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Thesis Summary

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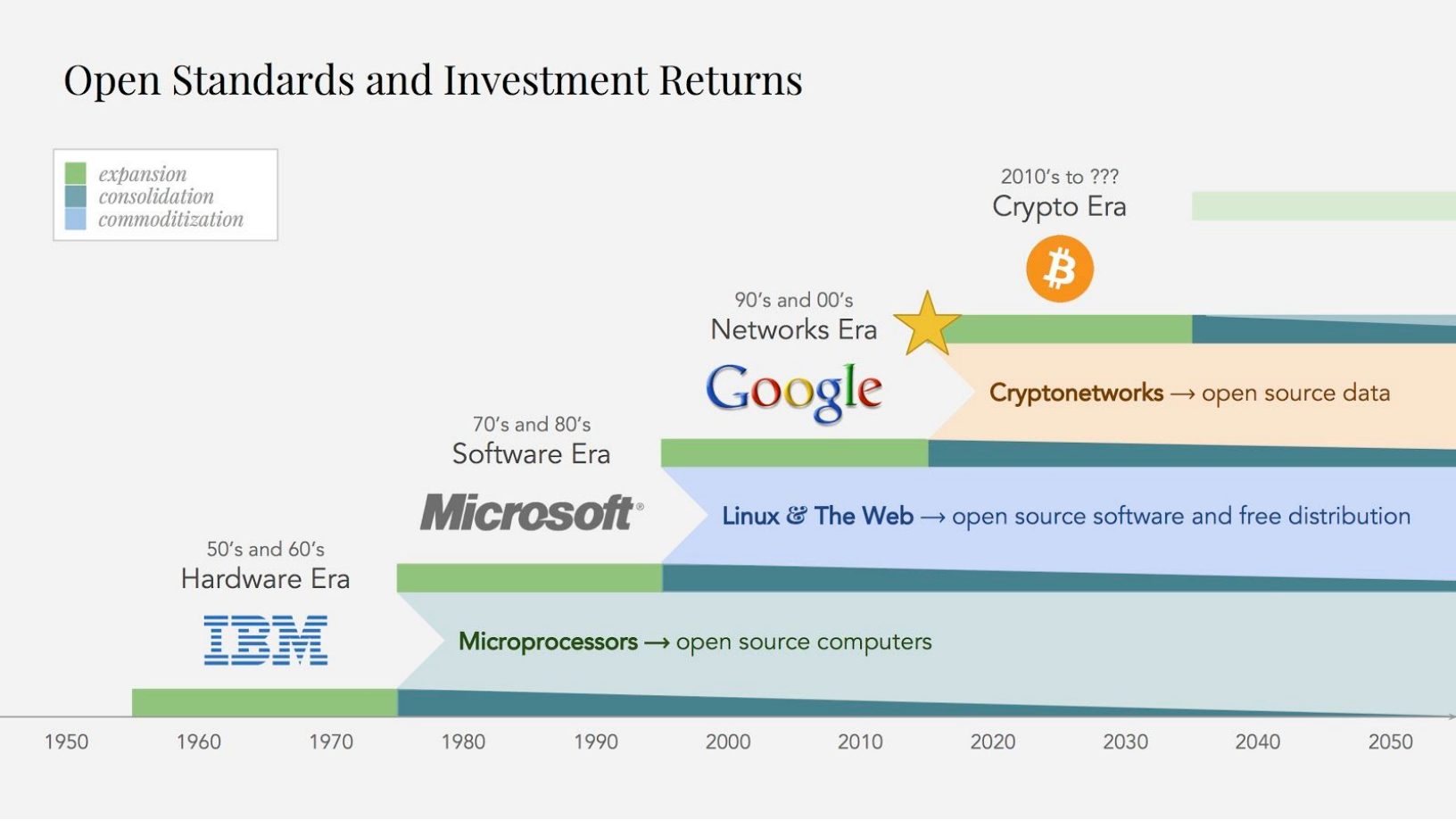
1. Thesis: Open Standards, Market Cycles and Investment Returns



Information technology evolves in multi-decade cycles of expansion, consolidation and decentralization. Periods of expansion follow the introduction of a new open platform that reduces the production costs of technology as it becomes a shared standard. As production costs fall, new firms come to market leveraging the standard to compete with established incumbents, pushing down prices and margins, and decentralizing existing market powers.

