

Changing Hands

The Future of Blockchain Peer-to-Peer Economies



From gritty dollar bills changing hands in bustling New York side streets to financial securities silently finding new owners in frigid Hong Kong server farms, value transfer is a ceaseless activity around the planet. Since the early stone coins of Yap islanders, through the latest cryptocurrency offered on virtual exchanges, humans have demonstrated an endless capacity for devising new ways to create value and trade it with peers. With the rise of blockchain technology, we're seeing not just new kinds of currency, but the emergence of an entirely new digital economy, one that enables peer-to-peer transactions and eliminates the need for third-party facilitators. These emerging decentralized value transfer networks will empower disenfranchised populations and global giants alike.

Transactions at every scale will be inscribed in chains of immutable digital records. They will be broadcast from nanoscale bots, parsed and organized by scrappy entrepreneurs, and broadcast to distributed watchdog organizations for auditing. Humble merchants will prop up their first digital storefronts using free or low-cost enterprise-grade platforms. Granular monetary tokens of all kinds will flow like water between machines, people, and autonomous algorithmic agents.

Controversial applications of these newfound powers will meet intense opposition from



established authorities and communities. Regulators and law enforcers at all levels will struggle to regain control over capital routed through encrypted alleyways. Communities will push for economic designs that protect them from collapse and exploitation at the hands of malicious actors.

Through the chaos and coordination, we will enter an unprecedented ecosystem of frictionless financial activity, one that transcends borders, routes around censorship, levels playing fields, and directly connects transactors, both human and machine.



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You Are Not the Product: Decentralized Marketplaces



Brian Hoffman is CEO of OB1, the parent company of the decentralized P2P marketplace OpenBazaar.

Today's online retailers are like traditional big box outlets, scaling commerce at the expense of supplier control. New peer-to-peer markets like **OpenBazaar** connect merchants with customers directly, using cryptocurrency for unmediated payments.

Q Why does something like OpenBazaar need to exist?

Hoffman: Because places like eBay and Amazon have evolved into rent-seeking organizations. They've created an online shopping mall and are taking a healthy cut. But these kinds of structures can be built in a peer-to-peer decentralized fashion that doesn't have the overhead costs that Amazon and eBay charge. In OpenBazaar you're distributing the workload across all the users, and you can eliminate those rent fees. If you're selling tens of thousands of dollars of goods each month and paying 15% to Amazon, you'll get to keep that from now on.

Our idea was to take the peer-to-peer technologies we've seen with BitTorrent and Bitcoin and replace incumbent marketplaces with something that's unstoppable. It's a completely decentralized tool owned by no one. While darknet marketplaces aim to bring more freedom to people around the globe and let them do whatever they want, they are squarely focused on drugs and weapons and the like. The concept of OpenBazaar is to expand into a broader worldwide marketplace that allows anything, not just illicit goods.

“ Every centralized business that exists today will get replicated in the decentralized world

Q Aside from cost savings, what else makes a peer-to-peer structure useful for marketplaces?

Hoffman: The advantage of a decentralized peer-to-peer structure is that data ownership goes back to the users, the creators, the owners. Mainstream users who rely on centralized services like Facebook, Google, and Amazon don't question what's happening to their personal data. Users become a product for the services. Advertising is built off your data that you're funneling into these services, and the services are capturing it all.

When you're using something like Amazon or eBay, they know all your data. They know all your customers. They know what you bought. That's your data, but they're hosting it, and they're using it to benefit themselves. For instance, Amazon will promote their own white label products over a hot selling product that one of their users has. The user has no control over that. In a P2P marketplace the playing field is level.

Q What are some other advantages of a distributed marketplace?

Hoffman: Your business can't be taken away from you or shut down. If your content resides on one server, a bad actor could

figure out how to get that server off the network and then you'd disappear. In a distributed network, like IPFS or Bitcoin, all the data is available to everyone.

It also runs faster. For instance, in OpenBazaar a lot of our merchants are in places with bad internet connections. They don't have the option to set up an Amazon store. They're able to set up the OpenBazaar app, create a storefront, and have all that data get replicated across other nodes in the network that are much faster, in better locations, and geographically dispersed.

