WideIOT

Industrial Intelligent Gateway

IOT Open Platform

Development Manual

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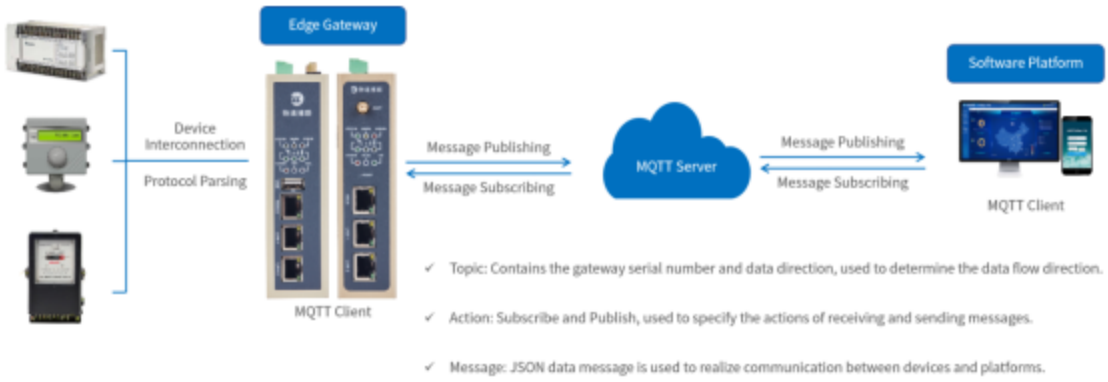
Contents

一、Industrial Intelligent Gateway

The gateway is an industrial-grade intelligent gateway with the characteristics of integration of industrialization and informatization and edge computing. It can collect data from various on-site instruments, meters, and controllers, upload the data to the cloud platform, and support the development of edge computing programs in the gateway to realize edge-side device monitoring and linkage with the cloud. It is highly suitable for the development of professional Industry 4.0 application systems.

"The 3rd-Generation Industrial Intelligent Gateway: High-Speed, Stable, and Intelligent"

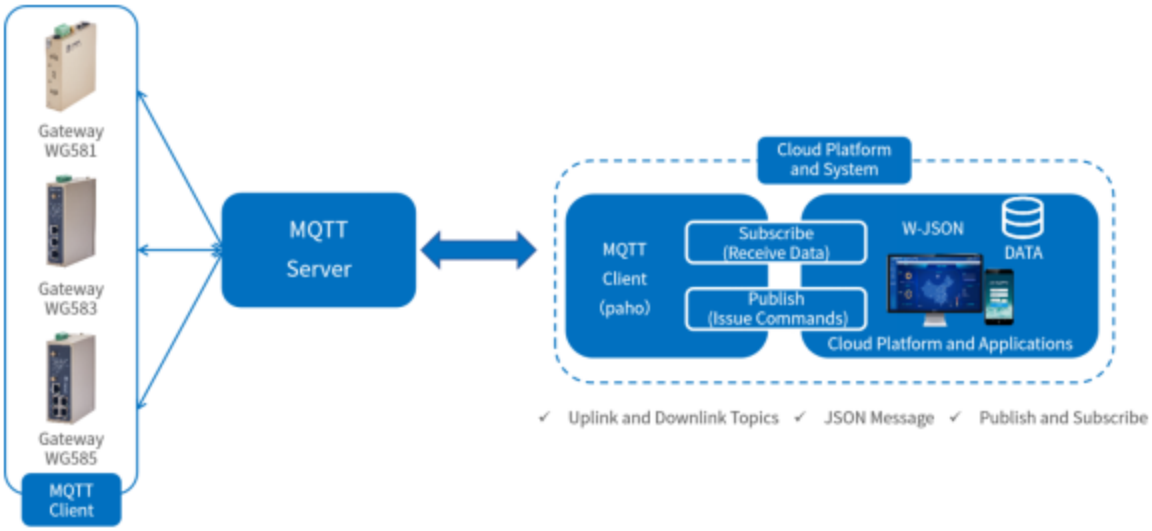


The industrial intelligent gateway supports 1/2/3/5 network ports, and is compatible with 5G/4G/3G/WIFI/PPPOE/WAN wired networks. It embeds industrial control protocols and integrates technologies such as edge computing and remote operation and maintenance, making it a highly reliable and secure industrial-grade intelligent gateway. It is

suitable as an access node for large-scale distributed devices, with strong device IoT connectivity and protocol parsing capabilities. It interacts with the cloud platform by transmitting data in JSON format via the MQTT protocol, enabling users to quickly build an efficient, high-concurrency industrial Internet system and Industry 4.0 service platform using advanced IoT technology and integration of industrialization and informatization. The gateway is widely used in industrial fields such as intelligent equipment, intelligent factories, smart grids, intelligent water treatment, environmental monitoring, sewage treatment, water supply equipment, and thermal boilers.

