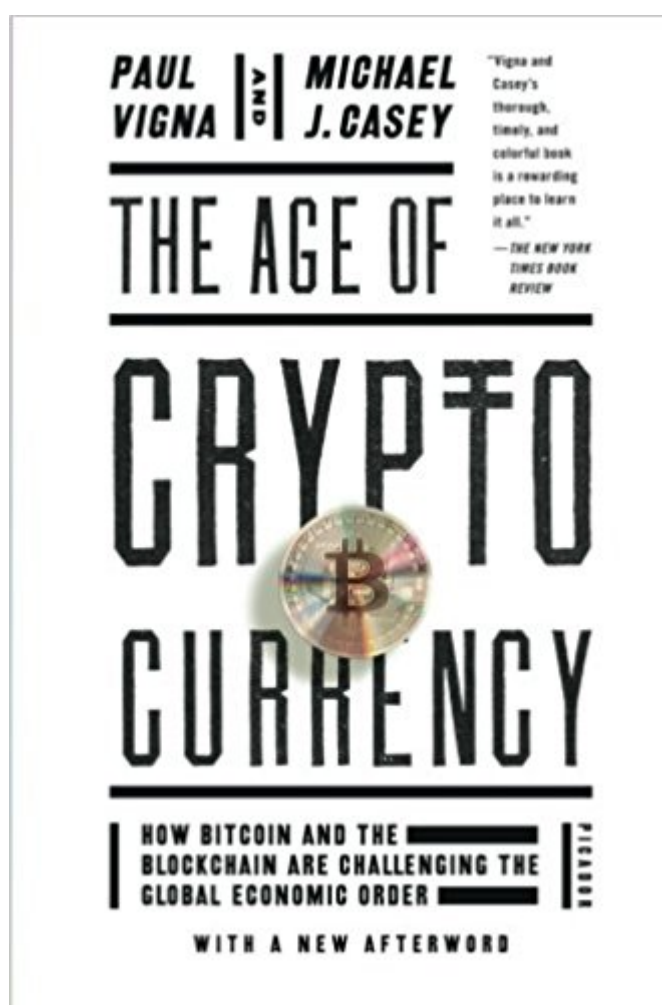


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The Age Of Cryptocurrency: How Bitcoin And The Blockchain Are Challenging The Global Economic Order



Synopsis

Bitcoin became a buzzword overnight. A cyber-enigma with an enthusiastic following, it pops up in headlines and fuels endless media debate. You can apparently use it to buy anything from coffee to cars, yet few people seem to truly understand what it is. This raises the question: Why should anyone care about bitcoin? In *The Age of Cryptocurrency*, Wall Street journalists Paul Vigna and Michael J. Casey deliver the definitive answer to this question. Cybermoney is poised to launch a revolution, one that could reinvent traditional financial and social structures while bringing the world's billions of "unbanked" individuals into a new global economy. Cryptocurrency holds the promise of a financial system without a middleman, one owned by the people who use it and one safeguarded from the devastation of a 2008-type crash. But bitcoin, the most famous of the cybermonies, carries a reputation for instability, wild fluctuation, and illicit business; some fear it has the power to eliminate jobs and to upend the concept of a nation-state. It implies, above all, monumental and wide-reaching change—*for better and for worse*. But it is here to stay, and you ignore it at your peril. Vigna and Casey demystify cryptocurrency—its origins, its function, and what you need to know to navigate a cyber-economy. The digital currency world will look very different from the paper currency world; *The Age of Cryptocurrency* will teach you how to be ready.

