

# **RTEMS Eclipse Manual**

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The RTEMS Project is hosted at https://www.rtems.org. Any inquiries concerning RTEMS, its related support components, or its documentation should be directed to the RTEMS Project community.

RTEMS Online Resources							
Home	https://www.rtems.org						
Documentation	https://docs.rtems.org						
Mailing Lists	https://lists.rtems.org						
Bug Reporting	https://devel.rtems.org/wiki/Developer/Bug_Reporting						
Git Repositories	https://git.rtems.org						
Developers	https://devel.rtems.org						

## **OVERVIEW**

Welcome to the RTEMS Eclipse Manual.

This document covers using Eclipse with RTEMS.

RTEMS, Real-Time Executive for Multiprocessor Systems, is a real-time executive (kernel) which provides a high performance environment for embedded applications.

Eclipse is an Integrated Development Environment (IDE) for a wide range of languages and platforms.

RTEMS's eco-system provides all the tools and capabilities to integrate with Eclipse. You can build and develop RTEMS with Eclipse as well as build applications with Eclipse.

Unless otherwise stated this document refers to the Eclipse Mars release.

CHAPTER

TWO

# **RTEMS DEVELOPMENT**

RTEMS can be developed using Eclipse. The RTEMS kernel is an *autotools* or *autoconf* and *automake* based package. You can create a project in Eclipse that lets you configure and build a BSP for an architecture. We assume you have already build and installed your tools using the RTEMS Source Builder.

## 2.1 Kernel Source

Download or clone the RTEMS Kernel source code. We will clone the source code:

```
1 $ git clone git://git.rtems.org/rtems.git rtems.master
2 Cloning into 'rtems'...
3 remote: Counting objects: 483342, done.
4 remote: Compressing objects: 100% (88974/88974), done.
5 remote: Total 483342 (delta 390053), reused 475669 (delta 383809)
6 Receiving objects: 100% (483342/483342), 69.88 MiB | 1.37 MiB/s, done.
7 Resolving deltas: 100% (390053/390053), done.
8 Checking connectivity... done.
```

We need to *bootstrap* the kernel source code. A *botostrap* invokes the various *autotools* commands need to generate build system files. First we need to the path to our tools:

```
1 $ export PATH=/opt/rtems/5/bin:$PATH
```

Now run the *bootstrap* command:

1 \$ cd rtems.master

```
2 $ ./bootstrap
```

Sit back, this can take a while. The Getting Started Guide talks about using the RSB's *sb*-*bootstrap* to run the bootstrap process in parallel on all available cores. The output of the bootstrap has not been copied into this documentment.

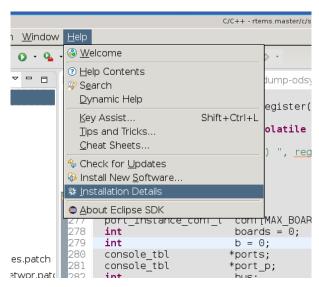
The source code is now ready.

### 2.2 Eclipse SDK Software

We need the following Eclipse SDK Software packages installed:

- C/C++ Autotools support
- C/C++ Development Tools
- C/C++ GCC Cross Compiler Support

Start Eclipse and check to see if you have the them installed via the **Help, Installation Details** menu item:



The dialog box shows the installed software packages and you can see the C/C++ Autotools support and the C/C++ Development Tools are installed:

Name	Version	Id	Provider
		I	
C/C++ Autotools support	8.8.1.20160205100	Corg.eclipse.cdt.autotools.feature.group	Eclipse CDT
🖗 C/C++ Development Tools	8.8.1.20160205100	0 org.eclipse.cdt.feature.group	Eclipse CDT
称 C/C++ GCC Cross Compiler Support	8.8.1.20160205100	0 org.eclipse.cdt.build.crossgcc.feature.gr	<sup>r</sup> Eclipse CDT
ጭ C/C++ GDB Hardware Debugging	8.8.1.20160205100	0 org.eclipse.cdt.debug.gdbjtag.feature.gr	Eclipse CDT
🖗 Eclipse SDK	4.5.2.M20160212-1	org.eclipse.sdk.ide	Eclipse.org

You can see some other software packages are installed in the figure. You can ignore those.

