

BLOCKCHAIN - INTERNET OF THINGS

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Overview

1. Internet of things
2. LP-WAN
3. Security and Privacy in IOT
4. Blockchain
5. Blockchain in IOT
6. Conclusion

Internet of things : Definition

The internet of Things describe the vision where objects become part of the Internet : where every Object is uniquely identified, and accessible to the network , its position and status known, where services and intelligence are added to this expanded Internet, fusion the digital and physical world into a single one

Internet of things : Example of lot devices

There is a very large variety of smart lot devices that are being introduced at each layer of IT.

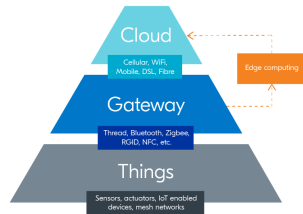


Figure: lot devices

HUMAN IS NOT THE CENTER OF THE SYSTEM, BUT PART OF IT.

Internet of things : Architecture

- **Things:** Uniquely identifiable node, primarily sensors that communicate without human interaction using different connectivity methods.
- **Gateways :** They act as intermediaries between things and cloud to provide the needed connectivity, security and manageability
- **Network infrastructure :** Set of devices that control and secure data flow (routers,gateways,repeaters)
- **Cloud Infrastructure :** Pools of virtualized servers and storage that are networked together with computing and analytical capabilities



Lora WAN

LoRaWAN is one of the low power wide area network (LPWAN) technologies that have received significant attention by the research community in the recent years.

- Long Range Wide Area Network
- Originally developed by Cyclos in France
- Originally developed by Cyclos in France
- Bidirectional communication
- Low Rate
- Licence Free



No LPWAN article would be complete without mentioning Sigfox, which is the company that awoke the world to the potential for IOT devices to use very low bandwidth connections..

- **It consumes a low amount of power.**
- **It works well for simple devices that transmit infrequently, because it sends very small amounts of data very slowly**
- **It supports a wide coverage area in the areas where it is located.**
- **Bidirectional communication**
- **Low Rate**
- **Licence Free**



NB-IOT

Narrowband IoT (NB-IoT) is a cellular low-power wide-area (LPWA) connectivity standard that enables IoT devices to send their data directly to the cloud without a gateway in between.

By low power, we mean that IoT devices can run on battery for 10+ years

- **It consumes a low amount of power**
- **Power Efficiency.**
- **Cost Savings**
- **Reliability**
- **Wider Deployment**
- **Licence Free**



Difference between Sigfox - NB IoT - Lora

	LoRa	NB-IoT	Sigfox
Bandwidth	125 KHz	180 KHz	100 Hz
Frequency	Below 1 GHz	Below or above 1GHz	Below 1 GHz
Downlink peak data rate	50 Kbps	250 Kbps	600 bps
Uplink peak data rate	50 Kbps	250 Kbps	100 bps
Module cost	Low	Low	Very low
Data confidentiality	Yes	Yes	No
Authentication and encryption	Yes(AES 128)	Yes (LTE Encryption)	No
Bidirectional	Yes/Half-duplex	Yes/Half-duplex	Limited/Half-duplex
Standardization	LoRa Alliance	3GPP	Sigfox company
Range	15-20 km	22 km	30-50 km
Battery life	10 years	10 years	10 years

Figure: Comparaison Sigfox - NB IoT - Lora

Security and Privacy : OPEN PROBLEMS ?

Too Much Data

If we are connecting more than 64 billion IoT devices by 2025 , with 150 millions data point generate every day by 10,000 households This creates more entry points for hackers and leaves sensitive information vulnerable.

Eavesdropping

For example , hackers could actually use a connected device to virtually invade a person's home, to determine what television show someone was watching at that moment.

Unwanted Public Profile

Every new connected appliance generates more data about you,your behaviour and create digital trail of your personal detail that could fall into the wrong hands

*What is the solution to ensure **security and privacy** in IoT ?*

Block Chain : Definition

A Block Chain is a distributed database that maintains a continuously growing list of records, called blocks.

- it's an open distributed ledger that can record transactions between parties efficiently in a verifiable permanent way
- it offers a decentralized identity management (the user can register in the chain all by himself)

Block Chain Network

A block Chain consists of two types of elements:

- **Transactions** : The actions created by the users in the system
- **Blocks** : record of valid transactions in the correct sequence that are hashed and encoded into a Merkle tree

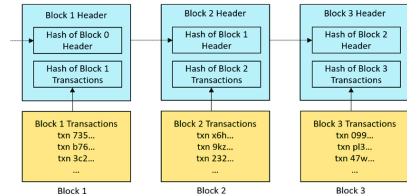


Figure: Block Chain Transactions and Blocks

Block Chain Miner

Any node in the PEER-TO-PEER network of BC can choose to be a miner

- **Miner** : Is an entity that is responsible for mining or adding new blocks to BC by solving a resource-intensive cryptographic puzzle called **Proof Of Work** and appending new blocks to BC
- When a new transaction occurs , it is broadcasted to the entire network.
- All miners who receive the new transaction verify it by validating the signatures contained within the transaction
- Each miner appends the verified transaction to its own pending block of transaction that are waiting to be mined

