

CEX.IO Compass: Q4 2022

The power and resilience
of Bitcoin's influence on
financial inclusion and the
DeFi revolution



Not investment advice. Seek professional advice. Digital assets involve risk.
Do your own research.

Happy New Year crypto community members -

There's an expectation among crypto enthusiasts that market downturns are the price of admission. That to survive a bear market, or better yet, a crypto winter, is to earn one's stripes. This has long been an accepted notion in the digital asset space, but 2022 tested the resilience and durability of even the most hardened traders. On top of the boom and bust cycles typical of late-capital, the crypto ecosystem witnessed multiple black swan events in the past calendar year.

From Russia's invasion of Ukraine, to the bottoming out of Terra/Luna, to FTX's house of cards, 2021's bull run earnings all but disintegrated. Like a skilled matador, 2022 brought a powerful force to a reluctant halt. While this quick succession of events has spurred stories of eroded confidence in the crypto space, what is often overlooked are the many lessons revealed from these compounding disasters.

The immediate aftermath of the war in Ukraine saw a groundswell of support showered on the beleaguered country in the form of digital asset donations. Often touted as a "solution in search of a problem," crypto outpaced traditional finance as the most effective way to circulate real-time relief to individuals and organizations on the ground. From housing, to medicine, to transportation, Ukrainians were able to secure the resources they needed for defense and survival through crypto donations as banks struggled to keep up.

In turn, Terra/Luna and FTX were painful reminders of the dangers lurking in financial fiction. The crypto ecosystem encourages and rewards innovation, but there's no escaping the finality of market forces. Like the famous last flight of Icarus, or something pulled from the pages of Mary Shelley's Frankenstein, what we observed in each failed, charismatic founder was a tragic misappropriation of their own creations - and egos. Although unequivocally devastating, these events provided an opportunity to reassert our core values as an ethical, time-tested crypto guide.

Happy New Year crypto community members -

Now, as we continue to assess the fallout, the question of what lies ahead is at the forefront. Thankfully, 2022 also saw one of the greatest technological advances to shake the crypto space since Satoshi Nakamoto's infamous white paper: [the Ethereum Merge](#). While this story is still unfolding, the event has helped highlight the untapped potential waiting to be discovered in the crypto ecosystem.

It's with this fresh optimism that we turn to 2023, and take stock of crypto's foundational asset, Bitcoin, as it enters its 14th year on the market. In this report, we'll examine how the currency has fared since its debut, and dissect its performance amidst recent market turbulence and inflationary pressure. Our research team relies on diagnostic evidence to assert that Bitcoin's dominance remains rooted in its tenacious community and network integrity. Plus, we'll reflect on how the digital asset space continuously applies new knowledge and refines itself from lessons learned.

Additionally, this report analyzes the technical features of Bitcoin that make it unique as a monetary network and asset. Chief among these traits is Bitcoin's role as the seed that led to the eventual blossoming of a blockchain-based financial ecosystem, commonly referred to as decentralized finance (DeFi). Since DeFi is an ever-expanding rabbit hole of information, this report only covers some of the more widely used pieces of infrastructure, such as stablecoins and DEXs, and areas that have seen exponential growth.

Progress is often nonlinear, but each setback provides a fresh opportunity to chart a more thoughtful course. We hope you'll join us as we explore this next chapter in the ecosystem's ongoing evolution, and may the New Year bring a wealth of prosperity along your crypto journey.



Oleksandr Lutskevych
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The difference Bitcoin makes

A holistic approach to Bitcoin

Bitcoin's fiat denominated price is often used as a window for peering into its success and impact on the world. From this perspective, BTC, its underlying network, and the policies that govern it, give an impression of erratic behavior, volatility, and, through recent events, deceit. This perception, however, doesn't accurately and fully represent Bitcoin's reality, the opportunities it enables for users, and the impact it ultimately has on the world.

The problem with assessing Bitcoin solely on price performance is that it evaluates the currency through the lens of a divergent system that exists outside its borders. That is, the fiat price of Bitcoin is subject to the ebb and flow of fiat currency, the policy that governs it, and the system that it exists within. In this case, Bitcoin is viewed from "outside - in," instead of looking at the network and the asset in its own context. Instead, evaluating from an "inside - out" perspective offers a more full view of what Bitcoin is, and why it is unique and highly impactful as a monetary network and asset.

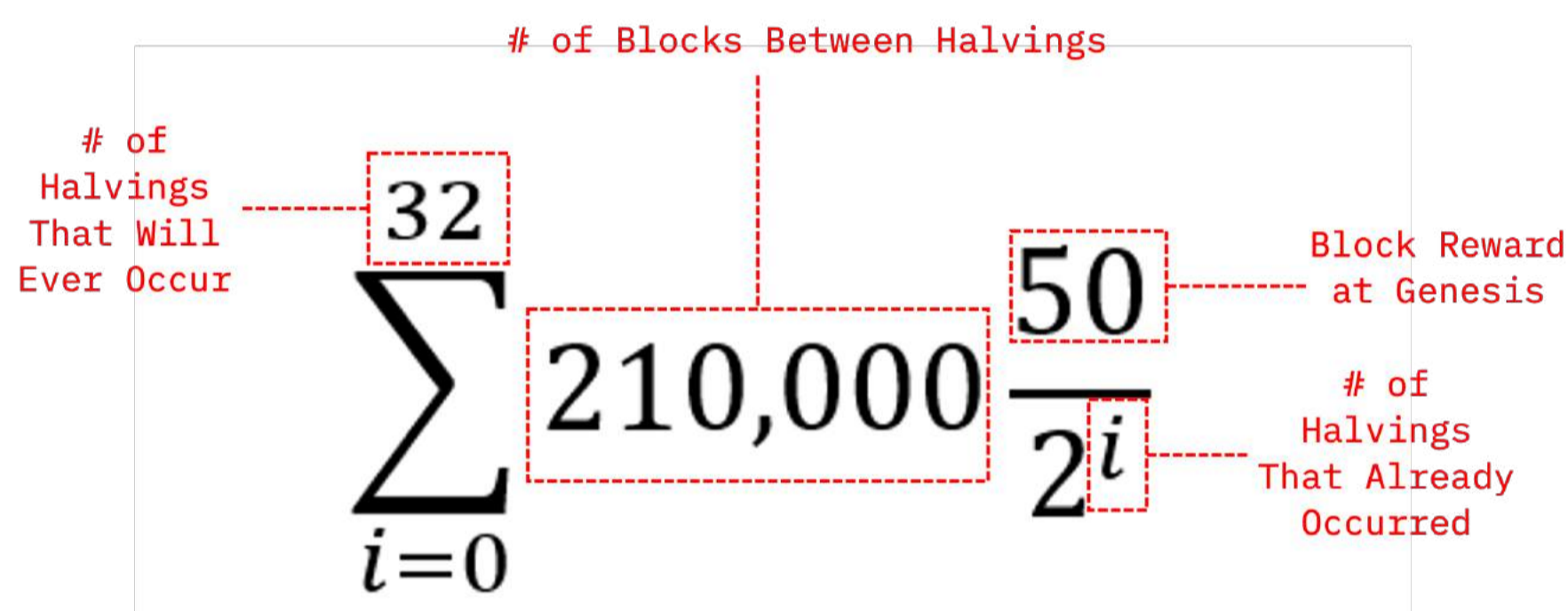
Functionality of the network in the wake of chaos

This past year was turbulent, plain and simple. War breaking out in Eastern Europe, inflationary pressure not experienced since the 1970s and 1980s, and record financial tightening by central planners hardly scratches the surface. In spite of all these hectic, negative events, the Bitcoin network's policy and functionality remained consistent. Network inflation stayed on the same path outlined in Satoshi's 14 year-old whitepaper, users remained free to move value no matter where they were in the world, and incentive to keep the network moving forward was as it has always been.

At its core, BTC is uninfluenced by the events that revolve around it. The ability of the Bitcoin Network to remain unchanged as the world rapidly develops, for better or worse, is what makes it one of the most important discoveries in recent history. Grasping this view, however, isn't easy when looking at Bitcoin purely from the perspective of price.

A robust monetary system with programmatic policy and functionality

Bitcoin's monetary policy can be summed up through a simple formula. It is built around the network's halving feature, which slashes new issuance through block rewards every 210,000 blocks, or approximately every four years. The result of the formula is the number of BTC that will be discovered at each halving period, and ends when BTC's supply reaches approximately 21 million units. Components directly related to Bitcoin's functionality, like block interval, block reward, inflation, and hash rate, all have ties to this formula.



The diagram illustrates the formula for calculating the total number of Bitcoins that will ever be mined. The formula is:

$$\sum_{i=0}^{32} 210,000 \frac{50}{2^i}$$

Annotations in red text explain the components:

- 32**: # of Halvings That Will Ever Occur
- 210,000**: # of Blocks Between Halvings
- 50**: Block Reward at Genesis
- 2^i** : # of Halvings That Already Occurred

Observing these key components of the network's function and monetary policy, and how they behave through turmoil, emphasizes Bitcoin's stability under the hood. This characteristic is what differentiates the network from the legacy financial system, assets that exist within it, and what empowers Bitcoin to positively impact the lives of millions globally.

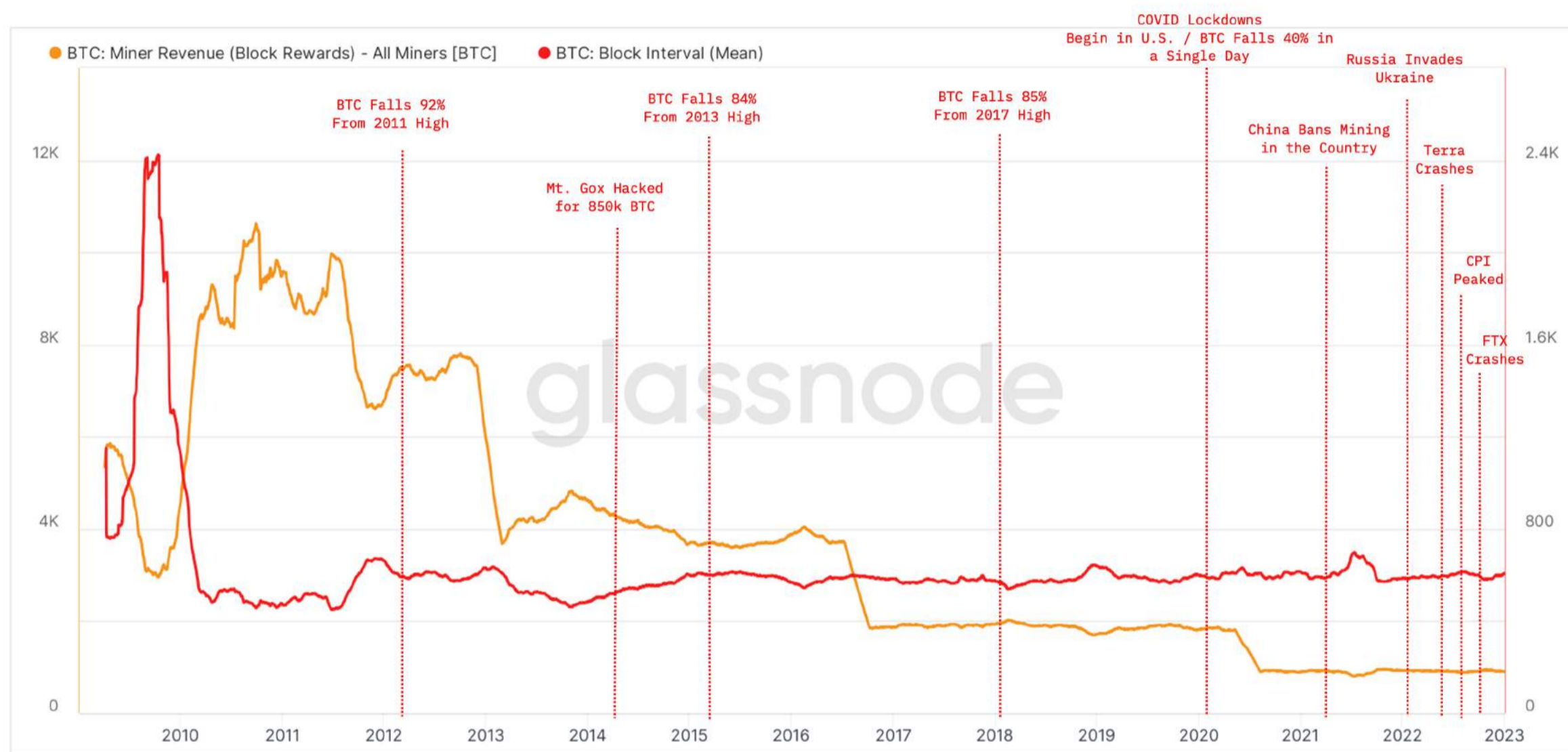
Block interval and block reward

Satoshi outlined in his whitepaper that blocks, and by extension supply, are set to be discovered at 10 minute, or 600 second, intervals - no matter how much computing power is behind the network. This policy ensures that BTC's inflation rate remains steady, and that it can maintain its supply characteristic of absolute scarcity (cap on number of blocks, and new supply discovered each day). These characteristics are imperative to a robust monetary system and medium of value.

Hash rate can be viewed as the network's computational horsepower, or capacity to add blocks of transactions to the Bitcoin blockchain, and discover new supply. Coupled with the difficulty adjustment mechanism, blocks are added (and by extension, supply is discovered) at this fixed rate, independent of the network's horsepower. When hash declines and the network's capacity to forge blocks is compromised, difficulty adjustments make it easier to add blocks/find supply, while the fixed interval between blocks is restored. The opposite occurs when hash rises aggressively. These adjustments happen every 2,016 blocks, or approximately every two weeks.

An example of this rose to attention after China banned mining in the country in Q2 of 2021. At the time, hash declined as miners went offline, and block intervals increased as a consequence. The network's difficulty adjustment made it easier to discover blocks over the following weeks, and the block interval was restored to its target rate.

Block Interval and Block Reward



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Bitcoin's average mean daily block interval was 598.66 seconds through 2022, and 610.96 seconds through 2021, using the 90-day simple moving average (SMA). Furthermore, 910 BTC was discovered each day on average through 2022, and 902 BTC in 2021. The target rate of invention over these periods was 900 BTC per day. This emphasizes the network's ability to remain steadfast in the face of economic adversity, and in the wake of massive change to its own system through the miner migration of 2021. In addition, this event helps demonstrate how the network is able to preserve its policy through waves of positive and negative events. Its ability to do so has allowed users to freely store and move value without impediment, even as outside forces try to rattle the network.

