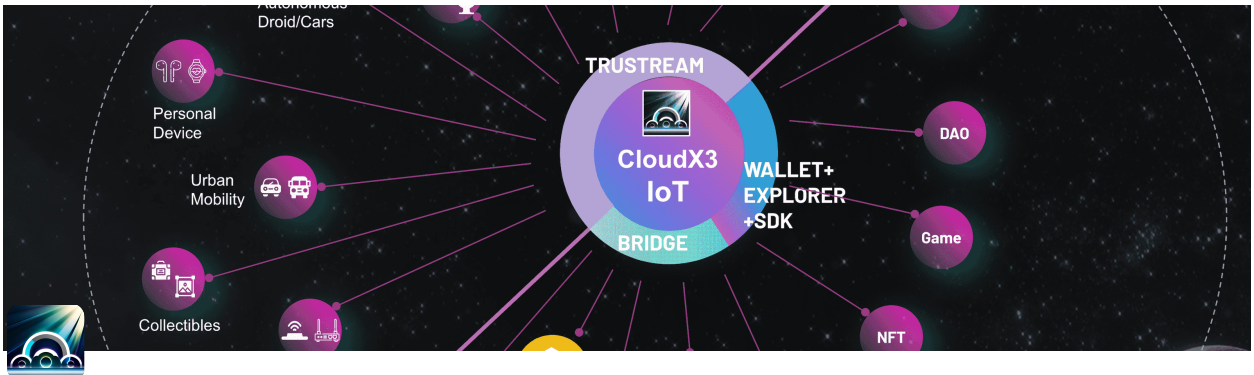


A framework for connecting the physical world to Web3·Volume 丨 Overview

1. Introduction

The Internet of Things (IoT) could unlock up to $12.6 trillion in global economic value by 2030. McKinsey's report reveals the possibilities of the Internet of Things and its place in changing the way we all live our lives [[1]] (https://www.mckinsey.com/~/media/mckinsey/business functions/mckinsey%20digital/our%20insights/iot%20value%20set%20to%20accelerate%20through%202030%20where%20and%20how%20t internet-of-things-catching-up-to-an- accelerating-opportunity-final.pdf?shouldIndex=false). Today's IoT businesses are largely built on centralized infrastructure, with organizations extensively using data collected by IoT devices to make business decisions. Because IoT devices are centrally managed by organizations, customers don't truly own their devices and associated data.

The CloudX3-IoT framework developed by STC Labs aims to break the status quo of traditional Web2-based IoT businesses and help organizations and community developers build innovative Web3-based IoT applications, thereby enabling device owners to make their devices efficient utility.

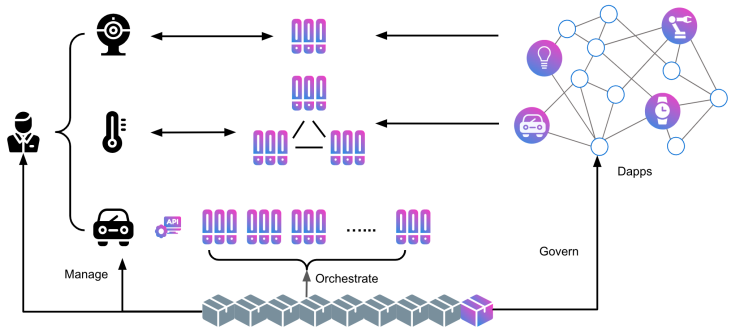
The CloudX3-IoT framework has the following notable features, making it possible to unleash a new wave of decentralized applications driven by data from the physical world

1. **Fast IoT device development and access**: The CloudX3-IoT framework simplifies complexity as much as possible by optimizing descriptions so that developers can more easily understand and use the framework. This streamlined description method helps improve development efficiency and reduces the possibility of errors.
2. **Efficient utilization of computing resources**: CloudX3-IoT provides an IoT cloud computing resource market to improve the efficiency of the cloud hosting market by reusing the computing resources wasted in the current market. This means device owners can rent out their idle computing resources to other users, maximizing resource utilization, reducing costs and increasing efficiency.
3. **Innovative Applications Based on Web3**: Traditional IoT businesses are mainly built on centralized infrastructure, and the goal of CloudX3-IoT is to help organizations and community developers build innovative IoT applications based on Web3. Web3 technology introduces decentralization and transparency, giving device owners greater control over their devices and data, and creating a more open and trustworthy IoT ecosystem.
4. **Introducing Blockchain Technology**: CloudX3-IoT leverages blockchain technology to introduce decentralization and transparency into an industry currently controlled by monopolies. The distributed nature and immutable nature of blockchain increases the security and credibility of data while reducing trust issues and the involvement of middlemen, thereby reducing costs for consumers and increasing revenue for providers.

Through these features, the CloudX3-IoT framework promotes the innovation and development of IoT applications, provides users and developers with greater control and economic value, and promotes the further development of the IoT industry.