（一）Gateway Development Method

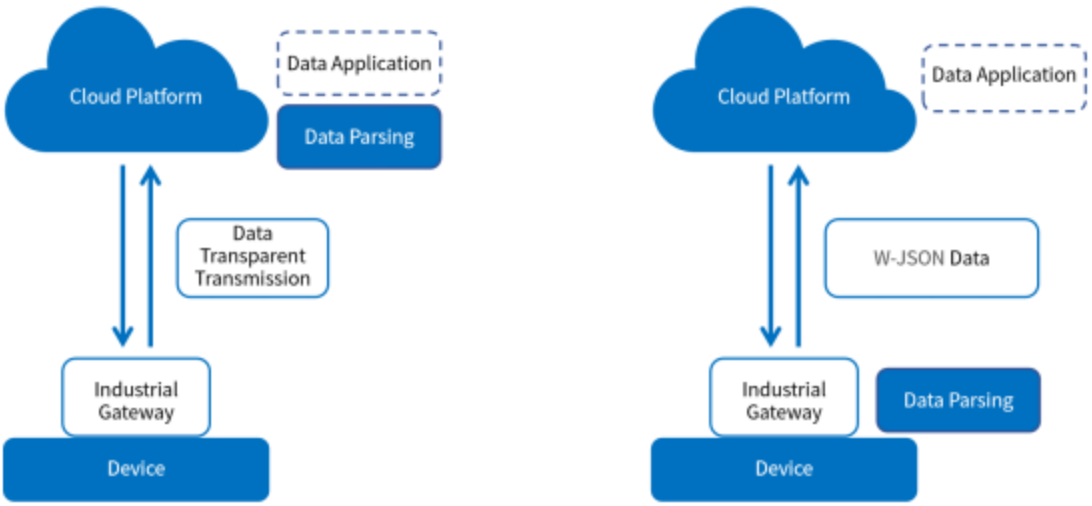
The underlying link of the gateway is developed based on the MQTT IoT protocol. Therefore, the gateway embeds an MQTT client, which establishes a two-way communication link with the MQTT Broker deployed on the server. Meanwhile, the cloud platform (or local software) independently developed by the customer also realizes two-way communication for data subscription and publishing with the MQTT Broker through an MQTT client. After MQTT establishes a connection between the gateway and the industrial cloud platform, the W-JSON message is used to realize on-site device data monitoring and control.



（二）Gateway Data Parsing Method

Two parsing methods are provided: edge parsing and cloud parsing:

For devices with built-in drivers in the gateway, edge parsing is directly used, and the standardized W-JSON format data is uploaded to the cloud for storage.For device data that cannot be parsed by the gateway, the data is directly transmitted to the cloud through the MQTT channel for parsing and subsequent storage.



二、Gateway Access to Cloud Development

The gateway is a gateway for the integration of industrialization and informatization (integration of automation and informatization). It collects and parses data from different types of devices at edge nodes, standardizes the data, and provides various data subscriptions and data reverse control functions for cloud applications.

The gateway supports multiple command formats, and the main command formats are listed below:

Command Character	Command Value
cmdId(Message CommandType)	1: Gateway Online Notification
	2: Gateway Offline Notification
	3: Gateway Heartbeat Packet
	85: Read Variable
	86: Read Response
	87: Write Variable
	88: Write Variable Response
	91: Read Gateway Status Information and Gateway Command
	92: Gateway Command Information and Command Response
	103: Data Reporting

	300: Alarm Reporting
	104: Device Online Heartbeat

Topic Description

(Note: Except for the data reporting topics listed in the table, which support multiple entries, other topics share one topic for their corresponding command types. For example, a gateway can only set one uplink topic and cannot set separate topics for different commands belonging to the uplink topic.)

Customizable Topics	**Corresponding cmdId**	**Default Topic($gatewaySn = Gateway Serial Number)**
Uplink Topic	1, 86, 88, 92, 104	/sys/$gatewaySn/up
Downlink Topic	85, 87, 91	/$gatewaySn/down
Heartbeat Packet Topic	3	/sys/$gatewaySn/up
Alarm Reporting Topic	300	/sys/$gatewaySn/event/warn
Data Reporting Topic	103	/sys/$gatewaySn/up

Non-Customizable Topics	**Corresponding cmdId**	**Default Topic($gatewaySn = Gateway Serial Number)**
Gateway Offline Packet	2	/sys/$gatewaySn/up

(一) Real-Time Data Reporting

Real-time data reporting refers to the gateway periodically reporting on-site device data to the cloud IOT platform. Each device (corresponding to one devSn) is reported in a separate message.