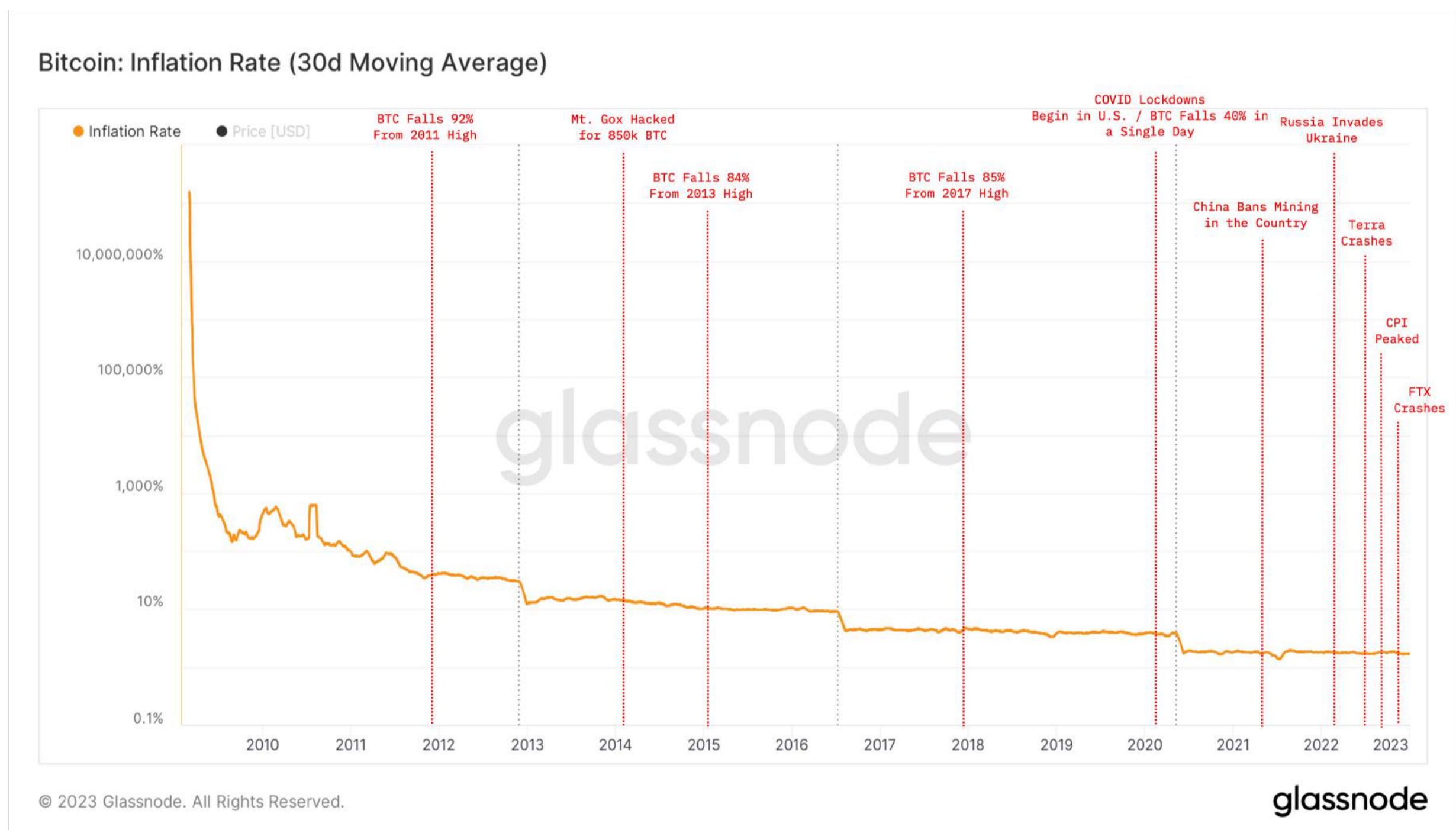
Dissecting Bitcoin's fixed block interval and BTC discovery

Having fixed block intervals and supply discovery exist independently of the network's capacity to push, are both differentiating factors for BTC as a medium of value. Gold is comparable to BTC in the respect of supply discovery. There is a direct relationship between gold miners' capability to unearth gold, and the amount of gold they find on a daily basis. That is, they dig up more supply with bigger crews and more sophisticated tools. However, this negatively impacts the rate at which supply grows (inflation), and typically means more supply is discovered by more experienced miners. The global supply of gold that theoretically exists is also completely unknown.

This is not the case with BTC's fixed discovery via difficulty adjustments and halving events. Continuing with the gold example, difficulty adjustments are the equivalent of a cap on the amount of gold that can be unearthed daily, and limiting the amount of gold discovered every four years. In this case, gold miners could employ 100 workers or one million workers, and the same amount of gold will still be discovered on a daily basis. Think about how the supply growth, and thus the value of gold, would behave if there was a daily limit on additional supply coming online, and the amount of unearthed gold dwindled every year. There would be supply constraints on new gold, existing gold would be more scarce, and there would be less gold for miners to split as competition increases, and time passes. However, this is exactly how Satoshi envisioned the Bitcoin network existing, allowing it to have a novel relationship with deflationary forces.

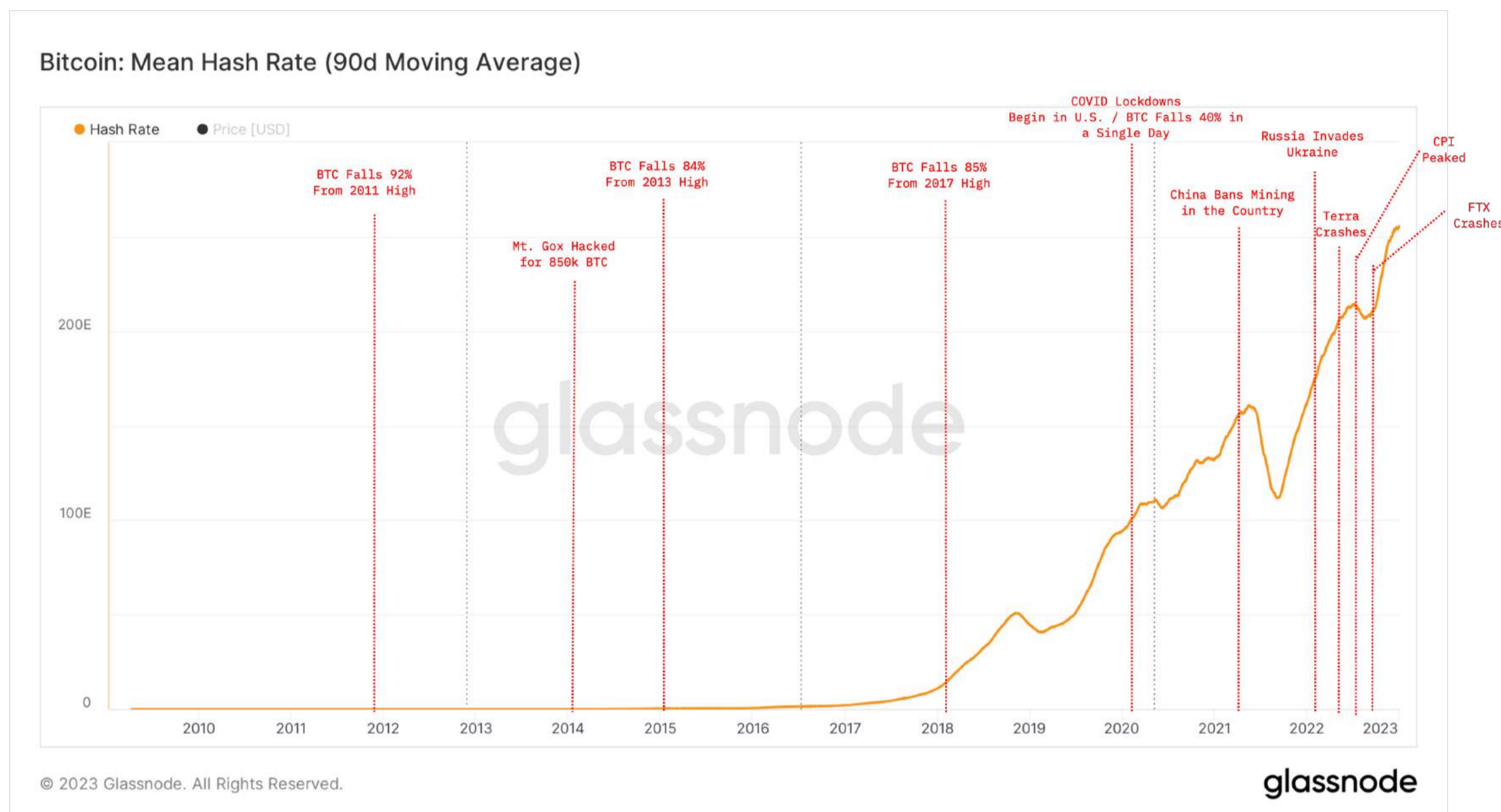
Inflation rate

As outlined in Satoshi's whitepaper, BTC's inflation rate is programmatically deflationary and stable as a result of fixed supply issuance. That is, it's slashed in half every 210,000 blocks in accordance with halving events, and can't grow beyond the borders of the network's issuance policy. Thus, BTC's inflation rate is completely known in advance and trends to zero, instead of fluctuating between a target rate. Users need not worry about their holdings becoming devalued by more than what is already known, and the rate at which devaluation occurs dwindles over time.



Hash rate

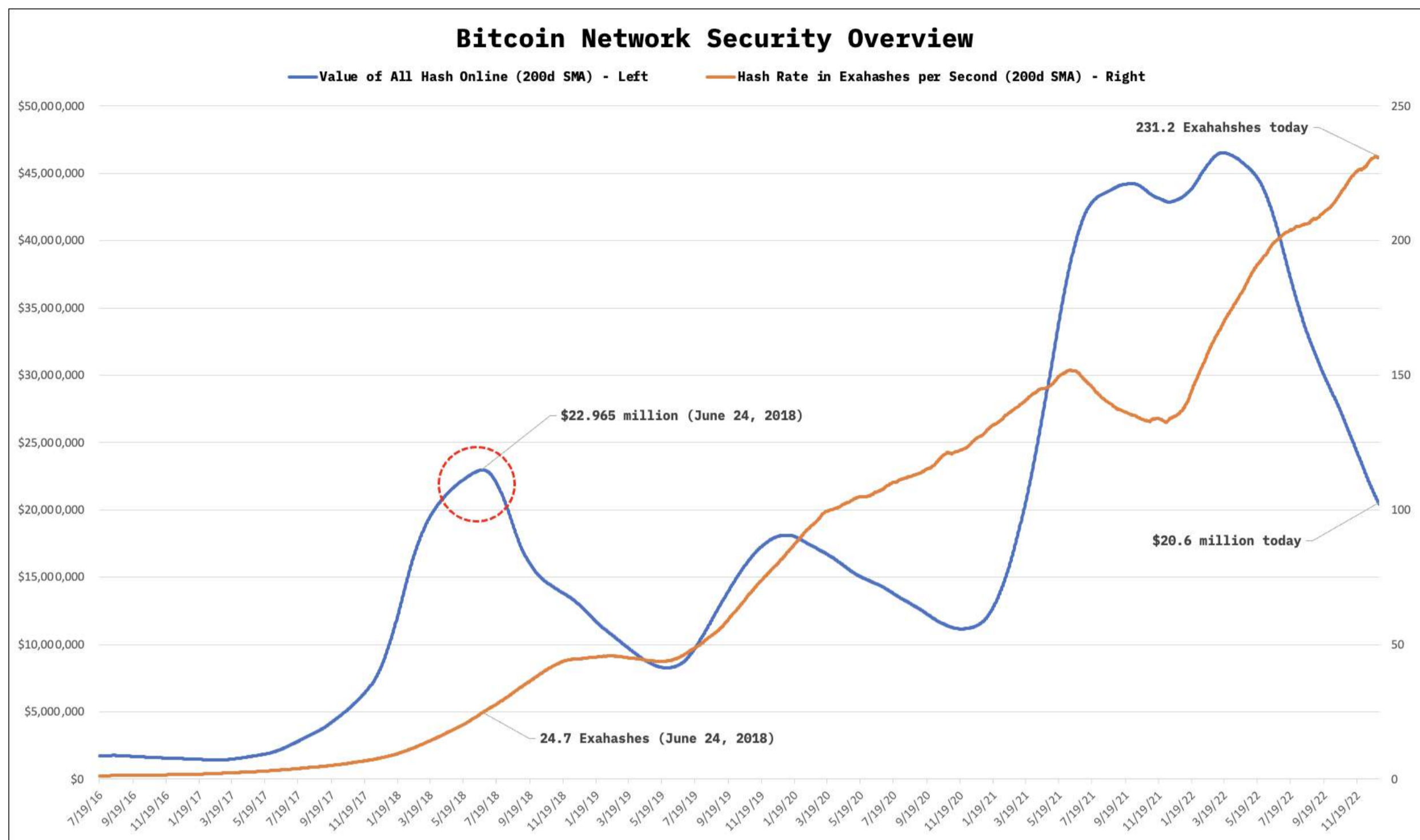
BTC's raw hash rate saw excellent growth through 2022, as it climbed roughly 33%. The 90-day SMA closed the year around 255 ExaHashes, after opening at 161. Hash power plays a key role in discovering new supply and adding blocks of transactions to the chain, as outlined above. Thus, growth in hash shows the network has grown more secure, even as financial conditions deteriorated and price fell by nearly 65% in 2022. Rising hash is also an indicator of mounting competition between miners. The more competition, the less BTC each miner can capture, which leads to increasing scarcity of BTC.



Understanding hash rate and Bitcoin's security model

The following chart highlights the trend in Bitcoin's security since 2016. There are two components that must be assessed to fully understand Bitcoin's network safety. They are: 1) the monetary cost/reasonable ability to acquire hash (i.e. monetary cost and supply availability of application specific integrated circuits, or ASICs) and 2) the monetary cost/reasonable ability to gather the physical infrastructure to attack the network (i.e. monetary cost and supply of energy infrastructure, infrastructure to house and deploy ASICs, and the like).

As the chart indicates below, the dollar value of all online hash currently sits at approximately the 2018 local peak. This means the dollar amount to acquire enough hash to attack the network is about the same now as it was then. The key difference today, however, is that an attacker would need to acquire much more hardware (physical hash), energy infrastructure, and infrastructure around their ASICs to get that much hash online. While the surface level monetary constraint of obtaining enough hash to attack the network is roughly the same, the physical constraint to do so has grown exponentially.



The 200-day SMA value of online hash at the 2018 peak was roughly \$23 million, with an amount of about 24.7 ExaHashes. This means an attacker could have controlled 51% of the network by adding around 25.71 ExaHashes of power (assuming it couldn't be sourced from existing miners). That is, 24.7 ExaHashes of computing power would have made up about 49% of total hash, at roughly 50.4 ExaHashes of network-wide hash rate. At the time, this was the equivalent of nearly \$24 million and 257,100 100 Th/s (TeraHash per second) Antminer S19J Pro ASICs. 1 Terahash of power is the equivalent of 0.000001 ExaHashes of power. One of the most popular ASICs on the market today, Antminer S19J Pro, holds around 100 Th/s of power, or 0.0001 ExaHashes. Dividing 25.71 ExaHashes, by the .0001 ExaHashes of power per Antminer S19J Pro, arrives at the 257,100 machines necessary to accomplish the feat.

\$24 million isn't a large amount of money in the grand scheme of global finance. However, having the physical and financial means of sourcing that much hardware, and the infrastructure to get it online, would have been, and still is, unfathomably difficult.

It is even harder to carry out the same attack today despite the 200-day SMA net value of online hash hovering 10% below the 2018 peak. Today, the net value of online hash is around \$20 million, but the amount of computing power has ballooned by nearly 10 times to 231.2 ExaHashes. This means that for someone to carry out the same 51% attack (assuming they couldn't source hash from existing miners), they would need to acquire 240.6 ExaHashes worth of ASICs (2.406 million 100 Th/s Antminer S19J Pros), at a cost of \$21.3 million. The dollar amount may seem feasible for a motivated actor, but the physical constraint of finding nearly 2.5 million machines, and the infrastructure to get them online is nearly prohibitive.

