GigaDevice Semiconductor Inc.

Arm® Cortex®-M3/4/23/33 32-bit MCU

应用笔记

AN033

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1. Introduction

We usually use the IDE under windows to develop MCU project, This article describes how to manage a RTOS projects in a Linux environment with multiple Makefiles, develop an LED flashing feature in RTOS task. This scheme can specify modules or files to compile.

2. Development environment construction

The development environment prepare:

- Hardware development board: GD32F303-Test-V1.1
- Cpmpile environment: ubuntu16.04
- Tool chain: gcc-arm-none-eabi, gcc-arm-none-objcopy
- Programing tools: SEGGR J-FlashVV6.50b

2.1. Install Ubuntu VM

VMware workstation download address:https://www.vmware.com/cn/products/workstation-pro/workstation-pro-evaluation.html.

Double-click the installation package and follow the installation wizard, shown in ***Figure 2-1. Ubuntu vm installation wizard 1*** click"next", Select the default settings.

Figure 2-1. Ubuntu vm installation wizard 1

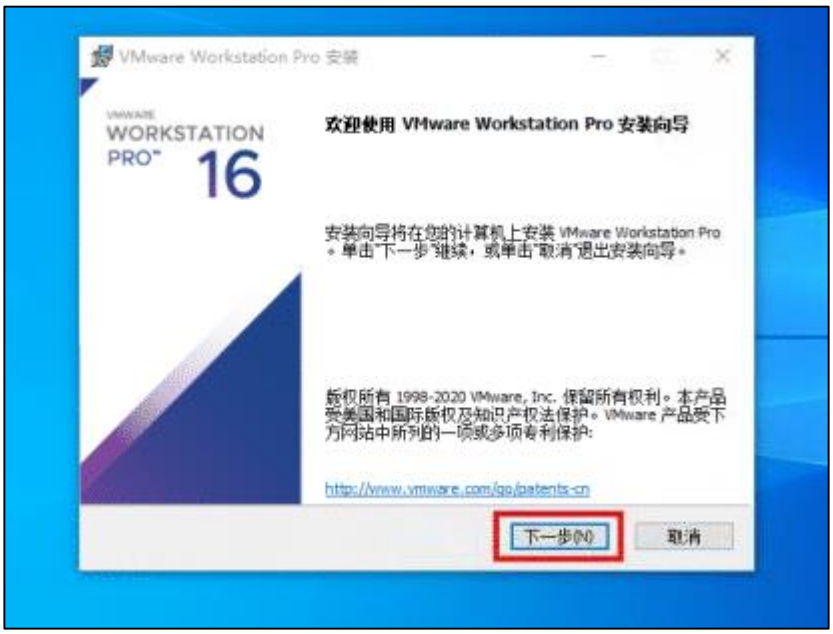


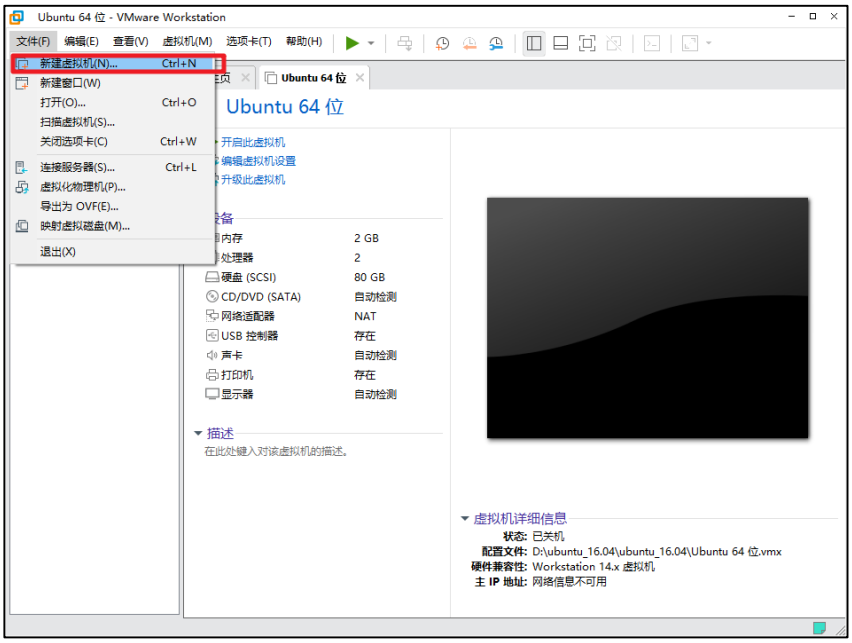
Figure 2-2. Ubuntu vm installation wizard 2

Click ”finish”, finish install.

