ESP8266

Quick Start Guide

Version 1.2

About This Guide

This document is a quick user guide to getting started with ESP8266. The document is structured as follows.

Chapter	Title	Content
Chapter 1	Configuring the Development Board—ESP-LAUNCHER.	Introduction to the ESP8266 development board—ESP-LAUNCHER, and how to download firmware to the board and run it.
Chapter 2	Compiling Applications	Compiling the AT application based on ESP8266_NONOS_SDK as example.
Chapter 3	Learn More About ***ESP8266_RTOS_SDK***	More information on ***ESP8266_RTOS_SDK***.
Chapter 4	Debug Methods	Common debugging methods and sample codes.
Chapter 5	Downloading Firmware into The ESP-WROOM-02	Introduction on how to flash firmware with ESP-WROOM-02.
Appendix A	Learning Resources	ESP8266-related must-read documents and must-have resources.

Release Notes

Date	Version	Release notes
2016.08	V1.0	First release.
2016.11	V1.1	Added Appendix A—Learning Resources.
2017.01	V1.2	Added two Github links of RTOS and non-OS SDK sample code in Appendix A.2—Must-Have Resources.

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1. Configuring the development board—ESP-LAUNCHER

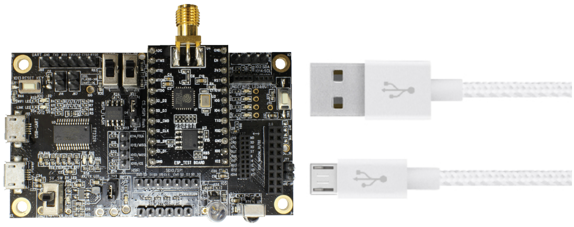
1.1. Hardware Preparation

To get started with developing applications for the ESP8266, hardware and the corresponding software tools are needed as follows:

- One of the following ESP8266 Hardware Development Kit (HDK):
  - ESP8266 official development board, ESP-LAUNCHER, as shown in Table 1-1.
  - ESP8266 official module, ESP-WROOM-02, as described in ***Chapter 5***.
- PC for programming: Windows XP or Windows 7 OS is recommended, with enough RAM to run a Linux virtual machine.
- Micro USB cable.

> 📖 ***Notes:***
>
> - *If users use the third-party development boards or modules that integrate the ESP8266, please use the development firmware provided by the corresponding manufacturers.*
> - *To purchase ESP-WROOM-02 or ESP-LAUNCHER, please visit Espressif's official online store at: https://espressif.taobao.com,.*

Table 1-1. The ESP8266 Development Board

ESP-LAUNCHER	
• 1 ESP-LAUNCHER • 1 Micro USB cable	

> ⚠️ **Notice:**
>
> *The ESP8266 Wi-Fi module requires 3.3V power supply and may draw a minimum current of 500 mA.*

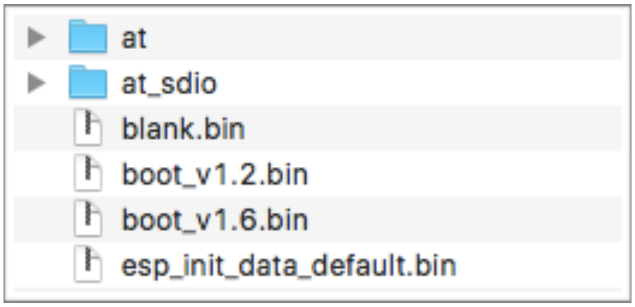
1.2. Software Preparation

- ESP8266 official Flash Download Tool
  - Download: http://www.espressif.com/support/download/other-tools
- ESP8266 official SDK

  - Download SDK: http://www.espressif.com/support/download/sdks-demos
  - The official AT firmware (ESP8266_NONOS_SDK\bin\at) can be downloaded into the ESP-LAUNCHER by referring to the BIN locations mentioned in the ***Readme*** file which is in the same directory. For instructions on downloading the firmware into the ESP-LAUNCHER, please refer to ***Section 1.3***.
- PC UART terminal emulator tool
  - SecureCRT/minicom is recommended.
  - UART tools mentioned above can support the default baud rate of 74880. Note that certain USB-UART converters may not support all baud rates if users use a third-party development board.

1.3. Download Firmware into the ESP-LAUNCHER

1. Using the ***ESP8266_NONOS_SDK_V2.0.0_16_07_19*** as example. The AT firmware binaries are located in ***ESP8266_NONOS_SDK_V2.0.0_16_07_19\ESP8266_NONOS_SDK\bin***.



```
at
at_sdio
blank.bin
boot_v1.2.bin
boot_v1.6.bin
esp_init_data_default.bin
```

Figure 1-1. ESP8266_NONOS_SDK BIN Folder

2. Settings of the development board, ESP-LAUNCHER.

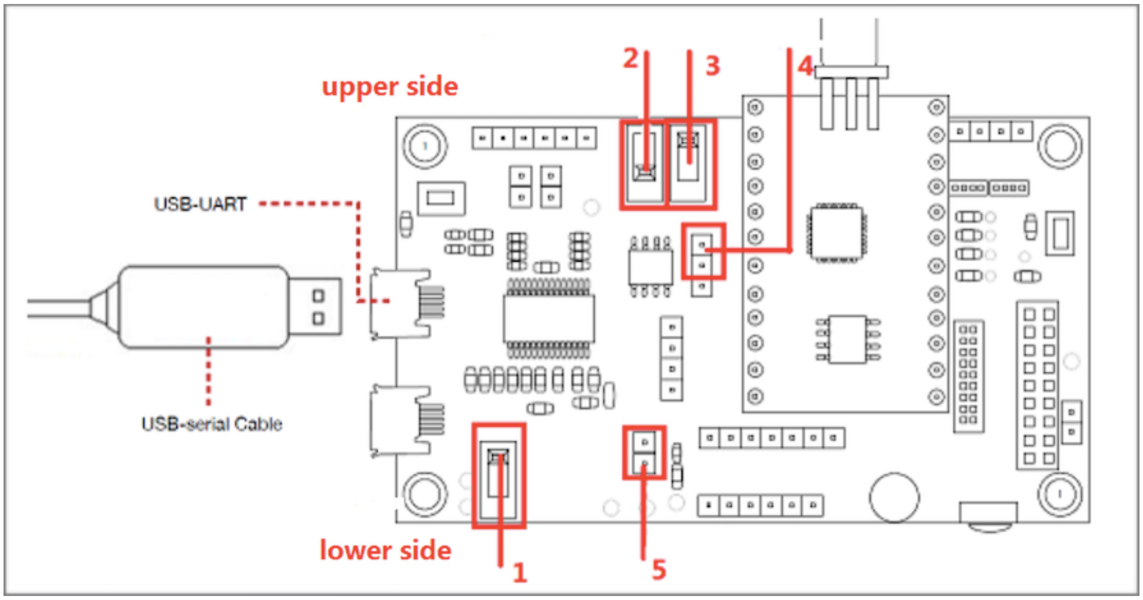
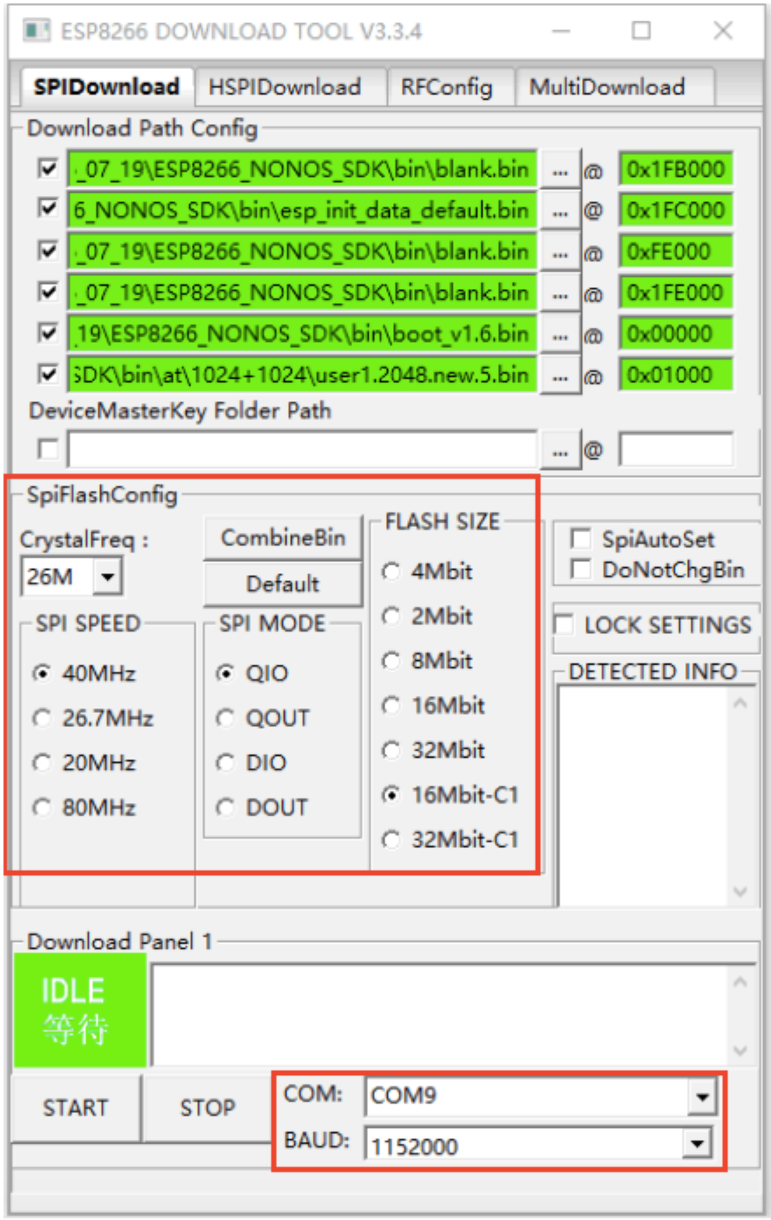