Q How will reputation work on peer-to-peer networks like OpenBazaar?

Hoffman: There will be a web-of trust type of model, or something similar to what Facebook uses, where people vouch for others. You can use large sets of data to derive reputation and trust trends and patterns. You tend to see these large networks get better as time goes on because they learn more about their users. At scale, there are clear patterns, and fraud is much easier to detect when you have tens of thousands of people interacting on the network.

Q Are there ways to establish trust in a peer-to-peer economy before it starts scaling up?

Hoffman: There are some game theory schemes that could help, like "double deposits." That's where the buyer and the merchant both put money into escrow. If one party screws up or they come to a deadlock, they both have a countdown to figure it out, or they both lose. The money goes away; it gets burned. Double deposits give you an incentive to be honest in your transaction. It's not based on a reputation score. It's based on you losing financial value. There's a million of these little things that people can try. They haven't been done before, so these are all experiments to some extent.

Q Where will peer-to-peer platforms be in ten years?

Hoffman: If they start taking off, people are going to move to these platforms because they're more transparent and give users absolute control of their business. But it will take good tools and user experiences to make it viable. You can't replicate a YouTube in OpenBazaar right now. It's not built for that, but if someone builds that tool, then it could start attracting those users.

What we see right now is a tiny sliver of what we'll see in the future. If these kinds of trade protocols and other things start to get traction, you're going to see tons of businesses building on top of these protocols. Every centralized business that exists today will get replicated in the decentralized world.

Q What will it take to make that happen?

Hoffman: The technology is too complex right now. Not enough people understand it well enough to create a good user experience around it. It'll take time to build it into something that can be commoditized so non-techies can digest it. We're not there yet.

Allison Clift-Jennings is CEO of Filament, a distributed software and firmware platform incorporating blockchain technology for a decentralized Internet of Things



The Machine-to-Machine Economy

People aren't the only entities that will transact over peer-to-peer networks. Smart devices will also transfer information and money, according to Alison Clift-Jennings, CEO of **Filament**, a company that makes secure standalone networks that wirelessly monitor and control devices and equipment.

Q What happens when machines can start paying each other?

Clift-Jennings: If a machine can pay another machine for its services, then all sorts of interesting things start to happen, just like when you have a bunch of APIs that can talk to each other in software. It will be more efficient than people doing it, and it will probably allow new capabilities for products to be sold as a service or purchased per use. It's probably going to be much more efficient from a landfill and consumption standpoint.

The higher the complexity of the device, the more it makes sense to move to a service-based model. Let's take big, old industries, for example, like oil and gas and energy, construction, manufacturing, etc. Many of these companies are trying to find new service-based capabilities for their cash cows.

We bring up the example of Rolls Royce selling their jet engines per flight hour of time. Since it's such a complex machine, they don't necessarily sell jet engines to airlines. They sell flight hours. They include all the maintenance, all the uptake, all the data acquisition and monitoring and predictive maintenance. All of these things are part of that fee. It's jet engine as a service.

Q What's the benefit of introducing the blockchain into the peer-to-peer economy?

Clift-Jennings: The truth is that it is way easier to use a centralized system. We often joke about that internally: "Gosh, if we were just centralized, we'd be done by now."

At Filament, we have two-fold perspective on this. One is pragmatic and one is philosophical. The pragmatic side is that we've had several discussions with potential Fortune 100 customers who've told us, "We like what you offer, however, you're a scrappy startup and we're a huge company. What happens if you guys implode next year and you're gone? Do these devices brick or worse? What if you get bought by our competitor and your board structure changes and now you are stealing our data?"

The answer that we can give them, is it doesn't matter who runs Filament Inc., because the contractual agreements that are bound fundamentally, cryptographically, to a blockchain, cannot be modified by anyone, including us, the manufacturer of these devices.

In some ways, the blockchain allows us to protect our customers from the future us. Internally, we call this concept "contractuality." It's the ability for devices to establish contractual agreements with other parties. Those contractual agreements—you can call them

smart contracts if you wish—are essentially pieces of code that are self-enforcing, self-executing on the device, and they enforce what can and cannot be done in the time duration for those contractual agreements.

Q And what about the philosophical argument?

