



Installing LEON VxWorks

Installing LEON VxWorks-6.7 Source distribution

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Installing LEON VxWorks-6.7

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1. Introduction

This document is a guide on how to install the Cobham Gaisler VxWorks 6.7 Source distribution. The distribution includes a SPARC port of the VxWorks 6.7 kernel, a generic BSP for use with and without a MMU, several board specific BSPs, the GNU GCC LEON toolchain, DIAB patches and LEON plug-ins for the Workbench.

The installation process consists of the following steps:

1. Install the WindRiver VxWorks GPP Platform (WindRiver source license). Basic build support exists for the PNE platform, however the added functionality is not supported. Other WindRiver platforms than GPP or PNE, such as Automotive, are not supported at this time. Only version 3.1 of the workbench is supported.
2. Install 6.7 Service Pack 1, DVD-R138711.1-6-01.zip
3. Install the GNU GCC LEON toolchain
4. Install the Cobham Gaisler LEON distribution over the VxWorks Platform
5. Build the SPARC/LEON VxWorks kernel and libraries
6. Update Workbench build rules

You need to have a WindRiver source license for GPP 3.7 to install and run the LEON SPARC BSP and Hardware Abstraction Layer (HAL). The installation steps are described in separate chapters and each step must be executed in the order indicated by the chapter arrangement.

Before proceeding with the installation, the WindRiver VxWorks General Purpose Platform (GPP), including the Workbench, full kernel sources and the DIAB compiler must be installed and working.

If the Windriver installer presents a screen saying *Updates are available for the Installer itself*, then choose *Skip*.

For the default paths to match, the WindRiver Platform should be installed into C:\WindRiver6.7 on Windows or /opt/WindRiver6.7 on Linux. This is however not a requirement.

Note that the VxWorks version from WindRiver must be of the same version as the Cobham Gaisler VxWorks distribution, i.e. WindRiver VxWorks 6.7 can not be used with the Cobham Gaisler VxWorks 6.5 distribution.

1.1. Installing 6.7 Service Pack 1, DVD-R138711.1-6-01.zip

The LEON VxWorks distribution is created against the WindRiver VxWorks Platform with Service Pack 1 applied. To install the Service Pack 1 download the file DVD-R138711.1-6-01.zip from <https://support.windriver.com/olsPortal/faces/maintenance/downloadDetails.jspx?contentId=034893> (you need to be logged into Support) or search for "Service Pack 1 for VxWorks 6.7.1 and VxWorks Edition 3.7 Platforms" on the Support Page. Then follow the instructions shown on the page. When starting the installer deselect the "Check on-line for latest Wind River product updates" to avoid version mismatches.

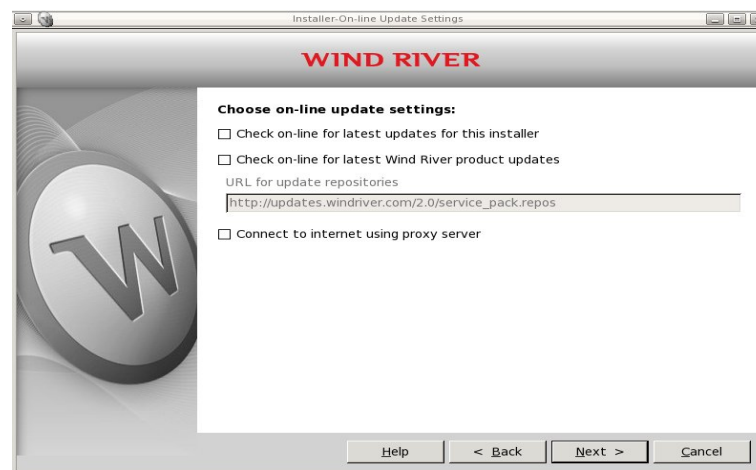


Figure 1.1. Deselect updating

2. Installing Toolchain

The section describes how to install the GNU GCC LEON toolchain. LEON VxWorks can be used together with GNU GCC or DIAB. DIAB comes with the WindRiver installation DVD whereas the GNU GCC toolchain is available together with the LEON VxWorks distribution or can be downloaded from the protected web download area at www.gaisler.com/vxworks6/vxworks-6.7.html.

