

WIND RIVER

Wind River® Workbench

USER'S GUIDE

2.5

VxWorks Version

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Contents

PART I: INTRODUCTION

1	Overview	3
1.1	Introduction	3
1.2	Wind River Documentation	4
1.3	Road Map to the Wind River Workbench User's Guide	4
1.4	Understanding Cross-Development Concepts	5
1.4.1	Hardware in a Cross-Development Environment	5
1.5	Basic Eclipse Concepts	7
1.5.1	Window	7
1.5.2	Workspace	7
1.5.3	Perspectives	8
1.5.4	Views	10
1.5.5	Editors	11
1.5.6	Projects	11
1.6	Accessing Additional Interface Information	12

2	Wind River Workbench Tutorials	13
2.1	Introduction	13
2.2	Starting Wind River Workbench	14
2.3	Tutorial: Creating a Project and Running a Program	15
2.3.1	Before You Begin	15
2.3.2	Creating a Project	16
2.3.3	Importing Source Files Into Your Project	16
2.3.4	Building Your Project	17
2.3.5	Creating a Connection Definition to the VxWorks simulator	17
2.3.6	Downloading the Program and Attaching the Debugger	18
2.3.7	Setting Up the Device Debug Perspective	19
2.3.8	Setting and Running to a Breakpoint.	21
2.3.9	Modifying the Breakpoint	22
2.4	Tutorial: Editing and Debugging Source Files	22
2.4.1	Before You Begin	23
2.4.2	Introducing an Error into the Source Code	23
2.4.3	Tracking Down a Build Failure	23
2.4.4	Displaying File History	24
2.4.5	Rebuilding the Project	24
2.5	Tutorial: Using the Editor's Code Development Features	24
2.5.1	Using Code Completion to Add Symbols to Your File	24
2.5.2	Finding Symbols in Source Files	25
2.5.3	Using Parameter Hints	26
2.5.4	Using Bracket Matching to Clarify Syntax	27
2.6	Tutorial: Tracking Items of Interest in Your Files	27
2.6.1	Creating a Bookmark on a Source Line in a File	27
2.6.2	Creating a Bookmark for an Entire File	28

2.6.3	Locating and Viewing Your Bookmarks	28
2.7	Tutorial: Using Workbench to Debug a VxWorks 5.5 Target	28
2.7.1	Before You Begin	28
2.7.2	Creating a Project	29
2.7.3	Creating a VxWorks 5.5.x Target Server Connection	29
2.7.4	Launching a Kernel Task and Attaching the Debugger	30
2.7.5	Setting and Running to a Breakpoint	31
2.7.6	System Mode Debugging	32
2.7.7	Using Core Dump Files	33
2.7.8	Using Already Available Tornado 2 Projects	33
3	Setting Up Your Hardware	35
3.1	Introduction	35
3.1.1	Overview of Host and Target Configuration Tasks	36
3.1.2	Understanding Target Servers and Target Agents	36
3.2	Configuring Your Cross-Development System	39
3.2.1	Configuring Host Software	39
3.2.2	Verifying Serial Setup and Power	44
3.3	Setting Up a Boot Mechanism	48
3.4	Bootting VxWorks	49
3.4.1	Default Boot Process	50
3.4.2	Entering New Boot Parameters	51
3.4.3	Boot Program Commands	52
3.4.4	Description of Boot Parameters	54
3.4.5	Bootting With New Parameters	57
3.4.6	Alternate Boot Methods	58
3.4.7	Rebooting VxWorks	59

3.5	Configuring Host-Target Communication for Workbench	60
3.5.1	Ethernet Connections	60
3.5.2	Serial-Line Connections	63
3.6	Troubleshooting VxWorks Problems	66

PART II: PROJECTS

4	Projects Overview	69
4.1	Introduction	69
4.2	Workspace/Project Location	70
4.3	Creating New Projects	70
4.3.1	Subsequent Modification of Project Creation Wizard Settings	71
4.3.2	Projects and Application Code	71
4.4	Overview of Preconfigured Project Types	71
4.4.1	Workbench Sample Projects	72
4.4.2	VxWorks Image Project	72
4.4.3	VxWorks Boot Loader Project	73
4.4.4	VxWorks Downloadable Kernel Module Project	73
4.4.5	Real-time Process Project	74
4.4.6	VxWorks Shared Library Project	75
4.4.7	VxWorks ROMFS File System Project	75
4.4.8	VxWorks User-Defined Projects	76
4.4.9	Native Application Project	76
4.5	Projects and Project Structures	77
4.5.1	Adding Subprojects to a Project	77
4.5.2	Project Structures and Host File System Directory Structure	78
4.5.3	Project Structures and the Build System	79

4.5.4	Project Structures and Sharing Subprojects	80
4.5.5	Customizing Build Settings for Shared Subprojects	80
5	VxWorks Image Projects	83
5.1	Introduction	83
5.2	Importing a VxWorks Image Project	84
5.2.1	Migrating a VxWorks Image Project	84
5.3	Creating a VxWorks Image Project	85
5.4	VxWorks Image Projects in the Project Navigator	88
5.4.1	Global Project Nodes	89
5.4.2	Project Build Specs and Target Nodes	89
5.4.3	Build Output Folders	90
5.4.4	Makefile Nodes	91
5.4.5	Project File Nodes	91
5.5	Configuring Kernel Components	93
5.5.1	The Kernel Editor	93
5.6	Adding Application Projects to the VxWorks Image Project	94
5.7	Notes on Board Support Packages (BSPs)	95
5.7.1	Using the Simulator BSP	95
5.7.2	Using a Wind River or Third-Party BSP	95
5.7.3	Using a Custom BSP for Custom Hardware	95
6	Boot Loader Project	97
6.1	Introduction	97
6.2	Creating a Boot Loader Project	98

6.3	Boot Loader Projects in the Project Navigator	99
6.3.1	Global Project Nodes	99
6.3.2	Project Build Specs and Target Nodes	99
6.3.3	Makefile Nodes	100
6.3.4	Other Project Files	100
7	VxWorks ROMFS File System Projects	101
7.1	Introduction	101
7.2	Creating a VxWorks ROMFS File System Project	102
7.3	VxWorks ROMFS File System Projects in the Project Navigator	102
7.3.1	Global Project Nodes	103
7.3.2	Project File Nodes	103
7.3.3	Configuring the VxWorks ROMFS File System	103
8	VxWorks Real-time Process Projects	105
8.1	Introduction	105
8.2	Creating a VxWorks Real-time Process Project	106
8.3	VxWorks Real-time Processes in the Project Navigator	108
8.3.1	Global Project Nodes	109
8.3.2	Project Build Specs and Target Nodes	109
8.3.3	Makefile Nodes	109
8.3.4	Project File Nodes	110
8.4	Application Code for a VxWorks Real-time Process Project	111
8.5	Linking to VxWorks and Using Shared Libraries	111
9	VxWorks Shared Library Projects	113
9.1	Introduction	113

9.2	Creating a VxWorks Shared Library Project	114
9.3	Shared Libraries in the Project Navigator	116
9.3.1	Global Project Nodes	116
9.3.2	Target Node	116
9.3.3	Makefile Nodes	117
9.3.4	Project File Nodes	117
9.4	Source Code for the Shared Library	117
9.5	Making Shared Libraries Available to Applications	118
9.5.1	Configuring the Shared Library Project	118
9.5.2	Configuring the Application Projects	118
10	VxWorks Downloadable Kernel Module Projects	119
10.1	Introduction	119
10.2	Creating a VxWorks Downloadable Kernel Module Project	120
10.3	Downloadable Kernel Modules in the Project Navigator	122
10.3.1	Global Project Nodes	123
10.3.2	Project Build Specs and Target Nodes	123
10.3.3	Makefile Nodes	123
10.3.4	Project File Nodes	124
10.4	Application Code for a VxWorks DKM Project	124
11	VxWorks User-Defined Projects	127
11.1	Introduction	127
11.2	Creating a User-Defined Project	128
11.2.1	Linking to External Files	128
11.3	Creating an Application for VxWorks	130

12	Native Application Projects	131
12.1	Introduction	131
12.2	Creating a Native Application Project	132
12.3	Native Applications in the Project Navigator	134
12.3.1	Global Project Nodes	134
12.3.2	Project Build Specs and Target Nodes	134
12.3.3	Makefile Nodes	135
12.3.4	Project File Nodes	136
12.4	Application Code for a Native Application Project	136
13	Working in the Project Navigator	137
13.1	Introduction	137
13.2	Creating Projects	138
13.3	Adding Application Code to Projects	138
13.3.1	Importing Resources	138
13.3.2	Adding New Files to Projects	139
13.4	Opening and Closing Projects	139
13.4.1	Closing a Project	139
13.5	Scoping and Navigation	140
13.6	Moving, Copying, and Deleting Resources and Nodes	141
13.6.1	Resources and Logical Nodes	141
13.6.2	Manipulating Files	142
13.6.3	Manipulating Project Nodes	143
13.6.4	Manipulating Target Nodes	144

14	Advanced Project Scenarios	145
14.1	Introduction	145
14.2	Resource Locations	146
14.3	Multiple, Unrelated Software Systems	147
14.3.1	Using Different Workspaces for Different Systems	147
14.3.2	Using the Same Workspace for Different Software Systems	148
14.4	Complex Project Structures	148
14.4.1	Project Assumptions	149
14.4.2	Infrastructure Design	150
14.4.3	Development	155
14.4.4	Finalization	160

PART III: DEVELOPMENT

15	Navigating and Editing	169
15.1	Introduction	169
15.2	Wind River Workbench Context Navigation	170
15.2.1	The Symbol Browser	171
15.2.2	The Outline View	171
15.2.3	The File Navigator	172
15.2.4	Type Hierarchy View	172
15.2.5	Include Browser	172
15.3	The Editor	173
15.3.1	Code Templates	173
15.4	Search and Replace: The Retriever	175
15.4.1	Initiating Text Retrieval	175

15.5	Static Analysis	175
15.5.1	Sharing Static Analysis Data with a Team	176
16	Building Projects	179
16.1	Introduction	179
16.2	Configuring Workbench Managed Builds	182
16.2.1	Configuring Standard Managed Builds	182
16.2.2	Configuring Flexible Managed Builds	182
16.3	Configuring User-Defined Builds	188
16.4	Accessing Build Properties	188
16.4.1	Workbench Global Build Properties	189
16.4.2	Project-specific Build Properties	189
16.4.3	Folder, File, and Build Target Properties	189
16.4.4	Multiple Target Operating Systems and Versions	190
16.5	Build Specs	190
16.6	Makefiles	191
16.6.1	Derived File Build Support	191
17	Building: Use Cases	195
17.1	Introduction	195
17.2	Adding Compiler Flags	196
17.2.1	Add a Compiler Flag by Hand	196
17.2.2	Add a Compiler Flag with GUI Assistance	197
17.3	Building Applications for Different Boards	198
17.4	Creating Library Build-Targets for Testing and Release	199
17.5	Architecture-Specific Implementation of Functions	202

17.6	Executables that Dynamically Link to Shared Libraries	203
17.7	User-Defined Build-Targets in the Project Navigator	206
17.7.1	Custom Build-Targets in User-Defined Projects	206
17.7.2	Custom Build-Targets in Workbench Managed Projects	207
17.7.3	User Build Arguments	207
17.8	A Build Spec for New Compilers and Other Tools	207
17.9	Developing on Remote Hosts	209
17.9.1	General Requirements	210
17.9.2	Remote Build Scenarios	210
17.9.3	Setting Up a Remote Environment	211
17.9.4	Building Projects Remotely	212
17.9.5	Running Applications Remotely	213
17.9.6	Rlogin Connection Description	213
18	RTPs and Shared Libraries from Host to Target	215
18.1	Introduction	215
18.2	A VxWorks Real-time Process from Host to Target	216
18.2.1	Set Up the Project Structure for Real-time Processes	216
18.2.2	Add Code to the Real-time Process Project	217
18.2.3	Add the Real-time Process to the VxWorks ROMFS Target File System	218
18.2.4	Build the System	220
18.2.5	Set up the Target Connection	220
18.2.6	Run the Real-time Process on the Simulator	221
18.3	A VxWorks Shared Library from Real-time Process to Target	221
18.3.1	Set Up the VxWorks Shared Library Project	221
18.3.2	Add Code to the Shared Library Project	222

18.3.3	Add the Shared Library to the Run-Time Process	223
18.3.4	Modify the Code in the Real-time Process Project	225
18.3.5	Generate Include Search Paths	225
18.3.6	Add Libraries to the VxWorks ROMFS Target File System	226
18.3.7	Build the System Again	227
18.3.8	Run the RTP with the Shared Library on the Simulator	227

PART IV: TARGET MANAGEMENT

19	Connecting to Targets	231
19.1	Introduction	231
19.2	The Target Manager View	232
19.3	Defining a New Connection	232
19.4	The Registry	233
19.4.1	Launching the Registry	234
19.4.2	Remote Registries	234
19.4.3	Shutting Down the Registry	235
19.4.4	Changing the Default Registry	235
19.5	Establishing a Connection	236
19.5.1	Assumptions	236
19.6	Connect to the Target	236
19.6.1	The Kernel Shell	237
20	New Target Server Connections	239
20.1	Introduction	239
20.2	Defining a New Target Server Connection	239
20.2.1	Wind River Target Server	240

20.2.2	Target Server Connection Page	240
20.2.3	Object Path Mappings Page	244
20.2.4	Target State Refresh Page	247
20.2.5	Connection Summary Page	248
20.3	Kernel Configuration	249
21	New VxWorks Simulator Connections	251
21.1	Introduction	251
21.2	Defining a New Wind River VxWorks Simulator Connection	251
21.2.1	VxWorks Boot Parameters Page	252
21.2.2	VxSim Memory Options Page	252
21.2.3	VxWorks Simulator Miscellaneous Options Page	252
21.2.4	Target Server Options Page	253
22	New On-Chip Debugging Connections	255
22.1	Defining a New Wind River ICE SX Connection	255
22.2	Defining a New Wind River ISS Connection	267
22.3	Defining a New Wind River Probe Connection	271

PART V: DEBUGGING

23	Launching Programs	283
23.1	Introduction	283
23.2	Launching a Kernel Task or a Process	284
23.2.1	Defining the Target Connection	285
23.2.2	Defining the Kernel Task or Process to Run	285
23.2.3	Specifying a Build Target to Download	286

23.2.4	Specifying The Projects to Build	286
23.2.5	Defining Debug Behavior	287
23.2.6	Specifying Where Workbench Should Look for Source Files	288
23.2.7	Configuring Access Methods	288
23.2.8	Using Your Launch Configuration	289
23.3	Reset & Download: Hardware Debugging Launches	289
23.4	Launching a Native Application	290
23.4.1	Specifying the Location and Arguments for Your Application	290
23.4.2	Specifying Remote Settings	290
23.4.3	Setting Environment Variables	291
23.4.4	Configuring Access Methods	291
23.4.5	Running Your Native Application	292
23.5	Relaunching Recently Run Programs	292
23.5.1	Increasing the Size of the Launch History List	293
23.6	Using Attach-to-Target Launches	293
23.6.1	Attaching the Debugger to a Running Task or Process	294
23.6.2	Attaching the Debugger to the Kernel	295
23.6.3	Attaching the Kernel in Task Mode	295
23.6.4	Attaching the Kernel in System Mode	295
23.7	Suggested Workflow	296
24	Managing Breakpoints	297
24.1	Introduction	297
24.2	Types of Breakpoints	297
24.2.1	Line Breakpoints	298
24.2.2	Expression Breakpoints	299
24.2.3	Hardware Breakpoints	299

24.3	Manipulating Breakpoints	301
24.3.1	Importing Breakpoints	301
24.3.2	Exporting Breakpoints	302
24.3.3	Refreshing Breakpoints	302
24.3.4	Disabling Breakpoints	302
24.3.5	Removing Breakpoints	302
25	Debugging Projects	305
25.1	Introduction	305
25.2	Using the Debug View	306
25.2.1	Understanding the Debug View Display	307
25.3	Coloring Views	310
25.4	Stepping Through a Program	311
25.5	Using Debug Modes	311
25.5.1	Setting and Recognizing the Debug Mode of a Connection	314
25.5.2	Debugging Multiple Target Connections	315
25.5.3	Disconnecting and Terminating Processes	315
25.6	Understanding Source Lookup Path Settings	315
25.7	Using the Disassembly View	316
25.7.1	Opening the Disassembly View	316
25.7.2	Understanding the Disassembly View Display	316
25.8	Using the Kernel Objects View	317
25.8.1	Understanding the Kernel Objects View Display	319
25.9	Run/Debug Preferences	319

26	Troubleshooting	321
26.1	Introduction	321
26.2	Startup Problems	322
26.2.1	Pango Error on Linux	325
26.3	General Problems	325
26.3.1	Java Development Tools (JDT) Dependency	325
26.3.2	Help System Does Not Display on Solaris or Linux	326
26.3.3	Help System Does Not Display on Windows	326
26.3.4	Removing Unwanted Target Connections	326
26.4	Error Messages	327
26.4.1	Project System Errors	327
26.4.2	Build System Errors	329
26.4.3	Target Manager Errors	332
26.4.4	Launch Configuration Errors	337
26.4.5	Debugger Errors	338
26.4.6	Static Analysis Errors	338
26.5	Troubleshooting VxWorks Configuration Problems	339
26.5.1	What to Check	339
26.6	Error Log View	342
26.7	Error Logs Generated by Workbench	342
26.7.1	Creating a ZIP file of Logs	343
26.7.2	Eclipse Log	343
26.7.3	DFW GDB/MI and Debug Tracing Logs	344
26.7.4	Debugger Views GDB/MI Log	345
26.7.5	Debugger Views Internal Errors Log	345
26.7.6	Debugger Views Broadcast Message Debug Tracing Log	345

26.7.7	Target Server Output Log	346
26.7.8	Target Server Back End Log	347
26.7.9	Target Server WTX Log	347
26.7.10	Target Manager Debug Tracing Log	348
26.7.11	Static Analysis Parser Logs	349
26.8	Technical Support	349

PART VI: UPDATING

27	Integrating Plug-ins	353
27.1	Introduction	353
27.2	Finding New Plug-ins	354
27.3	Incorporating New Plug-ins into Workbench	354
27.3.1	Creating a Plug-in Directory Structure	354
27.3.2	Installing a ClearCase Plug-in	355
27.4	Disabling Plug-in Functionality	357
27.5	Using Workbench with ClearCase Views	357
27.5.1	Adding Workbench Project Files to Version Control	358
27.6	Downloading and Installing Java Development Tools (JDT)	360
27.6.1	Creating a JDT Directory Structure	360
27.6.2	Downloading the JDT SDK	360
27.6.3	Making JDT Available to Workbench	361
27.7	Managing Multiple Plug-in Configurations	361
27.8	Using Workbench in an Eclipse Environment	362
27.8.1	Recommended Software Versions and Limitations	362
27.8.2	Setting Up Workbench	363

PART VII: REFERENCE

A	Updating Workspaces on the Command-line	367
A.1	Overview	367
A.2	wrws_update Reference	368
B	Glossary	371
	Index	377

PART I

Introduction

1	Overview	3
2	Wind River Workbench Tutorials	13
3	Setting Up Your Hardware	35

1

Overview

- 1.1 Introduction 3
- 1.2 Wind River Documentation 4
- 1.3 Road Map to the Wind River Workbench User's Guide 4
- 1.4 Understanding Cross-Development Concepts 5
- 1.5 Basic Eclipse Concepts 7
- 1.6 Accessing Additional Interface Information 12

1.1 Introduction

Welcome to the *Wind River Workbench User's Guide*. Wind River Workbench 2.5 is an Eclipse¹-based development suite that provides an efficient way to develop real-time and embedded applications with minimal intrusion on the target system.

Wind River Workbench is available on Windows, Linux, and Solaris hosts, but in this guide, screenshots and paths will be shown as on Windows.

1. Eclipse is an industry-standard framework for building development suites.

1.2 Wind River Documentation

A wide variety of documentation in many different formats is available to Workbench customers. See the getting started for your platform for a description of the full document set.

1.3 Road Map to the Wind River Workbench User's Guide

- This chapter provides an overview of cross-development concepts, and an introduction to basic Eclipse terminology and functionality.
- [2. Wind River Workbench Tutorials](#) provides a tutorial that walks you through all the major features of Workbench: creating projects, building and debugging code, connecting to the VxWorks simulator, and running your program.
- [3. Setting Up Your Hardware](#) explains how to set up your host and target in order to run your programs on real target hardware.
- [Part II. Projects](#) explains the **Project System**, including creating new projects, importing and exporting existing projects, and creating VxWorks images and user applications.
- [Part III. Development](#) describes the **Editor**, **Static Analysis**, and **Build System** features of Workbench.
- [Part IV. Target Management](#) provides details about using the **Target Manager**, including how to configure a target server, and how to create and manage your target connections.
- [Part V. Debugging](#) explains **Debugger** functionality, including launch configurations, attaching the debugger to processes, working with breakpoints, displaying processes in the Debug and Disassembly views, and examining registers and memory. This section also provides **Troubleshooting** information, explaining how to respond to error messages you may see while using Workbench.
- [Part VI. Updating](#) describes how to incorporate **plug-ins**, such as ClearCase, into Workbench.

- [Part VII. Reference](#) provides information about updating your workspace with the command-line, as well as a **Glossary** of Workbench and Eclipse terms for which you may want more information.

1.4 Understanding Cross-Development Concepts

Cross-development is the process of writing code on one system, known as a *host*, that will run on another system, known as a *target*.

Cross-development allows you to write code on a system that you have available to you (such as a PC running Linux, Windows, or Solaris) and produce applications that run on hardware that you would have no other convenient way of programming, such as a chip destined for a mobile phone.

1.4.1 Hardware in a Cross-Development Environment

A typical host is equipped with large amounts of RAM and disk space, backup media, printers, and other peripherals. In contrast, a typical target has only the resources required by the real-time application with perhaps some small amount of additional resources for testing and debugging.

Working on the Host

You use the host just as you would if you were writing code to run on the host itself—to manage project files; edit, compile, link, store multiple versions of your real-time code, and configure the operating system destined to run on the target.

Connecting the Target to the Host

A number of alternatives exist for connecting the target system to the host, such as Ethernet, serial, and JTAG. See [3. Setting Up Your Hardware](#) for more information about setting up your hardware.

Running Your Application Code

Run-time code is the code that is intended for the final application. The run-time includes the kernel, your application-specific code, and some selected library code. The term run-time does not usually refer to the target agent, although you will typically include it during development and debugging. See [3.1.2 Understanding Target Servers and Target Agents](#), p.36 for more information about the target agent.

Workbench allows you to avoid the cumbersome process of downloading your complete run-time code each time you make a change by allowing you to download and run individual application modules as they are developed. You can even run application modules on the host in the integrated target simulator, Wind River VxWorks Simulator, if target hardware is not available.

Advantages of Using Wind River Workbench

Wind River Workbench ensures the smallest possible difference between the performance of the target you use during development, and the performance of the target after deployment, by keeping most development tools on the host.

A fundamental advantage of using Wind River Workbench is that your application does not need to be fully linked. Code that is only partially completed can be downloaded for incremental testing and debugging; application modules do not need to be linked with the run-time system libraries, or even with each other. The host-resident shell and debugger can be used interactively to invoke and test either individual application routines or complete tasks.

Workbench loads the relocatable object modules directly, and maintains a complete host-resident symbol table for the target. This symbol table is incremental: the target server incorporates symbols as it downloads each object module. You can examine variables, call subroutines, spawn tasks, disassemble code in memory, set breakpoints, trace subroutine calls, and so forth, all using the original symbol names.

Wind River Workbench shortens the cycle between developing an idea and implementing it by allowing you to quickly download your incremental run-time code and dynamically link it with the operating system. Your application is available for symbolic interaction and testing with minimal delay.

The Workbench debugger allows you to view and debug applications in the original source code. Setting breakpoints, single-stepping, examining structures, and so on are all done at the source level, using a convenient graphical interface.

1.5 Basic Eclipse Concepts

Wind River Workbench is based on the Eclipse Platform, an industry-standard framework for building development suites.

This section provides a very brief overview of some of the Workbench components inherited from Eclipse.

1.5.1 Window

The term *window* refers to the desktop development environment. You can open more than one window at a time by selecting **Window > New Window** (each window will see the same projects and workspace.) A Workbench window can contain one or more *perspectives*.

1.5.2 Workspace

Workbench uses a *workspace* to store your current working environment. Some of the items that are saved with the workspace include the set of open projects, and the size and location of views.

The workspace also contains information about the current session, including the types and positions of your views when you last exited Workbench, current projects, and installed breakpoints.

The default location of your workspace is *installDir\workspace*, but it can be located elsewhere if necessary. If you want to run two or more copies of Workbench, each must have its own workspace.

Maintaining More Than One Workspace

If you want to run two independent copies of Workbench (to keep some projects and files completely separate from others) you must establish a second workspace. This is not a required step for the tutorial in [2. Wind River Workbench Tutorials](#).

1. Launch Workbench as described in [2.2 Starting Wind River Workbench](#), p.14.
2. Select **File > Switch Workspace** to open the **Select a workspace** dialog.
3. Select the directory where you want your workspace to be located, then select **Make New Folder**. Type the name of your new workspace, then click **OK**.

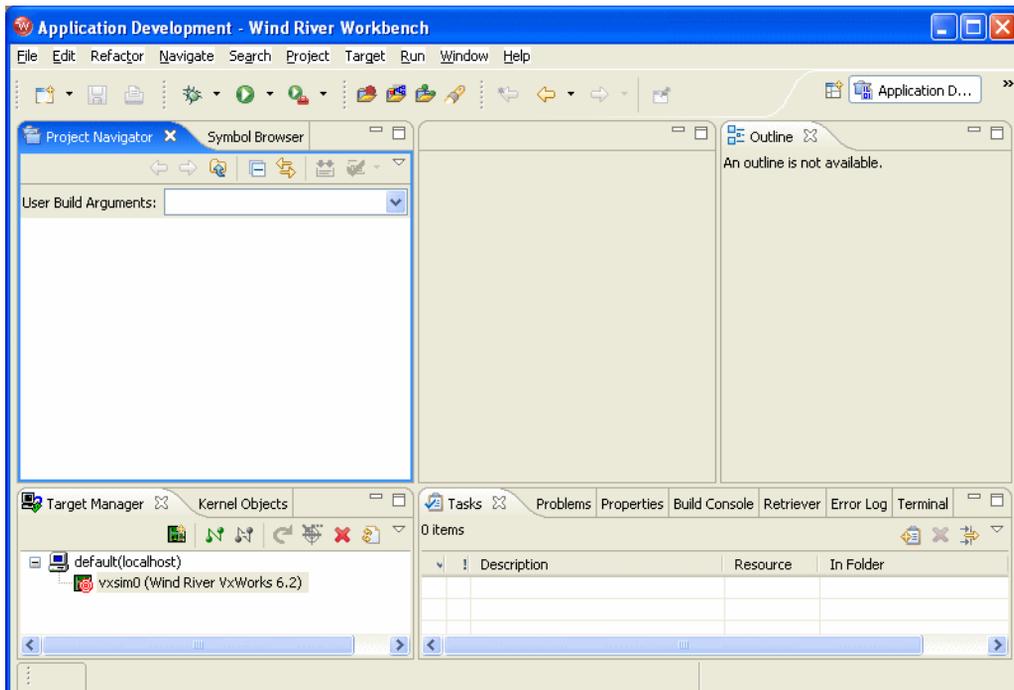
➔ **NOTE:** The path to each of your workspaces must be unique. If you want a new workspace to be located in the installation directory alongside your original workspace, it must have a unique name (for example, **workspace2** or **newWorkspace**). If it is located in a different directory, it can have the same name as the original: **workspace**.

1.5.3 Perspectives

A *perspective* groups together an editor area and one or more views that are convenient to have available while working on a particular task.

For example, [Figure 1-1](#) shows the Application Development perspective, which is designed to help you create projects, browse files, and edit and build source code.

Figure 1-1 Application Development Perspective

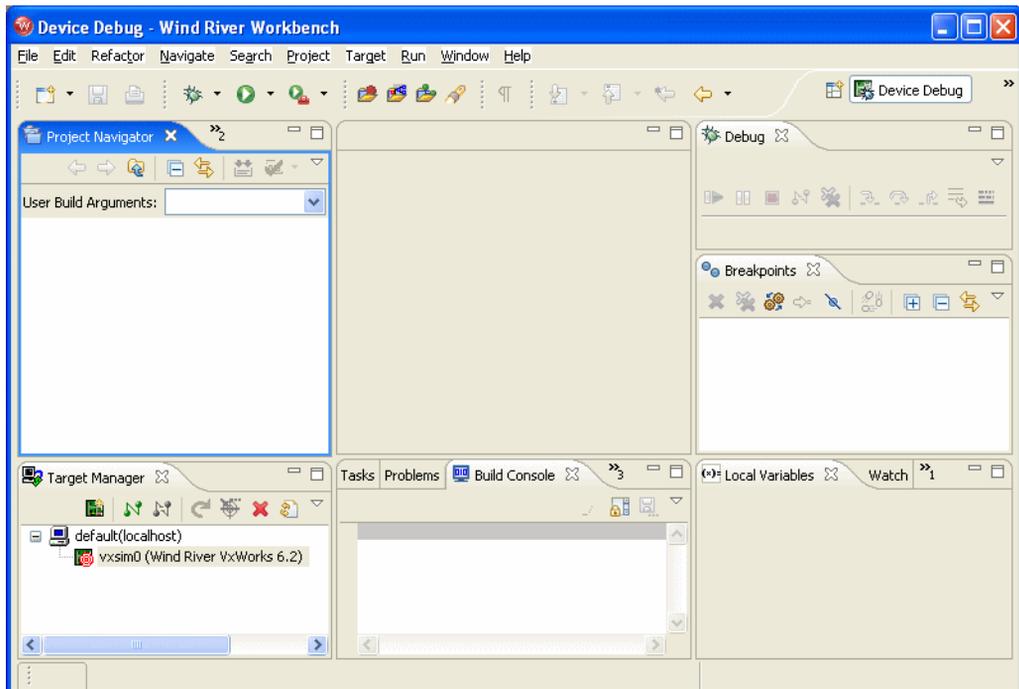


It includes the Project Navigator on the top-left side of the screen, the Outline view on the top-right, the Target Manager on the bottom-left, and the Stacked view (also known as a tabbed notebook) on the bottom-right with the Tasks view visible.

To open a new perspective, select **Window > Open Perspective > Other** and choose a perspective you want to explore, or click the **Open a perspective** icon in the upper right corner of the Workbench window, select **Other**, and choose a perspective.

Figure 1-2 shows the Device Debug perspective, which contains views that are useful when you are running and debugging programs, including the Debug and Breakpoints views, and a tabbed notebook containing the Local Variables, Watch, and Register views. These views replace the Outline view of the Application Development perspective.

Figure 1-2 Device Debug Perspective



The Application Development perspective opens by default, but you can switch between perspectives by selecting an icon in the shortcut bar along the top right edge of the Workbench window. When you start Workbench for the first time, the

Open a perspective icon and the **Application Development** tab appear as shown in [Figure 1-3](#).

Figure 1-3 **Perspectives Shortcut Bar**



As you open perspectives, their icons appear in the shortcut bar. To see them all side by side, click to the left of the **Open a Perspective** icon and drag to the left until all open perspectives are visible.

To customize a perspective, you can open, close, and move views to create a comfortable work environment, then select **Window > Save Perspective As** and give your perspective a name. That configuration of views will be restored the next time you open your perspective. You can further customize your perspective by selecting **Window > Customize Perspective**.

You can restore a perspective to its default configuration by selecting **Window > Reset Perspective**.

1.5.4 Views

Views reside in perspectives, and allow you to display, manipulate, and navigate the information in Workbench.

Certain views appear in particular perspectives by default, but you can add any view to any perspective by selecting **Window > Show View**, then either selecting the view you want, or selecting **Other**, selecting the perspective containing that view, then choosing the view from the list.

There are two things to remember when using views:

- Only one view (or editor) can be active at a time. The title bar of the active view is highlighted.
- Only one instance of a type of view can be present in a perspective at a time (but multiple editors can be present to view multiple source files).

Many views have their own menus. To open the menu for a view, click the down arrow at the right end of the view's title bar. Some views also have their own tool bars. The actions represented by buttons on view toolbars only affect the items within that view.

Moving and Maximizing Views

Move a view by clicking either its title bar or its tab in a stacked notebook, and dragging it to a new location.

There are several ways to relocate a view:

- Drag the view to the edge of another view and drop it. The area is then split, and both views are tiled in the same area. The cursor changes to an appropriate directional arrow as you approach the edge of a view.
- Drag the view to the title bar of an existing view and drop it. The view will be added to a stacked notebook with tabs. When you drag the view to stack it, the cursor changes to an icon of a set of stacked folders.
- If you drag a view over a tab in an existing view, the view will be stacked in that notebook with its tab at the left of the existing view. You can also drag an existing tab to the right of another tab to arrange tabs to your liking.

To quickly maximize a view to fill the entire perspective area, double-click its title bar. Double-click the title bar again to restore it.

1.5.5 Editors

An editor is a special type of view used to edit files. You can associate different editors with different types of files such as C, C++, Ada, Assembler, and Makefiles. When you open a file, the associated editor opens in the perspective's editor area.

Any number of editors can be open at once, but only one can be active at a time. By default, editors are stacked in the editor area, but you can tile them in order to view source files simultaneously (see [15. Navigating and Editing](#) for more information about Editors).

Tabs in the editor area indicate the names of files that are currently open for editing. An asterisk (*) indicates that an editor contains unsaved changes.

1.5.6 Projects

Workbench uses projects as logical containers and as building blocks that can be linked together to create a software system. The Project Navigator lets you visually organize projects into structures that reflect their inner dependencies, and therefore the order in which they are compiled and linked.

1.6 Accessing Additional Interface Information

For more information about the Workbench interface, press **F1** (or **CTRL+F1** on Linux, or the **Help** button on Solaris) to open a dialog (called an *infopop*) containing a brief description of the current view. At the bottom of many infopops, you will see links to sections of Workbench documentation with more information on the same topic. You can also access the help system by selecting **Help > Help Contents > Wind River Documentation**.

For more information on Eclipse functionality, see the *Eclipse Workbench User Guide* under **Help > Help Contents > Wind River Partner Documentation > Eclipse Platform Documentation**, as well as the Eclipse web site at www.eclipse.org.

2

Wind River Workbench Tutorials

- 2.1 Introduction 13
- 2.2 Starting Wind River Workbench 14
- 2.3 Tutorial: Creating a Project and Running a Program 15
- 2.4 Tutorial: Editing and Debugging Source Files 22
- 2.5 Tutorial: Using the Editor's Code Development Features 24
- 2.6 Tutorial: Tracking Items of Interest in Your Files 27
- 2.7 Tutorial: Using Workbench to Debug a VxWorks 5.5 Target 28

2.1 Introduction

This chapter provides tutorials designed to introduce you to Wind River Workbench and to familiarize you with its views and development concepts. The VxWorks Simulator is used to execute the sample programs, and no special hardware or system setup is required.

In the course of these tutorials, you will:

- Create a project.
- Import source files.
- Build a project.
- Connect to a simulator.

- Set breakpoints.
- Step through code.
- Set a Watch variable.
- Run code.
- Edit source files.
- Track build errors.
- Debug a project.
- Rebuild and rerun your code.

These tutorials assume a basic understanding of embedded projects and debugging concepts. They also assume that you have the Workbench software (with VxWorks support) installed correctly on your host, and that the software is installed in the default location and with the default settings.

To run the VxWorks 5.5 debugging tutorial, you must also have VxWorks 5.5 and Tornado 2 installed.

For definitions of unfamiliar terminology, see [B. Glossary](#).

2.2 Starting Wind River Workbench

1. Before you can run the tutorials, you must start Workbench.

On Windows:

**Start > Programs > Wind River > Workbench 2.5 > Wind River
Workbench 2.5**

On Linux and Solaris:

Open a terminal window, then navigate to your Workbench installation directory. From the command line, type:

```
./startWorkbench.sh
```

2. When you start Workbench for the first time, Workbench creates a new registry database¹. A dialog appears telling you how to migrate your registry settings from a previous registry to the new one².

1. A new database will also be created in **/tmp** if the default database is not accessible.
2. If you did not have a previous version of Workbench installed and therefore do not have registry settings to migrate over, you can safely ignore this dialog.

3. Click **OK**. The Wind River Workbench welcome screen appears.
4. Select the **Start** arrow to open a second welcome screen containing links to useful destinations, including the Workbench window itself.
5. To follow these tutorials, select the **Workbench** arrow. Workbench opens and displays the Application Development perspective.

2.3 Tutorial: Creating a Project and Running a Program

This tutorial uses the **ball** sample program, written in C. This program implements a set of balls bouncing in a two-dimensional grid. As the balls bounce, they collide with each other and with the walls. You see the balls move by setting a breakpoint with the property **Continue on break** at the outer move loop, and watching a global grid array variable in the Memory window.

First, you will create a new project in your workspace, then you will import the ball source files into it from their directory in the Workbench installation.

2.3.1 Before You Begin

Workbench preserves its configuration when you close it, so that at next launch you can resume where you left off in your development.

If you experimented with opening perspectives and moving views before starting this tutorial, switch back to the Application Development perspective by clicking its icon in the upper right corner of the Workbench window. If its icon is not visible, drag the shortcut bar to the left (your cursor will turn to a double-headed arrow) or click the double-right arrows (a dropdown list will open).



To reset the perspective and its views to their default settings, select **Window > Reset Perspective**.

2.3.2 Creating a Project

1. Select **File > New > VxWorks Downloadable Kernel Module Project**. The **Project** dialog appears.
2. Enter **ball** in the **Project Name** field, then click **Next**. If this is your first Workbench project, skip to step 5.
3. If you previously created any projects before starting this tutorial, the **Project Structure** dialog appears. Here you can choose to make your new project a subproject of an existing one, or to make an existing project a subproject of your new one. For now, do not change anything. Click **Next**.
4. If you have any existing projects, the **Build Setup and Defaults** dialog appears. Here you can choose whether your project should use the **Standard** or **Flexible** managed build system.

If you have an existing project of the same type, you can decide whether to use the build defaults from that project, or from the default Workbench template. For now, select **Standard** build, then click **Next**.

5. The **Build Support** dialog appears. Click **Next** to accept the default settings.
6. The **Build Specs** screen appears. Click **Deselect All**, then select the check box next to the VxWorks simulator build spec for your platform and compiler (you can select more than one if you want). Leave **Debug Mode** checked, then click **Next**.
 - On Windows, select **SIMNTdiab** or **SIMNTgnu**
 - On Linux, select **SIMLINUXdiab** or **SIMLINUXgnu**
 - On Solaris, select **SIMSPARCSOLARISdiab** or **SIMSPARCSOLARISgnu**
7. The **Build Target** screen appears. By default the build target name is the same as the project name, but you can customize it if you prefer. Click **Next**.
8. The **Static Analysis** screen appears. Leave these options checked for now. Click **Finish** to create the project files. The new **ball** project appears in the Project Navigator.

2.3.3 Importing Source Files Into Your Project

Next, import the ball sample project files.

1. Right-click the **ball** project folder, then select **Import**. The **Import** wizard appears.

2. Select **File System** and click **Next**. The **File System** page of the **Import** wizard appears.
3. Click the **Browse** button next to the **From directory** field. The **Import from directory** page appears.
4. Navigate to the *installDir\workbench-2.5\samples* directory. Select **ball**, then click **OK**. The **File system** page reappears, with the **ball** folder in the left pane and the files in that folder in the right pane.
5. Select the check box next to **ball**. This automatically selects all the files in the right pane. Because you are importing into the **ball** project, **ball** appears in the **Into folder** field. Click **Finish**.
6. To see the contents of the **ball** project folder, click the plus next to it in the Project Navigator. You will see the project files in black, and the build targets in blue. Any files that appear in gray are read-only.

2.3.4 Building Your Project

1. Build the **ball** project by right-clicking the **ball** folder in the Project Navigator and selecting **Build Project** from the context menu.
2. The first time you build a project, a dialog appears asking if you want Workbench to generate include paths (for more information about include paths, see *Wind River Workbench User Interface Reference: Build Properties*). You do not need to do this for the tutorial, so click **Continue**.
3. Build output displays in the Build Console tab at the bottom of the screen, and the output file **ball.out** appears in a subdirectory of **ball** called **ball.out (SIMNTdiab_DEBUG)**.



NOTE: The string **SIMNTdiab_DEBUG** reflects the active build spec, and the fact that debug mode flags are turned on by default. If you selected a different build spec, or turned off debug mode flags, the string will be different.

2.3.5 Creating a Connection Definition to the VxWorks simulator

You create and manage connections to a target, including the VxWorks simulator, using the Target Manager.



NOTE: If you installed VxWorks support when you installed Workbench, a VxWorks simulator connection definition named **vxsim0** automatically appears below **default(localhost)**.

This is a valid connection definition, but to understand how to manually create new target connections, continue with this tutorial.

1. To create a new target connection definition, click the **Create a New Target Connection** icon on the Target Manager toolbar, or right-click in the Target Manager and select **New > Connection**.
2. In the **New Connection** wizard, select **Wind River VxWorks Simulator Connection**, then click **Next**.
3. Continue clicking **Next** to accept all of the default configuration settings, then click **Finish** to create your connection definition. Because the **Immediately connect to target if possible** box is selected by default, Workbench attempts to connect to the simulator.

Workbench displays **connecting**, then **connected - target server running** in the Workbench status line at the bottom of the window³ once the connection is made. A VxWorks simulator window opens⁴, and the connection appears under **default(localhost)**, with the type of target displayed under the connection.

You are now ready to run the sample program.

2.3.6 Downloading the Program and Attaching the Debugger

1. In the **Project Navigator**, right-click the build target **ball.out**, then select **Debug Kernel Task**. The **Debug** launch configuration dialog appears, with **ball.out** already filled in as part of the **Name** of the launch.
 2. Type **main** in the **Entry Point** field (or select it from the drop-down list), then click **Debug**.
 3. Several events now occur: Workbench automatically switches to the Device Debug perspective, runs the ball program on the simulator, attaches the debugger, executes the program up to **main()**, and then breaks.
-
3. To display this and other status information in the Target Manager, select **Window > Preferences > Target Manager > Label Decorations**, then choose what you want to display.
 4. You do not need the VxWorks simulator window for this tutorial, so minimize it if you wish, but do not close it. For more information, see *Wind River VxWorks Simulator User's Guide*.

For more information about using the other tabs and fields in the launch configuration dialog, see [23. Launching Programs](#) and *Wind River Workbench User Interface Reference: Launch Configuration Dialog*.

2.3.7 Setting Up the Device Debug Perspective

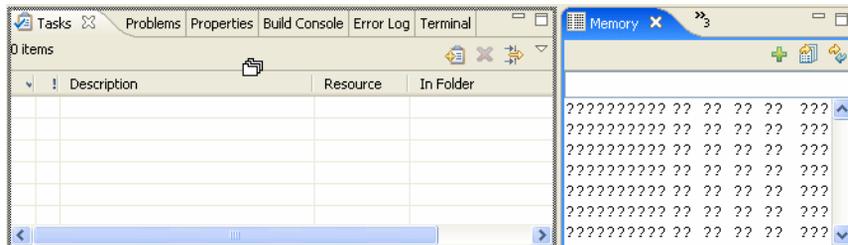
As with the Application Development perspective, the views in the Device Debug perspective can be repositioned to suit your needs.

To set up the Device Debug perspective to match this tutorial:

1. The action of the ball program is viewed in the Memory view, so select **Window > Show View > Other > Device Debug > Memory**. Click **OK**.

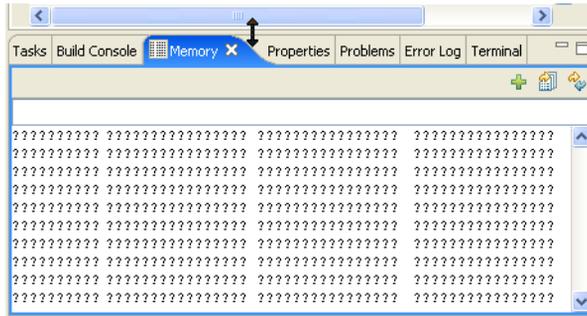
The Memory view appears in the lower-right corner of the Workbench window, in the tabbed notebook with the Local Variables and Watch views.

2. Click on the title bar of the Memory view and drag it to the left, over the tabbed notebook containing the Tasks view and the Build Console. Wait for an icon of a set of stacked folders to appear at the cursor, then drop the view.



3. Right-click in the Memory view and select **Display > Items size - 8 bytes**.
4. Resize the Memory view so you see at least 10 rows (place the cursor over the top border of the view, and when it becomes a double-headed arrow, click and drag upwards).
5. Resize the view horizontally so you see one column in the Address pane, two columns in the Binary pane (the central section of the Memory view) and one column in the Text pane (the right-hand section of the view). The view should look similar to [Figure 2-1](#).

Figure 2-1 Resizing the Memory View



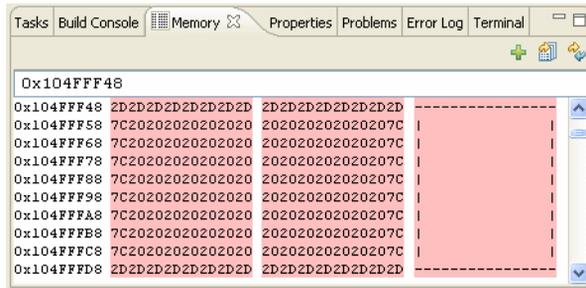
6. In the Watch view⁵, click the **Name** column, then type **grid** and press **ENTER**. The memory address of the **grid** global variable appears in the **value** column. This address can vary from one session to another if something changes, for example if you compile with the GNU compiler instead of the Wind River Compiler.
7. Type the memory address of the **grid** global variable into the Memory view address bar and press **ENTER**.
8. To initialize the program, click the **Step Over** icon in the Debug view twice so the Memory view displays an empty box. If necessary, resize the Memory view horizontally or vertically to frame the box correctly, as shown in [Figure 2-2](#).



NOTE: If the box does not appear, make sure the address you entered in the **Memory** window is that of the **grid** global variable.

5. If it is not visible in the lower right corner, click the >> next to the name tab and select it from the list.

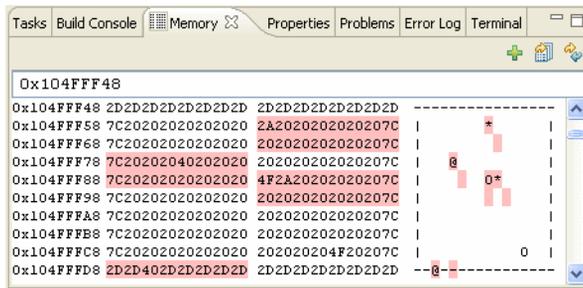
Figure 2-2 Initializing the ball Program



As the program runs, characters representing different types of balls (two zeros, two @ signs, and two asterisks) appear in this empty box, bounce around, and collide with each other and with the walls.

2.3.8 Setting and Running to a Breakpoint.

1. In `main.c` (which should still be open in the Editor) scroll past the three initialization `for` loops and set a breakpoint at the `while` statement by double-clicking in the vertical ruler to the left of it.
A blue dot appears in the vertical ruler, and the Breakpoints view displays the module and line number of the breakpoint.
2. With the breakpoint set, run to it by clicking the **Resume** button in the Debug view. Workbench stops when it hits the breakpoint.
3. Examine the Memory view. You should see the six characters of the sample program (representing balls) in the box. Click **Resume** again; colored highlights indicate changes in ball position since the Memory view was last refreshed.



2.3.9 Modifying the Breakpoint

Next, change the behavior of the breakpoint so that at each break, the display will refresh (to show the bouncing balls) without stopping execution.

1. Right-click the breakpoint in the vertical ruler and select **Breakpoint Properties** from the context menu (or right-click the breakpoint in the Breakpoints view and select **Properties**). The **Line Breakpoint Properties** dialog appears.
2. Select the checkbox next to **Continue on Break**, change the **Continue Delay** to **50**, then click **OK**.
3. Now click the **Resume** button and watch the balls bounce in the Memory window.
4. To stop the program, open the **Breakpoint Properties** dialog again, clear **Continue on Break**, then click **OK**. The balls may bounce once more after you click **OK**, but they will stop.

2.4 Tutorial: Editing and Debugging Source Files

This tutorial demonstrates how Workbench can help you with some of the most basic activities in development: editing code, building your project and noting where the build fails, and tracking and fixing errors.

2.4.1 Before You Begin

To set up Workbench for this tutorial, switch back to the default Application Development perspective as described in [2.3.1 Before You Begin](#), p.15.

2.4.2 Introducing an Error into the Source Code

Because the ball sample program is shipped without errors, you must introduce one into the sources in order to view a failed build.

1. In the Project Navigator, double-click **main.c** to open it in the Editor.
2. Select **main()** in the Outline view. The Editor switches focus to display it.
3. Delete the semicolon (;) after the call to **gridInit()** so that it reads as follows:

```
gridInit()
```



NOTE: The status bar at the bottom of the Workbench window displays the line number and column (61:16) where your cursor is located in the Editor.

4. Right-click in the **Editor** and select **Save** to save the file.
5. Click the **X** on the tab (at the top of the view) to close the **main.c** file.

2.4.3 Tracking Down a Build Failure

1. Build the ball project by right-clicking the **ball** folder in the Project Navigator and selecting **Build Project** from the context menu. Build output appears in the Build Console tab at the bottom of the screen.
2. When the build encounters the error you created in the **main.c** file, the build fails. Workbench displays a red icon containing a white **X** in several places:
 - In the Build Console, which comes to the foreground and displays information about the error, including the general location where the problem is suspected to be.
 - In the Project Navigator, which displays red error markers to alert you that the build failure was in the **ball** project, and that **main.c** is the file containing the error.
 - In the Problems view, which displays a description of the error, including the filename, folder, and line number.

3. Double-clicking the red icon in any of these locations opens the **main.c** file in the Editor, with the focus at (or near) the line suspected of containing the error.
4. Replace the semicolon after **gridInit**.
5. Save and close the file.

2.4.4 Displaying File History

Workbench tracks all changes that you make to any files in the project. To display the change history of the **main.c** file, right-click the file in the Project Navigator and select **Compare With > Local History**.

The **Compare with Local History** dialog appears. The upper area of the dialog displays a list of the dates and times when the file was changed. When you select one of the list entries in the upper part, the lower part displays the file as of that time on the left and the version before then on the right (that is, the changes associated with that save). Note the changes you just made. When you are finished, click **OK** to close the dialog.

2.4.5 Rebuilding the Project

This time, right-click the **ball** folder at the top of the project tree and select **Rebuild Project**. The project compiles with no errors.

2.5 Tutorial: Using the Editor's Code Development Features

The Wind River Workbench editor provides code completion, parameter hints, and bracket matching that can help you develop your code.

2.5.1 Using Code Completion to Add Symbols to Your File

Code completion automatically suggests methods, properties and events as you enter code.

To use code completion, begin typing in the Editor. Right-click in the Editor and select **Source > Content Assist**. You can also use **CTRL+SPACE** to display a pop-up list containing valid choices based on the letters you have typed so far.

For example, in ball's **main.c**:

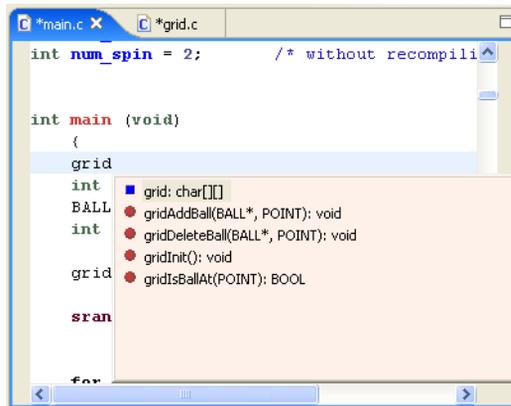
1. Position your cursor inside the function **main()** to the right of the first { character and press **ENTER**. Note that the cursor automatically indents beneath the brace.



NOTE: You can change indentation, brace style, and other code formatting options by selecting **Window > Preferences > General > Editors > Wind River Workbench Editor**.

2. Begin typing **grid** and invoke code completion: **g, r, CTRL+SPACE**.

A dialog appears with suggestions, and as you continue to type the **i** and the **d**, your choices narrow:



Select **gridAddBall()** and press **ENTER** to add the function to the file.

2.5.2 Finding Symbols in Source Files

The easiest way to find a symbol in a source file you are working with is to select it in the Outline view, but sometimes that is not possible. So Workbench also provides other ways to find symbols.

1. If it is not already open, double-click the ball project's **main.c** file to open it.
2. Select **main(): int** in the Outline view. The Editor immediately switches focus and highlights the declaration of **main()**.
3. Several lines below **main()** is the symbol **gridInit()**. This symbol does not appear in the Outline view because that view only displays symbols declared in the file that is open (and has focus) in the Editor.



NOTE: Hovering over **gridInit()** displays a pop-up showing the comments and declaration for the function.

4. To see the declaration of **gridInit()**, double-click it and then press **F3**. The **grid.c** file opens automatically in the Editor, positioned at the declaration of **gridInit()**.

2.5.3 Using Parameter Hints

Parameter hints describe what data types a function accepts. When you add a function using code completion, or when you enter a function name and an open parenthesis, the Workbench Editor automatically displays any available parameter hints.

