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Research Paymaster = Crypto, but not crypto

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Intro

As 2022 ended, a lot of articles and outlooks were published on the direction the cryptocurrency industry would take following what can easily be described as one of the most disastrous years for investors in the nascent technology sector. Ambitions that this sector would improve different aspects of everyday financial transactions remain high nonetheless.

The effects from the overarching centralized players have weighed both positively and negatively, depending on who you ask, on the ecosystem's infrastructure. The learning curve though costly is likely to be a positive outlook for the future as it has been a catalyst for investors and participants to question how to properly set up their infrastructure when taking a position in this space.

The negative of course is the dwindling faith in what the industry, and more specifically, what blockchain can achieve. Although predictions varied, all outlooks had a general sense of optimism. This, however, is a given as it preaches to the choir.

Most, if not all reports, broke down their outlook and assessments based on certain protocols, development, or industry direction. From the tokenization of Real-world assets (RWA) to focusing on increased integration of zero-knowledge technology that would allow for scale and efficiency, pundits voiced a great deal of potential for the growth of the industry.

Looking at every moving part individually, however, is only a fraction of the equation and doesn't address how all these elements would, and if they even could, work together for that greater good that has been promised for well over a decade now.

Furthermore, little was discussed on how these future developments increase adoption and whether it would even be necessary should traditional financial industry players begin to catch up with the possibilities that come from the use of digital assets. Traditional finance have the advantage of a user base in place – their customers (i.e. the global banking infrastructure). The giant steps forward from this breakthrough technology promising open access to a wide array of financial services previously reserved for the banking sector's wealth management arm require someone to actually use it.

But the User Experience (UX) and User Interface (UI) for crypto haven't been very friendly, but quite the opposite depending on the complexity of the transaction and the protocols users interact with.

For this research team, the most interesting report that gives crypto a great deal of room for adoption potential wasn't an article on crypto at all, but on the User Experience (UX) of legacy and challenger neobanks.

As the crypto ecosystem continues to focus its building efforts around finance, the incumbent UX is of the utmost importance to examine as this is the benchmark expectation of any incoming adopter.

Where we're at

'But build what?' was the title question of an article published by Bloomberg's Crypto Blogger Emily Nicolle towards the end of 2022.

<u>The article</u> → suggested that "if the industry is to grow back to its original size and then some, the crypto community needs to figure out how it can attract those outside its peripheral vision with usable products and convince external investors it's worth waiting out the storm."

Keywords being usable products and Ms Nicolle isn't alone in highlighting this fact. Co-founder of Ethereum, Vitalik Buterin, took his New Year's Eve to discuss what a good crypto future would entail, which included finding a fix for scaling, privacy, and the user experience.

vitalik.eth 🤡 @VitalikButerin

- * fix scaling
- * fix privacy
- * fix UX
- * user accounts more secure for avg users than centralized services
- * payments + SoV + defi provide value to many people
- * crypto social takes off
- * identity + SIWE succeed
- * DAOs pioneer new organization paradigms that see broader adoption...

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Interestingly, taking a step back and looking at what is currently at play shows that the cryptocurrency ecosystem has slowly gathered all the right ingredients to push through a better user experience that has hindered adoption in its intended manner of self-custody and removing the counter-party risks that retail investors have been penalized for time and time again in crypto with the trust of centralized exchanges.

Various products are being developed and deployed that address the path toward seamless and organic adoption on the retail front. Without growth in retail demand, institutions will not find the use case particularly interesting. Although far from perfection, there is finally a glimmer of a recipe for addressing a notoriously poor crypto experience.

The individual improvements will provide a collective benefit. Part and parcel to this is the potential separation of adoption and investment through the use of middle-men 'Paymasters' who will be able to provide decentralized services with users being none the wiser.

In this report, we'll break down and explain several of the key elements that will lead to a seamless user experience as crypto products begin to derive benefits from one another in what can will easily becomes a multi-layered symbiotic relationship.

Not how, but why the Internet saw growth



Source: Deutsche Bank forecasts, InternetWorldStats.com and Blockchain.com. We measure "adoption rate" by the number of users adopting internet and bitcoins since they went public.

The wrong chart: Internet vs. Crypto Adoption

If crypto's goal is to be internet money, then it better act like users of the internet expects it to. One of this research team's pet peeves is the use of various comparisons that focus on trends of similar techbased technology that has previously, much like crypto, had a steep learning curve.

It would be hard to go through earlier research papers and not find reference and the comparison of growth forecasts of crypto versus the internet (see chart). The reason this is perhaps the incorrect or shortsighted way of looking at potential adoption is the fact that there isn't enough information other than a trend line.