NOTE: WindRiver distributes a GCC toolchain together with the VxWorks CD/DVD. It can not be used together with LEON. If the WindRiver GCC toolchain was installed from the WindRiver CD/DVD, one must make sure that the Gaisler GCC is found first (must be first in PATH).

The toolchain is required to be located at C:\opt (Windows) or at /opt (Linux).

2.1. Installing GCC on Windows

On Windows there are two ways of installing the GNU GCC toolchain, manually or by using the installer.

2.1.1. Installer

The Windows GCC toolchain installer is named `sparc-wrs-vxworks-4.1-x.y.z-mingw.exe`. The installation procedure is started by executing the file.

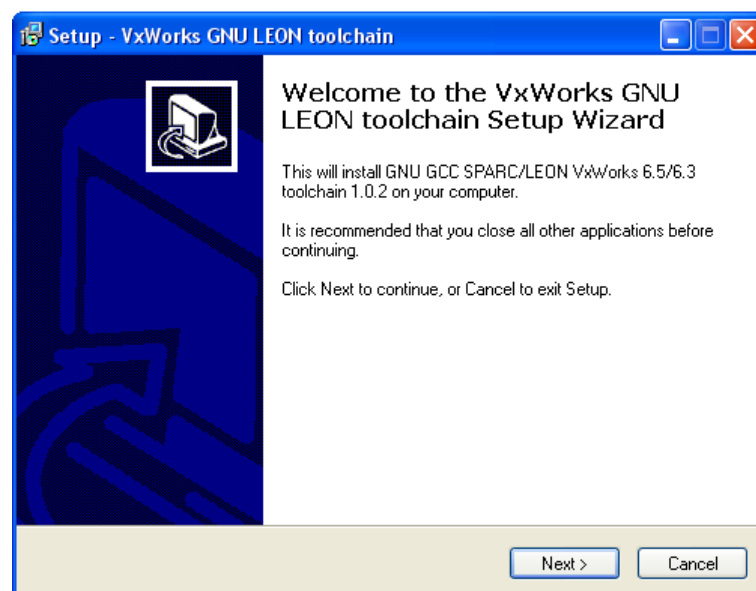


Figure 2.1. VxWorks GNU GCC LEON toolchain Windows installer

The installer will install the toolchain to C:\opt\sparc-wrs-vxworks-mingw, and add the bin directory where the executable files are located to the Windows PATH environment variable.

The PATH variable is changed but is not updated until next log-on, please log-out and log-in again before proceeding. Otherwise the kernel compilation step will fail.

2.1.2. Manual install

The Windows toolchain is compressed in the ZIP-file named `sparc-wrs-vxworks-4.1-x.y.z-mingw.zip`.

The toolchain must be extracted into C:\opt creating the directory C:\opt\sparc-wrs-vxworks-mingw. The C:\opt\sparc-wrs-vxworks-mingw\bin directory must be added to the PATH variable by "My Computer -> Advanced Tab -> Environment Variable".

2.2. Installing GCC on Linux

The Linux toolchain is compressed in the archive named `sparc-wrs-vxworks-4.1-x.y.z-linux.tar.bz2`.

The toolchain is extracted into `/opt` creating the directory `/opt/sparc-wrs-vxworks`. The `/opt/sparc-wrs-vxworks/bin` directory must be added to the `PATH` variable:

```
$ cd /opt
$ tar -xf sparc-wrs-vxworks-4.1-x.y.z-linux.tar.bz2
$ export PATH=/opt/sparc-wrs-vxworks/bin:$PATH
```

3. Installing LEON VxWorks distribution

The section describes how to install the LEON VxWorks distribution. The LEON VxWorks distribution is provided as a password protected zip archive. It is available on the distribution CD or can be downloaded from the protected web download area at www.gaisler.com/vxworks6/vxworks-6.7.html. The distribution is named `dist-vxworks-6.7-x.y.z.tar.gz.zip`.

