RTEMS Eclipse Manual

Release 5.1-rc2 (14th August 2020)

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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

CHAPTER

ONE

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:

```
$ git clone git://git.rtems.org/rtems.git rtems.master
Cloning into 'rtems'...
remote: Counting objects: 483342, done.
remote: Compressing objects: 100% (88974/88974), done.
remote: Total 483342 (delta 390053), reused 475669 (delta 383809)
Receiving objects: 100% (483342/483342), 69.88 MiB | 1.37 MiB/s, done.
Resolving deltas: 100% (390053/390053), done.
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:

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

Now run the *bootstrap* command:

```
$ cd rtems.master
$ ./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.

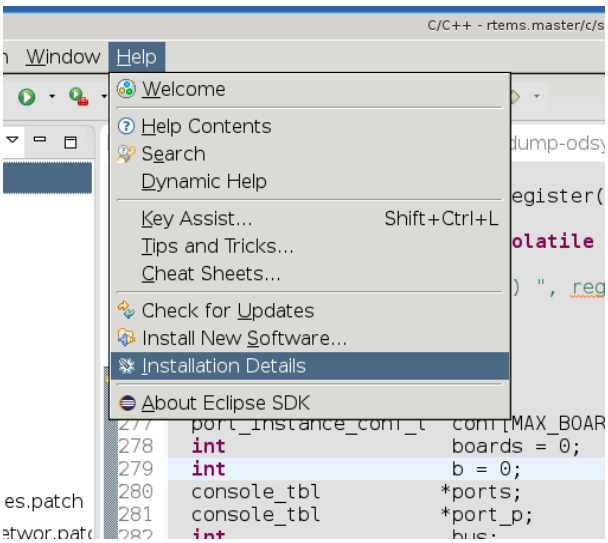
The source code is now ready.

2.2 Eclipse SDK Software

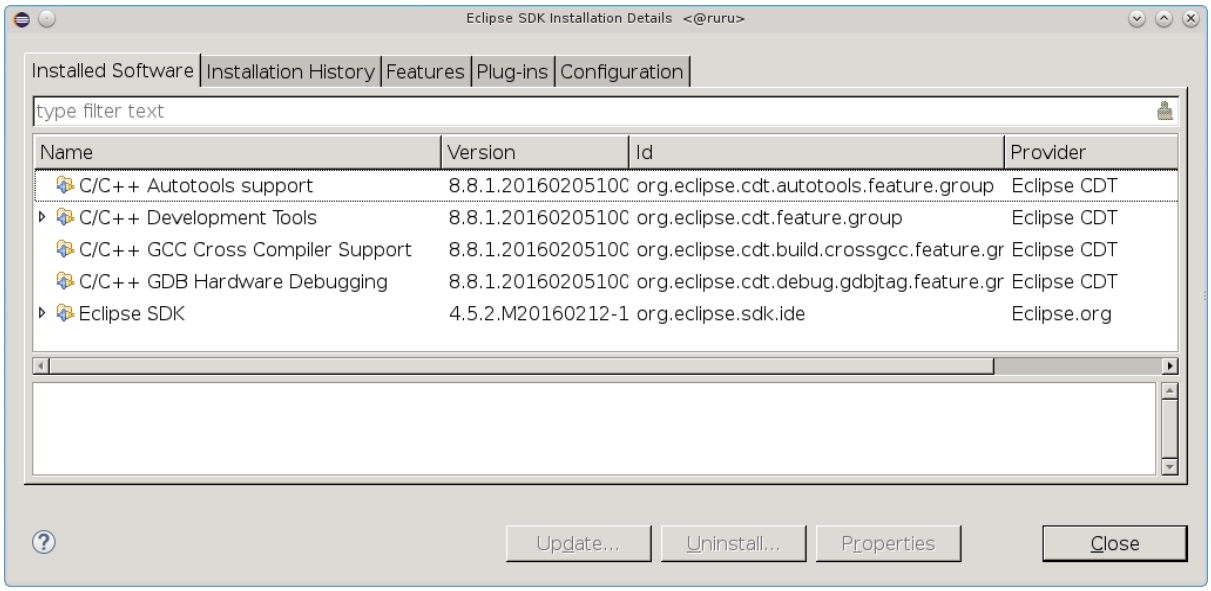
We need the following Eclipse SDK Software packages installed:

- 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:

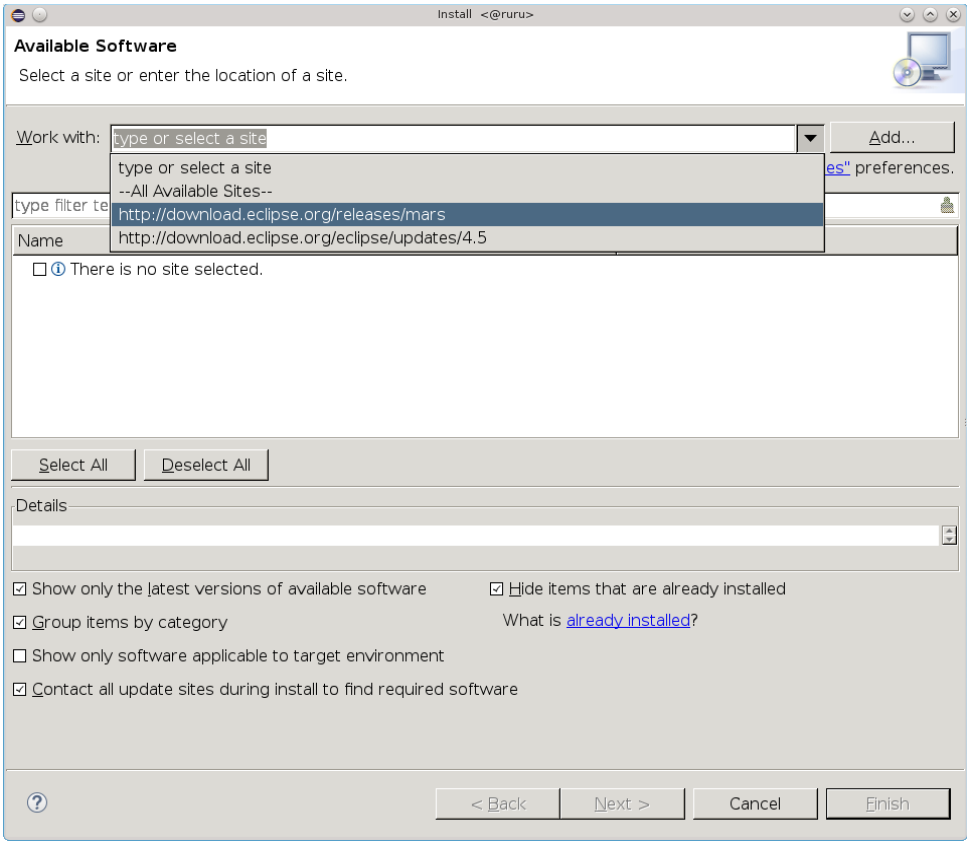


The dialog box shows the installed software packages and you can see the **C/C++ Autotools support** and the **C/C++ Development Tools** are installed:



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**.

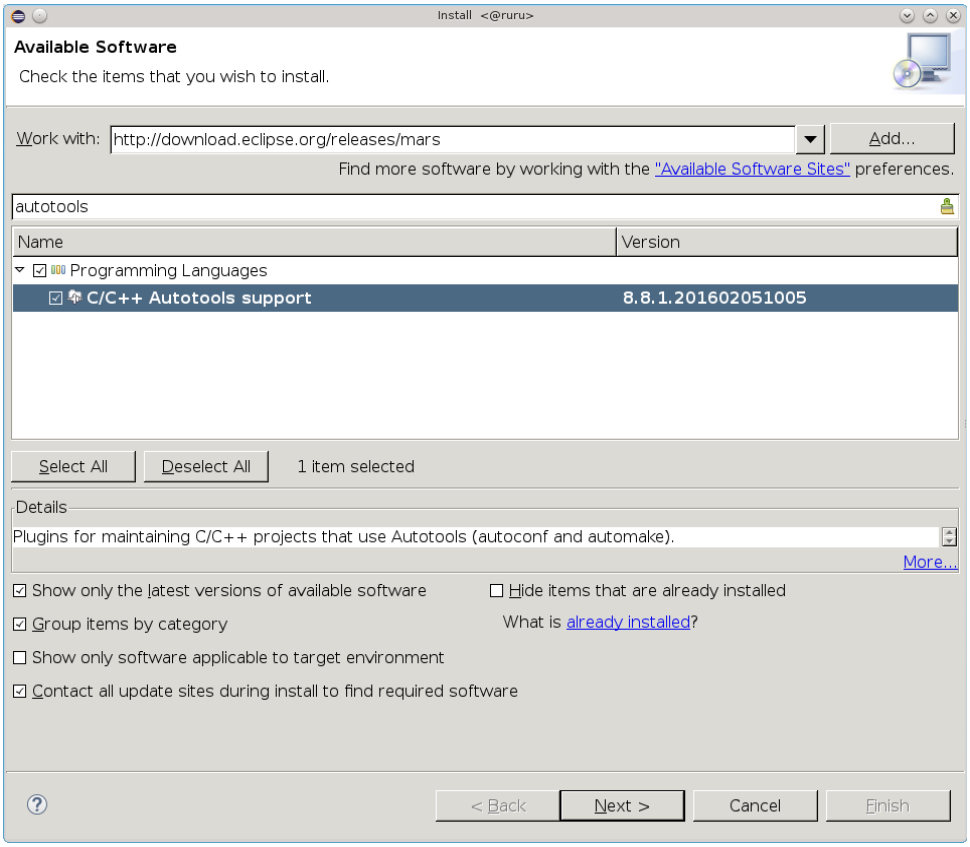


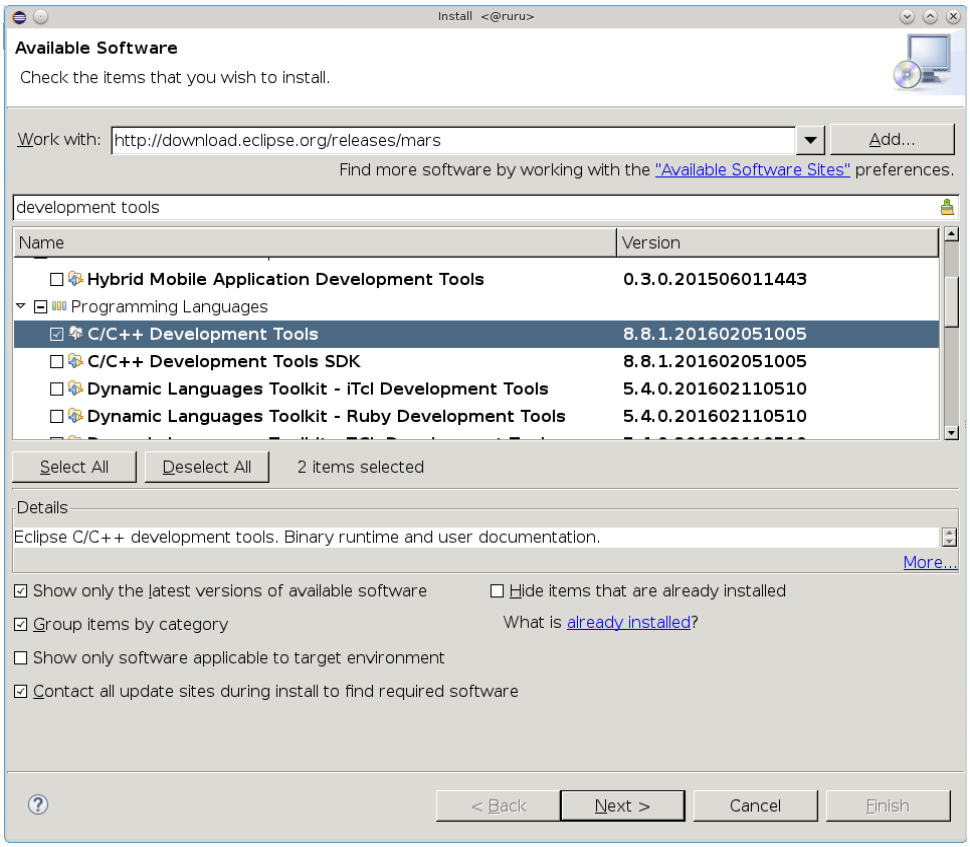
Afer a small period of time a list of available packages will populate and you can select the ones we are interested in. Enter `autotools` in the search box and select the package:

