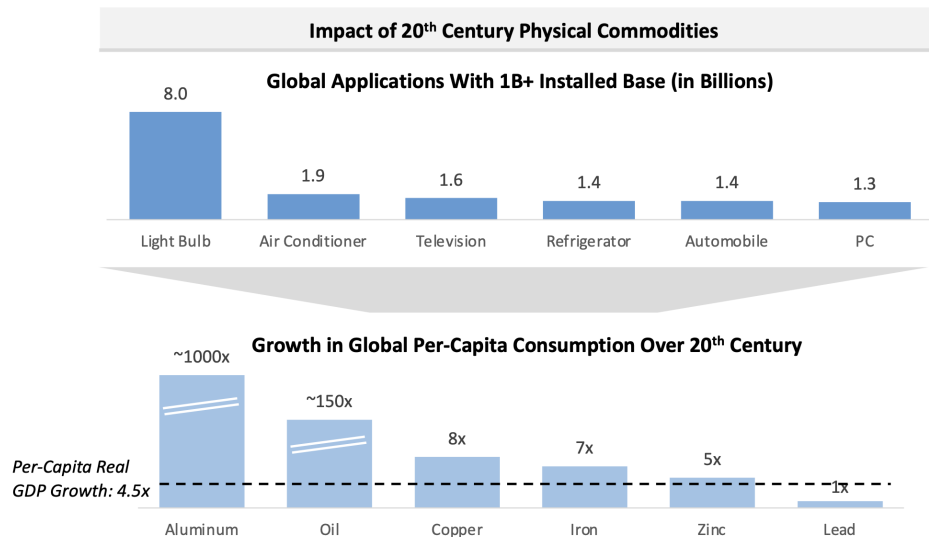


On Investing In Digital Commodities

Crypto-networks will bring a renaissance in human innovation and improvements in quality of life. When we put on our most patient, future-looking glasses, what kind of impact can we see crypto having over the coming decades?

What does it mean to invest in digital commodities? With our rose-colored glasses on, let's consider the impact that *physical* commodities had on humanity in the 20th century.

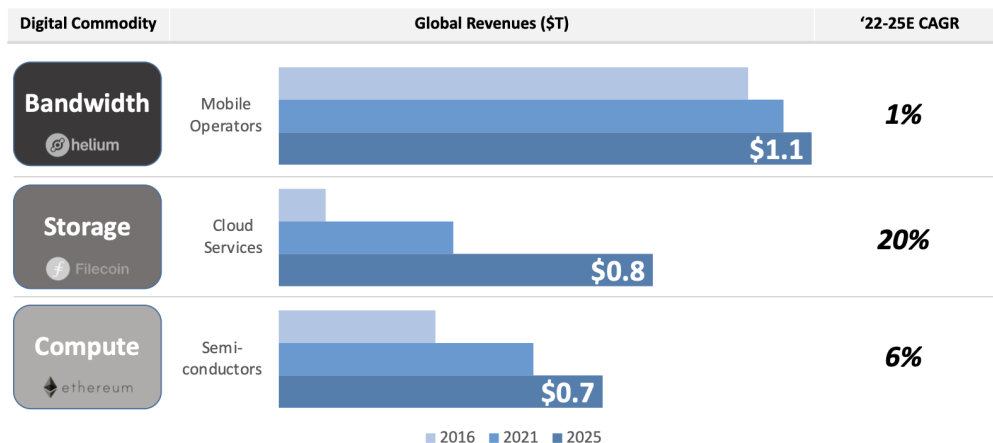


Per-capita real GDP increased by 4.5x over the course of the century. During those 100 years, entrepreneurs and industrialists figured out how to turn newly-discovered commodities, such as aluminum and oil, into use cases that would reach billions of people. Image life without light bulbs, air conditioning, refrigeration, television, cars, planes, computers, or smartphones... 4.5x is surely an underestimate for how much “better” our lives are relative to our great-great ancestors.