Clift-Jennings: We're big believers that the largest successful systems are built or exist in a decentralized fashion. You can look at natural systems, like the brain or ant colonies or swarms of animals, and you'll see very much decentralization. Then you can look at human-made systems, like the internet or other very large systems that are basically lots of small pieces working together as necessary, not top-down designed, not top-down controlled. When you get to a certain scale, it seems that centralized top-down control either starts to fail or there's a lucrative abuse vector that becomes so powerful that people can't keep their hands off it and they end up manipulating it for their own gain, as individual actors tend to do. We believe that when you look at the potential size of the Internet of Things market, with billions of devices, it's probably going to only work well long-term in a decentralized method, in our opinion.

“ The blockchain allows us to protect our customers from the future us ”

Q From a technology standpoint, what are the pieces needed to allow machines to participate freely, efficiently, and properly?

Clift-Jennings: You need some pretty fundamental blocks to be correct or else everything built on top of it starts to fall apart. Hardware needs to have secure cryptographic key storage, like a separate semi-conductor chip with keys you can trust haven't been tampered with. It's a very simple thing—these chips are under 50 cents at volume. It's a requirement if you want to build things on top of it, like device identity verifiability and transaction capability. If you don't have that then everything else falls apart.

You also have to be able to trust data in transit. Basically the networking aspect of this becomes very important. It just so happens that our company worked on a network protocol called Telehash that allows for a lot of the capabilities that are required. There's no server or client concept in Telehash, it's endpoint-to-endpoint. We required very, very strict privacy and security. It gets kind of scary when, in light of the Snowden revelations, what that means for devices communicating.

Meta-data's pretty important too, so we've got to be very careful about what leaks out of these things. If someone sits outside of a warehouse and watches what radio's being sent when, can that infer or suggest things to corporate espionage? There's lots of pieces to this.



BUILDING BLOCKS

The following four building blocks will drive peer-to-peer economies in a blockchain-enabled world. Our journey will follow new **ASSETS** as they change hands through **TRANSACTIONS** at unprecedented scale according to unfaltering **CONTRACTS**, amounting to rich and diverse global **MARKETS**. Each building block points to new possibilities making themselves visible as signals in the present.

ASSETS

Blockchain technology will reinvent the way people store value, helping peers commodify and track virtual and physical assets themselves.

As one of the most fundamental assets in an economy, currency was a natural first application for blockchain architectures. Bitcoin, the first truly decentralized digital money and payment system, uses a blockchain to track sequential ownership records for its namesake digital tokens. Records and accounts are secured using cryptography, giving rise to the term cryptocurrency. Bitcoin also has a mechanism for rewarding payment processors, known as miners, with fresh coins at random over predictable time periods. These miners allow the network to run over the Internet without a central authority, making it open to use by anyone globally without permission or censorship.

Business owners, migrant family members, and criminals will all use highly fungible cryptocurrencies like Bitcoin for international trade and remittances wherever the Internet is available. New markets will emerge as unbanked populations store and invest wealth for the first time. National governments will try to curb capital flight and tax evasion while benefitting from cryptocurrency's use in low-cost, dependable trade. Some nations experiencing financial volatility will consider Bitcoin as a national

currency, or develop regulated national cryptocurrencies themselves.

Since it is designed as open-source software, Bitcoin's code is trivial to copy and modify, allowing developers to create new cryptocurrencies: so-called alternative coins or altcoins. Though early altcoins were largely short-lived speculative assets, new application-specific "appcoins" promise to incentivize peer-to-peer service providers for sharing resources within a blockchain network. Further, people will tie specific cryptocurrency tokens to shares of high-value items like car and home titles, traditional financial securities, and even voting rights. Tokens will be tracked and traded at lightning pace, creating new flows for previously illiquid property. The definition of "net worth" will expand to mean "net resource access," measured by combined token holdings. People will set some tokens aside for immediate use in "hot" wallets, and store the rest securely offline in "cold" storage. They will buy or earn context-specific tokens to transact across numerous insular economies. We will present tokens of all kinds to access things we need.

TRANSACTIONS

Blockchain technology will radically expand the scale and scope of transactions between parties, shifting power and ownership effortlessly.