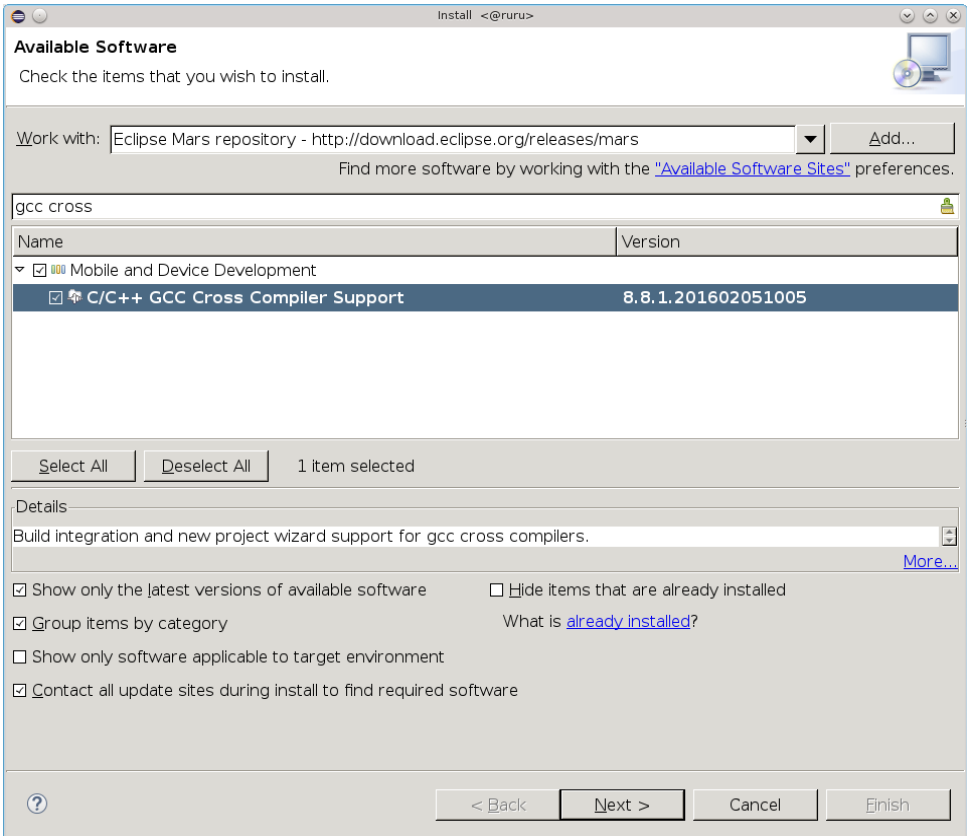
Clear the search line and enter `development tools` in the search box and then scroll down to find **C/C++ Development Tools**:

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.


Install <@ruru>
Available Software
Check the items that you wish to install.
Work with: http://download.eclipse.org/releases/mars
Add...
Find more software by working with the "Available Software Sites" preferences.
autotools
Name
Version
Programming Languages
C/C++ Autotools support
8.8.1.201602051005
Select All
Deselect All
1 item selected
Details
Plugins for maintaining C/C++ projects that use Autotools (autoconf and automake).
More...
Show only the latest versions of available software
Hide items that are already installed
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
< Back
Next >
Cancel
Finish


Install <@ruru>
Available Software
Check the items that you wish to install.
Work with: http://download.eclipse.org/releases/mars
Add...
Find more software by working with the "Available Software Sites" preferences.
development tools
Name
Version
Hybrid Mobile Application Development Tools
0.3.0.201506011443
Programming Languages
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
Dynamic Languages Toolkit - Ruby Development Tools
5.4.0.201602110510
Select All
Deselect All
2 items selected
Details
Eclipse C/C++ development tools. Binary runtime and user documentation.
More...
Show only the latest versions of available software
Hide items that are already installed
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
< Back
Next >
Cancel
Finish


Install <@ruru>
Available Software
Check the items that you wish to install.
Work with:
Eclipse Mars repository - http://download.eclipse.org/releases/mars
Add...
Find more software by working with the "Available Software Sites" preferences.
gcc cross
Name
Version
Mobile and Device Development
C/C++ GCC Cross Compiler Support
8.8.1.201602051005
Select All
Deselect All
1 item selected
Details
Build integration and new project wizard support for gcc cross compilers.
More...
Show only the latest versions of available software
Hide items that are already installed
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
< Back
Next >
Cancel
Finish

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 `i386` 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.

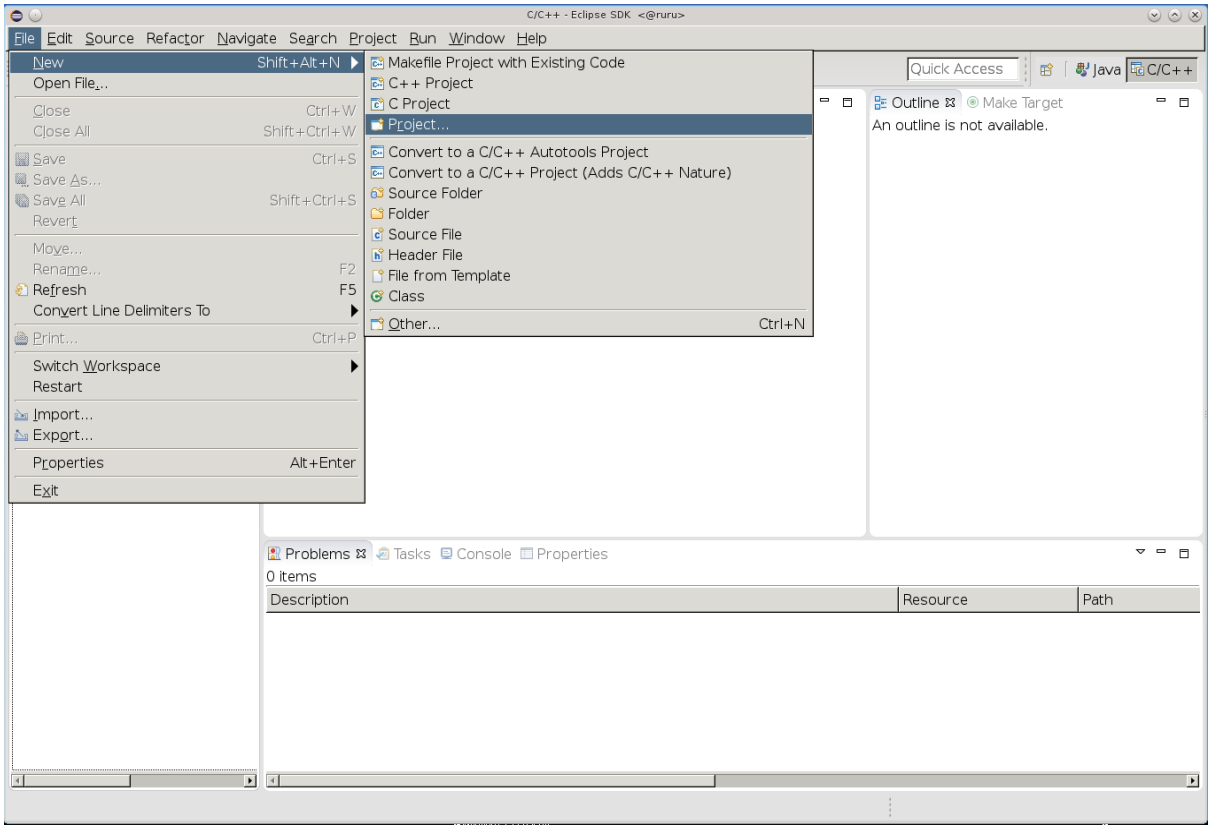
`/opt/work/chris/rtems/kernel/rtems.master`
The RTEMS Kernel source code.

`/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.

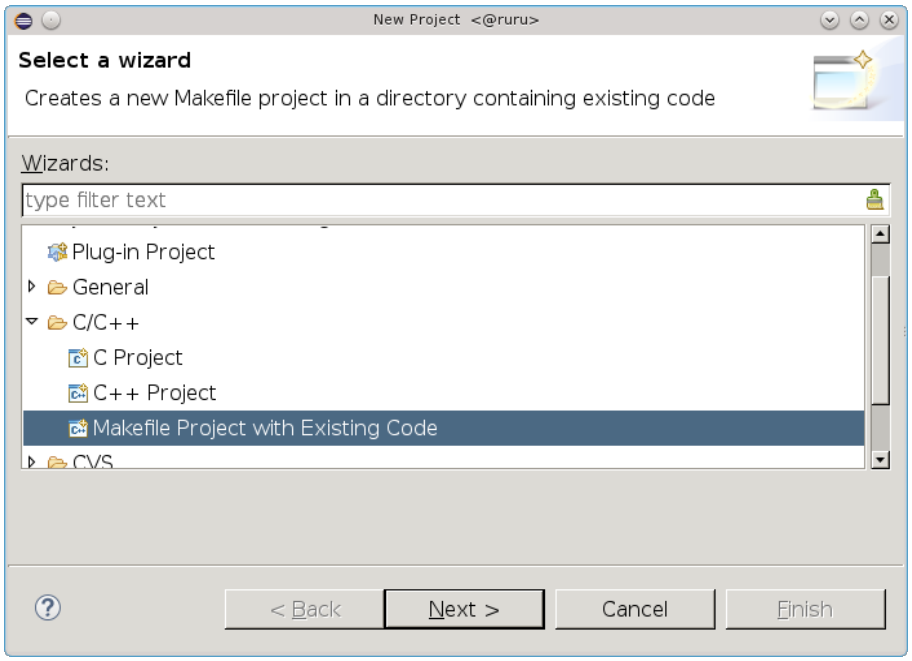
Select **File, New, Project** :

