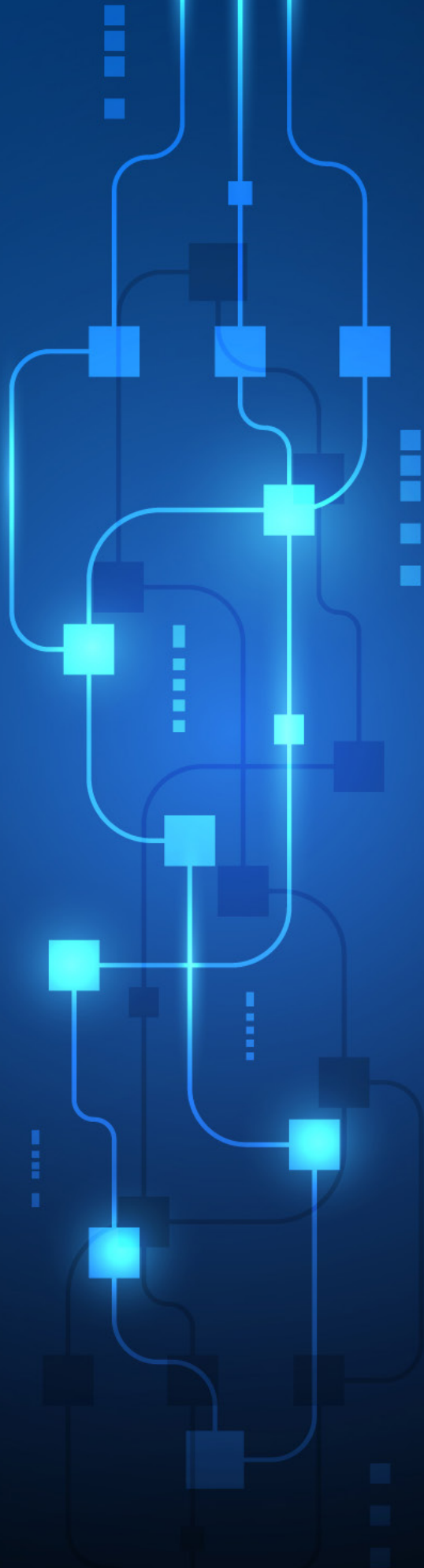


William Blair

Private Wealth
Management

Understanding Blockchain as a Potential Disruptor





The interest in blockchain stems from the idea that its development is comparable to the early days of the internet. The internet created an open network and distribution space for information and communication. Blockchain proponents hope it can do the same for digital assets and transaction data.

With these expectations, cryptocurrencies and the blockchain that underpins them are generating significant interest from investors. But how much of this excitement stems from headlines vs. the potential it holds to improve how people and entities transact and share information with each other?

Cryptocurrencies and blockchain present innumerable possibilities for global commerce and information sharing. They also raise challenging questions for investors. At William Blair, we believe it's important for investors to understand blockchain as a disruptor, and how it could affect financial markets, industries, and companies. Investors need to consider how companies of all sizes, and across all sectors, are preparing to adapt to the dramatic changes in how entities transact and share information that could be ushered in by the growing adoption of blockchain.

Blockchain Basics

Much of the interest in blockchain comes from the seemingly endless potential for the secure exchange and recording of digital value and information that does not rely on a third-party intermediary. Essentially, this is a “world without middleman” in the words of *Harvard Business Review*. Before understanding the many applications for blockchain, it is first important to understand the basics of how the technology works and some key terminology. The three main components of blockchain are: decentralized and distributed ledgers, secure key cryptography, and network participation.

One key tenet of blockchain is the use of a decentralized ledger, or list of transactions, rather than a centralized ledger. With traditional types of transaction record-keeping, one party, such as a bank or government agency, keeps the central book, validates transactions, and maintains a transaction history. Blockchain relies on multiple participants in the network to approve transactions by consensus—they share and agree on the same transaction data.