Figure 1-2. The ESP-LAUNCHER

- The ***switch 1***: toggle to the lower side;
- The ***switch 2***: toggle to the lower side;
- The ***switch 3***: toggle to the upper side;
- The ***pin4***: put a jumper cap on the above 2 pins;
- The ***pin5***: put a jumper cap on it.

3. Use micro USB cable to connect the ESP-LAUNCHER to the PC. The UART driver needs to be installed on the PC.

4. Double-click ***ESPFlashDownloadTool_v3.3.4.exe*** to run the ESP8266 Flash Download Tool on the PC.



Download Path Config

☑	_07_19\ESP8266_NONOS_SDK\bin\blank.bin	@	0x1FB000
☑	6_NONOS_SDK\bin\esp_init_data_default.bin	@	0x1FC000
☑	_07_19\ESP8266_NONOS_SDK\bin\blank.bin	@	0xFE000
☑	_07_19\ESP8266_NONOS_SDK\bin\blank.bin	@	0x1FE000
☑	19\ESP8266_NONOS_SDK\bin\boot_v1.6.bin	@	0x00000
☑	SDK\bin\at\1024+1024\user1.2048.new.5.bin	@	0x01000

DeviceMasterKey Folder Path

□ @

SpiFlashConfig

CrystalFreq : 26M

SPI SPEED: ● 40MHz ○ 26.7MHz ○ 20MHz ○ 80MHz

SPI MODE: ● QIO ○ QOUT ○ DIO ○ DOUT

FLASH SIZE: ○ 4Mbit ○ 2Mbit ○ 8Mbit ○ 16Mbit ○ 32Mbit ● 16Mbit-C1 ○ 32Mbit-C1

□ SpiAutoSet
□ DoNotChgBin
□ LOCK SETTINGS

DETECTED INFO

Download Panel 1

COM: COM9
BAUD: 1152000

Figure 1-3. ESP8266 Flash Download Tool

Figure 1-3 uses ***16Mbit-C1*** (1024+1024 map) flash as an example. The locations of binaries to be downloaded into are shown in Table 1-2.

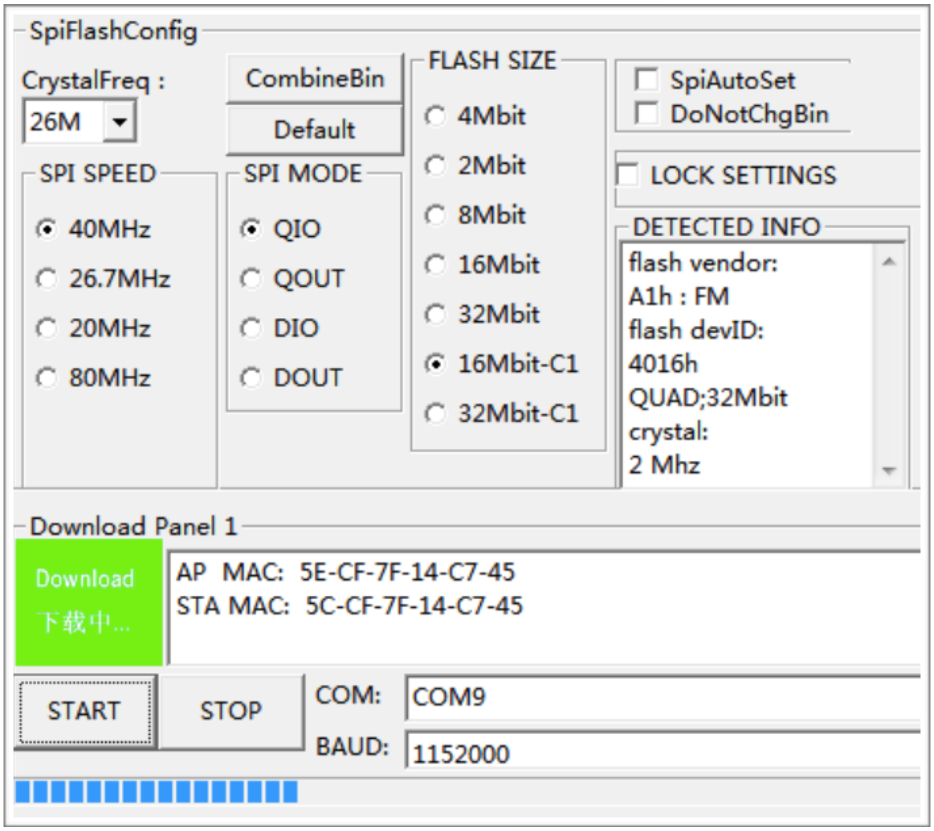
Table 1-2. Download AT Binaries for 16 Mbit-C1 Flash Map

BIN	Address	Description
blank.bin	0x1FB000	It initializes RF_CAL parameter area.
esp_init_data_default.bin	0x1FC000	It stores the default RF parameter values and has to be downloaded into the flash at least once. If the RF_CAL parameter area is initialized, this BIN has to be downloaded too.
blank.bin	0xFE000	It initializes the user parameter area.
blank.bin	0x1FE000	It initializes the system parameter area.
boot.bin	0x00000	It is the main program located in ***\bin\at***.
user1.2048.new.5.bin	0x01000	It is the main program located in ***\bin\at\1024+1024***.