The screenshot shows a code editor window with two tabs: `*main.c` and `*grid.c`. The `*main.c` tab is active and shows the following code:

```
int num_spin = 2; /* without recompili...  
  
int main (void)  
{  
    gridAddBall()  
    int i;  
    BALL * p;  
    int seed = 3;  
  
    gridInit ();  
  
    srand(seed); /* stop here and set  
                /* initial ball arra  
  
    for (i = 0; i < num_balls; i++)
```

A parameter hint box is displayed over the `gridAddBall()` call, showing the signature `BALL * pBall, POINT point`.

You can also request parameter hints as you enter your code by right-clicking in the Editor and selecting **Source > Parameter Hints**, or by using the **CTRL+SHIFT+SPACE** keyboard shortcut.

2.5.4 Using Bracket Matching to Clarify Syntax

Bracket matching helps you read and troubleshoot complex syntax by highlighting related parentheses, square brackets, and braces.

If you position your cursor before an open bracket or after a closing bracket, a rectangle will enclose the corresponding bracket to make it easier to find. You can jump between the opening and closing brackets by pressing **CTRL+SHIFT+P**. Bracket matching operates on the following characters:

`() , [] , { } , " " , / * * / , < > (C/C++ only)`

2.6 Tutorial: Tracking Items of Interest in Your Files

Adding a bookmark to a source file is similar to placing a bookmark in a book: it allows you to find an item you are interested in at a later time by looking in the Bookmarks view. Open the Bookmarks view by selecting **Window > Show View > Bookmarks**.

You can create a bookmark on a particular line of code within a file, or you can bookmark the file itself.

2.6.1 Creating a Bookmark on a Source Line in a File

1. To create a bookmark on a line of code in your file, right-click in the Editor gutter to the left of the item you want to keep track of, then select **Add Bookmark**.
2. In the **Add Bookmark** dialog, enter a meaningful comment to help you identify it later, then click **OK**. A small bookmark icon appears in the Editor gutter, and a marker, or annotation, appears in the overview ruler at the right edge of the Editor showing your bookmark relative to its position in the file. An entry also appears in the Bookmarks view.

Hovering over the bookmark icon shows you the text you entered, and clicking the annotation on the right will return the Editor's focus to this position if you scroll to a different line in the file.

2.6.2 Creating a Bookmark for an Entire File

1. To create a bookmark for a file, right-click it in the Project Navigator and select **Add Bookmark**.
2. In the **Add Bookmark** dialog, enter a meaningful comment to help you identify it later, then click **OK**.
3. The file will not look any different in the Project Navigator, but the comment you typed, the filename, and the folder appear in the Bookmarks view.

2.6.3 Locating and Viewing Your Bookmarks

1. To see the bookmarks in all your projects, open the Bookmarks view by selecting **Window > Show View > Bookmarks**.
2. To open the file that contains a particular bookmark, double-click the bookmark (or right-click it and select **Go To**). The file opens in the Editor with the bookmark location highlighted.

2.7 Tutorial: Using Workbench to Debug a VxWorks 5.5 Target

This tutorial explains how to use Workbench to create a Tornado 2 target server connection and debug a VxWorks 5.5.x target.

To use these instructions, you must have Workbench 2.5, VxWorks 5.5.x, and Tornado 2 installed.

2.7.1 Before You Begin

1. To allow Workbench to find your Tornado installation, run the `installDir/workbench-2.5/x86-win32/bin/wrregistert22x.bat` script in a command shell.
2. When the script asks for the location of your Tornado installation, type the path and press **Enter**. The script will update your `install.properties` file.

2.7.2 Creating a Project

1. Select **File > New > Example**, then select **VxWorks 5.5 Downloadable Kernel Module Sample Project** and click **Next**.
2. Select the **Cobble demo**, then click **Finish**. The project appears in the Project Navigator.
3. Right-click the new **cobble_55** project, then select **Build Options > Set Active Build Spec**. From the dialog that appears, change the active build spec to **PPC603diab** and select **Debug mode**. Click **OK**.
4. Right-click the project and select **Build Project**. The Build Console displays a warning about a bug in the code.

```

Tasks Problems Properties Build Console Retriever Error Log Terminal
C:\Tornado2.2\target\h-IC:/Tornado2.2/target/h-IC:/Tornado2.2/target/h/wrn/coreip -DCPU=PPC603 -DTCOOL_FAMILY=dab -DTCOOL=dab -D...
ble.d" -fPPC603FH:vxworks55 -IC:/Tornado2.2/target/h-IC:/Tornado2.2/target/h/wrn/coreip -DCPU=PPC603 -DTCOOL_FAMILY=dab -DTCOOL=dab -D...
ab_DEBUG/cobble.o" && rm -f "cobble.o"
building PPC603diab_DEBUG/cobble.o
cobble.c, line 280: warning (dcr1060): possibly 'm' instead of 'me'?
echo "building PPC603diab_DEBUG/cobble_S5.out";rm -f "PPC603diab_DEBUG/cobble_S5.out";mmpc PPC603diab_DEBUG/cobble.o | wextd C:/Tornado2.
c;cd -g -fPPC603FH:vxworks55 -x$dollar-in-ident -IC:/Tornado2.2/target/h-IC:/Tornado2.2/target/h/wrn/coreip -DCPU=PPC603 -DTCOOL_FAMILY=dab
o -c PPC603diab_DEBUG/obj.c; dd -fPPC603FH:vxworks55 -X -r -H -o "PPC603diab_DEBUG/cobble_S5.out" PPC603diab_DEBUG/cobble.o PPC603di
building PPC603diab_DEBUG/cobble_S5.out
echo "building PPC603diab_DEBUG/cobble_S5_partialImage.o"; dd -fPPC603FH:vxworks55 -X -r -o "PPC603diab_DEBUG/cobble_S5_partialImage.o" PPC6
building PPC603diab_DEBUG/cobble_S5_partialImage.o
make: built targets of C:/WindRiverCD65/workspace/cobble_55
Build Finished in Project 'cobble_55': 01 Feb 2006 09:36:53 (Elapsed Time: 00:12)

```

5. Double-click the error symbol to open **cobble.c** to line 280, then fix the bug.
6. Edit line 133⁶ and change the priority of task **tCrunch** to **210**. If you do not do this, it will appear that breakpoints are not hit.
7. Right-click the project folder and select **Rebuild Project** (Workbench saves your changes before starting the build).

Your project should build cleanly this time.

2.7.3 Creating a VxWorks 5.5.x Target Server Connection

Now that you have created your project, you are ready to create a target server connection.

1. From the Target Manager toolbar, click **Create a New Target Connection**. The New Connection wizard opens.
6. You can display line numbers by right-clicking in the Editor, selecting **Preferences**, then selecting **Show line numbers**, or you can just scroll up or down and click in the file. The line number and column position of the cursor is displayed at the bottom of the window.

2. From the Connection Type list, select **Wind River VxWorks 5.5.x Target Server Connection**. Click **Next**.
3. Click **Next** through the next few screens, reviewing and customizing the target server options as necessary. Click **Finish** to create your connection definition.



NOTE: If you get a target server connection error, it could be caused by a long delay in checking out a license for the Tornado 2 target server. To lengthen the timeout, select **Window > Preferences > Target Manager** and increase the time in the **Workbench timeout till target server must be connected** field.

Once the connection to the Tornado target server is established, it appears under **default(localhost)** followed by [**Target Server running**].

4. To connect to the Tornado 2 target, right-click the target server and select **Connect**. The target connection appears under the target server connection⁷.

2.7.4 Launching a Kernel Task and Attaching the Debugger

1. In the Target Manager, right-click your target, then select **Target Mode**. Make sure **Task** is selected.
2. Right-click your target again, and this time select **Debug Kernel Task**. The debug launch configuration dialog appears. This dialog allows you to define which downloadable module to load, which entry point to call, which debugging options to implement, and what the source lookup path should be.
You will see that the **Name** field displays your project's build target and target name, but as yet no entry point is defined.
3. Click **Browse** next to the Entry Point field, then select **Downloads > cobble_55.out > progStart**. Click **OK**.
4. Click the Download tab to bring it to the foreground, then click **Add**. In the Download dialog, type or browse to the location of your project's build target (*installDir/workspace/cobble_55/PPC603diab_DEBUG/cobble_55.out*). Make sure **Load Symbols to Debug Server** is selected, then click **OK**.
5. Click the Debug Options tab to bring it to the foreground. Select **Automatically attach spawned Kernel Tasks**.

7. If you like, click  next to Kernel Tasks to display the list of kernel tasks running in the system as well as the name of the core file.

6. The launch configuration is now complete. Click **Debug** to launch the task and attach the debugger. Workbench changes to the Device Debug perspective, displays the task in the Debug view, and opens **cobble.c** in the Editor (if it is not already open) with the focus in **progStart**.

2.7.5 Setting and Running to a Breakpoint

The easiest way to find a particular function that you want to place a breakpoint on is to use the Outline view.

1. The Outline view does not appear by default in the Device Debug perspective, so open it by selecting **Window > Show View > Outline**.
2. Select the function **cosmos**; the Editor will shift focus to that section of **cobble.c**, with **cosmos** highlighted.
3. Scroll down to line 166 (containing **nadaNichtsIdx**) then right-click in the left Editor gutter and select **Breakpoints** to open the Breakpoints submenu.
4. When adding a breakpoint, you can specify the breakpoint's scope: either the task that is selected in the Debug view (here, **tProgStart**) or every task (**Unrestricted**). In this example, the code is run by the task **tCosmos**, not **tProgStart**, so select **Add Breakpoint (Scope = Unrestricted)**. If you had selected **Scope = tProgStart**, the breakpoint would never have been triggered.
5. Workbench also allows you to specify the stop scope: either **Stop Triggering Thread**, or to **Stop All**. However, in VxWorks 5.5, **Stop All** is not supported; it behaves the same as **Stop Triggering Thread**. So in this example you do not need to select either one.
6. With your breakpoint set, select **tProgStart** in the Debug view and click **Resume**.

The task **tProgStart** disappears from the Debug view; its only purpose was to launch the **tCrunch**, **tCosmos**, and **tMonitor** tasks that now appear in the Debug view and under **Kernel Tasks** in Target Manager.

7. Select the task **tCrunch** in the Debug view to set the scope, then select the function **crunch** in the Outline view. The Editor switches its focus and highlights the function. Several lines below **crunch**, right-click in the gutter beside line 268 (beginning **while**) and select **Breakpoints > Add Breakpoint (Scope = tCrunch)**.

8. Back in the Debug view, select **tCosmos** and click **Resume**. When **tCosmos** hits its breakpoint, click **Resume** again 9 more times. At this point the task **tCrunch** hits its breakpoint and both tasks stop.

2.7.6 System Mode Debugging

In system mode, when a breakpoint is hit, the whole system stops.

1. Before switching to system mode, highlight **tCrunch** and **tCosmos** in the Debug view, click **Resume**, then click **Disconnect** (not **Terminate**).
2. In the Target Manager, right-click your target (which should still be running), then select **Target Mode > System** to switch into system mode.
3. Open the target console by right-clicking your target and selecting **Target Tools > Target Console**. At the prompt, type **i** to display the list of running tasks. If you clicked **Disconnect** (and not **Terminate**), **tCosmos** and **tCrunch** are still running.
4. In the Target Manager, right-click your target and select **Attach to Kernel (System Mode)**.

Once the target is in system mode, you can right-click various system tasks and select **Attach to Kernel Task (System Mode)**. Then when the system stops, you can get the backtrace of the tasks you have attached.

5. Right-click **tCosmos** and **tCrunch** and select **Attach to Kernel Task**. The tasks appear in the Debug view.
6. Select **monitor** in the Outline view; this will switch the Editor's focus to that part of **cobble.c**.
7. Set a breakpoint by right-clicking in the gutter next to line 302 (beginning **if**).

If you select **Breakpoints > Add Breakpoint (Scope = tCosmos)**, the breakpoint will never be triggered because the code is only run by the **tMonitor** task.

Therefore, set the breakpoint using either **Scope = Unrestricted** or **Scope = tMonitor** (you must select **tMonitor** in the Debug view before you can choose it as the breakpoint scope).

8. When the breakpoint is triggered, the whole system stops, as shown in the Target Manager and in the Debug view. If you try to type something in the target console, nothing appears because the whole target is stopped.

9. Remove the breakpoint by right-clicking it in the Breakpoints view and selecting **Remove**. In the Debug view, select **tMonitor** and click **Resume** to resume the system.

2.7.7 Using Core Dump Files

You can use core dump files to see backtraces of various tasks.

1. On the Target Manager toolbar, click **Create a New Target Connection**.
2. In the New Connection wizard, select **Wind River VxWorks 5.5.x Core Dump Connection**, then click **Next**.
3. On the next screen, type in or navigate to the location of your core dump file and the VxWorks kernel image. Click **Next** through the next few screens and adjust settings if necessary, then click **Finish**. Since **Immediately connect to target if possible** is selected by default, the connection definition will appear in the Target Manager and Workbench will connect.
4. A dialog appears telling you that the core dump was successfully attached, but since Workbench cannot determine the cause for a VxWorks 5.5 core dump the cause is listed as **UNKNOWN**. The dialog also displays the program counter of the current execution context.
5. In the Debug view, the backtrace of the current execution context appears. Note that the run control icons are disabled. You can also attach to other tasks and see their backtraces.

2.7.8 Using Already Available Tornado 2 Projects

You can import existing Tornado 2 projects into Workbench.

1. Create a new user-defined project by selecting **File > New > User-Defined Project**.
2. In the Target Operating System dialog, select **Wind River VxWorks 5.5** (this allows you to use the Tornado 2 compilers). Click **Next**.
3. On the next screen, type a descriptive name into the **Project name** field, then select **Create project at external location** and type in or browse to the location of your existing Tornado 2 project. Click **Next**.
4. A dialog appears telling you that the directory you pointed to already contains project information. Click **Yes** to overwrite existing project information.

5. Click **Finish**. Your project now appears in the Project Navigator.
6. Right-click the new project and select **Build Project**. Since this is a user-defined project, the build calls the Makefile generated by Tornado 2 tools. If you need to add or remove files, you still need to use the Tornado 2 IDE or edit the Makefile manually.

To launch Tornado from Workbench, select **Target > Launch Wind River Tornado**.

To debug a kernel module, proceed as described in [2.7.4 Launching a Kernel Task and Attaching the Debugger](#), p.30. You can also import a kernel project and rebuild it as well.

Workbench provides added value over Tornado in your ability to use the Retriever, the Outline view, and the very powerful static analysis tools to manage your projects.

Limitations and Known Issues

To have module synchronization, you must specify the **-s** option to the target server.

When the target loads a module, it appears in the Target Manager. You can select and delete it, and it will disappear from the Target Manager, but the module is still running on the target. This is because the target server cannot remove a module loaded by the target. This is a limitation of Tornado 2, and the Workbench debugger cannot overcome this limitation.

This chapter has been a brief introduction to basic operations with perspectives, views, and editors, and simple debugging capabilities. The rest of this guide provides more in depth information about these and other features of Wind River Workbench.

3

Setting Up Your Hardware

- 3.1 Introduction 35
- 3.2 Configuring Your Cross-Development System 39
- 3.3 Setting Up a Boot Mechanism 48
- 3.4 Booting VxWorks 49
- 3.5 Configuring Host-Target Communication for Workbench 60
- 3.6 Troubleshooting VxWorks Problems 66

3.1 Introduction

This chapter explains how to configure your host and target, including how to download a VxWorks image and boot your target.

For a discussion of common configuration and setup problems and tips for how to solve them, see [26.5 Troubleshooting VxWorks Configuration Problems](#), p.339. For definitions of terminology that may be unfamiliar to you, see [B. Glossary](#).

You do not need much of this chapter if all you want to do is connect to a target that is already set up on your network. If this is the case, read [3.2 Configuring Your Cross-Development System](#), p.39 and then proceed with [3.4 Booting VxWorks](#), p.49.

3.1.1 Overview of Host and Target Configuration Tasks

Host Configuration Tasks

You will need to complete these configuration tasks once per host:

- Install Wind River Workbench.
- Configure TCP/IP for your host.
- Configure a method for transferring a VxWorks image to your target, such as FTP on Windows and Linux or `rsh` on Solaris.

Target Configuration Tasks

You will need to complete these configuration tasks once *for each new target*:

- Install the VxWorks boot loader for your target (see the *Wind River Workbench On-Chip Debugging Guide* for details).
- Set up one or more physical connections between your target and host.
- Define a Workbench target server to connect to the new target.

Normal Operation

You will need to repeat these tasks each time you want to re-initialize your target during development:

- Boot VxWorks on the target. VxWorks includes a target agent, the interface between VxWorks and all other Wind River Workbench tools, by default.
- Launch or restart a Workbench target server on the host.



NOTE: Paths to Workbench directories and files are prefixed by *installDir* in this guide. Substitute the actual path to your Workbench installation directory.

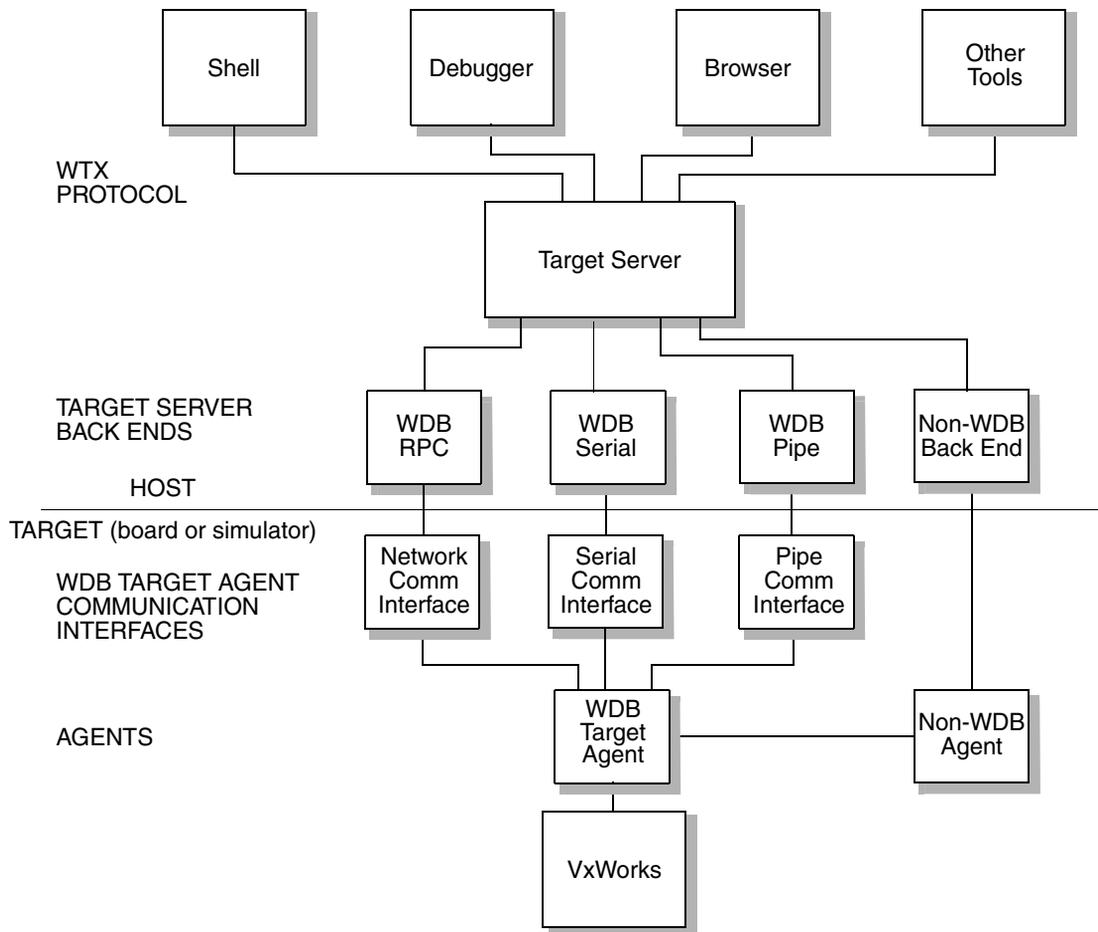
3.1.2 Understanding Target Servers and Target Agents

Wind River Workbench host tools such as shells and debuggers communicate with the target system through a *target server*. A target server can be configured with a

variety of *back ends*, which provide for various modes of communication with the *target agent*. On the target side, VxWorks can be configured and built with a variety of target agent communication interfaces.

Your choice of target server back end and target agent communication interface is based on the mode of communication that you establish between the host and target (network, serial, JTAG, and so on). The target server *must* be configured with a back end that matches the target agent interface with which VxWorks has been configured and built. See [Figure 3-1](#) for a detailed diagram of host-target communications.

Figure 3-1 Wind River Workbench Host-Target Communication



Target Agent Modes

All of the standard target server back ends included with Workbench connect to the target through the target agent. Thus, in order to understand the features of each back end, you must understand the modes in which the target agent can execute. These modes are called *user mode*, *system mode*, and *dual mode*.

- In user mode, the agent runs as a VxWorks task. Debugging is performed on a per-task basis: you can isolate the task or tasks of interest without affecting the rest of the target system.
- In system mode, the agent runs externally from VxWorks, almost like a ROM monitor. This allows you to debug an application as if it and VxWorks were a single thread of execution. In this mode, when the target run-time encounters a breakpoint, VxWorks and the application are stopped and interrupts are locked. One of the biggest advantages of this mode is that you can single-step through ISRs; on the other hand, it is more difficult to manipulate individual tasks. Another drawback is that this mode is more intrusive; it adds significant interrupt latency to the system, because the agent runs with interrupts locked when it takes control (for example, after a breakpoint).
- In dual mode, two agents are configured into the run-time simultaneously: a user-mode agent, and a system-mode agent. Only one of these agents is active at a time; switching between the two can be controlled from either the Workbench debugger (see [25.5 Using Debug Modes](#), p.311) or the host shell (see *Wind River Workbench Command Line Tools User's Guide: Using the Host Shell*).

In order to support a system-mode or dual-mode agent, the target communication path must work in polled mode (because the external agent needs to communicate to the host even when the system is suspended). Thus, the choice of communication path can affect what debugging modes are available.

Communication Paths

The most common VxWorks communication path—both for server-agent communications during development, and for applications—is TCP/IP networking over Ethernet. That connection method provides a very high bandwidth, as well as all the advantages of a network connection.

Nevertheless, there are situations where you may wish to use a non-network connection, such as a serial line or a ROM-emulator connection. For example, if you have a memory-constrained application that does not require networking, you may wish to remove the VxWorks network code from the target system during

development. Also, if you wish to perform system-mode debugging, you need a communication path that can work in polled mode.

Note that the target server back end connection is not always the same as the connection used to load the VxWorks image into target memory. For example, you can boot VxWorks over Ethernet, but use a serial line connection to exploit a polled-mode serial driver for system-mode debugging.

You can also use a non-default method of getting the run-time system itself into your target board. For example, you might burn your VxWorks run-time system directly into target ROM, as described in the *VxWorks Programmer's Guide: Configuration and Build*. Alternatively, you can use a ROM emulator to quickly download new VxWorks images to the target's ROM sockets. Another possibility is to boot from a disk locally attached to the target; see the *VxWorks Programmer's Guide: Local File Systems*. Individual Board Support Packages (BSPs) may provide other alternatives, such as flash memory; see the reference information for your BSP.

For a tutorial that explains how to use Wind River ICE or Wind River Probe to load the run-time system onto your target, see *Wind River ICE for Wind River Workbench Hardware Reference* or *Wind River Probe for Wind River Workbench Hardware Reference*.

3.2 **Configuring Your Cross-Development System**

Before VxWorks can boot an executable image obtained from the host, the network software on the host must be correctly configured (see [Configuring Host Software](#), p.39), your target must be connected and powered up (see [Verifying Serial Setup and Power](#), p.44), and the boot loader must be loaded onto your target.

3.2.1 **Configuring Host Software**

For your target to communicate with the Workbench host tools, you need to have a Wind River registry, TCP/IP, and FTP running on your host.

The following sections describe these procedures in more detail.

Establishing the VxWorks Target Name and IP Address

You can configure the server that provides Domain Name Service (DNS) so that your computer uses that server to translate system names to network IP addresses. Consult your operating system documentation on how to configure your system to take advantage of DNS.

If you do not have a domain name server at your site, you can specify how to map machine names to IP addresses in a file called **hosts** (C:\Windows\system32\drivers\etc\hosts on Windows, /etc/hosts on Linux and Solaris) which records the names and IP network addresses of systems accessible on the network from the local system (otherwise, you would have to identify targets by IP address).

Each line consists of an IP address and the name (or names) of the system at that address.

For example, suppose your host system is called **mars** and has Internet address 90.0.0.1, and you want to name your VxWorks target **phobos** and assign it address 90.0.0.50. The **hosts** file must then contain the following lines:

```
90.0.0.1      mars
90.0.0.50    phobos
```

This configuration is represented in [Figure 3-7](#).



CAUTION: If you are in a networked environment, do not pick arbitrary IP addresses for your host and target as they could be assigned to someone else. Contact with your system administrator for available IP addresses.

Configuring FTP on Windows

To use the default VxWorks configuration and boot VxWorks over the network, you must have an FTP server running on the host where the VxWorks system image is stored, and the FTP server must have a user ID and password defined that your VxWorks target can use to identify itself.

Workbench includes an FTP server application, **WFTPD**. Start this FTP server from the Windows **Start** menu by selecting **Programs > Wind River > VxWorks 6.x and General Purpose Technologies > FTP Server**.

Before an FTP client can connect to WFTPD, you must complete the following steps:

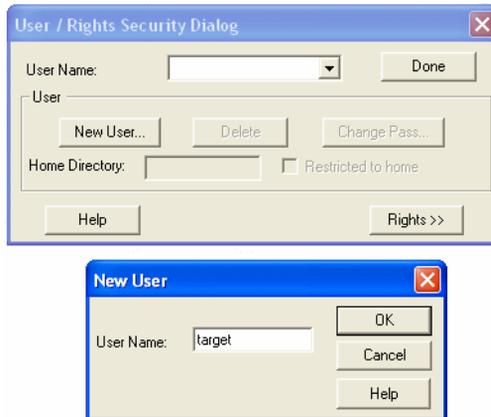
1. Open the WFTPD window and select **Security > Users/rights** ([Figure 3-2](#)).

Figure 3-2 WFTPD Security Menu



2. WFTPD displays the **User / Rights Security Dialog** box shown in Figure 3-3. Click the **New User** button; another dialog box (also shown in Figure 3-3) appears where you can enter whatever arbitrary name you wish as the user ID for the VxWorks boot ROM. Be sure to use this same name when you assign the **user (u)** VxWorks boot parameter described in [3.4.4 Description of Boot Parameters](#), p.54.

Figure 3-3 Adding a New User for WFTPD



3. After you specify the user name and click **OK**, WFTPD displays a third dialog box where you can specify a password (Figure 3-4). Use any memorable arbitrary string, and be sure to use this same string when you assign the **ftp password (pw)** VxWorks boot parameter described in [3.4.4 Description of Boot Parameters](#), p.54.

Because the password does not display as you type it, you must type it twice to be sure the correct password is recorded.

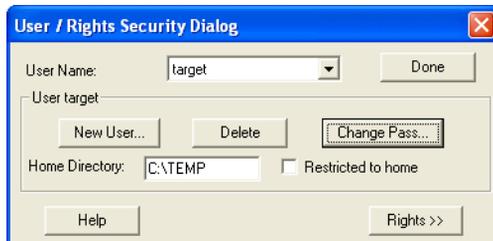
Figure 3-4 WFTPD Password Dialog Box



→ **NOTE:** Your password must not be an empty string.

4. After defining the new user ID and password, be sure to fill in the **Home Directory** text box (Figure 3-5). The VxWorks boot loader does not require this information, but WFTPD refuses to connect to a client unless you specify a home directory. Any directory will be fine, as long as you permit sufficient disk access for the VxWorks boot loader to read the boot image on your Windows disk.

Figure 3-5 WFTPD Home Directory



5. Close the **User / Rights Security Dialog** box by clicking **Done**.

→ **NOTE:** You can run the FTP server as a restricted user, but you cannot add new users and passwords if you are a restricted user. A non-restricted user must add the new users and passwords for you.

6. To enable logging of FTP activities, select **Logging > Log Options** and select the types of activities you want to log. The log file will be saved in the home directory you specified above.

When you have finished configuring your FTP settings, leave the FTP server running. It must be running on your host when your target tries to access the vxWorks image.

Becoming Familiar with the Wind River Registry

The Wind River target server registry is a service that keeps track of running target servers. The registry must be running for Workbench tools to communicate with VxWorks targets. Workbench development tools communicate with the target server using TCP/IP, which in turn communicates with the VxWorks target over the selected communication method (such as serial, Ethernet, or TMD). The registry is always required, independent of the link between the target server and the VxWorks target.

Workbench starts the default registry automatically, though if required you can connect to a registry running on a networked host instead (see [19.6 Connect to the Target](#), p.236 for details about connecting to other registries).

You can tell that the Wind River registry is running on your host system if:

- The registry icon is displayed in the Windows system tray.
- Running the **ps** command on Linux or Solaris shows **wtxregd.ex** in the jobs list.

To shut down the registry:

- Right-click the registry icon in the Windows system tray and select **Shutdown**.
- Type **killall wtxregd.ex** in a Solaris terminal window.
- Type **wrenv.linux -p workbench-2.5 wtxregd stop** in a Linux terminal window.

Changing Wind River Registry Daemon Default Behavior

The behavior of the Wind River registry daemon can be changed by updating the registry default options. These options control the location of the registry daemon database, log file locations, levels, and timeouts, and so on.

You can update the registry default options from a terminal window command line, or by modifying the registry daemon default options configuration file (*installDir/workbench-2.5/foundation/4.x/resource/wtxregd/wtxregd.conf*).

For available options and other information about the operation of the registry, type *installDir/workbench-2.5/foundation/4.x/host_type/bin/wtxregd help* at a command line, refer to the **wtxregd.conf** file, or see the online reference entry for **wtxregd** (**Help > Help Contents > Wind River Documentation > References > Host Tools > Wind River Workbench Host Tools API Reference**).

Example Usage

Store the Wind River registry daemon database within a user specific directory.

On Windows:

```
wtxregd -d $(HOME)/registry-db
```

On UNIX:

```
wtxregd start -d $(HOME)/registry-db
```

3.2.2 Verifying Serial Setup and Power

Hardware settings are specific to your target and host. This section describes in general terms the types of hardware connections you must make to follow the instructions in this book, but be aware that you may need to make adjustments to accommodate your specific cross-development system.

Configuring your target hardware may involve the following tasks:

- Protecting your equipment against electrostatic discharge.
- Setting switches and jumpers on the target CPU board.
- Connecting a serial cable and/or an Ethernet cable, if the target supports networking.
- Connecting a power supply.

Perform the following general procedures as appropriate for your particular target hardware. For details, see the target reference for your BSP (such as *installDir/vxworks-6.x/target/config/bspname/target.ref*) and the documentation provided by your target system's manufacturer.



NOTE: If you are using a Wind River ICE or Wind River Probe emulator to connect to your target, see the *Wind River ICE for Wind River Workbench Hardware Reference* or *Wind River Probe for Wind River Workbench Hardware Reference* for information about how to connect to your target.

Protecting Equipment from Electrostatic Discharge (ESD)

You should always discharge the static electricity that may have collected on your body before you touch integrated circuit boards, including targets and network interface cards (NICs).

Electrostatic discharge precautions include:

- touching the metal enclosure of a plugged-in piece of electrical equipment (such as a PC or a power supply in a metal case)
- placing your equipment on, or standing on, an anti-static mat
- wearing an ESD wrist strap



CAUTION: Failure to take proper ESD precautions can degrade target hardware over time, leading to intermittent errors or hardware failure.

Setting Board Switches and Jumpers

Many CPU and Ethernet controller boards still have configuration options that are selected by hardware jumpers, although this is less common than in the past. These jumpers must be set correctly before VxWorks can boot successfully.

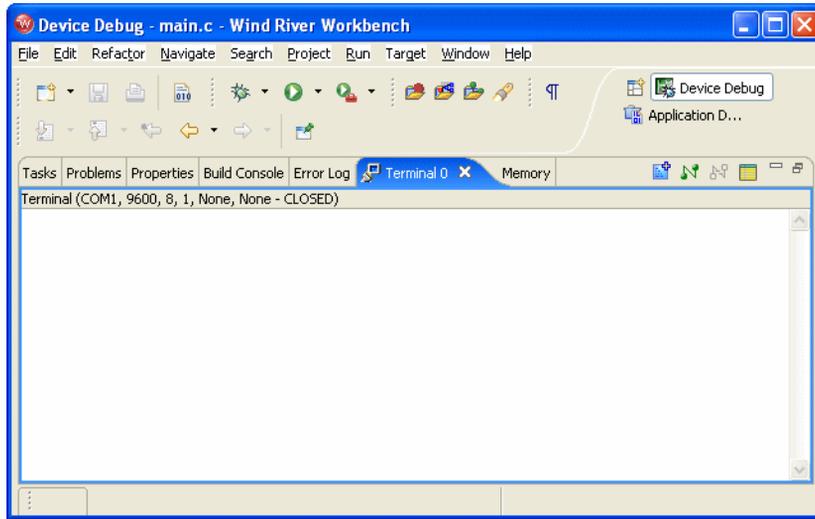
You can determine the correct jumper configuration for your target CPU from the information provided in the target information reference for your BSP, and in the target system's documentation.

Connecting a Serial Cable and Configuring the Terminal View

Most targets include at least one on-board serial port. Wind River Workbench includes a Terminal view that you can use to open a serial connection from within Workbench, just as you would with any other terminal emulation program such as hyperterminal, minicom, or telnet.

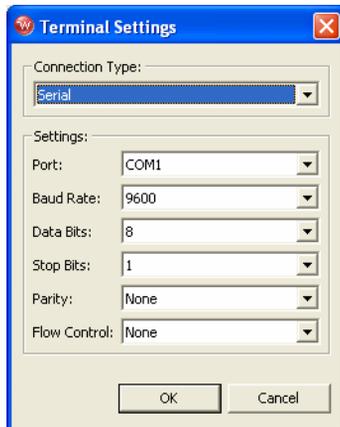
To configure the Terminal view:

1. Stop any other program already using the serial port.
2. If it is not already running, start Workbench.
3. If it is not already visible, open the Terminal view (select **Window > Show View > Terminal**).
4. To get a better view of what is happening in the Terminal view, double click on the tab at the top of the view. The view will expand to fill the Workbench window.



5. If the default settings shown at the top of the view are correct for your board, click the green **Connect** icon.

If the settings need to be adjusted, click the square **Settings** button to open the **Terminal Settings** dialog.



6. Configure the terminal settings as appropriate for your system:

Connection Type

Select **Serial**.

On Linux, if you are not running your Linux host as a root user, make sure the permissions are set correctly for you to access the serial port (if you do not have permissions set correctly, only the **NET** option is available under **Connection Type**).

To set them, issue one of the following commands (depending on which port you plan to use):

```
$ chmod 666 /dev/ttyS0  
$ chmod 666 /dev/ttyS1
```

Port

Set the port to the port you are using. Defaults are **COM1** on Windows, **ttyS0** on Linux, and **/dev/cua/a** on Solaris.

Baud Rate

Configure the baud rate to match the speed of your connection.

Data Bits

Default on all platforms is **8**.

Stop Bits

Default on all platforms is **1**.

Parity

Default on all platforms is **None**.

Flow In

Default on all platforms is **None**.

Flow Out

Default on all platforms is **None**.

7. Click **OK** to open a serial connection to your target.
8. To disconnect from your target, click **Disconnect**.
To reopen the connection with the existing settings, click **Connect**.

After initially configuring the boot parameters and getting started with VxWorks, you may wish to configure VxWorks to boot automatically without a terminal. Refer to the target system hardware documentation for proper connection of the RS-232 signals.

Connecting a Cable for the Ethernet Connection

Always make sure you use the correct cable:

- when connecting your board directly to your host, use a crossover cable
- when connecting your board to a LAN, use a non-crossover cable



CAUTION: Be sure to follow ESD precautions (see [Protecting Equipment from Electrostatic Discharge \(ESD\)](#), p.44) whenever working with integrated circuit boards, including targets and NICs.

Connecting A Power Supply

For standalone targets, use the power supply recommended by the board manufacturer.

3.3 Setting Up a Boot Mechanism

Workbench is shipped with the following VxWorks images, compiled both with the Wind River Compiler and with the GNU compiler:

```
vxWorks  
vxWorks_rom  
vxWorks_romCompress  
vxWorks_romResident
```

In every case, you will need to create your own boot medium. Your board will require one of the following media:

ROM

Most boards boot from ROMs.

For cases where boot ROMs are used to boot VxWorks, install the appropriate set of boot ROMs on your target board(s). When installing boot ROMs, be careful to:

- Install each device only in the socket indicated on the label.
- Note the correct orientation of pin 1 for each device.

- Use anti-static precautions whenever working with integrated circuit devices. For more information, see [Protecting Equipment from Electrostatic Discharge \(ESD\)](#), p.44.

Floppy Disk

Some BSPs for systems that include floppy drives use boot diskettes instead of a boot ROM. For example, Pentium systems usually boot from diskette.

Flash Memory

For boards that support flash memory, the BSP may be designed to write the boot program there. In such cases, an auxiliary program to write the boot program into flash memory is supplied by the board vendor.

For specific information on a particular booting method, see **Help > Help Contents > Wind River Documentation > Guides > Operating System > VxWorks BSP Developer's Guide**. Instructions for making a floppy disk for booting a Pentium target are in the **target.ref** file for the BSP.

You may also wish to replace a boot ROM, even if it is available, with a ROM emulator. This is particularly desirable if your target has no Ethernet capability, because the ROM emulator can be used to provide connectivity at near-Ethernet speeds. Contact Wind River for information about support for ROM emulators.

3.4 Booting VxWorks

Once you have configured your host software and target hardware, you are ready to boot VxWorks.

With your target connected to your host and a serial connection open in the Terminal view, click **Connect** (see [Connecting a Serial Cable and Configuring the Terminal View](#), p.45).



NOTE: If you are using a VxWorks image configured for a network connection (the default), you must have an FTP server running on the Windows host where the VxWorks system image is stored. See [Configuring FTP on Windows](#), p.40 for more information.

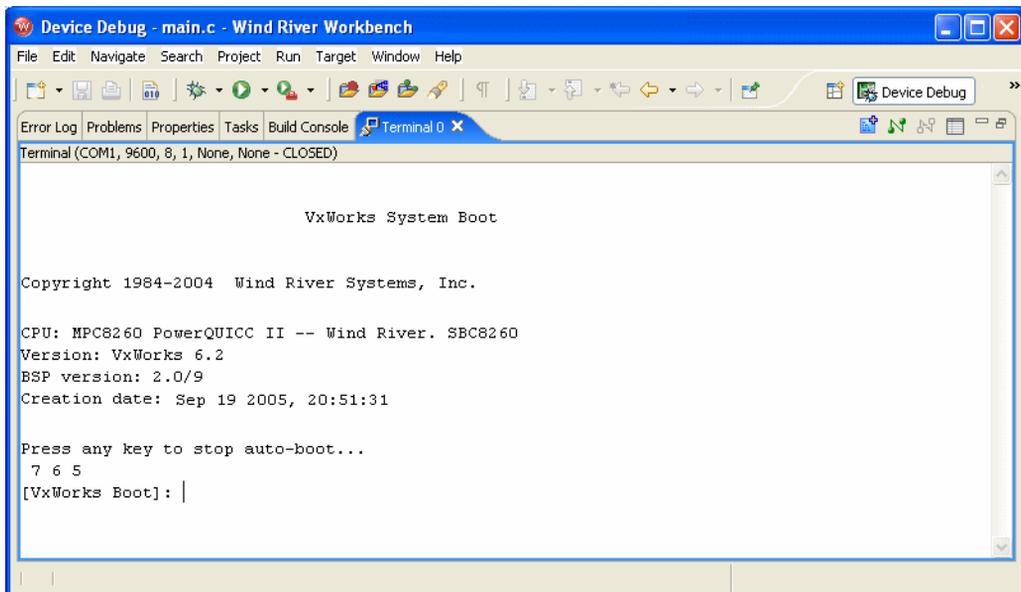
3.4.1 Default Boot Process

When you boot VxWorks with the default boot program (from a ROM, a diskette, or another medium), you must use the VxWorks command line to provide the boot program with information that allows it to find the VxWorks image on the host and load it onto the target. The default boot program is designed for a networked target, and needs to have the correct host and target network addresses, the full path and name of the file to be booted, the user name, and so on.

Unless your target CPU has non-volatile RAM (NV-RAM), you will eventually find it useful to build a new version of the boot loader that includes all parameters required for booting a VxWorks image. In the course of developing an application, you will also build bootable applications

When you power on the target hardware (and each time you reset it), the target system executes the boot program from ROM; during the boot process, the target uses its serial port to communicate with your terminal or workstation. The boot program first displays a banner page, and then starts a seven-second countdown, visible on the screen as shown in [Figure 3-6](#).

Figure 3-6 **Boot Program Banner Display**



Unless you press any key on the keyboard within that seven-second period, the boot loader will attempt to proceed with a default configuration, and will not be able to boot the target with VxWorks.

3.4.2 Entering New Boot Parameters

To interrupt the boot process and provide the correct boot parameters, first power on (or reset) the target; then stop the boot sequence by pressing any key during the seven-second countdown.

The boot program displays the VxWorks boot prompt:

```
[VxWorks Boot]:
```

To display the current (default) boot parameters, type **p** at the boot prompt:

```
[VxWorks Boot]: p
```

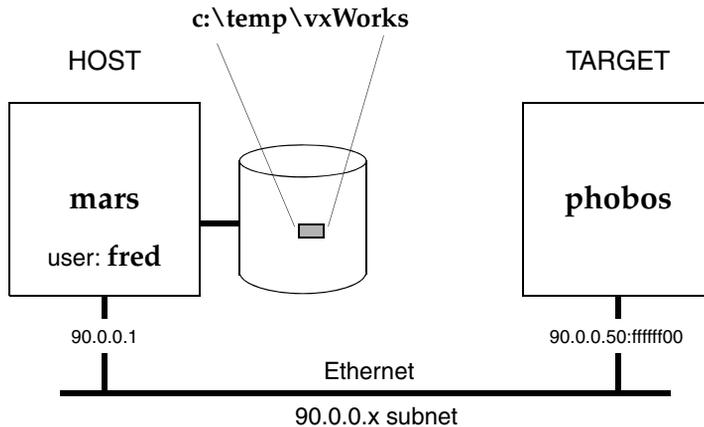
A display similar to the following appears; the meaning of each of these parameters is described in [3.4.4 Description of Boot Parameters](#), p.54.

```
boot device           : ln
unit number          : 0
processor number     : 0
host name            : mars
file name            : c:\temp\vxWorks1
inet on ethernet (e) : 90.0.0.50:ffffff00
inet on backplane (b) :
host inet (h)        : 90.0.0.1
gateway inet (g)     :
user (u)             : fred
ftp password (pw) (blank=use rsh) :secret
flags (f)            : 0x0
target name (tn)     : phobos
startup script (s)   :
other (o)            :
```

This example corresponds to the configuration shown in [Figure 3-7](#). The **p** command does not actually display the lines with blank fields, although this example shows them for completeness.

1. Pre-built VxWorks images are available in `installDir\vxworks-6.2\target\proj\bsp-compiler\default`, but in this example the `vxWorks` file has been copied to `c:\temp`.

Figure 3-7 Boot Configuration Example



To change the boot parameters, type **c** at the boot prompt:

```
[VxWorks Boot]: c
```

In response, the boot program prompts you for each parameter. If a particular field has the correct value already, press **ENTER**. To clear a field, enter a period (.), then press **ENTER**. To go back to change the previous parameter, enter a dash (-), then press **ENTER**. If you want to quit before completing all parameters, type **CTRL+D**.

Network information *must* be entered to match your particular cross-development system configuration. The Internet addresses must match those in the **hosts** file on your system (or those known to your Domain Name Server), as described in [Establishing the VxWorks Target Name and IP Address](#), p.40.

If your target has non-volatile RAM (NV-RAM), the boot parameters are stored there and retained even if power is turned off. For each subsequent power-on or system reset, the boot program uses these stored parameters for the automatic boot configuration.

3.4.3 Boot Program Commands

The VxWorks boot program provides a limited set of commands. To see a list of available commands, type either **h** or **?** at the boot prompt, followed by **ENTER**:

```
[VxWorks Boot]: ?
```

Table 3-1 describes each of the VxWorks boot commands and their arguments.

Table 3-1 **VxWorks Boot Commands**

Command	Description
h	Help command—print a list of available boot commands.
?	Same as h .
@	Boot (load and execute file) using the current boot parameters.
p	Print the current boot parameter values.
c	Change the boot parameter values.
l	Load the file using current boot parameters, but without executing.
g <i>adrs</i>	Go to (execute at) hex address <i>adrs</i> .
d <i>adrs</i>[, <i>n</i>]	Display <i>n</i> words of memory starting at hex address <i>adrs</i> . If <i>n</i> is omitted, the default is 64.
m <i>adrs</i>	Modify memory at location <i>adrs</i> (hex). The system prompts for modifications to memory, starting at the specified address. It prints each address, and the current 16-bit value at that address, in turn. You can respond in one of several ways: ENTER: Do not change that address, but continue prompting at the next address. <i>number:</i> Set the 16-bit contents to <i>number</i> . . (dot): Do not change that address, and quit.
f <i>adrs</i>, <i>nbytes</i>, <i>value</i>	Fill <i>nbytes</i> of memory, starting at <i>adrs</i> with <i>value</i> .
t <i>adrs1</i>, <i>adrs2</i>, <i>nbytes</i>	Copy <i>nbytes</i> of memory, starting at <i>adrs1</i> , to <i>adrs2</i> .
s [0 1]	Turn the CPU system controller ON (1) or OFF (0) (only on boards where the system controller can be enabled by software).
e	Display a synopsis of the last occurring VxWorks exception.

Table 3-1 VxWorks Boot Commands (cont'd)

Command	Description
v	Display BSP and boot ROM version.
N	Set Ethernet address.

3.4.4 Description of Boot Parameters

Each of the boot parameters is described below, with reference to the example in [3.4.2 Entering New Boot Parameters](#), p.51. The letters in parentheses after some parameters indicate how to specify the parameters in the command line boot procedure described in [3.4.6 Alternate Boot Methods](#), p.58.

boot device

The type of device to boot from. This must be one of the drivers included in the boot ROMs (for example, **enp** for a CMC controller). Due to limited space in the boot ROMs, only a few drivers can be included. A list of included drivers is displayed at the console (type **?** or **h**).

unit number

The unit number of the boot device, starting at zero.

processor number

A unique numerical target identifier for systems with multiple targets on a backplane. The backplane master must have its processor number set to zero. For boards not connected to a backplane, a value of zero is typically used but is not required.

host name

The name of the host machine to boot from. This is the name by which the host is known to VxWorks; it need not be the name used by the host itself. (The host name is **mars** in the example of [3.4.2 Entering New Boot Parameters](#), p.51.)

file name

The full pathname of the VxWorks image to be booted (**c:\temp\vxWorks** in the example). This pathname is also reported to the host when you start a target server, so that it can locate the host-resident image of VxWorks. The pathname is limited to a 160 byte string, including the null terminator.²

inet on ethernet (e)

The Internet Protocol (IP) address of a target system Ethernet interface, as well as the subnet mask used for that interface. The address consists of the IP address, in dot decimal format, followed by a colon, followed by the mask in

hex format (here, 90.0.0.50:ffffff00). For more information about working with IP addresses, see *Establishing the VxWorks Target Name and IP Address*, p.40.

inet on backplane (b)

The Internet address of a target system with a backplane interface (blank in the example).

host inet (h)

The Internet address of the host to boot from (90.0.0.1 in the example).

gateway inet (g)

The Internet address of a gateway node if the host is not on the same network as the target (blank in the example).

user (u)

The user ID that VxWorks uses to access the host for the purpose of boot loading the file specified by the **filename** boot parameter (**fred** in the example); use the user name you created in *Configuring FTP on Windows*, p.40. That user must have permission to read the VxWorks boot-image file.

On a Windows host, the user must have FTP access to that host. On a UNIX host, the user must have FTP or **rsh** access. The **ftp password** boot parameter described below controls how the boot loader accesses the host. For **rsh**, the user must be granted access by adding the user ID to the host's **/etc/host.equiv** file, or more typically to the user's **.rhosts** file (**~userName/.rhosts**).

ftp password (pw)

The **user** password used by the boot loader to access the host using FTP for the purpose of boot loading the file specified by the **filename** boot parameter. Use the password you created in *Configuring FTP on Windows*, p.40.



NOTE: This field is not required by the boot program, but you must supply it to boot over the network from a Windows host. Without it, the boot ROM attempts to load the run-time system image using a protocol based on the UNIX **rsh** utility, which is not available for Windows hosts. So an FTP password is required, but only for host access during boot loading.

2. If the same pathname is not suitable for both host and target—for example, if you boot from a disk attached only to the target—you can specify the host path separately to the target server, using the **-c filename** option in the **Advanced Target Server Options** field of the **New Target Server Connection** dialog.

flags (f)

Configuration options specified as a numeric value that is the sum of the values of selected option bits defined below. (This field is zero in the example because no special boot options were selected.)

- 0x01 = Do not enable the system controller, even if the processor number is 0. (This option is board specific; refer to your target documentation.)
- 0x02 = Load all VxWorks symbols^a, instead of just globals.
- 0x04 = Do not auto-boot.
- 0x08 = Auto-boot fast (short countdown).
- 0x20 = Disable login security.
- 0x40 = Use BOOTP to get boot parameters.
- 0x80 = Use TFTP to get boot image.
- 0x100 = Use proxy ARP.
- 0x200 = Use WDB agent.
- 0x400 = Set system to debug mode for the error detection and reporting facility (depending on whether you are working on kernel modules or user applications, for more information see the *VxWorks Kernel Programmer's Guide: Error Detection and Reporting* or the *VxWorks Application Programmer's Guide: Error Detection and Reporting*).

- a. Very large symbol loads can cause delays of up to several minutes while Workbench loads the symbols. For information about how to specify the size of the symbol batch to load, see *Wind River Workbench User Interface Reference: Debug View*.

target name (tn)

The name of the target system to be added to the host table (here, **phobos**).

startup script (s)

If the kernel shell is included in the downloaded image, this parameter allows you to pass to it the path and filename of a startup script to execute after the system boots. A startup script file can contain only the shell's C interpreter commands. This parameter can also be used to specify process-based applications to run automatically at boot time, if VxWorks has been configured with the appropriate components. See *VxWorks Application Programmer's Guide: Applications and Processes* and *Target Tools*.

other (o)

This parameter is generally unused and available for applications (blank in the example). It can be used when booting from a local SCSI disk to specify a network interface to be included.

3.4.5 Booting With New Parameters

After entering the boot parameters, initiate booting by typing the @ command:

```
[VxWorks Boot]: @
```

Figure 3-8 VxWorks Booting Display

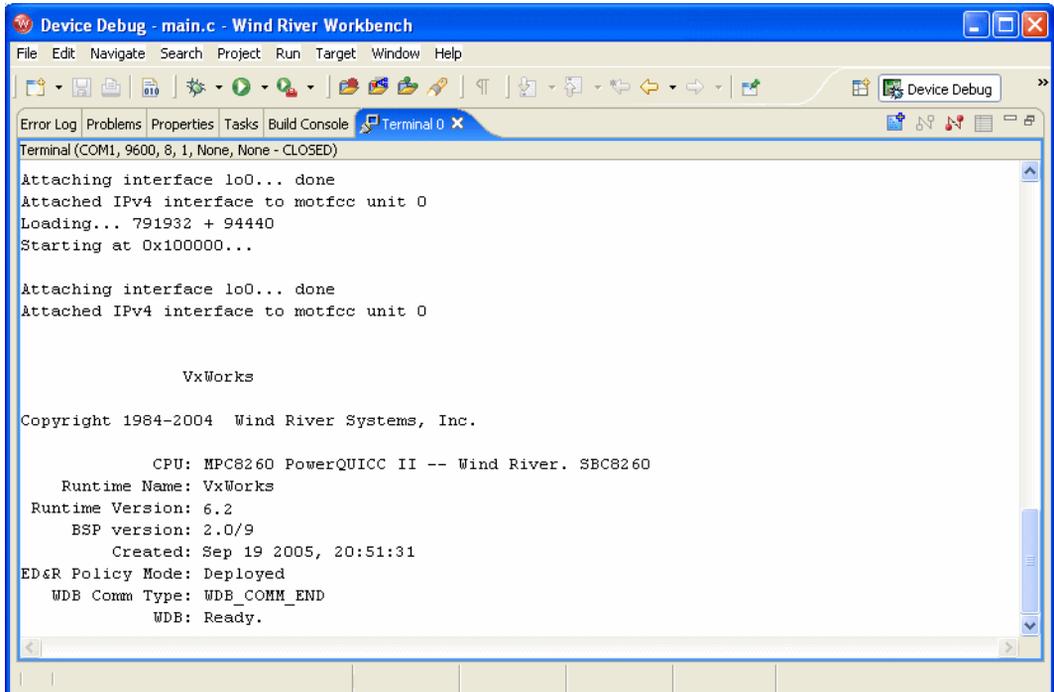


Figure 3-8 shows a typical VxWorks boot display. The VxWorks boot program prints the boot parameters, and the downloading process begins.

The following information is displayed during the boot process:

- The boot program first initializes its network interfaces.
- After the system is completely loaded, the boot program displays the entry address and transfers control to the loaded VxWorks system.
- When VxWorks starts up, it begins just as the boot ROM did, by initializing its network interfaces; the network-initialization messages appear again, sometimes accompanied by other messages about optional VxWorks facilities.

