

LAT1057

Local Application Tips

CubeMX 创建 WL LoRa AT_Slave 应用

关键字: STM32WL, LORA

前言

本篇 LAT 介绍使用 CubeMX 创建基于 STM32WL 的 LoRa 应用。

STM32Cube_FW_WL_V1.0.0\Projects\NUCLEO-WL55JC 中的例程都是基于 STM32WL BGA73 的, CubeMX 无法 直接创建基于 STM32WL QFN48 的例程。

同时介绍如何参考 STM32Cube_FW_WL_V1.0.0\Projects\NUCLEO-WL55JC\Applications\LoRaWAN\LoRaWAN_AT_Slave 创建一个 WLEx_AT_Slave 的例子。

关于不同 MCU 间的移植可参考

UM1718 11.9 Switching to another MCU

UM1718 15 Tutorial 5: Exporting current project configuration to a compatible MCU

需要提前准备的环境:

STM32WL 官网		https://www.st.com/STM32WL
		https://www.stmcu.com.cn/STM32WL
硬件	HW	NUCLEO-WL55JC
		https://www.st.com/en/evaluation-tools/nucleo-wl55jc.html
		MB1389-WL55JC-highband-D04 Schematic
		MB1389-WL55JC-lowband-D04 Schematic
代码生成工具	CubeMX	STM32CubeMX v6.2.0
		https://www.st.com/en/development-tools/stm32cubemx.html
软件源码库	CubeWL	STM32Cube_FW_WL_V1.0.0
		https://www.st.com/en/embedded-software/stm32cubewl.html
集成开发环境	IAR	8.50.9 (以上版本不需要打补丁)
		https://netstorage.iar.com//SuppDB/Public/UPDINFO/015020/arm/do
		c/infocenter/readme.ENU.html

IAR v8.50.9 以下版本需要打补丁

STM32Cube_FW_WL_V1.0.0\Utilities\PC_Softwar\EWARMv8_STM32WLxx_V4.6.zip





1 配置 CubeMX

1.1 配置 CubeMX 并下载 CubeWL

可以使用 CubeMX 默认安装的仓库目录

也可以自定义仓库目录,本例使用<mark>自定义</mark>的仓库目录 <mark>C:\Users\gongw\STM32Cube\Repository\CubeWL</mark>,如下 Help=>Updater Settings=>Repository ForIder=><mark>C:\Users\gongw\STM32Cube\Repository\CubeWL</mark>=>OK

Help	(19)
Help	F1	
About	Alt-A	
Docs & Resources	Alt-D	
Refresh Data	Alt-R	£4
User Preferences		ILW
Check for Updates	Alt-C	
Manage embedded software packages	Alt-U	
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Settings for the Updater		



WX Updater Settings X
Updater Settings Connection Parameters
Firmware Repository
Repository Folder
C:\Users\gongw\STM32Cube\Repository\CubeWL Browse
Check and Update Settings
O Manual Check
Automatic Check Interval between two Checks (days) 5
Data Auto-Refresh
O No Auto-Refresh at Application start
 Auto-Refresh Data-only at Application start
O Auto-Refresh Data and Docs at Application start
Interval between two data-refreshs (days) 3
OK <u>Cancel</u>

选择 Manage software installations 中的 Install or remove embedded software packages 下的 "INSTALL / REMOVE"

Manage software installations
Check for STM32CubeMX and embedded software packages updates CHECK FOR UPDATES
Install or remove embedded software packages



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► !	STM32MP1		
► !	STM32WB		
▶ !	STM32WL		
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•	STM32L1	Check Firmware & Software	
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•	STM32MP1	Check index file	- 1
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Fresh 结束后,点开 STM32WL 左侧的黑色三角,选中 STM32WL 下版本 1.0.0 的 STM32Cube MCU Package for STM32WL Series,点 Install Now



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4 77 S	M32Cube MCU Packages 🛛 🕶 STMicroelectronics 🛛 ARM		
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Deta	S		
<u>STM</u> Mair	2CubeWL Firmware Package V1.0.0 / 28-October-2020 Changes		
	 CMSIS/LL/HAL Drivers with full Quality criteria (MISRA-C® 2012 & CodeSonal All Middlewares Legacy (FatFS, FreeRTOS) All Middlewares RF (LoRaWAN, Sigfox, SubGhz_Phy) All Middlewares Security (STM32_Secure_Engine, STM32_Key_Management All Utilities 	r) _Services, mbed-crypt	0)
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点击 Close

1.2 CubeMX 新建项目

打开 STM32CubeMX,在 New Project 下有三中选择, 请根据需求选择 New Project 的方式!