Understanding the above is paramount to grasping the robustness of Bitcoin's security. It doesn't matter how much monetary capital an attacker has, as security has roots in energy and computational power. Thus, an attacker can have an unlimited amount of money and still not have the ability to disrupt the network, when the physical infrastructure required to do so is factored. As it currently stands, completing a successful 51% attack on Bitcoin would not only be incredibly difficult, but also nearly impossible to do without being immediately noticed.

The importance of Bitcoin as a robust monetary network

Bitcoin's internal programming set a new standard for monetary systems where the way a monetary system functions is not affected by the external forces. Anyone is free to opt into an open network where policy is known and cemented, no individual or group has outsized influence over the network, and the negative impacts of dilution wane with time. As a result, the network has gained an increasing number of users, facilitated the transfer of trillions in value, and is the fastest growing value pool in recorded history.

Strides Bitcoin has made

While Bitcoin's programming helps it raise the bar on financial freedom, the growth of its usership is a critical piece to understanding the solutions revealed by the network. From serving as a monetary outlet for the financially underserved, to building the first unified monetary system that connects all corners of the earth, Bitcoin's true impact is difficult to measure. But what are some ways it can be assessed? Below, we'll unpack how the community around BTC has proved instrumental in its global adoption and success as a foundational digital asset.

User growth and dedication

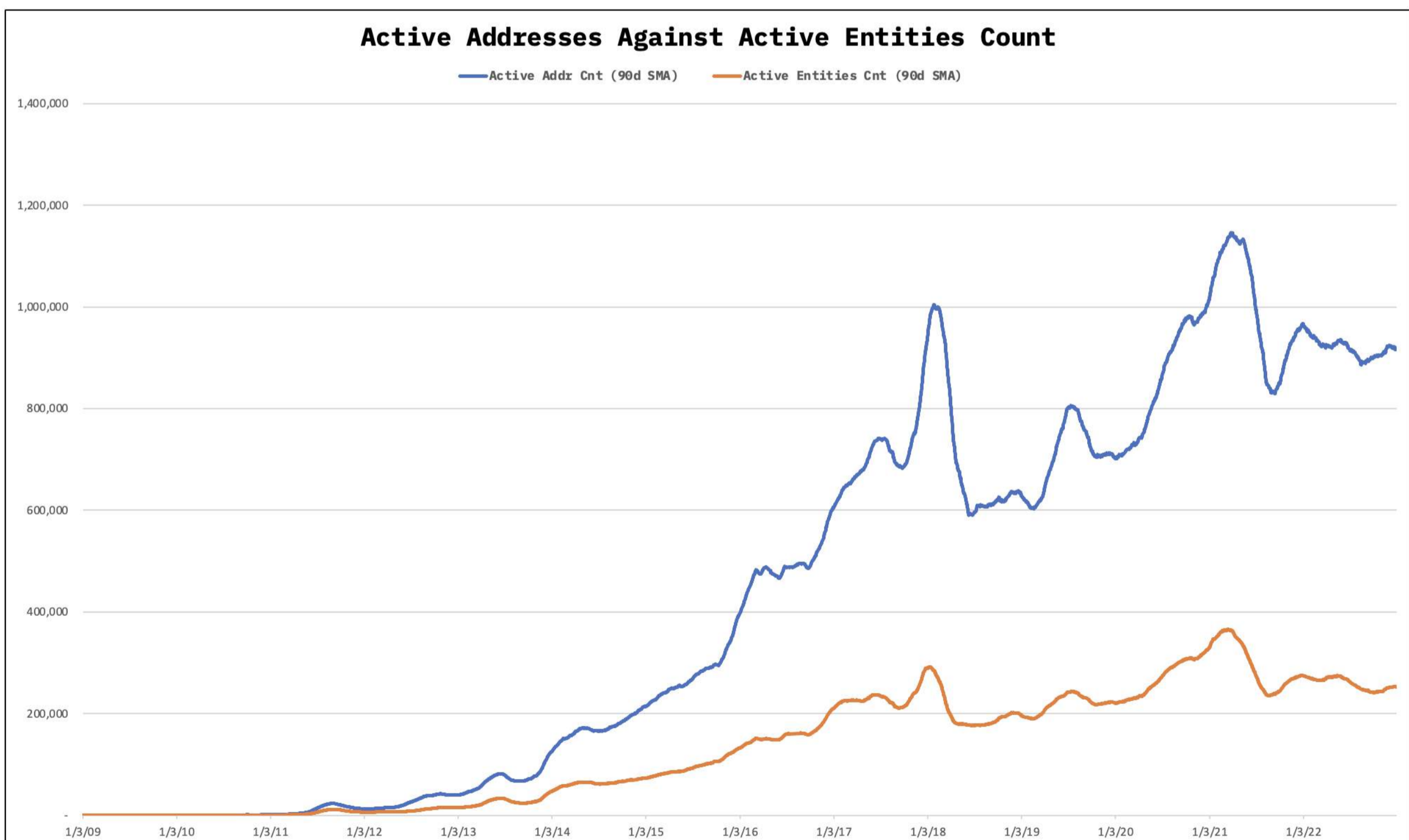
Bitcoin has amassed the creation of more than 1.05 billion addresses on the network in its short 14 years of existence. On-chain data shows that an increasing number of the addresses created remain active, and the conviction of the users controlling these addresses is increasingly strong. This highlights two key points about the network's growth and BTC's impact on the world: 1) the network's antifragility and utility of permissionlessly moving value anywhere in the world is becoming a preferred rail for global users, and 2) BTC's characteristics of scarcity have made it a desirable asset for users to hodl as time passes.

Active address and active entity count

The network had approximately 1.15 million active addresses, and 370,000 active entities using the 90-day SMA at the peak of the most recent cycle. They notched growth of ~15%, and ~33% respectively over their 2018 highs. The number of active addresses on the network was about flat through 2022 in spite of BTC's poor performance. Recently, however, the new address momentum indicator flipped positive when the number of unique addresses that appeared for the first time in a transaction on the network expanded. This is indicated by the 30-day SMA (monthly moving average) of new addresses crossing over the 365 day SMA (yearly moving average) of the same metric. The cross is indicative of a recent expansion in on-chain activity, with upticks in active addresses and entities offering further proof.

Active addresses are those that have sent or received BTC. An address is only considered active if it successfully sent or received coins; addresses that attempted to send or receive coins, but failed, are omitted from active address count.

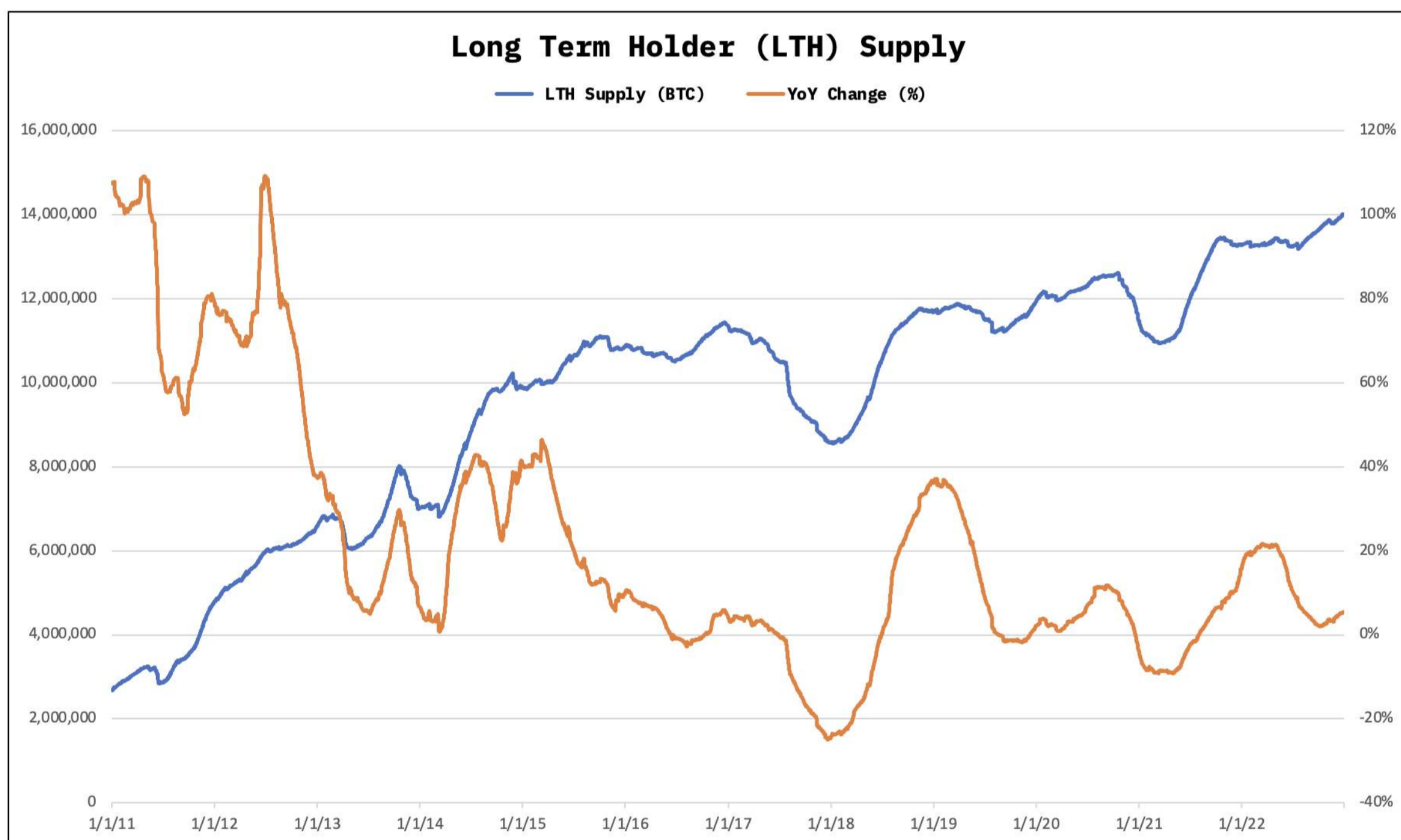
Entities are defined as a cluster of addresses controlled by the same user, and are estimated through advanced heuristics and Glassnode's proprietary clustering algorithms. In other words, active entity counts take into consideration that multiple addresses can be owned by a single user. It should be noted that entity-based metrics are founded in data science techniques and statistical information that changes over time, and are therefore mutable. So, while this number is merely a highly educated estimate, it is still important to follow.



Growing conviction of holders

The conviction of BTC holders has inched to all-time-highs, even as the freeze of crypto winter is felt across the market. The amount of supply held by users who historically hodl their coins, and the age of coins on-chain highlight that conviction has never been greater. High conviction users are the network's anchor. Their belief in the system, taken in tandem with Bitcoin's progressive programmatic policy growth, suggests that BTC is playing an increasingly important role in the lives of its advocates.

The amount of supply held by long-term holders (LTHs), or those who exhibit the behavior of seldom spending their coins, has crossed the 14 million BTC mark. Comprising two-thirds of BTC's sovereign supply of 21 million units, and ~73% of circulating supply, the majority of BTC is now in the hands of high conviction holders. LTH supply grew by 5.4%, and ~720,000 BTC in 2022. At current prices, that is the equivalent of roughly \$12.1 billion.



Regarding user conviction, the age of BTC's supply is also telling. More than 66% of all BTC in circulation hasn't moved in over a year. That is, more than 12.7 million BTC have not been spent on-chain in more than 365 days. This suggests that an increasing amount of supply is being hodl'ed, with users growing more reluctant to part with their coins. Moreover, we're witnessing these trends most abundantly in fractional valuations.

Bitcoin: Percent of Supply Last Active 1+ Years Ago



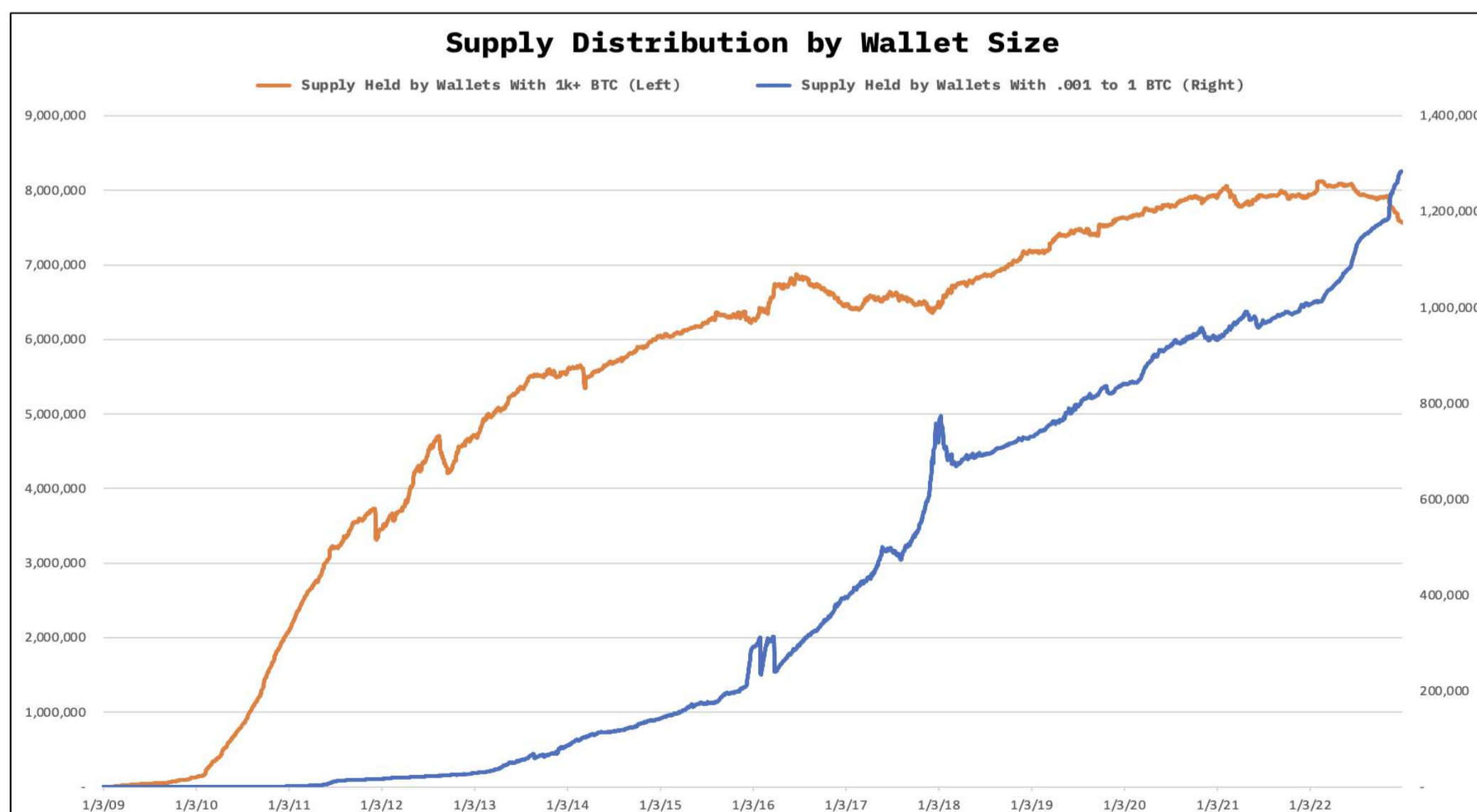
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Addresses with a balance between .001 and 1 BTC

One of the most important developments in BTC's user landscape is the current redistribution of supply across large and small users. The recent cycle saw a massive uptick in the portion of supply held by smaller users (those holding between .001 BTC and 1 BTC), while the amount of supply held by large users (1,000 BTC or more) peaked, and is now on the decline. The increasing amount of supply captured by smaller users indicates the network is being adopted by everyday people, not just financial institutions and the global elite. This redistribution of supply will allow Bitcoin's network and BTC to have an increasingly positive impact on the world, as it allows individuals from all walks of life to benefit from a free, open monetary system.

