The Endgame
A Thesis on the Future of Chainlink & Web 3.0

Abstraction Capital

27 Jan 2023

Abstract

Chainlink's Cross Chain Interoperability Protocol (CCIP) is set to become the global standard for inter-blockchain messaging. Their partnership with SWIFT further reinforces the network effect of CCIP, as it will enable any SWIFT bank to interact with any blockchain environment. In turn, CCIP will connect the legacy financial infrastructure to the blockchain ecosystem, enabling a unified blockchain-based global financial system. The Chainlink network will capture more transactional data than any other piece of infrastructure in this new financial system. As discussed at SmartCon 2022, Eric Schmidt believes this will enable a new suite of global network platforms, where the data generated on blockchains and oracle networks can be used to train powerful AI models. Chainlink is uniquely positioned to capture the most value from this shift due to its growing market dominance and technological lead on competitors.

Contents

1 Introduction

After attending SmartCon 2022, the third annual conference for Chainlink, I found the conference impressive, providing clarity on some topics I have been interested in writing about for a while. In my opinion this was Chainlink exiting stealth mode, as it confirmed many things that the community has speculated about since 2017. The biggest announcements include the launch of Explicit Staking (Economics 2.0)[1] in December, CCIP[2] and DECO[3] currently being alpha tested by various dApps, and the official announcement of Chainlink and SWIFT working together to connect the global financial system to Web 3.0 through a CCIP-powered abstraction layer[4].

The core implications of these developments have been examined in my recent papers as Sergey and the Chainlink team have discussed them over the past few years, albeit without any concrete announcements. This raises the natural question: Was there anything new the team *unofficially* announced at the conference that left us speculating on the future? The Eric Schmidt fireside chat was the most interesting and significant part of the event for this exact reason.

Chainlink has come a long way since 2017. It has developed a range of features, from price feeds to off-chain compute and cross-chain communication, that demonstrate the full extent of the Chainlink team's original vision. This is clear not just from the name of the protocol, but also from the following statement from page 4 of Whitepaper 1.0[5], "[Chainlink] intends to support all leading smart contracts networks for both off-chain and cross-chain interactions." The ultimate goal of Chainlink is to create a network that connects all aspects of the global financial system and provides crucial services to every smart contract on every blockchain. It's no surprise that the CEO of Google, the company that indexed the vast majority of Web 2.0 data, identified Chainlink as the company capable of doing the same with Web 3.0. While there will be value scattered across Web 3.0, the real value lies in the data, and the Chainlink network is set to capture the data of every interaction in the global economy that uses hybrid smart contracts rather than traditional digital agreements. If indexing the open Web resulted in the creation of one of the most valuable companies ever, just imagine the value of indexing all economic transactions represented by tokens moving throughout blockchains.

The endgame is revealed. By creating a cross-chain network that connects financial institutions to blockchains and blockchains to one another, the Chainlink Network will control the largest, unified dataset of financial transactions. This data can be packaged and sold to AI companies that are now capable of running cross-chain distributed analytics over a model of the global financial system. Some potential use cases include averting market crashes by identifying correlated assets or optimizing economic systems through generative analytics.

The key to all of this is the invention of network tokens. Tokens are much more than a new form of money; they are simultaneously both money and information, and possess the power to incentivize behavior.

---

[1] https://www.youtube.com/watch?v=lMHaQGB1Wdc&t=2242s
[2] https://www.youtube.com/watch?v=speIh3ctygM
[3] https://www.youtube.com/watch?v=eJqZQ2_VBzo
[4] https://www.youtube.com/watch?v=6DgnHKTI-EU
[5] https://research.chain.link/whitepaper-v1.pdf

Tokens can represent anything from stocks, bonds, energy on a power grid, units of lithium, to pounds of grain. Tokens will become the medium of information supply chains that represent physical world systems. In other words, the tokens are the data, and the Chainlink network is primed to facilitate the movement of all tokens throughout a multi-chain world. As we move into the 4th Industrial Revolution, the intersection of IoT, hybrid smart contracts, and AI will extend the scope of Chainlink and other blockchain networks beyond financial transactions into the realm of generalized physical economic interactions represented by token supply chains.

From an investment perspective, it's important to recognize that the value of a well-designed token will increase directly with demand given tokens must be used to pay for network services. In the case of blockchain networks, demand scales exponentially due to the nature of network effects as defined by Metcalf's law. If Chainlink becomes the standard for off-chain and cross-chain compute, the network value could very well be an order of magnitude greater than the largest tech companies of today.

In this paper, I will argue why CCIP will become the industry standard interoperability protocol, shaping the terminal architecture of the Web 3.0 stack. I will then discuss Chainlink's role at the heart of this infrastructure and the position it puts them in to capture, index, and sell the data that flows through their network to a suite of new applications designed to gain insights into the global financial system. I then present the Fat Middleware Thesis and describe how the Chainlink network will capture value as the Web 3.0 space grows. Finally, I will speculate on the future of Web 3.0 as it relates to regulation, decentralization, privacy, and the intersection with the current boom in AI.

2 CCIP and its Implications on the Terminal Architecture of Web 3.0

CCIP, upon release, will unlock the full potential of the Blockchain Economy. Currently, blockchain economic activity is siloed amongst various chains. Due to poor wallet and bridge technology, liquidity is fragmented, ultimately slowing the growth of the industry. Although multiple chains have significant network effects, if the TVL, usage, and utility of every chain was combined and accessible to developers through a single abstraction layer – CCIP – the sum of the space would be *greater* than the sum of the individual parts.

In chapter 2.1 I argue that Chainlink has achieved complete market dominance for its current products. Analysis shows that this market dominance for price feeds and OCR has increased in the bear market. In chapter 2.2 I argue that institutional adoption will further drive market dominance. In chapter 2.3 I argue that Secure cross-chain interoperability is highly synergistic with modularized blockchain infrastructure, enabling it to be the most secure and cost-efficient architecture for Web 3.0.

2.1 Everything is just Information: Chainlink's Unique Position to Tackle Interoperability

Chainlink was designed from the ground up to be modular and blockchain-agnostic. It is already integrated and trusted by over 1400 protocols for price feeds and off-chain computation, with no security failures since inception. These protocols, among many more that are currently being built, will choose Chainlink CCIP for cross-chain messaging. Cross-chain messaging is simply information transfer, akin to Chainlink's other services. As stated in my paper, Monetary Wars: "the security they currently provide for other systems is fungible to a degree with cross-chain interoperability, because it uses the same consensus mechanism." [1]. Sergey confirms this viewpoint in his recent speech at Smartcon 2022:

"Cross-chain is basically the same computational problem as providing data. You want to take some data from over here, you want to come to reliable un-gameable fraud proof consensus somewhere in the middle and then you want to get it over there for that data to do something. That sounds really familiar. That's what the cross-chain problem is, except they want to do it for tokens, and they want to do it for messages. Considering we have the most value securing, best track record, no external security breaches throughout the life of the protocol since production, system for transmitting commands and information, things moving across chains is just information. Its not some new magical information, it's just information, but its about tokens and commands. I think the security we have been able to create for these other things is extremely applicable to cross chain. We are definitely taking our time on getting that right because it is not difficult to make a bridge it is difficult to make a bridge that will actually secure value reliably to the tune of billions of dollars and that's what we are doing."

Figure 1 - Sergey Keynote at SmartCon 2022

Chainlink's off-chain reporting consensus mechanism, OCR 2.0, is far superior to any competitor's strategy. Leading cross-chain bridge protocols that are considered competitors don't even have a consensus mechanism because they rely on Chainlink to read the block header information from the source chain and send it to the destination chain[6]. In this sense, the so-called competitors are really just building token bridges on top of Chainlink's messaging layer, who has already solved the most crucial portion of the stack. Chainlink is years ahead of any competitor because they have effectively been working on the core component of this problem since the price feed days. A multi-year lead is usually a significant enough moat to protect against competitor disruption. In network-effect based businesses, this lead is further amplified, as Eric Schmidt discussed at SmartCon 2022:

"At the end of the day, the companies that won in Web 2.0 were better technology, they put more capital to work, and they moved faster, and they scaled faster. And these are network businesses, so once you get a little bit ahead, it gets very hard to catch up to the person ahead of you. In (Chainlink's) case, because you were very early and very smart obviously, you got in there first. I think in Web 3.0 you are going to see the same dynamic of new things entering, and the winners, I think this is absolutely true of Chainlink, have better technology and it scales better"

---

[6] While I was writing this paper Layer Zero announced they are using Chainlink for their oracle mechanism [12]

Chainlink's significant lead has resulted in a growing monopoly on the oracle space. Per Eric Wallach of Platoon Digital, at the end of 2022, Chainlink's share of oracle Total Value Secured (TVS) reached 92%, excluding single-platform oracles such as Maker. Chainlink secures 33x more value than its closest competitor, Band Protocol. Chainlink is being utilized as the primary oracle for top 5 protocols that Band secures value for - KyberSwap, Loopring, Homora V2, dForce, and CREAM Finance. If one removes value on protocols where Chainlink is the primary oracle and Band is the backup oracle, then Chainlink secures approximately 250.44x more value than BAND protocol. Chainlink secures 234 DeFi protocols, 2.6x more than its closest competitor, TWAP, and 6.3x more than Pyth [2].
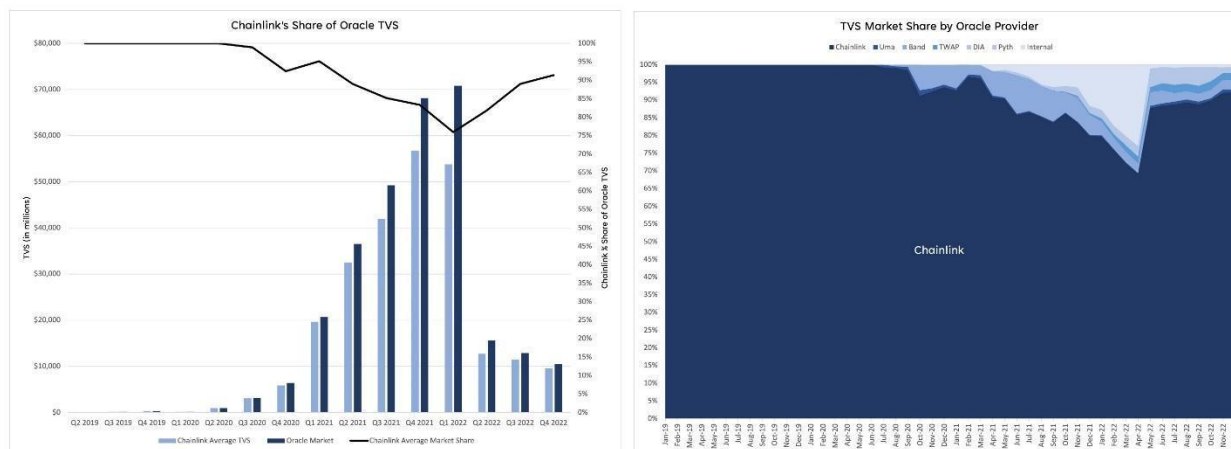

Figure 2 – Chainlink Market Dominance

Per Eric Wallach, "Despite total crypto transactions decreasing 13% Y/Y from 4.12bn to 3.56bn for Ethereum, Ethereum L2s, and EVM-compatible blockchains, Chainlink Price Feed TXs are up 172% Y/Y from 84 mm to 228mm transactions. Including Solana, Chainlink Price Feeds TXs are up 244% Y/Y to 289mm. Chainlink's average share of total transactions for these blockchains increased from 2.04% to 6.41%, and Chainlink now represents 7.13% of all ETH L1, ETH L2, and EVM-compatible transactions, or 3.68% including Solana. While total BNB and Polygon network transactions are decreasing Q/Q, Chainlink continues to grow transactions in both absolute and relative terms:

● Chainlink Price Feed TXs averaged 20% of all Polygon network TXs compared to 9% in FY21. Chainlink Price Feed TXs on Polygon are up 37% Y/Y despite total Polygon network transactions down 40% Y/Y.
● Chainlink Price Feed TXs averaged 0.46% of all Binance TXs compared to 0.20% in FY21. Chainlink Price Feed TXs on BNB are up 33% Y/Y despite total BNB network TXs down 44% Y/Y [2].

	Q3 2019	Q4 2019	Q1 2020	Q2 2020	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	Q1 2022	Q2 2022	Q3 2022	Q4 2022		2019	2020	2021	2022
Chainlink Price Feed TXs (1000s)																			
Chainlink	0	0	0	0	0	11	124	1,038	31,103	51,709	51,277	61,809	61,067	54,147		0	11	83,974	228,300
%Q/Q							1077%	737%	2896%	66%	-1%	21%	-1%	-11%				796620%	172%
Total	65,362	59,615	59,665	78,663	106,578	124,776	273,512	1,054,065	1,308,885	1,480,932	1,061,382	950,685	790,332	759,681		124,977	369,682	4,117,394	3,562,080
%Q/Q							119%	285%	24%	13%	-28%	-10%	-17%	-4%				1014%	-13%
Total Share (%)	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.05%	0.10%	2.38%	3.49%	4.83%	6.50%	7.73%	7.13%			0.00%	2.04%	6.41%
Incremental Share (%)						0.06%	0.08%	0.12%	11.80%	11.98%	0.10%	-9.51%	0.46%	22.58%			0.00%	2.24%	

Chainlink Price Feed TXs	2021	2022	Y/Y
Ethereum	1,351,311	1,572,181	16%
Polygon	78,129,232	213,552,568	173%
Binance	4,016,448	7,143,670	78%
Fantom	139,529	939,907	574%
Avalanche	214,920	1,267,823	490%
Arbitrum	122,866	1,645,602	1239%
Optimism	0	2,178,191	
Total	**83,974,306**	**228,299,942**	**172%**

Total TXs	2021	2022	Y/Y
Ethereum	461,787,962	403,782,743	-13%
Polygon	1,248,208,414	1,063,810,973	-15%
Binance	2,200,603,801	1,541,422,464	-30%
Fantom	146,531,691	287,040,100	96%
Avalanche	53,816,936	157,534,772	193%
Arbitrum	4,638,449	54,568,250	1076%
Optimism	1,806,561	53,921,179	2885%
Total	**4,117,393,814**	**3,562,080,439**	**-13%**

Chainlink Share	2021	2022	Y/Y
Ethereum	0.29%	0.39%	0.10%
Polygon	6.26%	20.07%	13.81%
Binance	0.18%	0.46%	0.28%
Fantom	0.10%	0.33%	0.23%
Avalanche	0.40%	0.80%	0.41%
Arbitrum	2.65%	3.02%	0.37%
Optimism	0.00%	4.04%	4.04%
Total	**2.04%**	**6.41%**	**4.37%**

Figure 3 - Chainlink transactional share dominance

Finally, Chainlink has become profitable this year, driven by node operators making more in transaction fees than they pay in gas. This has been due to Chainlink growing on low cost blockchains, as well as the release of L2s this year. "Ethereum's share of Chainlink Network revenue declined from 91% to 54% Y/Y. Meanwhile, EVM-compatible blockchains are up from 8% to 39%, and Ethereum L2s are up from 1% to 7%. Polygon and BNB Chain now represent significant shares of Chainlink Network revenue – up from 4% and 5% respectively to 12% and 20%. I expect non-ETH revenue to account for greater than 50% of revenue by 2023, making Chainlink the first truly multi-chain dApp." [2].

