

# W60X OpenOCD 调试指导

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### 1 引言

#### 1.1 编写目的

指导如何在 Eclipse 环境中集成 OpenOCD 使用 GDB 调试代码; 指导 W60X 相关的开发人员使用 OpenOCD 对 W60X 进行单步调试;

#### 1.2 预期读者

所有 W60X 相关的开发人员

### 1.3 术语定义

OpenOCD: Open On-Chip Debugger

#### 1.4 参考资料



#### 2 快速上手: 使用 Eclipse+OpenOCD 调试 W60X

#### 2.1 连接模块

OpenOCD必须搭配JTAG仿真器使用,选定一款JTAG仿真器(如JLINK、CMSIS-DAP等),使用杜邦线连接JTAG仿真器和W60X模块,其连接方式如下图:



如图所示接线之后,给W60X模块上电,JTAG仿真器连接到上位机(本文所使用的上位机都是PC电脑)。

电源接线根据实际情况而定,有些仿真器不需要连接电源线。

不同的 JTAG 仿真器所有使用的驱动不同,如果使用 JLINK 仿真器其驱动安装请参考 3.3.1 章节的安装; 如果使用 CMSIS-DAP 仿真器则不需要安装驱动; 其他的 JTAG 仿真器请自行安装驱动。

#### 2.2 安装 Eclipse

这里建议使用我们打包配置好的环境,请在 http://www.winnermicro.com/html/1/156/158/497.html 下载,该压缩包里我们提供了Eclipse(已经集成了zylincdt调试插件)、Cygwin(已经安装好了OpenOCD)、 交叉编译工具(arm-none-eabi-gcc)等。

解压压缩包之后,请先阅读压缩包里的 ReadMe.txt 里面的说明,然后通过双击 W60X\_IDE.exe 启动我 们已经配好的 Eclipse。

最终工作时的界面将会如下图所示:



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		HTT THE	Detsug
Debug     OpenOCD     Ope	* Variables Threaders Theorem Andreaders Andreaders Name * data * max, addr - enable 变量/寄存器视图	Value oucooccocor oucooccocor oucooccocor oucooccocor oucooccocor oucooccocor oucooccocor	调试视图
11111111111111111111111111111111111111			
100 {     ut mar_sddr[6]:s [8408,8x25,8x88,8x81,8x81,8x81];       111 bool emable = FALE;     111 /* mait sall first to comfigure golo Alternate functions according to golo_config()]       125 ese fit TLS_CONFIG_HARD_CRYPT0     442 11 210 200 200	ng the bardware design */		
133 tis_crypto_init(); 100010000 133 Hendif 133 133 tis_comfid_is_sPi) 141 tis_spi_init(); 141 tis_spi_init();	~		
Constant of the second s		124144	
MM SDK Default (2ylin Embedded debug (Native)) arm-none-eabi-gdb (18/12/10 FF12:10)			
Note: automatically using hardware breakpoints for read-only addresses.			-
Breakpoint 1, main () at wm_main.cl172 命令行视	图,这里可敲入命令		

### 2.3 下载 W60X\_SDK 源码

可以在 http://www.winnermicro.com 下载 SDK 包,目前支持 OpenOCD 调试的 SDK 版本为 G3.1 或比 G3.1 更高的版本;

2.4 在 Eclipse 中导入 SDK 工程

导入步骤如下图所示:



File	Edit	Source	Refactor	Navigate	Search	Project	Run \
	New					Alt+Sh	ift+N >
	Open	File					
	Close					Ct	trl+W
	Close	All				Ctrl+Shi	ift+W
	Save					C	trl+S
E.	Save A	As					
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	Revert	t					
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	Renan	ne					F2
81	Refres	ih 					F5
	Conve	rt Line De	elimiters I c	)			>
Ð	Print					C	trl+P
	Switch	Workspa	ace				>
_	Restar	t					
4	Impor	t					
2	Export	t					
	Prope	rties				Alt+	Enter
	1 wm_	cpu.c [W	600_SDK_0	63.0Final/]			
	2 start	tup.s [We	500_SDK_G	3.0Final/]			
	3 wm_	main.c [\	W600_SDK_	G3.0Final/	./sys]		
	4 wm_	cpu.c [w	600_sdk/pl	atform/driv	ers]		
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WM_SDK				
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Languages ☑ C ☑ C++		_	_	117
Toolchain for Indexer Settings				
Cross GCC Cygwin GCC GNU Autotools Toolchain Microsoft Visual C++	tform			
(2) < <u>Back</u> <u>Next</u> >	Einish	Cance	el	

导入之后,需要将编译脚本目录重定向到 Makefile 所在的目录,请按下图步骤操作:

.



Project Expl	orer 🛙	E \$   \$ 5 0 0
WM_SD*	New Go Into	>
1	Open in New Window Copy Paste Delete Remove from Context Source Move Rename	Ctrl+C Ctrl+V Delete Ctrl+Alt+Shift+Down > F2
3	<ul> <li>Import</li> <li>Export</li> <li>Build Project</li> <li>Clean Project</li> <li>Refresh</li> <li>Close Project</li> <li>Close Unrelated Projects</li> </ul>	F5
	Make Targets Index Build Configurations	> >
	Show in Remote System Profiling Tools Run As Debug As Profile As Restore from Local Histo	s view > > > > > > >
	Team Compare With	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>



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Builders	Configuration: Default [ Active ]	<ul> <li>Manage Configurations</li> </ul>
Linux Tools Path	= Builder Settings - Behavior 🕜 Refresh	1 Policy
Project References Run/Debug Settings	Builder	
Task Repository	Builder type: External builder	
WikiText	Use default build command	
	Build command: make	Variables
	Makefile generation	Expand Env. Variable Refs in Makefiles
	Build location	
	Build directory: \${workspace_loc:/WM_SDK	9/
		Workspace File system Variables
		Restore Defaults Apply
		Restore Defaults Apply
4		
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ype filter text	C/C++ Build
Resource Builders C/C++ Build C/C++ General	Configuration: Default [Active] · Manage Configurations
Linux Tools Path Project References Run/Debug Settings Task Repository WikiText	Builder Settings  Behavior  Refresh Policy Builder Builder Use default builder
1010100000	Build command: make Variables
	Makefile generation
	Build location
	Build directory: \${workspace_loc:/WM_SDK/Tools/GNU}
	Workspace File system Variables
	Restore Defaults Apply
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### 2.5 配置 OpenOCD 启动

这里配置如何在 Eclipse 中如何启动 OpenOCD,这样操作的好处就是以后就不用再开一个 cygwin 窗口 用来启动 OpenOCD。





#### Create, manage, and run configurations

Run a program

1 B X B > *	Name OpenOCD			
type filter text	This Defrech D	id = Faulton mont = Comm		
- 9 Program	Location:	und = Environment = Commo	n	
* openoco	C:\W600 IDE\cygwin	\usr\local\bin\openocd.exe		
		Browse Workspace	Browse File System	Variables
	Working Directory:			-
	1997 	Browse Workspace	Browse File System	Variables
	Arguments:			
	-f /usr/local/share/op /usr/local/share/ope	penocd/scripts/board/w600_ nocd/scripts/	cmsis-dap.cfg -s	2
	Note: Forless on area		a deuble euster (*)	Variables
	Note. Enclose an arg	ument containing spaces usir	ig double-quotes ( ).	
Filter matched 2 of 2 items			Revert	Apply
Ø			Run	Close



#### X External Tools Configurations

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	۵			

0 B <b>X</b>   6 F <b>*</b>	Name: OpenOCD	
type filter text	Main Refresh Build Environment Common	
- • Program • OpenOCD	Build before launch	
	The entire workspace     The project containing the selected resource	
	O Specific projects	Projects
	include reterenced projects	
Filter matched 2 of 2 items	Reye	rt Apply
0	Run	Close