The amount of supply held by addresses with .001 BTC to 1 BTC grew by 53% from January 1, 2020, to December 31, 2022. At the same time, the amount of supply held by addresses with 1,000 BTC or more rose by 2%; this figure is now down ~4.5% from its peak of 12.009 million BTC in February 2022. From this same point, supply held by smaller addresses has grown more than 26%.



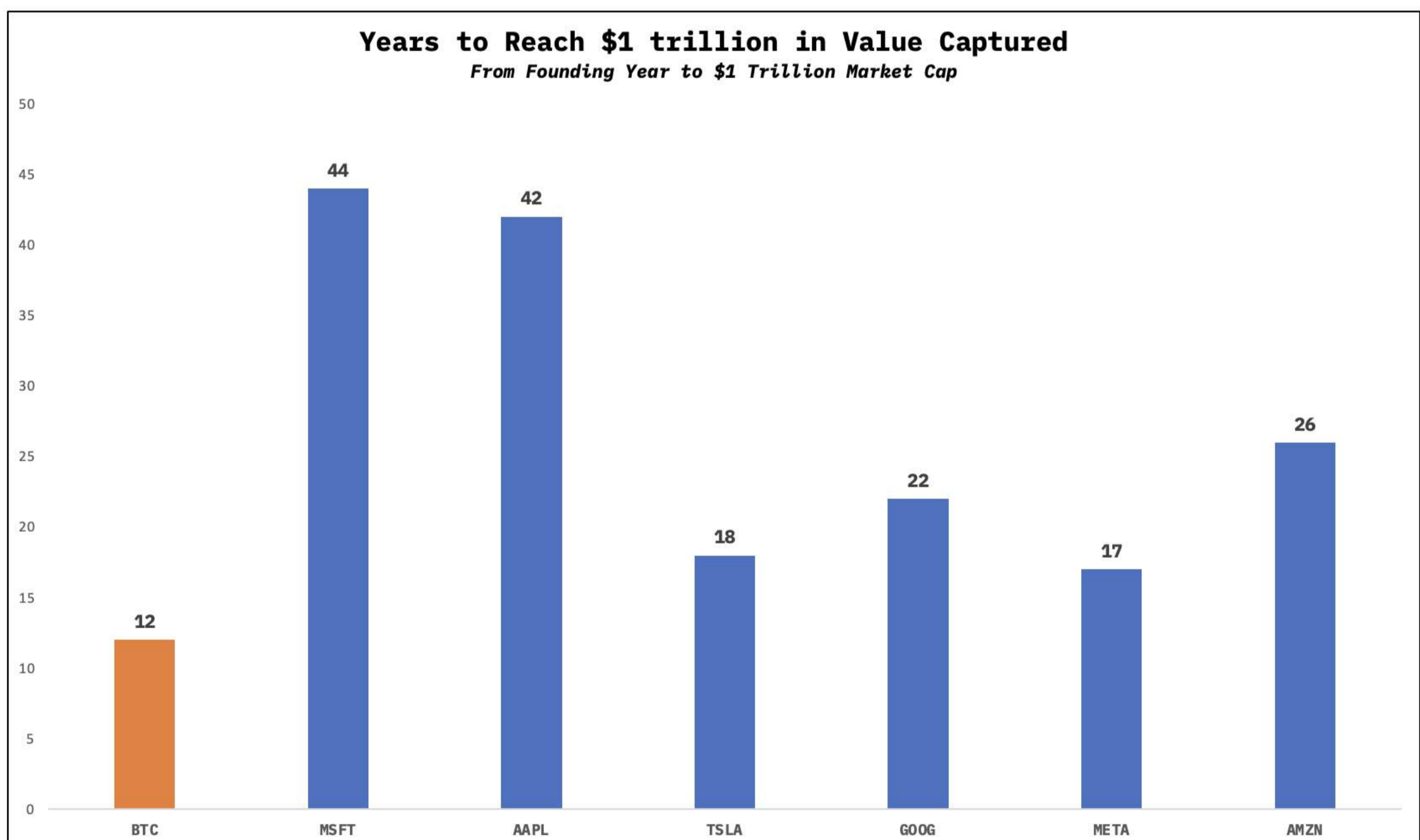
Value growth

Bitcoin's impact can also be measured by the amount of value it has captured and made available for use among its community. The asset's ferocious growth to \$1 trillion in market cap, in addition to the U.S. dollar value of coins moved on-chain, both show Bitcoin has had a great influence on how the world functions and communicates financially.

Growth against other assets

Bitcoin became the fastest asset to reach \$1 trillion in circulating market capitalization, when it crossed \$50,000 for the first time in February 2021, at 12 years of age. Few assets and companies in the world have reached this milestone, let alone in just over a decade. In turn, BTC's market capitalization reached a cycle peak of more than \$1.2 trillion in November 2021.

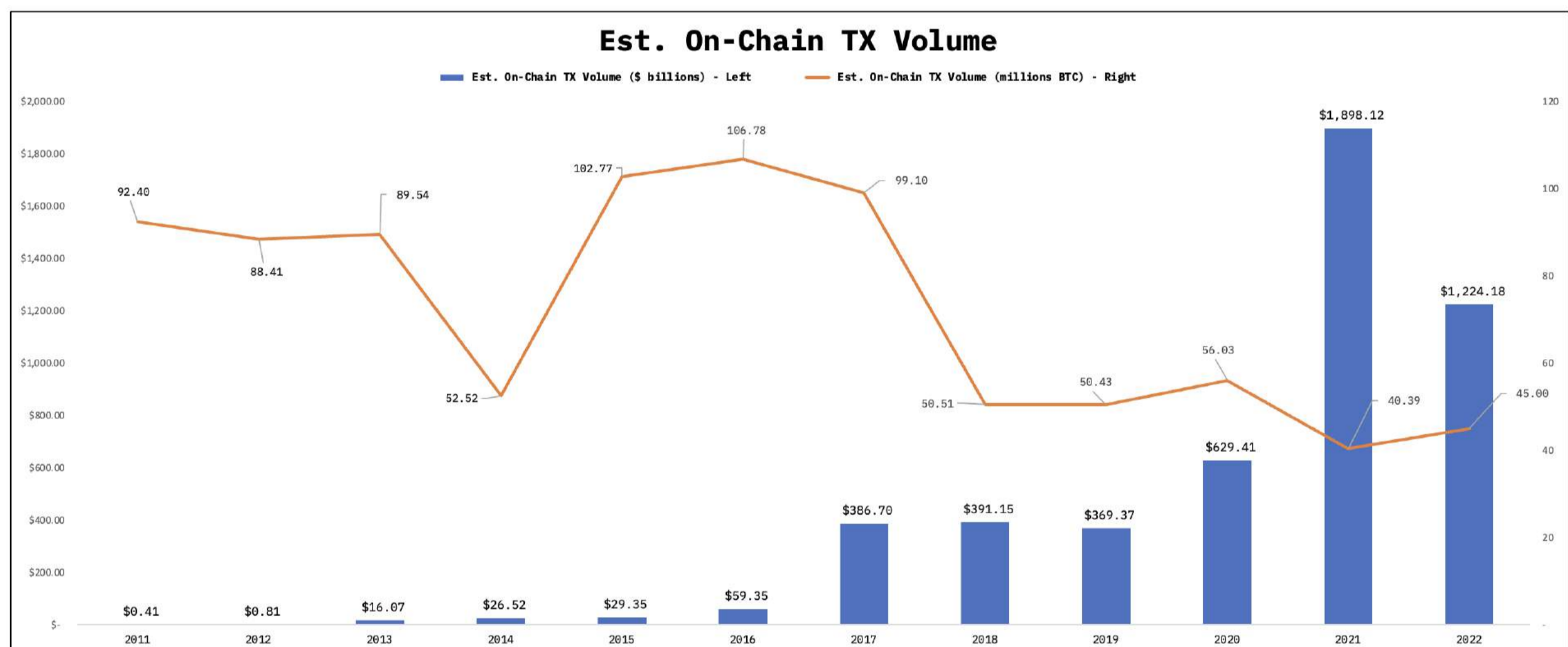
Compared to some of the most notable and highly valued global companies, BTC reached this impressive milestone at least 30% faster. Tesla and Facebook (now Meta) were the second and third youngest assets to reach \$1 trillion in market capitalization. It took Meta 17 years after its founding in 2004, and Tesla 18 years after launching in 2003, to accomplish this feat. Note that this example does not take into consideration the devaluation of the U.S. Dollar. It looks at it from the perspective of simply reaching an accumulated value of \$1 trillion.



Value moved on-chain

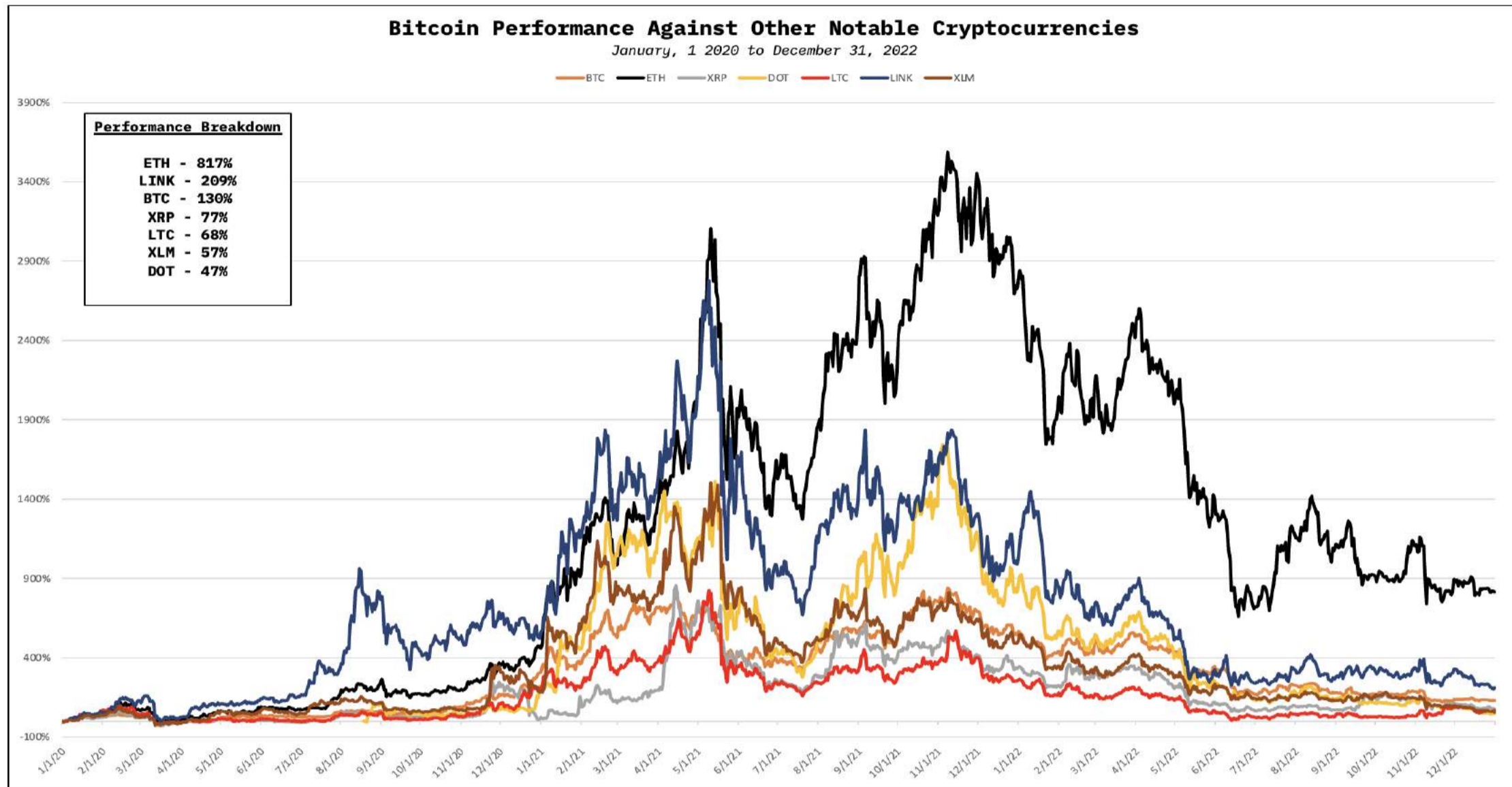
Bitcoin has facilitated the transfer of roughly \$5.031 trillion, approximately 873.86 million BTC, in value since the start of 2011. In 2022, the network moved an estimated \$1.2 trillion, and \$1.9 trillion the year prior. These figures eclipse the highs of the 2017/2018 bull market by more than 213% and 385%, respectively. Although the U.S. dollar denominated value of on-chain transfer volume was down about 36% year-over-year in 2022, the total amount of BTC transferred grew by 11.4%. As the U.S. dollar denominated price closed 2022 down 64%, a 36% reduction in U.S. dollar transfer volume also shows the chain's increased use in 2022.

It's important to note what the value transfer facilitated by the Bitcoin network represents, and what goes into on-chain transfer volume. The examples range wide, including but not limited to value permissionlessly moved to facilitate remittance payments by migrants to their families at home, payments received by merchants who didn't have access to sufficient systems, and funds moved by individuals to assess opportunities or to escape intermediation by traditional financial entities. The amount of value settled on-chain shows that the network's use is expanding, and it also highlights the increasingly important role Bitcoin is playing in the lives of global populations. While this is noticeable most explicitly with Bitcoin, crypto's subsequent explosion has sparked a growing trend.

