IoT Device Access

Service Overview

Issue 1.0

Date 2022-08-30

HUAWEI

HUAWEI CLOUD COMPUTING TECHNOLOGIES CO., LTD.

Trademarks and Permissions


and other Huawei trademarks are the property of Huawei Technologies Co., Ltd.
All other trademarks and trade names mentioned in this document are the property of their respective holders.

Notice

The purchased products, services and features are stipulated by the contract made between Huawei Cloud and the customer. All or part of the products, services and features described in this document may not be within the purchase scope or the usage scope. Unless otherwise specified in the contract, all statements, information, and recommendations in this document are provided "AS IS" without warranties, guarantees or representations of any kind, either express or implied.

The information in this document is subject to change without notice. Every effort has been made in the preparation of this document to ensure accuracy of the contents, but all statements, information, and recommendations in this document do not constitute a warranty of any kind, express or implied.

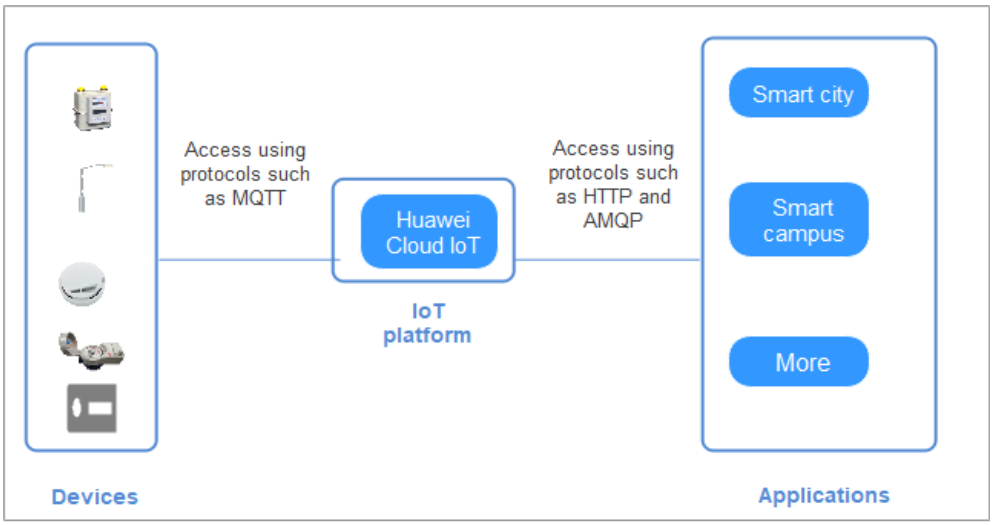
Contents

1 Overview

Huawei Cloud IoT Device Access (IoTDA) allows you to connect your physical devices to the cloud, where you can collect device data and deliver commands to devices for remote control. It can also work with other Huawei Cloud services to help you quickly develop IoT solutions.

A complete IoT solution consists of the IoT platform, devices, and applications.

- The IoT platform is located between applications and devices. It harmonizes differences between device interfaces to enable quick device access. It provides robust capabilities to help you develop diverse IoT solutions.
- Devices can access the platform via fixed broadband (FBB), 2G/3G/4G/5G, Narrowband Internet of Things (NB-IoT), and Wi-Fi networks. They can report service data to the platform using Message Queuing Telemetry Transport (MQTT), Lightweight Machine-to-Machine (LWM2M) over Constrained Application Protocol (CoAP), and Hypertext Transfer Protocol Secure (HTTPS). Devices can also receive commands from the platform.
- Applications call application programming interfaces (APIs) provided by the platform to implement service scenarios such as data collection, command delivery, and device management.



Devices can connect to the platform directly or through industrial gateways or home gateways. The platform supports multi-network access, multi-protocol

access, and serialized Agent access, preventing issues caused by complex, diversified, and fragmented device access. It also provides comprehensive device management capabilities, simplifies management of device fleets, and improves management efficiency. The following table describes the IoTDA functions.

Feature Category	Function	Description
Device access	Native protocol access	You can connect devices to the platform using MQTT, CoAP, LwM2M, and HTTPS protocols.
	Serial device SDKs	IoT Device SDK and IoT Device SDK Tiny for C and Java programming languages are supported. For details, see **Introduction to IoT Device SDKs**.
	Industry protocol access	You can connect devices to the platform through edge gateways using Modbus and OPC Unified Architecture (OPC UA) and using industry protocols based on plug-ins.
	Device access authentication	Authentication modes such as one-device-one-secret and X.509 certificates are supported.
Device management	Device lifecycle management	You can add, delete, modify, and query devices, manage device status, freeze and unfreeze devices, and manage child devices.
	Groups and tags	You can group or tag devices. For details, see **Groups and Tags**.
	Product model	You can define a product model (profile) for devices. For details, see **Product Model Definition**.
	Device shadow	You can configure and query device shadows. For details, see **Device Shadow**.
	OTA upgrade	You can upgrade the software and firmware of the device. For details, see **Firmware Upgrades** and **Software Upgrades**.
	Device file upload	Devices can upload files to OBS and request files from the cloud. For details, see **File Uploads**.
	Batch device operations	You can perform batch operations on devices, including **batch device registration**, **batch software/firmware upgrades**, and **batch command delivery**.

Feature Category	Function	Description
Message communications	Bidirectional transparent transmission	Device messages can be pushed to applications using HTTP and AMQP. Applications can deliver messages to devices asynchronously.
	Product model topic communications	Applications and devices communicate with each other based on the properties, commands, and events defined in the product model in a decoupled mode.
	Custom topic communications	You can customize topics for bidirectional message communications.
	Data parsing and conversion	You can develop codecs online to parse and convert device data.
	Command delivery	Commands can be delivered to online devices in synchronous mode. In the NB-IoT scenario, commands can be delivered in asynchronous mode. For details, see **Command Delivery**.
Rules	Data forwarding	Data can be forwarded to Huawei Cloud Kafka, Object Storage Service (OBS), GaussDB, Data Ingestion Service (DIS), Distributed Message Service (DMS), ROMA Connect, and IoT Analytics (IoTA). For details, see **Rules**.
	Device linkage	You can create rules for device linkage control. For details, see **Rules**.
	Subscription and push	Applications can subscribe to data reported by devices through HTTP or AMQP.
Monitoring and O&M	Logging	The console provides message tracing, integrates with Log Tank Service (LTS) for log analysis, and integrates with Cloud Trace Service (CTS) for log audit. For details, see **Monitoring and O&M**.
	Alarming	The platform provides notifications and management of system alarms (such as threshold alarms) and alarms triggered by device rules by integrating with Application Operations Management (AOM). For details, see **Alarms**.

Feature Category	Function	Description
	Metric monitoring	The platform provides monitoring reports of tenant-level service metrics (such as device status, commands, subscription and push, and message transfer) by integrating with AOM. For details, see **Reports**.

Security and Data Protection

IoTDA established an end-to-end trustworthy security system. It is graded level-4 of China's Multi-Level Protection Scheme 2.0 and obtains international security certifications such as ISO27001, ISO27017, ISO27018, and CSA STAR. It complies with European Union's General Data Protection Regulations (GDPR).

- Device security: It provides a one-device-one-secret authentication mechanism to prevent unauthorized access and supports device security check.
- Data transmission: Secure transmission channels are provided based on Transport Layer Security (TLS), Datagram Transport Layer Security (DTLS), and DTLS+.
- Platform security: Threat defense is performed on the entire Huawei Cloud. Huawei Cloud security service products or components and security D&R department are fully leveraged to build a comprehensive security defense system that covers security analysis, design, coding, testing, and defense.
- Data protection: It complies with GDPR.

2 Advantages

With service development, an increasing number of enterprises choose to combine IoT technologies for business growth. Huawei Cloud IoT services have outstanding advantages in capabilities, costs, O&M, security, and ecosystem compared with MQTT clusters managed by enterprises.

Table 2-1 Comparison

Dimension	Item	Huawei Cloud IoT	MQTT Cluster Managed by Enterprises
Capabilities	Flexible protocols	Supports mainstream IoT protocols and proprietary protocols to meet requirements of different devices and access scenarios. Provides the plug-in mechanism to parse custom protocols.	Supports only the MQTT protocol. The capability of supporting other protocols requires development. It is difficult, expensive, and inefficient to maintain multiple protocols.
	Access	Provides series of multi-language, open-source IoT device SDKs. SDKs are pre-integrated in popular modules and chips for multi-network and multi-protocol access. This simplifies device access and shortens the access time to hours.	Developers are required to be familiar with different programming languages, causing heavy development workload.

