Espressif IOT SDK User Manual

Version 1.0.1

Espressif Systems IOT Team

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Table of Contents

1. Preambles

This manual introduces the setting up of toolchain, and codes for ESP8266-based SDK for Internet of Things.

More information can be found at Espressif's BBS: http://bbs.espressif.com/

The user starter guide can be found at: http://bbs.espressif.com/viewforum.php?f=21

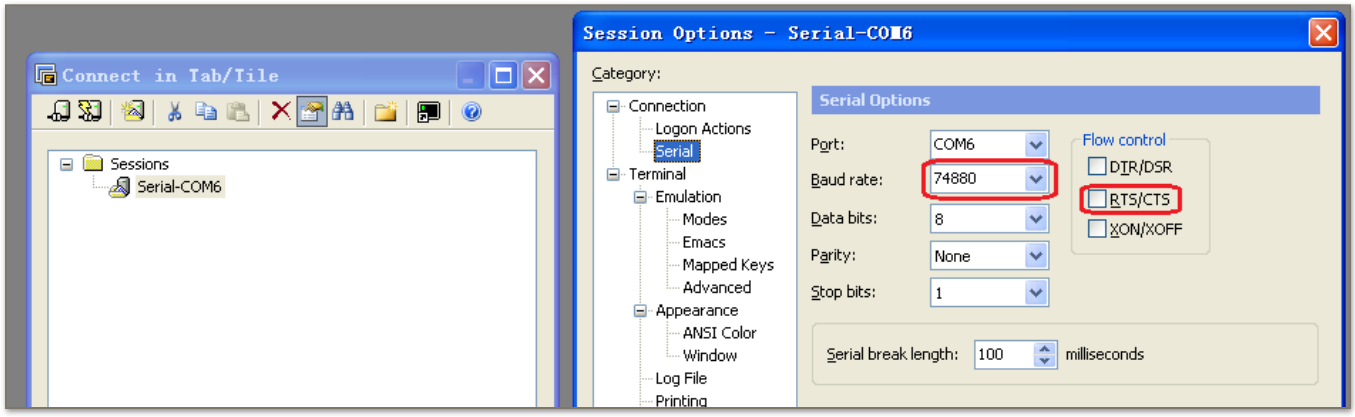
2. Development Tools

Use download tool to download the firmware to flash, use serial port tool to print logs to debug.

2.1. Serial Port Tool – SecureCRT

Here use SecureCRT as an example of serial port tool, in fact, you can use any other serial port tool to debug.

ESP8266 module adopts 74880 baud rate which can be set in SecureCRT.



2.2. Download Tools: FLASH_DOWNLOAD_TOOLS

Espressif provides the tool "ESP_FLASH_DOWNLOAD" for users to burn several bin files altogether at once, and download several complied *.bin files at a time into the SPI Flash on the ESP8266 motherboard.

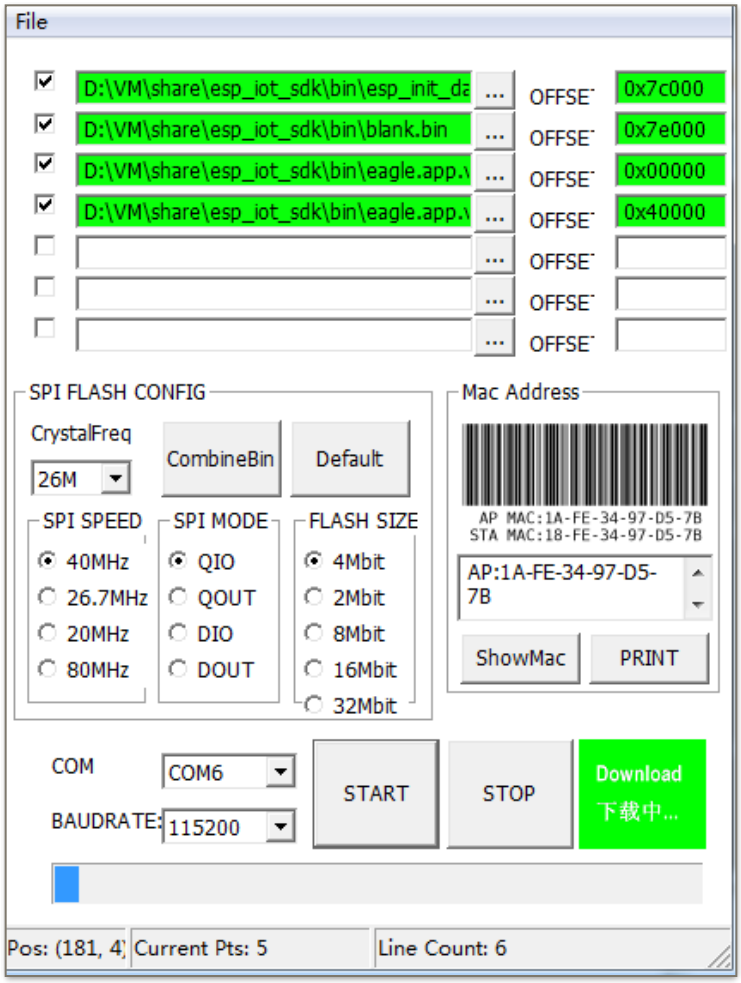
Using **ESP_FLASH_DOWNLOAD**:

