

Blockchain: A detailed survey to explore innovative implementation of disruptive technology

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Abstract

Blockchain technology is a major disruptive technology breakthroughs in the past two decade. This technology can be easily understood as a ledger of records which are irreversible and verifiable. The greatest impact of this application is in the massive generation of crypto-currencies. Over the years, block chain has proved to be more comprehensive and beneficial in more ways than one; not just as an archive of records or virtual currency domain. This paper comes up with a survey done to bring out the key developments of block chain into other domains of practice. Despite the most prevalent adoption of block chain happened to be financial and banking sector but there are researches and trials been done in many other sector by technology game changers. This paper will explore and present diverse uses of block chain in other domains, its impacts and the future course of implementation practices that may be tested.

Keywords: Blockchain, Crypto-currency, Disruptive technology, Distributed Ledger Technology (DLT), Minting, Ledger Layer.

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1. Introduction

Blockchain technology is one of the fastest growing technologies in recent years. A block chain is described as a list of growing records called blocks, Cryptography technology is used in Blockchain. In this technology, each block consists of cryptographic hash of the previous block, timestamp and transaction data. In other words, Block chain can be defined as a chain consisting of various blocks and forming a chain along with the information in each block. Block chain use secure transactions for money transfer, property, contacts etc. In 1991, a study on crypto-graphic block chain was published by Stuart Haber and W. Scott Stornetta. The goal was to invent and implement a technique which didn't alter the timestamps of the document. A year later, Haber and Stornetta implemented Merkle Tree format to improve the block chain design for efficiency. Data recorded cannot be changed; updation is not possible [1]. This paper discusses a detailed review of block chain technology literature and its applications [2].

2. Blockchain – Overview

A blockchain is a network of separate, distributed and digital ledger which is maintained by more than one party using cryptography. It ensures security of transmission, access and storage consistency of data. Distributed Ledger Technology (DLT) is used to record information that's distributed across a network. Block keyword is been used to store data in block. Each block holds cryptographic hash of the prior block in block chain. The blocks are linked to one another through Chains [3]. During the phase of 1991-2008 the Evolution of Block chain Technology took place. In 2008 to 2013, Blockchain 1.0 and Bitcoin emerged. Then moving forward, 2013 to 2015 Block chain 2nd version 2.0 was introduced and Ethereum Development took place, now from 2018 Blockchain 3.0 was introduced and known as the future.

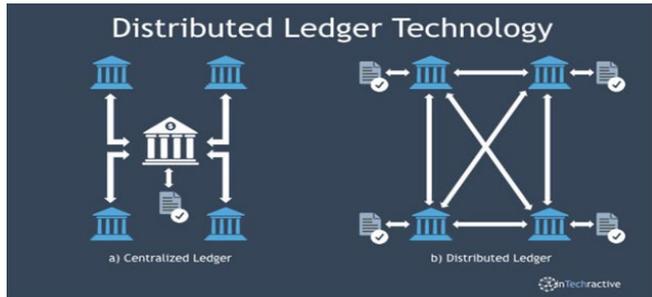


Figure 1. Distributed Ledger Technology (DLT)
Source: whichblockchain.com

The literature study for this survey comprises of various research papers, books and book chapters, journal papers, crypto-currency sites and Wikipedia, conference papers, company PoVs and experiments published in white papers Blockchain is the buzzword these days because it shot to fame through the famous crypto currency the Bitcoin. Public and Private sector banks have taken the smart decision to implement block chain into their transactions. The potential and possibilities of his concept is tremendous which can change the way transactions are done in future to a great extent [4][5]

