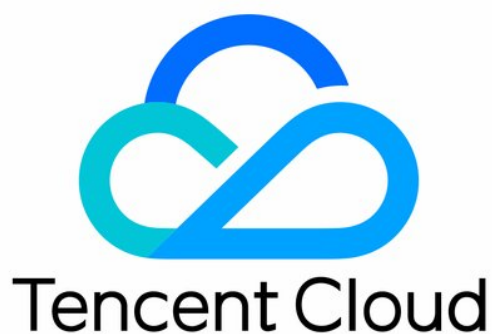


# Internet of Things Hub

## Product Introduction



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# Product Introduction Overview

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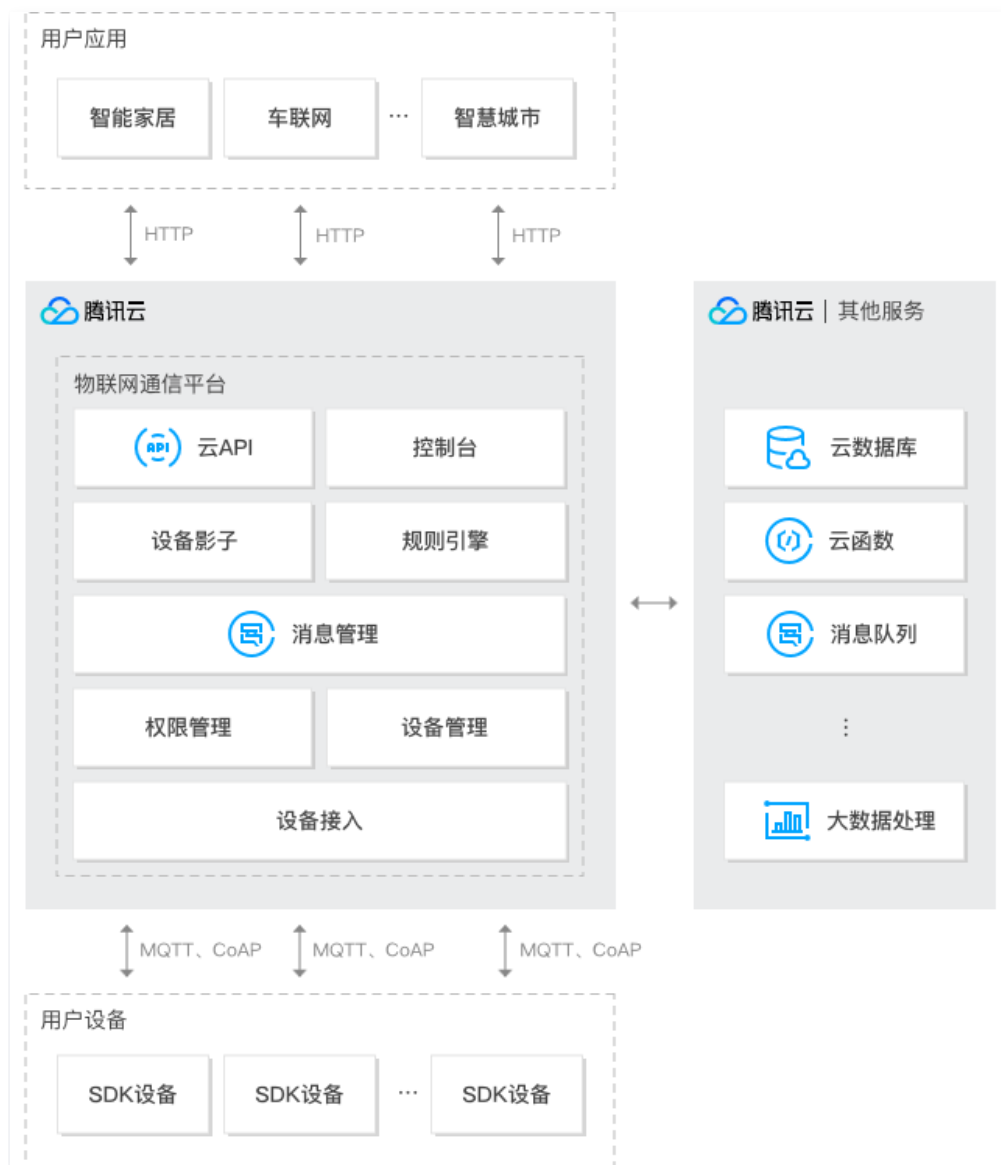
## Introduction

Tencent Cloud IoT Hub aims to provide a secure, stable, and efficient connection platform, helping developers achieve reliable, high-concurrency data communication between "device-to-device," "device-to-user application," and "device-to-cloud service" at low cost and with rapidity. It not only enables device interaction, data reporting, and configuration distribution but also facilitates the storage, compute, and intelligent analysis of massive device data through function integration with the rule engine and Tencent Cloud products.

