

"国产MCU开发技术与生态建设"

第三期线上分享系列课程

第3讲: Embedded Studio嵌入式开发入门

主讲人: 吕裔枫 2020年/8月/19日











Segger Embedded Studio快速入门



Segger Embedded Studio实例演示

















德国segger集团总部(Monheim)

Segger公司创始人

Segger公司的产品手册



- 高可靠性
- 高性能
- 高效率
- 快速设置









* Embedded Studio集成开发环境

嵌入式系统的C/C++集成开发环境

Embedded Studio 是一款功能强大的嵌入式系统 C/C++ IDE,为用户提供专业的嵌入式C编程的一体化解 决方案。

- 轻松启动通用微控制器的项目生成器
- 功能强大的工程管理和源代码编辑器
- 具有高级调试信息窗口的集成调试器
- 直接 J-Link 集成

可视化工作室式风格为嵌入式工程世界提供了与 PC 开发人员所熟悉的直观使用方式。





* Embedded Studio集成开发环境



内核支持

Embedded Studio支 持基于ARM和RISC-V 的微控制器。

效率

快速启动,较短的项目 加载时间和并行构建, 可最大程度地减少等待 时间,并提高效率。

移植性

Embedded Studio支持 在Windows, macOS和 Linux上使用。

工具链

Embedded Studio附带 的两个工具链GCC和 LLVM。



* 内核支持

- Cortex-M0, Cortex-M0+, Cortex-M1, Cortex-M3, Cortex-M4, Cortex-M7
- Cortex-M23和Cortex-M33
- Cortex-A和Cortex-R
- 传统 ARM7、ARM9、ARM11
- RISC-V RV32

SEGGER Embedded Studio V3.10 - Package Manager

• CPU 支持包提供一切, 使您轻松入门

? X

Search Packages				Q
litle	Version	Туре	Status	Action
E C Internet				
CMSIS-CORE Support Package CMSIS-DSP Support Package	4.00 1.04	Core Support Core Support	Installed	No Action No Action
CMSIS-CORE Support Package CMSIS-DSP Support Package Package Information	4.00 1.04	Core Support Core Support	Installed	No Action No Action
CMSIS-CORE Support Package CMSIS-DSP Support Package Package Information Total Packages	4.00 1.04 43	Core Support Core Support	Installed Installed	No Action No Action
CMSIS-CORE Support Package CMSIS-DSP Support Package Package Information Total Packages Total Packages Installed	4.00 1.04 43 7	Core Support Core Support	Installed Installed	No Action No Action





* 包管理器

CPU支持包包括了启动文件、内存映射、CPU 初始化等 所有文件,用于为您的设备创建一个完整的新项目。此外, 预先配置的示例项目也包含在每个包中



* Embedded Studio集成开发环境



内核支持

Embedded Studio支 持基于ARM和RISC-V 的微控制器。

效率

快速启动,较短的项目 加载时间和并行构建, 可最大程度地减少等待 时间,并提高效率。

移植性

Embedded Studio支持 在Windows, macOS和 Linux上使用。

工具链

Embedded Studio附带 的两个工具链GCC和 LLVM。



•启动与项目加载

启动	1 秒
项目加载	1 秒

•多线程构建

•6	个工程中的	400	个源文件,	Windows	7	64	位
----	-------	-----	-------	---------	---	----	---

1线程构建	41 秒(10 个文件/秒)
8线程构建	13 秒(31 文件/秒)

•使用J-Link调试

调试启动,无源更改

重新 启动

•496 kByTe 应用,	Kinetis K60,	SWD,	16 MHz
调试启动,空设备	7 秒		

2秒

1秒

Out	put					D 🖗	×		
3	Building 'IP' in configuration 'Debug' Completed				65 targets in 2 30 targets/s	.15	ок		
3	Building 'FS' in configuration 'Debug' Completed				99 targets in 3 29 targets/s	.4s	ОК		
3	Building 'USBD' in configuration 'Debug' Completed				18 targets in 0. 19 targets/s	.9s	ОК		
2	Building 'CRYPTO' in configuration 'Debug' Completed				117 targets in 3 33 targets/s	3.5s	ок		
Building 'SSL' in configuration 'Debug' Completed					16 targets in 0. 25 targets/s	.6s	ок		
2	Building 'emPower' in Completed	configur	ation 'Debug	9'	85 targets in 3. 27 targets/s	.15	ок		
7	Build complete				6 projects in 13	Bs	ок		
_	Completed	Output						D 🔊	
		Show:	Target		- * * [Tasks 🔻]		
		Co	paring targe	t for downlo	ad				
		Pro We	gramming 49 orking	94.1 KB of ad	dresses 0000000	0 — 0007b8	8f		
		Pro We	gramming 0. orking	7 KB of addr	esses 0007b890 -	— 0007bb6f			
		ו-נ 🍞 און ש	SEGGER J-L	Link - Flash d	ownload (496 K	B)			
		🕽 Ex	Compare		10	00.0%			0.067s
			Erase		10	00.0%			0.758s
			Program		1(00.0%			5.553s
			Verify		1(00.0%			0.037s



* Embedded Studio集成开发环境



内核支持

Embedded Studio支 持基于ARM和RISC-V 的微控制器。

效率

快速启动,较短的项目 加载时间和并行构建, 可最大程度地减少等待 时间,并提高效率。

移植性

Embedded Studio支持 在Windows, macOS和 Linux上使用。

工具链

Embedded Studio附带 的两个工具链GCC和 LLVM。



* 移植性

Embedded Studio支持的操作系统:

• Windows

- Linux
- MacOS





* Embedded Studio集成开发环境



内核支持

Embedded Studio支 持基于ARM和RISC-V 的微控制器。

效率

快速启动,较短的项目 加载时间和并行构建, 可最大程度地减少等待 时间,并提高效率。

移植性

Embedded Studio支持 在Windows, macOS和 Linux上使用。

工具链

Embedded Studio附带 的两个工具链GCC和 LLVM。



* 工具链

- 包括从编译到生成执行文件所有工具
- GCC
- Clang/LLVM
- GNU连接器与库管理
- 支持使用外部工具链
- 内置优化的标准C库

Embedded Studio支持从其他开发环境导入工程:

- Eclipse
- IAR EWARM
- Keil MDK
- Keil MDK (ARM Compiler 6)