If you do not have the listed software packages install select **Help, Install New Software** and in the **Work with:** list box select **http://download.eclipse.org/releases/mars**.

● ◯ Install <@ruru>	$\odot$ $\odot$ $\otimes$
Available Software	
Select a site or enter the location of a site.	
Work with: type or select a site	▲ dd
type or select a site	<u>es"</u> preferences.
type filter te http://download.eclipse.org/releases/mars	<u> </u>
Name http://download.eclipse.org/eclipse/updates/4.5	
□ ① There is no site selected.	
Select All Deselect All	
Details	
	A V
☑ Show only the latest versions of available software ☑ Hide items that are already installed	
Group items by category What is <u>already installed</u> ?	
Show only software applicable to target environment	
☑ <u>C</u> ontact all update sites during install to find required software	
< Back	Einish

Afer a small period of time a list of available packages will populate and you can select the ones we are interested in. Enter autotools in the search box and select the package:

Clear the search line and enter development tools in the search box and then scroll down to find C/C++ Development Tools:

Again clear the search line and enter gcc cross in the search box and select the package:

Click **Next** and once the **Install Details** have determined what is needed select **Finish** to install the packages.

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, Find more s	software by working with the <u>"Available Software Site</u>	es" preferences.
autotools		<u> </u>
Name	Version	
▼		
🗹 ᅒ C/C++ Autotools support	8.8.1.201602051005	
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Details		
Plugins for maintaining C/C++ projects that use Auto	tools (autoconf and automake).	×
		More
Show only the latest versions of available software	$\Box$ Hide items that are already installed	
☑ <u>G</u> roup items by category	What is <u>already installed</u> ?	
Show only software applicable to target environme	ent	
☑ Contact all update sites during install to find require	ed software	
0	< Back Next > Cancel	Finish
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		$\odot$
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Find more software by working	with the <u>"Available Software Sit</u>	es" preferences
development tools		6
Name	Version	
	0.3.0.201506011443	
▼ 🖃 🎟 Programming Languages		
🗹 ᅒ C/C++ Development Tools	8.8.1.201602051005	
🗌 🖗 C/C++ Development Tools SDK	8.8.1.201602051005	
🗆 🖗 Dynamic Languages Toolkit - iTcl Development Tools	5.4.0.201602110510	
Working Anguages Toolkit - Ruby Development Tools	5.4.0.201602110510	
Select All         Deselect All         2 items selected	5.4.0.201602110510	
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🗹 ᅒ C/C++ GCC Cross Compiler Support	8.8.1.201602051005	
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Details		
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Show only the latest versions of available software	$\Box$ <u>H</u> ide items that are already installed	
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Show only software applicable to target environme	ent	
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## 2.3 Kernel Build Project

We create a project in Eclipse that can configure and build RTEMS for the pc686 BSP. This BSP is based on the pc386 BSP and is under the i386 architecture.

We assume you have built and installed the i 386 RTEMS Tools, obtained the RTEMS kernel code and bootstrapped it if a git clone, and installed the required Eclipse Software packages.

The paths used in this project are:

#### /opt/work/rtems/4.11

The RTEMS Tools prefix the tools are install under.

#### /opt/work/chris/rtems/kernel/rtems.master

The RTEMS Kernel source code.

/opt/work/chris/rtems/kernel/5
The RTEMS Kernel prefix.

#### /opt/work/chris/rtems/kernel/bsp/pc

The RTEMS Kernel BSP build directory.

The menus shown here may vary from those you have as Eclipse changes them based on what you do.

● _ C/C++ - Eclipse SDK <@ruru> 🛛 ⊙ ⊗							
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	hift+Alt+N 🕨	🖻 Makefile Project with Existing Code			Quick Access	🐉 Java 🗖 C	/C++
Open File <u>.</u>		C++ Project				,	
Close	CLIT+ VV	C Project		- 0	🗄 Outline 🛱 🖲 Make Target		
Close All		📑 P <u>r</u> oject			An outline is not available.		
Save	Ctrl+S	Convert to a C/C++ Autotools Project					
🖳 Save <u>A</u> s		Convert to a C/C++ Project (Adds C/C++ Nature)					
	Shift+Ctrl+S	Source Folder					
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	Description				Resource	Path	
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#### Select File, New, Project :

