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Tech Accelerator

Blockchain for businesses: The ultimate enterprise guide

DEFINITION

blockchain

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What is blockchain?

Blockchain is a record-keeping technology designed to make it impossible to hack the system or forge the data stored on the blockchain, thereby making it secure and immutable. It's a type of distributed ledger technology ([DLT](#)), a digital record-keeping system for recording transactions and related data in multiple places at the same time.

Each computer in a blockchain network maintains a copy of the ledger where transactions are recorded to prevent a [single point of failure](#). Also, all copies are updated and validated simultaneously.

Blockchain is also considered a type of database, but it differs substantially from conventional databases in how it stores and manages information. Instead of storing data in rows, columns, tables and files as traditional databases do, [blockchain stores data](#) in blocks that are digitally chained together. In addition, a blockchain is a decentralized database managed by computers belonging to a [peer-to-peer](#) network instead of a central computer like in traditional databases.

[Bitcoin](#), launched in 2009 on the Bitcoin blockchain, was the first [cryptocurrency](#) and popular application to successfully use blockchain. As a result, blockchain has been most

often associated with Bitcoin and alternatives such as Dogecoin and Bitcoin Cash, which both use public ledgers.

THIS ARTICLE IS PART OF



Blockchain for businesses: The ultimate enterprise guide

Which also includes:

Top 10 benefits of blockchain for business

What are the 4 different types of blockchain technology?

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However, the use of private ledger blockchains has expanded to other applications since Bitcoin's inception. Logistics companies use blockchain to track and trace goods as they move through the supply chain. Government central banks and the global financial community have been testing [blockchain technology as a foundation for currency exchange](#). And various industries, including the legal community and entertainment, are using blockchain as the basis for [smart contracts](#) and other mechanisms for transferring and protecting intellectual property rights.

In fact, companies and other organizations are using blockchain-based applications as a secure and cost-effective way to create and manage a distributed database and maintain records for digital transactions of all types. As a result, blockchain is increasingly viewed as a way of securely tracking and sharing data between multiple business entities.

What is Blockchain?



Key features of blockchain technology

Blockchain technology is built on a foundation of unique characteristics that differentiate it from traditional databases. The following are its most important and defining characteristics:

- **Decentralization.** [Blockchain decentralization](#) is one of the fundamental aspects of the technology. Unlike centralized databases where a central authority, such as a bank, controls and verifies transactions, blockchain operates on a distributed ledger. This means multiple transparent participants, known as [nodes](#), maintain, verify and update the ledger. Each node is spread across a network and contains a copy of the whole blockchain.
- **Immutability and security.** Cryptographic [algorithms](#) are used in blockchain to provide strong security, recording transactions and making tampering nearly impossible. Information is stored in blocks that are linked together using cryptographic hashes. If someone tries to tamper or modify a block, it would require the alteration of every subsequent block, making tampering computationally infeasible. This inherent blockchain security feature ensures immutability of information and makes blockchain an ideal platform for storing sensitive data and conducting secure transactions.
- **Transparency and traceability.** The inherent transparency of blockchain technology ensures every network participant has access to identical information. For instance,

every transaction becomes part of a public ledger, visible to all participants. This transparency ensures trust and network accountability, because any inconsistency can be promptly recognized and resolved. Additionally, the blockchain's capacity to track the origin and trajectory of assets facilitates audits and decreases the likelihood of fraudulent activities.

- **Smart contracts.** These contracts are automated agreements encoded in software that execute the stipulations of a contract automatically. Smart contract codes are stored on the blockchain and carry out their functions once predetermined conditions are met. These contracts eliminate the need for intermediaries, streamline transactions, save money and speed up close times. They're used in a [range of diverse sectors](#), including supply chain management, insurance and finance.

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How blockchain and distributed ledger technology work

Blockchain uses a multistep process that includes these five steps:

1. An authorized participant inputs a transaction, which must be authenticated by the technology.
2. That action creates a block that represents that specific transaction or data.
3. The block is sent to every computer node in the network.
4. Authorized nodes validate transactions and add the block to the existing blockchain.
5. The update is distributed across the network, which finalizes the transaction.

These steps take place in near real time and involve a range of elements. Nodes in public blockchain networks are referred to as miners; they're typically paid for this task -- often in processes called [proof of work or proof of stake](#) -- usually in the form of cryptocurrency.

A blockchain ledger consists of two types of records, individual transactions and blocks. The first block has a header and data that pertain to transactions taking place within a set time period. The block's timestamp is used to help create an alphanumeric string called a [hash](#). After the first block has been created, each subsequent block in the ledger uses the previous block's hash to calculate its own hash.