Dimension	Item	Huawei Cloud IoT	MQTT Cluster Managed by Enterprises
	Performance stability	Supports smooth and elastic expansion of service resources after purchase. Supports secure and stable connections of hundreds of millions of devices, reliable communications with 100,000 TPS concurrency, and devices going online concurrently with tens of thousands of TPS. Ensures 99.95% service availability.	R&D engineers need to perform tuning. To ensure 99.9% or higher availability, R&D engineers who are proficient in open source MQTT and senior architecture personnel are required.

Dimension	Item	Huawei Cloud IoT	MQTT Cluster Managed by Enterprises
	Features	• Cell-based technologies control the fault scope. • Message tracing facilitates fault locating and cause analysis. • Supports device shadows. • Supports over-the-air (OTA) upgrades. • Supports product models, which abstract and summarize product functions to decouple software and hardware development and improve system integration efficiency. • Supports the plug-in mechanism to parse custom protocols. • Supports data forwarding rules. Data can be forwarded to more than 10 cloud services. • Supports device linkage rules. Rules can be customized based on time, conditions, actions to configure scenario linkage and implement automatic collaboration across applications, subsystems, and devices. • The open architecture is used to leverage cutting-edge technologies and services of cloud computing. • Extensive functions and solutions have served many customers in different industries.	Open-source MQTT provides basic functions. Developers need to develop a complete solution based on open-source capabilities. However, some open-source code left unmodified during intrusive modification by developers may cause accidents on the live network during open-source middleware upgrades.
	-	-	-

Dimension	Item	Huawei Cloud IoT	MQTT Cluster Managed by Enterprises
	Technical support	Provides 24/7 professional support. The service ticket system responds within 10 minutes.	Open source MQTT does not provide technical support and has a large number of default configuration parameters. Enterprises need to adjust the parameters based on service scenarios. If developers of enterprises are not familiar with the open source code, their improper parameter adjustments pose huge potential risks to commercial systems. When problems occur, they have to solve problems by themselves.
Costs	Server cost	Servers do not need to be purchased.	Servers need to be purchased.
	Labor cost	No extra labor is required for cloud services.	Enterprises need to pay for professional development and O&M teams.
	Resource use	Resources are out-of-the-box and elastic for service growth and scale-out without interruption.	Enterprises need to develop the elastic resource scaling function by themselves.
	Architecture cost	The high-availability, high-performance, and secure architecture is built based on cloud native 2.0 and supports continuous evolution.	It is difficult for an enterprise to build the architecture that achieves high availability, high performance, and high security.
O&M	Infrastructure O&M	Provides unified O&M, quick response, scaling, upgrade, and troubleshooting based on professional teams.	Enterprises need to build their own O&M teams or use third-party O&M teams to solve scaling, upgrade, and O&M problems. Statistics show that most service faults are triggered by scaling and upgrade operations. The O&M cost is several times or even dozens of times the development cost.

Dimension	Item	Huawei Cloud IoT	MQTT Cluster Managed by Enterprises
	Service platform version	Provides unified update by public cloud service providers, fast version iteration.	It is managed by enterprises.
	O&M	• Provides full-link log analysis and message tracing. • Provides real-time monitoring and sensing of device statuses. • Supports custom service metric alarms.	It is managed by enterprises.

Dimension	Item	Huawei Cloud IoT	MQTT Cluster Managed by Enterprises
Security	System security	Establishes a trusted security system: It obtains international security certifications such as ISO27001, ISO27017, ISO27018, and CSA STAR. It complies with EU's GDPR. ● Transport network layer: Border security protection is provided based on web application firewall (WAF) and distributed denial of service (DDoS). Efficient, secure transmission protocols such as DTLS, TLS, HTTPS, CoAPS, and MQTTS are provided. ● Device side: A unique digital certificate is provisioned for each device for secure access. LiteOS-based security capabilities are provided. ● Platform side: Threat analysis is performed on entire Huawei Cloud network. Huawei Cloud security service products and public security services or components are fully reused to build a security defense system.	It is managed by enterprises. End-to-end security is a systematic project with high requirements. It is expensive and difficult to build and maintain system-level security capabilities.
	Data security	Provides a complete security protection system. Data is stored in redundant mode in the data center of the cloud service provider, ensuing data security.	Enterprises need to build data redundancy, backup, and recovery capabilities.

Dimension	Item	Huawei Cloud IoT	MQTT Cluster Managed by Enterprises
	Disaster recovery	Supports active-active service deployment, multi-data center DR, as well as high availability and DR capabilities based on multiple regions and availability zones (AZs).	Self-managed clusters usually do not have DR capabilities. Huge investment in active-active service deployment and DR devices often ends up with low return on investment (ROI).
	Vulnerability fixing	Establishes a comprehensive vulnerability management system and a dedicated security research department to detect, track, and fix vulnerabilities in a timely manner.	Most enterprises do not have a vulnerability management mechanism or fix vulnerabilities in a timely manner. As a result, they are prone to attacks and are not aware of attacks and data theft.
Ecosystem	Third-party access	Integrates upstream and downstream ecosystem resources and provides value-added services.	It is built by vendors.
	Scalability	1. The platform supports fast scale-out of tens of thousands of devices to hundreds of millions of devices without service interruption. 2. When other functions, such as AI, are required for service development, the platform can be seamlessly interconnected with other Huawei Cloud big data, EI, and middleware products to implement storage, computing, and intelligent analysis of device data at scale. In addition, cloud-based products support small-scale verification, facilitating fast, low-cost trial and error and service innovation.	The scaling period is long. Enterprises need to implement system or component interconnection. The labor and equipment costs are high.

Table 2-2 Expense comparison

Item	Huawei Cloud IoT	MQTT Cluster Managed by Enterprises
Cloud resource cost	An SU1 allows up to 400,000 messages per day and costs USD25 per month or USD300 per year. Total: about USD300/year	• Server resources: Two ECSs (AP-Singapore region, x86 architecture, general computing, 4 vCPUs, 8 GB memory, and 40 GB high I/O disk) cost USD2102.64 per year. • Relational Database Service (RDS): A general-purpose DB instance (MySQL engine, 2 vCPUs, 4 GB memory, 40 GB cloud SSD disk, and primary/standby type) costs USD890.56 per year. • Elastic Load Balance (ELB): An instance (AP-Singapore region, pay-per-use, public network, shared load balancer, and 1 Mbit/s bandwidth) costs USD262.8 per year. Total: USD3256/year

Labor cost	None	Basic middleware implements basic functions. • One engineer is required for routine O&M and R&D of the platform. • Assume that the engineer devotes 50% of efforts and the monthly salary is USD10,000. • Total: CNY10,000 x 12 x 50% = USD60,000/year Special functions are added based on the basic middleware. • Assume that only some functions are implemented without considering high availability, high performance, and high security of the platform. • Two full-stack development engineers are required for the platform frontend and backend development and O&M of functions such as device management, message communications, and rules. • One protocol professionals are required for device-side development, including implementing device access through native protocols, generic protocols industry protocols, and SDKs. • Assume that all engineers devote 100% of efforts and the monthly salary is USD10,000. • Total: 3 x CNY10,000 x 12 x 100% = USD360,000/month Bonuses are not included.
Total	USD300/year	Basic functions: USD63,256/year Basic and special functions: USD423,256/year

3 Application Scenarios

Huawei Cloud IoT Device Access (IoTDA) allows you to connect your physical devices to the cloud, where you can collect device data and deliver commands to devices.

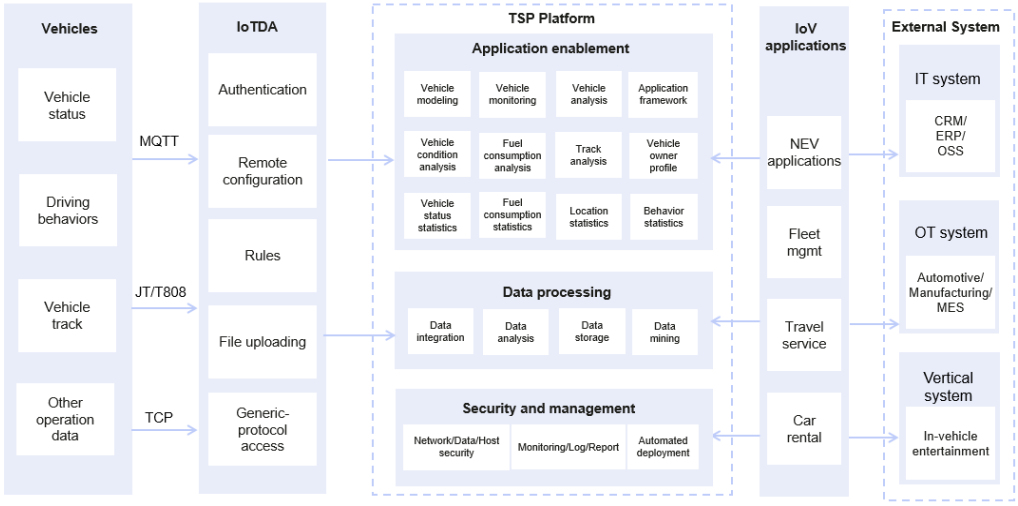
IoV

Requirements: For better management, automotive vendors access vehicles to cloud platform. The platform needs to support data transmission using protocols such as JT/T808 and MQTT and can clean data for big data analysis and data mining.