Message Topic：/sys/$gatewaySn/up (Data reporting topic, customizable)

Example：/sys/WG585LL072007000001/up

1、Scheduled Data Reporting

The following example shows the reporting of values of four variables ("V100", "Q0.1", "M1.1", "V200") in the device "wtbl10008":

```
{
    "cmdId": 103,
    "type": 0,
    "devList": [
        {
            "devSn": "wtbl10008",
            "varList": {
                "V100": 40.38,
                "Q0.1": 1,
                "M1.1": 0,
                "V200": "hello,wtblnet!"
            }
            "devSort": "meter",
            "ts": 1510732255,
        }
    ],
    "ver": "0.5.1.0",
    "seq": "81100000111111",
    "time": "2011-04-19 10:12:09"
}
```

Field Name	Data Type	Meaning

cmdId	int	Command value, 103 indicates data reporting (see Chapter 2 for details)
type	int	0: Real-time data1: Resumable data
devList	Array[]	Device list
devSn	string	Device serial number
varList	Array[]	Variable list
devSort	string	Device type
ts	int	Collection time
ver	string	Version number (e.g., 0.5.1.0 in this example:0 = Gateway, 5 = Gateway Series, 1 = Protocol Version, 0 = Minor Version)
seq	string	Random value or incremental value
time	string	Reporting time

2、Resumable Data Transmission

Resumable data refers to the data cached in the gateway when the network is abnormal, which is uploaded to the cloud platform after the

network is restored. Note that the topic is the same as the real-time data reporting uplink topic.


```
{
    "cmdId": 103,
    "type": 1,
    "devList": [
        {
            "devSn": "wtbl10008",
            "varList": {
                "V100": 40.38,
                "Q0.1": 1,
                "M1.1": 0,
                "V200": "hello,wtblnet!"
            }
            "devSort": "meter",
            "ts": 1510732255,
        }
    ],
    "ver": "0.5.1.0",
    "seq": "81100000111111",
    "time": "2011-04-19 10:12:09"
}
```


(二) Alarm Data Reporting

Alarm data is triggered by the edge computing module on the gateway. After triggering, the data is uploaded to the alarm topic of the cloud platform.

When the gateway detects an alarm for the first time, the alarm message is a new alarm notification. Subsequent repeated alarms detected in each collection cycle are reported at the repeated alarm interval (the message type is repeated alarm notification). When the gateway detects that the alarm has been resolved, it sends an alarm

recovery notification.

Default Alarm Reporting Topic: /sys/$gatewaySn/event/warn (customizable by users).(Note: If the alarm topic configured for gateway-cloud access is empty, the default topic is used; if the customer has a custom topic, the custom topic is used.)

Message Topic: /sys/$gatewaySn/event/warn (Alarm reporting topic, customizable)

1、Device Parameter Alarm

The gateway performs range alarm calculation on device variables:


```
    {
"cmdId": 300,
"warnSort": 1,
"devSn": "wtbl0001",
"devSort": "meter",
"warnList": [
    {
        "varName": "temp",
        "warnType": 1,
        "code": 1,
        "value": 97.2
    },
    {
        "varName": "Q0.1",
        "warnType": 2,
        "code": 2,
        "value": 1
    }
],
"ver": "0.5.1.0",
"seq": "81100000111111",
"time": "2020-06-09 16:59:10"
}
```

Field Name	Data Type	Meaning
cmdId	int	Command value, 300 indicates alarm data reporting (see Chapter 2 for details)
warnSort	int	0: Gateway Alarm1: Device Alarm2: Variable Alarm
devSn	string	Device serial number
devSort	string	Device type
warnList	Array[]	Alarm list
varName	string	Variable name
warnType	int	1: First Alarm2: Repeated Alarm3: Alarm Recovery
code	-	0: Offline1: High Alarm2: Low Alarm3: On Alarm4: Off Alarm5: Null Value6: Illegal Value
value	int	Variable value
ver	string	Version number (e.g., 0.5.1.0 in this example:0 = Gateway, 5 = Gateway

		Series, 1 = Protocol Version, 0 = Minor Version)
seq	string	Random value or incremental value
time	string	Reporting time

2、Device Offline Alarm

The alarm is sent once when the device is offline and once when it is restored; no repeated alarms are sent during normal operation.