- After this point, VxWorks is up and ready to attach to the Wind River Workbench tools.
- The boot display may be useful for troubleshooting. The following hints refer to [Figure 3-8](#). For more troubleshooting ideas, see [26.5 Troubleshooting VxWorks Configuration Problems](#), p.339.
 - If **Attaching network interface** is displayed without the corresponding **done**, verify that the system controller is configured properly and the network interface card is properly jumpered. This error may also indicate a problem with the network driver in the newly loaded VxWorks image.
 - If **Loading...** is displayed for more than 30-45 seconds without the size of the VxWorks image appearing, this may indicate problems with the Ethernet cable or connection, or an error in the network configuration (for example, a bad host or gateway Internet address).
 - If the line **Starting at** is printed and there is no further indication of activity from VxWorks, this generally indicates there is a problem with the boot image.

3.4.6 Alternate Boot Methods

To boot VxWorks, you can also use the command line, take advantage of non-volatile RAM, or create new boot programs for your target.

Command Line Parameters

Instead of being prompted for each of the boot parameters, you can supply the boot program with all the parameters on a single line at the boot prompt (**[VxWorks Boot]:**) beginning with a dollar sign character (“\$”). For example:

```
$ln(0,0)mars:c:\temp\vxWorks e=90.0.0.50 h=90.0.0.1 u=fred pw=...
```

The order of the assigned fields (those containing equal signs) is not important. Omit any assigned fields that are irrelevant. The codes for the assigned fields correspond to the letter codes shown in parentheses by the **p** command. For a full description of the format, see the reference entry for **bootParseLib**.

This method can be useful if your workstation has programmable function keys. You can program a function key with a command line appropriate to your configuration.

Non-volatile RAM (NV-RAM)

As noted previously, if your target CPU has non-volatile RAM (NV-RAM), all the values you enter in the boot parameters are retained in the NV-RAM. In this case, you can let the boot program auto-boot without having a terminal program connected to the target system.

Customized Boot Programs

See the *VxWorks Kernel Programmer's Guide* for instructions on creating a new boot program for your boot media, with parameters customized for your site. With this method, you no longer need to alter boot parameters before booting.

BSPs Requiring TFTP on the Host

Some Motorola boards that use Bug ROMs and place boot code in flash require the TFTP protocol on the host in order to burn a new VxWorks image into flash. Workbench ships with a version of TFTP. See your target system documentation on how to burn flash for these boards.

3.4.7 Rebooting VxWorks

When VxWorks is running, there are several ways you can reboot it. Rebooting by any of these means restarts the attached target server on the host as well:

- Entering **CTRL+X** in the Terminal view (other Windows terminal emulators do not pass **CTRL+X** to the target, because of its standard Windows meaning.)
- Invoking **reboot()** from the host shell.
- Pressing the reset button on the target system.
- Turning the target's power off and on.

When you reboot VxWorks in any of these ways, the auto-boot sequence begins again from the countdown.



CAUTION: Be sure to follow ESD precautions (see *Protecting Equipment from Electrostatic Discharge (ESD)*, p.44) whenever working with integrated circuit boards, including targets and NICs.

3.5 Configuring Host-Target Communication for Workbench

If you are developing applications, an Ethernet connection is the easiest to set up and use, since most VxWorks targets already use the network (for example, to boot), so no additional target set-up is required. Furthermore, a network interface is typically a board's fastest physical communication channel.

If you need a JTAG or other emulator connection, see the *Wind River ICE for Wind River Workbench Hardware Reference* or the *Wind River Probe for Wind River Workbench Hardware Reference* for information about making emulator connections to your target.

The next few sections describe the setup of Ethernet, serial line, and TMD connections within Workbench.

3.5.1 Ethernet Connections

When VxWorks is configured and built with a network interface for the target agent (the default configuration), the target server can connect to the target agent using the default *wdbrpc* back end.



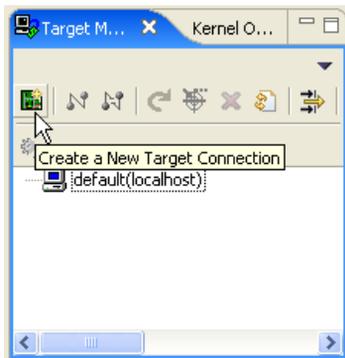
NOTE: If you experience problems when using Workbench tools with a hardware platform with a new Ethernet driver/chipset, it is highly recommended that you use the WDB agent over a different communications link (such as serial or the JTAG Transparent Mode Driver) isolate if the driver is the source of the problem.

The target agent can receive requests over any device for which a VxWorks network interface driver is installed. The typical case is to use the device from which the target was booted; however, any device can be used by specifying its IP address to the target server.

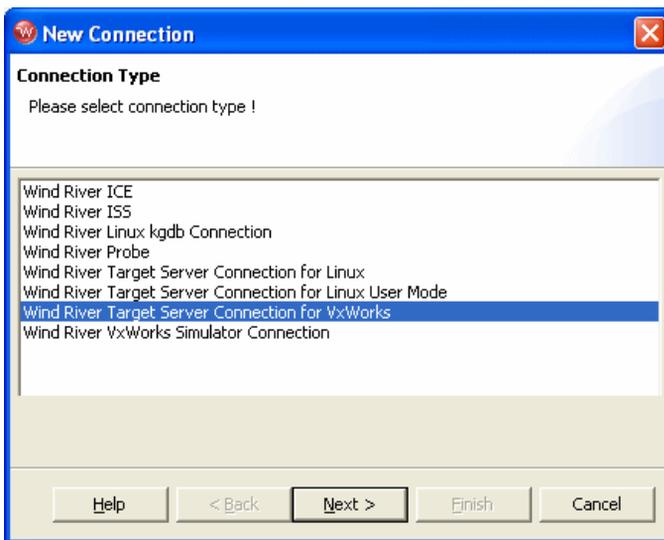
Connecting to the Target Server

You can connect the target server to the agent by following these steps:

1. Click the **Create a new target connection** icon in the Target Manager toolbar.

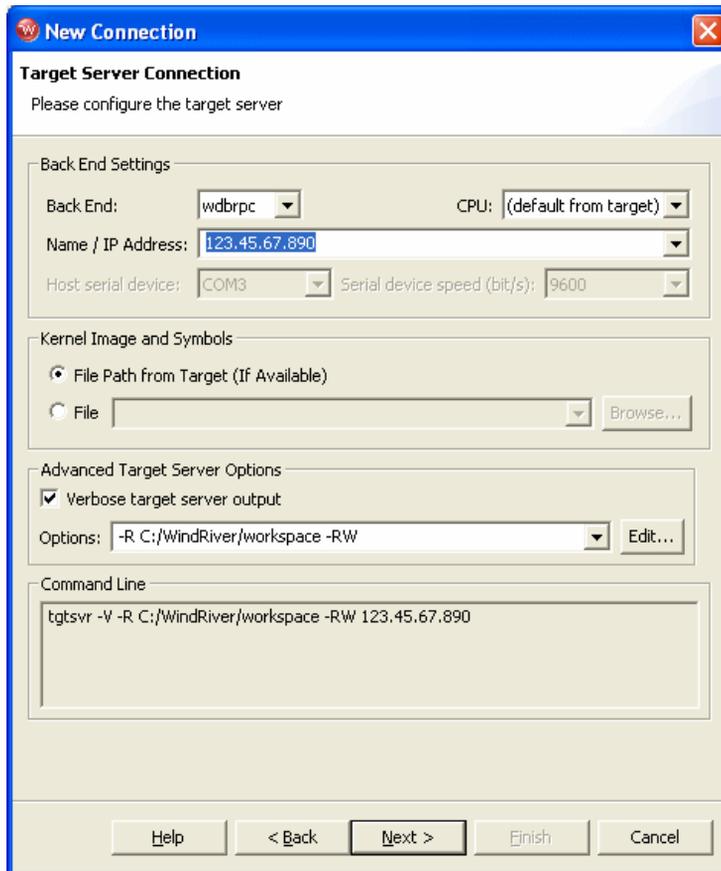


The **Connection Type** dialog appears.



NOTE: You will see both VxWorks and Linux connection types only if you have licensed both products.

2. Select **Wind River Target Server Connection for VxWorks** then click **Next**. The **Target Server Connection** dialog appears.



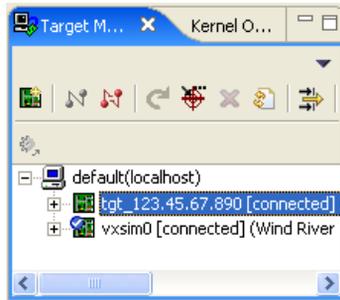
3. Select the **wdbrpc** back end, and type in the name or IP address of the target (you may specify a name only if you added it to your hosts file in [Establishing the VxWorks Target Name and IP Address](#), p.40).
4. In the **Advanced Target Server Options** section, select the **Verbose target server output**.

Your command line should look like this:

```
tgtsvr -V -R C:/installDir/workspace -RW ipaddress
```

5. Click **Next** through the next two screens, then click **Finish**. Your new target server connection definition will appear in the Target Manager connection list, along with the simulator connection definition you created in [2.3.5 Creating a Connection Definition to the VxWorks simulator](#), p.17.

The **Immediately connect to target if possible** box is selected by default, so if your target booted successfully in *Booting With New Parameters*, p.57, the Target Manager will attempt to connect to your target.



6. If everything is set up properly, you will see **[connected]** after the target server connection. If you have problems connecting, see *Troubleshooting VxWorks Configuration Problems*, p.339.

3.5.2 Serial-Line Connections

A minimal cross-development configuration is one in which the standalone target is connected to the host development system by a single serial line. For a configuration of this sort, use a combination of a boot mechanism that does not require a network and an alternative Workbench communications back end.

Workbench can operate over a raw serial connection between the host and target systems, and can operate on non-networked systems, but this type of connection is very slow and may not be practical for real-world debugging.

When you connect the host and target exclusively over serial lines, you must:

- Configure and build a boot program to download over the serial connection, or build an image that boots directly from on-board Flash/ROM memory.
- Reconfigure and rebuild VxWorks with a target agent configuration for a serial connection.
- Configure and start a target server for a serial connection.

A raw serial connection has some advantages over an IP connection. The raw serial connection allows you to scale down the VxWorks system (even during development) for memory-constrained applications that do not require networking: you can remove the VxWorks network code from the target system.

When working over a serial link, use the fastest possible line speed. The Workbench tools—especially the debugger—make it easy to set up system snapshots that are periodically refreshed. Refreshing such snapshots requires continuing traffic between host and target. On a serial connection, the line speed can be a bottleneck in this situation. If your Workbench tools seem unresponsive over a serial connection, try turning off periodic updates in the browser, or else closing any debugger displays you can spare.

Configuring the Target Agent For Serial Connection

To configure the target agent for a raw serial communication connection, reconfigure and rebuild VxWorks with a serial communication interface for the target agent (see the *VxWorks Programmer's Guide* for details).

Configuring the Boot Program for Serial Connection

When you connect the host and target exclusively over serial lines, you must configure and build a boot program for the serial connection because the default boot configuration uses an FTP download from the host.

Testing the Connection

Be sure to use the right kind of cable to connect your host and target. Use a simple Tx/Rx/GND serial cable because the host serial port is configured not to use handshaking. Many targets require a null-modem cable; consult the target system's documentation. Configure your host system serial port for a full-duplex (no local echo), 8-bit connection with one stop bit and no parity bit. The line speed must match whatever is configured into your target agent.

Before trying to attach the target server for the first time, test that the serial connection to the target is good. To help verify the connection, the target agent sends the following message over the serial line when it boots (with `WDB_COMM_SERIAL`):

```
WDB READY
```

To test the connection, attach a terminal emulator to the target-agent serial port, then reset the target (see [Connecting a Serial Cable and Configuring the Terminal View](#), p.45). If the `WDB READY` message does not appear, or if it is garbled, check the configuration of the serial port you are using on your host.

As a further debugging aid, you can also configure the serial-mode target agent to echo all characters it receives over the serial line. This is not the default configuration, because as a side effect it stops the boot process until a target server is attached. If you need this configuration in order to set up your host serial port, edit `installDir\vxworks-6.1\target\config\comps\src\wdbSerial.c`.

Look for the following lines:

```
#ifdef INCLUDE_WDB_TTY_TEST
{
    int waitChar = 0;

    if (WDB_TTY_ECHO)
        waitChar = 0333;

#ifdef INCLUDE_KERNEL
    /* test in polled mode if the kernel hasn't started */

    if (taskIdCurrent == 0)
        wdbSioTest (pSioChan, SIO_MODE_POLL, waitChar);
    else
        wdbSioTest (pSioChan, SIO_MODE_INT, waitChar);
#else /* INCLUDE_KERNEL */
    wdbSioTest (pSioChan, SIO_MODE_POLL, waitChar);
#endif /* INCLUDE_KERNEL */
}
#endif /* INCLUDE_WDB_TTY_TEST */
```

In each call to `wdbSioTest()`, change `waitChar` to 0300.

With this configuration, attach any terminal emulator on the host to the COM port connected to the target to verify the serial connection. When the serial-line settings are correct, whatever you type to the target is echoed as you type it.



NOTE: This configuration change also prevents the target from completing its boot process until a target server attaches to it. Thus, it is best to change the `wdbSioTest()` calls back to the default as soon as you verify that the serial line is set up correctly.

Connecting to the Target Server

After successfully testing the serial connection, you can connect the target server to the agent by following steps similar to those in [Connecting to the Target Server](#), p.60:

1. Close the serial port that you opened for testing (if you do not close the port, it will be busy when the target server tries to use it).

2. Click the **Create a new target connection** icon in the **Target Manager** toolbar. The **Connection Type** dialog appears.
3. Select **Wind River Target Server Connection** then click **Next**. The **Target Server Connection** dialog appears.
4. Select the **wdbserial** back end, and type in the name or IP address of the target (you may specify a name only if you added it to your hosts file in [Establishing the VxWorks Target Name and IP Address](#), p.40).
5. In the **Advanced Target Server Options** section, select **Verbose target server output**, then specify the communications port with **-d**, and also specify the line speed to match the speed configured into your target. Your command line should look like this:

```
tgtsvr -v -d comport -bps speed -B wdbserial ipaddress
```
6. Click **Next** through the next two screens, then click **Finish**. Your new target server connection definition will appear in the Target Manager connection list.
7. Select the target server definition you just created, then click the **Connect** icon. If everything is set up properly, you will see **[connected]** after the target server connection. If you have problems connecting, see [Troubleshooting VxWorks Configuration Problems](#), p.339.

3.6 Troubleshooting VxWorks Problems

If you encountered problems booting or exercising VxWorks, there are many possible causes. Read [26.5 Troubleshooting VxWorks Configuration Problems](#), p.339 before contacting Wind River customer support. Often, you can locate the problem just by rechecking the installation steps and your hardware configuration.

PART II
Projects

4	Projects Overview	69
5	VxWorks Image Projects	83
6	Boot Loader Project	97
7	VxWorks ROMFS File System Projects	101
8	VxWorks Real-time Process Projects	105
9	VxWorks Shared Library Projects	113
10	VxWorks Downloadable Kernel Module Projects	119
11	VxWorks User-Defined Projects	127
12	Native Application Projects	131
13	Working in the Project Navigator	137
14	Advanced Project Scenarios	145

4

Projects Overview

- 4.1 Introduction 69
- 4.2 Workspace/Project Location 70
- 4.3 Creating New Projects 70
- 4.4 Overview of Preconfigured Project Types 71
- 4.5 Projects and Project Structures 77

4.1 Introduction

Workbench uses projects as logical containers and as building blocks that can be linked together to create a software system. The Project Navigator lets you, among other things, visually organize projects into structures that reflect their inner dependencies, and therefore the order in which they are compiled and linked.

Pre-configured templates for various project types allow you to create or import projects using simple wizards that need only minimal input.

4.2 Workspace/Project Location

The Wind River Workbench cannot know where your source files are located, so it initially suggests a default workspace directory within the installation directory. However, this is not a requirement, or even necessarily desirable. If you use a workspace directory outside of the Workbench installation tree this ensures that the integrity of your projects is preserved after product upgrades or installation modifications.

Normally, you would set your workspace directory at the root of your existing source code tree and create your Workbench projects there. For multiple, unrelated source code trees, you can use multiple workspaces.

4.3 Creating New Projects

Although you can create projects anywhere, you would generally create them in your workspace directory (see [4.2 Workspace/Project Location](#), p.70, above). If you follow this recommendation, there will generally be no need to navigate out of the workspace when you create projects. Note that if you do create projects outside the workspace, you must have write permission at the external location because Workbench project administration files are written to this location.

To create a new project, select **File > New > Project** to open the New Project wizard. It will help you create one of the pre-configured project types. You can also select the specific type of project you want to create from **File > New > ProjectType**. For more information about these projects, see [Overview of Preconfigured Project Types](#), p.71.

To create one of the demonstration sample projects, select **File > New > Example** to open the New Example wizard. Each comes with instructions explaining the behavior of the program.

Whichever menu command you choose, a wizard will guide you through the process of creating the specific type of project you select. Note that most settings in the New Project wizard can be inspected and modified at any time after project creation in the Project Properties, see [16.4 Accessing Build Properties](#), p.188

For step-by-step descriptions of how to create projects of each type, see the chapters:

- [5. VxWorks Image Projects](#)
- [6. Boot Loader Project](#)
- [7. VxWorks ROMFS File System Projects](#)
- [8. VxWorks Real-time Process Projects](#)
- [9. VxWorks Shared Library Projects](#)
- [10. VxWorks Downloadable Kernel Module Projects](#)
- [11. VxWorks User-Defined Projects](#)
- [12. Native Application Projects](#)

4.3.1 Subsequent Modification of Project Creation Wizard Settings

All project creation wizard settings can be modified in the Project Properties once the project exists. To access the Project Properties from the Project Navigator, right-click the icon of the project you want to modify and select **Properties**.

Project structural settings (sub- and superproject context of the project you are creating) can be most easily modified in the Project Navigator by dragging-and-dropping project folders into or outside other folders.

4.3.2 Projects and Application Code

All application code is managed by projects of one type or another. You can import an existing Workbench-compatible project as a whole, or you can add new or existing source code files to your projects. For more information, see *Wind River Workbench User Interface Reference: Import File Dialog*.

4.4 Overview of Preconfigured Project Types

Different types of projects are used for different purposes. Workbench supports a number of such project types, each of which will be discussed in more detail in later chapters. This section contains a brief overview of the available project types.

In the Project Navigator, you can identify the project type by its icon.

Table 4-1 **Project Type Icons**

Icon	Project Type
	<i>VxWorks Image Project</i> , p.72
	<i>VxWorks Boot Loader Project</i> , p.73
	<i>VxWorks Downloadable Kernel Module Project</i> , p.73
	<i>Real-time Process Project</i> , p.74
	<i>VxWorks Shared Library Project</i> , p.75
	<i>VxWorks ROMFS File System Project</i> , p.75
	<i>VxWorks User-Defined Projects</i> , p.76
	<i>Native Application Project</i> , p.76



NOTE: This manual does not discuss Middleware Component projects, as they are only functional if you have licensed the **Wind River Platforms** product. For more information about these projects, see the documentation for your run-time technologies products.

This manual also does not discuss Standalone Application Projects, as they are only functional if you have licensed the **Wind River On-Chip Debugging** product. For more information about these projects, see *Wind River Workbench On-Chip Debugging Guide: Using the OCD Standalone Project Wizard*.

4.4.1 Workbench Sample Projects

A good place to start exploring the sample projects is [2. Wind River Workbench Tutorials](#). The Guide uses sample projects to walk you through many aspects of Workbench and shows you some of the project types introduced below.

4.4.2 VxWorks Image Project

Use a VxWorks Image project to configure (customize/scale) and build a VxWorks kernel image to boot your target. By adding a VxWorks ROMFS File System project

and kernel modules, applications, libraries and data files, you can link a complete system into a single image.

A new VxWorks Image project can be based either on an existing project of the same type, or on a *Board Support Package*. For more information, please see [5.7 Notes on Board Support Packages \(BSPs\)](#), p.95.

Please refer to [5. VxWorks Image Projects](#) for more information on working with this type of project.

4.4.3 VxWorks Boot Loader Project

Use a *VxWorks Boot Loader* project to create a VxWorks *boot loader* (also referred to as the VxWorks *boot ROM*) to boot load a target with the VxWorks kernel.

Boot loaders are used in a development environment to load a VxWorks image that is stored on a host system, where VxWorks can be quickly modified and rebuilt. Boot loaders are also used in production systems where both the boot loader and operating system image are stored on a disk.

Boot loaders are not required for standalone VxWorks systems that are stored in ROM.

4.4.4 VxWorks Downloadable Kernel Module Project

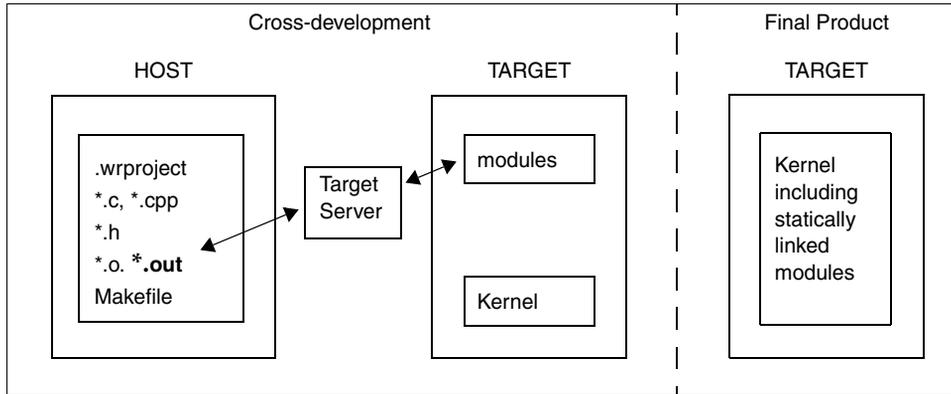
Use *Downloadable Kernel Module* projects to manage and build modules that will exist in the kernel space. You can separately build the modules, run, and debug them on a target running VxWorks, loading, unloading, and reloading on the fly. Once your development work is complete, the modules can be statically linked into the kernel, or they can use a file system if one is present (see [4.4.7 VxWorks ROMFS File System Project](#), p.75). [Figure 4-1](#) illustrates a situation without a file system on the target.

Kernel-mode development is the traditional VxWorks method of development; all the tasks you spawn run in an unprotected environment, and all have full access to the hardware in the system.

A Downloadable Kernel Module that is linked into the kernel is a bootable application that starts when the target is booted.

Please refer to [10. VxWorks Downloadable Kernel Module Projects](#) for more information on working with this type of project.

Figure 4-1 Downloadable Kernel Modules: Overview



4.4.5 Real-time Process Project

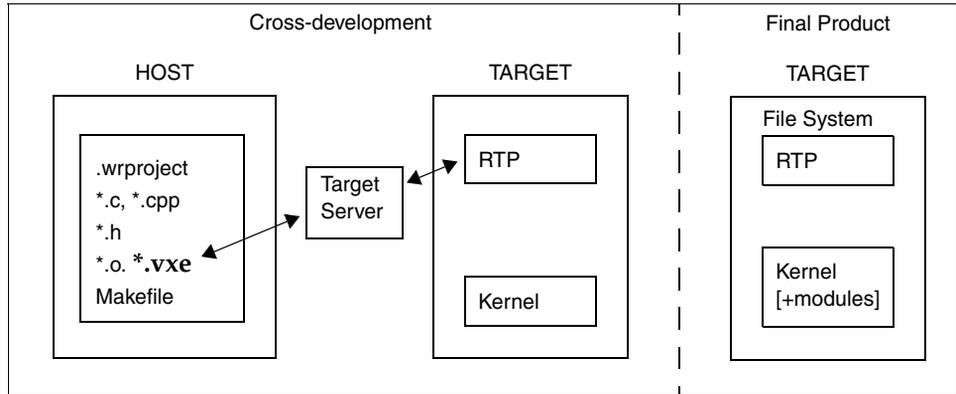
Use *Real-time Process* projects to manage and build executables that will exist outside the kernel space. You can separately build, run, and debug the executable.

At run-time, the executable file is downloaded to a separate process address space to run as an independent process. A Real-time Process binary can be stored on a target-side file system such as ROMFS, see [7. VxWorks ROMFS File System Projects](#).

Please refer to [8. VxWorks Real-time Process Projects, 17.6 Executables that Dynamically Link to Shared Libraries](#), p.203, and [18. RTPs and Shared Libraries from Host to Target](#) for more information on working with this type of project.

[Figure 4-2](#) shows how executables, when loaded into a Real-time Process, run as a separate entity from the kernel.

Figure 4-2 Real-time Processes: Overview



4.4.6 VxWorks Shared Library Project

Use *VxWorks Shared Library* projects for libraries that are dynamically linked to VxWorks Real-time Process projects at run-time. Such a shared library will need to be stored, like the Real-time Process project, on a target-side file system, which can be created using [4.4.7 VxWorks ROMFS File System Project](#), p.75. You can also use VxWorks Shared Library projects to create subprojects that are statically linked into other project types at build time.

Please refer to [9. VxWorks Shared Library Projects](#), [17.6 Executables that Dynamically Link to Shared Libraries](#), p.203, and [18. RTPs and Shared Libraries from Host to Target](#) for more information on working with this type of project.

4.4.7 VxWorks ROMFS File System Project

Use a *VxWorks ROMFS File System* project as a subproject of any other project type that requires target-side file system functionality.

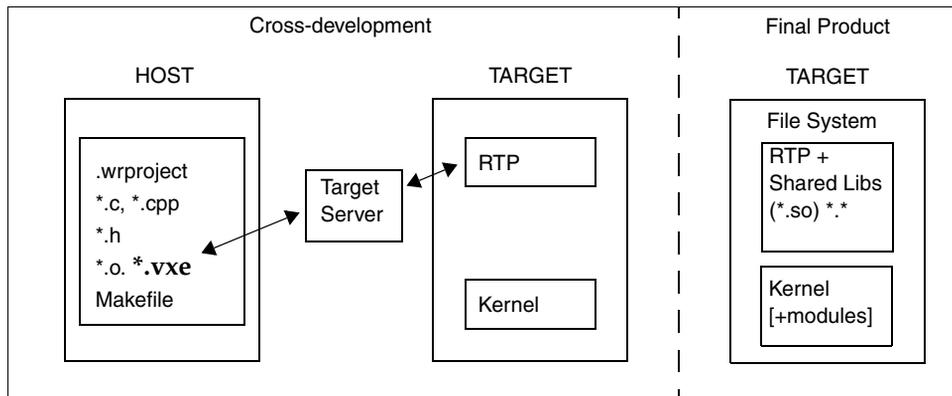
So, for example, you may not need a file system project for Downloadable Kernel Module projects (which can be linked to the VxWorks kernel directly, see [10. VxWorks Downloadable Kernel Module Projects](#) for details), but you will need to create one for other project types.

This project type is designed for bundling applications and other files, of any type, with a VxWorks system image in a ROMFS file system. No storage media is required beyond that used for the VxWorks boot image. Therefore, no other file

system is required to store files; systems can be fully functional without recourse to local or NFS drives, RSH or FTP protocols, and so on. Note that the name ROMFS has nothing to do with ROM media. It stands for *Read Only Memory File System*.

Please refer to [7. VxWorks ROMFS File System Projects](#) for more information on working with this type of project.

Figure 4-3 **VxWorks ROMFS File System: Overview**



4.4.8 VxWorks User-Defined Projects

VxWorks User-Defined projects assume that you are responsible for setting up and maintaining your own build system, file system population, and so on. The user interface nevertheless provides support for the following:

- You can configure the build command used to launch your build utility; this allows you to start builds from the Workbench GUI.
- You can create build targets in the Project Navigator that reflect rules in your makefiles; this allows you to select and build any of your make rules directly from the Project Navigator.
- Build output is captured to the Build Console.

4.4.9 Native Application Project

Use a *Native Application project* for C/C++ applications developed for your host environment. Wind River Workbench provides build and static analysis support

for native GNU 2.9x, GNU 3.x, and Microsoft development utilities (assembler, compiler, linker, archiver). There is no debugger integration for such projects in Workbench, so you have to use the appropriate native tools for debugging.

4.5 Projects and Project Structures

All individual projects of whatever type are self-contained units that have no inherent relationship with any other projects. The system as such is initially completely flat and unstructured. You can, however, construct hierarchies of project references within Workbench. These hierarchies will reflect inter-project dependencies and therefore also the build order.

When you attempt to create such hierarchies of references, this is validated by Workbench; that is, if a certain project type does not make sense as a subproject of some other, or even the same, project type, such a reference will not be permitted.

4.5.1 Adding Subprojects to a Project

Workbench provides several ways to create a subproject/superproject structure:

- In the **New Project** wizard, use the **Project Structure** dialog to specify a superproject and subprojects. This method works only when a project is first created and only if a valid existing superproject is selected in the Project Navigator when the **New Project** wizard is invoked.
- Drag-and-drop nodes in the Project Navigator. This is the easiest way to set up a structure among existing projects. Select the project that you want to make into a subproject and drag it onto its new parent (superproject).
- Use the **Add as Project Reference** dialog. In the Project Navigator, select the project that you want to make into a subproject and choose **Project > Add as Project Reference** (or right-click the project node and choose **Add as Project Reference**). In the dialog, you will see a list of valid superprojects; you can select more than one.
- Use the **Project References** page in the **Properties** dialog. In the Project Navigator, select the project that you want to make into a *super*project and choose **Project > Properties** (or right-click the project node and choose

Properties). Then select **Project References**. In the dialog, you will see a list of projects; select the ones that you want to make into subprojects.

Subproject nodes appear as a subnodes of their parents (superprojects); see [Figure 4-4](#) and [Figure 4-5](#).

Workbench validates subproject/superproject relationships based on project type and target operating system. It does not allow you to create certain combinations. For example, a Real-time Process project cannot be a direct subproject of a VxWorks Image project (but it can be added to a ROMFS File System project). In general, a user-defined project can be a subproject or superproject of any other project with a compatible target operating system.

For additional information about project structure, see [14.4 Complex Project Structures](#), p. 148.

Removing Subprojects

To undo a subproject/superproject relationship, use one of these methods:

- In the Project Navigator, select the subproject and choose **Project > Remove Project Reference** (or right-click the subproject and choose **Remove Project Reference**).
- In the Project Navigator, select the superproject and choose **Project > Properties** (or right-click the superproject and choose **Properties**). Then select **Project References** and uncheck the subprojects that you want to disassociate from their current parent.

4.5.2 Project Structures and Host File System Directory Structure

A tree of directories has only one Workbench project at the top, all subdirectories will automatically be included in this project. Do *not* attempt to create project hierarchies by creating projects for subdirectories in a tree. This will result in overlapping projects, which is not permissible.

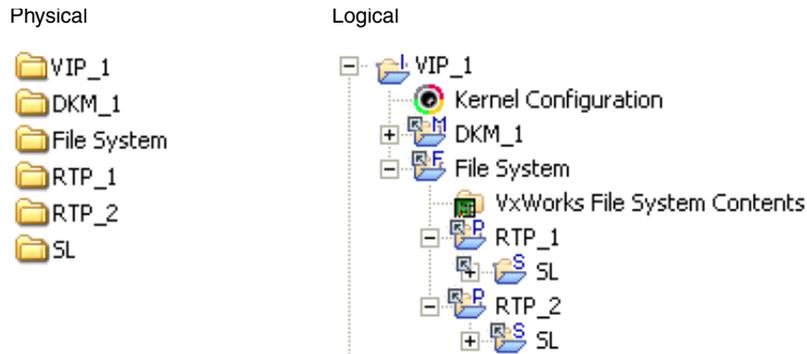
[Figure 4-4](#) illustrates an ideal host file system directory structure. This flat system, on the left, maps to the project structure displayed on the right, which also represents the ideal (recommended) basic project structure (assuming you need all the project types displayed).

The illustrated project structure is achieved as follows:

1. Create a project for each of the directories on the left.

2. In the Project Navigator, drag and drop the individual projects into place.

Figure 4-4 **Workspace/Directory Structure and Project Structure**



4.5.3 Project Structures and the Build System

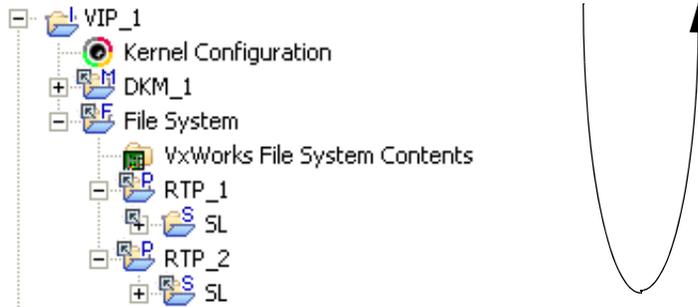
As you can see in [Figure 4-4](#) above, project structures are logical, not physical, hierarchies. These hierarchies define and reflect the inner dependencies between projects, and therefore also the order in which they have to be built.



NOTE: All references in this section to *build* and *the build system* assume that your projects use Workbench build support. That is, your user-defined projects are not automatically included in these descriptions, though it is possible to integrate custom projects into such a system.

[Figure 4-5](#) illustrates the build order in this project structure. The build starts at the top of the structure, recursively checks dependencies in each branch, and builds all out of date objects and targets at each leaf, until it finishes at the top of the tree.

Figure 4-5 **Build Order in Project Structures**



Assuming that everything in [Figure 4-5](#) needs to be built, the build order will be:

1. DKM_1
2. SL
3. RTP_1
4. (SL already built in 2 above.)
5. RTP_2
6. FS
7. VIP_1

4.5.4 Project Structures and Sharing Subprojects

Project structures can share subprojects. That is, a single physical project can be referenced by (dragged and dropped into) any number of logical project structures.

The products of any update or build of a subproject, or element thereof, will be available to project structures that reference that subproject.

4.5.5 Customizing Build Settings for Shared Subprojects

A single file system folder can be imported into multiple logical project structures, appearing as a subproject of each one. In each case, you can assign a different build specification (known as a *build spec*) depending on what is required by each project.

A folder can also be assigned several different build specs within the same project.

Later, when you set a particular active build spec for the project as a whole, the sub folder that is assigned the same build spec will be included in the build, while others assigned different build specs will be excluded. See [17.5 Architecture-Specific Implementation of Functions](#), p.202 for an example.

5

VxWorks Image Projects

- 5.1 Introduction 83
- 5.2 Importing a VxWorks Image Project 84
- 5.3 Creating a VxWorks Image Project 85
- 5.4 VxWorks Image Projects in the Project Navigator 88
- 5.5 Configuring Kernel Components 93
- 5.6 Adding Application Projects to the VxWorks Image Project 94
- 5.7 Notes on Board Support Packages (BSPs) 95

5.1 Introduction

Use a *VxWorks Image* project (VIP) to configure, customize, scale, and build a VxWorks kernel image to boot your target. A VIP can be a complete application and can also contain projects of other types. For example, you can add Downloadable Kernel Modules or, through an intermediary VxWorks ROMFS File System, Shared Libraries and Real-time Processes to your VIP.

A new VxWorks Image project can be based on an existing VIP (which can be imported into your workspace; see *Importing a VxWorks Image Project*, p.84) or on a *Board Support Package* (see *5.7 Notes on Board Support Packages (BSPs)*, p.95).

5.2 Importing a VxWorks Image Project

One situation where you would want to import a VxWorks Image project is if you are using the `vxprj` command-line project facility to build a custom board support package (see the *VxWorks Command-Line Tools User's Guide: Working with Projects and Components* and the `vxprj` API reference entry for more information).

You can then import the custom-built BSP into Workbench as follows:

1. Right-click the Project Navigator and choose **Import**.
2. Select **Existing VxWorks Image Project into Workspace**, then click **Next**.
3. Browse to the location of the custom-built BSP (a `*.wpj` file), click **Finish**.

5.2.1 Migrating a VxWorks Image Project

In Workbench 2.2 and 2.3, the `.wrmakefile` template used to generate the Makefiles for the VIP project contained all functionality on how to build VIP projects.

In Workbench 2.4, the VIP-specific instructions moved to a dedicated `vxWorks.makefile`, which now contains the necessary functionality to build the VIP. The `.wrmakefile` now only covers generic managed build process instructions such as recursion.

So when migrating existing VIP projects created with versions older than Workbench 2.4 to Workbench 2.5, you must update the makefile template manually.

- If you updated your Workbench installation to version 2.4 or 2.5 and want to continue using VxWorks 6.1, copy over the newly installed (version 2.4 or 2.5) `.wrmakefile` and `vxWorks.makefile` to your existing VIP project to cause the project to work properly with the new build system. The simplest way to get these files is to create a new VIP (using the defaults), copy over the two files, and delete the VIP again.
- If you also updated your VxWorks installation to version 6.2 or 6.3, then you must not only copy over the above two files but also run `tcMigrate` to migrate your VIP project from VxWorks 6.1 to 6.2 or 6.3.

For more information about migrating to a new version of VxWorks, see the `tcMigrate` help entry (by typing `tcMigrate` into the help system **Search** field) and the *Wind River Workbench Migration Guide: Workbench Projects*.



NOTE: If you made any manual modifications to your previous `.wrmakefile` file, you must manually migrate those to the new version of the file. If your modifications affected VxWorks image-specific instructions, migrate them to the new `vxWorks.makefile`.

5.3 Creating a VxWorks Image Project

Before creating the project, please take a look at the general comments on projects and project creation in [4. Projects Overview](#).

To create a VxWorks Image project, proceed as follows.

1. Choose **File > New > VxWorks Image Project**.

The **New VxWorks Image Project** wizard appears. If applicable, you are asked to select a target operating system. Select a VxWorks version from the drop-down list and click **Next**.

2. You are asked to enter a **Project name** and **Location**.

If **Create project in workspace** is selected, the project is created in the current workspace. If **Create project at external location** is selected, you can navigate to a directory outside the workspace. See also [4.2 Workspace/Project Location](#), p.70.

When you are ready, click **Next**.

3. The next page of the wizard asks what the project is based on. You are asked whether you would like to base your project on **An existing VxWorks Image project**, or on **A board support package (BSP)**.

- If you have already configured a **VxWorks Image project** that closely matches your current needs, you can base your project on that.

Project creation will be faster using an existing VxWorks Image project since the project facility does not have to regenerate configuration information from BSP configuration files. The files are simply copied.

- You can select a supplied BSP from the dropdown list, or navigate to a third party or other custom BSP (see also [5.7 Notes on Board Support Packages \(BSPs\)](#), p.95). The list of known BSPs will depend on the BSPs you have installed (including the simulator).



NOTE: Once the VxWorks Image project is created, you cannot change the BSP that it is based on. You must create a new project with the correct BSP.

- If you select **A board support package**, you are asked to select a **Tool chain**. A tool chain is the suite of tools (compiler, linker, and so on) that will be used to build projects. This is part of the build spec that configures how things are built. The available list of tool chains depends on what you have installed.



NOTE: If you intend to select one of the VxWorks scalability profiles, your toolchain must be based on the Wind River Compiler (**diab**).

When you are ready, click **Next**.

4. You are asked to select networking options for the kernel.
 - Select **Use IPv6 enabled kernel libraries** to include IPv6 support.
 - Select **Use System Viewer free kernel libraries** to exclude Wind River System Viewer support. This option builds the project without System Viewer instrumentation, provided the kernel has previously been compiled with **OPT=-fr** or **OPT=-inet6_fr** specified. (Instrumentation-free kernel libraries are not supplied with the product.)

For information on building the VxWorks kernel, see the source-code installation and build instructions in your getting started guide. For information about the System Viewer, see the *Wind River System Viewer User's Guide*.

- Select **Use source mode build** to build from source, rather than from libraries, whenever possible. This compiles only those parts of the system that are needed by that specific project configuration, greatly increasing its ability to scale VxWorks down to smaller sizes. Source builds also enable the system to perform better, because only the needed source is compiled.

If the component configuration does not allow a build from source, then the project facility will build from libraries as usual.



NOTE: In this release, only the following BSPs allow configurations that are buildable from source: **integrator1136jfs**, **wrSbcPowerQuiccII**, **wrPpmc74xx**, **Bcm1250_cpu0_mips64**, **Bcm1250_cpu1_mips64**, **Bcm1250eCpu0_mips64**, and **Bcm1250eCpu1_mips64**.

When you are ready, click **Next**.

5. You are asked if you want to select a kernel configuration **Profile**. A *Profile* is a preconfigured collection of kernel components that attempts to match given needs. Selecting a profile can save you quite a bit of manual configuration, but it is not required.

PROFILE_MINIMAL_KERNEL—Minimal VxWorks Kernel Profile

This profile provides the lowest level at which a VxWorks system can operate. It consists of the micro-kernel, and basic CPU and BSP support. This profile is meant to provide a very small VxWorks systems that can support multitasking and interrupt management at a very minimum, but semaphores and watchdogs are also supported by default. (See the *VxWorks Profiles for a Scaling the Operating System* section in *VxWorks Kernel Programmer's Guide: Kernel*.)

PROFILE_BASIC_KERNEL—Basic VxWorks Kernel Profile

This profile builds on the minimal kernel profile, adding support for message queues, task hooks, and memory allocation and deallocation. Applications based on this profile can be more dynamic and feature rich than the minimal kernel. (See the *VxWorks Profiles for a Scaling the Operating System* section in *VxWorks Kernel Programmer's Guide: Kernel*.)

PROFILE_BASIC_OS—Basic VxWorks OS Profile

This profile provides a small operating system on which higher level constructs and facilities can be built. It supports an I/O system, file descriptors, and related ANSI routines. It also supports task and environment variables, signals, pipes, coprocessor management, and a VxWorks ROMFS file system. (See the *VxWorks Profiles for a Scaling the Operating System* section in *VxWorks Kernel Programmer's Guide: Kernel*.)

PROFILE_COMPATIBLE—VxWorks 5.5 Compatible Profile

This profile provides the minimal configuration that is compatible with VxWorks 5.5.

PROFILE_DEVELOPMENT—VxWorks Kernel Development Profile

This profile provides a VxWorks kernel that includes development and debugging components.

PROFILE_ENHANCED_NET—Enhanced Network Profile

This profile adds to the default profile certain components appropriate for typical managed network client host devices. The primary components added are the DHCP client and DNS resolver, the Telnet server (shell not included), and several command-line-style configuration utilities.

Please refer to the *VxWorks Kernel Programmer's Guide: Kernel* and the help page for **vxprj::profile** for more information about profiles.



CAUTION: The OS scale profiles (**PROFILE_MINIMAL_KERNEL**, **PROFILE_BASIC_KERNEL**, and **PROFILE_BASIC_OS**) are built from source code, so you must install VxWorks source to use them. For this release, the profiles can only be built with the Wind River Compiler. In addition, the profiles are only available for the BSPs listed in the Note on page 86.

When you are ready, click **Next**.

6. You are asked to configure **Static Analysis** settings. Static analysis is enabled by default, but you can disable it if you prefer. This is sometimes useful, especially for very large projects or when you can import shared static analysis data from your team. For details, see [15.5 Static Analysis](#), p. 175.
7. When you are done configuring your project, click **Finish**. The new VxWorks Image project will appear at the root level in the Project Navigator.



NOTE: If Workbench encounters a problem during project configuration, it will display an error and ask you if you want to delete the project. If you click **OK**, the New Project wizard will reappear with all the settings you chose for the project that failed. This gives you the opportunity to fix just the setting causing the problem, rather than having to re-enter all the selections in the wizard.

If you do not want to fix the problem and recreate the project, click **Cancel**.

5.4 VxWorks Image Projects in the Project Navigator

After a VxWorks Image project has been created (see [5.3 Creating a VxWorks Image Project](#), p. 85), a number of nodes appear in the Project Navigator. This section describes these nodes as they appear immediately after project creation, as well as some that only appear after the projects are built using a specific build specification (referred to here, and in the user interface as build spec).

For general notes about manipulating nodes, for example, moving, copying, filtering, and so forth, please see [13. Working in the Project Navigator](#).

5.4.1 Global Project Nodes



ProjectName

The icon at the root of the project tree identifies the type of project; the icon's label is the name you gave the project when you created it.



Kernel Configuration

Immediately below the project node of a VxWorks Image project, there is the **Kernel Configuration** node. Double-click the **Kernel Configuration** node to open the **Kernel Editor**. Please refer to [5.5 Configuring Kernel Components](#), p.93, for information on using this editor.

5

5.4.2 Project Build Specs and Target Nodes

Each target node is associated with a predefined build spec.

The default VIP target is a RAM-based image. If you want to create an image of another type, select a different target node when you build the project. See [Creating New Build Targets](#), p.90 for more information.



NOTE: What follows is a typical list of build specs. The build specs initially available for a project are determined by the board support package. The VxWorks simulator BSP (see [5.7.1 Using the Simulator BSP](#), p.95) does not supply ROM build specs.

default

This represents the target built using the **default** build spec and appears immediately after the project is created. It is a RAM-based image, usually loaded into memory by a VxWorks boot loader. This is the default development image and the only one that is available if you specify a simulator as your target “board”. It is also available in formats such as **vxWorks.bin** and **vxWorks.hex**. The **.hex** options are variants of the main options with Motorola S-Record output. The **.bin** options are variants of the main options with binary output.

default_rom

This is a ROM-based image that copies itself to RAM before executing. This image generally has a slower startup time, but a faster execution time than **default_romResident**. It is also available in **.bin** and **.hex** formats.

default_romCompress

A compressed ROM image that copies itself to RAM and decompresses before executing. It takes longer to boot than **default_rom** but takes up less space than other ROM-based images (nearly half). The run-time execution is the same speed as **default_rom**. It is also available in **.bin** and **.hex** formats.

default_romResident

A ROM-resident image. Only the data segment is copied to RAM on startup. It has the fastest startup time and uses the smallest amount of RAM. Typically, however, it runs slower than the other ROM images because ROM access is slower. It is also available in **.bin** and **.hex** formats.

Creating New Build Targets

To add a build target to a project, select the project and choose **File > New > Build Target** (or right-click on the project and choose **New > Build Target**). Type a name for the new build target and click **Finish**.

For VxWorks Image projects, build-target names should have the form **vxWorks[type][format]**, where *type* can be empty (the default RAM-based image), **_rom**, **_romCompress**, or **_romResident**, and *format* can be empty (the default ELF image), **.bin**, or **.hex**. Examples:

```
vxWorks  
vxWorks.hex  
vxWorks_rom  
vxWorks_romResident.hex  
vxWorks_romCompress.bin
```

Each target name corresponds to one of the build specs described above. Target names are case-sensitive and must be spelled correctly to invoke the intended predefined build specs.

5.4.3 Build Output Folders

When you create the project, a node called **vxWorks (default)** is added to the project tree. It will hold the build output of the **default** target (created by setting the active build spec to **default**). Nodes are created for each target as you build

them. The names of the nodes match those of the targets and will, once built, hold the corresponding target's build output.

Other build output folders will be created if you use other build specs. These will have the same names as the build spec used (see [5.4.2 Project Build Specs and Target Nodes](#), p.89).

5.4.4 Makefile Nodes

Three Makefiles are created in the project folder. One is a template that can also be used for entering custom make rules. The others are dynamically regenerated from build spec data at each build.



.wrmakefile

A template used by Wind River Workbench to generate the project's **Makefile**. Add user-specific build-targets and make rules in this file. These will then be automatically dumped into the Makefile.



Makefile.mk

Called from **Makefile**. Connects the Workbench project to the VxWorks build system. Includes a list of components and build parameters. Do not edit.



Makefile

Do *not* add custom code to this file. This **Makefile** is regenerated every time the project is built. The information used to generate the file is taken from the build specification on which the target node is based.

5.4.5 Project File Nodes

The project creation facility generates, or includes copies of, a variety of files when a VxWorks Image project is created.

Application Initialization Stubs

Two of the files that are copied to the project at creation time are stubs for entering calls to your application code:



usrAppInit.c

A stub for adding DKM application initialization routines.



usrRtpAppInit.c

A stub for adding RTP application initialization routines.

Other Project Files

Normally, you need not be concerned with the remaining project files. However, here a brief summary of the remaining VxWorks Image project files displayed in the Project Navigator:



***projectName*.wpj**

Contains information about the project used for generating the project makefile, as well as project source files such as **prjConfig.c**.



.project

Eclipse platform project file containing builder information and project nature.



.wrproject

Workbench project file containing common project properties such as project type, etc.



linkSyms.c

A dynamically generated configuration file (therefore not to be checked in to your version control system) that includes code from the VxWorks archive by creating references to the appropriate symbols. It contains symbols for components that do not have initialization routines.



prjConfig.c

A dynamically generated configuration file (therefore not to be checked in to your version control system) that contains initialization code for components included in the current configuration of VxWorks.



prjComps.h

A dynamically generated configuration file (therefore not to be checked in) that contains the preprocessor definitions (macros) used to include VxWorks components.



prjParams.h

A dynamically generated configuration file (therefore not to be checked in) that contains component parameters.

5.5 Configuring Kernel Components

The Wind River Workbench distribution includes VxWorks kernel images located in *installDir/vxworks-version/target/config*. A *kernel image* is a binary module that can be booted and run on a target system. The kernel image consists of system object modules linked into a single non-locatable object module with no unresolved external references. In most cases, you will find the supplied kernel image adequate for initial development. However, later in the cycle you may want to create a custom VxWorks kernel image.

The VxWorks kernel is a flexible, scalable operating system with numerous facilities that can be tuned, and included or excluded, depending on the requirements of your application and the stage of the development cycle. For example, various networking and file system components may be required for one application and not another; the Kernel Editor provides a simple means for including or excluding such components. In addition, it may be useful to build VxWorks with various target tools (such as the target-resident shell) during development, and then exclude them from the production application.

For more information about kernel components, please refer to the *VxWorks Kernel Programmer's Guide: Kernel*.

5.5.1 The Kernel Editor

To configure the kernel of a VxWorks Image project, in the Project Navigator, double-click the **Kernel Configuration** node immediately under the VxWorks Image project root node. This opens the **Kernel Editor**.

The **Kernel Editor** consists of three tabs (select at the bottom edge of the view).

- The **Overview** tab provides a read-only summary of the configuration that is updated by changes you make on the other two tabs.
- The **Bundles** tab allows you to add or remove entire bundles of components that you can fine-tune to your needs in the **Components** tab.
- The **Components** tab displays a tree of bundles and, at the leaf nodes of expanded bundles, individual components and their parameters.

For more information about the Kernel Editor, see *Wind River Workbench User Interface Reference: Kernel Editor View*.

5.6 Adding Application Projects to the VxWorks Image Project

Once you have created application projects, populated these with code, and successfully built them, you will want to add these to the VxWorks Image project. You may also want to add a VxWorks ROMFS file system (see [7. VxWorks ROMFS File System Projects](#)).

Step 1: Link the application projects to the VxWorks Image project.

Some projects, including downloadable kernel modules and user-defined projects, can be managed as subprojects of a VxWorks Image project. If your application projects are not already set up as subprojects of a VIP, see [4.5.1 Adding Subprojects to a Project](#), p.77 for information on how to do this. Building VIPs with application subprojects helps assure correct linking and dependency-checking.

RTP and shared-library projects cannot be direct subprojects of a VIP, but they can be subprojects of a File System project that is in turn a subproject of a VIP.

Step 2: Add the application initialization routines to the VxWorks Image project.

When VxWorks boots, it initializes all operating system components (as needed), and then passes control to the user's application for initialization. To add application initialization calls to VxWorks do the following:

- For DKM projects, double-click **userAppInit.c** to open the file for editing, and add the necessary calls to the **usrAppInit()** function.
- For RTP projects, double-click **userRtpAppInit.c** to open the file for editing, and add the necessary calls to the **usrRtpAppInit()** function.

Step 3: Configure the VxWorks Image project VxWorks kernel.

VxWorks must be configured to support the calls your application makes to it, or you will not be able to link your image. If your BSP provides a "bare-bones" VxWorks configuration, you may wish to use the Kernel Editor's **Auto Scale** facility to detect and add most of the VxWorks functionality you require.

Auto Scale will compile your code, analyze the symbols in your object modules, map them to components, and offer to include those components. There may be some components that **Auto Scale** does not detect. If you **Auto Scale**, build, and still get link errors, you will need to add the additional components from the Kernel Editor (for more information about auto scale and the kernel editor, see the *Wind River Workbench User Interface Reference: Kernel Editor View*).

5.7 Notes on Board Support Packages (BSPs)

A *Board Support Package (BSP)* consists primarily of the hardware-specific VxWorks code for a particular target board. A BSP includes facilities for hardware initialization, interrupt handling and generation, hardware clock and timer management, mapping of local and bus memory space, and so on.

You can base a VxWorks Image project on the VxWorks simulator BSP, a Wind River BSP supplied with Workbench, or a third-party BSP; or you can create your own custom BSP.

5.7.1 Using the Simulator BSP

You can base your VxWorks Image project on the VxWorks simulator BSP if you want to develop a custom BSP and application code for your product in parallel, or if your target hardware is not yet ready. The simulator BSP contains default VxWorks functionality sufficient for supporting most applications.

5.7.2 Using a Wind River or Third-Party BSP

Wind River Workbench BSP

If your BSP was installed with Workbench 2.3, you can create a VxWorks Image project from it directly (see [5.3 Creating a VxWorks Image Project](#), p.85).

Tornado 2.x BSP or SNIFF+ 4.1 and Newer BSP

For information on migrating a Tornado 2.x-compliant BSP or a SNIFF+ 4.1 (or newer) BSP to Workbench, see the *Wind River Workbench Migration Guide*.

5.7.3 Using a Custom BSP for Custom Hardware

Creating a BSP

If you need to create your own BSP, please refer to the *VxWorks BSP Developer's Guide*. If you wish to develop the BSP and the application code in parallel, you may

want to begin application development on the VxWorks Simulator. See [5.7.1 Using the Simulator BSP](#), p.95.

