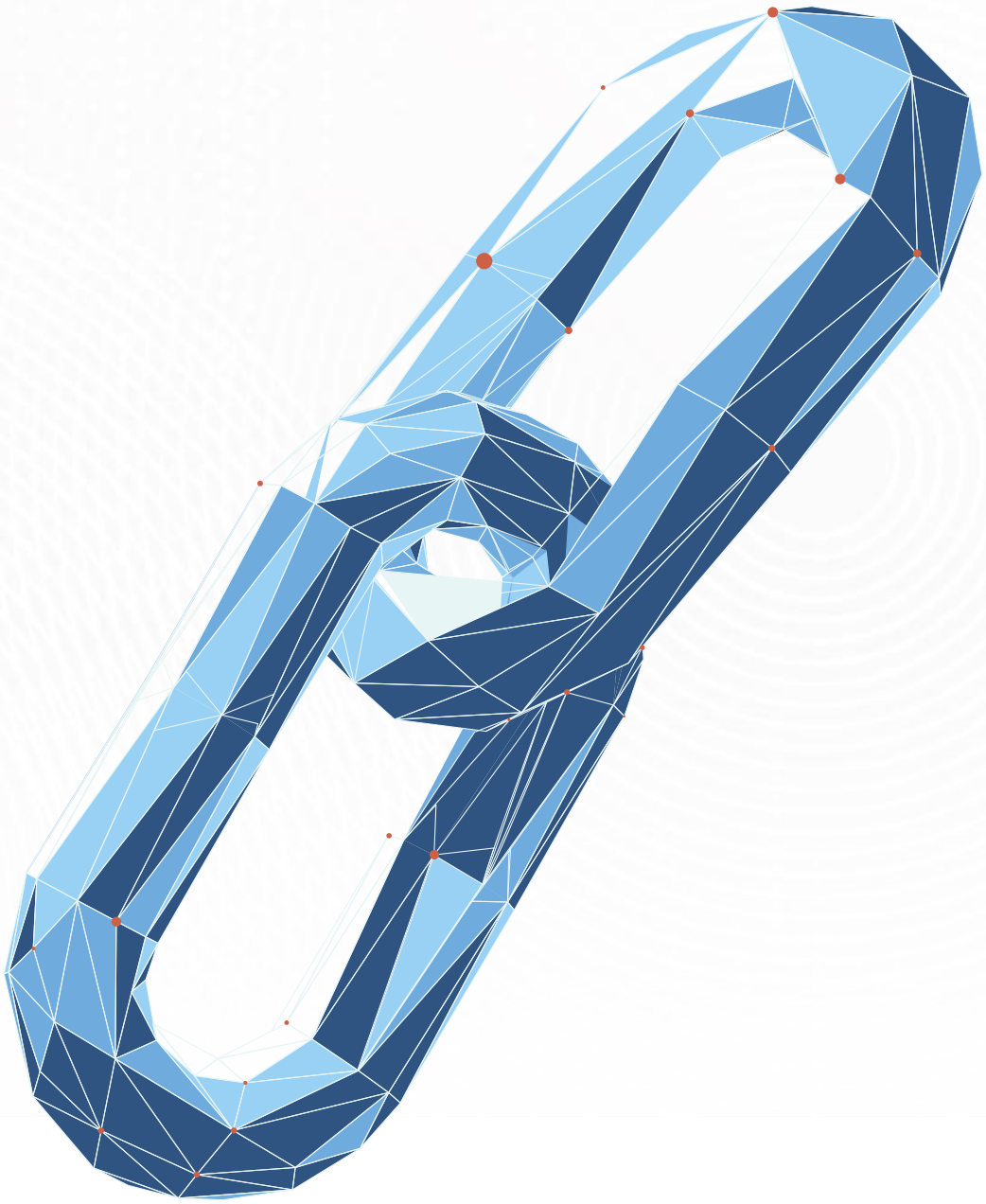

GoDgtl
by PruTech

HOW **BLOCKCHAIN TECHNOLOGY** IS EVOLVING IN THE CLOUD

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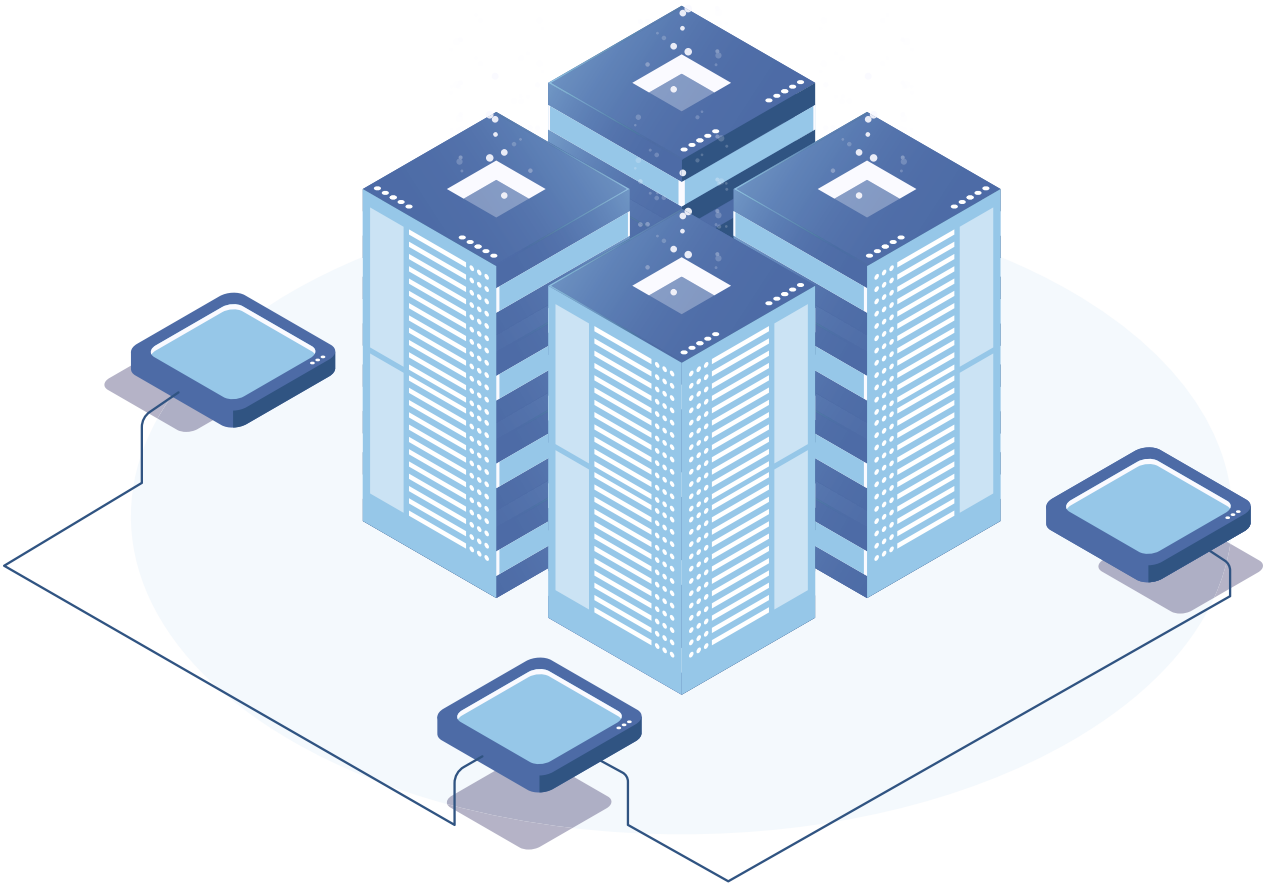
Introduction

Blockchain is famous for its use as the technology behind cryptocurrencies. However, it has many other applications. One such application is in cloud computing, providing additional security and several other benefits. Cloud and blockchain are increasingly becoming the most valuable combinations to enhance the security of enterprise data living on the cloud.