1.2.1 Start My project from MCU

第1种可使用于所有的WL产品,只能生成和配置的用户自定义(User Defined)的 LoRaWAN/SigFox/SUBGHZ 应用,不能生成 CubeWL 中 AT_Slave/EndNode/PingPong demo

1.2.2 Start My project from BOARD

第 2 种适用于 NUCLEO-WL55JC1 和 NUCLEO-WL55JC1 两种 Demo 板,只能生成和配置的用 户自定义(User Defined)的 LoRaWAN/SigFox/SUBGHZ 应用,不能生成 CubeWL 中 AT_Slave/EndNode/PingPong demo

1.2.3 Start My project from EXAMPLES

第3种适用于生成 CubeWL 中 NUCLEO-WL55JC1 和 NUCLEO-WL55JC1 的 Examples,可生成和配置 CubeWL 中 AT_Slave/EndNode/PingPong demo

1.2.4 Start My project from MCU STM32WLEx

在 New Project 下选择, "Start My project from MCU "下的"ACCESS TO MCU SELECTOR"



OK	Cancel	OK	Cancel



选择 Series 下的 STM32WL

Series		\sim
С	heck/Uncheck All	
STM32V	/L	

根据自己的需求选择 STM32WLE5Cx 中的任意一款

MCUs/MPUs List:	19 items	+ Dis	splay similar items								📤 Export
*	Part No 🌻	Reference	Marketing Status 🛛 🗙		Board	>	< Package	× Flash	× RAM	× 10 >	< Freq.
☆	STM32WLE5UB	STM32WLE5UBYx	NA				WLCSP59	128 kBytes	48 kBytes	22	48 MHz
☆	STM32WLE5U8	STM32WLE5U8Yx	NA				WLCSP59	64 kBytes	20 kBytes	22	48 MHz
☆	STM32WLE5JC	STM32WLE5JCIx	Active				UFBGA73	256 kBytes	64 kBytes	43	48 MHz
☆	STM32WLE5JB	STM32WLE5JBIx	Active				UFBGA73	128 kBytes	48 kBytes	43	48 MHz
☆	STM32WLE5J8	STM32WLE5J8Ix	Active				UFBGA73	64 kBytes	20 kBytes	43	48 MHz
☆	STM32WLE5CC	STM32WLE5CCUx	Active		-		UFQFPN48	256 kBytes	64 kBytes	29	48 MHz
☆	STM32WLE5CB	STM32WLE5CBUx	Active				UFQFPN48	128 kBytes	48 kBytes	29	48 MHz
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☆	STM32WLE4JC	STM32WLE4JCIx	Active				UFBGA73	256 kBytes	64 kBytes	43	48 MHz
☆	STM32WLE4JB	STM32WLE4JBIx	NA				UFBGA73	128 kBytes	48 kBytes	43	48 MHz
☆	STM32WLE4J8	STM32WLE4J8Ix	NA				UFBGA73	64 kBytes	20 kBytes	43	48 MHz
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☆	STM32WLE4CB	STM32WLE4CBUx	NA				UFQFPN48	128 kBytes	64 kBytes	29	48 MHz
☆	STM32WLE4C8	STM32WLE4C8Ux	NA				UFQFPN48	64 kBytes	64 kBytes	29	48 MHz
☆	STM32WL55UC	STM32WL55UCYx	NA				WLCSP59	256 kBytes	64 kBytes	22	48 MHz
\$	STM32WL55JC	STM32WL55JCIx	Active	NUCLEO-WL55JC	NUCLEO-WL55JC1 N	JCLEO-WL55JC2	UFBGA73	256 kBytes	64 kBytes	43	48 MHz
☆	STM32WL55CC	STM32WL55CCUx	Active				UFQFPN48	256 kBytes	64 kBytes	29	48 MHz
☆	STM32WL54JC	STM32WL54JCIx	Active				UFBGA73	256 kBytes	64 kBytes	43	48 MHz
☆	STM32WL54CC	STM32WL54CCUx	Active				UFQFPN48	256 kBytes	20 kBytes	29	48 MHz

点击"Start Project"开始创建项目

G→ Start Project

选择 Single Core Project, 点击 OK





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Connectivity > PB5 PA11	
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Security > PB8 PB2	
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(可选)为最大化窗口,可在 Window 中取消 Output 窗口的选择





STM32CubeMX Untitled: STM32WLE5CCUx				– o ×
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Analog >	PB3		PA13	
Timers >	PB4		PA12	
Connectivity >	PB5		PA11	
Multimedia >	PB6		PA10 PB12	
Security >	PB8		PB2	
Computing >	PAO		PB0	
Middleware >	PA1		VDDR	
Trace and Debug	PA2		VDDR	
	VDD	STM32WLE5CCUX		
Power and Thermal >	PA4	UFQFPN48	VDDP	
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1.3 CubeMX 导入参考项目

	File 1		Window Help		
2	New Project Ctri Load Project Ctri	'I-N 'I-L	onfiguration >		
2	Import Project	1-1	ock Configuration		Ρ
	Save Project Ctr Save Project As . Imp	′I-S port∣	project: available for new Project without	It compound pin	าร
3	Close Project		1 Mode and Configuration		
	Generate Report Ctr	I-R	Mode		
	Recent Projects	•		\sim	
	Exit Ctr	I-X			



Import Project X
Imported Project
C:\Users\gongw\STM32Cube\Repository\CubeWL\STM32Cube_FW_WL_V1.0.0\Projects\NUCLEO-WL55JC\Applications\LoRaWAN\LoRaWAN_AT_Slave\LoRaWAN_AT_Slave.ioc
Import MX Settings
Import Power Consumption Calculator Settings
Import Project Settings
Import Pinout/Clock Configuration/Configuration Settings
Automatic Import
O Manual Import
Import Pinning Status
Import Peripherals Configuration
(Peripheral List
From STM To STM32WLE5CCUx 2
ADC ADV TRA V ADV TRACE
DMA 🗹 DMA
MISC MISC
RCC RTC
SEQUEN Import to SEQUENCER
SUBGHZ SUBGHZ
TIMER TIMER
Import Analysis: C:\Users\gongw\STM32Cube\Repository\CubeWL\STM32Cube_FV_VL_V1.0.0\Projects\NUCLEO-WLS5JC\Applications\LoRaWAN\LoRaWA The Mcu (STM32WL55JCIx) found in the Project being imported is not the same as the Mcu (STM32WLE5CCUx) currently edited
MX Import Project X
Only compatible part of project is imported.
Import RCC : PASS:
Close
Window 1
🗹 Outputs 📿
可通过 Window=>Output 切换是否查看 import 的提示 log