Using a Pre-Existing BSP with the Wind River Workbench Project Facility

If you already have a custom BSP that is Tornado 2.x compliant, please see the *VxWorks Migration Guide* for information on migrating to Workbench.

If you already have a custom, non-compliant BSP, you will need to modify it to conform to the guidelines outlined in the *VxWorks BSP Developer's Guide* in order to use it with the Workbench project facility. Once you have modified it, verify that it builds properly before creating a project for it.



NOTE: If you do not make your BSP Workbench compliant, Workbench will not be able to provide project-based support for customizing, configuring, or building it.

Using a BSP Outside the Wind River Workbench

You may still use a non-compliant BSP by managing its configuration manually. For information on using manual methods, see the *Wind River Workbench Command Line User's Guide*. You can still create downloadable projects to hold your application code and download them to a target booted with a non-compliant BSP.

6

Boot Loader Project

- 6.1 Introduction 97
- 6.2 Creating a Boot Loader Project 98
- 6.3 Boot Loader Projects in the Project Navigator 99

6.1 Introduction

Use a *VxWorks Boot Loader* project to create a VxWorks *boot loader* (also referred to as the VxWorks *boot ROM*) to boot-load a target with the VxWorks kernel.

Boot loaders are used in a development environment to load a VxWorks image that is stored on a host system, where VxWorks can be quickly modified and rebuilt. Boot loaders are also used in production systems where both the boot loader and operating system image are stored on a disk.

Because Boot Loader projects provide rudimentary board support (boot loading), they can also be used for loading standalone Downloadable Kernel Module Applications without a full-blown VxWorks kernel.

Boot loaders are not required for standalone VxWorks systems that are stored in ROM, nor is it possible to create a boot loader for an image meant to be run on the VxWorks simulator.

Please refer to the *VxWorks Kernel Programmer's Guide: Kernel* for more information on boot loaders.

6.2 Creating a Boot Loader Project

Before creating the project, please take a look at the general comments on projects and project creation in [4. Projects Overview](#).

To create a Boot Loader project, proceed as follows.

1. Choose **File > New > VxWorks Boot Loader Project**.

The **New VxWorks Boot Loader Project** wizard appears. If applicable, you are asked to select a target operating system. Select a VxWorks version from the drop-down list and click **Next**.

2. You are asked to enter a **Project name** and **Location**.

If **Create project in workspace** is selected, the project is created in the current workspace. If **Create project at external location** is selected, you can navigate to a directory outside the workspace. See also [4.2 Workspace/Project Location](#), p.70.

When you are ready, click **Next**.

3. The next page of the wizard asks you to set:
 - The **Board support package** for which you want to create a boot loader.
 - The **Boot loader image Style** and **Format**.

Boot loader images come in the following styles: **Compressed**, **Uncompressed**, **ROM-Resident**, and **ROM-Resident At High Address**. These are functionally the same but have different memory requirements and execution times. After the project has been created, you can change the **Style** by right-clicking the project and selecting **Set Active Build Spec**.

The *VxWorks Kernel Programmer's Guide: Kernel* chapter provides detailed information on **Style** and **Format**. BSP documentation specifies which types are available for a specific target.

When you are ready, click **Finish**. The new Boot Loader project will appear at the root level in the Project Navigator.

6.3 Boot Loader Projects in the Project Navigator

After a Boot Loader has been created, a number of nodes appear in the Project Navigator. This section describes these nodes as they appear immediately after project creation.

For general notes about manipulating nodes, for example, moving, copying, filtering, etc., please see [13. Working in the Project Navigator](#).

6.3.1 Global Project Nodes



The icon at the root of the project tree identifies the type of project; the icon's label is the name you gave the project when you created it.

6.3.2 Project Build Specs and Target Nodes

Each Boot Loader project has a single IDE-managed build target whose name has the form *bsp (buildSpec)*—for example, **simpc (bootloader_res)**. To switch build specs, right-click and choose **Set Active Build Spec**.

Build-spec names have the form **bootloader[style][format]**, where *style* can be empty (the default compressed image), **_uncmp** (uncompressed), **_res** (ROM-resident), or **_res_high** (ROM-resident at high address), and *format* can be empty (the default ELF image), **.bin** (binary output), or **.hex** (Motorola S-Record). Examples:

```
bootloader
bootloader.bin
bootloader_res_high
bootloader_uncmp.hex
```

You can create new build targets with user-defined make rules by choosing **File > New > Build Target** or right-clicking on the project and choosing **New > Build Target**.

6.3.3 Makefile Nodes



Makefile

Do *not* add custom code to this file. This **Makefile** is regenerated every time the project is built. The information used to generate the file is taken from the build specification on which the target node is based.

6.3.4 Other Project Files

Normally, you need not be concerned with the remaining project files. However, here a brief summary of the remaining VxWorks Boot Loader project files displayed in the Project Navigator:



.project

Eclipse platform project file containing builder information and project nature.



.wrproject

Workbench project file containing common project properties such as project type, etc.

7

VxWorks ROMFS File System Projects

[7.1 Introduction 101](#)

[7.2 Creating a VxWorks ROMFS File System Project 102](#)

[7.3 VxWorks ROMFS File System Projects in the Project Navigator 102](#)

7.1 Introduction

Use a *VxWorks ROMFS File System* project as a subproject of a VxWorks Image project that requires ROMFS. The VxWorks ROMFS file system provides a means for bundling RTP applications and shared libraries with the VxWorks system image. At runtime, these files can be accessed in the VxWorks `/romfs` directory (and any subdirectories you create).

To use other file systems—such as dosFs—in your applications, configure VxWorks with the appropriate components.

For more information about ROMFS and other file systems, see the *VxWorks Kernel Programmer's Guide: Local File Systems* or the *VxWorks Application Programmer's Guide: Local File Systems*; and the *VxWorks Application Programmer's Guide: Applications and Processes*.

7.2 Creating a VxWorks ROMFS File System Project

Before creating the project, please take a look at the general comments on projects and project creation in [4. Projects Overview](#).

To create a VxWorks ROMFS File System project, proceed as follows.

1. Choose **File > New > VxWorks ROMFS File System Project**.

The **New VxWorks ROMFS File System Project** wizard appears. If applicable, you are asked to select a target operating system. Select a VxWorks version from the drop-down list and click **Next**.

2. You are asked to enter a **Project name** and **Location**.

If you select **Create project in workspace**, the project is created in the current workspace. If you select **Create project at external location**, you can navigate to a directory outside the workspace where the project is created. For more information, see [4.2 Workspace/Project Location](#), p.70. When ready, click **Next**.

3. You are asked to define the project structure (the superproject and subproject context) for the project you are creating. This is an optional step; it is not necessary to select a superproject or subprojects.

The **Superproject** check box refers to VxWorks Image project (VIP) that is currently highlighted in the Project Navigator. If you do not see this check box, or if the check box is grayed, no valid project is highlighted in the Project Navigator. If you select the check box, the project you are creating will be a subproject of the indicated VIP.

The **Referenced subprojects** check boxes list the remaining projects in the workspace that can be added to the current project as subprojects.

When you are ready, click **Finish**. The VxWorks ROMFS File System is created and appears in the Project Navigator, either at the root level or linked under a VxWorks Image project, depending on your selection above.

7.3 VxWorks ROMFS File System Projects in the Project Navigator

After a VxWorks ROMFS file system project has been created (see [7.2 Creating a VxWorks ROMFS File System Project](#), p.102) a number of nodes appear in the Project

Navigator. This section describes these nodes as they appear immediately after project creation. For general notes about manipulating nodes, for example, moving, copying, filtering, etc., please see [13. Working in the Project Navigator](#).

7.3.1 Global Project Nodes



ProjectName

The icon at the root of the VxWorks ROMFS File System project tree identifies the type of project; the icon's label is the name you gave the project when you created it.



VxWorks ROMFS File System Contents

Immediately below the project node, there is the **VxWorks ROMFS File System Contents** node. Double-click the **VxWorks ROMFS File System Contents** to open the File System Contents Editor. Please refer to [7.3.3 Configuring the VxWorks ROMFS File System](#), p.103, for information on using this editor.

7.3.2 Project File Nodes

The project creation facility generates, or includes copies of, a variety of files when a VxWorks ROMFS File System project is created. Normally, you need not be concerned with these files. However, here is a brief summary of the VxWorks ROMFS File System project files displayed in the Project Navigator:



.project

Eclipse platform project file containing builder information and project nature.



.wrproject

Workbench project file containing common project properties such as project type, etc.

7.3.3 Configuring the VxWorks ROMFS File System

To add files or create subdirectories, in the Project Navigator, double-click the **VxWorks ROMFS File System Contents** node immediately under the VxWorks ROMFS File System root node of the project. This opens the File System Contents Editor.

Two panels, one for the host and one for the target, allow you to add and remove files. You can also create or delete subdirectories in the **Target Contents** panel.

The panel at the bottom of the view displays a summary of properties for the selected element in the **Target Contents** (right) panel.

Make sure that you add the correct binary or data files. Click the file names in the **Target Contents** pane and verify the path in the **Host path** field in the bottom panel. This can be useful, for example, to check that:

- You have used the correct version of a versioned shared library.
- You have taken files from the correct build-spec output folder.

8

VxWorks Real-time Process Projects

- 8.1 Introduction 105
- 8.2 Creating a VxWorks Real-time Process Project 106
- 8.3 VxWorks Real-time Processes in the Project Navigator 108
- 8.4 Application Code for a VxWorks Real-time Process Project 111
- 8.5 Linking to VxWorks and Using Shared Libraries 111

8.1 Introduction

Using *VxWorks Real-time Process (RTP)* projects to manage and build modules that will exist outside of the kernel space, you can separately build, run, and debug the VxWorks Real-time Process executable.

At run-time, the executable file is downloaded to a separate address space to run as an independent process. The binary produced from a VxWorks Real-time Process project will need to be stored on a target-side file system, see [7. VxWorks ROMFS File System Projects](#).

VxWorks Real-time Process projects provide a protected, process-based, user-mode environment for developing applications. In this mode, applications are developed as VxWorks executables. An application has a well-defined start address. When the executable is loaded, memory is allocated by the system for the executable, execution begins at the known start address, and all tasks in the

process run within the same memory-protected address space. When the application terminates, all the resources associated with it are freed back to the system.

8.2 Creating a VxWorks Real-time Process Project

Before creating the project, please take a look at the general comments on projects and project creation in [4. Projects Overview](#).

To create a VxWorks Real-time Process project proceed as follows.

1. Choose **File > New > VxWorks Real Time Process Project**.

The **New VxWorks Real Time Process Project** wizard appears. If you have multiple versions of VxWorks installed, you are asked to select a target operating system. If applicable; that is, if you see this wizard page at all, select a VxWorks version from the drop-down list and click **Next**.

2. You are asked to enter a **Project name** and **Location**.

If you choose **Create project in workspace** (default) the project will be created under the current workspace directory. If you choose to **Create project at external location**, you can navigate to a location outside the workspace (see also [4.2 Workspace/Project Location](#), p.70 and [4.3 Creating New Projects](#), p.70).

After project creation, the project name will appear in the Project Navigator (see [8.3 VxWorks Real-time Processes in the Project Navigator](#), p.108). To see the project location, right-click on the project and select **Properties**, then select the **Info** node of the Properties dialog.

When you are ready, click **Next**.

3. You are asked to define the project structure (the super- and subproject context) for the project you are creating.

The text beside the **Link to superproject** check box refers to whatever project is currently highlighted in the Project Navigator (if you do not see this check box, no valid project is highlighted). If you select the check box, this will be the superproject of the project you are currently creating.

The check boxes in the **Referenced subprojects** list represent the remaining projects in the workspace that can be validly referenced as subprojects by the project you are currently creating.

After project creation, you can change the project structure in the Project Navigator using drag-and-drop.

When you are ready, click **Next**.

4. You are asked to specify the **Build Defaults** source either from an existing template or an existing project. If you select **Use Default**, preconfigured default templates are used.

You can inspect and, if necessary modify, the default settings for new projects of each project type from **Window > Preferences > Build Properties** (for more information, see *Wind River Workbench User Interface Reference: Build Properties*).

When you are ready, click **Next**.



NOTE: All settings in the following wizard pages are build related. You can therefore verify /modify them after project creation in the Build Properties node of the project's Properties.

5. A VxWorks Real-time Process project is a predefined project type that uses Workbench **Build support**, so you can only select either this, or no build support at all. If you are creating a project because you want to browse symbol information only and you are not interested in building it, you could also disable build support.

The **Build command** specifies the make tool command line.

Build output passing: If the project is a subproject in a tree, its own objects (implicit targets) as well as the explicit targets of its subprojects, can be passed on to be linked into the build targets of projects that are further up in the hierarchy.

When you are ready, click **Next**.

6. **Build Specs:** The list of available build specs will always be available. By checkmarking individual specs, you enable them for the current project, which means that you will, in normal day to day work, only see relevant (enabled) specs in the user interface, rather than the whole list. Additional specs can be enabled/disabled at any time after the project has been created.

The **Debug Mode** checkbox specifies whether or not the build output includes debug information or not.

7. **Build Target:** The **Build target name** is the same as the project name by default. If you delete the contents of the field no target will be created.

Build tool: For a VxWorks Real-time Process project you can select:

- **Linker:** This is the default selection. The linker produces a *BuildTargetName.vxe* file. This single, partially linked and *munched* (integrated with code to call C++ static constructors and destructors) object is intended for downloading.

The **Linker** output product cannot be passed up to superprojects, although the current project's own, unlinked object files can, as can any output products received from projects further down in the hierarchy (see step 5. above).

- **Librarian:** This is the default selection if you specified that the project is to be linked into a project structure as a subproject. The Librarian produces an archive *TargetName.a* file.

The **Librarian** output product can be passed up to superprojects, as can the current project's own, unlinked object files, as well as any output products received from projects further down in the hierarchy (see step 5. above).

8. When you are ready, you can review your settings using the **Back** button or click **Finish**.

The VxWorks Real-time Process project is created and appears in the Project Navigator, either at the root level, or linked into a project tree, depending on your selection in step 3. above.

8.3 VxWorks Real-time Processes in the Project Navigator

After a VxWorks Real-time Process has been created, a number of nodes appear in the Project Navigator. This section describes these nodes as they appear immediately after project creation. For general notes about manipulating nodes, for example, moving, copying, filtering, etc., please see [13. Working in the Project Navigator](#).

8.3.1 Global Project Nodes



ProjectName

The icon at the root of the project tree identifies the type of project; the icon's label is the name you gave the project when you created it.

8.3.2 Project Build Specs and Target Nodes

Each target node is associated with a predefined build specification.

The RTP build targets depend on the options you selected during project creation. Specifically, you will not have both an archive (*TargetName.a*) target and a *TargetName.out* target immediately after project creation. Which of these will be visible depends on the build tool you selected. Also, the presence or absence of the green upward arrow on the target icon (to indicate whether the target is passed up the hierarchy) will be determined by your project settings.



TargetName.vxe (*BuildSpecName[_DEBUG]*)

This single, partially linked and munched (integrated with code to call C++ static constructors and destructors) object, produced by the **Linker** build tool is intended for downloading.



TargetName.a (*BuildSpecName[_DEBUG]*)

An archive produced by the **Librarian** build tool that has to be statically linked into an executable.

8.3.3 Makefile Nodes

At project generation time two Makefiles are copied to the project. One is a template that can also be used for entering custom make rules. The other is dynamically regenerated from build spec data at each build.



.wrmakefile

A template used by Workbench to generate the project's **Makefile**. Add user-specific build-targets and make-rules in this file. These will then be automatically dumped into the Makefile.

 **Makefile**

Do *not* add custom code to this file. This **Makefile** is regenerated every time the project is built. The information used to generate the file is taken from the build specification that on which the target node is based.

8.3.4 Project File Nodes

The project creation facility generates, or includes copies of, a variety of files when a project is created. Normally, you need not be concerned with these files. However, here a brief summary of the DKM project files displayed in the Project Navigator:

 **.project**

Eclipse platform project file containing builder information and project nature.

 **.wrproject**

Workbench project file containing common project properties such as project type, etc.

8.4 Application Code for a VxWorks Real-time Process Project

After project creation you have the infrastructure for a VxWorks Real-time Process project, but often no actual application code. If you are writing code from the beginning, you can add new files to a project. If you already have source code files, you will want to import these to the project. For more information please refer to [13.3.1 Importing Resources](#), p.138, and [13.3.2 Adding New Files to Projects](#), p.139.

8.5 Linking to VxWorks and Using Shared Libraries

In order to have your VxWorks Real-time Process project binary initialized once the kernel has booted, you will need to:

- Create a VxWorks Image project, see [5.3 Creating a VxWorks Image Project](#), p.85.
- Configure the VxWorks Image project as described under [5.6 Adding Application Projects to the VxWorks Image Project](#), p.94 and [5.5 Configuring Kernel Components](#), p.93.
- Create a ROMFS target file system before the target is disconnected from the host system, see [7.2 Creating a VxWorks ROMFS File System Project](#), p.102.
- If you want to dynamically link to shared libraries, the VxWorks Real-time Process project needs to be appropriately configured, see [17.6 Executables that Dynamically Link to Shared Libraries](#), p.203, and [18. RTPs and Shared Libraries from Host to Target](#).

9

VxWorks Shared Library Projects

- 9.1 Introduction 113
- 9.2 Creating a VxWorks Shared Library Project 114
- 9.3 Shared Libraries in the Project Navigator 116
- 9.4 Source Code for the Shared Library 117
- 9.5 Making Shared Libraries Available to Applications 118

9.1 Introduction

Use *VxWorks Shared Library* projects for libraries that are dynamically linked to VxWorks Real-time Process projects at run-time. Such a shared library will need to be stored, like the Real-time Process project, on a target-side file system (see [7. VxWorks ROMFS File System Projects](#)). You can also use VxWorks Shared Library projects to create subprojects that are statically linked into other project types at build time.

Please refer to [9. VxWorks Shared Library Projects](#), [17.6 Executables that Dynamically Link to Shared Libraries](#), p.203, and [18. RTPs and Shared Libraries from Host to Target](#) for more information on working with this type of project.

9.2 Creating a VxWorks Shared Library Project

Before creating the project, please take a look at the general comments on projects and project creation in [4. Projects Overview](#).

To create a VxWorks Shared Library project, proceed as follows.

1. Choose **File > New > VxWorks Shared Library Project**.

The **New VxWorks Shared Library Project** wizard appears. If you have multiple versions of VxWorks installed, you are asked to select a target operating system. If applicable; that is, if you see this wizard page at all, select a VxWorks version from the drop-down list and click **Next**.

2. You are asked to enter a **Project name** and **Location**.

If you choose **Create project in workspace** (default) the project will be created under the current workspace directory. If you choose to **Create project at external location**, you can navigate to a location outside the workspace (see also [4.2 Workspace/Project Location](#), p.70 and [4.3 Creating New Projects](#), p.70).

After project creation, the project name will appear in the Project Navigator (see [9.3 Shared Libraries in the Project Navigator](#), p.116). To see the project location, right-click on the project and select **Properties**, then select the **Info** node of the Properties dialog.

When you are ready, click **Next**.

3. You are asked to define the project structure (the super- and subproject context) for the project you are creating.

The text beside the **Superproject** check box refers to whatever project is currently highlighted in the Project Navigator (if you do not see this check box, no valid project is highlighted). If you select the check box, the new VxWorks Shared Library project will be created as a subproject of the highlighted project, and will be built as part of it.

The check boxes in the **Referenced subprojects** list represent the remaining projects in the workspace that can be validly referenced as subprojects by the project you are currently creating.

After project creation, you can change the project structure in the Project Navigator using drag-and-drop. When you are ready, click **Next**.

4. You are asked to specify the **Build Defaults** source either from an existing template or an existing project. If you select **Use Default**, preconfigured default templates are used.

You can inspect and, if necessary modify, the default settings for new projects of each project type from **Window > Preferences > Build Properties** (for more information, see *Wind River Workbench User Interface Reference: Build Properties*). When you are ready, click **Next**.



NOTE: All settings in the following wizard pages are build related. You can therefore verify /modify them after project creation in the Build Properties node of the project's Properties.

5. A VxWorks Shared Library project is a predefined project type that uses Workbench **Build support**, so you can only select either this, or no build support at all. If you are creating a project because you want to browse symbol information only and you are not interested in building it, you could also disable build support.

Build command: specifies the make tool command line.

Build output passing: if the project is a subproject in a tree, its own unlinked objects, as well as the explicit targets of its subprojects, can be passed on to be linked into the build targets of projects that are further up in the hierarchy.

When you are ready, click **Next**.

6. **Build Specs:** the list of available build specs is always accessible in the Project Properties. By selecting individual specs, you enable them for the current project, which means that you will only see relevant specs rather than a whole long list. Additional specs can be enabled/disabled at any time after the project has been created.

The **Debug Mode** checkbox specifies whether or not the build output includes debug information or not.

7. **Build Target:** **Build target name** is the same as the project name by default. If you delete the contents of the field no target will be created.

The **Build tool** can be the **Shared Library Linker** or a custom user-defined tool.

The **Shared Library Linker** produces a *BuildTargetName.so* target that is dynamically linked to at run-time.

The output product of the **Shared Library Linker** will normally be passed up to superprojects. If you do not pass the library target up to its superprojects,

references in the superprojects' application code cannot be resolved at compile time. If you specified that the VxWorks Shared Library project you are currently creating links to a superproject (see step 3 above), the check box will be selected by default.

8. When you are ready, you can review your settings using the **Back** button or click **Finish**.

The VxWorks Shared Library project is created and appears in the Project Navigator, either at the root level, or linked into a project tree, depending on your selection in step 3. above.

9.3 Shared Libraries in the Project Navigator

After a VxWorks Shared Library project has been created, a number of nodes appear in the Project Navigator. This section describes these nodes as they appear immediately after project creation. For general notes about manipulating nodes, for example, moving, copying, filtering, and so on, please see [13. Working in the Project Navigator](#).

9.3.1 Global Project Nodes



ProjectName

The icon at the root of the project tree identifies the type of project; the icon's label is the name you gave the project when you created it.

9.3.2 Target Node



TargetName.so (BuildSpecName[_DEBUG])

A VxWorks Shared Library produced by the **Shared Library Linker** that is dynamically linked at run-time.

9.3.3 Makefile Nodes

At project generation time a template that can also be used for entering custom make rules is copied to the project.



.wrmakefile

A template used by Workbench to generate the project's **Makefile**. Add user-specific build-targets and make-rules in this file.

9.3.4 Project File Nodes

The project creation facility generates, or includes copies of, a variety of files when a project is created. Normally, you need not be concerned with these files. However, here a brief summary of the Shared Library project files displayed in the Project Navigator:



.project

Eclipse platform project file containing builder information and project nature.



.wrproject

Workbench project file containing common project properties such as project type, etc.

9.4 Source Code for the Shared Library

After project creation you have the infrastructure for a Shared Library project, but often no actual library source code. If you are writing code from the beginning, you can add new files to a project. If you already have source code files, you will want to import these to the project. For more information refer to [13.3.1 Importing Resources](#), p.138, and [13.3.2 Adding New Files to Projects](#), p.139.

9.5 Making Shared Libraries Available to Applications

To make shared libraries accessible to your applications at run-time, you have to make sure of a few configuration details, both on the library side and on the application side. You also need a file system project to store the library on the target (see [7. VxWorks ROMFS File System Projects](#)).

9.5.1 Configuring the Shared Library Project

1. Make sure the shared library is a subproject of all applications that need to access it. If the library is used by many applications, create projects for each application and make the library a subproject of each (see [13. Working in the Project Navigator](#) for information on how to do this).
2. Make sure the library target is passed to superprojects. You can do this during project creation (see step 7 under [9.2 Creating a VxWorks Shared Library Project](#), p.114), or subsequently in the Project Properties as follows:
 - In the Project Navigator, highlight the shared library project folder you are interested in and right-click **Project Properties**. (If the project folder is a subnode under several different superprojects, it does not matter which you choose because these nodes are only logical representations of one and the same project.)
 - In **Project Properties**, select **Build Properties** node, then the **Build Tools** tab. On the **Build Tools** tab, be sure the **Generated build target can be passed** check box is selected. If the output of the library build is not passed up to superprojects, references from the superproject to the library subproject cannot be resolved at build-time.
3. Click **OK** to close the Project Properties.

9.5.2 Configuring the Application Projects

Most shared library projects are created as subprojects of one or more application projects. Although a superproject knows the location of its subprojects, it does not know that a particular subproject is a shared library, so the application project's linker has to be configured to accommodate dynamic access to shared libraries. For more information, please see [17.6 Executables that Dynamically Link to Shared Libraries](#), p.203, and [18. RTPs and Shared Libraries from Host to Target](#).

10

VxWorks Downloadable Kernel Module Projects

- 10.1 Introduction 119
- 10.2 Creating a VxWorks Downloadable Kernel Module Project 120
- 10.3 Downloadable Kernel Modules in the Project Navigator 122
- 10.4 Application Code for a VxWorks DKM Project 124

10.1 Introduction

Use *VxWorks Downloadable Kernel Module* (DKM) projects to manage and build modules that will exist in the kernel space. You can separately build the modules, then run and debug them on a target running VxWorks, loading, unloading, and reloading on the fly.

Once your development work is complete, the modules can be statically linked into the kernel or use a file system if one is present.

Kernel-mode development is the traditional VxWorks method of development. All the tasks you spawn run in an unprotected environment and all have full access to the hardware in the system.

10.2 Creating a VxWorks Downloadable Kernel Module Project

To create a VxWorks Downloadable Kernel Module project, proceed as follows.

1. Choose **File > New > VxWorks Downloadable Kernel Module Project**.

The **New VxWorks Downloadable Kernel Module Project** wizard appears. If applicable, you are asked to select a target operating system. Select a VxWorks version from the drop-down list and click **Next**.

2. You are asked to enter a **Project name** and **Location**.

If you choose **Create project in workspace** (default) the project will be created under the current workspace root directory. If you choose to **Create project at external location**, you can navigate to a location outside the workspace (see also [4.2 Workspace/Project Location](#), p.70 and [4.3 Creating New Projects](#), p.70).

After project creation, the project name will appear in the Project Navigator (see [10.3 Downloadable Kernel Modules in the Project Navigator](#), p.122). To see the project location, right-click on the project and select **Properties**, then select the **Info** node of the Properties dialog.

When you are ready, click **Next**.

3. You are asked to define the project structure (the superproject and subproject context) for the project you are creating.

The text beside the **Link to superproject** check box refers to whatever project is currently highlighted in the Project Navigator (if you do not see this check box, no valid project is highlighted). If you select the check box, this will be the superproject of the project you are currently creating.

The check boxes in the **Referenced subprojects** list represent the remaining projects in the workspace that can be validly referenced as subprojects by the project you are currently creating.

After project creation, you can change the project structure in the Project Navigator using drag-and-drop.

When you are ready, click **Next**.

4. You are asked to specify the **Build Defaults** source either from an existing template or an existing project. If you select **Use Default**, preconfigured default templates are used.

You can inspect and, if necessary modify, the default settings for new projects of each project type from **Window > Preferences > Build Properties** (for more information, see *Wind River Workbench User Interface Reference: Build Properties*).

When you are ready, click **Next**.



NOTE: All settings in the following wizard pages are build related. These can therefore all be verified or modified after project creation in the Build Properties node of the project's Properties.

5. **Build Support** options: A VxWorks Downloadable Kernel Module project is a predefined project type that uses Workbench build support, so in most cases you will want to select **Managed build** to use makefiles generated by the IDE. If you are creating a project because you want to browse symbol information only and you are not interested in building it, you could also disable build support by selecting **Disabled** (and enable it later, if needed). The **User-defined build** option is not available for VxWorks Downloadable Kernel Module projects.

The **Build command** specifies the make tool command line.

Build output passing: If the project is a subproject in a tree, its own objects (implicit targets) as well as well as the explicit targets of its subprojects can be passed on to be linked into the build targets of projects that are further up in the hierarchy.

When you are ready, click **Next**.

6. **Build Specs:** The list of available build specs will always be available. By checkmarking individual specs, you enable them for the current project, which means that you will, in normal day to day work, only see relevant (enabled) specs in the user interface, rather than the whole list. Additional specs can be enabled/disabled at any time after the project has been created.

When you are ready, click **Next**.

7. **Build Target:** The **Build target name** is the same as the project name by default. If you delete the contents of the field no target will be created. However, a default target named **PartialImage.pl** will always be built and passed to the superproject.

Build tool: For a VxWorks Downloadable Kernel Module project you can select:

- **Linker:** This is the default selection if you did *not* specify that the project is to be linked into a project structure as a subproject. The linker produces

a *BuildTargetName.out* file. This single, partially linked and munched (integrated with code to call C++ static constructors and destructors) object is intended for downloading.

The **Linker** output product cannot be passed up to superprojects, although the current project's own, unlinked object files can, as can any output products received from projects further down in the hierarchy (see step 5. above).

- **Librarian:** This is the default selection if you specified that the project is to be linked into a project structure as a subproject. The **Librarian** produces an archive *TargetName.a* file.

The **Librarian** output product can be passed up to superprojects, as can the current project's own, unlinked object files, as well as any output products received from projects further down in the hierarchy (see step 5. above).

- **Partial Image Linker:** The Partial Image Linker produces a *TargetName.pl* file. This single, partially linked, but not munched (not integrated with code to call C++ static constructors and destructors) object is for subproject support only; it is *not* intended for download.

The **Partial Image Linker** output product can be passed up to superprojects, as can current project's own, unlinked object files, as well as any output products received from projects further down in the hierarchy (see step 5. above).

8. When you are ready, you can review your settings using the **Back** button, or click **Finish**.

The VxWorks Downloadable Kernel Module is created and appears in the Project Navigator, either at the root level or linked into a project tree, depending on you selection in step 3. above.

10.3 Downloadable Kernel Modules in the Project Navigator

After a VxWorks Downloadable Kernel Module has been created, a number of nodes appear in the Project Navigator. This section describes these nodes as they appear immediately after project creation. For general notes about manipulating nodes, for example, moving, copying, filtering, and so forth. Please see [13. Working in the Project Navigator](#).

10.3.1 Global Project Nodes



ProjectName

The icon at the root of the project tree identifies the type of project; the icon's label is the name you gave the project when you created it.

10.3.2 Project Build Specs and Target Nodes

Each target node is associated with a predefined build specification.

The VxWorks Downloadable Kernel Module project software targets depend on the options you selected during project creation. Specifically, you will not have both an archive (*TargetName.a*) target and a *TargetName.out* target immediately after project creating. Which, if any, of these will be visible depends on the build tool you selected. Also, the presence or absence of the green upward arrow on the target icon (to indicate whether the target is passed up the hierarchy) will be determined by your creation settings.



PartialImage.pl

This default target is always built for VxWorks Downloadable Kernel Module project. This single, partially linked, but not munched object is for subproject support only; it is *not* intended for download. By default, the build target is passed to the next level (hence the green upward arrow on the icon).



TargetName.out (BuildSpecName[_DEBUG])

This single, partially linked and munched object, produced by the **Linker** build tool is intended for downloading.



TargetName.a (BuildSpecName[_DEBUG])

An archive produced by the **Librarian** build tool that has to be statically linked into an executable.

10.3.3 Makefile Nodes

At project generation time two Makefiles are copied to the project. One is a template that can also be used for entering custom make rules. The other is dynamically regenerated from build spec data at each build.



.wrmakefile

A template used by Workbench to generate the project's **Makefile**. Add user-specific build-targets and make-rules in this file. These will then be automatically dumped into the Makefile.



Makefile

Do *not* add custom code to this file. This **Makefile** is regenerated every time the project is built. The information used to generate the file is taken from the build specification on which the target node is based.

10.3.4 Project File Nodes

The project creation facility generates, or includes copies of, a variety of files when a project is created. Normally, you need not be concerned with these files. However, here a brief summary of the VxWorks Downloadable Kernel Module project files displayed in the Project Navigator:



.project

Eclipse platform project file containing builder information and project nature.



.wrproject

Workbench project file containing common project properties such as project type, and so on.

10.4 Application Code for a VxWorks DKM Project

After project creation, you have the infrastructure for a VxWorks Downloadable Kernel Module project, but often no actual application code. If you are writing code from the beginning, you can add new files to a project. If you already have source code files, you will want to import these to the project. For more information please refer to [13.3.1 Importing Resources](#), p.138, and [13.3.2 Adding New Files to Projects](#), p.139.

You can link your VxWorks Downloadable Kernel Module with the operating system and have it start automatically at boot time. To do this:

1. Create a VxWorks Image project. See [5.3 Creating a VxWorks Image Project](#), p.85.

2. Configure the VxWorks Image project as described under [5.6 Adding Application Projects to the VxWorks Image Project](#), p.94 and [5.5 Configuring Kernel Components](#), p.93.

11

VxWorks User-Defined Projects

[11.1 Introduction](#) 127

[11.2 Creating a User-Defined Project](#) 128

[11.3 Creating an Application for VxWorks](#) 130

11.1 Introduction

VxWorks User-Defined Projects assume that you are responsible for setting up and maintaining your own build system, file system population, and so on. The user interface provides support for the following:

- You can configure the build command used to launch your build utility; this allows you to start builds from the Workbench GUI. You can also configure different rules for building, rebuilding and cleaning the project.
- You can create build targets in the Project Navigator that reflect rules in your makefiles; this allows you to select and build any of your make rules directly from the Project Navigator.
- Build output is captured to the Build Console.

11.2 Creating a User-Defined Project

Before creating the project, please take a look at the general comments on projects and project creation in [4. Projects Overview](#).

When you create a User-Defined project, Workbench checks the root location of the project's resources for the existence of a file named **Makefile** (or, if you specified a different filename in the New Project wizard's **Build Command** field using the **-f** make option, which can include a relative or absolute path to a subdirectory, Workbench checks for the file you specified). If it does not exist, Workbench creates a skeleton **Makefile** with a default **all** rule and a **clean**. This allows you to use the **Build Project**, **Rebuild Project**, and **Clean Project** menu commands, as well as preventing the generation of build errors. You are responsible for maintaining this Makefile, and you can write any other rules into this file at any time.

If you base your User-Defined project on an existing project, the **Makefile** (or whatever filename specified in the build command) of that project will be taken and copied to the new project. If you change the name of the makefile used by the build command in the New Project wizard's **Build Command** field using the **-f** make option, the file will be renamed accordingly. In this case the file, if it already exists in the new project's location, will be overwritten.



NOTE: If you specify an absolute path for a makefile in the New Project wizard's **Build Command** field using the **-f** make option, no Makefile will be generated at any time.

11.2.1 Linking to External Files

If you have a large source tree of existing files that you do not want to copy into your workspace, a User-Defined project allows you to link to the directory where the sources are located.

1. Create a User-Defined project by selecting **File > New > VxWorks User-Defined Project**. The New User-Defined Project wizard appears.
2. Select your target operating system, then click **Next**.
3. Type a name for your project.
4. Decide where to create your project, then click **Next**.
 - Leave **Create project in workspace** selected if you want the project to be created under the current workspace directory (typical for projects created from scratch with no existing sources, or for projects where existing

sources will be imported into them later on—see [Adding Application Code to Projects](#), p.138—or for projects where you do not have write permission to the location of your source files¹).

- Select **Create project at external location**, click **Browse**, then navigate to a different location if you want the project to be created outside the workspace (typical for projects being set up for already existing sources—removing the need to import or link to them later on—or for projects being version-controlled, where sources are located outside the workspace).
5. On the next few screens, adjust the settings if necessary, then click **Finish**. Your project appears in the Project Navigator.

If you created your project in the directory where your source files are located, you can use your project immediately.

If you created your project in your workspace, then you need to create a link to your source files.

1. Right-click on the project, then select **New > Folder**. The New Folder dialog appears.
2. Choose the parent folder (your project) then type a name for the new folder.
3. Click the **Advanced** button at the bottom of the dialog, then click **Link to folder in the file system**. Browse to the directory containing your sources, then click **OK**.

Your project now contains a folder that links to your source files in their original location. You may repeat this process to create links to as many source directories as you need.



NOTE: This process is different from importing sources into your project. When you import files, they are copied into the project's directory in your workspace. When you link to files, you see them in the Project Navigator but they remain in their original location.

-
1. If you do not have write permission to the file system location where you want to create any project of any type, you either need to get it temporarily to be able to add the project files to that directory, or you have to import the sources into your project if you want a managed build, or you could create a folder in a User-Defined project and link it to your sources.

11.3 Creating an Application for VxWorks

In order to have your application initialized once the kernel has booted, you will need to:

- Create a VxWorks Image project, see [5.3 Creating a VxWorks Image Project](#), p.85.
- Configure the VxWorks Image project as described under [5.6 Adding Application Projects to the VxWorks Image Project](#), p.94 and [5.5 Configuring Kernel Components](#), p.93.
- Before the target is disconnected from the host system, create a target-side file system, see [7.2 Creating a VxWorks ROMFS File System Project](#), p.102.

12

Native Application Projects

[12.1 Introduction](#) 131

[12.2 Creating a Native Application Project](#) 132

[12.3 Native Applications in the Project Navigator](#) 134

[12.4 Application Code for a Native Application Project](#) 136

12.1 Introduction

Use a *Native Application project* for C/C++ applications developed for your host environment.

Workbench provides build and static analysis support for native GNU 2.9x, GNU 3.x, and Microsoft development utilities (assembler, compiler¹, linker, archiver) though you must acquire and install these utilities as they are not distributed with Workbench.

There is no debugger integration for native application projects in Workbench, so you must acquire and use the appropriate native tools for debugging as well.

1. Workbench supports the MinGW, Cygnus, and MS DevStudio compilers. Compilers for native development are distributed with Wind River Platforms, but not with Workbench.

12.2 Creating a Native Application Project

Before creating the project, please take a look at the general comments on projects and project creation in [4. Projects Overview](#).

To create a Native Application project, proceed as follows.

1. Choose **File > New > Native Application Project**.

The **New Native Application Project** wizard appears. If you have multiple versions of VxWorks installed, you are asked to select a target operating system. If you see this field, select a VxWorks version from the drop-down list and click **Next**.

2. Enter a **Project name** and **Location**.

If you choose **Create project in workspace** (default) the project will be created under the current workspace directory. If you choose to **Create project at external location**, you can navigate to a location outside the workspace (see also [4.2 Workspace/Project Location](#), p.70 and [4.3 Creating New Projects](#), p.70).

The project appears in the Project Navigator (see [12.3 Native Applications in the Project Navigator](#), p.134). To see the project location, right-click on the project and select **Properties**, then select the **Info** node of the Properties dialog.

When you are ready, click **Next**.

3. If you have created other projects, you are asked to define the project structure (the super- and subproject context) for the project you are creating.

The text beside the **Link to superproject** check box refers to whatever project is currently highlighted in the Project Navigator (if you do not see this check box, no valid project is highlighted). If you select the check box, this will be the superproject of the project you are currently creating.

The check boxes in the **Referenced subprojects** list represent the remaining projects in the workspace that can be validly referenced as subprojects by the project you are currently creating.

After project creation, you can change the project structure in the Project Navigator using drag-and-drop.

When you are ready, click **Next**.



NOTE: All settings in the following wizard pages are build related. You can therefore verify /modify them after project creation in the Build Properties node of the project's Properties. For more information, see *Wind River Workbench User Interface Reference: Build Properties*.

4. A Native Application project is a predefined project type that uses Workbench **Build support**, so you can only select either this, or no build support at all. If you are creating a project because you want to browse symbol information only and you are not interested in building it, you could also disable build support.

The **Build command** specifies the make tool command line.

Build output passing: If the project is a subproject in a tree, its own objects (implicit targets) as well as the explicit targets of its subprojects, can be passed on to be linked into the build targets of projects that are further up in the hierarchy.

When you are ready, click **Next**.

5. **Build Specs:** The list of available build specs will always be available. By checkmarking individual specs, you enable them for the current project, which means that you will, in normal day to day work, only see relevant (enabled) specs in the user interface, rather than the whole list.

If you are working on a Windows application, you would normally enable the **msvc_native** build spec, and disable the **gnu-native** build specs. If you are working on a Linux or Solaris native application, you would normally enable the GNU tool version you are using, and disable all others.

The **Debug Mode** checkbox specifies whether or not the build output includes debug information.

When you are ready, click **Next**.

6. **Build Target:** The **Build target name** is the same as the project name by default. You can change the name if necessary, but if you delete the contents of the field, no target will be created.

Build tool: For a Native Application project you can select:

- **Linker:** This is the default selection. The linker produces a *BuildTargetName(.exe* for Windows native projects) executable file.

The **Linker** output product cannot be passed up to superprojects, although the current project's own, unlinked object files can, as can any output

products received from projects further down in the hierarchy (see step 4. above).

- **Librarian:** This is the default selection if you specified that the project is to be linked into a project structure as a subproject. The Librarian produces a *TargetName.a* (or *.lib* for Windows native projects) archive file.

The **Librarian** output product can be passed up to superprojects, as can the current project's own, unlinked object files, as well as any output products received from projects further down in the hierarchy (see step 4. above).

7. When you are ready, you can review your settings using the **Back** button or click **Finish**.

The Native Application project is created and appears in the Project Navigator, either at the root level, or linked into a project tree, depending on your selection in step 3. above.

12.3 Native Applications in the Project Navigator

After a Native Application project has been created, a number of nodes appear in the Project Navigator. This section describes these nodes as they appear immediately after project creation. For general notes about manipulating nodes, for example, moving, copying, filtering, etc., please see [13. Working in the Project Navigator](#).

12.3.1 Global Project Nodes



ProjectName

The icon at the root of the project tree identifies the type of project; the icon's label is the name you gave the project when you created it.

12.3.2 Project Build Specs and Target Nodes

Each target node is associated with a predefined build specification.

The build target depends on the options you selected during project creation. Specifically, you will not have both an archive (*TargetName.a* for a **gnu** build spec, or *TargetName.lib* for a **msvc** build spec) target and a *TargetName.exe* for a **msvc** build spec) target immediately after project creation. Which of these will be visible depends on the build tool you selected. Also, the presence or absence of the green upward arrow on the target icon (to indicate whether the target is passed up the hierarchy) will be determined by your project settings.



TargetName.exe (*BuildSpecName_DEBUG*)

An executable.



TargetName.a | .lib (*BuildSpecName_DEBUG*)

An archive produced by the **Librarian** build tool.

12.3.3 Makefile Nodes

At project generation time two Makefiles are copied to the project. One is a template that can also be used for entering custom make rules. The other is dynamically regenerated from build spec data at each build.



.wrmakefile

A template used by Workbench to generate the project's **Makefile**. Add user-specific build-targets and make-rules in this file. These will then be automatically dumped into the Makefile.



Makefile

Do *not* add custom code to this file. This **Makefile** is regenerated every time the project is built. The information used to generate the file is taken from the build specification that on which the target node is based.

12.3.4 Project File Nodes

The project creation facility generates, or includes copies of, a variety of files when a project is created. Normally, you need not be concerned with these files. However, here a brief summary of the DKM project files displayed in the Project Navigator:



.project

Eclipse platform project file containing builder information and project nature.



.wrproject

Workbench project file containing common project properties such as project type, etc.

12.4 Application Code for a Native Application Project

After project creation you have the infrastructure for a Native Application project, but often no actual application code. If you are writing code from the beginning, you can add new files to a project. If you already have source code files, you will want to import these to the project. For more information please refer to [13.3.1 Importing Resources](#), p.138, and [13.3.2 Adding New Files to Projects](#), p.139.

13

Working in the Project Navigator

- [13.1 Introduction 137](#)
- [13.2 Creating Projects 138](#)
- [13.3 Adding Application Code to Projects 138](#)
- [13.4 Opening and Closing Projects 139](#)
- [13.5 Scoping and Navigation 140](#)
- [13.6 Moving, Copying, and Deleting Resources and Nodes 141](#)

13.1 Introduction

The Project Navigator is your main graphical interface for working with projects. You use the Project Navigator to create, open, close, modify, and build projects. You also use it to add or import application code, to import, or customize build specifications, and to access your version control system.

Various filters, sorting mechanisms, and viewing options help to make project management and navigation more efficient. Use the arrow at the top-right of the Project Navigator to open a drop-down menu of these options.

13.2 Creating Projects

Creating projects is discussed in general under [4.3 Creating New Projects](#), p.70. Specific descriptions for creating individual project types are provided in the other chapters in [Part II. Projects](#).

13.3 Adding Application Code to Projects

After creating a project, you have the infrastructure for a given project type, but no actual application code. If you already have source code files, you will want to import these to the project.

13.3.1 Importing Resources

You can import various types of existing resources to (newly created) projects by choosing **File > Import**.

For details about the entries in the Import File dialog, see *Wind River Workbench User Interface Reference: Import File Dialog*.



NOTE: If Workbench encounters a problem while importing resources, it will display an error (such as the project already contains a file with the same name). If you click **OK**, the Import wizard reappears with all the original settings. This gives you the opportunity to fix just the item causing the problem, rather than having to re-enter all the selections in the wizard.

If you do not want to fix the problem and import the resources now, click **Cancel**.



NOTE: Importing resources creates a link to the location of those resources; it does not copy them into your workspace.

Later, if you want to delete a project, check the path in the **Confirm Project Delete** dialog very carefully when deciding whether to choose **Also delete contents under 'path'** or **Do not delete contents**—choosing to delete the project contents may delete your original sources or the contents of a project in a different workspace, rather than the project in your current workspace.

13.3.2 Adding New Files to Projects

To add a new file to a project, choose **File > New > File**.

You are asked to **Enter or select the parent folder**, and to supply **Filename**.

For a description of the **Advanced** button, and what it reveals, press **F1** and select **New file wizard**.

13.4 Opening and Closing Projects

You can open or close a project by selecting it in the tree and choosing **Project > Open** (if it is currently closed), or **Project > Close** (if it is currently open). You can also use the corresponding commands on the Project Navigator's right-click context menu.

13.4.1 Closing a Project

- The icon changes to its closed state (by default grayed) and the tree collapses.
- All project member files that are open in the editor are closed.
- All subprojects that are linked exclusively to the closed project are closed as well. However, subprojects that are shared among multiple projects remain open as long as a parent project is still open, but can be closed explicitly at any time.
- In general, closed projects are excluded from all actions such as symbol information queries, and from workspace or project structure builds (that is, if a parent project of a closed subproject gets built).
- It is not possible to manipulate closed projects. You cannot add, delete, move, or rename resources, nor can you modify properties. The only possible modification is to delete the project itself.
- Closed projects require less memory.

13.5 Scoping and Navigation

There are a number of strategies and Workbench features that can help you manage the projects in your workspace, whether you are working with multiple projects related to a single software system, or multiple unrelated software systems.

- **Close projects**

If you expect to be working in a different context (under a different root project) for a while, you can select the root project you are leaving, and right-click **Close Project**.

If you close your root projects when you stop working on them, you will see just the symbols and resources for the project on which you are currently working (see also [13.4.1 Closing a Project](#), p.139).

- **Go into a project**

If you want to see, for example, the contents of only one software system in the Project Navigator, select its root project node and right-click **Go Into**. You can then use the navigation arrows at the top of the Project Navigator to go back out of the project you are in, or to navigate history views.

- **Open a project in a new window**

If you expect to be switching back and forth between software systems (or other contexts) at short intervals, and you do not want to change your current configuration of open editors and layout of other views, you can open the other software system's root project in a new window (right-click **Open in New Window**). This essentially does the same as **Go Into** (see **Go Into a Project**), except that a new window is opened, thereby leaving your current Workbench layout intact.

- **Open a new window**

You can open a new window by choosing **Window > New Window**. This opens a new window to the same workspace, leaving your current Workbench window layout intact while you work on some other context in the new window.

- **Use Working Sets**

Using working sets lets you set the scope for all sorts of queries. You can, for example, create working sets for each of your different software systems, or any constellation of projects, and then scope the displayed Project Navigator

content (and other query requests) using the pull-down at the top-right of the Project Navigator.

To create a Working Set, from the drop-down menu, choose **Select Working Set**. In the dialog that appears, click **New**, then, in the next dialog, specify the **Resource** type.

In the next dialog select, for example, a software-system root project and give the working set a name. When you click **Finish**, your new working set will appear in the **Select Working Set** dialog's list of available working sets.

After the first time you select a working set in the **Select Working Set** dialog, the working set is inserted into the Project Navigator's drop-down menu, so that you can directly access it from there.

- **Use the Navigate Menu**

For day-to-day work, there is generally no absolute need to see the contents of your software systems as presented in the Project Navigator.

Using the **Navigate > Open Resource** (to navigate files) and **Navigate > Open Symbol** (to jump straight to a symbol definition) may often prove to be the most convenient and efficient way to navigate within, or among, systems.

13.6 Moving, Copying, and Deleting Resources and Nodes

The resources you see in the Project Navigator are normally displayed in their logical, as opposed to physical, configuration (see [4.5 Projects and Project Structures](#), p.77). Depending on the type of resource (file, project folder) or purely logical element (target node) you are manipulating, different things will happen. The following section briefly summarizes what is meant by resource types and logical nodes.

13.6.1 Resources and Logical Nodes

Resources is a collective term for the *projects, folders, and files* that exist in Workbench.

There are three basic types of resources:

- *Files*
Equivalent to files as you see them in the file system.
- *Folders*
Equivalent to directories on a file system. In Workbench, folders are contained in projects or other folders. Folders can contain files and other folders.
- *Projects*
Contain folders and files. Projects are used for builds, version management, sharing, and resource organization. Like folders, projects map to directories in the file system. When you create a project, you specify a location for it in the file system.

When a project is open, the structure of the project can be changed and you will see the contents. A discussion of closed projects is provided under [13.4.1 Closing a Project](#), p.139.

Logical nodes is a collective term for nodes in the Project Navigator that provide structural information or access points for project-specific tools.

- *Subprojects*
A project is a resource in the root position. A project that references a superproject is, however, a logical entity; it is a reference only, not necessarily (or even normally) a physical subdirectory of the superproject's directory in the file system.
- *Build Target Nodes*
These are purely logical nodes to associate the project's build output with the project.
- *Tool Access Nodes*
These allow access to project-specific configuration tools. VxWorks ROMFS File System Projects have a node that opens a tool for mapping host-side project contents to target file system contents. VxWorks Image Projects have a node that opens the Kernel Editor for configuring the VxWorks kernel.

13.6.2 Manipulating Files

Individual files, for example source code files, can be copied, moved, or deleted. These are physical manipulations. For example, if you hold down **CTRL** while you

drag-and-drop a source file from one project to another, you will create a physical copy, and editing one copy will have no effect on the other.

13.6.3 Manipulating Project Nodes

Although copying, moving, or deleting project nodes are undertaken with the same commands you would use for normal files, the results are somewhat different because a project folder is a semi-logical entity. That is, a project is a normal resource in the root position. A project that is referenced as a subnode is, however, a logical entity; it is a reference only, not a physical instance.

If you copy/paste (or hold down **CTRL** while you drag-and-drop) a project folder node to a new location in the project editor (for example, under some other project node to be used as a subproject there) all that happens is that a reference to one and the same project is inserted. This means that if you modify the properties of one instance of the subproject node, all other instances (which are really only references) are also modified. One such property would be, for example, the project name. If you rename the project node in one context, it will also be renamed in all other contexts.

Moving and (Un-)Referencing Project Nodes

If you drag-and-drop a project folder, you are making a logical, structural change. However, if you select a project folder node and right-click **Move**, you will be asked to enter (browse for) a new file system location. All the files associated with the current project will then be physically moved to the location you select, without any visible change in the Project Navigator (you can verify the new location in the **Project Properties**).

When you drag-and-drop a project node, you are actually performing the equivalent of right-click **Add as Reference** or, if you have selected a subproject, also right-click **Remove Reference**. These commands open a dialog allowing you to either have the currently selected project reference other projects as a subproject, or, in the **Remove Reference** dialog, to remove the currently selected project from its structural (logical) context as a subproject, in which case it will be moved to the root level as a standalone project in the Project Navigator.

Deleting Project Nodes

To delete a subproject, which might potentially be linked into any number of other project structures, you first have to either unlink (right-click it and press **Delete**) all instances of the subproject, or get a *flat* view of your workspace. To do this, open the drop-down list at the top-right of the Project Navigator's toolbar and choose **Hide > Project Structure**. This hides the logical project organization and provides a flat view with a single instance of the (sub)project that you can then delete by pressing **Delete** again.

When you delete a project you are asked whether or not you want to delete the contents. If you choose not to delete the contents, the only thing that happens is that the project (and all its files) are no longer visible in the workspace; there are no file system changes.

13.6.4 Manipulating Target Nodes

Target nodes cannot be copied or moved. These are purely logical nodes that make no sense anywhere except in the projects for which they were created. If you copy or move entire projects, however, the target nodes and generated build-targets beneath them are also copied.

Deleting Target Nodes

Deleting a target node also removes the convenience node that represents the generated, physically existing build-target. However, the physically existing build-target (if built) is not deleted from the disk.

The convenience node referred to above, lets you see at a glance whether the target has been built or not, even if you have uncluttered your view in the Project Navigator by hiding build resources (in the drop-down menu at the top-right choose **Hide > Build Resources**) and/or collapsing the actual target node. If you have collapsed the node, the + sign will indicate that the build-target exists).

14

Advanced Project Scenarios

[14.1 Introduction](#) 145

[14.2 Resource Locations](#) 146

[14.3 Multiple, Unrelated Software Systems](#) 147

[14.4 Complex Project Structures](#) 148

14.1 Introduction

The scenarios developed in this chapter suggest how you could use the Wind River Workbench to manage various constellations of projects and project types. Because Workbench provides a variety of possibilities for achieving different ends, the scenarios are neither prescriptive, nor comprehensive. All we can do here is offer some suggestions.

