RT-THREAD Cloud Platform User Manual

RT-THREAD Documentation Center

Copyright **@2019** Shanghai Ruiside Electronic Technology Co., Ltd.

WWW.RT-THREAD.ORG

Wednesday 17th October, 2018

Table of contents

1 Introduction to RT-Thread Cloud Platform. . . 1

1.1 Introduction to cloud platform. . 1

1.2 Cloud Functionality . . . 1

1.2.1. Device access. . 1

1.2.2. Security Management. . 1

1.2.3. Device Management. . 1

1.3 Advantages of cloud platform. . 1

1.4 Glossary . . . 2

2 RT-Thread Cloud Platform Usage. . . 2

2.1 Registration and Login . . . 2

2.2 Create a product . . . 2

2.3 Adding a device . . . 4

3. Device access and use. . . . 5

3.1 Device access . . . 5

3.2 Use of Equipment . . . 5

3.2.1. Web Shell Functionality . . . 6

3.3 Web Log Function. 7

3.4 OTA upgrade function. 8

3.4.1. Introduction to OTA Tools. . . 8

3.4.2. OTA function introduction. . . 9

4 Notes . . . 12

1 Introduction to RT-Thread Cloud Platform

1.1 Introduction to the Cloud Platform

RT-Thread Cloud Platform It is a set of IoT device maintenance cloud platform developed by Shanghai Ruiside Electronic Technology Co., Ltd. Its purpose is to help developers build a safe and effective data transmission channel, facilitate two-way communication between device terminals and the cloud, and realize device upgrades, maintenance and management functions in the cloud.

The cloud platform is designed to manage connected products and devices securely and efficiently, and can realize remote control of devices and log storage management.

As well as the firmware version management function, it helps developers quickly build a stable and reliable IoT device maintenance cloud platform.

1.2 Cloud Functions

RT-Thread cloud platform provides users with a method to quickly build secure and reliable IoT development applications. Its main features are as follows:

1.2.1. Device access

- Supports multiple protocols for accessing the cloud, such as MQTT, HTTP/HTTPS, etc., to meet users' needs for short real-time connections and long connections. The need for communication;
- Can be adapted to various models of devices on different platforms to meet the access requirements of different devices;

1.2.2. Security Management

- Each product and each device provides a unique authentication and encryption mechanism to ensure the security of user device use;
- The device supports TLS security protocol to connect to the cloud, and device data transmission is encrypted to ensure data security;
- The device provides secure device key transmission and storage functions to prevent device information leakage;

1.2.3. Device Management

- Provide a complete life cycle management of products and equipment, and realize the entire process of registration, modification, release, and deletion;
- **Web Shell** function: realize remote Shell control function in the cloud, and users can control the equipment without connecting to the serial port device. Management, meeting users' needs for remote device management.
- **Web Log** function: Realize real-time display and storage of device logs in the cloud, collect device data and monitor device status. The viewing function allows users to view device dynamics and historical records at any time.
- **OTA** upgrade function: realize the remote upgrade function of the device, support encryption and compression upgrade, multiple firmware upgrade, breakpoint resume and other functions, meet Users demand OTA upgrades for multiple devices.

1.3 Advantages of cloud platform

- Easy to manage: The cloud focuses on the management and maintenance of equipment, realizing management and maintenance methods covering the entire life cycle of equipment, and real-time monitoring of equipment Line status;
- Safe and reliable: Provides dynamic device activation authentication process to ensure device security and uniqueness, and double encryption of transmitted data to prevent tampering. Device keys are securely stored to prevent them from being accessed;

- Open and compatible: It can adapt to the access of various devices, and the connection protocol supports MQTT and HTTP/HTTPS. Supports QuickLZ, FastLZ Compression methods such as .txt and .txt can be used to reduce the size of the firmware upgrade; support AES256 encryption to ensure secure firmware transmission. More connection protocols and encryption Compression methods will be supported in due course.

1.4 Glossary

noun	explain
product	A general term for a type of equipment. Users can classify them by product. Different devices, and manage them uniformly
ProductID	The cloud issues a unique identifier for each product. To save device activations for this product
ProductKey	The cloud issues a key for each product, which the user needs to save Device activation for this product
equipment	Instantiation of products, each device corresponds to a product, Multiple devices per product
SN	Unique device identifier used to distinguish different devices Equipment, need to be obtained in the device, for the cloud device New construction
DeviceID	The cloud issues a unique identifier for each device, and the device activates Acquired after activation, used for device connection to the cloud
DeviceKey	The cloud issues a key to each device, which is obtained after the device is activated. Get, used for devices to connect to the cloud

2 RT-Thread Cloud Platform Usage

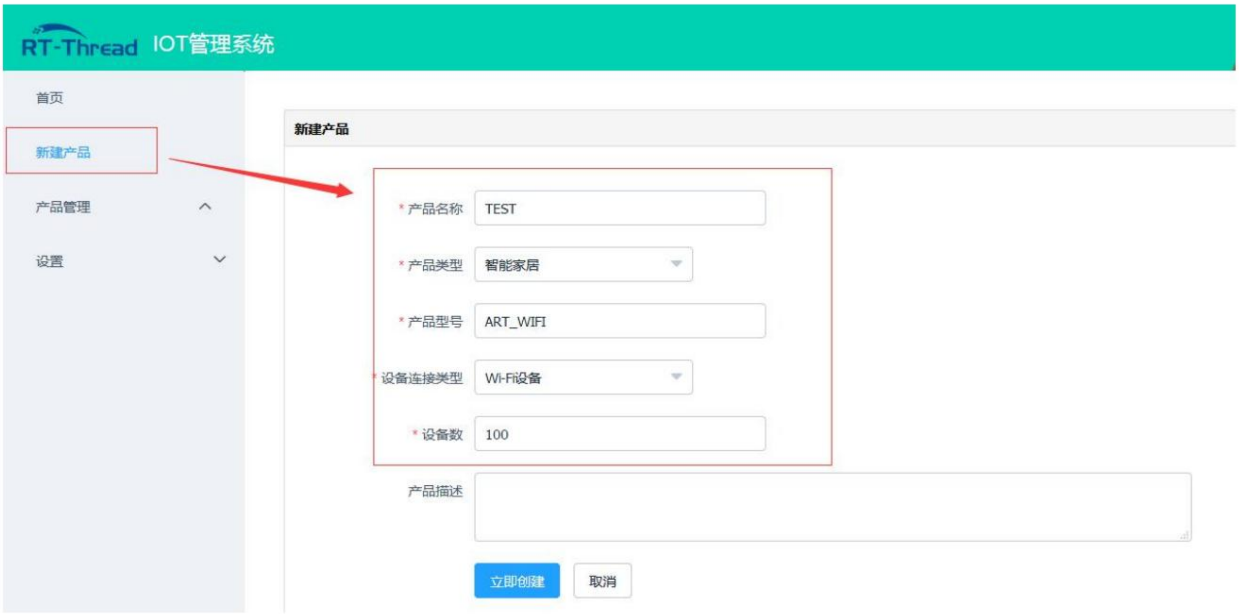
2.1 Registration and Login

RT-Thread cloud platform address: iot.rt-thread.com

Log in with your user account and password to enter the RT_Thread cloud platform. New users need to register a new account using their mobile phone and then log in to their account.

2.2 Create Products

When you first enter the RT-Thread cloud platform, you need to create a new product: click New Product, enter relevant product information, and create a new product. Taste.