1.1 CloudX3 IoT Overview

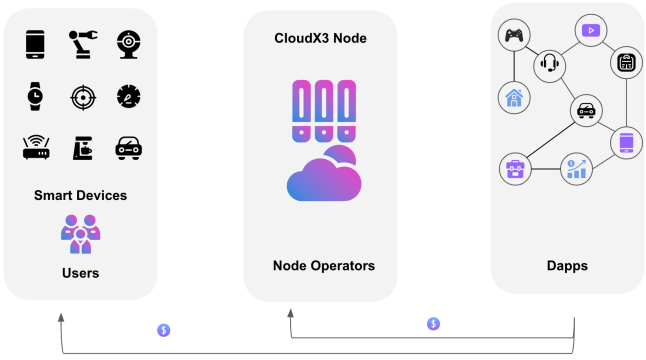
CloudX3-IoT is a universal framework that connects the physical world with Web3 using an innovative combination of blockchain and IoT. It is built on a blockchain built on Cosmos to manage device ownership and coordinates a decentralized network of CloudX3-IoT nodes to establish two-way communication between IoT devices in the physical world and decentralized applications (Dapps) in Web3. With CloudX3-IoT, device owners can monetize their IoT data by participating in certain Dapps, while Dapp developers are able to manage a group of IoT devices that complete specific tasks.



With the help of the CloudX3 IOT platform, IoT development and the network of IoT devices can have the following features:

1. **Device Ownership Management**: CloudX3-IoT uses blockchain technology to ensure the transparency and security of device ownership. Blockchain records device ownership changes and transactions, enabling device owners to accurately control and manage their devices and ensuring data security and privacy.
2. **IoT Data Monetization**: CloudX3-IoT allows device owners to monetize their IoT data by participating in specific Dapps. This provides a new economic model for device owners to earn financial rewards from sharing and selling data, incentivizing them to participate more actively in the IoT ecosystem.
3. **Decentralized Network Coordination**: CloudX3-IoT builds a decentralized network consisting of multiple nodes, and nodes coordinate and communicate through the blockchain. This decentralized network structure is highly robust and scalable, enabling direct communication between devices and applications, reducing intermediate links and improving efficiency.
4. **Task Management and Collaboration**: Dapp developers can use CloudX3-IoT to manage a group of IoT devices that complete specific tasks. Through the functionality provided by the framework, Dapp developers can collaborate with device owners, delegate tasks, and track device execution, enabling more complex IoT applications.
5. **Extremely fast device access:** From construction machinery using private drivers to temperature and humidity meters using standard protocols, CloudX3 IOT provides an ultra-high compatibility framework that allows you to easily deal with various heterogeneous devices.
6. **Modular deployment and efficient application development**: Devices and applications connected to the CloudX3 IOT framework will be encapsulated into Lego-style modules. You can use these modules to build a development framework that perfectly fits the scenario. After connecting to the device, the IOT framework layer will automatically abstract the device's capabilities into APIs, completely decoupling your application from the hardware device.
7. **Decentralized cloud-native ecosystem:** The signal layer and control layer of IoT devices are hosted on CloudX3 IOT and will be automatically transformed into a decentralized cloud-native structure, and Service Mesh service stability management and telemetry will be performed. , allowing the web2 layer of IoT devices to achieve ultra-high stability and security.

1.2 Roles



Role name	Description
IoT devices	IoT devices are the basic components of the framework. They can be various sensors, actuators, smart devices, etc. These devices transmit data from the physical world into the decentralized network by connecting to the Internet and communicating with CloudX3-IoT nodes. The role of IoT devices is to provide data and perform tasks
Users	Users are the owners or users of IoT devices, they can be individuals, organizations or businesses. Users can manage and control their IoT devices by participating in specific Dapps, decide how to use the

Role name	Description
	data generated by the devices, and interact with other participants when needed.
Decentralized cloud infrastructure	The CloudX3-IoT framework establishes a decentralized cloud infrastructure, which is composed of multiple nodes that work together to provide web3 IOT application deployment and computing environment. The role of the decentralized cloud infrastructure is to provide decentralized storage, Computing and communication capabilities to support interactions between IoT devices and users.
IoT cloud node	IoT cloud nodes are key components in the framework. They are the interfaces that connect IoT devices to decentralized cloud infrastructure and blockchain. These nodes are responsible for processing data sent by IoT devices and transmitting it to the appropriate decentralized cloud node. The role of an IoT cloud node is to establish two-way communication between IoT devices and the decentralized cloud infrastructure.
Dapps	Dapps are decentralized applications developed based on the CloudX3-IoT framework. They can be smart contracts, data analysis tools, task management systems, etc. Dapps can be created by developers and implement specific functionality and business logic by interacting with IoT devices and users. The role of Dapps is to provide specific application functions to help users manage and use data from IoT devices.