The following video provides a detailed introduction to IoT Hub:

[Watch video](#)

## Product Architecture



## Access IoT Hub

User devices can be connected to IoT Hub through SDKs. The underlying data transfer is based on MQTT or CoAP protocols, which effectively lowers the consumption of network bandwidth. In terms of security, IoT Hub introduces secure network transfer protocols (TLS and DTLS) to prevent risks such as unauthorized access, data theft, and tampering. Taking into account the diversity of devices and use cases, it supports both asymmetric encryption (authentication based on device certificates for scenarios with high security requirements) and symmetric encryption (authentication based on keys for resource-constrained devices).

## Messages can be published and subscribed to by devices through SDKs

In order to isolate device data for security purposes, IoT Hub currently limits that devices can only publish and subscribe to messages in their own topics, but they can access messages of other entities by configuring the rule engine.

## **The rule engine can be configured in the console to enable devices to access messages of other entities**

Currently, the rule engine supports SQL-like syntax operations. It can achieve message communication capability between devices through repub (re-publish messages) and device message forwarding to third-party services through forward (forward messages to user server). It also supports device message forwarding to CDB, time series database, message queue, and other Tencent Cloud products (function integration with SCF, big data analysis suite, RayData Interactive System, business intelligence analysis, etc., is also under construction).

## **Device messages can be interconnected with third-party services**

As devices are connected only to IoT Hub, IoT Hub can quickly write specified device messages to Tencent Cloud TDMQ or CKafka queues, with the message queue feature enabled. From there, third-party services can get and consume the data through the SDK of TDMQ or CKafka queues, achieving async message communication between devices and third-party services.

## **Device shadows can effectively achieve two-way sync of configuration and status data between devices and applications**

On the one hand, configuration parameters can be set for device shadows through TencentCloud API, so that when devices are connected or online, they can get the configuration parameters from the shadows. When the status of a device is queried, it is sufficient to query its shadow without having to perform direct network communication with the device.

## **Devices can be managed through TencentCloud API**

IoT Hub provides convenient SDK tools to enhance IoT device management capabilities. These tools enable quick and batch creating, querying, and operation on the backend, greatly improving the efficiency. Currently, Python, PHP, and Java toolkits are supported.

# Product Features

Last updated: 2025-03-19 14:43:16

You can watch the following videos to learn about the features of Tencent Cloud IoT Hub.

[Watch video](#)

## Device Connection

### SDK Integration

IoT Hub currently supports SDKs for various platforms such as Linux and Android. For SDK download addresses, please see [SDK Download](#) documentation.

### Transfer protocol

- TCP- and TLS-based MQTT (encrypted connection) is a mainstream IoT communication protocol and is appropriate for communication between devices or receiving reverse control signals and configurations.
- UDP- and DTLS-based CoAP (encrypted connection) has less consumption and requirements for resources, which is applicable for pure data reporting.

### Security Protocol

IoT Hub performs two-way authentication and encrypted data transfer between client and server based on security protocols such as TLS and DTLS, so as to prevent risks including unauthorized access, data theft, and tampering. Taking into account the diversity of devices and use cases, it supports both asymmetric encryption (authentication based on device certificates for scenarios with high security requirements) and symmetric encryption (authentication based on keys for resource-constrained devices). Authentication at the device granularity ensures the confidentiality of cloud-to-device and device-to-cloud messages.

### RTOS portability

IoT Hub's SDK supports cross-platform porting and detachment of framework from hardware abstraction layer, enabling quick and easy connection to IoT Hub from different platforms.

### Device firmware update

When firmware has security risks or functional problems, IoT Hub servers can perform OTA updates to eliminate dangers and reduce security risks.

### Gateway product connection

IoT Hub supports the creation of gateway and subdevice products. You can bind a gateway device and the corresponding subdevice, and then the gateway device can connect, disconnect, and send/receive messages on behalf of the subdevice over the MQTT protocol.