可通过 Window=>Output 切换是否查看 import 的提示 log



MCUs Selection Output
 ▲ GPIO_Output has been removed: it was locked on PC5 which is no longer existing ▲ GPIO_Output has been removed: it was locked on PC3 which is no longer existing ▲ GPIO_EXTIG has been removed: it was locked on PC6 which is no longer existing ▲ Some parameters can't be imported for RTC
<pre>ACan't import parameter:SSRU Underflow Interrupt = Enable, it isn't a possible value in STM32WLESCBUx, it's set to default value.</pre> ASome parameters can't be imported for SUBGH2 PHY
ACan't import SubGHz Phy application:Trace verbose level, it doesn't exist in STM32WLESCBUx
Only compatible part of project is imported. Import RCC : PASS;
Creating: STM32WLE5CCUx
Initializing: STM32WLE5CCUx
Import Analysis:
C:\Users\gongw\STM32Cube\Repository\CubeWL\STM32Cube_FW_WL_V1.0.0\Projects\N
project
The Mcu (STM32WL55 ICIv) found in the Project being imported is not the same as the Mcu
(STM32WL ESCELIX) currently edited
(Child 2 Welever and a standard and a standard a
Import ·
import RTC partly failed
error: Alarm A Internal Alarm A conflicts with IRTC is already used for system time base
GPIO Output has been removed: it was locked on PB9 which is no longer existing
GPIO Output has been removed: it was locked on PB11 which is no longer existing
GPIO Output has been removed; it was locked on PB10 which is no longer existing
GPIO Output has been removed: it was locked on PB15 which is no longer existing
GPIO Output has been removed: it was locked on PB14 which is no longer existing
GPIO Output has been removed: it was locked on PB13 which is no longer existing
GPIO Output has been removed; it was locked on PC4 which is no longer existing
GPIO Output has been removed; it was locked on PC5 which is no longer existing
GPIO Output has been removed: it was locked on PC3 which is no longer existing
GPIO EXTI6 has been removed: it was locked on PC6 which is no longer existing
Some parameters can't be imported for LORAWAN
Can't import LoRaWAN application: Trace verbose level, it doesn't exist in
STM32WLE5CCUx
Some parameters can't be imported for RTC
Can't import parameter:SSRU Underflow Interrupt = Enable, it isn't a possible value in
STM32WLE5CCUx, it's set to default value.
Importing project completed
Only compatible part of project is imported. Import RCC : PASS;

此时再查看 File =>Import Project 选项,变为灰色,表示新项目已被配置,不能再 import 参考项目。



	File 1	1	Window Help
	New Project Ctr Load Project Ctr	'I-N 'I-L	onfiguration >
5	Import Project (2) Ctr Save Project Imp	l-l ort pr l-A	ock Configuration oject: available for new Project without compound pins tware Packs
	Close Project	1.0	SUBGHZ_PHY Mode and Configuration
,	Recent Projects	•	Wide
	Exit Ctr	1-X	

1.4 CubeMX 配置项目

1.4.1 CubeMX 配置 Project Manager

选择 Project Manager

1.4.1.1 配置 Project

选择右侧 Project 并配置如下:

Project Name: WLEx_AT_Slave
Project Location :
C:\Users\gongw\STM32Cube\Repository\CubeWL\STM32Cube_FW_WL_V1.0.0\Projects\NUCLEO-
WL55JC\Applications\LoRaWAN
Application Structure : Advanced
Toolchain / IDE EWARM V8
Minimum Heap Size: 0x200
Minimum Stack Size: 0x800
CubeWL 版本: STM32Cube_FW_WL_V1.0.0

注意:

通过 Browse 选择 Project 保存的目录

- 项目名称 WLEx_AT_Slave 创建在 STM32Cube_FW_WL_V1.0.0\Projects\NUCLEO-WL55JC\Applications\LoRaWAN 下,和 LoRaWAN_End_Node 同级目录,即 C:\Users\gongw\STM32Cube\Repository\CubeWL\STM32Cube_FW_WL_V1.0.0\Projects\NUCLEO-WL55JC\Applications\LoRaWAN\WLEx_AT_Slave,以便于与 LoRaWAN_End_Node 进行比较
- 配置 Application Structure 为 Advanced 与 basic 有什么区别?

Application Structure 为 Advanced 时目录结构分类分级目录更清晰。

Application Structure 为 Basic 时,所有的*.h 都在 WLEx_AT_Slave\Inc 目录下,所有的*.c 在 WLEx_AT_Slave\Src 目录下。

一旦生成过一次代码后目录结构就<mark>无法更改</mark>了!!!