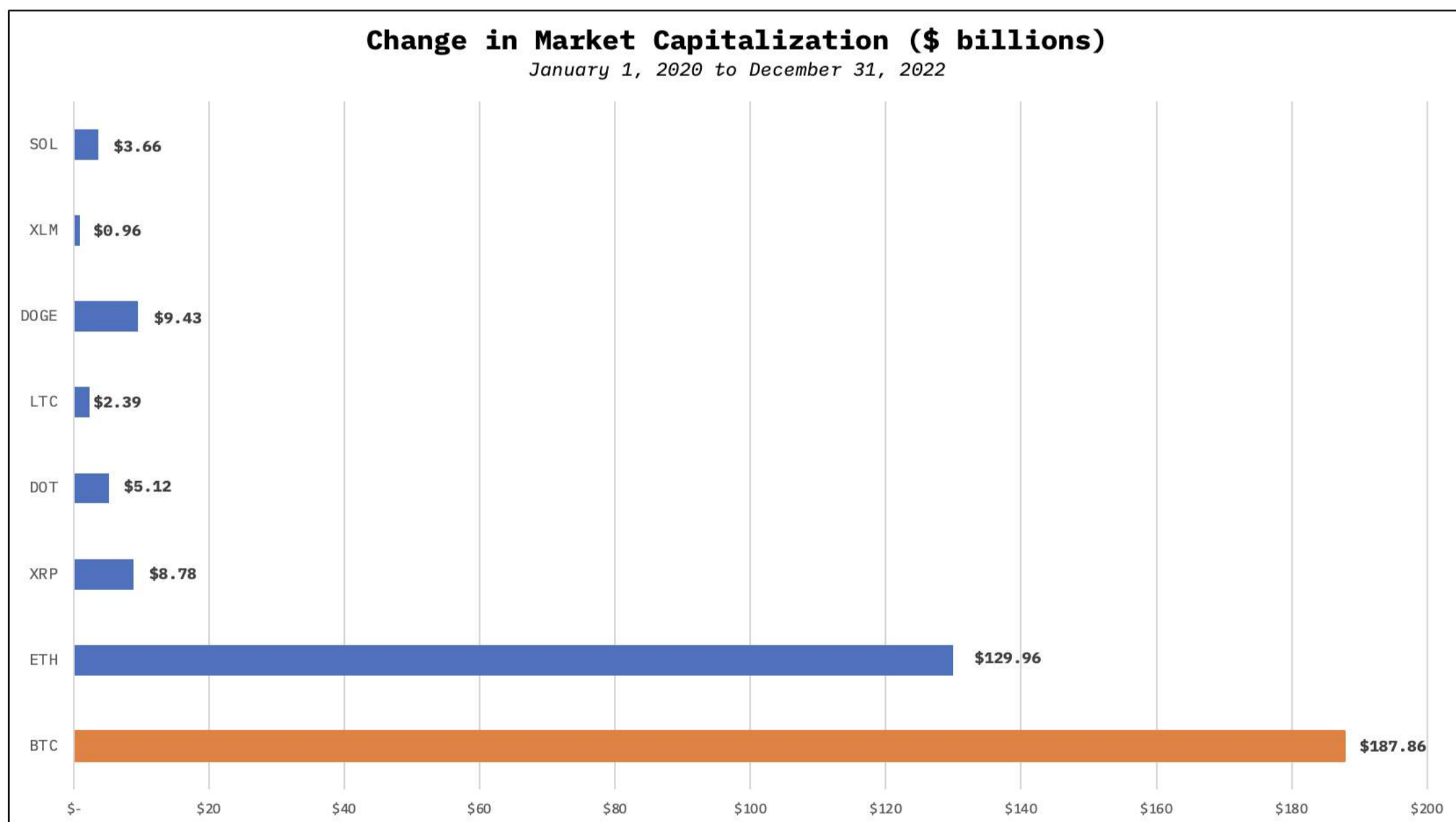


Performance against other cryptocurrencies

The rise of DeFi saw heavy inflows of capital toward utility-centric platforms, and smart contract Layer 1 (L1) solutions. As a result, a number of assets managed to overperform BTC through the most recent cycle. ETH was among the most notable, returning more than 800% from January 2020 through the end of 2022. LINK also performed well, growing by about 201%. Comparatively, Bitcoin added around \$190 billion to its market capitalization over this period, and grew by 130%.

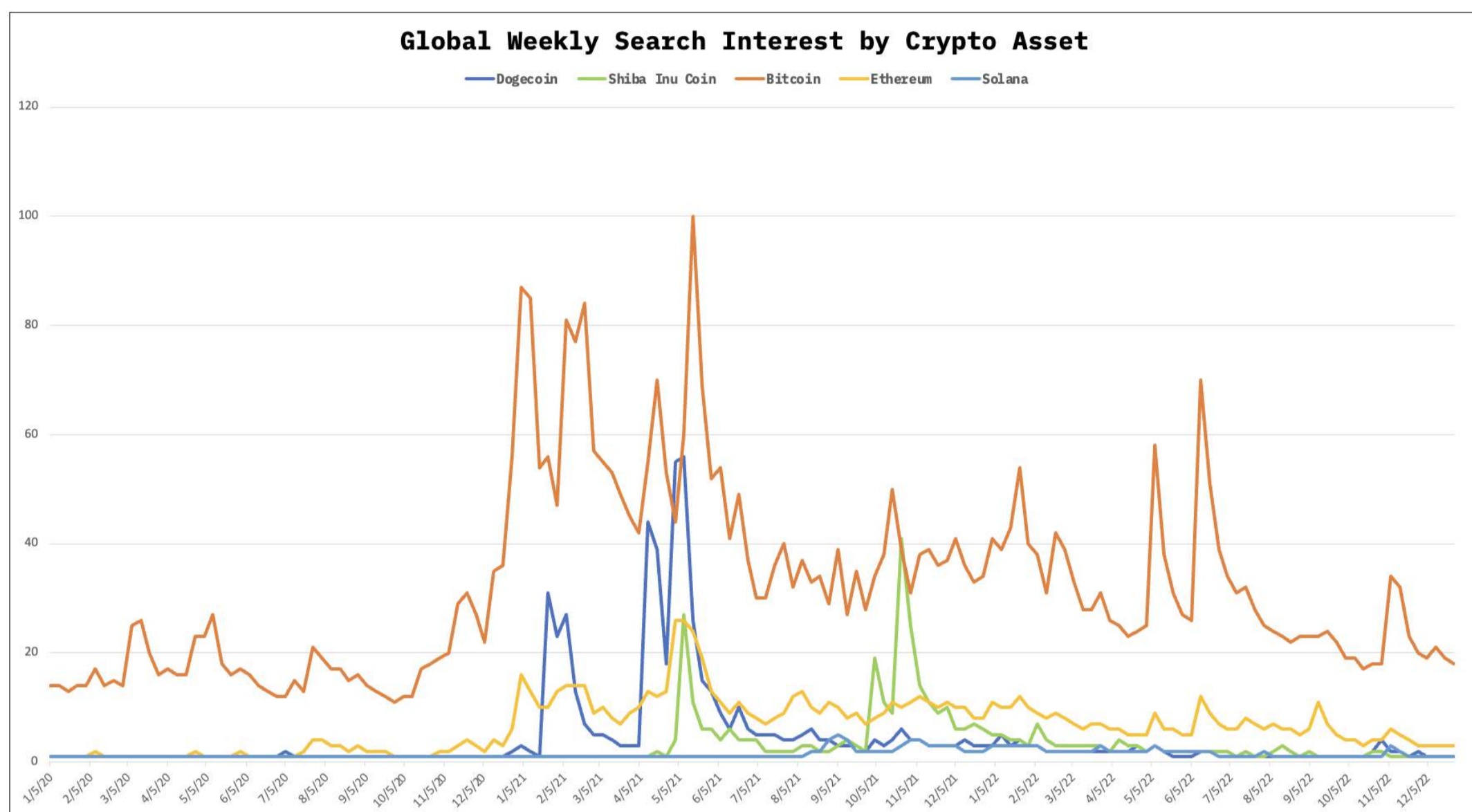


However, it's important to note the size of each market when comparing the relative growth of disparate networks. Larger markets require more inflow to move than smaller ones do. While BTC's market grew 130%, it added more value in dollar terms than every other network over the period. The second closest to BTC's \$188 billion in value added was ETH, which added an impressive \$130 billion in market capitalization.



And then there's the question of sheer popularity. According to Google Trends, Bitcoin remained the most searched crypto asset against other major cryptocurrencies and meme coins throughout this period. This perspective highlights that, while other assets may have eclipsed the raw growth of BTC, users still remained heavily interested in the world's largest cryptocurrency.

From January 1, 2020 through the end of 2022, residents of El Salvador and Nigeria were among the most frequent searchers of Bitcoin on Google. This is largely attributed to the new avenues made available to underserved communities by the legacy crypto asset.



A means of payment for the financially underserved

An underreported side-effect of Bitcoin's dominance has been the construction of key infrastructure built around it. The rise of the Lightning Network, for example, and the role it has played in BTC payments has led to adoption by processing giants and sovereign nations alike. Lightning was a big part of El Salvador's adoption of Bitcoin. The government-backed Chivo wallet supports Lightning payments, and a number of businesses accepting BTC as a form of payment rely on this Layer 2 (L2) solution. The development and growth of such infrastructure has broadened the impact of Bitcoin on countries like El Salvador, and awakened its users to new opportunities.

Lightning allows merchants and individuals in financially underserved areas to send and receive payments at low costs. Nearly 70% of citizens in El Salvador, or 4.42 million individuals, were not in possession of a bank account at the time of the Bitcoin Law's passing. In the 45 days preceding its signature, 4 million El Salvadorans, or roughly 63% of the country's population, downloaded Chivo. Lightning, in conjunction with Chivo, gives these individuals access to some services that would otherwise be offered through a bank. It is a light-weight, unbounded substitute to traditional payment processors and mobile payment platforms, merely requiring a connection to the internet.

Lightning has increasing potential to fill a large and important hole in the global financial economy. As a result, its adoption has encouraged a rising number of coins and contributors to join the network which we will cover in the "[Measuring Lightning's growth, and with it, BTC's real-world utility](#)" section. First, let's get into some of the basics of what Lightning is.

What is Lightning?

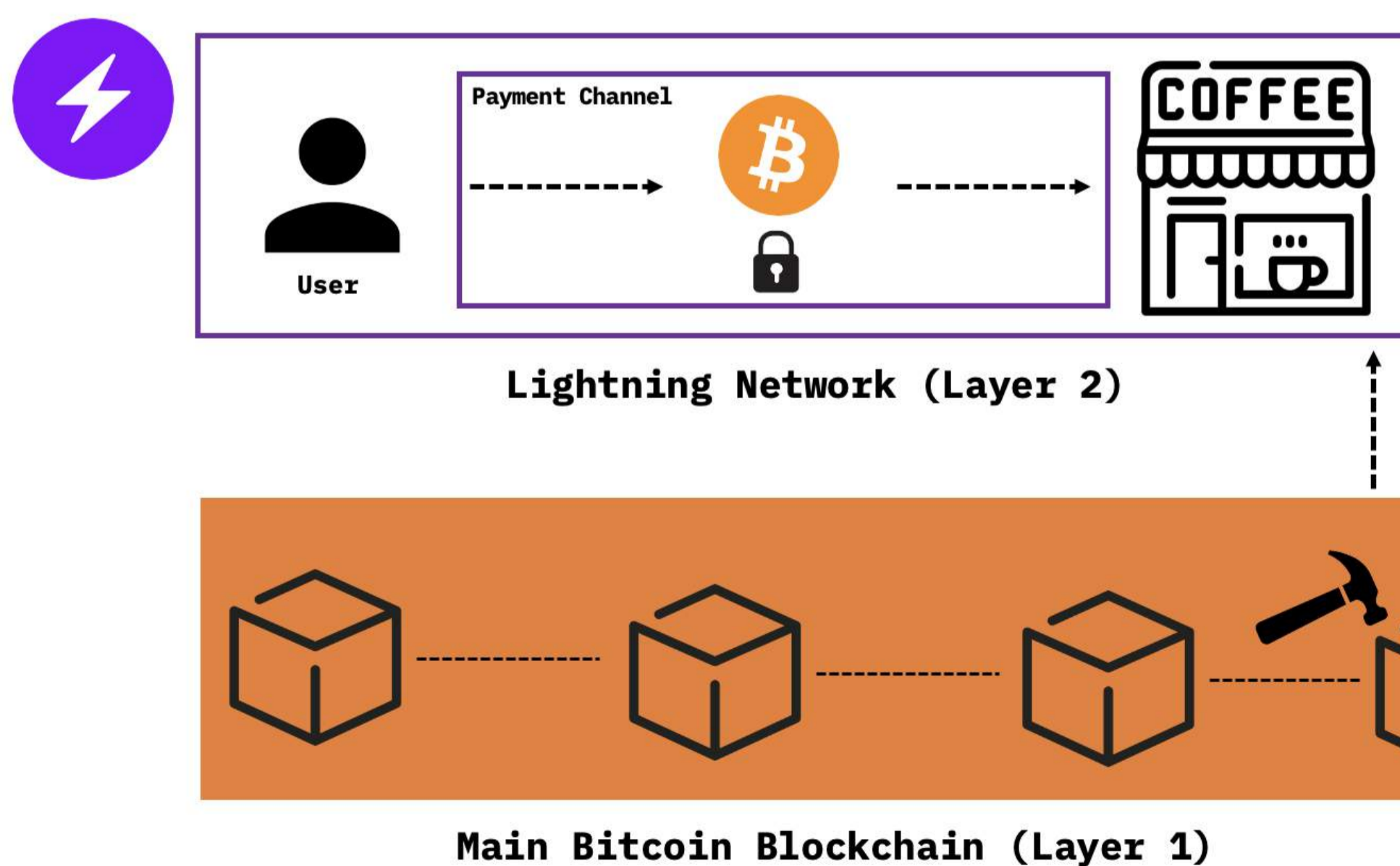
Lightning is a L2 solution built on top of the main Bitcoin network (Layer 1 or L1). It allows for faster and cheaper transactions than what is possible on Bitcoin's L1 infrastructure. While Bitcoin's L1 settlement process is a key function of its overall security, it is inconvenient for certain types of transactions.

Let's use this simplified example: say you want to use BTC to buy a \$2.50 cup of coffee. Using Bitcoin's L1, the transaction would take up to 600 seconds to settle (note block interval times mentioned earlier), and would cost roughly \$0.31 just to move that value (at the time of writing). The coffee shop doesn't want to wait 600 seconds for their payment to settle, and you don't want to pay 12% more to buy your coffee. Enter Lightning.

Lightning uses smart contracts that enable users to forge payment channels between each other. These payment channels directly connect two users (which can be individual to individual, individual to business, etc.) and run parallel to the main Bitcoin blockchain. You and your coffee shop can open a channel, which allows you to send BTC over Lightning an unlimited number of times. You could buy a cup of coffee everyday for the next year through this channel, which settles transactions instantly and comes at little to no cost.

One day, however, you decide to move across the country and will no longer buy coffee at this shop. The shop closes the channel, which morphs every transaction you made buying coffee from them into one transaction, which is then confirmed on Bitcoin's L1. So, if you bought one coffee from the shop every morning for a year, you only pay for a single Bitcoin L1 transaction, despite making 365 payments to the shop. Alternatively, you can look at it from the perspective of waiting 600 seconds and paying a single Bitcoin L1 fee for 365 days' worth of coffee. This is the power of Lightning.

In practice, the coffee shop is likely to settle the payments made on a more frequent basis. This allows them to free up their coins and realize revenues on a fixed schedule.



Why are technologies like Lightning necessary to Bitcoin's adoption as a payment method?

Solutions like Lightning improve the Bitcoin transaction experience by lowering costs, improving settlement speed, and rendering it scalable:

Cost: while Bitcoin's L1 fees seem low, they can be quite expensive. For some types of transactions, the fees can be greater than or equal to the amount a user is trying to send (think about the coffee shop example above). Lightning allows for any number of payments to be made at economically-friendly costs. The median base fee on Lightning is around \$0.0000002.

Speed: Lightning transactions settle instantaneously, allowing it to process significantly more volume than Bitcoin's L1. Lightning can handle over 1 million transactions per second, while Bitcoin alone can process around seven transactions per second.

Scalability: on top of the speed benefit, Lightning's channel design allows users to transact without the need to establish a direct connection between them. For example, if user 1 has a channel established with user 2, and user 2 has a channel set up with user 3, user 1 would be able to transact with user 3 through their shared connection with user 2. This unique feature allows for exponential growth among any shared channel.