Block chain is the solution

Some features of BC make it an attractive technology for addressing the security and privacy challenges in IOT

- **Decentralization** : the lack of central control ensures scalability and robustness by using resources of all participating nodes and eliminating many-to-one traffic flows. This Also decreases delay and overcomes the problem of a single point of failure
- **Anonymity** ! The inherent anonymity afforded is well-suited for most IOT use cases where the identity of the users must be kept private
- **Security** : BC realizes a secure network over untrusted parties which is desirable in IoT with numerous and heterogeneous devices

Device Identity

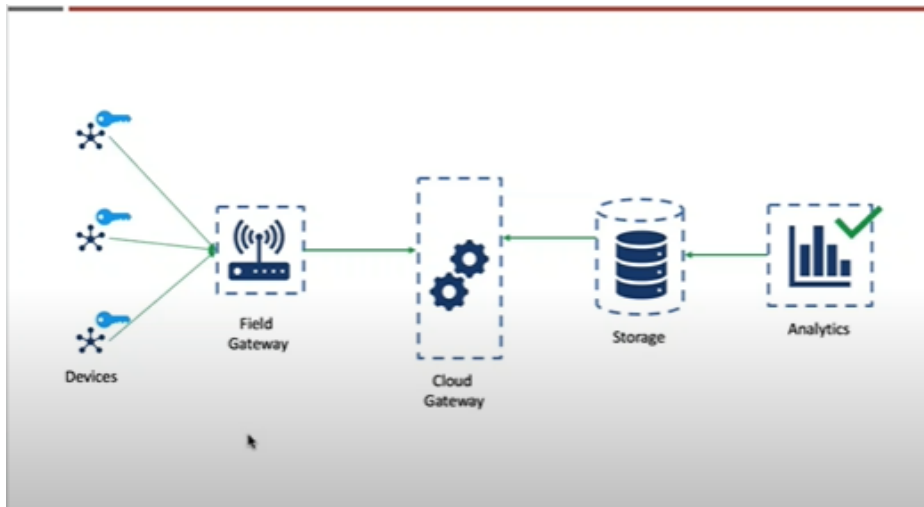


Figure: Devices in iot

Centralized Validation rules

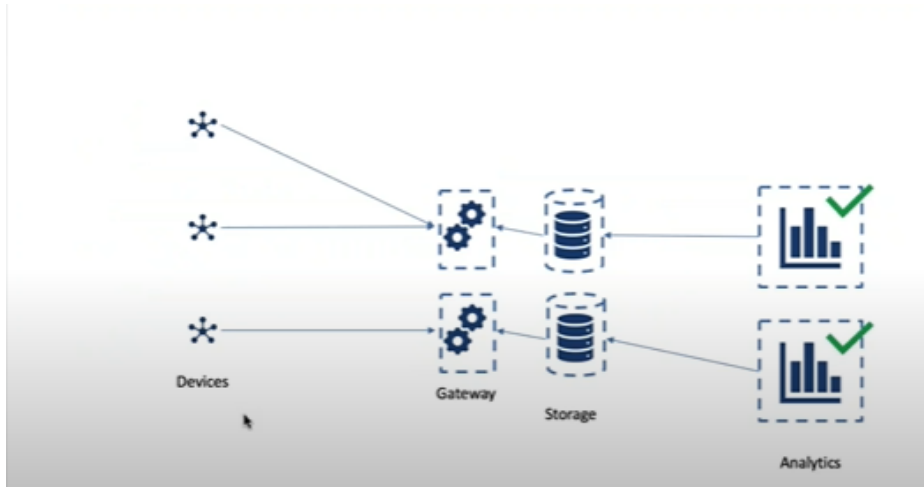


Figure: Centralized validation rules

Devices on-chain

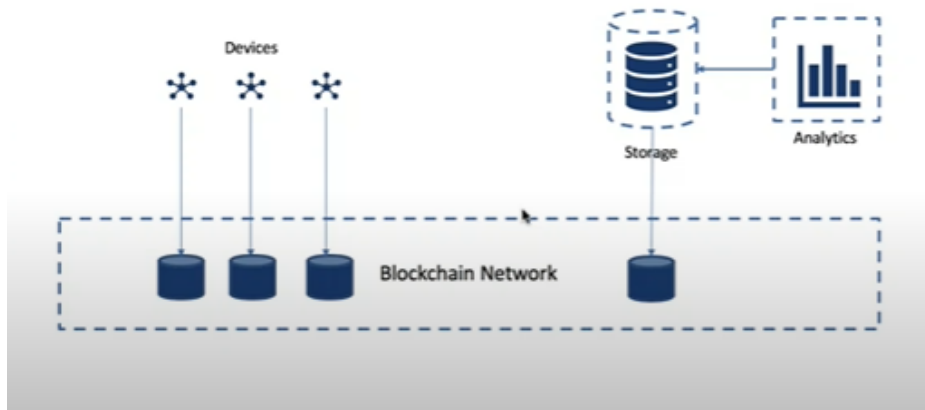


Figure: Devices on-chain

Conclusion

References



What is Narrowband IoT (NB-IoT)? - Explanation and 5 Business Benefits



IoT Alliances and Consortiums

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NB-IoT vs. LoRa vs. Sigfox

The End