Figure 2-3. Ubuntu vm installation wizard 3

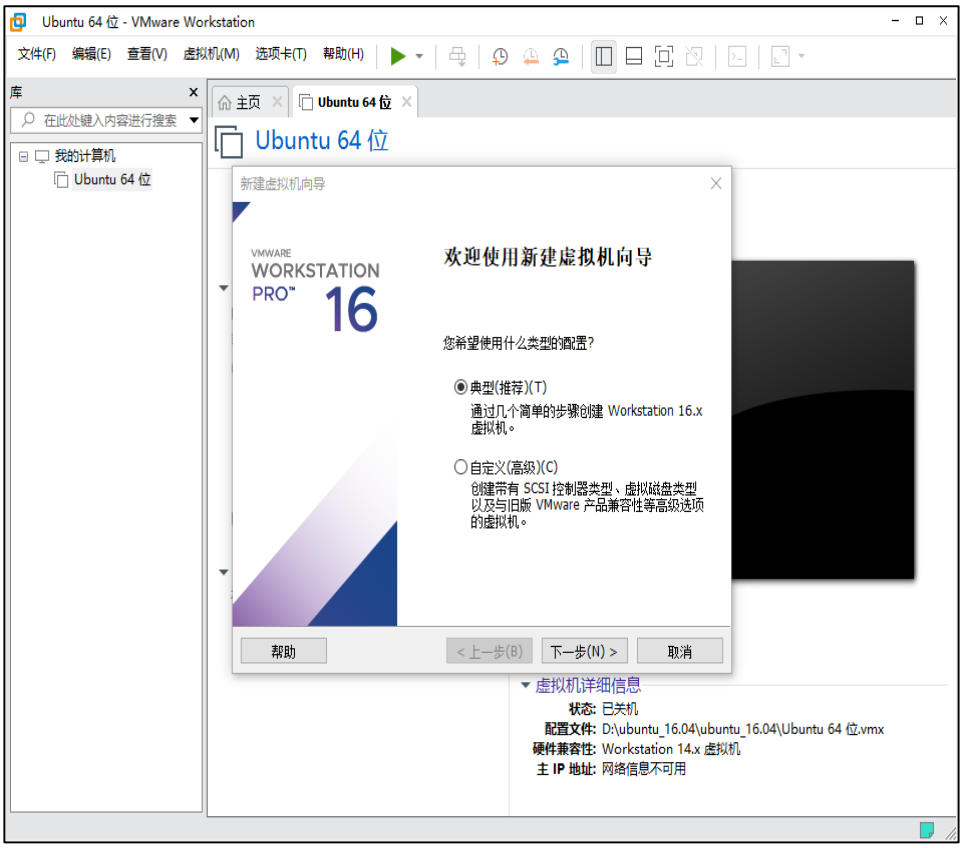
Download ubuntu iso file and install.download address:http://mirrors.aliyun.com/ubuntu-releases/16.04/ After dowmload Ubuntu iso,open VMware, click ”file --> create new virtual machine”.