Click on C/C++ and select Makefile Project with Existing Code then select Next :

Enter the project name rtems-git into the **Project Name** field and select the **Browse...** button and the path to the RTEMS Kernel source code then click **Finish** :

Eclipse will show the RTEMS Kernel source code in the Project Explorer panel:

• •	New Project <@ruru>	$\odot \odot \otimes$
Select a wizard		
Creates a new Make	efile project in a directory containing existing code	
<u>W</u> izards:		
type filter text		<u></u>
Plug-in Project	-	-
🕨 🗁 General		
マ 🗁 C/C++		
🖻 C Project		
🗟 C++ Project		
ᄚ Makefile Proj	ect with Existing Code	
De CVS		-
?	< Back Next > Cancel	inish

• •	1	New Project <@ruru>		$\odot$ $\otimes$				
Import Existing Co	Import Existing Code							
Create a new Makef directory	ile project from	existing code in th	at same					
Project Name								
rtems-git								
Existing Code Loca	tion							
/opt/work/chris/rte	ms/kernel/rtem	s.master		Browse				
Languages								
☑ C ☑ C++								
Toolchain for Index	er Settings							
<none></none>								
Cross GCC								
GNU Autotools Too	olchain							
☑ Show only availa	ble toolchains th	hat support this pla	atform					
?	< <u>B</u> ack	<u>N</u> ext >	Cancel	<u>F</u> inish				

• •	C/C++ - Eclipse SDK <@ruru>		S O S
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ြ Project Explorer थ्र 📃 🗖 🗖		e Outline ¤	
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🖹 configure 🚾 configure.ac	Description	Resource	Path
COPYING depcomp INSTALL install-sh LICENSE LICENSE.JFFS2	▶ 9 Errors (1 item)		
			Þ
🚰 rtems-git			

We now convert the project to an Autotools project. Select **File**, **New**, **Convert to a C/C++ Autotools Project** :

Select C Project then Finish :

We now configure the project's properties by right clicking on the rtems-git project title and then **Properties** :

Click on the **Autotools** item then **Configure Settings** and **Platform specifiers** and set the **Target platform** field with i386-rtems5:

Select **Platform directories** and enter the **Arch-independent install directory (–prefix)** to the RTEMS Kernel prefix of /opt/work/chris/rtems/kernel/5:

We disable networking to use the external LibBSD package and set the BSP to pc686. Select the **Advanced** and in the **Additional command-line options** enter --disable-networking and --enable-rtemsbsps=pc686. You can add extra options you may need:

Select C/C++ Build and Environment. Uncheck or clear the Use default build command and add -j N where N is the number of cores you have in your machine. The figure has told *make* to run 8 jobs, one per core for an 8 core machine. Click on the File system... button and navigate to the BSP build directory. This is the location Eclipse builds the BSP. RTEMS requires you build outside the source tree and in this example we are forcing the build directory to something specific. Finish by pressing **Apply** :

Select **Environment** under C/C++ **Build** as we need to set the path to the RTEMS Tools. In this example we set the path in the Eclipse project so each project can have a specific set of tools. Press the Add... button:

Enter the path to the tools, in our case it is /opt/work/rtems/5/bin, then press Variables :

Scroll down and select **PATH** and then press **OK** :

•		C/C++ - Eclipse SDK <@ruru>				$\odot \odot \otimes$	
Elle Edit Source Refactor Navigate Se <u>a</u> rch Project Bun <u>Wi</u> ndow <u>H</u> elp							
New Open File <u>.</u>	Shift+Alt+N ▶	Makefile Project with Existing Code C++ Project			Quick Access		
<u>C</u> iose C <u>i</u> ose All	Ctrl+W Shift+Ctrl+W	C Project Project			Be Outline & Make Target An outline is not available.		
i Save i Save As i Sav <u>e</u> All Rever <u>t</u>		Convert to a C/C++ Autotools Project Convert to a C/C++ Project (Adds C/C++ Nature) Source Folder Folder					
Move Rename Refresh Convert Line Delimiters To	F2 F5	<ul> <li>♂ Source File</li> <li>№ Header File</li> <li>♡ File from Template</li> <li>♥ Class</li> <li>♥ Other</li> </ul>	Ctrl+N				
Switch Workspace Restart	Ctrl+P						
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🚰 rtems-git							