The price drop attracts new users, increasing the overall size of the market and creating new opportunities for mass consumer applications. Entrepreneurial talent moves to serve the new markets where costs are low, competition is scarce, and the upside is high. Often these early entrepreneurs will introduce new kinds of business models, orthogonal to existing ones.

Those who succeed the most and establish successful platforms “on top” of the open standard later tend to consolidate the industry by leveraging their scale (in assets and distribution) to integrate vertically and expand horizontally at the expense of smaller companies. Competing in this new environment suddenly becomes expensive and startups struggle to create value in the shadow of incumbents, compressing venture returns.

Demand then builds for a low cost, open source alternative to the incumbent platforms, and the cycle repeats itself: the new open standard emerges and gets adopted, the market decentralizes as new firms leverage the cost savings to compete with the old on price, value creation shifts upwards (once more), and so on.

We’ve seen this pattern play out over the different cycles in information technology. In the 1950’s the transistor collapsed the production cost of electronics by replacing expensive vacuum tubes with smaller, cheaper and more reliable switches, giving birth to the modern computer industry that eventually consolidated around IBM.

In the 1970’s, the microprocessor (new platform) collapsed the production cost of computers by reducing expensive, bespoke CPU systems down to a single, small general purpose processor that was easy to mass produce. New firms came to market leveraging the microprocessor to compete with IBM in a movement that brought us the minicomputer, the PC, laptops, mobile phones and all the new “things” on the internet.

As the hardware layer decentralized and became more competitive (compressing margins, and thus prices), new value creation moved up to the software layer. Cheaper computers attracted more users, which created new demand for software services and in particular a shared operating system. Microsoft took advantage of that opportunity by creating a proprietary operating system and securing a distribution advantage through lock-in contracts with manufacturers. They then leveraged this position to consolidate the industry by building more functionality into Windows

and competing directly with some of its most successful applications. By the late 90's, we'd gone from hundreds of PC software companies to essentially one.

What undid *that* consolidation was the combination of Linux and the Web (HTTP), both of which surfaced around 1991. Microsoft's business depended on proprietary software and expensive retail distribution. Linux provided a free, open source operating system, and the Web a marginally free distribution network (software is just data, after all). As before, new firms came to market leveraging the standard to compete with Microsoft on price (e.g. Red Hat), while new value creation moved out of the software business and into online networks.

Out of the dot-com boom, bust, and phenomenal growth that followed Linux and HTTP, came some of today's most important companies: Google, Amazon, Facebook, eBay, Twitter, PayPal, Netflix, to select a few. With little leverage left in proprietary software, it was bargained away in exchange for user networks[1] from which a company might extract uniquely valuable data to monetize in some other fashion, significantly expanding the potential universe of services.

Where we are today deserves a few paragraphs. The market is now consolidating around Google, Apple, Facebook and Amazon at an incredible pace and the cost of innovation for younger companies is increasing as it becomes more expensive for smaller companies to compete and create independent value.

Even larger, more established companies like Snapchat and Spotify are feeling the pain. As an example, it took 7 years for Snapchat to build a 150 million user base for disappearing photos and stories; it took Facebook less than a year to surpass that with Instagram stories, limiting Snap's ability to build a large advertising business. And Snap is an established, public company with a large balance sheet – smaller players are not as equipped to navigate the threat.

[1] http://cdixon.org/2015/01/31/come-for-the-tool-stay-for-the-network/

Finding venture-scale returns on the web going forward is going to be difficult. The sheer scale in distribution of the incumbents is simply too expensive to overcome without a radical shift in market structure and business models. The way to play a consolidating market is to invest heavily into the consolidating incumbents (which are likely to continue growing strongly for a long period of time) and to invest progressively in the insurgent platforms that will grow to commoditize the incumbent business models and create a new wave of innovation. We are focused on the latter.

2. Opportunity: Open Source Data

The business model of the web comes down to one thing: amassing large, uniquely valuable data sets and monetizing by charging users directly, placing ads, skimming transaction fees, etc. All of these business models rely on data being closed and proprietary. They don't work if the company doesn't control both the database and the user interface. This comes at a great social cost: by restricting our ability to access information in order to extract profits, web incumbents prevent us from accessing the enormous potential of truly open data.

Following the history of information technology and the massive trend towards open source, we can see that democratizing information is the natural next step in the incessant trend to open source, and thus the next big opportunity for innovation.