With major public cloud service providers like Amazon, Google, and Microsoft already offering Blockchain-as-a-Service (BaaS), businesses moving to the cloud and looking to improve their data security can reap the benefits of this emerging technology.

This whitepaper provides an understanding of blockchain technology, its increasing role in cloud computing, and an overview of BaaS offerings from major cloud platforms. The paper also sheds light on how cloud computing will play a critical role in future Blockchain-based applications.



What is Blockchain?

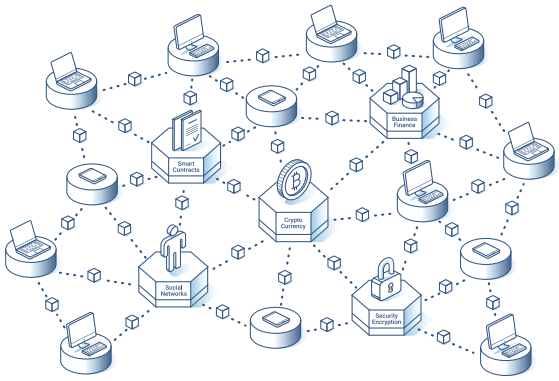
The term “blockchain” became popular with the rise of cryptocurrencies several years ago. However, the technology is not restricted to these decentralized currencies. Blockchain is continuously evolving and is creating impacts in the cloud computing world as well.

Here is an overview of what blockchain technology involves:

- A blockchain is a database that stores encrypted blocks of data and then chains them together to form a chronological single-source-of-truth for the data.
- Digital assets are distributed instead of copied or transferred, creating an immutable record of an asset.
- The asset is decentralized, allowing full real-time access and transparency to the public.
- A transparent ledger of changes preserves the integrity of the document, which creates trust in the asset.
- Blockchain’s inherent security measures and public ledger make it a prime technology for almost every sector.

How is Blockchain Different from a Database?

At first, a blockchain and a database may look similar. However, one key difference between a typical database and a blockchain is how the data is structured. A blockchain collects information together in groups, known as blocks, that hold sets of information. These blocks have certain storage capacities and, when filled, are closed and linked to the previously filled block, forming a chain of data known as the blockchain. Any new information that follows will get added into a newly formed block. Once filled, this new block will get added again to the chain.



While a database usually structures its data into tables, a blockchain, like its name implies, structures its data into chunks (blocks) that are strung together. This data structure inherently makes an irreversible timeline of data when implemented in a decentralized nature. When a block gets filled, it is set in stone and becomes a part of this timeline line. Each block in the chain is given an exact timestamp when added to the chain.

How Does Blockchain Work?

Blockchain consists of three essential concepts: Blocks, Nodes, and Miners.

BLOCKS

Every chain consists of multiple blocks, and each block consists of three basic elements:

- The data in the block.
- A 32-bit whole number called a nonce. The nonce is randomly generated when a block is created, which then generates a block header hash.
- The hash is a 256-bit number wedded to the nonce. It must start with a huge number of zeroes (i.e., be extremely small).

When the first block of a chain gets created, a nonce (number only used once) generates the cryptographic hash. Hash is a one-way function that produces an output of a fixed length that cannot be deciphered. The data within the block is considered signed and forever tied to the nonce and hash unless it is mined.

NODES

One of the most critical concepts in blockchain technology is decentralization. No one computer or organization can own the chain. Instead, it is a distributed ledger via the nodes connected to the chain. These nodes can be any kind of electronic device that maintains copies of the blockchain and keeps the network functioning.

Every node has its own copy of the blockchain, and the network must algorithmically approve any newly mined block for the chain to be updated, trusted, and verified. Since blockchains are transparent, it is possible to check and view every action in the ledger. Each participant is given a unique alphanumeric identification number that shows their transactions.