First the zip-file must be extracted. Please contact support@gaisler.com for the password.

3.1. Installing on Windows

Note: It is recommended to make a backup of the WindRiver Platform installation using an archive tool like Zip or WinRAR. Using the backup the previous state can be recovered in case an error occurs while installing the LEON SPARC port.

A Windows installer is available that installs all files of the distribution. The installer is located in `dist-x.y.z/install/setup-6.7-x.y.z.exe` and can be started by a double click. The installation script requires the WindRiver path, the path to where the WindRiver platform was installed.

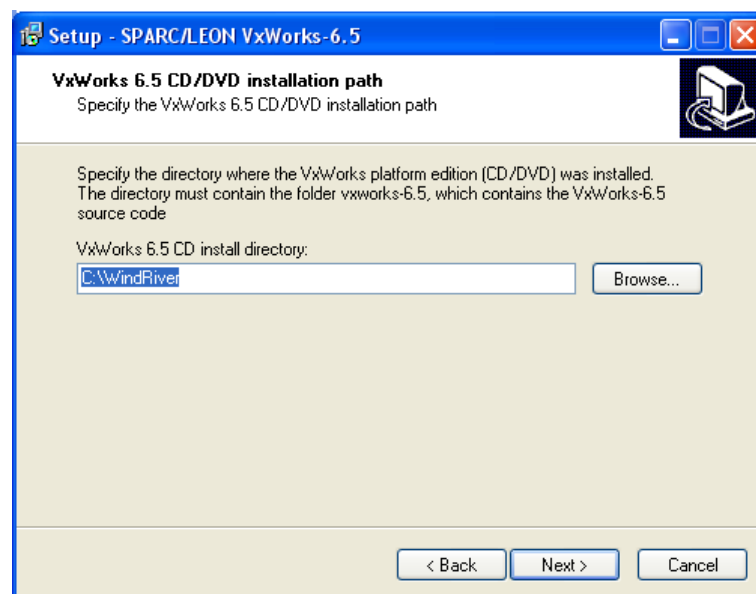


Figure 3.1. Windows installer, enter WindRiver path

The installer will backup existing files into a newly created folder `grbck` inside the WindRiver platform directory. It will also create a folder `grbck.new` where newly created files will be registered. You can browse the two directories after the installation has finished.

After the installation is finished the LEON sources will be located in the `vxworks` directory in the WindRiver directory. The distribution Makefile used to build the kernel will jump into the WindRiver directory when building.

3.2. Installing on Linux

The installation is performed by an installation script located at `dist-x.y.z/install/install.sh`. The installation script will perform the following steps:

1. Uninstall previous LEON distribution
2. Install LEON plug-ins for the workbench
3. Install the LEON BSP and SPARC Port sources
4. Update `dist-x.y.z/Makefile`

The installation script require write permission in the WindRiver directory. The WindRiver/vxworks-6.7 directory will be backed up to WindRiver/vxworks-6.7.ori and all files replaced outside the vxworks-6.7 directory will be backed up with the filename ending ".grbak" and all new files will be marked by an empty file with the ending ".grnew". This way the uninstallation script can restore the original files.

After the installation is finished the LEON sources will be located in the vxworks directory in the WindRiver directory. The distribution Makefile used to build the kernel will jump into the WindRiver directory when building.

On Linux hosts the installation script must be started from a terminal console, the script must be started from the dist-x.y.z/install directory. The installation script has been tested with *bash* and the WindRiver shell. The script requires write permission in the WindRiver directory and in the distribution directory as mentioned above.