## Device management

### Lifecycle Management

Devices can be registered, added, deleted, or terminated in the console. This can also be done through the SDK toolkits for Python, PHP, and Java, which is faster and more efficient.

### Device status

Device status can be monitored throughout the entire process, with instant notifications for any status changes.

### Group Management

IoT Hub supports group management for devices under different products to meet the multi-level management needs of different types of devices in different business scenarios.

### Log Collection

IoT Hub can collect and report the upstream and downstream communication logs, message content logs, and SDK debugging logs of devices to meet the query requirements in multiple business scenarios.

## Device Communication

The topics that devices can publish and subscribe to are managed by permission control, and all devices under the same product have the same topic class permissions. For data transfer over MQTT, QoS=0 and QoS=1 message features are supported. Plus, messages can be stored offline, and the rule engine can swiftly implement message communication between devices.

## Device Shadow

Device shadow is essentially a copy of device data in JSON format cached on the server and is mainly used to save:

- Current device configuration
- Current device status

As a medium, device shadow can effectively implement two-way data sync between device and user application:

- For device configuration, the user application does not need to directly modify the device; instead, it can modify the device shadow on the server, which will sync modifications to the device. In this way, if the device is offline at the time of modification, it will receive the latest configuration from the shadow once going back online.
- For device status, the device reports the status to the device shadow, and when users initiate queries, they can simply query the shadow. This can effectively reduce the network interactions between the device and the server, especially for low-power devices.

## Rule Engine

### Syntax Rules

IoT Hub supports SQL-like syntax and basic semantic operations. The contents of device messages can be parsed, filtered, extracted, and reintegrated through simple syntax, with the results forwarded to Tencent Cloud's backend services such as storage, function, and TBDS for seamless data connection.

### Device Interconnection

In order to isolate device data, devices can only publish and subscribe to messages in their own topics. Message connection between devices can be achieved through the repub feature of the rule engine.

### Device message forwarding to third-party

The rule engine can configure directly forwarding device messages to third-party services, thereby quickly enabling communication between the device and the connecting party's backend services.

### Device-Cloud connection

Tencent Cloud offers corresponding services (such as TencentDB, SCF, message queue, and TBDS) for scenarios where users require further processing of device data (such as persistent storage, function computing, and big data analysis). In addition, the direct connection between IoT Hub and these Tencent Cloud services will be available soon.

### Cloud Message Queue

As devices are connected only to IoT Hub, IoT Hub can write specified device messages to Tencent Cloud TDMQ or CKafka queues. From there, third-party services can get the device messages through the SDK APIs of TDMQ or CKafka, enabling async message communication between devices and third-party services. Based on this, data storage, computational analysis, and device control logic can be implemented on the backend.

## Collaboration Management

IoT Hub supports secure access, use, and management of cloud account resources through CAM. Isolation and collaboration of IoT Hub resources are implemented through identity and policy management of sub-accounts and collaborators.

## Data Processing

### Real-time computing

In the field of IoT, massive amounts of data is reported in real time, and core businesses have high requirements for the timeliness of data monitoring, making stream computing and real-time computing significant for such use cases. The rule engine forwards device data to CKafka in real time, which is connected to Storm/SparkStreaming for stream computing. This helps you implement real-time computation of device data.

### Intelligent processing

IoT Hub enables data connection with TBDS. TBDS' extraordinary capabilities in data discovery, analysis, and mining enable users to quickly process data from billions of IoT devices, tap into the value of data, increase efficiency, and seize market opportunities.

### Visualization

IoT Hub can access Tencent Cloud RayData, a service for big data visualization. Powered by the real-time data rendering technology, you can visualize, contextualize, and interact with massive amounts of data reported from devices, achieving personalized data management and usage.

# Advantages

Last updated: 2025-03-19 14:44:32

## Security

IoT Hub integrates secure network transfer protocols (TLS or DTLS) for device connection and data transfer. In this way, every device has its own certificate for authentication, which effectively prevents unauthorized access, data theft, and tampering.

## Fast

With the aid of the SDK, console, or TencentCloud API, IoT Hub allows you to quickly enable device data communication without having to worry about the details of the underlying communication protocols (such as MQTT protocol fields).

## Stability

With Tencent's years of experience in numerous services to leverage upon, IoT Hub has various features on the backend, such as automatic disaster recovery and load balancing, providing you with 24/7 OPS monitoring services.