* 产品名称 TEST

* 产品类型 智能家居

* 产品型号 ART_WIFI

* 设备连接类型 Wi-Fi设备

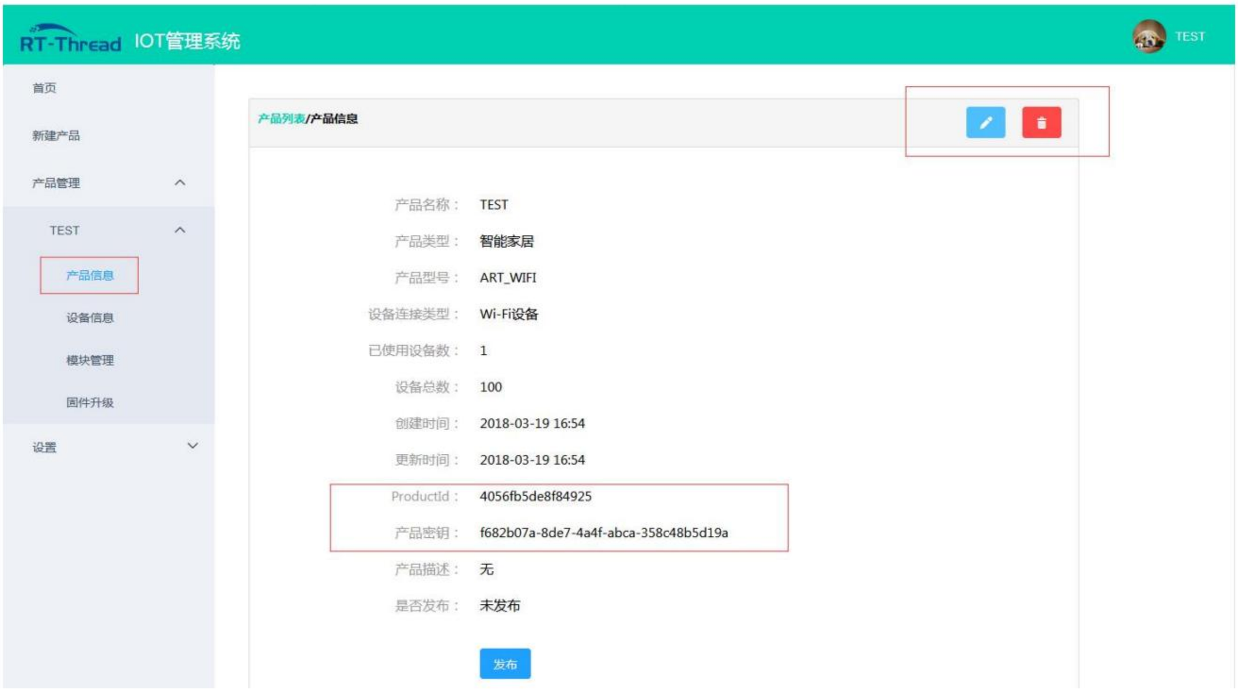
* 设备数 100

产品描述

figure **1:** Create New Product

- Product Name: Name the product, keeping it unique within the account;
- Product type: defined according to the type of your product;
- Product Model: The specific model of the equipment used in the product;
- Device connection type: how the product connects to the cloud;
- Number of devices: The maximum number of devices supported by the product. The number of devices cannot be changed after the product is released.

After the product is successfully created, you can click Product Management to view the information of the product you just created in the product information interface. Click the Modify button in the upper right corner to modify the information of unpublished products, and click the Delete button to delete unpublished products.



产品名称： TEST

产品类型： 智能家居

产品型号： ART_WIFI

设备连接类型： Wi-Fi设备

已使用设备数： 1

设备总数： 100

创建时间： 2018-03-19 16:54

更新时间： 2018-03-19 16:54

ProductId： 4056fb5de8f84925

产品密钥： f682b07a-8de7-4a4f-abca-358c48b5d19a

产品描述： 无

是否发布： 未发布

figure **2:** product information

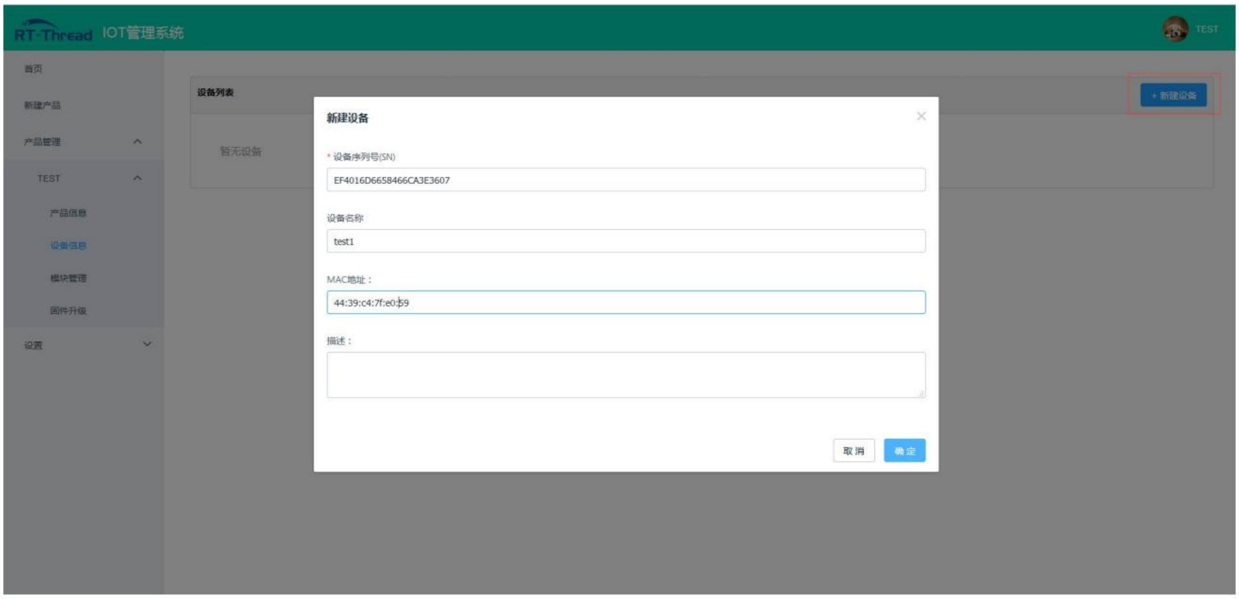
- ProductID: The product is an identifier that the user needs to store for later device connection;

- Product key: ProductKey, which users need to store for later device connection;

Each device has a unique **ProductID** and ProductKey. Users need to record the information for **CloudSDK** library migration. Connect devices to the cloud.

2.3 Adding Devices

After the product is created, you can add a device to the product. Enter the product management interface, click Device Information, and enter the unique Identifier SN (can be customized by the user, and must be consistent with the ClouSDK library porting file), device name and device MAC Address, click New Device to create a new device.