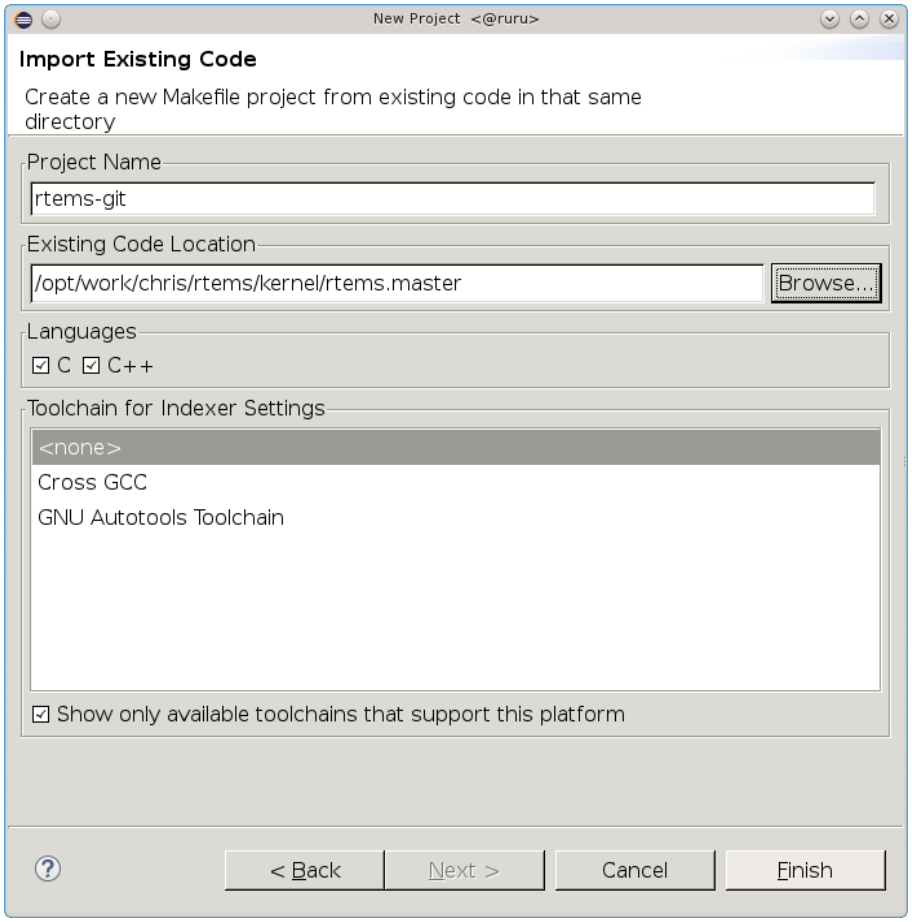


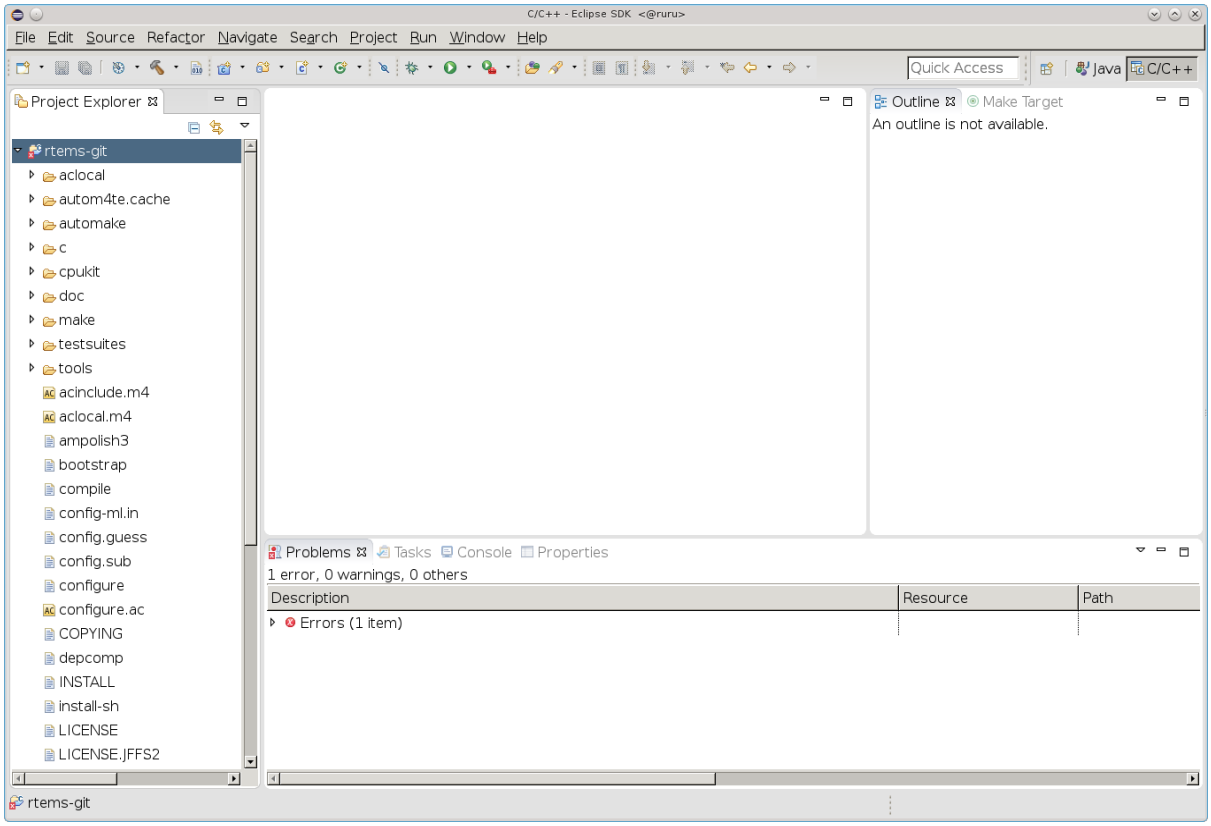
Click on **C/C++** and select **Makefile Project with Existing Code** then select **Next** :

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>
Select a wizard
Creates a new Makefile project in a directory containing existing code
Wizards:
type filter text
Plug-in Project
General
C/C++
C Project
C++ Project
Makefile Project with Existing Code
CVS
< Back
Next >
Cancel
Finish


New Project <@ruru>
Import Existing Code
Create a new Makefile project from existing code in that same directory
Project Name
rtems-git
Existing Code Location
/opt/work/chris/rtems/kernel/rtems.master
Browse...
Languages
C C++
Toolchain for Indexer Settings
<none>
Cross GCC
GNU Autotools Toolchain
Show only available toolchains that support this platform
< Back
Next >
Cancel
Finish



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`:

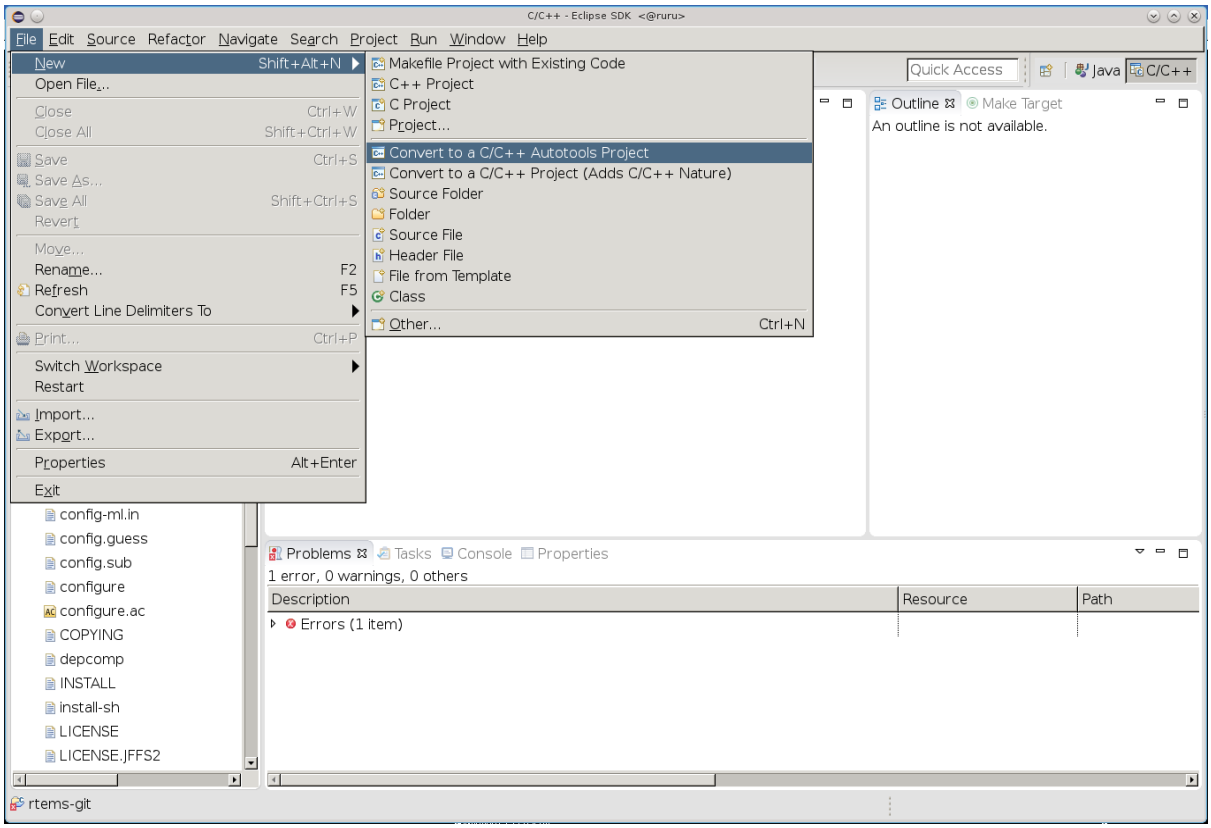
We disable networking to use the external LibBSD package and set the BSP to `pc686`. Select the **Advanced** and in the **Additional command-line options** enter `--disable-networking` and `--enable-rtemsbsps=pc686`. You can add extra options you may need:

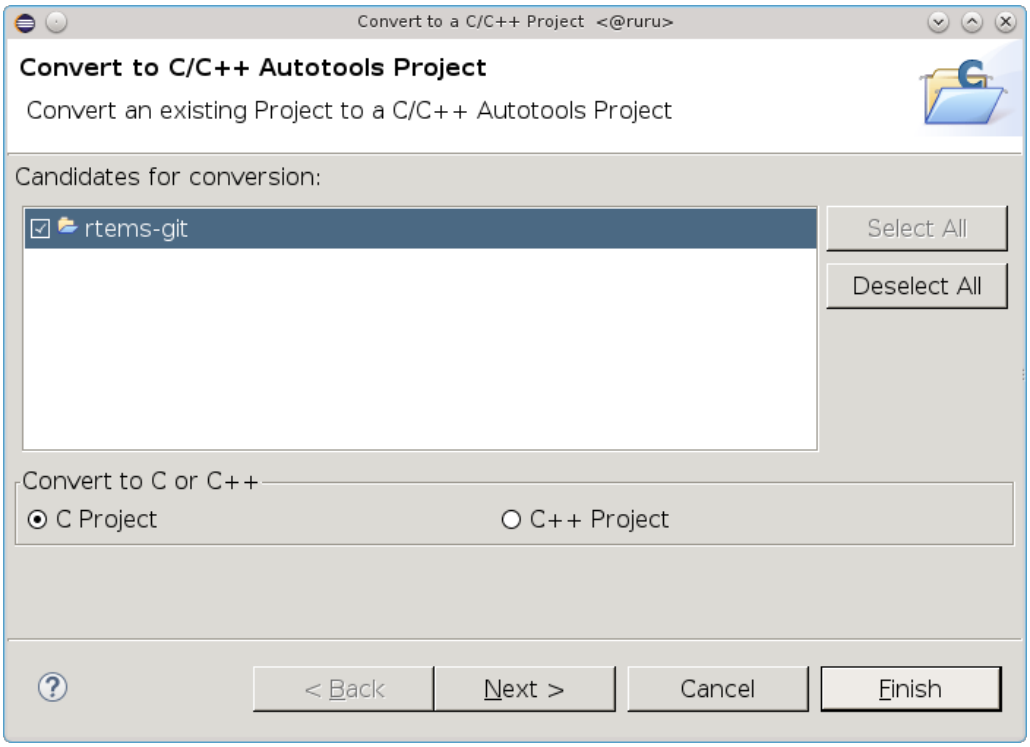
Select **C/C++ Build** and **Environment**. Uncheck or clear the **Use default build command** and add `-j N` where `N` is the number of cores you have in your machine. The figure has told *make* to run 8 jobs, one per core for an 8 core machine. Click on the **File system...** button and navigate to 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** :