	Q3 2019	Q4 2019	Q1 2020	Q2 2020	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	Q1 2022	Q2 2022	Q3 2022	Q4 2022	2019	2020	2021	2022
Rewards by Network																		
Ethereum						100%	99%	89%	88%	91%	86%	79%	65%	54%	100%	100%	93%	74%
Binance						0%	1%	11%	9%	4%	4%	5%	10%	12%	0%	0%	1%	8%
Polygon						0%	0%	0%	3%	3%	5%	5%	11%	20%	0%	0%	5%	7%
Fantom						0%	0%	0%	1%	0%	1%	1%	1%	2%	0%	0%	0%	1%
Avalanche						0%	0%	0%	0%	1%	2%	2%	5%	5%	0%	0%	0%	3%
Arbitrum						0%	0%	0%	0%	1%	2%	4%	5%	3%	0%	0%	0%	3%
Optimism						0%	0%	0%	0%	0%	1%	4%	3%	4%	0%	0%	0%	3%
Gas Costs by Network																		
Ethereum						100%	100%	99%	92%	91%	81%	73%	47%	42%	0%	100%	94%	72%
Polygon						0%	0%	1%	5%	3%	3%	5%	15%	16%	0%	0%	2%	12%
Binance						0%	0%	0%	2%	4%	9%	7%	26%	35%	0%	0%	3%	6%
Fantom						0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avalanche						0%	0%	0%	1%	0%	1%	1%	1%	1%	0%	0%	0%	1%
Arbitrum						0%	0%	0%	1%	2%	4%	7%	7%	2%	0%	0%	1%	5%
Optimism						0%	0%	0%	0%	0%	2%	7%	4%	5%	0%	0%	0%	4%

Figure 4 - Chainlink Revenue Diversification

Although revenue is down, this bear market has led to Chainlink obtaining further market dominance.

2.2 Users Follow the Liquidity: The Significance of SWIFT and other Enterprise Partnerships

Current network metrics paint a clear picture that Chainlink has a growing monopoly over the oracle space. Their moat will only grow with the addition of SWIFT as a partner. At SmartCon 2022 we received official confirmation from Sergey that Chainlink and SWIFT are building a proof of concept together utilizing CCIP. Jonathan Ehrenfeld Solé, Strategy Director at SWIFT, explained how Chainlink and SWIFT have been working together since 2016:

"The POC that we're doing, it's the end of a long story, right, I think five or seven years ago was the first time SWIFT and Chainlink started working together. You were actually one of the first startups that we bet on; you went on to win the start challenge that we used to have a long time ago even before blockchain was something that Financial Services had in their minds. SWIFT and Chainlink worked together on the first POC that we did on bond issuance and redemption. It was quite successful and that that was maybe the first steps of this sort of love story between Swift and Chainlink which continues today".

Jonathan discusses why SWIFT wants to continue working with Chainlink:

"Now, why we want to continue to work (with you) today, I think there's two factors that I want to explain. The first factor is there is undeniable interest from institutional investors into digital assets, whether these are stable coins, CBDCs, or anything that you can tokenize on the Capital Markets space, so that could be equities, bonds, or anything else.

Those institutional investors want to have access to these assets at the same time that they have access to traditional assets and that means that an asset manager, for example, wants to use the same custodian they use today, and those custodians probably wants to use the same custodians to settle at the same infrastructures that they do today and that in theory means that they want to use a network that can connect to all of these capabilities, and that's where SWIFT comes into play.

In reality connecting to this network for digital asset doesn't mean connecting to new infrastructures, it means that you have to bridge the gap between these infrastructures that have been there for ages and all of these new blockchains that are going to provide these services, whether it's issuance, clearing, trading, settlement of tokenized assets, and they're going to be many of them.

There's already a few of them, some of them are private, some of them are Ethereum based, some of them are in any fabric that you can imagine, right, so SWIFT doesn't always have the potential to go and try to connect to all of them because if we bet on 10 this year and those 10 disappear then we are losing investment in that, and it's the same for the banks, so this is where CCIP comes into place.

It's the perfect example of if you have SWIFT using this interoperability Network, we connect 11,000 Banks today to 15, to 50 blockchains, but you can connect to more in the future. That's the bet that we're putting on you guys. When you have these two infrastructures that are secure, that are reliable, that are scalable, that can actually work, you can buy an asset wherever you want, and you can transact it in whatever country and serve institutions such as Bank of New York Mellon or DTCC to actually do that cross-border".

In summary, SWIFT wants to continue working with Chainlink because of the undeniable interest from institutional investors in digital assets, as well as creating a way for these investors to access these assets through their existing infrastructure. It is worth noting that SWIFT serves more than 2 billion people through the 11,000 banks that use their software. They have already created the Public Key Infrastructure (PKI) capable of securely sending messages between banks to trigger financial transactions worth around 600 billion dollars every day. With CCIP, banks don't need to upgrade any of their legacy infrastructure or retrain any of their employees to use this infrastructure to transact with blockchains.

A common critique of this partnership is that crypto will replace SWIFT and this infrastructure will be worthless within the decade. I disagree with this argument for a variety of reasons.

Currently, there are hundreds of trillions of dollars sitting in various pockets of the financial system. How will this value flow into crypto? Are all the governments, banks, sovereign wealth funds, etc. going to liquidate their assets and send them all to Coinbase, FTX[7], or Binance, to buy spot crypto holdings? Are they going to spend years developing custody solutions while simultaneously losing their customer base to crypto native solutions? How will these entities interact with DeFi if that is what their customers demand? It would take years to upgrade their archaic infrastructure to interact with blockchains. Ultimately, these entities would end up utilizing centralized solutions such as Fireblocks. This would create more centralization than what currently exists in the current financial system and give immense power to the few exchanges and CeDeFi solutions that currently exist. There must be a way for these hundreds of trillions of dollars to access DeFi that doesn't go through centralized rails.
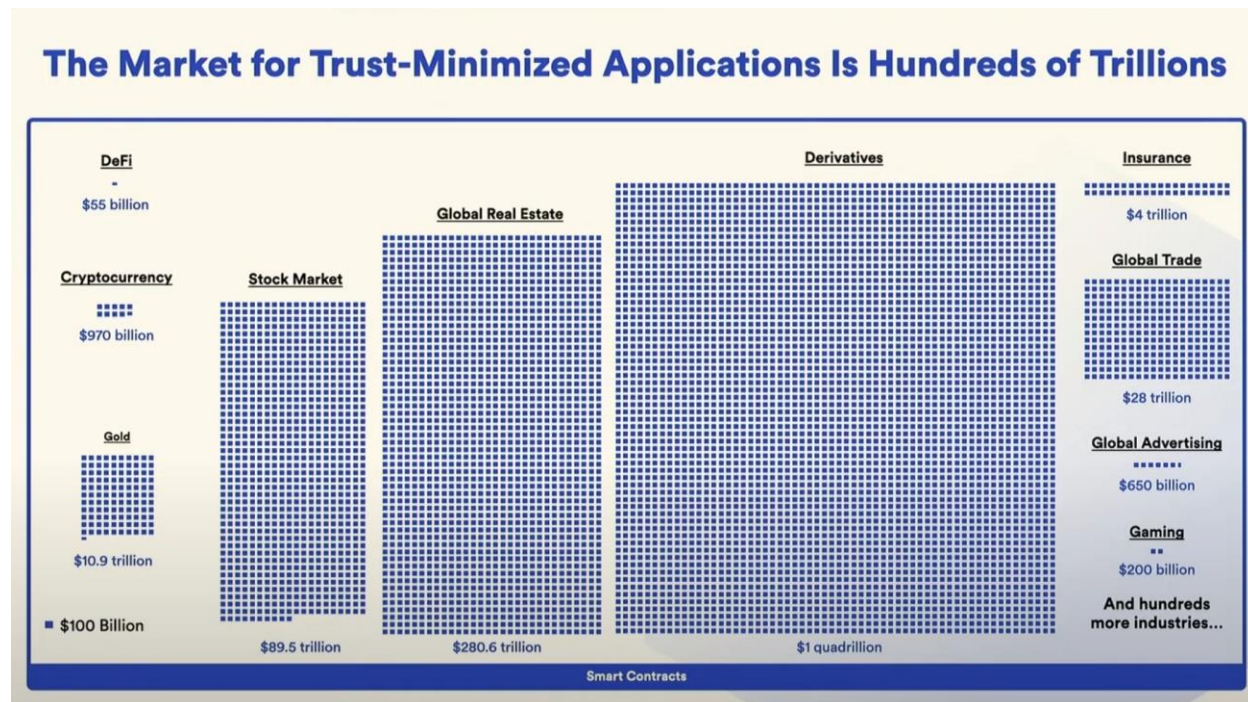

Figure 5 - Pockets of Value in the Global Economy

The Chainlink Network represents an open source, permissionless network that will soon have the decentralization and security necessary to move trillions of dollars of value directly into DeFi without any third-party intermediaries. Sergey constantly states that all they do is make oracles. They are not beholden to any VC investors or any single protocol, and are partnered with over 100 blockchains, over 1000 projects, and now through SWIFT, thousands of financial institutions. Chainlink is a credible, neutral third-party intermediary, where all users can unilaterally benefit from a single standard that produces the lowest costs, benefit from a single set of documentation where contributions from any source benefit the entire network, and trust that no other player gains an unfair advantage from owning the IP of this interoperability layer. As discussed in the Chainlink Whitepaper 2.0, eventually it will be all the dApp

---

[7] Was written before the blowup, but leaving it in further strengthens my argument

teams, protocol teams, and financial institutions running Chainlink nodes that will sit on the second tier of the explicit staking arbitration committee. Everyone will have skin in the game and benefit from CCIP. One additional observation is that SWIFT is not a single company. They are a cooperative in over 200 countries governed by an elected board of 25 members. They do not get paid, and they have a maximum of two members from a single country. By today's standards, they are very decentralized, which is why they have been able to maintain a monopoly on interbank messaging since 1977. SWIFT understands the power of a decentralized standard that everyone can benefit from, which is why Sergey was initially convinced to partner with SWIFT, as detailed in last year's SmartCon talk with Jonathan [3]. This partnership is also proof that Chainlink is attempting to signal themselves as a neutral piece of infrastructure. No SWIFT bank would opt to utilize a solution that is predominantly controlled by any major bank.

Focusing on retail participants of the financial system, it is unrealistic to expect everyone in the world to understand DeFi, let alone know how to operate a hardware wallet or MetaMask. It is even more unrealistic to expect the institutions that manage trillions of dollars to give up their positions of power to CeDeFi banks/onramps. The much more elegant solution that can occur in a matter of years, instead of decades, is for current institutions to act as the front-end interface for users, and for DeFi to operate as the backend infrastructure. This is what Chainlink, SWIFT, and CCIP uniquely enable. At first, these institutions won't want or even need exposure to tokens. What they want are the benefits that DeFi offers. Using some type of CBDC or USD stable coin solution, they can access all the benefits of DeFi without having to assume token risk[8]. If their customers demand crypto custody, then they will eventually offer that as well.

Once CCIP solves liquidity fragmentation and Layer 2/3 protocols are able to drive transaction costs down to a fraction of a cent, the cheapest way for these behemoth-sized institutions to gain exposure to tokens could be to purchase directly on chain on a DEX via CCIP. Obviously, the largest players in crypto who hold the most assets are centralized players (such as Binance), and there is a high likelihood they will onboard financial institutions through OTC deals. Once a token-based balance sheet has been obtained, these institutions can retain their customers while offering them exposure to tokens as well as DeFi products through their CCIP-powered front-end user interfaces.

When the SWIFT proof of concept goes live, within a few years trillions of dollars will flow from financial institutions into DeFi protocols. The TVL across the blockchain space will spike from tens of billions to tens of trillions. Any competing network would need to build out this entire infrastructure on their own. Just as SWIFT has had a monopoly on interbank messaging for nearly 50 years, Chainlink will also have a monopoly on cross-chain messaging (and oracle services), and it is unlikely that either will be disrupted. In a decade or more, once most of the world's value exists within the blockchain ecosystem, the financial infrastructure could evolve into something unrecognizable from what we have today, with no SWIFT and largely distributed self-custody. That is beyond any reasonable investable time horizon, and even in this scenario the value of the Chainlink network and CCIP would not be diminished. If the world's financial

---

[8] Note there is a pilot program occurring with Chainlink partners on a USD CBDC [14]

infrastructure is fully decentralized with the vast majority of humans opting for self-custody, CCIP as the global standard for blockchain interoperability would likely be the most valuable piece of infrastructure.

Other large financial institutions hinted interest in CCIP at SmartCon 2022 as well. Among Sergey and Jonathan on the SmartCon 2022 panel were Stephen Prosperi, Head of Product Management, Digital Securities Management from the DTCC and Victor O'Laughlin, Managing Director, Head of Tokenization, from BNY Mellon.