Solutions: IoTDA provides secure and reliable connections with low-latency and supports multiple standard protocols. It uploads road, vehicle, and driving behavior data collected by vehicles to the cloud and processes the data with rules and FunctionGraph. In addition, IoTDA stores data in InfluxDB and DWS for big data analysis and use Modelarts to perform machine learning to mine valuable data.

The following figure shows the service architecture of the IoV scenario.

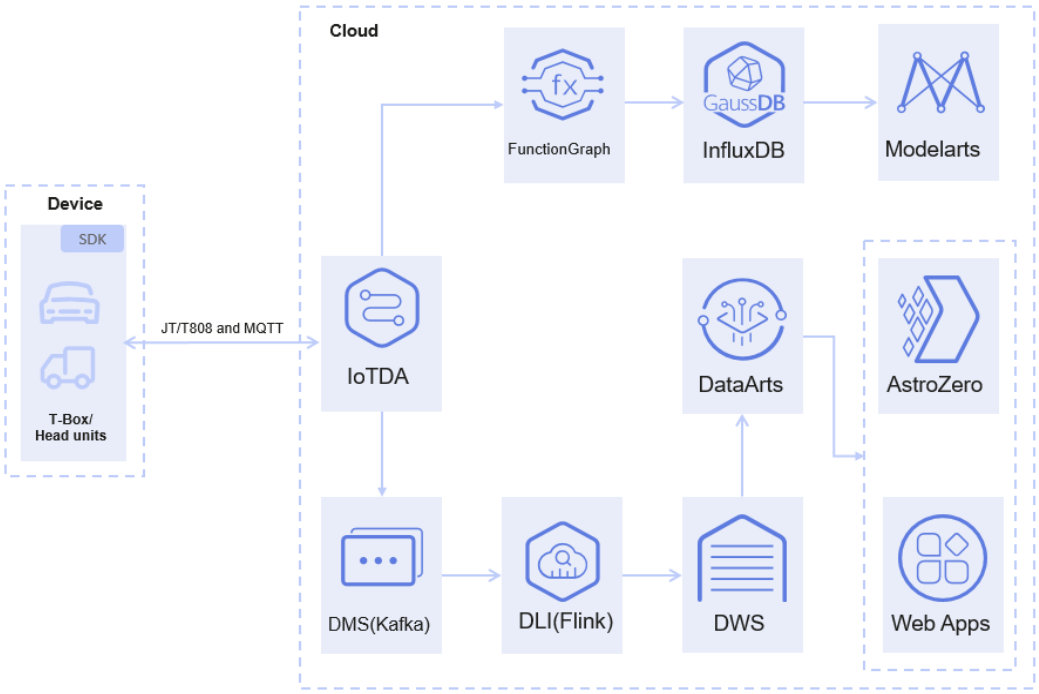
Figure 3-1 Service architecture in the IoV scenario



Reference architecture of the IoV scenario:

- The T-Box on the device side reports data such as vehicle status, driving behavior, and vehicle track to the cloud through MQTT or JT/T808.
- IoTDA transfers data to different cloud services for data cleaning, storage, and analysis, building multiple IoV data applications.

Figure 3-2 Reference architecture of the IoV scenario



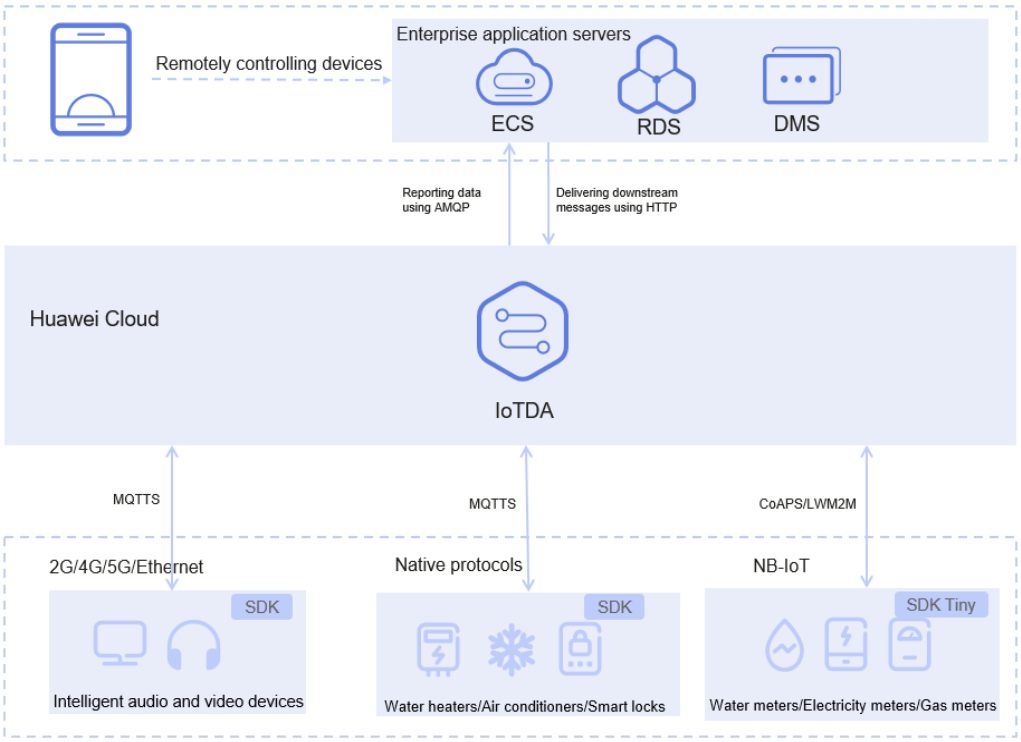
Smart Home

Requirements: Home appliances, such as refrigerators, air conditioners, washing machines, sockets, TVs, and lighting devices, need to be connected to the cloud for data reporting and running status detection. Users can also run commands on applications provided by device vendors to remotely control devices.

Solutions: IoTDA provides a secure and reliable system to support massive device connections. It supports multiple protocols, such as MQTT, CoAP, HTTP, LWM2M, and WebSocket, and allows users to deliver messages and commands from the cloud to control devices in a timely manner.

The following figure shows the reference architecture of the smart home scenario.

Figure 3-3 Reference architecture of the smart home scenario



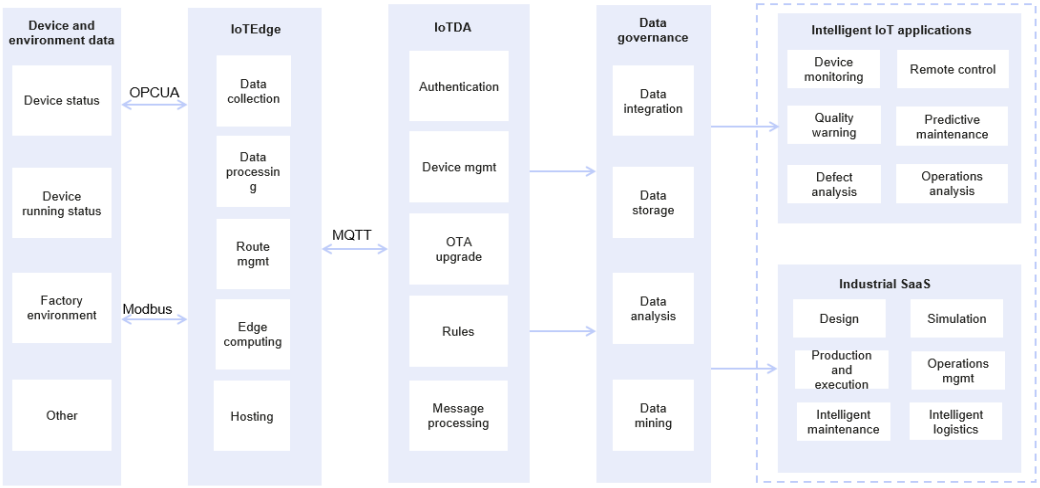
Smart Manufacturing

Requirements: To manage mechanical devices of various brands and types on the assembly lines, factories need to collect device running and environment monitoring data with a cloud platform. The platform should calculate and analyze device running status in real time, provide device exception or fault prediction and alarm, and allow users to perform remote maintenance and upgrade.

