Blockchain Building Blocks:

Creating a world of opportunity for insurance from an evolving area of technology

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Introducing the Blockchain: Our Next New Frontier

The blockchain may end up being considered one of the most important financial services innovations of the twenty-first century. But what exactly is a blockchain and why does this technology seem to have such extraordinary capabilities—lending it to seemingly limitless opportunities? This paper aims to illuminate just that by explaining the blockchain's significance and implications for the insurance industry, as well as outlining the rich and fascinating history behind it.

The blockchain is significant in that it combines a **distributed database** and **decentralized ledger**, completely removing the need for verification by a central authority. For example, through its underlying blockchain technology, bitcoin solved the **double-spending problem**, which stymied digital currencies before it. It also reinvented the concept of monetary networks by providing a true peer-to-peer payment system and eliminating the need for intermediary banks, including central banks.

However, blockchain applications are much larger in scope than bitcoin and the associated transaction protocol. More recent blockchains, like the blockchain associated with the Ethereum Virutal Machine (EVM), have further extended the blockchain disruption by establishing the use of smart contracts—programmable code that can be built and stored in the Ethereum blockchain itself.

Original blockchains, like bitcoin's or Ethereum's, function as shared databases that are both public, in that transactions can be viewed by users, and anonymous, because the associated cryptography hides the identities of parties to the transactions. Since then, however, business has grown more interested in testing this decentralized ledger technology, so private and permissioned blockchains have developed. And the most recent advancements have led to development of permissioned chains on a public blockchain.

Distributed database

Distributed database—a database with portions that are stored in multiple locations and processing that is distributed among multiple database nodes.

Decentralized ledger

Decentralized ledger—ledgers, or systems of record for a business's economic activities and interest, that are dispersed instead of reliant on and housed within one third-party system, such as a financial institution.

Double-spending problem

Double-spending problem—the risk, particularly when digital currency is exchanged, that a person could concurrently send a single unit of currency to two different sources.

Regardless of whether the blockchain is private, permissioned, or public, and whether it allows transactions or contracts, the very concept of the decentralized ledger has the potential to change financial services and insurance on the same scale as the internet did—maybe even more significantly.

Blockchain could have widespread ramifications across the insurance value chain, increasing market reach and customer personalization while also cutting costs in these ways:

- *Insurance products, pricing, and distribution* may be wildly altered as blockchain proliferation and its associated smart contracts spawn new products, like parametric insurance and insurance implanted in transactional purchases, and realize efficiencies in the insurance process, thereby lowering prices and allowing for broader reach into emerging markets.

- *Underwriting and risk management* may see data-sharing capabilities and risk registries emerge through blockchain-enabled provenance features and peer-to-peer insurance models, as well as shared industry ledgers.
- *Policyholder acquisition and servicing* could become more efficient because new customer data will be increasingly confirmed at the origin. In addition, insurance life cycle documents will be easily updated with blockchain technology, avoiding repeat entry and verification and easing concerns with know-your-customer/anti-money laundering regulations.
- *Claims management* itself could be simplified through smart contracts, while an industry-wide shared ledger could help with multilayer settlements and fraud inspection.
- *Finance, payments, and accounting* in insurance could also change. A distributed ledger like blockchain could allow for lower-cost international payments, more efficiency in subrogation via smart contracts, and new forms of raising capital.
- *Insurance regulation and compliance* could be transformed, as regulators would be able to monitor all insurance variables in real time and potentially create an industry-wide proof of insurance ledger.

This multitude of possibilities provides an undeniably exciting path forward. While the true breadth and depth of the blockchain's influence and effects are impossible to know with certainty, current data shows that the blockchain is an important part of today's highly dynamic environment. To best prepare to engage in the opportunities to follow, you must first understand the basics around the blockchain: its origin and its system.

Many believe that blockchain applications will reach full potential five years from now and that the greatest potential lies in the insurance industry. As this report demonstrates, use cases are plausible for each area within the insurance value chain, aiming to create efficiencies and optimize output—and insurers are beginning to notice. Read on to learn more about this important technology and what insurers can do to get in front of it.

Contents

Build-up to the Blockchain: A Historical Overview

The blockchain was made possible by developments in many areas, including computers and databases, encryption, monetary systems and systems of pay (like e-commerce), and information networks. These changes served as the foundation for all cryptocurrencies, including bitcoin (which birthed the concept of the blockchain) and Ethereum. In the paragraphs below, the blockchain's building blocks are inspected in a dispersed yet linear fashion.

The history of databases goes back centuries, but in the late 1800s, Herman Hollerith made a key contribution: he devised Hollerith cards, which were used to gather data in the 1880 United States census via holes on punch cards. His company later merged with several others to form International Business Machines (IBM). Data organization began to take hold in the early 1900s, as punch cards and tabulating mechanisms became standard in most offices.

1880
Hollerith cards used in U.S. census

As data organization turned to punch cards, the American monetary system was also turning—toward central banking. After a brief depression and the Panic of 1907, the American populace began to reconsider the concept of a centralized bank. By 1913, the Federal Reserve System, the country's third central banking system, was established.

1907
Panic of 1907

The Federal Reserve sought to expand the money supply in case of emergency, which some believed would help smooth the economic downturns that had become so frequent. Unfortunately, recessions and panics continued, culminating in the Great Depression.

1913
Federal Reserve System established

During the Great Depression, the role of the Federal Reserve expanded as Congress removed the nation from the gold standard, a system that required banks to convert bank notes to gold on demand. The Great Depression ended in 1939, as World War II was beginning. Several years later, with the war still raging, delegates from the allied nations met in Bretton Woods, New Hampshire, to map out the future international economic system. This Bretton Woods agreement brought back a quasi-gold standard that tied each country's currency to the U.S. dollar at a fixed rate, and the dollar was pegged to gold at $35 an ounce. With this agreement, the U.S. dollar became the world's reserve currency.

Meanwhile, data organization continued to progress. Punch cards were replaced by tape-based machines, leading to rapid evolution in data storage. One of the first machines to use tape was Colossus, the world's first electronic, digital, and programmable computer, which was invented by the British in the 1940s to break Nazi Germany's encrypted messages. Some have asserted that right around this point in computer history, the president of IBM, Thomas J. Watson Jr., opined, "I think there is a world market for maybe five computers."[1] Within a decade, this belief seemed ludicrous, as technology continued to advance and be more widely adopted. Throughout the 1950s and 1960s, digital tape-based computers entered the working world on a large scale.

1943–45
Colossus developed

1944
Bretton Woods conference

During the same period, credit cards also entered the mainstream. The first universal credit card that could be used at different businesses was introduced by Diners' Club in 1950.[2] Credit cards quickly expanded from there.

1950
Diners' Club credit card introduced

1950–55
ERMA developed

1960s
Navigational databases developed

1969
ARPANET launched

1969
First ATM

1971
Nixon removes U.S. from international gold standard

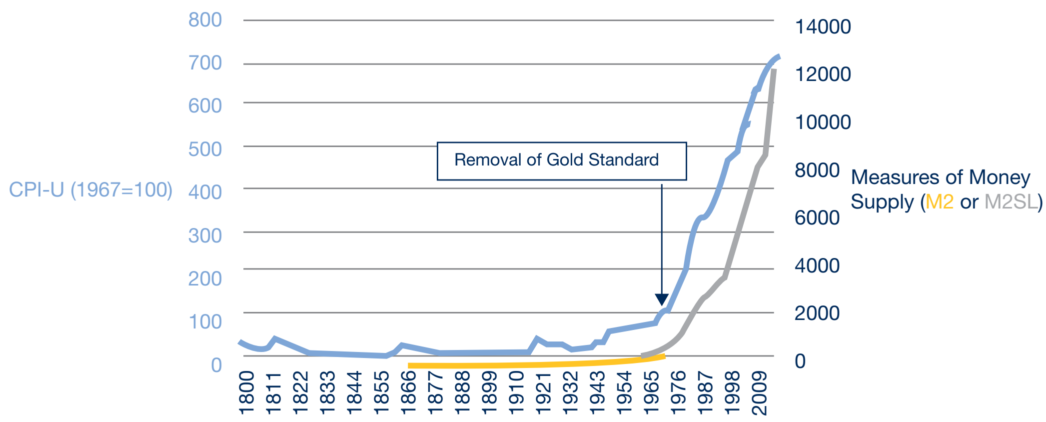
Database management also continued to evolve. For example, ERMA (Electronic Recording Machine, Accounting), which was developed between 1950 and 1955, helped automate banking bookkeeping by using a file system similar to the library classification system.[3] In the 1960s, navigational databases were established, further enhancing the ability of computers to organize and interpret data.[4]

Major developments in computer networks were also made during this time. In 1969, ARPANET, the Advanced Research Projects Agency Network, became the general purpose network that could connect different kinds of computers.[5] The technology used to create ARPANET was later used to create a network of networks—the internet.

Meanwhile, several innovations in banking emerged. On September 2, 1969, the first automated teller machine (ATM) began dispersing cash to customers at Chemical Bank in Rockville Center, New York. ATMs went on to revolutionize the banking industry by eliminating the need to visit a bank to conduct basic financial transactions.

In 1971, monetary systems took another large-scale turn, this time, away from the gold standard. Amid growing concerns about stagflation (a combination of high unemployment and high inflation), President Richard Nixon officially closed the gold window and removed the U.S. from the international gold standard. This ended the international convertibility of the U.S. dollar to gold. Nixon explained to the U.S. and the world that this would allow the Federal Reserve to further increase the money supply in order to combat economic issues. The value of gold subsequently rose 2,330 percent over the decade—rising from $35 an ounce to $850 an ounce. Charts 1 and 2 show that the money supply (and accompanying inflation) also started a sharp ascent in the 1970s.

Chart 1: Money Supply and Inflation Spiking
CPI and Money Supply From 1800-Present



This period also saw banking networks advance. The Society for Worldwide Interbank Financial Telecommunication (SWIFT), a cooperative society headquartered in Belgium, was formed by 239 banks to solve a common problem: how to communicate about cross-border payments. SWIFT established a network that enables financial institutions worldwide to send and receive information about financial transactions in a secure, standardized, and reliable environment.

The 1970s further saw significant advancements in the relational capabilities of databases. Edgar Codd sought to improve upon existing database models by making them searchable. Codd wrote a number of papers that outlined a new approach to database construction, eventually culminating in the groundbreaking article, “A Relational Model of Data for Large Shared Data Banks.” The impact of this article was significant, with the database taking on a new relational form. Data was no longer conceived of as a means of organization; instead, the database could be used to query hidden relationships within.[6] IBM developed a prototype of the relational database model as early as 1974, called System R, which would later become the widely used Structured Query Language (SQL) database upon its release in 1981.

1974
IBM develops System R, a prototype relational database model

As advances in databases and finance continued, a huge evolution in computing was also under way. In the late 1970s, a number of personal computers started to pop up, including Apple's kit computer, Apple 1. Soon after, the Commodore computer invaded homes, and the IBM personal computer (PC) revolutionized both business and home life. But computing advances did not stop with hardware. In 1984, Microsoft announced the development of Windows, a graphical user interface for its own operating system, MS-DOS. These developments forever changed the world of computing, which found a new place in both the office and homes.

As computer use increased, so did demand for high-speed interconnections between computer systems. Local area networks (or LANs) and the Ethernet, both of which enabled interoffice PC connections, got their start in the early 1970s. Network technology quickly progressed from there, leading to the birth of the web in the 1980s. France Telecom offered free Minitel terminals to every phone subscriber, launching the first mass "web" in 1981. Some PC owners then began subscribing to online services like MircoNet or The Source and connecting to a bulletin board service, or BBS.