Figure 6 - Jonathan Ehrenfeld Solé from SWIFT, Stephen Prosperi from DTCC, and Victor O'Laughlen from BNY Mellon discuss bridging Traditional Finance and DeFi

They both discussed how their respective companies could utilize CCIP. Per Stephen Prosperi on the DTCC and CCIP:

"A post trade market infrastructure provider, our core business is providing clearance and settlement services for US securities markets and post some pretty big numbers, last year we processed 2.4 quadrillion dollars' worth of securities. We often get asked if that is a real number, it is in fact a real number. It represents basically all broker-to-broker trades of equities, corporate debt, treasuries in the us markets. Naturally they are very focused on blockchain and the opportunity it can present in the industry where they sit. Getting back to the question of cross chain interoperability we think it is very important from day one of their exploration of the space for 6 or more years now we felt it was very important there won't be one blockchain to rule them all there will be multiple. Currencies will live across multiple chains and other assets of value represented as tokens will live across different chains. Very similar to the role we play in traditional markets of bringing all of those together, similar to SWIFT in that nature, being connected to all the banks and broker dealers to provide services, whether its clearing, settlement, a lot of the same aspects will transform and look a little bit different, but fundamentally are very similar I think in a digital asset world so in most of the initiatives we take on we look at how can this plug into multiple blockchains

and how can things coming down the pipe like CCIP be used to help us maintain that view, and again not build something that is already built and not to have to build up infrastructure to support 100 blockchains if we can support 1 piece that can then plug into those 100 blockchains today and maybe 200 blockchains tomorrow."

The DTCC is the world's largest clearance and settlement service provider, handling over 2.4 quadrillion dollars worth of securities last year. They are integrating CCIP in order to maintain their position in a digital asset future. Similarly, Victor from BNY Mellon provided his thoughts on the relationship between BNY Mellon and CCIP:

"BNY Mellon was founded in 1784 by Alexander Hamilton, the first treasurer of the US…first stock traded on the stock exchange, first loan to the US government…we continue to stay relevant because we innovate and want to continue to stay engaged and grow. We service 20% of the world's investible assets, so that's twice the worlds GDP in terms of custody. We clear and settle 10 trillion a day in US Government treasury securities, 2 trillion in payments, and we have wealth management and a strong distribution franchise, essentially services broker dealers and registered investment advisors. I am the head of the enterprise tokenization in the bank, so I have a view of what's happening across all different lines of business, and I see this interoperability play happening not only connecting banks and others to each other because historically what financial institutions haven't done well is connect. So, what's happened is we all have our own islands, and we all try to operate the best way we can but there is always some sort of fear or nervousness around what happens If we connect more broadly into the market, what happens to our market share, what happens to my business. It is a complicated question, and we see blockchains and chainlink and others not only connecting infrastructure to each other, market infrastructure like DTCC or SWFIT, but even within banks, you know because we have multiple systems, you have multiple lines of business and they have grown up independent of each other so there is a lot of integration that needs to happen within banks. So BNY Mellon is very much focused on building a centralized digital asset platform, connecting our individual lines of business in different rails we have, but also connecting more broadly to the likes of DTCC, SWIFT, and perhaps one day, Chainlink".

In his discussion of CCIP, Victor highlights not only its potential for connecting banks to existing systems like SWIFT and the DTCC, but also its potential for facilitating communication and asset movement between banks and even within a single bank. Additionally, CCIP offers the potential to increase interoperability between markets and remove the need for large capital buffers. It also allows banks to access DeFi money markets with reduced counterparty risk through the use of diversified collateral pools.

In the world of financial messaging, clearance, and settlement, giants like SWIFT, the DTCC, and BNY Mellon hold significant market share. It is likely that they are also exploring the use of Chainlink and CCIP through proof of concepts, as demonstrated by the recent SWIFT PoC at SmartCon 2021.

The theory of natural selection tells us that diverse systems are subject to differing levels of success. Pareto's theory of exponential winning and losing further supports the idea that those who are successful tend to continue to succeed while those who struggle tend to fall further behind. This concept can be applied to markets as well, where liquidity begets liquidity, and users (and fees) follow the liquidity. The fact that major players in the global financial system are partnering with Chainlink and exploring CCIP

through proof of concepts is strong evidence that CCIP has the potential to become the global standard. Not to mention the current business relationships between SWIFT banks will likely be extended to Chainlink via the SWIFT-CCIP proof of concept.

2.3   Don't be Caught in No-Man's Land: The Modularizing Forcing Function of CCIP

CCIP will allow applications to access the services of multiple blockchains simultaneously. In essence, the core code of a protocol can remain on a platform like Ethereum, while execution can take place in a faster and more cost-effective environment. As such, CCIP will act as a forcing function which will lead to a modular terminal architecture of Web 3.0. Ultimately, the architecture will consist of security layers (also known as base or L1 layers) and execution layers (also known as L2 or L3 blockchains). Security layers prioritize decentralization at the expense of speed and cost, while execution layers optimize for speed and cost by leveraging the security of the underlying L1 layer.

Before elaborating on this thesis, it is crucial to understand how L1 blockchains like Ethereum achieve their security. Most L1s use a Proof of Stake consensus protocol, in which validators earn token yield in exchange for verifying transactions. The yield comes from both protocol-level inflation and network fees. If network fees are very low, more inflation is necessary to incentivize validators. This is where monolithic chains may encounter inflation and incentive issues in the future as they race to attract users by reducing fees to zero. Eventually staking rewards are decreased, and these chains must rely more heavily on token inflation to maintain network security. Networks are only secure if there is a strong economic incentive for many users to validate transactions. With the total yield capped as the sum of network inflation and fees, the yield per validator is equal to the total yield divided by the number of validators. If the total yield is not high enough, the chain may not have the ability to incentivize a large number of economic actors to participate in validation, resulting in less decentralization and less security. It is much easier to launch a 51% attack or DDOS attack on a network with 1000 validators than one with 100 million. If a protocol cannot promise a yield greater than that of US treasuries, it will have a difficult time attracting rational economic agents. Considering the possibility of a secular trend towards higher inflation and interest rates, the yield of US Treasuries should be higher this decade, putting more pressure on protocols to survive.

Unlike L1s, Layer 2s purchase security from an L1 like Ethereum by bundling and "rolling up" multiple transactions into a single one that is processed and recorded on the L1. In turn, this allows for the reduction of fees to nearly zero, while generating revenue through mechanisms like MEV, order flow, or transaction data. With advances in rollup technology and Ethereum through initiatives like EIP-4844 and Danksharding, rollups are projected to reach 10 million TPS with network fees in the range of fractions of a cent within the next decade.

An example of a monolithic L1 is Solana which has set fees at $0.00025. In order to offer this extremely low fee per transaction, they have sacrificed decentralization on a relative basis compared to Ethereum[9].

---

[9] By some metrics Solana is much more decentralized than previous alternative L1s. On a relative basis, it is inarguably less decentralized that Ethereum and has no path to become as decentralized due to validator hardware costs

To remain competitive, they must maintain lower fees than their more decentralized competitors while continuing to meet the market demand for fast, cheap, and small transactions.

Since inception, Solana has processed over 111 billion transactions but only generated $27.5 million in network fees. The inflation rate is set at 8%, continuously decreasing by 15% per year. The total supply is expected to nearly double over the next decade, which will negatively impact the price of the token. As competing L2s improve, Solana may face increased pressure to further prioritize this tradeoff and rely even more heavily on network inflation to pay validators if fees don't significantly increase. Solana has already achieved a massive market cap, but as diminishing returns set in, they may not be able to rely on the token price increasing significantly to cover this inflation. The number of validators that can earn a yield higher than, for example, US Treasuries, is capped. This does not imply that Solana will necessarily fail, but it does limit the maximum amount of value that can be transacted safely on the chain. If L2s reach cost parity with Solana, why would anyone choose the less secure option? In the short term (1-3 years), yield and incentives may not be a major issue, but in the medium to long term, Solana may need to consider positioning itself as an execution layer that differentiates itself through a unique developer experience (Solana uses the programming language Rust), ultra-low latency, and a rollup structure that connects to the Ethereum main chain or some other security hub. This same concept applies to every monolithic blockchain.

So where does CCIP fit into this landscape? CCIP allows apps to utilize multiple execution layers, while retaining the security of an L1 like Ethereum. For example, Uniswap could scan multiple L2s, L3s, app-chains, and alternative L1s simultaneously and route the trade to the platform offering the lowest fees and slippage. CCIP solves the problem of liquidity fragmentation and makes it easy for end users to move assets between chains. The friction to move assets off a chain or to a new chain will effectively disappear. When wallets integrate CCIP natively, users interacting with dApp interfaces will not even need to be aware of the specific chain they are using, just as they are unaware of the specific cloud provider when using a service like Netflix. Chains that cannot compete on price will lose volume and liquidity as it shifts to the best execution layers. CCIP literally drives modularization. To achieve the lowest costs, it is necessary to optimize for said cost and offload security to the base layer. If both security and cost are concerns, it is difficult to compete on just cost, ultimately leading to liquidity emigrating off the platform.

All chains will either trend towards becoming security hubs or execution hubs. Anyone caught in no-man's land will die.

Figure 7 - Chains caught in no-man's land will die

Ultimately, I believe every app which does not become a public good will exist on its own applications-specific chain. Whether this is on cosmos, an AVAX subnet, or a L3, these will all purchase security from a security hub directly or indirectly via something like Eigenlayer. Block space is block space, regardless of whether it is on Solana, Avalanche, Arbitrum, Optimism, ZK Sync, Starkware, Cosmos, etc. Every chain is simply a group of nodes coming to consensus on some specific trust-minimized computation. Some chains will be more efficient than others (offer cheaper transactions), some will have better or differentiated developer experiences, and some will have stronger network effects and more block space. CCIP allows for these tradeoffs to be explored while simultaneously solving liquidity fragmentation and providing composability[10]. The future iterations of chains will optimize for specific types of computation, and dApps will rely on multiple blockchains to provide the best experience for end users.

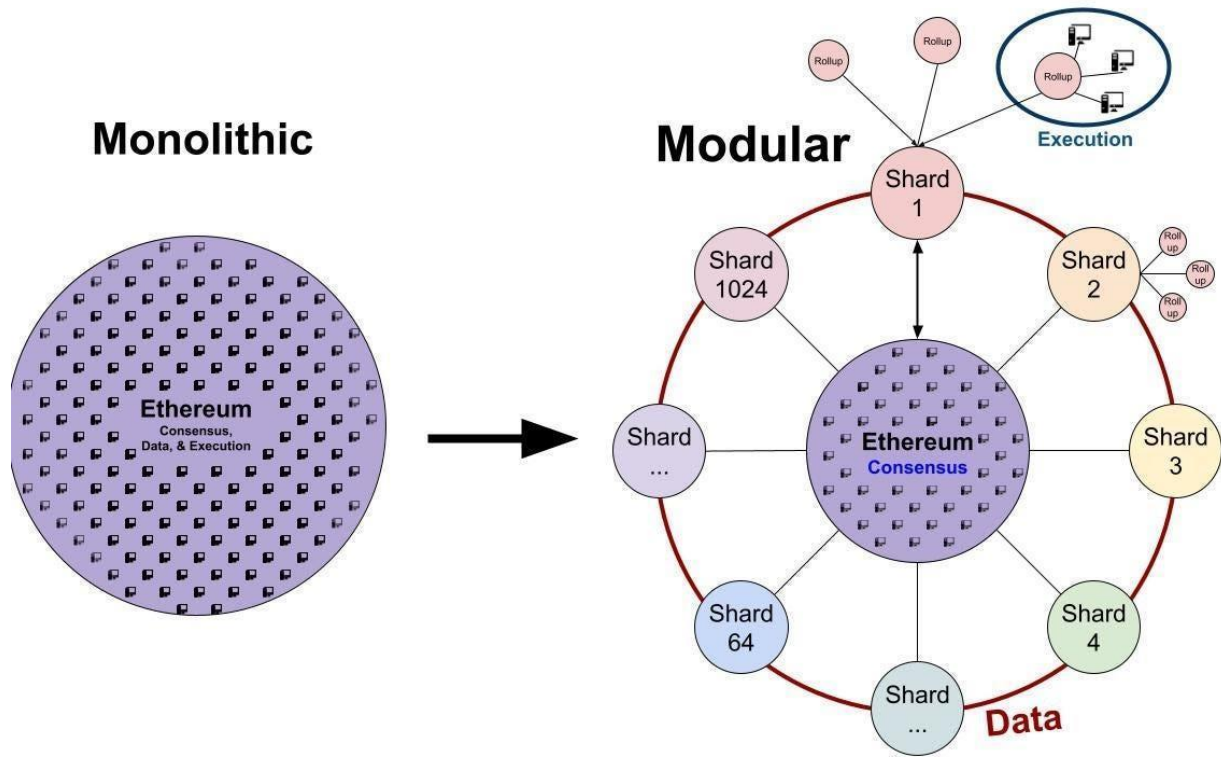[10] Lower latency composability than if applications were all on the same chain

Figure 8 - Ethereum as a security hub (sharded), rollups as execution layers, apps as L3s connecting to execution layers

3 The Google of Web 3.0

Having discussed the lower levels of Web 3.0 architecture, I will now examine how Chainlink fits into the application layer. Eric Schmidt discussed how Google's strategy was to "have a little bit of Google in every service". As examined in section 3.1, Chainlink appears to be mirroring this strategy. In section 3.2, I discuss the idea that network tokens are both money and information simultaneously. In section 3.3 I argue that this information can be captured, ultimately enabling the creation of a new suite of applications that are powered by this data. Similar to Google's model, the data captured by Chainlink's services is highly valuable.