1. Bin-Select Area: Choose bins to burn, and burn them in corresponding address.
2. SPI FLASH CONFIG: Set config of SPI flash. "CombineBin" merges all bins selected above to one (target.bin). "Default" reset to the default config.
3. Mac Address: MAC address of ESP8266.

Also set the jumper on the motherboard as **MTDO:0**, **GPIO0:0**, **GPIO2:1**; this causes the chip to enter the download mode. Steps are as follows:

- See the red boxes in the picture above, select the bin file to be written → fill in the path → check burning options.
- Set COM port and baud rate.
- Click "START" to start downloading.
- After the downloading, disconnect the power for the motherboard, and change the jumper into operation mode. Re-connect the power for operation. Set the jumper on the motherboard as **MTDO:0**, **GPIO0:1**, **GPIO2:1** for operating mode.

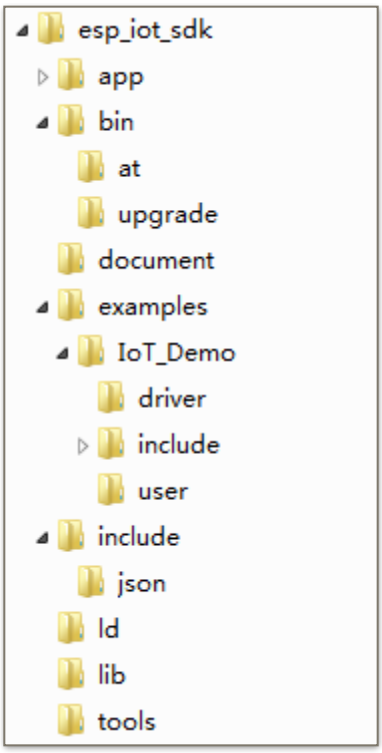
PS: Please disconnect the power when setting the jumper.



3. SDK Software Package

3.1. Directory Structure

All header files, library files and compilation files needed for secondary development are included in the SDK software package. See the picture below for directory structure:



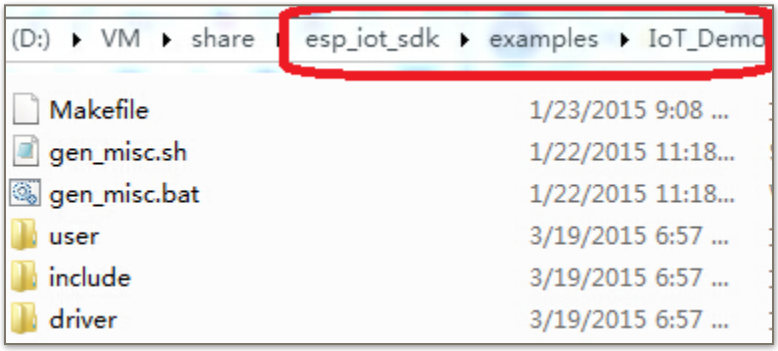
Detailed description:

- The "app" folder is the main working folder, we need to copy source codes to this folder to compile.
- "bin" folder stores the bin files downloaded into the Flash:
  - "at" folder :stores the bin files that support AT+ instructions, provided by Espressif;
  - "upgrade" folder :stores the bin files that support cloud update, generate by compilation;
  - "bin" folder root:stores the bin files that don't support cloud update, generate by compilation, and other bin files provided by Espressif.
- "examples" folder stores SDK examples, we need to copy the source code here (all files in the IoT_Demo folder) to "app" folder;
- "include" folder stores the header files pre-installed in the SDK, which may include relevant API functions and other definitions. Users can use them directly and do not need to change anything;