Mass-producing these new products drove significant increase in per-capita consumption of physical commodities - in some cases, as much as two- (copper), three- (oil), or even four (aluminum) orders of magnitude on a global basis. While many underlying commodities experienced exponential growth, they all served three primitives: motion (moving matter), materials (transforming matter), conductivity (communicating via matter).

So-called “layer 1” crypto-networks provision **digital commodities**, and - we believe - will drive a similar global wealth effect for humanity over the coming decades, as physical commodities did over the 20th century. Digital commodities do the same thing for bits that physical commodities do for atoms. The digital version of motion (moving matter) is **compute** (moving bits): layer-1 blockchains like Ethereum, Solana, or Binance Smart Chain provision compute. The digital analogue to materials (storing entropy in matter) is **storage** (storing entropy in bits): layer-1 blockchains like Filecoin, Arweave, and Sia provision storage. The digital analogue to conductivity (communicating via matter) is **connectivity** (communicating via bits): layer-1 blockchains like Helium, Pollen, and XNET provision connectivity.

Each of these markets represent market opportunities in the hundreds of billions of dollars.



While it's helpful to intuitively categorize commodities, it's not clear what qualities define a commodity. Smarter folks than us have identified three such qualities: **usefulness**, **fungibility**, and **combustibility** (Ondatjee, 2017). All of the physical commodities listed above satisfy these properties. A barrel of oil is clearly useful: it can powers your car or home; it's clearly fungible: within a certain grade, i'm indifferent as to which specific barrel I own; and it's clearly combustible: i can only use it once.

ETH, or SOL, and your favorite L1 token generally try to satisfy these three properties: they're useful because they enable you to use apps on the network with some guarantees of censorship-resistance; they're fungible by nature of token standards; and they're combustible, since using the network requires burning tokens. (caveat: not all L1s are designed this way, and this assumes post-merge ETH).

	Commodity	Use Case	Useful?	Fungible?	Combustible?
20th Century Physical Commodities	Oil and Gas	<i>Motion (Compute)</i>	✓	✓	✓
	Aluminum and Steel	<i>Materials (Storage)</i>	✓	✓	✓
	Copper and Gold	<i>Conductivity (Connectivity)</i>	✓	✓	✓
21st Century Digital Commodities	ETH and SOL	<i>Compute (Motion)</i>	✓	✓	✓
	FIL and AR	<i>Storage (Materials)</i>	✓	✓	✓
	HNT and PCN	<i>Connectivity (Conductivity)</i>	✓	✓	✓

Let's assume we're right about digital commodities, and have correctly categorized them into three primitives of **compute**, **storage**, and **connectivity**.

Can we find evidence for the same types of killer use cases as physical commodities enabled in the 20th century? Well, more than 4 billion people use e-mail and social networks. More than 3 billion people play video games. More

than 2 billion people use Youtube every month. Judging by a 1B+ users threshold, clearly digital commodities can enable killer use cases similar to their physical commodity counterparts.

We believe the coming decades will see even more billion-user digitally-native use cases. Entrepreneurs building autonomous vehicles, smart homes/cities, industrial IoT, crypto gaming, and metaverse startups all believe in a version of the world where they've unlocked the next great billion-user app.

But the road to hell is paved with good intentions: many technologies ultimately prove overhyped or uneconomic, despite having talented entrepreneurs and well-funded investors. However, there's a common thread - in Josh Wolfe's words, a directional arrow of progress - that unites virtually all technology entrepreneurs and investors: that future generations will use digital apps that consume massive amounts of compute, storage, and connectivity.

From where we're sitting, it doesn't look like a bad bet: from 2016 to 2021, global internet traffic grew at a 35% CAGR, while global population grew at a mere 1% CAGR, implying that per-capita internet traffic has more than quadrupled in the past half-decade.

On Crypto Value Accrual

As fundamental, long-term investors, our job is to figure out how to stand to gain the most - on a risk-adjusted basis - if our thesis proves correct, and crypto-networks become the backbone of compute, storage, and connectivity for the global technology industry.