3.1   A Little bit of Chainlink in Every Web 3.0 Application

Like the shift from monolithic systems to microservices-based architecture that occurred in Web 2.0, the Chainlink team is betting on a similar dynamic taking place in Web 3.0.
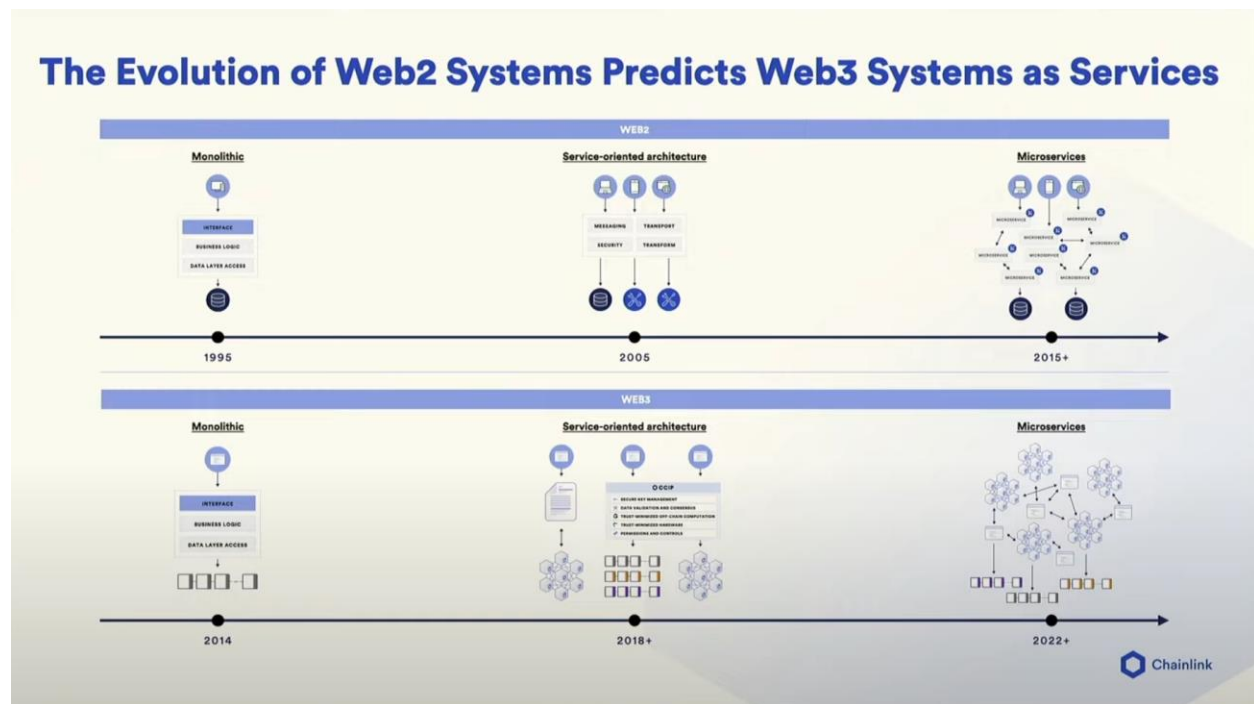

Figure 9 - Web 2.0 predicts how Web 3.0 will evolve

The development of microservices, accessible through plug-and-play APIs, enabled the creation of some of today's most prominent apps. For example, Uber's core application code is integrated with Google Maps for location, Twilio for text messaging, and Stripe for payments. Without these APIs, it is highly unlikely that Uber would have been built, as creating companies to deliver these services individually is a massive undertaking. In the end, it was the availability of these APIs that allowed various founders to rapidly innovate and create new businesses that found product-market fit at scale.

Several services will eventually be essential for widespread enterprise adoption, in addition to external data which enables the existence of many blockchain-based services such as DeFi. Identity/privacy and

fair sequencing are two key services in this regard. No large company or financial institution will conduct transactions on the blockchain if all of their moves are broadcasted in real-time or if they incur high costs due to MEV from hostile actors. Additionally, in many jurisdictions citizens will not be able to access DeFi without KYC, which can be enabled through privacy-preserving identity solutions. Chainlink is addressing these barriers with DECO and Fair Sequencing Services (FSS). By solving the problems that act as barriers to mass adoption, Chainlink is filling critical holes that will lead to massive fee capture potential. Chainlink's goal of having a presence in every computation is similar to Google's strategy as outlined by Eric Schmidt at SmartCon 2022:

"When we were initially doing Google, the rule was we want a little piece of Google in everyone's computation, for example the DNS you use is almost certainly the Google DNS right Google roughly a third of the world's internet traffic goes through I think that's still the number uh through Google Fiber you would never know that now all are these gifts to the world yes thank you very much but they were also in our direct financial interest because it meant that we knew what was going on".

Other services include smart contract automation, verifiable randomness, general purpose compute, and proof of reserves.
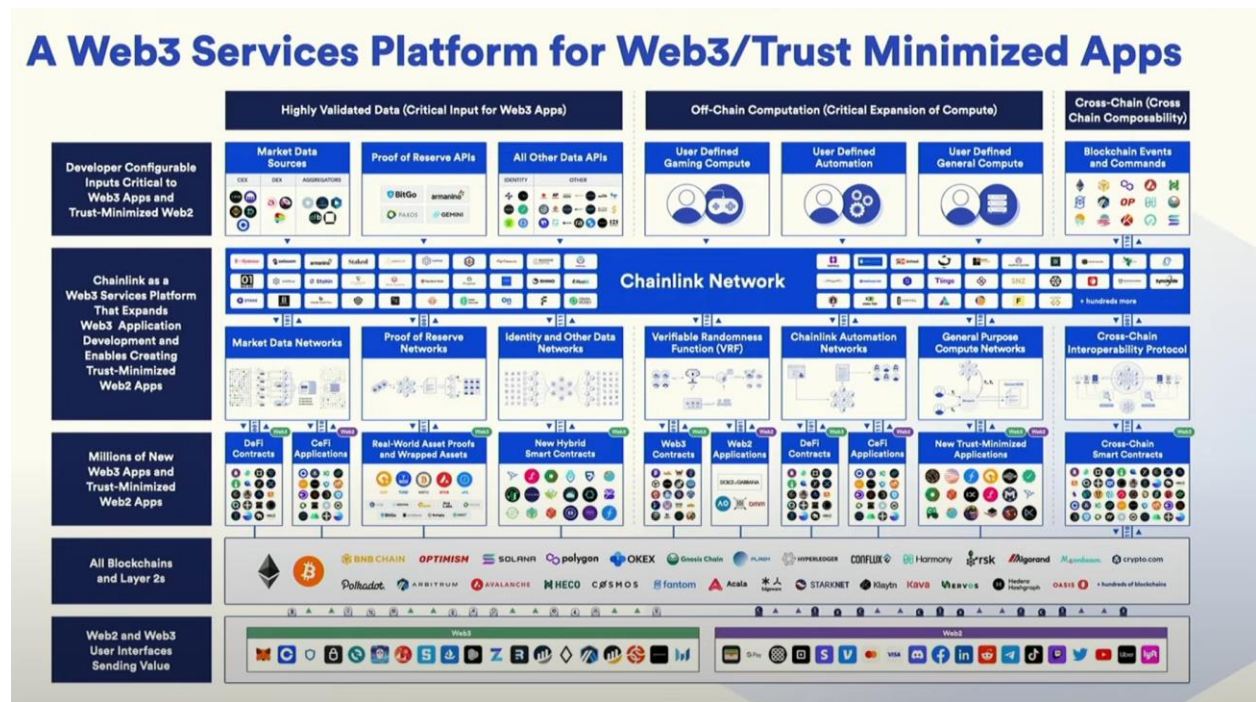

Figure 10 - Chainlink services

Sergey expanded on this notion in his Fireside Chat with Eric Schmidt:

"I actually see more and more computation moving into Oracle networks because blockchains don't fulfill the scalability or privacy properties (necessary), and if they fulfill those properties that's fine, that computation can go there. But I think there will be an interim stage where they won't fulfill those requirements and so there needs to be a bridge, just like blockchains couldn't fulfill the requirement of

providing data, there are all these requirements that you have to build more advanced applications to really realize web3 and all those requirements are really what Oracle networks seek to fulfill. Some of them will fall away and go into a blockchain, but many of them won't, it's just not very easy to predict which requirements will fall away and which won't. But we're building a pretty flexible system that, as you can, tell provides data, identity, randomness, cross chain soon, all these things. So that's my plan to solve it, is to basically plug all the holes and then the holes that are left are probably very valuable holes to keep filled and that's where I think that the value will land in that decade, half decade time series."

The Chainlink team is striving to provide every service that smart contracts require, with the exception of those provided by blockchains. Because smart contracts are effectively useless without external computation or data, Chainlink has created a flexible system to service any smart contract on any chain. As a result, Chainlink is uniquely positioned to capture and index the data associated with the execution of hybrid smart contracts. Tokens are much more than just money.

3.2 Information Supply Chains: The Tokens *are* the Data

The term 'cryptocurrency' gives a misleading impression of the total scope of blockchain technology. While the term makes sense in the context of Bitcoin being the primary digital asset, blockchains have evolved significantly with the inclusion of smart contracts and oracles. Tokens represent private property rights and allow for the complete digital proof of these property rights without the need for a third-party intermediary. In this sense, tokens can represent anything, not just money. This concept of individual ownership is already being explored through the tokenization of real estate, stocks, commodities, etc., enabling end users to transfer ownership of assets instantly and at low cost without the presence of rent-seeking third-party intermediaries.

The benefits of tokenization go beyond just reducing costs and decreasing settlement times. Every time a token is transferred, it is recorded permanently on a node or blockchain ledger. While these movements may be encrypted and private to the public, authorized parties will have the potential to purchase and analyze this data. With verifiable data, it is possible to have real-time situational awareness of the state of the network. As discussed earlier, the network can represent anything that is representable with tokens, which is any physical or digital good.

It is easy to envision a future in which all assets are tokenized. While these tokens may not exist on a single chain or within a single institution, a complete history of every token's movement will exist. Imagine this history as a branch on a tree. Eventually, all of these branches can be combined to form the entire picture. While each financial entity will only be able to see their own branch and any public branches, in theory, the entire tree can be reconstructed. This has significant implications for the financial system.
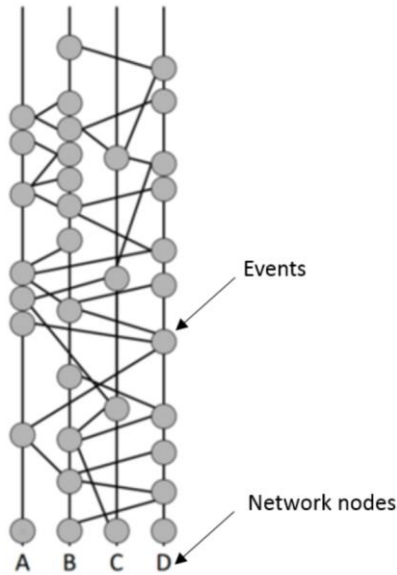
Figure 11 - Graph representing token movements between nodes

At this point it is important to describe mechanically how this would work. Initially, the source of a transaction begins with a user interacting with some application, whether that is some legacy bank app, or a crypto native dApp. If it is a legacy financial application such as Wells Fargo's mobile app, that transaction will get routed from the bank's servers to the SWIFT system, through the CCIP abstraction layer, and end up interacting with a dApp's source code. This dApp would call an off-chain CCIP oracle network, powered by OCR 2.0, to route commands to some blockchain to execute the transaction. Ultimately, all transactions are permanently recorded on whatever blockchain the transaction occurred on. This means that, with a time delay, some final transaction data will be publicly accessible. One can navigate to Etherscan to explore finalized block data. Nearly all financial transaction data from large institutions will be private, though, and not accessible through block explorers like Etherscan.
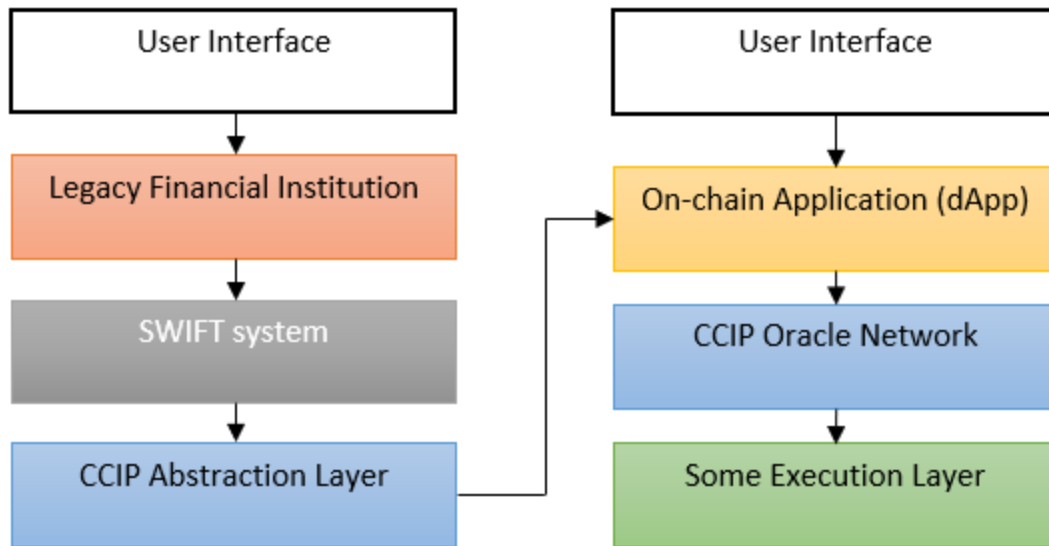
Figure 12 – User Transaction Flow

CCIP oracle networks will route, off-chain, the initial transaction data that is propagated from legacy financial institutions. If the vast majority of transactions are coming from the 687 trillion dollars of value that exist in the current financial system, and utilizing DeFi as a backend, this means that it will be CCIP oracle networks that connect these two environments which will capture this feature rich data, which could include the bank and information about the user of the specific account that generated the transaction. In terms of the flow of information, CCIP oracle networks will know what transactions are occurring before the execution environments.
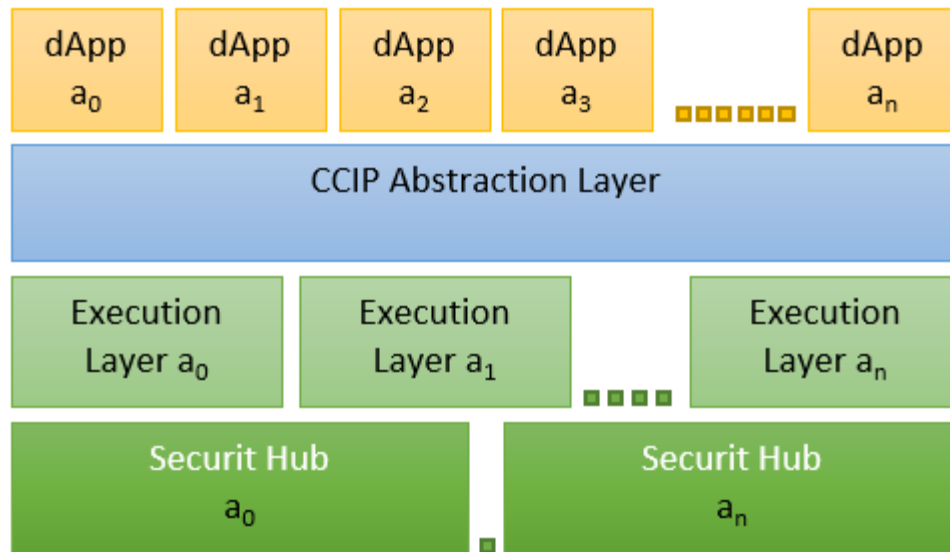
Figure 13 – Global Transaction Flow

CCIP nodes can collect this data in a privacy preserving fashion through the use of ZKPs or Trusted Execution Environments (TEEs). While independent CCIP oracle networks are transmitting messages, the global, independently secured CCIP Anti-Fraud network will be proactively monitoring all blockchain networks and CCIP oracle networks to detect anomalies and take preventative measures when malicious activity is detected. As such, this specific network which will likely be the largest oracle network aside from the 2nd tier explicit staking arbitration network. It will be monitoring in real time the execution of transactions across all CCIP networks, in turn capturing this data.