IoT devices serve as data providers and task performers, users serve as device owners or users, decentralized cloud infrastructure and IoT cloud nodes provide infrastructure for connection and communication, while Dapps provide specific application functions and business logic . These roles work together to enable interaction and data flow between IoT devices, users, decentralized cloud infrastructure, IoT cloud nodes, and Dapps.

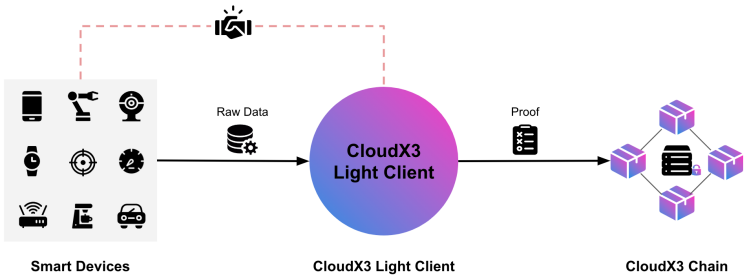
1.3 Trust model

CloudX3-IoT can adapt to different trust models, and the choice of trust model determines the specific implementation architecture.

1.3.1 Cloud computing trust model

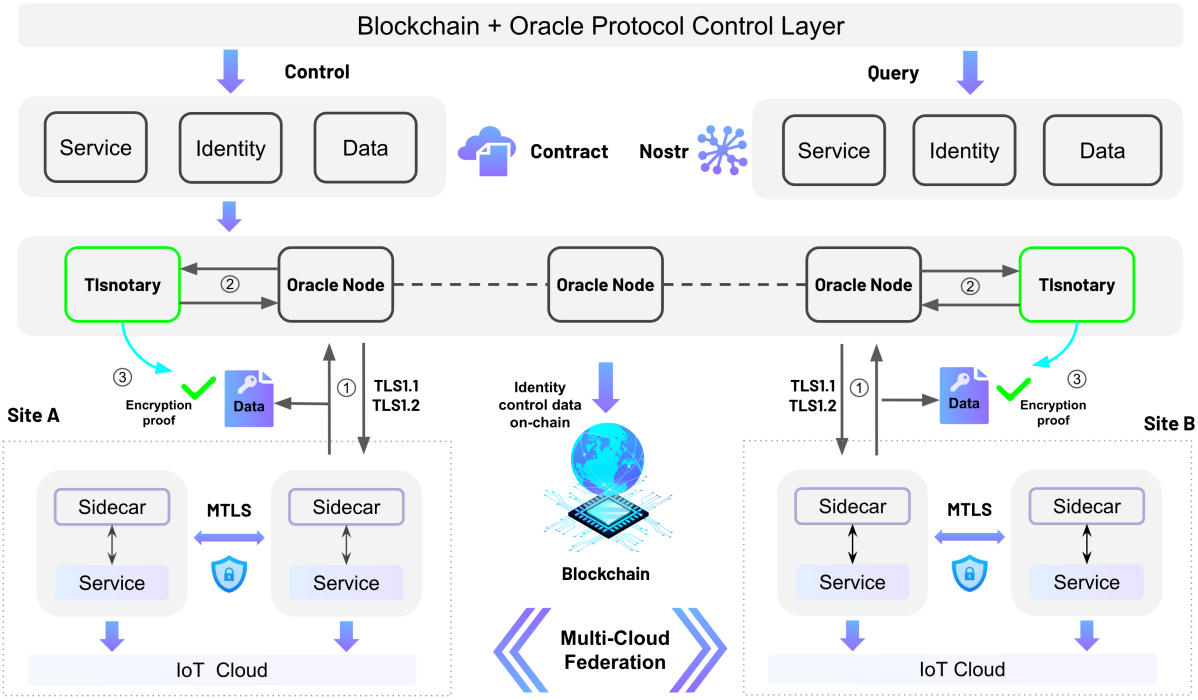
In the cloud computing trust model, users have a high degree of trust in the light wallet client of CloudX3-IoT. This means that users have complete trust in the reliability and security of the client, allowing them to securely obtain device raw data collected from nodes and access all raw data transmitted by IoT devices.

At the same time, Dapps do not receive raw data directly. Instead, they interact through business related to CloudX3-IoT’s blockchain network interface and tokens. Dapps can query the data stored on the blockchain, verify the authenticity and integrity of the data, and execute token-related business logic, such as token transfers, smart contract execution, etc.



1.3.2 TLS Proof model of oracle machine

For IoT cloud nodes, in the CloudX3-IoT framework, the oracle is used to drive on-chain and off-chain communication. In order to ensure the identity and credibility of communication, CloudX3-IoT introduces TLS Proof (Transport Layer Security Proof).)mechanism. TLS Proof is a technology built on top of Transport Layer Security (TLS) to verify the identity and ensure the integrity of communications.



