected in the **capital inflows exceeding \$7 bil-**

**lion at the end of 2022**<sup>208</sup>. Despite this, metaverse projects experienced an **average drop of 92%**<sup>209</sup> in **transaction volume**, as well as a 38%<sup>210</sup> decline in land sales compared to the first quarter of 2022. While the opportunities offered by metaverses are promising, the added value they provide may sometimes seem unclear and misunderstood. Here we offer you an overview of the current situation as well as a review of past and future initiatives.

Figure 6:  
Evolution of trading volumes and sales in the main crypto-metaverses



208 Investments in the Metaverse projects, <https://dappradar.com/blog/metaverse-report-2-demand-for-metaverse-remains-amidst-crypto-turmoil>

209 *Ibid.*

210 *Ibid.*

The concept of "metaverse" is often used wrongly and is **over-mediated**. **Many "metaverse" projects have emerged, with a technological core in reality only based on virtual reality**, if not entirely empty... Interpol's recent announcement of its "police metaverse"<sup>211</sup> illustrates the disproportionate path this trend has taken and the desire for all actors to create their own virtual world at all costs. As presented in our Crypto Outlook 2022 report<sup>212</sup>, **these initiatives, with broad and often unclear concepts, must be distinguished from the crypto-metaverses, that have the potential to bring real technological innovation, incorporating concepts of digital ownership and interoperability through cryptos.**

However, the expectations for crypto-metaverses could also be disproportionate, especially if we consider the time needed for the adoption of cryptos by the general public. The two most well-known crypto-metaverses, Decentraland and The Sandbox, were the subject of massive investments by companies in 2022. Despite this, it must be noted that the use of these technologies by the general public is still limited, as shown by the few thousand daily users<sup>213</sup> on Decentraland.

### High potential stakes and attractive initiatives: the example of the Australian Open

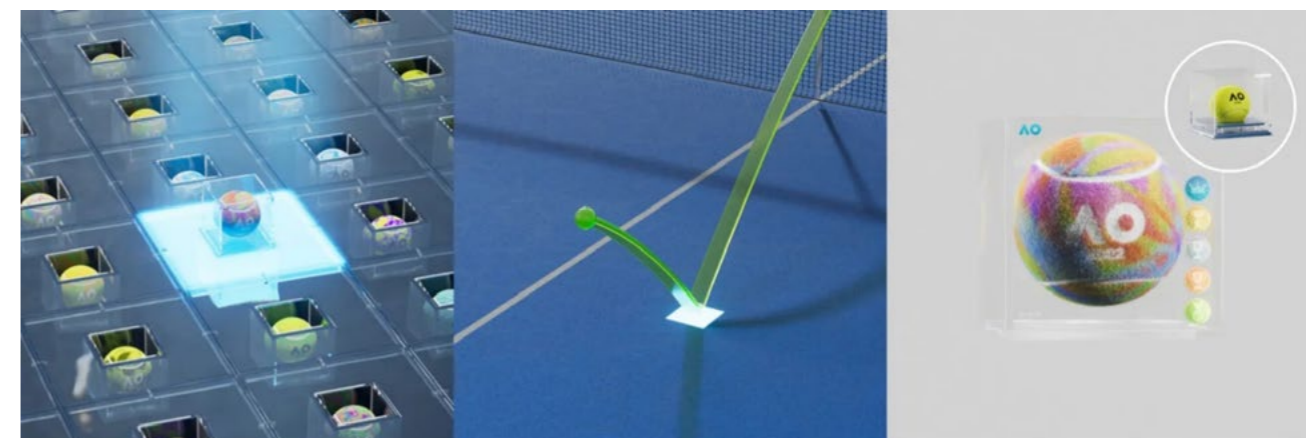
Beyond a simple communication lever, investments in crypto-metaverses can represent a **long-term strategic challenge for companies**, paving the way for many opportunities. The most likely driver of potential adoption is set to be the **gamification of the user**

**experience** (POAP<sup>214</sup>, customer retention, community engagement, exclusive rewards and experiences, etc.). It is in the interest of brands to own virtual land, creating a new channel to further enrich and personalise the customer relationship.