Just as Google indexed the web, Chainlink has the potential to "index" Web 3.0 due to its large surface area with respect to the "global" economic history tree. Note, Chainlink is a decentralized network, meaning it is the collection of individual node operators that index this data. This data provides additional incentives to operate a Chainlink node, which requires the posting of LINK collateral to obtain jobs. This means that the value of this data is propagated to the LINK token, as the tokenomics of the network ensure that the incentives amongst all participants are aligned with the network.

3.3   The Grand Vision: AI-Powered, Cross-Chain Distributed Analytics

Google created public goods that became adopted by large networks of individuals. From the data generated from their products, they were able to create business models that in many vases returned more value than charging an upfront fee for their product. Schmidt sees this dynamic repeating in Web 3.0:

"Something for you all to think about is I have a simple rule which is if you give me a hundred million users, I can make money from them. Trust me, right if they're doing something I can find a way to monetize it

using, again, traditional web 2 techniques. What is the same answer on top of Web 3.0? Because in your vision web 3 will be universal across the globe it'll be used in some form by almost everyone".

By providing all the services necessary for smart contract adoption and serving as the rails that route the information contained in every economic transaction via CCIP, Chainlink will be in a unique position to capture and index almost all of the public and private data that flows through the blockchain ecosystem. Schmidt believes this enables the development of unique applications that were previously not possible:

"To me the most interesting question are what are the new services that are not easily done today in Cloud? I mean there's a straightforward list in Cloud because the cloud stuff just replaced the stuff I used to do before Cloud existed. Right so it's file Services, scheduling invocation, you know figuring out how to run services and so forth. There will eventually be some sort of Ethereum zero knowledge virtual machine – today the smart contracts are pretty poor in their capabilities – and that functionality should get there because of all the research that's being done in the industry. To me the question is then, what can you then do that you can't do today? One of the most obvious things is doing distributed analytics over these kinds of decentralized systems because when you talk to the banks they roughly, in some cases, know what's going on in their own banking system, but they have no idea what the other ones (are doing). and when you talk to the banking Regulators, they have no visibility to anything."

What Schmidt is proposing here is the ability to analyze blockchains and decentralized oracle networks to gain insights about the blockchain economy in a privacy-preserving manner utilizing ZKPs.

"I've mostly been working on AI stuff. Once you have the data, just think of the generative design, the sort of analytics – and we can talk about this if you're interested in it – but you know the eventual vision is a new set of apps that allow you to manage the system better. We were struck within 2008-2009 that there were no uncorrelated assets. Well, that's something that should be easily discoverable right by (Chainlink's) technology running on the top of the things that you're building.

I think the most important thing to know is that you're going to be able to do computations on the equivalent of blockchain's layer one, layer two, using homomorphic encryption and zero knowledge proofs so you will be able to analyze these things without necessarily getting into trouble."

In the *Age of AI*, Schmidt predicts new global network platforms which are built on the ever-increasing-in-power AI models, such as ChatGPT. Future AI platforms will require data to retrain and improve their models. With trust-minimized applications set to transform financial markets, Chainlink is uniquely positioned to index the largest amount of data about these markets. Not only does Chainlink provide external data to trigger every hybrid contract, but it also has the ability to monitor all token movements via CCIP. This data can be sold to companies to train powerful AI models and create new products that were previously impossible. Using ZKPs, even private data can be used to train these algorithms. As I discuss in the next section, any part of the blockchain stack has the potential to profit from transactional data.

In my Chainlink Thesis[11], I differentiate between the first wave of blockchain innovation, which is set to disrupt the financial sector, and the eventual convergence of IoT, AI, and blockchains to enable advanced autonomous systems. Examples include parametric insurance, autonomous supply chains, and eventually cyber-physical systems such as self-driving car networks or autonomous shipping companies. The ability to generate tokens allows for digital representations of physical goods to be tracked throughout their lifecycle. For instance, tokens are created and burned when a supply chain moves a certain number of units of a commodity from one place to another, or when a package is shipped to its final destination. Even energy itself can be tokenized and monitored, which opens the door for grid optimization and individuals to sell excess energy [4]. As more autonomous systems interact with our lives, these token movements will represent a dataset that is increasingly representative of the global economy. The end game is a suite of applications that extend beyond the financial system and can provide deep insights into the economy.

---

[11] https://www.abstraction.capital/insights

4 The Fat Middleware Thesis

In a modular Web 3.0 architecture, security hubs, execution hubs, middleware, and application-specific chains are all components that will find a way to capture value. Middleware, and more specifically Chainlink, has the potential to win in either a 'fat protocol' or 'fat application' scenario. I later discuss the power of tokens, and why I expect network-based tokens to outperform other investments over the following decade.

4.1 The Evolution of the Fat Protocol Thesis

There has been much debate about where value will be generated in Web 3.0. The 'Fat Protocol Thesis' was coined by Joel Monegro in 2016 to show the contrast between value capture in Web 2.0 and Web 3.0. Monegro argued that the protocol layer will capture the majority of value in Web 3.0.
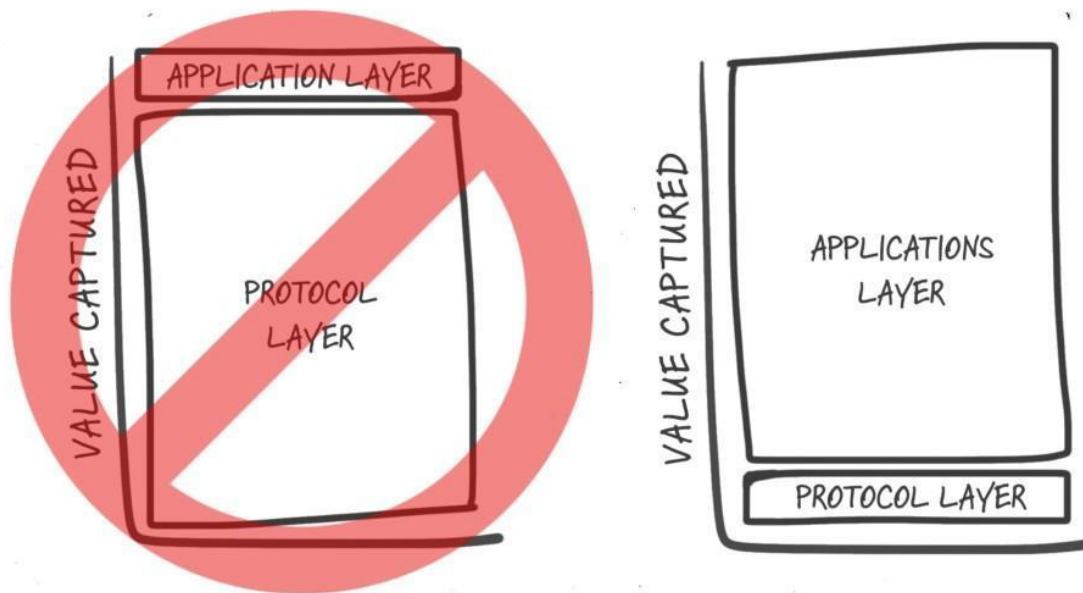

Figure 14 - Value capture of Web 2.0 vs 3.0

Recent history has supported the Fat Protocol Thesis, as Ethereum and other Layer 1s have consistently had the highest valuations. Based on fee data from some of the largest dApps (particularly towards the end of 2021), however, this thesis showed signs of cracking as various protocols generated more fees than Layer 1 blockchains. The 'Fat App Thesis' emerged, as it seemed users were willing to pay non-zero fees for the unique value provided by top applications. In the figure below, we can see that Uniswap and GMX, two DEXs, had more fees than every smart contract protocol other than Ethereum as of November 10, 2022.

Name	▼ 1 Day Fees	7 Day Avg. Fees
Ethereum	$4,399,980.54	$4,050,984.71 ∨
Uniswap	$1,424,279.65	$1,467,254.47 ∨
BNB Smart Chain	$505,677.44	$515,594.39 ∨
Bitcoin	$276,627.52	$347,189.36 ∨
SushiSwap	$271,753.47	$202,233.62 ∨
GMX	$242,556.69	$346,376.61 ∨
Aave	$185,437.10	$279,984.72 ∨
Curve	$139,909.18	$145,821.99 ∨
SpookySwap	$72,372.42	$38,911.48 ∨
Compound	$62,085.35	$51,411.18 ∨
Polygon	$56,244.75	$42,880.66 ∨
Balancer	$55,135.21	$61,034.65 ∨
Arbitrum One	$50,474.60	$33,836.99 ∨
Solana	$45,073.14	$46,517.67 ∨
Optimism	$41,877.68	$41,634.10 ∨

Figure 15 – Apps in white, Protocols in purple. Fees as of 01/27/2023

As execution layer costs continue to drop towards zero and applications move to their own L3 chains as standalone blockchains, do applications actually capture more value than the execution or base layer? It is possible, but I also believe that applications are more easily forked. At present, users may choose to use trusted applications because of smart contract bugs and liquidity. Improvements in development and auditing tools, CCIP, and the ability to easily bridge funds across chains will make it possible for application fees to be driven towards the zero bound, especially because the code is open source. This hasn't occurred yet due to composability and liquidity fragmentation issues, but CCIP could accelerate this future. Although apps may be able to charge high fees for the next five years, in the longer term, it is not unreasonable to consider that some of these services may become public goods. That said, collecting and selling data is not restricted to the Chainlink network. Similar to the largest apps in Web 2.0 offering products for free (Facebook, Instagram, Snapchat, Twitter, etc.), the applications with the most volume will also collect the most data about their usage, which will have immense value.

Although I anticipate that most L1s will fail, I do believe that the surviving L1 security hubs will capture significant value. Their tokens will command a premium due to their high level of security and decentralization, and the effect that tokenomics have on their supply/demand dynamics. For example, Ethereum yield has the potential to form the foundation of a new yield curve, and Ether could become the base currency for the Metaverse, gaming, and art NFTs. In contrast to Web 2.0, the base layer of Web 3.0 relies on token incentives to function, unlike TCP/IP or HTTP. This means that the Fat Protocol Thesis can still hold true in a scenario where apps capture more value.

With respect to execution layers, they will control the MEV and be able to package and sell that as order flow, providing them with another means of capturing value in addition to transaction fees. While transaction fees may approach zero, in a world where execution layers are processing potentially millions of transactions per second, the fee capture upside here can still be significant. Additionally, execution layers will collect data on all apps built on top of them, which presents an additional source of value.

The Fat Protocol and Fat App theses represent the extremes of the protocol versus app debate. It is likely that there will be network effect winners in both domains, and due to the concentration of liquidity and developer talent, key applications or base protocols on each side will capture significant value. Regardless of whether apps or protocols capture 'more' value, as an investor, one can succeed by choosing an industry leader, regardless of which side of the stack one is betting on. The one constant, however, is that both sides require middleware, such as Chainlink, to function.

The Fat Middleware Thesis states, regardless of which apps or protocols capture significant value, Chainlink must also capture value. To be more specific, the amount of value captured by Chainlink will increase with the total number of applications. Whether an application needs price data, weather data, cross-chain communication, random numbers, proof of reserves, identity, smart contract automation, or any other middleware service, Chainlink will generate cashflow. With a monopoly on this part of the stack, it is entirely possible that Chainlink captures more value than any other protocol or application[12] [1]. The

---

[12] In [2] I discuss why

Chainlink network is likely to capture more data than any other individual application or blockchain, further strengthening this argument.

4.2 Tying Incentives to Network Effects: The Implications of Tokens on Network Valuations

The cryptoeconomic design of a network has a significant effect on its success. For an application to survive, it must find a way to make its token essential for its operation and link the growth of the network to the demand for the token. If a service can create the need for its token, it will have a strong impact on its value, as discussed by Schmidt:

"Using tokens to incentivize behavior is a really powerful dynamic…and that changes the economics in some really fundamental ways…Now in my whole career I've always had compensation tied to stock options which was tied to corporate wealth and so forth, but the fact that the token goes up in value based on network effects is a real discovery and I don't think people understand quite the economics of this…it's a new way of tying compensation and incentives to network scale that's a big deal"

Traditionally, the price of a stock increases because the quarterly earnings have increased therefore market participants purchase more stock with the expectation that others will also value it at a higher price. The invention of blockchains and the ability for networks to create their own money (tokens) has ushered in a new paradigm. Now the value of a network will increase directly with demand because the token itself is needed to pay for network services. Schmidt believes "That's a big deal". I echoed this sentiment in my Chainlink Thesis [5]:

"We believe the investable assets that will appreciate the most during this revolution are the native tokens of various Blockchain protocols…Because blockchain protocols are effectively globally accessible public utilities which economically incentivize users to provide services, their potential market cap is significantly higher than any single company. Since inception, the Dow Jones has risen approximately 200,000% including dividends. Microsoft, Apple, and Amazon have risen 330,000%, 88,000%, and 138,000% respectively. Bitcoin has risen 105,000,000% since 2010. Bitcoin was the fastest investable asset to ever reach a 1 trillion-dollar valuation, and its market cap will likely be larger than any company by the end of this market cycle."