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Convert to C/C++	- Autotools Project	
Convert an existing	Project to a C/C++ Autotools Project	
Candidates for conv	ersion:	
🗹 🎘 rtems-git		Select All
		Deselect All
Convert to C or C+		
⊙ C Project	O C++ Project	
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•			C/C++ - Eclipse SDK <@ruru>			$\odot \odot \otimes$
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📄 config.guess	Make Targets	► E	ole 🔲 Properties			~
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• •	Properties for rtems-git <@ruru>	$\odot$ $\odot$
type filter text 🔒	Configure Settings	$\diamond \cdot \diamond \cdot \bullet$
	Configure Settings	↓ Anage Configurations Host platform (host) Build platform (build) Target platform (target) [i386-rtems4.12]
		Restore Defaults Apply
?		Cancel OK

• •		Properties for rtems-git <@ruru>		0	$\otimes$
type filter text 🛛 🔒	Configure Settings			← • ⇒ •	-
<ul> <li>Resource</li> <li>Autotools</li> <li>Configure Settings         General         Builders</li> <li>C/C++ Build         Build Variables         Environment         Logging         Settings         Tool Chain Editor</li> </ul>	Configure Settings Configuration: Default [ Ac	Arch-independent install directory (prefix) Arch-dependent install directory (exec-prefix) Object code library directory (libdir) User executable directory (bindir) System admin executable directory (sbindir) C Header file directory (includdir)	/opt/work/c		-
<ul> <li>C/C++ General Project References Run/Debug Settings</li> </ul>	2 Options	Read-only arch-independent data (datadir) Read-only single-machine data directory (sysconfdir) Info file directory (infodir) Man file documentation directory (mandir) Sources directory (srcdir) Single-machine data directory (localstatedir) Arch-independent data directory (sharedstatedir) Program executable directory (ibexecdir) Non-gcc C header file directory (oldincludedir)			
?	< >			re Defaults Apply	
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● ⊙	Pr	operties for rtems-git <@ruru>		S © S
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Configure Settings General Builders • C/C++ Build Build Variables Environment Logging Settings Tool Chain Editor • C/C++ General Project References Run/Debug Settings	Builder Settings Builder Builder type: External builder Use default build command Build command: make -j 8 Makefile generation Generate Makefiles automatically Expand Env. Variable Refs in Makefiles Build location Build girectory: //opt/work/chris/rtems/kernel/bsps/pc Workspace File system Restore Defaults	Variables
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Logging	PWD	/opt/work/chris/rte	BUILD SYSTEM		Edit
Settings Tool Chain Editor					Delete
<ul> <li>C/C++ General</li> </ul>					Undefine
Project References					
Run/Debug Settings					
	Append vari	ables to native environm	ent		
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				Restor	re <u>D</u> efaults <u>A</u> pply
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•	Edit variable <@ruru>	$\odot$ $\otimes$
Name:	PATH	
Value:	/opt/work/rtems/4.12/bin	Variables
Cancel OK		

0	Select build	variable <@ruru>	$\odot$ $\odot$ $\otimes$
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			<b>v</b>
?		Cancel	OK

You will now see the path in the **Value:** field. Make sure you have a path separator between the end of the tools path and the path variable we have just added. In this case is a Unix host and the separator is :. Windows use ;. Press **OK** when you have a valid path:

• •	Edit variable <@ruru>
Name:	PATH
Value:	opt/work/rtems/4.12/bin:\${PATH} Variables
Cancel OK	

The **Environment** panel will now show the added *PATH* variable. Click **Replace native environment with specified one** as shown and then press **Apply** :

• •		Properties	for rtems-git <@ruru>			$\odot$ $\odot$
type filter text 🛛 🐣	Environment				<	b • ¢ • •
<ul> <li>Resource</li> <li>Autotools</li> <li>Builders</li> </ul>	Configuration:	Default [ Active ]		[▼	Manage Confi	gurations
▼ C/C++ Build	Environment var	riables to set				Add
Build Variables	Variable	Value	Origin			
Environment	CWD	/opt/work/chris/rte	BUILD SYSTEM			Select
Logging	PATH	/opt/work/rtems/4	USER: CONFIG			Edit
Settings Tool Chain Editor	PWD	/opt/work/chris/rte	BUILD SYSTEM			Delete
<ul> <li>C/C++ General Project References Run/Debug Settings</li> </ul>						Undefine
		oles to native environm				
		e environment with spe native environment with		Restor	re <u>D</u> efaults	Apply
?				С	ancel	ОК