The script requires one argument, the WindRiver directory. It can be started as follows if the WindRiver installation is located in /opt/WindRiver6.7:

```
$ cd dist-x.y.z
$ bash ./install/install.sh /opt/WindRiver6.7
```

3.3. Manual installation

If the standard installation flow does not fit your needs, a manual installation may be an option. A manual installation involves extracting the SPARC/LEON VxWorks source files and installing workbench plug-ins and configuration files.

3.3.1. Install VxWorks Sources

Make a backup copy of the vxworks-6.7 folder before installing the SPARC/LEON VxWorks source files. Then extract the file release/vxworks-6.7-x.y.z.tar.gz to the source directory vxworks-6.7.

```
$ cd WindRiver
$ mv vxworks-6.7 vxworks-6.7.ori
$ cp -r vxworks-6.7.ori vxworks-6.7
$ gunzip /path/to/dist-x.y.z/release/vxworks-6.7-x.y.z.tar.gz
$ tar -xf /path/to/dist-x.y.z/release/vxworks-6.7-x.y.z.tar
```

The VXWORKSDIR_PATH variable located in the Makefile must point to the vxworks-6.7 source directory including the SPARC/LEON patched sources. One can choose this location outside the WindRiver Platform directory if needed, however normally it is set to VXWORKSDIRCD_PATH/vxworks-6.7. Please see the Makefile for more information.

3.3.2. Prepare Workbench for SPARC/LEON

In order for the Workbench to successfully connect to a SPARC target one must have a dll-file aimed for SPARC development and SPARC configuration files. The SPARC plug-ins are missing in the Windows release of Wind River Workbench while the plug-ins for Linux and Solaris is included in the distribution of the Workbench.

The SPARC plug-ins and the configuration files are distributed in a ZIP-file, release/sparccpuplugin-6.7.tar.gz, found in the Gaisler VxWorks SPARC distribution. Extracting the ZIP-file into the Workbench directory installs the files needed correctly. Below is an example of how to extract the file using the Workbench command shell:

```
Using Linux:
$ cd /opt/WindRiver
$ tar -zxvf /path/to/distdir/release/sparccpuplugin-6.7.tar.gz

Using Windows:
```



```
$ gunzip C:/vxworks-sparc/dist-x.y.z/release/sparccpuplugin-6.7.tar.gz  
$ cd C:/WindRiver  
$ tar -xf C:/vxworks-sparc/dist-x.y.z/release/sparccpuplugin-6.7.tar
```

4. Building LEON VxWorks

The section describes how to build the LEON VxWorks kernel and libraries. The build procedure will build the VxWorks SPARC/LEON kernel with libraries. The SPARC kernel may be compiled using different toolchains and compiler flags (TOOL).

The distribution must be extracted before continuing, the distribution is ZIP password protected, please email support@gaisler.com for the password if needed. After unzipping, the distribution is extracted as indicated below. For windows users the commands can be executed from the WindRiver shell (Run: C:\WindRiver6.7\wrenv.exe -p vxworks-6.7 sh).

```
$ gunzip dist-vxworks-6.7-x.y.z.tar.gz
$ tar -xf dist-vxworks-6.7-x.y.z.tar
```

The distribution directory includes build scripts (Makefile) to build the kernel for one or multiple TOOLS, however it is not supported to build using both DIAB and GNU GCC toolchain at once. Please the next section how to start the build script. The different tools are described in the compiler document that comes with this distribution. The different TOOLS are also listed hereafter.