Combining public information with a checks-and-balances system helps the blockchain maintain integrity and create trust among users. Essentially, blockchains can be thought of as the scalability of trust via technology.

MINERS

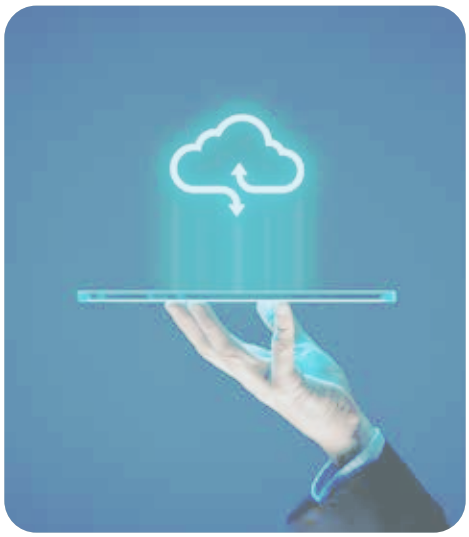
Miners create new blocks on the chain through a process called mining.

In a blockchain, every block has its unique nonce and hash but also references the hash of the previous block in the chain. Hence, mining a block isn't easy, especially on large chains.

Miners use special software to solve the incredibly complex math problem of finding a nonce that generates an accepted hash. Because the nonce is only 32 bits and the hash is 256, roughly four billion possible nonce-hash combinations must be mined before the right one gets found. When that happens, miners are said to have found the "golden nonce," and their block gets added to the chain.

Making a change to any block earlier in the chain requires re-mining, not just the block with the change, but all the blocks that come after. It is this complex process that makes manipulating blockchain technology extremely difficult. Think of it as "safety in math" since finding golden nonces requires enormous time and computing power.

When a block is successfully mined, the change is accepted by all of the nodes on the network, and the miner is rewarded financially.



Cloud and Blockchain

The primary advantage of leveraging blockchain technology in cloud computing comes in the form of new and increased security measures to protect data. It is an unbeatable combination that is increasingly becoming accepted and implemented in enterprises and organizations across all industry verticals. While advancements are already happening in cloud data security, blockchain brings along its security enhancement benefit.

Cloud computing works in a centralized format and has massive servers that store the information and make it available to users with the help of software. However, these centralized-based models often make organizations compromise on authorization, privacy, and security. Cloud computing also lacks trust, as the information stored can be accessed by anyone, especially illegally by hackers and malware attacks, leading to confidential data leakage.

Advantages of Blockchain

Blockchain is a core technology that presents many use cases. Blockchain applications on their own, and when coupled with other technologies, provide a plethora of advantages.

- Blockchain technology addresses the major challenge of cloud computing, which is security and privacy. According to Statista, in 2021, 64% of the respondents felt that their biggest cloud security concern was data loss/leakage. Encryption of data accounts for the security and protected databases that blockchain provides.
- According to the same Statista report, 44% of the respondents also treat visibility/transparency as a major threat to cloud security. Blockchain helps construct a decentralized and distributed trust model that allows more transparency. Public blockchain allows every action to be visible and eliminates the hampering of data. Once stored on the blockchain, data cannot be changed by any person.
- Erasing/misusing data from anyone's computer on a blockchain network does not affect the data stored on other devices in the network, thus guaranteeing no loss of data and authenticity.
- Blockchain facilitates the user ownership of data which is the need of the hour. Data stored on a blockchain remains permanent, allowing easy data traceability as to where, when, and how it is being used and by whom. This proof of history for all transactions and changes acts as an audit and provides an authentication benefit.
- Cloud computing involves third-party providers, and a crash/downfall of the third-party providers can lead to a huge loss of data for enterprises. Blockchains, on the other hand, are governed by codes and do not involve third-party provisions, and thus can be a safer option to move forward with.