Outside of a notable exception - Bitcoin - the vast majority of developer activity, venture funding, and network value has accrued to **compute** blockchains. Excluding stablecoins, every top-10 cryptoasset by network value is a compute-focused layer-1 chain. As of the time of writing, there's more than \$240B of network value across the top 5 crypto-networks in this category alone (ETH, BSC, SOL, ADA, and DOT). Venture investors showed their appetite for these networks in 2021 and early 2022, funding large rounds into protocols like Terra (\$1B), NEAR (\$350M), Avalanche (\$230M), Aleo (\$200M), and MINA (\$92M). Perhaps it's no surprise that more than half of the rounds listed in the previous sentence were led by Three Arrows, who was revealed to be fatally over-leveraged a few short months later.

Despite the \$240B of value attributed to compute-focused blockchains, crypto markets value blockchains provisioning connectivity and storage at less than \$5B... combined. The market leaders in connectivity - Helium and Pollen - are valued at \$1.1B and \$0.2B, respectively, and the market leaders in storage - Filecoin and Arweave - are valued at \$1.4B and \$0.5B network value, respectively.

When markets dramatically over- or under-price assets, there's often a hidden culprit: "multiples". Despite some usefulness, multiples are too often used by investors to rationalize lazy thinking. Multiples are backwards-looking, or, in the case of forward multiples, only as good as your forward projections. Rational investors should care about the discounted future expected utility (or cash flows) of crypto networks, not backwards-looking multiples.

According to [watchtheburn.com](https://www.watchtheburn.com), trailing 7-day Ethereum usage was \$24M, or roughly \$1.3B annualized. At the current network value of \$170B, ETH is priced at roughly 130x its network cash flows.

In [previous letters](#), we presented an argument for why data credits burned for data transfer is the correct “cash flow” or “net revenue” metric on which to value Helium. Unfortunately, at the time the best available data suggested Helium’s LoRa network was generating \$100K of annualized cash flows, growing 20x YoY. Recently, Helium’s core developers announced the discovery of gaming of a data credit faucet, which was overstating the on-chain metrics. Now that most of the gaming is being prevented, cash flows from Helium’s LoRa network have fallen below \$33K annualized, with no meaningful growth over the past twelve months. At Helium’s current \$1.1B network valuation, crypto markets are applying a 30,000x multiple for Helium’s LoRa cash flows — **in other words, 250x more expensive than ETH on a multiples basis**. Pollen, a new DeWi network that’s fully-focused on 5G, is similarly valued multiple orders of magnitude more expensive than ETH on a cash flow multiples basis. PCN is trading at a network value of \$0.2-0.3B in OTC markets, admittedly with thin liquidity, while presumably generating negligible organic cash flow given there are less than 320 active Pollen SIMs on the network ([honeybees](#)).

So, maybe the market isn’t so crazy after all: while DeWi networks have massive growth potential, the traction is so early, i.e. the cash flows are so risky, that a total network value of <\$2B is an appropriately priced option on the success of DeWi. In other words, connectivity blockchains *should be* valued at <1% of compute blockchains.

We disagree. While investing in the leading DeWi networks on a “multiples” basis looks insane today, consider the following:

- Dish disclosed a [partnership](#) with FreedomFi, a company leading the Helium network’s expansion into 5G, in Dec-2021, announcing “DISH and FreedomFi will also actively work on a bilateral roaming agreement.” FreedomFi’s original [2022 roadmap](#) suggested that 3+ offload partners would be announced by Q2’22, meaning there could be latent announcements coming in H2’22.