📖 ***Notes:***

- *The **SpiFlashConfig** and the **COM** on the ESP8266 Flash Download Tool should be set according to the actual situation.*
- *For more information on downloading AT firmware, please refer to documentation ESP8266 AT Instruction Set.*

5. Click the ***START*** button and wait for the ESP-LAUNCHER to power up.
6. Power on the ESP-LAUNCHER by toggling the ***switch 1*** in Figure 1-2 to the upper side.
7. The ESP8266 Flash Download Tool will start to download AT firmware into the ESP-LAUNCHER. The ***DETECTED INFO*** area will display information of the flash chip on the ESP-LAUNCHER.



CrystalFreq : 26M

SPI SPEED: ● 40MHz ○ 26.7MHz ○ 20MHz ○ 80MHz

SPI MODE: ● QIO ○ QOUT ○ DIO ○ DOUT

FLASH SIZE: ○ 4Mbit ○ 2Mbit ○ 8Mbit ○ 16Mbit ○ 32Mbit ● 16Mbit-C1 ○ 32Mbit-C1

□ SpiAutoSet
□ DoNotChgBin
□ LOCK SETTINGS

DETECTED INFO
flash vendor:
A1h : FM
flash devID:
4016h
QUAD;32Mbit
crystal:
2 Mhz

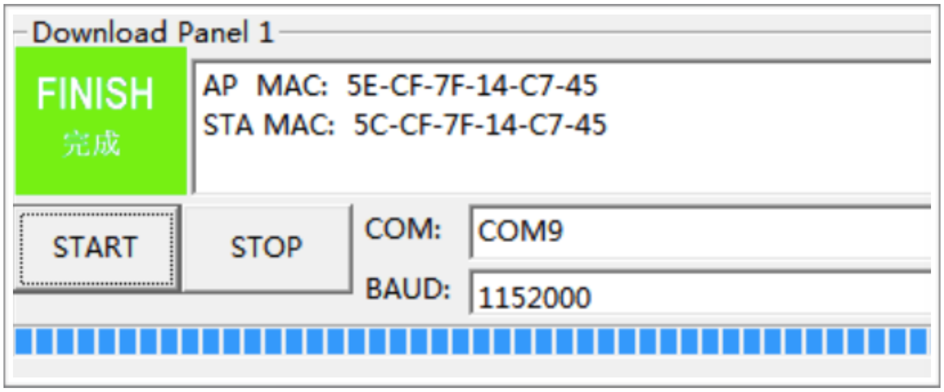
Download Panel 1
Download
下载中...

AP MAC: 5E-CF-7F-14-C7-45
STA MAC: 5C-CF-7F-14-C7-45

COM: COM9
BAUD: 1152000

Figure 1-4. ESP8266 Flash Download Tool - Downloading Firmware

8. After the download is finished, toggle the ***switch 1*** to the lower side to power off the ESP-LAUNCHER.



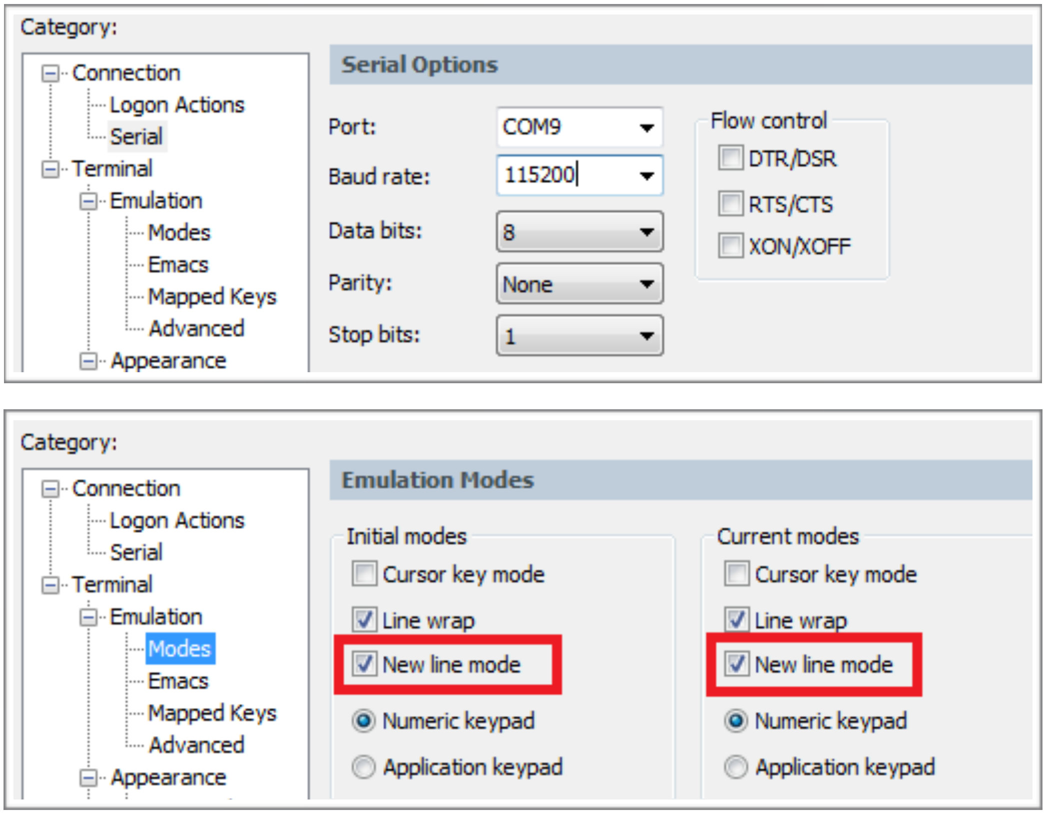
Download Panel 1
FINISH
完成

AP MAC: 5E-CF-7F-14-C7-45
STA MAC: 5C-CF-7F-14-C7-45

COM: COM9
BAUD: 1152000

Figure 1-5. ESP8266 Flash Download Tool - Finishing downloading Firmware

9. Open the UART tool on PC, set baud rate to 115200, check the ***New line mode*** for the UART tool.



Category:

- Connection
  - Logon Actions
  - Serial
- Terminal
  - Emulation
    - Modes
    - Emacs
    - Mapped Keys
    - Advanced
  - Appearance

Serial Options

Port: COM9

Baud rate: 115200

Data bits: 8

Parity: None

Stop bits: 1

Flow control

□ DTR/DSR

□ RTS/CTS

□ XON/XOFF

Category:

- Connection
  - Logon Actions
  - Serial
- Terminal
  - Emulation
    - Modes
    - Emacs
    - Mapped Keys
    - Advanced
  - Appearance

Emulation Modes

Initial modes

□ Cursor key mode

☑ Line wrap

☑ New line mode

● Numeric keypad

○ Application keypad

Current modes

□ Cursor key mode

☑ Line wrap

☑ New line mode

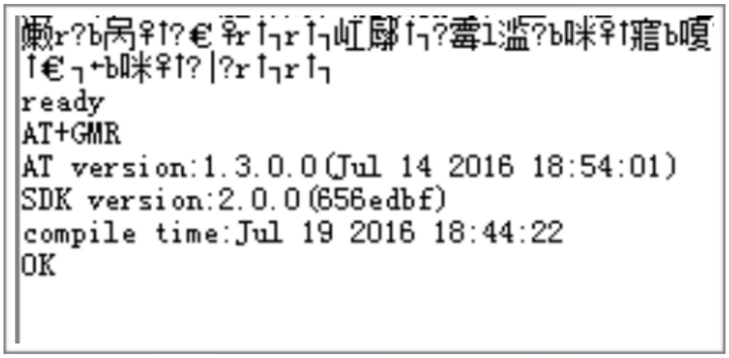
● Numeric keypad

○ Application keypad

Figure 1-6. UART Emulator Tool on the PC

10.Set the ESP8266 to operation mode by toggling the ***switch 2*** to the upper side. Then toggle the ***switch 1*** to the upper side to power on the ESP-LAUNCHER.