The scenarios do not look at the edit/compile/debug cycle; the emphasis is on project organization and handling. The discussion looks at:

- resource locations
- strategies for working with multiple, unrelated software systems
- complexities within a single software system, including project structure design, development, and finalization steps

14.2 Resource Locations

One complexity that you might be faced with, especially in team development situations, is that you might have to use file system resources (files and directories) that are outside your workspace.

As long as file system resources are located in the default location (your own workspace), for example because you have checked them out from your version control system, there is nothing to discuss.

When you create projects in Workbench, project-specific administrative files are stored at the file system location of the resources used by the project. This means that, if these resources are outside your workspace, you may not have write permission there and that the necessary files therefore cannot be created.

This may be an issue, for example, also with respect to centrally maintained header files and third party libraries. In such cases you have the following options:

- Have your administrator, who does have write permission, create the project (see [Creating Projects for External Headers](#), p.159) and import the project as follows:
 - In the Project Navigator, right-click **Import**.
 - In the **Import** wizard, select **Existing Project into Workspace** and click **Next**.
 - **Browse** to the directory where the project was created and click **OK**, then **Finish**.

This is the recommended way to proceed in cases where not everyone is allowed to write to resource directories. This way all team members always access both the *same*, most up to date source files and the *same* project, thereby ensuring consistency across the entire team without any synchronization overhead. Note that, if you have multiple workspaces, you would have to import the project to each workspace.

Furthermore, if the external resources are not just header files; that is, if they are buildable, build support must be either disabled for the imported project (if existing build-output is externally available), or build output of the imported projects must be redirected somewhere that users have write permission (see the *Build Paths* section of *Wind River Workbench User Interface Reference: Build Properties*). Write permission will also be required for the **.wrproject** file in the project directory and the **.wrfolder** files in each folder, for modifications (added/removed resources) and for maintaining changes in build properties.

- The other option is to copy the resources to somewhere that you do have write permission.

This option is *not* recommended because of the synchronizations problems that are bound to arise sooner or later. Consider this a last resort.

14.3 Multiple, Unrelated Software Systems

The assumption is that you work on multiple, unrelated software systems in parallel. Each of these systems will normally (but not necessarily) consist of any number of subprojects organized into project structures; that is, each system will normally be arranged as a tree under a single superproject. However, ignoring the internal organization of your software systems for the moment (this is discussed under [Complex Project Structures](#), p. 148), first look at the software systems as a whole.

During the course of any working day you might spend time working in different software systems that have nothing to do with each other (other than the fact that you happen to be working in them). You will presumably want to be able to focus as fully as possible, with as little distraction as possible, on the software system you are working on at any given time. If you have to switch from one system to the other fairly frequently, the switch should be easy and rapid.

14.3.1 Using Different Workspaces for Different Systems

Using different workspaces for unrelated software systems lets you keep these systems completely separate, without seeing any sign of the currently non-relevant context anywhere.

However, when you switch from one workspace to another (choose **File > Switch Workspace**), you are actually closing your current Workbench instance and reopening a new instance that uses the selected new workspace. This takes time, but offers the advantage that the new workspace opens exactly as you left it when you last closed it.

This option, because of the time overhead involved in switching, is probably most feasible if you have only a few separate software systems, and if you spend extended periods of time in one or other context without interruption.

However, if you have, a system that you work on most of the time, and several other systems where you have to frequently do relatively minor maintenance work, you might find it more convenient to use a single workspace for all, or many of, your projects.

Naturally, there is no reason why you should not have both multiple workspaces as outlined here, and, within one or more of these, also maintain multiple, unrelated software systems in the same workspace as discussed below.

14.3.2 Using the Same Workspace for Different Software Systems

Using the same workspace for any number of unrelated software systems does not stop you from keeping these systems completely separate. The only sign of each currently non-relevant system can be a single icon (or not even that if you **Go Into** a project - see [13.5 Scoping and Navigation](#), p.140). This means that all software systems are immediately visible and accessible, without being unduly obtrusive. Furthermore, switching from one software system to another is much faster than using different workspaces as described above. On the other hand, if you are working on multiple, very large software systems, general performance might become an issue that would suggest using separate workspaces.

Some of the ways that will help you handle multiple software systems in the same workspace are introduced under [13.5 Scoping and Navigation](#), p.140

14.4 Complex Project Structures

This section develops a simple infrastructure as a possible approach to a high-level, internal organization of an individual software system.

14.4.1 Project Assumptions

The following discussion attempts to align how Workbench project structures and project types can support a software system that includes the following requirements.

- **There is a kernel**

In the design phase, you need not think too much about the kernel. It is sufficient to know that there will be one at some point.

Use a simulator for initial development and testing.

- **The output product must be a single flashable image**

This image will contain the kernel as well as all the run-time components (binaries from Real-time Process Projects, libraries, data files, and so on). A target-side file system is therefore required; this will be implemented using Wind River ROMFS technology by setting up a VxWorks ROMFS File System project.

However, in the design phase, you do not need not worry about this; it is sufficient to know that there will be a VxWorks ROMFS File System project at some point.

- **The software system will have to be ported to different boards**

Although the kernel as such is not initially of primary importance, the assumption that you will have to port the system at some stage may be a design consideration. If you are developing and testing on a simulator (see above), there will be porting to do anyway.

- **There is middleware**

- **One or more modules are needed as abstraction layers that wrap around the kernel**

Use Downloadable Kernel Module Projects for these.

- **There are application modules**

These have to be process-based and they have to run in their own memory-protected address space.

Use Real-time Process Projects for these.

- **There are shared libraries**

These are potentially used by any or all of the application modules.

Use Shared Library Projects for these.

- **There is legacy code**

Use User-Defined Projects and/or Real-time Process Projects and/or Downloadable Kernel Module Projects.

User-Defined Projects are appropriate in situations where you would rather not tamper with how the application is built. In other situations, you can wrap your legacy projects in one of the standard project types supported by Workbench.

- **There are external headers**

These are centrally maintained and are potentially used by any or all of the software system's modules.

Use a User-Defined project (without build support) for these.

- **Building a complete product image must be simple**

14.4.2 Infrastructure Design, p. 150, tries to meet all the above requirements and provide a push-button build of the full product image, including all its components, for multiple architectures.

14.4.2 Infrastructure Design

Based on the *Project Assumptions*, p. 149, the following describes how you could go about building an infrastructure for such a software system.



NOTE: The screenshots in the following have been filtered in various ways to hide everything that is not related to project structure. If you follow the procedures described, you will see this same structure, as well as a number of additional files, folders, target nodes, and so on.

The infrastructure described here is not a requirement for project management in Workbench. It can however be convenient to create such an infrastructure to facilitate porting a software system to other boards, as well as to allow building an entire product image, even for multiple boards, all at once. Furthermore, such an infrastructure does not need to be in place from the start; it can be folded over a project system at any stage of development.

Create Container Projects

This infrastructure uses empty container projects at the superproject level as well as at subproject levels. The type of container used in each case will depend on the type of content the container will later accommodate.

In the current context, the term *container project* is therefore used to denote a project of any type that does not, however, itself contain any source code files; all application source files will be in subprojects referenced by the empty container project.

Step 1: Create a container project.

Creating a container project as the topmost superproject the software system is an organizational artifact to provide a convenient way of keeping everything together, and thereby also cleanly separating the software system from other software systems you might work on in the same workspace.

The only other real functionality the superproject container project needs to provide is that it has to be buildable. Although the project itself contains no source code files, you will want to be able to start the build at the top of your future project tree to recursively build the whole structure.

The default User-Defined project provided by Workbench is exactly what you need for a topmost container project.

To create a new User-Defined project, in the Project Navigator, right-click **New > User-Defined Project**.

In the wizard that appears, in the **Project name** field, enter: **playpen_sim** (this is an arbitrary name for a fictitious software system; the suffix **_sim** reflects that this system will be built for the simulator) and click **Finish**. (You can ignore the **Next** button and the other Wizard pages because the defaults are fine.)

This creates a default User-Defined project; that is, one that supports a user-defined build based on existing makefiles. Since this is a just a container project without any (user-defined) makefiles, Workbench will create a **Makefile** with a default **all** rule and a **clean**. This allows you to use the **Build Project**, **Rebuild Project**, and **Clean Project** menu commands, as well as preventing the generation of irritating build errors. If you want, you can write any other rules into this file at any time. See also [11. VxWorks User-Defined Projects](#).

Step 2: Create container projects for each project type and for external headers.

Recall that *Project Assumptions*, p. 149, stated requirements for Downloadable Kernel Modules, Real-time Process Projects, Shared Library Projects, and User-Defined projects.

Creating empty projects for each of these project types facilitates porting from the simulator to a board, and from one board to another. This is because, in a tree of projects of the same type, all subprojects are built using the same build spec as that used by the topmost project. This applies to all project types except User-Defined projects (there is no way to predict how these are built).

So, for example, by creating an empty Real-time Process project type container project and later populating this container with real Real-time Process project type subprojects, then you only need to use a different build spec for the container when it comes to porting the system to a different board (more about this later).

Note that Real-time Process projects and Shared Library projects actually use the same build specs, so, technically speaking, you could lump these two project types together under one container and save yourself a couple of steps. However, the orderly separation of project types appears a little cleaner and is therefore adopted here.

The naming convention used for these containers indicates the project type that will be stored within (actually only reference) these containers, plus a suffix that indicates the software system they belong to and the board they will be built for (**_playpen_sim**).

To create the empty container project types, proceed as follows:

➔ **NOTE:** You can ignore the **Next** button and click **Finish** on the first page in each of the wizards because the defaults are fine for the moment.

➔ **NOTE:** Project references can only be created if the projects are based on the same Platform. *Platform* here refers to the settings in **Window > Preferences > General > Target Operating Systems**.

- To create a new container Downloadable Kernel Module project, in the Project Navigator, right-click **New > Downloadable Kernel Module Project**.
In the wizard that appears, in the **Project name** field, enter: **DKMs_playpen_sim** and click **Finish**.
- To create a new container Real-time Process project, in the Project Navigator, right-click **New > Real Time Process Project**.

In the wizard that appears, in the **Project name** field, enter:
RTPs_playpen_sim and click **Finish**.

- To create a new container Shared Library project, in the Project Navigator, right-click **New > Shared Library Project**.

In the wizard that appears, in the **Project name** field, enter:
LIBs_playpen_sim and click **Finish**.

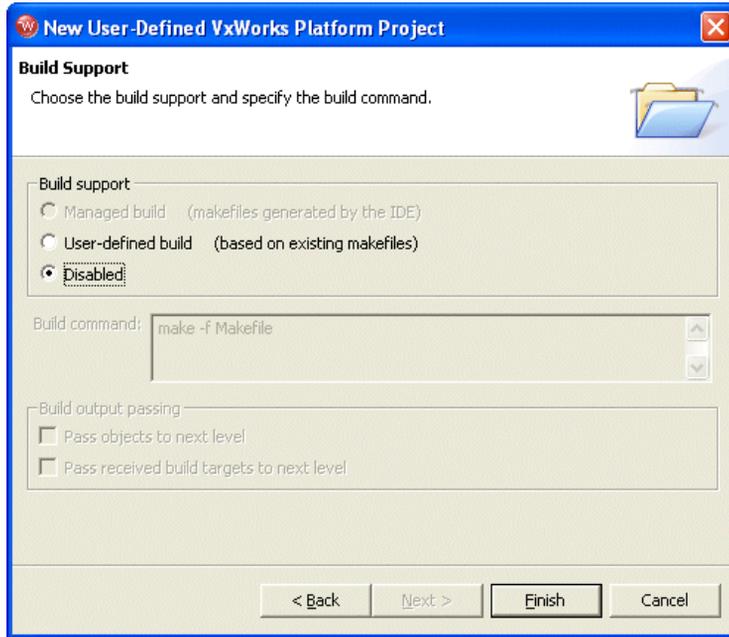
- To create a new container User-Defined project, in the Project Navigator, right-click **New > User Defined Project**.

In the wizard that appears, in the **Project name** field, enter:
UDPs_playpen_sim and click **Finish**.

- To create a new container User-Defined project (without build support) to accommodate the external, centrally maintained header files mentioned in [Project Assumptions](#), p.149, in the Project Navigator, right-click **New > User-Defined Project**.

In the wizard that appears, in the **Project name** field, enter: **headers_playpen** (notice that we have not appended the suffix **_sim**; this is because this project does not use a build spec, see below) and keep clicking **Next** until you get to the wizard's **Build Support** page.

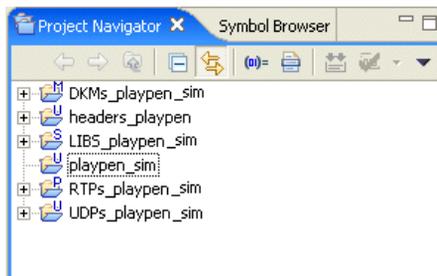
Figure 14-1 **Disable Build Support for Header Projects**



In the wizard's **Build Support** page, select the **Disabled** option and click **Finish**.

In the Project Navigator you should now see the flat list of container projects (collapsed) shown in [Figure 14-2](#).

Figure 14-2 **Container Projects**



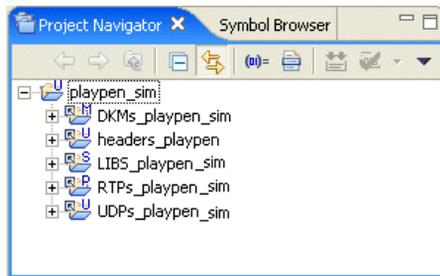
Step 3: Drop all container projects onto the topmost container project.

The topmost container project must be referenced by all other container projects; in other words, all other container projects must be subprojects of **playpen_sim**.

In the Project Navigator, select all projects except **playpen_sim** and drag-and-drop them into **playpen_sim**.

Figure 14-3 illustrates the infrastructure created in the above steps. Notice the referencing arrows at the left of the subproject icons.

Figure 14-3 **Container Projects Referenced by the Topmost Container**



14.4.3 Development

Once you set up the infrastructure for your first board (or simulator), you will populate the container projects with real projects that actually contain source files.

In order to later facilitate porting the software system to other boards you would, organize these, at least initially, so that:

- All Real-time Process projects are subprojects of **RTPs_playpen_sim**.
- All Downloadable Kernel Module projects are subprojects of **DKMs_playpen_sim**.
- All Shared Library projects are subprojects of **LIBS_playpen_sim**.
- All projects for external headers are in **headers_playpen**.
- All User-Defined projects (except the ones in **headers_playpen**, where build support is disabled) are subprojects of **UDPs_playpen_sim**.

Referencing Containers

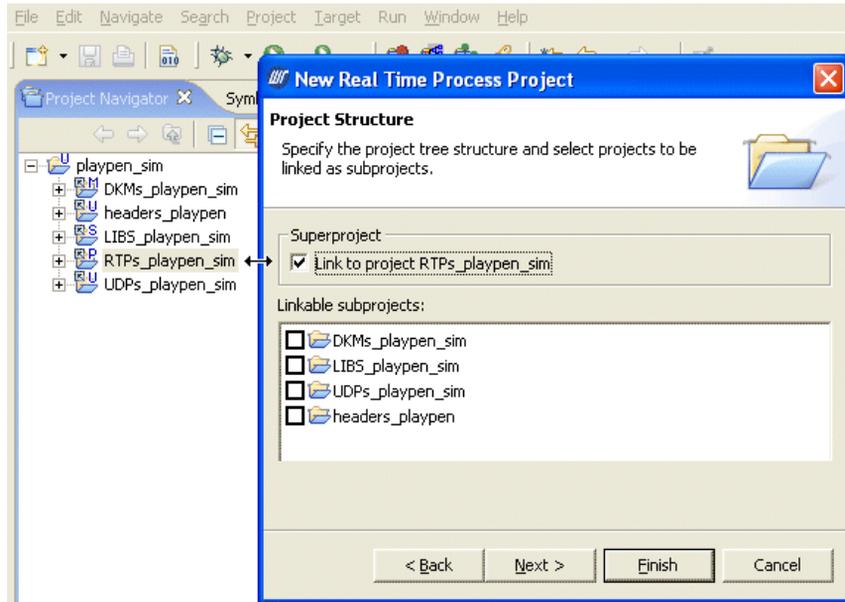
There are a number of ways you can associate projects with other projects as subprojects. Above, during the creation of the container project infrastructure, drag-and-drop was used. Another method is to right-click **Add Reference**. You can also create the reference during project creation as demonstrated in the example below.

Example 14-1 **Creating and a Project and Referencing its Container**

Assumption: you are creating a Real-time Process project. This, according to the conventions outlined above, will be a subproject of **RTPs_playpen_sim**. The quickest way to achieve this is:

1. In the Project Navigator, select **RTPs_playpen_sim**. This is the Real-time Process project you are currently creating should reference as a subproject.
2. Right-click **New > Real Time Process Project**.
3. In the wizard, enter a **Project name** (use **rtp_1** in this example) and click **Next**.
4. In the wizard's **Project Structure** page there is a **Superproject** check box labelled **Link to project RTPs_playpen_sim**. This check box appears because you selected the **RTPs_playpen_sim** project in step 1, above.
5. Select **Reference RTPs_playpen_sim** and continue to create the project.

Figure 14-4 Linking as Subproject during Project Creation

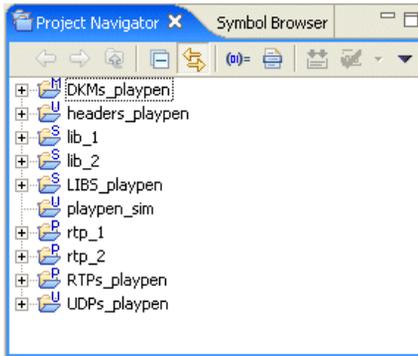


Shared Libraries

The recommended convention, above that “All Shared Library projects are subprojects of LIBS_playpen_sim.” might seem strange. Shared libraries are normally subprojects of the projects that use them, so why put shared libraries in this seemingly disconnected location (LIBS_playpen_sim)?

The libraries are actually even more disconnected than they appear. Remember that, physically speaking, all the projects in any project structure, no matter how deep, are topographically flat as shown in Figure 14-5. This figure shows exactly the same system as Figure 14-6, which displays the logical view you normally see (you can switch from one representation to the other using the drop-down menu at the top-right of the Project Navigator **Hide > Project Structure**).

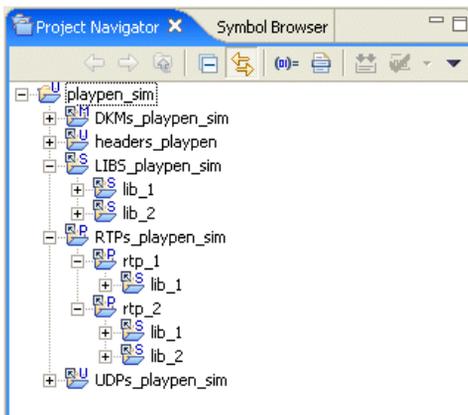
Figure 14-5 **Physical View of the System**



While it is true that you will normally only have libraries as subprojects of applications that use them (even if you are developing a library you will probably have a test application project above the library), it does not matter how often a library node occurs in a given tree, or even in the entire workspace, it is physically only one library and will therefore only be built once (see [Figure 14-5](#)). In this sense, it does not matter that the libraries will appear in one extra place, **LIBS_playpen_sim**.

[Figure 14-6](#) shows exactly the same system as [Figure 14-5](#). Notice that the Shared Library project, **lib_1**, occurs three times: once each under **rtp_1** and **rtp_2**, and once, seemingly unnecessarily, under **LIBS_playpen_sim**.

Figure 14-6 **Logical View of the System**



If you adhere to the convention recommended above, that “[All Shared Library projects are subprojects of LIBs_playpen_sim.](#)”, you will have to copy” (for example, using hold down **CTRL** while you drag-and-drop) library nodes to subproject locations under applications that use them. Note again that when you do this, you are not really copying anything; you are creating references—if anything, you are copying *links* (again note the reference arrows on subproject icons). However, on the upside, whenever you need to add your library projects to applications, you will know exactly where to find them because they are neatly collected in their container project, in our example, **LIBs_playpen_sim**.

The other advantage of adhering to this convention will, as already mentioned, become apparent when it is time to port the software system to different boards.

External Headers and Projects that Use Them

This section starts by describing how to create projects for external headers on the assumption that you follow the convention of having projects of the same type referencing their respective container projects, in our example, **headers_playpen**. The discussion continues with an outline of the steps you need to apply to the projects that use these header projects.

Creating Projects for External Headers

Headers, or any other resources that are external to your workspace, might be a problem if you do not have write permission. If you do not have write permission, proceed as described under [14.2 Resource Locations](#), p.146.

If you have write permission, and it is up to you to create projects for external headers, you would create User-Defined projects for these. These projects, like their container project, **headers_playpen**, will have build support disabled.

To create projects for the external headers:

1. In the Project Navigator, right-click **headers_playpen** and select **New > User-Defined Project**.
2. On the first wizard page, give the project a name (**headers_1** in the example), clear the **Default** check box and browse to the root directory that contains the files you need. Click **Next**.

On the **Project Structure** page, select **Link to project headers_playpen**. If you do not see a check box, or if the label is different, you did not select **headers_playpen** in step 1, above. In this case you can manually move the project when you are finished. Click **Next** twice.

3. In the wizard's **Build Support** page, select **Disabled**, click **Finish**.

Generating Include Search Paths for Projects

Once you have created the header project(s), others can import them (see [14.2 Resource Locations](#), p. 146). Whether you create the header projects yourself, or whether you import them, the include paths of the projects that use the headers have to be updated. If you are able to import the header projects, the chances are that you will also be able to import (or use your version control system to synchronize) the projects that use the headers.

On the other hand, if you are the one who creates the headers project(s), you will probably also be the one who updates the projects that use them and then makes these available to others. In this case, or if you create a new project that uses the headers project from the start, you will generally proceed as follows.

Once your workspace knows the headers (because there is a project for them), include search paths can be generated.

For each topmost project that uses the headers proceed as follows:

In the Project Navigator, select the project that uses the headers and choose **Project > Generate Include Search Paths**.

In the wizard that appears you can configure and generate include search paths for the project, its subprojects and folders, as well as for multiple build specs.

Note that in the **Project Properties** dialog, **Build Properties** node, **Build Paths** tab, and the **Generate** button (for include paths) invoke a similar wizard. This wizard, only lets you configure include paths for one build spec at a time.

Testing and Debugging

A simulator connection should be sufficient for initial testing and debugging of your applications. Please refer to [21. New VxWorks Simulator Connections](#) for information about simulator connections, and to [25. Debugging Projects](#) for information on debugging.

14.4.4 Finalization

Once things are working on the simulator, and your board and hardware connections are up and running, it is time to port the software system from the simulator to the board(s).

The steps below, especially step 2, where you create four new container (sub) projects might initially seem tedious. However, you cannot just copy the existing ones because as you remember, no physical copies are created, only references (that look like copies) are created.

Creating four empty container projects per architecture does not take long, and you only do it once. After that, the advantages include:

- Your projects are clearly and systematically organized.
- You never need to worry about changing build specs for individual projects.
- You can build your whole workspace (all the boards you support) at one time, again without manipulating the build specs.
- Any resource modifications, adding, removing, editing, at source project level will be reflected in all the project structures (=boards) simultaneously, regardless of where you make the modification since these are references, not copies.

Repeat the following steps for each board you will be supporting.

Step 1: Create VxWorks Image project and VxWorks ROMFS File System projects.

1. First, create a VxWorks Image project using the BSP appropriate to your board, see [5. VxWorks Image Projects](#).

This will be a top-level project. If you follow the naming conventions used in this chapter, the project might be named something like **playpen_ppc**.

2. Then, if you are using Real-time Process projects and/or Shared Library projects, you will also need to create a VxWorks ROMFS File System project, see [7. VxWorks ROMFS File System Projects](#).

This will be a subproject of the VxWorks Image project (**playpen_ppc**). The file system will be linked with the VxWorks system image created from the VxWorks Image project, and will hold the binary and data files of the system's run-time components. These are associated with the file system in [Step 3](#) below.

When you build the VxWorks Image project, the VxWorks ROMFS File System subproject and the other associated subprojects will be compiled to binaries and linked to the kernel. If you update files in the file system, rebuilding it creates a new file system image, which is then re-linked to the kernel.

Step 2: Create container subprojects for each project type (except headers).

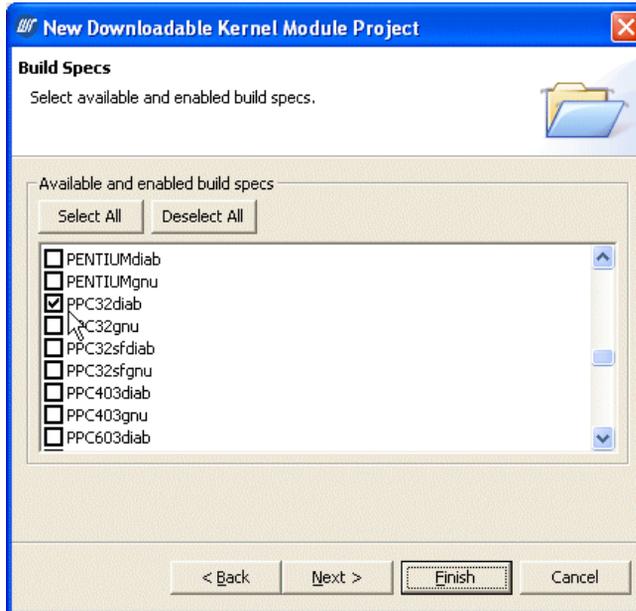
Essentially, you repeat the procedure outlined under *Step 2:Create container projects for each project type and for external headers.*, p.152, *except* that:

- You do not need to create another project for the headers as they do not use a build spec.
- Instead of appending the suffix **_sim** to the project names, you would, in our example, append **_ppc**.
- You have to set the build spec for each container (except the one for User-Defined projects, which cannot have pre-defined build specs) because the wizard default (simulator) will no longer apply.

Step-by-step, the procedure is as follows:

1. To create a new container Downloadable Kernel Module project:
 - a. Right-click in the Project Navigator and select **New > VxWorks Downloadable Kernel Module Project**.
 - b. In the wizard that appears, in the **Project name** field, enter: **DKMs_playpen_ppc** and click **Next** until you reach the wizard's **Build Specs** page.
 - c. In the **Build Specs** page, select **Deselect All**, then select the check box next to the appropriate build spec (only one) from the list, for example, **PPC32diab** and click **Finish**.

Figure 14-7 Select the Build Spec



2. To create a new container Real-time Process project, right-click in the Project Navigator and select **New > VxWorks Real Time Process Project**.
 - a. In the wizard that appears, in the **Project name** field, enter: **RTPs_playpen_ppc** and click **Next** until you reach the wizard's **Build Specs** page.
 - b. In the **Build Specs** page, select **Deselect All**, then select the check box next to the appropriate build spec (only one) from the list, for example, **PPC32diab_RTP** and click **Finish**.
3. To create a new container Shared Library project, right-click in the Project Navigator and select **New > VxWorks Shared Library Project**.
 - a. In the wizard that appears, in the **Project name** field, enter: **LIBs_playpen_ppc** and click **Next** until you reach the wizard's **Build Specs** page.
 - b. In the **Build Specs** page, select **Deselect All**, then select the check box next to the appropriate build spec (only one) from the list, for example, **PPCdiab** and click **Finish**.

4. To create a new container User-Defined project, right-click in the Project Navigator and select **New > User Defined Project**.
 - a. In the wizard that appears, in the **Project name** field, enter:
UDPs_playpen_ppc and click **Finish**.

By definition, there can be no predefined build specs for User-Defined projects. Workbench does not manage the build; it is up to you to know what needs to be done with them to complete the porting.

Step 3: Drop all new container projects onto the VxWorks ROMFS File System project.

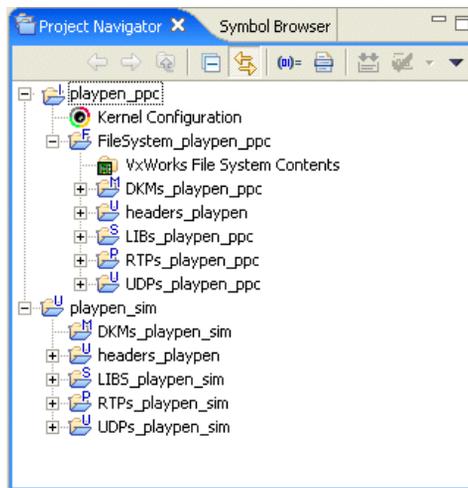
The VxWorks ROMFS File System project is a subproject of the VxWorks Image project (see [Step 1](#)). The new containers you have just created, as well as the **headers_playpen** project, should, in turn, be subprojects of this VxWorks ROMFS File System project.

- Select all the container projects you have just created and drop them onto the **FileSystem_playpen_ppc** project you created under [Step 1](#).
- Select the **headers_playpen** subproject under **playpen_sim** and while holding down **CTRL**, drag-and-drop it onto the **FileSystem_playpen_ppc** project. It should now appear under both **playpen_sim** and **FileSystem_playpen_ppc**.

The infrastructure for the new board is now complete (see [Figure 14-8](#)).

Next, you have to create references to the source code projects.

Figure 14-8 **Project Organization for Two Boards**



Step 4: Referencing source code subprojects.

Insert references from the source code subprojects from each per-type container subproject under **playpen_sim** to the corresponding container under **playpen_ppc**.

That is, while holding down **CTRL**, drag-and-drop it to create the references from all source code subprojects under:

- **DKMs_playpen_sim** to **DKMs_playpen_ppc**
- **LIBs_playpen_sim** to **LIBs_playpen_ppc**
- **RTPs_playpen_sim** to **RTPs_playpen_ppc**
- **UDPs_playpen_sim** to **UDPs_playpen_ppc**

Step 5: Configure the VxWorks Image project and VxWorks ROMFS File System projects.

You will need to configure the VxWorks Image project (add initialization routines and configure components) and the VxWorks ROMFS File System project.

For more information on this subject, see [5. VxWorks Image Projects](#), [7. VxWorks ROMFS File System Projects](#), and the *VxWorks Kernel Programmer's Guide*.

PART III
Development

15	Navigating and Editing	169
16	Building Projects	179
17	Building: Use Cases	195
18	RTPs and Shared Libraries from Host to Target	215

15

Navigating and Editing

[15.1 Introduction](#) 169

[15.2 Wind River Workbench Context Navigation](#) 170

[15.3 The Editor](#) 173

[15.4 Search and Replace: The Retriever](#) 175

[15.5 Static Analysis](#) 175

15.1 Introduction

Workbench navigation views allow seamless cross-file navigation based on symbol information. For example, if you know the name of a function, you can navigate to that function without worrying about which file it is in. You can do this either from an editing context, or starting from the *The Symbol Browser*, p.171. On the other hand, if you prefer navigating within and between files, you can use the *The File Navigator*, p.172.

Static analysis is the parsing and analysis of source code symbol information. This information is used to provide code editing assistance features such as multi-language syntax highlighting, code completion, parameter hints, definition/declaration navigation for files within your projects.

Apart from the things you see directly in the Editor, static analysis also provides the data for code comprehension and navigation features such as include

browsing, call trees, as well as resolving includes to provide the compiler with include search paths.



NOTE: Syntax highlighting is provided for filesystem files that you open in the Editor, but no other static analysis features are available for files that are outside your projects.

15.2 Wind River Workbench Context Navigation

Various filters are available on each tool's local toolbar. Hover the mouse over the buttons to see a tooltip describing what these buttons do. At the top-right, a pull-down menu provides additional filters, including *working sets* (if you have defined any). An active working set is marked by a bullet next to its name in the pull-down menu.

Generally, you will want to navigate to symbols, or analyze symbol-related information, from an Editor context. The entry points are:

- The right-click context menu of a symbol
- Keyboard shortcuts that act on the current selection in the Editor:
 - F3 — Jump between associated code, for example, between definition/declaration or function definition/call. There is no navigation from workspace files to external files, i.e. files outside your projects.
 - F4 — Open the type hierarchy of the current selection (see [15.2.4 Type Hierarchy View](#), p.172).
 - CTRL+ALT+H — Open the call tree of the current selection (see *Wind River Workbench User Interface Reference: Call Tree View*).
 - CTRL+I — Open the include browser to view the includes of the current selection (see [15.2.5 Include Browser](#), p.172).
- Keyboard shortcuts that open dialogs from which you can access symbols in any of your projects:
 - SHIFT+F3 — Display the **Open Symbol** dialog.
 - SHIFT+F4 — Display the **Open Type Hierarchy** dialog.
 - ALT+SHIFT+H — Display the **Open Call Tree** dialog.

CTRL+SHIFT+R — Displays the **Open Resource** dialog.

These options are also available from the **Navigate** toolbar menu.

15.2.1 The Symbol Browser

By default, the Symbol Browser is a tab in the left pane of the main window, together with the Project Navigator.

Use the Symbol Browser for global navigation. Because the Symbol Browser presents a flat list of all the symbols in all the open projects in your workspace, you might want to constrain the list by using *Working Sets*. You can configure and select working sets using the Project Navigator's local pull-down menu.

In addition, very large symbol loads can cause delays of up to several minutes while Workbench loads the symbols. Loading smaller batches of symbols can decrease this delay. Specify the size of the symbol batch using the Preferences dialog. For more information, see *Wind River Workbench User Interface Reference: Debug View*.

Text Filtering

The **Name Filter** field at the top of the view provides match-as-you-type filtering. The field also supports wild cards: type a question mark (?) to match any single letter; type an asterisk (*) to match any number of arbitrary letters. Selecting **Hide Matching** next to the **Name Filter** field inverts the filter you entered in the field, so you see only those entries that do not match your search criteria.

For a guide to the icons in the Symbol Browser, see *Wind River Workbench User Interface Reference: Symbol Browser View*.

15.2.2 The Outline View

The Outline view is to the right of the currently active Editor, and shows symbols in the currently active file.

Use the Outline view to sort, filter, and navigate the symbols in the context of the file in the currently active Editor, as well as to navigate out of the current file context by following call and reference relationships.

For a guide to the icons in the Outline view, see *Wind River Workbench User Interface Reference: Outline View*.

15.2.3 The File Navigator

If you have never used the File Navigator, you can open it by choosing **Window > Show View > Other**. In the dialog that opens, select **Wind River Workbench > File Navigator** and click **OK**. After the first time you open the File Navigator, a shortcut appears directly under the **Window > Show View** menu. By default, the File Navigator appears as a tab at the left of the Wind River Workbench window, along with the Project Navigator and the Symbol Browser.

The File Navigator presents a flat list of all the files in the open projects in your workspace, so you can constrain the list by using *Working Sets*. You can configure and select working sets using the File Navigator's local pull-down menu.

The left column of the File Navigator shows the file name, and is active; double-clicking on a file name opens the file in the Editor, and right-clicking on a file allows you to compile the file and build the project, among other tasks. The right column displays the project path location of the file.

The **File Filter** field at the top of the view works in the same way as the **Name Filter** field in the Symbol Browser, see [15.2.1 The Symbol Browser](#), p.171.

15.2.4 Type Hierarchy View

Use the Type Hierarchy view to see hierarchical **typedef** and type-member information.

To open the Type Hierarchy view:

- Right-click a symbol in the Editor, Outline, or Symbol Browser view and select **Type Hierarchy view**.
- Click the toolbar button on the main toolbar.
- Select **Navigate > Open Type Hierarchy**.

For more information, see the *Wind River Workbench User Interface Reference: Type Hierarchy View*.

15.2.5 Include Browser

By default, the Include Browser appears as a tab at the bottom-right.

To open the Include Browser:

- Right-click a symbol in the Editor, Outline, or Symbol Browser view and select **Open Include Browser**.
- Right-click a file in the File Navigator or the Project Navigator and select **Include Browser**.
- Select **Navigate > Open Include Browser**.

Use the Include Browser to see which file includes, or is included by, the file you are examining. Use the buttons on the Include Browser's local toolbar to toggle between showing include and included-by relationships. Double-click on an included file in the Include Browser to open the file in the Editor at the include statement.

15.3 The Editor

The Editor is your primary view for editing and debugging source code. The Editor is language-aware, can parse C, C++, Ada, and Assembler files, and now can be used in vi-emulation mode. Many Editor features are configurable in the Preferences (see *Wind River Workbench User Interface Reference: Editor*).

15.3.1 Code Templates

The Editor uses templates to extend code assist (shortcut **CTRL+SPACE**) by inserting recurring patterns of text.

In the case of source code, common patterns are **for** loops, **if** statements and comment blocks. Those patterns can be parameterized with variable placeholders that are resolved and substituted when the template is inserted into the text. Unresolved variables can be link-edited after inserting the template, which means that the first unresolved variable is selected, and all occurrences of this variable are edited simultaneously when you enter the correct text.

An example template might look like the following:

```
for (int ${var} = 0; ${var} < ${max}; ++${var}) {  
    ${cursor}  
}
```

Provided Templates

Workbench provides the following templates. Auto-insert is turned on by default.

Name	Description
author	author name
catch	catch block
class	class declaration
comment	default multiline comment
do	do while statement
else	else block
elseif	else if block
for	for loop
for	for loop with temporary variable
if	if statement
ifelse	if else statement
main	main method
namespace	namespace declaration
new	create new object
stderr	print to standard error
stdout	print to standard output
switch	switch case statement
try	try catch block
using	using a namespace

Many template options are configurable in the Preferences (see *Wind River Workbench User Interface Reference: Editor*).

15.4 Search and Replace: The Retriever

The Retriever is a fast, index-based global text search/replace tool. The scope of a search can be anything from a single file to all open projects in the workspace. You can query for normal text strings, or regular expressions. Matches can be filtered according to location context (for example, show only matches occurring in comments). Text can be globally or individually replaced, and restored if necessary. You can create working sets from matched files, and you can save and reload existing queries.

15.4.1 Initiating Text Retrieval

Text retrieval is context sensitive to text selected in the Editor. If no text is selected in the Editor, an empty instance of the Retriever opens. If text is selected in the Editor, the retrieval is immediately initiated according to the criteria currently defined in the Retriever's **Find** tab.

To open the Retriever, or to initiate a context sensitive search, use:

- the keyboard shortcut **CTRL+2**.
- right-click in the Editor and choose **Retrieve in Files**.
- from the global menu, choose **Search > Retrieve in Files**.
- Click the **Retriever** tab in the lower panel of the Workbench window, where the Retriever appears by default.

For more information, see the *Wind River Workbench User Interface Reference: Retriever*.

15.5 Static Analysis

Editing, navigating, and code comprehension rely on static analysis parsing of source code.

You can enable static analysis in two ways: automatically, by leaving **Enable Static Analysis** selected when you create your project, or manually, by right-clicking your project in the Project Navigator and selecting **Static Analysis > Enable**.



NOTE: If this is your first use of static analysis, you may need to select **Static Analysis > Activate Plug-in** before you can access other static analysis features.

For information about global and project-specific preferences, see the *Wind River Workbench User Interface Reference: Static Analysis Preferences*.

15.5.1 Sharing Static Analysis Data with a Team

Static analysis of a large project can take quite a bit of time, so once you have parsed the source code of your project, you can share the generated data with your team members using your group's source control tool.

To share generated data with your team:

1. In the Project Navigator, right-click a project then select **Static Analysis > Export Shared Team Data**¹. The **Team Data Export Options** dialog appears, where you can set export options and specify how to resolve file version differences in other workspaces (for details about this dialog, see *Wind River User Interface Reference: Static Analysis Preferences*). Click **Finish**. Workbench exports the data to the file system location you specified.
2. Using your team's source control tool, make the generated data available to other team members (for example, by checking it into ClearCase). After that, when the project is imported into another workspace, Workbench will use the shared data instead of parsing the project.
3. Changes to the source-code are not propagated to the shared data automatically, they are stored local to the workspace. You must export the data again to make these changes available to team-members.
4. Once you have made local changes to a project in your workspace, Workbench uses that local data in preference to the shared data. To abandon your local changes and go back to using shared data, right-click a project and select **Import Shared Team Data**. Workbench launches a wizard that removes your local data in favor of the shared data.

1. If this is your first use of Static Analysis, select **Static Analysis > Activate Plug-in**, then select **Static Analysis > Export Shared Team Data**.

Comparing Local Data with Shared Team Data

The tricky part about working with shared team data is to figure out which of the resources in your workspace have been changed relative to the shared data. In other words, you need a technique to compare the version of the file in your workspace with the one used to generate the shared data. Workbench comes with several mechanisms to do that:

- **Compare Timestamps:** In some setups (e.g. ClearCase dynamic views) a file of a certain version will have the same timestamp no matter in which workspace it appears. This makes it easy to check the version of a file against the shared data. This technique is preferable because it is fast, but many setups do not allow it (such as CVS and ClearCase snapshot views).
- **Use team data for all read-only files:** In other setups, all files in a workspace that are in sync with the repository of the source control tool are read-only. As a heuristic, we can use the shared data for all files that are read-only. The fact that a file of the workspace is in sync with the repository does not actually guarantee that the file version is the same as the one used to generate the shared data. If you update the shared data regularly though, the heuristic will be good.
- **Use checksums as a fallback:** If accessing the source code is reasonably fast and doesn't cause too much drag on the system (unlike in a ClearCase dynamic view) computing and comparing checksums for each file is a reasonable approach.

When you export shared data, you can specify in the dialog which of the techniques described above can be used by team members using the shared data. **Compare time stamps** and **Use team data for all files** will always be available to them in the import wizard, but you can disable **Use team data for all files** and **Compare checksums** by unchecking the corresponding checkboxes in the export wizard.

When you import a project with shared data into your workspace, Workbench will choose the best available comparison method.

Team-Shared Exclusion Filter

The project property page, accessible by right-clicking a project and selecting **Static Analysis > Edit Exclusion Filter** now allows you to share filters with your team.

The filters are organized into a tree with two root nodes: one for shared filters and one for workspace private ones. You can convert shared filters into

workspace-private ones if you would like to edit them, or you can share a private filter with your team if you find it particularly useful. For details about exclusion filters, see *Wind River User Interface Reference: Static Analysis Preferences*.

16

Building Projects

- 16.1 Introduction 179
- 16.2 Configuring Workbench Managed Builds 182
- 16.3 Configuring User-Defined Builds 188
- 16.4 Accessing Build Properties 188
- 16.5 Build Specs 190
- 16.6 Makefiles 191

16.1 Introduction

The process of building in Workbench starts during project creation, when you select a build type for your projects, folders, and build targets. Individual build settings can be changed later, and in some cases you can switch from a managed build to a user-defined or disabled build, but if you want Workbench to manage your builds, you must select **Managed Build** in the New Project wizard.

Workbench offers several levels of build support:

Managed Build

Workbench provides two types of managed build support—Standard and Flexible—for all project types except VxWorks Image, VxWorks Boot Loader, VxWorks ROMFS File System, and User-Defined projects.

Workbench provides default build settings (that you can change as necessary), creates makefiles, and controls all phases of the build.

There are advantages to each type of managed build, depending on many things including how much control you need over your build output and what your source tree looks like.

Table 16-1 shows a comparison of standard and flexible managed build features.

User-Defined build

With **User-Defined** builds, you are responsible for setting up and maintaining your own build system and Makefiles, but Workbench does provide minimal build support.

- It allows you to configure the build command used to launch your build utility, so you can start builds from the Workbench GUI.
- You can create build targets in the Project Navigator that reflect rules in your makefiles, so you can select and build any of your make rules directly from the Project Navigator.
- Workbench displays build output in the Build Console.

Disabled build

If you select Disabled build for a project or folder, Workbench provides no build support at all. This is useful for projects or folders that contain, for example, only header or documentation files that do not need to be built.

Disabling the build for such folders or projects improves performance both during makefile generation as well as during the build run itself.



NOTE: You cannot change from a lower level of build support to a managed build once the project is created. If you later want Workbench to manage your build, create a new project with the desired type of managed build support, either on top of the existing sources, or import your sources into it.

Table 16-1 Comparison of Standard and Flexible Managed Build Features

Standard Managed Build	Flexible Managed Build
Build structure parallels the file system structure.	Build structure can be defined independently from the file system structure.
Build order is determined by the project and folder hierarchies as displayed in the Project Navigator.	Build order is flexible, and you can customize settings per build tool and build target.
Project contains folders and files. Project metadata and build information is stored in the source code location.	Project contains folders, files, and information about how the build targets of the project are built (stored in the .wrproject file). No information is stored in .wrfolder files in the source code location.
Project can contain multiple build targets, but the build options are the same regardless of the build target the file is built into.	Project can contain multiple build targets. You can add the same file to multiple build targets, and set specific options depending on which build target the file is built into.
Build target can contain only files within the project.	Build targets can contain any file, folder, project, or other build target in the workspace, including linked resources. Virtual folders allow you to group objects from different sources and apply build settings to them.
Build target contains all contents of included folders.	Folders and files can be excluded from the build target using regular expressions.
Workbench creates one Makefile per folder with all build specs. Makefiles are based on data you enter at project creation time, or later in the Build Properties dialog.	Workbench creates one Makefile per build spec for the whole project.
Leveling chain is project > folder > file .	Leveling chain is project > build target > folder > file .

Table 16-1 **Comparison of Standard and Flexible Managed Build Features** (cont'd)

Standard Managed Build	Flexible Managed Build
Workbench generates include search paths for header files that are visible in the workspace.	Same
Build output is displayed in the Build Console.	Same

16.2 Configuring Workbench Managed Builds

The process of configuring Workbench managed builds differs significantly depending on whether you selected a standard or a flexible managed build.

16.2.1 Configuring Standard Managed Builds

Standard managed builds have not changed from previous versions of Workbench. When you select **Standard** in the New Project wizard, your project is created and contains a preliminary build target in addition to the usual project files.

To create the build target, right-click your project in the Project Navigator and select **Build Project**.

16.2.2 Configuring Flexible Managed Builds

When you select **Flexible**, your projects are created in the same way and also contain the usual project files, but you must create your build targets manually.

Adding Build Targets to Flexible Managed Builds

Once your project is created, you will see a **Build Targets** node inside it.

1. To add a build target to your project, right-click the **Build Targets** node and select **New Build Target**. The **New Build Target** dialog appears.
2. By default the **Build target name** and **Binary output name**¹ are the same as the project name, but if you are going to create multiple build targets you will want to type in more descriptive names. Choose the appropriate **Build tool** for your project, then click **Next**. The **Edit Content** dialog appears.
3. To display files, folders, and other build targets from outside your current project, select **Show all projects**. If you have created a **Working Set**, you can restrict the display by selecting it from the pull-down list.
4. You can add contents to your build target in several ways:
 - a. You can select specific files, folders, projects, or other build targets in the left column and click **Add**. What you can add depends on the build tool you use; for example, you cannot add an executable build target to another build target.

When choosing folders or projects, they can be added “flat” or with recursive content.

- Clicking **Add** creates a “flat” structure, meaning that Workbench adds the exact items you choose and skips any subfolders and files.
- Clicking **Add Recursive** creates a structure that includes subfolders and files.



NOTE: Adding linked resources to a build target may cause problems within a team if the linked resources are added using an absolute path instead of a variable.

To define a path variable, select **Window > Preferences > General > Workspace > Linked Resources**, click **New**, then enter a variable name and location.

- b. You can create a virtual folder within your build target by clicking **Add Virtual Folder**, typing a descriptive name in the dialog, and clicking **OK**. Virtual folders allow you to group objects within the build target so you can apply the same build settings to them; they also provide a way to add files with the same name from different locations.

-
1. Your build targets must have unique names, but you can use the same **Binary output name** for each one. This allows you to deliver an output file with the same name in multiple configurations. Workbench adds a build tool-appropriate file extension to the name you type, so do not include the file extension in this field.

- i. To add contents to your virtual folder, right-click it in the Project Navigator and select **Edit Content**.
 - ii. Select content as described in step [a](#) above, and click **Finish**.
5. To adjust the order of the build target contents, select items in the right column and click **Up**, **Down**, or **Remove**.



NOTE: Folders appear in the specified place in the list, but the files within them are added alphabetically.

6. When you have configured your build target, click **Finish**. It appears in the Project Navigator under the **Build Targets** node of your project.

Modifying Build Targets

There are several ways to modify your build target once it has been created.

Editing Content

To add additional items, adjust the order, or make any other changes to your build target, right-click it in the Project Navigator and select **Edit Content**. The **Edit Content** dialog appears, with the build target content displayed in the right column. Adjust the contents as necessary, then click **Finish**.

Renaming Build Targets and Virtual Folders

To rename your build target or virtual folder, select it in the Project Navigator, press **F2**, and type a new name.

Copying Build Targets

To copy a build target, right-click the build target and select **Copy**, then right-click the destination project's **Build Targets** node and select **Paste** (if you are pasting back into the original project, type a unique name for the new build target).

This is useful for setting up the same build targets in multiple projects with different project types (for example, a library for a native application and a downloadable kernel module will have the same contents but different flags).



NOTE: The build target and its contents are copied, but any overridden attributes are not.

Removing Content

To remove an item from the build target, right-click it in the Project Navigator and select **Remove from Build Target**, or just select it and press **Delete**.

Depending on the item you selected, the menu item may change to **Exclude from Build Target** if the item cannot be deleted (for example, recursive content cannot be deleted). Pressing **Delete** also reinstates an item by removing the exclusion.

Excluding Content

To exclude a specific item from the build target that was included recursively, right-click it in the Project Navigator and select **Exclude from Build Target**.

You can also use regular expressions to exclude groups of items.

1. To add a pattern to the excludes list, right-click a folder in the build target, then select **Properties**, then select the **Excludes** tab.
2. Click **Add File** to define a pattern to exclude specific files or file types. For example, type `*_test.c` to exclude any file named `filename_test.c`.

You can include additional parts of the path to better define the file you want to exclude; for example, type `lib/standard_test.c` to exclude that specific file.

3. Click **Add Folder** to define a pattern to exclude folders within specific folders. For example, type `*/lib/*_test.c` to exclude any file located in a folder named `lib` and named `filename_test.c`.

Dragging and Dropping Content

To modify build target contents without opening the **Specify Content** dialog, you can drag and drop items in the Project Navigator.

- You can drop resources onto build target nodes or virtual folders to add them to a build. Workbench checks the validity of the action and reports errors if the move is not allowed. Workbench also asks you if the resource should be added “flat” or recursively.
- You can reorder build target contents by dragging and dropping an item on the same level.
- You can drop a build target node onto other build targets to add the first build target as a reference (for example, dropping a library onto an executable, or dropping an executable onto an executable). Workbench checks to make sure it is a valid operation before allowing you to complete the action.



NOTE: If your build target contains projects or folders, any files you add to them later will be automatically added to the build target as well. So you do not need to manually update your build target in this case.

Leveling Attributes

The leveling of build-specific settings in flexible managed builds is significantly different from the leveling of standard managed build projects. The leveling chain for flexible managed build projects is shown below.

Project > Target > Folder > File
Project > Target > Folder > Subfolder > File
Project > Target > Virtual folder > File
Project > Target > Virtual folder > Folder >
Project > Target > File

The folder level here is related to folders underneath a build target, as described in [Adding Build Targets to Flexible Managed Builds](#), p.182.

The information that can be leveled is equivalent to the current implementation of standard managed build projects, plus additional information so that you can enable files to be built on a per build-spec basis (standard managed build allows this only on folder level).

You can now configure the build target with specific settings for all build tools on a build target level (for example, you can set compiler options for the source files related to that build target).

Target Passing and Project Structure

Passing build targets is only supported when passing to VxWorks kernel image superprojects; it is not possible to pass flexible managed build targets to standard managed build or other flexible managed build superprojects.

To reference other flexible managed build targets, add them to the contents of a build target as described in [Adding Build Targets to Flexible Managed Builds](#), p.182.

Understanding Flexible Managed Build Output

The output of a flexible managed build is significantly different from the output of a standard managed build.

Workbench does not create build redirection directories for each folder, as the objects might be built differently when building them for specific targets. Instead, Workbench creates a build-specific redirection directory, which you can configure on the **Build Properties** > **Build Paths** tab, underneath the project root directory.

The redirection directory contains a directory for each build target; inside those are directories named **Debug** or **NonDebug** depending on the debug mode you chose for the build. Workbench generates the output files according to the structure you defined in the build target, storing them in the debug mode directory.

In general, the build output is structured like this:

Project directory
Project dir/build specific redirection dir
Project dir/build specific redirection dir/target dir
Project dir/build specific redirection dir/target dir/debug mode dir
Project dir/build specific redirection dir/target dir/debug mode dir/binary output file of the build target

All objects belonging to the build target are stored in an additional **Objects** subfolder:

Project dir/build specific redirection dir/target dir/debug mode dir/Objects/structure of object files

Example Build Target and Build Output Structure

To understand how the build target structure influences the build output, below is an example of a project source tree.

```
proj1/
proj1/a.c
proj1/b.c
proj1/folder1/c.c
proj1/folder1/d.c
```

Target1 contains these two items:

```
a.c
folder1/*.c
```

Target2 contains these two items:

```
b.c
d.c
```

Configuring the project to use **spec1** as the active build spec, naming the redirection directory **spec1**, and turning debug-mode **on** produces the output structure seen below.

```
proj1/spec1/Target1/Debug/Target1.out  
proj1/spec1/Target1/Debug/Objects/a.o  
proj1/spec1/Target1/Debug/Objects/folder1/c.o  
proj1/spec1/Target1/Debug/Objects/folder1/d.o
```

```
proj1/spec1/Target2/Debug/Target2.out  
proj1/spec1/Target2/Debug/Objects/b.o  
proj1/spec1/Target2/Debug/Objects/d.o
```

16.3 Configuring User-Defined Builds

When you create a User-Defined project, you can configure the build command, make rules, build target name, and build tool (for more information, see [11. VxWorks User-Defined Projects](#)). To create the build target, right-click your project in the Project Navigator and select **Build Project**.