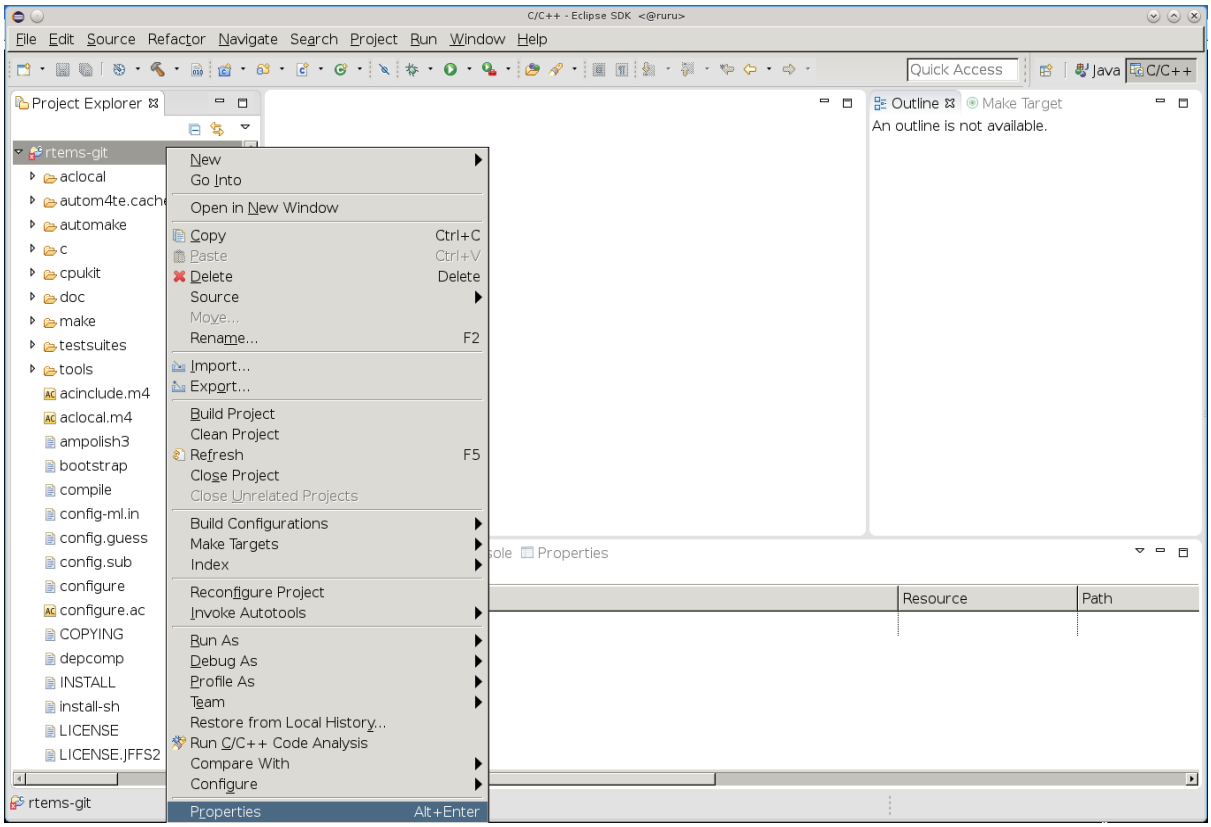
Select **Environment** under **C/C++ Build** as we need to set the path to the RTEMS Tools. In this example we set the path in the Eclipse project so each project can have a specific set of tools. Press the **Add...** button:

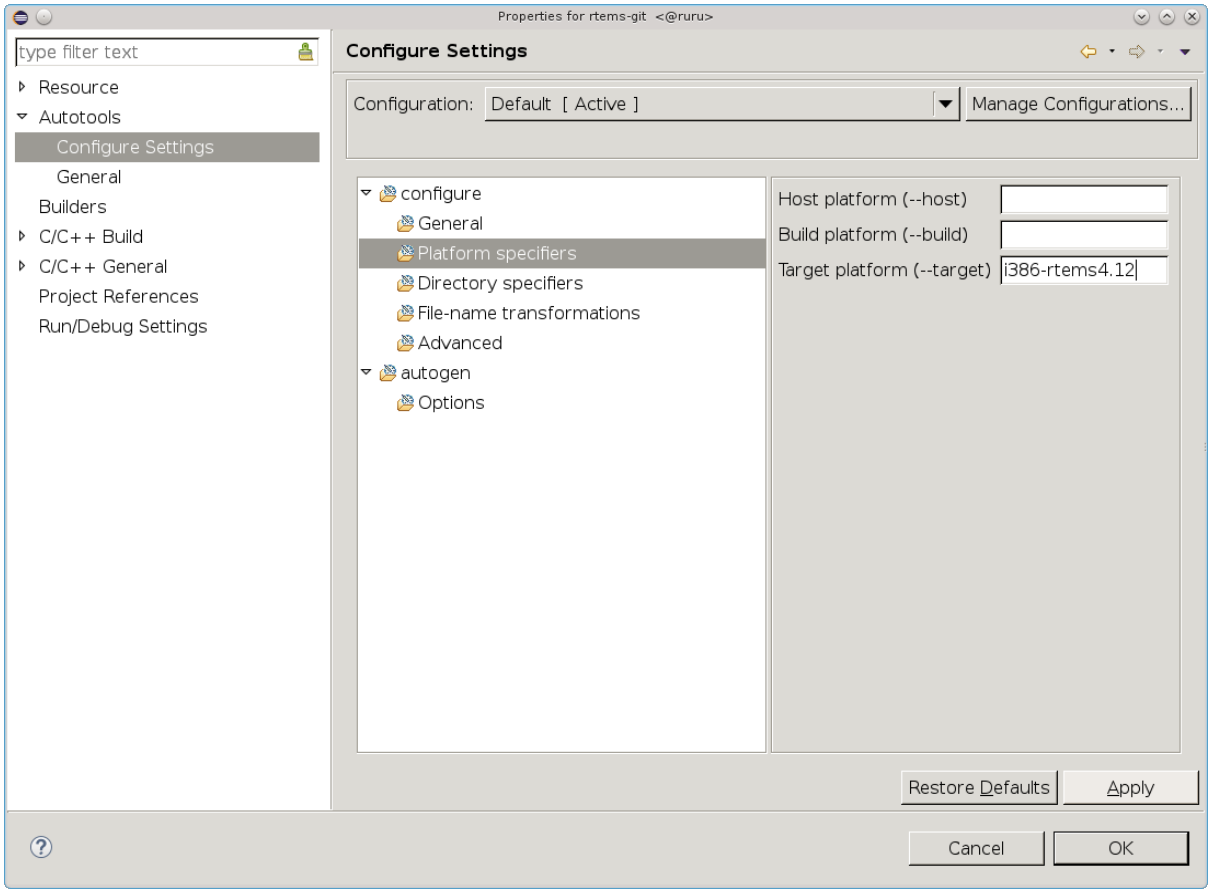
Enter the path to the tools, in our case it is `/opt/work/rtems/5/bin`, then press **Variables** :

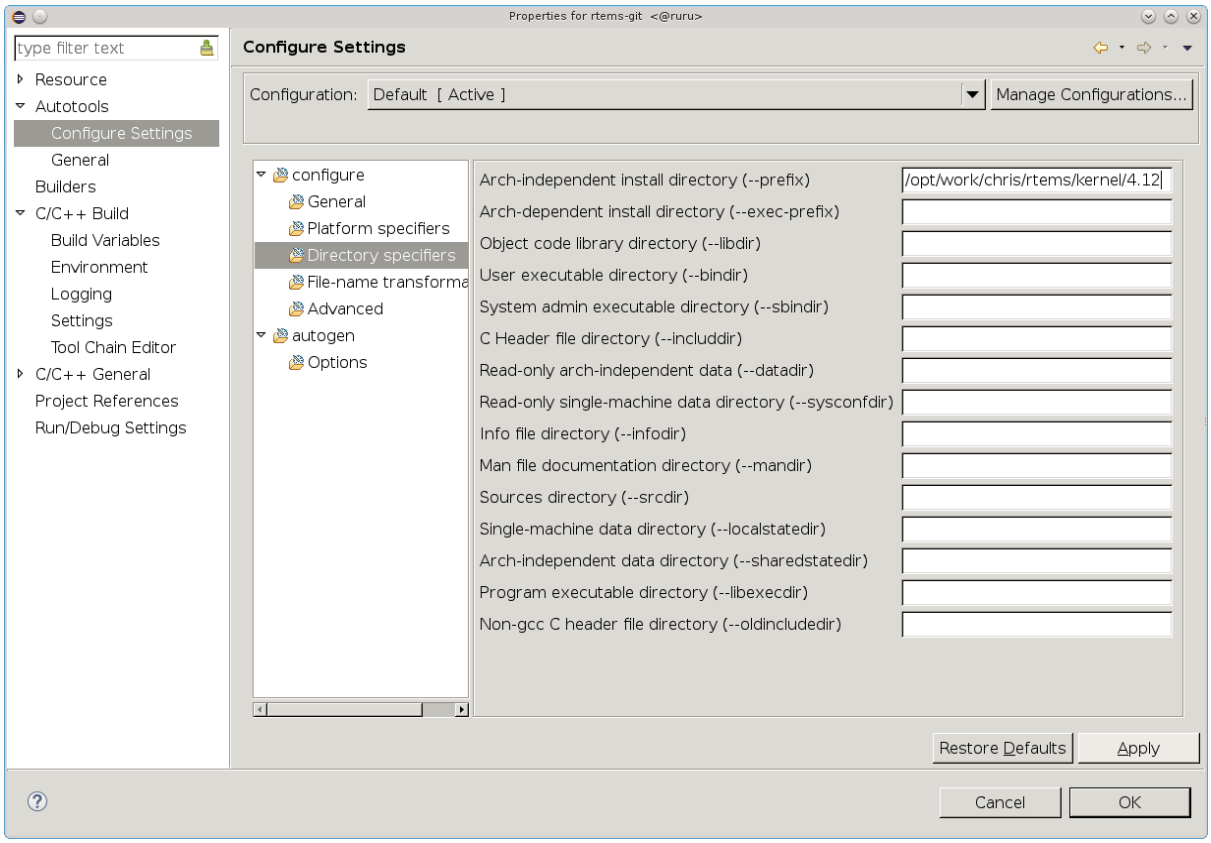
Scroll down and select **PATH** and then press **OK** :