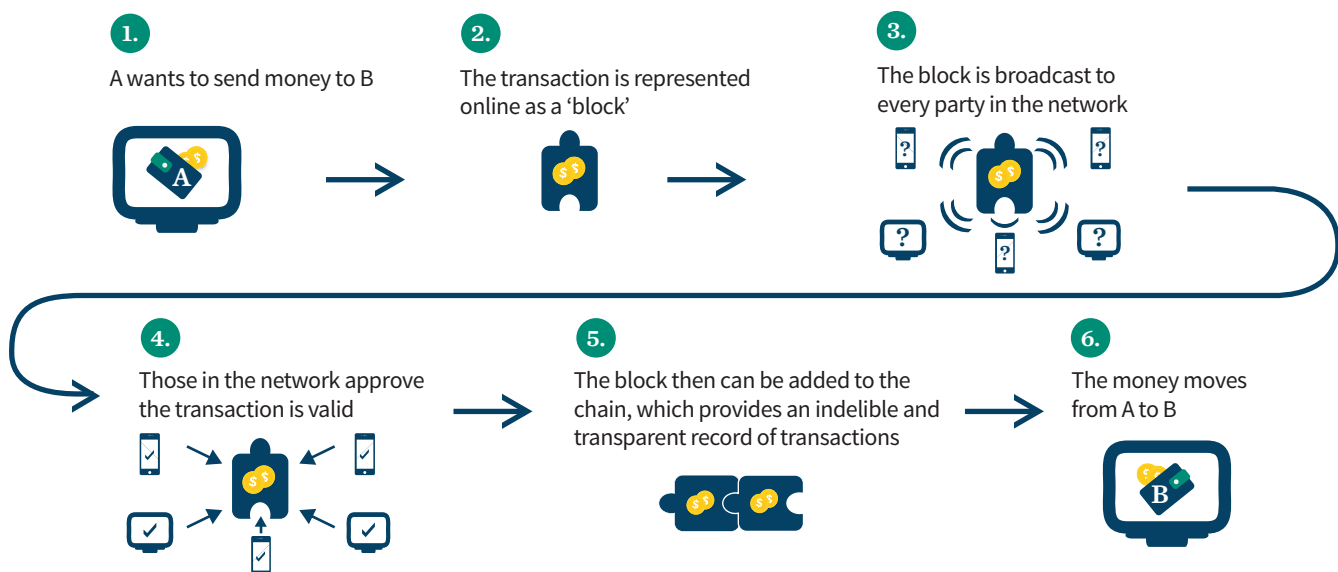
Blockchain is a continually growing list of records on blocks, which are spread across a decentralized digital ledger (or distributed database)—linked and secured using cryptography and creating an immutable record of transactions.

In theory, it works like this: A transaction is requested and broadcast to a network of computers, called nodes. Once nodes in the system verify and approve the transaction, it is completed, given a timestamp, and then added to a group

of other approved transactions (called a block). Once a block is filled with transactions, it is added chronologically to the “chain” of previous blocks that have been filled with approved transactions. Lastly, when a block is added to the chain, it is given a unique cryptographic signature that references the previous block, meaning blocks in the chain cannot be altered or moved and are in an irreversible chain, creating a secure, synchronized, and traceable transaction history shared and accessible by all network participants. What used to be managed, validated, secured, and stored by central third-party intermediaries is now done so on a distributed network of nodes.

As blockchain evolved, it split into private and public networks, which are defined by who controls the consensus function and the incentives that drive the network. In a private blockchain, every participant in the network has access to the data, but only a few participants have permission to modify, verify, and reconcile the data. The incentives driving a private blockchain are greater efficiencies to the organization controlling the consensus function. In a public blockchain, such as the network that supports Bitcoin, every participant in the network houses the blockchain, makes decisions about the accuracy of the data, and reconciles transactions. In this instance, the public controls the consensus, and cryptocurrencies (Bitcoin in this case) are the incentives that drive people to spend time verifying and approving transactions. Miners, or the public who use their computing power and serve as auditors and validators of the data, are rewarded with cryptocurrencies.