## Scalability

By connecting device data to Tencent Cloud services based on the rule engine, IoT Hub can implement the storage, real-time computation, and intelligent processing and analysis of massive amounts of data with speed and ease.

## Low Costs

- Service fees are calculated based on message volume, resulting in low initial cost pressure.
- IoT Hub's one-stop service architecture reduces labor and time costs for development.

# Use Cases

Last updated: 2025-03-19 14:44:46

## Internet of Vehicles

**Human-Car Interaction:** Collect and analyze the driving habits of the driver, monitor the real-time conditions of vehicle components such as tires, brake pads, air conditioners, and traffic conditions, and provide timely driving recommendations. Further, this data can be combined with the insurance company database to provide the most suitable insurance plans.



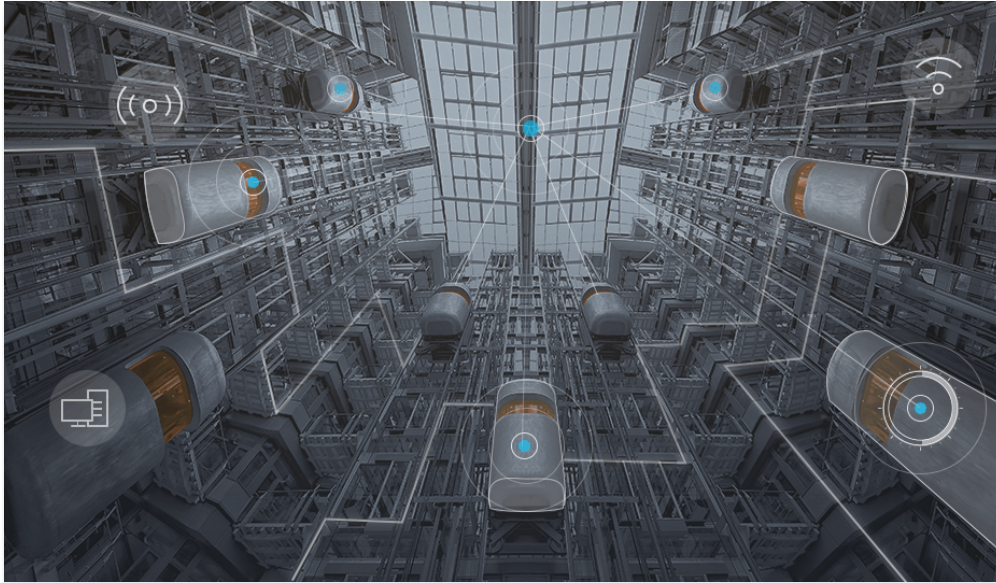
## Smart Home

**Human-Home appliance interaction:** IoT Hub monitors the real-time temperatures, timing, and whether users are home through door sensors and turns on/off appliances such as air conditioners, lamps, television, and speakers.



## Industrial Equipment

IoT Hub enables enterprises to build IoT networks with speed and ease to achieve automatic control and real-time monitoring of equipment, helping improve corporate efficiency.



## Smart Transportation/City

IoT Hub can connect a large number of sensing and controlling devices in cities and then use Tencent Cloud's big data services and intelligent algorithms to monitor and predict group behaviors, so as to improve the urban management efficiency and reduce labor costs.



# Use Limits

Last updated: 2025-03-19 14:45:01

## Device Connection

| Limit Category          | Description                                                                        | Limit Parameters |
|-------------------------|------------------------------------------------------------------------------------|------------------|
| Number of Products      | By default, an account can create 5 products. Paid users can create 200 products.  | –                |
| Number of Devices       | By default, a product can create 10 devices. Paid users can create 50,000 devices. | –                |
| Gateway and Sub-devices | The maximum number of Sub-devices that can be added under a Gateway.               | 500              |
| Cloud Logs              | The number of days cloud logs generated by device operations are stored.           | 7 days           |
| OTA Upgrade             | The file size limit for an upgrade package.                                        | 1024MB           |
|                         | The maximum number of devices that can be upgraded in a single batch upgrade.      | 10,000           |

