

N58 OpenCPU SDK Developer Guide

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Notice

This document provides guide for users to use N58 OpenCPU.

This document is intended for system engineers (SEs), development engineers, and test engineers.

THIS GUIDE PROVIDES INSTRUCTIONS FOR CUSTOMERS TO DESIGN THEIR APPLICATIONS. PLEASE FOLLOW THE RULES AND PARAMETERS IN THIS GUIDE TO DESIGN AND COMMISSION. NEOWAY WILL NOT TAKE ANY RESPONSIBILITY OF BODILY HURT OR ASSET LOSS CAUSED BY IMPROPER OPERATIONS.

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About This Document

Scope

This document is applicable to the N58 OpenCPU series.

Audience

This document is intended for system engineers (SEs), development engineers, and test engineers.

Change History

Issue	Date	Change	Changed By
1.0	2020-03	Initial draft	Wu Guoqing

Conventions

Symbol	Indication
0	This warning symbol means danger. You are in a situation that could cause fatal device damage or even bodily damage.
	Means reader be careful. In this situation, you might perform an action that could result in module or product damages.
•	Means note or tips for readers to use the module

1 Overview

The N58 OpenCPU module runs a FreeRTOS. This document mainly describes the process of developing an application based on N58 OpenCPU SDK, including drivers installation, SDK environment establishment, source code development, APPImg burning, APPImg debugging, etc.

Before the development, you need to have the following knowledge:

- FreeRTOS
- Standard C language
- Inter-task communication and synchronization mechanisms in FreeRTOS
- Network protocols including TCP, FTP, HTTP, etc.
- Mechanisms of controlling the I/O interfaces such as UART, SPI and I2C and some peripherals of the N58 Open CPU module.

2 Installing USB Driver

After the USB drivers are installed in Windows OS, Device Manager displays 7 COM ports. The table below lists these ports and their functions.

No.	Port name	Description
1	Neoway USB AP_TRACE	Used to output logs of the applications. The log can be captured through Coolwatch .
2	Neoway USB AT	Used for AT communications
3	Neoway USB CP_TRACE	Used to output logs of the kernel. The logs can be captured through ArmTrace .
4	Neoway USB Diag	Diagnostic port
5	Neoway USB Modem	Modem port, used for PPP dialing
6	Neoway USB Modem	Used to output GPS data (used by the N58 AT module)
7	Neoway USB OPEN_CON	Used to output logs by N58 OpenCPU.



For how to install N58 drivers, see *Neoway_N58_Driver_Installation_Guide*.



For the details of capturing the AP and CP logs, see Neoway_N58_Log_Capturing_Guide.

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3 Setting Up SDK Environments

3.1 Compilation Environment

System Requirements

Windows 7 SP1, x64 or Windows 10, x64 Visual C++ Redistributable for Visual Studio 2015 x86 or later versions Python 3 or later versions

Cross Compiler

Stored in the /tool/ directory of the SDK package.



For the environment installation packages of Windows OS, contact Neoway FAE.

The name of the directory that stores the SDK package should contain letters, digits, or underscores only. Otherwise, errors will occur in SDK compilation.

3.2 Development Environment

- System requirements
 Windows 7/8/10
- Programming editor

Source Insight (other options are also available)

3.3 Debugging Environment

System requirements

Windows 7/8/10

Debugging tool

PuTTY or other common debugging tools The logs are output from the **Neoway USB OPEN_CON**.

4 Developing Application

To facilitate the development of application images in N58 OpenCPU, Neoway provides various SDK APIs. For details, see *Neoway_N58 OpenCPU_API_Note*.

4.1 APIs

Category	Function
IO interfaces	To enable and invoke IO interfaces, including UART I2C SPI GPIO ADC
Peripheral	 To enable and invoke peripheral interfaces, including Audio LED Keypad
Service	 To enable and invoke network service interfaces, including Data Voice SIM SMS Location Wi-Fi Scan (only STA is supported, used to assist in indoor positioning) Network (network registration) FOTA (delta upgrade) AT (to send and receive AT commands) Socket
Protocol (POSIX)*	 TCP FTP HTTP UDP For details, learn from the internet or refer to the demo programs provided by Neoway.
Other interfaces*	FreeRTOS queueTimer

* indicates in development.

4.2 Adding Log Printing Interface

To facilitate the module commissioning, Neoway provides the API that is used to print logs. The log can be output to the USB port by calling the **nwy_ext_echo()** function.