Figure 2-4. Ubuntu vm installation wizard 4



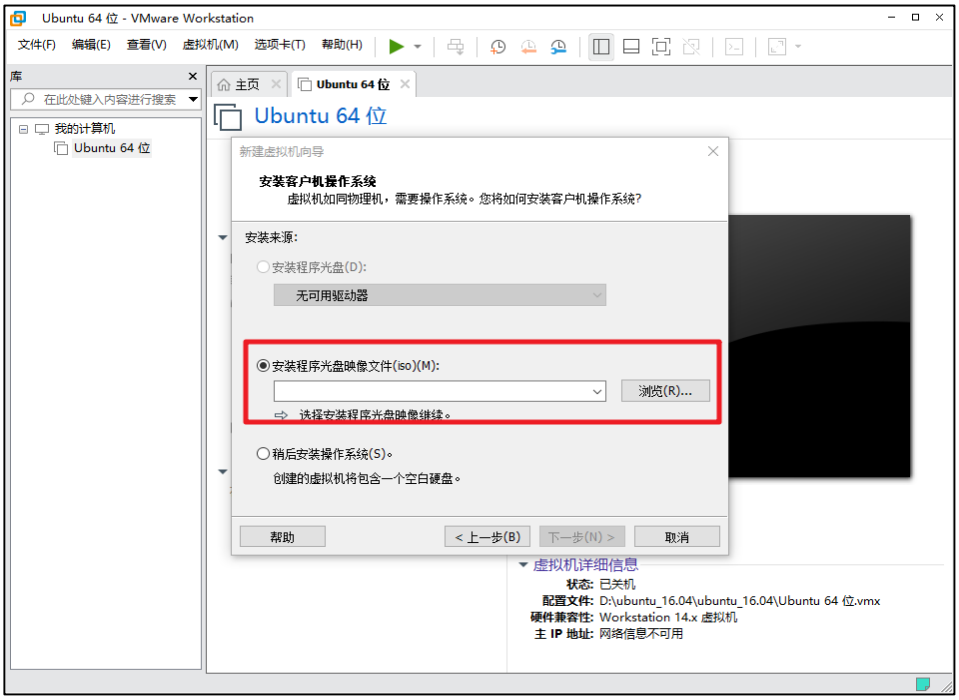
Use default settings, click”next”.

Figure 2-5. Ubuntu vm installation wizard 5



Select the Ubuntu iso file downloaded earlier,use default settings and click “next”.

Figure 2-6. Ubuntu vm installation wizard 6



Click start this virtual machine, the first startup takes a long time, select the default settings until startup is complete.

Figure 2-7. Ubuntu vm installation wizard 7

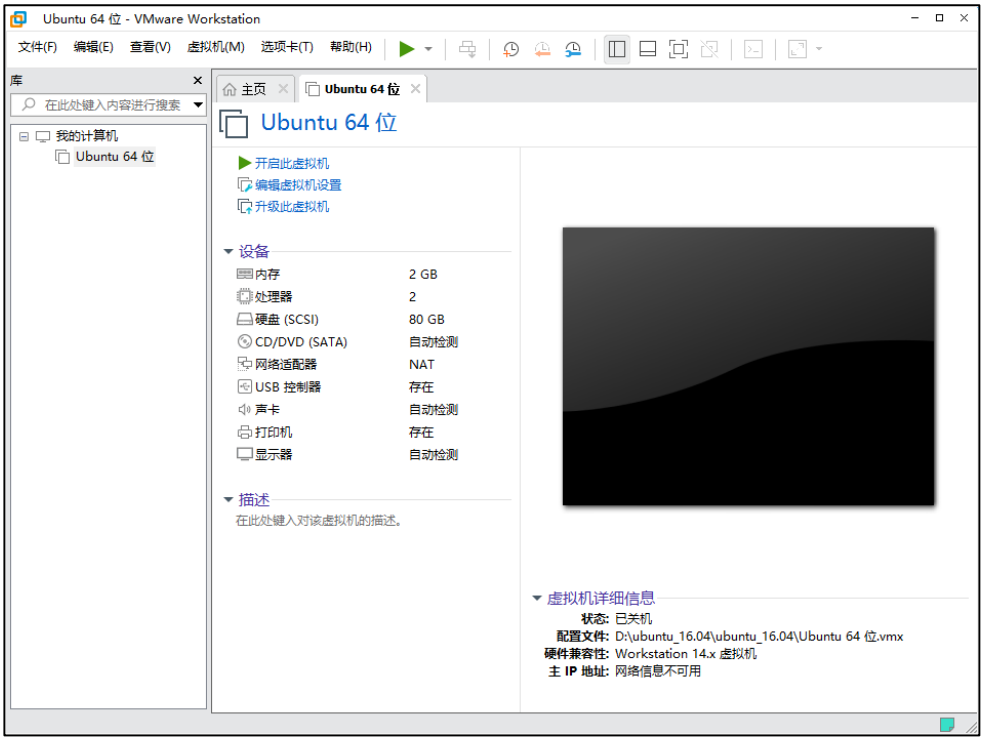
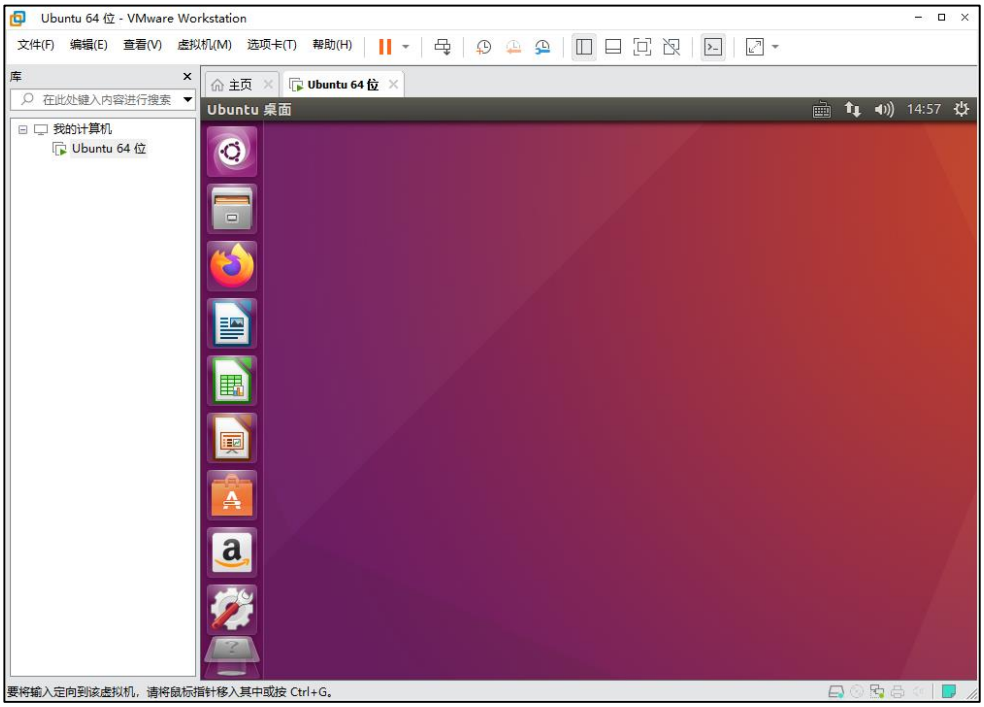