In a peer-to-peer economy, everyday purchases will be managed directly using personal wallets, as with cash systems today. These wallets can hold digitized fiat currencies, cryptocurrencies, or any combination, making it easy to buy goods or services using the merchant's preferred form of payment. When wallets run low on funds or become too fat, owners will transfer funds to or from secure hardware vaults that are either air-gapped from the network or locked with strong encryption and multi-factor authentication.

Rather than seeking a payment account through a centralized system, people and machines will use sensor-laden technology to pick up a counterparty's receiving address. The process will be nearly effortless, and perhaps even invisible with AI bots to determine transaction intent. Imagine an Amazon Prime Air delivery drone automatically depositing microtransactions into homeowners' accounts to purchase permission to fly over their yards as it makes a delivery in the neighborhood. Homeowners will have readers on their roof, much like a toll road reader, and Amazon's drones will have RFID chips to identify them.

Since cryptocurrencies are defined by code, they can be made infinitely divisible. As a result, transactions need not be an episodic event. Instead, infinitely divisible micropayments will amount to an ongoing flow of value between parties. This enables complex metering opportunities, like pay-per-kilo-

byte Internet, pay-per-call developer APIs, pay-per-electron energy, and pay-per-gaze advertising. Services known as payment channels will allow people to transact off-chain, and periodically settle with the rest of the network on-chain. This approach reduces mining and settlement burden and stands to dramatically increase the pace of possible transactions, making micropayments and other time-sensitive services possible.

Blockchains can even sign, broadcast, and synchronize records for traditional off-chain transactions as well. This capacity will be used to openly track and audit spending by charities, bureaucracies, and companies down to individual payments. Companies will track their supply chains for signed messages from logistics providers and manufacturers, tracing financial and operational issues back to the source. End consumers will use both of these features to make informed purchase and donation decisions, confident that the goods they are buying aren't counterfeited or adulterated and that the charities they are supporting are putting their donations to good use.

Internet-connected devices will pay and charge other devices and humans for on-demand services. They will transact on their own terms according to pre-defined transaction filters. Some will maximize profit. Others will act as non-profits to support equity and access. Still others will stop at nothing to disrupt competitors through criminal or subversive actions.

CONTRACTS

Blockchain technology won't just track value transfers in the present moment. It will also help economic peers state intentions for the future and ensure they are met without fail.

Computer scientist, legal scholar, and cryptographer Nick Szabo first outlined the concept of smart contracts in the journal *Extropy* in 1996. He wrote, "The basic idea of smart contracts is that many kinds of contractual clauses (such as liens, bonding, delineation of property rights, etc.) can be embedded in the hardware and software we deal with, in such a way as to make breach of contract expensive (if desired, sometimes prohibitively so) for the breacher."

With these code-based contracts, any machine would be able to evaluate when conditions were met and take action as a result. Ethereum, a decentralized platform that runs smart contracts, took this concept and applied it to blockchain structures, allowing networked storage and automatic execution of contracts. By distributing information about the state of a contract across many parties, smart contracts will facilitate transfers between peers without the possibility of interruptions, fraud, censorship, or interference by an outside party.

Contract terms will be triggered by events ranging from money put up in escrow to tracked real-world actions. They will rely upon oracles—trusted parties that can attest to the veracity of external sources of information—to confirm actions occurring off-chain and "push" them into the smart contract. Parties to the contract will mutually agree on oracles, which will frequently take the form of algorithmic event observers. For example, people may soon use smart contracts to string together insurance pools with compatible peers. Claims will

link to automobile sensor oracles or human witness oracles, releasing funds if sufficient evidence exists.

Smart contracts will shift forms of value and power far beyond currency. These will soon include document editing privileges, physical infrastructure control, and more. They will hold up privileges and assets in escrow, forming a near-perfect third party for peer-to-peer exchanges. Smart contracts will take their effect by tapping services via APIs and actuating devices through Internet of Things systems.

The potential complexity of contracts presents a unique challenge for the long-term future. Ethereum's scripting language is designed to perform any task modern computing hardware can handle. This means that without explicit fallback procedures, code will execute even if it goes against one's original intent. Smart contracts will become even "smarter" but far harder to parse and understand as artificial intelligence tasks are embedded in contracts. Independent AI agents will be released into the digital wild, generating unthinkable value but increasing the likelihood of unintentional systemic failures.