## Message Communication

| Limit Category                   | Description                                                                                                                      | Limit Parameters |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------|------------------|
| Device Connection Limit          | Using the same device certificate information, only one connection can be established with the platform server at the same time. | Yes              |
| Number of Connections            | Maximum number of MQTT connection requests per second for a device.                                                              | 1 time/5s        |
| Number of Device Subscriptions   | Maximum number of subscriptions for a device.                                                                                    | 100              |
| Message Communication Rate Limit | Maximum number of messages a device can report per second.                                                                       | 20               |

|                      |                                                                                                                                                              |                                                |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
|                      | Maximum number of downlink messages a device can receive per second (limited by network environment)                                                         | 20                                             |
| MQTT Message Length  | Maximum length of a single published MQTT message. Publish requests exceeding this size will be directly rejected.                                           | 16KB                                           |
| CoAP Message Length  | Maximum length of a single CoAP publish message. Publish requests exceeding this size will be directly rejected.                                             | 1KB                                            |
| MQTT Keep-Alive Time | By configuring the MQTT KeepAlive, set the connection heartbeat time. If the heartbeat time is not within this range, the server will reject the connection. | 60~850s                                        |
| RRPC Timeout         | Timeout for the device to respond to RRPC requests.                                                                                                          | 10s                                            |
| Offline Messages     | Number of offline messages.                                                                                                                                  | A maximum of 150 messages per device.          |
|                      | Offline message storage duration.                                                                                                                            | Messages are stored for a maximum of 24 hours. |

## Topic

| Limit Category               | Description                                                                 | Limit Parameters                     |
|------------------------------|-----------------------------------------------------------------------------|--------------------------------------|
| Number of Custom Topic Types | Maximum number of Topic Types defined per product.                          | 20                                   |
| Topic Length                 | Topic Length Restriction.                                                   | 255 bytes, UTF-8 encoded characters. |
| Topic Category               | The maximum number of hierarchical categories a Topic can contain, that is, | 6                                    |

|                         |                                                               |    |
|-------------------------|---------------------------------------------------------------|----|
|                         | the maximum number of slashes in a Topic.                     |    |
| Number of Subscriptions | Maximum number of subscriptions for each Topic.               | 1  |
| Time to Take Effect     | Subscription and unsubscription are both time to take effect. | 5s |

## Rule Engine

| Limit Category                        | Description                                                                                                                                  | Limit Parameters                                               |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| Number of Rules                       | Maximum number of rules an account can set.                                                                                                  | 100                                                            |
| Number of Transfer Targets            | The number of data forwarding operations in a rule.                                                                                          | 5                                                              |
| Rule Engine Message Processing Volume | Data forwarding capability provided to an account for data processing.                                                                       | 1,000 entries/s                                                |
| Message write volume                  | If the target cloud product instance has sufficient performance, data forwarding capability provided to an account.                          | 1,000 entries/s                                                |
| Message Deduplication                 | To ensure message delivery during data flow, the same message may be sent repeatedly until the client returns an ACK or the message expires. | None, the unique ID in the sent message is implemented freely. |

## Device Shadow

| Limit Category | Description                                       | Limit Parameters |
|----------------|---------------------------------------------------|------------------|
| JSON Hierarchy | Maximum depth of the device shadow JSON document. | 5                |
| File Size      | Maximum limit of the device shadow JSON document. | 16KB             |

|                      |                                                     |    |
|----------------------|-----------------------------------------------------|----|
| Number of Attributes | Attribute limit of the device shadow JSON document. | 20 |
|----------------------|-----------------------------------------------------|----|

# Basic Concepts

Last updated: 2025-03-19 14:45:14

## Product

A collection of a certain type of equipment, usually with consistent features. IoT Hub issues a globally unique ProductID for each product. Devices, Topic permissions, and data processing operations for the entire product category can be managed within the product.

## ProductID

The globally unique identifier assigned by the platform for the product, facilitating product retrieval and used for identity authentication when devices connect to the platform. It can be viewed in the product's basic information.

### 基本信息

|        |                                         |
|--------|-----------------------------------------|
| 产品名称   | 测试产品id                                  |
| 产品类型   | 普通产品                                    |
| 产品ID   | <div></div>                             |
| 认证方式   | 证书认证                                    |
| 数据格式   | JSON                                    |
| 产品描述   | 未填写                                     |
| CA证书   | 腾讯云证书 <a href="#">点击下载</a>              |
| 是否禁用 ⓘ | <input checked="" type="checkbox"/> 已启用 |

### 动态注册配置 ⓘ

|      |                          |
|------|--------------------------|
| 动态注册 | <input type="checkbox"/> |
|------|--------------------------|

## DeviceName

The name of the device in the product, used for identity authentication when the device connects to the platform.