Figure 2-8. Ubuntu vm start done 8 show the page after the Ubuntu VM is started.

Figure 2-8. Ubuntu vm start done 8

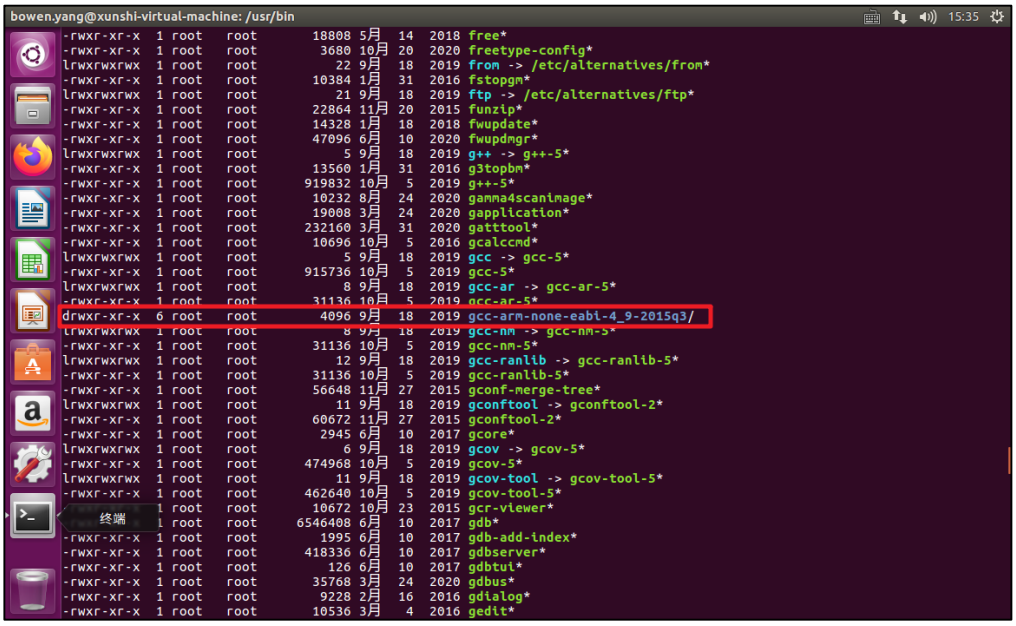


2.2. Install toolchain

Use the compiled toolchain,download address:https://launchpad.net/gcc-arm-embedded/+download.