Despite being wrong about Bitcoin's market cap in the past, I stand by my belief in the unprecedented potential of tokens that are tied to actual network demand. Bitcoin's success speaks to the incredible potential of token-based incentives. Even with Bitcoin being the best performing asset in human history in one third of the time as second place (Microsoft), it is important to note that Bitcoin itself is not needed to pay for any service. The service is just to hold Bitcoin. Ethereum and Chainlink differentiate themselves here because their tokens, ETH and LINK respectively, are actually needed to pay for network services. As discussed, these two protocols have the potential to be the backbone of a new blockchain based financial system. The demand for these assets will be incredible.

The LINK token serves a dual purpose, not only being required to pay for network services, but also being staked as collateral by node operators for the jobs they perform. This has a deflationary effect on the free float supply, which is positive for the price, by acting like a perpetual stock buyback that scales with Total

Value Enabled (TVE). Chainlink also has a fixed supply. Most traditional assets that are considered inelastic are not perfectly inelastic. Aside from real-estate in prime locations, new homes are created all the time. Even gold has a 1.85% inflation rate. The unique characteristics of tokens, including their digitally programmable scarcity, makes them unlike any other asset in human history.
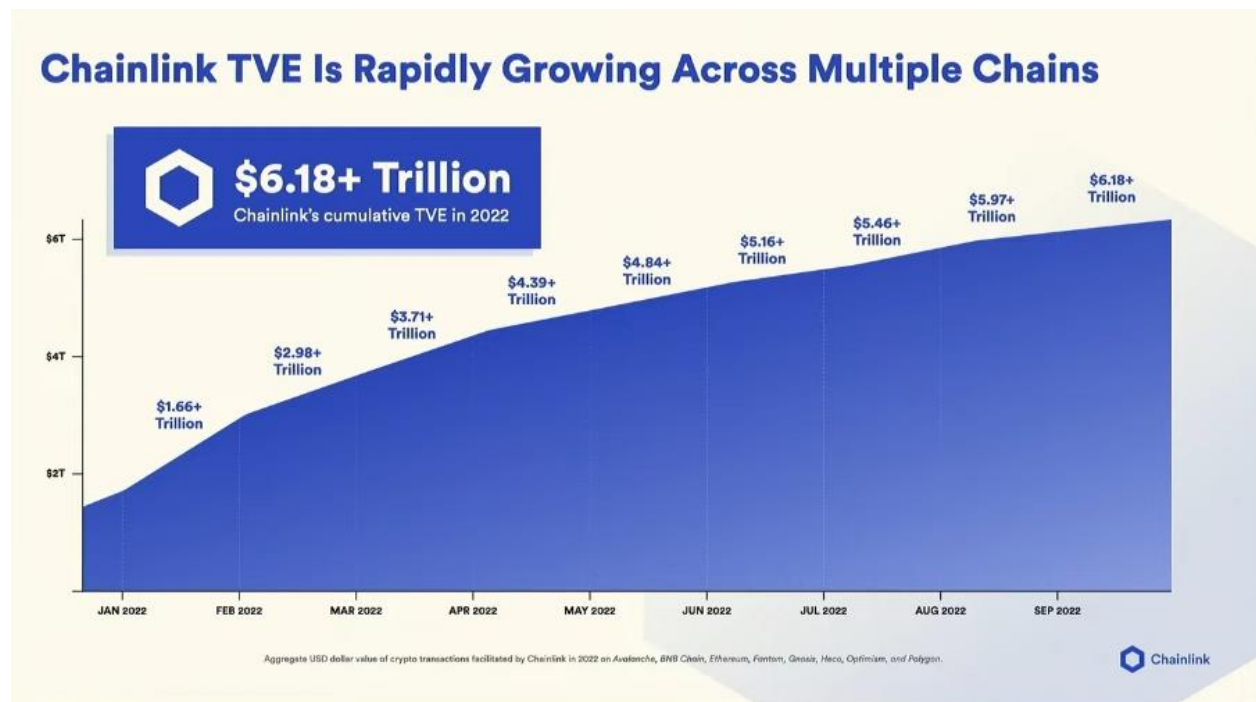

Figure 16 - Chainlink TVE

The early success of Ethereum, particularly when Proof of Stake was implemented, is an example of the powerful effect of strong tokenomics. I believe the deflationary dynamics of the LINK token are even stronger than those of Ethereum, due to the way that the total value of staked tokens scales with TVE. As Chainlink's TVE grows, so will the amount of supply that must be removed from circulation.

5 Where we Head from Here: Regulation, Decentralization, Privacy, and AI

In conclusion, I'd like to address a few of the topics that Schmidt discusses in the fireside chat, including regulation, decentralization, privacy, and AI.

5.1 Regulation

Schmidt's experience dealing with regulators throughout his career highlights the challenges and complexities of navigating this area:

"For those of you who have not dealt with Regulators don't ask for regulation early please. You want – I've done this now for 45 years, no 47, sorry I was doing a little math – you don't want premature regulation you want these systems to get built so people can understand what the really hard problems are and then you want to figure out what problems they cause. Now right now, it's important to understand that many of you would prefer not to have any regulation at all, welcome to being a libertarian, and societies don't reward libertarian thinking very much because of all the issues around power and control and so forth and so on. it's highly unlikely that a purely libertarian view of how these things are going to emerge is going to work what instead is going to happen is governments will assert their authority partly because that's what they do and you want to do it in such a way that it's rational and today, for example in the United States, it's not at all clear who the regulatory bodies are going to be right they're still thinking about, it they're still talking about it. Is it an asset that is regulated by the CFTC, how do we deal with AML, KYC issues and so forth? These are real issues, but my overall message is for those of you that are working with Regulators, take it slow right, get the regulation right and it's very hard to get the regulation right such that it prevents the bad things, but allows all of the good things. It's really a difficult knife edge to be on. I have lived this; I have done this for the past 30 years."

Schmidt advises taking a measured approach to regulation and allowing systems to be built before fully understanding their potential consequences. This advice contrasts with the actions of Sam Bankman-Fried, who was pushing for the DCCPA bill to be passed by Congress without fully considering the implications. Erik Vorhees was right to call him out on this during their debate, as it appeared that Bankman-Fried was too quick to concede ground [6]. It has become clear that the Jump/FTX/Alameda group was seeking to regulate DeFi in order to strengthen FTX's competitive advantage, and the recent FTX incident only confirms this. The main question now is how regulators will respond to these events and the broader industry. It is crucial that they strike the right balance between promoting innovation and protecting consumers.

The FTX incident, rather than being a negative for DeFi, should actually be seen as an advertisement. Whether FTX was a cryptocurrency company or a traditional financial institution, the fact that they took user funds without sufficient backing is a fundamental issue of transparency and trust, not a problem specific to the crypto industry. This serves as another reminder of the need for trust-minimized infrastructure in the form of DeFi, which relies on cryptographic truth rather than trusting the promises of centralized institutions.

Chainlink's Proof of Reserves is an example of the type of technology that is necessary for a fair and transparent economic future. As more and more centralized institutions fail, the distinction between DeFi and traditional finance will become even clearer. It is my belief that DeFi will play a critical role in shaping the future economy.
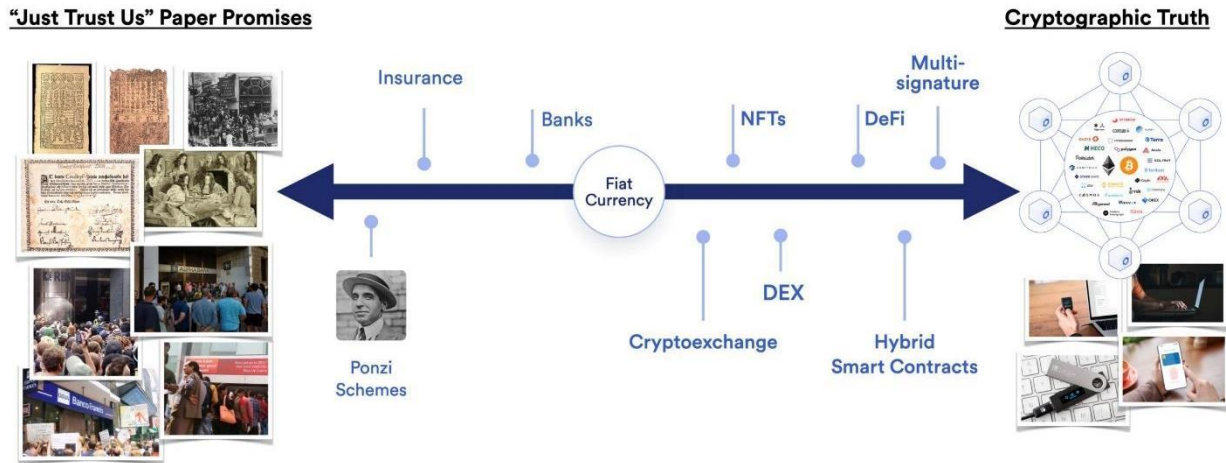

Figure 17 – The spectrum between the world of "just trust us" paper promises and cryptographic truth
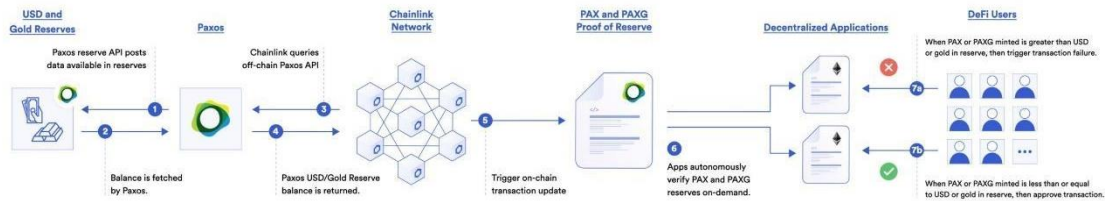

Figure 18 - Example of Chainlink Proof of Reserves

5.2   Decentralization

As we consider the role of DeFi in shaping the future economy, it's important to consider whether true decentralization is beneficial for society as a whole. In my previous discussions, I have highlighted that the distribution of wealth throughout society follows power laws, as discovered by Pareto.
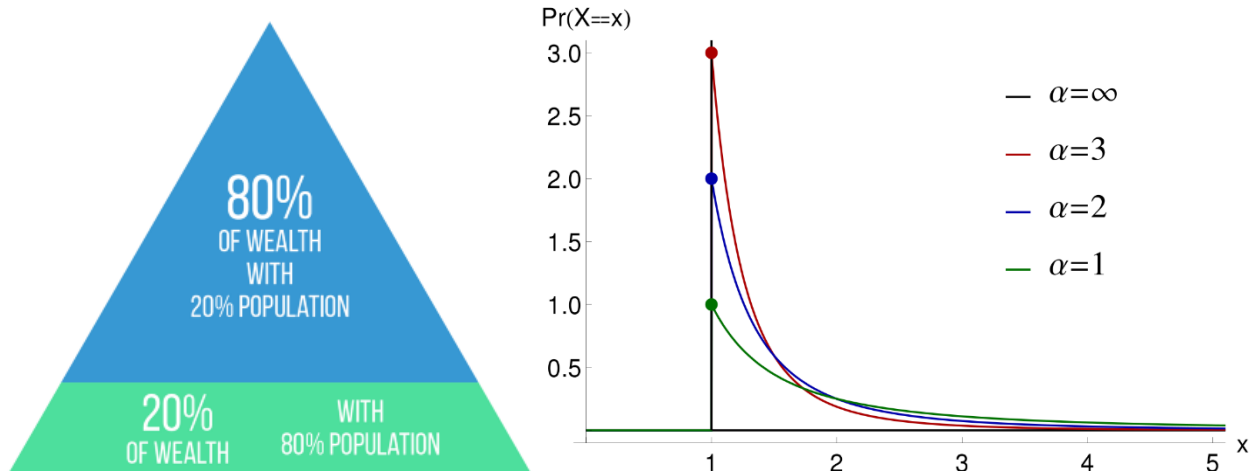
Figure 19 - Pareto Distribution

We do not currently live in a society where resources are evenly distributed. In a truly decentralized protocol, where every user has voting power proportional to the number of tokens they hold, an entity with disproportionate wealth could come in, buy a majority of the tokens, and manipulate the rules to benefit themselves. Schmidt highlights this risk, as he was initially very bullish on the potential for Web 2.0 to be highly decentralized, only for it to become centralized under the control of a few dominant companies.

"A note of caution on web 2, and by the way when we were doing this, we didn't call it web 2, we just called it the web. What happened (was) we all started with a notion of true decentralization, true empowerment of individuals. All of the things that I did 25 years ago involving Mosaic and the internet and HTML was presumed of the fact that that the world would become disaggregated, that everyone have equal access all the stuff, all that religion and stuff, and we believed it – I really believed it. If you look at the structure today of what you think of as web 2 it's highly concentrated around relatively proprietary systems and that's not what we started off in.

So, if you look at it in the arc of my career over 20 years the same thing could happen to you and you go "oh my God that would be terrible", but let me tell you what might happen, and this is not a prediction. There are economic benefits and returns to scale and you have really clever entrepreneurs who are very, very smart, they're moving quickly, they create value, and they can begin to merge and acquire things. There are also technical benefits to centralization because of the Sybil effect, that truly distributed systems spend the vast majority, estimates are up to 90% of their time making sure there isn't an interloper in the protocol. There are Technical Solutions to that, so you've got a system where it spends an awful lot of time making sure there aren't other people around. It's Perfectly possible that that could lead to a small number of high-end large players. So, I don't think web3 is immune from the kind of centralization that surprised me. Now I was also one of the people who caused it so I'm not trying to be misled you but the economic incentives the scale incentives and the technology incentive itself tend to favor centralization.