👁 stm32l476RG - SEGGER Embedded Studio for ARM V4.30c (64-bit) - Non-Commercial License





* 工具链

Embedded Studio导入IAR工程:

- 点击Import IAR EWARM Project开始导入
- 定位到IAR工程文件(*.eww/*.ewp)
- 选择工具链
- 开始开发/编译/调试

导入成功

SEGGER Embedded Studio for ARM V4.52c - Project Importer

🖉 Project Is Imported

The following items have been imported:

- Project source files
- Project structure
- Include directories
- Preprocessor definitions

ø	SEGGER	Embedd	led Studio	for ARM V4	4.52c (64-	bit) - Non	-Commer	cial Licen	se					
<u>F</u> ile	<u>E</u> dit	<u>V</u> iew	<u>S</u> earch	<u>N</u> avigate	<u>P</u> roject	<u>B</u> uild	<u>D</u> ebug	T <u>a</u> rget	Tools	<u>W</u> indow	F			
	New Blar Open Open File Open Stu Close New Proj Op <u>e</u> n Sol	nk File e Fro <u>m</u> Sudio Fold ject	olution	Ctrl+K, Ctrl+O Alt+Shil Ctrl+F4 Ctrl+Shi Ctrl+Shi	Ctrl+N it+O ift+N ift+O						-			
	Import P	roject			•	Impo	rt Eclipse l	Project			1			
đ	Close So	lu <u>t</u> ion				Impo	rt IAR EWA	ARM Proje	ct					
H	<u>S</u> ave Save <u>A</u> s	w. Of Δε		Ctrl+S Ctrl+K,	A	Impo Impo	rt Keil MD rt Keil MD	K Project K Project (ARM Cor	npiler 6)				
14 (7	Save An <u>c</u> Save A <u>l</u>	<u>I</u> Close		Ctrl+K, I Ctrl+Shi	D ift+S		v 🥯 seo Imp	GGER Eml	ild Cor	Studio for A nfiguratio	RM V4.	52c - Pro	oject Im	×
m	Sou <u>r</u> ce C Page Set	ontrol		Ctrl+K :	► Shift+P		Cre © © IAR In	ate Build C External T Internal To Internal an	Configurat coolchain coolchain nd Extern Directory	tions For: (IAR) al Toolchains				

Cancel

OK

· ...



Х

> -3 X

> > **%**

> Į0 X

×

ОК

OK

_

* 工具链

Embedded Studio导入IAR工程:

自动替换汇编文件 ٠

IAR_Import_Test - SEGGER Embedded Studio for A	RM V4.52c	(64-bit) - M	Non-Com	nercial License — 🗌)
<u>File Edit View Search Navigate Project</u>	<u>B</u> uild <u>D</u> eb	oug T <u>ar</u> g	jet <u>T</u> oo	is <u>W</u> indow <u>H</u> elp	
Project Explorer		🖸 🛛 🗙	main) 💀	1
🕄 IAR_Import_Test Internal 🔻 🔲 💼 💼 🕹 🍕	> fi	7 .	← -	→	. 1
Project Items	Code	Data		1 /* USER CODE BEGIN Header */	
Solution 'IAR_Import_Test'				***************************************	***
Project 'IAR_Import_Test'	6.8K	142 byte	s	*@file : main.c	
a 🔄 Application 4 files	[818 bytes]	[64 bytes	1	* @brief : Main program body	
🔺 🔄 EWARM 🛛 1 file					***
sm startup_stm32f401xe.s (modified option	n:			* @attention *	
🔺 🔄 User 🛛 3 files	[818 bytes]	[64 bytes	1	* <h2><center>&conv: Convright (c) 2020 STMicroelectronics.</center></h2>	
b 📄 main.c	524 bytes	64 byte	s 1	<pre>0 * All rights reserved.</pre>	
stm32f4xx_hal_msp.c	260 bytes			*	
stm32f4xx_it.c	34 bytes			* This software component is licensed by ST under BSD 3-Clause license	з,
Drivers 17 files	[264 bytes]	[28 bytes	1	* the "License"; You may not use this file except in compliance with t	the
a 🔄 CMSIS 1 file	[264 bytes]	[28 bytes	1	* License. You may obtain a copy of the License at: * opensource org/licenses/RSD-3-Clause	
system_stm32f4xx.c	264 bytes	28 byte	s	*	
STM32F4xx_HAL_Driver 16 files				*****	***
a 🔄 Internal Files 🛛 2 files	[686 pytes]	[4 bytes	<		>
▷ Km Cortex_M_Startup.s	292 bytes				
SEGGER_THUMB_Startup.s	394 bytes	4 byte	Outpu		
🖻 📄 Output Files			Show:	Transcript 🔹 🍢 🔭 Tasks 💌	
			👮 В	uilding 'IAR_Import_Test' from solution 'IAR_Import_Test' in configuratio 23 targets in 1.7s	0
				in the second seco	_
				uild complete ompleted	O
			FLAS	SH1 RAM1	
			6.9 K	B 1% // bytes 0%	
					-



* Embedded Studio集成开发环境



免费使用

对于非商业性和非营 利性的教育用途, Embedded Studio是免 费提供的。

您可以将其用于课程, 学校或在家中的业余 爱好项目。



项目设置

项目管理器可以在一个 地方组织和管理项目源 代码。

多项目解决方案,动态 文件夹和属性继承为您 的项目设置提供了灵活 性。



调试器

J-Link / J-Trace调试 仿真器无缝集成到 Embedded Studio调试 器中,以启用其所有强 大功能。

调试器可以提供有关操 作系统的信息-当前正 在执行的任务,或者每 个任务使用堆栈等。





Segger Embedded Studio 快速入门

Preparing target for download Completed Frasing 'gdvf103vnew.elf' on J-Link

Downloading 'gdvf103vnew.elf' to J-Link

Erase successful

Download successful



4.0 KB in 0.1s

4.0 KB in 0.4s

36.5 KB/s

9.4 KB/S

OK

OK

* 启动界面

esnooseo	
<u></u>	6
3	A min
SEGGER Em	hedded Studio
SEGGER LI	bedded Stadio
SEGGER Embedded Studio for RISC-V is up to date Check for Updates	Projects 🗁 Open existing 🗅 Create new
	Today
	[] gdfv103
All packages are up to date Check for Packages	C gdfv103 C GDVF103V-EVLA
All packages are up to date Check for Packages (gdfv103 GDVF103V-EVLA Start_Simulator
All packages are up to date Check for Packages	gdfv103 GDVF103V-EVLA Start_Simulator Three Weeks Ago
All packages are up to date Check for Packages	GDVF103V-EVLA GDVF103V-EVLA GSVF103V-EVLA GSVF103V-EVLA GSVF10