Table 4.1. TOOL variants

TOOL	Compiler	Floating Point	MUL/DIV
gnu	GNU GCC	Hardware	SPARCv7 (Software MUL/DIV)
gnuv8	GNU GCC	Hardware	SPARCv8 (Hardware MUL/DIV)
sfgnu	GNU GCC	Software	SPARCv7 (Software MUL/DIV)
sfgnuv8	GNU GCC	Software	SPARCv8 (Hardware MUL/DIV)
diab	WindRiver DIAB	Hardware	Mix of SPARC v8 and v7 (Hardware MUL, software DIV)
sfdiab	WindRiver DIAB	Software	Mix of SPARC v8 and v7 (Hardware MUL, software DIV)

Note that the build script will only update the VxWorks directory used to build the kernel, in case of a non-standard installation where the VxWorks source directory is outside the WindRiver directory the VxWorks libraries must be copied into the WindRiver VxWorks directory so that the Workbench is able to find them.

4.1. UT699

For UT699 targets the extra GCC switch `-mtune=ut699` should be appended to GCC calls when compiling/linking. A patch `dist-x.y.z/release/ut699-6.7.diff` is supplied that will add this switch to the default GCC command invocation. Note that it is recommended to use GCC for UT699 targets as DIAB might produce inconsistent FPU code for those targets. For more details please read the UT699 FPU errata.

The patch can be applied using the `patch` program. A Windows version of the program can be downloaded at <http://gnuwin32.sourceforge.net/packages/patch.htm>. Copy the the patch file to the `vxworks-6.7` directory in your VxWorks installation folder. Then, from the WindRiver shell, change to the same directory and enter:

```
patch -p1 < ut699-6.7.diff
```

To revert the patch, use the same command with the addition of the `-R` flag.

4.2. Windows

The kernel and libraries can be built invoking the build scripts from the WindRiver shell, or by using the GUI build utility found in `dist-x.y.z/install/compile-6.7.exe`. Note that compiling take very long to finish. If you want to recompile more quickly you should use the WindRiver Shell and the Makefile of the

distribution and selectively issue build rules. By default the kernel is build in several variants (*src*, *basic* and *ipv6*), to disable this you can change the `VXWORKS_COMPILE_TARGETS` macro in the distributions `Makefile` by removing the unneeded targets.

4.2.1. GUI Kernel builder

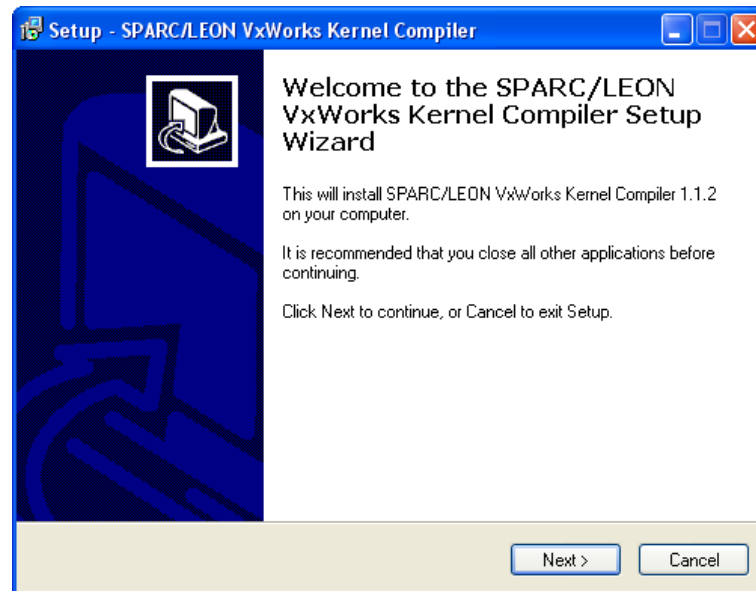


Figure 4.1. LEON VxWorks Kernel builder GUI

The installation script requires the WindRiver path, the default path is taken from the `install/settings` created by the installation script.