2. System components and processes

2.1 Machine Identity

In CloudX3-IoT, machine identity and secure communication are achieved through mechanisms for authentication and access control using wallet addresses created on the blockchain. These wallet addresses are used to uniquely identify and authorize machines, ensuring identity trustworthiness and data security during communications.

2.1.1 Decentralized identity (machine wallet mechanism)

1. Decentralization: It does not rely on a centralized identity verification agency, but is based on nodes in the blockchain network for verification. This eliminates the risk of single points of failure and centralized control, providing greater decentralization and

system reliability.

2. High security: Use blockchain cryptography mechanisms, including public and private key encryption and digital signatures, to ensure the security of identity and communication. The machine wallet is controlled through private keys, so that only authorized machines can perform authentication and access control, preventing unauthorized access and data tampering.
3. Anonymity and privacy protection: The machine wallet address serves as an identity identifier, providing a certain degree of anonymity and is not directly associated with personal identity information. This effectively protects user privacy and reduces the risk of identity leakage.
4. Autonomous control and credibility: Users have full control of the private key of the machine wallet and have the ability to independently manage and control their identity. This kind of autonomous control not only enhances user trust, but also reduces dependence on third parties and improves the credibility of the system.

2.2 Machine message control

In the Internet of Things (IoT) world, ensuring secure, trusted message communication between devices is critical to enable efficient data exchange and interoperability. In order to meet this demand, CloudX3-IoT introduces machine message control, which provides a secure and decentralized blockchain message communication mechanism for IoT devices based on its blockchain architecture and the provided blockchain API light wallet. For machine message control, all are encapsulated into the CloudX3 IOT framework. Users can deploy SideCar components with the following functions through automated deployment:

- **Device Wallet Registration**: In CloudX3-IoT, IoT devices can complete the wallet registration process, that is, create a unique wallet address on the blockchain. The registration process ensures the uniqueness of the device and the reliability of the identity.
- **Blockchain API SDK**: CloudX3-IoT provides a blockchain API light wallet and SDK, providing a convenient blockchain message communication interface and secure data transmission for IoT devices. Devices can use the API to send and receive messages and query data stored on the blockchain.
- **Secure Blockchain Message Communication**: Machine message control is based on the CloudX3-IoT blockchain architecture, realizing secure blockchain message communication. Combined with Tendermint ABCI, it builds the decentralized data and communication capabilities required by IOT devices. The devices can use functions based on the blockchain SDK.
- **Decentralized message communication**: CloudX3-IoT's machine message control is based on the decentralized nature of the blockchain, eliminating dependence on centralized third-party organizations. The device communicates messages directly on the blockchain network, which not only improves the efficiency of communication, but also enhances the reliability and censorship resistance of the system. This decentralized communication method provides IoT devices with a more trusted messaging and data exchange environment.

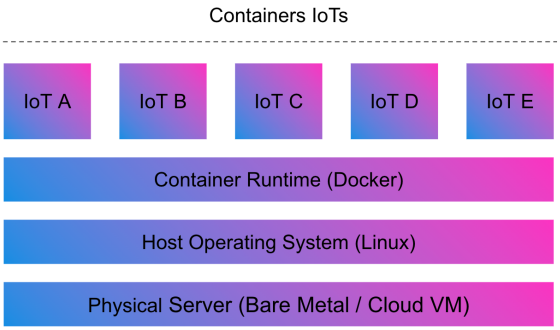
2.3 Decentralized cloud infrastructure

In order to facilitate decentralized access to global IOT devices, CloudX3-IoT provides a decentralized cloud resource market that connects people who need computing resources (clients) with people who have rental computing capabilities (providers) . CloudX3-IoT acts as a super cloud platform, providing a unified layer on top of all providers in the market to provide customers with a single cloud platform, regardless of which specific provider they use.

Tenants use CloudX3-IoT because of its cost advantages and geolocation, availability and flexibility to move between cloud providers, and the performance advantages of global deployments. Providers use CloudX3-IoT because it allows them to earn profits from dedicated or temporarily unused capacity.

Compute units (CPU, memory, disk) are rented as containers on CloudX3-IoT. A container is a standard unit of software that packages code and all of its dependencies so applications can run quickly and reliably from one computing environment to another. A container image is a lightweight, self-contained executable package that contains everything needed to run an application: code, runtime, system tools, system libraries, and settings.

Anyone with a physical machine (i.e. computer, server) can use a process called virtualization to split the machine's resources into containers.



2.4 IoT devices

CloudX3-IoT provides IOT Mesh framework access to IOT devices and protocols in the current web2 environment, which can accommodate a variety of IoT devices with different hardware components and functions, from traditional Web2-based products to community-driven development boards, to emerging Web3-based devices.