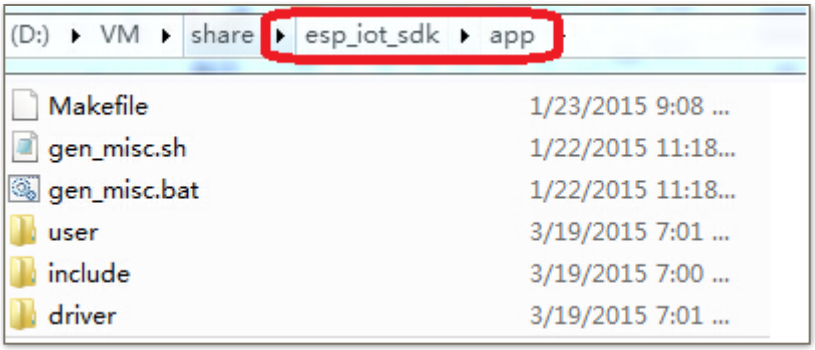
- "ld" folder stores the files needed for SDK software link. Users can use them directly and do not need to change anything;
- "lib" folder stores the library files needed for SDK compilation; "tools" folder stores the tools needed for generating bin files. Users can use them directly and do not need to change anything.

2. Compilation

When compiling, please remember to copy the sub-folders in the esp_iot_sdk/examples/IOT_Demo to esp_iot_sdk/app.



Copy all files in the picture above to esp_iot_sdk/app to compile.



2.1. Compilation for Version 0.9.5 SDK and After

With the release of esp_iot_sdk_v0.9.5, the compile process was simplified with a script in the APP folder.

Compile : ./gen_misc.sh

```
esp8266@esp8266-VirtualBox:~/Share/esp_iot_sdk/app$ ./gen_misc.sh
Please follow below steps(1-5) to generate specific bin(s):
STEP 1: choose boot version(0=boot_v1.1, 1=boot_v1.2+, 2=none)
enter(0/1/2, default 2):
```

Then follow the tips and steps.

Notice,

- boot_v1.1 & boot_v1.2 : we recommend using the latest boot; choosing boot in compilation will get user1.bin or user2.bin which support FOTA (firmware upgrade through WiFi)
- none boot : generate eagle.flash.bin and eagle.irom0text.bin which do not support FOTA.
- Compile succeeds: it shows the address for the bins to be written to. For example:

```
eagle.app.v6.flash.bin---------->addr:0x00000
eagle.app.v6.irom0text.bin------>addr:0x40000
!!!
esp8266@esp8266-VirtualBox:~/Share/esp_iot_sdk/app$
```

Or,

```
Generate user1.512.old.bin successully in folder bin/upgrade.
Support boot_v1.1 and +
user1.512.old.bin------>addr:0x1000
!!!
esp8266@esp8266-VirtualBox:~/Share/esp_iot_sdk/app$
```

2.2. Compilation for Version 0.9.5 SDK and After

For esp_iot_sdk_v0.9.4 and before, FW does not support upgrade through WiFi compiled by ./gen_misc.sh.

FW support upgrade through WiFi (FOTA) compiled as:

(1) Run ./gen_misc_plus.sh 1 to generate user1.bin at /esp_iot_sdk/bin/upgrade

(2) Run make clean to clean up all previous compilation

(3) Run ./gen_misc_plus.sh 2 to generate user2.bin at /esp_iot_sdk/bin/upgrade

Note:

1) Please refer to document "**Firmware update through cloud server**" for details about FOTA.
2) `esp_iot_sdk_v0.7` and previous versions do not support FOTA.
3) `esp_iot_sdk_v0.8` and later versions support cloud update and are compatible with previous compilation and burning methods.

3. Writing Image Into Flash

According to compiling method and flash size, we can choose one of the following ways to write the image to the flash device.

Note:

- Flash system parameter area is the last 4 sectors of flash, 4KBytes per sector, so it's the last 16KB of flash;
- Flash user parameter area depends on user-defined application; in IOT_Demo which is using 512KB flash as example, user parameter area is 4 sectors start from `0x3C000`
- `master_device_key.bin` is needed if you are using Espressif Cloud，otherwise it need not to burn into Flash; it is only necessary for initial write-in and revision of `master_device_key`; download into the third sector of user parameter area.
- `blank.bin` as initialization, to be written to the last but one in flash;
- `esp_init_data_default.bin` stores default RF parameter values and to be written to the forth sector from the end of flash;
- How to use 1MB or larger flash can refer to BBS : http://bbs.espressif.com/viewtopic.php?f=10&t=305

3.1. Without Support For Cloud Update (OTA)

1. 512KB Flash

bin	Address	Description
master_device_key.bin	0x3E000	Obtained from Espressif Cloud by users themselves to get Espressif Cloud service
esp_init_data_default.bin	0x7C000	Stores default RF parameter values, provided in SDK
blank.bin	0x7E000	Stores default system parameter values, provided in SDK
eagle.flash.bin	0x00000	Compiled by the steps said above
eagle.irom0text.bin	0x40000	Compiled by the steps said above