Solutions: Factories can use IoTEdge to collect OT data such as device and environment data, report them to IoTDA through industrial gateways, and transfer them to other cloud services for data conversion and analysis. With these data, factories can monitor devices, receive alarms for abnormal devices, and upgrade and maintain devices remotely.

The following figure shows the business architecture of the smart manufacturing scenario.

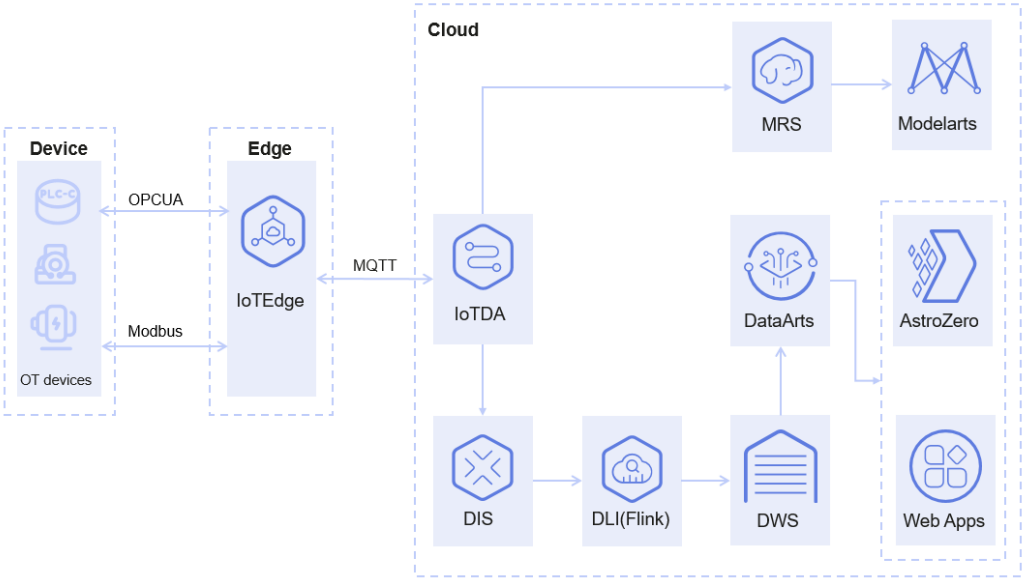
Figure 3-4 Business architecture of the smart manufacturing scenario



Reference architecture of the smart manufacturing scenario:

- Edge nodes deployed on devices support protocols such as OPCUA and Modbus, collect running data, status data, and environment monitoring data of various OT devices, and report data from edge gateways to IoTDA.
- IoTDA uses the rules to transfer data to Data Ingestion Service (DIS). After being processed by DLI-Flink, the data is written to Data Warehouse Service (DWS) for subsequent data governance. Data can also be transferred to MapReduce Service (MRS) for big data cleaning and processing, facilitating subsequent AI analysis and data mining.

Figure 3-5 Reference architecture of the smart manufacturing scenario



Distributed Photovoltaics (PV)

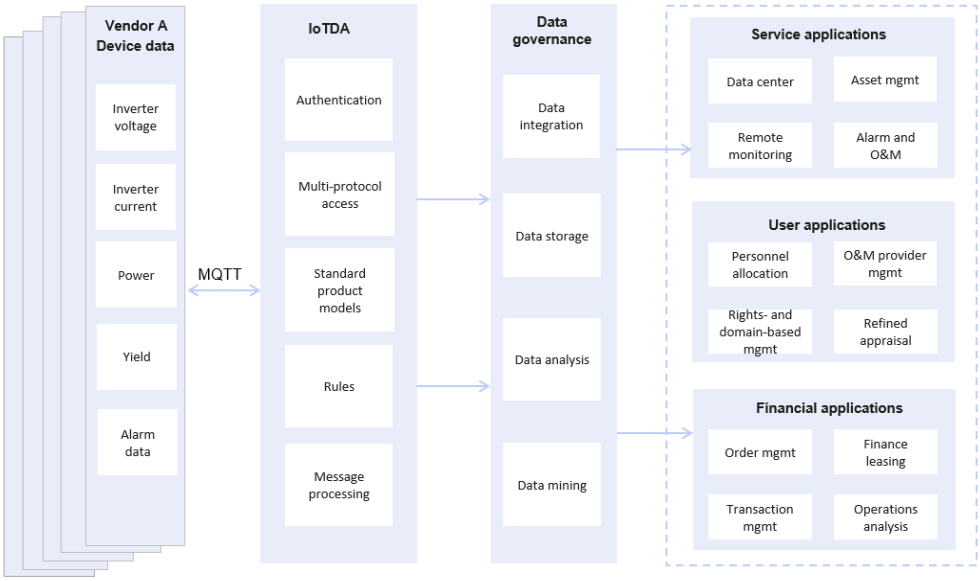
Requirements: New energy companies need to collect the voltage, current, power, yield, and alarm data of inverters produced by various vendors to the cloud for

further data processing and analysis, facilitating data center development, alarm O&M, and operation analysis.

Solutions: IoTDA provides standard object models and supports multi-protocol access Shielding the format and protocol differences of data reported by devices from multiple PV device vendors, IoTDA uses rules to transfer data to Object Storage Service (OBS) for storage and MRS for further data processing.

The following figure shows the service architecture of distributed PV scenarios.

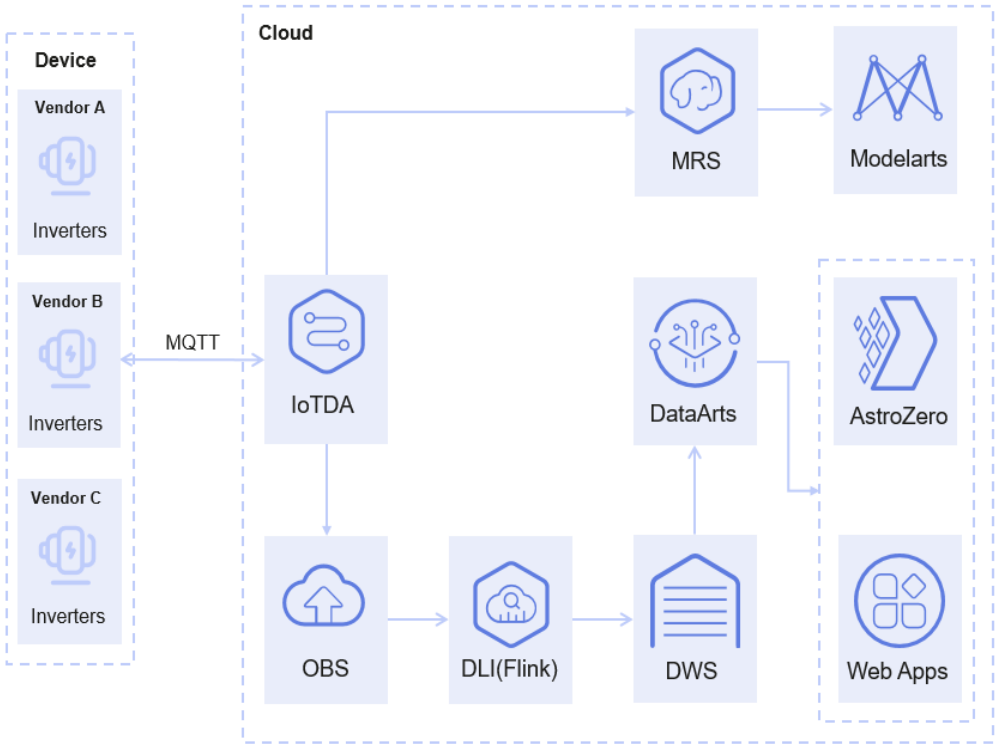
Figure 3-6 Service architecture in the distributed PV scenario



Reference architecture of the distributed PV scenario:

- Inverters from different vendors report data such as voltage, current, power, and yield to the cloud through MQTT.
- IoTDA uses rules to transfer data to OBS for storage. After being processed by DLI-Flink, the data is written to DWS for subsequent data governance. Data can also be transferred to MRS for big data cleaning and processing, facilitating subsequent AI analysis and data mining.