At first, the PC UART tool will output some garbage characters (which is normal, because the power-on-default baud rate of ESP8266 is 74880). The PC UART tool will then output "ready" message, indicating that the ESP-LAUNCHER is running the AT firmware successfully.



```
瀬r?b冎?t?€?r t┐r t┐屽鄏t┐?毒l滥?b咪?t瘖b嗄
t€┐+b咪?t?|?r t┐r t┐
ready
AT+GMR
AT version:1.3.0.0(Jul 14 2016 18:54:01)
SDK version:2.0.0(656edbf)
compile time:Jul 19 2016 18:44:22
OK
```

Figure 1-7. AT Logs on the UART Tool

11.Input command `AT+GMR` through the UART tool, and press ***Enter*** button. You will get a response printing the version information of the AT firmware.

For more AT commands and examples, please refer to documents: *ESP8266 AT Instruction Set* and *ESP8266 AT Command Examples*.

2. Compiling Applications

This chapter describes how to compile a program based on the ***ESP8266_NONOS_SDK***, using the AT demo application provided by Espressif Systems as an example.

2.1. Downloading the Virtual Machine

1. PC: Windows XP or Windows 7 OS is recommended.
2. The development environment provided by Espressif Systems is based on Lubuntu. The Espressif Systems also provides a virtual image of the development environment that can be run on VirtualBox.
    - Download ***VirtualBox-5.0.16-105871-Win.exe*** from:

      https://www.virtualbox.org/wiki/Downloads

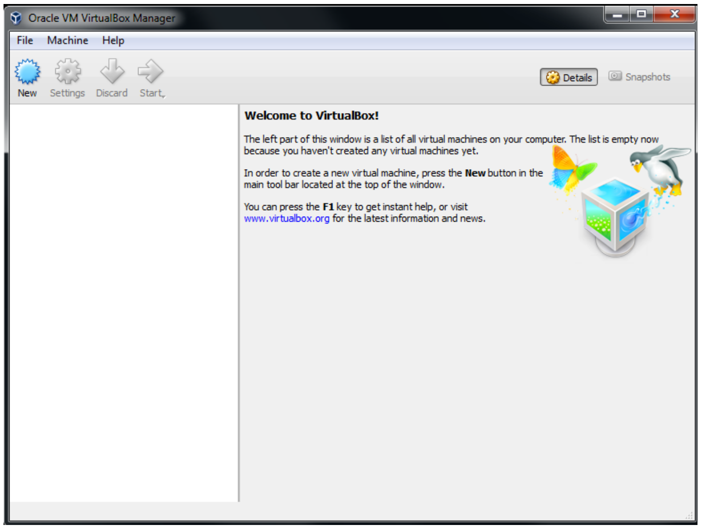
> 📖 ***Note:***
>
> *Please choose the correct version of VirtualBox according to the host machine's OS.*

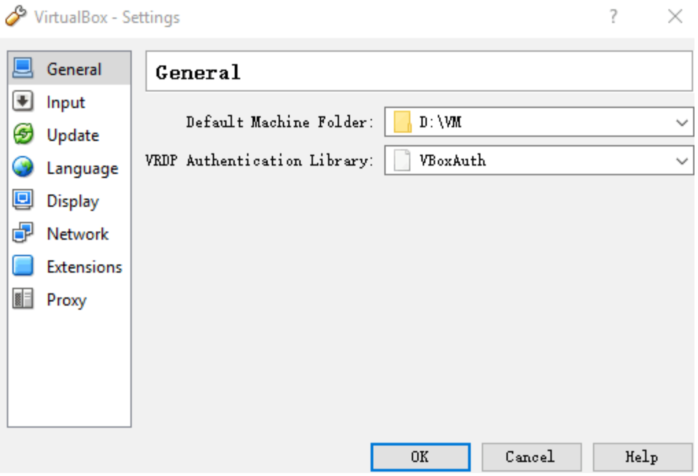
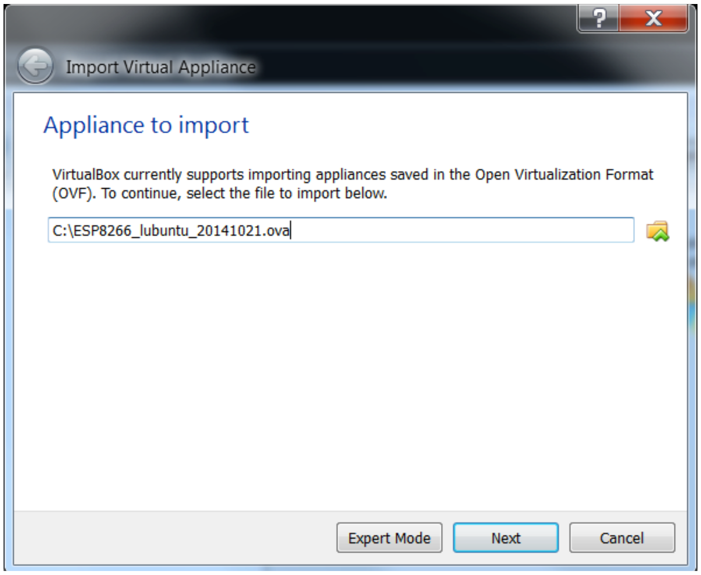
- Download ***ESP8266_lubuntu_20141021.ova*** from:

  Baidu: *https://pan.baidu.com/s/1dEOw8bZ* (Password: v81b)

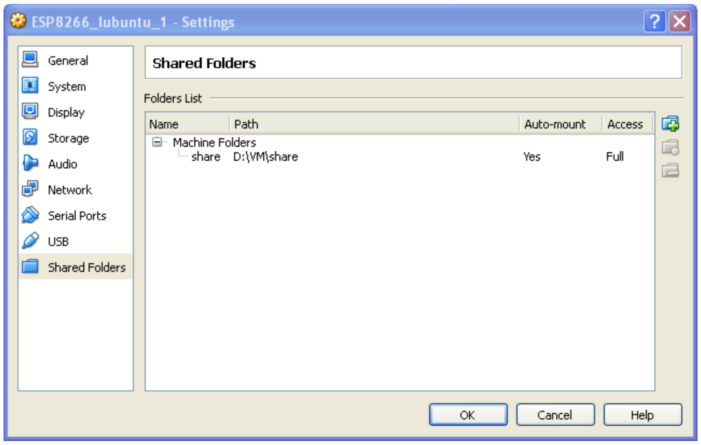
  Google: *https://drive.google.com/folderview?id=0B5bwBE9A5dBXaExvdDExVFNrUXM&usp=sharing*

2.2. Setting up Development Environment

Steps	Results
1. Start Windows OS and install the virtual machine.	
• Double-click ***VirtualBox-5.0.16-105871-Win.exe*** and install VirtualBox. 📖 ***Note:*** *VirtualBox has different versions. We are using Windows V.5.0.16 as an example.* • Double-click ***Oracle VM VirtualBox.exe*** to run the program and the system will display the main menu 👉 . 💬 ***Tip:*** *ESP8266 virtual machine takes up a lot of space (RAM). Please make sure the machine has enough memory to spare.*	 Oracle VM VirtualBox Manager File Machine Help New Settings Discard Start Details Snapshots **Welcome to VirtualBox!** The left part of this window is a list of all virtual machines on your computer. The list is empty now because you haven't created any virtual machines yet. In order to create a new virtual machine, press the **New** button in the main tool bar located at the top of the window. You can press the **F1** key to get instant help, or visit www.virtualbox.org for the latest information and news.