Pinout & Cor	figuration	Clock Configuration	1 Project Manager
2 Project	Project Settings- Project Name WLEx_AT_Slave Project Location [_V1.0.0\Projects Application Struc	3 NUCLEO-WL55JC\Applications\LoF	RaWAN Browse
Code Generator	Advanced Toolchain Folder V1.0.0\Projects\ Toolchain / IDE EWARM	5 ✓ Do not ger Location NUCLEO-WL55JC\Applications\LoR Min Version 6 ✓ V8 ✓ 7	aWAN\WLEx_AT_Slave\ Generate Under
Advanced Settings	Linker Settings– Minimum Heap S Minimum Stack	Size 0x200 8 Size 0x800 9	
	Mcu and Firmwar Mcu Reference STM32WLE5CC Firmware Packa STM32Cube FW Use Default I //32Cube/Reposi	re Package Ux ge Name and Version r_WL V1.0.0 Firmware Location tory/CubeWL/STM32Cube_FW_WL	Browse

1.4.1.2 配置 Code Generator

选择右侧 Code Generator 并配置如下,选择"Add necessary library files as reference in the toolchain project configuration file ",这样将不生成 Drivers 和 Middlewares 目录。

选择 Generated files 下的 "Generate peripheral initialization as a pair of '.c/.h' per peripheral "

Pinout & Configuration		Clock Configuration	Project Manager			
Project	STM32Cube N O Copy all u O Copy only Add neces	ICU packages and embedded software p sed libraries into the project folder the necessary library files ssary library files as reference in the tool s	oacks			
Code Generator	 Generate peripheral initialization as a pair of '.c/.h' files per peripheral Backup previously generated files when re-generating Keep User Code when re-generating Delete previously generated files when not re-generated 					
Advanced Settings	Set all free Enable Fu	e pins as analog (to optimize the power o III Assert ings	consumption)			



STM32Cube Firmware Library Package

- O Copy all used libraries into the project folder
- O Copy only the necessary library files

Add necessary library files as reference in the toolchain project configuration file

注意:

- Copy all used library Package (如复制 Drivers\STM32WLxx_HAL_Driver 下的所有驱动)
 WLEx AT Slave 复制到其他目录下,还能工作
- Copy only the necessary library files(如仅复制 Drivers\STM32WLxx_HAL_Driver 下使用到的驱动)
 WLEx_AT_Slave 复制到其他目录下,还能工作
- Add necessary library files as reference in the toolchain project configuration file(不生成 Drivers 和 Middlewares 目录, 仅参考 Drivers\STM32WLxx_HAL_Driver 下的所有驱动)
 WLEx_AT_Slave 复制到其他目录下,不能工作

参考 UM1718 4.9 Project Manager view

Generated files

- Generate peripheral initialization as a pair of '.c/.h' files per peripheral
- □ Backup previously generated files when re-generating
 ✓ Keep User Code when re-generating
- Delete previously generated files when not re-generated

2 配置外设

2.1 使能外设

2.1.1 Middleware=>LORAWAN

Middleware=>LORAWAN=>Mode 中勾选 Enabled, LORAWAN 功能就使能了,同时 SIGFOX 和 SUBGHZ_PHY 就 失能了,<mark>默认界面如下</mark>,后续再继续配置 LORAWAN 应用。



Pinout & Configura	tion	Clock Co	nfiguration	
	\sim	Software Packs	~	Pinout
Q ~ Ø	F	LORAWAN Mod	le and Configuration	
Categories A->Z		N	lode	
_Analog >	4 ⊻	Enabled		
Timers >				
Connectivity >				
Multimedia >				
Security >				
Computing >				
2Middleware ~				
\$		Confi	guration	
FATES	Re	set Configuration		
KMS		C Diatfa	rm Cottingo	
	\odot	LoRaWAN middlewa	re Settings Viser Con	stants
SIGFOX		🕑 LoRaWAN	l commissioning	
SUBGIL_FIT		📀 LoRaW,	AN application	

2.1.2 Timers=>RTC 使能

Timers=>RTC=>勾选 Activate Clock Source, 并配置 Alarm A 为 Internal Alarm A



2.2 RTC 配置 Alarm A 为 Internal Alarm A





Pinout & Configuration					
Q	~ (RTC Mode and Configuration			
Categories A->	Z	Mode			
System Core	>	4 ✓ Activate Clock Source			
		5 🔽 Activate Calendar			
Analog		Alarm A Internal Alarm A 🛛 6 🗸 🗸			
2 Timers 🗸 🗸		Alarm B Disable 🗸 🗸			
÷		🗌 Timestamp			
LPTIM1		WakeUp Disable 🗸 🗸 🗸			
LPTIM2		🗆 Tamper 1			
3 RTC		🗆 Tamper 2			
TIM1 TIM2 TIM16 TIM17		🗆 Tamper 3			
		Calibration Disable 🗸			
		Reference clock detection			

Clock Configuration => RTC Clock Mux=>LSE 在 Clock Configuration 中检查 RTC Clock Mux 是否配置为 LSE