2.4.1 Non-invasive modification of equipment

For traditional IoT devices, they are usually smart devices that already exist on the market. Making significant changes to these legacy devices can be difficult due to limitations in manufacturing processes and device firmware. These devices typically serve Web2-based IoT applications and interact with centralized backends. For such massive devices, we use the underlying IOT access layer of CloudX3 to be compatible with MQTT and HTTP protocols to facilitate the docking of IoT devices, and integrate the CloudX3 IOT blockchain SDK through the cloud-native Service Mesh's SideCar technology to help the Internet of Things. Devices are non-invasively upgraded to the Web3 IoT architecture.

2.4.2 Device credibility

The trustworthiness of an IoT device can be proven using on-chain wallet communications published by the device user. It is up to Dapp developers to decide which type of IoT device meets the security and business needs of their corresponding Web3 application.

2.4.3 Data encoding

Considering the resource limitations of many IoT devices in terms of communication bandwidth and power consumption, compared with traditional JSON encoding, a compact data encoding method (such as binary encoding) may be preferable for IoT devices transmitting data packets to CloudX3-IoT Provider. ideal. Therefore, CloudX3-IoT supports the binary message format Protobuf, Google's language-neutral, platform-neutral, extensible mechanism for serializing structured data when communicating with resource-constrained IoT devices.

2.5 Blockchain Node

CloudX3-IoT is a blockchain solution built on Cosmos SDK and Tendermint. CloudX3-IoT provides blockchain cloud nodes, allowing anyone to provide machines to run nodes and participate in various Dapp applications.

System Components	Description
On-chain RPC service endpoint	CloudX3-IoT provides a set of API interfaces that enable developers to interact with the blockchain through these interfaces. These API interfaces include query interfaces, transaction interfaces, identity verification interfaces, etc., providing flexible functions and access methods for applications. Developers can use these API interfaces to query data on the blockchain, perform transaction operations, perform identity verification, etc. API

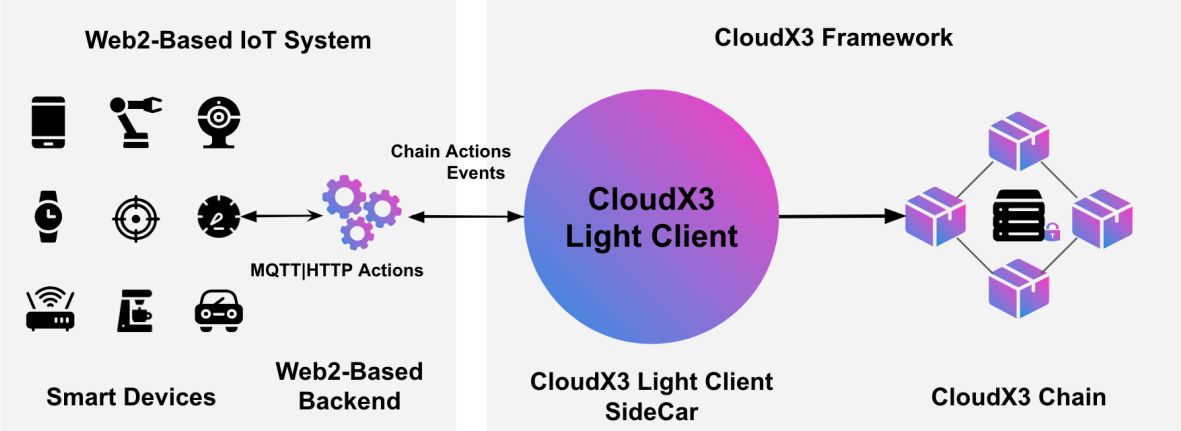
System Components	Description
	services provide developers with a higher level of abstraction, simplifying the process of interacting with the blockchain, making it easier for developers to build their own applications.
On-chain API query service	CloudX3-IoT Node provides a set of API interfaces that enable developers to interact with the blockchain through these interfaces. These APIs can include query interfaces, transaction interfaces, authentication interfaces, etc., providing flexible functions and access methods for applications
On-chain execution engine	CloudX3-IoT nodes use a customized execution engine to implement on-chain logic. The execution engine is the core component of the node and is responsible for receiving and processing transactions, executing the code of smart contracts, and updating the state of the blockchain. Through the execution engine, nodes are able to efficiently process and verify transactions and ensure the consistency and security of the blockchain.
Decentralized storage	CloudX3-IoT node combines the decentralized storage technology at the core of Cosmos SDK. This means that the data is not just stored on a single node, but is distributed across multiple nodes in the network. This decentralized storage improves the availability, censorship resistance, and security of IoT device data. At the same time, the integrity and credibility of the data can be ensured through the indexing and verification mechanism of the blockchain. Decentralized storage enables CloudX3-IoT nodes to better respond to node failures, network attacks, etc., and provide more reliable and stable blockchain services.
Light wallet and SDK	In order to support a wide range of applications and business needs, CloudX3-IoT provides light wallet SDK and light client. The light wallet SDK is used to interact with IoT devices, blockchains and verification nodes, providing convenient interfaces and tools to enable developers to easily manage and operate wallets. The light client is a tool used to monitor, read and write the CloudX3-IoT blockchain network. Users can access and operate data on the blockchain through the light client. The provision of light wallet SDK and light client enables users and developers to more conveniently participate in the CloudX3-IoT ecosystem and enjoy the convenience and innovation brought by blockchain technology.
Nostr IoT device telemetry	By integrating Nostr IoT devices, CloudX3-IoT can realize real-time monitoring and data collection of IoT devices. These telemetry data can include sensor data, device status, environmental parameters, etc.