Steps	Results
2. Set VirtualBox default machine folder.	
• Create a new folder, for example, ***D:\VM.*** • Select ***File*** > ***Preferences***, the system shows the dialog box 👉. • In the ***General*** tab, set the location for the virtual machine in ***Default Machine Folder***, for example, ***D:\VM***. 💬 ***Tip:*** *ESP8266 virtual machine takes up a lot of space (RAM). Please make sure the machine has enough memory to spare.*	 VirtualBox - Settings General Input Update Language Display Network Extensions Proxy General Default Machine Folder: D:\VM VRDP Authentication Library: VBoxAuth
3. Import the image file.	
• Select ***File*** > ***Import Appliance***, a dialog box will show up 👉. • Select the image file, for example, ***C:\ESP8266_lubuntu_20141021.ova***, and click ***Next***. • Click ***Import*** to confirm the settings.	 Import Virtual Appliance Appliance to import VirtualBox currently supports importing appliances saved in the Open Virtualization Format (OVF). To continue, select the file to import below. C:\ESP8266_lubuntu_20141021.ova
4. Create a shared folder.	

- Create a new folder named ***D:\VM\share***.
- Select ***Machine > Settings > Shared Folders…***, a dialog box will show up 👉.
- Select the shared folder in ***Machine Folders***, for example, ***D:\VM\share***.


ESP8266_lubuntu_1 - Settings

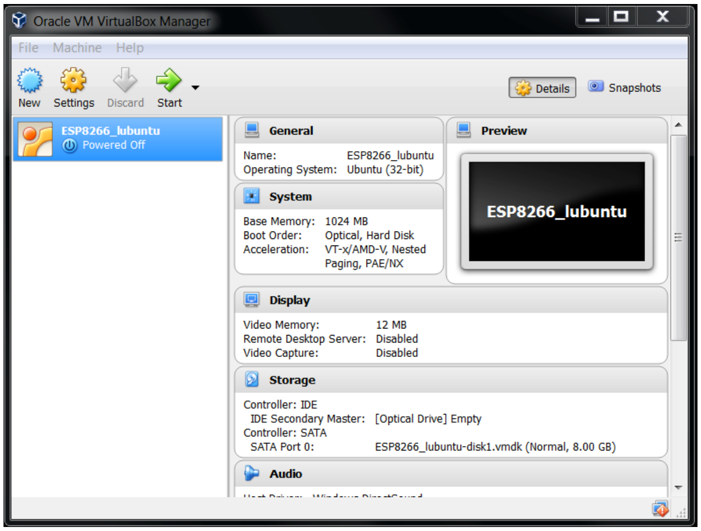
Shared Folders

Folders List

Name	Path	Auto-mount	Access
Machine Folders			
share	D:\VM\share	Yes	Full

5. Run the virtual machine.

- After importing, a virtual machine named ***ESP8266_lubuntu*** shows up 👉.
- Double-click ***ESP8266_lubuntu*** or ***Start*** to power on the virtual machine.


Oracle VM VirtualBox Manager

ESP8266_lubuntu
Powered Off

General
Name: ESP8266_lubuntu
Operating System: Ubuntu (32-bit)

System
Base Memory: 1024 MB
Boot Order: Optical, Hard Disk
Acceleration: VT-x/AMD-V, Nested Paging, PAE/NX

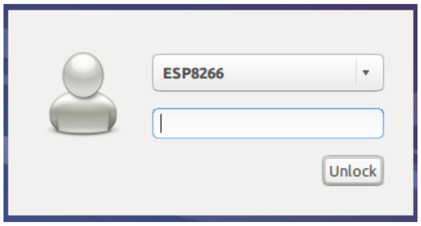
Preview
ESP8266_lubuntu

Display
Video Memory: 12 MB
Remote Desktop Server: Disabled
Video Capture: Disabled

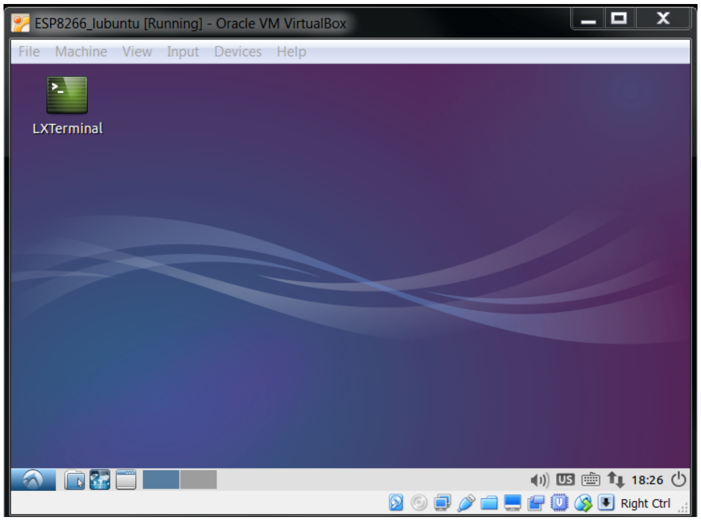
Storage
Controller: IDE
IDE Secondary Master: [Optical Drive] Empty
Controller: SATA
SATA Port 0: ESP8266_lubuntu-disk1.vmdk (Normal, 8.00 GB)

Audio

- The system shows ESP8266 virtual machine 👉.
- If the virtual machine enters idle mode and is locked, a dialog box as below 👇 will show up, please enter the password: ***espressif***.

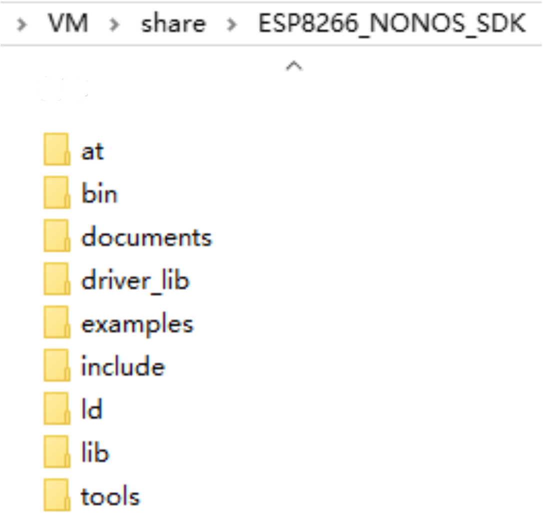

ESP8266

- Double-click ***LXTerminal*** to start compiling applications, for more details please refer to ***Chapter 2.3***.


ESP8266_lubuntu [Running] - Oracle VM VirtualBox

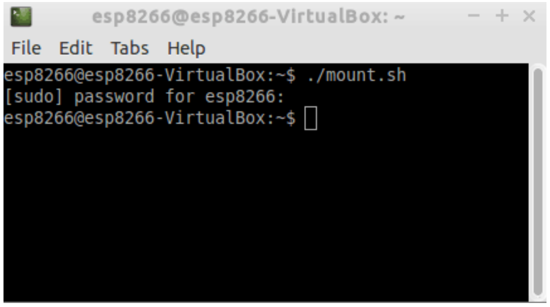
2.3. Compiling Applications Using *ESP8266_NONOS_SDK*

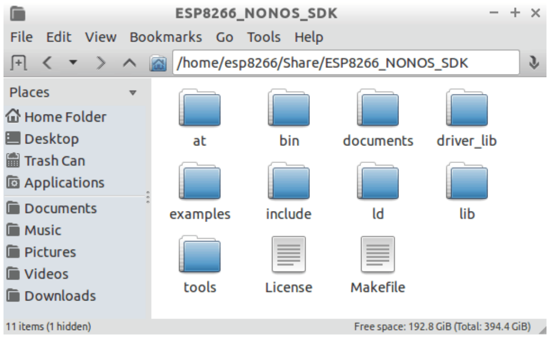
1. Start the virtual machine. Run ***LXTerminal*** on the desktop of the virtual machine.
2. Copy the ***ESP8266_NONOS_SDK*** to be compiled to the shared folder.