Measuring Lightning's growth, and with it, BTC's real-world utility

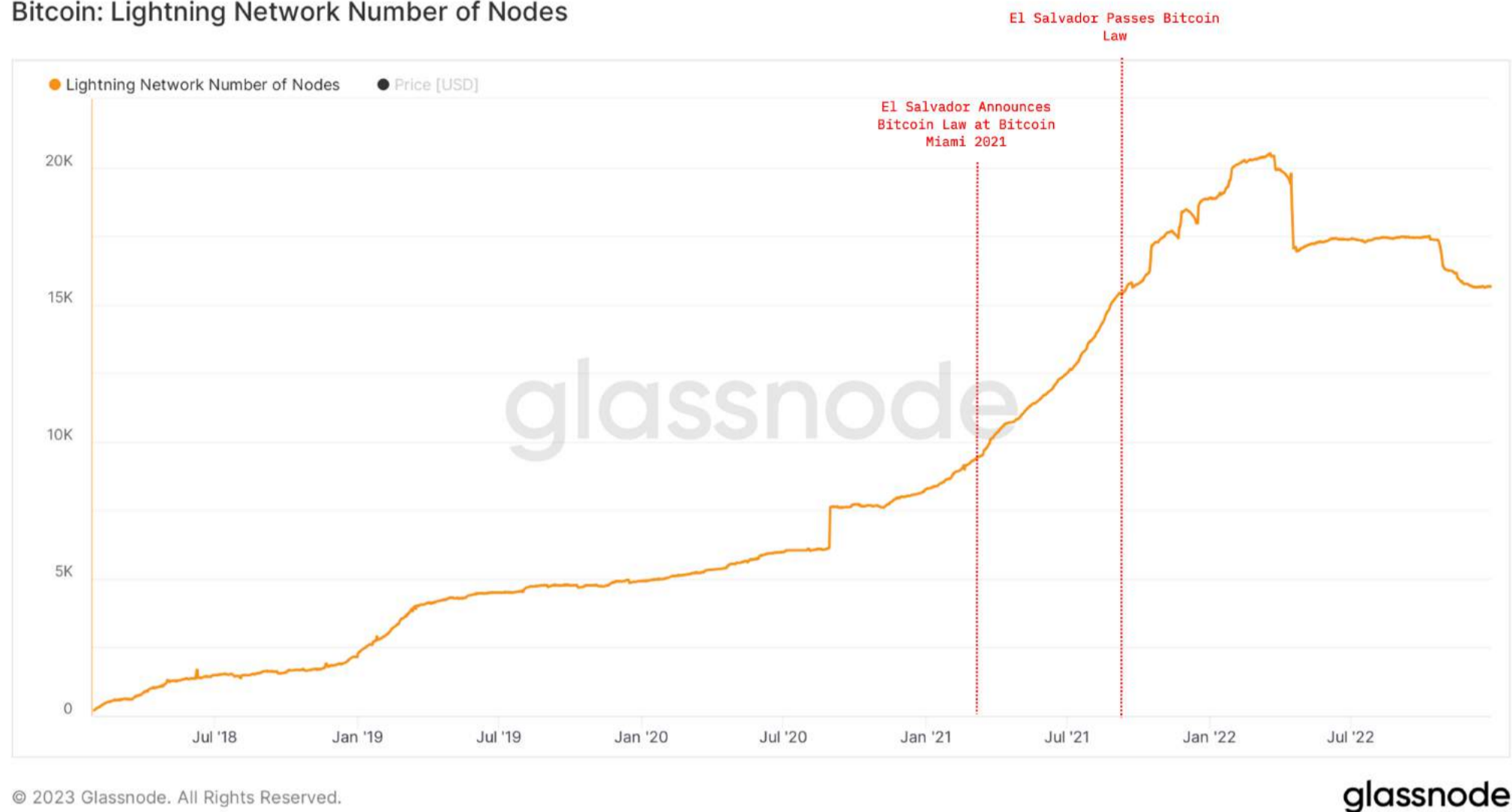
Node count

Lightning nodes are key pieces of infrastructure that allow users to transact with each other on the L2, and while still relying on Bitcoin's L1 to confirm final settlement. Without nodes, transactions can't be routed on Lightning, and users cannot interact peer-to-peer. Lightning nodes effectively act as the scorekeeper that tracks the amount of BTC each user has within a channel, while also possessing the ability to communicate this information to the main Bitcoin blockchain.

Lightning's online node count, at 15,671, is about 23% off its all-time high of ~20,400. Despite this lapse in volume that began in the second quarter of 2022, node growth on the network has been strong over the last couple of years. Currently, the Lightning node count is up 42% since El Salvador's announcement of the Bitcoin Law in May of 2021, about the level it was at the time of the law's passing.

The primary concern of a declining node count revolves around the centralization of parties routing payments on the network. Fewer nodes means each individual node has a higher level of relative responsibility. This can give some nodes an outsized influence over the routing of payments.

Bitcoin: Lightning Network Number of Nodes



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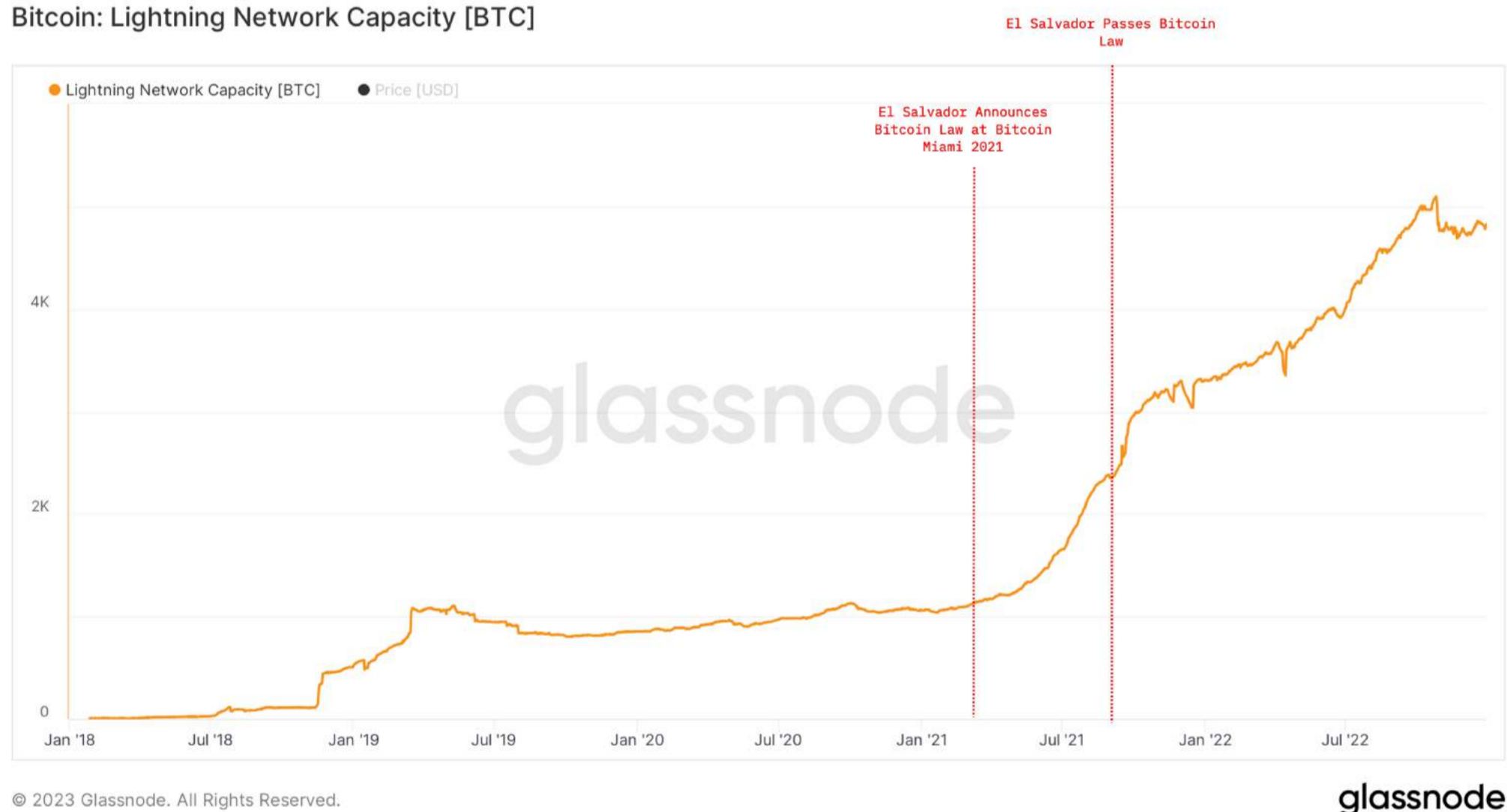
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Lightning capacity

The amount of BTC on Lightning has continued to increase throughout the recent crypto winter, ballooning some 50% in 2022. Reaching a peak of around 5,100 BTC in October 2022, Lightning capacity has been hovering around the 4,800 BTC mark.

El Salvador’s announcement and passing of its Bitcoin Law in 2021 marked two points at which Lightning capacity saw strong growth. Since President Bukele’s announcement of the law at Bitcoin Miami, Lightning capacity has grown by 285%, or ~3,600 BTC. Since the Bitcoin Law officially passed, capacity has seen an increase of about ~2,100 BTC or 77%. This is the equivalent to \$60.5 million and \$35.3 million, respectively at current prices.

Bitcoin: Lightning Network Capacity [BTC]



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Channel count and size

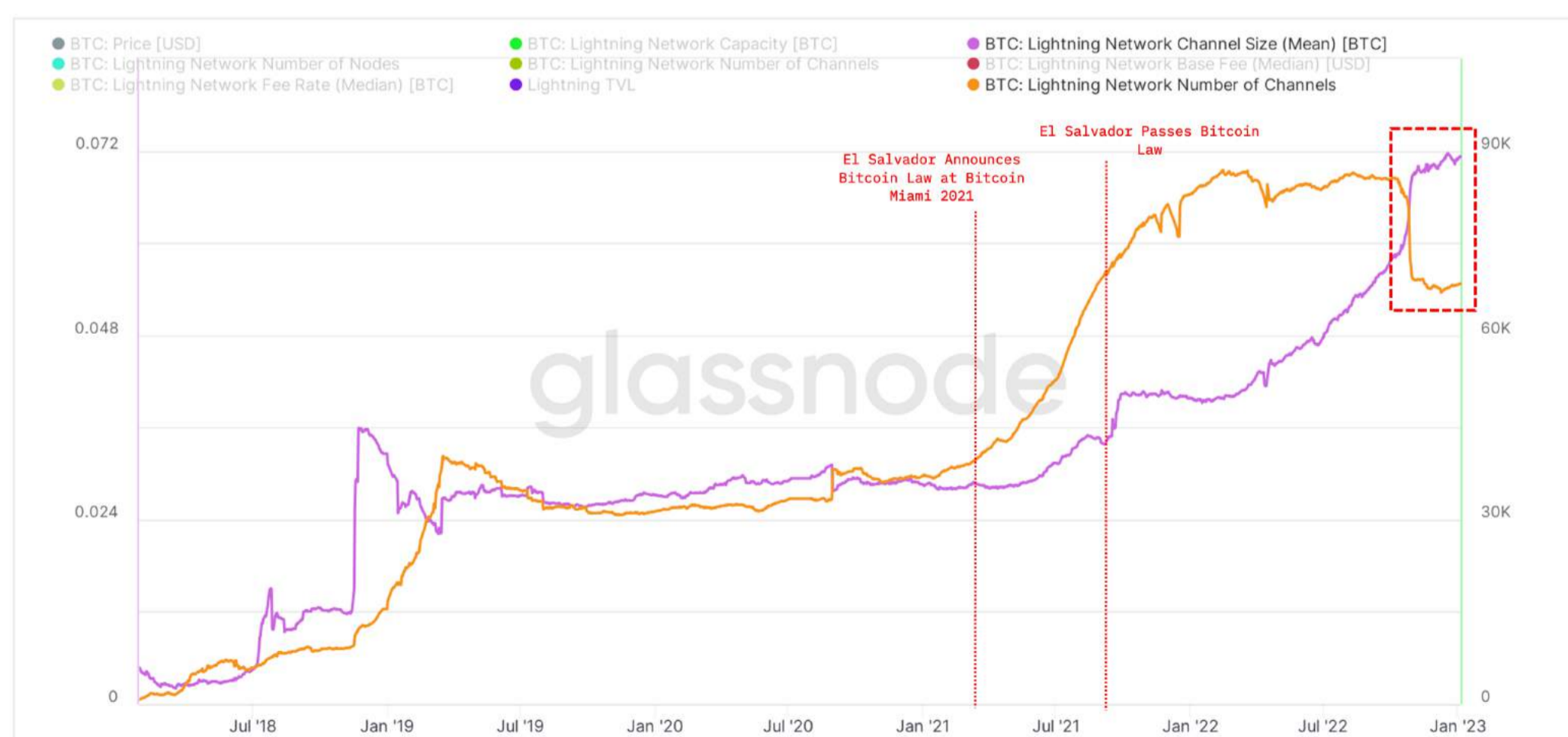
Channels are like roads connecting one city to another. The more roads built, the easier it is for people to travel. In the case of Lightning, more channels means more users are connecting with each other, and it is easier for them to transact. The size of a channel can be viewed as the average number of cars on a road at any given time. The more cars on a road, the more popular its use.

In recent months, the number of Lightning channels has decreased by about 20%, however the average size of them has increased by roughly 22%. Declining channel count may sound like a negative in the context of the road example above. After all, less roads between cities makes it harder to get around, right? However, the unique design of Lightning channels against their growing average size shows that users aren't capitulating. In fact, the network is becoming more efficient. Remember, Lightning users have the capability to jump channels and transact on adjacent, shared connections. Let's use the road and car example to express this.

Say a driver is trying to get from New York City to San Francisco. They have a friend who lives midway through the journey in Chicago, and this friend also has family in San Francisco. The indirect connection the driver in New York City has to their friend's family in San Francisco means they don't need to build a new road to make their journey. In this case, a road count of what could be three can remain at two, and the number of cars on the three-road system is captured by the two existing ones. Additionally, drivers can get back to NYC from SF using the same route; there's no need to add additional roads. And so it is with users on Lightning becoming more interconnected, and the network is becoming more efficient. With Lightning, fewer channels are required to transact the same amount of BTC and establish peer-to-peer connections.

Even with a 20% drop in channel count over the last two plus months, the number of channels on Lightning has experienced strong growth in recent years. Channel count has more than doubled since January 2020, and is up around 50% since El Salvador's announcement of the Bitcoin Law in May 2021. Additionally, mean channel size has almost doubled since Bitcoin became legal tender in El Salvador and has increased nearly 150% since January 2020. Part of what's helped drive this increase is the ameliorating effect the L2 solution has had on network fees.

Lightning Network



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Cost to transact

A primary benefit of Lightning is its cheap transaction costs. The monetary fee associated with using Lightning has been steadily decreasing since its documentation began in late 2021. At the current dollar denominated base fee of \$0.00000017, or 0.00000000025 BTC, Lightning fees are down 99% from its dollar denominated high. The high of \$0.00068 came in November 2021. At that point, the average fee rate in BTC terms was 0.0000000004 BTC. Today, the average BTC denominated fee rate is still 38% lower.