To update the build settings, right-click your project in the Project Navigator and select **Properties**, then select **Build Properties**.

See *Wind River Workbench User Interface Reference: Build Properties* for more information about the settings described on the build properties tabs.

16.4 Accessing Build Properties

There are two ways to set build properties: in the Workbench preferences, to be automatically applied to all new projects of a specific type, and manually, on an individual project, folder, or file basis. The properties displayed will differ depending on the type of node and the type of project you selected, as well as the type of build associated with the project.

For details, see *Wind River Workbench User Interface Reference: Build Properties*.

16.4.1 Workbench Global Build Properties

To access global build properties, select **Window > Preferences** and choose the **Build Properties** node.

This node allows you to select a project type, then set default build properties to be applied to all new projects of that type.

16.4.2 Project-specific Build Properties

To access build properties from the Project Navigator, right-click a project and select **Properties**. In the Properties dialog, select the **Build Properties** node.

The project-specific Build Properties node has tabs that are practically identical to the ones in the Workbench preferences, but these settings apply to an existing project that is selected in the Project Navigator.



NOTE: Build properties for VxWorks Image Projects (VIPs) can differ substantially from the general properties of other project types.

See *Wind River Workbench User Interface Reference: Build Properties* for more information about VIP build properties, and consult the *VxWorks Kernel Programmer's Guide* for general information about VIPs.

16.4.3 Folder, File, and Build Target Properties

Folders, files, and build-targets inherit (reference) project build properties where these are appropriate and applicable. However, these properties can be overridden at the folder/file level. Inherited properties are displayed in blue typeface, overridden properties are displayed in black typeface.

Overridden settings are maintained in the **.wrproject** file (and also in **.wrfolder** files in standard managed builds). These files should therefore also be version controlled. Note that you can revert to the inherited settings by clicking the eraser icon next to a field.

16.4.4 Multiple Target Operating Systems and Versions

If you installed Workbench for multiple target operating systems and/or versions, you can set a default target operating system/version for new projects in the Workbench Preferences, under **General > Target Operating Systems**.

For existing projects, you can verify the target operating system (version) by right-clicking the project in the Project Navigator, then selecting **Properties**, then **Project Info**.



NOTE: In most cases, it will *not* be possible to successfully migrate a project from one target operating system or version to another simply by switching the selected **Target Operating System and Version**.

In the Project Navigator (and elsewhere), the target operating system and version are displayed next to the project name by default. You can toggle the display of this information in the Preferences, **General > Appearance > Label Decorations**, using the **Project Target Operating Systems** checkbox.

If you have multiple versions of the same operating system installed, the New Project wizard allows you to select which version to use when creating a new project.

16.5 Build Specs

A build spec is a group of build-related settings that lets you build the same project for different target architectures and/or different tool chains by simply switching from one build spec to another. Note that the architecture/tool chain associations are preconfigured examples; you can also create your own build specs (usually from copies of existing ones, using the **Copy** button) for any constellation of the many configurable properties that make up a spec (see also [17.8 A Build Spec for New Compilers and Other Tools](#), p.207).

It is important to remember that the build spec used when you build must match the target board; that is, it must match the VxWorks Image project that the application project will be associated with.

16.6 Makefiles

The build system uses the build property settings to generate a self-contained makefile named **Makefile**.

- For standard managed builds, a Makefile is generated in each project and folder at each build run. This allows you to build individual folders, projects, and subtrees in a project structure.
- For flexible managed builds, only one Makefile is created per build spec.

By default makefiles are stored in project directories; if you specified an absolute **Redirection Root Directory** (see *Wind River Workbench User Interface Reference: Build Paths*), they are stored there, in subdirectories that match the project directory names.

The generated makefile is based on a template makefile named **.wrmakefile** that is copied over at project creation time. If you want to use custom make rules, enter these in **.wrmakefile**, *not* in **Makefile**, because this is regenerated for each build. The template makefile, **.wrmakefile**, references the generated macros in the placeholder **%IDE_GENERATED%**, so you can add custom rules either before or after this placeholder. You can also add ***.makefile** files to the project directory.

For other ways of setting custom rules, see [17.7 User-Defined Build-Targets in the Project Navigator](#), p.206.



NOTE: If you configure your project for a remote build, the generated Makefile contains paths for remote locations rather than local ones. For more information about remote builds, see [17.9 Developing on Remote Hosts](#), p.209.

16.6.1 Derived File Build Support

The Yacc Example

Workbench provides a sample project, **yacc_example**, that includes a makefile extension showing how you can implement derived file build support. It is based on **yacc** (Yet Another Compiler Compiler) which is not contained in the Workbench or VxWorks installation. To actually do a build of the example you need to have **yacc** or a compatible tool (like GNU's **bison**) installed on your system, and you should have extensive knowledge about make.

The makefile, **yacc.makefile**, demonstrates how a yacc compiler can be integrated with the managed build and contains information on how this works.

1. Create the example project by selecting **New > Project > Example > Native Sample Project > Yacc Demonstration Program**.
2. Right-click the **yacc_example** project folder, then select **New > Build Target**. The New Build Target dialog appears.
3. In the **Build target name** field, type **pre_build**.
4. From the **Build tool** drop-down list, select **(User-defined)**, then click **Finish** to create the build target.
5. In the Project Navigator, right-click **pre_build** and select **Build Target**. This will use the makefile extension **yacc.makefile** to compile the yacc source file to the corresponding C and header files. The build output appears in the Build Console.



NOTE: It is necessary to execute this build step prior to the project build, because the files generated by **yacc** will not be used by the managed build otherwise. This is due to the fact that the managed build generates the corresponding makefile before the build is started and all files that are part of the project at this time are taken into account.

6. When the build is finished, right-click the **yacc_example** folder and select **Build Project**.

Additional information on how you can extend the managed build is located in **yacc.makefile**. It makes use of the extensions provided in the makefile template **.wrmakefile**, which can also be adapted to specific needs.

General Approach

To implement derived file support for your own project, create a project-specific makefile called *name_of_your_choice*.**makefile**. This file will automatically be used by the managed build and its make-rules will be executed on builds.

It is possible to include multiple ***.makefile** files in the project, but they are included in alphabetical order. So if multiple build steps must be done in a specific order, it is suggested that you use one ***.makefile** and specify the order of the tools to be called using appropriate make rules.

For example:

1. Execute a lex compiler.
2. Execute a yacc compiler (depending on lex output).
3. Execute a SQL C tool (depending on the yacc output).

Solution: (using the **generate_sources** make rule)

```
generate_sources :: do_lex do_yacc do_sql
do_lex:
    @...

do_yacc:
    @...

do_sql:
    @...
```

OR

```
generate_sources :: $(LEX_GENERATED_SOURCES) $(YACC_GENERATED_SOURCES)
$(SQL_GENERATED_SOURCES)
```

Add appropriate rules like those shown in the file **yacc.makefile**.

17

Building: Use Cases

- 17.1 Introduction 195
- 17.2 Adding Compiler Flags 196
- 17.3 Building Applications for Different Boards 198
- 17.4 Creating Library Build-Targets for Testing and Release 199
- 17.5 Architecture-Specific Implementation of Functions 202
- 17.6 Executables that Dynamically Link to Shared Libraries 203
- 17.7 User-Defined Build-Targets in the Project Navigator 206
- 17.8 A Build Spec for New Compilers and Other Tools 207
- 17.9 Developing on Remote Hosts 209

17.1 Introduction

This chapter suggests some of the ways you can go about completing various build-specific tasks in Wind River Workbench.

17.2 Adding Compiler Flags

Let us assume:

1. You are working on a Real-time Process project (referred to in the following as **MyRTP**), and you are using the build spec, **SIMPENTIUMgnu_RTP**.
2. You want to suppress compiler warnings, and you are familiar with the GNU compiler (used by the given build spec) command line.
3. You later have to change the build spec to **SIMPENTIUMdiab_RTP**; that is you have to use the Wind River Compiler tools, with which you are not familiar, but you still want to suppress compiler warnings.

17.2.1 Add a Compiler Flag by Hand

According to assumption 2, above, you are familiar with the GNU compiler command line, so you just want to know *where* to enter the **-w** option.

1. In the Project Navigator, right-click on the **MyRTP** project and select **Properties**.
2. In the Properties dialog, select the **Build Properties** node.
3. In the **Build Properties** node, select the **Build Tools** tab.
4. In the **Build Tools** tab:
 - Set the **Build tool** to **C-compiler**
 - The **Active build spec** will, according to assumption 1, above, already be set to **SIMPENTIUMgnu_RTP**.
 - In the field next to the **Tool Flags** button, append a space and **-w**

The contents of this, the **Tool Flags** field you have just modified, is expanded to the **%ToolFlags%** macro you see in the **Command** field above it. Because you entered the **-w** in the **Tool Flags** field, rather than the **Debug** or **Non Debug** mode fields, warnings will always be suppressed, rather than only in either **Debug** or **Non Debug** mode.

17.2.2 Add a Compiler Flag with GUI Assistance

According to assumption 3, above, you have to change to the Wind River Compiler tool chain used by the **SIMPENTIUMdiab_RTP** build spec, and you are not familiar with the new command line tool options.

Step 1: Change the Active Build Spec

1. In the Project Navigator, right-click on the **MyRTP** project, and select **Set Active Build Spec**.

If the **SIMPENTIUMdiab_RTP** build spec is enabled, you will see it listed in the dialog that appears. In this case, all you would have to do is select **SIMPENTIUMdiab_RTP** from the list and click **OK**.

However, we shall assume **SIMPENTIUMdiab_RTP** is not enabled, and therefore not available in the list.

2. In the Project Navigator, right-click on the **MyRTP** project, and select **Properties**.
3. In the Properties dialog, select the **Build Specs** node.
4. In the **Build Specs** node, select the **SIMPENTIUMdiab_RTP** build spec and set both the **Default build spec** and the **Active build spec** to **SIMPENTIUMdiab_RTP**.

Leave the Properties dialog open to complete [Step 2](#), below.

Step 2: Use the GUI to Add a Compiler Flag

1. Select the **Build Tools** tab.
2. In the **Build Tools** tab:
 - Set the **Build tool** to **C-compiler**
 - The **Active build spec** will already be set to **SIMPENTIUMdiab_RTP** (see [4](#) above).
 - We assumed you are unfamiliar with the Wind River compiler options so, to open the Wind River Compiler Options dialog, click the **Tool Flags** button.

- In the Wind River Compiler Options dialog, click your way down the navigation tree at the left of the dialog and take a look at the available options.

When you get to the **Compilation > Diagnostics** node, select the check box labelled **Suppress all compiler warnings**.

Notice that **-Xsuppress-warnings** now appears in the list of command line options at the right of the dialog.

Click **OK**.

3. Back in the **Build Tools** node of the Properties dialog, you will see that the option you selected now appears in the field next to the **Tool Flags** button.

The contents of this, the **Tool Flags** field, is expanded to the **%ToolFlags%** macro you see in the **Command** field above it.

17.3 Building Applications for Different Boards

Generally, but not necessarily, you would have a VxWorks Image project (VIP) for each architecture you support. If, however, you are developing applications and/or libraries only, you might not have VIPs.

If you do have VIPs, you will probably only set the build spec once for the application subprojects to match the VIP they are under. On the other hand, if you do not have VIPs, you might switch the build spec to build projects for different architectures.

The target nodes under projects in the Project Navigator display, in blue, the name of the currently active build spec.

If, for example, you want to build an application for testing on a simulator, and then build the same project to run on a real board, you would simply switch build specs as follows:

1. Right-click the project or the target node and, from the context menu, select **Set Active Build Spec**.

2. In the dialog that appears, select the build spec you want to change to and specify whether or not you want debug information.

When you close the dialog, you will notice that the label of the target node has changed. If you selected debug mode in the dialog, the build spec name is suffixed with `_DEBUG`.

3. Build the project for the new architecture.

17.4 Creating Library Build-Targets for Testing and Release

Assume you have a library that consists of the files `source1.c`, `source2.c`, and `test.c`. The file `test.c` implements a `main()` function and is required exclusively for testing, and is not to be included in the release version of the library.

One way to handle this is to use different targets that are built with different tools as described below.

1. Create a Real-time Process project to hold all the files mentioned above. Use this project type, because you will need to use both the **Linker** and the **Librarian** build tools later.

In the first page of the project creation wizard, name the project, for example, **LIB** and click **Finish**. You will need to do some tweaking in the **Project's Properties** dialog anyway, so you might as well do everything there.

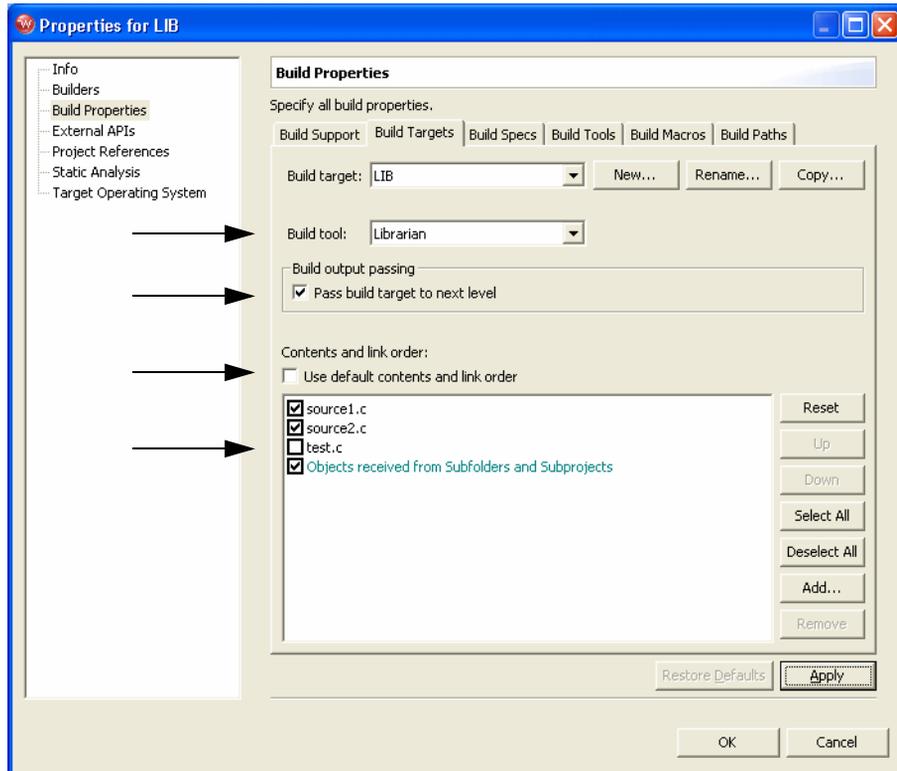
2. Right-click the newly created **LIB** project, and select **Properties**. In the **Properties** dialog, select the **Build Properties** node, then the **Build Targets** tab.

First create a build-target for the release version of your library.

- Change the **Build tool** to **Librarian**.
- Select **Pass build target to next level**.
- Clear the **Use default contents and link order** check box.
- Clear the check box next to `test.c`.
- Click **Apply**.

[Figure 17-1](#) shows the results.

Figure 17-1 Release Version of the Library

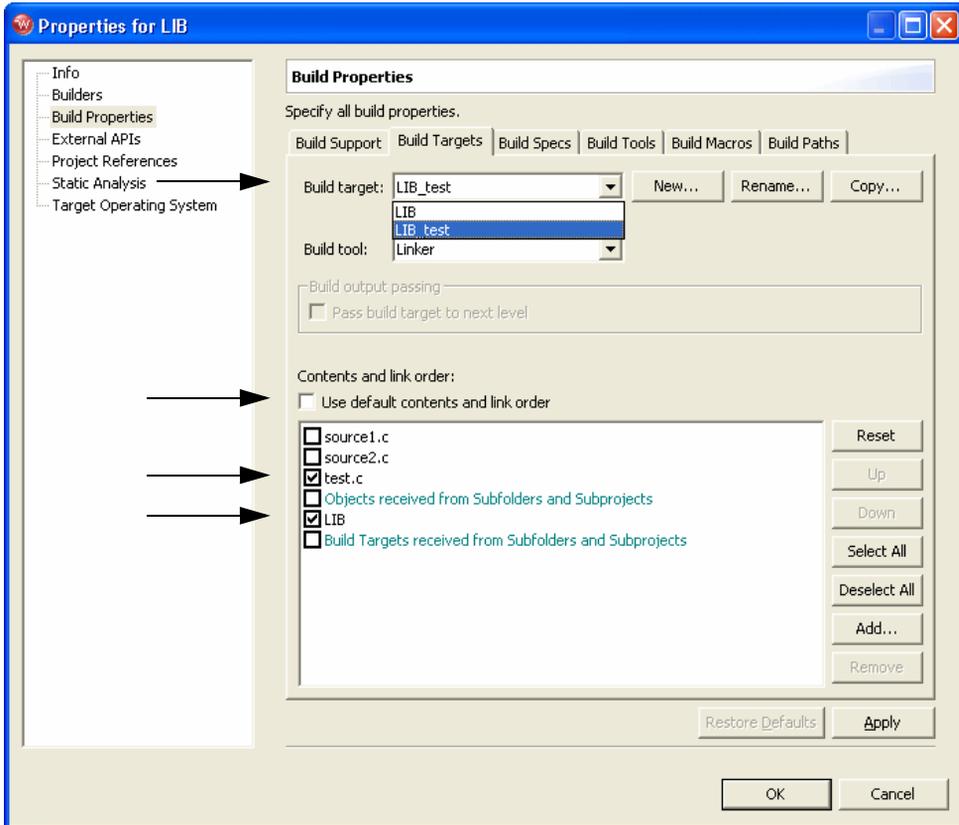


3. Next, create a target for the test version of the library.
 - Click **New** then enter, for example, **LIB_test** in the dialog that appears.

Notice that the **Build Tool** is set to **Linker**, this is because the Linker is the default tool for Real-time Process Projects, and that the **LIB** (your previous build-target) has been added to the **Contents and link order** list.
 - Clear the **Use default contents and link order** check box.
 - In the **Contents and link order** list, select only the check boxes next to **LIB** and **test.c**; clear all other check boxes.

Figure 17-2 shows the results.

Figure 17-2 Test Version of the Library



After you close the **Properties** dialog, there will be two new build-target nodes in the **LIB** project. If you build **LIB_test**, then **LIB** will automatically also be built if it is out of date.

17.5 Architecture-Specific Implementation of Functions

You can enable/disable build specs at the project as well as at the folder level. This allows architecture-specific implementation of functions within same project.

Figure 17-3 shows a simplified project tree with two subprojects, **arch 1** and **arch2**, that each use code that is specific to different target architectures. This is how projects could be set up to build a software target that requires the implementation of a function that is specific to different target boards, where only the active build spec in the topmost project has to be changed. The inner build spec relationships are outlined in Table 17-1.

Figure 17-3 Simple Project Structure for Architecture-Specific Functions

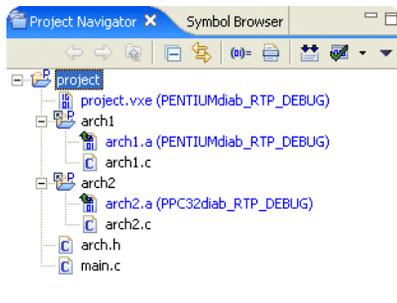


Table 17-1 Project Content and Build Spec Configuration of the Structure in Figure 17-3

Directories/Folders	Files	Enabled Build Specs
/project	main.c, arch.h	PENTIUMdiab_RTP and PPC32diab_RTP
/project/arch1	arch1.c	PENTIUMdiab_RTP only
/project/arch2	arch2.c	PPC32diab_RTP only

The function `int arch_specific (void)` is declared in `arch.h` and the file `arch1.c` implements `int arch_specific (void)` for **PENTIUM** (the only build spec enabled for the **arch1** project), while the file `arch2.c` implements `int arch_specific (void)` for **PPC32** (the only build spec enabled for the **arch2** project).

If the active build spec for **project** is set to **PENTIUMdiab_RTP**, the subproject **arch1** will be built, and its objects will be passed up to be linked into the **project**

build-target. The **arch2** subproject will not be built, and its objects will not be passed up to be linked into the **project** build target because the **PENTIUMdiab_RTP** build spec is not enabled for **arch2**.

The same applies if the **PPC32diab_RTP** is the active build spec for **project**: the **arch2** subproject will be built, but the **arch1** subproject will not.

17.6 Executables that Dynamically Link to Shared Libraries

Only executables produced from RTP projects can dynamically link to shared libraries. Note that you will need a VxWorks ROMFS File System project to hold the library binary on the target. The compiled library must be located in the host and target side directories you specify as described below.

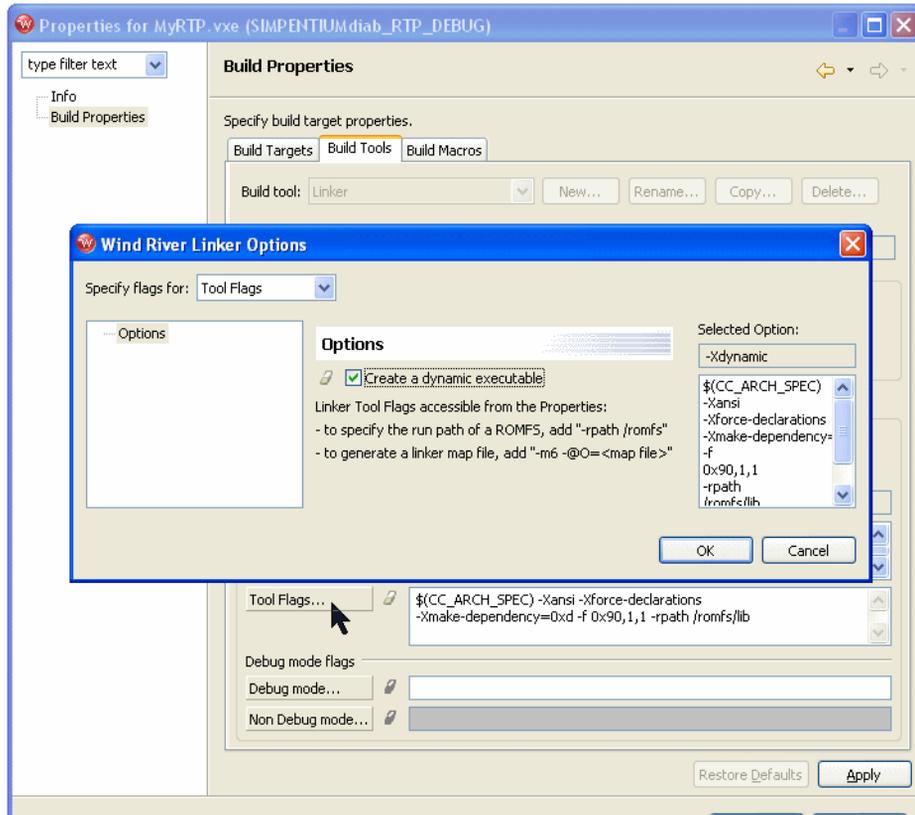
Step 1: Modify the Real-time Process build-target build properties.

1. Right-click the RTP's target node and select **Properties**.
2. In the **Properties** dialog, select the **Build Properties** node.

Step 2: Set up the Linker Build Tool for a dynamic executable and target-side run path.

1. Select the **Build Tools** tab.
2. In the field next to the **Tool Flags** button, enter the *run path* (**-rpath**) to the directory that will hold the shared library on your target, for example, **-rpath /romfs/lib** (**romfs** is the default root directory of the ROMFS created by VxWorks ROMFS File System projects).
3. Click **Tool Flags**.

Figure 17-4 Build Options for Dynamic Executables



4. In the **Linker Options** dialog that appears, select **Create a dynamic executable**.

You will notice that the option, as used on the command line, appears in the **Selected Options** list on the right. After you click **OK** to close the **Linker Options** dialog, you will see the option again in the field next to the **Tool Flags** button.

Step 3: Define Build Macros for the host-side location and library binary.

1. Select the **Build Macros** tab.
2. In the list of **Build spec specific settings**, select the **LIBS** macro and click **Edit**.

In the dialog that appears, add a space after the existing value (**-lstdlstd**), followed by the basename of the shared library binary you want to link to, for example, **MySharedLibrary**:

-l:MySharedLibrary.so

When you close the dialog you should see:

```
LIBPATH      -lstdlstd -l:MySharedLibrary.so
```

3. In the list of **Build spec specific settings**, select for the **LIBPATH** macro and click **Edit**.

In the dialog that appears, enter the host-side directory location of the library binary you want to dynamically link to, for example:

-L../MySharedLibrary/\$(OBJ_DIR)

Note that **\$(OBJ_DIR)** expands to wherever the build output for **MySharedLibrary** is generated to. Using **\$(OBJ_DIR)** is generic and therefore offers the advantage of not having to change the **LIBPATH** macro if you change build specs.

Note further that the relative reference assumes the Shared Library project is located in the same workspace as the Real-time Process project.

Click **OK** to close the project's build-target **Properties** dialog.

The next time you build the project structure, a dynamic executable capable of run-time linking to the shared library with the file basename and the directories (host and target side) you specified above will be produced.



NOTE: If your application is *not* built as described in this section ([17.6 Executables that Dynamically Link to Shared Libraries](#), p.203), you must set the `LD_LIBRARY_PATH` environment variable.

Click **Edit** beside the **Environment** field, then click **Add** in the **Edit Environment** dialog, then type `LD_LIBRARY_PATH` in the **Name** field and the full path to your shared library file (using forward slashes and excluding the filename itself) in the **Value** field. The path must be defined in terms of the file system as seen on the target.

Click **OK**. The **Edit Environment** dialog should contain the new environment variable; click **OK**.

17.7 User-Defined Build-Targets in the Project Navigator

In the Project Navigator you can create custom build-targets that reflect rules in makefiles. This is especially useful if you have User-Defined projects, which are projects where the build is not managed by Workbench. However, you might also find this feature useful in other projects as well.

17.7.1 Custom Build-Targets in User-Defined Projects

Assuming you have two rules in a makefile, **clean** and **all**, you can define a custom build-target for either or both of these rules. To do so:

1. Right-click a project or folder and select **New > Build Target**.
2. In the dialog that appears, enter the rule(s) you want to create a target for. If you want to execute multiple rules, separate each one with a space.

In our example, enter **clean all** to have both these rules, which must exist in your makefile(s), executed when you build your new user-defined target.

Click **Finish**. The new build-target node appears under the project or folder you selected. The node icon has a superimposed **M** to identify it as a user-defined make rule.

To execute the rule(s), right-click the new target node and select **Build Target**.

17.7.2 Custom Build-Targets in Workbench Managed Projects

First write the make rules you need into the `.wrmakefile` file in the project directory.

1. Right-click a project or folder and select **New > Build Target**.
2. In the dialog that appears, enter the rule name(s) you created in `.wrmakefile`. If you want to execute multiple rules, separate each one with a space.

Set the **Build tool** to **User-defined**, click **Finish**.

The new build target node appears under the project or folder you selected. The node icon has a superimposed **M** to identify it as a user-defined rule.

To execute the rule(s), right-click the new target node and select **Build Target**.

17.7.3 User Build Arguments

You can use the User Build Arguments view to execute any existing make rule, or overwrite any macro, or anything else that is understood by make, at every build, regardless of what is being built. The view is toggled by choosing User Build Arguments view from the drop-down menu at the top right of the Project Navigator, or by clicking the button in the Project Navigator's toolbar.

If the **User Build Arguments** check box is selected, the rule, or rules separated by a space, or macro re-definitions, and so on will override the makefile entries on the fly at every build, regardless of context.

17.8 A Build Spec for New Compilers and Other Tools

The easiest way to define a build spec for a new compiler and other associated tools (known as a *tool chain*) is to copy one of the pre-configured build specs of an existing tool chain and architecture, and modify the copy.

Step 1: Copy an Existing Build Spec.

1. Open an application project's, for example an RTP, build properties as described under [16.4 Accessing Build Properties](#), p. 188.

Using an application project has the advantage that these have a fuller range of generic build tools (**Assembler**, language-specific **Compiler**, **Librarian**, and **Linker**).

2. Select the **Build Specs** tab and look at the existing specs. The pre-configured build spec names follow an *ArchitectureToolChain_ProjectType* convention, for example, **PENTIUMgnu_RTP**. This spec is configured for a Pentium target board, using GNU tools to create an Real-time Process (RTP).

In the **Build Specs** tab, select the build spec that comes closest to your needs, at least in terms of target architecture, or a tool chain that you are familiar with, and click **Copy**.

You will be warned that build properties need to be saved before proceeding. Click **OK**, then enter a name for the copy you are creating in the next dialog and click **OK** again.

3. Still in the **Build Specs** tab, set the **Active build spec** to your newly created copy (this is initially right at the bottom of the list of **Available and enabled build specs**. Whatever you set here is also propagated to the Build Tools, Build Macros, and Build Paths tabs (described in more detail in *Wind River Workbench User Interface Reference: Build Properties*).

Each of these tabs has a generic section at the top with **Build spec specific settings** below. The generic section will normally be correct, which is one advantage of copying an existing spec, rather than creating a new spec from the beginning.

Step 2: Configure the Build Tool.

The build system uses generic build tools, for example, a **C-Compiler**. So if you are adding a new, unsupported C compiler, you will have to configure a build spec that understands this specific instance of the generic **C-Compiler** build tool. Using the compiler as an example, proceed as follows:

1. Select the **Build Tools** tab and set the **Build tool** drop-down list to **C-Compiler**.

The generic settings regarding **Suffixes** and **Build output generation** should be correct, if not modify accordingly. (If you were adding a compiler for a new language, **foolanguage**, you could first create a **Copy** of a generic **C-Compiler Build tool** and name that, for example, **Foo-Compiler**, and then configure the generic settings as required.)

2. In the **Build spec specific settings** you would configure the options that are specific to your particular compiler.

- The **Active build spec** should already be set to your newly created build spec.
- The **Derived suffix** refers to the file suffix of the compiler’s output.
- The **Command** is the command line call to your compiler with all the options you want to pass.

In theory, you could simply type a hard command in this field. However, using the predefined macros of the form `%MacroName%` and macros (your own and/or pre-defined) that are defined on the **Macros** tab and referenced using `$(MacroName)` generally makes more sense, as does separating common **Tool Flags** and **Debug mode** and **Non Debug mode** flags. For more detailed information please refer to the *Build Tools* section of *Wind River Workbench User Interface Reference: Build Properties*.

3. If you are using your own and/or pre-defined using macros in the **Command** field, set these in the **Build Macros** tab.

For more detailed information please refer to the *Build Macros* section of *Wind River Workbench User Interface Reference: Build Properties*.

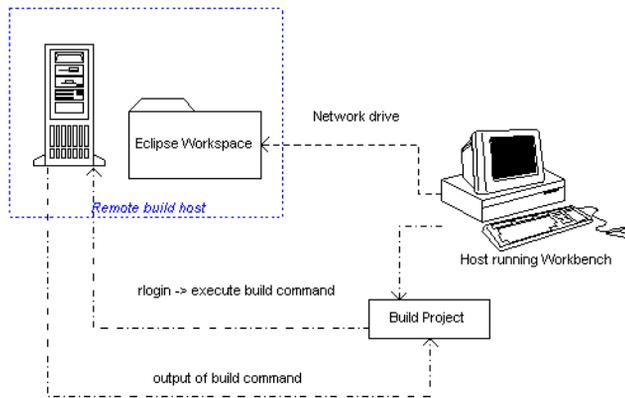
4. In the **Build Paths** tab, configure the redirection directories for build output and set the include search paths (if applicable; that is, if you are configuring a build spec for a C/C++ compiler) using the **Generate** and **Add** buttons.

For more detailed information please refer to the *Build Paths* section of *Wind River Workbench User Interface Reference: Build Properties*.

After you have configured the build spec for the first tool in the chain, for example, the compiler, go back to the **Build Tools** tab (see [Step 2](#), above) to configure any additional tools, such as the **Linker** or **Librarian**.

17.9 Developing on Remote Hosts

The Workbench *remote build* feature allows you to develop, build and run your applications on a local host running Workbench, using a workspace that is located on a remote host as if it were on a local disk.



In the case of a managed build (standard or flexible), Workbench generates the makefiles on the local machine running Workbench using a path mapping of the workspace root location, so that the generated makefiles will be correctly dumped for a build that is executed on the remote machine. When launching the build, a network connection (**rlogin**) is established to the build host, and the actual build command is executed there by using an intermediate script to allow you to set up the needed environment for the build process.

17.9.1 General Requirements

- The workspace root directory has to be accessible from both machines.
- Only Eclipse projects located underneath the workspace root can be remotely built. In other words, linked resources are not supported for files outside the workspace.
- A **rlogin** remote connection to the build machine must be possible.

17.9.2 Remote Build Scenarios

Local Windows, Remote UNIX:

The workspace root directory should be located on the remote UNIX host and mapped to a specific network drive on Windows. It may also be possible to locate the root directory on the Windows machine, but then there is the need to mount the Windows disk on the build host. This may lead to problems regarding

permissions and performance, so a mapping of the workspace root-directory is definitely needed.

Local UNIX, Remote UNIX:

As it is possible to access the workspace root directory on both machines with the equivalent path (automount) it may be possible to skip the path mapping.

Local UNIX, Remote Windows:

This scenario is not supported, as you would need to execute the build command on Windows from a UNIX host.

17.9.3 Setting Up a Remote Environment

To set up your environment on the remote machine prior to a build or run, use the **Edit remote command script** button to include additional commands. It will open the file `workspaceDir/.metadata/.plugins/com.windriver.ide.core/remote_cmd.sh`.

For example, to extend the path before a build, add the highlighted lines to the default file:

```
#!/bin/sh

WORKSPACE_ROOT="%WorkspaceRoot%"
export WORKSPACE_ROOT
DISPLAY=%Display%
export DISPLAY

PATH=/MyTools/gmake_special/bin:$PATH
export PATH

cd $WORKSPACE_ROOT

cd "$1"
shift 1

exec "$@"
```

You can add any commands you need, but all commands must be in **sh** shell style.

17.9.4 Building Projects Remotely

1. Switch to a workspace that contains existing projects by selecting **File > Switch Workspace**. Type the path to the appropriate workspace, or click **Browse** and navigate to it.
2. In the Project Navigator, right-click a project and select **Build Options > Remote Connection**. The **Remote Connections** dialog appears.
3. Click **Add** and type a descriptive name for this remote connection. Click **OK**.
4. In the **Connection Settings** fields, add the following information to create a remote connection:

Hostname

The name of the build host (can also be an IP address).

Username

The username used to establish the connection (the remote user may differ from the local user).

Remote Workspace Location

The root directory of the workspace as seen on the remote host.



NOTE: This field must contain the absolute path to the directory; environment variables are not supported.

Display (XServer)

IP address of the machine where the output should be displayed.

By clicking the **Advanced** button you can also access these fields:

Password request string

A string that will be recognized as a password request to prompt you for the password.

Remember Password during Workbench sessions

A switch to specify whether the password entered should be remembered during the current session. This is useful during a lengthy build/run session.

5. Click **Connect** to connect immediately. Remote connection settings are stored, and are specific to this workspace. They are not accessible from any other workspace.
6. The build is executed on the remote host, with the build output listed in the standard Workbench Build Console. The XServer (IP address listed in the

Display field) is used whenever any type of X application is started, either during builds or runs.

7. To return to local development, select **Local Host** from the list of connections, then click **Connect**.

17.9.5 Running Applications Remotely

This section provides information about running native applications only, as running VxWorks projects remotely is handled differently.

Running native applications remotely is quite similar to running applications locally: a **Native Application** launch configuration must be created that defines the executable to be run, as well as remote execution settings for the launch. On the **Remote settings** tab are:

Remote Program

Enter the command that is used to launch the application. This may be useful for command-line applications that could then be launched within an xterm, for instance.

Remote Working Directory

This setting is optional, but if a remote working directory is given, it overrides the entry in the **Working Directory** field of the **Arguments** tab.

For remote runs, a new connection similar to the active connection will be established to allow control of Eclipse process handling, as the new remote process will be shown in the Debug view. The Remember password during Workbench sessions feature is very useful here.

Command-line application's output and input is redirected to the standard Eclipse console unless the application is started within an external process that creates a new window (such as **xterm**). The default for remote execution is a remote command like **xterm -e %Application%**, therefore a local XServer (like Exceed or Cygwin X) must be set up and running.

For more information about creating launch configurations, see [23. Launching Programs](#).

17.9.6 Rlogin Connection Description

The **rlogin** connection used in the Workbench remote build makes use of the standard **rlogin** protocol and ports. It establishes a connection on port 513 on the

remote host, and the local port used must be in the range of 512 to 1023 per **rlogin** protocol convention.

On Windows the **rlogin** connection is implemented directly from within Workbench, so you do not need an existing **rlogin** client. The UNIX implementation is different, because for security reasons the local port (range: 512 to 1023) is restricted to root access, which cannot be granted from within Workbench. Therefore an external **rlogin** process is spawned using the command-line:

```
rlogin -l username hostname
```

rlogin on UNIX platforms makes use of **setUID root** to ensure that the needed root privileges are available.

The standard **rlogin** protocol doesn't support access to **stderr** of the remote connection, so all output is treated as **stdout**. Coloring in the Build Console of Workbench for **stderr** is therefore not available.



NOTE: On Linux the **rlogin** client and server daemon can be switched off per default. So if the machine is used as a Workbench (remote build client) host, the **rlogin** executable must be enabled (or built) and if the machine is acting as build server (remote build host) the **rlogin** daemon must be enabled. Details may be found in the system documentation of the host.

18

RTPs and Shared Libraries from Host to Target

[18.1 Introduction](#) 215

[18.2 A VxWorks Real-time Process from Host to Target](#) 216

[18.3 A VxWorks Shared Library from Real-time Process to Target](#) 221

18.1 Introduction

This chapter uses hands-on examples to illustrate one of the ways you might set up, build, and run VxWorks Real-time Processes and VxWorks Shared Libraries from host to target. The target used will be a VxWorks Simulator.



NOTE: Descriptions, screenshots, default values, and settings reflect working with Workbench on a Windows host. If you are working on another host OS, defaults might change but usually should work in a similar way. The default build spec for Windows is `SIMPENTIUMdiab_RTP_DEBUG`.

The Shared Library example ([18.3 A VxWorks Shared Library from Real-time Process to Target](#), p.221) follows from the Real-time Process example, and therefore assumes that you have completed the steps outlined under [18.2 A VxWorks Real-time Process from Host to Target](#), p.216.

18.2 A VxWorks Real-time Process from Host to Target

This section describes how to set up a VxWorks Real-time Process. Although the section is self-contained, you will also need to set up a VxWorks Real-time Process with the infrastructure described here if you want to use a VxWorks Shared Library.

18.2.1 Set Up the Project Structure for Real-time Processes

You will need a VxWorks Image project, a VxWorks ROMFS File System project, and a VxWorks Real-time Process project to start with. When this is done, you will need to add some code and to create a target connection to test the system.

Step 1: Set up a VxWorks image project.

1. In the Project Navigator, right-click and select **New > VxWorks Image Project**.
2. In the **Project name** field, type **VxWorksSim**. Click **Next**.
3. On the next wizard page, set **A board support package** to **simpc** and **Tool chain** to **diab**. Click **Finish**.

Step 2: Set up a VxWorks ROMFS File System project.

1. In the Project Navigator, be sure the project you just created, **VxWorksSim**, is selected so that the new VxWorks ROMFS File System project you are about to create will automatically become a subproject of **VxWorksSim**.
2. In the Project Navigator, right-click and select **New > VxWorks ROMFS File System Project**.
3. In the **Project name** field, type **VxWorksSimFS**, then click **Finish**.
4. In the Project Navigator, you will see that the **VxWorksSimFS** project you just created is a subproject of **VxWorksSim**.

Step 3: Set up a VxWorks Real-time Process project.

1. Right-click in the Project Navigator and select **New > VxWorks Real Time Process Project**.
2. In the **Project name** field, type **MyRTP**. Click **Next** a few times, then on the Build Target page choose **Linker** from the **Build Tool** dropdown list. Click **Finish**.

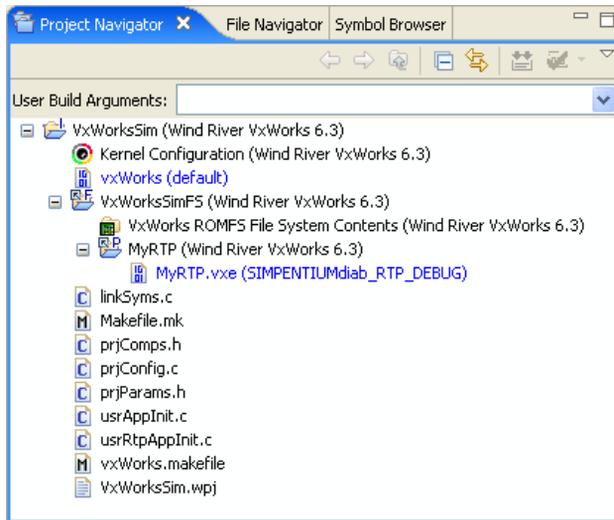
By default, the build spec `SIMPENTIUMdiab_RTP_DEBUG` is activated for the project. This matches the board support package you set for the VxWorks Image project in [Step 1](#) above.

Step 4: Add the Real-time Process project to the VxWorks ROMFS File System project.

In the Project Navigator, drag-and-drop the `MyRTP` project onto the `VxWorksSimFS` project (the `VxWorksSim` project must be expanded).

[Figure 18-1](#) shows the project setup so far (note that `.*` files have been filtered out by clicking the downward arrow on the Project Navigator toolbar, selecting **Filters**, selecting the `.*` checkbox, then clicking **OK**).

Figure 18-1 **Project Hierarchy for a VxWorks Real-time Process**



18.2.2 Add Code to the Real-time Process Project

You need some code that will let you verify that everything works.

1. In the Project Navigator, right-click `MyRTP` and select **New > File from Template**. In the **File Name** field, type `MyRTP.c`.
2. Click **Finish**; the file `MyRTP.c` opens in the Editor view.
3. In `MyRTP.c`, change the following lines (the results are also shown in [Figure 18-2](#)):

Change:

```
#include "MyRTP.h"
```

to read:

```
#include <stdio.h>
```

4. Change the function:

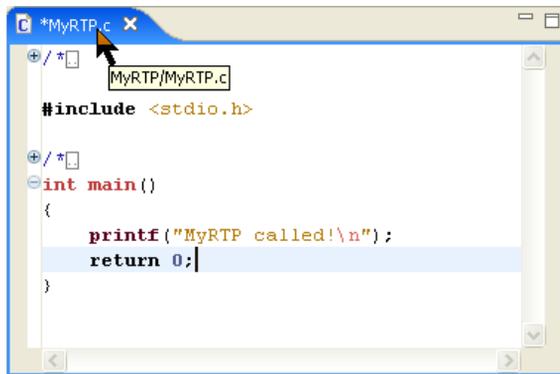
```
void MyRTP()  
{  
}
```

to read:

```
int main()  
{  
    printf("MyRTP called!\n");  
    return 0;  
}
```

Figure 18-2 shows the modified source file, **MyRTP.c**.

Figure 18-2 The MyRTP.c Source



5. Save the file but leave it open. You will need it again if you intend to follow [18.3 A VxWorks Shared Library from Real-time Process to Target](#), p.221.

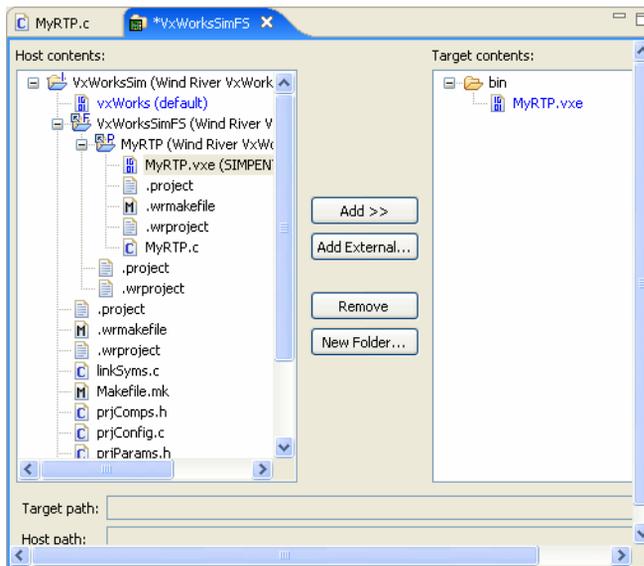
18.2.3 Add the Real-time Process to the VxWorks ROMFS Target File System

Although you do not have a Real-time Process binary yet, you can make provision for the binary to be on the target file system once the system is built.

1. In the Project Manager, under the **VxWorksSimFS** File System project you created earlier, double-click the **VxWorks ROMFS File System Contents** node to open the **File System Contents Editor**.
2. In the **File System Contents Editor**, click **New Folder** and type **bin** in the **Name** field. Click **OK**. The **bin** folder appears in the **Target Contents** panel.
3. In the **Target Contents** panel select the **bin** node, then in the **Host Contents** panel, expand the project nodes until you can see the target node that represents the (future) Real-time Process binary, namely: **MyRTP.vxe (SIMPENTIUMdiab_RTP_DEBUG)**.
4. Select this node and click **Add**. The **MyRTP.vxe** binary (which does not yet exist) appears in the **Target Contents** panel under the **bin** folder.

Figure 18-3 shows the results.

Figure 18-3 The Executable on the VxWorks ROMFS Target File System



5. Leave the **File System Contents Editor** open. You will need it again if you intend to follow [18.3 A VxWorks Shared Library from Real-time Process to Target](#), p.221.

18.2.4 Build the System

Now build the system and locate your VxWorks image.

1. In the Project Navigator, right-click the VxWorks Image project, **VxWorksSim**, and select **Build Project**.

The structure is recursively built, starting in **MyRTP**, as you can see in the Build Console. Next the VxWorks ROMFS File System project, **VxWorksSimFS**, is built. The build finishes at the top, in **VxWorksSim**.

2. In the next step ([Set up the Target Connection](#), p.220) you need to know the location of the VxWorks kernel image you just built. Under **VxWorksSim** expand **vxWorks (default)**, right-click **vxWorks**, then select **Properties**. Highlight the path next to **Location**, then right-click it and select **Copy**. Click **OK** to close the dialog.

18.2.5 Set up the Target Connection

To test the system you have just built, you need to create a connection to the target.

1. In the **Target Manager**, right-click **default(localhost)** and select **New > Connection**.
2. On the first wizard page, select **Wind River VxWorks 6.x Simulator Connection** and click **Next**.
3. On the next wizard page, select **Custom Simulator**. You have to select **Custom Simulator** because your image, unlike the **Standard Simulator**, has a VxWorks ROMFS File System that holds a Real-time Process binary linked to it.
 - If you copied the path to the **VxWorks kernel image** you just built (under [Build the System](#), p.220), paste it in this field.
 - Otherwise, click **Browse** and navigate to the image, then click **Open**.

In general terms, the location of the image is
WorkspaceDirectory/ProjectName/BuildSpecName/vxWorks.

In this example, the image is
installDir/workspace/VxWorksSim/default/vxWorks (the *BuildSpecName* is **default** because you are using the simulator rather than a target board).

4. Click **Next** until you reach the last wizard page (when the **Finish** button is enabled). Type **VxWorksSim** in the **Connection name** field. Leave the **Immediately connect to target if possible** check box selected. Click **Finish**.

The connection is immediately established and the kernel shell opens.

18.2.6 Run the Real-time Process on the Simulator

To test the system, run your RTP in the kernel shell.

1. At the kernel shell prompt, type:

```
cd "/romfs/bin"
```

2. Press ENTER and type:

```
rtpSpawn "MyRTP.vxe"
```

3. Press ENTER again. The output **MyRTP called!** should appear. Close the kernel shell.

18.3 A VxWorks Shared Library from Real-time Process to Target

Much of the initial work required for using a VxWorks Shared Library project is done under [18.2 A VxWorks Real-time Process from Host to Target](#), p.216. Complete all the steps in that section; the procedures outlined below follow on from there.

18.3.1 Set Up the VxWorks Shared Library Project

First, create a new VxWorks Shared Library project to add to the project structure you created under [18.2 A VxWorks Real-time Process from Host to Target](#), p.216.

1. Right-click in the Project Navigator and select **New > VxWorks Shared Library Project**.
2. On the first wizard page, type **MySharedLibrary** in the **Project name** field and click **Next**.
3. Click **Next** until you get to the **Build Target** screen. Select **Pass build target to next level**, then click **Finish**.

Note that if you add the Shared Library as a subproject beneath a Real-time Process project, the Shared Library will automatically inherit the active build spec of the Real-time Process during build, no matter which build spec is active in the Shared Library. The active build spec of the Shared Library will be taken only if you build the Shared Library directly.

18.3.2 Add Code to the Shared Library Project

You need some code that will let you verify that everything works.

1. In the Project Navigator, right-click **MySharedLibrary**, select **New > File from Template**, and type **MySharedLibrary.h** in the **File Name** field. Click **Finish**; the file **MySharedLibrary.h** opens in the Editor view.
2. In the Project Navigator, right-click **MySharedLibrary**, select **New > File from Template**, and under **File Name** type **MySharedLibrary.c**. Click **Finish**; the file **MySharedLibrary.c** opens in the Editor view.
3. In **MySharedLibrary.c** add the following line:

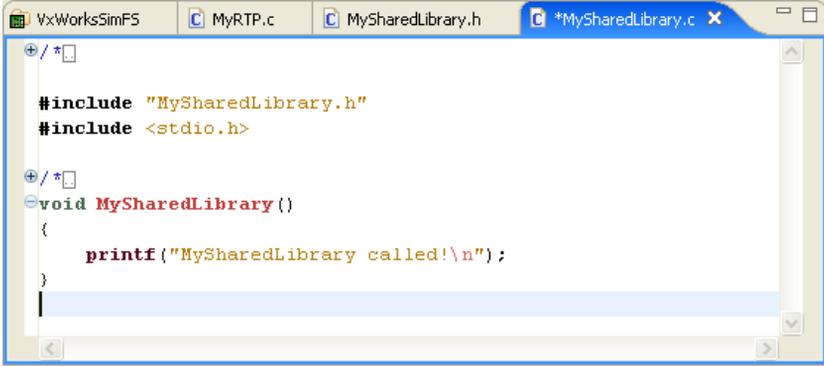
```
#include <stdio.h>
```

4. Insert the following line into the **MySharedLibrary** function:

```
printf("MySharedLibrary called!\n");
```

Figure 18-4 shows the modified source file, **MySharedLibrary.c**.

Figure 18-4 The MySharedLibrary.c Source



```
VxWorksSimFS  MyRTP.c  MySharedLibrary.h  *MySharedLibrary.c X
+ / *
#include "MySharedLibrary.h"
#include <stdio.h>
+ / *
void MySharedLibrary()
{
    printf("MySharedLibrary called!\n");
}
```

5. Save **MySharedLibrary.c**.

18.3.3 Add the Shared Library to the Run-Time Process

The Shared Library must be built before the Real-time Process, so it is added as a subproject. Furthermore, the library binary must be located in the host and target side directories you specify as described below.

Step 1: Add the library as a subproject.

In the Project Navigator, drag-and-drop the **MySharedLibrary** project onto the **MyRTP** project.

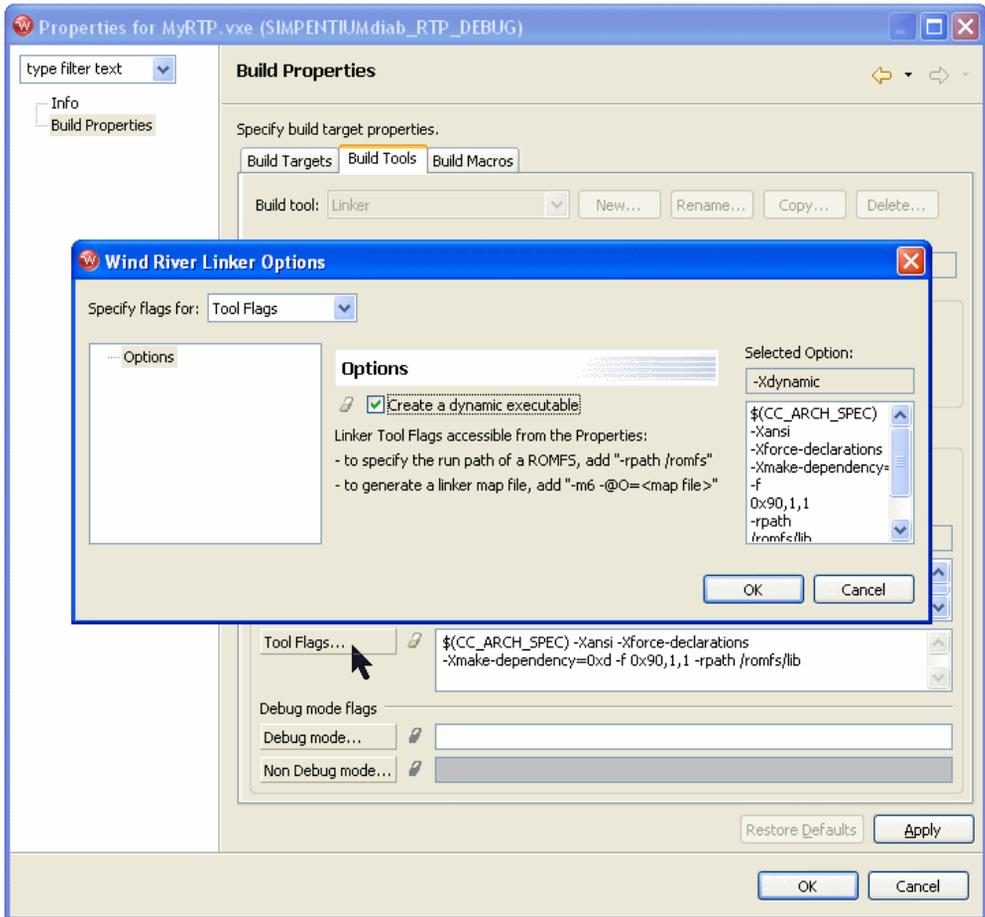
Step 2: Modify the Real-time Process build-target build properties.