1981
Minitel becomes first mass web

These technological advancements picked up speed in the late '80s and early '90s. During this time, Tim Berners-Lee was building what he called the World Wide Web, which included the web programming language known as HTML, uniform resource locators (URLs), and the first true browser. The early '90s also saw increased browser usage, fueling competition between Netscape and Internet Explorer.

1985
Windows 1.0 launches

As the internet came into being, its far-reaching applications were realized. E-commerce had long been a dream, but a distant one. From the beginning, there were many hesitations and concerns with online shopping, but the development of a security protocol by Netscape in 1994—the Secure Sockets Layer (SSL) encryption certificate—provided a safe means to transmit data over the internet. Web browsers could now check and identify whether a site had an authenticated SSL certificate and was trustworthy.

1989
Tim Berners-Lee invents World Wide Web

This period also witnessed the launch of Amazon, an online bookstore that could hold more books because it lacked a physical location. The dot-com bubble—rampant speculation in the internet sector and related fields—heated up around this time, as sites like eBay and Zappos saw similar e-commerce success. As the '90s went on, a search engine battle between Yahoo! and Google erupted, both of which later formed e-commerce-related subsidiaries. PayPal also entered the scene in the late '90s, contributing significantly to the e-commerce revolution.

1995–2001
Dot-com bubble

One of the more recent advances in networking, social media, began during this time as well. America Online allowed users to create profiles in which they could post various details about themselves—a very progressive notion. Yahoo! followed suit, and even more entrants appeared by the late '90s. Classmates.com, for example, aimed to connect users with schoolmates from long ago.

As the dot-com boom went bust in the early 2000s, social networks really took off. Friendster was an early entrant, but LinkedIn and MySpace quickly followed. And of course, social media truly came to fruition with the 2004 birth of Facebook, which launched as a network for college students, but quickly expanded its reach.

The aforementioned developments in computers, databases, encryption, networks, monetary systems and systems of pay led to the development of the blockchain. But it wasn't until the late 2000s that the building blocks began to stack up—more specifically, after the 2008 financial crisis.

As the Economy Tumbles, the Blocks Stack Up

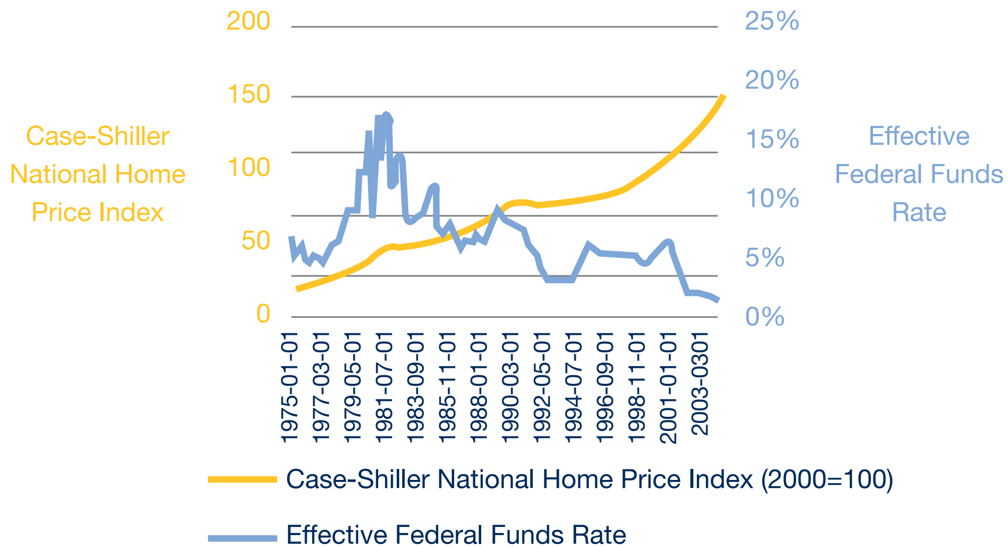
2001
Terrorist attacks of September 11, 2001

In the year 2000, the Federal Reserve set the federal funds interest rate at 6.5 percent, its highest point in about a decade. The dot-com bubble began to pop that same year. The Federal Reserve pulled the federal funds rate down as the stock market fell, and the economy contracted. In March 2001, the economy slipped into a brief recession. And just as the recession was coming to a close in the fall of 2001, the economy was dealt another blow. The terrorist attacks of September 11, 2001, not only shocked the country but also affected the economy by limiting travel and decreasing consumer confidence. To spur growth, the Federal Reserve continued to slowly lower interest rates, hitting a 40-year low of 1 percent in June 2003.

2003–04
Home prices reach new highs

The federal funds rate sat at about 1 percent for a full year. And during the early 2000s, the housing market was cruising. Home prices, as measured by the Case-Shiller National Home Price Index, hit new growth highs in 2003 and 2004.

Chart 2: During the Bubble: House Prices and the Federal Funds Rate



The Federal Reserve kept rates low into early 2004. In fact, in an October 24, 2010, op-ed in *The New York Times*, Michael Burry (made famous in *The Big Short*) wrote the following about Federal Reserve Chair Alan Greenspan: "[He] told Americans [in February 2004] that they would be missing out if they failed to take advantage of cost-saving adjustable-rate mortgages. And he suggested to the banks that 'American consumers might benefit if lenders provided greater mortgage product alternatives to the traditional fixed-rate mortgage.'" Burry goes on to say that "within a year, lenders made interest-only adjustable-rate mortgages readily available to subprime borrowers. And within eighteen months, lenders offered subprime borrowers so-called pay-option adjustable-rate mortgages, which allowed borrowers to make partial monthly payments and have the remainder added to the loan balance (much like payments on a credit card)."[7]

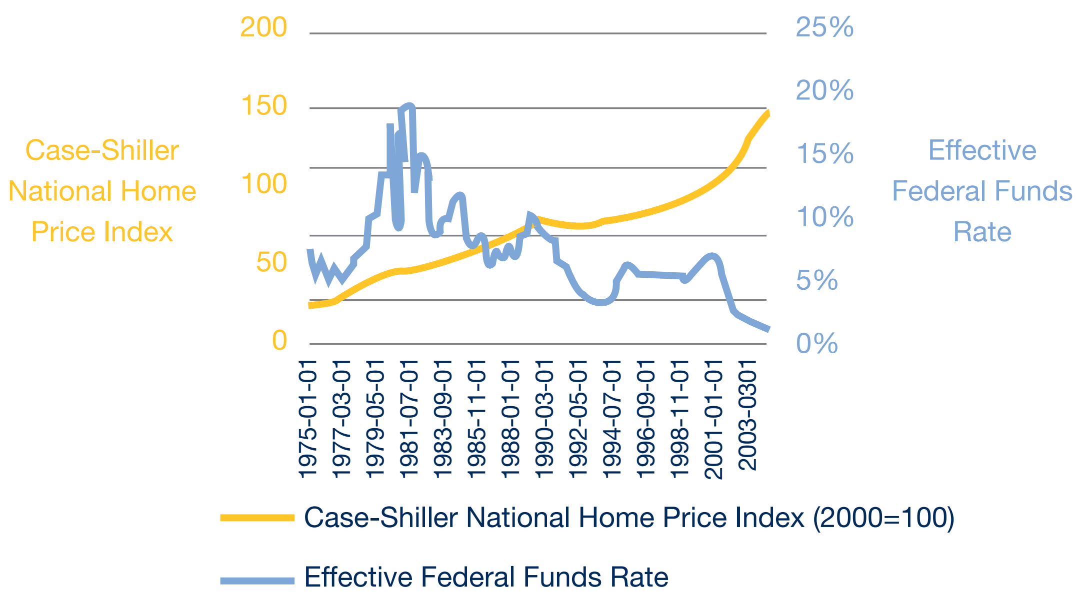
2006
Housing bubble peaks

Later that same year, Alan Greenspan and the Federal Reserve began to raise interest rates dramatically. The federal funds rate hit a cyclical high of 5.25 percent in July 2006 and remained there for a year. Around this time, at the height of the housing bubble, more than 50 percent of mortgages originated as adjustable-rate mortgages.

The story from there is one for the history books.

As interest rates reset to new highs, many homeowners were not able to make their mortgage payments. Speculation in housing declined, and demand retrenched. As prices declined, the problems in housing bled into other industries. Soon, the U.S. economy was in its worst financial downturn since the Great Depression (see Chart 3).

Chart 3: Look Out Below...



2008
Federal funds rate hits 0%

To fight the financial crisis, the Federal Reserve again expanded the money supply and cut interest rates. The effective federal funds rate hit a cyclical low of 0 percent in late 2008. Although Keynesian economists strongly supported lowering interest rates (i.e., zero interest rate policy) and unconventional monetary policy (such as quantitative easing), adherents of other economic schools of thought (e.g., the Chicago School, Austrians, etc.) felt that these expansions of the money supply and subsequent low rates would lead to further economic instability. So just as the financial crisis erupted, concerns about volatility and the growing potential for inflation grew. Many investors sought protection by investing in gold, which was often considered a safe haven. And right about this time, bitcoin and the blockchain were created.

The Birth of Bitcoin and the Blockchain

2008
Bitcoin introduced

Just weeks after Lehman Brothers collapsed in October of 2008, a white paper appeared online. This paper introduced a form of peer-to-peer digital cash with properties similar to those of gold.[8] The whitepaper and the associated system it disclosed immediately gained attention because it solved the double-spending problem that had plagued attempts at electronic cash before it. This digital currency was called bitcoin, and the author of the paper was Satoshi Nakamoto.

Satoshi Nakamoto, the true identity of whom is unknown, delivered the whitepaper, "Bitcoin: A Peer-to-Peer Electronic Cash System." By January 9, 2009, Nakamoto released bitcoin's code, established the network, dispersed the first bitcoins (the cryptocurrency associated with Nakamoto's system), and unveiled the world's first blockchain (the system of verification and confirmation). In the beginning, Nakamoto interacted with others—particularly developers in building the network, which was completely open source. Nakamoto created the bitcoin.org website and continued to collaborate with other developers until mid-2010. At this time, he handed the reins over to Gavin Andresen, and he has not been heard from since.

So, what is bitcoin?

Bitcoin is a digital token that can be stored in a digital wallet and is designed to work as a currency. It is often called a **cryptocurrency** because encryption techniques are used to secure transactions and control the creation of additional units. Bitcoin may be the best-known digital currency, but it was not the first. What made it unique was that it solved problems that previous efforts could not—in particular, double spending—through an innovative decentralized verification system.

Bitcoin was immediately attractive to those looking for alternative investments to hedge against the unconventional monetary policies of the Federal Reserve (such as zero interest rate policy and quantitative easing).

Cryptocurrency

Cryptocurrency is a digital currency in which encryption techniques are used to regulate the generation of units of currency and verify the transfer of funds, operating independently of a central bank.

Demand for bitcoin grew for three key reasons:

1. **First, like gold, bitcoins are scarce.** According to the monetary policy laid out by Nakamoto, no more than roughly 21 million bitcoins will ever be in circulation, a number not expected to be reached until 2140. Until then, bitcoins are generated every ten minutes to reward so-called miners—owners of specialized computers on the network—for verifying blocks (which will be discussed later). So the bitcoin money supply is growing, albeit much more slowly than the U.S. dollar.