2.6 Communication standards

Currently web2 IoT devices enter the Cloudx3 IOT web3 system and communicate through the non-invasive light wallet sidecar.

2.6.1 Proxy mode

In proxy mode, CloudX3-IoT achieves seamless integration with third-party IoT services through the proxy endpoint it provides, allowing CloudX3-IoT to work with many Web2-based IoT systems. This communication mode brings a series of optimizations to CloudX3-IoT, further enhancing its functionality and performance.

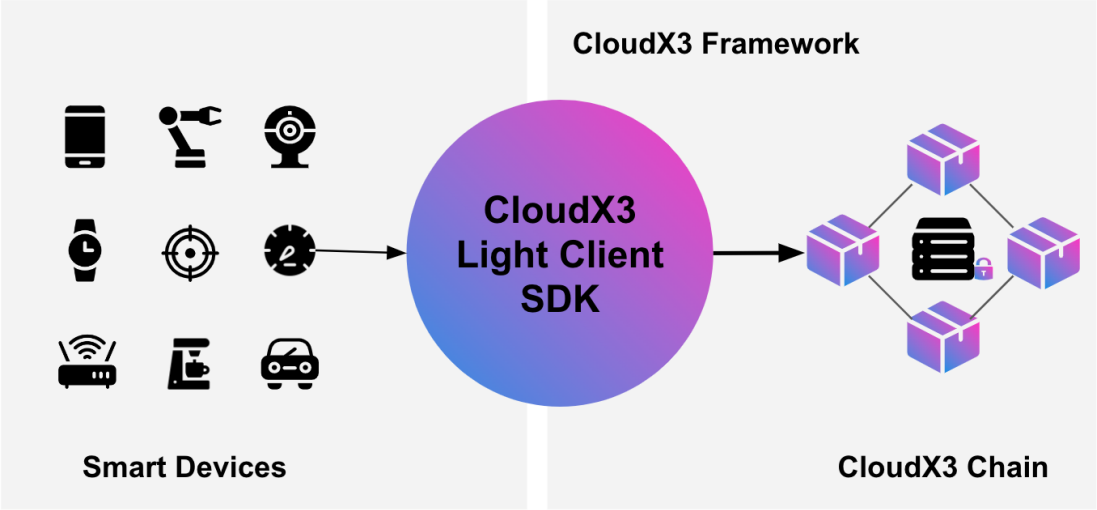


The proxy mode has many benefits for IoT devices, including:

- **Flexibility and Scalability**: The proxy mode enables CloudX3-IoT to integrate with a variety of different third-party IoT services, whether based on different protocols, communication methods, or data formats. This flexibility enables CloudX3-IoT to adapt to a variety of different IoT systems and easily communicate and exchange data with them. At the same time, the proxy mode also makes CloudX3-IoT have good scalability and can support the access of large-scale Internet of Things systems and devices.
- **Security and Privacy Protection**: Proxy mode can enhance data security and privacy protection. IoT devices send data to third-party IoT services through proxy endpoints, and various security mechanisms and protocols can be used to protect the transmission and storage of data. At the same time, the proxy endpoint can also implement data encryption and authentication to ensure the security of data during transmission. This security and privacy protection mechanism enables CloudX3-IoT to meet users' security needs when exchanging data with third-party systems.
- **Performance Optimization**: Proxy mode can optimize the performance of data transmission. IoT devices can directly send data to third-party IoT services closer to them, improving the efficiency and real-time nature of data transmission through shorter network paths and higher transmission bandwidth. In this way, the risk of delay and packet loss can be reduced during data transmission, ensuring the timeliness and integrity of data.

2.6.2 Direct mode

In direct mode, data collected by IoT devices is sent directly to CloudX3 nodes without going through a proxy service. This communication model is designed to power new types of IoT devices specifically designed to enhance Web3 applications. In this case, Dapps can establish trust based on the IoT device itself.



2.7 Main process

2.7.1 Device access

CloudX3-IoT provides a flexible device access mechanism, allowing IoT devices to connect to the CloudX3-IoT network. This can be achieved in a variety of ways, including communication between the device directly and the CloudX3-IoT node or connecting IoT devices to the CloudX3-IoT network through a gateway device. During the device access process, CloudX3-IoT can provide device identity verification, security authentication and other mechanisms to ensure that only legitimate devices can access the network.