- 处理器基于软件包管理
- 完整的IDE功能
- 强大的调试器
- 跨平台



* 下载支持包

- 进入包管理器
 - Tools->Package Manager



SEGGER Embedded Studio for RISC-V V4.22 - Package Manager				?	×
Select Packages					l
iearch Packages				Ð	~
litle	Version	Туре	Status	Action	1
	100	Library	Installed	No Astion	
STEPORE LIDIARY Package	1.00	Library		NO ACTION	1
GigaDevice					

- 选择支持包下载
 - 在Select Packages下面右侧按 刷新 按钮,第一次 会显示所有包的列表,如果没有安装的,可以用鼠 标点在你需要的包上选择下载安装
 - 双击选中GDVFXX处理器支持包,点击Next进行下载 安装



* 工程配置管理

保存不同的工程配置方便管理与调试



右键工程名,选择Options进入工程配置页面





* 基本工程配置



Dulia	
 Always Rebuild 	No
 Batch Build Configurations 	
 Build Quietly 	Yes
 Dependency File Name 	None
 Enable Unused Symbol Removal 	Yes
 Exclude From Build 	No
 External Compiler 	None
 Include Debug Information 	Yes
 Intermediate Directory 	Output/\$(ProjectName) \$(Configuration)/Obj
 Memory Map File 	None
Memony Man Macros	

② Compiler选项:设置C语言标准与编译器

Compiler

Duild

٠	Additional C Compiler Only Options	
٠	Additional C Compiler Only Options From File	None
٠	Additional C/C++ Compiler Options	
٠	Additional C/C++ Compiler Options From File	None
٠	Additional C++ Compiler Only Options	
٠	Additional C++ Compiler Only Options From File	None
•	C Language Standard	gnu99
+	C++ Language Standard	gnu++98
	Compiler	gcc
٠	Enable All Warnings	No

③ Linker选项:设置定位文件与 二进制文件输出格式

🔺 📕 Linker

٠	Executable File Name	\$(OutDir)/\$(ProjectName)\$(EXE)
	Additional Input Files	
•	Link Dependent Projects	Yes
+	Use Manual Linker Script	No
F	Section Placement File	\$(ProjectDir)/flash_placement_riscv.xml (inherits)
+	Section Placement Macros	
٠	Default Fill Pattern	None
F	Additional Output Format	None (inherits)
÷	Generate Map File	Yes

④ Preprocessor选项:设置宏定义与 预处理头文件目录

Preprocessor

٠	Ignore Includes	No
•	Preprocessor Definitions	inherits
+	Preprocessor Undefinitions	
	System Include Directories	
+	Undefine All Preprocessor Definitions	No
	User Include Directories	inherits



* 基本工程配置



⑤: Debugger选项:设置调试器与目标芯片

🛛 📕 Debugger

 Target Connection 	I-Link (inherits)
Run To Control	Always
 Run To 	main
 Startup Completion Point 	main
 Start From Entry Point Symbol 	Yes
 Leave Target Running 	No
 Register Definition File 	<pre>\$(ProjectDir)/GD32VF103_Registers</pre>
 Debug Terminal Log File 	None
 Threads Script File 	None
 Thread Maximum 	25
 Working Directory 	\$(ProjectDir)
 Command Arguments 	<pre>\$(ProjectName)\$(EXE)</pre>
 Entry Point Symbol 	None
 Load Additional Projects 	
 PULP Extensions Debug 	Yes
 RTT Control Block Address 	_SEGGER_RTT
 RTT Enable 	Yes
 Starting Stack Pointer Value 	None
 Target Device 	GD32VF103VBT6 inherits
 Debug Symbols File[0] 	None

* ①Build选项

1,选择编译器

2,设置中间文件,与二进制文件输出位置,可使用默认位置

🔺 📕 Build

 Always Rebuild 	No
 Batch Build Configurations 	
 Build Quietly 	Yes
 Dependency File Name 	None
 Enable Unused Symbol Removal 	Yes
Exclude From Build	No
 External Compiler 	None
Include Debug Information	Yes
Intermediate Directory	Output/\$(ProjectName) \$(Configuration)/Obj
 Memory Map File 	None
Memony Man Macros	

Build		
Always Rebuild	No	
 Batch Build Configurations 		
 Build Quietly 	SEGGER EMD	eaded Studio for KISC-V V4.52C - Property Editor 💦 🔨
 Dependency File Name 		
 Enable Unused Symbol Rer 	Set Externa	l Compiler
Exclude From Build		
External Compiler	Project:	gdvf103v1
Include Debug Information	6	D have
Intermediate Directory	Configuration:	Debug
Memory Map File	External Compiler:	None 👻
Memory Map Macros		RV22 GNU
Memory Segments		Ness
 Output Directory 		OK Cancel
 Project Can Build In Paralle 		
 Project Dependencies 	Select build ontion	os for an external compiler
 Project Directory 	Select build option	is for an external complicit
 Project Macros 	inh	herits
 Project Type 	Exe	cutable inherits
 Property Groups File 	Nor	ne
 Suppress Warnings 	No	
Tool Chain Directory	\$(St	tudioDir)/gcc/\$(GCCTarget)/bin





* ①Build选项-使用外部工具链(芯来官方工具链为例)

1 修改Project Type为Externally Built Executable

2 修改Tool Chain Directory为 \\$(StudioDir)/Nuclei_Toolchain/gcc/bin

3 修改工程宏

	SEGGER Embedded Studio for RISC-V V4.52c - Property Editor X	
Search Options	Set Project Type	
Option Always Rebuild Batch Build Configurations Build Options Generic File Name Exclude From Build External Compiler Intermediate Directory Memory Map File Memory Map Macros Memory Segments Output Directory Project Can Build In Parallel 	Project: GD32VF103_EVAL_Demo Configuration: Debug Project Type: Externally Built Executable OK Cancel	
Project Dependencies Project Directory Project Macros Project Type	L None modified CORE_FLAGS=-march=rv32imafc -mabi=ilp32f -mcmodel=medany COMMON_FLAGS=- Externally Built Executable modified	
Tool Chain Directory	S(StudioDir)/Nuclei_Toolchain/gcc/bin modified	