OpenOCD 的配置文件要根据实际的 JTAG 仿真器来填写,不同的 JTAG 仿真器使用的配置文件是不同的, 我们提供的集成压缩包开发环境中已经附带了 JLINK、CMSIS-DAP 的配置文件。

配置文件在 cygwin 的/usr/local/share/openocd/scripts/board/目录下,配置文件分别为 W60X\_jlink.cfg、W60X\_cmsis-dap.cfg。

设置时请根据实际使用的 JTAG 仿真器选择对应的配置文件,下图使用了 CMSIS-DAP 举例:



#### X External Tools Configurations

#### Create, manage, and run configurations



×

Run a program

1 単 第 1 日 中 - ▼	Name: OpenOCD			
type filter text	E Main Refresh B	uild Environment Commo	n	
- 9 Program	Location:			
sopenoco	C:\W600_IDE\cygwin	\usr\local\bin\openocd.exe		
		Browse Workspace	Browse File System	Variables
	Working Directory:			1
		Browse Workspace	Browse File System	Variables
	Arguments:			
	-f /usr/local/share/o /usr/local/share/ope	penocd/scripts/board/w600_o nocd/scripts/	:msis-dap.cfg -s	0
	11 			Variables
	Note: Enclose an arg	ument containing spaces usir	ng double-quotes (*).	
Filter matched 2 of 2 items			Revert	Apply
10			Run	Close

配置完成之后点击 Run 启动 OpenOCD, 启动成功则会在 console 窗口输出信息:

```
© Console ≈ @ Tasks ≥ Problems © Executables @ Memory
OpenOCD [Program] C:\W600 IDE\cygwin\usr\local\bin\openocd.exe
Open On-Chip Debugger 0.10.0+dev-00577-gea41048-dirty (2018-11-21-13:39)
Licensed under GNU GPL v2
For bug reports, read
        http://openocd.org/doc/doxygen/bugs.html
adapter speed: 200 kHz
adapter speed: 1000 kHz
adapter_nsrst_delay: 100
none separate
cortex_m reset_config sysresetreq
Info : Listening on port 6666 for tcl connections
Info : Listening on port 4444 for telnet connections
Info : CMSIS-DAP: SWD Supported
Info : CMSIS-DAP: JTAG Supported
Info : CMSIS-DAP: FW Version = 2.0.0
Info : CMSIS-DAP: Interface Initialised (SWD)
Info : SWCLK/TCK = 1 SWDIO/TMS = 1 TDI = 0 TDO = 1 nTRST = 0 nRESET = 1
Info : CMSIS-DAP: Interface ready
Info : clock speed 1000 kHz
Info : SWD DPIDR 0x2ba01477
Info : w600.cpu: hardware has 6 breakpoints, 4 watchpoints
Info : Listening on port 3333 for gdb connections
```



如果 OpenOCD 启动中发现无法识别 W60X 模块,可能是 W60X 模块当前所用的固件没有打开 SWD 引脚的调试功能,可参考下面的使用串口烧写固件章节烧写固件之后再尝试。

之后的启动也可以通过点击如下图所示来启动:

Run	Window Help		
	Resume	F8	9 - 9 - 10 0 4 - 1 1 1
	Suspend	Ct 1, 52	onsole.h 🖸 wm main.c 💽 wm dem
	Terminate	Ctrl+F2	44
64	Disconnect		:puDiv;¤¶
3	Step Into	FD	
<u>د</u> ه	Step Over	FO	<pre>s_reg_read32(HR_CLK_DIV_CTL);</pre>
_ <b>!!</b>	Step Return	F7	gValue>>4)&0x0F;¤¶
크	Kun to Line	Ctrl+K	xFFFFF000;¤
- Sc.	Use Step Filters		-1
0	Run	Ctrl+F11	
柩	Debug	F11	CLK_40M:¤¶
₿	Profile		.v·=·4;¤¶
	Profile History	>	;¤¶
	Profile As	>	1
	Profile Configurations		v·=·2:¤¶
	Run History	>	;¤¶
	Run As	>	
	Run Configurations		<pre>(wlanDiv*4/cpuDiv)&lt;&lt;8)   (wla</pre>
			32(HR_CLK_DIV_CIL, RegValue);
	Debug History	,	
	Debug As	,	
	Debug Configurations		
0	Toggle Breakpoint	Ctrl+Shift+B	1
Θ	Toggle Line Breakpoint		wThis function is used to -
0	Toggle Method Breakpoint		···»Inis·Tunction·is·used·to·g
000	Toggle Watchpoint		··*sysclk» point to the addr
8	Skip All Breakpoints	Ctrl+Alt+B	
X	Remove All Breakpoints		· · · »None¤¶
	Breakpoint Types	>	
<b>G</b>	External Tools	>	💁 1 OpenOCD



### 2.6 配置 Eclipse 调试功能

在工程管理窗口中右键 SDK 项目,选择 DEBUG 配置,如下图:

### X C/C++ - Eclipse

Eile Edit Source Refactor Navigate Search Project Run Window

roject Explorer =	641× ** 0	
WM SDK		
New Go Into	*	
Open in New Window		
<ul> <li>Copy</li> <li>Paste</li> <li>Delete</li> <li>Remove from Context</li> <li>Source</li> <li>Move</li> </ul>	Ctrl+C Ctrl+V Delete Ctrl+Alt+Shift+Down	
Rename	F2	
Export		
Build Project Clean Project © Refresh Close Project Close Unrelated Projects	F5	
Make Targets	>	
Index	>	
Build Configurations	>	
Show in Remote Systems view Profiling Tools Run As	/ >	
Debug As	>	I Local C/C++ Application
Profile As	>	Debug Configurations

双击左侧的 ₮C Zylin Embedded debug (Native),新建一个调试配置:



X Debug Configurations

#### Create, manage, and run configurations



<ul> <li>C/C++ Application</li> <li>C/C++ Attach to Application</li> <li>C/C++ Postmortem Debugger</li> <li>C/C++ Remote Application</li> <li>Launch Group</li> <li>Zylin Embedded debug (Cygwin)</li> <li>Zylin Embedded debug (Native)</li> </ul>	Configure launch settings from this dialog: <ul> <li>Press the 'New' button to create a configuration of the selected type.</li> <li>Press the 'Duplicate' button to copy the selected configuration.</li> <li>Press the 'Delete' button to remove the selected configuration.</li> <li>Press the 'Filter' button to configure filtering options.</li> <li>Edit or view an existing configuration by selecting it.</li> </ul> Configure launch perspective settings from the 'Perspectives' preference page.
2	Debug Close

名称最好保持和工程一致,便于区分其他工程:



#### X Debug Configurations





	Name: WM SDK Default		
type filter text	Aain Debugger Comman	ds 🛯 Source 🛎 Environme	nt "
C/C++ Application	Project (optional):		
■ C/C++ Postmortem Debugger	WM SDK		Browse
■C/C++ Remote Application	C/C++ Application:		
Launch Group		Search Project	Browse
<ul> <li>► Launch Group</li> <li>≈ Zylin Embedded debug (Cygwin)</li> <li>≈ Zylin Embedded debug (Native)</li> <li>∞ WM_SDK Default</li> </ul>	Application console		
		Revert	ânniu
Filter matched 8 of 9 items		AVEXCOL.	white

所用的调试器为 arm-none-eabi-gdb,我们提供的集成安装包里已经安装了交叉编译工具,路径在 cygwin 的/opt/arm-none-eabi-gcc/目录下。

我们提供的集成安装包已经配好了环境变量,所以只需要如下图设置即可:



(@ <b>#</b>  0∋ ▼	Name: WM_SDK De	fault				
ype filter text	Main P Debugger	Commands Source	Environment	□Common		
TC/C++ Application	Debugger: Embed	ded GDB		4	^	
III C/C++ Postmortem Debugger		at main Advances				
SC/C++ Remote Application	Stop on startup	at: main Advanced	1			
Launch Group	Debugger Options					
Sylin Embedded debug (Cygwin)	Main					
WM SDK Default	GDB debugger:	arm-none-eabi-gdb		Browse		
-	GDB command fi	le:		Browse		
	(Warning: Some operation of the	commands in this file may debugger, for example "r	/ interfere with un".)	the startup		
	GDB command s	et: Standard 🖂				
	Protocol:	mi ~				
	Verbose conse	Verbose console mode				
	Use full file pa	th to set breakpoints				
		8				
					~	
Iter matched 8 of 9 items			Revert	Apply		
the matched o or 5 items						
2			Debug	Close		
	X					
		$\sim$				
Debug Configurations	×	$\diamond$			×	
Debug Configurations	ι, Č	$\gg$			×	
Debug Configurations eate, manage, and run configurations	1.x ×	>			×	
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Debug Configurations eate, manage, and run configurations	Name: WM_SDK Default Main * Debugger = Con	nmands -> Source = Environme	nt = Common		×	
Debug Configurations eate, manage, and run configurations pe filter text IC/C++ Application IC/C++ Attach to Application	Name: WM_SDK Default Main * Debugger = Con Help/tips on how to setu	nmands > Source = Environme p GDRI init script	nt = Common		×	
Debug Configurations eate, manage, and run configurations eate, manage, and run configurations filter text C/C++ Attach to Application C/C++ Attach to Application C/C++ Postmortem Debugger C/C++ Remote Amplication	Name: WM_SDK Default Main * Debugger = Cor Help/tips on how setu 'Initialize' commands	nmands > Source = Environme p GDR init script	nt = Common		×	
Debug Configurations eate, manage, and run configurations eate, manage, and run configurations eater text C/C++ Application C/C++ Attach to Application C/C++ Remote Application C/C++ Remote Application Launch Group	Name: WM_SDK Default Main * Debugger • Cor Help/lips on how to sefu Initialize commands monitor reset halt monitor flash write imag	nmands > Source *Environme p GDR init script e erase /cygdrive/c/workdir/Wi	nt = Common 4_SDK/8in/W600_D	NBG.img 0x08010000	×	
Debug Configurations eate, manage, and run configurations eate, manage, and run configurations eate, manage, and run configurations eater text C/C++ Attach to Application C/C++ Attach to Application C/C++ Remote Application Launch Group Zylin Embedded debug (Cygwin) Zylin Embedded debug (Cygwin)	Name: WM_SDK Default Main * Debugger • Cor Help/tips on how to setu Initialize' commands monitor reset halt monitor reset halt monitor reset halt monitor reset halt monitor reset halt monitor reset halt	nmands > Source * Environme p GDR init script e erase /cygdrive/c/workdir/Wh	nt @ Common 4_SDK/Bin/W600_D	98G.img 0x08010000	× 🏘	
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Debug Configurations eate, manage, and run configurations eate, manage, and run configurations eater and the second se	Name: WM_SDK Default = Main * Debugger = Con Help/tips on how to setu 'Initialize' commands monitor flash write imag file ./Tools/GNU/W600.et 'Run' commands	nmands > Source = Environme p GDB init script e erase /cygdrive/c/workdir/WN lf	nt = Common 1_SDK/Bin/W600_D	98G.img 0x08010000	×	
Debug Configurations eate, manage, and run configurations eate, manage, and run configurations eate, manage, and run configurations filter text C/C++ Application C/C++ Attach to Application C/C++ Remote Application C/C++ Remote Application Launch Group Zylin Embedded debug (Cygwin) Zylin Embedded debug (Native) - WM_SDK Default	Name: WM_SDK Default Main * Debugger = Cor Help/tipe on how to setu 'Initialize' commands monitor reset halt monitor flash write_imag file_/Tools/GNU/W600.et 'Run' commands	nmands • Source = Environme p GDR init script e erase /cygdrive/c/workdir/Wh lf	nt = Common 1_SDK/Bin/W600_D	98G.img 0x08010000	× *	
Debug Configurations reate, manage, and run configurations reate, manage, and run configurations Provide the second se	Name: WM_SDK Default Main * Debugger • Corr Help/lips on how to setu 'Initialize' commands monitor flash write_imag file_/Tools/GNU/W600.e 'Run' commands	nmands Source = Environme p GDR init script ge erase /cygdrive/c/workdir/W/ lf	nt = Common 1_SDK/Bin/W600_D	28G.img 0x08010000	×	
Debug Configurations reate, manage, and run configurations reate, manage, and run configurations reate, manage, and run configurations perfilter text C/C + a Application C/C + A Application C/C + A Remote Application C/C + Remote Application C/C + Remote Application Launch Group Zylin Embedded debug (Cygwin) Zylin Embedded debug (Native) WM SDK Default	Name: WM_SDK Default Main * Debugger = Cor Help/lips on how to setu 'Initialize' commands monitor flash write_imag file_/Tools/GNU/W600.e 'Run' commands	nmands > Source *Environme p GDR init script ge erase /cygdrive/c/workdir/W/ lf	nt = Common 4_SDK/8in/W600_D	NBG.img 0x08010000	× 🏘	
Debug Configurations reate, manage, and run configurations reate, manage, and run configurations pe filter text I C/C + Application C/C + Application C/C + Postmortem Debugger C/C + Remote Application = Launch Group = Zylin Embedded debug (Cygwin) = Zylin Embedded debug (Native) - WM SDK Default	Name: WM_SDK Default - Main * Debugger = Cor Help/tips on how to setu Initialize' commands monitor flash write_imag file_/Tools/GNU/W600.e 'Run' commands	nmands > Source * Environme p GDR init script e erase /cygdrive/c/workdir/WN If	nt = Common 4_SDK/Bin/W600_D	98G.img 0x08010000	×	
Debug Configurations reate, manage, and run configurations reate, manage, and run configurations pe filter test I C/C+ + Application C/C+ + Application C/C+ + Remote Application C/C+ + Remote Application Launch Group Zylin Embedded debug (Cygwin) Zylin Embedded debug (Native) - WM_SDK Default	Name: WM_SDK Default - Main * Debugger = Con Help/Sips on how to setu 'Initialize' commands monitor reset halt monitor flash write_imag file_/Tools/GNU/W600.e 'Run' commands	nmands > Source = Environme p GDB init script e erase /cygdrive/c/workdir/Wh lf	nt © Common 4_SDK/Bin/W600_D	98G.img 0x08010000	×	
Debug Configurations reate, manage, and run configurations reate, manage, and run configurations Particle and the second seco	Name: WM_SDK Default Main * Debugger * Con Helpfälger commands monitor riset halt monitor flash write_imag file_/Tools/GNU/W600.e *Run* commands	nmands Source #Environme p GDR init script e erase /cygdrive/c/workdir/Wit	nt = Common 1_SDK/Bin/W600_D	98G.img 0x08010000	×	
Debug Configurations eate, manage, and run configurations eate, manage, and run configurations perfilter text C/C++ Attach to Application C/C++ Attach to Application C/C++ Remote Application C/C++ Remote Application Launch Group Zylin Embedded debug (Cygwin) Zylin Embedded debug (Native) - WM SDK Default	Name: WM_SDK Default Main © Debugger © Cor Help/lips on how to sefu 'Initialize' commands monitor riset halt monitor flash write_imag file_/Tools/GNU/W600.e 'Run' commands	nmands Source #Environme p.GDR init script ge erase /cygdrive/c/workdir/W/ lf	nt = Common 1_SDK/Bin/W600_D	28G.img 0x08010000	×	
Debug Configurations eate, manage, and run configurations eate, manage, and run configurations eater and the set of th	Name: WM_SDK Default = Main * Debugger = Cor Help/tips on how to setu Initialize' commands monitor flash write_imag file_/Tools/GNU/W600.e 'Run' commands	nmands > Source *Environme p GDR init script e erase /cygdrive/c/workdir/W/ ff	nt = Common 4_SDK/Bin/W600_D	28G.img 0x08010000	×	