A contract is only as good as its enforcement. By moving to code-based and encryption-hardened agreements, smart contracts will ensure rigid conditions for compliance. With contracts on the blockchain, promises aren't kept through good will and trust. Instead, they are orchestrated with the watchful eyes of distributed computation.

MARKETS

Blockchain technology will form the basis for new global markets driven by participation without central matchmakers.

At its core, blockchain technology creates markets for decentralized record keeping and computing. Miners, who devote their computers to logging transactions and storing copies of the blockchain, primarily do so to earn cryptocurrency rewards and additional mining fees. Thus, they help create a distributed market infrastructure through their contribution of computing power.

We can expect to see an extension of this model as miners get paid to host business website files across the world, creating an incentive to keep sites available and synchronized. The resulting digital free market will lower costs and improve visibility for small businesses seeking market network effects.

"Dark markets" will take advantage of enterprise-grade blockchain tools to sell wares between gray and black-market participants. They will innovate at the margins to bypass national regulations and withstand law enforcement seizure attempts. At the same time, they will aim to provide private, trustworthy, and efficient user experiences that rival legitimate sites.

Global financial markets will be transformed along the way as securities and payments are settled on borderless blockchain systems. Traditional exchanges will give way to peer-to-peer asset transfer networks. Trades will settle instantaneously on shared ledgers, reducing reserve requirements and enhancing transparency.

Some markets will be created with private blockchains and limited participants. They will often perform background functions like synchronizing ledgers. Leading-edge companies are already prototyping closed-access business solutions for inter-bank transfers and letters of credit. The privacy, authorization speed, and control that private blockchains offer industrial players may soon be extended to public blockchains through advanced cryptography and payment channels.

People will pay miners to store and share replicated machine code and records, collectively giving rise to the world's first global, general-purpose, trustless blockchain computer. Individual computers will combine their power to achieve massive scale and performance. All the while, they will prove that they share a common "state" with other machines based on verifiable code. Unlike individually managed servers of today's Internet, this combined computer will give users peace of mind that applications and market services they participate in are running as intended. Data used in computation will remain with the user client-side whenever possible. Advertisers and data analysts will pay for using personal information for one cycle, managed through tokenized proofs constructed from obscured personal data.

This is the dawn of unstoppable markets and globally trusted computation.

Carbonshopper

Carbonshopper is an online store that exclusively sells eco-friendly goods, which can only be purchased with Carboncoin cryptocurrency. carboncoin.cc/

Enabling Total Cost Accounting

Cryptocurrencies will help us properly account for hidden costs in things we buy every day. Consumer protection groups, governments, and local communities will determine the subjective cost of products using blockchain-hosted transparent supply chain information and reflect these in the composite, multi-token cost of goods. These programs will feel similar to nation-scale initiatives like carbon credits, but at the individual level.

Advertisers will promote sales with cryptocurrency discounts for products produced ethically. A ride in a gasoline-driven car will be more expensive for people who previously elected to receive carbon currency tokens to buy other goods. For those who have made their wealth in labor-conscious communities, the total cost of a computer will be lower if it uses conflict-free metals. We will come to understand the true societal cost of what we buy in ways fiat currency could never reveal.

Creating a Bottom-up Universal Basic Income

Altcoin creation opens the door to fundamental monetary innovations without the need for a central government or bank. In a world where traditional job-based incomes are in flux, one possibility is an opt-in universal basic income (UBI).

Circles, by Consensys' Martin Köppelmann, is one such proposal based on the Ethereum blockchain. Participants mint their own personal currencies, then develop parity with other personal currencies to accept payment for goods and services. Over time these parity networks scale to include many people. If participants agree to always start with a positive number of coins, they will receive a de-facto basic income for use within their parity network for goods and services.

The problem for the next decade to solve is how to scale these economies to make them viable across geographies and for all kinds of exchanges—that is, to create a system for managing massively many personal currencies. Y Combinator is running experiments with opt-in UBI in Oakland, California, and this may be a new tool for groups looking to do the same.