Major Cloud Platforms offering Blockchain-as-a-Service (BaaS)

With blockchain services moving away from only supporting cryptocurrency operations into many other areas of digital transformation and IT operations, public cloud platforms like Azure, Amazon, Google, and IBM have all come out with their own managed blockchain services.

In 2019, most major cloud platforms started offering initial blockchain services, and since then, the market has responded favorably to these offerings.

Microsoft began offering blockchain-based storage through its Azure cloud service, charging $0.05/GB/month. Azure Blockchain is a fully managed blockchain service. It enables users to grow and operate blockchain networks and eliminates the need to build, manage, and expand the underlying network themselves.

AMAZON

Amazon also launched its Managed Blockchain service based on the opensource Hyperledger Fabric and Ethereum specifications. In addition, Amazon is also offering a fully managed service called Amazon Managed Blockchain aimed at providing blockchain networks that span multiple AWS accounts.

- This service enables users to deploy decentralized apps to the network, execute transactions, and share data with others on their network without a central authority.
- There's no need to manually provision hardware, configure software, or set up networking and security components.
- An API allows network participants to add or remove members.
- Amazon's pricing starts at $0.30 per hour, per node.

The hyperscaler also runs a peer node storage service that maintains a user's blockchain ledger and applications. Peer node storage is charged in GB-per-month increments. Some of the most established players across different market segments rely on Amazon's BaaS, including Verizon, Accenture, DTCC, Liberty Mutual, and GE Aviation.

IBM

IBM's Blockchain Platform is arguably the most mature and prominent service available. It forms the basis for many global proofs of concepts involving supply chain management and cross-border financial services transactions.

Last year, IBM began offering Cloud Pak, a collection of pre-integrated development and deployment tools and services that customers can install and utilize quickly on Red Hat OpenShift public and private cloud environments.

Cloud Pak for Applications – one of five products in the suite – enables organizations to build, deploy, and run applications, including decentralized cloud-native applications. These applications can use the blockchain tools, infrastructure services, containerization, and microservices architecture to provide greater visibility and consistency across multi-cloud environments.

OTHERS

Along with established technology vendors, more than a half dozen start-ups are developing or have launched decentralized backup, archive, and file-sharing services based on blockchain's DLT and P2P protocols. Some of these new services aggregate unused drive capacity from data centers, consumer computers, or both. In some instances, it can act as a form of edge computing by only using storage resources closest to a customer's regional location.

The companies that have already launched or are well along in developing object storage services by blockchain include **BloqCloud, Cryptyk, Filecoin, Sia, ScPrime, Storj Labs, and 0Chain.**

Where Blockchain is Headed

Blockchain technology has evolved and will continue to be a disruptive force in many industries. **At present, one of the strongest use cases is non-fungible tokens or NFTs. Another relevant solid case can be made for cryptocurrency.**

However, a shift is being seen in blockchain technology with a bright future for not just crypto's and NFT's but also with transactions. Faster transactions make it almost impossible to allow hackers to access sensitive data in transactions. Due to the secured and decentralized nature of blockchain technology, this new type of data is highly secure, and transactions can be processed much faster without compromising security.

Digital identity is another area that is rapidly adopting blockchain technology. Many of us are accustomed to our digital space needing a plethora of login and password information. However, with blockchain technology, we are moving to an area where authentication will no longer be based on security questions and icons for verification. Instead, these will get replaced by a digital identity made up of a unique set of numbers assigned to each user on a blockchain network.

These are examples of only a few areas where the growth and adoption of blockchain technology are on the rise. The scope of blockchain will expand and include IoT, data analysis, finance, and more. The global blockchain market is expected to grow tremendously over the next few years approaching a market cap of almost $34B by 2026. The cloud will continue to play an essential role in managing, providing, and using blockchain technology. Blockchain technology has already been implemented in many fields, including digital identities, payment systems, cloud data storage, smart contracts, issuance of cryptocurrencies (ICO), logistics management, and IoT transactions. These use cases are expected to serve as new foundations for entirely new types of businesses and services in the future.

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