Steps	Result
• Copy ***ESP8266_NONOS_SDK*** folder on PC to the shared directory, for example, ***D:\VM\share***. • Copy ***ESP8266_NONOS_SDK\examples\at*** folder to the directory ***D:\VM\share \ESP8266_NONOS_SDK***, as shown in the figure on the right 👉.	 › VM › share › ESP8266_NONOS_SDK at bin documents driver_lib examples include ld lib tools

3. Mount the shared directory to the virtual machine.

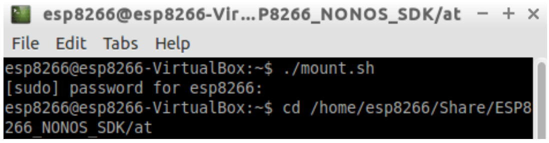
Steps	Result

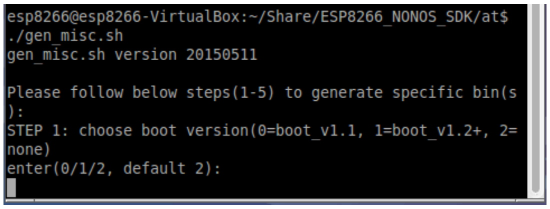
• Execute command `./mount.sh` in the LXTerminal.
• Input the password: ***espressif***. Shared folder mounting is completed.
	
	`esp8266@esp8266-VirtualBox:~$ ./mount.sh`
	`[sudo] password for esp8266:`
	`esp8266@esp8266-VirtualBox:~$`

• Open the shared directory ***ESP8266_NONOS_SDK*** in the virtual machine and confirm if the mounting is successful. - If successful, the directory contains files as the figure on the right 👉 shows. - If not, the directory will be empty and you will need to repeat the above step again.	 ESP8266_NONOS_SDK File Edit View Bookmarks Go Tools Help /home/esp8266/Share/ESP8266_NONOS_SDK Places Home Folder Desktop Trash Can Applications Documents Music Pictures Videos Downloads at bin documents driver_lib examples include ld lib tools License Makefile 11 items (1 hidden) Free space: 192.8 GiB (Total: 394.4 GiB)

4. Change the directory to ***/share/ESP8266_NONOS_SDK/at*** in the LXTerminal and compile it.

Steps	Result

• In the LXTerminal, change the directory by executing command: `cd /home/esp8266/Share/ESP8266_NONOS_SDK/at`	 esp8266@esp8266-Vir…P8266_NONOS_SDK/at
	File Edit Tabs Help
	`esp8266@esp8266-VirtualBox:~$ ./mount.sh`
	`[sudo] password for esp8266:`
	`esp8266@esp8266-VirtualBox:~$ cd /home/esp8266/Share/ESP8`
	`266_NONOS_SDK/at`

• Then execute command: `./gen_misc.sh` to start compiling.
• For example, the choices for STEP 1 ~ 5 in the compilation can be: 1, 1, 2, 0 and 5 respectively.
	
	`esp8266@esp8266-VirtualBox:~/Share/ESP8266_NONOS_SDK/at$`
	`./gen_misc.sh`
	`gen_misc.sh version 20150511`
	
	`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):`

📖 ***Note:***

For more details on compiling applications, please refer to ESP8266 SDK Getting Started Guide.

5. After compilation, the binaries generated and their corresponding download addresses in the flash memory are as follows:

```
Support boot_v1.4 and +

Generate user1.2048.new.5.bin successfully in folder bin/upgrade.

boot.bin------------>0x00000

user1.2048.new.5.bin--->0x01000

!!!
```

📖 ***Note:***

*Users can open **/home/esp8266/Share/ESP8266_NONOS_SDK/bin/upgrade** directory and check the binaries compiled.*

6. The AT binaries generated can be downloaded to the ESP-LAUNCHER (refer to ***Section 1.3***) and run.

3. Learn More About *ESP8266_RTOS_SDK*

3.1. Compiling Application Using *ESP8266_RTOS_SDK*

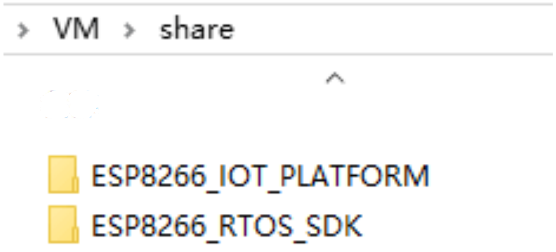
1. Download the ***ESP8266_RTOS_SDK*** from:

   https://github.com/espressif/ESP8266_RTOS_SDK

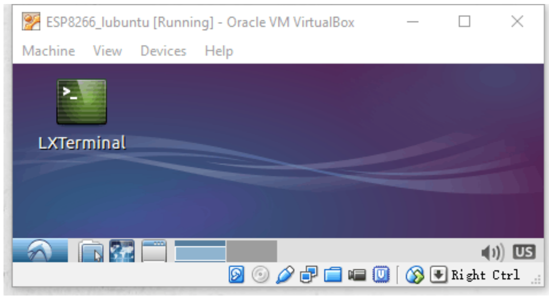
   ESP8266_IOT_PLATFORM is a demo application based on ***ESP8266_RTOS_SDK***.

   Download from: https://github.com/espressif/ESP8266_IOT_PLATFORM

2. Copy ***ESP8266_IOT_PLATFORM*** and ***ESP8266_RTOS_SDK*** to the PC's shared folder.

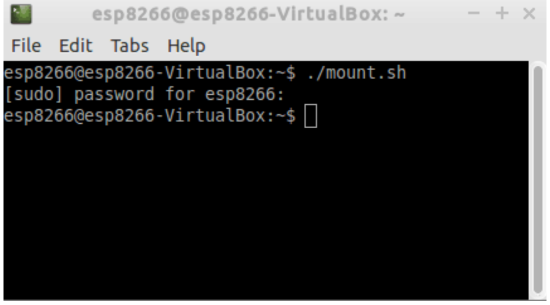
Steps	Result
• Copy ***ESP8266_RTOS_SDK*** and ***ESP8266_IOT_PLATFORM*** folder to the shared folder of the PC, for example, ***D:\VM\share***. • As shown in the figure on the right 👉.	

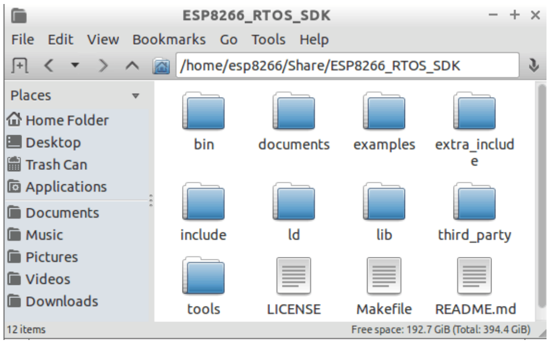
3. Start the virtual machine. Run ***LXTerminal*** on the desktop of the virtual machine.

Steps	Result
• Start ESP8266 virtual machine 👉. - If the virtual machine is locked, please enter the password: ***espressif*** to unlock it. • Double-click ***LXTerminal*** to start compilation.	 ESP8266_lubuntu [Running] - Oracle VM VirtualBox Machine View Devices Help LXTerminal US Right Ctrl

4. Mount the shared directory to the virtual machine.

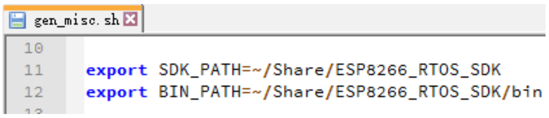
Steps	Result

• Execute command `./mount.sh` in the LXTerminal.
• Input the password: ***espressif***.
Shared folder mounting is completed.
	