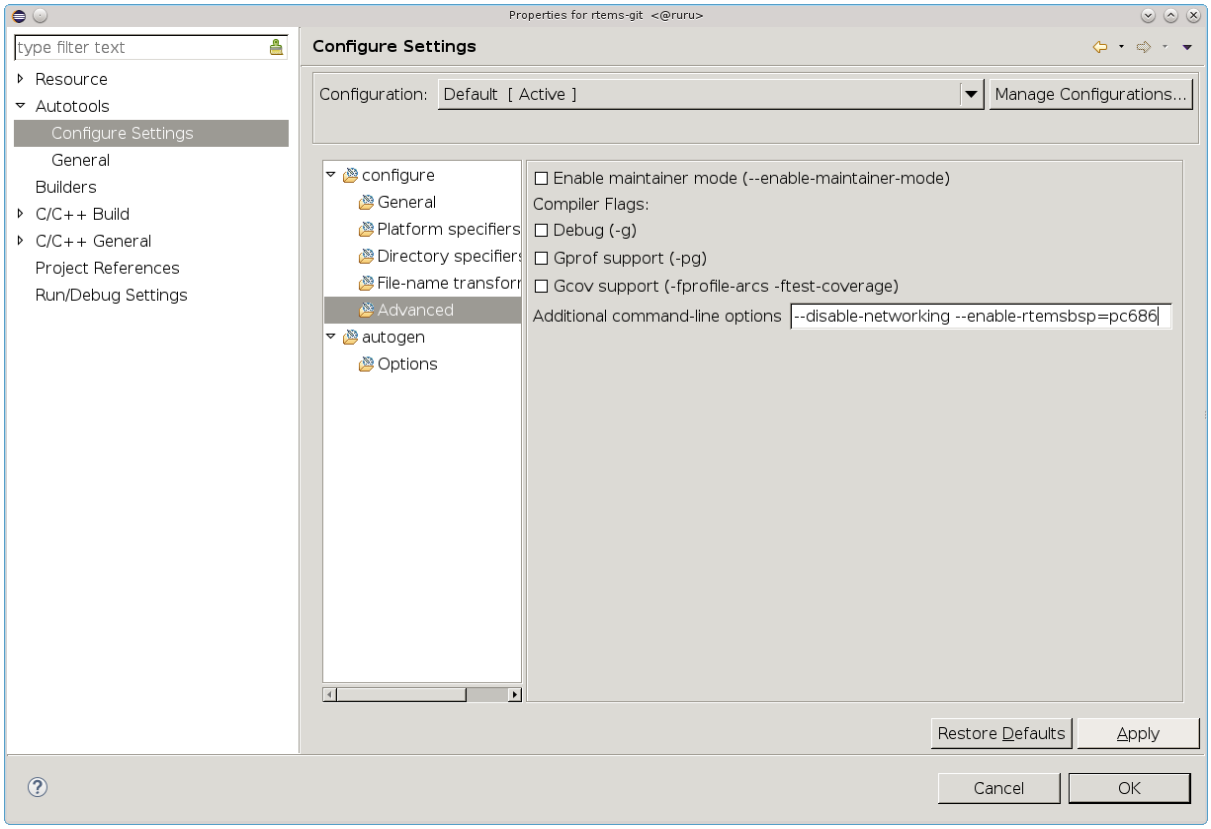

C/C++ - Eclipse SDK <@ruru>
File Edit Source Refactor Navigate Search Project Run Window Help
New Shift+Alt+N
Open File...
Close Ctrl+W
Close All Shift+Ctrl+W
Save Ctrl+S
Save As...
Save All Shift+Ctrl+S
Revert
Move...
Rename... F2
Refresh F5
Convert Line Delimiters To
Print... Ctrl+P
Switch Workspace
Restart
Import...
Export...
Properties Alt+Enter
Exit
Makefile Project with Existing Code
C++ Project
C Project
Project...
Convert to a C/C++ Autotools Project
Convert to a C/C++ Project (Adds C/C++ Nature)
Source Folder
Folder
Source File
Header File
File from Template
Class
Other... Ctrl+N
Quick Access
Java
C/C++
Outline
Make Target
An outline is not available.
config-ml.in
config.guess
config.sub
configure
configure.ac
COPYING
depcomp
INSTALL
install-sh
LICENSE
LICENSE.JFFS2
Problems
Tasks
Console
Properties
1 error, 0 warnings, 0 others
Description
Resource
Path
Errors (1 item)
rtems-git

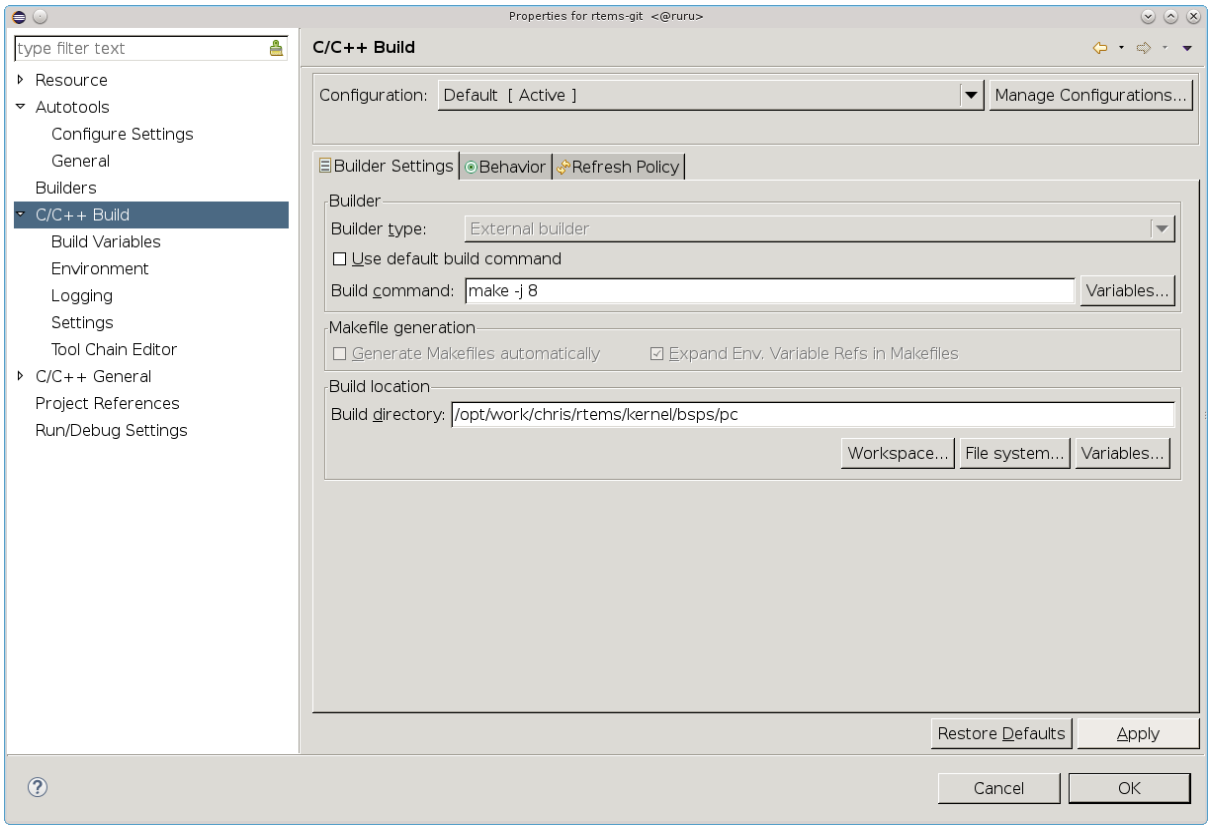

Convert to a C/C++ Project <@ruru>
Convert to C/C++ Autotools Project
Convert an existing Project to a C/C++ Autotools Project
Candidates for conversion:
rtems-git
Select All
Deselect All
Convert to C or C++
C Project
C++ Project
< Back
Next >
Cancel
Finish

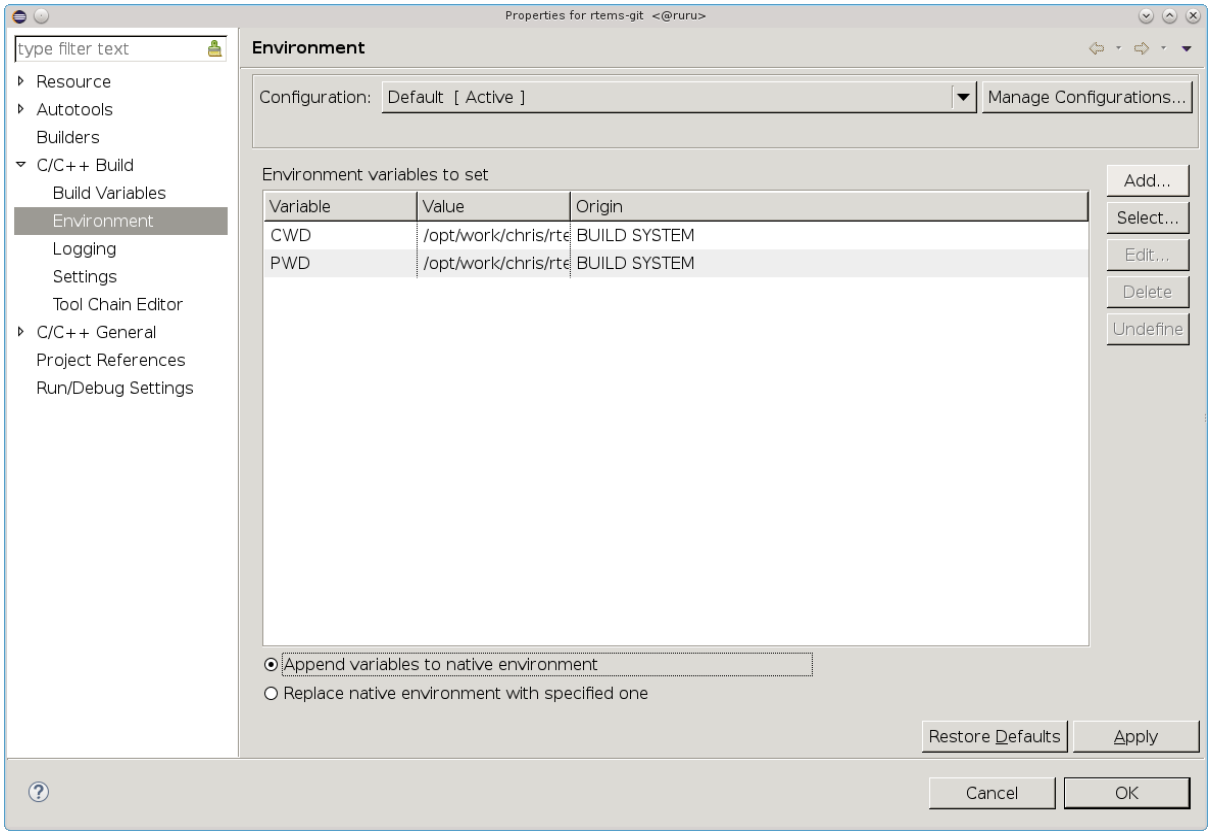

C/C++ - Eclipse SDK <@ruru>
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Java
C/C++
Project Explorer
rtems-git
aclocal
autom4te.cache
automake
c
cpukit
doc
make
testsuites
tools
acinclude.m4
aclocal.m4
ampolish3
bootstrap
compile
config-ml.in
config.guess
config.sub
configure
configure.ac
COPYING
depcomp
INSTALL
install-sh
LICENSE
LICENSE.JFFS2
New
Go Into
Open in New Window
Copy Ctrl+C
Paste Ctrl+V
Delete Delete
Source
Move...
Rename... F2
Import...
Export...
Build Project
Clean Project
Refresh F5
Close Project
Close Unrelated Projects
Build Configurations
Make Targets
Index
Reconfigure Project
Invoke Autotools
Run As
Debug As
Profile As
Team
Restore from Local History...
Run C/C++ Code Analysis
Compare With
Configure
Properties Alt+Enter
Outline
Make Target
An outline is not available.
Properties
Resource
Path