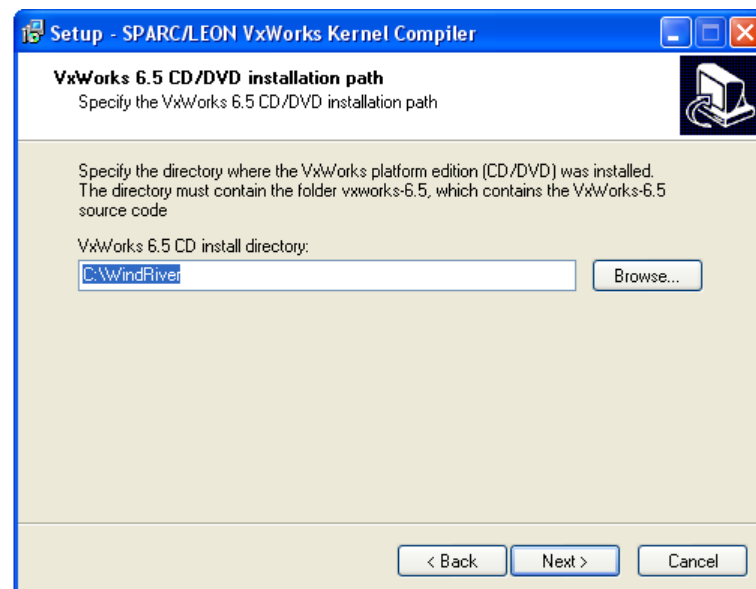


Figure 4.2. Kernel Builder, enter WindRiver path

In the second step, one select with what TOOLS the kernel will be built with, the kernel can be built multiple times using different compiler flags, however it will take longer time. Later on when a BSP is created one of the TOOLS used when building the kernel must be selected to link against. Building the kernel for multiple TOOLS makes is possible to create different projects with different hardware, or for example benchmarking with/without hardware FPU.

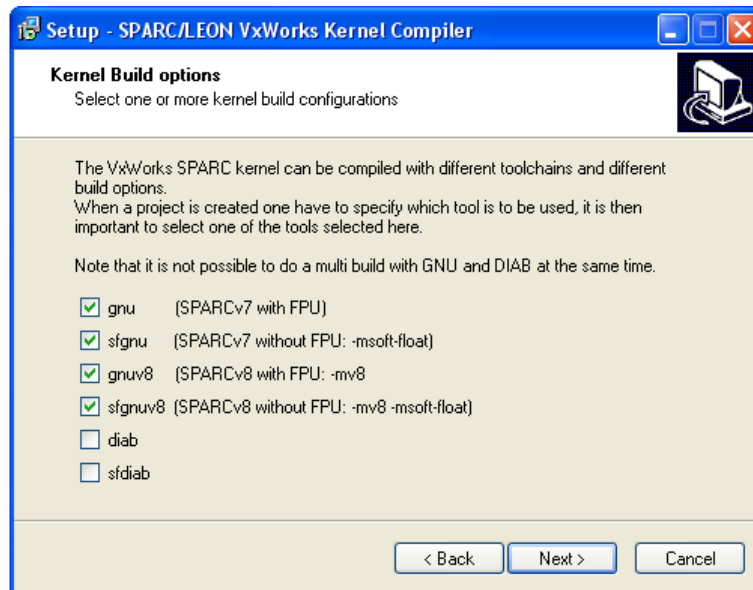


Figure 4.3. Kernel Builder, enter WindRiver path

When the build script is started a Windows console will appear as in Figure 4.4, it must not be shutdown. Note that the build procedure may take quite some time.