初始化填入的命令为:

target remote localhost:3333 monitor reset halt monitor flash write\_image erase /cygdrive/c/workdir/WM\_SDK/Bin/W60X\_DBG.img 0x08010000 file ./Tools/GNU/W60X.elf

W60X 的调试固件烧写地址为 0x08010000,请勿修改避免造成 flash 损坏而导致模块无法正常工作。 命令里的两个路径要根据实际的工程路径填写,其中固件文件 W60X\_DBG.img 路径必须要使用绝对路 径,符号表文件 W60X.elf 必须使用相对路径,否则会产生找不到文件的错误。

其他的保持默认即可,最后点击 Apply 保存配置。

如果调试中不是每次都需要更新固件,可以去掉 flash write\_image 这条命令以减少固件烧写到 flash 的 等待时间。

#### 2.7 修改 SDK 源码优化级别

为了单步调试时使用符号表,将编译时的优化-Os修改为-g便于生成调试信息:



New Open Open With	*	
New Open Open With	>	
Open Open With		
Open With		1
open man	2	Text Editor
Comu	Circler	System Editor
Pasta	Ctrl+U	In-Place Editor
Delete	Delete	Default Editor
Remove from Context	Ctrl+Alt+Shift+Down	Other
Mark as Landmark	Ctrl+Alt+Shift+Lin	Ouler
Move	currantop	
Bassan	F2	
Rename	F2	
Import		
Export		
Refresh	F5	
Make Targets	>	
Chan in Damata Castana dian		
Show in Remote Systems view		
Profiling Tools	2	
Run As	>	
Debug As	>	
Profile As	>	
Run C/C++ Code Analysis		
Team	>	
Compare With	2	
Replace With		
replace with	,	
Properties	Alt+Enter	0
	Delete Remove from Context Mark as Landmark Move Rename Import Export Refresh Make Targets Show in Remote Systems view Profiling Tools Run As Debug As Profile As Run C/C++ Code Analysis Team Compare With Replace With Properties	Delete     Delete       Remove from Context     Ctrl+Alt+Shift+Down       Mark as Landmark     Ctrl+Alt+Shift+Up       Move     Rename       Rename     F2       Import     Export       Export     Refresh       Refresh     F5       Make Targets     >       Show in Remote Systems view     >       Profiling Tools     >       Run As     >       Debug As     >       Profile As     >       Run C/C++ Code Analysis     >       Team     >       Compare With     >       Replace With     >       Properties     Alt+Enter



#### C/C++ - WM\_SDK/Tools/toolchain.def - Eclipse

Eile Edit Source Refactor Navigate Search Project Run Window

Project Explorer	■ N * toolchain.def =
WM SDK	71
= App	72#
🔋 👄 Bin	73# Complier options
> = Demo	74#
> = Doc	75
> = Include	76CXX_optimization = -g
· = Lib	77
Platform	78ifeq (\$(TOOL_GNU),1)
· = Src	79 CFLAGS := -Wall \
- m Tools	80 -DGCC_COMPILE=1 \
GNU	81 -mthumb \
Keil	82 \$(CXX_optimization) \
- makeimosource	83Tunction-sections \
download py	84 data-sections (
library zip	85 -std=gnu99 \
≡ makeimo	87 -mabi=aapcs \
= makeimg all	88 -march=army7-m \
a makeimo all exe	89 -fno-builtin
makeima dha	90 ARMCFLAGS := -Wall \
B makeimo, dho ave	91 -DGCC COMPILE=1 -DWM W600=1 \
= makeing_obg.exe	92 -mthumb \
makeimo fis ny	93 \$(CXX_optimization) \
B makeimo eve	94function-sections \
I makeima ny	95data-sections \
h python34 dll	96 -mcpu=cortex-m3 \
» pychoris4.cm	97 -std=gnu99 \
= reachie.txt	98 -march=armv7-m \
= requirements.txt	99 -mabi=aapcs \
= rules.mk	100 -fno-builtin
= supuli.mk	101 ASMFLAGS := -Wall \
= test.bm	102 -mthumb-interwork \

修改后保存文件即可完成修改。

2.8 编译 SDK



SU*				
New			>	
Go Into				
Open in New Window		Ctrl	+C	
<ul> <li>Paste</li> </ul>		Ctrl	+C +V	
× Delete		Dele	ete	
Remove from Context Source	Ctrl+	Alt+Shift+Dov	wn	Ζ
Move			8	$\mathcal{X}$
Rename			F2 177	Ň.
in Import				•
🔤 Export				
Build Project				
Clean Project		$X / \lambda$		
			)	
l Project				×
Puilding project				
Building project				
ere and to be also and				
ays run in background				
Run in Bac	ckground	Cancel	Details >>	a ].



#### # Problems © Console # CDT Build Console [WM\_SDK] CC ../../App/main.c CC ../../Platform/Boot/gcc/startup\_ARMCM3.S CC ../../Platform/Boot/gcc/retarget\_gcc.o OBJCP ../../Platform/Boot/gcc/retarget\_gcc.o ../Bin/W600.bin: 28.7% -- replaced with ../Bin/W600.bin.gz secboot\_len:375c, app\_imglen:4e0b8, total:5c0b8

```
#@./createimg.sh -e cygwin -r
```

18:56:50 Build Finished (took 1m:13s.247ms)

#### 2.9 启动调试

在启动调试之前需要先运行 OpenOCD(可以使用前面的配置启动 OpenOCD)再执行下面的操作。

C/C++ - Eclipse

Project Explorer =	691× 720	
WM_SDK		
New Go Into	*	
Open in New Window		
<ul> <li>Copy</li> <li>Paste</li> <li>Delete</li> <li>Remove from Context</li> <li>Source</li> <li>Move</li> </ul>	Ctrl+C Ctrl+V Delete Ctrl+Alt+Shift+Down	
<ul> <li>Import</li> <li>Export</li> </ul>	12	
Build Project Clean Project Refresh Close Project Close Unrelated Projects	F5	
Make Targets Index Build Configurations	>	
Show in Remote Systems vie Profiling Tools Run As	ew >	
Debug As	>	1 Local C/C++ Application
Profile As	> <b>Г</b>	Debug Configurations



×

💥 Debug Configurations

	Name: WM SDK Default			
type filter text	Main      Pebugger     Commands      Source      Environment      Common			
III C/C++ Application	Project (optional):			
III C/C++ Postmortem Debugger	WM SDK	Browse		
EC/C++ Remote Application = Launch Group = Zylin Embedded debug (Cygwin) = Zylin Embedded debug (Native) = WM_SDK Default	C/C++ Application:			
	Search Project	Browse		
	Application console			
Filter matched 8 of 9 items	Resert	Apply		
a	Debug	Close		

X Errors in Workspace		×
Errors exist in a required project. C	Continue launch?	
Always launch without asking		
	Yes	No

然后会提示是否 debug,确认一下即可:



en the Debug perspective when it support application debugging. It abug stack, variables and breakpoint now? Yes No Pkg写完成之后,会出现下图提示:
support application debugging. It abug stack, variables and breakpoint now? Yes No 牛烧写完成之后,会出现下图提示:
now? Yes No 牛烧写完成之后,会出现下图提示: Cust Acces * Const Nerre * Value
Yes No 牛烧写完成之后,会出现下图提示: *Vetuables * Provincents * Regions * Modates Name Value
Yes No 牛烧写完成之后,会出现下图提示: Cuick Access **********************************
牛烧写完成之后,会出现下图提示: 
- D X Ouick Access = NGC #Debug Value Name Value
• Variables • • Prosiquents • Registers = Modules.         • • • • • • • • • • • • • • • • • • •
Name Value
An outline is not available.
**************************************
ccun10000
3,4572371 (4,485 K(B/S)