Declining fees allow Lightning to fulfill its intended purpose of offering a cheap, fast, and scalable payment rail for BTC. And this benefits everyone. But it's important to remember that there would be no use case for Lightning, were it not for Bitcoin. It's the lynchpin asset around which so much of our current and future financial potential is built.

Bitcoin: Lightning Network Base Fee (Median) [USD]



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What Bitcoin has enabled

When Bitcoin debuted in 2009, it planted a seed that blossomed into the flowering cryptocurrency and blockchain ecosystem known today. The fundamental ideology for smart contracts, DEXs, and the intricacies of DeFi all started with the advent of Bitcoin. The sum of these platforms have scaled into a multi-trillion dollar conglomerate that permanently changed the way the world deploys value and accesses new opportunities.

DeFi offers potential plumbing for nations that lack adequate banking infrastructure, and could present an efficient alternative to those who live in more developed countries. The ability to take advantage of these opportunities exists outside the reach of the Bitcoin network, and primarily resides with networks like Ethereum and the Cosmos. However, Bitcoin's ability to serve as the precursor to something bigger than itself is a key part of its story as a world-altering piece of technology.

But how big has DeFi really grown? How many users have benefitted from its efficiency, and the new opportunities it affords? And where are some areas of bloom despite the chill of crypto winter? The following section offers some answers to these important questions.

DeFi

Decentralized Finance is a unique and quickly growing component of the digital economy. It offers similar services to that of the traditional economy, such as borrowing, lending, and trading assets. However, DeFi-based services are different from their traditional counterparts in the important areas of availability and transparency.

DeFi products and services are available 24-hours a day, seven days a week, and remain accessible to anyone with a stable internet connection. They don't rely on physical infrastructure or intermediaries, as the entire ecosystem is based on smart contracts and open-source software. These characteristics allow DeFi to freely function around the clock, and opens up the inner workings of the system for transparency and tinkering. With DeFi, users can examine the data produced by protocols, (e.g. how much ETH was traded for USDT last week) and even audit the contracts that propel its function.

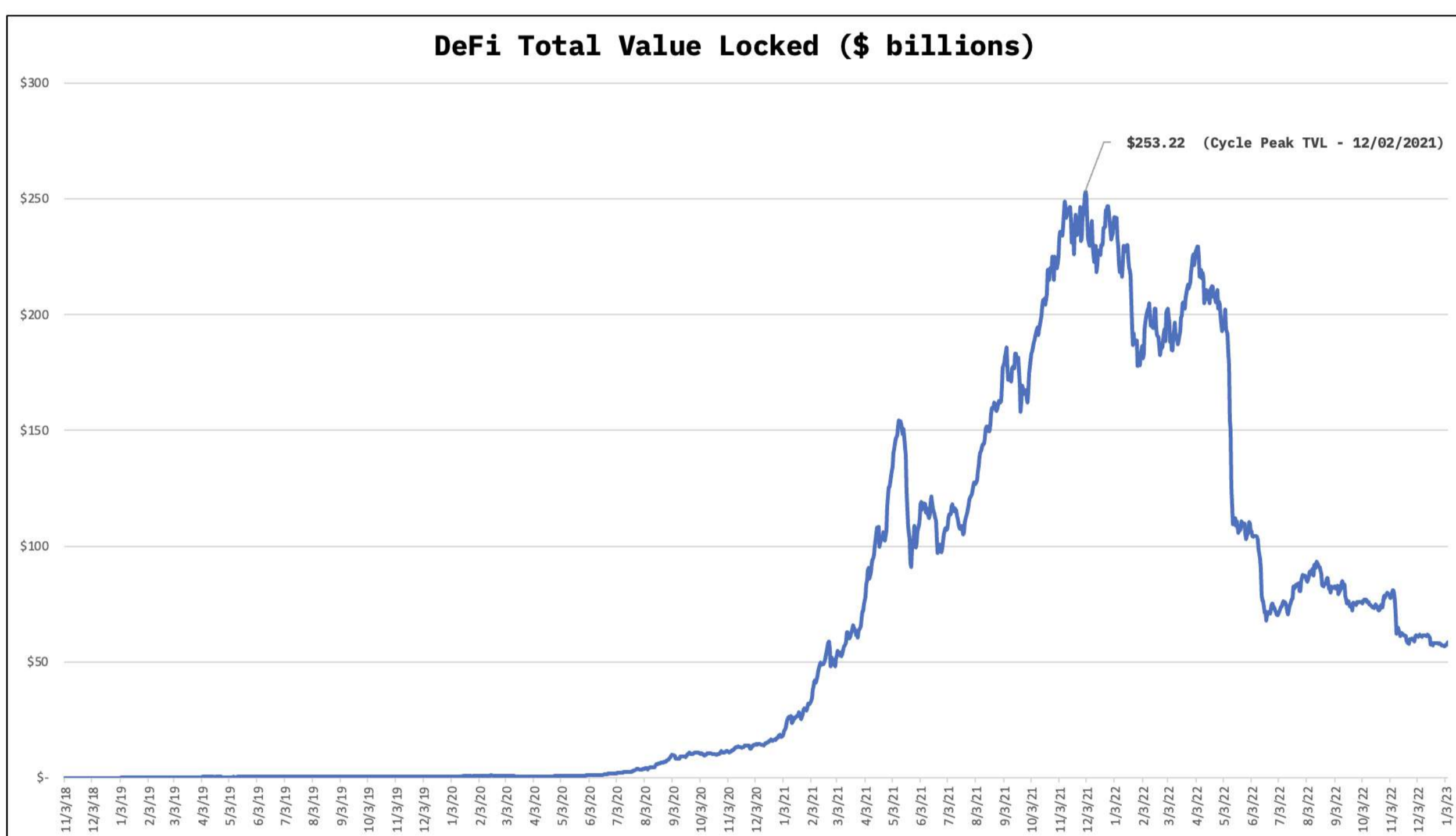
In a modern world in which transparency is valued as key to personal empowerment, DeFi offers an attractive promise. Theoretically, nothing is a secret. Almost any piece of information can be uncovered with a user or contract address and a [chain explorer](#) (e.g. [Etherscan](#), [Mintscan](#), and [Aptos Explorer](#)). This aids in building trust in the platforms that constitute the space. It also allows users to access a broad set of information that can be harnessed to protect them and help them make more informed decisions. Under this system of transparency, users can check protocols for vulnerabilities, view if their contracts have been verified as authentic, and gain insight into actions being taken by other users (e.g. a whale swapped a large sum of ETH on the Uniswap DEX). Characteristics such as these have helped catapult DeFi adoption in recent years.

DeFi Total value locked (TVL)

TVL is one barometer for assessing DeFi's growth. TVL is a measure of how much cumulative value sits on decentralized protocols, like Uniswap, AAVE, and Lido, and across all the networks that enable them. These networks include Ethereum, the Cosmos, Polkadot, and other smart contract platforms.

Occupying around \$60 billion in value, DeFi's cumulative TVL across all chains is down almost 80% in dollar terms. However, the price volatility of the assets included in DeFi means dollar denominated TVL can be deceiving, and can lead to under or overestimation of fluctuations in user activity. For example, Ethereum DeFi TVL is down 75% from its cycle peak in dollar terms, but the amount of ETH locked is down just 38%. This highlights that the declining price of ETH contributed more to the drawdown in Ethereum DeFi TVL, than users simply withdrawing their ETH and capitulating.

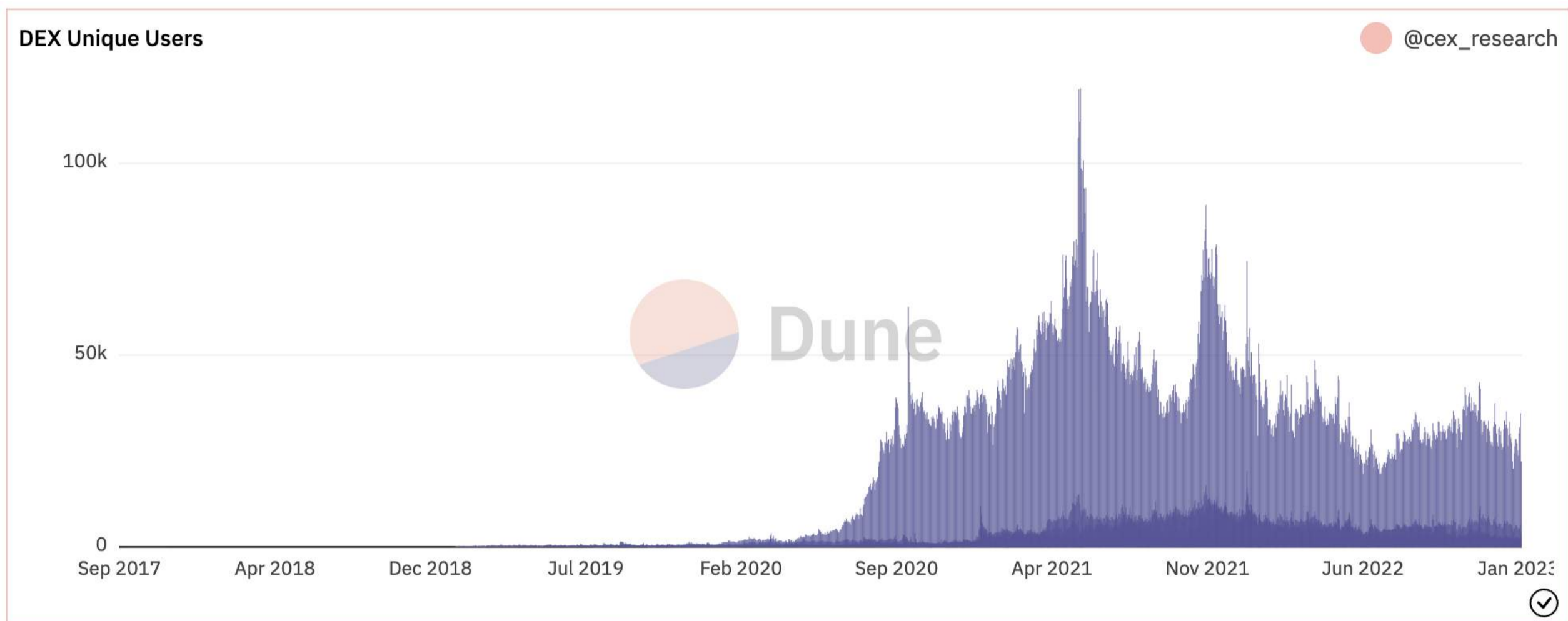
Sitting at just \$602 million in TVL on January 1, 2020, DeFi exploded to capture more than \$250 billion in value by December 2, 2021. In just 701 days, DeFi grew by \$252.6 billion, or 41,988%. At the current TVL of \$58.4 billion, DeFi has still grown by 9,599% since January 1, 2020.



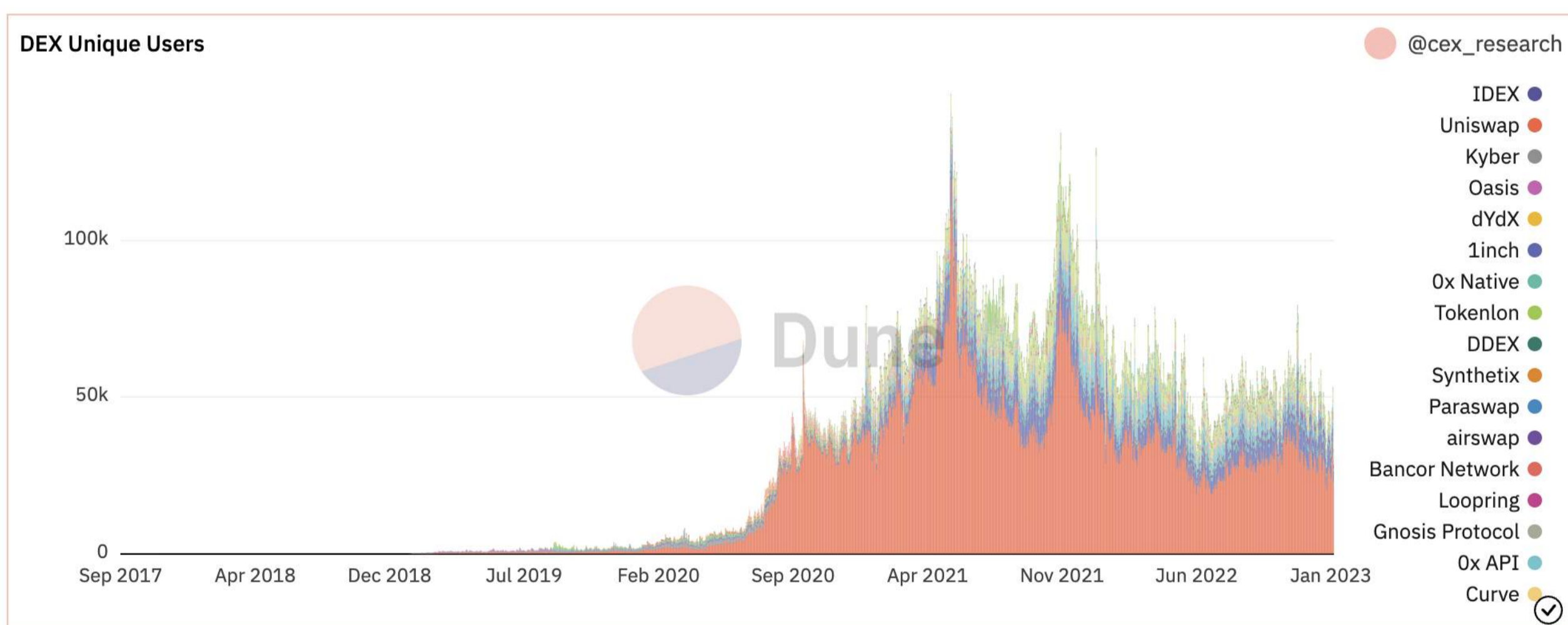
DEXs volume and user highlights

DEXs have become foundational pieces of infrastructure in DeFi that allow users to swap assets in a decentralized way. This is evident by the number of DEXs across all chains outnumbering that of any other protocol type, in addition to sustained daily volumes in the hundreds of millions, to billions of dollars. As a result, they are also a source of earning yield through liquidity provision for many users.

Even through the latest crypto winter, DEXs remain a prominently exercised tool for DeFi users. The cumulative daily volume achieved on Ethereum DEX surpassed \$6 billion on November 9 and November 10, 2022. Since then, DEX volumes on Ethereum have consistently hovered in the \$100 million to \$200 million daily volume range.