Figure 3-7 Reference architecture of the distributed PV scenario



Smart Charging Pile

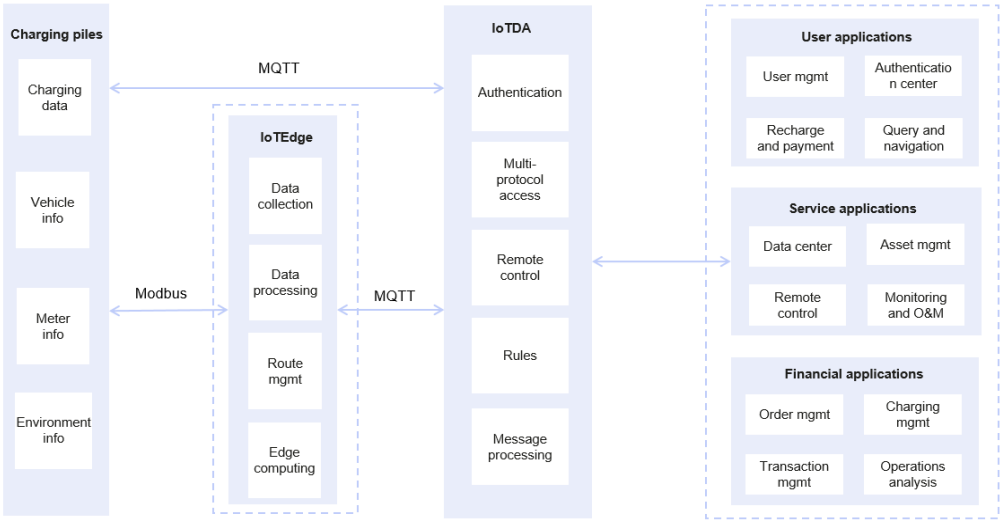
Requirements: Charging pile operators need to collect charging data, meter information, and charging vehicle information of charging piles produced by different vendors to the cloud, so cloud applications can detect the status of user vehicles and charging piles in real time for fee calculation. Applications need to deliver commands to start and stop the charging.

Solution 1: Charging pile devices from multiple vendors are directly connected to the IoTDA through MQTT. Generic-protocol plug-ins are deployed on the cloud for parsing and multi-protocol access. IoTDA can directly push data to customers' applications and allow applications to deliver commands to control the start and stop of the charging. This solution applies to urban areas or outdoor areas with good network environments.

Solution 2: Use IoTEdge to collect charging pile data from multiple vendors. Protocol plug-ins can be deployed on edge nodes to shield proprietary protocols of multiple vendors. Some simple computing applications can also be deployed on edge nodes to reduce interaction with the cloud. The edge gateway reports data to the IoTDA through MQTT. IoTDA can directly push data to customers' applications and allow applications to deliver commands to control the start and stop of the charging. This solution applies to areas with poor network environments, such as high-speed service areas and underground parking lots.

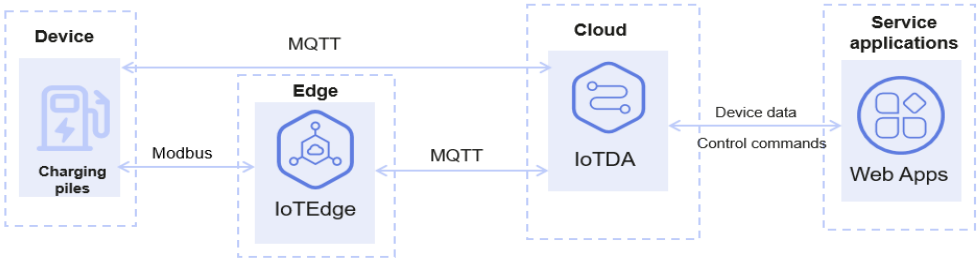
The following figure shows the service architecture of the smart charging pile scenario.

Figure 3-8 Service architecture in the smart charging pile scenario



The following figure shows the reference architecture of the smart charging pile scenario.

Figure 3-9 Reference architecture of the smart charging pile scenario



4 Specifications

Specifications of Standard Edition

IoTDA provides standard instances for device access and service processing. Each Huawei Cloud user can enable up to one standard instance in the same region. If it cannot meet your requirements, submit a service ticket. You can select the type and number of units in the standard instance to determine the total number of messages allowed per day between devices and the platform. If you increase the number of units of the same type, the total number of messages will increase and the function **limitations** will change as well.

After an instance is enabled, you are billed based on the usage duration (days) and unit type and quantity you select.

Table 4-1 Unit specifications

Unit Type	Messages/Day/ Unit	Message Size (KB)	Monthly Price/ Unit (Estimate)
SUF	10,000	4	Free
SU1	400,000	4	USD25
SU2	4 million	4	USD165
SU3	40 million	4	USD1050
SU4	300 million	4	USD2500

NOTE

- A standard instance can be configured with multiple units of the same type, for example, five SU1 units, but cannot be configured with different types of units, for example, two SU1 units and three SU2 units. You can change the number and type of units at any time. For example, you can upgrade two SU1 units to five SU1 units or two SU1 units to two SU2 units. You can enable only one SUF unit but 100 SU1, SU2, SU3, or SU4 units. An SUF unit can be upgraded to an SU1, SU2, SU3, or SU4 units. After the upgrade, the original SUF unit is no longer retained.
- Number of messages: Charged messages include upstream and downstream messages between devices and the platform, messages sent by an application by calling platform APIs, and messages pushed by the platform to the server. Protocol messages, such as heartbeat messages and ACK messages at the protocol layer, are free of charge. For details, see **Table 5-2**. You are advised to limit the number of calls to ensure that the number of messages does not exceed the limit. If the limit is exceeded, IoTDA will generate an alarm and rejects messages. Upgrade the unit specifications or increase the number of units in a timely manner.
- Message size: The maximum length of a single message published using MQTT is 1 MB. The maximum length of a single message published using LwM2M over CoAP is 1 KB. If the message size exceeds the limit, the message will be rejected. A message that is smaller than or equal to 4 KB is counted as one message. A message that is larger than 4 KB is counted as two or more messages.
- Number of devices: A standard instance supports a maximum of two million registered devices. If you want to increase the quota, **submit a service ticket** to describe your requirements. The number of concurrent online devices supported is equal to the number of registered devices. When only an SUF unit is enabled, up to 1000 devices can be registered.
- TPS of upstream and downstream messages: It describes the maximum throughput of upstream and downstream messages per second, that is, the total number of messages sent from all devices in an instance to the platform and from the platform to devices per second. The quotas of a standard instance are determined by the type and number of units.

  Specific quota limits are as follows:

  SUF: 10 TPS/unit

  SU1: 10 TPS/unit

  SU2: 100 TPS/unit

  SU3: 1000 TPS/unit

  SU4: 6000 TPS/unit

  If the quotas cannot meet your service requirements, **submit a service ticket** to describe your requirements.
- For details about other limitations except for the specifications and quota limits listed above, see **Limitations**.

Example

Scenario: A user enables the IoTDA standard instance and plans to register 100,000 devices. The average number of online devices per day is 10,000. Each online device sends a message (smaller than 4 KB) to the platform every 5 seconds on average. No API calls or push messages are involved. The daily working duration is 8 hours.

The TPS of upstream and downstream messages is 2000 (10,000 devices ÷ 5 seconds/message/device). The total number of messages per day is 57,600,000 (8 hours x 60 x 60 seconds x 2000 TPS). In this case, you can purchase two SU3 units, which support 2000 TPS, 80 million messages per day, and up to 2 million

registered devices, and cost about USD2100 (USD1050 x 2). Alternatively, you can purchase 20 SU2 units. Bills are generated and deduction is triggered every day.

5 Pricing Details

This topic describes the billing modes, billing items, configuration changes, renewal, expiration, and arrears of IoTDA.

Billing Modes and Items

Table 5-1 Standard Edition billing modes

Edition	Billing Mode	Billing Item	Unit Price
Standard	Pay per use	You are billed based on the instance specifications and required duration. For details about the Standard Edition specifications, see **Product Pricing Details**.	For details about product prices, see **Product Pricing Details**.