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Customer Reviews

“Vigna and Casey’s thorough, timely and colorful book is a rewarding place to learn it all.”
—*The New York Times Book Review*
“For any book on bitcoin to be worth reading, it has to delve further: into the crypto-currency’s ideological and technical roots, for

instance, or what it adds to the narrative of money, or even what its economic and political impact may be. The currency's...underlying technology provides plenty of intellectual fodder-and is unlikely to go away. So there is plenty to write about if you are serious. Paul Vigna and Michael Casey, two journalists at the Wall Street Journal, are certainly serious. The Economist [Vigna and Casey] have produced more than a bitcoin 101: their [book] is a smarter, more holistic take on not just bitcoin, but the potential of all digital currencies to change the way we send each other money. Fortune "This book by @mikejcasey and @paulvigna is a new must-read on Bitcoin and cryptocurrency! Marc Andreessen (@pmarca) "To their ample credit, Paul Vigna and Michael J. Casey, veteran Wall Street Journal reporters, resist the common temptations to hype their trendy subject. They've written a reported explainer that patiently documents bitcoin's rise, acknowledges its flaws and highlights its promise. Smart and conscientious, The Age of Cryptocurrency is the most thorough and readable account of the short life of this controversial currency. The Washington Post "This book should be required reading for anyone who has an interest in digital currency or the capabilities of the blockchain. Bitcoin Magazine "If you are baffled by Bitcoin and bemused by blockchains then The Age of Cryptocurrency... includes everything you could possibly want to know about cryptocurrencies, without the need for being either a skilled mathematician or uber-geek computer engineer. Global Finance Magazine "Thorough, multidisciplinary approach to the topic, including a fascinating examination of the origin of money... newcomers will gain a better understanding of the revolutionary potential of digital currency...And the explication of the non-currency applications of the concepts behind Bitcoin--such as tamper-proof records of verified information will be valuable to any reader. Publishers Weekly, starred review "Anyone who doubts that bitcoin and its imitators are at the early stage of altering fundamentally the global payments system--if not the nature of money itself--will find it difficult to resist Michael Casey and Paul Vigna's admirably clear and judicious account. If the word 'blockchain' makes you want to call a plumber, or if you think Satoshi is some kind of raw fish, you need to read The Age of Cryptocurrency today. If you're already a bit-convert, you'll still learn a lot. Niall Ferguson, author of The Ascent of Money "Anyone who views bitcoin as a voodoo concept must read this totally comprehensible narrative outlining the history of money and how bitcoin might become a new and better currency. For those confused by bitcoin concepts, this clearheaded and readable book sets forth credible reasons why bitcoin might or might not be an evolving economic miracle. Arthur Levitt, 25th Chairman of the United States Securities and Exchange

Commissioner — “An invaluable book: a fascinating field guide to the phenomenon in which three of the most powerful forces shaping our world today--the reform of finance, technological innovation, and the rejection of traditional politics--meet.” — Felix Martin, author of *Money: The Unauthorized Biography* — “The Age of Cryptocurrency not only demystifies and explains bitcoin, but also shows where it fits into the cultural zeitgeist and where it’s pointed, and what that may mean for our financial system.” — John Mauldin, New York Times bestselling author of *Endgame* — “The thought-provoking Age of Cryptocurrency was a pleasure to read. The authors have successfully demystified cryptocurrencies like bitcoin so that even a traditionalist like myself can understand them and embrace their potential. And the references to money were so spot-on, they even taught this old dog some new tricks.” — Edmund C. Moy, 38th Director of the United States Mint, 2006-2011 — “Vigna and Casey unlock the mysteries of cryptocurrencies and their implications for the future of financial transactions in an engaging, lucid, and thought-provoking account. The technological developments described in this book will someday affect every one of us and I can think of no better guide to what the future holds.” — Eswar Prasad, author of *The Dollar Trap* — “Even to a bitcoin skeptic like myself, Vigna and Casey’s book is a fascinating journey into the cast of characters and oddballs behind the movement into the digital currency realm.” — Barry Ritholtz, CIO, Ritholtz Wealth Management — “Vigna and Casey are cautious, though enthusiastic guides to this strange new world. Being Wall Street Journal reporters, they know how to dig beneath the surface and they also know how to write. The book is full of fascinating stories, from the origins of money to the future of decentralised commerce, from the Mt Gox meltdown to the Silk Road bust.” — Matt Ridley, Times of London — “[I]n...their fascinating book on the topic, Wall Street Journal columnists Paul Vigna and Michael Casey set out to convince readers that bitcoin is not only going straight, but has the potential to change the world.” — Literary Review — “[T]he book is extremely well written, and easy to understand. In a nutshell, it narrates the chronology of Bitcoin’s evolution with impeccable precision. It is free of hype, while not being shy in pinning the important role that cryptocurrencies will play in our future.” — William Mougayar, Venture Advisor — “Bitcoin and Bitchain (sic) are likely to revolutionize money...The book to read on this topic is *The Age of Cryptocurrency* by Vigna and Casey two Wall Street Journal financial journalists.” — Rishad Tobaccowala — “This sober yet exciting account of cryptocurrency, told by two very smart and objective reporters, is exactly the way to introduce yourself, or a sophisticated newbie you know, to the technology’s revolutionary potential. I recommend you check it out.” — Jerry Brito, Executive Director, Coin Center