It is also important to highlight the importance of linking digital with physical dimensions, to the benefit of the end user. The **partnership<sup>215</sup> between the Australian Open and Decentraland** last January is a very good illustration of this. In addition to creating Melbourne Park's flagship complex inside the metaverse, allowing, among other things, to virtually visit the stadium and follow matches in live, the project is based on a **real customisation of the user experience**. First, the Australian Open launched a collection of 6.776 NFTs with an original concept: **each NFT is connected to a land area of 19 cm<sup>2</sup> on the tennis court**. Their use is simple: if the last ball played in the game lands on the area owned by the user, the latter receives access to several benefits, both digital and physical. Among them, balls used during the games in a custom case, virtual meeting with players or **access to private events in the Decentraland metaverse**. This is an excellent way to engage fans through gamification and blockchain technologies.

In general, more and more solutions are emerging on holistic metaverses, each offering unique business concepts and models. The success of Decentral Games, developing free and interactive games such as poker on Decentraland, also available in mobile versions, confirms this.

Figure 7:  
Illustration du NFT représentant une zone de terrain spécifique et sa gamification par Aus Open



211 [INTERPOL launches the world's first police metaverse](#)

212 [Crypto Outlook 2022 - KPMG France \(home.kpmg\)](#)

213 [Decentraland on Twitter: „Let's have a look at some of September's data: 56,697 MAU 1,074 Users interacting with smart contracts 1,732 minted Emotes 6,315 sold Wearables 300 Creators received royalties 161 created Community Events 148 DAO Proposals“ / Twitter](#)

214 POAP – Proof of Attendance Protocol: A POAP represents an NFT enabling the presence of a physical or virtual event to be certified.

215 [Inside The Australian Open's Successful Integration Of NFTs And The Metaverse \(crunchbase.com\)](#)

### Questions remain regarding the metaverse model

As presented in our Crypto Outlook 2022 report<sup>216</sup>, the **potential of crypto-metaverses remains unchanged**. However, developing an ecosystem and a new business model in Web3 takes time, as shown by the minor progress observed in most of the metaverses over the past year. Similarly, we can of course **question the evolution of the current business models** of the projects. Indeed, the land registry model chosen for most of them remains questionable, in a completely intangible and digital world, where parcels appear inaccessible to the general public, due to the high prices<sup>217</sup>. Similarly, the short-term boom of just one, single crypto-metaverse, seems unlikely, where the **importance of developing interoperability solutions** to establish connections between the different virtual worlds. This is the ambition of the company Msquared<sup>218</sup> with the creation of bridges between metaverses, which should allow users to transfer their assets from one world to another.

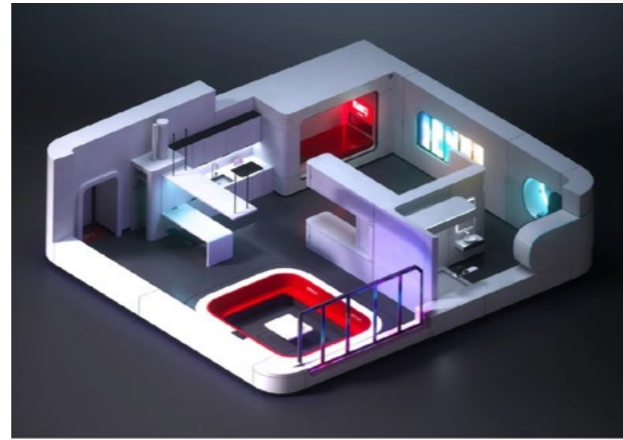
Furthermore, **the real decentralisation of crypto metaverses is an additional focus**. Some crypto metaverses are now less decentralised than we believe. Indeed, behind each 'item', such as a parcel of land, there is an NFT and its metadata. Thanks to the transparency of the blockchain infrastructures, it is possible to see where this metadata is hosted. However, a large part of it remains hosted in centralised databases, allowing for censorship or manipulation by a third party. The use of decentralised hosting solutions would enable these vulnerabilities to be addressed (see the section "*Decentralised storage: high potential under the radar*").