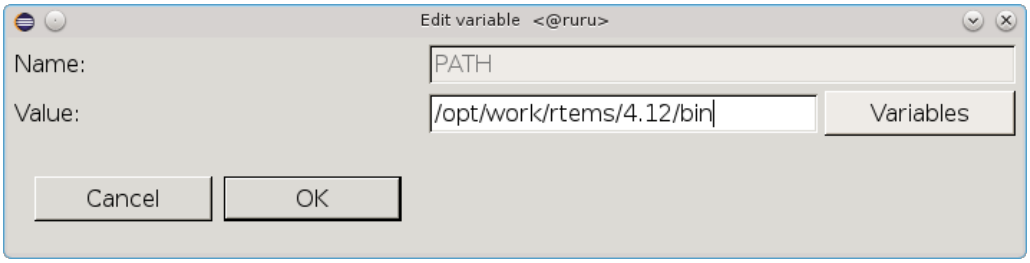

Properties for rtems-git <@ruru>
type filter text
Resource
Autotools
Configure Settings
General
Builders
C/C++ Build
C/C++ General
Project References
Run/Debug Settings
Configure Settings
Configuration: Default [Active]
Manage Configurations...
configure
General
Platform specifiers
Directory specifiers
File-name transformations
Advanced
autogen
Options
Host platform (--host)
Build platform (--build)
Target platform (--target) i386-rtems4.12
Restore Defaults
Apply
Cancel
OK

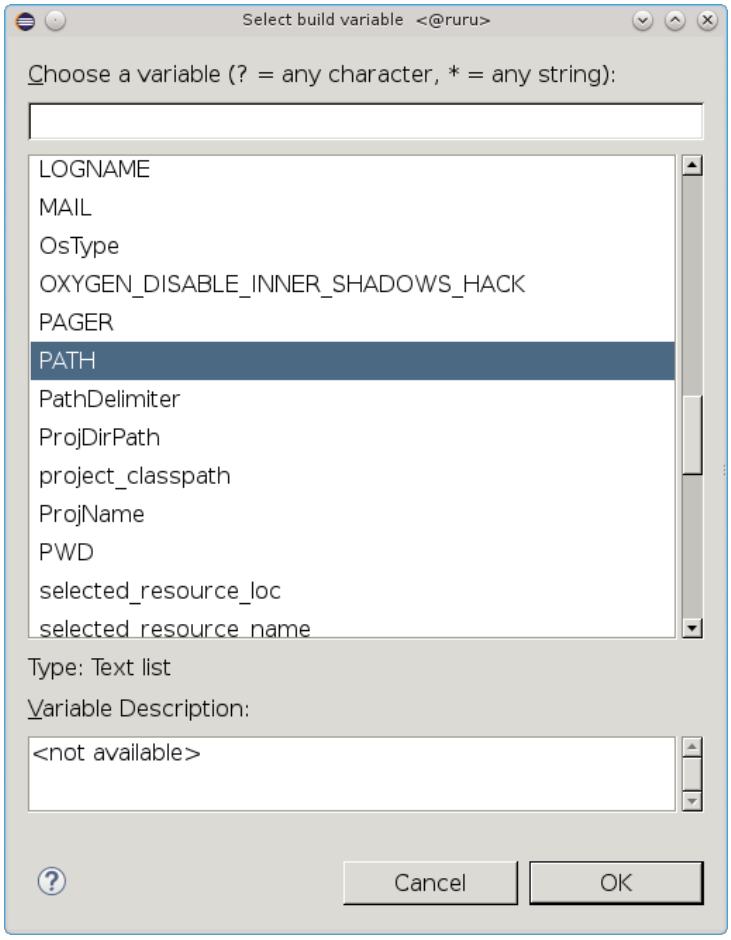

Properties for rtems-git <@ruru>
type filter text
Resource
Autotools
Configure Settings
General
Builders
C/C++ Build
Build Variables
Environment
Logging
Settings
Tool Chain Editor
C/C++ General
Project References
Run/Debug Settings
Configure Settings
Configuration: Default [Active]
Manage Configurations...
configure
General
Platform specifiers
Directory specifiers
File-name transforma
Advanced
autogen
Options
Arch-independent install directory (--prefix)
/opt/work/chris/rtems/kernel/4.12
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)
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 (--libexecdir)
Non-gcc C header file directory (--oldincludedir)
Restore Defaults
Apply
Cancel
OK


Properties for rtems-git <@ruru>
type filter text
Resource
Autotools
Configure Settings
General
Builders
C/C++ Build
C/C++ General
Project References
Run/Debug Settings
Configure Settings
Configuration: Default [Active]
Manage Configurations...
configure
General
Platform specifiers
Directory specifiers
File-name transfor
Advanced
autogen
Options
Enable maintainer mode (--enable-maintainer-mode)
Compiler Flags:
Debug (-g)
Gprof support (-pg)
Gcov support (-fprofile-arcs -ftest-coverage)
Additional command-line options
--disable-networking --enable-rtemsbsp=pc686
Restore Defaults
Apply
Cancel
OK

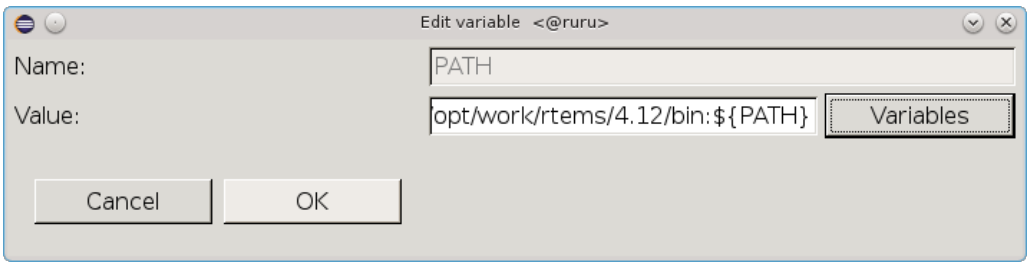

Properties for rtems-git <@ruru>
type filter text
Resource
Autotools
Configure Settings
General
Builders
C/C++ Build
Build Variables
Environment
Logging
Settings
Tool Chain Editor
C/C++ General
Project References
Run/Debug Settings
C/C++ Build
Configuration: Default [Active]
Manage Configurations...
Builder Settings
Behavior
Refresh Policy
Builder
Builder type: External builder
Use default build command
Build command: make -j 8
Variables...
Makefile generation
Generate Makefiles automatically
Expand Env. Variable Refs in Makefiles
Build location
Build directory: /opt/work/chris/rtems/kernel/bsps/pc
Workspace...
File system...
Variables...
Restore Defaults
Apply
Cancel
OK


Properties for rtems-git <@ruru>
type filter text
Resource
Autotools
Builders
C/C++ Build
Build Variables
Environment
Logging
Settings
Tool Chain Editor
C/C++ General
Project References
Run/Debug Settings
Environment
Configuration: Default [Active]
Manage Configurations...
Environment variables to set
Variable
Value
Origin
CWD
/opt/work/chris/rte
BUILD SYSTEM
PWD
/opt/work/chris/rte
BUILD SYSTEM
Add...
Select...
Edit...
Delete
Undefine
Append variables to native environment
Replace native environment with specified one
Restore Defaults
Apply
Cancel
OK

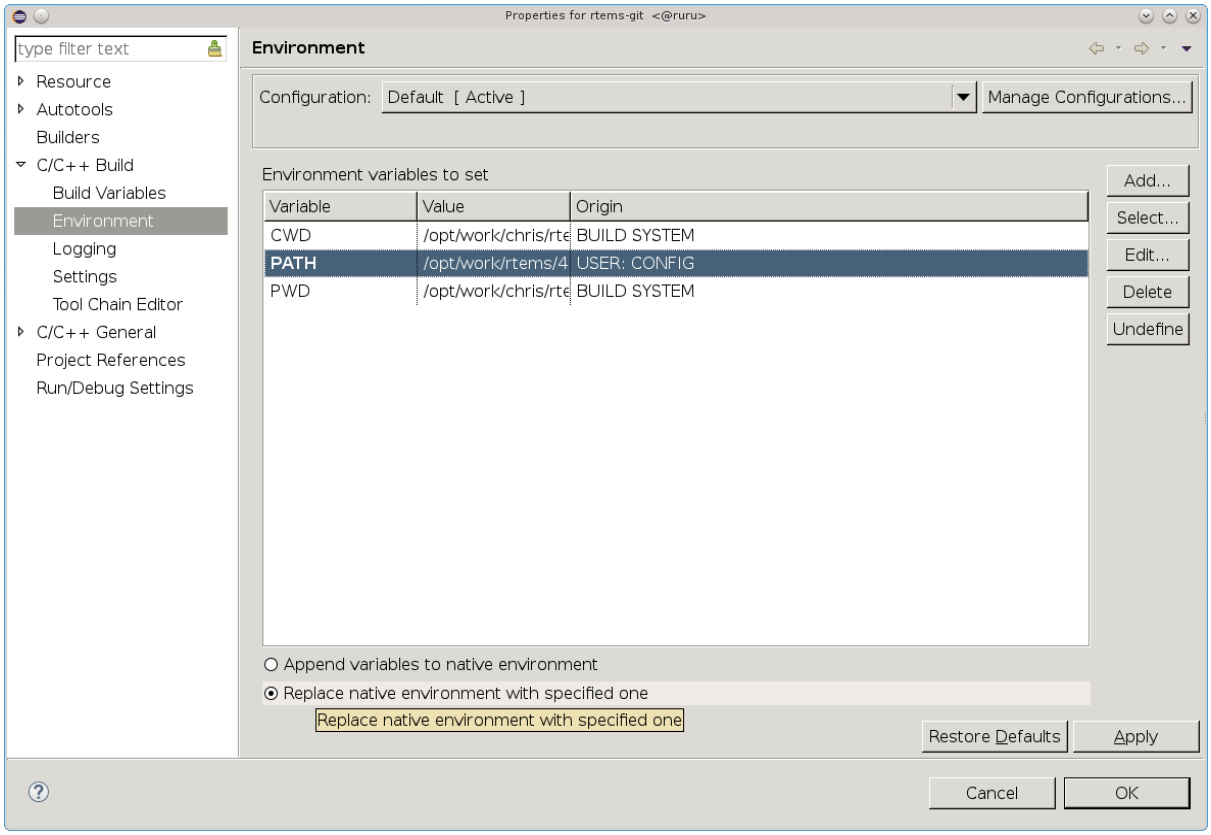

Edit variable <@ruru>
Name:
PATH
Value:
/opt/work/rtems/4.12/bin
Variables
Cancel
OK