Before a new block can be added to the chain, its authenticity must be verified by a computational process called validation or consensus. At this point in the blockchain process, a majority of nodes in the network must agree the new block's hash has been calculated correctly. Consensus ensures that all copies of the blockchain distributed ledger share the same state.

Once a block has been added, it can be referenced in subsequent blocks, but it can't be changed. If someone attempts to swap out a block, the hashes for previous and subsequent blocks will also change and disrupt the ledger's shared state.

When consensus is no longer possible, other computers in the network are aware that a problem has occurred, and no new blocks will be added to the chain until the problem is solved. Typically, the block causing the error will be discarded and the consensus process will be repeated. This eliminates a single point of failure.

Blockchain, digital currency, cryptocurrency and Bitcoin explained

The terms *blockchain*, *cryptocurrency* and *Bitcoin* are frequently lumped together, along with Digital currency; sometimes they're erroneously used interchangeably. Although they're all under the umbrella of DLT, each one is a distinct entity.

- **Blockchain.** Blockchain is the technology that digital currency, cryptocurrency and Bitcoin are built on. More specifically, it's the underlying technology that constructs a decentralized digital ledger that enables exchanges between multiple parties in a secure, immutable manner.
- **Digital currency.** Digital currency refers to any form of currency that is available in digital or electronic form and shared without an intermediary. This includes digital money issued by governments and central banks, as well as cryptocurrency. Digital currency is sometimes called digital money, electronic money, electronic currency or cybercash.

- **Cryptocurrency.** Cryptocurrency is a digital asset that can be exchanged on a blockchain network. It's a subset of digital currency that isn't issued by government entities. Think of cryptocurrency as tokens issued by private entities or groups that can be used to pay for items sold by those who also operate in the blockchain network. As of September 2023, market research website CoinMarketCap [listed 9,111 publicly traded](#) cryptocurrencies.
- **Bitcoin.** Bitcoin is the first and most popular cryptocurrency. It was introduced by an anonymous person or group of people using the pseudonym Satoshi Nakamoto. Bitcoin operates on a decentralized network known as the Bitcoin blockchain, which lets participants send and receive it without the need for intermediaries. New Bitcoin is introduced to the supply through [Bitcoin mining](#), a process that requires significant computational power. Miners solve complex mathematical problems; the miner who solves the puzzle and validates the transaction is rewarded with new Bitcoin.

 Five steps in the blockchain process

All blockchain technology works in five basic steps, sometimes referred to as mining, in which transactions and data are executed and verified.

Blockchain and smart contracts

Smart contracts are one of the most important features of blockchain technology. These

are self-executing digital contracts written in code. They operate automatically according to predefined rules and conditions. Smart contracts are designed to facilitate, verify and enforce the negotiation or performance of an agreement without the need for intermediaries, such as lawyers, banks or other third parties. Once the specified conditions are met, the smart contract automatically executes the agreed-upon actions or transactions, ensuring that all parties involved adhere to the terms of the contract.

Smart contracts are typically deployed on blockchain platforms, which provide the necessary security and transparency for their execution. Ethereum is a [popular blockchain platform for smart contracts](#). It's used for a range of applications such as financial transactions, supply chain management, real estate deals and digital identity verification.

[Smart contracts have several benefits](#). By eliminating intermediaries, smart contract technology reduces the costs. It also cuts out complications and interference intermediaries can cause, speeding processes while also enhancing security.

Additional blockchain examples and use cases

Blockchain continues to mature and gain acceptance as more companies across various industries learn to use it. Blockchain's [use cases and industry applications](#) have grown far outside its original cryptocurrency application to include smart contracts, cybersecurity, internet of things (IoT) and non-fungible tokens ([NFTs](#)). NFTs are digital assets representing all or portions of real-world objects such as art or music. They're bought, sold and traded online, and are a popular way to buy and sell digital artwork.

Some of blockchain technology's real-world applications include the following areas:

Supply chain management. The end-to-end visibility, traceability and accountability of [blockchain is useful in managing supply chains](#). Stakeholders can record, track and authenticate products, prevent counterfeit goods from getting into the supply chain, and streamline logistics processes.

Healthcare. Along with artificial intelligence and IoT, blockchain has emerged [as an innovative healthcare technology](#). In healthcare, blockchain is used to securely store and share patient data. The technology lets patients control their medical records, granting access to healthcare providers only when necessary. This enables seamless and secure sharing of medical information, improving treatment outcomes and reducing administrative burdens.

Identity management. Blockchain-based identity management systems enhance security, privacy and control over personal data. By [storing identity information on the blockchain](#), users can have a portable and verifiable digital identity. This eliminates the need for multiple identity documents, reduces identity theft and simplifies identity verification processes.