### Building a 'metaverse' strategy requires stepping back

Lastly, while the metaverse is characterised by the creation or purchase of virtual spaces based on crypto and blockchain technologies, there are **alternative applications to digital worlds such as Decentraland, with less potential but that is more easily actionable** for companies. This is where OnCyber's value proposition lies, which allows brands to create virtual showrooms (3D/VR) and develop a 3D online experience, through the exhibition of NFT galleries. For example, Nike subsidiary RTFKT has put up for sale a series of 20,000<sup>219</sup> immersive spaces that allow each user or company to exhibit their own collections. Visitors can then buy the work directly from the gallery if they want

to. A simple, affordable and interesting way to interact in virtual spaces with NFTs, for both companies and users.

Figure 7 :  
**Illustration d'un espace immersif et interactif créé par RTFKT, disponible sur OnCyber**



To conclude, the work of acculturation to the challenges of metaverses must continue, both from a technical and operational point of view. Beyond the media positioning, a real **long-term thought process and the identification of concrete use cases** are essential. Support on these two verticals is therefore necessary to avoid any unfounded and irrelevant investment.

216 [Crypto Outlook 2022 - KPMG France \(home.kpmg\)](#)

217 As at 30 September 2022, the floor price of a plot in The Sandbox and Decentraland was \$2,317 and \$2,315, respectively. Source: [Metaverse Report #2: Demand for Metaverse Remains Amidst Crypto Turmoil \(dappradar.com\)](#)

218 [Home - M<sup>2</sup> \(msquared.io\)](#)

219 [oncyber - build your own world, experience with others.](#)

# Key takeaways

2022 was marked by the development of 'metaverse' projects, surfing on a **disproportionate marketing trend** and for the most part **ignoring the added value of crypto and blockchain technologies**, by limiting themselves to the use of virtual reality.

While the coming year remains uncertain due to an unstable global context, **initiatives have nevertheless been successful** (e.g. Australian Open on Decentraland) **and give a glimpse of real use**, particularly in terms of customer engagement.

Companies continue to show interest for metaverses, and the challenges they pose **require a long-term strategic positioning**, on the condition that the limitations and opportunities implied by these technologies are kept in mind.

## Decentralised storage: high potential under the radar

### The contribution of Web3 in data and content governance

We generate nearly **2,500 PB<sup>220</sup> of content per day<sup>221</sup>**, and the amount of data created, captured and consumed worldwide increased 32-fold between 2010 and 2020<sup>222</sup>. Storing and accessing data has never been so easy, with solutions becoming increasingly efficient : from hard drives to the cloud storage allowing quick access to the largest files (e.g. Big Data), the evolution of storage means is obvious.

However, a large majority of these solutions are built on **infrastructure managed by a handful of players**. Individuals, companies and institutions are **often forced to trust tech giants to preserve the existence and integrity of their data**. Since their creation, the GAFAM have often been accused of being able to modify, censor or even eliminate at their discretion the data of which they are the guardians. Thus, in recent years, growing distrust of these players has led public and private institutions to explore alternative data storage solutions<sup>223</sup>.

**With the arrival of Bitcoin and, more broadly, the development of Web3, it is now possible to possess value without going through a centralised third party**, but what about our data? It is in particular thanks to the rise of the crypto industry, and the new pillar concepts it (re)introduces, that the **need to store data in a decentralised manner** has been expressed. Indeed, the growth of Web3 fosters collective awareness of the importance of real ownership and independence from tech giants. Thus, some projects offer alternative data backup solutions to meet this need. Despite many persisting challenges that still need to be resolved, the scale of the theme of decentralised storage is often underestimated due to a lack of information, but it **potentially represents a fundamental pillar of the new Internet**.

