



## BLOCKCHAIN APPLICATIONS

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LaibaAlam

### Abstract

Blockchain is the technology behind bitcoin, but its scope is not limited to it. If you have been following banking, investing, or cryptocurrency over the past years, you may be familiar with “blockchain” as the record-keeping technology that is decentralized, transparent and immutable. Many define it as “a distributed, decentralized, public ledger”. In a nutshell, blockchain is a collection of blocks that are interconnected and contains digital piece of information that is visible to everyone on the blockchain. There are two types of a blockchain, private and public blockchain. Blockchain has its benefits almost in every industry like banking, healthcare, finance, cryptocurrency, supply chain and many more.

### KeyWords

Applications, blockchain, consensus mechanism, nonce, private and public keys, types of blockchain.

## 1. INTRODUCTON

### 1.1. BLOCKCHAIN

A blockchain is, in the simplest of terms, a time-stamped series of immutable records of data that is managed by a cluster of computers not owned by any single entity [1]. Each of these blocks contains digital data and securely connected together through complicated cryptography. The question is what makes it so special that it is disrupting the basic working of every industry? Answer is that it has no central authority and it is the definition of a democratic system.

On a blockchain, one party initiates the transaction by creating a block. This block is verified by thousands, perhaps millions of computers distributed around the peer to peer network. The verified block is added to a chain, which is stored across the net, creating not just a unique record, but a unique record with a unique history and time stamp. Falsifying a single record would mean tempering the entire chain in millions of instances. That is practically impossible.

### 1.2. BLOCKCHAIN TYPES

There are two types of a blockchain, private and public blockchain, use of which depends on the requirements of the network. Private blockchain is accessible by a limited number of users within a private network, whereas public blockchain is accessible by everyone on a peer to peer network.

## 2. HOW IT WORKS?

### 2.1. CONSENSUS MECHANISM

Blockchain technology works using consensus mechanism, and in order for a block to be added to the blockchain seven things must happen:

- A transaction must be initiated.

- Nodes must collect new transaction.
- Nodes compete to find a nonce.
- Nonce is broadcasted on the network once found.
- That transaction must be verified.
- That transaction must be stored in a block.
- That block must be given a hash.

## 2.2. NODES

Nodes form the infrastructure of a blockchain. They store, preserve and transfer information on the blockchain. So basically they are the backbone of the blockchain without which, blockchain will simply not exist.

## 2.3. GENESIS BLOCK

The first block on the blockchain on which all other blocks are formed is known as the genesis block. It is also known as zero block. New block is added approximately after every 10 minutes to the blockchain.

## 2.4. HASHES

Hashes are identifiers that uniquely distinguish files. They take large volume of data and produce a small alpha numeric output. In a blockchain, the hash of a previous block in a sequence is a tamper-proof sequence because as a function of the design, a hash is very sensitive. So, to change any variable of any one of the hashes in a given block would cause a domino effect, altering all of the previous transactions in the block. Blockchain hashes are deterministic, which means that the input data will produce the same result each time [4].

## 2.5. PUBLIC AND PRIVATE KEYS

Blockchain automatically generates keys for its users. Address which is used by the user on the network is his public key, while private key let user to access funds that are stored on a particular public address. You can think of a public key as a school locker and the private key as the locker combination. Teachers, students, and even your crush can insert letters and notes through the opening in your locker. However, the only person that can retrieve the contents of the mailbox is the one that has the unique key [2].

## 2.6. PROOF OF WORK

Proof-of-work is a must for a miner in order to get incentives after mining a block and its mechanism requires a lot of energy and computer power to reach a consensus and is thereby a very expensive option. The underlying idea is that miners in a network must prove that they have made a certain effort. Miners provide the computing power needed to maintain the blockchain and to verify transactions. At the same time, miners ensure the network's immunity against hackers. They compete against each other in order to chain together a group of transactions that then later become blocks [3].

# 3. PILLARS OF THE BLOCKCHAIN

## 3.1. DECENTRALIZATION

The blockchain database isn't stored in any single location, meaning the records it keeps are truly public and easily verifiable. No centralized version of this information exists for a hacker to corrupt. Hosted by millions of computers simultaneously, its data is accessible to anyone on the internet.

In a decentralized network, if you wanted to interact with your friend then you can do so directly without going through a third party. That was the main ideology behind Bitcoins. You and only you alone are in charge of your money. You can send your money to anyone you want without having to go through a bank.

## 3.2. TRANSPARENCY

There is a question circulating around, how blockchain is private if it is transparent? Answer is simple, although every transaction is available on the network, but no actual names of users are mentioned in the transactions that takes place on the blockchain. For example Alex sends 10 bitcoins to Adam. This transaction is visible on the network as "1MF1bhsFLkBzzz9vpFYEmvwT2TbyCt7NZJ sent 10 BTC to 1MF1bhsFLkBzzz9vpFRmvwT4TbyCt7NZJ".

### 3.3. IMMUTABILITY

Immutability, in the context of the blockchain, means that once something has been entered into the blockchain, it cannot be tampered with. The reason why the blockchain gets this property is that of the cryptographic hash function. In the context of cryptocurrencies like bitcoin, the transactions are taken as input and run through a hashing algorithm (Bitcoin uses SHA-256) which gives an output of a fixed length.

## 4. APPLICATIONS OF BLOCKCHAIN

### 4.1. BLOCKCHAIN IN HEALTHCARE

Blockchain in healthcare provide numerous possibilities. Keeping our important medical data safe and secure is the most popular blockchain healthcare application at the moment, which isn't surprising. Security is a major issue in the healthcare industry. Blockchain technology allows patients to assign access rules for their medical data, for example, permitting specific researchers to access parts of their data for a fixed period of time. With blockchain technology, patients can connect to other hospitals and collect their medical data automatically [5].