   At the end of 2016, about 16 million bitcoins were in circulation—and another 2 million are expected to enter circulation by 2020. Supply will grow more and more slowly over time until the final bitcoin is produced in 2140.

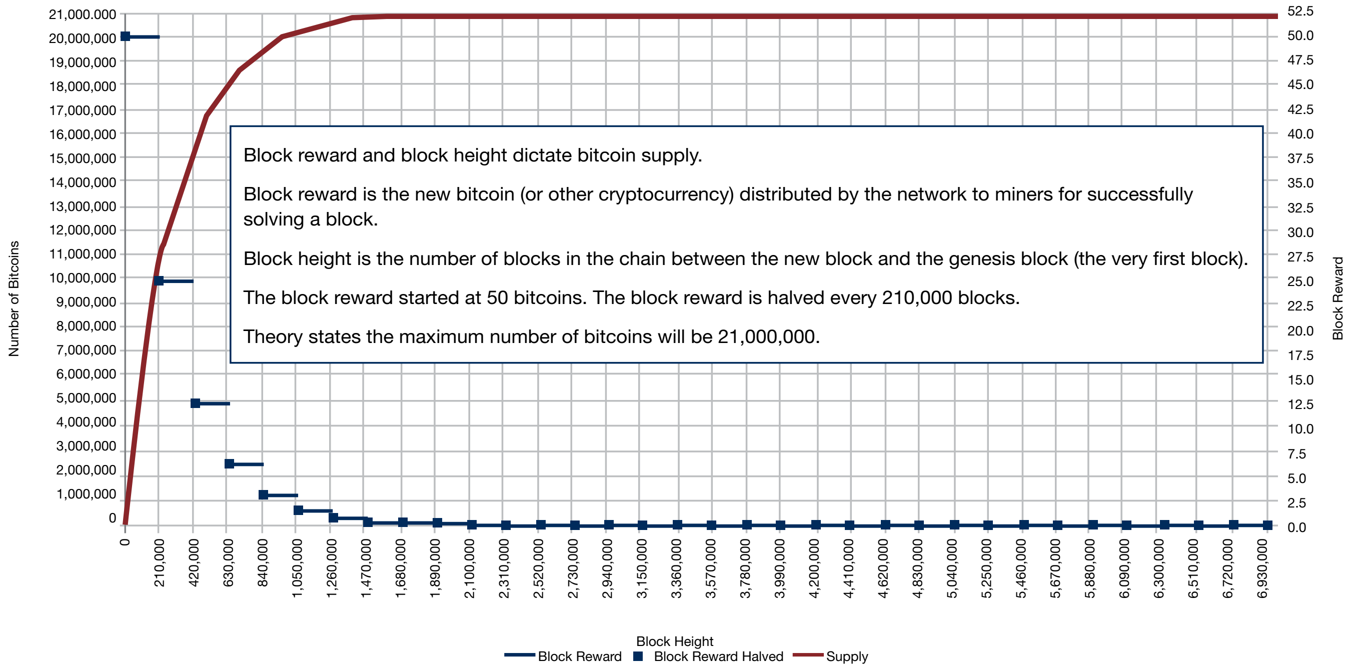
   So why does scarcity matter? Recall the earlier discussion about the U.S. gold standard. The government had a reason to link U.S. monetary policy to gold, which has a set supply and is only discovered and extracted so often: doing this ensured that the money supply could not expand too rapidly.

   Many economists believe that controlling the money supply of a currency is necessary to prevent inflation, which limits purchasing power and can lead to other problems. Bitcoin offers investors a scarce, usable currency with a controlled supply that is valued in a traditional currency, like the U.S. dollar (see Chart 4). And considering that its supply has recently grown at a rampant rate, the appreciation in bitcoin relative to the U.S. dollar is hardly surprising. In layman's terms, many saw bitcoin as an inflation hedge against the existing monetary policies of western nations' central banks. This use of cryptocurrency as a hedge is not expected to change.

The growth in bitcoin's money supply versus that of other currencies is expected to widen. Many economists believe that in 2140, when bitcoin production ceases, bitcoin should be considered a deflationary currency. At that time, bitcoin's fractional coin system may become more important. Bitcoin's creator seems to have already thought of that—the smallest bitcoin denomination is currently 0.00000001 bitcoin, referred to as one satoshi.

Chart 4: Bitcoin—Controlled Supply

Number of Bitcoins as a Function of Block Height



2. **The second reason that bitcoin generated market demand was that it offered a peer-to-peer exchange, similar to that of cash, through electronic transmission.** One could send bitcoins as easily as an email. Although each transaction is logged on the public ledger, bitcoin is generally considered anonymous because the cryptography involved allows people to make bitcoin transactions without revealing any personally identifiable information.[9]

   The ability to send bitcoins electronically and the system's near-total anonymity made bitcoin popular at a time when fears of intrusion into private online activities were increasing. However, bitcoin's anonymity also appealed to those involved in nefarious activities, which inevitably damaged its reputation.

3. **Finally, since 2008, trust in the financial system has been eroding, and bitcoin offered an alternative to the traditional banking system.** Bitcoin's peer-to-peer transaction protocol eliminated the need to store currency in banks and also cut out the Federal Reserve's intermediary role in transaction clearance and verification. As frustration with the existing banking backdrop grew around this time, bitcoin provided an alternative structure that many early adopters felt could lead to fundamental change.

As bitcoin gained traction with investors looking for a scarce asset, a quasi-anonymous peer-to-peer exchange, or alternatives to the existing banking industry, it also garnered increased attention from the media, academia, and government entities. Inspections called bitcoin's legitimacy as money (or currency) into question.

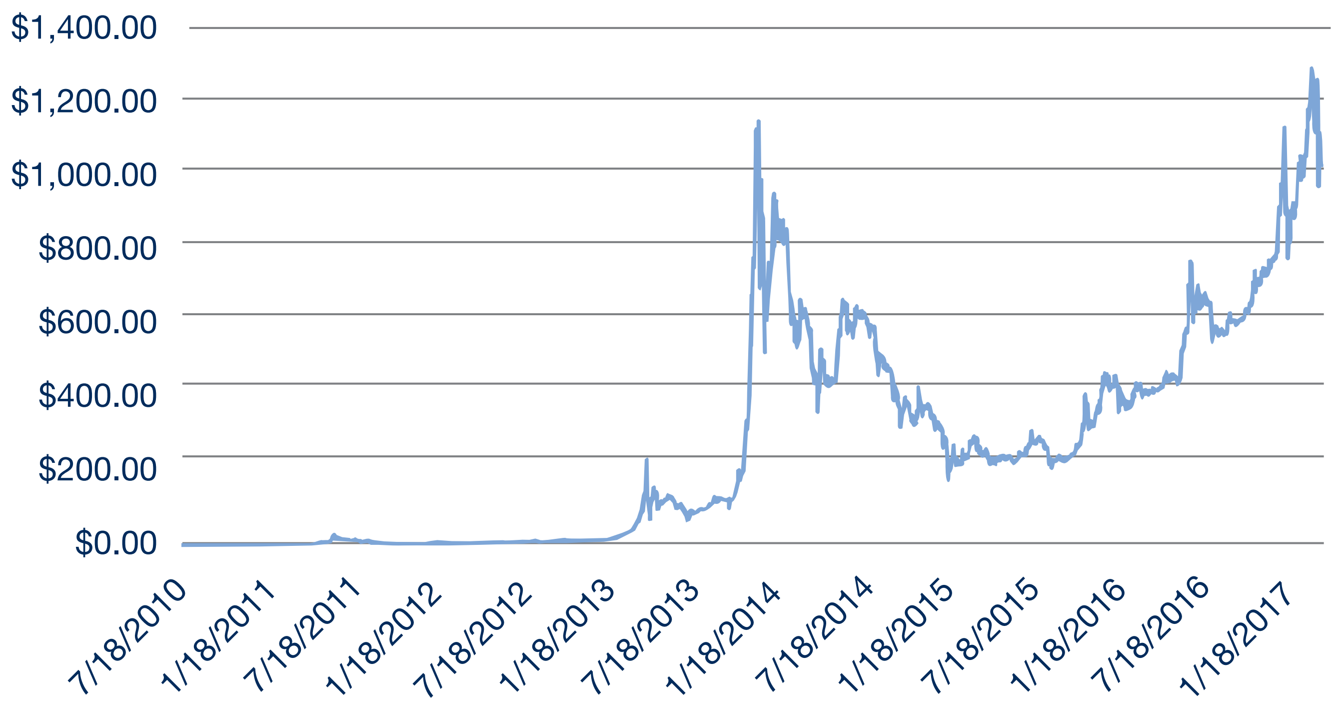
Money can be any object that is generally accepted as payment for goods, services, and the repayment of debt. True money fulfills three key functions:[10]

1. Medium of exchange—The basic purpose of money is to pay for goods or services; it functions as a medium of exchange. Bitcoin clearly fulfills this function.

2. Unit of account—Money is the standard unit used to measure the market value of goods and services. To fulfill this function, the unit of currency must be divisible without losing value, fungible (that is, one unit is equivalent to and interchangeable with another of the same type), or countable through a specific weight or size. Cryptocurrencies, including bitcoin, fulfill this function in that they are divisible and fungible.

3. Store of value—For bitcoin (or any other object) to be considered money and a store of value, users must be able to save, store, and retrieve it—and when used in transactions, its value must be predictable. Furthermore, its value must at least be stable, if not improve, over time. Many who believe that cryptocurrencies, such as bitcoin, are not true money state that their volatility precludes them from storing value. Opposing points of view, however, cite bitcoin's appreciation as evidence that it does store value. For example, the bitcoin-to-U.S.-dollar exchange rate has been extremely volatile, but bitcoin has largely appreciated against the U.S. dollar (see Chart 5).

Chart 5: Bitcoin Price Over Time



Source: Coindesk

For additional perspective, consider this example: The very first bitcoin transaction, made in 2010, was for two pizzas. In that exchange, 10,000 bitcoins, or BTC, were exchanged for two pizzas, which were worth about $25.[11] At that rate, the value of one bitcoin was well below one U.S. cent. But the value of bitcoin relative to the U.S. dollar has since appreciated dramatically. Today, at a value of about $1,250 for one bitcoin, 10,000 BTC would be worth $12.5 million—and make for one rich pizza man.

So, how does blockchain relate?

The birth of bitcoin was remarkable. However, the true novelty of the bitcoin system is under the hood: it is not the currency itself, but the verification and clearance system that allows for peer-to-peer transactions—its blockchain. This is the system that creates efficiencies.

This system is not unique to bitcoin. There are hundreds of cryptocurrencies, each with their own blockchain. To truly understand the blockchain's vast potential, a more thorough explanation of its mechanics is necessary.

Getting to Know the Blockchain: A Working Understanding

The first section of this paper explained that blockchain technology came about through a fusion of advancements in databases, networks, computers, and e-commerce. The second section discussed how the blockchain was founded via bitcoin.

But what exactly is a blockchain?

A blockchain is a distributed database and decentralized ledger that maintains a continuously growing list of records, called blocks, in chronological order. In most blockchains, new blocks and the data within (transactions, smart contracts, and so forth) are confirmed and verified through a consensus process called mining. This verification process removes intermediary validation and establishes trust without the use of a centralized authority.

After a block is confirmed and the data within it is verified through the decentralized consensus process, the block is time-stamped and added to the preexisting blocks in the chain, hence the term "blockchain." Each node in the system has a copy. The blockchain is encrypted, and it is considered immutable, which means that it is protected against tampering and revision. **If implemented, this technology has the potential to simplify processes and drastically lower costs.**

Digital wallet

Digital wallet—cryptocurrency software that holds the user's digital cash; a digital certificate and signature to verify payments; and billing, shipping, and payment information.