Dish Network announces pilot program with FreedomFi

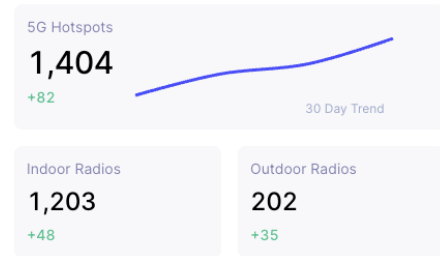
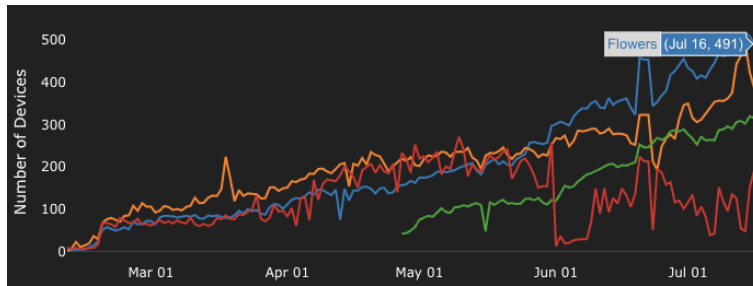


News Wire Feed
LIGHT READING
12/16/2021

BOULDER, Colo. – DISH (NYSE:DISH) and FreedomFi, an open 5G networking company, will collaborate on a pilot program that may provide DISH’s current and future wireless customers with access to the world’s first community-driven, neutral host CBRS hotspot network. This collaboration furthers DISH’s position that the next generation of wireless networks can be cloud-native open source platforms, leveraging OpenRAN.

Open source platforms unlock innovation among developers - providing better and faster-to-market products and services. The collaboration between DISH and FreedomFi will help encourage individuals and communities to take part in their connectivity future.

- Helium’s 5G network has already grown to 1,400+ indoor and outdoor radios online, adding 80+ radios in the last thirty days (6%+ MoM growth). This growth has come before the official launch of token incentives - Helium is launching 5G incentive rewards [in July](#) which will further accelerate growth. For comparison, Pollen’s 5G network which has been live with incentives since February, has grown to 500 outdoor radios, and is adding 130+ radios in the past thirty days (35%+ MoM growth).



- Nova Labs' founder made a public bet in Helium's Discord channel suggesting that at least one US nationwide carrier with 200K+ users will be roaming onto Helium's 5G the network by the end of 2022.



In addition to underpricing the near-term potential for organic cash flows from roaming agreements with national carriers, crypto markets are fundamentally handicapping the long-term potential of connectivity blockchains.

Compute blockchains provide censorship-resistant (or, in their weaker form, credibly-neutral) compute. As far back as 2018 [critics](#) have dismissed compute blockchains by portraying them as “AWS, but 10,000x+ more expensive (per computation)”. The truth is, censorship-resistance blockspace turns out to be quite expensive (credibly-neutral blockspace, less so...) - and that's exactly why it's valuable. In Vitalik's [words](#), decentralized blockchains exist to be “a light in dark places, when all other lights go out.” Compute blockchains make users *pay* for censorship-resistance.

Blockchains are being used every day by unbanked and underbanked people, by activists, by sex workers, by refugees, and by many other groups either who are uninteresting for profit-seeking centralized financial institutions to serve, or who have enemies that don't *want* them to be served. They are used as a primary lifeline by many people to make their payments and store their savings.

And to that end, public blockchains sacrifice *a lot* for security:

- Blockchains require each transaction to be independently verified thousands of times to be accepted.
- Unlike centralized systems that confirm transactions in a few hundred milliseconds, blockchains require users to wait anywhere from 10 seconds to 10 minutes to get a confirmation.
- Blockchains require users to be fully in charge of authenticating themselves: if you lose your key, you lose your coins.
- Blockchains sacrifice privacy, requiring *even crazier and more expensive technology* to get that privacy back.

What are all of these sacrifices for? To create a system that can survive in an unfriendly world, and actually do the job of being "a light in dark places, when all other lights go out".