Cryptonetworks are decentralized information networks coordinated via a scarce, programmable digital token (or *cryptoasset*) whose supply is programmed and enforced by a blockchain or similar consensus network. They are different from centralized web services in that the service is produced by a network of independent peers who collaborate to provide some utility in exchange for these tokens. On the other side, to consume the service, users must hold and 'spend' the tokens. Tokens are freely tradable on exchanges around the world, so they're priced by the market. As a result, the price of a token increases in value together with increasing usage.

The first thing to note is that the entire technology stack is open source: the hardware, the software, the network and, now, the data. In order for independent, anonymous nodes to collaborate effectively on providing a consistent service, they must necessarily share the data among themselves. And in order to create a large scale decentralized service, the protocol must allow anyone who downloads the software to become a node and get a copy of the database. It becomes impossible for any single party to monopolize the data, breaking data monopolies as a result.

This innovation is like transistors, microprocessors, linux and the web in that it collapses the production costs of technology by using open source alternatives. In this case, crypto collapses the cost of building and scaling information networks by replacing centralized coordination with universal financial incentives.

Core developers build and maintain the open source software that facilitates the service, while cryptoeconomic incentives, if done right, incentivize independent third parties to deploy and scale the infrastructure. It also attracts an army of users, developers and entrepreneurs who are motivated to grow the network by promoting it to their friends, contributing code, and starting companies "on top" which make use of the underlying protocol: they all share an interest in the network, and collaborate directly and indirectly to make it a success. It's a high-leverage business model which provides the potential to reach unprecedented levels of scale at near-zero capex for the innovators.

We've also realized how inefficient the joint-stock equity industry model is at accounting for and distributing the real value created by online networks. The value of a share of stock is necessarily a function of profits; the price of Twitter's stock only reflects Twitter Inc's ability to monetize the data – and not the actual worth of the service. Tokens solve this inefficiency by deriving financial value directly from user demand as opposed to "taxing" by extracting profits.

Most of the use cases today involve compensating machine work (transaction processing, file storage, etc.) with tokens: the building blocks of decentralized applications. But the greatest long-term opportunity is in networks where tokens are earned by end-users themselves. For instance, Steem[2] is a social media network similar to Reddit, where users earn tokens (worth real money) as they add valuable content to Steem's media blockchain. Now, thousands of users worldwide share in the financial value they help create as they interact online.

Crypto provides a new mechanism for organizing human activity on a global basis using programmable financial incentives. It's an opportunity to design information networks which can achieve unprecedented levels of scale by decentralizing the infrastructure, open sourcing the data, and distributing value more broadly. What we've discovered is the native business model of networks – which, as it turns out, encompass the entire economy.

3. How we invest

We fund the development of decentralized information networks coordinated by a scarce cryptoasset – or *token* – native to the protocol. Our thesis is that decentralization and standardization at the data layer of the internet is collapsing the production costs of information networks, eliminating data monopolies and creating a new wave of innovation. Cryptonetworks accomplish this by replacing expensive, centralized coordination (e.g. PayPal) with universal financial incentives (e.g. Bitcoin). These networks introduce a new, natively digital asset class which shifts value away from equity in companies to tokens in decentralized networks[3].

Bitcoin and Ethereum are attracting an influx of new capital and talent, but the market is still immature and the opportunity remains fresh. Despite the liquidity of cryptoassets, underlying products and teams more closely resemble the profile of a risky and volatile seed stage startup than a publicly traded company.

[2] http://steem.io
[3] http://usv.com/blog/fat-protocols

Key to our strategy is building close working relationships with entrepreneurs by adding value to their team. In turn, these relationships help inform how we build, value and scale the portfolio over the Fund's life.

We invest early and build positions over time. A committed capital structure allows us to make long-term commitments and injects both use-case and time diversity into the portfolio. This approach allows us to invest proactively and evolve our thesis with the market as the opportunity develops, versus the inherently reactive style of continuously rebalancing a fully-invested portfolio to keep up with the many abrupt changes in the industry. We believe investing slowly and with conviction around a thesis is the best way to discover the opportunities that will achieve global scale and deliver the highest long-term value to token holders.

We expect to make a relatively small number of investments (15-20) over a four-year investment period, with initial check sizes within the typical Seed to Series A range. Our collective experience as a partnership, combined with the scale of our personal networks more broadly, is particularly useful in key areas like governance, cryptoeconomic protocol design, community management, strategy, and organizational development.

We prize collaborative relationships with our LPs, entrepreneurs, and fellow investors. Like ARK and USV, we believe open sourcing our knowledge and sharing our ideas attracts the best entrepreneurs and builds a strong community around the firm. We collaborate extensively with fellow firms such as USV, a16z and BlueYard (to name a few), which share our long-term view on the opportunity.