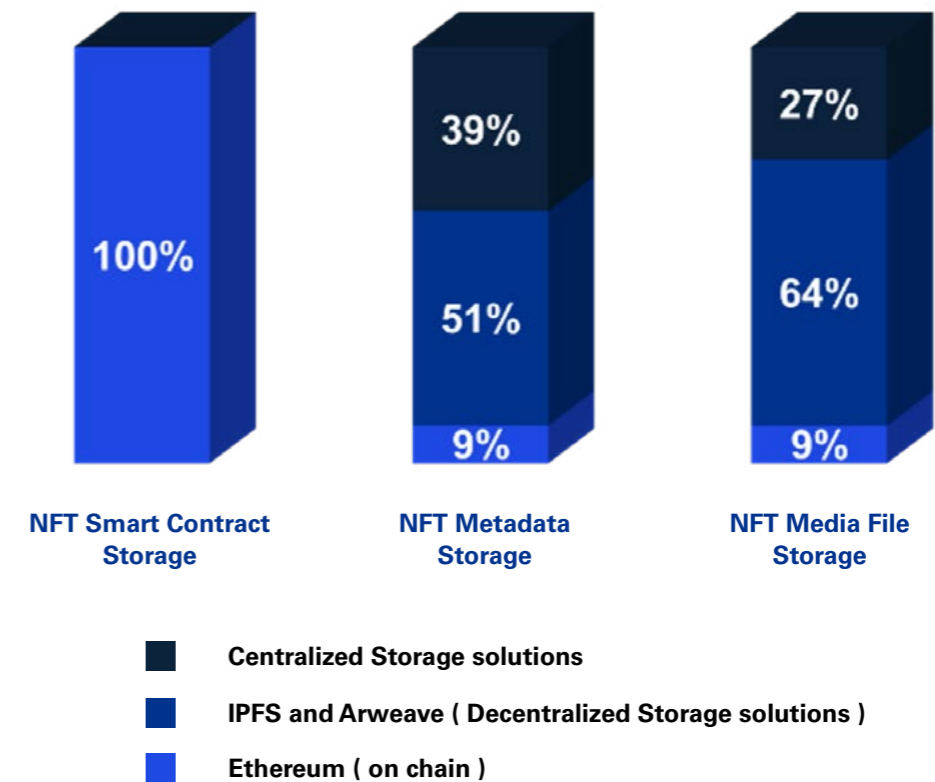
### An issue of sovereignty, from digital assets to personal files

The rise of the NFT (*Non-Fungible Tokens*) market, often linked to art objects (image, video, music, etc.) (see section "*NFTs: a market that has lost momentum*")

but confirms the fundamental trends"), has raised a crucial question: **where are these art objects saved?** A *Non-Fungible Token* is an asset circulating on a blockchain infrastructure (Ethereum, Polygon, etc.). As a result, it can be directly owned and decentralised by users. However, the NFT only represents the property token. The underlying asset represented, whether it is a digital work, a video game item or another, must itself be stored somewhere. As a result **most NFTs are in reality not fully decentralised** (see chart below). Their level of decentralisation also depends on the method of storing the data related to the represented asset. An NFT results from three major components:

- The **smart contract**: by nature on-chain;
- The **metadata**: containing the characteristics of the NFT;
- The associated **media file**: video, jpeg, text, music, etc.

Figure 8 : Breakdown of the storage method of Ethereum NFTs, by type of data. Only 9% of the media files associated with Ethereum NFTs are stored on-chain<sup>224</sup>



When buying an NFT, the certificate of ownership of the asset is registered on the blockchain; it is the token itself. However, since it is not possible<sup>225</sup> to also save the media file on-chain, the platforms creating the NFTs<sup>226</sup> or the issuers directly (brands, corporates, etc.) tend to **use traditional centralised solutions or the cloud** for storing this data.

**This therefore jeopardises the NFT, whose visual component (image, video, etc.) could disappear** – unlike the certificate of ownership – if the centralised

hosting server deletes the file or simply ceases to function. In some cases, when the metadata is also on a centralised server, **the creator of the NFT can even modify its artistic aspect** without the approval of the beneficial owner.

**The risk of loss or modification extends easily to any other type of data**: contracts, research documents, company data, historical archives, visual interfaces ('front end') of websites (with the "Error 404" message), etc.

220 PB stands for Petabyte, a unit for measuring IT storage. In comparison, a Petabyte is equivalent to one million Gigabytes (GB).

221 [How Much Data Is Created Every Day? +27 Staggering Stats \(seedscientific.com\)](#)

222 [Total data volume worldwide 2010-2025 | Statista](#)

223 The pressure of lobbying and public opinion has intensified in recent years, and regulation around GAFAM has become more restrictive, particularly with regard to anti-competition practices and monopolies in user data governance.