A Digital Currency Transaction

Sending Digital Currency

Imagine that John wants to send one unit of a digital currency—bitcoin, in this case—to Jane. First, John would go to his **digital wallet**, which holds his bitcoin balance. This digital wallet is very similar in some ways to an online bank account. It contains individual account information, including the keys.

Keys are sets of numbers, and they come in pairs: a private key and a public key. They function in a similar manner as a private PIN and a bank account number. Public keys are used to publicly identify the parties to a transaction, and the parties use their respective private keys to verify their own identities. The public key is derived from the private key, so they are related, but it is impossible to derive the private key from the public key.

To authorize the transaction, John needs his private key. Without it, he cannot spend his bitcoins. The private key mathematically proves that John (or at least someone with his private key) sent the bitcoin, similar to how a signature is used to verify transactions.

Next, John enters Jane's address. Each wallet has an address, which is a hashed public key that is generally shorter than the public key itself. The address is not kept secret; in this case, John must know Jane's address in order to send his bitcoin to her wallet. He enters the address and sends the bitcoin to Jane.

The details behind the curtain—the mechanics of the blockchain—are rather complicated, but as with email, the average user need not fully understand all the technical details. To summarize the example, John simply logs into his wallet, enters Jane's address (a collection of letters and numbers), and enters the number of bitcoins to send to her. He clicks Send, and the bitcoin is sent to Jane's address.

The Mechanics of the Blockchain

When John decides to transfer a bitcoin to Jane and clicks Send, John's wallet should have one less bitcoin—and Jane's should have one more. At this point, the verification process begins. The transaction request from John is broadcast to the entire network. Anyone on the network can use the public key to confirm that the transaction request came from the legitimate account owner. But the transaction is not yet verified. This is where miners come in.

The verification process ensures that John has the ability to send Jane the bitcoin. All digital currencies have blockchains with their own unique mechanics, but in bitcoin's case, a new block is added to the blockchain every ten minutes. Miners, those specialized computers on the network, race to package data from John and Jane's pending transaction with other unrecorded transactions into a new block (assume that the block containing John and Jane's transaction is block #400000). The preceding block (#399999) is included in the miners' procedure, as well as a random number known as a nonce. The miners race to solve mathematical computations associated with block #400000 in order to win an award: newly created bitcoins.

Transactions are verifiable when the miners produce a unique cryptographic fingerprint using a **hash function**. The hashed block must have a definite, but random, number of zeroes at the beginning. The hash with the correct number of zeroes is entirely unpredictable, so the miners keep trying different hashes. When the winning miner finds a hash with the correct number of zeroes, the discovery is announced to the rest of the network. Other miners confirm recognition, and they immediately turn their attention to the next block (#400001), an element of which is the newly verified block #400000. The blockchain code then rewards the miner that verified block #400000 with 12.5 BTC. The hashed block is time-stamped and published, which means that block #400000 is added to the chain of preexisting blocks. The blockchain stems all the way back to the first block, which is called the genesis block.

Hash function

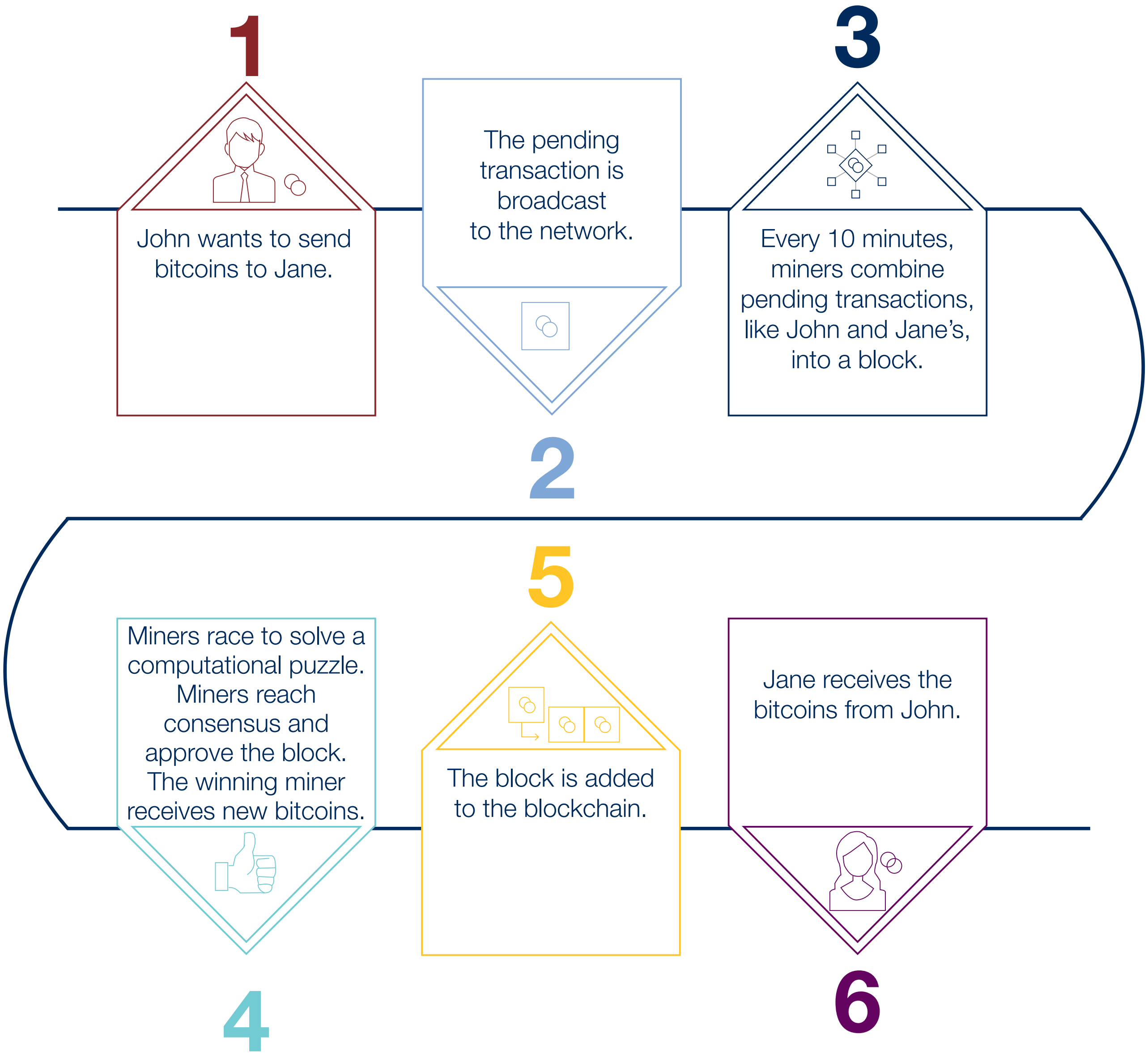
A hash function takes a set of digital data and delivers a numeric piece of data with a fixed range. If you deliver the same exact data to a hash function, it will deliver the same exact numeric piece of data every time. If the data input varies even by one variable, the hash function's output will change.

Receiving the Digital Currency

All that may sound very complicated, but for John and Jane, it is fairly straightforward. John sends the bitcoin to Jane via his digital wallet and shortly thereafter, it arrives in Jane's. For a visual depiction of this process, see "A Digital Currency Transaction: John and Jane" on page 16.

Bitcoin is an attractive alternative to cash in this situation because trading cash electronically involves individuals' banks and the Federal Reserve Bank for verification and transfer purposes. International transactions take an even longer time to verify and may involve fees. A blockchain completely removes such middlemen and simplifies the process.

A Digital Currency Transaction: John and Jane



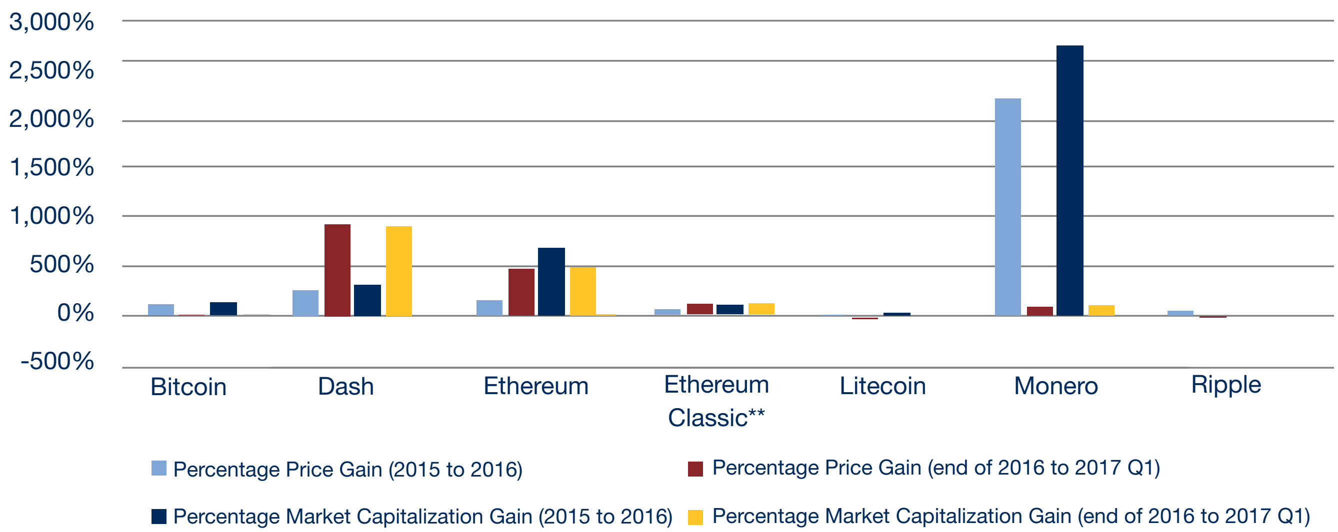
Blockchain 2.0: Alternative Cryptocurrencies and Blockchain Models

It is important to point out again that bitcoin is not the only cryptocurrency, nor is its blockchain the only model. According to CoinMarketCap, more than 700 cryptocurrencies existed at the time this paper was finalized.[12]

Most cryptocurrencies and blockchains serve a specific purpose. For example, some cryptocurrencies are devoted to social networking (such as Steem), others to forecasting (like Augur, which is built on the Ethereum blockchain), and some to privacy (Monero and Zcash). And there are plenty of others with unique purposes. Some developers simply copied the bitcoin open-source code and altered it slightly, as was the case with Litecoin. Other cryptocurrencies were created to achieve unique objectives.

Among the top seven cryptocurrencies, Monero and Ethereum had the greatest market capitalization gains in 2016, followed closely by Dash. Through early 2017, the greatest market capitalization gains have come from Dash and Ethereum (see Chart 6).[13]

Chart 6: Top Seven Cryptocurrencies Gains in 2016 and in Early 2017*



Sources: CoinMarketCap, CoinDesk, Schmid

*2017 Q1 as of March 22, 2017. See CoinMarketCap.com for the latest figures.

**Ethereum Classic did not have a full year of data in 2016.

Despite the growth trends in other cryptocurrencies, bitcoin maintains the highest overall market capitalization, at four times that of its closest competitor. Yet, Ethereum, Dash, and Monero are gaining. Other than bitcoin, the only cryptocurrency with a market capitalization greater than $1 billion is Ethereum, whose market capitalization is more than five times that of Dash (see Chart 7).