1. Right-click the **MyRTP** project's build target node, **MyRTP.vxe(SIMPENTIUMdiab_RTP_DEBUG)**, and select **Properties**.
2. In the project's **Properties** dialog, select the **Build Properties** node.

Step 3: Set up the Linker Build Tool for a dynamic executable and target-side run path.

1. Select the **Build Tools** tab.
2. In the field next to the **Tool Flags** button, append the *run path*, in other words the directory that will hold the shared library on your target.
 - If you are using the Wind River Compiler, type **-rpath /romfs/lib** (**romfs** is the default root directory of the ROMFS created by the File System project you set up earlier).
 - If you are using the Wind River GNU Compiler, type **-Wl,-rpath /romfs/lib** instead.
3. Click the **Tool Flags** button. In the **Linker Options** dialog that appears, select **Create a dynamic executable**.

Figure 18-5 Tool Flags for Dynamic Executables



You will notice that the option as used on the command line (**-Xdynamic**) appears in the **Selected Options** list on the right.

4. Click **OK** to close the **Linker Options** dialog. You will see the option again in the field next to the **Tool Flags** button. Click **OK** to close the **Build Properties** dialog.

18.3.4 Modify the Code in the Real-time Process Project

You need some code that will let you verify that everything works.

1. Open **MyRTP.c** in the editor, if it is not already open.
2. In **MyRTP.c**, insert the line:

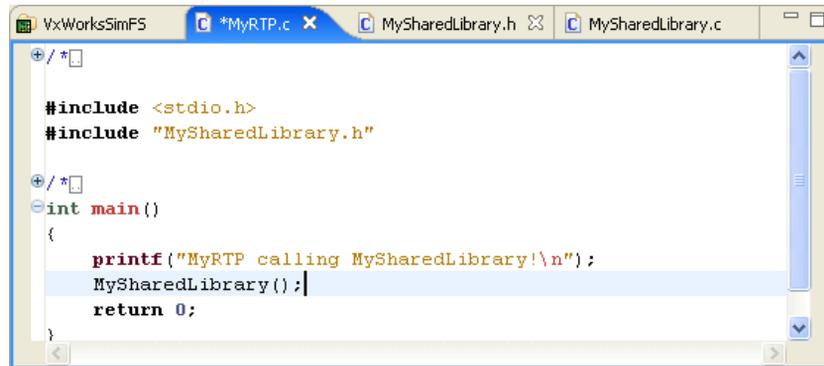
```
#include "MySharedLibrary.h"
```

3. Modify **main()** as follows:

```
int main()
{
    printf("MyRTP calling MySharedLibrary!\n");
    MySharedLibrary();
    return 0;
}
```

Figure 18-6 shows the modified source file, **MyRTP.c**.

Figure 18-6 The Modified MyRTP.c Source



4. Save **MyRTP.c**.

18.3.5 Generate Include Search Paths

The file you included in **MyRTP.c**, **MySharedLibrary.h**, is not in the same project (directory). So you need to resolve the include path for successful compilation.

1. In the Project Navigator, right-click the **MyRTP** project and select **Build Options > Generate Include Search Paths**.

2. In the dialog that appears, click **Next**, and on the next page click **Resolve All**.
Notice that the entry **%Proj-MySharedLibrary%** appears in the lower **Include Search Paths** panel. Click **Next**, then **Finish**.

18.3.6 Add Libraries to the VxWorks ROMFS Target File System

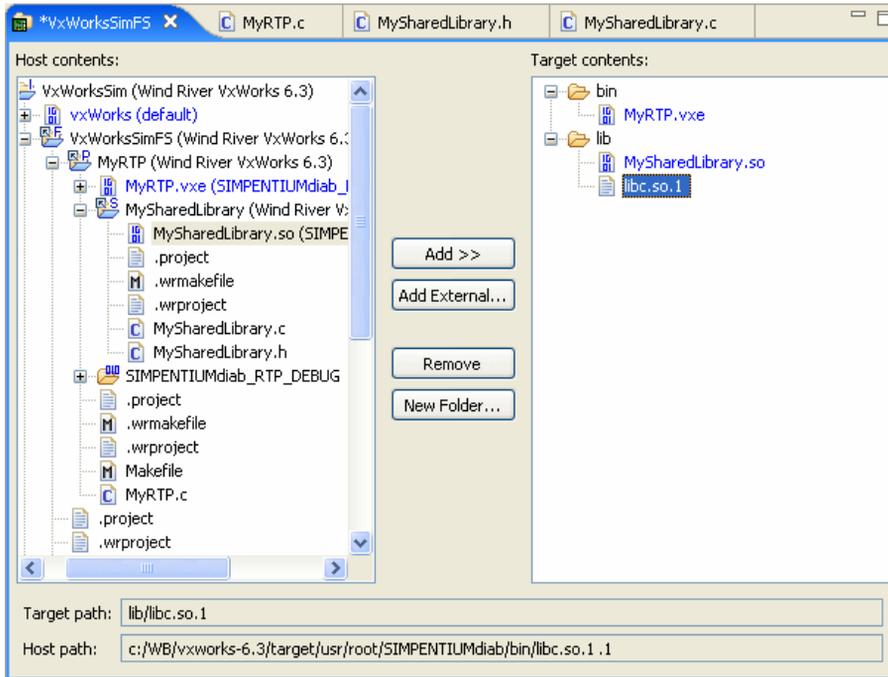
Although you do not have a Shared Library binary yet, you can make provision for the binary to be on the target file system once the system is built. You must also include **libc.so.1** (the RTP run-time shared library version of **libc**) so it is accessible to the executable at run-time.

1. The File System Contents Editor should still be open. If not, in the **Project Navigator**, under the **VxWorksSimFS** File System project you created earlier, double-click the **VxWorks File System Contents** node to open it.
2. In the File System Contents Editor, make sure **bin** is not selected. Click **New Folder** and type **lib** in the **Name** field, then click **OK**. The **lib** folder appears at the same level as **bin** in the **Target Contents** panel¹.
3. In the **Target Contents** panel select the **lib** node, and in the **Host Contents** panel, expand the project nodes until you can see the target node that represents the (future) Shared Library binary, namely:
MySharedLibrary.so (SIMPENTIUMdiab_RTP_DEBUG).
4. Select this node and click **Add**. The **MySharedLibrary.so** binary (which does not yet exist) appears in the **Target Contents** panel under the **lib** folder.
5. To add **libc.so.1** to the target contents, select **lib**, then click **Add External** and navigate to *installDir/vxworks-6.x/target/usr/root/cpuTool/bin*. Select **libc.so.1** and click **Open**.

[Figure 18-3](#) shows the results. Notice that when you click on items in the **Target contents** pane, their **Target path** and **Host path** information appears in the fields at the bottom of the view.

1. If the **lib** folder is created under the **bin** folder, drag it to the left and away from **bin**, then drop it.

Figure 18-7 The Library Binary on the Target File System



18.3.7 Build the System Again

In the Project Navigator, right-click the VxWorks Image project, **VxWorksSim**, and select **Build Project**.

The structure is recursively built, starting, as you can see in the Build Console, in **MySharedLibrary**, followed by **MyRTP**, followed by the VxWorks ROMFS File System project, **VxWorksSimFS**, and finishing at the top in **VxWorksSim**.

18.3.8 Run the RTP with the Shared Library on the Simulator

1. In the Target Manager, right-click **VxWorksSim**, the connection you created under [18.2.5 Set up the Target Connection](#), p.220, and select **Connect**.

Once the connection has been established, the kernel shell appears.

2. At the kernel shell prompt, type:

```
cd "/romfs/bin"
```

3. Press **ENTER** and type:

```
rtpSpawn "MyRTP.vxe"
```

4. Press **ENTER** again.

The following output should appear:

```
MyRTP calling MySharedLibrary!  
MySharedLibrary called!
```

5. Close the kernel shell.

For more information about using shared libraries and **romfs** subdirectories, see *VxWorks Application Programmer's Guide: Applications and Processes*, specifically the *Developing Shared Libraries* section.

Target Management

19	Connecting to Targets	231
20	New Target Server Connections	239
21	New VxWorks Simulator Connections	251
22	New On-Chip Debugging Connections	255

19

Connecting to Targets

- 19.1 Introduction 231
- 19.2 The Target Manager View 232
- 19.3 Defining a New Connection 232
- 19.4 The Registry 233
- 19.5 Establishing a Connection 236
- 19.6 Connect to the Target 236

19.1 Introduction

A target connection manages communication between the Workbench host tools and the target system. A connection must be configured and established before host tools can interact with the target.

All host-side connection configuration work and connection-related activity is done in the Target Manager view. Connections are registered and made accessible to users by the Wind River Registry.

This chapter describes ways to configure, start, and manage target connections in the Target Manager view. For detailed information about the Target Server and Registry, see the **tgtsvr** and **wtxregd** API reference entries (see **Help > Help Contents > Wind River Documentation > References > Host API and Command References > Wind River Host Tools API Reference**).

19.2 The Target Manager View

A connection to a Target Server, a VxWorks Simulator, an Instruction Set Simulator (ISS), or an on-chip debugging device (OCD) such as Wind River ICE and Wind River Probe must be defined and established before tools can communicate with a target system.

All host-side connection configuration work and connection-related activity is done in the Target Manager view. The target side (required for Target Server and VxWorks Simulator connections) is configured in the Kernel Editor (see [5.5.1 The Kernel Editor](#), p.93).

By default, the Target Manager view is on a tab at the bottom-left of Workbench. It is available in the Application Development perspective and in the Device Debug perspective. If the view is not visible, choose **Window > Show View > Target Manager** (or, if it is not listed there, **Window > Show View > Other**).

The most important tasks in the Target Manager view are:

- defining new connections
- connecting to targets
- disconnecting from targets

Once you have connected to a target, more commands are enabled on the right-click context menu (see also [23. Launching Programs](#)).

19.3 Defining a New Connection

All connections types are defined from the Target Manager view (see [19.2 The Target Manager View](#), p.232).

To open the New Connection wizard, use the appropriate toolbar icon or right-click in the **Target Manager** and select **New > Connection**.

The first thing the New Connection wizard asks you to do is to select one of the following connection types:

- **Wind River ICE**
See [22.1 Defining a New Wind River ICE SX Connection](#), p.255.
- **Wind River ISS**

See [22.2 Defining a New Wind River ISS Connection](#), p.267.

- **Wind River Probe**

See [22.3 Defining a New Wind River Probe Connection](#), p.271

- **Wind River Target Server Connection**

Separate options are presented for Linux and VxWorks. For VxWorks connections, see [20.2 Defining a New Target Server Connection](#), p.239.

- **Wind River VxWorks Simulator Connection**

See [21.2 Defining a New Wind River VxWorks Simulator Connection](#), p.251.

Properties you set using the New Connection wizard can be modified later by right-clicking the connection in the Target Manager and choosing **Properties**. In most cases, you will have to disconnect and reconnect for the changes to take effect.

19.4 The Registry

The Wind River Registry is a database of target servers, boards, ports, and other items used by Workbench to communicate with targets. For details about the registry, see the **wtxregd** and **wtxreg** reference entries.

If Workbench finds an installed VxWorks platform on start-up, it creates a default VxWorks Simulator connection. Before any target connections have been defined, the default registry—which runs on the local host—appears as a single node in the Target Manager. (Under Linux, the default registry is a target-server connection for Linux user mode.) Additional registries can be established on remote hosts.

Registries serve a number of purposes:

- The registry stores target connection configuration data. Once you have defined a connection, this information is persistently stored across sessions and is accessible from other computers.

You can also share connection configuration data that is stored in the registry. This allows easy access to targets that have already been defined by other team members.



NOTE: Having connection configuration data does not yet mean that the target is actually connected.

- The registry keeps track of the currently running target servers and administrates access to them.
- Workbench needs the registry to detect and launch target servers.
If Workbench does not detect a running default registry at start-up, it launches one. After quitting, the registry is kept running in case it is needed by other tools.

19.4.1 Launching the Registry

To launch the default registry, open the **Target** menu or right-click in the Target Manager and select **Launch Default Registry**.



NOTE: These menu items are only available if the registry is not running, and the default registry host is identical to the local host.

The registry stores its internal data in the file *installDir/wind/wtxregd.hostname*. If this file is not writable on launch, the registry attempts to write to */var/tmp/wtxregd.hostname* instead. If this file is also not writable, the registry cannot start and an error message appears.

19.4.2 Remote Registries

If you have multiple target boards being used by multiple users, it makes sense to maintain connection data in a central place (the remote registry) that is accessible to everybody on the team. This saves everyone from having to remember communications parameters such as IP addresses for every board that they might need to use.

Creating a Remote Registry

You might want to create a new *master registry* on a networked remote host that is accessible to everybody. To do so:

1. Workbench needs to be installed and the registry needs to be running on the remote host. The easiest way to launch the registry is to start and quit Workbench. However, you can also launch the **wtxregd** program from the command line. (For more information about **wtxregd**, see

Help > Help Contents > Wind River Documentation > References > Host API and Command References > Wind River Host Tools API Reference.)

2. Right-click in the Target Manager, (see [19.2 The Target Manager View](#), p.232), then select **New > Registry** from the context menu.
3. In the dialog that appears, enter either the host name or the IP address of the remote host.

Workbench immediately attempts to connect to the remote registry. If the host is invalid, or if no registry is identified on the remote host, this information is displayed in the Target Manager.

19.4.3 Shutting Down the Registry

Because other tools use the registry, it is not automatically shut down when you quit Workbench. Before updating or uninstalling Workbench (or other products that use the registry), it is advisable to shut down the registry so that the new one starts with a fresh database. To shut down the registry:

- On Windows, right-click the registry icon in the system tray, and choose **Shutdown**.
- On Linux and UNIX, execute **wtxregd stop**, or manually kill the **wtxregd** process.

If you want to migrate your existing registry database and all of your existing connection configurations to the new version, make a backup of the registry data file *installDir/wind/wtxregd.hostname* and copy it to the corresponding new product installation location.

19.4.4 Changing the Default Registry

Normally, the default registry runs on the local computer. You can change this if you want to force a default remote registry (see [19.4.2 Remote Registries](#), p.234). To do this on Linux and UNIX, modify the **WIND_REGISTRY** environment variable. To do this on Windows, under the Windows Registry **HKEY_LOCAL_MACHINE** node, modify the field **Software\Wind River Systems\Wtx\N.N\WIND_REGISTRY**.

19.5 Establishing a Connection

Once you have created your application projects and defined connections, you will want to run, test, and debug the projects on your target or simulator. To do this, you first need to connect to the target.

19.5.1 Assumptions

- You are using a simulator (VxWorks Simulator or the on-chip debugging simulator, ISS), or you are using a target board and your hardware connections are set up and running.
- If you are using a target board (not a simulator), you have correctly configured your FTP service as described in [3. Setting Up Your Hardware](#) and in the *Wind River ICE for Wind River Workbench Hardware Reference* and *Wind River Probe for Wind River Workbench Hardware Reference*.
- You have defined one or more host-target connections as described in [20. New Target Server Connections](#), [21. New VxWorks Simulator Connections](#), and [22. New On-Chip Debugging Connections](#).

19.6 Connect to the Target

The first step in running an application on the target is to establish a connection to that target.

Connect to and disconnect from targets in the Target Manager (see [19.2 The Target Manager View](#), p.232) by selecting a connection node and then using the appropriate toolbar icon, or by right-clicking and selecting **Connect**.

Once the connection has been established:

- If the connection is to a simulator, the Kernel Shell appears (see [19.6.1 The Kernel Shell](#), p.237, for more information).
- On Windows, a registry icon appears (if it is not there already) in the Windows system tray (the area at the right of the Windows taskbar) to indicate the registry is running (see also [19.4 The Registry](#), p.233).
- In the Target Manager:

- A blue check mark is superimposed on the top-left corner of the connection node, the node is labeled *ConnectionName* [connected], and new nodes appear under the connection node.
- A subnode appears under the connection node. This node’s label identifies the connection type and the kernel. The node’s right-click context menu offers a subset of the connection node’s context menu (restricted to the most commonly used commands) as well as the **Kernel Objects** command. The **Kernel Objects** command populates and opens the **Kernel Objects** tab (by default located behind the Target Manager).
- A number of additional subnodes appear. These are described in [Table 19-1](#). Please refer to the *Wind River Workbench User Interface Reference: Target Manager View* for a full list of the icons that you might see in the Target Manager.

Table 19-1 VxWorks Connections

Node	Description
 Real Time Processes	When you run RTPs, they will appear as subnodes under this node.
 Kernel Tasks	When the connection is initially established, you see the VxWorks tasks. When you download and run DKMs, they will appear as additional subnodes under this node.
 VxWorks location	The kernel node and its host location. A superimposed red S at the top-right of the icon indicates that symbol information has been downloaded.

19.6.1 The Kernel Shell

The Kernel Shell¹ that appears when you establish a connection displays output generated by applications running on the kernel.

If you are using a VxWorks Simulator connection, shell components are included in the kernel by default and the Kernel Shell also provides a prompt and accepts

1. In versions of VxWorks prior to 6.0, the Kernel Shell was called the Target Shell. The new name reflects the fact that the target-resident shell runs in the kernel and not in a process.

input like the Host Shell (see the *VxWorks Command-Line Tools User's Guide*). If you are using a real board connection, the kernel shell does not provide an input prompt by default; you can, however, include the necessary components in the VxWorks kernel (see [5.5 Configuring Kernel Components](#), p.93 as well as the *VxWorks Kernel Programmer's Guide* and the *VxWorks Application Programmer's Guide*).

For the most part, the Kernel Shell works the same as the Host Shell. For detailed information about the Host Shell see the *VxWorks Command-Line Tools User's Guide*. For information about the differences between the Host and Kernel shells, see the *VxWorks API Reference* entries for **dbgLib**, **shellLib**, and **usrLib**.

20

New Target Server Connections

[20.1 Introduction](#) 239

[20.2 Defining a New Target Server Connection](#) 239

[20.3 Kernel Configuration](#) 249

20.1 Introduction

Target Server connections are defined in the Target Manager view (see [19. Connecting to Targets](#)).

20.2 Defining a New Target Server Connection

To open the **New Connection** wizard, right-click in the Target Manager, then select **New > Connection**.

20.2.1 Wind River Target Server

On the initial page of the New Connection wizard, select **Wind River Target Server Connection for VxWorks** and click **Next**.

20.2.2 Target Server Connection Page

Back End Settings

Back end

The **Back end** settings specify how a target server will communicate with a target. [Table 20-1](#) provides descriptions of the available options in the **Back end** drop-down list.

Table 20-1 **Communications Back Ends for Target Server**

Back End	Description
wdbrpc	WDB RPC. This is the default. It supports any kind of IP connection (for example, Ethernet). Polled-mode Ethernet drivers are available for most BSPs to support system-mode debugging for this type of connection.
wdbpipe	WDB Pipe. The back end for VxWorks target simulators.
wdbserial	WDB Serial. For serial hardware connections; does not require SLIP on the host system. If you select this option, also choose a Host serial device (port) and Serial device speed (bits per second).
wdbproxy	WDB Proxy. The backend for UDP, TCP, and TIPC connections.



CAUTION: The target server *must* be configured with the same communication back end as the one built into the kernel image and used by the target agent. The standard back end options are described in [Table 20-1](#); the compatible kernel components are listed in [Table 20-4](#).



CAUTION: Do *not* choose the TIPC WDB Proxy connection type unless you have included the **TIPC network stack (INCLUDE_TIPC_ONLY)** component in your VxWorks Image Project.

For more information about finding components to include in your VxWorks Image Project, see *Wind River Workbench User Interface Reference: Kernel Configuration Editor*.

For more information about TIPC, see *Wind River TIPC for VxWorks 6 Programmer's Guide: Building VxWorks to Include Wind River TIPC*.

CPU

Workbench can correctly identify the target CPU. In rare cases, a close variant might be misidentified, so you can manually set the CPU here.

Name/IP address

The **Name/IP Address** field specifies the network name or the IP address of the target hardware for networked targets. If you are using a serial port, enter either **COM1** or **COM2**.

Kernel Image and Symbols

The **Kernel Image and Symbols** properties relate to a copy of the target kernel that resides on the host.

File path from target (if available)

Select this option to search for an image of the software running on the target using the target path.

File

If the run-time image file is not in the same location on the host that is configured into the target (or if host and target have different views of the file system), select this option and use the adjacent text box to specify the host location of the kernel image.

For example, if you are using a target programmed with a **vxWorks_rom.hex**, **vxWorks_romCompressed.hex**, or any other on-board VxWorks image, you must use this option to identify the kernel file location; otherwise the target server will not be able to identify the target symbols.

Advanced Target Server Options

Please see the **tgtsvr** reference entry in the online API reference and the *VxWorks Programmer's Guide* for more detailed information about target server options in the Target Manager, as well as on additional available options.

Options

These options are passed to the **tgtsvr** program on the command line. Enter these options manually, or use the **Edit** button for GUI-assisted editing.

Advanced Target Server Options Dialog

The properties in the **Advanced Target Server Options** dialog that you open with **Edit** on the main wizard page are subdivided into three tabbed groups: **Common**, **Memory**, and **Logging**.

The Common Tab

Target Server File System

The Target Server File System (TSFS) is a full-featured VxWorks file system that provides target access to files located on the host system. It is used by the Wind River System Viewer. It also provides the most convenient way to boot a target over a serial connection. Although somewhat slow, it is simple and easy to use.

A target can access files on the host it is booted from, if booted via **FTP** or **rsh**. However, if the target is booted from a remote host, you can use the TSFS as a simple method to access files on the local host.

The TSFS is also the default method used by the System Viewer for uploading event data from the target. The TSFS should therefore be enabled and writable (default) when using the System Viewer.



CAUTION: To use the TSFS, you must include the **WDB target server file system** component when you build the kernel image. See [20.3 Kernel Configuration](#), p.249, below, and the *VxWorks Kernel Application Programmer's Guide* for more details.

Root

If the **Enable File System** check box is selected, you have to identify the root of the host file system that will be made visible to target processes using the TSFS. By default, this is the Workspace root directory. If you use the TSFS for

booting a target, it is recommended that you use the default root directory. If you do not use TSFS, you must use the **Kernel Image and Symbols** configuration options to specify the location of the kernel image (see [Kernel Image and Symbols](#), p.241).

Make Target Server File System writable

To use the Wind River System Viewer, you must select this check box to allow uploading of event data from the target. Because this also allows other users to access your host file system, you may wish to set the TSFS option for your target server to read-only when you are not using the System Viewer.

Timeout Options

Specify allowable spawn time (in seconds) for kernel tasks and RTPs, time (in seconds) to wait for a response from the agent running on the target system, how often to retry, and at what intervals.

The Memory Tab

Memory Cache Size

To avoid excessive data-transfer transactions with the target, the target server maintains a cache on the host system. By default, this cache can grow up to a size of 1 MB.

A larger maximum cache size may be desirable if the memory pool used by host tools on the target is large, because transactions on memory outside the cache are far slower.

The Logging Tab

Options on the **Logging** tab are used mainly for troubleshooting by Customer Support.

A maximum size can be specified for each enabled log file. Files are rewritten from the beginning when the maximum size is reached. If a file exists, it is deleted when the target server restarts (for example, after a reboot).

For the WTX (Wind River Tool Exchange) log file, you can specify a *filter*, a regular expression that limits the type of information logged. In the absence of a filter, the log captures all WTX communication between host and target. Use this option in consultation with Customer Support.

20.2.3 Object Path Mappings Page

Object Path Mappings have two functions:

- To allow the debugger to find symbol files for processes created on the target by creating a correspondence between a path on the target and the appropriate path on the host.
- To calculate target paths for processes that you want to launch by browsing to them with a host file-system browser.

By default, the debug server attempts to load all of a module's symbols each time a module is loaded. In the rare cases where you want to download a module or start a process without loading the symbol file, uncheck **Load module symbols to debug server automatically if possible**.

The simplest way to create Object Path Mappings for a module that does not have symbols yet is to download the output file (or run the executable) manually. In the Target Manager, right-click the file or executable and select **Load Symbols to Debug Server**. From the Load Symbols dialog, select **create path mappings based on selection** and click **OK**. Object path mappings are created automatically, so that after the next disconnect/reconnect sequence the symbols will be found.

Pathname Prefix Mappings

This maps target path prefixes to host paths. Always use full host paths, not relative paths.

For example, mapping **/tgtsvr/** to **C:\workspace** tells the debugger that files accessible under **/tgtsvr/** on the target can be found under **C:\workspace** on the host.

If you launch the process **host:/usr/hello.vxe** on your target, Workbench needs to know what **host:/** corresponds to; in other words, where it can find the **hello.vxe** ELF file in the host file system. With an object path mapping of **host:/** to **C:\WindRiver**, Workbench knows that the host path to the file is **C:\WindRiver\usr\hello.vxe**.

In most cases Workbench provides correct defaults. If necessary, click **Add** to add new mappings, or select existing mappings and click **Edit** to modify existing mappings. The supplied default mappings are not editable.

To disable any listed object path mapping, including default mappings, unselect the checkbox to the left of that mapping. To re-enable it, select the checkbox again.

You can export your object path mappings to XML by clicking **Export** and providing a descriptive filename. Likewise you can import mappings by clicking **Import** and selecting an appropriate XML file.

Reverse Mapping

Sometimes host paths must be mapped to target paths. For example, if you want to browse to the process **C:\WindRiver\usr\hello.vxe** and launch it on the target, Workbench needs to know that the correct target path for this process is **host:/usr/hello.vxe**.

Path Mappings for Working with Remote Hosts

You may need to edit object path mappings if your target boots from a remote host or if your target server runs on a remote host.

Running the target server on a remote host (using a remote registry; see [19.4.2 Remote Registries](#), p.234 for details) allows you to:

- Access targets using a serial line **wdb** connection even if the targets are physically connected to a remote host.
- Have different IP subnets for the targets in a lab and the client running Workbench, with the target server being the intermediary to translate between the separate subnets.

In this discussion, the **target** is the VxWorks target, the **host** is the remote registry host that the target server is running on, and the **client** is the system on which Workbench is running.

Prerequisites

To allow Workbench to access targets attached to a remote host, two prerequisites must be met:

1. The VxWorks image must be visible to the target (for booting), the host (for the target server), and the client (for the debugger and the host shell).
2. A file system must be shared between the target and client for running RTPs.

Example: Adding New Path Mappings

When the target server is running on a host that can see the same (networked) file system that the client can, you do not need to adjust your object path mappings. The remote target server connections can be used exactly like local connections.

However, when the remote host and the client see different file systems, you need to create new path mappings to tell the debugger where it can find the files seen by the target server. In this case, the path to the kernel image is entered as seen on the remote host; path mappings must be added to tell the debugger where these paths are on the client.

When there are multiple clients with different file systems, you must add path mappings for each client. The debugger tries them in the order in which they appear.

For example, consider a scenario with two clients (one on Windows, one on UNIX) accessing a common target server host. [Table 20-2](#) shows how each client is set up; this is the information you would have to work with when figuring out the object path mappings for this scenario.

Table 20-2 **Clients Connected to a Common Target Server Host**

Station	Setup Description
target t100	Booted using rsh from moon:/export1/images/t100/vxWorks TSFS enabled
host moon	Kernel path from target, on /export1/images/t100/vxWorks TSFS enabled, with rootdir /Net/shares/tsfs/t100 Tgtsvr command line: tgtsvr -R /Net/shares/tsfs/t100 -RW t100
client c-unix	File system shared with host moon Kernel seen on /Net/moon/export1/images/t100/vxWorks TSFS path same as on moon
client c-win	Kernel seen on \\moon\export1\images\t100\vxWorks TSFS seen on L:\tsfs\t100

Based on this information, the host and target path mappings you would enter into the **Pathname Prefix Mappings** fields are shown in [Table 20-3](#).

Table 20-3 **Host and Target Paths Converted to Object Path Mappings**

Target Path	Host Path	Comment
moon:/export1	/Net/moon/export1	Access to the boot file system for UNIX clients. Allows Workbench to reverse-map for running RTPs, so when running the RTP /Net/moon/export1/myrtp.vxe , the target path will be computed as moon:/export1/myrtp.vxe
moon:/export1	\\moon\export1	Now the same for Windows clients.

Table 20-3 **Host and Target Paths Converted to Object Path Mappings** (cont'd)

<code>/export1</code>	<code>/Net/moon/export1</code>	Allows Workbench to find the kernel path: sent by the target server as <code>/export1/...</code> , this can be forward-mapped to the common UNIX file system for clients. ^a
<code>/export1</code>	<code>\\moon\export1</code>	Now the same for Windows clients.
<code>/tgtsvr</code>	<code>/Net/shares/tsfs/t100</code>	Allow reverse-mapping of the <code>tgtsvr</code> file system for UNIX hosts.
<code>/tgtsvr</code>	<code>L:\tsfs\t100</code>	Now the same for Windows hosts.

a. This mapping may be used only for forward-mapping the kernel image, so it must be listed *after* the previous mappings, which are used for reverse-mapping as well.

If you do not run RTPs, only the mappings for the kernel image are required (shown in the third and fourth rows of [Table 20-3](#)). None of the other mappings are necessary, since a file system is not needed for debugging kernel modules.

Basename Mappings

Use square brackets to enclose each mapping of target file basenames (left element) to host file basenames (right element), separated by a semi-colon (;). Mapping pairs (in square brackets) are separated by commas. You can use an asterisk (*) as a wildcard.

For example, if debug versions of files are identified by the extension `*.unstripped`, the mapping `[*;*unstripped]` will ensure that the debugger loads `yourApp.vxe.unstripped` when `yourApp.vxe` is launched on the target.

20.2.4 Target State Refresh Page

Since retrieving status information from the target leads to considerable target traffic, this page allows you to configure how often and under what conditions the information displayed in the Target Manager is refreshed.

These settings can be changed later by right-clicking the target connection and selecting **Refresh Properties**.

Available CPU(s) on Target Board

Workbench can correctly identify the target CPU. In rare cases, a close variant might be misidentified, so you can manually set the CPU here.

Initial Target State Query and Settings

Specify whether Workbench should query the target on connect, on stopped events, and/or on running events. You can select all options if you like.

Target State Refresh Settings

Specify whether Workbench should refresh the target state only when you manually choose to do so, or if (and how often) the display should be refreshed automatically.

Listen to execution context life-cycle events

Specify whether Workbench should listen for life-cycle events or not.

20.2.5 Connection Summary Page

This page proposes a unique **Connection name**, which you can modify, and displays a **Summary** of name and path mappings for review. To modify these mappings, click **Back**.

Shared

This option, which is available only for certain connection types, serves a dual purpose:

- When you define a target connection configuration, this connection is normally visible only for your user ID. If you define it as **Shared**, other users can also see the configuration in your registry, provided that they connect to your registry (by adding it as a remote registry on their computer; see [19.4.2 Remote Registries](#), p.234).
- Normally, when you terminate a target connection, the target server (and simulator) are killed because they are no longer needed. In a connection that is flagged as **Shared**, however, they are left running so that other users

can connect to them. In other words, you can flag a connection as shared if you want to keep the target server (and simulator) running after you disconnect or exit Workbench.

Immediately connect to target if possible

If you do not want to connect to the target immediately, you can connect to the target later using one of the ways described in [25. Debugging Projects](#). If you have applications ready to run using the connection(s) you just created, please see [23. Launching Programs](#).

20.3 Kernel Configuration

Once you have defined a Target Server (or VxWorks Simulator) connection, you may have to configure the kernel communication. The default configuration, however, will normally work fine for getting started.

The target server and the simulator communicate with the target system through the *target agent*. To communicate with the target agent, the target server uses a communication back end that has to be configured for the same communication protocol and transport layer as the target agent on the kernel.

When you create Target Server or VxWorks Simulator connections, you define host back end communication in the Kernel Editor. For more information about this topic, see [5.5.1 The Kernel Editor](#), p.93.

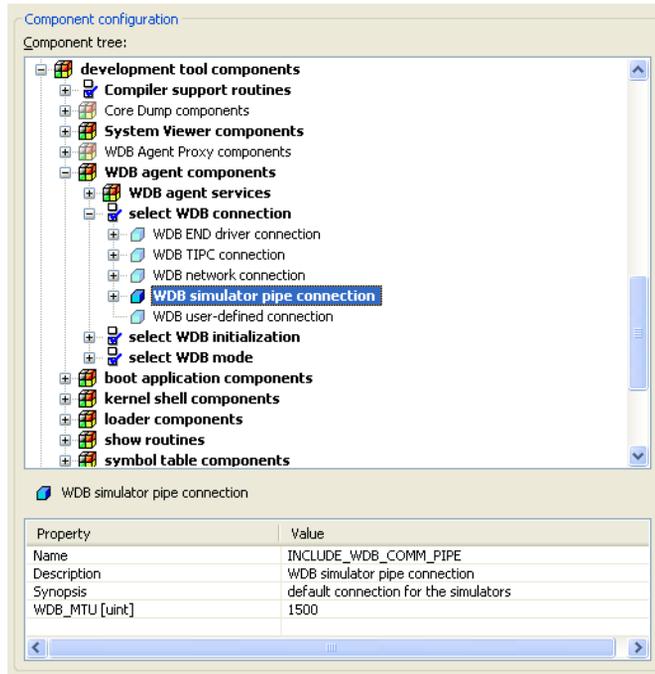
[Table 20-4](#) shows an overview of target server back ends and the kernel components that provide the required target-agent communication interface.

Table 20-4 **Communications Back Ends for Target Server and Compatible Kernel Components**

Back End	Compatible Kernel Component
wdbrpc	WDB END driver connection or WDB network connection
wdbpipe	WDB simulator pipe connection
wdbserial	WDB serial connection
wdbproxy	WDB network connection (for UDP/TCP) or TIPC network stack (for TIPC)

Figure 20-1 shows where to find these kernel components in the Kernel Editor.

Figure 20-1 Kernel Editor Showing WDB Connection Components



These and other communication-related kernel components are described in detail in the *VxWorks Programmer's Guide: Kernel Images, Components, and Configuration*.

21

New VxWorks Simulator Connections

[21.1 Introduction](#) 251

[21.2 Defining a New Wind River VxWorks Simulator Connection](#) 251

21.1 Introduction

The Wind River VxWorks Simulator allows you to simulate a connection to a standard or customized version of a VxWorks 6 kernel.

21.2 Defining a New Wind River VxWorks Simulator Connection

For VxWorks Simulator-specific information going beyond this description, please see the *Wind River VxWorks Simulator User's Guide*.

Target Server connections are defined in the Target Manager view (see [19.2 The Target Manager View](#), p.232).

To open the New Connection wizard, right-click in the Target Manager and choose **New > Connection**.

On the initial page of the New Connection wizard, select **Wind River VxWorks Simulator Connection** and click **Next**.

21.2.1 VxWorks Boot Parameters Page

Standard Simulator (Default)

Select this option to create a simulated connection to a standard VxWorks kernel.

Custom Simulator

Select this option if you are using a customized VxWorks kernel.

VxWorks Kernel Image

This field is enabled only if you select **Custom Simulator**. Navigate to the location of your customized kernel image.

Processor Number

Your system is automatically configured to run multiple simulators. Workbench assigns each simulator a unique positive number, known as the **Processor number**.

Advanced Boot Parameters

Please see the *Wind River VxWorks Simulator User's Guide* for information on the **vxsim** command-line options that can be set in this dialog.

21.2.2 VxSim Memory Options Page

These options allow you to manage your memory resources. Please see the *Wind River VxWorks Simulator User's Guide* for details.

21.2.3 VxWorks Simulator Miscellaneous Options Page

This page offers file-system location options (see the *Wind River VxWorks Simulator User's Guide* for details), the ability to influence the process priority of the simulator, and a field for entering additional command-line options that are passed as-is to **vxsim**.

21.2.4 Target Server Options Page

WDB back end type

This corresponds to the **Back end**, as described for the Target Server connection; see [Back End Settings](#), p.240. The VxWorks Simulator uses the **wdbpipe** back end by default.

Name/IP Address

Available only if the **wdbrpc** back end is selected. Specifies the network name or IP address of the target. If you are using a serial port, enter either **COM1** or **COM2**.

The remaining options in the wizard are the same as those outlined for the Target Server connection settings. These are described starting from [Advanced Target Server Options Dialog](#), p.242.

If you have created a connection for a standard simulator, the default settings should work. However, if you have defined a custom simulator connection, you may have to configure the kernel-side communication, see [20.3 Kernel Configuration](#), p.249.

If you have applications ready to run using the connection(s) you have just created, please see [23. Launching Programs](#).

22

New On-Chip Debugging Connections

[22.1 Defining a New Wind River ICE SX Connection](#) 255

[22.2 Defining a New Wind River ISS Connection](#) 267

[22.3 Defining a New Wind River Probe Connection](#) 271

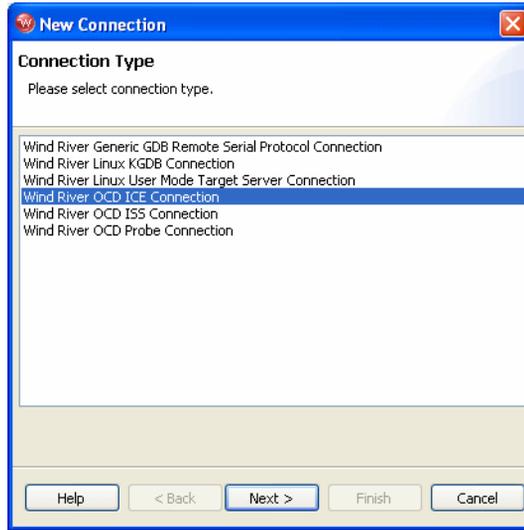
22.1 Defining a New Wind River ICE SX Connection

Wind River ICE SX connections are defined in the **Target Manager** view (see [19.2 The Target Manager View](#), p.232).

To open a new Wind River ICE SX connection, use the following steps:

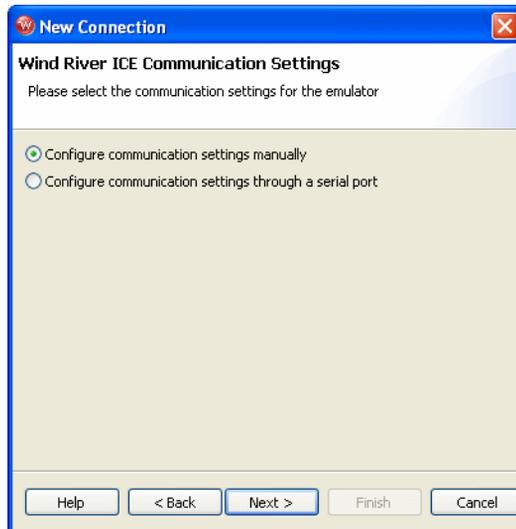
1. Right-click in the **Target Manager** view and select **New > Connection**. The **New Connection** wizard appears, as shown in [Figure 22-1](#).

Figure 22-1 **New Connection Wizard--ICE**



2. Choose **Wind River OCD ICE Connection** from the list of options and click **Next**. The **Communication Settings** dialog appears, as shown in [Figure 22-2](#).

Figure 22-2 **Communication Settings--ICE**



To configure communication settings manually, see [Configuring Communication Settings Manually, p.257](#). To configure communication settings through a serial port, see [Configuring Communication Settings Through a Serial Port, p.258](#).

Configuring Communication Settings Manually



NOTE: If you choose this option you will need to know either the network name of the emulator or its IP address. For information on assigning these values, see the *Wind River ICE SX for Wind River Workbench Hardware Reference: Configuring the Wind River ICE SX for Network Operation*.

3. Check the **Configure Communication Settings Manually** box and click **Next**.

The **Settings** dialog appears, as shown in [Figure 22-3](#).

4. In the **Designators** area, click **Select** to choose from a list of available target processors.

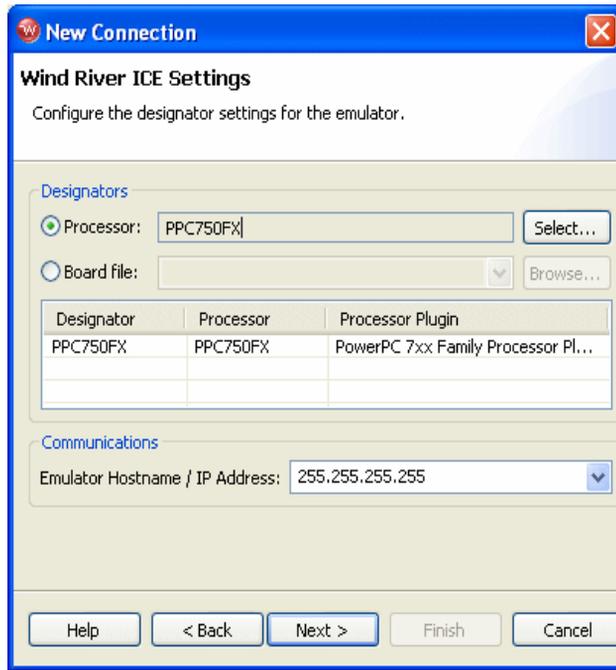
If you are using multiple processors, or if you have multiple devices (such as field-programmable gate arrays or application-specific integrated circuits) on your JTAG scan chain, specify a board file in the **Board File** field. If you are only connecting a single processor, you do not need a board file, and you can ignore the **Board File** field.

Either choice will populate the field below the **Board File** field with a summary description of your board.

5. In the **Communications** area, fill in the **IP Address** field with the IP address you have assigned to your ICE unit.

[Figure 22-3](#) shows the **Settings** dialog with values for a PPC750FX board.

Figure 22-3 **Settings Dialog**



- When you have entered the correct processor or board file and IP address, click **Next**. The **Target Operating System Settings** dialog appears. Proceed to Step 7.

Configuring Communication Settings Through a Serial Port

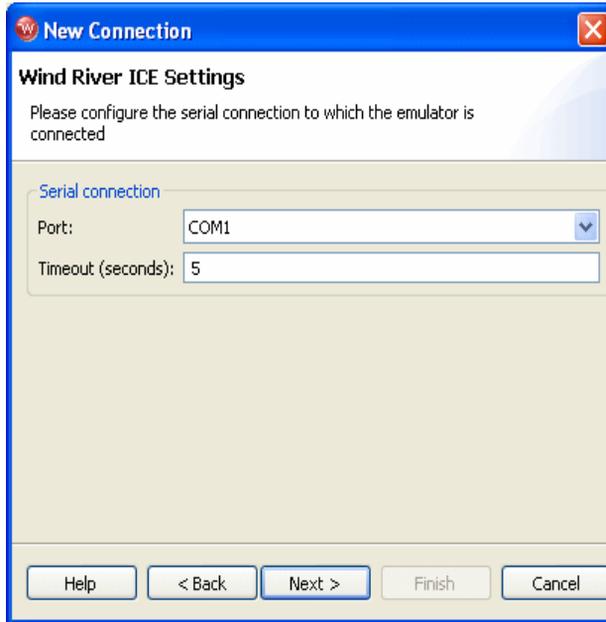
If you choose to make your connection using the serial port, make sure that a serial cable is connected between Wind River ICE SX and your host computer.



NOTE: A direct serial cable is required to create your connection this way. If you do not have a direct serial connection between your host and emulator, you must configure your ICE settings manually.

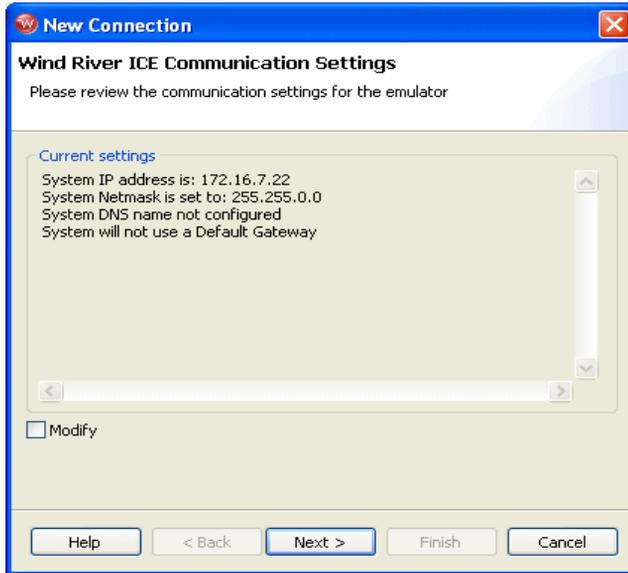
- Select **Configure Communication Settings Through a Serial Port** and click **Next**. The **Settings** dialog appears, as shown in [Figure 22-4](#).

Figure 22-4 **Serial Settings**



- b. Use this dialog to select the serial port you want to connect to, and set a timeout value in seconds. Communication settings such as the ICE's dynamically assigned IP address and other settings will be retrieved and displayed automatically, as shown in [Figure 22-5](#).

Figure 22-5 **Serial Settings Summary**



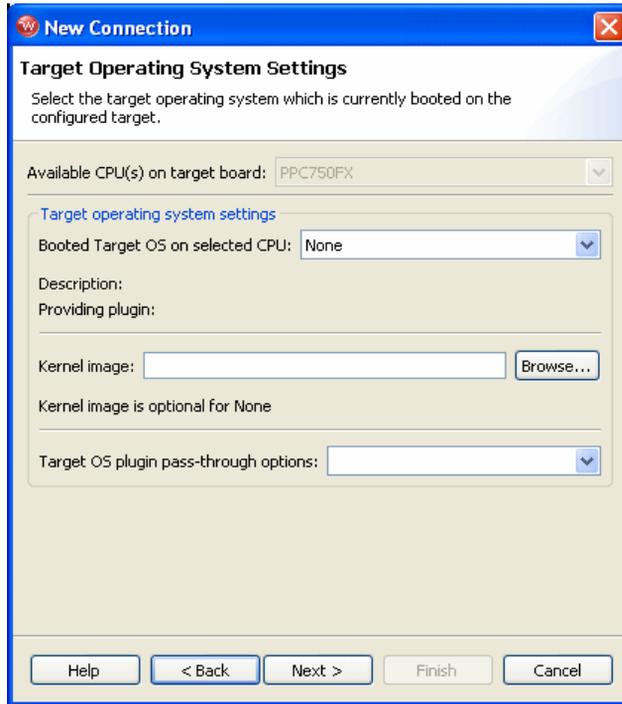
The retrieved settings can also be modified; that is, you can reconfigure the Wind River ICE SX communication settings using a serial connection. To do this, select the **Modify** checkbox.

If you have downloaded a target operating system (TOS) to the board, click into the **TOS plugin** column, select the operating system from the dropdown, and enter any required parameters in the next column.

c. Click **Next**.

The **Target Operating System Settings** dialog appears, as shown in [Figure 22-6](#).

Figure 22-6 Target OS Settings



7. In the **Booted Target OS on selected CPU** field, select the operating system that is running on your target processor. The default is **None**.
8. Next to the **Kernel Image** field, click **Browse** to navigate to the kernel image you wish to specify. If you selected **None** in the previous step, you do not need to specify a kernel image.
9. If you are using a Linux plug-in, specify the pass-through options in the **Target OS Pass-Through Options** field. If you are not using a Linux plug-in, skip this step.

Options are passed as pairs in the format *name=value*. Separate options with a comma. The following options are available:

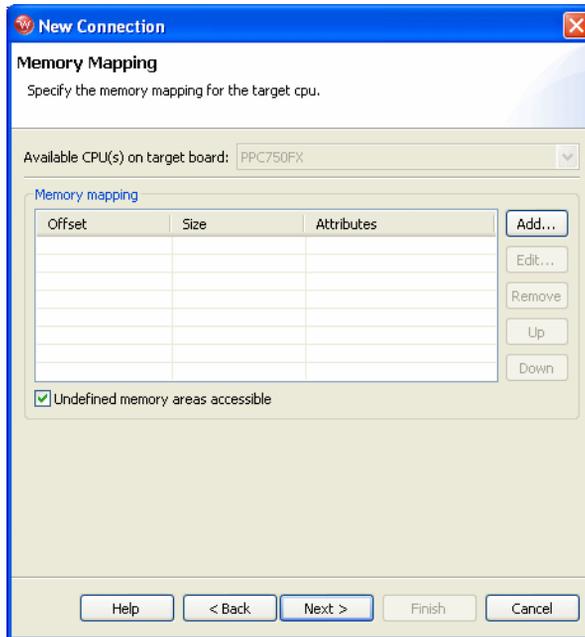
- **notasklist=1** : Never fetch process list.
- **noautomodules=1** : Do not plant internal breakpoints to do automatic kernel module load/unload detection. When this option is specified, you must manually refresh to see an updated module list.

- **noloadcheck=1** : Do not issue gophers until a hardware breakpoint is used to detect kernel load triggers. This option is for “sensitive” boards that do not accept access until the kernel loads and sets up memory mapping.
- **loaddetectloc=symbol or address** : Set the hardware breakpoint used to detect kernel load at *symbol* (for example, **loaddetectloc=start_kernel**) or *address* (for example, **loaddetectloc=0x1000**). If you do not specify a symbol or address, Workbench uses a default. For most architectures the default is **start_kernel**; for PowerPC targets, the default is **0x0**.

10. Click **Next**.

The **Memory Mapping** dialog appears, as shown in [Figure 22-7](#).

Figure 22-7 **Memory Mappings**



Use the **Memory Mappings** dialog to specify how memory on the target is partitioned, and what the attributes of the particular memory regions are.

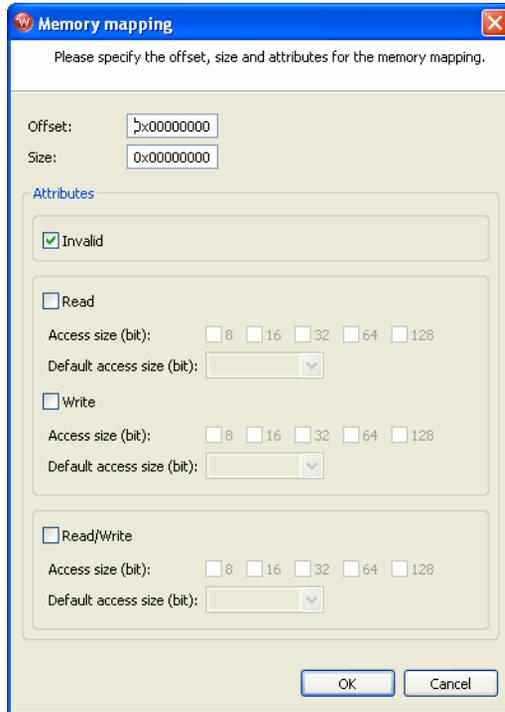


NOTE: The **Memory Mappings** dialog is only necessary for Linux or other non-VxWorks target operating systems.

To specify an area of memory, click **Add**.

The **Set Memory Map** dialog appears, as shown in [Figure 22-8](#).

Figure 22-8 **Set Memory Map Dialog**

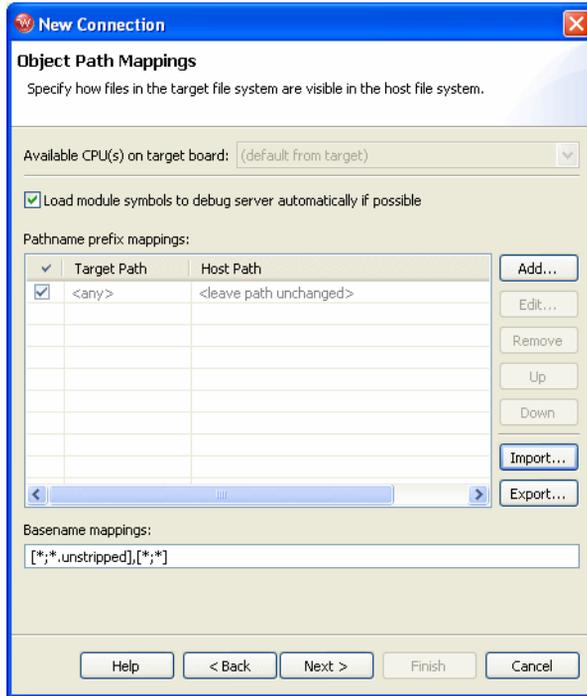


Use the **Set Memory Map** dialog to specify which memory areas are read-only, read-write, or write-only, and to specify the access width Workbench should use to read the data from those regions.

11. Click **Next**.

The **Object Path Mappings** dialog appears, as shown in [Figure 22-9](#).

Figure 22-9 **Object Path Mappings**

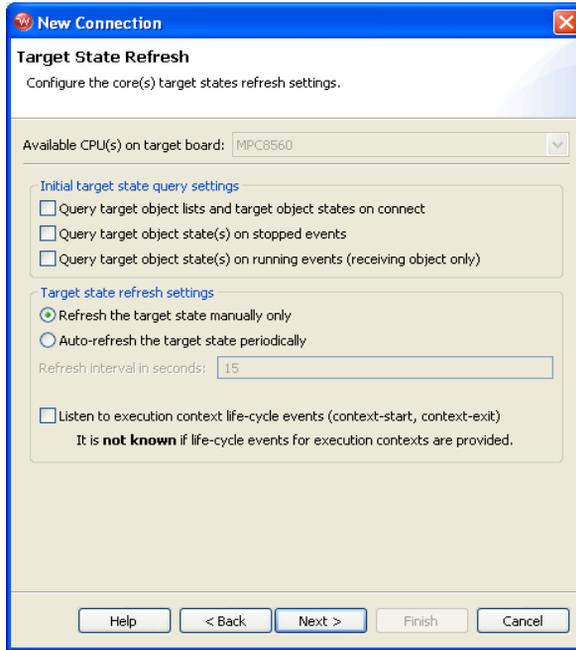


Use the **Object Path Mappings** dialog to specify how files in the target file system are visible in the host file system.