TransactiveGrid is a P2P system that securely monitors output from household energy sources, such as solar, and sells excess capacity on microgrids in the local community. transactivegrid.net



Bitwage allows global workers to receive all or part of their paycheck in Bitcoin. bitscan.com

Building Peer-to-Peer Utilities

As micropayments meet the Internet of Things over the next decade, a host of new experiments in peer-to-peer utilities is likely to emerge. These will build on the P2P computing platforms that enable blockchain transactions, connecting them to industrial machines that can be controlled and add value to the blockchain.

The starting place for such systems is likely to be energy microgrids. Already, companies like TransactiveGrid, are setting up microgrids in Brooklyn. TransactiveGrid leverages energy storage systems that can be integrated into municipal power grids, helping home owners monetize excess energy by selling to their neighbors. In the future, some microgrid models will track the sources of produced energy, incentivizing clean sources based on group preferences. Such systems will enable communities to rapidly update and manage transactional infrastructure economies, even in remote areas.

Working in a Borderless Economy

Despite growing sentiment worldwide in favor of isolationist trade policies to protect jobs, blockchain technology is creating a global infrastructure for borderless work. Blockchain-based work systems are positioned to streamline the process of matching people to gigs, securing work agreements even at a great distance, and instantly paying for work completed. In some cases these systems will be used to bypass existing trade restrictions, creating tensions between virtual workplaces and physical legal boundaries. Digital nomad workers and members of blockchain diasporas will receive and control their money anywhere, owning few physical belongings but summoning virtual wealth at a moment's notice.

As these platforms take the friction out of international labor, new kinds of labor protections—and labor abuses—are likely to emerge. HR watchdogs will reveal discriminatory hiring patterns through auditable hiring records, while human trafficking payments may prove untraceable. The coming decade will shine a light on the new era of labor economics, but it will not resolve the social and economic injustices it is likely to create.



Lock is an electronic lock that uses smart contracts to manage access to assets without a platform intermediary. postscapes.com



The flash crash of the stock market on May 6, 2010, was reportedly triggered by high-frequency algorithmic trading. CNBC

Reinventing the sharing economy

Over the next decade, smart contracts could transform the platform-based sharing economy of today into a truly decentralized sharing economy, in which contracts take the place of platforms for providing conditional access to houses, garages, cars and more across the country.

Rather than paying a platform service like AirBnB the 15% of the rental cost of a home, homeowners might simply set up a smart contract to manage access—including the physical lock that secures the property. Lock.it, for example, is a contract-controlled lock that serves as the intermediary between owner and renter. The renter pays the lock, and the lock pays the owner. In an IoT world, as more physical assets are registered on the blockchain, these kinds of smart contracts will disintermediate platforms, returning the margins to the owner or perhaps to a commons that provides services or dividends to everyone in the network.

Averting systemic failure

In effect, smart contracts will automate the blockchain. Standard templates for smart contracts will emerge for every type of transaction, from asset sharing to work-for-hire to complex, multi-tiered manufacturing projects in which manufactured objects report themselves as contract compliant. This evolution will not only reduce costs and increase speed of peer-to-peer transactions—it will streamline and speed up the entire economy.

At the same time, smart contracts will introduce a brittleness into the economy. It is true that grey areas, processing lags, and other "costs" of traditional transactions will disappear. But the increased speed and complexity of transactions will set the stage for unexpected—and sometimes cascading—system failures. The 2010 stock market "flash crash," brought on by automated high-frequency trading, perhaps gives us a preview of the potential for disruptive economic and social events in such a system. Ultimately, AI contracts could become too confusing to parse, and dependencies between them could lead to unstoppable feedback loops or even global collapse.



Open Bazaar is an open source app designed for online P2P commerce without any platform middlemen or transaction fees. blog.openbazaar.org



Golem is developing a global virtual computer, harnessing processing power shared on a blockchain. golem.network

Reimagining storefronts

Over the past two decades, the Internet has seen a consolidation of online storefronts, with very large companies like Amazon, eBay, the Apple Store, and even Etsy taking over as the equivalent of big box stores in the brick-and-mortar world. These companies hold increasing control over the product marketplace and escalate the costs of transactions by requiring the use of fee-based payment services like Visa and PayPal.