224 Study by [YourNfts: I Downloaded Them All](#)

225 Saving images in png format in a blockchain is technically feasible, but the cost to do so is exorbitant, as blockchain is not designed to store this type of heavy data.

226 Here we refer to platforms for buying and selling NFTs such as [OpenSea](#) or [Rarible](#) that also support the creation or 'minting' of the NFT.

## IPFS and Arweave: two major solutions for replicating and distributing content

Some protocols offer alternative means of data backup, allowing data to be **replicated and distributed through a peer-to-peer network, with no trusted intermediary**. We see the emergence of storage space markets, where customers can secure their content and suppliers are capitalising on their unused backup space.

Following this model, we find solutions such as IPFS/Filecoin, Arweave, Storj<sup>227</sup> and Sia<sup>228</sup>, to name the most popular ones. In particular, **IPFS or InterPlanetary File System<sup>229</sup>, created in 2015, is a pioneering project of its kind and leader in terms of adoption** (with at least 90% of the decentralised storage market share in July 2022<sup>230</sup>). The network connects computer equipment ("nodes") to create a **shared file registry system**. A user, by accessing an IPFS node, saves content, which is then replicated and shared with a large number of different nodes in the network. The file has an address (a CID<sup>231</sup>) through which the location of all its pieces can be found, distributed through the nodes. In addition to this network there is the **Filecoin** blockchain protocol, **the economic layer that incentivises IPFS nodes to host the content correctly, via the trading of FIL** (the native token of the Filecoin blockchain). Nodes obtain rewards by periodically providing cryptographic proof of data retention. Filecoin thus favours the permanence of data, which is not ensured solely using IPFS.

Other decentralised storage solutions natively integrate the permanence of file hosting. This is the case of

**Arweave, the only one of its kind, which proposes a pay once solution<sup>232</sup>**. Like Filecoin, the pecuniary exchange for the service on Arweave takes place via **AR tokens**, the native token of the infrastructure. The Arweave protocol has built a network similar to a blockchain, with a unique architecture that makes it possible to systematically host content in all network nodes. Thus, unlike distributed networks such as IPFS where content is stored on a certain number of nodes, **on Arweave each node hosts all the content, making it possible to further reduce the risk of data loss**.

Developing ecosystems but risks of recentralisation **The flip side to the significant potential of the services offered is that both IPFS/Filecoin and Arweave still have limitations in terms of functionalities and user interface (UX/UI)**. The best way to host content and download files is to run one's own IPFS node; however, this requires special knowledge and technical hardware. **This limit also hampers the decentralisation and security of the network**, given the challenge of creating new nodes.

NFT Storage, ArDrive, Web3 Storage, IPFS.io, etc. are all services that offer interfaces to better access storage solutions. **These are gateways and pinning services that guarantee attachment and the best access to content, but which very often include new centralisation points**. In particular, Arweave has communicated on the need to build new gateways since the main gateway (Arweave.net) suffered from a service interruption ('downtime')<sup>233</sup> at the end of 2021<sup>234</sup>.

227 [Storj - Upgrade your cloud storage](#)

228 [Sia - Decentralized data storage](#)

229 [IPFS Powers the Distributed Web](#)

230 KPMG data based on the comparative study of the main decentralised storage solutions on the market (IPFS, Arweave, Sia, Storj, Swarm). Sources: storage.filecoin, Viewblock, Siastats.

231 CID or Content Identifier, generated through coding and cryptography.

232 „Pay one, store forever“ [arweave](#)

233 Technical and operational shutdown

234 [How Can We Improve Decentralization for the Permaweb? - Arweave.news](#)

# Key takeaways

Decentralised storage solutions can represent **an alternative to the Cloud and central databases** for many use cases, including with no direct link to NFTs.

Existing technologies **are still lacking maturity** (particularly in terms of cybersecurity) and **currently remain difficult to access** for the general public. Nevertheless, their **potential and growth prospects are promising**.

Companies can begin to understand the stakes of decentralised storage and launch experiments in this area.



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