MICHAEL J. CASEY writes for The Wall Street Journal, covering global finance in his "Horizons" column. He is a frequent contributor to the Journal's MoneyBeat blog and co-authors the daily "BitBeat" with Paul Vigna. He is the host of the book-themed video series "WSJ Afterword" and a frequent guest on and host of "The News Hub" and "MoneyBeat." His podcast on world economic affairs is forthcoming. Casey has written for such publications as Foreign Policy, The Washington Post, and The Financial Times. He is the author of two books: *Che's Afterlife: The Legacy of an Image* (Vintage, 2009), one of Michiko Kakutani's "best books of 2009," and *The Unfair Trade: How Our Broken Financial System Destroys the Middle Class* (Crown, 2012). PAUL VIGNA is a markets reporter for The Wall Street Journal, covering equities and the economy. He is a columnist and anchor for MoneyBeat. Previously a writer and editor of the MarketTalk column in DowJones Newswires, he has been a guest on the Fox Business Network, CNN, the BBC, and the John Batchelor radio show. He has been interviewed by Bitcoin magazine and appeared on the Bitcoins & Gravy podcast, and boasts a collective 20 years of journalism experience.

The authors of this book are reporters, and as a piece of reportage it is broad, deep, and well-balanced. They take you through the history of bitcoin, the alternatives to bitcoin, all the technology behind bitcoin, and extended uses for this disruptive technology which could have wide implications throughout society. They provide a broad discussion of the projects underway in 2014 to employ bitcoin. If the book has one shortcoming, it does not define how it all works quite precisely enough for a techie. The reader of this review may find it useful to mix my point of view with that of the book itself in trying to envision the mechanics. The casual reader is somewhat familiar with the bitcoin phenomenon. It appears to have been started by a single idiosyncratic individual calling himself Satoshi Nakamoto but whose identity remains unknown and who dropped out of sight some three years ago. What this gifted technician did was to envision the architecture of an entire system, implement that system, find a group of disciples, fanatics if you will, to carry it on, and then quietly disappear. This is truly the stuff of science fiction. The thing that he invented is the thing that is most difficult to describe. Here I go in my own words, rearranging some thoughts from these authors. The first question is what a currency is. We are familiar with fiat currencies such as the dollar the euro and the yen. We are familiar with the fact that these have all evolved from metallic representations, such as silver dollars and \$20 gold pieces, to paper certificates indicating that metal was once held in storage to back them up, to fiat currencies which have nothing whatsoever behind them. The dollar today is an artificial construction, a unit of exchange. Actually, what every currency must be is