* 设备序列号(SN) EF4016D6658466CA3E3607

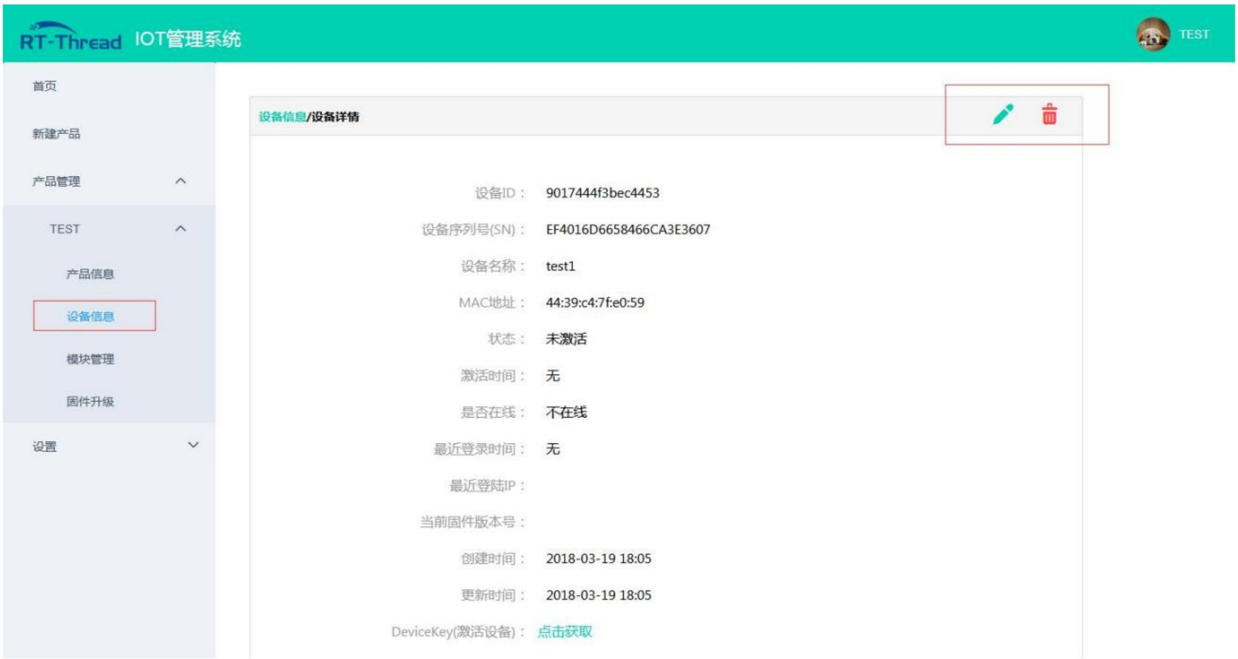
设备名称 test1

MAC地址： 44:39:c4:7f:e0:59

描述：

image **3:** Add a device

The device is added successfully. You can view the current status of the device in Device Information->Details: Not activated, Offline.



设备信息/设备详情

设备ID： 9017444f3bec4453
设备序列号(SN)： EF4016D6658466CA3E3607
设备名称： test1
MAC地址： 44:39:c4:7f:e0:59
状态： 未激活
激活时间： 无
是否在线： 不在线
最近登录时间： 无
最近登陆IP：
当前固件版本号：
创建时间： 2018-03-19 18:05
更新时间： 2018-03-19 18:05
DeviceKey(激活设备)： 点击获取

Figure **4**: Device Information

After the device is created successfully, get the parameters such as ProductID and ProductKey. Next, in the rt_cld_port.c file in the project

Configure the connection parameters, download and compile the CloudSDK library file, connect the device to the RT-Thread cloud platform and perform data communication.

3. Device access and use

3.1 Device Access

Before using cloud functions, you need to prepare the operating environment and port the CloudSDK library. The preparation work is as follows:

• RT_Thread system operating environment; • Obtain

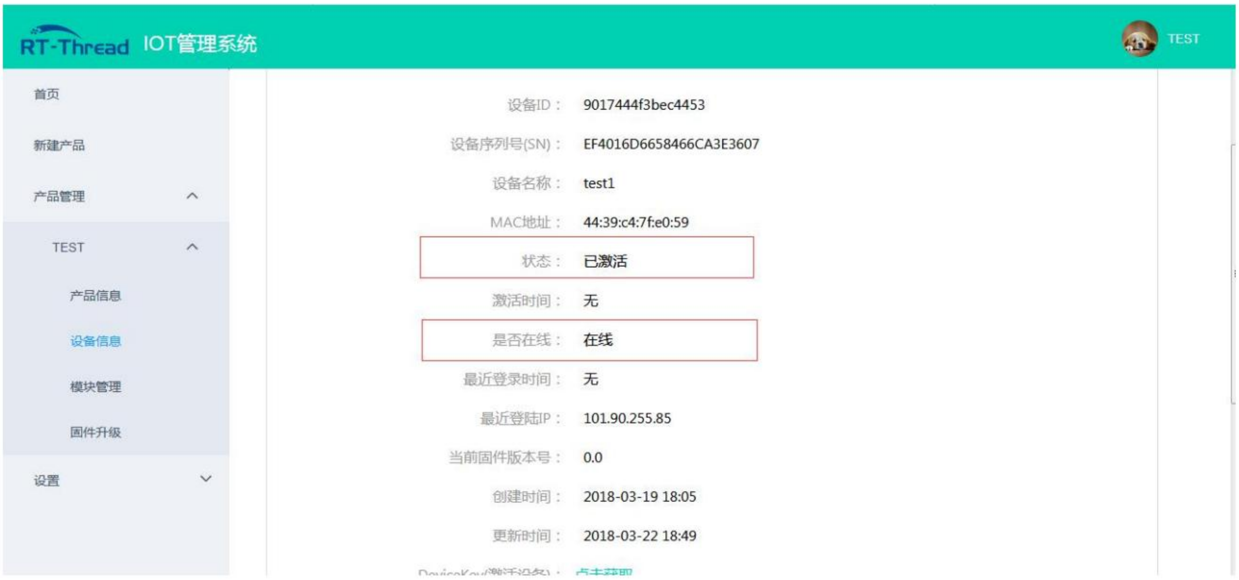
the SN, ProductID and ProductKey parameters corresponding to the current device from the cloud; • Use the parameters

obtained from the cloud to complete the migration of the CloudSDK library; • Burn the

bootloader for OTA upgrade;

3.2 Equipment Use

After the device is transplanted, the first time it is powered on, there will be a dynamic activation process for the device. After successful activation, the device obtains and stores the DeviceID and DeviceKey for the device to connect to the cloud. After successful activation, the device is online successfully, and the cloud displays device information: activated and online, as shown in the following figure:


RT-Thread IOT管理系统
TEST
首页
新建产品
产品管理
TEST
产品信息
设备信息
模块管理
固件升级
设置

设备ID：9017444f3bec4453
设备序列号(SN)：EF4016D6658466CA3E3607
设备名称：test1
MAC地址：44:39:c4:7f:e0:59
状态：已激活
激活时间：无
是否在线：在线
最近登录时间：无
最近登陆IP：101.90.255.85
当前固件版本号：0.0
创建时间：2018-03-19 18:05
更新时间：2018-03-22 18:49
DeviceKey(激活设备)：点击获取