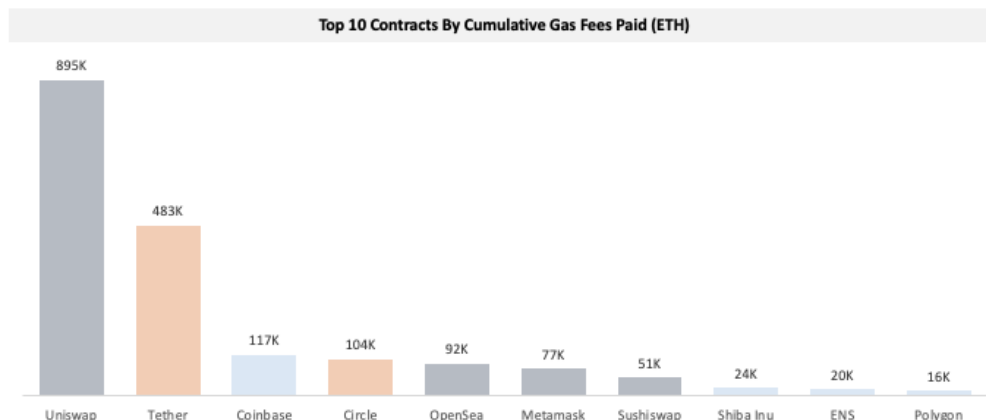
Vitalik Buterin, "In Defense of Bitcoin Maximalism"

This has two unfortunate barriers for mass adoption:

- At the current limits of blockchain scalability, censorship-resistance is prohibitively expensive for many real-world economic activities. A simple token swap costs \$3.75 on Ethereum's mainnet, or \$0.18 on leading layer-2 scaling solutions (Arbitrum/Optimism). Assuming a 1.5% fee tolerance by users, this level of fees prices out any transaction with economic value below \$250 on mainnet or \$12 on rollups.
- The general public are not used to paying for "security". The status quo is for citizens to take on embedded tail risks of censorship and centralization. Infractions don't happen often, but are extremely costly when they do (e.g., government data rights abuses or foreign election interference via social media platforms). People generally experience these events and think "I couldn't have known it would happen to me", they don't think "I should have protected myself against this risk". Paying for security requires new behavior from users.

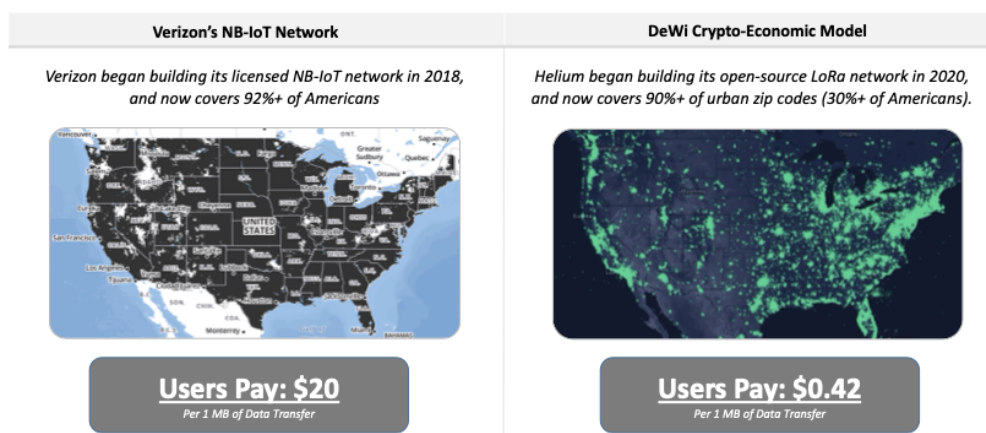
This has led to little real-world economic activity moving onto blockchains thus far, despite the 2018-era promise of redefining finance, healthcare, social media, and other global industries. The most successful applications built on Ethereum, in terms of demand for the underlying commodity of ETH, have been for crypto-native use cases like exchanging tokens and NFTs (Uniswap, OpenSea, Metamask).

A notable exception has been stablecoins, which are perhaps the only truly mass-market real-world use case for crypto today. Tether and Circle, the two largest stablecoin issuers, are both top-5 applications on Ethereum in terms of cumulative gas fees (although still not as big as Uniswap).