three things. It must be a unit of exchange, something that can be offered in exchange for goods or services. It must also be a store of wealth, so that today's labor can be converted into currency and stored to be spent later. Or vice versa, it can be borrowed against future earnings. The third measure is a unit of account. Everybody has income stated in some currency or another. You may make \$2,000 a month and have a net worth of 700,000 Francs. Businesses especially need such a measure of their performance. That's what currencies are. They have different strengths and weaknesses. Gold is difficult to carry and safeguard and doesn't come in small denominations. Fiat currencies are imminently bankable, they can be moved around electronically with great ease. However, they are subject to counterfeiting and inflation. The counterfeiter can create false paper money, and a financial manipulator or central bank can arbitrarily dilute current holders, expanding the money supply by creating dollars out of thin air. Moreover, the rapacious bankers scrape off a slice of every transaction, from 3% on a typical credit card transaction to 10% and more on international remittances. No currency is ideal. One characteristic that all traditional currencies have had is that they are fungible. If I have \$1,000 in the bank, I could not possibly say who previously owned those dollars. It's a silly question even to ask, like asking what happened to a raindrop falling into the ocean. Even the tangible stuff like the pennies in my pockets carry no history with them. I make an analogy that the authors do not: to real estate. Real property is recorded by a registrar. The fact that I own my house is known to the state and it is public information available to anybody. Not only that, but who I bought my house from, and who they bought from, is a matter of public record. How the land my house sits on was defined is public record. It was probably subdivided from some farm back in time. Thus, where land records are complete, there is a chain of ownership reflected in land records that guarantees the authenticity of a title. This is the most essential difference between bitcoin and other currencies: a perpetual chain of ownership. There is a permanent record electronic record of every past owner of every particular coin or fraction thereof, and of every transaction ever completed within the system. The implications of being able to trace the history of every transaction in which a piece of money has been involved are extremely broad. It means that there can be no question as to the validity of a transaction. Unlike with a bank, there cannot be an overdrawn account. If the money isn't there, the transaction is not accepted. If it is, the transaction is final. Unlike paper money you cannot have counterfeit. Unlike a Federal Reserve System you cannot have \$85 billion created every month out of thin air. The whole bitcoin universe knows where every piece of money came from. The bitcoin concept, which is called the block chain concept is revolutionary in that sense. There is a publicly available record of every transaction ever done within the system going back to Nakamoto's genesis block. Every account is identified only by

a number, a large one at 25-36 alphanumeric characters. The accounts are anonymous and password protected. Lose the password and the money is gone. There is no bureaucracy to help you out. Password length is up to user discretion, but the longer the better. It raises questions of control - who owns the system, and how is new money introduced, if it is at all. Lastly, and most importantly, it raises the technological question. How do you do that? The answer to the latter is called the block chain. The block chain works by hashing technology. Let's take an example. The letters in this paragraph can be interpreted as a number. A very large number, and very likely to be different from any other paragraph even in a large manuscript. Here is a table of the ASCII (internal) representations of the letters in the above paragraph. If you add up the values of the individual letters you get 15,050, a fairly large number. But if, just for instance, you interpret each string of six letters as a (12 place hexadecimal) number, and add those up, the result is huge: 5,642,316,386,171,830. That's five quadrillion, larger than the national debt measured in pennies. The probability that it is unique is extremely high. There is almost no way I could fiddle with the text in the paragraph without throwing the hash total off. Rest assured that bitcoin uses bigger numbers and a more sophisticated scheme than I show here.

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The take-home point is that a large volume of text can be (very close to) uniquely vouched for by a fairly compact number. If I changed any letter in the paragraph the number would change, indicating that the paragraph had lost its integrity. This device is called a hash total. Bitcoin uses hash total schemes, though certainly much fancier than this one, throughout. Every transaction document can thus be represented uniquely enough for bitcoin's purposes by some string of numbers. It takes a large number, but one which is very small in comparison to the original document for which it vouches. Bitcoin is capable of processing about seven transactions per second. It batches them every ten minutes. Each batch would thus contain fewer than $7 \times 60 \times 10 = 4200$ transactions. The 4200 hash totals would themselves be combined into a hash. Most importantly, this hash also includes the hash from the previous batch, which has in the