Figure 5: device status

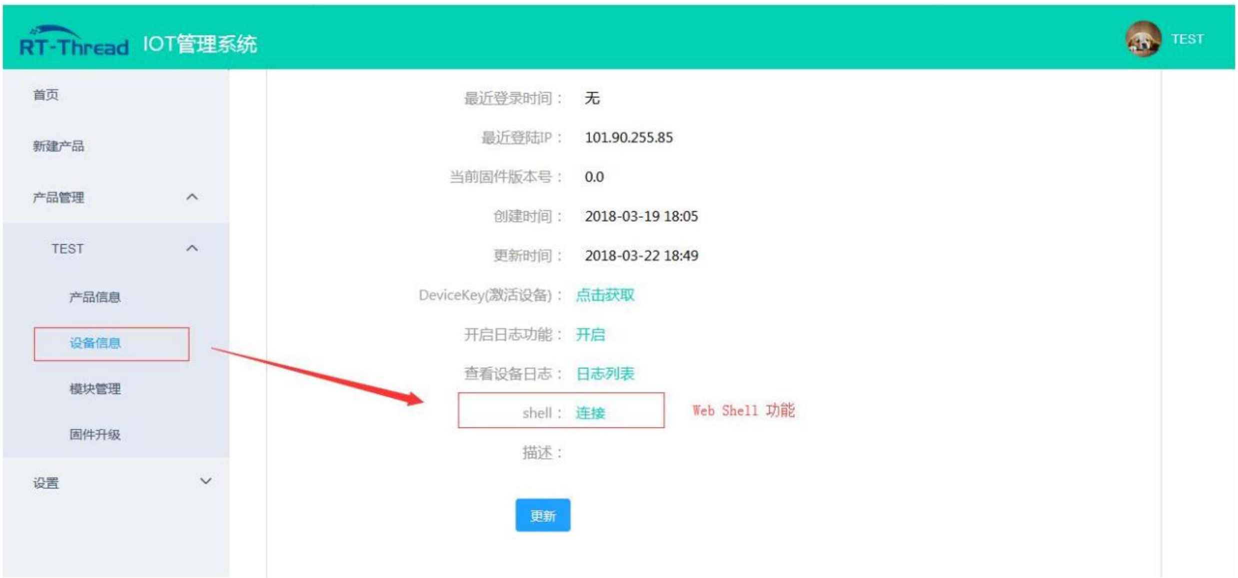
After successful activation and online, the device can complete the following functions:

- Web Shell Functionality
- Web Log function
- OTA upgrade function

3.2.1. Web Shell Functionality

The implementation of Web Shell is based on TCP/IP protocol and MQTT protocol. Its main function is to realize the remote Shell control function. Users do not need to By connecting to a serial port device, you can manage and debug the device in the cloud, and display the device printing information in real time.

The device is online successfully. In the cloud, click Device Information->Device Details->Shell: Connect to realize the FinSH terminal function in the cloud:

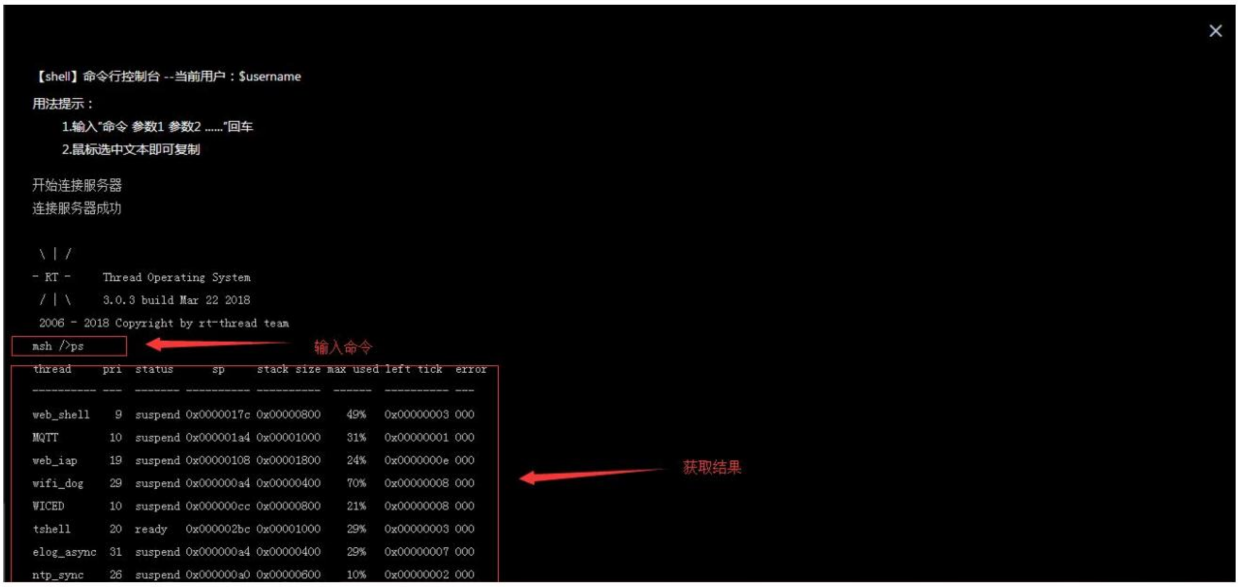

RT-Thread IOT管理系统
TEST
首页
新建产品
产品管理
TEST
产品信息
设备信息
模块管理
固件升级
设置
Web Shell 功能
更新

最近登录时间：无
最近登陆IP：101.90.255.85
当前固件版本号：0.0
创建时间：2018-03-19 18:05
更新时间：2018-03-22 18:49
DeviceKey(激活设备)：点击获取
开启日志功能：开启
查看设备日志：日志列表
shell：连接
描述：

Figure 6: Web Shell Location

After clicking Connect, the device console will switch to the cloud display. Similar to the FinSH console, you can enter commands in the cloud to get

The corresponding response is as shown below:



```
【shell】命令行控制台 --当前用户：$username
用法提示：
    1.输入"命令 参数1 参数2 ......"回车
    2.鼠标选中文本即可复制

开始连接服务器
连接服务器成功

 \ | /
- RT -     Thread Operating System
 / | \     3.0.3 build Mar 22 2018
 2006 - 2018 Copyright by rt-thread team
msh />ps
thread     pri  status      sp     stack size max used left tick  error
---------- ---  ------- ---------- ----------  ------  ---------- ---
web_shell    9  suspend 0x0000017c 0x00000800    49%   0x00000003 000
MQTT        10  suspend 0x000001a4 0x00001000    31%   0x00000001 000
web_iap     19  suspend 0x00000108 0x00001800    24%   0x0000000e 000
wifi_dog    29  suspend 0x000000a4 0x00000400    70%   0x00000008 000
WICED       10  suspend 0x000000cc 0x00000800    21%   0x00000008 000
tshell      20  ready   0x000002bc 0x00001000    29%   0x00000003 000
elog_async  31  suspend 0x000000a4 0x00000400    29%   0x00000007 000
ntp_sync    26  suspend 0x000000a0 0x00000600    10%   0x00000002 000
```