There may be good reason for that. Ethereum took what bitcoin started in transactions and extended it into new territory—allowing programmable code (rather than transactions) to be inserted into the blockchain and providing a system to build decentralized applications. The advent of Ethereum may actually have a larger impact on financial services—and the world at large—than bitcoin.

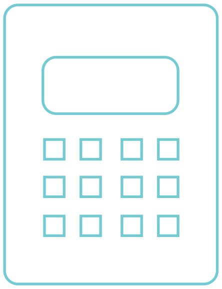
Chart 7: Overall Market Capitalization of Cryptocurrencies

Cryptocurrency	Overall Market Capitalization (Q1 2017, rounded)
Bitcoin	$17 billion
Ethereum	$4 billion
Dash	$724 million
Monero	$302 million
Ripple	$277 million
Ethereum Classic	$213 million
Litecoin	$198 million

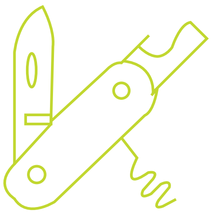
Source: CoinMarketCap (See CoinMarketCap.com for the latest figures.)

Ethereum's Background

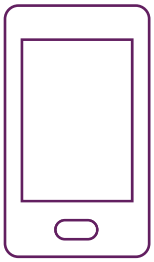
The ramifications of blockchain technology go far beyond trading money, the key purpose of bitcoin. Ethereum takes bitcoin's transactional capabilities and extends them dramatically by allowing code to be inserted into its blockchain. Before the Ethereum project was started in 2013, media buzz about bitcoin had been growing, and observers were excited about the potential applications of blockchain technology outside of money transfers. Several cryptocurrency projects were started with the aim of using blockchains for unique purposes, not just money transfers (for example, Namecoin, Colored Coins, and Mastercoin). At DevCon2, an Ethereum developer conference, Ethereum founder Vitalik Buterin described his viewpoint on the time frame associated with the birth of the ethereum protocol.[14]
He explains that before 2013, most blockchain protocols were designed like this:



Buterin uses the calculator analogy to point out that before 2013, blockchains operated as single-purpose devices, which work great for mathematical applications (like sending money), but that they did not have other capabilities. Of course, it is *possible* to hack a calculator to make it more applicable to alternative purposes—but that is quite difficult. Buterin goes on to point out that in 2013, more and more developers created cryptocurrency/blockchain protocols that resembled this:



Similar to a Swiss army knife, many of these cryptocurrency/blockchain protocols were created with a number of features in mind. Developers listed ten to twenty features they wanted their projects to incorporate, and they developed blockchains with an application for each one. For example, blockchains have been built for identity registrations, prediction markets and betting. But Buterin saw a flaw in this approach. He asked what would occur if a blockchain was built with twenty applications in mind, but developers later found a purpose for one or two more applications. Buterin used the following analogy to illustrate what Ethereum aimed to do:



He described smartphones as generic: people can buy them once, and they come with hundreds of built-in applications. Further, users can simply download a new application without buying a new phone or new hardware. In terms of the cost of writing an application, there is no manufacturer or distribution, just the act of writing the code.

What Is Ethereum? Why Is It Significant?

Ethereum is a world computer that allows codable contracts to be built and inserted into its blockchain so that contracts are enforced and verified without middlemen. In more complex terms, Ethereum is a public blockchain-based distributed computing platform with **smart contract** functionality.

Smart contract

Smart contract—computer protocols that facilitate, verify, and enforce the performance of a contract and that can be self-executing and self-enforcing.

What is unique about Ethereum? For starters, it is a virtual machine, or an emulation of a computer system. Virtual machines are based on computer architectures and provide the functionality of a physical computer. The goal of the Ethereum Virtual Machine is to create a globally decentralized digital computer that can be used to execute peer-to-peer contracts with a cryptocurrency called **ether**. It is considered the first world computer that cannot be shut down.

Ether

Ether—The cryptocurrency that runs the Ethereum Virtual Machine and its blockchain. Although a token, like bitcoin, ether is the fuel that powers Ethereum's computing platform. Ether is often likened to gasoline, as owners can offer ether to enact Ethereum-based smart contracts.

Ethereum uses a scripting language that is considered to be Turing complete, meaning that programs (or contracts) can be written to solve any logical step of a computational problem. The associated smart contract functionality removes the need for contractual clauses. Alternatively, the smart contracts can be self-executing and self-enforcing. If widely adopted, smart contracts could have dramatic effects on the way business is constructed and industries operate. The role of middlemen in traditional business models may become unnecessary as businesses adopt Ethereum-like technologies and embrace new opportunities for growth.

Ethereum makes the process of creating blockchain applications much easier and more efficient. Instead of requiring a unique blockchain for each application, Ethereum enables the development of limitless applications on one platform. These applications are known as decentralized applications, or DApps. A DApp is formally defined as a piece of software, which includes a user interface and a decentralized back end, that makes use of the Ethereum blockchain and smart contracts. Many DApps have already been built using Ethereum.

The blockchain model has already turned traditional business on its head by vastly lowering transaction costs and establishing efficiencies through mathematical processes (blockchain protocols) and machines (miners). Ethereum is additionally fascinating in that it even changes the need for human consumers: Ethereum's smart contract functionality enables end-to-end payments without the involvement of a human, which aligns the Ethereum protocol nicely with the ever-evolving Internet of Things (IoT).

Imagine, for example, a washing machine automatically ordering laundry detergent when necessary.[15] This is already being built. Ethereum provides an ecosystem for IoT-related monetary and data exchanges.

Ethereum enables another development that may change traditional business: the decentralized autonomous organization (DAO). A DAO is an organization that is run through smart contracts and that maintains financial records and program rules on a blockchain. Although one of the first DAOs set up using the Ethereum protocol ran into issues after becoming the largest crowdsale in history, the concept is becoming more and more feasible.[16]

Blockchain Use and Investment Outside of Insurance

While 2015 was the year of the bitcoin, 2016 saw the rise of blockchain applications and associated business projects—as demonstrated by these 2015 and 2016 headlines:

Related News in 2015 centered on bitcoin and world events:

Can Bitcoin Conquer Argentina?

With its volatile currency and dysfunctional banks, the country is the perfect place to experiment with a new digital currency.

By NATHANIEL POPPER APRIL 29, 2015

Greeks Turn To Bitcoin To Dodge Capital Controls

TECHNOLOGY NEWS | Wed Jul 22, 2015 11:17am EDT

Betting on blockchain: firms seek fortune in bitcoin's plumbing

SEP 9, 2015 @ 10:00 AM 70,124 VIEWS The Little Black

Bitcoin's Shared Ledger Technology: Money's New Operating System

Bitcoin Is Officially a Commodity, According to U.S. Regulator

The Commodity Futures Trading Commission makes its mark.

The Economist World politics Business & finance Economics Science & technology Cu

Blockchains

The great chain of being sure about things

The technology behind bitcoin lets people who do not know or trust each other build a dependable ledger. This has implications far beyond the cryptocurrency

Why the value of bitcoin is on an absolute tear

Published: Nov 4, 2015 11:09 a.m. ET

Bitcoin Inches Closer to Mainstream with USAA Partnership

ANDY GREENBERG AND GWERN BRANWEN SECURITY 12.08.15 4:25 PM

BITCOIN'S CREATOR SATOSHI NAKAMOTO IS PROBABLY THIS UNKNOWN AUSTRALIAN GENIUS

In 2016, the news shifted to blockchain, Ethereum, and business applications

Can an Arcane Crypto Ledger Replace Uber, Spotify and AirBnB?

January 20, 2016 5:01 am

Blockchain raises fundamental questions

Kadhim Shubber

UBS experiments with Ethereum blockchain

UBS has been experimenting on developing financial instruments based on the blockchain technology. The Swiss bank has developed prototypes of a bond and a loyalty card program using the Ethereum blockchain.

JPMorgan is launching a blockchain trial project with Blythe Masters

Microsoft Certifies Ethereum Offering in Blockchain Service First

Thomson Reuters Announces Ethereum Blockchain Plans

Bitcoin Industry Venture Capitalists Shift Focus to Non-Financial Applications and Ethereum Startups

Ethereum, a Virtual Currency, Enables Transactions That Rival Bitcoin's

Is Brooklyn's Microgrid-On-The-Blockchain The Future Of The Electric System?

'There's opportunity for blockchain': Nasdaq COO

CNBC.com staff | @CNBC

The Blockchain for Healthcare: Gem Launches Gem Health Network With Philips Blockchain Lab

The list below highlights just some of the far-reaching blockchain applications exhibited in various industries in 2016:

Chart 8: Blockchain Applications in 2016, by Industry

Topic	Organization	Singular Idea
Accounting	The American Institute of CPAs, ConsenSys, Balanc3 (Deloitte, Ernst & Young, KPMG, and PwC consortia)	Triple-entry accounting on blockchain.
Automobile sales	Visa and DocuSign	Blockchain to build proof of concept for car leasing: click, sign, and drive.
Banking	R3 (consortium of more than 70 major banks)	Corda synchronizes financial agreements among members.
Cloud storage	Storj	Storj and Counterparty developing near-instantaneous bitcoin micropayments.
Cyber security	Guardtime and Enigma	Using blockchains to fight cyber attacks.
Education	Holbertson School, Sony Global Education	Recording students' results on blockchain.
Energy	LO3, ConsenSys	Paid energy trade using blockchain.
Finance—stocks	Nasdaq	Opening blockchain services to global exchange partners.
Forecasting	Augur	Blockchain prediction market enters beta testing.
Government	Japanese government	Japan sends blockchain start-ups abroad as part of innovation program.
Healthcare	IBM Watson, U.S. Food and Drug Administration	IBM Watson and FDA use blockchain to improve public health.
Internet of Things	Chronicled, Amazon	Chronicled launches Internet of Things registry.
Mass media entertainment	Disney	Disney develops its own blockchain: the Dragonchain.
Money transfers	SWIFT	SWIFT testing blockchain technology.
Music	PledgeMusic, PeerTracks, and BitTunes	Using blockchain technology to change the music industry.
Real estate	Propy	Using blockchain for local and international real estate deals.
Social media	Steemit	Steemit uses blockchain to create new social media network that pays for content.
Sports	Microsoft and BraveLog	Microsoft Azure develops first sports blockchain: BraveLog.
Supply chain management	Walmart	Walmart tests supply chain management using blockchain.
Voting	Expanse Borderless	Americans voting on blockchain.

According to a World Economic Forum (WEF) report published in June 2016, more than $1.4 billion in venture capital investments poured into blockchain technology in just the previous three years. In 2015, half of financial-technology venture capital investment was in blockchain-related projects.[17] And many large, well-known corporations have invested in blockchain-related projects.[18]

Although the pace of growth for venture capital seemed to slow a bit in late 2016, the data may not reflect true capital investment, because blockchain technology had already turned traditional financing on its head. Consider the concept of an **initial coin offering** (ICO), for example. Many of the highest-funded crowdfunded projects—including the highest ever—have used ICOs. Also worth noting is that corporate blockchain investment (venture capital or otherwise) increased dramatically in 2015 and 2016. A recent Nasdaq report suggests that corporate investors outspent noncorporate investors ten to one in the first half of 2016.[19]

Initial coin offering

Initial coin offering—An unregulated means of raising financing for a new cryptocurrency venture. Start-ups use ICOs as a crowdsale, using a blockchain-based project to allow supporters to invest in the project by purchasing part of the cryptocurrency tokens in advance.