Table 5-2 IoTDA billing items

Item	Description	Billing Mode
Device messages	Messages sent by devices by calling the MQTT PUB interface	The number of messages is charged.
	Messages received by devices by calling the MQTT SUB interface	
	Messages sent by devices by calling the LWM2M Update/Notify interface	
	Response messages received by devices by calling the LWM2M Update interface	

Item	Description	Billing Mode
	Messages and properties reported by devices by calling the HTTP interface	
	Command messages sent by the platform by calling the LWM2M Read/Write/Write-Attributes/Execute interface and response messages reported by devices	
Application messages	Messages sent by applications by calling platform APIs	The number of messages is charged.
Messages forwarded by rules	Messages forwarded to other Huawei Cloud services using rules	If the number of forwarded messages is less than that of messages reported by devices, the forwarded messages are free of charge. If greater, the extra forwarded messages are charged.
	Messages pushed by the platform to applications (including HTTP and AMQP messages)	The number of messages is charged.
Protocol messages	Login messages Logout messages Heartbeat messages ACK messages at the protocol layer Subscription messages Unsubscription messages	Free
OTA upgrade	You will be billed for using OBS to store upgrade packages. For details, see **Software/Firmware Package Upload**.	OTA upgrade is free, but OBS is charged.

Configuration Changes of the Standard Edition

- You can increase the number of units in the instance online, for example, upgrading a Standard Edition instance from three SU2 units to five SU2 units.
- You can upgrade the unit type of an instance, for example, upgrading the instance units from SU2 to SU3.

  Note: The upgrade takes effect on all units in the instance.

Renewal

You can renew a resource package before it expires, or you can set auto-renewal rules for a resource package. For more information about renewing resource packages, see **Renewal Management**.

Expiration and Overdue Payment

Ensure that the balance in your Huawei Cloud account is sufficient to cover any upcoming charges. If a fee deduction fails due to insufficient balance, your account will be in arrears, which will affect the normal use of services. (If the balance is 0, the service can still be used.)

Huawei Cloud sets retention periods based on customer level. For details, see **Postpayment Instructions**.

- Within the retention period, new devices cannot be registered, messages cannot be reported from registered devices, and commands cannot be delivered to devices.
- If you do not pay the arrears after the retention period has expired, your IoTDA resources will be released and your devices will be deleted.

6 Limitations

The following table lists the technical specifications of IoTDA. If the specifications cannot meet your service requirements, **submit a service ticket** to describe your requirements.

Table 6-1 Resource restrictions

Category	Object	Description	Limit
Instance management	Standard edition instance	Number of units that can be purchased for a single standard instance. For details, see **Specifications**.	100
Resource space management	**Resource space**	Number of resource spaces supported by a single IoTDA instance.	10
Device access	MQTT	MQTT protocol standard.	MQTT v3.1, v3.1.1, and v5.0 are supported. QoS 2, and will and retained messages are not supported.
		Security levels supported by MQTT.	TLS 1.1, TLS 1.2, and TLS 1.3

		Heartbeat interval of MQTT connections. For details about how to set the device heartbeat interval, see **Establishing a Connection**.	30s to 1200s. 120s is recommended. If the heartbeat interval is not within the range, the server will reject the connection request.
		Maximum timeout interval = Heartbeat interval x 1.5. If no device message is received within the maximum timeout interval, the server automatically disconnects from the device.	
		Maximum number of connections that can be established between a device and IoTDA.	1
		Maximum length of a custom MQTT topic.	128 bytes
		Maximum length of a message reported by an MQTT device. (A message with the length greater than this value is rejected.)	1 MB
		Maximum number of subscriptions for an MQTT connection.	50
		Maximum bandwidth of an MQTT connection.	1 Mbit/s

		Maximum number of upstream messages per second for an MQTT connection.	50
		Maximum number of connection requests can be created per second for an IoTDA instance.	For the standard edition, see **Specifications of Standard Edition**.
		Maximum number of upstream requests for an IoTDA instance per second on the device side (assuming that the average payload of a message is 512 bytes).	For the standard edition, see **Specifications of Standard Edition**.
	CoAP/LwM2M	Supported CoAP version.	RFC 7252 standard 3
		Supported LwM2M version.	V1.0.2
		Transport layer protocol.	User Datagram Protocol (UDP)
		Security level supported by CoAP.	DTLS v1.2
		Supported size of a CoAP message packet.	1 KB
		Number of messages per minute for a device.	300
	HTTP	Supported HTTP versions.	HTTP 1.0 and HTTP 1.1
		Supported TLS versions.	TLS 1.1 and TLS 1.2

		Maximum size of a message body.	1 MB
Device management	Product	Number of products in a resource space.	1000
		Size of the service capability JSON file in a product.	500 KB
		Number of services in a product.	500
		Number of properties, events, or commands in a service capability.	500
	Topic customization	Number of custom topics for a product.	50
	Number of devices in a standard edition instance	Maximum number of devices can be registered for a standard edition (SU1, SU2, SU3, and SU4)	2,000,000 (If you want to increase the limit, submit a service ticket.)
		Number of devices can be registered for an SUF	1000
	Device	Maximum number of child devices that can be added to a gateway.	50,000
		Maximum depth of the gateway structure.	2 levels
	Device tag	Maximum number of tags that can be added to a device.	10
	Group	Maximum depth of a group.	5 levels

		Maximum number of groups in a resource space.	1000
		Maximum number of devices in a group.	20,000
		Maximum number of groups that a device can be added to.	10
	Batch task	Maximum number of devices that can be registered at a time.	100,000
	Codec	Number of codecs allowed in a product.	1
		Size of the codec package uploaded offline.	4 MB
		Maximum length of the codec script.	1 MB
		Timeout interval for a codec invoking request.	5s
	Device linkage rule	Maximum number of rules that can be added for an IoTDA instance.	Basic/Standard edition: 20
			Enterprise edition: 200
		Maximum number of actions supported by a rule.	10
		Maximum number of rule actions executed by devices per second for a single IoTDA instance.	Basic/Standard edition: 10
			Enterprise edition: 100

		Maximum number of waiting tasks for a single IoTDA instance.	Basic/Standard edition: 100
			Enterprise edition: 1000
	Batch task	Maximum number of batch tasks that can be concurrently processed in a resource space	10
		Maximum size of a batch task file.	2 MB
		Maximum number of lines in a batch task file.	100,000
		Maximum number of batch task files supported by an IoTDA instance.	10
	OTA upgrade	Size of an upgrade package.	The maximum size of the upgrade package that can be uploaded to IoTDA is 60 MB. The size of the upgrade package uploaded to OBS is not limited.
		Maximum number of upgrade packages that can be uploaded to a resource space.	200
		Maximum size of a file that can be uploaded to a single resource space.	The maximum size of a file that can be uploaded to IoTDA is 500 MB. The maximum size of a file uploaded to OBS is not limited.

Message communications	Synchronous command	Response time of a synchronous command device.	20 seconds
	Device message	Aging time of messages delivered by a device.	24 hours
		Maximum size of a message delivered by a device.	256 KB
		Number of caches of the messages delivered by a device.	20
	Device property	Maximum number of child devices of which properties can be reported by a gateway at a time	100
	Asynchronous command	Aging time of asynchronous device commands.	48 hours
		Maximum size of an asynchronous command.	256 KB
		Number of asynchronous command caches.	20
Message forwarding	Forwarding rule and action	Maximum number of rules that can be configured for an IoTDA instance.	100
		Maximum number of actions supported by a rule.	10
		Maximum length of the **select** parameter in the forwarding rule.	0.5 KB

		Maximum length of the **where** parameter in the forwarding rule.	0.5 KB
	Cache policy for message forwarding	Message cache size.	1 GB
		Message cache duration.	24 hours
	AMQP	AMQP protocol version.	AMQP 1.0
		Supported TLS versions.	TLS 1.2
		Maximum number of queues that can be configured for an IoTDA instance.	100
		Number of queues listened on for a connection.	10
		Number of connections allowed in an IoTDA instance.	32
Certificate management	Certificate configuration	Number of device CA certificates supported by an IoTDA instance.	100
		Number of application CA certificates supported by an IoTDA instance.	10

Application API Limitations

Unless otherwise specified, an API can be called up to 50 times per second for an account. The maximum number of API calls per second for an account is 100 for the standard edition.