With its ability to deflate the current spending bubble, protect patient data and improve the overall healthcare experience, blockchain may help ease the pain. The technology is already being used to do everything from securely encrypt patient data to manage the outbreak of harmful diseases.

### 4.2. BLOCKCHAIN IN EDUCATION

The most promising use case for blockchain in higher education is to transform the record keeping of degrees, certificates and diplomas. But new ways to apply blockchain technology in the higher education sector are emerging all the time. Over the past several years, more high-profile projects have received significant media attention, fueling further interest in the technology.

Blockchain could be also used for accreditation of educational institutions, a complex process in many countries, enabling them to verify quality or qualification to teach. A verifiable lifetime transcript would reduce CV fraud, streamline student transfers between universities, reduce the overhead related to credential verification, and make moving between states and countries less complex.

Processing student payments is labor-intensive and may involve the student, parents, scholarship-granting agencies, financial institutions, governments and educational institutions. In the future, cryptocurrencies — perhaps even custom cryptocurrencies — could be used as a method of student payments.

To date, higher education blockchain use cases have focused on record keeping and efficiency, while the real disruptive power often lies in creating new business models. If achieved, this new educational platform will aim to lower tuition fees at the same time it increases faculty remuneration by using blockchain smart contracts to automate administrative tasks, protect and secure faculty and students, and reduce administrative overhead costs [6].

### 4.3. BLOCKCHAIN AND FINANCE

Our global financial system moves trillions of dollars a day and serves billions of people. But the system is rife with problems, adding cost through fees and delays, creating friction through redundant and onerous paperwork, and opening up opportunities for fraud and crime.

Professionals within the financial services industry have been speculating about blockchain's potential for years now, waiting to see how the up-and-coming technology might one day impact business. Blockchain is already a buzzword. However, according to a recent IBM survey, 91% of banks are investing in blockchain solutions, and 66% of institutions are expecting to be running at scale with blockchain. It seems that blockchain is finally poised to shake up financial markets in a way that will benefit both consumers and financial institutions.

It's easy to see how blockchain's properties make it ideal for financial applications. Blockchain facilitates safe, easy transactions, and builds trust between trading partners. It can even be used to quickly identify individuals through digital IDs. When customer identifying information is secured using blockchain, banks can increase public trust while protecting against fraud and speeding up the verification process significantly. Transferring money across borders has traditionally been slow and expensive, since systems typically pass through multiple banks on the way to the payment's final destination. When used for cross-border transactions, blockchain can make the process faster, more accurate, and less expensive.

Credit reports which is another benefit of blockchain dramatically impact customers' financial lives. Blockchain-based credit reporting is more secure than traditional server-based reporting, as demonstrated by recent data breaches. Blockchain may also enable companies to take non-traditional factors into account

when calculating credit scores [7]

#### 4.4. BLOCKCHAIN IN GOVERNMENT

Governments and public sector organizations leverage blockchain technology to move away from siloed and inefficient centralized systems. Current systems are inherently insecure and costly, while blockchain networks offer more secure, agile, and cost-effective structures. A blockchain-based digital government can protect data, streamline processes, and reduce fraud, waste, and abuse while simultaneously increasing trust and accountability. On a blockchain-based government model, individuals, businesses, and governments share resources over a distributed ledger secured using cryptography. This structure eliminates a single point of failure and inherently protects sensitive citizen and government data.

A blockchain-based government has the potential to solve legacy pain points and enable the following advantages:

Secure storage of government, citizen, and business data, reduce labor-intensive processes, reduce excessive costs associated with managing accountability, diminish potential for corruption and abuse and increase trust in government and online civil systems [8].

More governments join the race to pass regulatory legislation and commence pilot projects centered around blockchain technology every day. Governments can leverage blockchain technology to provide cybersecurity, process optimization, and integrate hyperconnected services while bolstering trust and accountability.

Many countries like Canada, Mexico, Argentina, Austria, Denmark, Estonia, Germany, Georgia, Ireland, Italy and many more are already using blockchain technology to reinnovate ways of government businesses [9].

#### 4.5. BLOCKCHAIN IN TAX AND CUSTOM SYSTEM REGULARITY

In the World economic forum in Davos, in 2016, more than 800 observers and technology executives were questioned about when they thought that the Governments would begin to collect taxes using blockchain. The average responses pointed at 2023, with 73% of responses mentioning 2025[10].

Tax administrations were already interested in applications of blockchain technology and some actions and studies have taken place, initially associated with the Academy, to identify areas for application in the tax administration. Typically, VAT management and payment were the first designed applications, although at the academic level [11]. Blockchain provide applications that require the coordination of actions between tax administrations, administrations and taxpayers and between internal departments of a tax administration. Typically, tax applications are developed on a private blockchain.

Specialists warn that the blockchain is a potential facilitator, but not the complete solution. The expansion of the digital world and the shared economy will probably force the TAs to seek new legislation, methods and technologies to ensure the collection of taxes. Blockchain would be a potential partner in these efforts. It is admitted that this technology can change the way taxes are collected: the responsibility for collecting the tax on income or sales may possibly shift completely from tax authorities towards the participants of the shared economy.

### Conclusion

Blockchain is a technology that can not be ignored. It was possible previously when blockchain was thought to interwork only with bitcoin, but not after we came to know of its so many benefits and applications in various fields and industries. Blockchain's advantages like transparency, speed, traceability and immutability assist almost every business. Various industries like healthcare, finance, education, supply chain etc has many ongoing projects that involves blockchain technology, which means that we will be hearing more about blockchain maintained prosperous ventures in a near future.

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