The pace of growth in blockchain is staggering and only expected to continue in 2017. The WEF suggests that more than 24 countries are investing in blockchain projects, more than 90 central banks have engaged in blockchain discussions, hundreds of corporations have joined consortia, and 2,500 patents have been filed over three years. And perhaps most astonishing are the predictions. The WEF suggests that decentralized ledger technology like the blockchain "will become the beating heart of the global financial system." It predicts that at least 80 percent or more of banks will have blockchain projects by 2017 and that by 2027, 10 percent of all gross domestic product will be stored on blockchains.

The exuberance shown in these reports is reflected elsewhere. A global study of 500 senior banking and insurance executives by Pegasystems, Market Force, and Cognizant supported these findings. Nine out of ten believe that blockchain technology will disrupt all areas of the financial chain. In fact, 60 percent believe that the blockchain will prove to be the most significant technological development to affect financial services since the internet. One in five expects holding financial assets in a blockchain wallet to become mainstream within five years, and 45 percent think that the combination of blockchain wallets and peer-to-peer lending could herald the end of banking as we know it. However, the report says that just 17 percent have a blockchain strategy.[20]

Investment activity reflects these trends. McKinsey & Company estimates that capital market spending will increase by 59 percent annually through 2019.[21] The bitcoin blockchain provided a new way to send money from person to person, eliminating the involvement of banks and the need for an intermediary, like the Federal Reserve, to validate transactions. Banks quickly recognized the threat, and instead of ignoring it, looked at it as an opportunity. As alternatives to bitcoin emerged, such as Ethereum, banks realized that the blockchain's potential extends well beyond peer-to-peer transactions. The ability of smart contracts to automatically verify and enforce performance of agreements expanded the potential uses of blockchains. Banks decided to harness this technology themselves and invested large sums of capital to test it both individually and through consortia. But why were these industry-wide consortia formed?

In order to explain this, it is best to start with a few definitions. **Public blockchains**, like that of bitcoin or Ethereum, are quite useful. But some regulated industries, like banking, currently prefer **private blockchains**. At left, a few definitions are provided:[22]

Public blockchain

Public blockchain—An open platform that anyone in the world can join, provided that he or she is able to show proof of work. A public blockchain is considered fully decentralized.

Private blockchain

Private blockchain—Only the owner can make changes. This is similar to the current infrastructure, wherein the owner (a centralized authority) has the power to change the rules, revert transactions, etc., based on need.

Hybrid blockchain

Hybrid (or consortium) blockchain—A mix of both public and private blockchains. The ability to read and write can be extended to a certain number of people/nodes. A consortium blockchain can be used by groups of organizations that work together on developing different models by collaborating with each other, thereby developing solutions while maintaining intellectual property rights.

The development of blockchain consortia across various industries underscores the network and economic aspects associated with blockchain-enabled technology. To maximize the impact of blockchain technology, it must be adopted, just like a typical network. Consortia—and accordingly, **hybird (or consortia) blockchains**—are being formed because a variety of markets and industries are beginning to understand the need for them. R3, for example, is a consortium of more than seventy banks that cooperatively test and research blockchain technology. Through their efforts, these banks have created Corda, an open-source distributed ledger platform.[23] Corda, geared toward financial institutions (particularly banks), handles transactions and protects related data. R3 is an example of how competitors can test blockchain applications across an industry, with the ultimate goal of lowering costs—and therefore gaining profitability.

Even multi-industry consortia have been established. The Hyperledger project, for example, which is led by the not-for-profit Linux Foundation, aims to develop open-source layers of code robust enough to support enterprise blockchain applications. It works to create public building blocks that organizations can use to develop specific blockchain applications that can communicate with each other. The ultimate goal is to accelerate enterprise-level adoption of blockchain technology.

That seems to be coming to pass. In March of 2017, Hyperledger and IBM announced Hyperledger Fabric Blockchain as a Service, which allows customers to build their own secure blockchain networks.

Accounting firms are also considering consortia. The American Institute for Certified Public Accountants met with the Big Four accounting firms (Deloitte, Ernst & Young, KPMG, and PwC), ConsenSys (a group of Ethereum developers), and Microsoft (which has a blockchain-as-a-service platform on Microsoft Azure) to discuss formation of a blockchain consortium. They are currently working on a project related to triple-entry accounting.

The future looks bright for new consortia being developed using Ethereum, given recent advances. In fact, Microsoft has announced plans to launch an Ethereum Consortium Blockchain Network. In doing so, it hopes to help entire industries work together to more easily build increasingly complex consortia that better leverage the network effects of a shared, immutable ledger.[24] Meanwhile, J.P. Morgan's Quorum allows for private and permissioned blockchain aspects to be built on the more interoperable public Ethereum blockchain.[25]

Finally, the early 2017 announcement of the Enterprise Ethereum Alliance, of which The Institutes are a founding member, underscores this momentum and offers an inclusive opportunity for other organizations. As noted February 27, 2017, in *The New York Times*, the newly formed alliance aims to create a private version of Ethereum that can be rolled out for specific purposes and opened to permissioned participants.

While these advances are groundbreaking, they are not surprising when viewed historically. For example, most corporate testing began on intranets and local area networks before moving to the internet.

Next Up: Blockchain Offers Broad Benefits for Insurers

Insurers see vast potential in blockchain exploration. Most research on the topic uses two basic examples: travel insurance and crop insurance. With travel insurance, for example, if an airline cancels a flight for a covered reason, a smart contract built using blockchain technology could automatically enact payment to those with insurance. Crop insurance would work similarly: if insured crops suffer covered damage from the weather, a smart contract can confirm the loss using weather data and pay claims automatically.

These examples showcase a blockchain's ability to lower costs, thereby allowing consumers to realize savings. But as alluring as this may be, the potential for blockchain in insurance is much, much broader. In fact, recent research has shown that blockchain could have a profound and widespread impact on the insurance industry:

- Willis Towers Watson found that blockchains can improve access to underserved segments, enable instant policy issuance, and increase transparency in peer-to-peer insurance.[26]
- The WEF found that blockchains can automate claims processing using smart contracts, improve assessment using past claims data, and combat fraud.[27]
- According to the aforementioned survey by Market Force, Pegasystems, and Cognizant, 12 percent of insurance executives expect the use of the IoT, blockchain technology, and smart contracts to be mainstream within two years, and 74 percent expect it to be mainstream by 2025.[28]
- Capgemini research indicates that personal auto insurers could save $21 billion a year through lower costs, which can be realized through application of blockchain-enabled smart contracts.[29]
- Deloitte found that that "adopting a common blockchain across the sector could create a step-change in value in the insurance industry: claims handling could become more efficient and streamlined, resulting in an improved customer experience. Such an approach could also help to reduce further, if not entirely prevent, fraud if identity management was also enforced on the blockchain—meaning that criminals could no longer crash for cash."[30]
- In another report, McKinsey & Company found sixty-four different use cases for blockchain technology. The report found that the insurance industry accounts for the most nonbitcoin blockchain uses (22 percent of the total), distantly followed by the payments industry (13 percent).[31]
- PwC's recommendation is to "identify a group of firms willing to join a consortium to investigate the business case for at least one of the potential use cases."[32] McKinsey & Company agrees, recommending that the industry "work with consortia, technology experts and start-ups, regulators, and other market participants to identify the challenges around blockchain's open and decentralized nature. Among these challenges are technology limitations as well as market, legal/regulatory (Who is regulated in the absence of an intermediary or in cross-border solutions?), and operational requirements regarding, for example, data protection and standardization."[33]

Setting the Stage

Much of the research cited above illustrates the myriad ways that technology like the blockchain can add value in the insurance industry. Because every market is two sided, opportunities for improvement exist both on the consumer (demand) side and the insurer (supply) side. Some specific, representative areas are inspected on the next two pages.

From the Perspective of the **Insured**

In an extended period of weak income growth, rising prices, increased access to information, ever-evolving technology, and increasing globalization, consumers demand ever more from suppliers—including insurers. These are a few major themes expressed by insureds:

1 A wish for an improved customer experience

a. By creating efficiencies through means such as blockchain, insurers have a solid opportunity to increase customer satisfaction in this area, which a recent survey by the digital consultant Engine confirmed is low.[34]

b. For example, insureds have expressed dissatisfaction with the need to complete complex questionnaires and maintain physical receipts as proof of costs incurred because of losses when filing a claim.

c. Given new technology, insureds expect a simple, seamless, personalized solution with minimal delay.

2 Scrutiny regarding affordability

a. For decades, auto insurers have generally kept premium increases in line with income growth, which is no easy feat.[35] Nonetheless, auto insurers have come under increased scrutiny over affordability from consumer groups and organizations like the Federal Insurance Office.[36, 37]

b. Consumers always want lower premiums, but if loss frequency and severity increase, lowering premiums while maintaining solvency becomes increasingly difficult.

3 Greater product innovation

Insurance has not traditionally been associated with high innovation. However, the industry has recently adapted to new technologies and their related insurance needs. Examples include ridesharing services, the IoT, driverless cars, and drones.

4 Faster entry into emerging markets

Entering emerging markets can be costly, so insurers have not necessarily been able to pursue them fully—although the untapped market potential continues to increase. The first-mover advantage with blockchain, combined with efficient service, may prove invaluable in this area.

From the Perspective of the **Insurer**

In our increasingly competitive environment, low interest rates and low returns on investment are the norm. Insurers have adjusted accordingly and established their own set of priorities:

1 Lowering costs

The industry's record-keeping costs are high. As a matter of course, insurers verify identities and contract validity, registration of claims, and loss payouts. Several different parties record information at various points in the process—and house this information across their organizations. In addition, parties within the insurance industry operate in a sectioned environment where organizations often utilize service providers and other valuable intermediaries. Blockchain can help create efficiencies for all by lowering costs and turnaround times.

2 Easing data retrieval

PwC found that 93 percent of insurance CEOs consider data mining and analytics to be strategically important, a larger proportion than the rest of the financial services industry.[38] But implementation is difficult: insurers often must depend on data from third-party providers, which frequently offer only manual access and whose data may not be expressed in real time.

3 Simplifying processes

To process claims today, loss adjusters review claims, ensure completeness, request additional information when necessary, confirm coverage, determine liability, and calculate loss amounts. But what if there were a simpler way? According to Capgemini, personal auto insurers could save $21 billion a year by using smart contracts.[39]

4 Combatting fraud

According to the Insurance Research Council, fraud, including build-up, adds up to about $7 billion in excess payments for auto injury claims—in the U.S. alone.[40] Fraud makes insurance more expensive for insurers and insureds alike. So it stands to reason that by effectively combatting it, expenses for both groups could decrease.

5 Working within stringent regulations

Like the rest of the financial services industry, insurers are subject to complex and prescriptive regulations and standards. Any assistance in working within these parameters would surely prove helpful.

The blockchain technology speaks to all of these priorities, as it addresses automation, improved third-party integration, increased trust, more extensive market reach, and greater efficiency—thereby offering greater satisfaction among insureds and opportunities for growth by insurers.

And...Action! Some Recent Examples

Evaluation of blockchain use cases in other industries has steered researchers toward genesis use cases—ones that are not overly complicated and that involve pervasive, scalable issues that may result in immediate cost savings. The areas of opportunity presented in Chart 9, followed by a sampling of use cases, meet most, if not all, of these criteria, showcasing the blockchain's vast potential throughout the insurance industry.