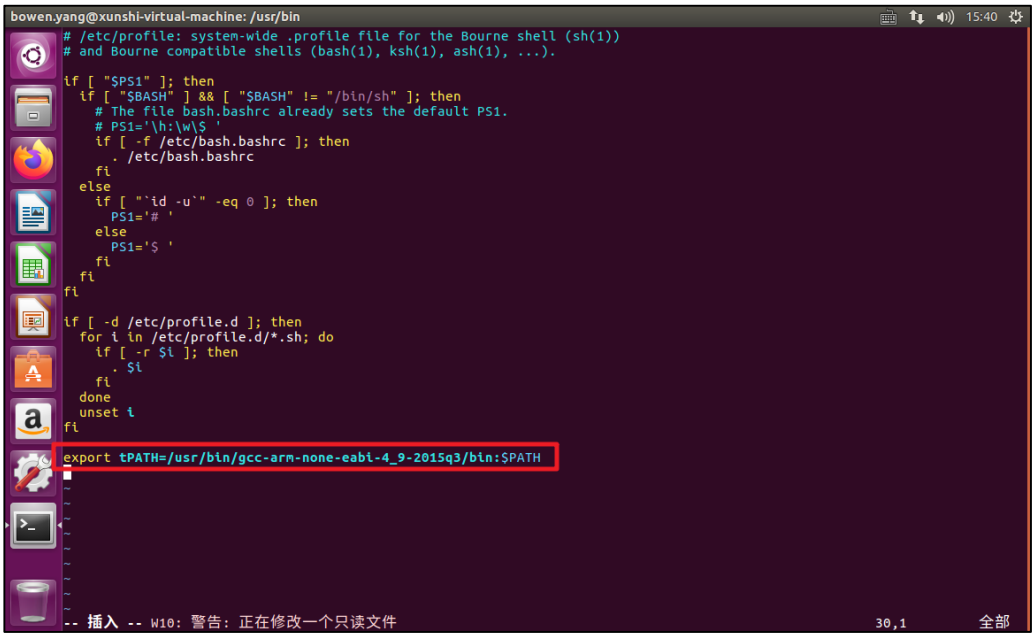
Decompress the downloaded toolchain to the /usr/bin directory of Ubuntu, get a directory gcc-arm-none-eabi-4_9-2015q3/. shown in ***Figure 2-9. directory of GCC toolchain***.

Figure 2-9. directory of GCC toolchain



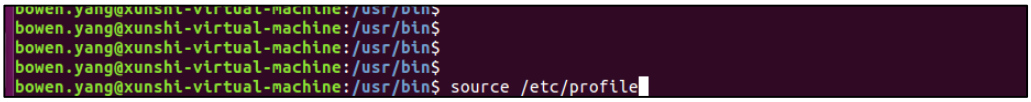
Configure the linux system environment variables. assign GCC toolchain directory in the last of /etc/profile.

Figure 2-10. configuration environment variable



Then input command ”source /etc/profile” make the environment variable effective. The Ubuntu VM dose not need to be restarted.

Figure 2-11. make the environment variable effective



After finishing, input command “arm”with the tab key,is successful if the tool chain list is displaye. shown in ***Figure 2-12. toolchain list*** here is arm-none-eabi-gcc and arm-none-eabi-objcopy we needed.

Figure 2-12. toolchain list

3. Create project

3.1. Create project directory

Place the code that needs to be compiled below the path D:\share\RTX\ubuntu, shown in *Figure 3-1. project code directory*.