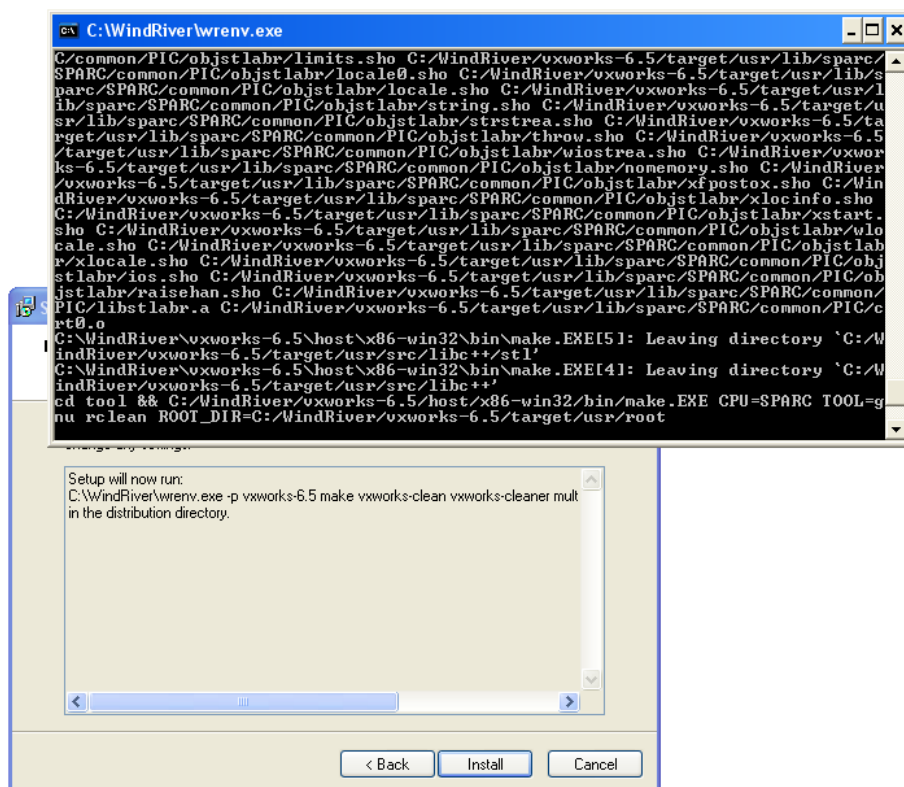


Figure 4.4. Kernel builder GUI invoked the build scripts

4.2.2. WindRiver Shell

The target *multibuild* can be used to build the kernel with one or multiple TOOLS. The make utility must be started from the WindRiver shell. The WindRiver shell is started by:

```
Start->Run: C:\WindRiver\wrenv.exe -p vxworks-6.7 sh
```

Press OK

Where C:\WindRiver is the installation directory of Wind River Workbench. The TOOLS variable determines for which tools the kernel and libraries will be built. Below is an example building the kernel twice, once for a SPARCv7 with FPU and once for a SPARCv8 with FPU.

```
# cd dist-x.y.z
# make multibuild TOOLS="gnu gnuv8"
```

4.3. Linux

The kernel and libraries can be built invoking the build scripts from a shell, bash and the WindRiver shell has been tested. The WindRiver shell is started by:

```
$ /opt/WindRiver/wrenv.sh -p vxworks-6.7 sh
```

Where /opt/WindRiver is the installation directory of Wind River Workbench. The target *multibuild* can be used to build the kernel with one or multiple TOOLS, the TOOLS variable determines for which tools the kernel and libraries will be built. Below is an example building the kernel twice, once for a SPARCv7 with FPU and once for a SPARCv8 with FPU.

```
$ cd dist-x.y.z
$ make multibuild TOOLS="gnu gnuv8"
```

4.4. Build status

After the build has been completed the build logs from the kernel and the user libraries are located in the folder the installation program was run from.

```
loc_sparc-compile-TOOL.out
loc_lib-compile_usrtool_TOOL_tool_TOOL.out
```

TOOL is the tool used during the build process.

Note that the PATH variable when installing the GNU toolchain using the Windows-installer is not updated until next log-on. Failing to find *ccsparc* will result in a build error.

It is always recommended to verify that the build was successful, especially when DIAB is used. On some systems DIAB crash causing the build process to fail. If "abnormal termination" is printed by DIAB it is most often due to bug in the optimizer part of DIAB, turning optimization off (removing -XO or -O flag) will make DIAB avoid the bug.