2. 1MB Flash

bin	Address	Description
master_device_key.bin	0x3E000	Obtained from Espressif Cloud by users themselves to get Espressif Cloud service
esp_init_data_default.bin	0xFC000	Stores default RF parameter values, provided in SDK
blank.bin	0xFE000	Stores default system parameter values, provided in SDK
eagle.flash.bin	0x00000	Compiled by the steps said above
eagle.irom0text.bin	0x40000	Compiled by the steps said above

3. 2MB Flash

bin	Address	Description
master_device_key.bin	0x3E000	Obtained from Espressif Cloud by users themselves to get Espressif Cloud service
esp_init_data_default.bin	0x1FC000	Stores default RF parameter values, provided in SDK
blank.bin	0x1FE000	Stores default system parameter values, provided in SDK
eagle.flash.bin	0x00000	Compiled by the steps said above
eagle.irom0text.bin	0x40000	Compiled by the steps said above

4. 4MB Flash

bin	Address	Description
master_device_key.bin	0x3E000	Obtained from Espressif Cloud by users themselves to get Espressif Cloud service
esp_init_data_default.bin	0x3FC000	Stores default RF parameter values, provided in SDK
blank.bin	0x3FE000	Stores default system parameter values, provided in SDK
eagle.flash.bin	0x00000	Compiled by the steps said above
eagle.irom0text.bin	0x40000	Compiled by the steps said above

3.2. Version that support Cloud Update (OTA)

Note:

- `User2.bin` need not to burn into Flash, it can be download through WiFi (FOTA)

1. 512KB Flash

bin	Address	Description
master_device_key.bin	0x3E000	Obtained from Espressif Cloud by users themselves to get Espressif Cloud service
esp_init_data_default.bin	0x7C000	Stores default RF parameter values, provided in SDK
blank.bin	0x7E000	Stores default system parameter values, provided in SDK
boot.bin	0x00000	Boot loader, provided in SDK, recommend to use the latest version
user1.bin	0x01000	Compiled by the steps said above
user2.bin	0x41000	Compiled by the steps said above, need not to be burned into flash, can be download through WiFi as upgrade

2. 1MB Flash

bin	Address	Description
master_device_key.bin	0x3E000	Obtained from Espressif Cloud by users themselves to get Espressif Cloud service; to be written into the third sector of flash user parameter area which is 0x3E000 in IOT_Demo, can be changed by user. If using 1MB or larger flash, recommend to change it to 0x7E000, refer to BBS http://bbs.espressif.com/viewtopic.php?f=10&t=305
esp_init_data_default.bin	0xFC000	Stores default RF parameter values, provided in SDK
blank.bin	0xFE000	Stores default system parameter values, provided in SDK
boot.bin	0x00000	Boot loader, provided in SDK, recommend to use the latest version
user1.bin	0x01000	Compiled by the steps said above
user2.bin	0x81000	Compiled by the steps said above, need not to be burned into flash, can be download through WiFi as upgrade

3. 2MB Flash

bin	Address	Description
master_device_key.bin	0x3E000	Obtained from Espressif Cloud by users themselves to get Espressif Cloud service; to be written into the third sector of flash user parameter area which is 0x3E000 in IOT_Demo, can be changed by user. If using 1MB or larger flash, recommend to change it to 0x7E000, refer to BBS http://bbs.espressif.com/viewtopic.php?f=10&t=305
esp_init_data_default.bin	0x1FC000	Stores default RF parameter values, provided in SDK
blank.bin	0x1FE000	Stores default system parameter values, provided in SDK
boot.bin	0x00000	Boot loader, provided in SDK, recommend to use the latest version
user1.bin	0x01000	Compiled by the steps said above
user2.bin	0x81000	Compiled by the steps said above, need not to be burned into flash, can be download through WiFi as upgrade

4. 4MB Flash

bin	Address	Description
master_device_key.bin	0x3E000	Obtained from Espressif Cloud by users themselves to get Espressif Cloud service; to be written into the third sector of flash user parameter area which is 0x3E000 in IOT_Demo, can be changed by user. If using 1MB or larger flash, recommend to change it to 0x7E000, refer to BBS http://bbs.espressif.com/viewtopic.php?f=10&t=305
esp_init_data_default.bin	0x3FC000	Stores default RF parameter values, provided in SDK
blank.bin	0x3FE000	Stores default system parameter values, provided in SDK
boot.bin	0x00000	Boot loader, provided in SDK, recommend to use the latest version
user1.bin	0x01000	Compiled by the steps said above
user2.bin	0x81000	Compiled by the steps said above, need not to be burned into flash, can be download through WiFi as upgrade