A great deal of effort, tweaks and minute iterations were executed by internet services providers, developers and web designers over the past few decades that allowed it to find massive sustainable and growing reach.



Average Internet Speed, Mbps Source



Speed & Cost: How two elements set the stage

Work-from-Home would simply not have been realistic in 2007, when the first iPhone came out and before video calls, mainly through the then-popular application Skype, was not even possible.

Although technology had advanced greatly since the advent of the world wide web, the speed of the internet would have made for a very poor experience (see chart). Today the world streams movies and music, but one would have been lucky to download a song within an hour 20 years ago.

Although speed began to increase from the outer layer of the internet infrastructure from broadband service providers, internet and web developers themselves also took very close notice on how users would interact with websites.

In 2010, Google introduced page loading speed as a factor in its search algorithm. The move was aimed at enhancing the user experience by elevating faster-loading pages in search results.

Websites began poorly ranking for being slow (speed). And later they were penalized for having blocked content or paywalls (cost).

The implementation of page loading speed as a ranking factor was a measure to improve user experience.

Rapid page loading times lead to heightened engagement and decreased bounce rates - a measurement that checked if users went on the website but did not continue interacting further within the page.

Google employed this metric to encourage website owners to optimize their pages for faster loading and enhance the general quality of the web. This change also ensured that Google's search results would not only be relevant and useful, but also easily accessible.

This wasn't the last evolutionary iteration on the matter for Google. In 2015 the search engine began to ranking mobile-first designed website (i.e. webpages that would load correctly on smaller screens which meant designers and developers had to optimize for both mobile and desktop devices).

US Contactless Payment Market

size, by type 2020-2030 (USD bn)



Speed & cost in banking

Users have become accustomed to very fast experiences and low to zero costs using the internet. It's not unconceivable that this expectation trickles into how people interact with their finances.

As the industry progress, consumers have come to expect better user experiences from mainstream apps. A great UX is no longer a unique selling point, it is a requirement in most industries. With a multi-year span, it is important for companies to focus on resolving issues and innovating around technical limitations.



This includes fixing bugs, highlighting missing context, and finding ways to improve overall user experience. Building complicated products is a non-linear process, but companies should strive to make improvements over time.

It is important to note that achieving 100% user satisfaction is not always possible. Some issues may be the best solution given certain limitations.

According to the latest research on banking application UX by Peter Ramsey, a large percentage of issues remain unresolved for over 2 years. It is difficult for a company to claim that they are actively working to improve their user experience with such timeframes.

This indicates that the idea of established banks catching up to newer, digital-first banks may not be accurate. In fact, it suggests that the latter may be pulling ahead of the competition at a faster rate. And one way to measure this is by looking at the frequency of updates as well as the speed of loading the application itself (See charts).

Banks are still charging high fees for international money transfers despite the rise of cryptocurrency and the popularity of alternative banks. The fees charged can be over £28 for sending £100 abroad. The problem is made worse by the lack of transparency in disclosing these fees, as they are often not revealed until the user is far into the transaction process. The banks are ranked based on their "true cost" and the point at which the fees are revealed to the user (see charts).

The comparison of crypto to the internet in terms of adoption and growth is short-sighted and doesn't consider the significant effort and improvements made by various players in the internet industry to enhance user experience.

Users have come to expect fast and low-cost experiences from the internet and are now starting to expect the same from their financial transactions. Neobanks, with their focus on improving user experience, may be ahead of established banks.

To keep up with user expectations, crypto should strive to offer the same level of user experience as the internet and continuously work on resolving technical limitations and improving overall user experience.

And perhaps this is coming closer to reality as wallet applications begin to implement various technologies that would make the flow a much better experience, as this report argues, crypto has collected all the right ingredients to make this happen.

The real cost of sending £100 to a US bank account USD. Costs in £ - Sender & FX Fees



Avg. number of days between updates Number of days



Average app boot time





Source: Peter Ramsey, UX of Banking



Next Phase of Crypto Wallets



One of the largest selling points of crypto is also perhaps it's Achilles' heel – self-custody. Ethereum which accounts for the largest ecosystem and various types of applications, depends on wallets infrastructure that has been inherited from the Bitcoin era. Many find that securing 12 words, what is commonly known as the recovery seed phrase, to be a daunting task. And it's not without reason as a loss of the seed phrase would result in total loss of funds in case a user requires to recover their wallet (e.g. a lost phone).

In comparison to neobanks, there are too many hurdles in the current crypto wallet infrastructure, although this is becoming better as we will examine.