Chart 9: Areas of Opportunity in the Insurance Value Chain

Products, Pricing, and Distribution	Underwriting and Risk Management	Policyholder Acquisition and Servicing	Claims Management	Finance, Payments, and Accounts	Regulation and Compliance
Parametric insurance	Provenance	Policyholder acquisition	Fraud register	Netting and payments across countries	Real-time regulatory monitoring
Insurance included in transactional purchases	Data sharing and risk registries	Placement documentation	Claims automation	Subrogation	Education/ licensing catalog
Mobile insurance for developing countries	Peer-to-peer insurance	Know your customer/ anti-money laundering efforts	Multilayer claims settlement	New forms of raising capital (crowd-funding)	Proof of insurance

Products, Pricing, and Distribution

Parametric Insurance—Smart Contracts and Automation

As insurers seek ways to cut costs and insurance-related data continues to mount, parametric insurance is increasingly being deployed. Parametric insurance is a type of insurance, reinsurance, or risk transfer arrangement that does not indemnify based on pure loss for the protection buyer, but agrees to make a payment upon occurrence of a triggering event. It is often used for low-frequency, high-severity risks—such as natural disasters, weather risks, and agricultural risks. The associated triggers within parametric insurance are related to risk. For example, wind speed, ground acceleration, temperature, and precipitation totals have all been used. Parametric triggers are often used in catastrophe bonds and insurance-linked securities.

The blockchain could help with parametric insurance by expanding parametric application in insurance and automating the entire process. Instead of indemnifying on pure loss, insurers would agree to pay a certain amount upon occurrence of triggers within present smart contracts. As mentioned earlier, blockchain-related research is already under way in flight insurance and crop insurance, but could easily be extended to niche coverages, catastrophe swaps, and other areas.

Underwriting and Risk Management

Data Sharing and Risk Registries

Underwriters and risk managers involved in the insurance process are increasingly finding value in sharing data and information. Risks need to be assessed, and insurance consumers frequently need to be screened—often for regulatory reasons, but also to ensure that they are who they say they are. Both involve directly collecting information, which can lead to duplicative efforts across the industry and increased costs over time. Data sharing and risk registries are seen as potential solutions and may also have other benefits, allowing the industry to capitalize on scale.

Blockchain technology can optimize processes related to data and information flow across the entire value chain, but particularly related to risk. A consortium chain can allow insurance-related parties to share data and register risk.

Policyholder Acquisition and Servicing

Policyholder Acquisition—Improving Record Keeping

In commercial insurance, exchanges of information and transactions often occur in a centralized manner. Much of the activity is documented on paper in great detail—a labor-intensive process, as insurers maintain electronic files, and often physical files, that describe the risk. To develop a quote, brokers may call multiple underwriters or search through various carrier websites. An agreed-upon contract is sent to the market for registration, transformed into a digital format (if not already done), processed (often manually), and then stored. Soon thereafter, copies of the contract are sent to the brokers and carriers—and the processing and recordkeeping begin again. Insurers may need to use these records in later stages of the insurance policy life cycle. In fact, the records are generally adjusted and updated throughout the life of the contract, potentially leading to reconciliation issues.

In response to these placement issues, the industry has considered alternative measures, such as electronic trading (e-trading). In e-trading, the placement process is somewhat flipped: The broker may offer a sales opportunity, which insurers can bid on digitally in an auction-style format. In this way, the broker can use one interface for all participating insurers and obtain all the information nearly in real time.

Still presenting a challenge, though, are the underlying costs related to documentation. Documentation difficulties, such as data updates that might not be duplicated in other versions of the same contract, may lead to processing delays, which in turn increase the overall cost of insurance. Moreover, such difficulties can limit growth opportunities by requiring that more and more labor resources be dedicated to administrative tasks.

A blockchain can help by providing access to contract documentation via keys. These keys can be shared with the necessary underwriters and brokers, allowing appropriate access to the documentation and updates that are reflected across the board. In this way, a blockchain can help ensure consistency among various parties and dramatically cut administrative costs.

Claims Management

Fraud Register—Shared Data

Insurance fraud is estimated to cost insurers about $80 billion a year across all lines and to account for 10 percent of property-casualty insurance losses and loss adjustment expenses each year.[41] The issue is particularly pervasive in homeowners insurance, but it also occurs in other areas—including auto insurance. In fact, the Insurance Research Council studied auto claims data and found that 21 percent of bodily injury claims and 18 percent of personal injury protection claims showed signs of fraud or buildup.[42]

Why is this such a challenging issue for the industry? One reason is that criminals take advantage of flaws in the system, which makes fraud difficult to identify. In auto insurance, for example, some criminals use synthetic identities to create multiple policies; in a single claim, one party may be listed as an accident victim, a driver, and a witness. Or claims with almost identical patterns could be filed with multiple insurers. Insurers invest a great amount of resources in gathering fraud-related data and conducting investigations.

Through blockchain technology, insurers could share certain fraud-related data through an insurer-only network while maintaining appropriate anonymity. Moreover, blockchain technology has the ability to generate a digital history of assets, which may help fight fraud and other crimes.

Further, blockchain technology could lessen current expenses and inefficiencies in the fraud-reduction process. If an industry-wide consortium blockchain were established in which each party operated as a network node, then owners of the nodes (insurers, brokers, and others) could share existing data. The blockchain and the smart contracts within could provide a means of uniting data for further inspection. This could largely, though not completely, automate fraud detection.[43] So, for example, multiple claims for the same car accident would be rejected because the shared fraud register would have recorded each claim. And a smart contract could reject submissions and generate follow-up requests.

The blockchain's potential could be even broader if such models are put into practice and refined. As blockchains weave their way into existing infrastructures, a blockchain-enabled fraud register could quite possibly become part of a new blockchain-enabled claims process. If a blockchain can help automate the claims process, a fraud-registry check could become just another step in the new smart claims process—a step that could prove beneficial for all.

Claims Automation—Creating a Seamless Experience

The economic climate today presents a multitude of challenges for insurers. Profits have been constrained by such factors as low interest rates and regulatory scrutiny. Blockchain technology can help—with cost containment through automation, particularly in the claims process.

The current claims experience is complex, in many instances still relying on paper processing, and feedback from customers—such as through a recent survey from the digital consultant Engine—indicates that there is great room for improvement.[44]

Insurance customers want seamless, personalized solutions with minimal delay. However, the existing insurance and claims processes involve many ingrained system complexities that hinder transition. For example, insurers interact with many intermediaries and third-party data providers throughout the claims process, which can lead to delays and increase costs. In addition, the current claims process is largely manual: adjusters manually inspect claims submissions, verify policy existence, review coverage, evaluate damages and liability, and negotiate loss amounts and settlements.

Blockchains can help reduce costs through automation, as blockchain-enabled smart contracts can be embedded throughout the claims experience. These smart contracts can establish rules to enforce policy terms and pay claims without requiring manual administration or having loss adjusters review every claim—instead, allowing them to focus on the more complex ones.

In addition, the claims submission process could be dramatically simplified and more customer focused by incorporating smart-contract-generated submissions. Engagement with intermediaries through the claims process may also improve because the flow of information would be automated and streamlined where appropriate.

Clearly, insurers can realize efficiencies through new claims processes with blockchain technology. Less clear is how long the necessary transition will take. But the future sure looks exciting.

Finance, Payments, and Accounts

Netting—a Transactional Example

Netting, or offsetting, is the right of parties that owe debts to each other to pay only the difference between the debts.[45] This right is available to both insurers and reinsurers, and incorporating it into the contractual terms requires planning.

A shared consortia ledger could allow contributing members to establish contractual rules up front and, accordingly, to insert these rules into smart contracts. Automated netting via smart contracts, in turn, could result in significant savings for insurers.

Traditionally, if Company X owes $500,000 to Company Y, then Company Y should have $500,000 in accounts receivable in its books, and Company X should have $500,000 in accounts payable. This transaction would typically be coordinated via invoices, which involves staffing and approval processes and which may require additional approvals or processing. With a blockchain, both Company X and Company Y are able to access the same shared ledger rather than individual ledgers and conclude the transaction more efficiently. Blockchain technology can also help accelerate transactions because blocks are confirmed every ten minutes. Finally, groups of transactions could be netted

Payments Across Countries—a Transactional Example

The amount of money exchanged in cross-border payments is staggering. And although not all insurers operate internationally, the industry as a whole often encounters these sorts of payments. A related issue noted by insurers is the time such exchanges take. Another is that the process relies on intermediaries. Through this process, money moves from one bank (in other words, a middleman) to the next. Each intermediary takes a slice of the funds before forwarding them along the chain, contributing to payment-processing delays, expensive customer fees, and risk related to weaker banking standards.[46]

A blockchain, which does not face the same geographic hurdles and can bypass middlemen, could change this approach, leading to lower fees and faster transactions. For insurers, this could mean that less administrative support would be necessary, fees would go down because fewer intermediaries would be involved, and money would change hands quicker.

These sorts of activities are already being investigated in the banking industry, which led to the cryptocurrency Ripple, and the industry appears to be using Ethereum more and more.[47, 48] Banks are also looking into ways to bypass the numerous intermediaries involved in small and medium-size international financial transactions, another possible source of significant savings. Global insurers could do the same.

Subrogation—a Transactional Example

Subrogation is the right of one party (an insurer) that has made a payment (to an insured) that was owed by another party (such as another driver's insurance company) to collect the money from the party that is legally liable for the loss. Because there is often a delay in establishing fault in insurance, when one party appears to be at fault in a claim, an insurance company will pay the claim for its insured and then seek to recover that money (or at least some of it) from the party at fault.

Subrogation is usually an exchange of monies between insurers. Therefore, a shared ledger, particularly a consortia shared ledger, could facilitate the netting of payments, eliminate manual processes, and speed up the entire process. It could also eliminate or reduce administrative costs and costs related to third parties—especially if the netting principles described above are automated via smart contracts.

Regulation and Compliance

Proof of Insurance—a Shared Ledger to Weed Out the Uninsured

The most common way a person can prove that he or she has valid insurance is by showing a paper card provided by the insurance company that lists policy information and effective dates. About thirty states have allowed e-insurance cards to serve as proof of insurance.

Regardless of the type, proof of insurance is issued for every vehicle with liability coverage—but costs accompany this proof. For example, during the policyholder life cycle, there is often a need to update the information, which can lead to additional costs, both direct and indirect. In addition, insurers, regulators, and policymakers seek to understand the uninsured, which make up a remarkable 13 percent of U.S. drivers.[49]

The blockchain can help. It can allow for electronic safekeeping and updating of information across the board. And smart contracts could be used to alert insurers and other parties to suspicion of uninsured motorists.

Imagine It: Your Place in the Blockchain

Imagine a world in which appliances like refrigerators or washing machines handle grocery shopping by checking inventories and enacting autonomous payments via smart contracts. A world in which self-driving electric cars charge by conduction at stop lights. This vision is quickly becoming reality—and represents the mere start of things to come.

Now imagine a world in which paperwork is minimized, if not eliminated, in your business. An insurance industry in which claims are verified and handled in real time and in which policy applications are approved or rejected immediately. Imagine if fraud were reduced using a decentralized ledger. Imagine how much money this increasing automation would save your business. Imagine, in real terms, how much cheaper insurance could become as the savings are passed on to consumers.

This world is not far off, and it presents a world of opportunity for players in the industry. Until recently, a crucial piece had been missing: shared data. The blockchain changes that. It allows for a shared version of reality and opens up countless new doors. The only question remaining is, Are you going to step through?