Timer =>RTC=>Users Constants



		1 Pinout & Configuration
۹	~ 💿	RTC Mode and Configuration
Categories A->Z		Mode
System Core	>	🛃 🗹 Activate Clock Source
		Activate Calendar
Analog	<u> </u>	6 Alarm A Internal Alarm A
2 Timers	~	Alarm B Disable 🗸 🗸
\$		□ Timestamp
LPTIM1		WakeUp Disable 🗸 🗸
LPTIM2		Tamper 1
3 RTC		🗆 Tamper 2
TIM2		□ Tamper 3
TIM16 TIM17		Calibration Disable 🗸 🗸
THVIT7		Reference clock detection
Connectivity	>	Configuration
Multimedia	>	Description Description Description N/C Settings
Security	>	Search Constants
Computing	>	Search (CrtI+F) 8 add remove
Middleware	>	Constant Name Constant Value
Trace and Debug	>	RTC_N_PREDIV_S 10 RTC_PREDIV_S ((1< <rtc_n_prediv_s)-1)< td=""> 9 (1<<rtc_n_prediv_s)-1)< td=""></rtc_n_prediv_s)-1)<></rtc_n_prediv_s)-1)<>
Power and Thermal	>	USART_BAUDRATE 115200



		Pinout & Configu	ration		
۵	~ 《	RTC Mode	and Configuratio	n 🛃	
Categories A->	·Ζ		Mode		
System Core	>	4 🗹 Activate Clock Source			
		5. Activate Calendar	_		
Analog	>	Alarm A Internal Alarm A	6	\sim	
Timers	\sim	Alarm B Disable		~	
•		🗌 Timestamp			
LPTIM1		WakeUp Disable		~	
LPTIM2		🗌 Tamper 1			
3 RTC		🗌 Tamper 2			
TIM1 TIM2		🗌 Tamper 3			
TIM16		Calibration Disable		~	
TIM17		Reference clock detectio	n		
		Cor	ofiguration		
Connectivity	>		niguration		
Multimodia	>	Reset Configuration	1		
wullimeula		📀 Parameter Settings 🛛 📀 L	Jser Constants	NVIC Settings	
Security	>	Saarah Constanta			
Computing	>	Search Constants		8 add rem	
computing		Search (Chi+F)			
Middleware	>	Constant Name	10	Constant Value	
Trace and Debu	a >	RTC_PREDIV_S	((1< <rtc< td=""><td>_N_PREDIV_S)-1)</td><td></td></rtc<>	_N_PREDIV_S)-1)	
Hace and Debu	9	RTC_PREDIV_A	((1<<(15-	RTC_N_PREDIV_S))-1)	
Power and Ther.	>	USART_BAUDRATE	115200	(9)	
		LFUARI_DAUDRATE	9000		
TC_N_PR	REDIV	/_S		10	
TC_PRED	DIV_S	5		((1< <rtc_n_prei< td=""><td>DIV_S)-1)</td></rtc_n_prei<>	DIV_S)-1)
TC_PRED	DIV_A	\		<u>((1<<(15-RTC_N_F</u>	PREDIV_S))-
SART_BA	UDR	ATE		115200	
PUART_B	AUD	RATE		9600	

Timer =>RTC=>Parameter Settings



		Pinout & Configuration	
Q	~ ©	RTC Mode and Configuration	
Categories A->Z		Mode	
System Core	>	✓ Activate Clock Source	
Analog	>		_
- indiag		Alarm A Internal Alarm A	~
2 Timers	\sim	Alarm B Disable	~
÷		🗆 Timestamp	
LPTIM1		WakeUp Disable	\sim
LPTIM2		Tamper 1	
3 RTC		□ Tamper 2	
TIM1		Tampar 2	
TIM2			_
TIM17		Calibration Disable	~
		Reference clock detection	
		Configuration	
Connectivity	>		
Multimedia	>	Reset Configuration	
		4 Parameter Settings 🛛 📀 User Constants 🛛 📀 NVIC Settings	
Security	>	Configure the below parameters :	
0	<u>,</u>	Q Search (CrtI+F) ③ ③	0
Computing		✓ General	
Middleware	>	Asynchronous Predivider value RTC_PREDIV_A 6	
		Bin Mode Free running Binary mode	
Trace and Debug	g >	V Alarm A	
·		Free running 32 bit value 0	
Power and Thermal	/	Binary AutoControl RTC_ALARMSUBSECONDBIN_AUTOCLR_NO	
Utilities	>	Free running 32 bit mask SS[31:0] are compared and must match to activate alarm.	

Timer =>RTC=>NVIC Settings



		1 Pinout & Configuration
٩	~ ©	RTC Mode and Configuration
Categories A->Z		Mode
System Core	>	✓ Activate Clock Source
		☑ Activate Calendar
Analog	>	Alarm A Internal Alarm A
2 Timers	~	Alarm B Disable
		□ Timestamp
LPTIM1		WakeUp Disable 🗸 🗸
LPTIM2		Tamper 1
3 RTC		Tamper 2
TIM1		Tamper 3
TIM12 TIM16		Calibration Disable
TIM17		Reference clock detection
Connectivity	>	Configuration
		Reset Configuration 4
Multimedia	>	Parameter Settings
Security	>	NVIC Interrupt Table Enabled Preemption Priority Sub Priority
		RTC Tamper, RTC TimeStamp, LSECSS and RTC SSRU Interru. 5 🔽 0 0
Computing	>	RTC Alarms (A and B) Interrupt 0 0