	`esp8266@esp8266-VirtualBox:~$ ./mount.sh`
	`[sudo] password for esp8266:`
	`esp8266@esp8266-VirtualBox:~$`

• Open the shared directory ***ESP8266_RTOS_SDK*** in the virtual machine and confirm if the mounting is successful. - If successful, the directory contains files as shown in the figure on the right 👉. - If not, the directory will be empty, you will need to repeat the above step again.	 ESP8266_RTOS_SDK File Edit View Bookmarks Go Tools Help /home/esp8266/Share/ESP8266_RTOS_SDK Places Home Folder Desktop Trash Can Applications Documents Music Pictures Videos Downloads bin documents examples extra_include include ld lib third_party tools LICENSE Makefile README.md 12 items Free space: 192.7 GiB (Total: 394.4 GiB)

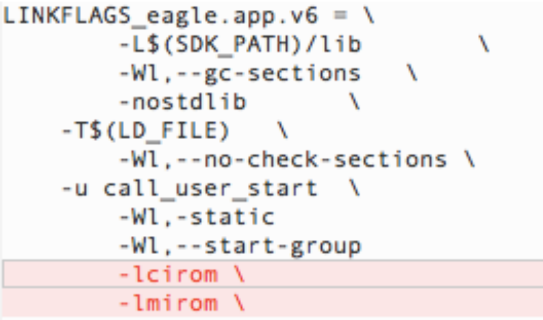
5. Set the ***SDK_PATH*** and the ***BIN_PATH*** in ***ESP8266_IOT_PLATFORM\gen_misc.sh***.

Steps	Result

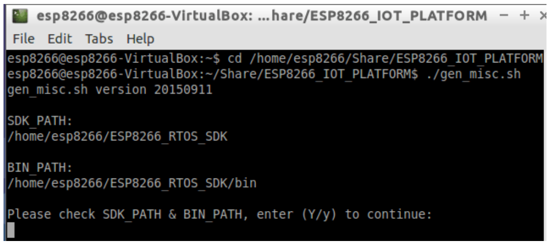
• ***SDK_PATH***: the directory of ***ESP8266_RTOS_SDK***
• ***BIN_PATH***: the directory which the binaries are generated in after compilation
• As the figure on the right 👉 shows.
	
	`export SDK_PATH=~/Share/ESP8266_RTOS_SDK`
	`export BIN_PATH=~/Share/ESP8266_RTOS_SDK/bin`

6. Revise the ***ESP8266_IOT_PLATFORM\makefile***.

Steps	Result

• Revise the ***LINKFLAGS_eagle.app.v6*** area in the ***ESP8266_IOT_PLATFORM\makefile***:
- Delete ***-lminic***
- Add ***-lcirom*** and ***-lmirom***
• As the figure on the right 👉 shows.
	
	`LINKFLAGS_eagle.app.v6 = \`
	`        -L$(SDK_PATH)/lib        \`
	`        -Wl,--gc-sections    \`
	`        -nostdlib            \`
	`    -T$(LD_FILE)    \`
	`        -Wl,--no-check-sections \`
	`    -u call_user_start   \`
	`        -Wl,-static`
	`        -Wl,--start-group`
	`        -lcirom \`
	`        -lmirom \`

7. Change the directory to ***/share/ESP8266_IOT_PLATFORM*** in the LXTerminal, and compile it.

Steps	Result
• In the LXTerminal, change the directory by executing command: `cd /home/esp8266/Share/ESP8266_IOT_PLATFORM` • Then execute command: `./gen_misc.sh` to start compiling.	

```
esp8266@esp8266-VirtualBox:~$ cd /home/esp8266/Share/ESP8266_IOT_PLATFORM
esp8266@esp8266-VirtualBox:~/Share/ESP8266_IOT_PLATFORM$ ./gen_misc.sh
gen_misc.sh version 20150911

SDK_PATH:
/home/esp8266/ESP8266_RTOS_SDK

BIN_PATH:
/home/esp8266/ESP8266_RTOS_SDK/bin

Please check SDK_PATH & BIN_PATH, enter (Y/y) to continue:
```

> 📖 ***Note:***
>
> *For more details on compilation, please refer to ESP8266 SDK Getting Started Guide.*

8. After compilation, the binaries are generated and the corresponding download addresses in the flash memory are as follows:

```
Support boot_v1.4 and +

Generate user1.1024.new.2.bin successfully in BIN_PATH

boot.bin------------>0x00000

user1.1024.new.2.bin--->0x01000

!!!
```

> 📖 ***Note:***
>
> *You can open **/home/esp8266/Share/ESP8266_RTOS_SDK/bin** directory and check the binaries compiled.*

9. Download the binaries generated to the ESP-LAUNCHER and run.

> 📖 ***Note:***
>
> *The power-on-default baud rate of ESP8266 is 74880 for the ESP-LAUNCHER.*

3.2. *ESP8266_RTOS_SDK* Architecture

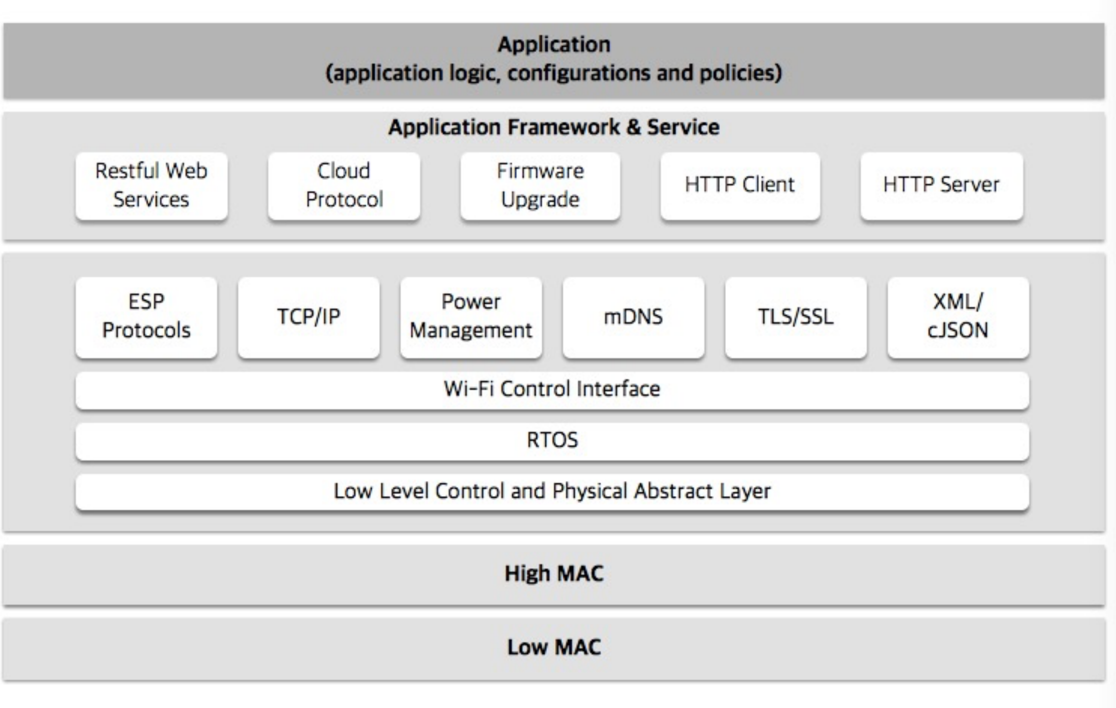


Figure 3-1. *ESP8266_RTOS_SDK* Architecture

4. Debug Methods

4.1. Debug Methods

4.1.1. Add UART Output Logs

For ***ESP8266_NONOS_SDK***, users can add debug logs as below:

```
os_printf("SDK version:%s\n", system_get_sdk_version());
```

For ***ESP8266_RTOS_SDK***, users can add debug logs as below:

```
printf("SDK version:%s\n", system_get_sdk_version());
```

4.1.2. Debug Fatal Exception

If a fatal exception occurred, UART output logs will be as shown:

```
Fatal exception (28):

epc1=0x4025bfa6, epc2=0x00000000, epc3=0x00000000, excvaddr=0x0000000f, depc=0x00000000
```

1. Find the corresponding ***.s*** file which is generated with the running binaries in the same directory (***ESP8266_SDK\bin***).