*①Build选项-使用外部工具链(芯来官方工具链为例)

修改编译指令

SEGGER Embedded Studio for RISC-V V4.52b - Options ×		
Project 'helloworld	l' Options	
↑ ↓ 🗘 FLASHXIP	Search Options	Show Modified Options Only
- Code	Option	Value
Assembler Build	✓ ■ External Build	
Compiler External Build File Linker Preprocessor	Assemble Command Build Command Compile Command C Compile Command C++ Link Command	"\$(ToolChainDir)/riscv-nuclei-elf-gcc" \$(CORE_FLAGS) \$(COMMON_FLAGS) \$(GC_CI None "\$(ToolChainDir)/riscv-nuclei-elf-gcc" \$(CORE_FLAGS) \$(COMMON_FLAGS) \$(GC_CI "\$(ToolChainDir)/riscv-nuclei-elf-g++" \$(CORE_FLAGS) \$(COMMON_FLAGS) \$(GC_C None
Source Code User Build Step Debug	 Clean Command Link Command Objects File 	None "\$(ToolChainDir)/riscv-nudei-elf-gcc" \$(CORE_FLAGS) \$(COMMON_FLAGS) \$(GC_LC None
Debugger GDB Server J-Link Loader		
Simulator Target Script	(No Property)	
		OK Cancel



*①Build选项-使用外部工具链(芯来官方工具链为例)

修改工程宏

CORE_FLAGS=-march=rv32imafc -mabi=ilp32f -mcmodel=medany COMMON_FLAGS=-g -fno-common -DDOWNLOAD_MODE=DOWNLOAD_MODE_FLASHXIP GC_CFLAGS=-ffunction-sections -fdata-sections GC_LDFLAGS=-WI,--gcsections -WI,--check-sections NEWLIB_LDFLAGS=--specs=nano.specs EXTRA_LDFLAGS=-u _isatty -u _write -u _sbrk -u _read -u _close -u _fstat -u _lseek

修改编译指令

Assemble Command: "\$(ToolChainDir)/riscv-nuclei-elf-gcc" \$(CORE_FLAGS) \$(COMMON_FLAGS) \$(GC_CFLAGS) \$(AsmOptions) \$(Defines) \$(Includes) -MD -MF "\$(RelDependencyPath)" -c -o "\$(RelTargetPath)" "\$(RelInputPath)"

C Compile Command: "\$(ToolChainDir)/riscv-nuclei-elf-gcc" \$(CORE_FLAGS) \$(COMMON_FLAGS) \$(GC_CFLAGS) \$(COptions) \$(COnlyOptions) \$(Defines) \$(Includes) -MD -MF "\$(RelDependencyPath)" -c -o "\$(RelTargetPath)" "\$(RelInputPath)"

C++ Compile Command: "\$(ToolChainDir)/riscv-nuclei-elf-g++" \$(CORE_FLAGS) \$(COMMON_FLAGS) \$(GC_CFLAGS) \$(COptions) \$(CppOnlyOptions) \$(Defines) \$(Includes) -MD -MF "\$(RelDependencyPath)" -c -o "\$(RelTargetPath)" "\$(RelInputPath)"

Link Command: "\$(ToolChainDir)/riscv-nuclei-elf-gcc" \$(CORE_FLAGS) \$(COMMON_FLAGS) \$(GC_LDFLAGS) \$(NEWLIB_LDFLAGS) \$(EXTRA_LDFLAGS) --specs=nosys.specs -MMD -MT \$(ProjectName)\$(EXE) -MF \$(ProjectName)\$(EXE).d \$(Objects) -o "\$(OutDir)/\$(ProjectName)\$(EXE)" -T "\$(RelLinkerScriptPath)" -lstdc++ -nostartfiles -WI,-M,-Map="\$(RelMapPath)" \$(LinkOptions)



* ②Compiler选项

- 1,选择要使用的C语言标准
- 2,设置使用的内置编译器



Compiler

 Additional C Compiler Only Options 	
 Additional C Compiler Only Options From 	n File None
 Additional C/C++ Compiler Options 	
 Additional C/C++ Compiler Options From 	n File None
 Additional C++ Compiler Only Options 	
 Additional C++ Compiler Only Options F 	rom File None
 C Language Standard 	gnu99
 C++ Language Standard 	gnu++98
Compiler	gcc
 Enable All Warnings 	No



* ③Linker选项

1,设置定位文件目录,程序移植时请确保此定位 文件位置正确。

- flash_placement.xml
- sram_placement.xml
- 2,设置二进制文件格式

🛛 📕 Linker

 Executable File Name 	\$(OutDir)/\$(ProjectName)\$(EXE)
 Additional Input Files 	
 Link Dependent Projects 	Yes
 Use Manual Linker Script 	No
 Section Placement File 	\$(ProjectDir)/flash_placement_riscv.xml inherits
 Section Placement Macros 	
 Default Fill Pattern 	None
 Additional Output Format 	None (inherits)
 Generate Map File 	Yes



* ④ Preprocessor选项

- 1,设置预处理宏定义
- 2,设置预处理头文件目录

Preprocessor

•	Ignore Includes	No
+	Preprocessor Definitions	inherits
 Preprocessor Undefinitions 		
+	System Include Directories	
+	Undefine All Preprocessor Definitions	No
+	User Include Directories	inherits



* ⑤Debugger选项

- 1,设置调试器
- Simulator
- J-Link
- GDB Server

2,设置目标芯片

Debugger

 Target Connection 	-Link (inherits)
Run lo Control	Always
 Run To 	main
 Startup Completion Point 	main
 Start From Entry Point Symbol 	Yes
 Leave Target Running 	No
 Register Definition File 	<pre>\$(ProjectDir)/GD32VF103_Registers</pre>
 Debug Terminal Log File 	None
 Threads Script File 	None
Thread Maximum	25
 Working Directory 	\$(ProjectDir)
 Command Arguments 	\$(ProjectName)\$(EXE)
 Entry Point Symbol 	None
Load Additional Projects	
• PULP Extensions Debug	Yes
 RTT Control Block Address 	_SEGGER_RTT
 RTT Enable 	Yes
Starting Stack Pointer Value	None
Target Device	GD32VF103VBT6 inherits
 Debug Symbols File[0] 	None