Middleware => LORAWAN => Platform Settings => Timer Server => RTC

● Pinout & Configuration			ation	Clock Co	onfiguration		Project Manager
				✓ Software	e Packs	✓ Pinout	
Q	~ Ø			LORAWA	N Mode and Configuration		1
Categories A->	>Z				Mode		
Multimedia	>	4 🗹 Ena	bled				
Security	>						
Computing	>	_			Configuration		
2 Middleware	~	Rasat (Configuration				
¢ FATFS FREERTOS		✓ LoRaV TimeServe	VAN application	LoRaWAN commissioning	🛛 🛇 LoRaWAN middleware	🛛 User Constants	 ♥ Platform Settings
3 LORAWAN	_	Name	IPs or Compon	ents	Found Solutions		BSP API
SIGFOX SUBGHZ_P	ΉY	RTC	RTC:RTC Enable	d	V RTC 6		✓ Unknown

2.3 DebugLine

Connectivity=>LPUART1 (AT_Slave)

	T VCP TX	SB3	B2	PA1	G3	
ADD D1 TV	ARD D1 TX	SB2	LPUART1_TX/USART2_TX	PA2	H2	PAI
AKD_DI_IA	T VCP RX	SB5 DNF	LPUART1_RX/USART2_RX	PA3	H1	
ADD DO DV	ARD D0 RX	SB4	ARD_D10	PA4	J1	PA3 DA4
AKD_D0_KA		DNF	ARD D13	PA5	J2	TA4







Clock Configuration => LPUART1 Clock Mux => LSE



Middleware => LORAWAN => LoRaWAN middleware => radio_board_if =>Activate Debug Line

I Pinout	& Configuration	Clock Configura	ation	Project Manag	er
		✓ Software Packs	~	Pinout	
Q ~	0	LORAWAN Mode a	nd Configuration		1
Categories A->Z		Mode	2		
Multimedia >	✓ Enabled				
Security >		Configura	ation		
Computing >	Reset Configuration	LoRaWAN commissioning SLoR:	aWAN middleware) User Constants 🛛 📀 Platform Setting	s
2 Middleware 🗸 🗸	Configure the below parameters				
\$	Search (CrtI+F)	\odot		6	
FATES	Region India freq: 865	5 🗆]		
FREERTOS	Region USA freq: 915	5 🔽	l i i i i i i i i i i i i i i i i i i i		
	Region Russia freq: 8	364]		
SIGEOX	Enable Hybrid mode]		
SUBGHZ PHY	Enable LoRaMAC Cl	assB]		
	✓ radio_board_if				
	Radio maximum wak	eup time (in ms) 10			
Trace and Debug >	TCXO support				
	- DCDC support		1		
Power and Ther >	Activate Radio Board	Interface			
	Activate Debug Line	_	'l 🔍		
Utilities >	- mw_log_cont Enable Middleware Ic)g 🗸]



Platform Settings => VCOM => LPUART1

1 Pinout &	Configuration	Clock Configuration	Project Manager
-		✓ Software Packs ✓	r Pinout
Q ~ Ø		LORAWAN Mode and Configuration	
Categories A->Z		Mode	
Multimedia >	Enabled		
Security >			
Computing >			
		Configuration	
Z Middleware Y	Reset Configuration		
÷	A LoDo\A/AN application		Lloor Constanto
FATES		ElokavvAN commissioning CollokavvAN middleware	See Constants Platform Settings
KMS	COM-		
3 LORAWAN	Name IPs or Componen	ts Found Solutions	BSP API
SIGFOX SUBGHZ_PHY	USART LPUART: Asynchror	nous 5 ~ LPUART1 6	Unknown

2.4 System Core => GPIO (RF SW CTRL / BUTTON / LED)

2.4.1 RF_CTRL

System Core => GPIO => PA8 (customizable)

RF front-end configuration	FE_CTRL1	FE_CTRL2	FE_CTRL3
Transmit high output power	Low	High	High
Transmit low output power	High	High	High
Receive	High	Low	High





Pinout & Configu	onfiguration		Clock Config	uration	F	Project Ma	nager		
		\sim	Software Packs	×	 Pinout 				
Q ~ Ø				GPIO Mode a	nd Configuration				1
Categories A->Z				Config	juration				
2 System Core 🗸 🗸	Group By Peri	pherals							~
\$	S GPIO	RCC 🛛 📀 U	JSART 🛛 🔗 NVIC						
3 GPIO HSEM WDG	Search Signals Search (CrtI+F	s 7)						□ Show only	Modified Pins
	Pin Name 🗢	Signal on Pin	GPIO output level	GPIO mode	GPIO Pull-up/	Maximum	Fast Mode	User Label	Modified
🗸 SYS	PA0 n	/a /a	n/a	External Interrupt	No pull-up and	n/a	n/a	BUT1 BUT2	
WWDG	PB8 4 n.	/a	Low 5	Output Push Pull	No pull-up and	Low	Disable	RF_CTRL2	

Middleware=>LORAWAN=>Platform Settings => Radio => RF SW CTRL

1 Pin	out & Config	guration	Clock Config	guration	Project Manager	
			✓ Software P	acks 🔨	 Pinout 	
Q	~ Ø		LORAW	AN Mode and Configuration		
Categories A->Z				Mode		
Multimedia	>	✓ Enabled				
Security	>			Configuration		
Computing	>	Reset Configuration				4
2 Middleware	~	✓ LoRaWAN application Radio	on 🔮 LoRaWAN commissioning	Scherker Sch	🔮 User Constants	✓ Platform Settings
¢		Name IPs or	Components	Found Solutions	5	BSP API
FREERTOS		RF SW CTRL 3 GPIO:0	Dutput	 ✓ Undefined 		∼ Unknown
KMS		RF SW CTRL 1 GPIO:0	Dutput	✓ Undefined		√ Unknown
SIGFOX SUBGHZ_PH	Ŷ	RF SW CTRL 2 GPIO:0	Dutput 5	V PB8 [RF_CTRL2]	6	✓ Unknown