2.7.2 Device status telemetry

Once devices are connected to the CloudX3-IoT network, they can upload their status information to the network through telemetry mechanisms. Device status telemetry can include sensor data, device operating status, environmental indicators, container monitoring indicators, etc. These data are released through the Nostr network, and decentralized data acquisition and display are performed. Important data among these data will also be recorded and stored on the blockchain and blockchain-extended decentralized data storage media to ensure It is tamper-proof and traceable. Equipment status telemetry provides real-time equipment monitoring and data collection functions, providing a basis for subsequent data analysis and decision-making.

For indicator data with strong real-time nature, we use Nostr network for signal collection and communication. The Nostr network is a lightweight, efficient communication protocol that can be used for real-time data transmission between IoT devices.

2.7.3 Device control signal release

CloudX3-IoT allows Dapp developers to publish control signals to IoT devices to achieve remote control of the devices. Dapp developers can send control instructions to specific IoT devices by interacting with the CloudX3-IoT network, such as switching devices on and off, adjusting parameters, etc. These control signals are propagated through the blockchain network to ensure their security and reliability. The release of device control signals enables Dapp to realize intelligent control and management of devices.

2.7.4 Decentralized data storage

CloudX3-IoT uses blockchain technology to expand decentralized data storage and provide decentralized data storage capabilities for IoT applications. Device data storage transactions will be broadcast in the blockchain and stored in the decentralized storage engine after the block node parses, ensuring the security and non-tamperability of the data. This means data is stored on multiple nodes, has no single point of failure, and can be verified and audited. Decentralized data storage improves the security and credibility of IoT data, and also facilitates data sharing and exchange.

2.7.5 Device log collection

CloudX3-IoT supports device log collection and records device operation logs and event logs. These log information can be used for troubleshooting, security auditing, and device behavior analysis. Log information will also be stored on the blockchain and decentralized data storage media to ensure its integrity and credibility. Equipment log collection provides important data support for equipment management and troubleshooting.

3. Application scenarios

With the diversity and number of smart devices in the world today, the use cases and innovations supported by the CloudX3-IoT framework are virtually limitless.

3.1 Smart Grid

Realize smart grid management and optimization and improve the efficiency, reliability and sustainability of the power system. By deploying CloudX3 IoT and corresponding Dapp in smart grid, the following scenarios can be realized. Electricity suppliers can use smart meter devices to connect to CloudX3 IoT, collect real-time electricity usage data, and store it on the blockchain. The data is digitally signed and encrypted to ensure security and trustworthiness, and then, through regulations Reward mechanism to motivate users to provide data. Power suppliers can use this data for load prediction and optimization to achieve efficient operation of the power system. At the same time, users can also receive corresponding rewards to encourage them to participate in the construction and management of smart grids.

3.2 Decentralized Machine Learning

A very valuable machine learning model can be created by leveraging trusted data collected from a large number of smart devices. In this use case, a data requester can deploy the app in the app store and publish it to the blockchain. The Dapp specifies requirements (e.g. number of devices, selection criteria, collection period, etc.) and rewards. All collected data is digitally signed and stored in encrypted form in the CloudX3-IoT node. When the data collection period ends, all device owners will receive their rewards. At the same time, the data requester can use the collected data to train the model and decide whether he/she will keep the data model privately or join the machine to further mark ownership of the data model by minting an NFT.

3.3 Decentralized Machine Game

The vast array of sensors and other peripherals available on smart devices enables developers to build a variety of interesting machine-driven games. For example, developers can deploy location-based applications in app stores and corresponding Dapps in the blockchain. Whenever a smart device equipped with a GPS module enters a specific geographical area, the Dapp mints the NFT. The GPS location is digitally signed by the smart device and verified by CloudX3-IoT nodes and Dapps. Multiple NFTs collected from different regions can be further combined to generate higher-level NFTs. Holding higher-level NFTs entitles users to mine additional tokens, which can be used to purchase tools or manage the in-game player community. This kind of decentralized, machine-driven game can bring new experiences to users in the Metaverse.

3.4 Connected Cars

Smart devices have huge potential to unlock data from billions of vehicles on the road and enable them to join the machine economy. For example, developers can deploy smartphone apps in Android/Apple app stores and corresponding Dapps in the blockchain. The smartphone app allows the driver to send a request to the vehicle ahead to get out of the way if the driver is in a hurry. When the vehicle ahead changes lanes, smartphone applications on these vehicles transmit continuous location information to the CloudX3-IoT node. Once the lane change event is recognized by the CloudX3-IoT node and verified by the Dapp, owners of all lane change vehicles will receive cryptocurrency rewards from the requester. These types of “earn while driving” opportunities will inspire people to change their driving habits and encourage drivers to help each other on the road.