Voting systems. Blockchain technology can address the [challenges of traditional voting systems](#) by providing secure and transparent voting platforms. Voting systems based on the technology eliminate voter fraud, ensure the integrity of the electoral process and enable remote voting while maintaining anonymity and privacy.

Finance and banking. Financial services use blockchain to accelerate transactions and speed up close times. Some banks also use blockchain for contract management and traceability purposes. For example, PayPal, the online payment platform, launched a

blockchain-based service in 2020 that lets users buy, hold and sell cryptocurrency. R3, a global consortium of financial institutions, developed its Corda platform to record, manage and synchronize financial information using blockchain [application programming interfaces](#) for specific platforms.

Media and entertainment. Blockchain technology expands royalty opportunities for companies and individuals. For instance, organizations can use blockchain to create digital on which they can collect royalties if the ticket gets resold. In April 2021, Live Nation SAS, the France-based arm of the global entertainment company of the same name, launched TixTo.Me, powered in part by blockchain company Aventus Network.

 List of blockchain use cases



Blockchain has many applications, including smart contracts and cybersecurity.

Advantages of blockchain

Experts cite [several key benefits to using blockchain](#), including the following:

- **Uncorruptible.** It's almost impossible to corrupt a blockchain because millions of computers share and continually reconcile the information. Blockchain also has no single point of failure.
- **Efficient.** Transactions are often more efficient than in non-DLT-based transactional systems, though public blockchains can sometimes suffer from slow speed and inefficiency.

- **Resilient.** Blockchain is resilient; if one node goes down, all the other nodes have a copy of the ledger.
- **Trustworthy.** It provides trust among participants on a network. Confirmed blocks are difficult to reverse, which means data is difficult to remove or change.
- **Cost-effective.** It can be cost-effective because it often reduces the expense associated with transactions by eliminating middlemen and third parties.



Blockchain is being increasingly adopted by businesses for its speed, security and traceability.

Disadvantages of blockchain

Experts say blockchain also has the following [potential drawbacks, risks and challenges](#):

- **Ownership.** Blockchain can raise questions about ownership and who's responsible when problems arise.
- **Infrastructure issues.** Questions also come up about whether organizations are capable of investing in the infrastructure needed to build, participate and maintain a blockchain-based network, or even willing to do so.
- **Data challenges.** Changing data in a blockchain typically takes a lot of work.
- **Private keys.** Users have to keep track of their private keys to avoid losing their money.

- **Storage.** The need for storage can grow to be very large over time, which risks the loss of nodes if the ledger becomes too large for users to download.
- **Vulnerabilities.** Blockchain is [susceptible to 51% attacks](#), which is a specific attack designed to overwhelm other participants in the network and change blocks.

Types of blockchain

There are [four main types of blockchain](#):

- **Private blockchain.** Private, or *permissioned*, blockchains require approval to access. These blockchains offer enhanced privacy and control over data, making them suitable for applications that require strict access controls and compliance with regulations. In a private, permissioned blockchain, such as Multichain, every node might be able to perform transactions, but participation in the consensus process is restricted to a limited number of approved nodes.
- **Public blockchain.** Public, or *permissionless*, blockchain doesn't require permission to enter the blockchain network. In a public, permissionless blockchain like Bitcoin, every node in the network can conduct transactions and participate in the consensus process.
- **Hybrid blockchain.** A hybrid blockchain is a type of blockchain that combines the characteristics of [permissioned and permissionless blockchains](#). A hybrid blockchain is set up by a single organization and consists of one public system on top of a private system, giving the organization access control over sensitive data.
- **Consortium blockchain.** Consortium, or federated, blockchain is a type of hybrid blockchain in which a group of organizations governs the blockchain. Consortium blockchains combine the benefits of decentralization and privacy, making them suitable for industries that require collaboration and trust among a select group of participants. However, the breach of just one member node can compromise its security.



There are four main types of blockchain technology -- public, private, hybrid and consortium.

Leading blockchain platforms

[Numerous blockchain platforms are available](#). Three of the most prominent are Ethereum blockchain, Hyperledger Fabric and OpenChain.

- **Ethereum.** This is a widely used, open source and custom-built blockchain platform. It's considered to be an industry-leading choice for enterprise applications. [Ethereum](#) enabled the development of smart contracts and decentralized applications, also known as [dApps](#). It has gained significant popularity due to its range of features, flexibility and large developer community. Ethereum's native cryptocurrency, called Ether, is used to compensate participants and power the platform.
- **Hyperledger Fabric.** Industries such as finance and manufacturing use this open source blockchain platform. Hyperledger Fabric is designed for permissioned networks, but it can also be used for decentralized hosting and storage of applications that employ smart contracts. It provides a modular framework for building private, permissionless blockchains tailored to specific business needs.
- **OpenChain.** This open source blockchain platform is for organizations that want to manage and preserve digital assets. An administrator of an OpenChain blockchain will define the rules used in the ledger. Users can then exchange value on the ledger by adhering to the rules.