2.4.2 LED

System Core => GPIO => PB2 (customizable)

Pinout & Config	uration		Clock Confi	guration	F	Project N	Manage	er		
		~	Software Pack		✓ Pinout					
Q ~ Ø				GPIO Mode and	Configuration					I
Categories A->Z				Configur	ation					
÷	Group By Peri	pherals							\sim	
DMA	⊘ GPIO	DEBUG	🥺 RCC 🛛 🔮 USA	RT 🛛 🔗 NVIC						
HSEM										
	Search Signal	s						Show only M	dified Dine	
A RCC	Search (Citi+i	F)				Q		Show only with	Julieu Filis	l
✓ SYS	Pin Name 🌻	Signal on Pin	GPIO output level	GPIO mode	GPIO Pull-up/Pull	Maximu	Fast M	User Label	Modified	L
WWDG	PA0 r	n/a	n/a	External Interrupt	No pull-up and no	n/a	n/a	BUT1	✓	L
	PA1 I	n/a	n/a	External Interrupt	No pull-up and no	n/a	n/a	BUT2	\checkmark	L
	PB2 I	n/a	Low	Output Push Pull	No pull-up and no	Low	n/a	LED1	V	
Analog >	PB8 r	n/a	Low	Output Push Pull	No pull-up and no	Low	Disable	RF_CTRL2	~	F
	PB12 I	n/a	Low	Output Push Pull	No pull-up and no	Low	n/a	DBG1	✓	



Middleware=>LORAWAN=>Platform Settings => Board resources => LED

1 Pinout	1 Pinout & Configuration		Cloc	Clock Configuration		t Manager
			✓ So	ftware Packs	✓ Pinout	
Q ~	٢			LORAWAN Mode and Configuration	n	
Categories A->Z				Mode		
Timers	>	🗹 Enabled				
Connectivity	>			Configuration		
Multimedia	>	Reset Configur	ation			4
Security	>	Soard resources	plication 🛛 LoRaWAN comm	issioning 🔮 LoRaWAN middlew	are 🛛 🤡 User Constants 🛛 😒 Pl	atform Settings
Computing	>	Name IPs o	or Components	Found Solutio	ns	BSP API
		LED 3 GPIO	:Output	✓ Undefined		✓ Unknown
Middleware		LED 2 GPIO	:Output	 ✓ Undefined 		∼ Unknown
¢ FATFS		LED 1 GPIO	:Output 5	✓ PB2 [LED1]	6	∼ Unknown
FREERTOS KMS		BUTTON 1 GPIO	EXTI	✓ PA0 [BUT1]		∼ Unknown
		BUTTON 3 Unde	fined	∼ No solution		∨ Unknown
SUBGHZ_PHY		BUTTON 2 GPIO	EXTI	✓ PA1 [BUT2]		∼ Unknown

3 STM32WL Templates Patches for CubeMX

STM32WL Templates 在如下目录,如需要可自行定制自己的 Templates

C:\Program Files\STMicroelectronics\STM32Cube\STM32CubeMX\db\templates\stm32wl

针对不同的客户定制化的板子,硬件外设配置不一致,客户可根据需要定制化自己的外设配置。

从 NUCLEO-WL55JC(BGA73) 移植到 STM32WLExCxUx(QFN48)定制化的板子上,射频开关(RF SW CTRL),按键 (BUTTON), LED 的配置会不一样,可能导致编译错误,如想生成的代码不会产生编译错误,需要编辑一下 STM32WL 的 template。

3.1 CubeMX template patches for stm32wl

请参考

C:\Program Files\STMicroelectronics\STM32Cube\STM32CubeMX\db\templates\stm32wl



其中包含 radio_board_if_c.ftl for RF SW CTRL radio_conf_h.ftl for DBG_GPIO_RADIO_TX board_resources_c.ftl & board_resources_h.ftl for BUTTON SubGHz_Phy_subghz_phy_app_c.ftl for LED LoRaWAN_lora_app_c.ftl for LED

3.2 CubeMX Updates from v6.1.1 to v6.2.0

main.c

void SystemClock_Config(void)	void SystemClock_Config(void)			
{	{			
RCC_OscInitTypeDef RCC_OscInitStruct = {0};	RCC_OscInitTypeDef RCC_OscInitStruct = {0};			
RCC_ClkInitTypeDef RCC_ClkInitStruct = {0};	RCC_ClkInitTypeDef RCC_ClkInitStruct = {0};			
/** Configure LSE Drive Capability	/** Configure LSE Drive Capability			
*/	*/			
	HAL_PWR_EnableBkUpAccess();			
HAL_RCC_LSEDRIVE_CONFIG(RCC_LSEDRIVE_				
LOW);	HAL_RCC_LSEDRIVE_CONFIG(RCC_LSEDRIVE_			
/** Configure the main internal regulator output	LOW);			
voltage				
/**				
* @brief Macro to configure the External Low Speed os	cillator (LSE) drive capability.			
* @note As the LSE is in the Backup domain and write	access is denied to			
* this domain after reset, you have to enable write a	access using			
* HAL_PWR_EnableBkUpAccess() function before	to configure the LSE			
* (to be done once after reset).				
* @paramLSEDRIVE specifies the new state of t	he LSE drive capability.			
* This parameter can be one of the following value	s:			
* @arg @ref RCC_LSEDRIVE_LOW LSE oscilla	ator low drive capability.			
* @arg @ref RCC_LSEDRIVE_MEDIUMLOW L	SE oscillator medium low drive capability.			
* @arg @ref RCC_LSEDRIVE_MEDIUMHIGH LSE oscillator medium high drive capability.				
* @arg @ref RCC_LSEDRIVE_HIGH LSE oscillator high drive capability.				
* @retval None				
*/				
#defineHAL_RCC_LSEDRIVE_CONFIG(LSEDRIVE)				
LL_RCC_LSE_SetDriveCapability(LSEDRIVE)				