Header File

#include "nwy_usb_serial.h"

Function

```
void nwy_ext_echo(char* fmt, ...)
{
   static char echo_str[NWY_EXT_SIO_RX_MAX];
   va_list a;
   va_start(a, fmt);
   vsprintf(echo_str, fmt, a);
   va_end(a);
   nwy_usb_serial_send(echo_str, strlen((char *)echo_str));
}
```

Log Capturing Methods

Output to	Description
USB port (recommended)	Use a serial port tool such as Putty to view log messages Call nwy_ext_echo() that is provided by Neoway.
UART port	Use Coolwatcher to view log messages of an application. Call the OSI_LOGI API that is provided by UNISOC

4.3 Customizing Configuration File

CMakeLists.txt is the input to the CMake build system for building software packages and it contains a set of directives and instructions describing the source files and target files (executable, library, or both) of the project. To compile the program, edit the file as follows:

Adding File Name of Source Code into CMake Configuration File

Assume that the name of the source code file to be compiled is **Neoway_test.c** (saved in the SDK home directory), make some modifications as shown below in the **CMakeLists.txt** file.

neoway

```
if(CONFIG_APPIMG_LOAD_FLASH)
   set(target Neoway_test_flash)
   add_appimg(${target} ${flash_ldscript} Neoway_test.c)
...
if(CONFIG_APPIMG_LOAD_FILE)
   set(target Neoway_test_file)
   add_appimg(${target} ${file_ldscript} Neoway_test.c)
```

If **Neoway_test.c** needs to call a function of other source files such as **Neoway_other.c**. Make the following modifications.

- Add the related header file in \components\include.
- Modify CMakeLists.txt

```
if(CONFIG_APPIMG_LOAD_FLASH)
   set(target Neoway_test_flash)
   add_appimg(${target} ${flash_ldscript} Neoway_test.c Neoway_other.c)
...
if(CONFIG_APPIMG_LOAD_FILE)
   set(target Neoway_test_file)
   add_appimg(${target} ${file_ldscript} Neoway_test.c Neoway_other.c)
```

Modifying the Directory of APPIMG

The generated image file **hello_flash.pac** is stored in **out\appimage_release\hex** by default. You can modify the content shown below in the **CMakeLists.txt** file to change the directory.

set PROJECT_OUT=%PROJECT_ROOT%\out\%BUILD_TARGET%_%BUILD_RELEASE_TYPE%

4.4 Compiling Program

The home directory of N58 Open SDK contains the **nwy_opencpu.bat** compilation script. If the source code is saved in the home directory, double-click the compilation script directly to generate the image file in **out\appimage_release\hex**.

📙 cmake	2020/3/9	文件夹	
components	2020/3/9	文件夹	
dscripts	2020/3/9	文件夹	
out	2020/3/2	文件夹	
prebuilts	2020/3/9	文件夹	
tools	2020/3/9	文件夹	
📄 .clang-format	2020/2/2	CLANG-FORMAT	1 KB
gitignore	2020/2/1	GITIGNORE 文件	1 KB
CMakeLists.txt	2020/3/2	文本文档	7 KB
C Neoway_test.c	2020/3/4	C Source file	82 KB
💿 nwy_opencpu.bat	2020/3/9	Windows 批处理	1 KB

4.5 Burning APPIMG

After generating an APPIMG, you can burn it into the N58 module through the **RESEARCHDOWNLOAD** tool.

Before burning APPIMG, ensure that the N58 module is embedded with the underlying firmware of N58 OpenCPU. Otherwise, the burning fails.

- Underlying firmware: the file system that is used to run programs, about 6M.
- APPImg: Generated in the SDK compilation, 100K

For the underlying firmware version of N58 OpenCPU, contact Neoway FAE.

Step 1: Set the module to download mode through the following methods:

Hardware

Short connect PIN_48 to the PIN_45. Then power the module and start it.

AT command

Send AT^FORCEDNLD or AT+CFUN=9,0 to the module through the serial port tool.



Step 2: Start the RESEARCHDOWNLOAD tool as an administrator.

\rightarrow \uparrow \uparrow \blacksquare \ll RES	EARCHDOWNLOAD_R22.19.1701 > Bin	~ (Search Bin
+ Quick access	Name ^	Date modified	Type
Cuick access Desktop Downloads Documents Pictures Local Disk (D:) Program files	 Channel9.dll Channel9.dll ChannelD.dll ChannelD.dll CmdDloader Guide LiveUpdatesDLL.dll LiveUpdatesDLL MCPType 	4/24/2015 8:05 PM 9/28/2015 5:54 PM 9/28/2015 5:54 PM 3/28/2019 1:37 PM 11/29/2017 2:21 PM 3/11/2015 6:03 PM 3/26/2019 12:47 PM 3/26/2019 12:47 PM 3/11/2015 6:03 PM	Application extens Application extens Application extens Application Configuration sett Compiled HTML Application extens Configuration sett Configuration sett
This PC	PhaseCheck PortHound.dll PortHound.dll	9/15/2015 10:39 AM 3/28/2019 1:37 PM 3/28/2019 1:37 PM	Configuration sett. Application extens. Application extens.
network 🛃	ProcessFlow.dll ProcessFlowSetting rdl_bkmark	3/11/2015 6:03 PM 3/11/2015 6:03 PM 3/11/2015 6:03 PM	Application extens. Configuration sett. BMP File
	ResearchDownload	4/30/2019 4:16 PM 4/30/2019 3:36 PM	Application Configuration sett.
	SecBinPack9.dll	3/15/2019 4:15 PM 3/15/2019 4:15 PM	Application extens. Application extens.
	SprdMes	3/8/2016 9:54 AM	Configuration sett.