Endnotes

1. Robert Strohmeyer, "The 7 Worst Tech Predictions of All Time," PCWorld, December 31, 2008, http://www.pcworld.com/article/155984/worst_tech_predictions.html (accessed February 7, 2017).

2. "Credit card," Encyclopædia Britannica, May 11, 2016, https://www.britannica.com/topic/credit-card (accessed February 7, 2017).

3. Stephen Fortune, "A Brief History of Databases," Avant.org, http://avant.org/project/history-of-databases/ (accessed February 7, 2017).

4. Two navigational models were established. First, there was the hierarchical model, epitomized by IBM's Information Management System. This model viewed data structures as hierarchical trees of records, each with one parent and many children. The second model was a network database model. This model allows each record to have multiple parent and child records, forming a generalized graph structure. This model also conceived of a flexible way to represent objects and their relationships.

5. "Timeline of Computer History," Computer History Museum, http://www.computerhistory.org/timeline/networking-the-web/ (accessed February 7, 2017).

6. Edgar F. Codd, "A Relational Model of Data for Large Shared Data Banks," *Communications of the ACM*, vol. 13, no. 6, June 1970, pp. 377–87, http://www.seas.upenn.edu/~zives/03f/cis550/codd.pdf (accessed February 9, 2017).

7. Michael J. Burry, "I Saw the Crisis Coming. Why Didn't the Fed?" *New York Times*, April 3, 2010, http://www.nytimes.com/2010/04/04/opinion/04burry.html?_r=0 (accessed February 9, 2017).

8. Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System," Bitcoin.org, November 2008, https://bitcoin.org/bitcoin.pdf (accessed February 9, 2017).

9. While bitcoin supports anonymity and was considered quite anonymous when first created, its current implementation offers less anonymity. See https://en.bitcoin.it/wiki/Anonymity for details.

10. "The Definition of Money," Boundless Economics, September 20, 2016, https://www.boundless.com/economics/textbooks/boundless-economics-textbook/the-monetary-system-27/introducing-money-114/the-definition-of-money-444-12541/ (accessed February 10, 2017).

11. Grace Caffyn, "Bitcoin Pizza Day: Celebrating the Pizzas Bought for 10,000 BTC," CoinDesk, May 22, 2014, http://www.coindesk.com/bitcoin-pizza-day-celebrating-pizza-bought-10000-btc/ (accessed February 10, 2017).

12. “Crypto-Currency Market Capitalizations,” CoinMarketCap, February 11, 2017, https://coinmarketcap.com/all/views/all/ (accessed February 11, 2017).

13. Frederick Reese, “Not Just Bitcoin: The Top 7 Cryptocurrencies All Gained in 2016,” CoinDesk, December 31, 2016, http://www.coindesk.com/not-just-bitcoin-the-top-7-cryptocurrencies-all-gained-in-2016/ (accessed February 11, 2017).

14. Vitalik Buterin, “DevCon2: Ethereum in 25 Minutes,” Ethereum Foundation, October 10, 2016, https://www.youtube.com/watch?v=66SaEDzlmP4 (accessed February 13, 2017).

15. Alex Scroxton, “IBM Looks to Bitcoin Blockchains for Internet of Things Platform,” *Computer Weekly*, January 22, 2015, http://www.computerweekly.com/news/2240238627/IBM-uses-Bitcoin-technology-to-build-internet-of-things-platform (accessed February 13, 2017).

16. Richard Waters, “Automated Company Raises Equivalent of $120M in Digital Currency,” CNBC, May 17, 2016, http://www.cnbc.com/2016/05/17/automated-company-raises-equivalent-of-120-million-in-digital-currency.html (accessed February 13, 2017).

17. JP Buntinx, “Blockchain Investments Equal Half of All 2015 Fintech VC Funding,” August 27, 2016, The Merkle Company, http://themerkle.com/blockchain-investments-equaled-half-of-all-2015-fintech-vc-funding/ (accessed February 13, 2017).

18. “Which Financial Services Firms and Corporations Are Investing in Blockchain and Bitcoin?” CB Insights, March 2, 2016, https://www.cbinsights.com/blog/financial-services-bitcoin-investors/ (accessed February 13, 2017).

19. James MacAlistair, “How Blockchain Is Changing Venture Capital, Enterprise Investment, And Startups,” Nasdaq, December 12, 2016, http://www.nasdaq.com/article/how-blockchain-is-changing-venture-capital-enterprise-investment-and-startups-cm719933 (accessed February 13, 2017).

20. “Blockchain Will Be Most Significant Technological Innovation Since the Internet, Say ‘In the Know’ Financial Services Retailers,” Pegasystems, May 25, 2016, https://www.pega.com/about/news/press-releases/blockchain-will-be-most-significant-technological-innovation-internet-say (accessed January 23, 2017).

21. “Blockchain Technology in the Insurance Sector,” McKinsey & Company, January 5, 2017, https://www.treasury.gov/initiatives/fio/Documents/McKinsey_FACI_Blockchain_in_Insurance.pdf (accessed February 14, 2017).

22. “Know More About Blockchain: Overview, Technology, Application Areas And Use Cases,” Let’s Talk Payments, 2015, https://letstalkpayments.com/an-overview-of-blockchain-technology/ (accessed January 23, 2017).

23. Richard G. Brown, “Introducing R3 Corda: A Distributed Ledger for Financial Services,” R3, April 5, 2016, https://www.r3cev.com/blog/2016/4/4/introducing-r3-corda-a-distributed-ledger-designed-for-financial-services (accessed February 13, 2017).

24. Michael del Castillo, “Microsoft Doubles Down on Ethereum With New Blockchain Product, CoinDesk, November 3, 2016, http://www.coindesk.com/microsoft-launching-new-ethereum-blockchain-product/ (accessed February 16, 2017).

25. Robert Hackett, “Why J.P. Morgan Chase is Building a Blockchain on Ethereum,” *Fortune*, October 4, 2016, http://fortune.com/2016/10/04/jp-morgan-chase-blockchain-ethereum-quorum/ (accessed February 16, 2017).

26. Magdalena Ramada-Sarasola, “Want to Get an Insurer’s Attention? Just Say Blockchain.” Willis Towers Watson, June 27, 2016, https://www.willistowerswatson.com/en/insights/2016/06/want-to-get-an-insurers-attention-just-say-blockchain (accessed January 23, 2017).

27. Peter Vanham, “Blockchain Will Become ‘Beating Heart’ of the Global Financial System,” World Economic Forum, August 12, 2016, https://www.weforum.org/press/2016/08/blockchain-will-become-beating-heart-of-the-global-financial-system/ (accessed January 23, 2017).

28. “Blockchain Will Be Most Significant Technological Innovation Since the Internet, Say ‘In the Know’ Financial Services Retailers,” Pegasystems.

29. “Consumers Set to Save Up to Sixteen Billion Dollars on Banking and Insurance Fees Thanks to Blockchain-Based Smart Contracts Says Capgemini Report,” Capgemini, October 11, 2016, https://www.capgemini.com/news/consumers-set-to-save-up-to-sixteen-billion-dollars-on-banking-and-insurance-fees-thanks-to (accessed January 23, 2017).

30. “Blockchain Applications in Insurance,” Deloitte, 2016, https://www2.deloitte.com/content/dam/Deloitte/ch/Documents/innovation/ch-en-innovation-deloitte-blockchain-app-in-insurance.pdf (accessed January 23, 2017).

31. “Blockchain Technology in the Insurance Sector,” McKinsey & Company.

32. “Chain Reaction: How Blockchain Technology Might Transform Wholesale Insurance,” PwC, http://www.pwc.com/gx/en/industries/financial-services/publications/blockchain-technology-might-transform-wholesale-insurance.html (accessed February 14, 2017).

33. “Blockchain in Insurance – Opportunity or Threat?” McKinsey & Company, July 2016, http://www.mckinsey.com/industries/financial-services/our-insights/blockchain-in-insurance-opportunity-or-threat (accessed February 14, 2017).

34. “Engine Annual Customer Experience Survey 2016,” Engine, September 14, 2016, http://enginegroup.co.uk/news-and-views/engine-annual-customer-experience-surveys-2016 (accessed February 13, 2017).

35. Patrick Schmid, “Auto Insurance Affordability,” *Journal of Insurance Regulation*, 2014, vol. 33, no. 9, http://www.naic.org/documents/prod_serv_jir_JIR-ZA-33-09-EL.pdf (accessed February 13, 2017).

36. “Auto Insurance,” Consumer Federation of America, 2015, http://consumerfed.org/issues/insurance/auto-insurance/ (accessed February 13, 2017).

37. “Treasury’s Federal Insurance Office Announces Adoption of Methodology for Monitoring the Affordability of Auto Insurance,” U.S. Department of the Treasury, July 13, 2016, https://www.treasury.gov/press-center/press-releases/Pages/jl0512.aspx (accessed February 13, 2017).

38. “Data Dominates: Capitalizing on Digital to Engage Customers, Find Talent, and More,” PwC, 2015, https://www.pwc.com/us/en/ceo-survey/img/data-finding.pdf (accessed February 14, 2017).

39. “Smart Contracts in Financial Services: Getting from Hype to Reality,” Capgemini, 2016, https://www.capgemini-consulting.com/resource-file-access/resource/pdf/smart-contracts.pdf (accessed February 14, 2017).

40. “Insurance Research Council Finds That Fraud and Buildup Add Up to $7.7 Billion in Excess Payments for Auto Injury Claims,” Insurance Research Council, February 3, 2015, http://www.insurance-research.org/research-publications/fraud-and-buildup-and-auto-injury-claims (accessed January 23, 2017).

41. “By the Numbers: Fraud Statistics,” Coalition Against Insurance Fraud, 2016, http://www.insurancefraud.org/statistics.htm (accessed January 23, 2017).

42. “Insurance Research Council Finds That Fraud and Buildup Add Up to $7.7 Billion in Excess Payments for Auto Injury Claims,” Insurance Research Council.

43. It is likely that it would still be useful for a third party to scan this shared database with sophisticated forms of analytics (such as predictive modeling, machine learning or artificial intelligence) to gain insights that could then be coded into smart contracts that inform insurers of potentially fraudulent activity.

44. "Engine Annual Customer Experience Survey 2016," Engine.

45. "Setoff," IRMI Online, https://www.irmi.com/online/insurance-glossary/terms/s/setoff.aspx (accessed February 14, 2017).

46. Nasreen Quibria, "BankThink Blockchain Holds Promise for Cross-Border Payments," August 7, 2015, https://www.americanbanker.com/opinion/blockchain-holds-promise-for-cross-border-payments (accessed February 14, 2017).

47. "Off the Rails: Can Regulation Help Blockchain Deliver Faster X-Border Payments?" PYMNTS, January 13, 2017, http://www.pymnts.com/news/cross-border-commerce/2017/regulation-blockchain-x-border-payments/ (accessed February 14, 2017).

48. Angus Leung, "Santander Confirms Fiat-Backed Token Project on Ethereum Blockchain," September 24, 2016, https://cointelegraph.com/news/santander-confirms-fiat-backed-token-project-on-ethereum-blockchain (accessed February 14, 2017).

49. Insurance Research Council, Uninsured Motorists, 2014 Edition (Malvern, Pennsylvania: The Institutes, 2014), http://www.insurance-research.org/research-publications/uninsured-motorists-2014-edition (accessed March 22, 2017).

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Patrick G. Schmid, PhD, is assistant vice president of Enterprise Research for The Institutes, where he leads teams that develop market insights and analytical research. He has written extensively on blockchain and serves as an expert on the topic for The Institutes.

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