rtc.c

CubeMX v6.1.1	CubeMX v6.2.0
if (HAL_RTC_SetAlarm_IT(&hrtc, &sAlarm,	if (HAL_RTC_SetAlarm_IT(&hrtc, &sAlarm, 0) !=
RTC_FORMAT_BCD) != HAL_OK)	HAL_OK)
#define RTC_FORMAT_BIN 0x00000000	* This parameter will trigger a SW conversion to fit with
the native BCD format of the HW Calendar.	
It should not be con	fused with the Binary mode @ref RTCEx_Binary_Mode.
*/	
#define RTC_FORMAT_BCD 0x0000001u	/* Native format of the HW Calendar.



It should not be confused with the Binary mode @ref RTCEx_Binary_Mode.

*/

Ticket 96721 - [Diff Examples] WL RTC: RTC_FORMAT_BCD removed from HAL_RTC_SetAlarm_IT call Ticket 100003 - [Diff Examples] WL RTC: RTC_FORMAT_BCD removed from HAL_RTC_SetAlarm_IT call Ticket 90404 - [HAL_RTC_SetAlarm & HAL_RTC_SetAlarm_IT] Unnecessary assertion on parameter when Alarm Masks defined

usart.c

CubeMX v6.1.1	CubeMX v6.2.0
if	删除了
(HAL_DMA_ConfigChannelAttributes(&hdma_lpuart1_tx,	
DMA_CHANNEL_NPRIV) != HAL_OK)	
{	
Error_Handler();	
}	

4 验证

4.0 参考工程



4.1 生成代码 GENERATE CODE





Ge	nerating user source code	
MX Cod	le Generation X	1
0	The Code is successfully generated under : C:/Users/gongw/STM32Cube/Repository/CubeWL/STM32Cube_FW_WL_V1.0.0/Projects/NUCLEO-WL55JC/Applications/LoRaWAN/WLEx_AT_Slave Project language : C	
	Warning: Projects using Sigfox, LoRaWAN or SubGHz_Phy may require a customized linker file. Examples can be found within the STM32Cube MCU Package for STM32WL series: C:/Users/gongw/STM32Cube/Repository/CubeWL/STM32Cube_FW_WL_V1.0.0	
	Open Folder Open Project Close	可

选择 Open Project 使用 IDE 直接打开 Project。

或选择 Open Folder 后,还需再选择 EWARM\Project.eww 打开 Project

STM32Cube_FW_WL_V1.0.0 > Projects > NUCLEO-WL55JC > Applications > LoRaWAN > WLEx_AT_Slave >				
Name	Date modified	Туре	Size	
Core	2/7/2021 15:55	File folder		
EWARM	2/7/2021 15:55	File folder		
📜 LoRaWAN	2/7/2021 15:55	File folder		
.mxproject	2/7/2021 15:55	MXPROJECT File	35 KB	
WLEx_AT_Slave.ioc	2/7/2021 15:54	STM32CubeMX	19 KB	

4.2 编译并下载

用 IAR 打开 STM32Cube_FW_WL_V1.0.0\Projects\NUCLEO-

 $WL55JC \label{eq:wls5} WL55JC \label{eq:wls$

如果 IAR 之前已经打开了 WLEx_AT_Slave,在每次重新生成代码时都如有如下提示,选择"Yes to All"

Project - IAR Embedded Workbench IDE - Arm 8.42.2					
File Edit View Project ST-Link Tools Window Help					
1 12 🖬 🚇 I 🔜 I 🖉 I 12 C I 🛛 🕞 🗸 📿 > ⇆ 🛤 🗘 I 2 I 13 🖬 🖷 I 2 C I 13 I 14					
Workspace 🗸 🖈 Iora_app.c 🗙 radio.c radio_driver.c					
WLEx_AT_Slave ~					
Files Image: Constraint of the second seco					
larldePm X					
The project WLEX_AT_Slave, located at C\Users\gongw\STM32Cube\Repository\CubeWL\STM32Cube_FW_WL_V1.0.0\Projects\NUCLEO-WL55JC\Applications\LoRaWAN\WLEX_AT_Slave\EWARM\WLEX_AT_Slave.ewp, has been modified on disk. Would you like to reload the project?					
Bu Yes Ves to All No					
Kingganga					



按 F7 或选择 Project=>Make(F7)来编译工程,如果编译无错误,选择 Project=>Download=>Download Active Application 下载 WLEx_AT_Slave 应用

版本历史

日期	版本	变更
2022年04月11日	1.0	首版发布

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