intervening ten minutes been vetted by a "proof of work" concept, authenticated and accepted by the electronic voting process of the bitcoin community. These summary hashes, combined with the backwards links in the block chain, knit together every transaction in the history of the bitcoin universe. A little arithmetic (mine, not the authors') demonstrates that the data volumes are well within the realm of modern computing. If documenting each transaction took 10kb, with 400 transactions/minute over five years, the total database would be 10 terabytes. That is not a frightening number. It is highly conceivable that many sites could keep the replicated copies of this data necessary for the integrity/voting process. The active data, the recent transactions and wallet/account balances, could be much smaller. Presumably, though it is not discussed, there is some kind of a tiered scheme, so as not to waste too much resource storing inactive data. The block chain serves two functions it guarantees the integrity of the system and it makes it compact enough that there is a way to work with it. The people who need to see the original transactions can look at the particular block in which they occurred, but most users who are not affected by historical transactions only need to deal with blocks that involve their activity. However, the information is widely enough shared that its integrity is insured. This hash total functioning, and in fact almost all of the operation, is highly encrypted using public key cryptography. For a good description, see "Nine Algorithms That Changed the Future: The Ingenious Ideas That Drive Today's Computers." There is a concept of "bitcoin mining" which is fundamental to the process. The mining involves the hashing process. In my simplistic example I said that we will digitize the representation of six characters and interpret the group as a large number. But in fact bitcoin uses much more complex algorithms, and the algorithms involve a variable part, a very long and unique number which is derived by an excruciatingly difficult series of computations. That bitcoin mining process involves coming up with the next suitable number. It is so computing-power intensive that one of the concerns about bitcoin is the carbon footprint that the computers executing bitcoin hashing algorithms use. Read the book to understand the difficulty. In any case understand that it is highly encrypted and robust against fraud. What fraud has occurred in bitcoin is due to human error rather than any architectural flaws. Going back to the book the authors do a good job of reporting the early days of bitcoin and then surveying how it is used today. It is still a minor player in the financial transactions field. They observe that bitcoin can only handle 7 transactions per second versus the 10,000 or so that Visa is structured to manage. It is several orders of magnitude different. In order for bitcoin to emerge as a competitor with the big financial houses, its architecture may need to be rethought. Bitcoin has been too unstable to serve as a store of wealth that allows one to sleep well at night. Its value rocketed from pennies up to over \$1,000 and back down to the low hundreds.

Presumably as it becomes more accepted the currency will achieve more stability. Many people are concerned that a bitcoin itself has no substance. There is no inherent value in this bunch of bits. The counterargument is that this is equally true of fiat currencies, and bitcoin has the benefit of scarcity. The original architecture of bitcoin calls for the introduction of new bitcoins as reward to the miners who come up with the new block total hashing numbers. As they become harder and harder to generate, it has resulted in the massive computer power and carbon footprint mentioned above. But the number of bitcoins to be eventually generated was specified at the very beginning and is strictly limited. So inflation is not going to be a problem with bitcoin. In fact, deflation is much more likely to occur. As the value of the coins goes up, the cost of things in bitcoins will go down. Deflation works against governments, which depend on inflation to progressively hike people's tax brackets and things like that. How governments deal with bitcoin is an interesting question into which the authors delve at length. Bitcoin is difficult to control difficult to tax difficult to understand and difficult to define legally. The authors do a good job of examining all of these aspects. The authors display a liberal bent. The thing that gets them most excited is that bitcoin may be a way to bring banking to that majority of mankind who do not currently have bank accounts. Such people are simply not worth the effort for banks to serve. Bitcoin transactions can be executed over telephones, not even smart phones. The authors look for entrepreneurs to make it work in the less-developed corners of the world. This sounds a bit idealistic, but one must recognize how idealistic it seemed only two decades ago to bring cell phone service to the same people. Now it is ubiquitous. Blockchain technology could be used to track other kinds of titles. Land records are subject to fraud in many parts of the world. Bribe the right judge and he will change the paper land records, depriving you of a property right. A blockchain approach to land records would make it impossible. It could also make bribery more visible. Conversely, as has already been seen, the anonymity of bitcoin is a boon for drug dealers and money launderers. Bitcoin is truly a transnational, borderless system. The authors talk about its attraction in a place like Argentina that has not had a reliable currency since Juan Peron in the 1950s. The currencies in many other parts of the world are under pressure right now. I have seen the value of my currency, the hryvnya, fall by 60% over the last year. Bitcoin could be a store of value. More important, it can serve as a medium of exchange among countries where the currencies are not functioning and are not easily exchangeable. The banks are controlled by governments, whereas bitcoin is out on its own. Therefore when the governments decree that you cannot change pesos or rubles or whatever the fiat currency is into something more attractive, bitcoin seems to offer an alternative. It would simply bypass the system. Governments are working hard to control it, and there is a question of how effective they will be in doing so given that anybody