这时候点击 F8 键执行 Resume 命令,即可跑到 main 函数处停住:



Debug - WM_SDK/Platform/Sys/wm_main.c - Eclipse		-	D ×
Sie Edit Source Refactor Navigata Search Project Run Window Help			
Accurate and a construction of the second second		Child Acons #	C/C++ Debug
* Obtage Super-DCD (Program) a C:yW600 (DD(v)graviniuer/Joca/bin/operroccl.exe - WM (DK Detash [2/s/s [mbedded debug [Natiwn]) - WM (DK Detash [2/s/s [mbedded debug [Natiwn]) - W Theode (DD (W/12/s) TFF12:1) - # Theode (DD (W/12/s) TFF12:10) # arm-mode-tabl-gob (TW/12/10 TFF12:10)	s an a second seco	- Pegnters - Modules Value	I A G B C
the state and the state of the		The Dutline I	
<pre>107 vm_spi_dc_config(NM_I0_P0_LE); 100 j) 100 jnt main(void) 170 jnt fil 172 tis_sys_clm_set(CP0_CLK_B0H); 173 tis_sys_clm_set(CP0_CLK_B0H); 174 tis_os_init(NULL); 175 tis_os_init(NULL); 177 /* before use mallec() function, must erreste mutes used by c_ 179 tis_os_sem_create(Allbc_Sem, 1); 188 182 { 183 tis_os_task_create(AULL, MULL, 183 tis_os_task_create(AULL, MULL,</pre>	lis */	<ul> <li>stringh</li> <li>um ingh</li> <li>um regh</li> <li>um regh</li> <li>um regh</li> <li>um regh</li> <li>um regh</li> <li>um righ</li> <li>um parch</li> <li>um parch</li> <li>um parch</li> <li>um parch</li> <li>um parch</li> <li>um righ</li> <li>um fighth</li> <li>um fighth</li> <li>um fighth</li> <li>um fighth</li> <li>um fighth</li> <li>um righth</li> <li>um fighth</li> <li>um fighth</li> <li>um datalh</li> <li>um datalh</li> <li>um fighth</li> <li>um fighth</li> </ul>	
Console - Tasks   Problema - Executables - Memory		· · · · · · · · · · · · · · · · · · ·	1033700.000
<pre>nm_Jok press(provided debug dramve) am none eab gdb (10/12/10 F=F12)0 feeding symbols from ./fools/ONU/WE00.elfdone.     wein Presspont 1 at 0x8010fcG: file we_main.c, line 172.     Note: automatically using hardware breakpoints for read-only addresses Presspont 1, main () at we_main.c:172     SystemInit(); </pre>			

此时就可以开始调试之旅了。

其他的调试命令可以自行在 Run 菜单中点击使用:

Att The sea



<u>R</u> un	<u>W</u> indow <u>H</u> elp		
i⇒	Instruction Stepping Mode		
\$	Move to Line (C/C++)		
ъ	Resume at Line (C/C++)		
	Resume	F8	
	Suspend		
	Terminate	Ctrl+F2	
59	Disconnect		
	Resume Without Signal		
₽	Step Into	F5	
3	Step Over	F6	
. P	Step Return	F7	
⇒]	Run to Line	Ctrl+R	
ক	Use Step Filters		
Q,	Run	Ctrl+F11	
榄	Debug	F11	
	Run History	>	XX
	Run As	>	7, K
	Run Configurations		X
	Debug History	>	
	Debug As	>	>
	Debug Configurations		
۲	Toggle Breakpoint	Ctrl+Shift+B	
۰	Toggle Line Breakpoint		
•	Toggle Method Breakpoint		
65	Toggle Watchpoint		
x	Skip All Breakpoints	Ctrl+Alt+B	
Sig.	Remove All Breakpoints		
	Breakpoint Types	>	
Q.	External Tools	>	

调试也可以直接点击工具栏图标进行快捷操作,其图示说明请参阅 Eclipse 安装章节。 如果遇到无法成功进入调试时,可以尝试手动重启W60X 模块和重启 OpenOCD 之后,再进入调试即可。

#### 2.10停止调试

停止调试时既可以停止 gdb,也选择可以停止 OpenOCD,这里根据情况自行选择。



W Debug - WM\_SDK/Platform/Sys/wm\_main.c - Eclipse

File Edit Source Refactor Navigate Search Project Run Window Help



停止调试必须是在 gdb 处于断住的情况下,否则点击停止 debug 是不会产生效果的。如果碰到这种情况 请先点击停止 OpenOCD,只要 OpenOCD 停止运行 gdb 也会停止。

#### 2.11编译 Release 固件

编译正式版本的固件时,需要将源码的优化级别改为-0s,如下图所示;



#### X C/C++ - WM\_SDK/Tools/toolchain.def - Eclipse

Eile Edit Source Refactor Navigate Search Project Run Window

Project Explorer	a a le fain.def a
WM SDK	72#
· · · App	73# Complier options
🔋 🧼 Bin	74#
🛛 🛥 Demo	75
e Doc	<pre>FCXX_optimization = -0s</pre>
🕫 Include	77
+⇒ Lib	78ifeq (\$(TOOL_GNU),1)
Platform	79 CFLAGS := -Wall \
+ - Src	80 -DGCC_COMPILE=1 \
- P Tools	81 -mthumb \
GNU	<pre>82 \$(CXX_optimization) \</pre>
e Keil	83function-sections \
e makeimosource	84data-sections \
download pv	85 -mcpu=contex-m3 \
library zin	86 -std=gnu99 \
= makeima	67 -madi=aapts \
= makeing all	80 -fno-builtin
= makeing_all eve	00 APMCELAGS := -Wall \
= makeima_dha	91
= makeinig_dog	92 -mthumb \
= makeiing_dbg.exe	93 \$(CXX optimization) \
= makeing_dbg.py	94 function-sections \
makeling_is.py	95data-sections \
= makeinig.exe	96 -mcpu=cortex-m3 \
= makeling.py	97 -std=gnu99 \
··· python34.dll	98 -march=armv7-m \
= readme.txt	99 -mabi=aapcs ∖
a requirements.txt	100 -fno-builtin
iii rules.mk	101 ASMFLAGS := -Wall \
subdir.mk	102 -mthumb-interwork \
test bin	103 -mthumb \
toolchain.def	104 -std=gnu99 \

SWD 复用引脚默认是否关闭由用户自行决定(调用接口函数 wm\_swd\_config(0) 设置即可)。

### 2.12使用串口下载固件

W60X 支持串口烧写固件,具体操作请参阅 http://www.winnermicro.com/html/1/156/158/497.html 提供的文档 "WM\_W60X\_固件升级指导"。

### 3 OpenOCD 使用进阶



#### 3.1 OpenOCD 简介

在嵌入式开发中,有很多优秀的调试、仿真工具,比如Keil、IAR、Rowley Associates 等,它们的安装、使用都很便利,功能强大,但是价格昂贵(几百美元甚至更多);还要购买相应的硬件,比如U-Link等USB 到JTAG 的转换盒,这也是一笔不小的开支。对于开发预算有限的工程师来说,完全可以使用免费的开发工具Eclipse、OpenOCD,然后通过一些便宜的JTAG 转接器(比如CMSIS-DAP)就可以达到接近、甚至超越上述商业软件的效果。

OpenOCD是一个开源的JTAG上位机程序,在嵌入式设备调试中起着承上启下的作用:对下使用JTAG仿真器连接嵌入式设备,对上则是为上位机提供通用的调试命令,整个使用的关系如下图所示:



目前 OpenOCD 已经支持的 JTAG 仿真器有如下:

AICE, ARM-JTAG-EW, ARM-USB-OCD, ARM-USB-TINY, AT91RM9200, axm0432, BCM2835, Bus Blaster, Buspirate, Chameleon, CMSIS-DAP, Cortino, DENX, Digilent JTAG-SMT2, DLC 5, DLP-USB1232H, embedded projects, eStick, FlashLINK, FlossJTAG, Flyswatter, Flyswatter2, Gateworks, Hoegl, ICDI, ICEBear, J-Link, JTAG VPI, JTAGkey, JTAGkey2, JTAG-lock-pick, KT-Link, Lisa/L, LPC1768-Stick, MiniModule, NGX, NXHX, OOCDLink, Opendous, OpenJTAG, Openmoko, OpenRD, OSBDM, Presto, Redbee, RLink, SheevaPlug devkit, Stellaris evkits, ST-LINK (SWO tracing supported), STM32-PerformanceStick, STR9-comStick, sysfsgpio, TUMPA, Turtelizer, ULINK, USB-A9260, USB-Blaster, USB-JTAG, USBprog, VPACLink, VSLLink, Wiggler, XDS100v2, Xverve

#### 目前OpenOCD已经支持调试的架构如下:

ARM11, ARM7, ARM9, AVR32, Cortex-A, Cortex-R, Cortex-M, LS102x-SAP, Feroceon/Dragonite, DSP563xx, DSP5680xx, EnSilica eSi-RISC, FA526, MIPS EJTAG, NDS32, XScale, Intel Quark

#### 而且OpenOCD还对很多的Flash都提供了支持: ADUC702x, AT91SAM, ATH79, AVR, CFI, DSP5680xx, EFM32, EM357, eSi-TSMC, FM3, FM4, Kinetis, LPC8xx/LPC1xxx/LPC2xxx/LPC541xx, LPC2900, LPCSPIFI,



Marvell QSPI, Milandr, NIIET, NuMicro, PIC32mx, PSoC4, PSoC5LP, SiM3x, Stellaris, STM32, STMSMI, STR7x, STR9x, nRF51; NAND controllers of AT91SAM9, LPC3180, LPC32xx, i.MX31, MXC, NUC910, Orion/Kirkwood, S3C24xx, S3C6400, XMC1xxx, XMC4xxx

#### 3.2 编译安装 OpenOCD

本节的操作都是基于 Windows 系统下的 Cygwin 环境,所以首先需要安装 Cygwin,在前面快速上手章节中我们已经提供了一个集成 Cygwin 的压缩包开发环境,建议普通用户直接下载使用打包好的环境以减轻工作量,安装好之后双击 cygwin\Cygwin. bat 则可打开一个 cygwin 的 shell 窗口,之后下面的操作都是在这个 shell 窗口中进行。

按照 OpenOCD 官方文档要求,编译必须依赖项有:

```
You'll also need:
```

- make
- libtool
- pkg-config >= 0.23 (or compatible)

Additionally, for building from git:

- autoconf >= 2.64 - automake >= 1.14
- texinfo

所以接下需要检查 Cygwin 环境是否支持,不支持的依赖项则需要用户自行安装,如果使用的是我们提供的环境则可以跳过这一步。

#### 3.2.1 编译安装 libusb

OpenOCD 部分仿真器需要 libusb 的支持,所以在编译 OpenOCD 之前需要先安装好 libusb,如果已经安装过 libusb 则可跳过这一步(我们提供的环境已经安装好了该库)。

libusb 的编译安装步骤为:

- 1. 在 https://libusb.info 下载源码包并解压
- 2. 进入源码目录
- 3. 执行./configure --prefix=/usr/生成 Makefile
- 4. 执行 make 编译



5. 执行 make install 安装

#### 3.2.2 编译安装 HIDAPI library

考虑到使用 CMSIS-DAP 仿真器的用户比较多,所以这里我们增加对了对其的支持,如果不需要使用 CMSIS-DAP 仿真器则可以跳过这一步。OpenOCD 需要 HIDAPI library 的支持,所以在编译 OpenOCD 之前 需要先安装好 HIDAPI library,如果已经安装过 HIDAPI library 则可跳过这一步(我们提供的环境已 经安装好了该库)。

HIDAPI library 的编译安装步骤为:

- 1. 执行 git clone https://github.com/signal11/hidapi.git 下载源码
- 2. 进入源码目录
- 3. 执行. /bootstrap 生成 configure 文件
- 4. 执行./configure --prefix=/usr 生成 Makefile
- 5. 执行 make 编译
- 6. 执行 make install 安装

#### 3.2.3 编译安装 OpenOCD

我们提供的环境已经安装好了 OpenOCD,

1. 下载 OpenOCD 源码:

请从网站 http://www.winnermicro.com/下载源码包,目前发布的版本为 W60X\_openocd\_0.10.0\_r1。

执行命令检查环境依赖项并生成 Makefile
 ./configure --enable-cmsis-dap --disable-werror

执行之后如果产生错误,那么说明缺少一些依赖,需要使用者自行修复,具体以实际环境为准。 如果不使用 CMSIS-DAP 仿真器,则可以不加-enable-cmsis-dap 选项。

检查完成时的结果如下图所示:



libjaylink configuration summary: - Package version - Library version - Installation prefix - Building on - Building for	0.2.0-git-8645845 0:0:0 /usr/local i686-pc-cygwin i686-pc-cygwin
Enabled transports: - USB - TCP	yes yes
openocd configuration summary	
MPSSE mode of FTDI based devices ST-Link JTAG Programmer TI ICDI JTAG Programmer Keil ULINK JTAG Programmer Altera USB-Blaster II Compatible Bitbang mode of FT232R based devices Versaloon-Link JTAG Programmer TI XDS110 Debug Probe OSBDM (JTAG only) Programmer estick/opendous JTAG Programmer Andes JTAG Programmer USBProg JTAG Programmer Raisonance RLink JTAG Programmer Olimex ARM-JTAG-EW Programmer	yes (auto) yes (auto) no no
CMSIS-DAP Compliant Debugger Cypress KitProg Programmer Altera USB-Blaster Compatible ASIX Presto Adapter OpenJTAG Adapter SEGGER J-Link Programmer	yes yes (auto) yes (auto) yes (auto) yes (auto) yes (auto)

3. 执行编译命令开始编译

make

4. 执行安装命令将OpenOCD安装到系统路径下,安装比较耗时请耐心等待至结束 make install

OpenOCD默认的的安装路径为/usr/local/bin,其配置文件默认的安装路径/usr/local/share/openocd。 成功安装之后在/usr/local/share/openocd/scripts/target目录下会存在一个名为W60X.cfg的配置文件,之后OpenOCD启动就会用到它。

### 3.3 使用 OpenOCD 命令行调试



### 3.3.1 使用 JLINK 仿真器启动 OpenOCD

#### 1. 安装驱动

JLINK 官方的驱动不能用于 OpenOCD, 按照 OpenOCD 官方文档描述, 需要使用 http://zadig.akeo.ie 提供的的驱动, 下载安装如下图所示:

🗾 Zadi	g				-	- 🗆 🗙
Device	Opt	tions	Help			
		List	All Devices	]		
	$\checkmark$	Igno	ore Hubs or Con	nposite Parents		✓ Edit
	~	Crea	ate a Catalog Fil	e		
Driver	~	Sign	n Catalog & Insta	all Autogenerated Certificate	Mo	ore Information
USB ID		Adva	anced Mode		libe	usb-win32
WCID		Log	Verbosity	>	libu	usbK
	_					NUSB (MICrosoft)
0 devices	; fou	ınd.				7adia 2.3.701
				- X		Zauly 2.5.701
🔼 Zadi	9				-	- 🗆 🗙
Device	Opt	tions	Help			
BULK in	terfa	ice (Int	terface 2)			✓ ☐ Edit
Driver	Win	IUSB (v	/6.1.7600.16385)	WinUSB (v6. 1. 7600. 16385)	Mo	ore Information
USB ID	136	6 0	0105 02		libu	usb-win32
werp ?	×	C ]	][]	Reinstall Driver	libu	usbK
WCID -	^				Wi	nUSB (Microsoft)
49.1.7_		1				
(YS						
		L				