So one thing for you all to do is to make a map of what you think of web3 will be and then figure out which points will be centralized which points will be regulated and which ones will be wide open the history of

technology is they start completely wide open and then there are centralizers there are consolidators there is probably a set of consolidators that will get either built founded or will come into the space and provide that to some of the infrastructure."

Sergey agrees with Schmidt's analysis that economies of scale can lead to centralization in certain systems, such as Bitcoin. For example, the four or five largest mining pools often contribute up to 75% of Bitcoin's hash rate. It is possible for multiple mining pools to be controlled by a single operator or to make secret agreements with each other, effectively functioning as a single entity. This is known as the Dynamic Membership problem. Before China implemented a ban on mining, over 51% of the network's hash power was controlled by three companies based in China. While the issue of centralization in China is no longer a concern, the inherent problem of dynamic membership remains, as end users of the Bitcoin Protocol cannot explicitly choose the nodes that process their specific transactions.
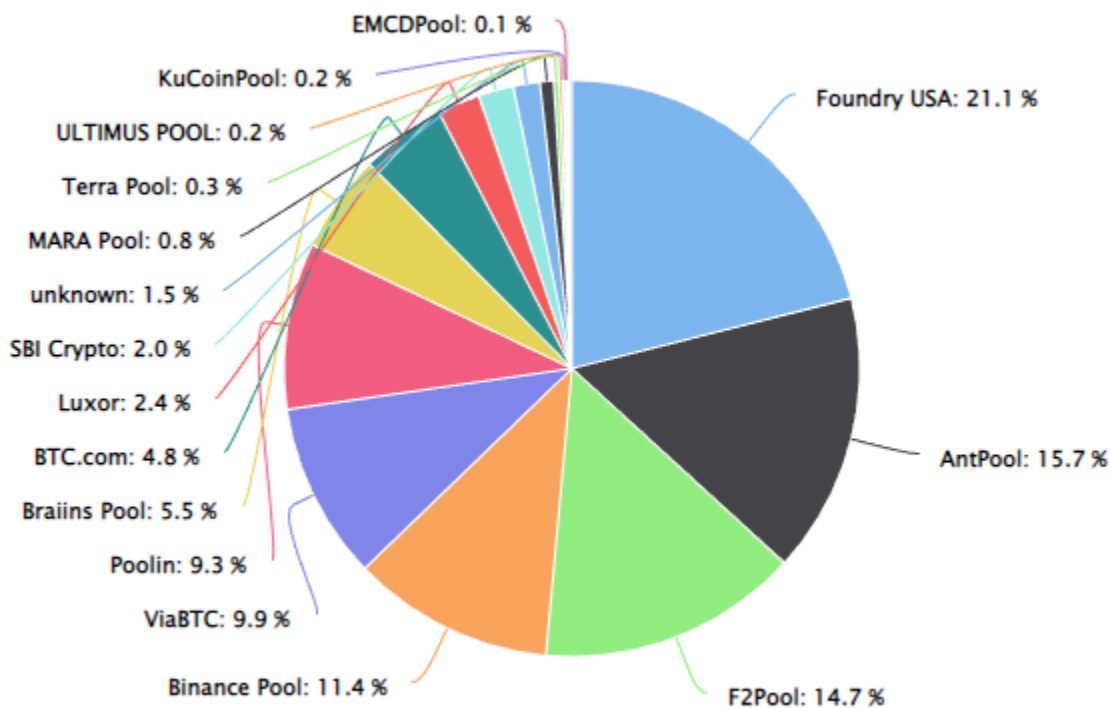

Figure 20 - Bitcoin Network Pool Distribution, 1y rolling

A network with a single group of nodes handling all transactions is vulnerable to the dynamic membership problem. The problem can only be mitigated by having a very large number of nodes, such that no individual node has a disproportionate share of the network. For the Bitcoin network, it would be ideal to see no single mining pool controlling more than a few percent of the total network.

Ethereum is not immune to the dynamic membership problem, but Proof of Stake helps to address it. In a future where millions or even billions of users stake their Ether to participate in consensus, the percentage of the network controlled by large entities is likely to decrease over time due to the inflation

and fee burning mechanisms. Eric Schmidt agrees that the blockchain community is "getting its act together" in addressing decentralization issues with the Ethereum move to Proof of Stake. However, he also notes that Ethereum has other centralization challenges.

For instance, over 67% of its network nodes are hosted by Microsoft, Google, and Amazon. In a Proof of Stake future where users could theoretically stake on their phones, the lack of a successful Web 3.0 phone means that all staking would be done on either Android or iOS, potentially creating a centralization issue. Furthermore, as of November 15th, 2022, staking provider Lido Finance holds approximately 33.80% of the total ETH staked on the network, representing a significant centralization risk. As seen with the Tornado Cash incident, unfavorable regulation could potentially lead to censorship of the entire network [7]. While I believe these are short-term problems that can be resolved as more competition enters the space, they are worth acknowledging. Bitcoin and Ethereum are the two largest and most decentralized protocols in the space. If they struggle from decentralization problems, it shows the space still has a way to mature before it is ready for primetime.

Naturally, the discussion moves towards Chainlink and how they have solved dynamic membership by allowing users to select the nodes which service their contract:

"Chainlink Oracle networks create large Committees of identified nodes where you can choose the decentralization that you want to achieve without having Dynamic membership that creates three or four pools under the control of one mining pool operator yeah I would say in that sense yes if you want a network of 100 nodes to do a very specific computation for you can choose the 100 nodes you can choose the jurisdiction they're in you can choose the trust assumptions you want to have with them you can choose their commitment to you and you know those are all choices you should be able to make and to create that type of decentralization in a very explicit way rather than a dynamic membership way that creates these large mining pools."

To which Schmidt responds,

"I think that you've just described a whole new industrial system that's not very well understood outside of this room."

As a modular network with a marketplace of nodes with on-chain reputation scores, users have the ability to choose the level of decentralization they desire for a specific task. They can select nodes located in different geographic regions, using different cloud providers, and requiring different levels of collateral for their services. This flexibility contrasts networks that have a single set of validators for every transaction. The Chainlink network is designed to offer users this level of control and customization, allowing them to select the level of decentralization that is most appropriate for their needs.

Unlike Ethereum and Bitcoin, the Chainlink network uses on-chain reputation scores to signal the quality of node operators. This creates a system where node operators compete to earn the most LINK and the highest reputations, as this directly impacts their returns. As node operators compete to earn better returns on their LINK, they create positive externalities for network participants, such as additional security, lower costs, and more services and data types. By having a large pool of node operators that are differentiated across various decentralization factors and have their reputation scores recorded

immutably on the blockchain, Chainlink can become immune to the dynamic membership problem. At the same time, this system will maximize the fitness of the overall network by both penalizing bad actors and rewarding good actors, creating a new industrial system that aims to be as efficient as possible, yet fair. With Ethereum transferring to Proof of Stake, they do allow for penalization of bad actors, which is a massive upgrade over Proof of Work. Where Ethereum's design falls short of Chainlink's, though, is where the staking system rewards all participants with the same yield and actually reduces yields as more ETH is staked. I believe Ethereum could see massive benefits in security, fees, and decentralization from having validators that are rewarded for running their own nodes on differentiated hardware, for instance. Instead, we are left with a network where Lido controls over a third of validators because there is no incentive for people to validate themselves. With that said, Lido takes a fee for validation, so this creates opportunity for other Liquid Staking Derivative (LSD) protocols to come in and compete, which should lead to more decentralization. These spreads will get compressed, though, which will eventually reach a point where no new market participants see an opportunity to offer LSD services, ultimately capping potential for more decentralization.

It's worth noting that achieving a pool of node operators that is highly differentiated is a major accomplishment in its own right, and something that Chainlink is still working towards. However, with the release of Staking 1.0, the network will become fully permissionless, in turn enabling the rapid growth of node operators. With the release of the SWIFT-CCIP abstraction layer, DECO, and FSS, I expect the network to generate significantly more cashflow than it currently does. If this is the case, there will be an extremely strong economic incentive for users to run Chainlink nodes. In my opinion, it's only a matter of time before Chainlink becomes highly decentralized.

Sergey also discusses his vision for the future of Chainlink and Web 3.0 in terms of providing true decentralization:

"I think back to your earlier point of mining pools, that's an example of the efficiency of a mining pool attracting a lot of hash power into a single entity that's probably through some back room social convention, kept at, 25 (nodes), but I really think that the difference in web 3 is that it's about creating open markets for those compute workloads for all of that. The successful protocol for me Isn't the one that centralizes the value of the compute under the control of one group like a mining pool, it's the one that successfully creates a market where people efficiently bid against each other to create more efficiency, more security, often through some form of formalized reputation. I think the real difference is that, yes those big companies could get better deals on hardware, better deals on data centers, better deals on cooling, better deals human capital, better deals on a bunch of things, but I think the real question is that if you make a market how does that market evolve when all you need is very proven inputs, very proven uptime, and that's what I think web 3 reputation systems really do."

Sergey believes that true decentralization is achieved when a free and open marketplace is created, where entities can compete on fair and transparent terms. With a formalized reputation system, bad actors will be eliminated over time. While this is a potential future, Schmidt challenges this perspective:

"They do until you have an evil actor. So I'll give you an example. I spent, I don't know a decade of my life fighting Microsoft at the Heyday of its consolidation including, antitrust 1996, 1997, all this kind of stuff.

Microsoft's tactics at the time, they don't do this anymore, included not allowing competitor access to the platforms, various pricing strategies, all of which were subject to antitrust rules, all of which has been discussed at length by my generation. So the internet comes along and Cisco for a while had more than 50 percent of control over the net, but Cisco didn't use the same business tactics as Microsoft. I kept wondering why, now partly it's because it's different people, different leadership, but also because it was a protocol network incentive, as opposed to an app control incentive if you see the distinction. So to the degree that your observation is about network scale and protocol (scale), it won't end up being dominated or taken over by a proprietary player. In other words your vision is correct to the degree that somebody can come in with significant money, significant network Power, and change the protocol to exclude competitors. Then then you'll have trouble and again you have a model of web3 as protocol network based, which I obviously like that a lot, I would be very careful in the design of those future Layer two or layer three protocols to make sure that they fully affect and realize the vision you outlined."

Schmidt argues that a formalized reputation system can always be gamed because it is humans who write the code. This highlights the fundamental problem of social coordination, which is similar to the challenges faced by the United States governance system. The founding fathers wrote the Constitution with the intention of creating a document that would lead to widespread wealth and happiness for future generations. They established free capital markets, which have created the most successful governance system in the history of mankind. However, the American experiment has its own problems, as the founding fathers could not anticipate every potential future issue. The ability for private markets to impact policy through lobbying has led to a form of crony capitalism.

If blockchains are set to become the foundational infrastructure for human collaboration, it is up to this generation of founders to write source code (the "constitutions" of their protocols) in an open manner and receive significant community feedback to ensure that their applications maintain positive market dynamics. This is a crucial task that requires developers and the community to formalize the rules of blockchain protocols in such a way that it negates the ability of bad actors to change the rules of these networks to benefit themselves at the expense of society. One innovative approach is the use of token-based voting, as demonstrated by the Optimism team with their Token House and Citizens' House. This system gives more weight to voters with more tokens, but also experiments with non-plutocratic governance that restricts Citizen House voting to one person, one vote [8].

Ultimately, Web 3.0 will likely have pockets of centralization. It is up to the community to support and fund developers who are creating fair systems, while also exposing bad actors. While achieving complete and total decentralization may be impossible, if Web 3.0 can create systems that are 10 times better than the old ones, however, it will be a major advancement. In fact, I believe we are on the cusp of a second renaissance in terms of human productivity if Web 3.0 yields a fair, transparent, and decentralized global financial system.

5.3 Privacy & AI
The intersection of AI and blockchain technology and its tree of potential outcomes is crucial to understand when thinking about end user privacy.

In this section, I will provide some background on AI before I discuss how it intersects with blockchain technology, likely impacting human privacy.

5.3.1 AI

AI has grown exponentially in the past five years, which can be attributed to the development of transformer models and the rapid advancement of GPU-based architectures. Today's AI has generative capabilities, such as Diffusion models used in DALL-E, OpenAI's image generation model, or ChatGPT. These models are extremely powerful and easily composable.

Figure 21 – OpenAI DALL-E 2. Generates images from natural language descriptions. Above image generated from text prompt "Teddy bears working on new AI research underwater with 1990s technology"

By moving from application-specific models to platforms, developers can easily build products on top of these highly advanced and well-trained systems, leading to an explosion in business productivity and use cases. Recently, Google's chatbot AI was declared sentient by one of its engineers, proving AI is becoming increasingly human-like [9]. According to Schmidt, AI will eventually be able to accurately mimic human behavior and create its own objective functions, leading to the development of Artificial General Intelligence (AGI). This level of intelligence will be unlike anything humans have experienced. For example, DeepMind's AlphaGo chess AI was able to beat the strongest chess engine (Stockfish 8) after only four hours of training, using moves that top grandmasters had never considered. DeepMind's Go AI would also make moves that were previously thought to be bad by the best Go players. This type of intelligence is beyond human comprehension. If the very early examples of this AI already make moves that humans have never considered, imagine what an AGI is capable of.

In their book *The Age of AI,* Henry Kissinger, along with Schmidt, argue that what we are seeing with AI is "a new epic". The "Age of Faith" is what philosophers and historians generally call the Middle Ages, where the answer to most questions was because "God did it", and absolute truth was derived from the holy text of one's religion. Next was the "Age of Reason" which generally began during the Renaissance. It is characterized by the belief that absolute truth can be discovered through science and logic. Kissinger believes that we are entering a new age due to AI's incomprehensible capabilities. He and Schmidt refer to this as the "Age of AI" [10].