First Alarm


```
{
    "cmdId": 300,
    "warnSort": 1,
    "devSn": "wtbl0001",
    "devSort": "meter",
    "warnList": [
        {
            "varName": "off-line",
            "warnType": 1,
            "code": 0,
            "des": "Connection refused"
        }
    ],
    "ver": "0.5.1.0",
    "seq": "81100000111111",
    "time": "2020-06-09 16:59:10"
}
```


Repeated Alarm


```
{
    "cmdId": 300,
    "warnSort": 1,
    "devSn": "wtbl0001",
    "devSort": "meter",
```

```
    "warnList": [
        {
            "varName": "off-line",
            "warnType": 2,
            "code": 0,
            "des": "Connection refused"
        }
    ],
    "ver": "0.5.1.0",
    "seq": "81100000111111",
    "time": "2020-06-09 16:59:10"
}
```


Alarm Recovery


```
{
    "cmdId": 300,
    "warnSort": 1,
    "devSn": "wtbl0001",
    "devSort": "meter",
    "warnList": [
        {
            "varName": "off-line",
            "warnType": 3,
            "code": 0,
            "des": "Success"
        }
    ],
    "ver": "0.5.1.0",
    "seq": "81100000111111",
    "time": "2020-06-09 16:59:10"
}
```


(三) Device Data Reading

Device data reading includes two types: immediate reading of all variables of a device and reading of specific variables of a specified device. The latter is commonly used in practice.

Message Topic: /$gatewaySn/down (Downlink topic, customizable)

Reading All Variables of a Device

Request Message：


```
{
    "cmdId": 85,
    "devSn": "wtbl10001",
    "req": "81100000111111"
}
```


Field Name	Data Type	Meaning
cmdId	int	Command value, 85 indicates data reading (see Chapter 2 for details)
devSn	string	Device serial number
req	string	Request ID (customizable), the gateway will return the same "seq"

Response Topic：/sys/$gatewaySn/up（Uplink topic, customizable）

Response Message：


```
{
    "cmdId": 86,
    "devSn": "wtbl10001",
    "devSort": "meter",
    "varList": {
        "V100": 50.25,
        "V200": 58,
        "Q0.1": 1
    },
    "flag": 1,
    "msg": "Success",
    "ver": "0.5.1.0",
    "seq": "81100000111111",
    "time": "2020-06-09 16:59:10"
}
```

Field Name	Data Type	Meaning
cmdId	int	Command value, 86 indicates read response (see Chapter 2 for details)
devSn	string	Device serial number
devSort	string	Device type
varList	Array[]	Variable list
flag	int	Flag bit: flag = 1 indicates successful command execution
msg	string	Message content
ver	string	Version number
seq	string	Response sequence number, the gateway returns the received "req"
time	string	Reporting time

Reading Specific Variables of a Device

Message Topic：/$gatewaySn/down（Downlink topic, customizable）

Request Message：

```
{
    "cmdId": 85,
    "devSn": "wtbl10001",
    "varList": [
```

```
            "Q0.1",
            "M1.1",
            "V100"
        ],
        "req": "81100000111111"
}
```

Response Topic：/sys/$gatewaySn/up（Uplink topic, customizable）

Response Message：

```
{
        "cmdId": 86,
        "devSn": "wtbl10001",
        "devSort": "meter",
        "varList": {
            "V100": 50.25,
            "V200": 58,
            "Q0.1": 1
        },
        "flag": 0,
        "msg": "Success",
        "ver": "0.5.1.0",
        "seq": "81100000111111",
        "time": "2020-06-09 16:59:10"
}
```

(四) Remote Device Writing

Data reverse control refers to the cloud IOT platform issuing data to the gateway to realize direct reverse control of the device.

Message Topic: /$gatewaySn/down (Downlink topic, customizable)

Request Message：

```
{
        "cmdId": 87,
        "devSn": "wtbl10001",
        "varList": {
            "V100": 11.2,                    // "Variable Name": Value to be written
            "Q0.1": 1
        },
        "req": "81100000111111"
```

```
}
```

Response Topic：/sys/$gatewaySn/up（Uplink topic, customizable）

Response Message：

```
{
    "cmdId": 88,
    "devSn": "wtbl10001",
    "varList": [
        {
            "varName": "V100",
            "flag": 1                    // 1 = Write successful
        },
        {
            "varName": "Q0.1",
            "flag": 0                    // 0 = Write failed
        }
    ],
    "flag": 1,                           // Command executed
    "msg": "Success",
    "ver": "0.5.1.0",
    "seq": "81100000111111",
    "time": "2020-06-09 16:59:10"
}
```