	SEGGER Embedded Studio for RISC-V V4.52c - Target Device	×
urch Options	Select Target Device	
Option		
	Search	
⊿ ■ Debugger	AndesTech	^
Target Connection	A25	
Bun To Control	GigaDevice	
Run To	GD32VF103C4T6	
 Startup Completion Point 	GD32VF103C6T6	
Start From Entry Point Syn	GD32VF103C8T6	
Leave Target Running	GD32VF103CBT6	
Register Definition File	GD32VF103R4T6	
 Debug Terminal Log File 	GD32VF103R6T6	
 Threads Script File 	GD32VE103R8T6	
Thread Maximum	GD32VE103RBT6	
 Working Directory 	GD32VE103T4U6	
 Command Arguments 	GD32VF1031400	
 Entry Point Symbol 	CD22VE102T016	
Load Additional Projects	CD32VF1031800	
 PULP Extensions Debug 		
RTT Control Block Addres		
 RTT Enable 	GD32VF103VB10	
 Starting Stack Pointer Valu 	Nuclei System	-
 Target Device 	W N101	
 Debug Symbols File[0] 	₩ N205	
	N207	
Target Device	N208	
T I C IL I C I	N305	
The name of the device to conn	N307	
Inherits	N308	~
	OK Car	ncel



* ④Debugger选项

1,J-Link调试器

- 连接类型
- 调试接口
- 调试速度
- 2, GDB Sever (GD-Link为例)
- 驱动下载
- 修改Type为OpenOCD。
- 修改GDB Server Command Line为: "\\$(StudioDir)/Nuclei_Toolchain/openocd/bin/openocd"-f 并且加上OpenOCD的设置文件路径。
- 修改Auto Start GDB Server为yes。

4	J-Link

Host Connection	USB
 Target Interface Type 	JTAG
 JTAG Instruction Register Size Before Target 	Auto Detect
 JTAG Number Of Devices Before Target 	Auto Detect
 Speed 	4,000 kHz
 Supply Power 	No
 Show Log Messages In Output Window 	Yes
 Log File 	None
 Script File 	None
Exclude Flash Cache Range	None
 Additional J-Link Options 	None
 Target Has Cycle Counter 	No

⊿ ■	GDB Server		
• Ho	ost	localhost	
 Type 	pe	OpenOCD modified	-
 GD 	B Server Command Line	"\$(StudioDir)/Nuclei_Toolchain/openocd/bin/openocd" -f "\$(StudioDir)//n100-sdk/bsp/core/env/openocd_hbird_ilm.cfg" modified	
• Au	to Start GDB Server	No modified	
 Po 	rt	3,333 (modified)	
 Re 	set and Stop Command	reset halt modified	
 Igr 	nore Checksum Errors	No (modified	
 All 	ow Memory Access During Execution	Yes (modified)	
• Re	gister Access	General and Individual modified	
 Lo 	g File	None	
 Tar 	rget XML File	None	
 Co 	nnect Timeout	5 seconds	
 Re 	ad Timeout	60 seconds	
Wr	rite Timeout	60 seconds	



* 编译工程

- 选中工程
- Build->Build gdvf103v1

Building 'gdvf103v1' from solution 'gdvf10 Completed 9 Notes	3v1' in configuration 'Debug'	9 targets in 1.2s 7 targets/s	ОК
Build complete Completed			ОК
FLASH1	RAM1		
4.0 KB 3%	2.0 KB	5%	

👁 gdvf10	3v1 - SEGG	ER Embed	ded Studio	for RISC-\	/ V4.22 (64-bit) - N	Ion-Comr	mercial Li	cense	
File Ec	it View	Search	Navigate	Project	Build	Debug	Target	Tools	Window	Help
Project Ex	plorer				💝 Bu	ild gdvf103	3v1		F7	Ī
					Re	build gdvf	103v1		Alt+F7	
🖏 Debug		•		1 0	Cl	ean gdvf10	3v1			
B 1 1 1										

• 编译结果

🧼 gdv	f103v1	- SEGG	ER Embec	ded Studio	for RISC-	V V4.22 (54-bi	t) - No	on-Comr	nercial Li	cense	
File	Edit	View	Search	Navigate	Project	Build	De	bug	Target	Tools	Window	Help
Projec	t Explor	er				•		Go	ו		F5	
		_		_	-		Ш	Break			Ctrl+.	
₹ " ΣDe	bug		•		1 0			Stop			Shift+F	5
Project	Items					Code	←	Resta	rt		Ctrl+Sh	ift+F5
Sol	ution 'g	dvf103v1	'									
4	Projec	t 'gdvf1(03v1′			3	-	Togg	le Breakp	oint	F9	1
4	🔁 Sci	ript Files	1 file					Break	points			•

• Debug->Go进入调试

See GD 32VF103 Demo 1 - SEGGER Embedded Studio for RISC-V V4.52c (64-bit) - Non-Commercial License (Stopped)