Figure 3-1. project code directory

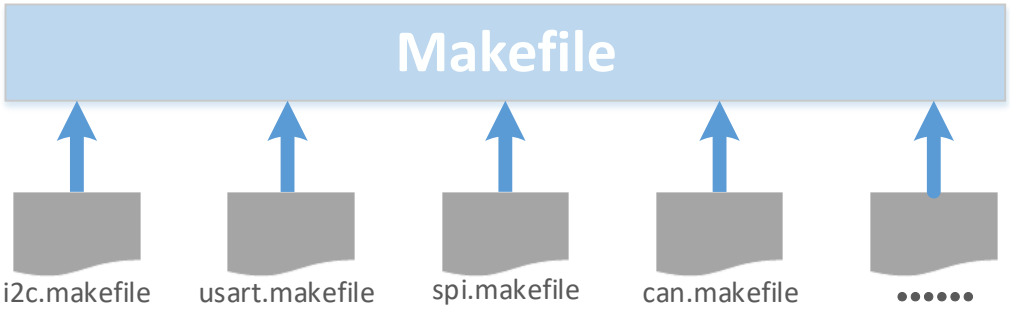
The directory structure is shown below, every directory needed a makefile.

```
├──APP
│     ├──include
│     └──source
├──CMSIS
│     ├──GCC
│     ├──include
│     └──source
├──Core
│     ├──include
│     └──source
├──Device
│     ├──include
│     └──source
└──SourceGroup
      ├──include
      └──source
```

3.2. Makefile writing

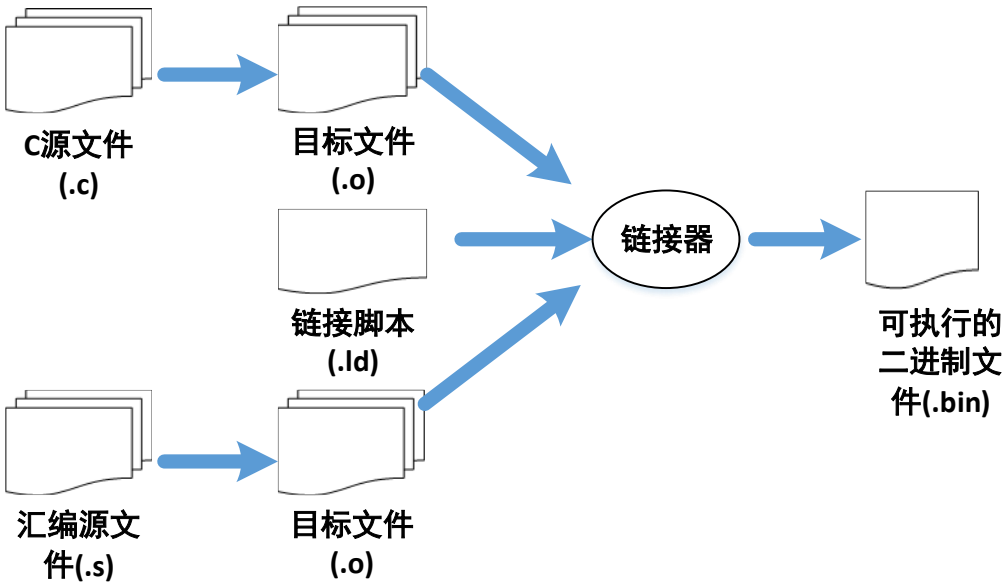
Use top-level makefile to manager makefile in subdirectories, shown in *Figure 3-2. makefile graphical*.

Figure 3-2. makefile graphical



The compilation processs shown in *Figure 3-3. compilation flow chart*.

Figure 3-3. compilation flow chart



Top-level makefile edit an below:

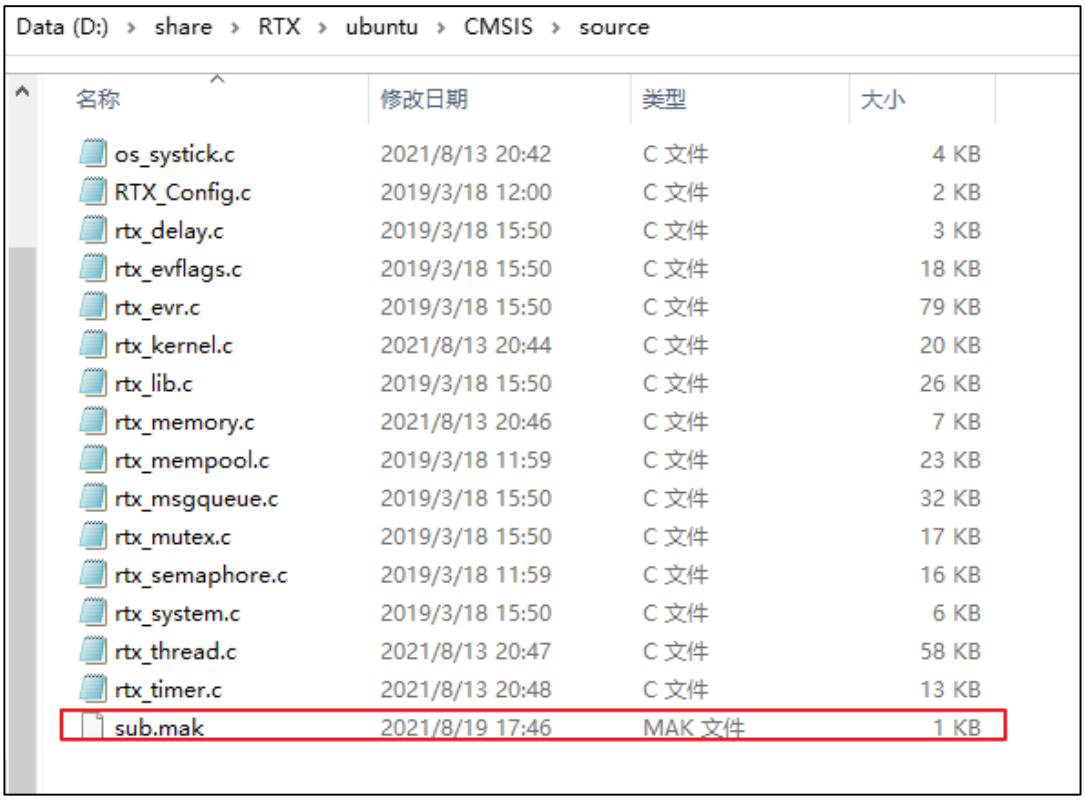
Table 3-1. top-level makefile edit

```
CROSS_COMPILE=arm-none-eabi-
CC                = $(CROSS_COMPILE)gcc
OBJCOPY           = $(CROSS_COMPILE)objcopy

TOP=$(shell pwd)
INC_FLAGS = -I$(TOP)/Device/include \
            -I$(TOP)/Core/include \
            -I$(TOP)/APP/include \
            -I$(TOP)/Stdlib/include \
            -I$(TOP)/CMSIS/include

CC_FLAGS = -W -Wall -g -mcpu=cortex-m4 -mthumb -D GD32F30X_HD -D
USE_STDPERIPH_DRIVER $(INC_FLAGS) -O0 -std=gnu11
```

```
CC_ASM_FLAGS = -mthumb -mcpu=cortex-m4 -g -Wa,--warn

CC_LD_FLAGS += -mthumb -mcpu=cortex-m4
CC_LD_FLAGS += -Wl,--start-group -lc -lm -Wl,--end-group -specs=nosys.specs -static -Wl,-cref,-u,Reset_Handler-Wl,-Map=RTX_Project.map-Wl,--gc-sections-Wl,--defsym=malloc_getpagesize_P=0x80

LD_PATH = -TDevice/source/gd32f30x_flash.ld
#Indicates whether the module participates in compilation
SUPPORT_IIC = yes
SUPPORT_SPI = yes
SUPPORT_CAN = yes
SUPPORT_KEY = no
#Specify the source file to compile
include APP/source/sub.mak
include CMSIS/source/sub.mak
include Device/source/sub.mak
include SourceGroup/source/sub.mak

TARGET = RTX_Project

.PHONY: clean all
#replace with.o
C_OBJ = $(C_SRC:%.c=%.o)
ASM_OBJ = $(ASM_SRC:%.s=%.o)

all:$(C_OBJ) $(ASM_OBJ)
	$(CC) $(C_OBJ) $(ASM_OBJ) $(LD_PATH) -o $(TARGET).elf $(CC_LD_FLAGS)
	$(OBJCOPY) $(TARGET).elf  $(TARGET).bin -Obinary

%.o:%.c
	$(CC) -c $(CC_FLAGS) -o $@ $<
%.o:%.s
	$(CC) -c $(CC_ASM_FLAGS) -o $@ $<

clean:
	rm -rf *.o $(C_OBJ) $(ASM_OBJ) $(TARGET) *.bin *.map *.elf
```