Figure **7:** *Web Shell* Function

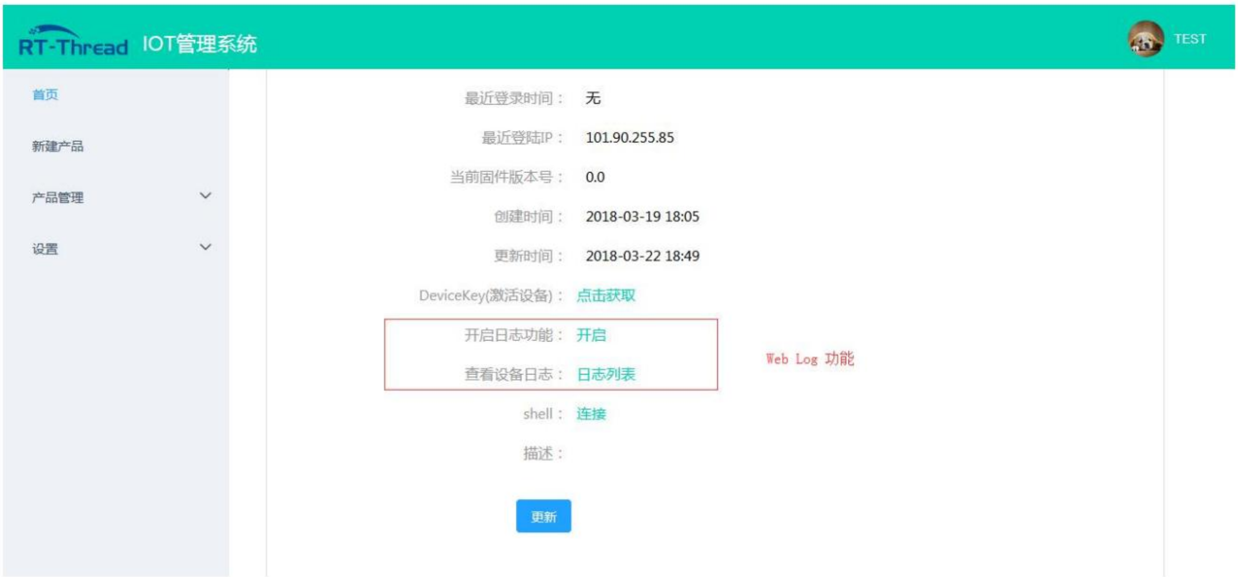
3.3 **Web Log** Function

Web Log is similar to Web Shell. Its main function is to store and query Shell input and output logs.

The main difference between Web Shell and Web Log is that Web Shell can display and manage the input and output of Shell in real time, while Web Log can log the output of Shell in real time. Input and output records are stored for later viewing.

The device is online successfully. Click Device Information->Device Details->Enable Log Function in the cloud: Enable, and the cloud will enable the device Web Log logging. Function, the input and output logs of the device console will be sent to the cloud for record keeping. Click to turn on the log function again: Turn off to turn off the log function.

The Web Log function has a timeout mechanism. If there is no data transmission within 5 minutes after the Web Log function is turned on, the server will automatically shut down. Web Log function.

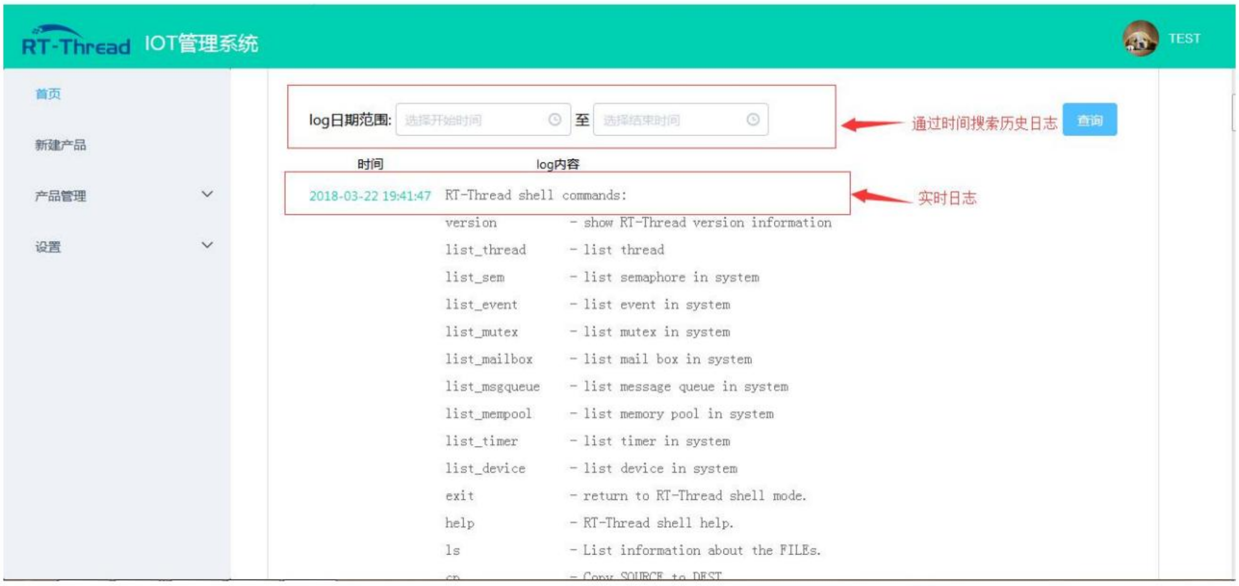


最近登录时间： 无
最近登陆IP： 101.90.255.85
当前固件版本号： 0.0
创建时间： 2018-03-19 18:05
更新时间： 2018-03-22 18:49
DeviceKey(激活设备)： 点击获取
开启日志功能： 开启
查看设备日志： 日志列表
shell： 连接
描述：

Figure **8:** *Web Log* Location

After enabling the Web Log function, you can enter the ps command in the local FinSH to view the current thread status, and the displayed log will be sent to the cloud.

And store it in the log list. Later, click View device log: Log list in the cloud to view historical log information.



```
2018-03-22 19:41:47  RT-Thread shell commands:
                     version          - show RT-Thread version information
                     list_thread      - list thread
                     list_sem         - list semaphore in system
                     list_event       - list event in system
                     list_mutex       - list mutex in system
                     list_mailbox     - list mail box in system
                     list_msgqueue    - list message queue in system
                     list_mempool     - list memory pool in system
                     list_timer       - list timer in system
                     list_device      - list device in system
                     exit             - return to RT-Thread shell mode.
                     help             - RT-Thread shell help.
                     ls               - List information about the FILEs.
                     cp               - Copy SOURCE to DEST.
```

Figure 9: Historical log information

3.4 OTA upgrade function

The OTA upgrade function of the RT-Thread cloud platform can realize remote device upgrades. Compared with other device upgrade methods, RT-Thread

The cloud platform has the following characteristics:

• Adaptable to different types of flash or file systems • Support

encrypted data transmission •

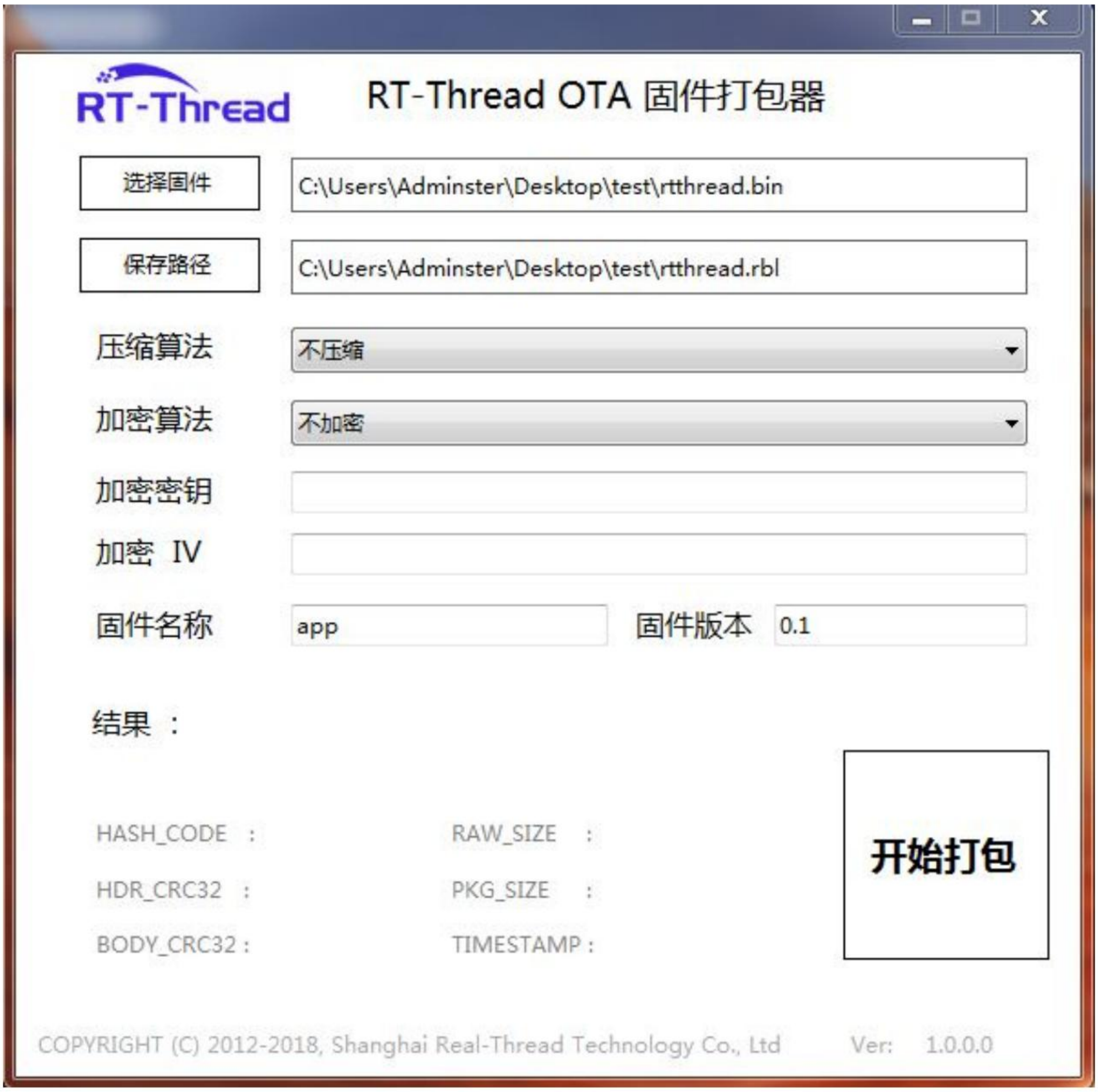
Support firmware encryption and compression

• Support breakpoint resume

function • Support multiple firmware upgrade functions

3.4.1. OTA Tool Introduction

The firmware files required for cloud OTA upgrades require specific format firmware support. For this purpose, we provide the RT-Thread OTA firmware packager, located at / tools/ota_packager/rt_ota_packaging_tool.exe . The firmware packaging tool can encrypt and compress the original format firmware files to generate upgrade firmware files in a specific format (.rbl suffix) for later uploading to the cloud and creating new upgrade tasks in the cloud. The interface of the tool is shown in the figure below:



RT-Thread OTA 固件打包器

选择固件: C:\Users\Adminster\Desktop\test\rtthread.bin

保存路径: C:\Users\Adminster\Desktop\test\rtthread.rbl

压缩算法: 不压缩

加密算法: 不加密

加密密钥:

加密 IV:

固件名称: app

固件版本: 0.1

结果 ：

HASH_CODE :

RAW_SIZE :

HDR_CRC32 :

PKG_SIZE :

BODY_CRC32 :

TIMESTAMP :

COPYRIGHT (C) 2012-2018, Shanghai Real-Thread Technology Co., Ltd Ver: 1.0.0.0

Figure **10:** *OTA* Packaging Tools

How to use the tool Users can choose whether to encrypt and compress the firmware according to their needs. The tool provides support for a variety of compression and encryption algorithms. The specific steps are as follows: - Select the firmware to be packaged - Select the location to generate the firmware - Select the compression algorithm (support QuickLZ, FastLZ compression) - Select encryption algorithm (support AES256 encryption) - Configure encryption key and IV (leave blank if not encrypted) - Fill in firmware name (firmware partition name) - Firmware version number (similar to xx) - Start packaging

3.4.2. OTA Function Introduction

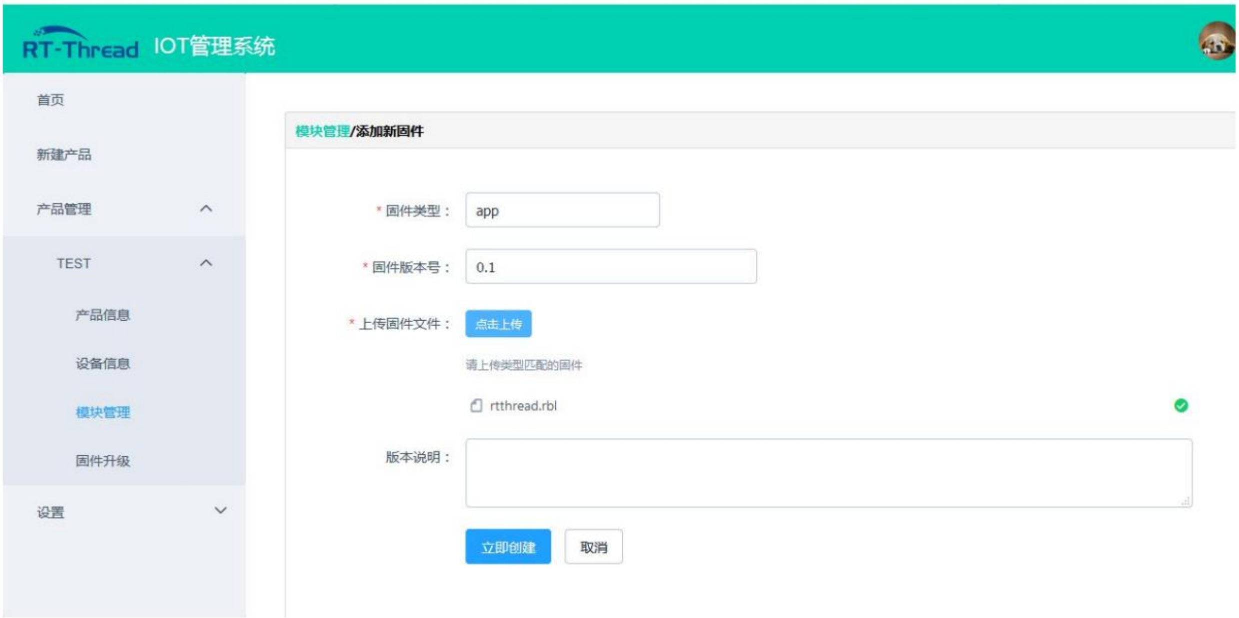
Prepare the firmware:

This function introduces and demonstrates the multi-firmware upgrade and encryption compression upgrade functions. In the preparation stage, compile and generate the latest firmware rtthread.bin of the device and the latest firmware filesystem.bin of the device file system , and then use the RT-Thread OTA firmware packager to generate rtthread.rbl and filesystem.rbl.

rtthread.rbl: only encrypt but not compress, the encryption algorithm is AES256; filesystem.rbl : only compress but not encrypt, the compression algorithm is QuickLZ;

Firmware upload:

The generated firmware needs to be uploaded to the cloud module management for firmware upgrade and firmware addition. As shown in the figure below, upload rtthread.rbl And filesystem.rbl firmware to the cloud:


RT-Thread IOT管理系统
首页
新建产品
产品管理
TEST
产品信息
设备信息
模块管理
固件升级
设置
模块管理/添加新固件
点击上传
立即创建
取消