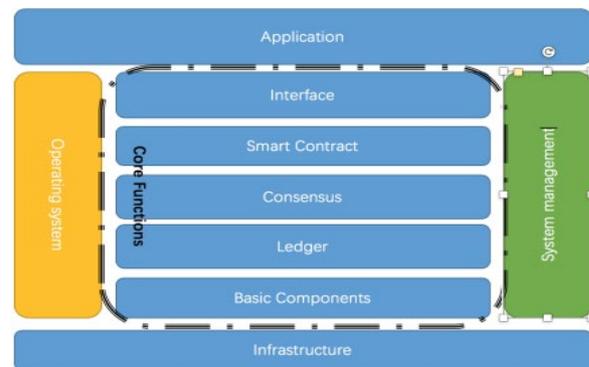
3. Blockchain Architecture

A Block chain is a chain of blocks which contain information. The data which is stored inside a block depends on the type of block chain[6]. In below Block chain architecture [7] diagram we have various modules integrated and explained which are used in block chain architecture[8][9].The layers of Architecture are

- a) Infrastructure Layer
- b) Utility Layer
- c) Ledger Layer
- d) Consensus Layer
- e) Smart Contract Layer
- f) System Management Layer
- g) Interface Layer
- h) Application and Operation Layer
- i) Maintenance layer

- a) **Infrastructure Layer** – This layer provides physical resources, drivers and operating environment for block chain system. Operating environment includes hardware like machines, cloud etc. Storage resources includes Cloud storage, hard Disks storage etc., Network resources include hubs, Switches, Routers etc.
- b) **Utility Layer** - This layer is responsible for recording, verifying and segregate information. It is distributed system which is responsible for transmission, storage and verifying.
- c) **Ledger Layer** – This layer stores information of block chain system as well as transaction data and generate data blocks for validity. This layer embed the hash of previous node into the next node data structure to ensure integrity and authenticity

- d) **Consensus Layer** – The job of this layer is to coordinate and maintain the consistency of all records in entire network. This layer set rules and arrangements to carry out block chain operations.
- e) **Smart Contract Layer** – The Job of smart contract layer is to compile, deploy, and implement the business logic of the block chain system. Smart Contract consist of digital assets hence modification is not possible when the data is on block chain.
- f) **Interface layer** – The job of interface layer is use for encapsulation of modules and make call for application layer.



Source:Adeptia.com

Figure 2. Blockchain Architecture [10] [25-27]

g) Application & Operation Layer – The job of application layer is to present the result to the user. This layer calls smart control layer. The application layer is responsible for the user facing components, and the implementation layer refers to everything that brings the application to life, like protocols and code[11].

h) Maintenance Layer – It maintain block chain system on daily basis, including various types of libraries like log library, monitoring library, management library, extension library etc [12].

4. Characteristics of Blockchain:

Block chain is rich in its features[13], in this paper few are functional characteristics are explore[14][15].

Increase capacity –This feature talks about the capacity of whole network as N number of machines work together to offer great power then few devices hence all the things are centralized [16].

Better security – Highest security is achieved when block chain technology is used, As block chain network consist

of number of nodes (computers) hence transaction confirmation is done by these nodes[17].

Immutability- This feature talks about the ability of block chain ledger to unchanged and changes in not applicable or unaltered.

Decentralized – Block chain technology store documents, files etc. at servers or networks and one can access via internet from remote locations [19]



Figure 3. Block chain | Features
Source: Dataflair.com

5. Technological trends of Blockchain Technology in 2020

Since recent times we have come across various new technologies which has emerge as a benchmark for users, industry and government organization [20]. Block chain technology is also one of the technology which is been now used in various sectors which include Social networks , financial services , Artificial intelligence etc[21] below list of latest trends of block chain in due to[22-23] which this technology is ready to provide various job opportunities to young minds in various sectors in year 2020[28-30].

- BAAS - BLOCKCHAIN AS SERVICE
- Block chain solve social networking problems
- Financial services lead in using block chain technology
- IoT and Block chain together
- Block chain in Artificial Intelligence
- Demand for Block chain experts

a. BAAS - Blockchain as service

BAAS Blockchain as a service is a recent trend in the industry, It is a cloud based service which is adopted by Most of the start-ups and enable users to develop products [31].

b. Blockchain in social networking

Minting - Minting is defined as the computer process of validating information, creating a new block and recording that information into the block chain.