Blockchain adoption considerations

Any enterprise considering whether to implement a blockchain application should first consider whether it really needs blockchain to achieve its objectives. Blockchain does indeed have several significant benefits, particularly in security, but [it doesn't cater to all database needs](#).

In fact, conventional, centralized databases are often the better option in many circumstances, especially when speed and performance are critical. They're also better when transactions only happen inside the enterprise or between a limited number of entities where trust has been fully established.

In choosing a blockchain platform, an organization should keep in mind which [consensus algorithm](#) to use. The consensus algorithm is a core piece of a blockchain network and one that can have a big impact on speed. It's the procedure through which the peers in a blockchain network reach agreement about the present state of the distributed ledger. This helps establish trust among users of the blockchain.

There are four standard methods that blockchain and other distributed database platforms use to arrive at a consensus. Common consensus algorithms include the following:

- **Proof-of-work (PoW)** algorithms are used to select a miner for the next block generation.
- **Practical Byzantine fault tolerance** algorithms are designed to work in asynchronous systems.
- **Proof-of-stake** algorithms are commonly used as alternatives to PoW.
- **Delegated proof-of-stake** algorithms are used for a voting and election process, designed to protect against malicious use or centralization in the blockchain.

Blockchain privacy and security

[Privacy and security are major advantages of blockchain](#). Private data is stored in blocks. Blocks are always stored chronologically, and it is extremely difficult to change a block once it has been added to the end of the blockchain.

Each block has its own hash code that contains the hash code of the block that comes before it. If a hacker tries to edit a block or access its information, the block's hash will

change, meaning the hacker would have to change the next block's hash in the chain, and so on. Therefore, to change one block, a hacker would have to change every other block that comes after it, which would take a massive amount of computing power.

Blockchain technology is still susceptible to 51% attacks, which can circumvent a consensus algorithm. With these attacks, an attacker has more than 50% control over all the computing power on a blockchain, giving them the ability to overwhelm the other participants on the network. This type of attack is unlikely, though, because it would take a large amount of effort and a lot of computing power to execute.

History of blockchain

The original idea for blockchain technology was contemplated decades ago. A protocol similar to blockchain was first proposed in a 1982 dissertation by David Chaum, an American computer scientist and cryptographer. In 1991, Stuart Haber and W. Scott Stornetta expanded on the original description of a chain of blocks secured through cryptography. From this point on, various individuals began working on developing digital currencies.

In 2008, a developer or group of developers working under the pseudonym Satoshi Nakamoto developed a white paper that established the model for blockchain, including the hash method used to timestamp blocks. In 2009, Satoshi Nakamoto implemented a blockchain using the Bitcoin currency. To this day, no one knows for sure who Satoshi Nakamoto is.

Interest in enterprise application of blockchain has grown since then as the technology has evolved, and as blockchain-based software and peer-to-peer networks designed for the enterprise came to market. Around 2014, blockchain technology applications distinct from its use in cryptocurrencies began to emerge as experts identified potential uses of the technology for other types of financial and organizational transactions.

Some specific early examples of enterprise applications include the following:

- In 2016, the online retail company Overstock.com used blockchain to sell and distribute more than 126,000 company shares. That marked the first time a publicly traded company used blockchain to support stock transactions.

- In 2018, Ticketmaster, the entertainment ticketing software and services company, bought blockchain technology provider Upgraded, which converts traditional tickets into secure interactive digital assets.
- In early 2020, blockchain company Theta Labs partnered with Google Cloud. The partnership [allows Google Cloud users to deploy and run nodes](#) from Theta's blockchain network.

In recent years, [several blockchain technology trends have arisen](#), including decentralized finance (DeFi), a type of financial framework based on the Ethereum blockchain network. DeFi is different from centralized finance models within cryptocurrency markets in that there's no centralized authority that can control or intercede in transactions.

Blockchain is also facing legal and regulatory challenges, as well as controversies surrounding fraudulent activities, such as the high-profile [collapse of exchange service FTX](#). Despite this, enterprises are continuing to invest in blockchain and its applications, most notably through the rise of NFTs and the NFT marketplace.

Blockchain is a growing enterprise technology. Learn more about it in our [ultimate enterprise guide to blockchain](#).

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