

# Blockchain Meets IoT: A Survey on Their Working and Application

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## Abstract:

Since its beginnings, The Internet of Things (IoT) is into well matured and established itself as a part of the future Internet. Nowadays, billions of devices are being connected with the Internet that produces a huge amount of useful data over the time. The main talent is to manage the data and it's become the threat worldwide due to centralization and distributed nature of IoT networks. Blockchain provides the solution i.e. decentralized that solve the security issue of IoT with a relative low cost. In this paper, first I would give an overview of the Blockchain technology and Internet of Things (IoT) after that dissert the application and comparison of IoT and Blockchain.

**Keyword:** Internet of Things (IoT), Blockchain, Security, Privacy.

## Introduction

As per prediction around 29 billion devices by 2022, of which approximate 18 billion will be related to Internet of Things (IoT) that has become a technology to regulate across plenty vertical markets. It is observed that IoT services are going to effect practically each and every useable item of daily lifestyle. In addition to this, the development of Blockchain is also growing vastly since it was first popularized in Bitcoin [1]. Blockchain solve the security issues of IoT, to make secure communication between IoT devices without involvement of any third party.



Figure 1 : Growth of IoT Devices [1]

## IoT - Meaning

Internet of things is developed gradually with the convergence of distinct technologies like real-time analytics, machine learning, wireless sensor networks, embedded systems etc. IoT is an ecosystem connected with everyday physical devices with an on and off switch through the internet [2]. This includes everything from small particle to large application like cellphones, microwaves, self-driving cars etc. In a nutshell, IoT can be anything it could be a person with a heart that supervise everything.

## How IoT Works?

IoT (Internet of Things) is an architecture, technology and concept which are sum up of all the feasible technologies [6]. It is identical with the concept of the internet that has switched our life to next level and connects through the World Wide Web. The objective of IoT is to focus on an advanced level beyond this by connecting various devices to the internet. It has made possible human-machine and machine-machine interactions through IoT [12].

## Building blocks of IoT:

- 1.) **Sensors**—First of all, sensors or devices help in collecting each and every data from the outside world. There are numerous complexities in the collection that vary from simple to complex.
- 2.) **IoT Gateways** – As from the name clear that it helps for linking between sensor and all the devices. This can be performing by the collection of data from sensor & internet devices.
- 3.) **Cloud/Server infrastructure & Big Data** – Using Big Data analytics engine, the data is securely stored & processed to use the intelligent actions.
- 4.) **End-user Mobile apps** – These mobile apps help the user to observe each and everything from their remote locations.

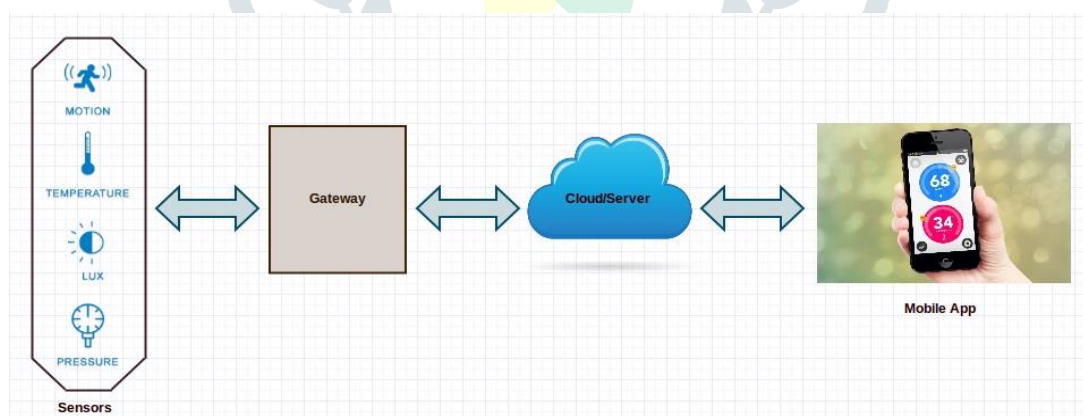


Figure 2: Working of IoT

## Application of IoT in Home Routine:

1. A temperature sensor network equipped in the room combined with the gateway to connect the network to the Internet via Cloud infrastructure.
2. Server acquires the specified records related to all devices connected with it. E.g. – Current and last status of the device and calculate the total count of device used.
3. Web service Restful is used to implement the connection via cloud.