Step 3: Click the Load packet button and then select the .pac file. For example, Neoway_test_flash.pac.

Part	Sten St	atus	Pr	aress	Time(s)	MCP Type		IN
	t+ tT#			591000	rino(o)	iiioi iypo		
	• 11/1							
	← → ~ ↑ <mark>.</mark> «	keiler → N58 → o	:ore_sdk1 → out → a	ppimage_release > hex		✓ ひ 搜索"hex"		, P
	组织 ▼ 新建文件夹						iii 🔹 🔟	
	7-固件升级;	* 名称	^	修改日期	类型	大小		
	8-应用指南	🗋 appimg fil	e delete.pac	2020/3/22 10:21	PAC 文件	70 KB		
	2019年完善	appimg_fla	ash_delete.pac	2020/3/22 10:21	PAC 文件	70 KB		
	drive	Neoway_te	est_file.pac	2020/3/22 10:21	PAC 文件	108 KB		
	i4Tools7	Neoway_te	est_flash.pac	2020/3/22 10:21	PAC 文件	109 KB		
	N58							
	core_sdk							
	cmake							
	_ compor							
	dscript:							
	out							
	appim							
	CMal							
	hex							
	1.96							



Step 4: Click the Setting button to select a download port.

😜 Res	searchDownload - R22.	19.1701					
0			IMG : 8910 N	IODULE (PA	CKAGE SIZE = 0.	106MB)	
Port	Step	Status		Progress	:	Time(s)	M
	Download settings					×	
	MCP Typ Main Page	e Vol Options Backup Port <mark> COM21 2</mark>	Freq Turning Flash Operations Budrate: Select Product:	Multi Lang 115200 PAC_UIX8910	Uat Port Switch uages LCD Cor	nigure	
	FileID	FileName		Base1	Size1	B	
	HOST_FDL	D:\keiler\tools\RESEARCHD0 D:\keiler\tools\RESEARCHD0	WNLOAD_R22	0x810000 0x818000	0x8000 0x10000		
	APPIMG	D:\keiler\tools\RESEARCHD0	WNLOAD_R22	0x60290000	0xE2000		

Step 5: Click the Start downloading button to flash the APPImg.

¥ Rese	earchDownload - R2	2.19.1701			
) 🚱 🕞		PIMG : 8910 MODULE (PACKAGE SIZE = 0.1	06MB)	
Port	Step	Status	Progress	Time(s) M	CP 1

Wait for a while, the tool interface displays **Passed** in green, indicating that the APPIMG is flashed into the module successfully. Cut off power supply of the module and power on it again, and the APPIMG runs automatically when the module starts.

😽 Res	* ResearchDownload - R22.19.1701							
0	APPIMG : 8910 MODULE (PACKAGE SIZE = 0.106MB)							
Port	Step	Status	Progress	Time(s)	МСР Туре			
21	APPIMG	Finish	Passed	3s	—			
				-				

4.6 Debugging APPIMG

To print logs to the Neoway USB OPEN_CON USB port, perform the following steps:

Step 1: Start PuTTY.

- Step 2: Check Serial to set its connection type.
- Step 3: In the PuTTY Configuration dialog box, enter the USB port number and then click Open.

Device Manager		- 🗆 ×
ïle Action View Help		
• 🔶 📰 🖾 🖉 🛐 🖳 💻 🗶 🗶 🖲		
 DESKTOP-TBTHRTU Audio inputs and outputs Computer Disk drives Display adapters Human Interface Devices Human Interface Devices Keyboards Mice and other pointing devices Keyboards Monitors Network adapters Portable Devices Portable Devices Ports (COM & LPT) ECP Printer Port (LPT1) Neoway USB AP_TRACE (COM9) Neoway USB AT (COM7) Neoway USB DIAG (COM8) Neoway USB DIAG (COM6) Neoway USB MAEA (COM5) Neoway USB NMEA (COM5) Neoway USB NMEA (COM5) Print queues 	PuTTY Configuration Category: Session Logging Terminal Keyboard Keyboard Real Features Window Appearance Behaviour Translation Selection Colours Outours Proxy Telnet Rlogin SSH Serial Close window on exit: Always	? × a for your PuTTY session you want to connect to Speed 115200 O Riogin SSH ● Serial stored session Load Saye Delete er Only on clean exit
> = >ortware devices		

Step 4: Debug the APPIMG.

The Neoway USB OPEN_CON port outputs debugging logs.

B COM41 - PuTTY	-	×
3. SIM test		1
4. Data test		
5. Network test		
6. Voice test		
7. Sms test		
8. Location test		
9. Fota test		
10. Uart test		
11. I2C test		
12. SPI test		
13. GPIO test		
14. ADC test		
15. PM test		
16. Audio test		
17. LED backlight test		
18. keypad test		
19. imei test		
20. file write and read test		
21. tcp test		
22. udp test		
23. tts test		
24. dtmf test		
Please input option:		
SIM pull out		