## Node Type

According to the types of devices actually connected to the IoT Hub platform, nodes can be divided into device type and gateway type.

### Gateway Node

Devices of a gateway node can be directly connected to the platform. Devices under a device product can be added as subdevices, and after their topic permissions are added, the gateway node can publish and subscribe to data on behalf of the subdevices.

### Device Node

Devices of a device node can be connected to the platform directly or through gateway devices. If the added devices cannot be connected to the platform directly, this node type can be selected, so that the devices will be connected to the platform through gateway devices.

## Product Type

According to different application scenarios, the IoT Hub platform defines the categories of various hardware products in different application fields, which can be selected based on the communication methods of the devices actually connected to the platform. For NB and LoRa products, the platform performs targeted processing on the data transfer link.

## Authentication Method

Device connection authentication supports certificate authentication (based on TLS asymmetric encryption and suitable for scenarios with high security requirements) and key authentication (based on symmetric encryption and suitable for resource-constrained devices). Authentication is performed at the device granularity to ensure the cloud-to-device and device-to-cloud message confidentiality. At the same time, the platform has designed a dynamic registration feature for scenarios where it is impossible to burn different firmware for each device. This feature supports getting a device key (or certificate + private key) through product-level key registration and then performing connection authentication, which enhances the connection flexibility.

### Certificate

Devices using certificate authentication need to carry ProductID, DeviceName, certificate file, key file, and CA certificate to prove their legitimacy and complete the connection with the platform. Certificate and key files will be generated after the device is created. They can be viewed in the device information.

**基本信息**

|                       |                                         |
|-----------------------|-----------------------------------------|
| 设备名称                  | test_device                             |
| 设备备注                  | 暂无填写                                    |
| 在线状态                  | 未激活 <a href="#">状态重置</a>                |
| 标签信息                  | <div></div> <a href="#">点击添加</a>        |
| 设备证书                  | <a href="#">下载</a>                      |
| 设备私钥                  | <a href="#">下载</a>                      |
| 是否禁用 <small>?</small> | <input checked="" type="checkbox"/> 已启用 |
| 固件版本                  | 未上报                                     |
| IP地址                  | 暂无                                      |

## CA Certificate

CA certificate is one of the identity authentication conditions for devices authenticated with certificate, which can be viewed in the basic information of the product.

**基本信息**

|                       |                                         |
|-----------------------|-----------------------------------------|
| 产品名称                  | CA证书                                    |
| 产品类型                  | 普通产品                                    |
| 产品ID                  | <div></div>                             |
| 认证方式                  | 证书认证                                    |
| 数据格式                  | JSON                                    |
| 产品描述                  | 未填写                                     |
| CA证书                  | test <a href="#">点击下载</a>               |
| 是否禁用 <small>?</small> | <input checked="" type="checkbox"/> 已启用 |

## Key Authentication

Devices using key authentication need to carry ProductID, DeviceName, and device key to prove their validity and complete the connection with the platform. The key can be viewed in the device information.

**基本信息**

|        |                                              |
|--------|----------------------------------------------|
| 设备名称   | test-2                                       |
| 设备备注   | 暂无填写                                         |
| 在线状态   | 未激活 <a href="#">状态重置</a>                     |
| 标签信息   | 无标签信息, <a href="#">点击添加</a>                  |
| 设备密钥   | Z6vA <a href="#">复制</a> <a href="#">更新密钥</a> |
| 是否禁用 ⓘ | <input checked="" type="checkbox"/> 已启用      |
| 固件版本   | 未上报                                          |
| IP地址   | 暂无                                           |

## ProductSecret

Product-level key is used to calculate the device-side signature during the dynamic device registration request, in exchange for the device-level key or certificate + private key.

## Dynamic Registration

The device carries a unified ProductId, ProductSecret, and custom DeviceName to complete the first authentication with the platform. After successful authentication, the platform will issue a device-level key or certificate + private key. The device carries the platform-issued device-level key or certificate + private key, along with ProductId + DeviceName, to complete the final authentication with the platform.

## Topic

A topic is a UTF-8 string as the medium for message publishing/subscribing. You can publish messages to a topic or subscribe to messages in a topic.

## Release

This is a type of permission (Pub) that manipulates a topic, i.e., publishing messages to the topic.

## Subscription

This is a type of permission (Sub) that manipulates a topic, i.e., subscribing to messages in the topic.