Select **Settings** under **C/C++ Build** and check **Elf Parser** and **GNU Elf Parser** and then press **OK** :

We are now ready to run configure using Eclipse. Right click on the project name rtems-git and then **Reconfigure Project** :

Select the **Console** tab in the output panel to view the configure process output. You will notice the end of the configure process shows the names of the BSPs we have asked to build. In our case this is the pc686 BSP:

We can now build RTEMS using Eclipse. Right click on the project name rtems-git and then select **Build Project** :

A **Build Project** message box will appear showing the progress:

When finished click on the **Problems** output tab to view any errors or warnings:

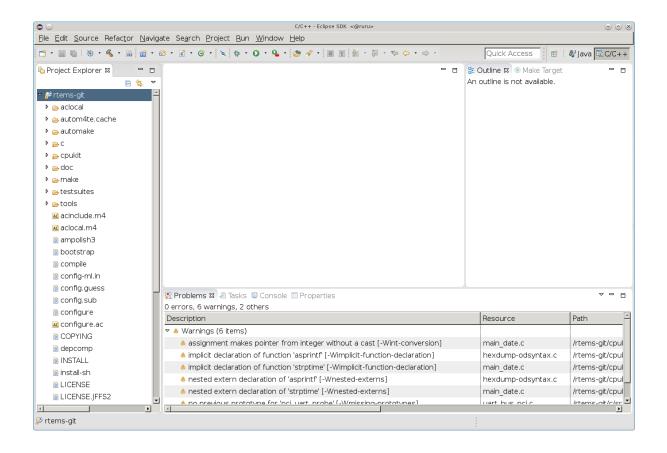
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If you get errors during the configure phase or building you will need to determine reason why. The main source of errors will be the path to the tools. Check the top of the config.log file configure generates. This file can be found in the top directory of you BSP build tree. The file will list the path components near the top and you should see the path to your tools listed first. While looking make sure the configure command matches what you expect and matches the documentation for configuring RTEMS.

If the contents of config.log look fine check the build log. The project's **Properties** dialog under C/C++ **Build**, **Logging** has a path to a build log. Open the build log and search for the error. If you cannot figure out the source of the error please ask on the Users Mailing List for help.

## CHAPTER THREE

# GLOSSARY

#### Binutils

GNU Binary Utilities such as the assembler as, linker 1d and a range of other tools used in the development of software.

#### DLL

Dynamically Linker Library used on Windows.

#### GCC

GNU Compiler Tool chain. It is the GNU C/C++ compiler, binutils and GDB.

### GDB

GNU Debugger

#### MinGW

Minimal GNU system for Windows that lets GCC built programs use the standard Windows operating system DLLs. It lets you build native Windows programs with the GNU GCC compiler.

#### MinGW64

Minimal GNU system for 64bit Windows. MinGW64 is not the MinGW project.

### MSYS2

Minimal System 2 is a fork of the MinGW project's MSYS tool and the MinGW MSYS tool is a fork of Cygwin project. The Cygwin project provides a POSIX emulation layer for Windows so POSIX software can run on Windows. MSYS is a minimal version that is just enough to let configure scripts run. MSYS has a simplified path structure to make it easier to building native Windows programs.

#### POSIX

Portable Operating System Interface is a standard that lets software be portable between compliant operating systems.

### prefix

A path used when building a package so all parts of the package reside under that path.

#### RSB

RTEMS Source Builder is part of the RTEMS Tools Project. It builds packages such as the tools for the RTEMS operating system.

#### RTEMS

The Real-Time Executive for Multiprocessor Systems or RTEMS is an open source fully featured Real Time Operating System or RTOS that supports a variety of open standard application programming interfaces (API) and interface standards such as POSIX and BSD sockets.

#### **Test Suite**

See Testsuite

#### Testsuite

RTEMS test suite located in the testsuites/ directory.

#### Waf

Waf build system. For more information see http://www.waf.io/

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