4. Market structure

We segment the market into three layers: *infrastructure protocols*, *decentralized applications*, and *user interfaces* (a simplified evolution of Joel's 2014 *The Blockchain Application Stack*[4]).

[4] http://joel.mn/post/103546215249/the-blockchain-application-stack

Infrastructure protocols offer a discrete service most directly useful to developers. The tokens within these protocols provide access to important components such as identity, compute, storage, bandwidth, transcoding, and so on. At this layer we find low-level blockchains which are differentiated by scale, security and consensus mechanisms. Some protocols are built on top of these low-level blockchains, providing an additional service provisioned by a different network of 'miners,' but using an underlying low-level chain for enforcing cryptoeconomic consensus. For example, Bitcoin and Ethereum both have their own blockchains, while Filecoin, 0x and Aragon use Ethereum's blockchain as infrastructure for *their* tokens.

Decentralized applications or *'dapps'* serve more vertical use cases and cater to end-users. The range of potential applications is infinite: everything that is an information network could be implemented as a decentralized application (and it turns out, most of the economy is an information network of some kind). Dapps rely on infrastructure protocols for key functionality but tie everything together with their own token. They compete on the basis of community, governance and cryptoeconomics.

End users interact with these networks through a variety of independent *user interfaces*. Sometimes interfaces provide additional functionality, but typically do not have their own token. For example, while Steem offers a decentralized Reddit style service as a dapp, there are other interfaces that also leverage Steem's open data to provide their own interface. Similarly, Coinbase offers hosted wallets with additional buy/sell functionality. Wallets, mobile apps, exchanges, etc. fall into the interface category. They typically employ traditional business models such as advertising, transaction fees or subscriptions.

Financial value and investment returns are distributed as described in Joel's 2016 work on "*Fat Protocols*":[5] tokens at the protocol and dapp layer where services are decentralized and the data is open source accrue significantly more value than the end-user interfaces on top, and provide the highest-leverage opportunities throughout the stack.

[5] https://usv.com/posts/fat-protocols

5. Investing through the technology cycle

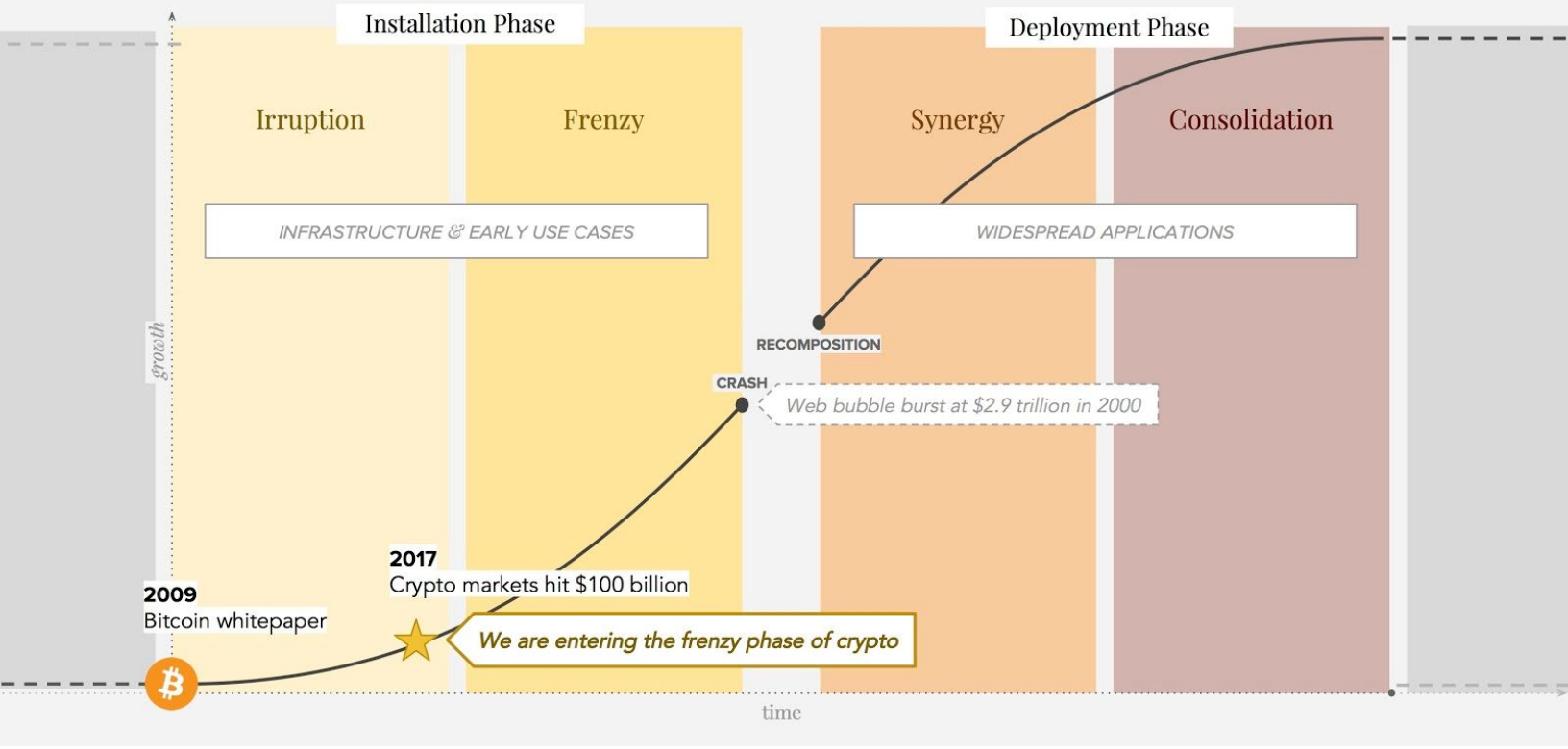
Understanding the drivers of supply and demand is key to developing a long-term investment strategy. Most of the growth we're experiencing today is driven by the supply side of the market. Bitcoin and Ethereum's financial success combined with diminishing returns on the web are pulling more and more entrepreneurs and investors away from consumer web and into crypto. By no means is it trivial to design, deploy and scale a functioning cryptonetwork, but it's so much *cheaper* than trying to compete with Google, Apple, Facebook, Amazon (GAFA), and the potential returns so astronomical that the rush is almost inevitable.