Select build variable <@ruru>
Choose a variable (? = any character, * = any string):
LOGNAME
MAIL
OsType
OXYGEN_DISABLE_INNER_SHADOWS_HACK
PAGER
PATH
PathDelimiter
ProjDirPath
project_classpath
ProjName
PWD
selected_resource_loc
selected_resource_name
Type: Text list
Variable Description:
<not available>
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:



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



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

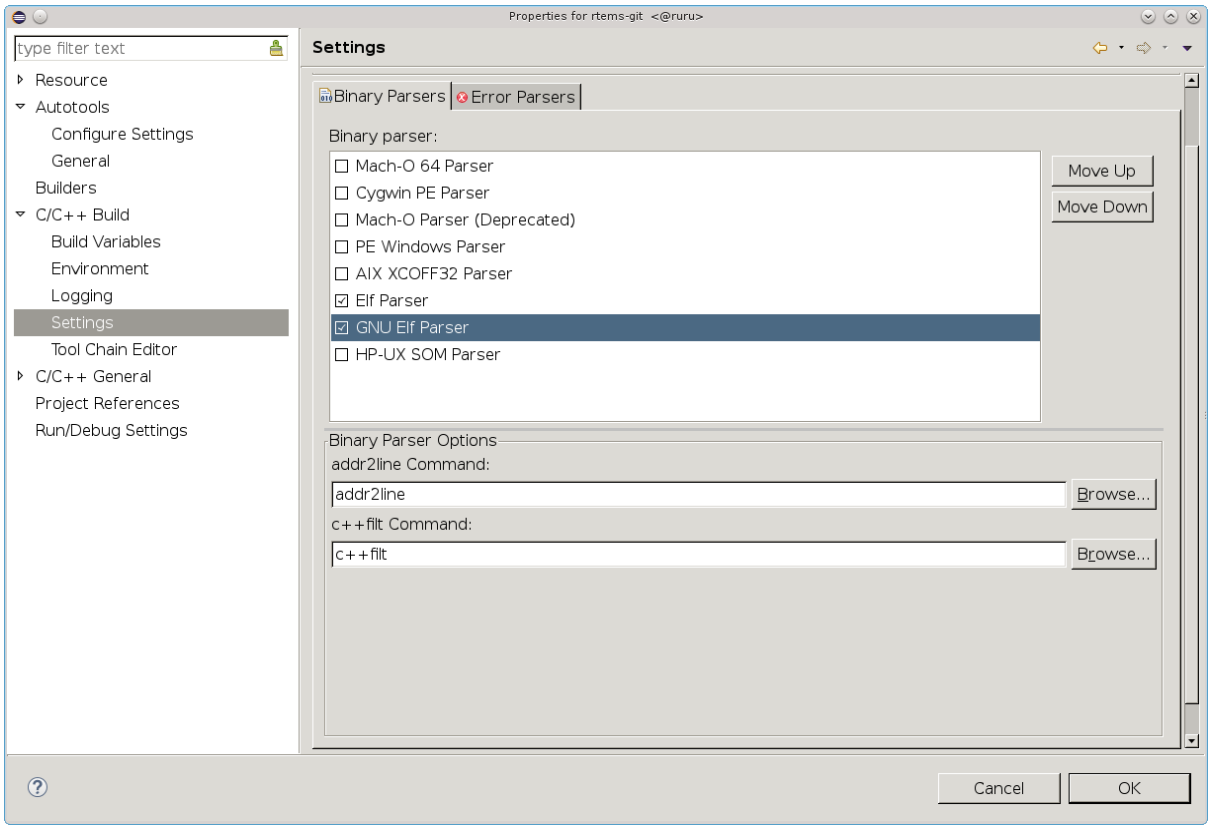
We are now ready to run configure using Eclipse. Right click on the project name `rtems-git` and then **Reconfigure Project** :

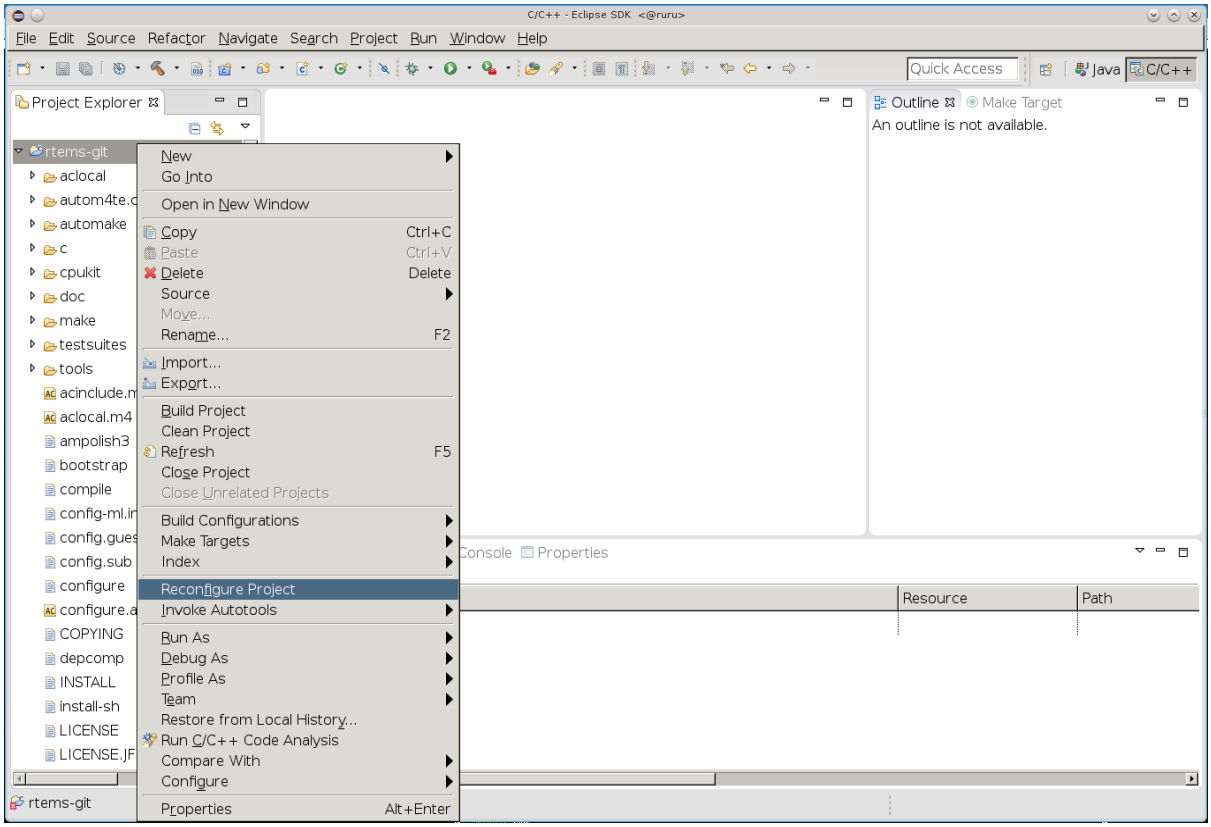
Select the **Console** tab in the output panel to view the configure process output. You will notice the end of the configure process shows the names of the BSPs we have asked to build. In our case this is the `pc686` BSP:

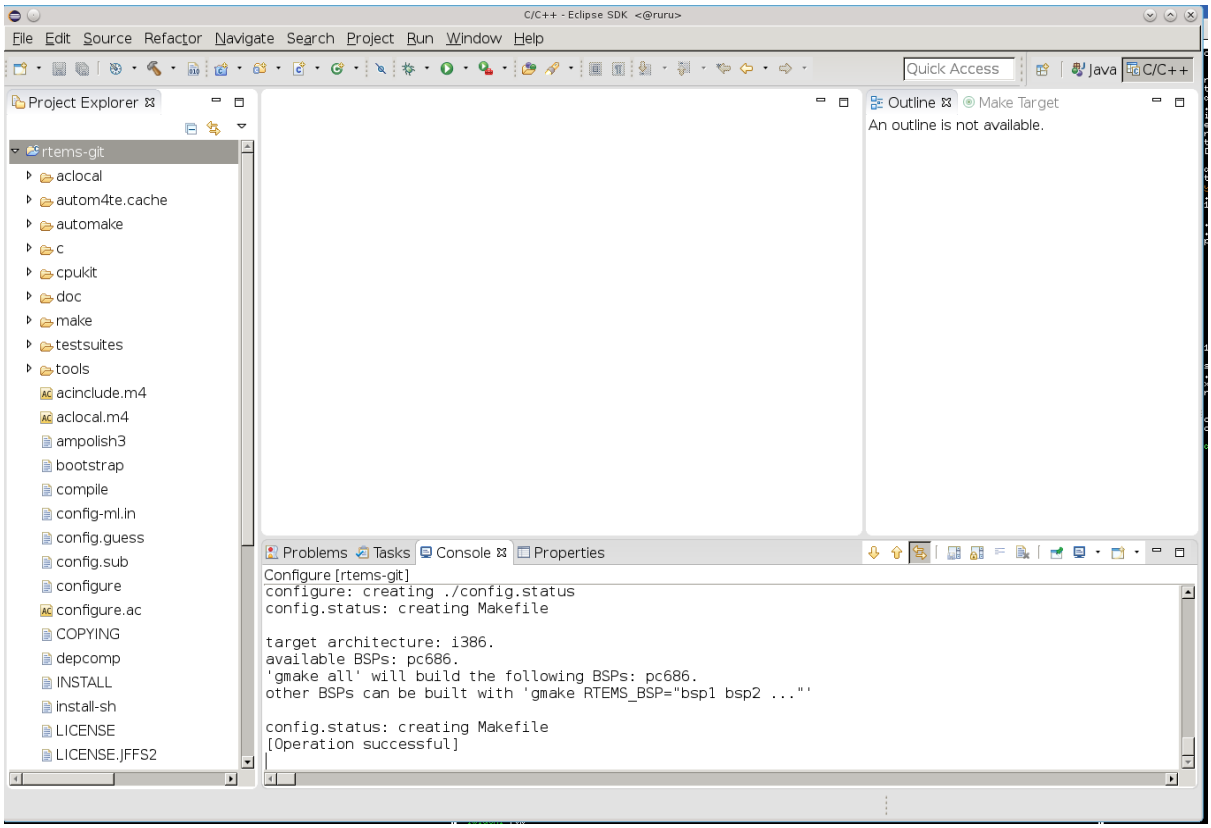
We can now build RTEMS using Eclipse. Right click on the project name `rtems-git` and then select **Build Project** :