Fast settlement – Block chain technology fasten the process of money transfer problem from number of days to few hours [18].

Around the world most of the people are connect with social media. As the users have increase rapidly the problems of social media related to security , data storage, content related issue, privacy etc has also increase, Online social networks systems have become popular in recent time due the massive usage of users around the world. Till date, 3.9 billion social media users in February 2020. So below so graphically [32] show the users across major social networking platforms and this trend will increase month after month and year after year. As by decentralization social network problems can be solved and block chain has the most sophisticated decentralized technique [33-35].

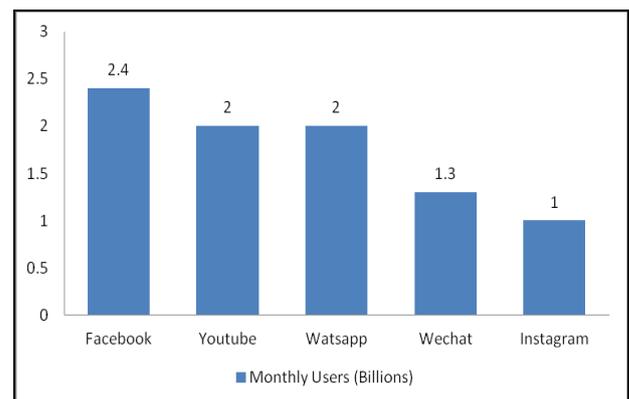


Figure 4. Social Network Users

c. Financial services lead in using block chain technology:

Block chain helps banks in processing transactions at faster rate, reduce transaction cost, reduce frauds, helps in known your kyc and removes fraud in trading sector



Figure 5. Blockchain Bank
Source: hyperlinkinfosystem

d. IoT and Blockchain together:

IoT sector is also one of the major booming sector in the industry [36]. The complexity of architecture design and security issue had led blockchain to cop up with safety challenges. As after some time IoT networks will become a safe place for hackers to perform unethical task. Till the end of 2020, 30 million devices will be connected [37] with internet which will be a new place for hackers. IoT devices are expected to generate 79.8 zetabytes data till 2025.

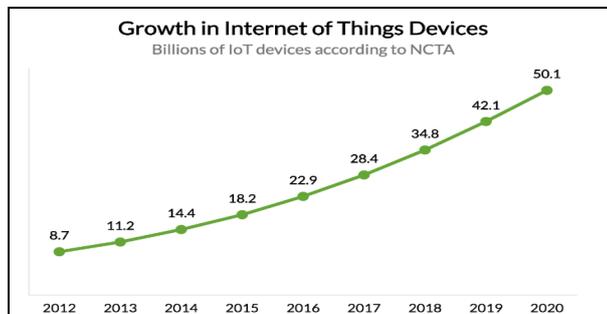


Figure 6. Blockchain Bank
Source: medium.com

e. Blockchain in Artificial Intelligence:

Blockchain and AI have now been used as benchmarks in terms of adoption of innovative technology usage across industries. Blockchain can be understood as a distributed network of computers that records and stores data which can be displayed chronologically by the authorized user at any point of time. By incorporating AI into the Blockchain technology can reap higher benefits with [38] improved number of supported applications. According to The International Data Corporation (IDC), the global investment on AI is expected to reach approximately \$67

billion by 2020. It is also foreseen that 55% of the businesses will be focusing on integration of AI with Blockchain for greater advantage.

Furthermore, Technology experts believe that Blockchain can also make AI more simplistic and comprehensive by enabling backward planning and better decision making since the ledger of Blockchain records all the data and its variables that are used by machine learning while making a decision.