- * 调试工程
 - 调试窗口

Image: State of the state o	<u>File Edit View Search Navigate Project Build Deb</u>	ug T <u>a</u> rget <u>T</u> ools <u>W</u> indow <u>H</u> elp	
com image: com	Diassembly	gd32vf103.h gd32vf103_libopt.h main.c systick.c n22_func.c 🥑 🗸 🗙	Threads 💀 🔀
Since the SS, 8(SS) Since the SS, 8(SS)	main → 🔳 🔶 🖓 🖓 🗸 🗸	● int main0	🐵 Reload Script 🛞 Refresh 📱 Show Lists 🛛 🚅 E
<pre>int wai(void) int wai(vo</pre>	BB0095E 439C Lw 55, 0(55) A 080005A0 88A1 andi 55, 55, 8 08000588 080005A2 DBFD begz a5, 0x08000598	40 /*! Vorief main function Vparam[in] none Vparam[out] none Vretval none */	No selected context
<pre>view is in the interview is in the interview is int</pre>	080005A4 0001 nop	int main(void)	
int main(val) ippe://milestate/state ippe://milestate/state ippe://milestate int main(val) ippe://milestate ippe://milestate ippe://milestate int int main(val) ippe://milestate ippe://milestate ippe://milestate int int int int int int ippe://milestate ippe://milestate ippe://milestate int int into ippe://milestate ippe://milestate ippe://milestate int into ippe://milestate ippe://milestate ippe://milestate int into ippe	000003A0 0141 adol 5p, 5p, 10 080005A8 8062 jr ra 080005A8 0000 ?????? main.c - 43 \param[out] none \retval none	<pre>/* enable the LED clock */ rcu_periph_clock_enable(RCU_GPIOC); 50 rcu_periph_clock_enable(RCU_GPIOE); /* configure LED GPID port */ BpiD_init(GPIDC, GPID_PVDE_OUT_PP, GPID_OSPEED_S00HZ, GPID_PIN_0 GPID_PIN_2); BpiD_init(GPIDC, GPID_PVDE_OUT_PP, GPID_OSPEED_S00HZ, GPID_PIN_0 GPID_PIN_2); BpiD_init(GPIDC, GPID_PVDE_OUT_PP, GPID_OSPEED_S00HZ, GPID_PIN_0 GPID_PIN_2); </pre>	Watch 1 ₽ ₽ ₽ ₽ ★ Each Second ▼ X2 X6 X6 X6 X #
inite	int main(void) { see a sec	S5 anip bit reset (GPIOC GPIO PIN 0 GPIO PIN 2).	GPIO_PIN_0 GPIO_PIN_0 symbol not
with the spin and the sp	<pre> @ 080005AC 1141 add1 sp, sp, -16 @ Sw ra, 12(sp) /* enable the LED clock */ rcu_periph_clock_enable(RCU_GPDIC); 06000530 60400513 11 a0, 1540</pre>	<pre>> >> gplo_bit_rest(GPIC, GPIO_PIN_0) GPIO_PIN_1);</pre>	Watch窗□
000000000000000000000000000000000000	239 jal 8x80808445 krcu rcu_periph_clock_enable(RCU_GFIDE); 88808586 08000586 60609513 1i a0, 1542 08000586 2835 jal 8x80808AF6 krcu main.c. 51 /* configure LED GPID port */ gpio_init(PECC, GPID (MOE_OUT_PP, GPID)	<pre>/ insert 200 ms detay '/ delay_ims(200); /* turn on LED2 */ gpio_bit_set(GPIOC, GPIO_PIN_2); /* insert 200 ms delay */ delay_ims(200);</pre>	VVatCIT ⊠ ⊢ Pgisters1 ⊙ Groups ♦ ♀ → ⊕ # %, 🕾 🖬
★ We	eeccestic 文社的编窗日	<pre>70</pre>	Name Value A • ABI, RV321 • 0x080005ac • 0x080005ac
断点设置 新点设置 weight with the set of the set	'ම 196 නි මූට හි 100 ගි ගි 100 කි ● Breakpoints ● main.c, line 61	<pre>/*turn on LED4 */ gpio_bit_set(GPIOE_GPIN_1); /*insert 200 ms delay */ </pre>	sp 0.20000000 gp 0.20000000 tp 0.20000000 a0 0.00000000
断点设置 「Int main」 Locals 窗口 輸出窗口 新出窗口 新出窗口		pebug Terminal 🛛 🗿 🛪 🖾 Stack 🖧 🔪	a2 0x20000004
xy x xo x	断点设置	Image: Control of the system Call Address int main() 0x080005AC start() 0x080005AC	a3 0x3ca35083 a4 0x0000005 a5 0x00001006 a6 0x00000000 a6 0x00000000 a7 0x00001000 b0 0x06671300 b1 0x0800000
Locals窗口 人 输出窗口 人 Stack窗口 人 Registers窗口	x ₂ x ₈ x ₀ x ₁₀ x ₁₀ x ₀ x 1 ■ ■ ■ ✓ Expression Value		12 0×00000000 13 0×000000000 14 0×000000000 15 0×000000000 16 0×000000000 16 0×000000000 12 0×000000000 12 0×000000000 12 0×000000000 13 0×00000166
The second secon	Locals窗口	▲ 輸出窗口 Stack窗口	

- * 调试工程
 - 观察寄存器
 - View->Register
 - 观察存储器
 - View->Memory
 - 观察其它信息
 - View->其它









Segger Embedded Studio 实例演示



* 使用环境

- 操作系统: Windows 10 64位版
- Embedded Studio for RISC-V: 4.52c 64位版
- 仿真器: J-link BASE 驱动 6.80c
- •目标板:GDVF103V-EVAL 2019.06 v1.0版
- * 启动软件
 - 从windows开始或从桌面图标启动Segger Embedded Studio

e	Relea SEGGER Embedded Studio for AF	RM 4.30
	SEGGER Embedded Studio for 最近添加	晴







* 软件下载

• 打开网址 <u>https://www.segger.com/downloads/embedded-studio/</u> 根据你使用 的计算机操作系统下载适合您的Embedded Studio for RISC-V软件

Embedded Studio for RISC-V				
	Version	Date	File size	*
Embedded Studio for RISC-V, Windows, 64-bit Simply download and run the installer.	V4.52c ↔	[2020-05-18]	226,210 KB	LOWNLOAD
Embedded Studio for RISC-V, Windows, 32-bit Simply download and run the installer.	V4.52c 🗸	[2020-05-18]	217,676 KB	LOWNLOAD
Embedded Studio for RISC-V, macOS Download and mount the image, then run the installer.	V4.52c ↔	[2020-05-18]	258,397 KB	LOWNLOAD
Embedded Studio for RISC-V, Linux, 64-bit Download and extract the archive, then run the installer.	V4.52c 🗸	[2020-05-18]	245,166 KB	LOWNLOAD
Embedded Studio for RISC-V, Linux, 32-bit Download and extract the archive, then run the installer.	V4.52c 🗸	[2020-05-18]	263,566 KB	LOWNLOAD



* 固件库下载

GD32VF103固件库下载: GD官网: <u>http://www.gd32mcu.com/</u> 资料下载->开发板资料->GD32VF1 MCU->GD32VF103 Demo Suites

拨素 GD32VF1 Q

免费获取GD32 MCU配套软硬件资源包,让您的开发变得简单!