Overall demand for this new kind of online service is coming from a variety of sources. Very broadly, all-time-high levels of distrust in institutions (government, financials, corporate multinationals) together with brewing socio-economic anxiety, driven in part by pervasive wealth inequality with no solution in sight. This lack of trust in the establishment is now extending to GAFA. We trust the networks, but not the operators: their business models are simply incompatible with the long-term needs of users. Cryptonetworks alleviate both of these problems by decentralizing power structures and distributing most of the value to the users in a way that better aligns incentives.

Using the work of Carlota Perez in *Technological Revolutions and Financial Capital* (2002)[6] as a framework, we believe crypto is transitioning from *irruption* to *frenzy*. Through the frenzy, asset prices balloon as financial capital (speculative value) rushes into the market faster than production capital (utility value), bubbling up to an inevitable "crash". But the associated technologies establish themselves as the *new default* and many of the application platforms that come to define the industry emerge during this period. So it's an opportunity for investors with long-term conviction to capture some of the highest returns throughout the cycle.

[6] https://www.amazon.com/Technological-Revolutions-Financial-Capital-Dynamics/dp/1843763311

Timing



The exact timing is, of course, impossible to predict. We do know we're far from the pop: the dot-com bubble peaked at around $3-4 trillion before crashing down to $1.2 trillion in 2000, while the entire crypto space hovers around $150 billion (with the occasional 30% swing in either direction). It's also likely that this frenzy will be much bigger than the web's, mostly due to the global nature of these assets and thereby much larger potential investor base.

Our goal is to capture some of the returns offered by the frenzy while building a portfolio that will persist through a highly volatile market. The most effective way to manage this risk is to develop the right investment thesis, at the right time, with the right fund structure.

In the current environment, we're more likely to find real utility value in "picks and shovels" services which support a wide variety of use cases. Key developer-side infrastructure like file

storage, content delivery, compute power, GPU flops, and so on (*cryptocommodities*, if you will) are particularly important but remain under-developed. There are also early opportunities in *user-side* infrastructure, in areas like identity, governance, communications and financial services.

We expect a bumpy ride to the top with several corrections on the way. We favor spreading price and risk by building up and averaging out of positions over time rather than speculating on speculation. A committed capital structure with significant capital reserves for staged follow-ons gives us the flexibility to build up our investments independent of market sentiment. We are shielded from having to dump assets on the market to honor redemption requests, avoiding the dreaded "death spiral" which can plague more liquid fund structures.