* 固件类型：app

* 固件版本号：0.1

* 上传固件文件：

请上传类型匹配的固件

rtthread.rbl

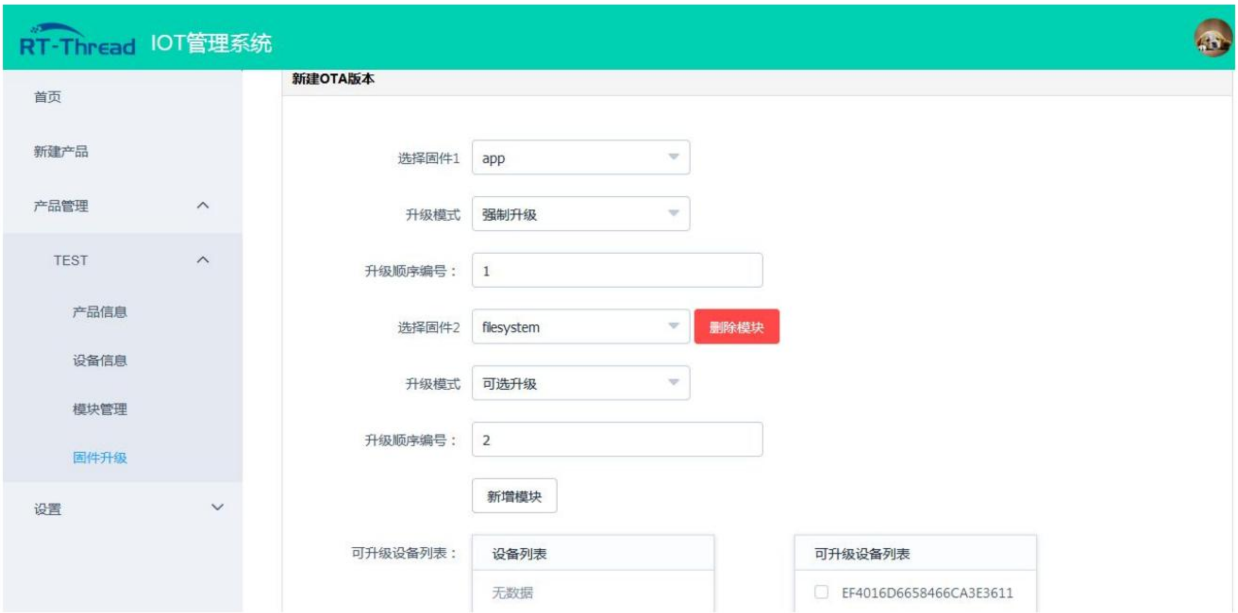
版本说明：

Figure 11: Firmware upload

- Firmware Type: The name of the firmware partition, which is consistent with the firmware name filled in when the tool generates the firmware;
- Firmware version number: It must be consistent with the firmware version filled in when the tool generates the firmware, and higher than the latest version number on the cloud;

Create a new **OTA** upgrade task:

After the firmware is uploaded successfully, you can create a new OTA upgrade task through the cloud (supports multiple firmware upgrades), and the cloud will push the upgrade request to the device. The device is upgraded. As shown in the following figure, two firmwares are packaged to generate an OTA upgrade task:


RT-Thread IOT管理系统
首页
新建产品
产品管理
TEST
产品信息
设备信息
模块管理
固件升级
设置
删除模块
新增模块

新建OTA版本

选择固件1 app

升级模式 强制升级

升级顺序编号：1

选择固件2 filesystem

升级模式 可选升级

升级顺序编号：2

可升级设备列表：

设备列表	可升级设备列表
无数据	☐ EF4016D6658466CA3E3611

Figure 12: New OTA Upgrade Tasks

- Upgrade Mode:

> Forced upgrade: Send an upgrade task, and the device will immediately execute the download
>
> upgrade. Optional upgrade: Send an upgrade task, and the user can customize the conditions for executing the download
>
> upgrade. Silent upgrade: Send an upgrade task, and the device will execute the download upgrade without prompting.

- Upgrade order: When upgrading multiple firmware, users can customize the upgrade order of multiple firmware. The cloud sends the upgrade task, and the device will upgrade according to the firmware.

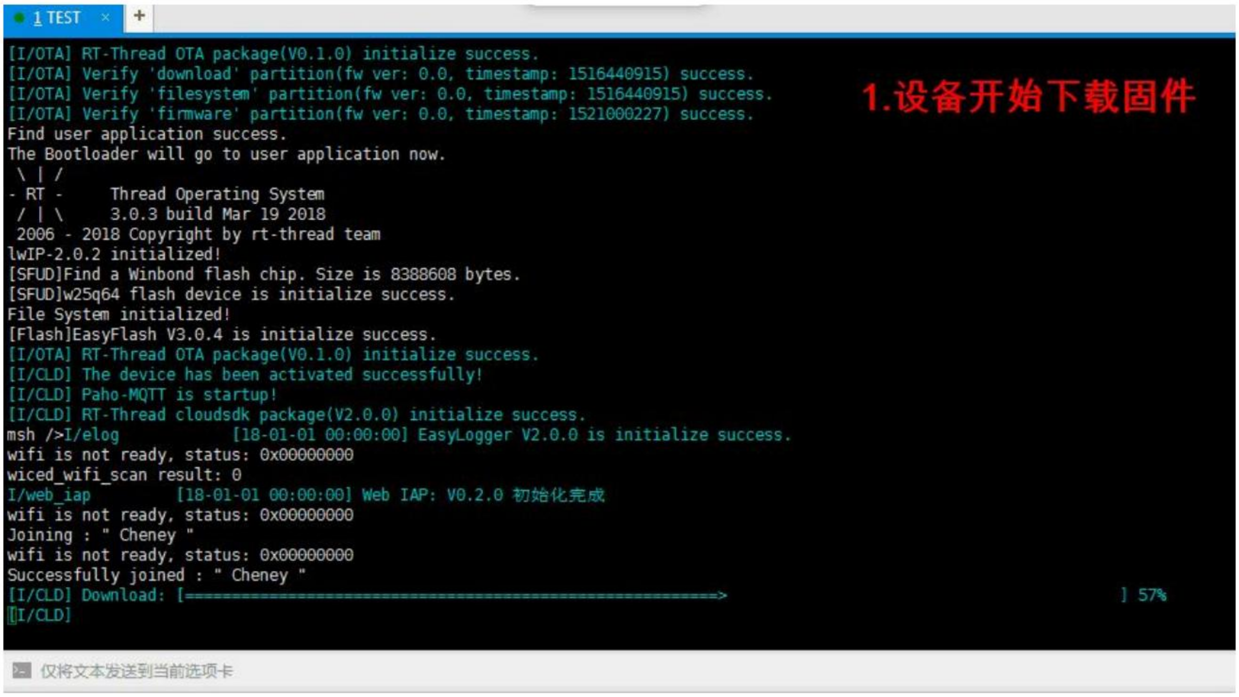
  Upgrade the firmware in the order of the firmware upgrade

- Upgradeable list: Users can add devices that need to be upgraded to the device list, and the cloud will send the upgrade task to the device list.

  on the device in;

Device **OTA** upgrade:

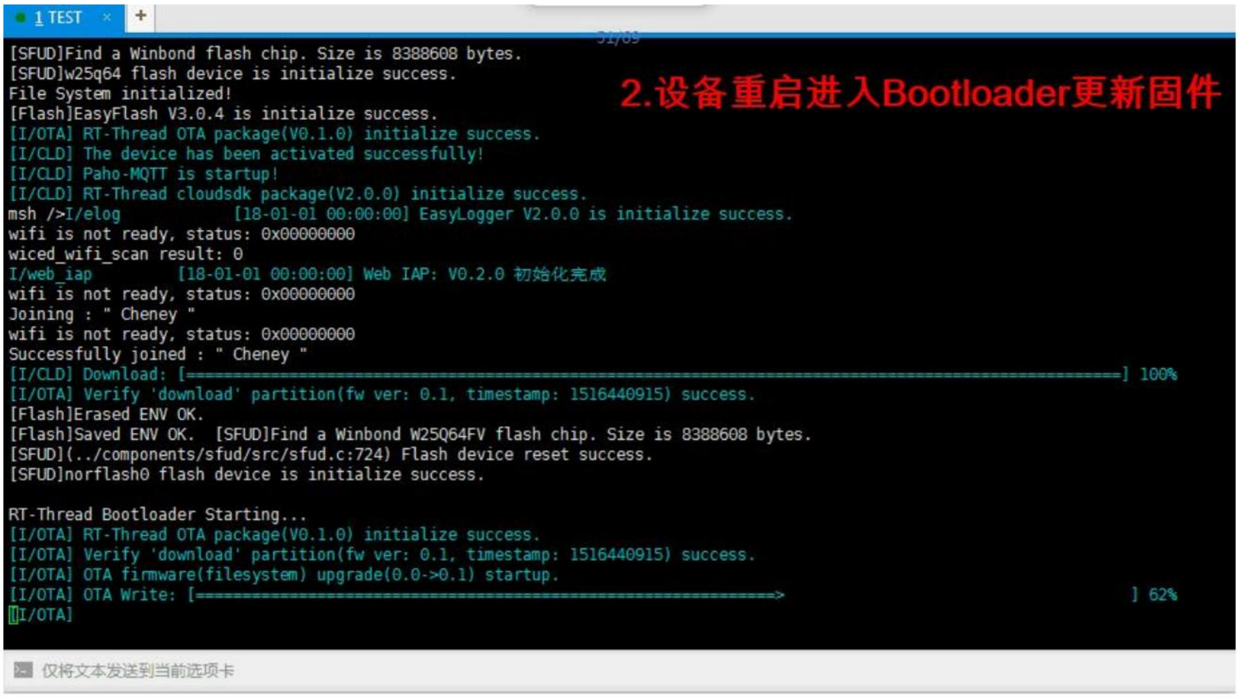
After the cloud upgrade task is successfully created, the cloud will send the firmware upgrade information through the MQTT protocol. After the device obtains the upgrade information, it will download the new firmware. If it is a multi-firmware upgrade, the device will restart once each time a firmware is upgraded until the last firmware is successfully upgraded. If there is a power outage or download failure during the upgrade process, the device supports breakpoint resume function to avoid repeated firmware downloads and reduce firmware upgrade time. The following figure shows the firmware download process:



```
[I/OTA] RT-Thread OTA package(V0.1.0) initialize success.
[I/OTA] Verify 'download' partition(fw ver: 0.0, timestamp: 1516440915) success.
[I/OTA] Verify 'filesystem' partition(fw ver: 0.0, timestamp: 1516440915) success.
[I/OTA] Verify 'firmware' partition(fw ver: 0.0, timestamp: 1521000227) success.
Find user application success.
The Bootloader will go to user application now.
 \ | /
- RT -     Thread Operating System
 / | \     3.0.3 build Mar 19 2018
 2006 - 2018 Copyright by rt-thread team
lwIP-2.0.2 initialized!
[SFUD]Find a Winbond flash chip. Size is 8388608 bytes.
[SFUD]w25q64 flash device is initialize success.
File System initialized!
[Flash]EasyFlash V3.0.4 is initialize success.
[I/OTA] RT-Thread OTA package(V0.1.0) initialize success.
[I/CLD] The device has been activated successfully!
[I/CLD] Paho-MQTT is startup!
[I/CLD] RT-Thread cloudsdk package(V2.0.0) initialize success.
msh />I/elog            [18-01-01 00:00:00] EasyLogger V2.0.0 is initialize success.
wifi is not ready, status: 0x00000000
wiced_wifi_scan result: 0
I/web_iap         [18-01-01 00:00:00] Web IAP: V0.2.0 初始化完成
wifi is not ready, status: 0x00000000
Joining : " Cheney "
wifi is not ready, status: 0x00000000
Successfully joined : " Cheney "
[I/CLD] Download: [=========================================================>                                           ] 57%
[I/CLD]
```

Figure 13: Device firmware download

After the device firmware is downloaded, the program will automatically jump to the Bootloader to run. The Bootloader will decompress and decrypt the firmware and copy the firmware to the specified application partition (here is the **filesystem** partition). The device status after the decompression, decryption and upgrade in the Bootloader is successful is as shown below:



```
[SFUD]Find a Winbond flash chip. Size is 8388608 bytes.
[SFUD]w25q64 flash device is initialize success.
File System initialized!
[Flash]EasyFlash V3.0.4 is initialize success.
[I/OTA] RT-Thread OTA package(V0.1.0) initialize success.
[I/CLD] The device has been activated successfully!
[I/CLD] Paho-MQTT is startup!
[I/CLD] RT-Thread cloudsdk package(V2.0.0) initialize success.
msh />I/elog           [18-01-01 00:00:00] EasyLogger V2.0.0 is initialize success.
wifi is not ready, status: 0x00000000
wiced_wifi_scan result: 0
I/web_iap         [18-01-01 00:00:00] Web IAP: V0.2.0 初始化完成
wifi is not ready, status: 0x00000000
Joining : " Cheney "
wifi is not ready, status: 0x00000000
Successfully joined : " Cheney "
[I/CLD] Download: [====================================================================================================] 100%
[I/OTA] Verify 'download' partition(fw ver: 0.1, timestamp: 1516440915) success.
[Flash]Erased ENV OK.
[Flash]Saved ENV OK.  [SFUD]Find a Winbond W25Q64FV flash chip. Size is 8388608 bytes.
[SFUD](../components/sfud/src/sfud.c:724) Flash device reset success.
[SFUD]norflash0 flash device is initialize success.

RT-Thread Bootloader Starting...
[I/OTA] RT-Thread OTA package(V0.1.0) initialize success.
[I/OTA] Verify 'download' partition(fw ver: 0.1, timestamp: 1516440915) success.
[I/OTA] OTA firmware(filesystem) upgrade(0.0->0.1) startup.
[I/OTA] OTA Write: [==============================================================>                                      ] 62%
[I/OTA]
```

Figure **14:** *Bootloader* Update the firmware

The firmware upgrade in the Bootloader is successful, the device automatically runs the new firmware, and the OTA upgrade process is completed;

4. Notes

- When creating a new device in the cloud, the SN device unique identifier entered must be consistent with the SN set in the CloudSDK library migration file ;
- The ProductID and ProductKey configured in the rt_cld_port.c file need to be the same as those obtained when creating a new product corresponding to the device in the cloud.

  ProductID and ProductKey are consistent;
- The first time the device is powered on and the CloudSDK component is started, an activation process is required. Make sure the device is connected to the Internet for activation to succeed.

  If the activation fails, a 400 error is returned. Check whether the SN obtained in the user-defined migration interface is consistent with the SN added when creating a new device on the cloud .