7 Security

7.1 Shared Responsibilities

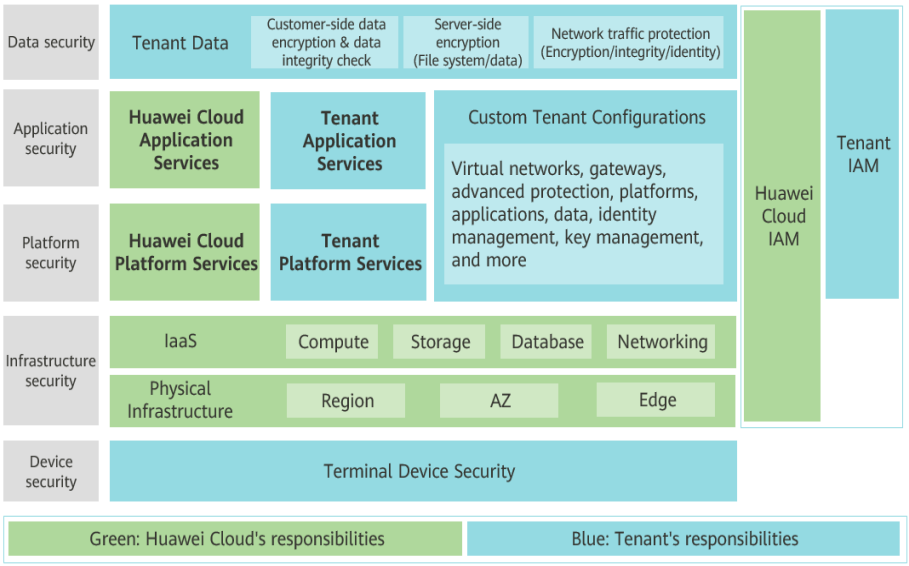
Huawei guarantees that its commitment to cyber security will never be outweighed by the consideration of commercial interests. To cope with emerging cloud security challenges and pervasive cloud security threats and attacks, Huawei Cloud builds a comprehensive cloud service security assurance system for different regions and industries based on Huawei's unique software and hardware advantages, laws, regulations, industry standards, and security ecosystem.

Figure 7-1 illustrates the responsibilities shared by Huawei Cloud and users.

- **Huawei Cloud**: Ensure the security of cloud services and provide secure clouds. Huawei Cloud's security responsibilities include ensuring the security of our IaaS, PaaS, and SaaS services, as well as the physical environments of the Huawei Cloud data centers where our IaaS, PaaS, and SaaS services operate. Huawei Cloud is responsible for not only the security functions and performance of our infrastructure, cloud services, and technologies, but also for the overall cloud O&M security and, in the broader sense, the security and compliance of our infrastructure and services.
- **Tenant**: Use the cloud securely. Tenants of Huawei Cloud are responsible for the secure and effective management of the tenant-customized configurations of cloud services including IaaS, PaaS, and SaaS. This includes but is not limited to virtual networks, the OS of virtual machine hosts and guests, virtual firewalls, API Gateway, advanced security services, all types of cloud services, tenant data, identity accounts, and key management.

Huawei Cloud Security White Paper elaborates on the ideas and measures for building Huawei Cloud security, including cloud security strategies, the shared responsibility model, compliance and privacy, security organizations and personnel, infrastructure security, tenant service and security, engineering security, O&M security, and ecosystem security.

Figure 7-1 Huawei Cloud shared security responsibility model



7.2 Identity Authentication and Access Control

Identity Authentication

You are required to carry your identity credential and verify the identity validity when calling IoTDA APIs. Different identity credentials are used in the following IoTDA access scenarios:

- IoTDA application APIs support authentication using an IAM token or access key (AK/SK). For details, see **Authentication**.
- For MQTT device connection authentication, carry the client ID, device ID, and encrypted device secret. For details, see **Device Connection Authentication**.
- For HTTP device connection authentication, carry the device ID, password authentication mode, timestamp, and encrypted device secret. For details, see **Authenticating a Device**.
- For authenticating the connection between the AMQP client and IoTDA, carry **accessKey** and **accessCode**. For details, see **AMQP Client Access**.

Access Control

IoTDA supports access control through IAM. IAM permissions define which actions on your cloud resources are allowed or denied. After creating an IAM user, the administrator needs to add it to a user group and grant the permissions required by IoTDA to the user group. Then, all users in this group automatically inherit the granted permissions.

IAM presets system permissions for each cloud service so that you can quickly configure basic permissions. The following table describes all system permissions of IoTDA.

Table 7-1

Role/Policy Name	Description	Type
Tenant Administrator	Permissions to perform all operations on all services except IAM	System-defined role
Tenant Guest	Permissions to perform read-only operations on all services except IAM	System-defined role
IoTDA FullAccess	Permissions to perform all operations on IoTDA resources.	System-defined policy
IoTDA ReadOnlyAccess	Permissions to perform read-only operations on IoTDA resources.	System-defined policy

7.3 Data Protection

The shared responsibility model applies to IoTDA data protection. IoTDA is responsible for the service security and provides a secure data protection mechanism. You are responsible for securely using IoTDA, including configuring security parameters and maintaining the control of permissions to use IoTDA and other dependent cloud services.

Table 7-2

Measure	Description	Reference
Transmission encryption (HTTPS)	IoTDA supports HTTPS. To secure data transmission, use TLS 1.2 or later.	**Using HTTPS For Access**
Transmission encryption (MQTTS)	IoTDA supports MQTTS. To secure data transmission, use TLS 1.2 or later. TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 and TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 are recommended as cipher suites.	**MQTT Protocol Support**

Measure	Description	Reference
Transmission encryption (AMQPS)	IoTDA supports AMQPS. To secure data transmission, the receiver must use TLS 1.2 or later for encryption. Non-encrypted TCP transmission is not supported.	AMQP Client Access

7.4 Auditing and Logging

Auditing

Cloud Trace Service (CTS) records operations on the cloud resources in your account. You can use the logs generated by CTS to perform security analysis, trace resource changes, audit compliance, and locate faults. For details about how to enable and configure CTS, see **Enabling CTS**.

When using IoTDA, you can use CTS to view your operations and results. For details about IoTDA audit records, see **Audit Logs**.

Logging

IoTDA records connections with devices and applications and reports them as logs to LTS. LTS provides real-time query, mass storage, structured processing, and visualized chart analysis.

For details about IoTDA logs, see **Run Logs**.

7.5 Risk Monitoring

IoTDA provides comprehensive monitoring and O&M capabilities, including device message trace, report viewing, alarm management, and device anomaly detection, helping you obtain information about all devices connected to IoTDA in real time.

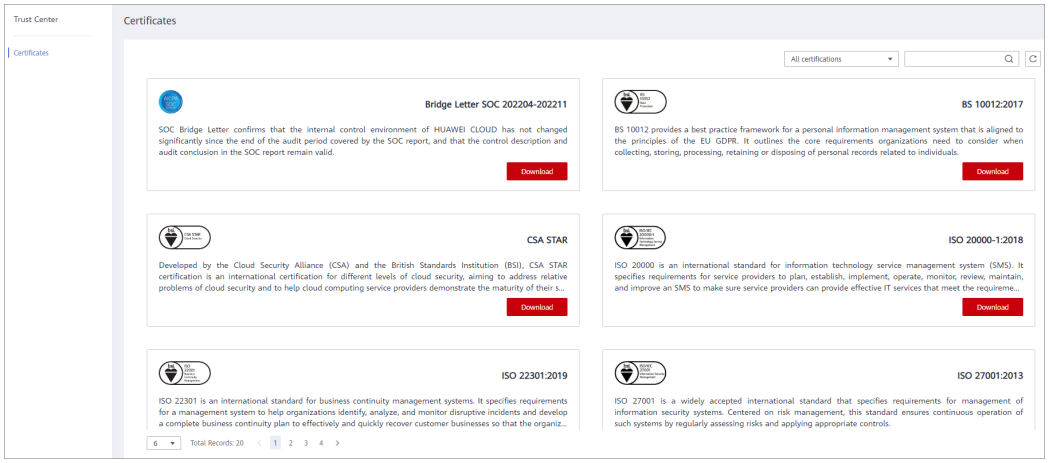
- **Message trace**: If a fault occurs during device authentication, command delivery, data reporting, data forwarding and other service scenarios, you can use message trace to quickly locate and analyze the fault.
- **Report Viewing**: You can view statistics in different dimensions, including device messages, device status, and the total number of devices.
- **Alarm management**: Based on the alarm notification capability of Application Operations Management (AOM), if a rule you set is triggered, IoTDA will send an alarm notification for you to pay attention to and handle the alarm in a timely manner.

7.6 Certificates

Compliance Certificates

Huawei Cloud services and platforms have obtained various security and compliance certifications from authoritative organizations, such as International Organization for Standardization (ISO). You can **download** them from the console.