(五) Device Online Heartbeat Packet

Default Topic：/sys/$gatewaySn/up（Uplink topic, customizable）

```
{
    "cmdId": 104,
    "devList": [
        {
            "devSn": "wtbl0001",
            "devSort": "meter",
            "ts": 1510732255,            // Status collection time
            "online": 1                  // 1 = Online, 0 = Offline
        }
    ],
    "ver": "0.5.1.0",
    "seq": "81100000111111",
    "time": "2020-06-09 16:01:30"
}
```

(六) Gateway Management Operations

Including device status, gateway status, time synchronization command, gateway diagnosis command, configuration deployment command, etc.

Default Topic: /sys/$gatewaySn/up (Uplink topic, customizable)

1、Gateway Heartbeat Packet

```
{
    "cmdId": 3,
    "gwSn": "WG585LL0720011300008",
    "csq": "26",                          //4G signal value (range: 0-31)
    "cell_location": "0,0,23015,0",       //Cell location information
    "gps_location": "114.22,88.2",        //GPS location information
    "gps_time": "2018-01-02 00:00:08",    //GPS time
    "ver": "0.5.1.0",
    "seq": "81100000111111",
    "time": "2018-01-02 00:00:08"
}
```

2、Gateway Status Command

Default Topic：/sys/$gatewaySn/up（Uplink topic, customizable）

A、Gateway Online Notification

```
{
    "cmdId": 1,
    "IMEI": "87655667788888",             //4G module IMEI
    "GSN": "876556677877778",             //Available when 4G module is present (identification code)
    "COPS": "china mobile",               //Carrier
    "netType": "LTE+",                    //Dial-up network type
    "wanMac": "20:21:33:24:b5:68",        //WAN port MAC address
    "wlanMac": "20:21:33:24:b5:70",       //WIFI MAC address
    "softType": "WMQTT",                  //Product software model
    "gwSn": " WG285WLAN17062300548"
}
```

B、Gateway Offline Notification (Will Registration Supported)

Default Topic：/sys/$gatewaySn/up（Non-customizable, fixed）

```
{
    "cmdId": 2,
    "gwSn": " WG285WLAN17062300548"
}
```

3、Gateway Time Synchronization Command

Message Topic：/$gatewaySn/down（Downlink topic, customizable）

Time Synchronization

（1）If the gateway has access to the external network, it will synchronize time automatically.

（2）If the gateway is in an intranet, the server needs to send a command to update the current time.

Request Message：

```
{
    "cmdId": 91,
    "execmd": "date -s '2017-06-10 10:10:10' ",
    "req": "81100000111111"
}
```

Response Topic：/sys/$gatewaySn/up（Uplink topic, customizable）

Response Message：

```
{
    "cmdId": 92,
    "gwSn": "WG585LL0720011300008",
    "flag": 1,
    "msg": "Sat Jun 10 10:10:10 CST 2017\n ",
    "ver": "0.5.1.0",
    "time": "2020-06-09 16:59:10",
    "seq": "81100000111111"
}
```

4、Gateway Command Issuance

Message Topic：/$gatewaySn/down（Downlink topic, customizable）

Request Message：

```
{
    "cmdId": 91,
    "execmd": "wtbl_gostatus text",
    "req": "81100000111111"
}
```

Response Topic：/sys/$gatewaySn/up（Customizable）

Response Message：

```
{
    "cmdId": 92,
    "gwSn": "WG585LL0717032700001",
    "flag": 1,
    "msg": "Success",
    "ver": "0.5.1.0",
    "seq": "81100000111111",
    "time": "2020-06-09 16:59:10",
    "cmdResult": "@wtblnet@17@WG285LL0516122500590@WR2.7N6.170327@LTE@1.9.4-180315.663@21@192.168.0.1@eth0.2:192.168.1.1@255.255.255.0@134.40 MB@8.89 MB@eth0.2@29124@0%@5568@13900@0.47 0.45 0.50@0 天 22 时 23 分 55 秒"
}
```

Common System Commands：

Gateway Command		
1	Get gateway status info	wtbl_gostatus text (Obtain signal value)
2	Reboot gateway	reboot
3	Restart collection	/etc/init.d/wtblcollector restart

	program	
4	Restart access program	/etc/init.d/wtblcloud restart
5	Time synchronization command	date -s '2017-06-10 10:10:10'
6	Obtain gateway interfaces	ifconfig
.....		

WideIOT

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