4. Users have relation with Cloud through the mobile app and the request is sent to the cloud with the device information and proof is applied to certify cybersecurity.
5. Through the device\_id, Cloud will recognize the device and send the request to the sensor.
6. After that, the temperature sensor will send response back to cloud by reading the current temperature.
7. The selective user can be identified by the cloud who has requested and push the data into the app. Through this current information of user directly appear on the screen.

## Blockchain

A blockchain is a chain of block that is made up of digital pieces of information that are linked together using cryptography [3]. Every block of a blockchain involve a cryptographic hash of the previous block. Blockchain is the term used in industries for creating and managing a distributed database in a secure and economical way to maintain records for digital transactions that improve accuracy by removing human involvement in verification. The digital information can be recorded and distributed in Blockchain, but not edited.

### How blockchain works?

A blockchain is a sequence of records that are called blocks and linked together using cryptography. Cryptography is a process which converts the plain text into cipher text that encrypts and secures data so that the intruder can't read private messages. Blockchain is vastly used by cryptocurrencies and distributed ledger is available to everyone [11][13]. Once the data has been recorded, it will never change similar a digital notary with timestamps. Private Key cryptography, Distributed network with a shared ledger and Record-keeping and security are the 3 principal used in Blockchain. The following example shows how they work.

### Cryptographic keys

In this Key, Two persons want to do transaction over the internet.

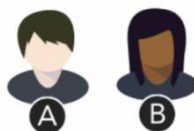


Figure 3 : Cryptographic Keys

Out of these, one have a private key and another one hold the public key.

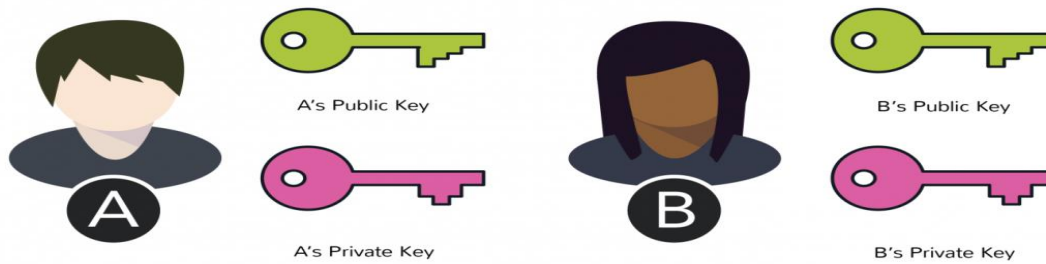


Figure 4 : Sharing Public and Private Key

To create a secure digital reference is the aim of blockchain technology based on combination of both public and private keys.

These keys creating an extremely useful digital signature that provides strong control of ownership.



Figure 5 : Digital Signature

**Application of Blockchain in Bank Industry:**

Let's consider you want to transfer money from your account to your friend account. For this, first of all, you visit the bank and ask them to transfer the money in your friend account address [4]. The banks keep an entry on the register of transaction that must be updated on both receiver and sender account.