A great deal of focus has been given as of late to an Ethereum Improvement Proposal (EIP) penned over five years ago that focuses on the idea of establishing smart contract wallets. After several different proposals and upgrades, Ethereum is closer to establishing new dynamics in how end-users will most likely interact with the ecosystem and protocols.

Very importantly, improvements in this regard need no changes to the core protocol that would have further delayed any sort of practical implementation.

Blockchain technology is an ever-evolving field, and the concept of Abstract Accounts (AA) is a recent development that promises to dramatically change the way users interact with blockchains.

Externally Owned Account (EA)	Contract Account (CA)
Creating an account costs nothing	Creating a contract has a cost because you're using network storage
Can initiate transactions	Can only send transactions in response to receiving a transaction
Transactions between externally- owned accounts can only be ETH/token transfers	Transactions from an external account to a contract account can trigger code which can execute many different actions, such as transferring tokens or even creating a new contract
Transactions between externally- owned accounts can only be ETH/token transfers	Contract accounts don't have private keys. Instead, they are controlled by the logic of the smart contract code

To understand AA, we must first examine the status quo of blockchain accounts, which are currently of two types: Contract Accounts and Externally Owned Accounts (EOAs) (see table).

Interacting with Ethereum through an EOA requires users to sign transactions with a private key, sending the signed transaction to the Ethereum network where it is included in a block by miners. This process incurs a gas fee paid in ETH (which is the later part of the burn mechanism).

But the inability to perform batch transactions creates more cost and an inefficient user experience. Which goes back to our original thesis about the internet – speed, cost and UX will be the likely checkboxes that users will decide whether or not crypto rails are useful and worth adopting.

A solution to these design challenges is to revert to the original idea of generating new abstractions, such as account abstraction (AA), which allows EOA accounts to be integrated into smart contracts. This decoupling of the signer from the account enables the development of more secure and user-friendly dApps.



With AA, users can change their wallet's key or use multiple signing keys, potentially eliminating the need for private keys and passwords, among other security features.

Furthermore, social recovery can become the standard for securing large amounts of capital by allowing authorized guardians to manage the signing key for a user's wallet (this is the model used by Argent (See table on various wallet providers).

EOA	AA	MPC	Hardware
Metamask	Safe	Copper	Ledger
Rainbow	Argent	Qredo	Trezor
Rabby	Ambire	Coinbase	Keepkey
Frame	Pillar	Metaco	BitBox
Trust	Linen	Fireblocks	Keystone
Coinbase	Sequence		Grid

Two or more users can also be required to approve a single transaction for improved security, and emergency account hold features can be implemented. These small features are part and parcel of allowing potential adopters feel safer in a new technologically challenging environment.

Abstract accounts are a paradigm for blockchains where assets are held by smart contracts exclusively. As such, any kind of account contract can be coded, and the answer to questions about key storage may vary depending on the implementation. However, it is possible to recover a key if lost, to have keyless wallets, and to create new wallets easily with only a single seed phrase.

We have been discussing Account Abstraction for the past five years, but it is only now that it is gaining traction. The focus of blockchain technology has shifted from core technology and scaling to user experience and interaction.

The current model of EOAs requires users to protect a password, which is not scalable.

Account Abstraction is the next challenge for the development and integration of the ecosystem. But it also represents the potential solution in bringing blockchain technology to users and represents an important and necessary UX shift in the management of self-custody.

Scale: It's not just about transaction numbers

Ethereum Road Map – The next phases



The Surge is a plan to improve scalability and privacy. A new way of making transactions called Proto Danksharding is being introduced, which will allow for better scalability and decentralization. This will enable the use of a scaling technique called Rollup and make the network resistant to quantum computers. The goal of The Increase is to make Ethereum able to handle 100,000 transactions per second while keeping it secure and stable.

The Scourge PHASE 2

The first improvement in The Scourge is Proposer/Builder Separation. This splits the process of proposing and building blocks among different parts of the network to prevent censorship and unfair profits. This has the potential to make Ethereum more resistant to censorship and able to handle more transactions.

The Verge PHASE 3

The Verge is about making transaction verification easier. A technology called ZKP will be used through something called zk-SNARKs to verify transactions more efficiently. This will also make the network smaller and easier to use for light clients.

The Purge PHASE 4

The purge focuses on making Ethereum more portable and user-friendly. The integration of ZK-snarks and verkels trees will allow for fast syncing of the main network and reduce the size and synchronization speed of the Ethereum blockchain.