. 创建配置文件

如果非使用 git 下载的源码包,可能在安装 OpenOCD 时就自动安装了该配置文件,可跳过这一步。

在/usr/local/share/openocd/scripts/board下新建一个文本文件,取名为W60X\_jlink\_cfg, 然后用记事本打开编辑,输入内容如下图所示:



f

### 北京联盛德微电子有限责任公司

```
2
    # Example configuration file to hook up an W600 module or board to a JTAG/SWD
    # adapter. Please modify this file to your local setup.
 3
 4
    #
 5
    ŧ
 6
 8
    # Include the configuration for the JTAG adapter. We use the Tian TUMPA here.
    # If you have a different interface, please edit this to include the
 9
    # configuration file of yours.
    #source [find interface/jlink.cfg]
11
    interface jlink
12
13
    # The W600 only supports JTAG.
    transport select swd
14
15
16
    # The speed of the JTAG interface, in KHz. If you get DSR/DIR errors (and they
    # do not relate to OpenOCD trying to read from a memory range without physical
17
18
    # memory being present there), you can try lowering this.
19
    adapter_khz 200
20
    # With no variables set, openocd will configure JTAG for the two cores of the W600 and
21
    # will do automatic RTOS detection. This can be be adjusted by uncommenting any of the
23
   # following lines:
24
25
    #Source the W600 configuration file
26 source [find target/w600.cfg]
27
```

保存后就创建好了 OpenOCD 连接 JLINK 的的配置文件。

3. 在 cygwin 的 shell 窗口中执行 openocd. exe -f

/usr/local/share/openocd/scripts/board/W60X\_jlink.cfg -s

/usr/local/share/openocd/scripts/之后,如果OpenOCD没有异常退出提示则说明启动成功,

此时结果如下:



#### 3.3.2 使用 CMSIS-DAP 仿真器启动 OpenOCD

1. 创建配置文件

如果非使用 git 下载的源码包,可能在安装 OpenOCD 时就自动安装了该配置文件,可跳过这一



步。

在/usr/local/share/openocd/scripts/board下新建一个文本文件,取名为 W60X cmsis-dap.cfg, 然后用记事本打开编辑, 输入内容如下图所示:

```
1
    #
    # Example configuration file to hook up an W600 module or board to a JTAG/SWD
    # adapter. Please modify this file to your local setup.
 3
 4
    #
 5
    #
 6
 7
 8
    # Include the configuration for the JTAG adapter. We use the Tian TUMPA here.
    # If you have a different interface, please edit this to include the
 9
10
    # configuration file of yours.
   #source [find interface/cmsis-dap.cfg]
11
   interface cmsis-dap
   # The W600 only supports JTAG.
13
   transport select swd
14
15
    # The speed of the JTAG interface, in KHz. If you get DSR/DIR errors (and they
16
    # do not relate to OpenOCD trying to read from a memory range without physical
17
   # memory being present there), you can try lowering this.
18
   adapter_khz 200
19
20
21
    # With no variables set, openocd will configure JTAG for the two cores of the W600 and
22
    # will do automatic RTOS detection. This can be be adjusted by uncommenting any of the
23
   # following lines:
24
25 #Source the W600 configuration file
   source [find target/w600.cfg]
26
27
```

保存后就创建好了 OpenOCD 连接 CMSIS-DAP 的的配置文件。

2. 在 cygwin 的 shell 窗口中执行 openocd. exe -f

/usr/local/share/openocd/scripts/board/W60X cmsis-dap.cfg -s

/usr/local/share/openocd/scripts/之后,如果OpenOCD没有异常退出提示则说明启动成功,

此时结果如下:





#### 3.3.3 上位机连接 OpenOCD

OpenOCD 在启动成功之后就可以通过 telnet 或 gdb 进行连接, tlenet 端口为 4444, gdb 端口为 3333。 OpenOCD 在启动之后可以按 ctrl+c 键终止运行, 启动之后请不要关闭 shell 窗口以保持 OpenOCD 的正 常运行, telnet 或 gdb 才能连接调试。

#### 3.3.3.1 使用 telnet 连接

Windows 系统自带 telnel 客户端(如果提示未找到请参考

https://jingyan.baidu.com/article/e73e26c09f6f4724adb6a7de.html 安装),使用时打开一个命令 提示符窗口,输入 telnet localhost 4444或 telnet 127.0.0.1 4444 连接至 OpenOCD 守护进程,连接 时效果如下图所示:

💽 选择C:\WINDOWS\system32\cmd.exe

D:\>telnet localhost 4444 I Telnet localhost D:\>telnet localhost 4444 正在连接localhost... I Telnet localhost Open On-Chip Debugger

之后就可以在命令行里键入命令进行调试,如下图:



#### 3.3.3.2 使用 gdb 连接

W60X 使用的交叉编译工具中的 gdb 为 arm-none-eabi-gdb, 下载地址为: https://launchpad.net/gcc-arm-embedded/4.9/4.9-2014-q4-major。



如果是下载的我们提供的集成包,那么已经安装好了该工具,可以直接使用,在 cygwin 的 shell 窗口 中执行命令 arm-none-eabi-gdb 即可启动 gdb,然后可以在 gdb 中敲入各种调试命令,如下图所示:

\$ arm-none-eabi-gdb GNU gdb (GNU Tools for ARM Embedded Processors) 7.8.1.20141128-cvs Copyright (C) 2014 Free Software Foundation, Inc. License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html> This is free software: you are free to change and redistribute it. There is NO WARRANTY, to the extent permitted by law. Type "show copying" and "show warranty" for details. This GDB was configuration" for configuration details. For bug reporting instructions, please see: <http://www.gnu.org/software/gdb/bugs/>. Find the GDB manual and other documentation resources online at: <http://www.gnu.org/software/gdb/documentation/>. For help, type "help". Type "apropos word" to search for commands related to "word". (gdb) target remote localhost:3333 Remote debugging using localhost:3333 Nox08010934 in ?? () (gdb) monitor poll background polling: on TAP: w600.cpu (enabled) target halted due to debug-request, current mode: Thread XPSR: 0x21000000 pc: 0x08010934 psp: 0x20007838 (gdb)

#### 3.3.4 常用命令

下表列出了一些 OpenOCD 中常用的命令,在使用中也可以敲入 help 命令查看当前支持的所有命令。 这些命令在 telnet 终端直接输入,但是在 gdb 终端里面,需要在命令前面添加 monitor。

11/2>

目标板状态处理命令(Target state	handling)	
poll	查询目标板当前状态	
halt	中断目标板的运行	
resume [address]	恢复目标板的运行,如果指定了address,则从address	
7/2-1	处开始运行	
step [address]	单步执行,如果指定了address,则从address 处开始	
	执行一条指令	
reset	复位目标板	
断点命令		
bp <addr> <length> [hw]</length></addr>	在地址addr 处设置断点,指令长度为length, hw 表	
	示硬件断点	
rbp <addr></addr>	删除地址addr 处的断点	
内存访问指令(Memory access commands)		
mdw ['phys'] <addr> [count]</addr>	显示从(物理)地址addr 开始的count(缺省是1)个字	
	(4 字节)	



mdh ['phys'] <addr> [count]</addr>	显示从(物理)地址addr 开始的count(缺省是1)个半		
	字(2 字节)		
mdb ['phys'] <addr> [count]</addr>	显示从(物理)地址addr 开始的count(缺省是1)个字		
	节		
<pre>mww ['phys'] <addr> <value></value></addr></pre>	向(物理)地址addr 写入一个字, 值为value		
<pre>mwh ['phys'] <addr> <value></value></addr></pre>	向(物理)地址addr 写入一个半字, 值为value		
<pre>mwb ['phys'] <addr> <value></value></addr></pre>	向(物理)地址addr 写入一个字节, 值为value		
flash write_image [erase] [unlock] filename [offset [file_type]]			
将固件filename烧写到flash的offs	et地址处		