Figure 7. Blockchain & AI Applications
Source: bbvaopenmind.com

f. Demand for Blockchain experts:

In simple words, A blockchain expert is a person who is expert in blockchain concepts and solves problems, understands, analyse and knows programming languages. He has a complete knowledge about how to build blockchain application for real life problems. The demand for the blockchain technology is increasing which is creating job opportunities for block chain developers. By the year 2023 there will be high demand for the block chain developers in the market [39]

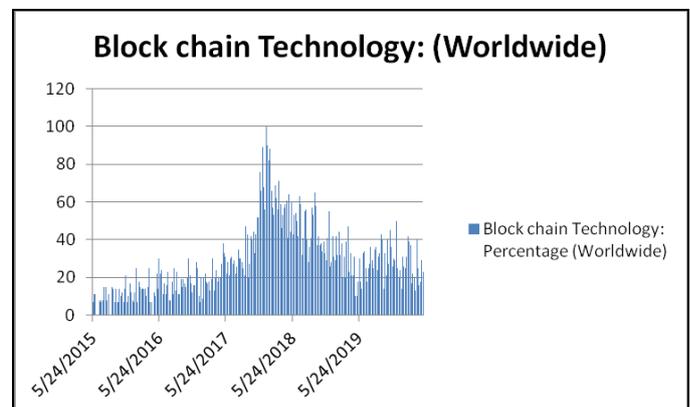


Figure 8. Blockchain Technology Growth

6. Applications of Blockchain

Block chain Technology is used widely in the different sectors as given in the following table.

Application Areas	Utilization
Markets	<ul style="list-style-type: none"> Bill generation, Data

	<ul style="list-style-type: none"> Analysis and Data Transfer • Supply chain management
Government Organizations	<ul style="list-style-type: none"> • Internet protocol registration • Polls and Voting • Smart contacts • Tele-attorney service • Tax services • Notary Services
Internet of Things IOT	<ul style="list-style-type: none"> • Smart Farming • Smart Homes • Smart City • Smart cars • Robots
Health	<ul style="list-style-type: none"> • Data management[8] • Universal EMR Health databanks • Medical Billing • Smart property • Health Token • Testing • Diagnosis / Results
Finance & Accounting	<ul style="list-style-type: none"> • Digital Currency Payment [9] • Payments & Remittance • Loans payment & Securities • KYC • Record sharing [10] • Clearing and settlement • Payment transfer • Journals and Accounts • Insurance Payment

- ✓ Reduce cost
- ✓ Decentralized
- ✓ Empower users
- ✓ High quality data
- ✓ fast traction
- ✓ Reliability
- ✓ Durability

Reasons for failure of Blockchain technology:

- ✗ Excess energy consumption
- ✗ Mining does not mean not security
- ✗ Not immutable
- ✗ Not scale able
- ✗ Inefficient
- ✗ Redundant performance
- ✗ Private keys
- ✗ No control of enterprise
- ✗ Integration concerned
- ✗ Complex signature verification
- ✗ High cost
- ✗ Privacy concerned

Future of blockchain technology:

- ✓ Gaming
- ✓ E-commerce
- ✓ Digital media
- ✓ Healthcare
- ✓ Supply chain
- ✓ Cloud computing
- ✓ Cyber security
- ✓ Government Banking
- ✓ Aerospace
- ✓ Defence

7. Conclusion

Block chain technology is the concept behind most famous crypto-currency in virtual finances has been extended to be served as an immutable ledger for transactions through different channels. Currently, blockchain based applications are implemented in varied functions like Internet of things (IoT) [40], financial services, retail reward systems, voting systems and so on. However, the scalability and security are still creating hurdles to use it as a permanent solution. This paper attempts to put forward a comprehensive summary on blockchain technology. This paper firstly provides an overview of the blockchain technology, its architecture, characteristics, uses, applications etc. Lastly, the reasons for the failure of blockchain technology and future trend of this technology in major industries are also forecasted, keeping in mind its present growth trend and advancements.

Keys for the success of Blockchain technology:

- ✓ Secure
- ✓ Transparent
- ✓ Traceable
- ✓ Documentation
- ✓ Less intermediate

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