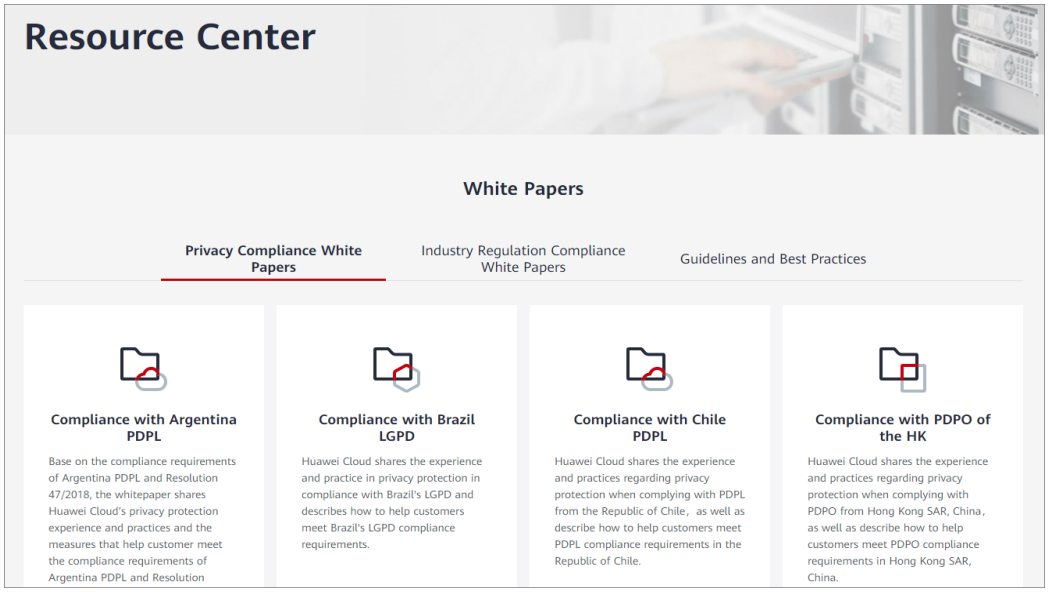
Figure 7-2 Downloading compliance certificates



Resource Center

Huawei Cloud also provides the following resources to help users meet compliance requirements. For details, see **Resource Center**.

Figure 7-3 Resource center



8 Terms

Term	Description
IoTDA	Short for IoT Device Access, a basic service of the Huawei Cloud IoT Platform. IoTDA provides functions such as device fleet access, bidirectional communication between devices and the cloud, batch device management, remote control and monitoring, OTA upgrade, and device linkage rules. It can flexibly transfer device data to other Huawei Cloud services. Using IoTDA, you can quickly connect devices to the platform and integrate your applications.
Resource space	A space allocated for your applications. Resources (such as products and devices) created on the platform must belong to a resource space. You can use the resource space for domain-based management as well as resource isolation and authorization management.
AppID	Resource space ID (the **app_id** parameter for API calling) used as the unique identifier of the resource space.
ProjectID	Unique identifier of a project. A default project is provided for each Huawei Cloud region to group and isolate resources (including compute, storage, and network resources) across physical regions. IAM users can be granted permissions to access all resources in a specific project.
IAM	Short for Identity and Access Management, a Huawei Cloud service that provides identity authentication and permission management. You can use IAM to manage user accounts (such as employees, systems, and applications) and control the operation permissions of these users on your resources.

Term	Description
Subscription and push	Subscription: An application calls a platform API to learn changes to device service details (such as device registration, data reporting, and device status) and management details (such as software or firmware upgrade statuses and upgrade results) from the platform. Push: After a subscription is successful, the platform pushes the corresponding change to the specified callback URL or AMQP message queue based on the type of data subscribed.
AMQP	AMQP, an advanced message queue protocol at the application layer of the unified messaging service, is an open standard application layer protocol for message-oriented middleware.
Product	A collection of devices with the same capabilities or features. It helps developers quickly develop product models and codecs, and provides capabilities such as device integration, online commissioning, and topic customization, facilitating end-to-end IoT development and helping you improve integration development efficiency and shorten the construction period of IoT solutions.
Product ID	Identifies the product to which a device belongs. This parameter is used to associate the product model of the device.
Product model	Also called profile, a model that describes the capabilities and features of a device. You can construct an abstract model of a device type by defining a profile on the platform, allowing it to understand the services, properties, and commands supported by the device.
CoAP	A software protocol designed to enable simple devices to perform interactive communication on the Internet. CoAPS refers to CoAP over DTLS. DTLS is used for encrypted transmission.
LWM2M	Short for Lightweight Machine to Machine, an IoT protocol defined by Open Mobile Alliance (OMA). It is mainly used for NB-IoT devices with limited resources (such as limited storage and power supply).
MQTT	An IoT transmission protocol designed for lightweight publish/subscription messaging. It provides reliable network services for IoT devices in low-bandwidth and unstable network environments. MQTTS refers to the combination of MQTT and SSL/TLS. SSL and TLS are used for encrypted transmission.

Term	Description
Codec	Plug-in used for format conversion. The platform communicates with applications using data in JSON format. For a device that reports binary data, you must develop codecs for the platform to convert binary data into JSON data. For a device that reports JSON data, you can develop codecs to convert data in different JSON formats.
Topic	A UTF-8 character string functioning as the transmission medium of publish/subscription messaging. You can publish messages to or subscribe to messages from a topic.
Service	Part of the product model that describes the capabilities of a device. Device capabilities are divided into several services. The properties, commands, and command parameters of each service are defined in the product model.
Property	Part of the product model that describes the running status of a device, such as the current ambient temperature read by an environment monitoring device.
Command	A capability or method that can be invoked by external systems.
Event	A functional model of a device, which is an event during device running. Events can be subscribed to and pushed.
Device	A device is a physical entity that belongs to a product. Each device has a unique ID. It can be a device directly connected to the platform, or a gateway through which child devices are connected to the platform.
Device ID	Uniquely identifies a device. It is allocated by the platform during device registration and used for device access authentication and message transmission.
Node ID	A unique physical identifier for a device, such as its IMEI or MAC address. This parameter is used by the platform to authenticate the device during device registration.
Device CA certificate	A certificate issued by a certification authority (CA) such as VeriSign, Symantec, and GlobalSign and used to verify the identity between the server and client during HTTPS link establishment.
X.509 device certificate	A digital certificate used to authenticate communication entities. After a device with authentication mode set to X.509 certificate is created, the platform issues the X.509 certificate to the device.
Module	Also called a communications module, an independent display unit consisting of display modules, drive circuits, control circuits, chips, and mechanical parts. Devices communicate with the platform through modules. Currently, 2G/3G/4G/5G, NB-IoT, and Wi-Fi communications modules are provided.

Term	Description
Gateway	A physical entity that manages child devices and connects child devices to the platform.
Child device	A physical device that connects to the platform through a gateway.
PSK	Used to encrypt the transmission channel between the platform and NB-IoT devices or devices integrated with the SDK.
Secret	Used for authentication when a device uses native MQTT to connect to the platform.
Firmware	A driver underlying the device hardware. It is responsible for the underlying work of a system, for example, the basic input/output system (BIOS) on a computer mainboard. Firmware upgrade, also called firmware over the air (FOTA), allows users to upgrade the firmware of LWM2M or MQTT devices in OTA mode. For example, an upgrade of an NB-IoT module is a firmware upgrade.
Software	Consists of system software and application software. The system software is for the basic device functions, such as the compilation tool and system file management. The application software provides functions such as data collection, analysis, and processing, depending on the features of the device. Software upgrade, also called software over the air (SOTA), allows users to upgrade the software of LWM2M or MQTT devices in OTA mode. For example, an MCU upgrade is a software upgrade.
PCP	A protocol that defines the communications content and format between devices and the platform for device upgrades.
IoT Edge	An open platform located close to devices or data sources. It integrates core capabilities of network, compute, storage, and applications to provide compute and intelligence services locally, making real-time services intelligent and ensuring data privacy and security.
Group	A collection of devices. You can create groups for all the devices in a project space based on different rules, such as regions and types, and you can manage and operate the devices by group.
Tag	You can define tags and bind tags to devices.
Device shadow	A JSON file that stores the device status, latest device properties reported, and device configurations to be delivered. Each device has only one shadow. A device can retrieve and set its shadow to synchronize the status, either from the shadow to the device or from the device to the shadow.

Term	Description
Rules	A preset condition used by the platform to trigger actions. The device will report device data, which is checked against the rules. When a rule condition is met, the platform will trigger corresponding actions such as delivering a command to the device or forwarding data to other Huawei Cloud services. You can create device linkage and data forwarding rules.
Token	An authentication parameter used to call platform APIs. When an application accesses the platform for the first time, it must call the authentication API to get authenticated and obtain a token.