with a computer has the ability to work with bitcoin. The problem seems to be in the exchanges, going back and forth between bitcoin and fiat currencies. This is a long review. Let me close in saying that this book will give you an insight into the modern financial system and a good appreciation of bitcoin, which may represent the most serious intellectual challenge to the structure of finance, both national and international, to arise within the past couple of centuries. It is absolutely worth reading.

This book was well-written and provided a broad yet detailed picture of the history, present and possible future of the cryptocurrency and its underlying blockchain. It's a bit long-winded in places, and somewhat rambling, jumping around to different points in time, but on the whole it's well worth the read.

This is a tremendous introduction to Bitcoin. If you are not technically minded, it's as good as you could possibly hope for. On the other hand, if you are a bit of a technophile, perhaps you may want to look for the fine detail somewhere else. First comes all the necessary background. You get a thorough introduction on what money is, or rather what it is that turns something into money, you get an introduction to the biosphere out of which Bitcoin sprung, including a long list of its predecessors, and that part of the book is rounded up by a brief history of the "genesis" of Bitcoin itself. Next comes an explanation of the Blockchain. Problem #1 with digital money is "how do I know this money is good money" and problem #2 is "how do I know that you are not presenting this good money twice at the same time to make two purchases." The Blockchain is a technology that puts together four pre-existing technologies in an inventive way, to incentivise independent agents to solve these two problems: 1. Public-key encryption 2. The hash 3. The peer-to-peer network of "nodes" 4. Proof of work. Feel free to skip if you know / to set me right if I've understood it wrong - it's not all there in the book and I've had to fill in the blanks myself by spending time on the Internet-----First, public-key encryption: This is a fantastic new way to write coded messages. The simplest one, RSA, works out as follows: 1. Take two prime numbers and multiply them with one another $3 \times 23 = 69$. Subtract one from each and multiply them again with one another $2 \times 22 = 44$. Add one to the second number $44 + 1 = 45$. Find two numbers that don't have any common factors and multiply to this third number $9 \times 5 = 45$. You're done. The public key is (9, 69) and the private key is (5, 69). To encrypt do $\text{mod}(x^9, 69)$ and it turns out that $(\text{mod}(\text{mod}(x^9, 69))^5, 69) = x$. So, for example, suppose I want number 20 to be my message $20^9 = 512000000000$ and $\text{mod}(512000000000, 69) = 5$. So the coded way to say "20" is "5". But $5^5 = 3125$ and $\text{mod}(3125, 69) = 20$, so, lo and behold,

"5" is decoded as "20"