An important but powerful nuance to understand about this technology cycle that is different from all the previous ones is that cryptonetworks don't *die* the way businesses do. Rampant speculation allowed companies in the dot-com era to raise capital at unsustainable valuations[7] and build organizations with large cost structures supported by investment capital and not revenues; they went bankrupt when the bottom fell out and it became impossible to raise additional capital.

Cryptonetworks don't suffer from the same problem. A significant correction can take out large chunks of the supply side of a network (as happened to a lot of Bitcoin miners following the coin's 85% drop in 2013 and 2014), but as long as one node continues to spin, the protocol lives on. This insight shows the importance of selecting properly decentralized systems with the right cryptoeconomic models when investing with a long time horizon. These are the ones that will thrive during the frenzy, persist through the crash, and scale throughout the deployment phase of crypto.

And it goes to show how everything about this space is new, fascinating and unusual.

[7] https://www.forbes.com/sites/greatspeculations/2010/12/13/the-biggest-ipo-flops/#2740e0c16391

6. Sourcing and selection criteria

Our sourcing and selection process begins with our investment thesis. We focus on (1) decentralized information networks (2) coordinated by a scarce token (3) which appreciates in value as user demand for the service grows. We believe these kinds of networks are going to generate the highest returns; we avoid equity businesses with traditional revenue-based business models, centralized services that use a token purely as a fundraising mechanism or payment method, private blockchains, and other implementations that would not be described as "open."

The relationships we build with teams is our greatest asset, so we select investments where we can be a partner to the core development team and work to become prominent members of their community. This founder-focused approach to investing has three advantages: (1) it evolves our investment thesis as the market develops through real-time inputs from the entrepreneurs (2) builds our reputation in the space as value-add investors, exposing us to more proprietary deal flow and (3) informs how we build up (or scale down) individual positions over time. Our long term edge comes from the direct support we provide to entrepreneurs and their communities on protocol design, cryptoeconomics, strategy, and governance.

Strong technology is particularly important at the infrastructure layer, where new consensus algorithms are being developed and the potential for edge case game theoretics may arise. Since these are open source systems, it is important that the team building and curating extends beyond the core developers and into a broader community of contributors. It is, however, not the primary driver of value and defensibility in these networks. Because all the software is open source, there is no long-term defensibility in the code (or data). We've seen teams with strong technology come to market, only to have a clone steal it from under them. Usually, this happens as a result of bad governance on the part of the core developers, which the market finds a way to punish.

Users defect from badly governed platforms, putting pressure on the developer team to follow the interests of the community. Given how the open source nature of cryptonetworks extends to the data layer, it is possible to *fork* (i.e., copy) an entire service, including its data, and start a competitor. If the promoters of a fork are able to recruit parts of the community and grow *their* network independently, the original implementation may begin to lose market share. Hence, it is critical to select founders with strong leadership and community management skills.

The ideal team looks different from that of a traditional business: open, transparent, inclusive and collaborative management styles succeed over traditional hierarchical management. Involving the community in protocol development and decision-making, and empowering them through proper implementation of community governance mechanisms is key to building loyal and engaged communities that will support a token over the long-term.

Domain expertise and the ability to execute continue to be important, but so is selecting teams led by founders whose commitment to the promise of decentralization is far greater than their desire to make money. The current market is fraught with opportunists looking to make a quick buck. But founders who are motivated primarily by profit are more likely to focus on short term appreciation (substantiated or otherwise), rather than creating long-term value for the network. We learn a lot about a team by exploring their theses, their track record within the space, and their knowledge of crypto history. Day trippers may convince fast money, but can't engage and lead communities.

The next thing to evaluate is a network's *cryptoeconomics*, which refers to the rules and policies that govern the behavior of its token, most importantly how it is created, distributed and earned. For example, Bitcoin's cryptoeconomic model dictates that (1) there will be a maximum of 21 million bitcoin, (2) they will be minted over time, at a defined rate, and awarded to miners as coinbase rewards, and (3) free market competition determines transaction fees. The ultimate effect is demand-driven scale in mining, initially subsidized by inflation (e.g. coinbase rewards), which has facilitated the rapid build-out of Bitcoin's legendary infrastructure security.