Over the next decade, blockchain technologies promise to rebuild this digital marketplace by making it possible for anyone to become a storefront without entering into agreements with aggregators, payment services, or even web hosting companies. Apps like OpenBazaar will enable peer-to-peer exchanges of goods and services, using blockchain payment systems that provide secure transactions for direct trade. Algorithmic matching will provide the advantages of an Amazon recommendation system using pseudonymous profiles. Markets of trust will evolve as trusted traders create network-based storefronts.

Building a trusted global computer

Dominic Williams, Ethereum Board Member and CTO of String Labs, describes the future of blockchains as a global, trustworthy virtual computer—a decentralized network of clients supporting immutable code-based "objects". These objects may be smart contracts or other code. They may be currencies, or they may be information files. Once they are part of the network, they will always be there, and in the case of smart contracts (or other code) they will execute their terms in perpetuity. This "computer" will have a cryptographic interface and will always know the state of all of the objects—that is, if and when the terms have been executed.

Such a computer will not only set the terms and conditions for individual peer-to-peer economic transactions among people and objects. It will become a global ledger of the world economy, and it could even evolve to become a self-adjusting economy as meta "contracts" analyze complex macro conditions in the ledger and execute code designed to repair system failures.

Anticipating Peer-to-Peer Economies

From stock markets to token markets

To bootstrap new blockchain networks, developers often create an “initial coin offering”: a crowdsale for people to buy into the service’s native token at reduced cost. Over the coming decade, expect an explosion of such crowdsales for organizations and systems of all kinds. They will provide an opportunity for people to vote early with their dollars on networks they believe will provide monetary or social benefit.

- What risks might these sales present if they are used to sell tokens for services that never materialize?
- How might you bootstrap support for moonshot ideas by giving people an early chance to buy into project-based micro economies?
- How might society benefit from massively crowd-supported infrastructural services?

From employment contracts to global gig bounties

Over the past few years, the combination of automation, API-based companies, and on-demand work platforms have made it possible for traditional companies to scale down their workforce and eke out what talent they need on the Internet, often with great cost savings. The blockchain will continue this trend, but expand the talent pool to unbanked populations and difficult-to-trust contributors. Direct peer-to-peer contracts will clearly outline gigs with autonomous bounties, open for anyone to complete. In this world, people will work on and for the blockchain, backed up by a token-based universal basic income.

- How will blockchain tools help you connect with new global work partners?
- How will organizations restructure to enable swarm labor from non-affiliated participants?
- What new global diasporas will emerge as tighter communities form around economic participation rather than geographic proximity?

From cloud services to trusted crowd computing

Services like Amazon and Google have leveraged cloud-based computing to build empire-sized markets that leverage massive amounts of data and algorithmic analysis to provide superior service at reduced cost. Now peer-to-peer computation markets like Golem are positioned to provide personal data control, uncensorable services, and autonomous contracting.

- What kinds of services could you create with a global, unstoppable computer?
- How will you harness globally archived data and self-executing applications while avoiding irreversible bugs?
- How will society shift as everyone gains access to mass-scale, permissionless economic computers?

From product aggregators to networked storefronts

Monopolistic online stores will face competition from small, but deeply connected individual storefronts constructed with cheap and simple web templates. The storefronts will be easily searchable on the user’s terms and will provide a host of long-tail offerings direct from producers. Revenues will remain with individual store owners (instead of a hefty commission going to the aggregator) as they manage payments and combined enterprise tools in conjunction with peers.

- What products and services will emerge as barriers to business entry fall further through open-access storefront networks?
- How might traditional organizations make their services available through disintermediated bazaars?
- How will emerging economies take advantage of peer-to-peer business networks?

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BLOCKCHAIN FUTURES LAB

IFTF’s Blockchain Futures Lab connects industry leaders with practical visionaries and domain experts to identify long-term opportunities and design considerations for blockchain technology. The Blockchain Futures Lab provides a community forum to discuss paths toward a more efficient, transparent, and equitable world using the full potential of distributed systems. www.iff.org/blockchainfutureslab