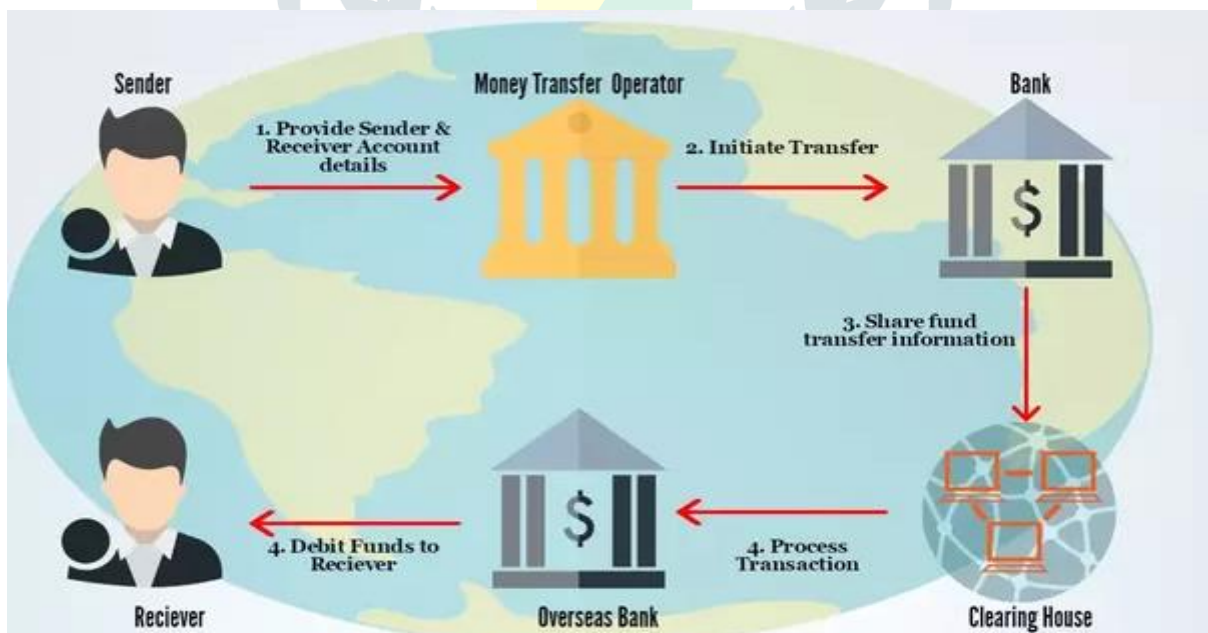


Figure 6 : Blockchain in Bank Industry

But in blockchain data is stored in the form of block and these blocks are connecting together in sequential order. Blockchain is a *distributed ledger* that is spread over the network among all clients in the network and

each client holds a copy of the complete ledger [7][8]. Following point show that Blockchain is better than traditional systems of ledger information keeping:[9][10]

- Blockchain perform peer to peer data means all the clients talk to each other that allows directly data exchange with third-party's involvement. There is no intermediate between them to change and control the data.
- The ledger is reach beyond the complete network which makes cool not so easy. For the security cryptography is used to make the ledger tamper-proof.
- Data can never be changed in blockchain because data added in time-sequential order.

### How Does It Work?

- 1 In the starting when transaction starts then digitally signing it with its private key. Data structure (transfer value between users) and Transaction data structure (logic of transfer of value and rules) are the most common action performed in blockchain.
- 2 A transaction is produced by using a flooding protocol, called Gossip protocol. More than one node is required to verify and validate the transaction based on preset criteria.
- 3 After the validation of Transaction, it is included in a block, which is then transferred onto the network. Then the transaction is considered confirmed.
- 4 The newly-created block added to the ledger and the next block links (hash pointer) itself cryptographically back to this block. In this step, block gets its first confirmation and transaction gets its second confirmation.
- 5 Every time when a new block is created, Transactions are then reconfirmed. Normally, six confirmations are considering the transaction final.

### Comparison between Blockchain and IoT

Features	Blockchain	IoT
System Architecture	Decentralized	Centralized
Latency	Block Mining is time consuming	Low Latency
Privacy	Ensured Privacy	Lack of Privacy
Security	Better Security	Lack of Security
Bandwidth	More bandwidth Consumption	Less Bandwidth Consumption

Table 1 : Comparison between Blockchain and IoT

### CONCLUSION AND FUTURE SCOPE

Both IoT and Blockchain are in their emerging stages with the promise of a future where all the communication will be effortless that deal with machine to machine. After recognizing the benefits of Blockchain Technology in various sectors like Digital Advertising, cyber security, Internet of things, networking and specially removing the third party in transactions, financial institutions have also started spending considerably in this particular field because each address used for transactions is stored forever on



the databases. In the industry, Blockchain technology has a vast eventual to provide the new openings that enhances the professional's potential to upgrade themselves.

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