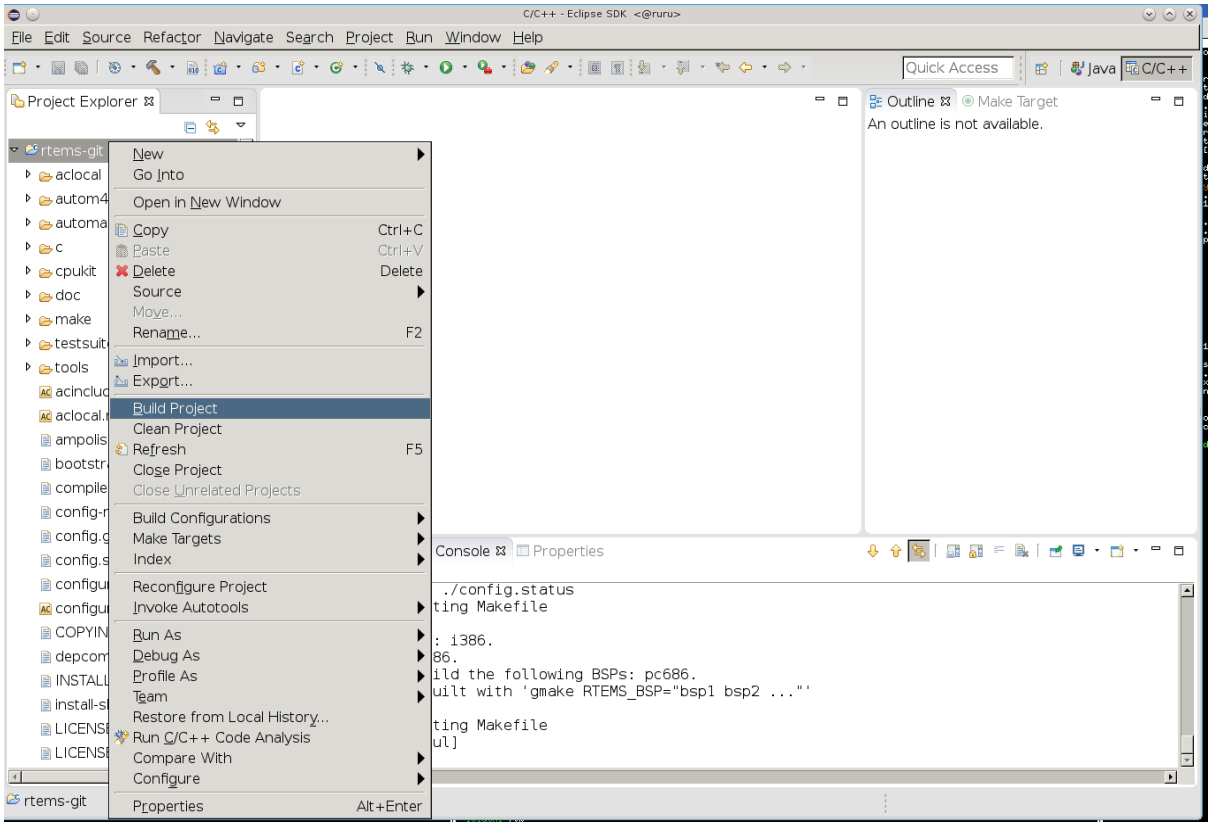
A **Build Project** message box will appear showing the progress:

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


Properties for rtems-git <@ruru>
type filter text
Resource
Autotools
Configure Settings
General
Builders
C/C++ Build
Build Variables
Environment
Logging
Settings
Tool Chain Editor
C/C++ General
Project References
Run/Debug Settings
Settings
Binary Parsers
Error Parsers
Binary parser:
Mach-O 64 Parser
Cygwin PE Parser
Mach-O Parser (Deprecated)
PE Windows Parser
AIX XCOFF32 Parser
Elf Parser
GNU Elf Parser
HP-UX SOM Parser
Move Up
Move Down
Binary Parser Options
addr2line Command:
addr2line
Browse...
c++filt Command:
c++filt
Browse...
Cancel
OK


C/C++ - Eclipse SDK <@ruru>
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Java
C/C++
Project Explorer
rtems-git
aclocal
autom4te.c
automake
c
cpukit
doc
make
testsuites
tools
acinclude.m
aclocal.m4
ampolish3
bootstrap
compile
config-ml.in
config.gues
config.sub
configure
configure.a
COPYING
depcomp
INSTALL
install-sh
LICENSE
LICENSE.JF
Outline
Make Target
An outline is not available.
Console
Properties
Resource
Path
New
Go Into
Open in New Window
Copy Ctrl+C
Paste Ctrl+V
Delete Delete
Source
Move...
Rename... F2
Import...
Export...
Build Project
Clean Project
Refresh F5
Close Project
Close Unrelated Projects
Build Configurations
Make Targets
Index
Reconfigure Project
Invoke Autotools
Run As
Debug As
Profile As
Team
Restore from Local History...
Run C/C++ Code Analysis
Compare With
Configure
Properties Alt+Enter
rtems-git


C/C++ - Eclipse SDK <@ruru>
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Java
C/C++
Project Explorer
rtems-git
aclocal
autom4te.cache
automake
c
cpukit
doc
make
testsuites
tools
acinclude.m4
aclocal.m4
ampolish3
bootstrap
compile
config-ml.in
config.guess
config.sub
configure
configure.ac
COPYING
depcomp
INSTALL
install-sh
LICENSE
LICENSE.JFFS2
Outline
Make Target
An outline is not available.
Problems
Tasks
Console
Properties
Configure [rtems-git]
configure: creating ./config.status
config.status: creating Makefile
target architecture: i386.
available BSPs: pc686.
'gmake all' will build the following BSPs: pc686.
other BSPs can be built with 'gmake RTEMS_BSP="bsp1 bsp2 ..."'
config.status: creating Makefile
[Operation successful]


C/C++ - Eclipse SDK <@ruru>
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Java
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Make Target
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Rename... F2
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Export...
Build Project
Clean Project
Refresh F5
Close Project
Close Unrelated Projects
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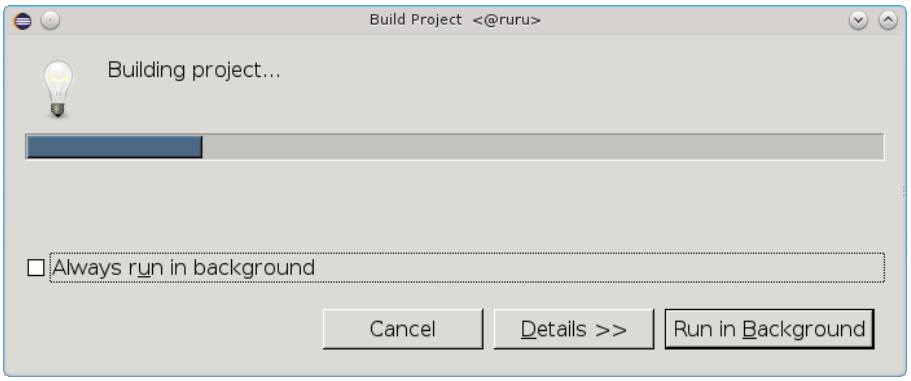
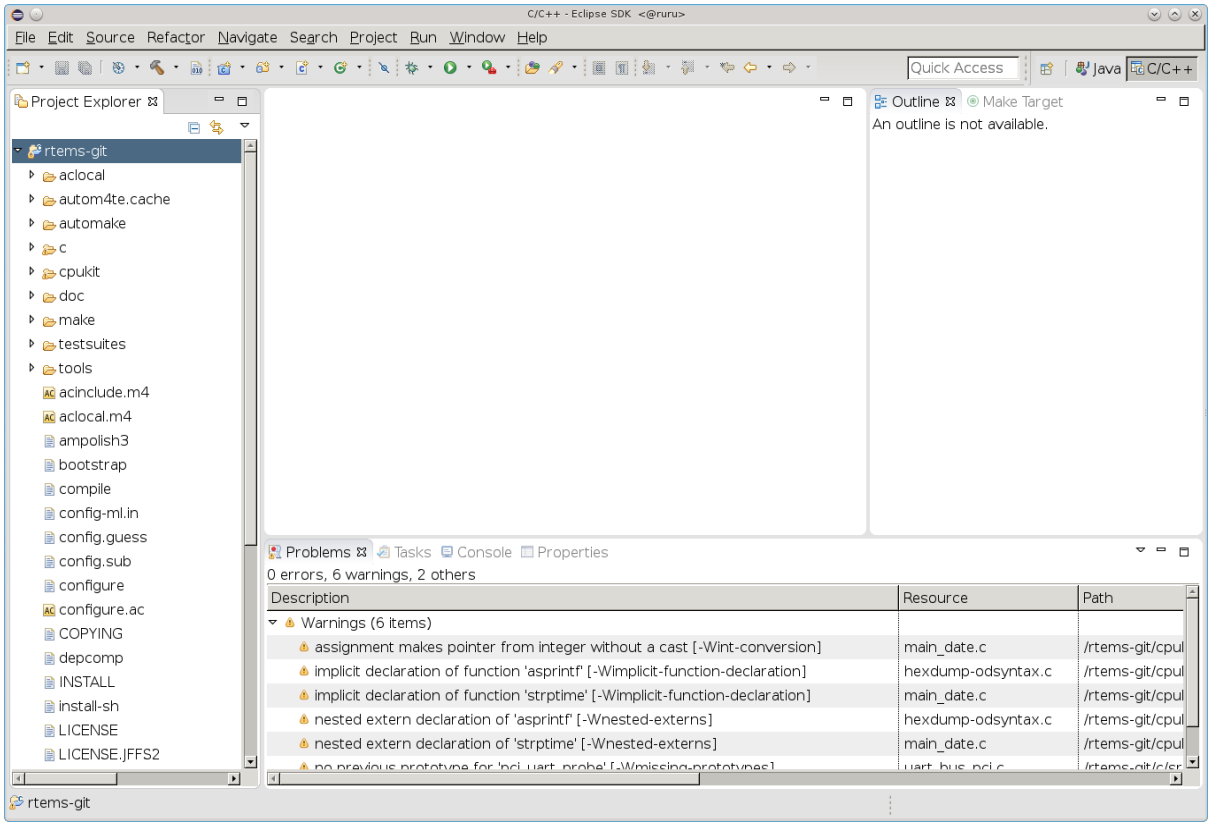
Restore from Local History...
Run C/C++ Code Analysis
Compare With
Configure
Properties Alt+Enter
Console
Properties
./config.status
ting Makefile
: i386.
86.
ild the following BSPs: pc686.
uilt with 'gmake RTEMS_BSP="bsp1 bsp2 ..."'
ting Makefile
ul]


Build Project <@ruru>
Building project...
Always run in background
Cancel
Details >>
Run in Background


C/C++ - Eclipse SDK <@ruru>
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Java
C/C++
Project Explorer
rtems-git
aclocal
autom4te.cache
automake
c
cpukit
doc
make
testsuites
tools
acinclude.m4
aclocal.m4
ampolish3
bootstrap
compile
config-ml.in
config.guess
config.sub
configure
configure.ac
COPYING
depcomp
INSTALL
install-sh
LICENSE
LICENSE.JFFS2
Outline
Make Target
An outline is not available.
Problems
Tasks
Console
Properties
0 errors, 6 warnings, 2 others
Description
Resource
Path
Warnings (6 items)
assignment makes pointer from integer without a cast [-Wint-conversion]
main_date.c
/rtems-git/cpul
implicit declaration of function 'asprintf' [-Wimplicit-function-declaration]
hexdump-odsyntax.c
/rtems-git/cpul
implicit declaration of function 'strptime' [-Wimplicit-function-declaration]
main_date.c
/rtems-git/cpul
nested extern declaration of 'asprintf' [-Wnested-externs]
hexdump-odsyntax.c
/rtems-git/cpul
nested extern declaration of 'strptime' [-Wnested-externs]
main_date.c
/rtems-git/cpul
rtems-git

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 `ld` 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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