更加详细的 OpenOCD 指令介绍,可以直接参考其官网的文档,其地址为: http://openocd.org/documentation/。

3.3.5 gdb 调试示例

本节使用 gdb 单步调试一段代码作为示例,指导用户如何开启 W60X 的单步调试之旅。

单步调试时需要有调试信息的固件和符号表,如何生成这样的文件请参阅后面章节的Eclipse编译SDK。 这里用 CMSIS-DAP 仿真器连接 W60X,在连接好之后,在 cygwin 中启动 OpenOCD:

S openocd, exe -r /usr/local/snare/openocd/scripts/board/w600_cmsis-dap.crg -s /usr/local/snare/openocd/scripts/ s openocd.exe -r /usr/local/snare/openocd/scripts/board/w600_cmsis-dap.crg -s /usr/local/snare/openocd/scripts/	1
Open On-Chip Debugger 0.10.0+dev-00577-gea41048-dirty (2018-11-17-20:01)	
Licensed under GNU GPL V2	
For bug reports, read	
http://openocd.org/doc/doxygen/bugs.html	
adapter speed: 200 kHz	
adapter speed: 1000 kHz, do vere monkale de la code openoco de la code de la code de la code de la code de la c	
adapter_nsrst_delay: 100	
none separate	
cortex_m reset_config/sysresetreq.or/kdln/th/gd_code/openoco/222/llbftdll=1.4/bolld	
Info : Listening on port 6666 for tcl connections	
Info : Listening on port 4444 for telnet connections	
Info:: CMSIS-DAP: SWD/ Supported workdow thind_Code/openoco/222/ http://doi.org/doi/of/doi/	
Info : CMSIS-DAP: JTAG Supported	
Info : CMSIS-DAP: FW Version = 2.0.0	
Info:: CMSIS-DAP: Interface Initialised (SWD)d_Code/OpenOCD/222/Hibitdii-I4/build	
Info : SWCLK/TCK = 1 SWDIO/TMS = 1 TDI = 0 TDO = 1 NTRST = 0 NRESET = 1	
Info : CMSIS-DAP: Interface ready	
Info : clock speed 1000 kHz vereinankding bird code openoco 222 historial-lashbaild	
Info : SWD DPIDR 0x2ba01477	
Info : w600.cpu: hardware has 6 breakpoints, 4 watchpoints	
Info : Listening on port 3333 for gdb connections a mean contract the data and the second second second second	

然后再新开一个 cygwin 窗口,执行 arm-none-eabi-gdb 程序:

\$ arm-none-eabi-gdb GNU gdb (GNU Tools for ARM Embedded Processors) 7.8.1.20141128-cvs Copyright (C) 2014 Free Software Foundation, Inc. License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html> This is free software: you are free to change and redistribute it. There is NO WARRANTY, to the extent permitted by law. Type "show copying" and "show warranty" for details. This GDB was configured as "--host=i686-w64-mingw32 --target=arm-none-eabi". Type "show configuration" for configuration details. For bug reporting instructions, please see: <http://www.gnu.org/software/gdb/bugs/>. Find the GDB manual and other documentation resources online at: <http://www.gnu.org/software/gdb/documentation/>. For help, type "help". Type "apropos word" to search for commands related to "word". (gdb)



然后使用 target remote localhost:3333 命令连接到 OpenOCD 守护进程上:

```
(gdb) target remote localhost:3333
Remote debugging using localhost:3333
0x080102cc in ?? ()
(gdb)
```

这时执行 monitor reset halt 命令,复位并停止 cpu 工作:

```
(gdb) monitor reset halt
target halted due to debug-request, current mode: Thread
xPSR: 0x01000000 pc: 0x0000051e msp: 0x20030cd8
(gdb)
```

接着执行 monitor flash write\_image erase /cygdrive/g/temp/W60X\_SDK\_G3. 0Final/image/W60X.dbg 0x08010000 命令烧写固件到 flash, 烧写需要等待一会儿才能完成:

(gdb) monitor flash write\_image erase /cygdrive/g/temp/w600\_s0%\_G3.0Final/image/w600.dbg 0x08010000 auto erase enabled wrote 438272 bytes from file /cygdrive/g/temp/w600\_s0K\_G3.0Final/image/w600.dbg in 82.988007s (5.157 KiB/s)

然后执行 file ./image/W60X.out 加载符号表:

```
(gdb) file ./image/w600.out
A program is being debugged already.
Are you sure you want to change the file? (y or n) [answered Y; input not from terminal]
Reading symbols from ./image/w600.out...done.
(adb)
```

然后执行 b main 设置一个断点,便于在进入 main 函数时停住:

```
(gdb) b main
Breakpoint 1 at 0x8011c96: file wm_main.c, line 165.
(gdb)
```

最后执行 c 命令让程序跑起来:

```
(gdb) c
Continuing.
Note: automatically using hardware breakpoints for read-only addresses.
```

很快程序就停在了 main 函数入口处:

```
Breakpoint 1, main () at wm_main.c:165
165 SystemInit();
(gdb)
```



这时即可使用 n 命令单步调试:

Breakpoint 1 165	l, main () at wm_main.c:165 SystemInit();
(gdb) n 167 (gdb) n	<pre>tls_sys_clk_set(CPU_CLK_80M);</pre>
(gdb) n 169 (gdb) n	<pre>tls_os_init(NULL);</pre>
172 (qdb)	<pre>tls_os_sem_create(&amp;libc_sem, 1);</pre>

可以使用 p libc\_sem 打印出指针地址:

(gdb)	p libc_	sem		
\$1 =	(tls_os_	_sem_t	*)	0x0

使用 set libc\_sem=0x100 修改指针地址:

(gdb) p libc_sem
\$1 = (tls_os_sem_t *) 0x0
(gdb) set libc_sem=0x100
(gdb) p libc_sem
$2 = (t]s_os_sem_t *) 0x100$
(gdb)

关于更多的 gdb 调试知识请自行参阅其文档 http://sourceware.org/gdb/current/onlinedocs/gdb/。

- 4 附录
- 4.1 Eclipse 安装 zylincdt 插件

Zylincdt 插件使得 Eclipse 能够支持嵌入式 GDB 在 Eclipse 中调试,我们提供的集成压缩包开发环境中已经默认安装了该插件。

插件更新源为 http://opensource.zylin.com/zylincdt,插件安装方法如下图所示:



He	p	
. 🜏	Welcome	
?	Help Contents	
89	Search	
	Dynamic Help	
	Key Assist Ctrl+Shift+L	~
	Tips and Tricks	
Æ	Report Bug or Enhancement	
	Cheat Sheets	
~~	Perform Setup Tasks	
2	Check for Updates	
₽	Install New Software	HA N
8	Installation Details	
2	Eclipse Marketplace	AL Y
۲	About Eclipse	



➡ Install		— 🗆 X			
Available Software					
Check the items that you wish to install.					
Work with: http://opensource.zylin.com/zylincdt		~ Add			
Find more software by working with the <u>"Available Software Sites"</u> preferences.					
type filter text					
Name	Version				
Select All Deselect All					
Details					
Zylin Embedded CDT 1.0.0.787S1cKDAnh		Ċ			
Show only the latest versions of available software	☑ Hide items that are already installed	More			
Group items by category	What is already installed?				
Show only software applicable to target environment					
Contact all update sites during install to find required software					
(V)	< Back Next > Fin	iish Cancel			
空壮时今五一此敬生。县丘今坦三雪更重白 Dalia	· 按照担于操作即可				
又表明云有 些言口, 取口云远小而安里口 Ccups	56,按照症小探下即可。				
7/2-					
A ·					