The beauty of this code is that if I pick two very large prime numbers a and b , NOBODY has the computing power to factorize $a \times b$. And if they are very big, then $(a - 1) \times (b - 1)$ can have a very wide choice of co-prime numbers c and d such that $c \times d = (a - 1) \times (b - 1) + 1$. Ergo, if I give away $(d, a \times b)$ nobody has the computing power to figure out what c is. So I can put out there $(d, a \times b)$ as a code for anybody in the world to send me a message. They can post it on the Internet. And only I can break the code. Even better, even if somebody out there rats me out and says: "here's how to encode messages for Athan to read" that still does not help the CIA read my messages. More prosaically, you can send me Bitcoin and you can sign it with my public key. Everybody can verify that it is my Bitcoin, because my Bitcoin address is (or is derivable from) my public key. But only I can turn around and assign the Bitcoin to somebody else, because only I have the private key that is necessary to do so. Neat, huh?

It all kind of breaks down if somebody one day writes a computer that can calculate hyper-fast and goes through all the numbers in the world, but the fastest computers on earth would currently take longer to break a good-enough code than mankind has existed! (It helps that raising to a power is not cake)

N.B. The above is merely an example; Bitcoin does not use RSA, it uses elliptic curves-based encryption, which (among other advantages) obviates the need to change private key every time you've changed your public key.

Second, the hash: The hash is a 26 to 34-character string that is the output of a function that generates a fixed-length alphanumeric representation of the data it received. To build it I need input (example 1: the sentence "to be or not to be

The combination of historical background information coupled with the contemporary state of the blockchain and bitcoin world is incredible. I loved this book! It's extremely well researched and written in a way most anyone can understand. Hard to believe we won't all be using some form of digital currency on a blockchain system in the near future - opportunities abound!

If you want to learn about Bitcoin and cryptocurrency in general, this is a great book. It's easy to understand and thorough. I am enjoying it immensely. This is something everyone needs to know about.

A well written and easy to read explanation of bitcoin and blockchain. A great starting point for anyone looking to participate in this coming revolution.

Really loved this book. I'm familiar with blockchain technology but I learned a lot about the world of

(non-crypto) currencies as well as the economic environment in which crypto currencies live. I also like the fluid writing style of the authors. If you need to know more about crypto currencies and how they relate to the world economic system, this book is for you.

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Blockchain: Step By Step Guide To Understanding The Blockchain Revolution And The Technology

Behind It (Information Technology, Blockchain For Beginners, Bitcoin, Blockchain Technology)

Mastering Bitcoin for Dummies: Bitcoin and Cryptocurrency Technologies, Mining, Investing and

Trading - Bitcoin Book 1, Blockchain, Wallet, Business Bitcoin: Everything You Need to Know about

Bitcoin, how to Mine Bitcoin, how to Exchange Bitcoin and how to Buy BTC. (Cryptocurrency Book

3) Cryptocurrency: How to Make a Lot of Money Investing and Trading in Cryptocurrency: Unlocking

the Lucrative World of Cryptocurrency (Cryptocurrency Investing and Trading Book 1)

Cryptocurrency: Understanding The Concept Of Cryptocurrency, Blockchain And Bitcoin - The

Simple Introduction To Internet Money, It's Benefits And What You Need To Know About Investing

Blockchain: The History, Mechanics, Technical Implementation And Powerful Uses of Blockchain

Technology (blockchain guide, smart contracts, financial technology, blockchain programming)
Blockchain Blueprint: The Complete Guide to Blockchain Technology and How it is Creating a
Revolution (Books on Bitcoin, Cryptocurrency, Ethereum, FinTech, Hidden Economy, Money, Smart
Contracts) Blockchain for Beginners: Guide to Understanding the Foundation and Basics of the
Revolutionary Blockchain Technology (Books on Bitcoin, Investing in Cryptocurrency, ... Ethereum,
FinTech Smart Contracts) Blockchain: Guide To Everything About Blockchain Technology And How
It Is Creating A Revolution (Bitcoin, Cryptocurrency, Money, Hidden Economy, Ethereum, Financial
Technology)

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