4.5. Rebuilding kernel and libraries

Rebuilding the kernel and libraries after a modification does not require to clean out all compiled libraries, the make script keeps track of what needs to be rebuilt. The following targets may be used to rebuild the kernel and libraries:

```
$ make vxworks-compile TOOL=tool
$ make vxworks-lib-compile TOOL=tool
```

The TOOL options determines what toolchain and compiler flags are used, the available tools are described in the Compiler document, they are gnu, gnuv8, sfgnu, sfgnuv8, diab, sfdiab.

5. Update build rules

This section describes how to update the RTP and Downloadable Kernel Module (DKM) build rules for the Workbench. The update is done from within the workbench GUI. The build rules must be updated for each workspace created. RTP and DKM projects can not be created for SPARC/LEON if this step is not completed.

The build rules can be updated by starting the workbench and selecting "Window -> Preferences -> Wind River -> Build -> Build Properties" as indicated by Figure 5.1 and Figure 5.2.

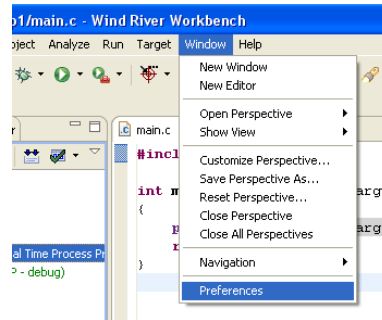


Figure 5.1. Open the Workbench 3.1 preferences

All the VxWorks build rules must be updated by selecting a build rule, one at a time in the combo box, and pressing "restore Defaults" every time.

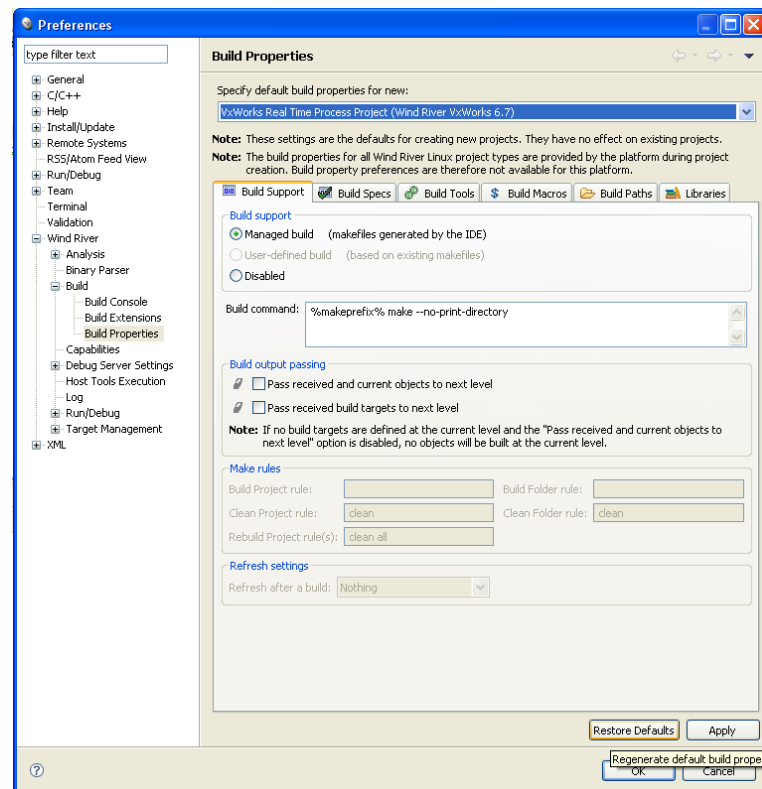


Figure 5.2. VxWorks project build rules for Workbench 3.1

6. Proceeding

The installation procedure is now complete and the kernel build done. There is a getting started guide how to create a project and run it on a LEON target, please see the docs directory in the distribution.

7. Support

For Support, contact the Cobham Gaisler support team at support@gaisler.com.

8. Disclaimer

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