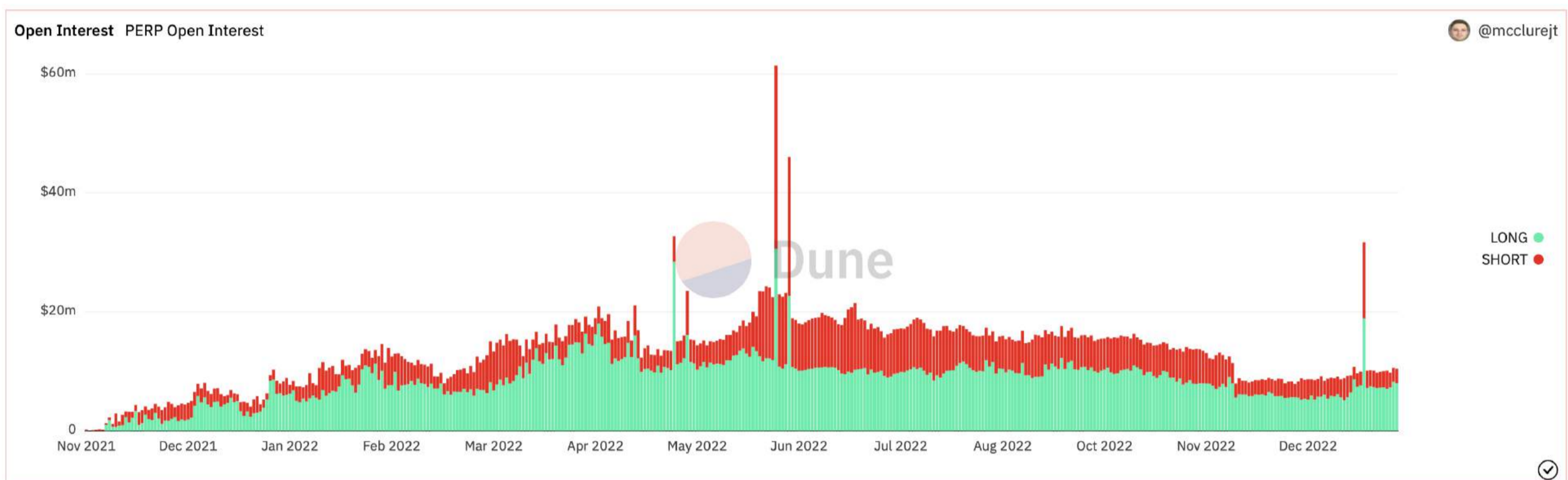
Volume isn't the only important factor when considering the use and adoption of decentralized exchanges. The number of users interacting with these protocols offers a perspective that transcends monetary factors, and provides a more accurate view of how many people these platforms are reaching. Throughout the latest crypto winter, DEXs have sustained 50,000 unique users on a daily basis, highlighting that even while volumes are down, users are still accessing these platforms.



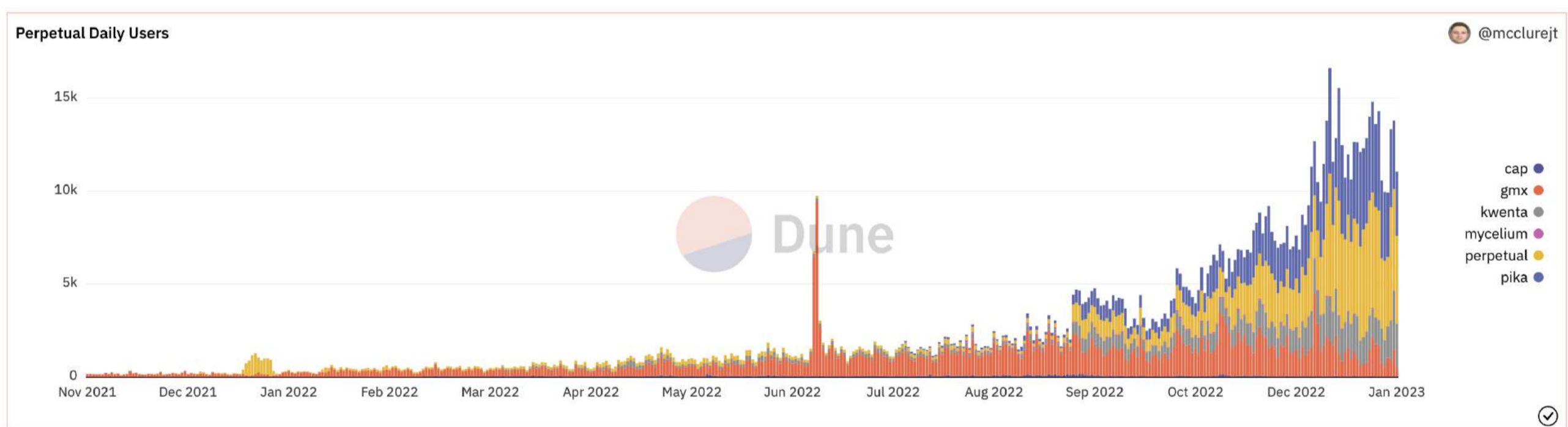
Derivatives volume

Decentralized futures trading is a relatively new phenomenon in DeFi that is beginning to gain serious traction. Bringing these instruments on-chain allows users to benefit from key tools that primarily exist in traditional finance, with the added benefits provided by blockchain technology. In the past, users could swap assets on a blockchain-native DEX, but had to hedge their positions on off-chain platforms. This presented a number of potentially deterring challenges, including the separation of funds, availability of contracts for some assets, and costs around trading contracts.

Measured in open interest (the total amount of funds allocated in open perpetual futures contracts), Ethereum on-chain perpetual futures trading has remained steady throughout this crypto winter. Floating around \$10 million in open interest since late November, DeFi perpetual futures open interest is now trading at more than half its average throughout most of 2022. This can be attributed to a number of factors including 1) the development of new and improved derivatives platforms, 2) users speculating through the bear market volatility, and 3) users hedging their holdings against market fluctuations.



Similar to DEXs, and other DeFi protocols, user count offers the best insight into the adoption of a sector of the ecosystem. The number of daily users on derivatives platforms has grown by more than 1,350% since the start of 2022. This comes in spite of open interest remaining at about the same level as January 2022. Boasting more than 12,000 daily users through the last leg of 2022, derivatives platforms only had about 900 to 1,000 daily users at the beginning of that year.



Stablecoins

DeFi also enables real world assets to be brought on-chain. Stablecoins, which are digital versions of fiat currencies, have played a big role in the adoption and use of DeFi. Making up nearly \$120 billion in value at their peak in early 2022, stablecoins have become a permanent fixture of the digital economy. Note, the \$120 billion in value is for Ethereum only.

There are three primary types of stablecoins:

Fiat collateralized stablecoins: those backed by physical fiat currencies. For example, one fiat collateralized U.S. dollar stablecoin will have one physical U.S. dollar backing it, and remains exchangeable at any time on a 1:1 basis. USDC is an example of a fiat collateralized stablecoin.

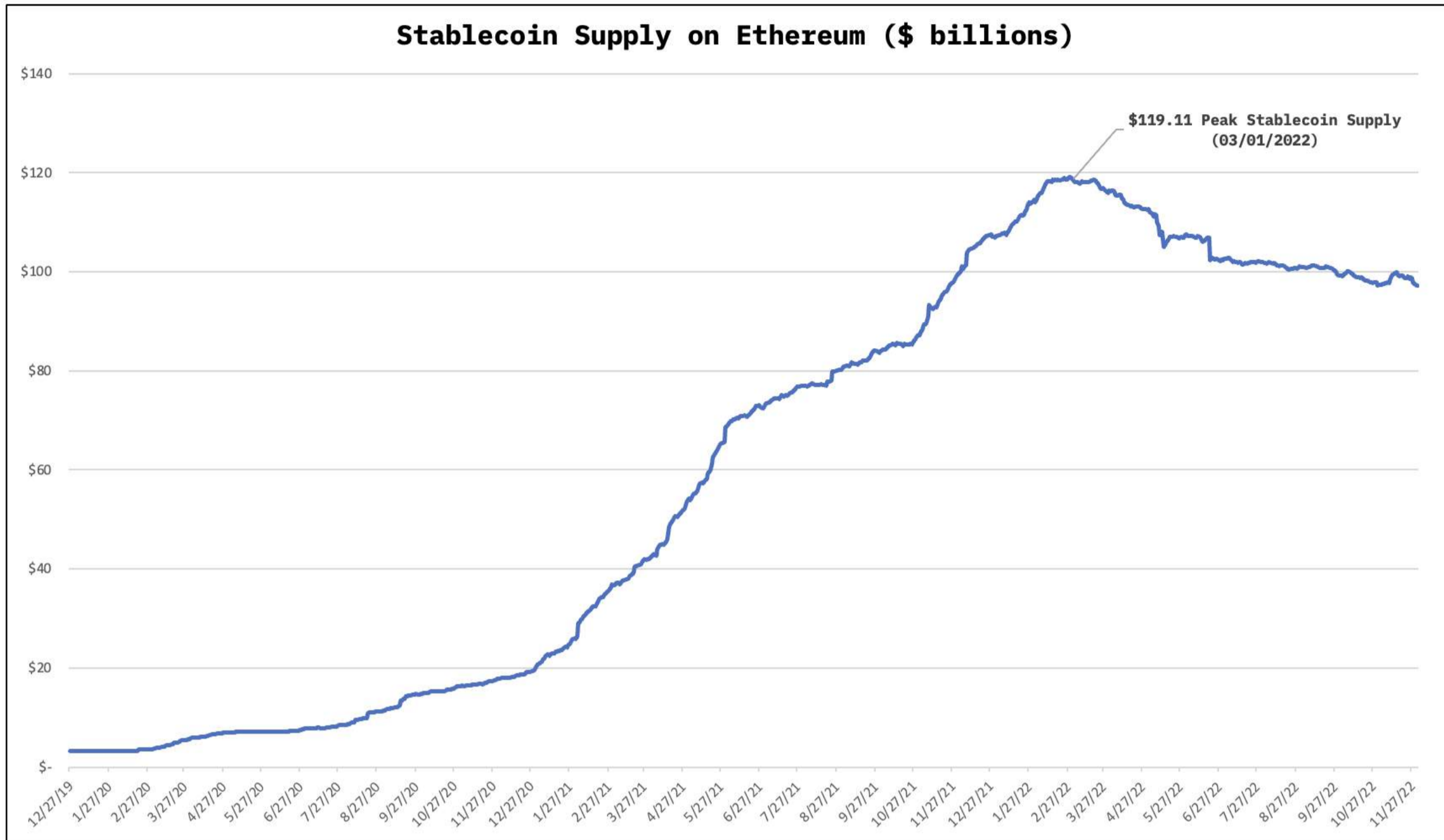
Crypto over-collateralized stablecoins: those that are backed by other cryptocurrencies. However, the total value of crypto backing these stablecoins often exceeds their circulating supply. For example, one crypto over-collateralized stablecoin will have \$1.50 of BTC backing it. fUSD is an example of a crypto over-collateralized stablecoin.

Algorithmic stablecoins: uncollateralized stablecoins tied to another digital asset whose supply fluctuates with the price and demand of the accompanying stablecoin. The maintenance of supply fluctuations are guided by smart contracts. For example, say you have one algo stablecoin tied to an asset called "Backing A," at this point the price of Backing A is \$1 (the equivalent of your one algo stablecoin). However, the price of Backing A drops to \$.50. The smart contract governing the stablecoin would then issue an additional unit of Backing A, ensuring that your one algo stable coin has adequate backing (in this case that is now two Backing A units). USDD is an example of a collateralized algorithmic stablecoin.

Total supply

Headwinds from the global economy dampened the growth of stablecoins throughout 2022. Over this period, the Federal Reserve aggressively hiked rates, which incentivized holding physical dollars over their digital counterparts. As a result, users began redeeming the dollars that backed their stablecoins en masse. The total supply of stablecoins shrunk by about 10% in 2022, and is down around 20% from its peak in March 2022.

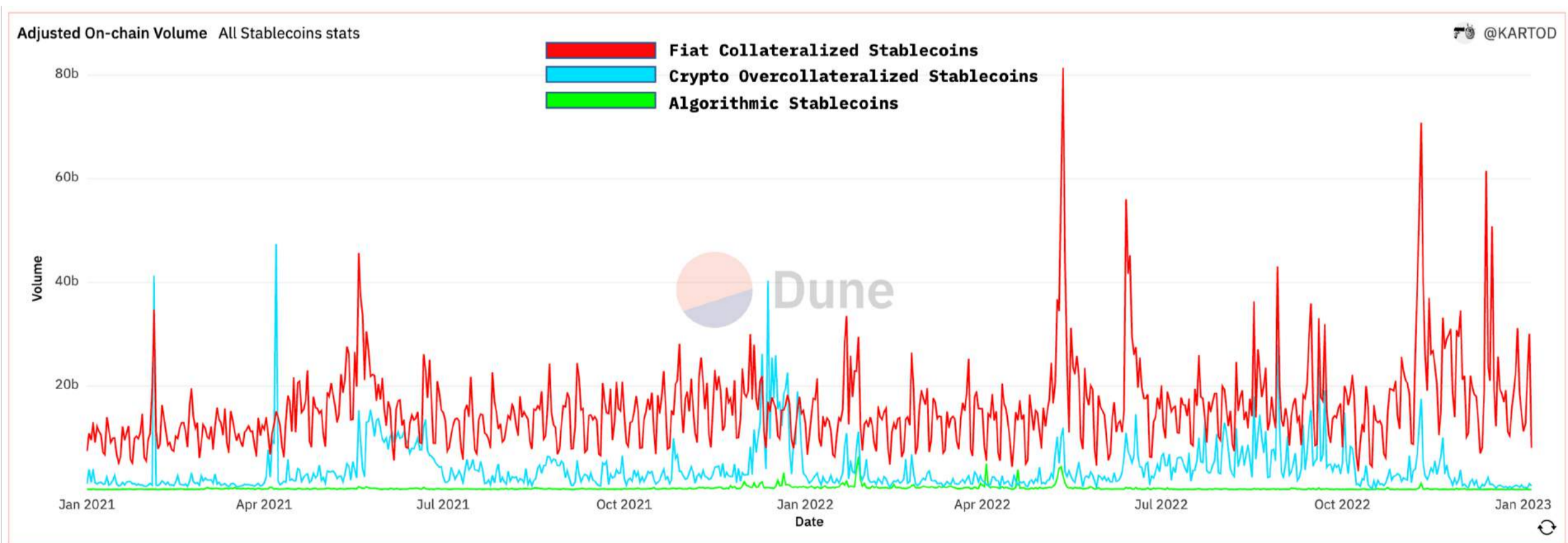
Nonetheless, stablecoins have seen strong growth and adoption. Supply has ballooned by more than 2,800% from January 2020 and by nearly five times in January 2021. None of this would be happening without the mother of all digital currencies initiating the momentum - Bitcoin.



On-chain volume

On-chain volume is a good measure of stablecoin use. It is a reliable indicator of how many stablecoins are moved each day. Ethereum stablecoins have seen sustained use throughout the crypto winter. Fiat collateralized stablecoins saw usage growth even through the latter, more volatile half of 2022. Printing daily volumes in the \$20 billion plus range, while use of other stablecoins dwindles, fiat collateralized stablecoins are absorbing volume from the other two types of stablecoins.

Additionally, there has been distrust of these assets after the collapse of UST and Terra in Q2 2022. Users began to seriously question the robustness of stablecoin backings. Fiat collateralized stablecoins took the driver's seat in the latter half of last year as a result.



Is Bitcoin the ultimate crypto “safe space?”

In a boundless world of financial unknowns, Bitcoin has been a beacon of light beckoning people to a consistent, dependable set of rules and expectations. Cemented policy, roots in computational power, and absolute scarcity of its native units gave Bitcoin radiance, a robust global monetary network. These characteristics have allowed it to accumulate the fastest growing pool of value the world has ever witnessed. In doing so, the currency has presented previously unimaginable opportunities to millions of individuals around the world.

Bitcoin's ethos and technological foundation have paved the way for other innovations, like Ethereum, which have carried the torch of blockchain to new heights. Through these platforms, real world assets and financial services are being positively impacted by advances in this technology, with more people enjoying the benefits. The dark days of global financial fragmentation are beginning to come to a close, and it all started with the invention of an orange coin by an unknown visionary.