Create sub.mak file in each source directory of APP, CMSIS, Core, Device, SourceGroup directory, all sub.mak files are written an the same way, just introduce the sub.mak of directory CMSIS/source as below:

Figure 3-4. sub.mak folder



Specifies the file in this directory to compile in sub.mak. shown as below:

Table 3-2. Subdirectory sub.mak

```
CMSIS_PATH = CMSIS/source
C_SRC += $(CMSIS_PATH)/os_systick.c \
                $(CMSIS_PATH)/RTX_Config.c \
                $(CMSIS_PATH)/rtx_delay.c \
                $(CMSIS_PATH)/rtx_evflags.c\
                $(CMSIS_PATH)/rtx_evr.c \
                $(CMSIS_PATH)/rtx_kernel.c \
                $(CMSIS_PATH)/rtx_lib.c \
                $(CMSIS_PATH)/rtx_memory.c \
                $(CMSIS_PATH)/rtx_mempool.c \
                $(CMSIS_PATH)/rtx_msgqueue.c \
                $(CMSIS_PATH)/rtx_mutex.c \
                $(CMSIS_PATH)/rtx_semaphore.c \
                $(CMSIS_PATH)/rtx_system.c \
                $(CMSIS_PATH)/rtx_thread.c \
                $(CMSIS_PATH)/rtx_timer.c

ifeq ($(SUPPORT_KEY), yes)
C_SRC += $(AUDIO_PATH)/rtx_keymanager.c
endif
```

```
ASM_SRC += $(CMSIS_PATH)/../GCC/irq_cm3.s
```

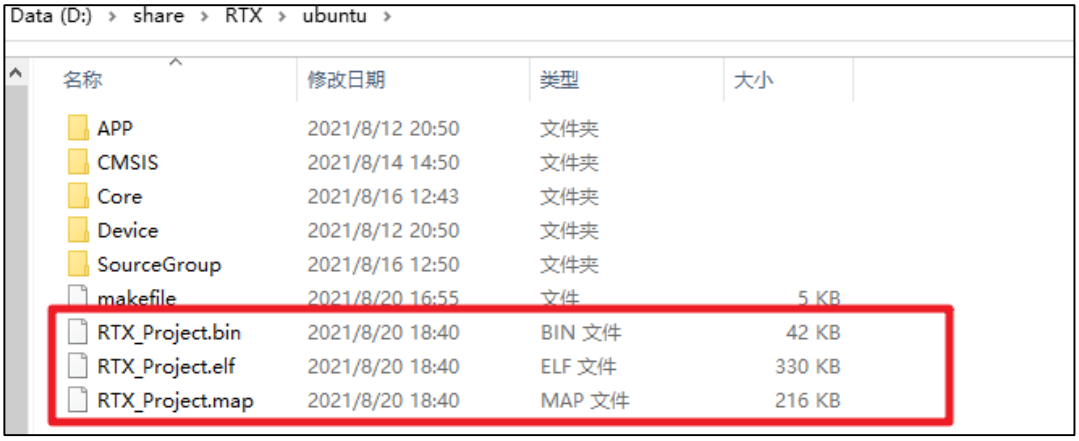
3.3. Compile and test

input command “ make” in the directory where the top-level makefile are.

Figure 3-5. make result

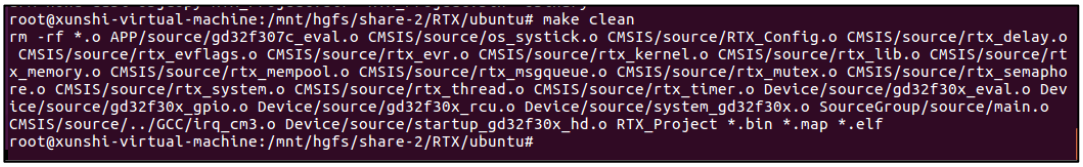
The top-level makefile folder will generate .bin file, .elf file and .map file.

Figure 3-6. top-level makefile folder



Input command “make clean” in top-level makefile folder, the .bin file, .elf file and .map file is deleted.

Figure 3-7. make clean result



Finally, we can use SEGGR J-Flash download the firmware to mcu for test. The LED is working.

4. Revision history

Table 4-1. Revision history

Revision No.	Description	Date
1.0	Initial Release	Aug.26, 2021

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