* 固件库

将下载的固件库GD32VF103_Demo_Suites_V1.0.3.rar解压到工程目录下,解压后的 文件包括了库文件GD32VF103_Firmware_Library,和开发板例程。 本次实验将要使用的工程是GD32VF103_Demo_Suites_V1.0.3\ GD32VF103V_EVAL_Demo_Suites\Projects\01_GPIO_Running_Led 的电量LED工程。

> GD32VF103_Firmware_Library GD32VF103C_START_Demo_Suites GD32VF103R_START_Demo_Suites GD32VF103T_START_Demo_Suites GD32VF103V_EVAL_Demo_Suites



* 软件界面	SEGGER Embedded Studio for RISC-V V4.22 (64-bit) - Non-Commercial License Eile Edit View Search Navigate Project Build Debug Target Jools Window Help	- σ ×				
- 1771177日4	Dathboard					
	SEGGER Emb	edded Studio				
	SEGGER Embedded Studio for RISC-V is up to date Check for Updates	Projects Deen existing Create new				
	All packages are up to date Check for Packages	Today D gdfv103 D GDVF103V-EVLA				
		C Start_Simulator				
		Three Weeks Ago				
		Last Month				
	(Output)	© ×				
	Show: Target Tarks	~				
	Completed	1171-11				
	Erase successful	42 AD III 0.15 36.5 KB/s				
	Downloading 'gdvf103vnewelf' to J-Link Download successful	4.0 KB m 0.4s OX V				



٠

久石上部按Creat New, 创建一个GDVF103V-EVAL枚子的工程 SECCER Freibedded Studio for RISC-V is up to Check for Updates Check for Packages are up to date Check for Packages Check for Packag	
bedded Studio	
Projects D Greate new	
Today	
HIFive1_Rev B Samples	
Digdix	
🗅 HIFive-RevB	
Executable_1	
[] GDEX	
	Projects Today Balance Today Balance Balance



BMR 麦克泰技术

- * 创建工程
 - 选择GDVF103V-EVAL板 子的包如下:
 - 选择 A C/C++ executable Gige Device GD32VF1xx
 - 在下面Name右侧的框中, 给你的项目起一个名字
 - 按 Next

- SEGGER Embedded Studio for RISC-V V4.22 New Project
- G Select new project template

A C/C++ executable for a HiFive1.

advf103v1

Name:

An externally huis everytable for a HiFiyel Rey R.

Location: D:/Users/jiang/Documents/SEGGER Embedded Studio for RISC-V Projects/gdvf103v1

Search Projects

SiFive

Silling

Back

Don't see your device or board? Use the Package Manager to install packages Description Manufacturer Board ^ An externally pulit executable for a KISC-V processor. Generic Generic KISC+1 A C/C++ executable for a RISC-V processor executing from FLASH memory (internal tools and external GNU tools). Generic Generic RISC-V A C/C++ executable for a RISC-V processor executing from RAM memory (internal tools and external GNU tools). Generic Generic RISC-V An empty solution. Generic (Standard Projects) A library project. Generic (Standard Projects) An object file project. Generic (Standard Projects) A project for copying files to a target directory. (Standard Projects) Generic A project for running a custom build when files have changed. Generic (Standard Projects) GigaDevice A C/C++ executable for GigaDevice GD32VF1xx. GigaDevice Generic GD32VF1xx An assembly code only executable for GigaDevice GD32VF1xx. Generic GD32VF1xx GigaDevice An externally built executable for GigaDevice GD32VF1xx. GigaDevice Generic GD32VF1xx A library for GigaDevice GD32VF1xx. GigaDevice Generic GD32VF1xx A C/C++ ejecutable for a 31_Coreplex_FPGA_Eval. SiFive Generic RISC-V A C/C++ executable for a HiFive1 Rev B. SiFive Generic RISCV

Browse

Cancel

Generic RISCV

Generic RISCV

Next

44

Embedded Studio 实例演示



- 弾出 Choose Common project setting窗口
 - 设置程序在哪里执行
 - 设置目标处理器的具体型号
 - 设置输出文件格式
- 按 Next

Select files to add to project
iles:
RTT Files
Script Files
Source Files
System Files

G Choose common project settings

Properties:	
Option	Value
Build	
 Section Placement 	Flash
 Target Processor 	GD32VF103VBT6
Linker	
 Additional Output Format 	None
Printf/Scanf	
 Printf Floating Point Supported 	No
 Printf Integer Support 	int
 Printf Width/Precision Supported 	No
 Scanf Classes Supported 	No
 Scanf Floating Point Supported 	No
 Scanf Integer Support 	int

- 弾出 Select files to add to project窗口
- 选择你需要的文件
- 按 Next



* 创建工程

- 弹出 Select configurations to add to project窗口
 - Debug
 - Release
- 选择你需要的配置,按 Finish。

-	Select	configurations	to	add	to	project

Configurations:

Debug

(

• 生成的工程如图所示

File	Edit	View	Search	Navigate	Project
Proje	ct Explo	rer			
C: De	ebug		•		😭 🔂 🐗
Projec	t Items				1
So So	lution 'o	dvf103v1	1'		
4	Proje	t 'gdvf1	03v1'		
4	So So	GD32V	1 file F1xx_Targe	t.js modifie	d options
1	So So	main.c	s 1 file, m	odified optio	ons
1	S)	stem File	es 8 files		
	Þ	gd32vf	103.h		
	e_	gd32vf	103_eclic.c		
	45	GD32V	F1xx_Startu	p.s	
	•	init.c			
	0] n22_fu	nc.c		
	as	riscy_c	rt0.s		
	0] system	_gd32vf10	B.c modifie	d options



* 查看工程选项

• 选中工程后,右键选择Options进入工程选项, 或在工具栏Project->Options中进入

🔶 🦆 Debug	Search Options	Show Modified Op	tions On
Code	Option	Value	
Assembler			
Code Constation	A Assembler		
Consulta	Additional Assembler Options		
Compiler	Additional Assembler Options From File	None	
External Build	Assembler Generate Assembler Listing File	gcc	
File	Generate Assembler Listing File	NO	
Libraries	e 🗖 Duild		
Library			
Linker	Always Rebuild	No	
Preprocessor	Batch Build Configurations	N	
Printf/Scanf	Build Quietiy Denenderers Eile Nerrer	Yes	
Runtime Memory Area	Enable University File Name Enable University Symptot Removal	None	
Section	Enable Onused Symbol Removal Exclude From Build	No	
Source Code	Exclude Hombulu External Compiler	None	
User Build Step	Include Debug Information	Vec	
Debug		0.1.1/6/0.1.101	10 C
Debugger			
CDB Server			
GDB Server			
J-Link			
Loader			
Simulator			