Ethereum continues to develop towards scale and has its own roadmap (see table). To address these scalability problems in the near term however, developers have created additional infrastructure on top of the mainnet, known as Layer 2 solutions (L2).

L2 offers a more efficient, faster, and cost-effective way to process transactions. By using L2, smaller computations will help alleviate pressure from the mainnet and improve the overall performance of the network.



One type of L2 solution is sidechains. Sidechains are separate blockchains that have their own consensus protocols and security measures, and they connect to the main chain through a two-way peg. Sidechains can improve transaction speed and reduce pressure on the mainnet, however, the level of security is not the same.

Ethereum's rollups is another L2 solution that has become much more popular in development due to several factors. Rollups are sets of transactions that are compressed into a single transaction, making the execution process faster and cheaper.

There are two types of rollups: optimistic and Zero-Knowledge (ZK). Optimistic rollups are easier to set up, but ZK rollups offer stronger security by relying on cryptographic proofs to verify transactions.

Optimistic Rollups	ZK Rollups						
Transaction Finality							
1 week delay in finalizing of transactions from the challenge period	Zero delays due to validity proofing feature of ZK Rollups						
Readiness	s for DeFi						
Similarity to EVM specific execution models	Only a few EVM- compatible ZK rollups. Most rollups lack diversified EVM support						
Validity	r Proof						
Validity is proven through fraud proofing	Embedded validity proofing as Zero- Knowledge Proofs (ZKPs)						
Programming Easiness							
More ease in programming as validity computation and data compression is not required	Difficulty in designing and implementing cryptographic proofs with ZK rollups.						
Transactio	nal Costs						
Costs are lower as transaction proofing and data publishing are not required in optimistic rollups	Costs are higher as high-end expensive hardware and proof verification are required for ZK rollups						
Trustability							
Trusted setup is not required	Trusted setup is essential						
Live Monitoring							
Live tracking of actual rollup state and reference state in the root is required from verifiers	No monitoring for fraud detection is required						
Security							
Users are provided with incentives for ensuring crypto- economic rollup security	Cryptographic proofs automatically guarantee security maintenance						



To outsiders the words "Zero-Knowledge" are nothing more than buzzwords, and often described as "Moon Math" by many within the cryptocurrency space. But ZK technology that is being implemented within the Ethereum ecosystem might be the most important missing ingredient for adoption to happen – the ability to scale as well as additional features of privacy on public blockchains.

As of the current state of play, there are plenty of different projects that are going in one direction or another in relation to which roll-up or scaling solution they see fit for their intended use case and there are certainly many different factors to consider from a technical perspective.

However, for the purposes of this exercise, which is focused on finding out how to reach the masses and see real adoption, a few interconnected projects stand out.

L1 + L2 + Wallet + Ramping



zkSync, a Zero-knowledge proof Layer-2 on Ethereum that closed it's Series C at the end of 2022 is showing great promise with over 150 launch partners including popular protocols in DeFi.

It is important to note that zkSync is compatible with any blockchain using the Ethereum Virtual Machine (EVM), including Avalanche, Solana, Polygon, and Binance Smart Chain. This compatibility allows developers who have already built products on Ethereum to quickly use zkSync for their scaling needs. The code for zkSync will also be opensourced.

zkSync provides a low-cost and fast solution for Ethereum transactions with up to 1/100 of the gas required by the main Ethereum network and speeds of over 2000 transactions per second, compared to just 14 transactions per second on the main network.

The security of zkSync is ensured by the main Ethereum blockchain, allowing for frictionless transfers between the mainnet and Layer 2. Additionally, zkSync offers censorship resistance as users can easily move their assets back to the main network at any time.

For these reasons, Argent, a Smart Contract Wallet based on the aforementioned Account Abstraction model discussed earlier, has chosen and already launched their Layer-2 wallet using zkSync.

The paired duo is incredibly powerful when considering the fact that Argent, a self-custodial wallet, also has direct on and off ramps using either Ramp or Moonpay.

This means that upon purchasing of crypto assets, including pegged stablecoins, these assets are already on the blockchain from traditional rails within seconds. And the coverage of these two service providers for fiat on-ramping and off-ramping is considerable, with Moonpay nearly being able to service all of the US states and Europe.



UX Game Changer: Paymaster Smart Contracts

The Paymaster, a feature within the Ethereum Improvement Proposal that is focused on Account Abstraction has not gathered as much attention as perhaps it should. The Paymaster, effectively a contract, will allow smart contract wallet providers to simplify the transaction process for users by separating the confirmation of a transactions and who actually pays for the transactions. To explain this a little bit better, the Paymaster contract can pay the fees of a particular transaction for a service without the need for the user to have Ethereum for gas fees, or even the token of a protocol should that be required to access its services (for example, Web 3.0 protocols such as Filecoin for storage).