Schmidt believes that there will be a few countries that build AGI supercomputers, just as there are a few countries that control nuclear weapons. These computers will be shielded in bomb shelter like structures and guarded by extensive amounts of military personnel. The capabilities of these AGI computers are likely to be profound. Schmidt believes that these knowledge systems will govern society, but will not be understandable by the average human due to their perfect rationale. Kissinger speculates that when these inanimate intelligences come to fruition, it will either lead to a revolution or the formation of a new religion. Schmidt, as the former CEO of Google, very well could be the singular human on this planet that has had the most exposure to advances in AI as well as exposure to the largest number of private sector companies working on this technology. His selection as the head of the Nation Security Commission on AI further strengthens this argument [11]. Other experts share similar viewpoints that strong general AI is built before the end of the decade [13]. I do not think it is a coincidence that Schmidt published *The Age of AI* roughly a year before ChatGPT was released to the public and society is starting to realize the power of this technology. In the next section I will explain how AI and blockchains intersect to impact privacy.

5.3.2 Privacy

Privacy is a core issue when it comes to discussing blockchains. By design, blockchains force transparency, as all transactions are recorded on a ledger that is accessible globally. These transactions are linked to a user's address, which does provide anonymity as long as that address is not linked to a specific individual. However, users typically access cryptocurrencies through centralized platforms that require KYC/AML checks. For example, a user may purchase ETH on Coinbase and then transfer it to a personal wallet to use with DeFi. In this case, Coinbase knows the address that the ETH was sent to, and this information could be traced back to the user if the government requests it from Coinbase or if Coinbase's server is hacked. Chainalysis is a company that has developed a product to track the movement of tokens between wallets.
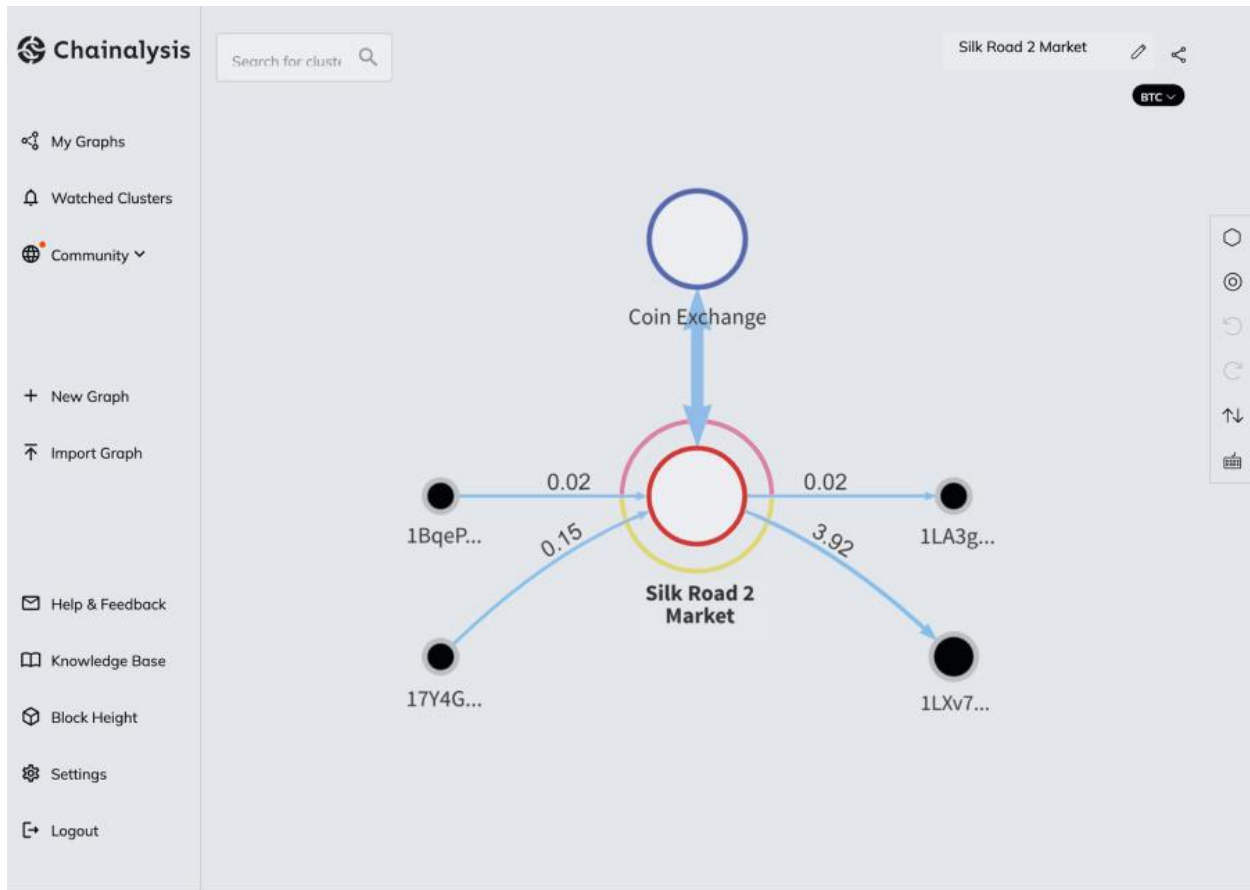
Figure 22 - Chainalysis Reactor Product to connect cryptocurrency transactions to real-world entities

It would be very difficult to maintain actual privacy unless centralized on-ramps did not store this data. That would go against KYC/AML laws, though, so I do not expect it to happen.

Even users who mine their own cryptocurrencies may not be able to maintain their privacy in the face of powerful AI platforms. For example, a government-controlled general AI with access to energy grid data and Bitcoin mining data could use a process of elimination to track every BTC and identify mining wallets. By using the number of coins in existence as a reference, such an AI could potentially associate specific coins with specific mining companies, thereby discovering the employees of those companies. With the shift to proof-of-stake for Ethereum, the only way to earn yield on ETH is to obtain it through a centralized platform. In the current state of affairs, it seems that user privacy is already lost.

In my view, there are two levels of privacy when it comes to cryptocurrencies: agent-level privacy and node-level privacy. Agent-level privacy means that it is physically impossible to identify the humans behind a crypto address. Node-level privacy means that transactions are private to everyone in the world except the government of the country in which the user resides. In other words, the user's address is visible to all humans, but the government is the only entity that knows which human is associated with that address.

As long as governments hold a monopoly on violence and have access to powerful general AI supercomputers, it is likely that agent-level privacy will be lost. While there is hope for projects like Zerocash and Monero, the challenge remains for users to convert their assets to these cryptocurrencies and for everyday services to accept payment in them. Node level privacy is still necessary for a healthy society.

Using zero knowledge proofs and homomorphic encryption, it is possible to maintain node-level privacy while still allowing AGI supercomputers to access and train on transactional data. This can be extremely beneficial for society, as long as the power of these AGIs is used to drive productivity growth rather than redistributing assets from the public to those who control the AGIs. However, if there is reasonable proof that a human being has broken the law, then law enforcement will be able to decrypt and analyze that specific user's transactions. While it may seem impossible to develop a legal framework that grants governments the right to decrypt private citizen data in a way that is free from corruption, it is technically possible within our current political system. With the increasing lack of trust in government and institutions that I anticipate over the next decade, it is possible that a new political party or leaders who act in the public's best interest will emerge, making this outcome, at the very least, slightly more likely.

As Shoshana Zuboff discusses in "The Age of Surveillance Capitalism," our privacy is essentially already lost. I worry that the combination of blockchains and AI will not be able to restore our privacy. However, these technologies will still have a significant positive impact on society and may provide humans with the tools to potentially achieve full agent-level privacy at some point in the future.

6 Conclusion

As trust-minimized, algorithmic systems become cheaper than corruptible, human-intermediary based systems, there will be no reason for any rational economic actor to choose the more expensive and riskier human intermediary-based systems. Given the current macro-economic and political state of the world, it is clear society is rapidly moving towards trust-minimized systems. The Chainlink network has the potential to become the core piece of infrastructure which captures the most value from this shift.

Blockchains such as Ethereum can be thought of as truth machines that generate consensus on who holds what tokens. Smart contracts enable the algorithmic movement of tokens, but ultimately the only thing blockchains can do is move tokens between accounts. Chainlink can be thought of as a *generalized* truth machine that can generate consensus on any *arbitrary piece of information or computation*, such as the price of a stock, generating a random number, or the transfer of a message between isolated systems. While Blockchains compete to move tokens, the Chainlink network has a growing monopoly on every other trust-minimized service that is necessary for smart contract adoption. Unlike the cost of on-chain trust-minimized computation, which appears to be highly deflationary, the services Chainlink provides have higher fixed costs [1].

One of the defining characteristics of Web 2.0 was the creation of free services that generated revenue from user data; this dynamic seems to be repeating in Web 3.0. The data that blockchains and oracle networks generate will hold massive value because it will represent more than what users search on the internet or what pictures they post on Instagram. This data will represent value moving around the global financial system as real-world goods and services are tokenized such as energy grids, supply chains, and real estate.

This means blockchains are effectively creating a digital representation of the physical world. They are representing atoms with bits, and permanently recording the state of those bits over time. Chainlink's data-feed service is the singular piece of infrastructure that enables arbitrary information about the physical world to be represented as bits on blockchains in a trust-minimized manner. It is the connection between the physical and the digital domain.

Once in the digital domain, Chainlink's CCIP will become the global standard for optimizing the movements of said information, in the form of tokens, throughout blockchains. In turn, the Chainlink network will generate more data than any other piece of infrastructure that makes up the Web 3.0 stack. Simply put, Chainlink is the Google of Web 3.0 – who better to validate this thesis than Eric Schmidt himself? His bet on Chainlink is a bet that this data will be extremely valuable to new global network platforms that will leverage it to train powerful AI models.

Given the economic implications of the network's tokenomics, I fully expect the LINK token to obtain a top 2 spot in market cap by the end of the decade, if not the highest spot. Considering its market cap is approximately 60 times less than Ethereum's, I believe LINK to be the best risk-adjusted investment in the cryptocurrency space.

Decentralized protocols represent the means by which a fair, permissionless, transparent, and global financial system can be created. We must continue to support good actors in the space, while expunging bad actors. Although 2022 brought devastation to market prices in crypto, it was a necessary cleanse which has set the space up for mass adoption in the future. The global and permissionless nature of crypto is a double-edged sword, enabling sophisticated scammers to infiltrate the space with ease. It is critical industry participants continue to educate newcomers and promote the protocols which are adhering to the mission of decentralization.

Decentralization is not enough, though. Ultimately, it will be up to humans to design the right constraints into these protocols such that no single entity with outsized capital can take control and change the rules to benefit themselves; this would lead to a system identical to the one we currently have. Eric Schmidt said he started out as an idealist, truly believing he was building the open and free web. The participants of Web 3.0 must ensure they are not heading down the same path.

Finally, crypto is not the only nascent technology that will drastically alter our future. The implications of AGI with access to real-time data on the global financial system, energy grids, supply chains, the real estate market, etc., are unknown but surely profound. Nevertheless, it will be up to humans to decide whether these powerful technologies are used for good or evil. I believe fair, decentralized systems for human coordination and commerce are societies' best chance to ensure they are used for good, which is why the design of these decentralized systems is perhaps the most important task of our time.

Daniel Shapiro
Founder & Chief Investment Officer
Abstraction Capital

Disclaimer

Nothing written in this paper should be considered financial advice by Abstraction Capital. Invest at your own risk, and never more than what you can afford to lose.

Works Cited

[1] Shapiro, Daniel. *Monetary Wars: The Role of Money in the Digital Asset Era.* https://www.abstraction.capital/insights

[2] Wallach, Erich. *Chainlink Network Financials and Valuation.* https://ewallach.substack.com/p/chainlink-network-financials-and?utm_source=twitter&utm_campaign=auto_share&r=ubg4i

[3] Sergey Nazarov & Jonathan Ehrenfeld Solé: *Connecting Smart Contracts With SWIFT.* https://www.youtube.com/watch?v=1uxF4Q6_glY&t=100s

[4] Nazarov, S., Preukschat, A., Lage, O., Fernandez, M. (2022) *Managing Climate Change in the Energy Industry With Blockchains and Oracles.* https://pages.chain.link/hubfs/e/managing-climate-change-energy-industry.pdf

[5] Shapiro, Daniel. *Chainlink Investment Thesis: Critical Infrastructure for the 4th Industrial Revolution.* https://www.abstraction.capital/insights

[6] Bankless. *SBF vs. Erik Voorhees: How Do We Regulate Crypto?* https://www.youtube.com/watch?v=Ytaa_5liwMA

[7] Zhang, A., Seira, R. *The Problem Tornado Cash Raises About Base Layer Censorship on Ethereum.* https://www.coindesk.com/layer2/2022/09/28/the-problem-tornado-cash-raises-about-base-layer-censorship-on-ethereum/

[8] https://community.optimism.io/docs/governance/

[9] Luscombe, Richard. *Google engineer put on leave after saying AI chatbot has become sentient.* https://www.theguardian.com/technology/2022/jun/12/google-engineer-ai-bot-sentient-blake-lemoine

[10] Kissinger, H., Schmidt, E. and Huttenlocher, D. (2022) *The age of ai and our human future*. London: John Murray.

[11] Schmidt Et al. National Security Commission on Artificial Intelligence. *Final Report.* https://www.nscai.gov/wp-content/uploads/2021/03/Full-Report-Digital-1.pdf

[12] Layer Zero Labs. *LayerZero Integrates Chainlink Oracles, Expanding Decentralization of the Omnichain Communication Protocol.* https://medium.com/layerzero-official/layerzero-integrates-chainlink-oracles-expanding-decentralization-of-the-omnichain-communication-2d9963678483

[13] Porby. *Why I think strong general AI is coming soon*. https://www.lesswrong.com/posts/K4urTDkBbtNuLivJx/why-i-think-strong-general-ai-is-coming-soon

[14] Nambiampurath, Rahul. *NY Fed Launches Digital Dollar Pilot Program with Big Banks.* https://www.investopedia.com/ny-fed-works-on-cbdc-6829573