   For example, if running ***eagle.flash.bin*** and ***eagle.irom0text.bin***, the corresponding file is ***eagle.s***.

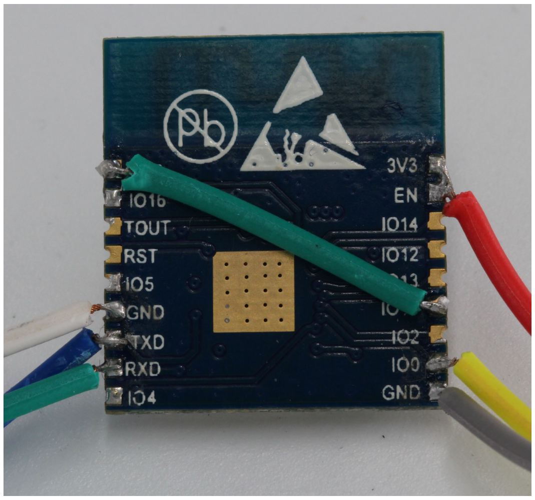
2. Locate the address of ***epc1*** (as 0x40XXXXXX) in the ***.s*** file to find the target function that fatal exception occurred.
3. Add logs before and after the target function is called to debug the fatal exception problem.

5. Downloading Firmware into the ESP-WROOM-02

Please follow the steps below to download firmware into ESP-WROOM-02.

1. ESP-WROOM-02 is the official ESP8266 module provided by Espressif Systems. Lead out the pins of ESP-WROOM-02 as shown in Table 5-1.

Table 5-1. ESP-WROOM-02 Pins

Pin	Pin status	Figure
EN	Pull up	 3V3 EN IO14 IO12 IO16 TOUT RST IO5 GND TXD RXD IO4 IO2 IO0 GND
3V3	3.3V power supply (VDD)	
IO15	Pull down	
IO0	UART Download mode: pull down; FLASH Boot mode: floating/pull up	
GND	GND	
RXD	UART Download Rx	
TXD	UART Download Tx, floating/pull up	

2. Connect ESP-WROOM-02 to USB-to-TTL converter using Dupont lines as shown in Figure 5-1.

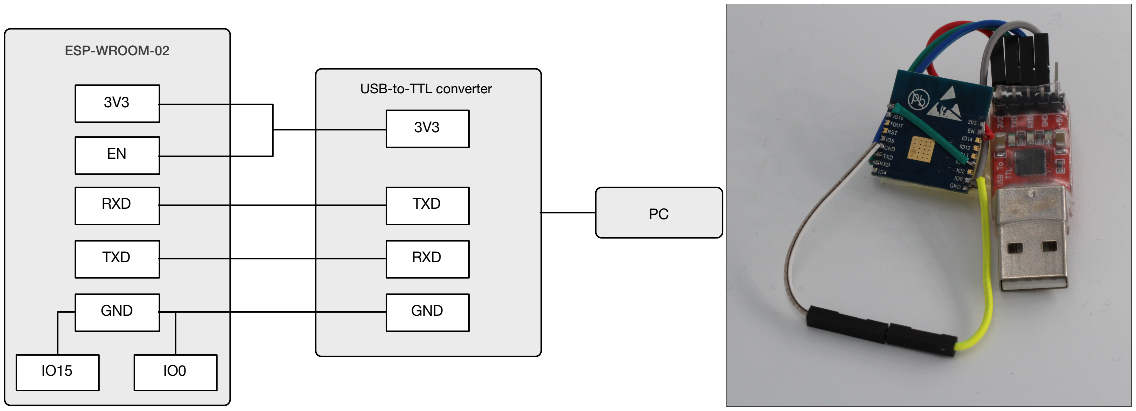


Figure 5-1. ESP-WROOM-02 Download Mode

3. Connect the USB-to-TTL converter to the PC.

4. Download firmware to flash with ESP8266 DOWNLOAD TOOL.

> 📖 ***Note:***
>
> *On how to download firmware, please refer to* ***Section 1.3****.*

5. After downloading, set `IO0` as floating or pull up and switch ESP-WROOM-02 to working mode.
6. Power on ESP-LAUNCHER again and the chip will read and run programs from the flash.

> 📖 ***Note:***
>
> `IO0` *is an internal pull-up pin. For more information on ESP-WROOM-02 hardware, please refer to ESP8266 System Description and ESP-WROOM-02 Datasheet.*

A. Appendix—Learning Resources

A.1. Must-Read Documents

- *ESP8266EX Datasheet*

  Description: This document introduces the specifications of ESP8266EX, including an overview of the features, protocols, technical parameters and applications. It also introduces pin layout and the relevant description, as well as major functional modules and protocols applied on ESP8266EX (CPU, flash and memory, clock, radio, Wi-Fi, and low-power management). Besides, it provides descriptions of peripheral interfaces integrated on ESP8266EX, lists the electrical data of ESP8266EX and illustrates the package details for ESP8266EX.

- *ESP8266 Hardware Resources*

  Description: This zip package includes manufacturing specifications of the ESP8266 board and the modules, manufacturing BOM and schematics.

- *ESP8266 Non-OS SDK IoT_Demo Guide*

  Description: This document provides simple demo implementations of three types of smart devices: Smart Light, Smart Power Plug, and Sensor Device. It also introduces the readers to curl toolkits, functions in LAN and WAN.

- *ESP8266 RTOS SDK Programming Guide*

  Description: This document provides sample codes based on ESP8266_RTOS_SDK, including basic examples, networking protocol examples and advanced examples.

- *ESP8266 AT Command Examples*

  Description: This document introduces some specific examples on the usage of Espressif AT commands, including single connection as a TCP client, UDP transmission and transparent transmission, and multiple connection as a TCP server.

- *ESP8266 AT Instruction Set*

  Description: This document provides lists of AT commands based on ESP8266_NONOS_SDK, including user-defined AT commands, basic AT commands, Wi-Fi AT commands and TCP/IP-related AT commands. It also introduces the downloading of AT firmware into flash.

- *ESP8266 Non-OS SDK API Reference*

  Description: This document lists ESP8266_NONOS_SDK APIs, provides an overview of ESP8266_NONOS_SDK and introduces the readers to system APIs, TCP/UDP APIs, mesh APIs, application specific APIs, definitions and data structures, and APIs for peripheral interfacing.

- *ESP8266 RTOS SDK API Reference*

  Description: This document lists ESP8266_RTOS_SDK APIs, including functions for Wi-Fi related APIs and boot APIs, etc.
- *FAQ*

A.2. Must-Have Resources

- *ESP8266 SDKs*

  Description: This website page provides links to the latest version of ESP8266 SDK and the older ones.
- *RTOS Sample Code*

  Description: This webpage provides the sample code for the commonly used functions.
- *Non-OS Sample Code*

  Description: This webpage provides the sample code for the commonly used functions.
- *ESP8266 Tools*

  Description: This website page provides links to the ESP8266 flash download tools and ESP8266 performance evaluation tools.
- *ESP8266 APK*
- *ESP8266 Certification and Test Guide*
- *ESP8266 BBS*
- *ESP8266 Resources*

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