In effect, smart contract wallets and developers can accept payment in US dollars to complete a transaction on behalf of the users in what might appear as a 'gasless' transaction (see diagram).





This means that users can pay for their whole Web 3.0 interaction with stablecoins (or other ERC-20 Tokens), for example, never actually touching other cryptocurrencies.

The Paymaster feature, which in essence can be a third-party contract/escrow service, allows for the very real possibility of users having end-to-end crypto infrastructure and transactions take place without them actually necessarily knowing what is happening in the background. For all they know, they've simply bought some (decentralized) storage space to store their documents and photos.

Adhering to the escrow principle, the Paymaster holds funds in a secure account until the conditions stipulated in the contract are met, instilling confidence in the parties and proving especially useful in transactions involving large sums of money or a degree of trust. Card network giant Visa <u>discussed</u> the possibility of recurring payments through self-custodial wallets using account abstraction on another L2 scaling solution protocol, Starknet (which also uses ZK Rollups). Although Visa did not delve into the details of the Paymaster feature, the overall setup would require the escrow contract that has been agreed through the smart contract. The overarching elements are very much the same as discussed throughout this report – speed, User-experience, ease of use and cost.



'Come together'

For the widespread adoption of crypto wallets to occur, the user experience must be at least as good as that offered by neobanks, which are already far superior to traditional banking applications in terms of speed, cost and the ability to be agile in responding to issues. The current self-custody management requirements for cryptocurrencies are not only far from being ideal, but have most likely repelled many from even thinking about participating in the ecosystem. Seed phrases and the potential total loss of funds is not an attractive prospect.



This means that using smart contract wallets is crucial as they change the self-custody dynamics and make recovery a straightforward process on the retail level. On the institutional level, Multi-party Computation (MPC) wallets have some distinct advantages in relation to off-chain recovery, being truly cross-chain, having no dependence on smart-contracts, removes gas overheads and signatures allow for interaction with all dApps without any special requirements.

However, MPC wallets are unlikely to gain traction on the retail level that will drive ecosystem adoption, but will serve institutions who will have organizational controls in place.

The Rebranding of Privacy to ZK

Zero-Knowledge has been a primary component as of late for the ability to scale the blockchain. However, there is another important factor within this technology to consider as vitally important – privacy.

Crypto has been mired with being synonymous with money-laundering and crime for most of its existence and this misinformed viewpoint is certainly not going away overnight. It also means that the ecosystem has failed to educate policy makers on what a public ledger actually is and the transparent tools it allows for law enforcement to follow the money trail.

But payment rails, domestic or global, are of systemic importance and of national security priority as they drive the exchanges of goods and services. This type of Financial Market Infrastructure simply cannot be placed on a public ledger for all to see as this introduces a great number of risks and puts a great deal of information in plain sight for bad actors to take advantage of.

However, crypto proponents will have a hard time selling the idea of increasing privacy, which is where Zero-Knowledge (ZK) technology will be a rewrite of the language. Most, if not all 2023 crypto outlooks in one way or another discussed ZK as being a primary growth factor for the overall ecosystem.

Additionally, zero-knowledge identity can provide a smoother user experience and remove barriers to using crypto financial rails.

This means that the onboarding of users becomes a simple task as the KYC element will have already been completed and only needs to be completed once.

Finally, the paymaster feature on Ethereum, which eliminates the need for users to pay in ETH or other tokens, further streamlines the experience and makes it more accessible to a wider audience. By addressing these key issues, crypto wallets can become a viable alternative to traditional banking systems, offering users greater control and security over their funds.

Maybe, or maybe not, the growth of crypto adoption will mirror the internet. What is near certain however is that the internet has set certain expectations and standards that need to be met for real adoption and there are necessary elements that need to be replicated by decentralized infrastructure providers.

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C		Total to pay: \$2,091.10					
		All accounts					
Total balance \$159,000,021.09		Total balance \$159,000,021	Available. 09 \$155,0	91,100.10	Processing @ \$1,091,100.10	ClearLo \$3,09	oop @ 1,100.10
		HOLDINGS STARING					
\$120.1K \$35.1M		Asset Bitcoin BTC	Quantity 129.092 avail. 99.12	Market value \$14M \$120,109.21	Processing 10.092 \$23K		ClearLoo O.OC SO.OC
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Storage trading \$120.1K				\$207K \$80.21			
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