• 工程选项中包括了工程代码配置与调试配置信息



* 裸板程序

- Solution 'GD32VF103V_Demo'
- Project 'GD32VF103V_Demo'
 - a 🔄 Script Files 🛛 file
 - GD32VF1xx_Target.js modified options
 - a 🗟 Source Files 1 file, modified options
 - b 🔄 main.c
 - 🔺 🚖 System Files 🛛 8 files
 - entry.s
 - h_] gd32vf103.h
 - gd32vf103_eclic.c
 - GD32VF1xx_Startup.s
 - 👂 📄 init.c
 - n22_func.c
 - ▷ asm riscv_crt0.s
 - system_gd32vf103.c modified options
 - a 👸 Output Files
 - GD32VF103V_Demo.elf
 - GD32VF103V_Demo.ind
 - GD32VF103V_Demo.ld
 - GD32VF103V_Demo.map

- Script Files
 - GD32VF1XX_Target.js
- Source Files
 - main.c
- System Files
 - entry.s
 - gd32vf103.h
 - gd32vf103_eclic.c
 - GD32VF1xx_Stertup.s
 - init.c
 - n22_func.c

//内核文件

//调试脚本

- riscv_crt0.s
- system_gd32vf103.c



- GD32VF1xx
 - Device
 - Include
 - gd32vf103.h •
 - gd32vf103_xxx.h •
 - n22 eclic.h •
 - n22_func.h •
 - n22 tmr.h •
 - riscv bits.h •
 - riscv const.h •
 - riscv_encoding.h •
 - system_gd32vf103.h
 - Source
 - entry.s
 - qd32vf103 eclic.c •
 - init.c •
 - n22 func.c •
 - system_gd32vf103.c •



- GD32VF1xx Target.js
- Source
 - GD32VF1xx_Startup.s

flash placement riscv.xml GD32VF103 Registers.xml GD32VF103V Demo.emProject GD32VF103V_Demo_Debug.jlink



riscv crt0.s



* 裸板程序

GD32VF1xx

- Output
- flash placement riscv.xml
- GD32VF103_Registers.xml
- GD32VF103V Demo.emProject
- GD32VF103V Demo Debug.jlink
- 🗾 main.c
- 🗾 riscv crt0.s
- SEGGER RTT.c
- 55 SEGGER RTT.h
- SEGGER_RTT_Conf.h
- SEGGER RTT Syscalls SES.c

* 修改ESE下工程结构

右键工程,点击New Folder添加存放固件库文件的 文件夹:

- Device
 - GD32_Std_Per
- 在Source Files下,删除main.c,添加BSP文件夹用于 存放开发板支持文件
- 删除System Files下的gd32vf103.h,gd32vf103_eclic.c 并且删除计算机工程目录中GD32VF1xx\Device\Include文 件夹下的gd32vf103.h与gd32vf103_xxx.h文件







* 添加源代码

- 右键文件夹,点击Add Existing File添加源代码。
- 将GD32VF103_Firmware_Library\ GD32VF103_standard_peripheral\Source文件夹下的C文件添加到工程的 Devices\GD32_Std_Per文件夹下
- 将GD32VF103_Demo_Suites_V1.0.3\
 GD32VF103V_EVAL_Demo_Suites\Projects\
 01_GPIO_Running_Led下的C文件添加到工程的Source Files文件夹下
- 将GD32VF103_Demo_Suites_V1.0.3\
 GD32VF103V_EVAL_Demo_Suites\Utilities下的C文件添加到Source Files\BSP文件表下



* 添加头文件路径

右键工程,选择Options在Preprocessor下的User Include Directories 下填入头文件路径

\$(ProjectDir)\GD32VF103_Demo_Suites_V1.0.3\GD32VF103_Firmware _Library\GD32VF103_standard_peripheral \$(ProjectDir)\GD32VF103_Demo_Suites_V1.0.3\GD32VF103_Firmware _Library\GD32VF103_standard_peripheral\Include \$(ProjectDir)\GD32VF103_Demo_Suites_V1.0.3\GD32VF103V_EVAL_De mo_Suites\Projects\01_GPIO_Running_Led \$(ProjectDir)\GD32VF103_Demo_Suites_V1.0.3\GD32VF103V_EVAL_De mo_Suites\Utilities







* 修改文件

移植完成后点击编译,会出现报错,报错显示没有 定义开发板,所以这里将开发板定义为 GD32VF103V EVAL

- /* define value of high speed crystal oscillator (HXTAL) in Hz */
 #if !defined HXTAL_VALUE
 #ifdef GD32VF103R_START
- 60 #define HXTAL_VALUE ((uint32_t)25000000) /*!< value of the external oscillatc #define HXTAL_VALUE_8M HXTAL_VALUE
- 62 #else defined(GD32VF103V_EVAL) || defined(GD32VF103C_START) || defined(GD32VF103T_S
 #define HXTAL_VALUE ((uint32_t)800000) /*!< value of the external oscillator
 #define HXTAL_VALUE_25M HXTAL_VALUE
 //#else</pre>
 - //#error "Please select the target board type used in your application (in gd32v
- 67 #endif
 - #endif /* high speed crystal oscillator value */

#include "gd32vf103 bkp.h" 40 #include "gd32vf103 can.h" #include "gd32vf103 crc.h" #include "gd32vf103 dac.h" #include "gd32vf103 dma.h" #include "gd32vf103 eclic.h" #include "gd32vf103 exmc.h" #include "gd32vf103 exti.h" #include "gd32vf103_fmc.h" #include "gd32vf103 gpio.h" #include "gd32vf103_i2c.h" 50 #include "gd32vf103_fwdgt.h" #include "gd32vf103 dbg.h" #include "gd32vf103 pmu.h" #include "gd32vf103 rcu.h" #include "gd32vf103 rtc.h" #include "gd32vf103 spi.h" #include "gd32vf103 timer.h" #include "gd32vf103 usart.h" #include "gd32vf103 wwdgt.h" 😫 59 #include "n200 func.h"

点击重新编译,报错显示没有n200_func.h这个文件

本工程使用的是n22_func.h,所以这里修改为n22_func.h





* 下载调试

再点击重新编译,编译通过,可以进行下载调试。







解答时间

系列课程后面安排: 8月20日,晚8点 第四讲: 从零开始学习RTOS 分析工具的使用 欢迎扫码申请入群 演示代码下载链接: https://eyun.baidu.com/s/3o970fDC 密码: Ma8k



Microcontrollers & Embedded