How a blockchain works in theory



Source: Financial Times

The Advantages of Blockchain

People believe that blockchain, with its inherent advantages of decentralization, security, and transparency, offers a superior system for recording transactions and sharing information.

Compared to traditional transactions that may take days to settle through a centralized infrastructure, dispersed blockchain participants can instantly respond and there is no need to reconcile disparate ledgers. This is a significant advantage in an era when consumers expect instantaneous interactions and existing infrastructures—in both government and the private sector—are grappling with the desire for faster payments and real-time reconciliation of everything from real estate transactions to tracking music rights of ownership and royalties.

In addition to its inherent efficiency, the built-in redundancy of decentralized record-keeping eliminates the vulnerability of any one node. More security and efficiency also come from the chain aspect of blockchain—the immutable sequence of blocks that creates an authentic, permanent, tamper-proof record.

A consensus mechanism, as opposed to a central authority, to validate transactions provides the benefit of transparency and reduces the risk of fraud and errors. With a vast array of network participants to observe and approve, the chances for catching misinformation increase significantly while also alleviating potential version-control issues.

Applications and Opportunities

Governmental bodies, industry leaders, business consortiums, and entrepreneurs alike are taking a practical look at what business protocols could be transformed, disrupted, or reinvented with blockchain.

Blockchain has the greatest potential to improve efficiency in industries that are transactional in nature and face high levels of regulatory, technical, and security cost, and where a third party is needed as a source of validation, verification, and trust—such as banking, healthcare, and other services industries where companies handle high volumes of transactions involving sensitive customer data. Clinical trial records, data storage and transfer, supply chain logistics, clearing and settlement, and regulatory compliance are critical areas in healthcare that could benefit from blockchain. For tasks where privacy is very important—such as with handling medical records, either within a hospital system or with insurance companies—private blockchains could be used to protect sensitive personal or competitive information.

Looking at the many valued coins and their associated blockchain platforms and protocols points to a broad range of potential commercial applications, including:

- Facilitating fast, low-cost cross-border payments
- Tracking supply chain data
- Managing tax collection and reporting
- Recording voter registration
- Transforming how publishers get paid for content consumption
- Leveraging unused disk space for distributed data storage
- Managing ownership rights

In addition to large, established enterprises and networks using blockchain, venture capital has been flowing to tech start-ups that are developing new ways to use the technology to solve difficult problems. Blockchain—through the advent of initial coin offerings (ICOs)—is even disrupting the way that tech start-ups raise money. ICOs are essentially a tokenized form of crowdfunding, though they do not carry ownership rights.

Risk and Limitations

Blockchain has the potential to fundamentally change the way entities transact and interact with each other, though there are some pressing issues:

Security	Exchange and wallet security concerns
Latency	Transaction limits/speed lag considerably behind major credit card networks
Scalability	Requires storage of large volumes of data
Regulation	How will governments interact with blockchain infrastructure?
Interoperability	Interconnection between individual blockchains without extra intermediary is still under development
Immutability	Inability to reverse mistakes not ideal for all enterprise cases
Complexity	Computations are highly sophisticated and intricate

A Trend Too Big to Ignore

Regardless of whether one views blockchain's and cryptocurrency's ability to revolutionize the way people around the globe conduct transactions and share information as hype or inevitability, investors can't afford to ignore the technology. Even if cryptocurrencies and their underlying technology never evolve into a widely accepted asset class, investors should think about how blockchain could influence their portfolio positioning.

Companies across sectors are investing significant resources in identifying ways to use the power of blockchain, and start-ups are using ICOs to fund their growth. Similarly, investors should be thinking about whether blockchain could disrupt business models in some industries and unlock new levels of efficiency in others.



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