A cryptoeconomic model is to a network what a business model is to a company. It can also be thought of as its "monetary policy." The long-term success of a token relies heavily on the quality of the design and implementation of its cryptoeconomic model. The market will select the protocols which provide the greatest benefit to the greatest number of people, so we pay special attention to the distribution of value across the community, the founding team, and the investors. Protocols which shift more value towards the users are more likely to succeed than those which over-concentrate value in a small group of developers or investors (including ourselves).

When evaluating cryptoeconomic models, we focus on a number of variables like transaction volumes, currency velocity, token supply schedule, savings rate, and other related factors. Modeling how these variables interact with each other as the network scales reveals the fundamental drivers of value in a network, along with possible flaws in the economics. This work is also useful for evaluating how to build up or scale down our position later in the lifecycle of an investment, when the assets are liquid.

Cryptonetworks are less like companies and more like small emerging economies. A useful analogy is to think of a network as a country which produces a single exportable good:

1) The consensus protocol is the constitution
2) The community is the constituency (miners are the supply side, users the demand side)
3) Core developers are the executive branch: they write the code and execute the strategy, but any changes to the protocol require approval from the constituency
4) The token is the internal currency
5) The investors underwrite the currency

These analogies are useful for understanding where to look for value in a token. From a diligence perspective, we can better appreciate what makes a good cryptonetwork by porting over some of

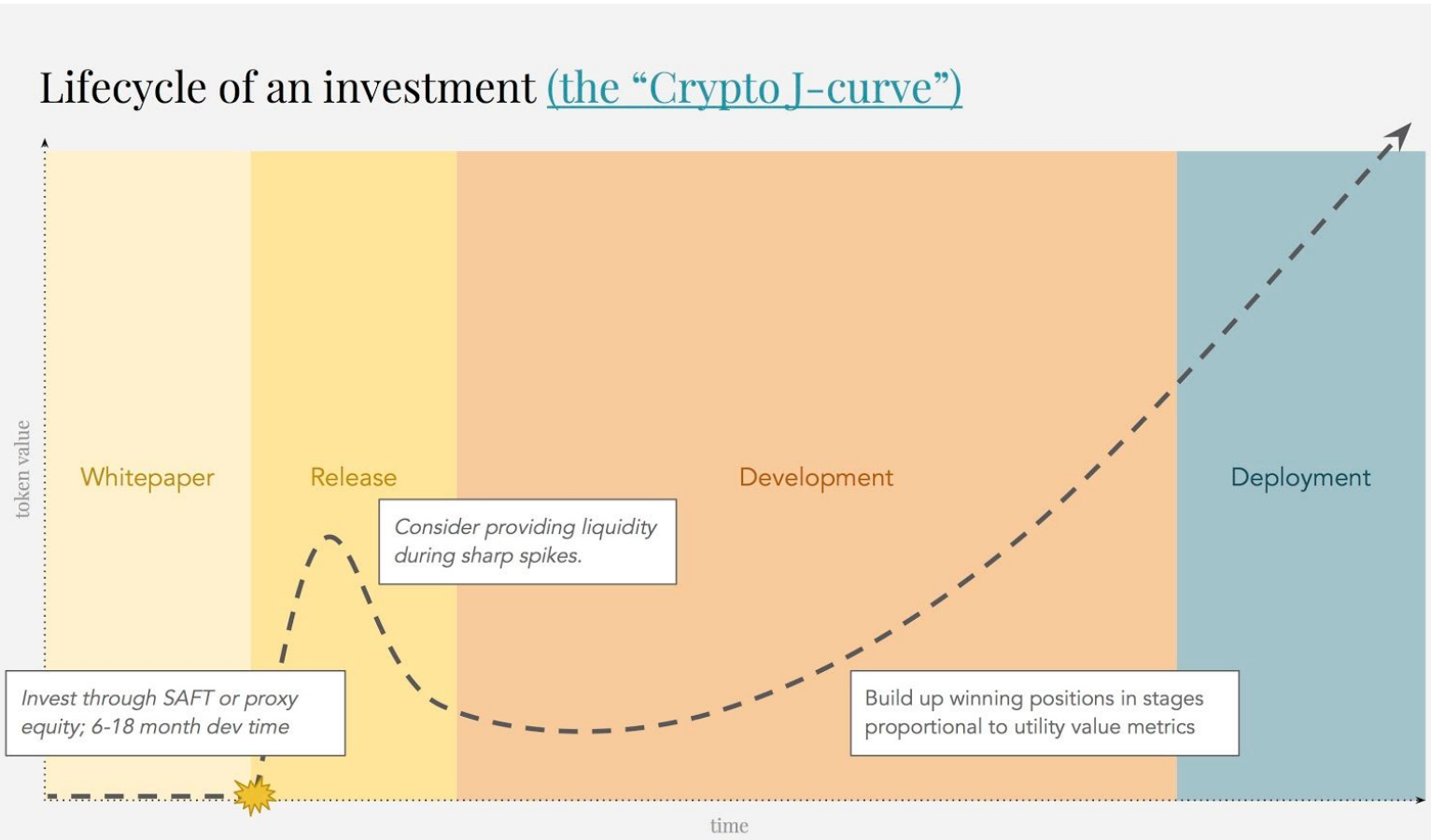
the criteria for evaluating a national economy: good governance, sound monetary policy, low corruption, low inequality, productivity trends and so on.