4. Business Integration Guide

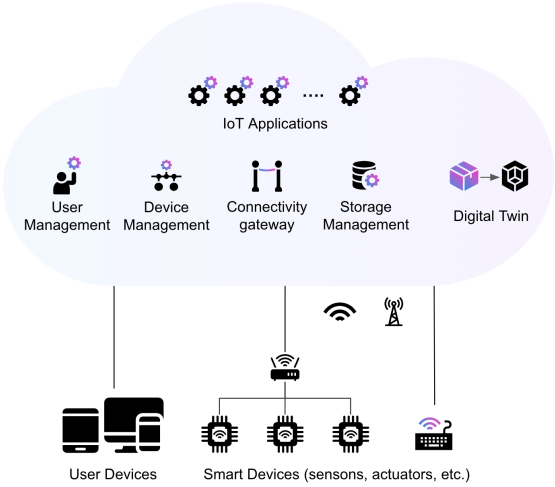
In this section, we provide how to integrate Web2-based IoT system architectures, including cloud-centric and edge-centric architectures.

4.1 Web2 Internet of Things Architecture

Typical Web2-based IoT applications are based on cloud-centric architecture or edge-centric architecture.

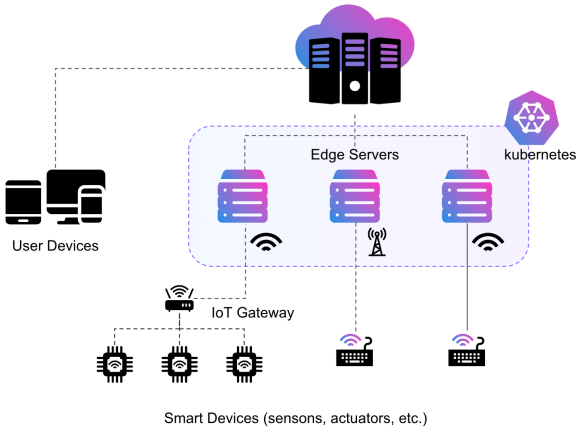
4.1.1 Cloud-centric architecture

In cloud-centric batch applications, all core functions (e.g., user management, device applications, connection gateways, storage management, digital twins, etc.) and business logic are built on multiple components provided by the cloud service provider. Depending on the capabilities of the IoT devices, they can reach the backend directly or through an IoT gateway.



4.1.2 Edge-centric architecture

In edge-centric IoT applications, kubernetes is used for coordination and is responsible for collecting and preprocessing IoT data in a distributed manner. Business logic is implemented on core servers hosted in the cloud or on-premises.



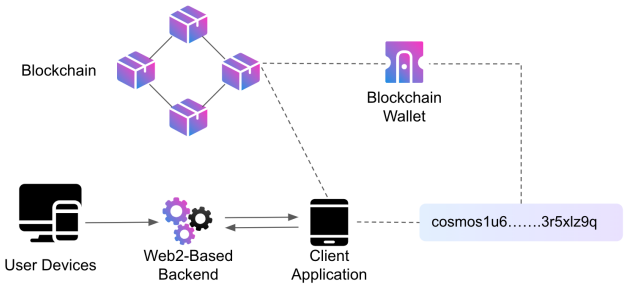
4.2 Integration Guide

To integrate the CloudX3-IoT framework with existing Web2-based IoT data, an agent-based integration pattern is adopted. This integration approach simplifies the integration process and requires only minimal changes to the backend of the Web2-based IoT system.

The agent-based integration pattern essentially uses a Web2-based IoT system as a trusted data source. The client application sends data collected from the Web2-based application to the CloudX3-IoT node, which then interacts with the blockchain and triggers smart contracts for performing token-related operations.

4.2.1 Web2-based IoT devices

In the agent-based integration model, the Web2-based IoT system manages all IoT devices, user accounts, and device ownership. Each IoT device is uniquely identified by a device wallet account, and users can own multiple IoT devices. The purpose of device binding is to associate a device's wallet account with its owner's wallet address.



To complete device binding for Web2-based IoT devices, you can use the following steps:

1. The client application generates a wallet account and represents the unique identifier of the IoT device;
2. The user adds the wallet account and user device identification to the blockchain device registry;
3. The client application monitors events on the blockchain and performs related operations;

4.2.2 Data interaction

At the request of the Dapp, the client application encodes the raw data collected from the Web2-based IoT system into a data object and signs it using the private key. The signed data objects are then sent via events to the CloudX3-IoT node for further processing.

5. Conclusion

The CloudX3-IoT framework aims to break the traditional Web2-based IoT business model and promote the development of innovative IoT applications based on Web3 by combining blockchain and IoT technologies. The framework provides functions such as device access, device status telemetry, device control signal release, decentralized data storage, and device log collection to build a safe, trustworthy, and efficient IoT ecosystem. By introducing blockchain technology, CloudX3-IoT provides decentralization and transparency, enhancing device ownership management and data security. The framework has the ability to accommodate various types of IoT devices and provides diversity, security, and scalability. The goal of CloudX3-IoT is to accelerate the development of the IoT field, promote innovation and progress, and achieve more efficient, intelligent and sustainable IoT applications.