Despite all these challenges to addressing real-world economic activities, **compute blockchains** are currently valued at more than \$250B+ of combined network value...100x+ higher than **connectivity blockchains**. We think this is backwards: all else equal, connectivity blockchains should be valued at a premium to compute blockchains. Why? While users of compute blockchains *have to pay* for censorship-resistance, users of connectivity blockchains *get paid* for censorship-resistance. By nature of decentralized wireless networks, they operate at structurally lower costs than traditional alternatives.

These aren't fairytale future economics: TODAY, Helium's LoRa network provides coverage to the >90% of urban Americans at \$0.00001 per data credit (at HNT's current market price, this implies a price of <\$0.50 per MB). Per publicly-listed pricing, transferring data on Verizon's comparable NB-IoT network is 40x more expensive. Helium's 5G network is a similar story, although coverage is still nascent: users pay \$0.50 per GB of data transfer, which is 5x cheaper than consumer pricing at traditional telcos.



For crypto investors who've spent past years investing in compute blockchains, DeWi sounds too good to be true. How can you afford to *pay for security* while simultaneously being *cheaper* than centralized alternatives? But by pushing costs out to the edges of the network, DeWi networks can actually provision bandwidth at radically lower production costs relative to TradWi.

DeWi has a structural cost advantage: on a long-enough time horizon, it's simply inevitable... without needing any change in how people use and pay for bandwidth.

	Traditional Telco Model: Top 3 US MNOs ¹	DeWi Crypto-Economic Model
Land & Equipment	<ul style="list-style-type: none"> \$260B of balance-sheet PP&E required to generate \$380B of revenues (~1.5x fixed asset turnover) 13% of revenues spent on non-spectrum capex (\$50B annually) 	<i>Third-party miners buy hardware (potentially with leverage) and incur their own incremental rent (potentially zero). At the network level, net revenue == free cash flow.</i>
Funding	<ul style="list-style-type: none"> \$400B of debt outstanding (~1.5x D/E); deleveraging has driven \$25B+ of tower asset sales, further reducing margins 4% of revenues spent on interest expense (\$15B annually) 	<i>Token structure rewards router operators (miners) with network "equity". Leverage exists at the miner level, with no systemic leverage in the protocol.</i>
Labor	<ul style="list-style-type: none"> 400K full-time employees needed to generate \$380B of revenues (<\$1M per FTE) 23% of revenues spent on SG&A (\$85B annually) 	<i>Miners incur their own labor expenses in cash and/or company equity. The most efficient miners build a long-term structural advantage.</i>
	<div>LoRa Users Pay \$20/MB</div> <div>5G Users Pay \$2.50/GB</div>	<div>LoRa Users Pay \$0.42/MB</div> <div>5G Users Pay \$0.50/GB</div>

To summarize:

- **Digital commodities** provision three primitives: compute, storage, and connectivity. While these three are similarly sized markets in the global economy (\$0.7-1.1T in 2025 revenues), crypto markets value connectivity blockchains at less than 1% of compute blockchains.
- **Compute blockchains** provide censorship-resistant compute, which is much more expensive than traditional centralized compute (AWS). This has limited real-world economic activity on-chain to date. Instead, crypto's killer apps have primarily been native to crypto (e.g., token offerings, NFTs).
- **Connectivity blockchains** provide censorship-resistant bandwidth, at much lower costs than centralized network operators. Users aren't forced to choose between high costs and decentralization: it's a no-brainer, because the decentralized version is *structurally* cheaper.
- **DeWi networks**, specifically Helium, are showing signs of a potential aggressive ramp in network cash flows over the next 12-18 months via 5G roaming offload agreements with national carriers. Assuming a similar valuation multiple to ETH (130x), it would only take \$8M network cash flows to justify Helium's current \$1.1B valuation.

At less than \$2B of aggregate market cap between Helium and Pollen, or <1% of the market cap of compute blockchains, we're confident crypto markets are underpricing DeWi's potential, with potential catalysts to drive meaningful network cash flows over the next 24 months.

Escape Velocity is actively investing behind our DeWi thesis and working alongside founders and communities to de-risk and scale these networks. If you're an entrepreneur building in DeWi, please reach out. You're building the rockets, we try to provide some fuel along the way 🚀

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