Since we make a limited number of investments in a given year, our selection process involves everyone in the investment committee and new opportunities are subject to a lengthy due diligence process. We aim to develop a deep understanding of the monetary policy, valuation drivers, and key performance indicators as the network evolves. We also forge working relationships with core developers as we get involved in the design process. We then leverage this understanding to inform how we build the portfolio over time, independent of market sentiment.

7. Lifecycle of an investment

Chris' *Crypto J-curve*[8] analysis describes three stages in the life of a cryptoasset. The *whitepaper stage* is where the team works to define and implement a "minimum viable protocol," which validates the network's functionality. The *release stage* is when a cryptonetwork's token is first made available to the public, and the *public stage* when the token begins trading on exchanges.

[8] https://medium.com/@cburniske/the-crypto-j-curve-be5fdddafa26



During the whitepaper stage, developer teams often (but not always) raise private capital to fund initial development by "pre-selling" tokens, potentially at a discount to their eventual release price. These funds allow the team to build the protocol.

The token can then be released to the public in a variety of ways: progressively through mining, via an ICO, an "air drop", and other combinations. But it takes a long time for utility value to pick up and begin supporting the token's price, during which time the protocol continues to be in active development. On its way to maturity, a network may fork several times as the protocol evolves, communities diverge, and so on, causing price volatility. Ultimately the network converges to an "equilibrium state" where the protocol is stable and the long term value of its currency is supported by actual increasing demand for the service.

We continue to work closely with core developers following the release and actively involve ourselves in the community. This work helps us understand the *people* behind the token – in particular, we pay attention to the ratio of users vs. speculators, and how that ratio evolves over time. We also become a "node" on the network when it goes live, which gives us a direct view into its performance outside of the market for its token. This helps us understand the rate at which the network's utility value is growing independent of the price of its token, which in turn informs how we build up (or scale down) positions over time.

Unlike a traditional venture fund, the decision *to sell* falls on us. Of course, it is impossible to define a perfect point where it is a good time to exit any position. Internally, we use a simple heuristic for deciding when to exit: we look for the moment when the thesis is fully played out and the protocol's vision becomes reality. For a cryptonetwork like Steem, for example, that might be when the service grows to surpass Reddit; for Filecoin it might be when millions of machines support the network.

Also new is the possibility of voluntary early exits, which could affect how we build the portfolio in interesting ways. In venture capital, it's difficult to get out of a bad investment. In crypto, the range of options extends from simply selling the position in the open market, to promoting and funding a fork of the network if we continue to believe in the protocol and its community but lose faith in the core developer team.

8. Value and valuations

This is a brand new asset class with fundamentally different drivers of value that are poorly understood today. The first step in making sense of the numbers is to remind ourselves that cryptonetworks are not companies, and that few of the tools and principles we've developed over generations of equity investors apply to this market.

A share of stock represents a proportional right to a permanent stream of cash flows generated by a business, meaning it derives all of its value from profits and margins. Tokens are more like national currencies in that their value tracks the overall activity within a network.

Classic macroeconomic models turn out to be quite useful in this context. For instance, we can apply the equation of exchange (MV=PQ) to a network model to reveal how elements like velocity (how often a unit of currency turns over in a given time period) may affect the price of a token as the network scales.

We've been working on this problem since 2015 (or about 20 crypto-years). Chris' recent post on the topic[9] goes a bit into the history, and much deeper into how we apply these insights to build network models that help us identify the right metrics to track. These are all experiments, bound to change as our understanding of the industry evolves, networks scale more, and new use cases emerge. Eventually we'll understand crypto as well as we understand equities; between now and then, we will continue driving the conversation.

[9] https://medium.com/@cburniske/cryptoasset-valuations-ac83479ffca7