12. To add a host or target path, click **Add** and type the path in the dialog that appears.
13. Click **Next**.

The **Target State Refresh** dialog appears, as shown in [Figure 22-10](#).

Figure 22-10 **Target State Refresh**

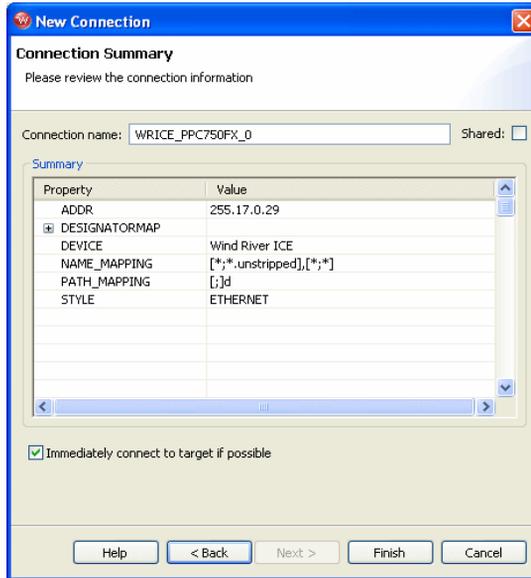


Use the **Target State Refresh** dialog to configure the target state query and target state refresh settings on your target processor.

14. Click **Next**.

The **Connection Summary** dialog appears, as shown in [Figure 22-11](#). Inspect the displayed values to make sure they are correct.

Figure 22-11 Connection Summary--ICE



15. If you want to connect to your target now, select **Immediately connect to target if possible**.

If you do not want to connect to the target immediately, you can connect to the target later using the **Target Manager** view to select the connection you have just defined, or you can create a Launch Configuration from the **Run > Debug...** menu. Launch Configurations allow you to combine applications with connection definitions, and to set various configuration parameters that are then persistently stored (see [23.2 Launching a Kernel Task or a Process](#), p.284 and [23.5 Relaunching Recently Run Programs](#), p.292). Also see the *Wind River ICE SX for Wind River Workbench Hardware Reference: Establishing Communications*.

16. If you want to share your target connection, select the **Shared** checkbox.

This option serves a dual purpose:

- When you define a target connection configuration, this connection is normally only visible for your user ID. If you define it as **Shared**, other users can also see the configuration in your registry, provided that they connect to your registry (by adding it as a remote registry on their computer; see [19.4.2 Remote Registries](#), p.234).

- Normally, when you disconnect a target connection, the target server (and simulator) are killed because they are no longer needed. In a connection that is flagged as **Shared**, however, they are left running so that other users can connect to them. In other words, you can flag a connection as shared if you want to keep the target server (and simulator) running after you disconnect or exit Workbench.

17. Click **Finish**.

Your connection is now visible in the **Target Manager** view.



NOTE: For Wind River ICE SX-specific information going beyond this chapter, including troubleshooting information, see the *Wind River ICE SX for Wind River Workbench Hardware Reference* and the *Wind River Workbench On-Chip Debugging Guide*.

22.2 Defining a New Wind River ISS Connection

For more information on the Wind River Instruction Set Simulator (ISS), please see the *Wind River Workbench On-Chip Debugging Guide: Using the Instruction Set Simulator* and the Wind River Workbench Compiler manuals.

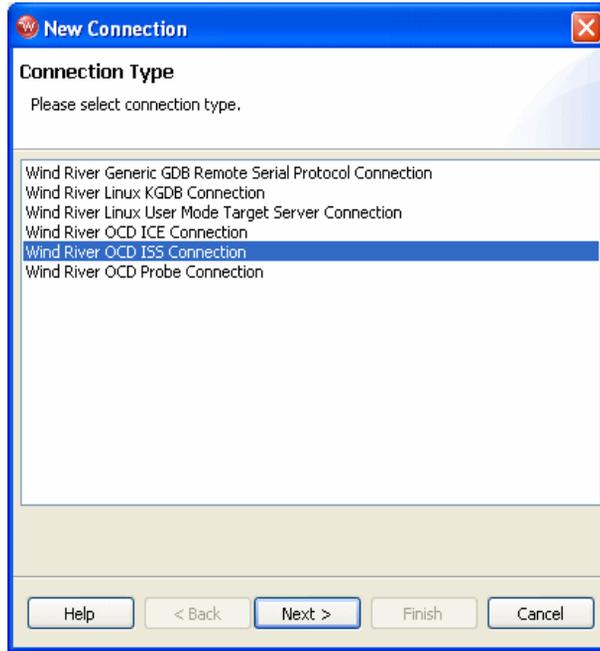
ISS connections are defined in the **Target Manager** view (see [19.2 The Target Manager View](#), p.232).

To define a Wind River ISS connection, use the following steps:

1. Right-click in the **Target Manager** view and select **New > Connection**.

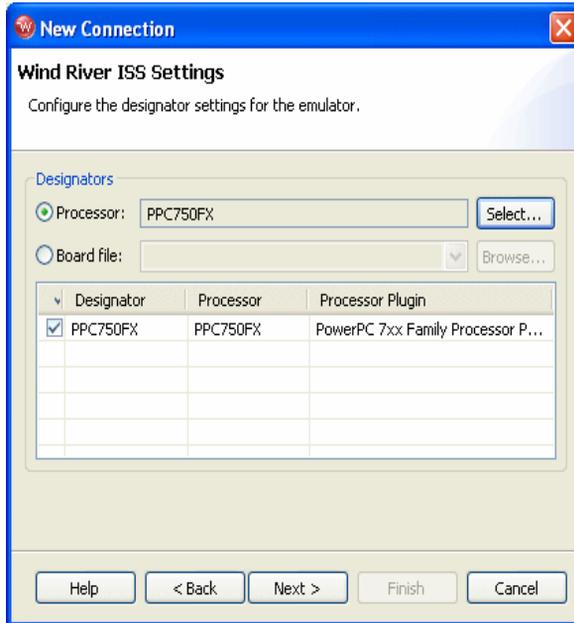
The **New Connection** Wizard appears, as shown in [Figure 22-12](#).

Figure 22-12 **New Connection Wizard--ISS**



2. Select **Wind River OCD ISS Connection** and click **Next**.
The **Settings** dialog appears, as shown in [Figure 22-13](#).

Figure 22-13 Instruction Set Simulator Settings



3. In the **Designators** area, select **Processor** (to simulate single-core debugging) or **Board file** (to simulate multi-core debugging) and click **Select** to choose from a list of available simulated targets.

This populates the list below the **Board file** field with a summary description of the board.

If you are simulating a board with multiple cores, the list will display a row for each. You can choose which cores you want to debug by selecting the checkbox in the first column of each row.

The second column displays the unique designator used to identify each core.



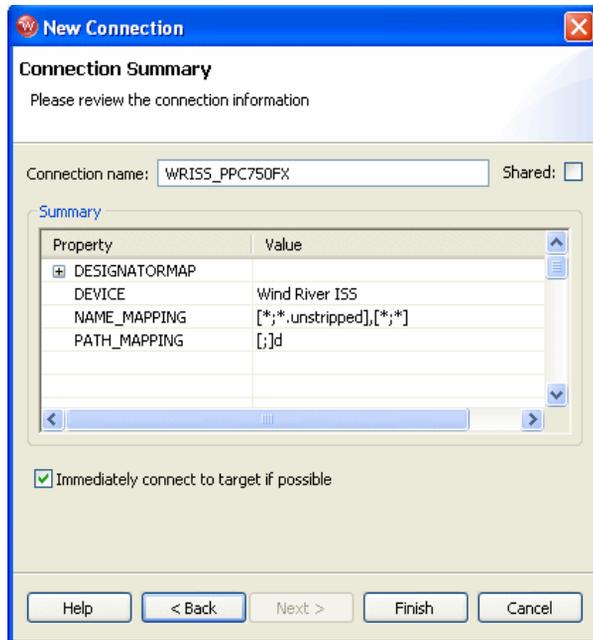
NOTE: The target operating system (TOS) plugin and TOS parameters are not supported for the Instruction Set Simulator.

4. Click **Next**.

The wizard next passes through four screens (**Target Operating System Settings**, **Memory Mapping**, **Object Path Mappings**, and **Target State Refresh**) that specify parameters on the target processor. Since this is a

simulated connection and there is no real target processor, you can ignore these screens. Click **Next** until the **Connection Summary** dialog appears, as shown in [Figure 22-14](#).

Figure 22-14 **Connection Summary--ISS**



5. Check the displayed values to make sure they are correct.
6. If you want to connect to your simulation now, select **Immediately connect to target if possible**.
If you do not want to connect to the simulation immediately, you can connect later using the **Target Manager** view to select the connection you just defined.
7. Click **Finish**.
Your connection is now visible in the **Target Manager** view.

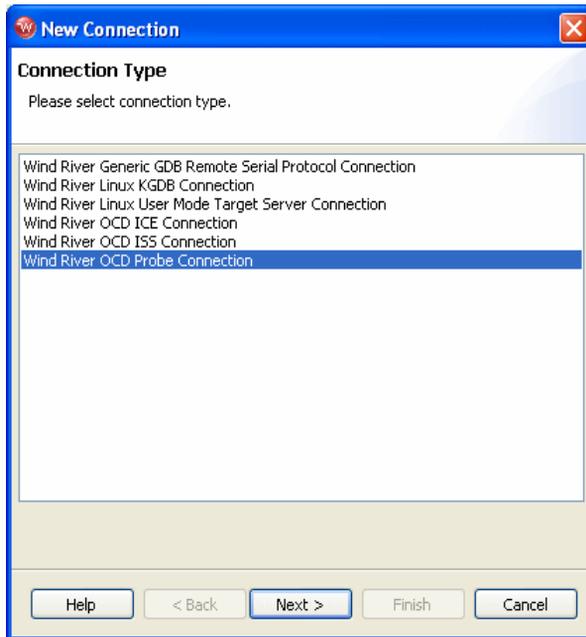
22.3 Defining a New Wind River Probe Connection

To open a new Wind River Probe connection, use the following steps:

1. Right-click in the **Target Manager** view and choose **New > Connection**.

The **New Connection** Wizard appears, as shown in [Figure 22-15](#).

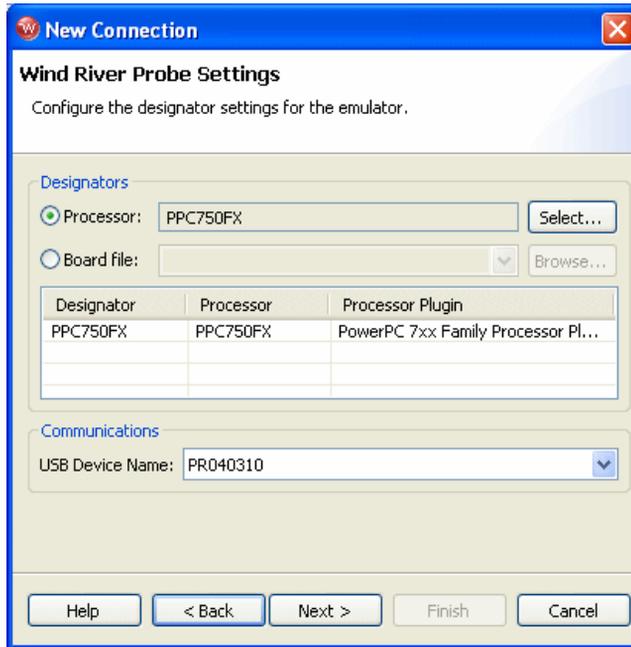
Figure 22-15 **New Connection--Probe**



2. Select **Wind River OCD Probe Connection** and click **Next**.

The **Settings** dialog appears, as shown in [Figure 22-16](#).

Figure 22-16 Settings--Probe



3. Click **Select** to choose from a list of available target processors.
4. If a board file is necessary for your target, check the **Board File** field and click **Browse** to specify the board file.



NOTE: Multi-core debugging is not supported for the Wind River Probe. Unless your target board has more than just the processor on the JTAG scan chain, you do not need to select a board file. (For example, the Wind River SBC405GP board has some FPGAs on the scan chain, so it does require a board file.)

This populates the list below the **Board file** field with a summary description of the board.

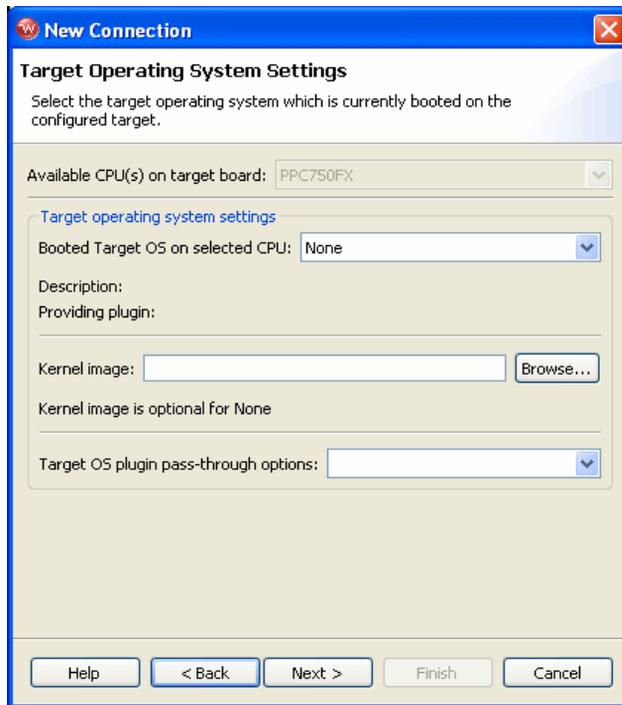
5. Inspect the **Device Name** field.

The **Device Name** field shows the serial number of your Wind River Probe unit. Since Wind River Probe uses a USB connection, there may be several units attached to your host computer at the same time. Make sure the **Device Name** field shows the serial number of the Wind River Probe you want to use.

6. Click **Next**.

The **Target Operating System Settings** dialog appears, as shown in [Figure 22-17](#).

Figure 22-17 **Target OS Settings**



7. In the **Booted Target OS on selected CPU** field, select the operating system that is running on your target processor. The default is **None**.
8. Next to the **Kernel Image** field, click **Browse** to navigate to the kernel image you wish to specify. If you selected **None** in the previous step, you do not need to specify a kernel image.
9. If you are using a Linux plug-in, specify the pass-through options in the **Target OS Pass-Through Options** field. If you are not using a Linux plug-in, skip this step.

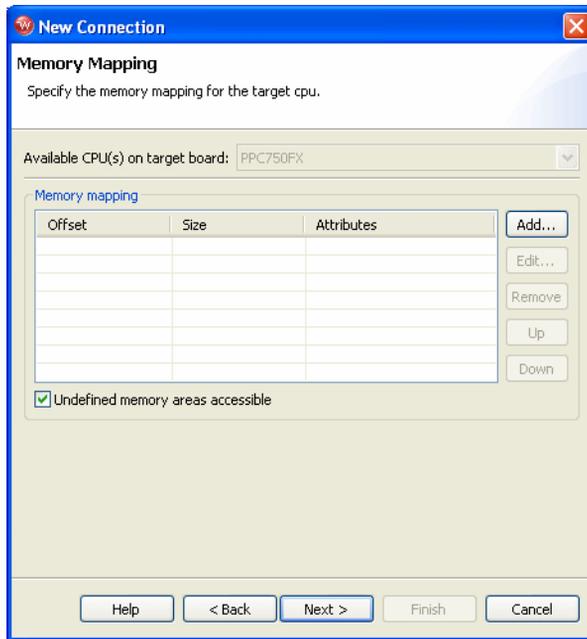
Options are passed as pairs in the format *name=value*. Separate options with a comma. The following options are available:

- **notasklist=1** : Never fetch process list.
- **noautomodules=1** : Do not plant internal breakpoints to do automatic kernel module load/unload detection. When this option is specified, you must manually refresh to see an updated module list.
- **noloadcheck=1** : Do not issue gophers until a hardware breakpoint is used to detect kernel load triggers. This option is for “sensitive” boards that do not accept access until the kernel loads and sets up memory mapping.
- **loaddetectloc=symbol or address** : Set the hardware breakpoint used to detect kernel load at *symbol* (for example, **loaddetectloc=start_kernel**) or *address* (for example, **loaddetectloc=0x1000**). If you do not specify a symbol or address, Workbench uses a default. For most architectures the default is **start_kernel**; for PowerPC targets, the default is **0x0**.

10. Click **Next**.

The **Memory Mapping** dialog appears, as shown in [Figure 22-18](#).

Figure 22-18 **Memory Mapping Dialog**



Use the **Memory Mappings** dialog to specify how memory on the target is partitioned, and what the attributes of the particular memory regions are.

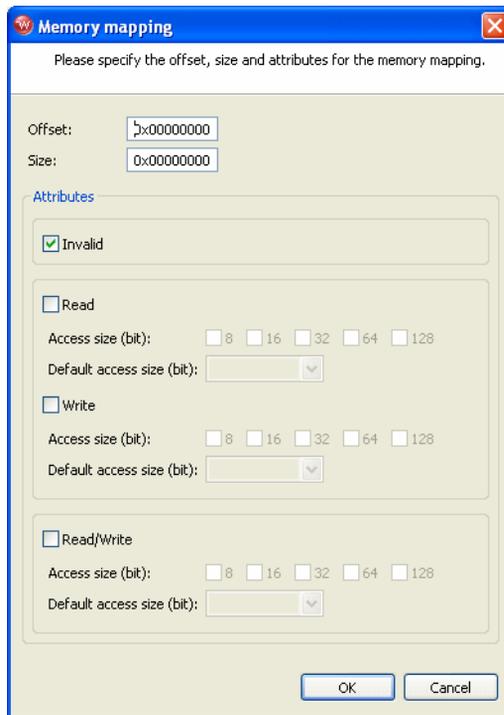


NOTE: The **Memory Mappings** dialog is only necessary for Linux or other non-VxWorks target operating systems.

To specify an area of memory, click **Add**.

The **Set Memory Map** dialog appears, as shown in [Figure 22-19](#)

Figure 22-19 **Set Memory Map Dialog**

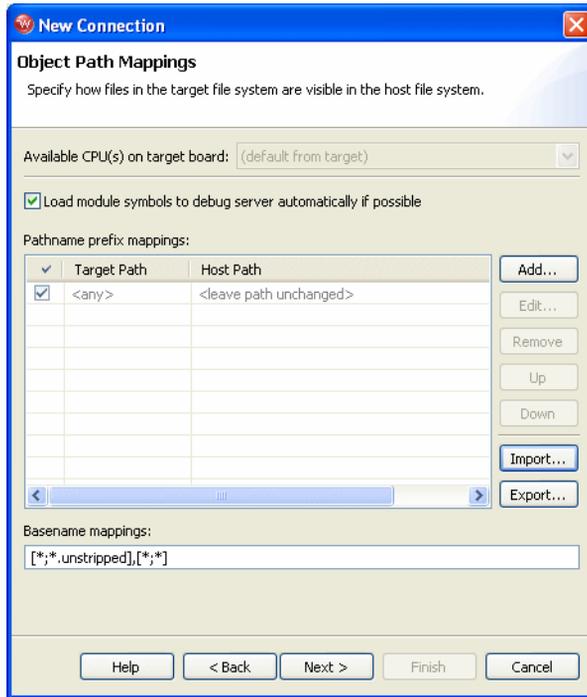


Use the **Set Memory Map** dialog to specify which memory areas are read-only, read-write, or write-only, and to specify the access width Workbench should use to read the data from those regions.

11. Click **Next**.

The **Object Path Mappings** dialog appears, as shown in [Figure 22-20](#).

Figure 22-20 **Object Path Mappings**

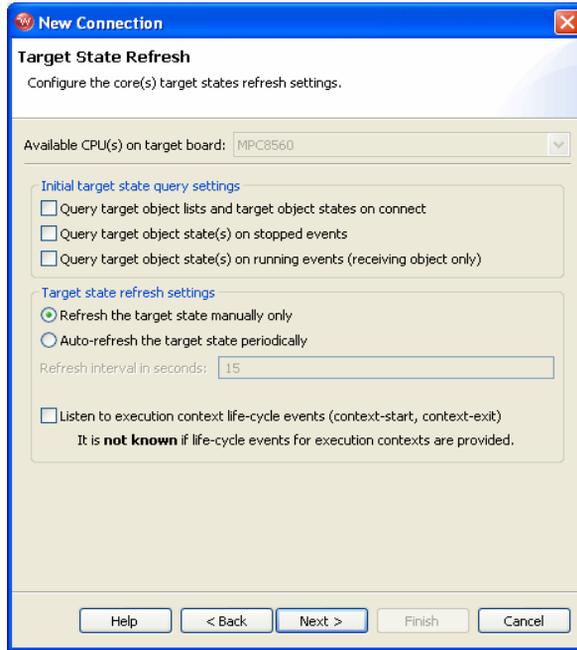


Use the **Object Path Mappings** dialog to specify how files in the target file system are visible in the host file system.

12. To add a host or target path, click **Add** and type the path in the dialog that appears.
13. Click **Next**.

The **Target State Refresh** dialog appears, as shown in [Figure 22-21](#).

Figure 22-21 Target State Refresh

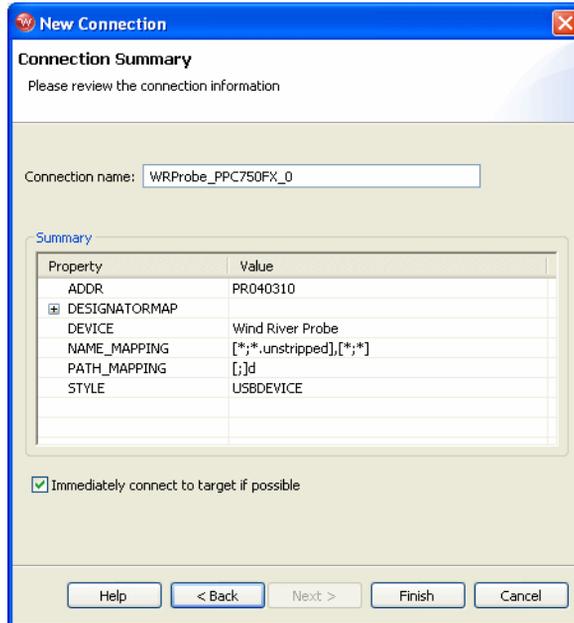


Use the **Target State Refresh** dialog to configure the target state query and target state refresh settings on your target processor.

14. Click **Next**.

The **Connection Summary** dialog appears, as shown in [Figure 22-22](#). Inspect the displayed values to make sure they are correct.

Figure 22-22 Connection Summary--Probe



15. If you want to connect to your target now, select **Immediately Connect To Target If Possible**.

If you do not want to connect to the target immediately, you can connect to the target later using the **Target Manager** view to select the connection you have just defined, or you can create a Launch Configuration from the **Run > Debug** menu.

Launch Configurations allow you to combine applications with connection definitions, and to set various configuration parameters that are then persistently stored (see [23.2 Launching a Kernel Task or a Process](#), p.284 and [23.5 Relaunching Recently Run Programs](#), p.292). Also see the *Wind River Probe for Wind River Workbench Hardware Reference: Establishing Communications*.

The **Shared** option is not available for the Wind River Probe. When you define a target connection configuration for the Wind River Probe, this connection is only visible for your user ID.

16. Click **Finish**.

Your connection is now visible in the **Target Manager** view.



NOTE: For Wind River Probe-specific information going beyond this description, including troubleshooting information, see the *Wind River Probe for Wind River Workbench Hardware Reference* and the *Wind River Workbench On-Chip Debugging Guide*.

PART V
Debugging

23	Launching Programs	283
24	Managing Breakpoints	297
25	Debugging Projects	305
26	Troubleshooting	321

23

Launching Programs

23.1 Introduction	283
23.2 Launching a Kernel Task or a Process	284
23.3 Reset & Download: Hardware Debugging Launches	289
23.4 Launching a Native Application	290
23.5 Relaunching Recently Run Programs	292
23.6 Using Attach-to-Target Launches	293
23.7 Suggested Workflow	296

23.1 Introduction

A launch configuration is like a named script that captures the whole process of building, connecting a target, downloading, running, and possibly attaching a debugger. Whenever you run a process, task, or program from the Project Navigator or the Target Manager, a **Launch Configuration** is automatically created for you. Launch configurations are stored persistently, so you can rerun your previous launches by clicking a single button, and you can share them with your team.

The same launch configuration can be executed in *Run-mode* and *Debug-mode*:

- Run-mode connects to your target, then launches a task or process.

- Debug-mode is like run-mode, but in addition to connecting to your target and launching your process, it also attaches the debugger.

This chapter explains how to create, edit, and fine-tune your launch configurations to provide a tight edit-compile-debug cycle, as well as how to manually attach the debugger to tasks and processes.

For descriptions of these dialogs as well as a guide to the icons you will see in the launch configuration wizard, see the *Wind River Workbench User Interface Reference: Launch Configuration Dialog*.

23.2 Launching a Kernel Task or a Process

Launch configurations that run kernel tasks, RTPs, and Linux processes are very similar. Only a few options and settings differ between them.

To create a new launch configuration, select a build target in the Project Navigator then select **Run > Run** or **Run > Debug**¹. The **Create, manage, and run configurations** dialog appears.

1. From the **Configurations** list, select the type of launch you want to create, then click **New**.
2. The **Name** field will display a default name based on the type of configuration you selected.
 - A new kernel task launch configuration is called **noEntryPoint - moduleName - connectionName**². As soon as you select an entry point for the configuration, the name changes to *entryPoint - moduleName - connectionName*. If you prefer, you can type a completely new name in the **Name** field.
 - A new process or RTP configuration is called **noExecPath - connectionName**. As soon as you select an Exec Path for the configuration (when you specify the executable to run), the name changes to *executable - connectionName*. Or, if you prefer, you can type a completely new name in the **Name** field.

-
1. You can also create a launch configuration by right-clicking on the build target in the Project Navigator and selecting the appropriate **Run** or **Debug** command from the context menu.
 2. If no target is connected, the default name is **noEntryPoint - moduleName - noDownload**.

23.2.1 Defining the Target Connection

The default **Connection to use** is the target that is currently connected. If you have more than one connection defined in the Target Manager, you can select a different one from the drop-down list.

1. To change the properties of the target connection, including target server options and object path mappings, click **Properties**.
2. To create a new connection definition, click **Add**.
3. To retrieve the connection-specific properties from the target, and adjust them if necessary, click **Connect**.

For more information about target connections, see [20. New Target Server Connections](#) and the *Wind River Workbench User Interface Reference: Target Manager View*.

23.2.2 Defining the Kernel Task or Process to Run

The settings in this section can be changed only when you are connected to a target.

Once your target is connected, you can select the **Entry Point** of your program from the drop-down list, click **Browse** next to the **Exec Path on Target** field and navigate to the executable to run³ (if it does not already appear), or change any of the other settings in this section.



NOTE: If your application is *not* built as described in [17.6 Executables that Dynamically Link to Shared Libraries](#), p.203, you must set the `LD_LIBRARY_PATH` environment variable. See that section for details.

For more information on the fields on the Main tab, see the *Wind River Workbench User Interface Reference: Launch Configuration Dialog*.

3. Workbench automatically maps the pathname from your host file system into a pathname that is valid on the target file system. To change the mappings, click **Properties**, scroll right to the **Object Path Mappings** tab, highlight the mapping you want to change, click **Edit**, then update and save your new settings.

23.2.3 Specifying a Build Target to Download

If you want Workbench to download a particular build target each time this launch is used, specify it on the **Downloads** tab (this is necessary only for kernel task launches). If you highlighted a build target in the Project Navigator before opening the launch dialog, the file appears in the **Downloads** list automatically.

1. To modify any of the settings of the output file that appears, click **Edit**.

To add a file or to specify additional files to be downloaded, click **Add**.

In both cases, the **Download** dialog appears. For details about the fields in this dialog, see *Wind River Workbench User Interface Reference: Launch Configuration Dialog*.

2. When you are finished adjusting the settings, click **OK**. The new information appears in the **Downloads** list.



NOTE: You can also create launches for kernel tasks that are already downloaded, or are resident in Flash or are part of the kernel image. Those tasks do not require an entry in the **Downloads** list since they do not need to be downloaded each time the configuration is run.

23.2.4 Specifying The Projects to Build

If you want Workbench to build a particular project or projects prior to launching this configuration, specify them on the **Projects to Build** tab. If you selected a build target in the Project Navigator, its project appears in the **Projects to Build** list automatically.

1. To add another project to the list, click **Add Project**, select one or more projects, then click **OK**.
2. To rearrange the build order in the list, select a project then click **Up** or **Down**.
3. If you do not want Workbench to build for this particular launch configuration, such as when you are working with very large projects, select all projects and select **Remove** to clear the list⁴.

4. To prevent Workbench from building prior to launching any of your programs, unselect **Window > Preferences > Run/Debug > Launching > Build (if required)** before launching.



NOTE: Workbench is aware of relationships between projects and subprojects. So if **myLib** is a subproject of **myProj** and you choose to add **myProj** to the list, you cannot add **myLib** to the list as well because it will be built automatically when you build **myProj**. Adding **myLib** as well would be redundant and so is disabled.

When you change the list of downloaded files for kernel task launches (see [Specifying a Build Target to Download](#), p.286) the projects containing those files are automatically added to the **Projects to Build** list. You should always review this list when you change the list of downloaded files.

23.2.5 Defining Debug Behavior

Break on Entry

When creating debug-mode launches, **Break on entry** is selected by default. Uncheck it if you want this program to run to the first breakpoint you set, rather than breaking immediately after startup.

If **Break on entry** is selected when the launch is run, four things happen:

- Workbench automatically switches to the Device Debug perspective (if it is not already open).⁵
- The task or process is displayed in the Debug view.
- A temporary breakpoint is planted and appears in the Breakpoints view.
- The program executes up to **Entry Point** and breaks.

Automatically Attach Spawned Kernel Tasks

For kernel task launches, select this option if you want Workbench to automatically attach spawned kernel tasks.

5. From the View Management Preferences screen (**Window > Preferences > Run/Debug > View Management**) you can control under what circumstances Workbench switches views based on your selection.

23.2.6 Specifying Where Workbench Should Look for Source Files

If your build target was compiled on the same host where you want to debug it, you do not need to change anything on the **Source** tab.

However, if the build target was compiled on a different host, and Workbench needs to find source files during debugging, it searches the locations listed on this tab in the specified order.



NOTE: If you do not specify a source lookup path, the debugger will ask for the correct source path as soon as it encounters a source it cannot find. So if you prefer, you can configure the source lookup manually as you go, rather than configuring it when creating the launch.

1. On the **Sources** tab, click **Add** to configure the source lookup path.
2. Select the type of source to add, then click **OK**.
3. Most choices require that you select a specific project, folder, or path. Make your selection, then click **OK**.
4. Click **Up** or **Down** to adjust the search order.
5. Check **Search for duplicate source files on the path** to have Workbench search the entire source lookup path and offer you a choice of all the files it finds that have the same filename, rather than automatically using the first file of that name it encounters.

For more information about the source locator, see [25.6 Understanding Source Lookup Path Settings](#), p.315 and *Wind River Workbench User Interface Reference: Source Lookup Path Dialog*.

23.2.7 Configuring Access Methods

Use the **Common** tab to specify whether this launch is local or shared, to add the launch to the Workbench toolbar favorites menus, and to indicate whether the program should be launched in the background or not.

1. By default this launch configuration is a local file available only to you. If you want to share it with others on your team, click **Shared**, then type or browse to the directory where you want to save the shared file.
2. If you want to be able to launch this program from the **Run** or **Debug** favorites menus (the drop-down menus on the Workbench toolbar), select **Run** or **Debug** in the **Display in favorites menu** box.

23.2.8 Using Your Launch Configuration

When you are finished configuring the launch configuration for your program, click **Apply** to save your settings but leave the dialog open, click **Close** to save your launch configuration for later use, or click **Run** or **Debug** to launch it now.

Running Your Program

If you select **Run** to launch your program, the output file or executable is loaded into target memory and its name and host location appear below your target connection in the Target Manager (RTPs appear under Real-time Processes). A red **S** over the output file icon indicates that symbol information has been downloaded to the debugger.



NOTE: If no symbol information was found, right-click the module and select **Load Symbols** to load the symbols for your module from an alternate location.

You can also match module paths with symbol information by selecting the **Create path mappings based on selection** checkbox in the Load Symbols dialog.

Debugging Your Program

If you select **Debug** to launch your program, in addition to loading the output file or executable into target memory and downloading symbol information, the debugger attaches to the task or process that then appears in the Debug view. For more information about debugging your programs, see [25. Debugging Projects](#) and the *Wind River Workbench User Interface Reference: Debug View*.

23.3 Reset & Download: Hardware Debugging Launches

For information about creating a Reset and Download launch configuration, see *Wind River ICE SX for Wind River Workbench Hardware Reference: Establishing Communications* or *Wind River Probe for Wind River Workbench Hardware Reference: Establishing Communications*, depending on whether you are using a Wind River ICE SX or Wind River Probe for your OCD connection.

23.4 Launching a Native Application

1. To create a new launch configuration that will run a native application on your local host or remote host, select your application's executable in the Project Navigator then select **Run > Run**. The **Create, manage, and run configurations** dialog appears.
2. From the **Configurations** list, select **Native Application**, then click **New**.
3. The default name of the new configuration is **New_configuration**. Type a descriptive name in the **Name** field.

23.4.1 Specifying the Location and Arguments for Your Application

1. To specify the location of your application's executable file, click **Browse Workspace** near the **Location** field. The **Select an application** dialog opens.
2. Select the executable and click **OK**. The executable appears in the **Location** field.
3. To specify the working directory for your application, click **Browse Workspace** to open the **Select a working directory** dialog, or **Browse File System** to open the **Browse for Folder** dialog.
4. Select a working directory, then click **OK**. The directory appears in the **Working Directory** field.
5. Type the arguments your application requires into the **Arguments** field, or click **Variables** to open the **Select Variable** dialog. Double-click the variable you want to use, or select it and click **OK** to add it to the **Arguments** field.

23.4.2 Specifying Remote Settings

These settings are optional, and are required only if you are running your application on a remote host. For more information about working with remote hosts, see [17.9.5 Running Applications Remotely](#), p.213.

Command-line application's output and input will be redirected to the standard Eclipse console unless the application is started within an external process that creates a new window, such as **xterm**.

1. If your application requires an interactive shell, type the program and arguments in the **Remote Program** field. The default for remote execution is a

remote command like `xterm -e %Application%`, so a local X-server like Exceed or Cygwin X must be running.

2. If you want to use a different working directory than the one specified on the Arguments tab, type the path to the desired directory (as seen on the remote host).

23.4.3 Setting Environment Variables

These settings define the environment variable values to use when running a Java application. By default, the environment is inherited from the Eclipse run time. You may override or append to the inherited environment.



NOTE: These settings apply to applications that run locally, not to remote applications.

1. To set a new environment variable, or to change or extend variables from the existing environment, click **New**. The **New Environment Variable** dialog opens.
2. Type a descriptive name for the variable.
3. Type the value for the variable, or click **Variables** and select the desired variable, add any required arguments, then click **OK**.
4. To include an existing environment variable, click **Select**. The Select Environment Variables dialog opens.
5. Select the checkbox next to the desired variable, then click **OK**.
6. For each variable, choose whether to append it to the native environment or substitute it for the native environment.

23.4.4 Configuring Access Methods

Use the **Common** tab to specify whether this launch is local or shared, to add the launch to the Workbench toolbar favorites menus, and to indicate whether the program should be launched in the background or not.

1. By default this launch configuration is a local file available only to you. If you want to share it with others on your team, click **Shared**, then type or browse to the directory where you want to save the shared file.

2. If you want to be able to launch this program from the **Run** favorites menu (the drop-down menu on the Workbench toolbar), select **Run** in the **Display in favorites menu** box.

23.4.5 Running Your Native Application

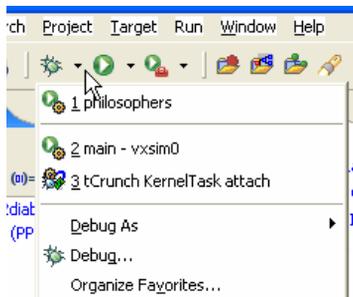
When you are finished configuring the launch configuration for your application, click **Apply** to save your settings but leave the dialog open, click **Close** to save your launch configuration for later use, or click **Run** to launch it now.

23.5 Relaunching Recently Run Programs

In a typical development scenario, you will run the same application many times in a single debugging session. After creating a launch configuration, you can click the **Run** or **Debug** icon or use a keyboard shortcut to run a process and attach the debugger in a few seconds.

To relaunch a recently run program:

- Press **CTRL+F11** to launch the last run-mode configuration you used, or **F11** to launch the last debug-mode configuration you used.
- Click the drop-down arrow next to the **Run** or **Debug** icon and select the configuration from the list. If you ran the configuration recently, it will appear on the menu. If you selected **Run** or **Debug** from the **Display in favorites menu** list (see [Configuring Access Methods](#), p.288) it will always appear on the list, whether you have run it recently or not.



- To run a configuration not listed on the favorites menu, click **Run > Run** or **Run > Debug**, then choose the configuration from the **Configurations** list and click **Run** or **Debug**.

23.5.1 Increasing the Size of the Launch History List

Workbench stores a history of previously launched configurations. The default length of the launch history is 10, but you can increase the history length by selecting **Window > Preferences > Run/Debug > Launching** and increasing the number in the **Size of recently launched applications list** field.

23.6 Using Attach-to-Target Launches

Workbench automatically creates **Attach to Target** launch configurations when you attach to an individual process or kernel task from the Target Manager. They do not actually run an application, they just connect to your target and attach the debugger to the specified task or process that already exists. These configurations are visible only in Debug mode.

Once **Attach to Target** launches are created, you can:

- Review them and delete those that you no longer need.
- Change which target connection should be used to run the process.
- Rename your launch configurations, and if you think they are valuable, put them into your **Favorites** menu using the **Common** tab.
- Change the mapping between source paths compiled into your objects and source paths in your workspace by editing the Source Locator information in the **Sources** tab.
- Change the **Projects to Build** settings for the launch. This is particularly valuable for **Attach to Kernel** launches on the VxWorks simulator: you can disconnect your simulator, rebuild your kernel as part of the launch, and then let the launch automatically restart and reconnect the simulator. Automatically rebuilding shared libraries is another use of **Build before launching**.



NOTE: When you attach to a process or task with the same name using the same connection, Workbench automatically reuses all the settings from the previous launch.

However, Workbench creates a new launch (requiring you to reconfigure the settings) when it detects that the properties of the connection have changed: for example, if the connection was renamed, a different kernel image was used, or the target server arguments or other connection properties were changed.

One way to avoid accumulating many similar launches is to make your configuration changes in the launch itself, rather than right-clicking a process in the Target Manager and selecting **Attach**. That way Workbench will always have the correct settings for the process you want to run.

23.6.1 Attaching the Debugger to a Running Task or Process

To attach the debugger to a task or RTP that is already running, right-click it in the Target Manager and select:

- **Attach to Real-time Process** to attach to a Real-time Process on VxWorks.
- **Attach to Kernel Task** to attach to a kernel task on VxWorks.
- **Attach to Process** to attach to a process on Linux.

Whenever you manually attach an individual process or task, Workbench automatically switches to the Device Debug perspective (if it is not already open) and displays the task or process in the Debug view, the debugger attaches without stopping the program, and Workbench automatically creates a corresponding **Attach-to-Target** launch configuration with those properties. For more information about how to use **Attach-to-Target** configurations, see [23.6 Using Attach-to-Target Launches](#), p.293.

Comparing Definitions: Running, Suspended, and Stopped Tasks

VxWorks and the Workbench Debug view both make a distinction between running, suspended, or stopped tasks, but their definitions are not identical.

VxWorks	Workbench Debug View	Definition
Running	Running	Task is active, and has focus.
Suspended	Running	Task is waiting while another task runs.

Stopped

Suspended

Task stopped at a breakpoint or other event, or was stopped by user.

23.6.2 Attaching the Debugger to the Kernel

The debugger functions differently depending on whether you attach to the kernel in task mode or system mode.

23.6.3 Attaching the Kernel in Task Mode

To attach to the kernel in Task Mode⁶ (VxWorks), right-click the **Kernel Tasks** node in the Target Manager and select **Attach All Kernel Tasks**.

The debugger will automatically track added and removed kernel tasks so that you can always debug the entire system. You can also stop (suspend) individual kernel tasks, unless they have the **VX_UNBREAKABLE** option set. When you stop a kernel task, the rest of the system will continue to run.

23.6.4 Attaching the Kernel in System Mode

To attach the kernel in System Mode (VxWorks and Linux dual-mode agent), right-click the CPU icon below the Connection icon and select **Attach-to-Kernel**.

This will create an **Attach-to-Target** launch configuration that automatically switches your target into System Mode before attaching the debugger. The Debugger will show a single node labelled **System Context** that represents the code that the CPU is currently executing. When you stop (suspend) the System Context, your entire System is stopped, including all the tasks, processes, and interrupt service routines. You can now also set breakpoints that will suspend the entire system when they are hit.

In addition to the single System Context node in the debugger, you can also attach to individual kernel tasks. This will create separate debug sessions. You can also set breakpoints that are specific to the task that is currently executing by selecting **restrict breakpoint scope to task** on the Scope tab of the breakpoint dialogs (for more information, see the line, expression, and hardware breakpoint dialog entries in the *Wind River Workbench User Interface Reference*).

6. Task mode is also known as user mode.

Note that System Mode breakpoints (breakpoints that are planted while a System Mode attach is active) will only be active when your target is in System Mode. You can switch your target between System Mode and User Mode by choosing the gear-wheel icon in the Target Manager, or by ticking the **Debug Mode** menu items in the Debugger. For more information about Debug Mode functionality, see [25.5 Using Debug Modes](#), p.311.

23.7 Suggested Workflow

Launch Configurations allow for a very tight Edit-Compile-Debug cycle when you need to repeatedly change your code, build and run it. You can use the **F11** (Debug Last Launched) key to build the projects you have specified, connect your target (unless it is already connected), download, and run your most important program over and over again.

The only thing to keep in mind is that it may not be possible to rebuild your program or kernel while it is still being debugged (or its debug info is still loaded into the debugger). Workbench will warn you with a dialog and suggest proper actions in case a problem of such simultaneous usage is detected. Depending on the size of the modules you run and debug, it can be the case that the debug server cannot load all the symbolic information for your modules into memory. By default, the size limit is set to 60MB (this can be changed by selecting **Preferences > Target Manager > Debug Server Settings > Symbol File Handling Settings**.)

If a module is bigger than this limit, it will be locked against overwriting as long as the debugger has symbols loaded. This means that when you try to rebuild this module, you will see a dialog asking you to unload the module's symbol information from the debugger before you continue building. You can usually unload symbolic information without problems, provided that you do not have a debug session open in the affected module. If you have a module open, you should terminate your debug session before continuing the new build and launch process.

24

Managing Breakpoints

- 24.1 Introduction 297
- 24.2 Types of Breakpoints 297
- 24.3 Manipulating Breakpoints 301

24.1 Introduction

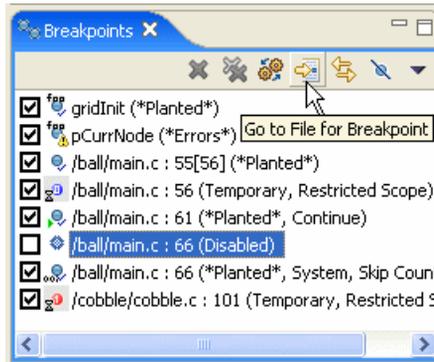
Breakpoints allow you to stop a running program at particular places in the code or when specific conditions exist. This chapter shows how you can use the Breakpoints view to keep track of all breakpoints, along with any conditions.

You can create breakpoints in different ways: by double-clicking or right-clicking in the Editor's left overview ruler (also known as the *gutter*), by opening the various breakpoint dialogs from the pull-down menu in the Breakpoints view itself, or by selecting one of the breakpoint options from the **Run** menu.

24.2 Types of Breakpoints

[Figure 24-1](#) shows the Breakpoints view with various types of breakpoints set.

Figure 24-1 Breakpoints View



See the sections below for when and how to use each type of breakpoint. For a guide to the icons you will see in the Breakpoints view, see *Wind River Workbench User Interface Reference: Breakpoints View*.

24.2.1 Line Breakpoints

Set a line breakpoint to stop your program at a particular line of source code.

Creating Line Breakpoints

To set a line breakpoint with an unrestricted scope (that will be hit by any process or task running on your target), double-click in the left gutter next to the line on which you want to set the breakpoint. A solid dot appears in the gutter, and the Breakpoints view displays the file and the line number of the breakpoint. You can also right-click in the gutter and select **Add Global Line Breakpoint**.

To set a line breakpoint that is restricted to just one task or process, right-click in the Editor gutter and select **Add Breakpoint for selected thread**. If the selected thread has a color in the Debug view, a dot with the same color will appear in the Editor gutter, with the number of the thread inscribed inside it.

Right-clicking in the Editor's gutter and selecting **Add Line Breakpoint**, or selecting **Add Line Breakpoint** from the Breakpoints view's pull-down menu will open the **Line Breakpoint dialog**, where you can create and adjust the properties of the breakpoint.

For more information about the settings in this dialog, see *Wind River Workbench User Interface Reference: Line Breakpoint Dialog*.

24.2.2 Expression Breakpoints

Set an expression breakpoint using any C expression that will evaluate to a memory address. This could be a function name, a function name plus a constant, a global variable, a line of assembly code, or just a memory address. Expression breakpoints appear in the Editor's gutter only when you are connected to a task.

Breakpoint conditions are evaluated after a breakpoint is triggered, in the context of the stopped task or process. Functions in the condition string are evaluated as addresses and are not executed. Other restrictions are similar to the C/C++ restrictions for calculating the address of a breakpoint using the Expression Breakpoint dialog.

Select **Add Expression Breakpoint** from the Breakpoints view's pull-down menu to open the **Expression Breakpoint dialog**, where you can create and adjust the properties for the breakpoint.

For more information about the settings in this dialog, see the *Wind River Workbench User Interface Reference: Expression Breakpoint Dialog*.

24.2.3 Hardware Breakpoints

Some processors provide specialized registers, called debug registers, which can be used to specify an area of memory to be monitored. For instance, IA-32 processors have four debug address registers, which can be used to set data breakpoints or control breakpoints.

Hardware breakpoints are particularly useful if you want to stop a process when a specific variable is written or read. For example, with hardware data breakpoints, a hardware trap is generated when a write or read occurs in a monitored area of memory. Hardware breakpoints are fast, but their availability is machine-dependent. On most CPUs that do support them, only four debug registers are provided, so only a maximum of four memory locations can be watched in this way.

There are two types of hardware breakpoints:

- A hardware *data breakpoint* occurs when a specific variable is read or written.

- A hardware *instruction breakpoint* or *code breakpoint* occurs when a specific instruction is read for execution.

Once a hardware breakpoint is trapped—either an instruction breakpoint or a data breakpoint—the debugger will behave in the same way as for a standard breakpoint and stop for user interaction.

Adding Hardware Instruction Breakpoints

There two ways to add a new hardware instruction breakpoint:

In the gutter (grey column) on the left of the source file, right-click and select **Add Hardware Code Breakpoint**. Or, double-click in the gutter to add a standard breakpoint and then, in the Breakpoints view, right-click the breakpoint you've just added and select **Properties**. In the last pane (**Hardware**) of the **Properties** dialog select **Enable Hardware Breakpoint**.

Adding Hardware Data Breakpoints

Set a hardware data breakpoint when:

- The debugger should break when an event (such as a read or write of a specific memory address) or a situation (such as data at one address matching data at another address) occurs.
- Threads are interfering with each other, or memory is being accessed improperly, or whenever the sequence or timing of runtime events is critical (hardware breakpoints are faster than software breakpoints).

Select **Add Data Breakpoint** from the Breakpoints view's pull-down menu to open the **Hardware Data Breakpoint dialog**, where you can create and adjust the properties for the breakpoint.

For more information about the settings in this dialog, see the *Wind River Workbench User Interface Reference: Hardware Data Breakpoints Dialog*.

Converting Line or Expression Breakpoints Into Hardware Code Breakpoints

To cause the debugger to request that a line or expression breakpoint be a hardware code breakpoint, select the **Hardware** check box on the **Hardware** tab of the **Line Breakpoint** or **Expression Breakpoint** dialogs.

This request does not guarantee that the hardware code breakpoint will be planted; that depends on whether the target supports hardware breakpoints, and if so, whether or not the total number supported by the target have already been planted. If the target does not support hardware code breakpoints, an error message will appear when the debugger tries to plant the breakpoint.

➔ **NOTE:** Workbench will set only the number of code breakpoints, with the specific capabilities, supported by your hardware.

➔ **NOTE:** If you create a breakpoint on a line that does not have any corresponding code, the debugger will plant the breakpoint on the next line that does have code. The breakpoint will appear on the new line in the Editor gutter.

In the Breakpoints view, the original line number will appear, with the new line number in square brackets [] after it. See the third breakpoint in [Figure 24-1](#).

Comparing Software and Hardware Breakpoints

Software breakpoints work by replacing the destination instruction with a software interrupt. Therefore it is impossible to debug code in ROM using software breakpoints.

Hardware breakpoints work by comparing the break condition against the execution stream. Therefore they work in RAM, ROM or flash.

Complex breakpoints involve conditions. An example might be, “Break if the program writes *value* to *variable* if and only if **function_name** was called first.”

24.3 Manipulating Breakpoints

Now that you have an understanding of the different types of breakpoints, this section will show you how to work with them.

24.3.1 Importing Breakpoints

To import breakpoint properties from a file:

1. Select **File > Import > Import Breakpoints**, then click **Next**. The Import Breakpoints dialog appears.
2. Select the breakpoint file you want to import, then click **Next**. The Select Breakpoints dialog appears.
3. Select one or more breakpoints to import, then click **Finish**. The breakpoint information will appear in the Breakpoints view, and the next time the context for that breakpoint is active in the Debug view, the breakpoint will be planted.

24.3.2 Exporting Breakpoints

To export breakpoint properties to a file:

1. Select **File > Export > Export Breakpoints**, then click **Next**. The Export Breakpoints dialog appears.
2. Select the breakpoint whose properties you want to export, and type in a file name for the exported file. Click **Finish**.

24.3.3 Refreshing Breakpoints

Right-clicking a breakpoint in the Breakpoints view and selecting **Refresh Breakpoint** causes the breakpoint to be removed and reinserted on the target. This is useful if something has changed on the target (for example, a new module was downloaded) and the breakpoint is not automatically updated.

To refresh all breakpoints in this way, select **Refresh All Breakpoints** from the Breakpoints view toolbar drop-down menu.

24.3.4 Disabling Breakpoints

To disable a breakpoint, clear its check box in the Breakpoints view. This retains all breakpoint properties, but ensures that it will not stop the running process. To re-enable the breakpoint, select the box again.

24.3.5 Removing Breakpoints

There are several ways to remove a breakpoint:

- right-click it in the Editor gutter and select **Remove Breakpoint**

- select it in the Breakpoints view and click the **Remove** icon
- right-click it in the Breakpoints view and select **Remove**

For more information about the Breakpoints view or any of the breakpoint dialogs, see the *Wind River Workbench User Interface Reference*.

25

Debugging Projects

- 25.1 Introduction 305
- 25.2 Using the Debug View 306
- 25.3 Coloring Views 310
- 25.4 Stepping Through a Program 311
- 25.5 Using Debug Modes 311
- 25.6 Understanding Source Lookup Path Settings 315
- 25.7 Using the Disassembly View 316
- 25.8 Using the Kernel Objects View 317
- 25.9 Run/Debug Preferences 319

25.1 Introduction

Like other debuggers you may have used, the Wind River Workbench debugger allows you to download object modules, launch new processes, and take control of processes already running on the target.

Unlike other debuggers, it allows you to attach to multiple processes simultaneously, without affecting the state of the items you are attaching to or requiring you to disconnect from one process in order to attach to another.

This chapter shows you how to use the Debug, Disassembly, and Kernel Objects views to debug your programs. For a guide to the dialogs and icons you will see while using them, see the *Wind River Workbench User Interface Reference* entries for those views.

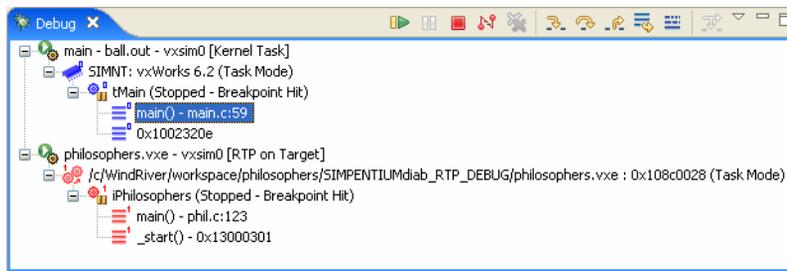
25.2 Using the Debug View

Use the Debug view to monitor, control, and manipulate the processes and tasks that you are actively debugging. Unlike the Target Manager, which shows all the processes that exist on the target, the Debug view shows only the ones that are currently under debugger control or were launched by Workbench.

To put a process or task under the control of the debugger and thus see it in the Debug view:

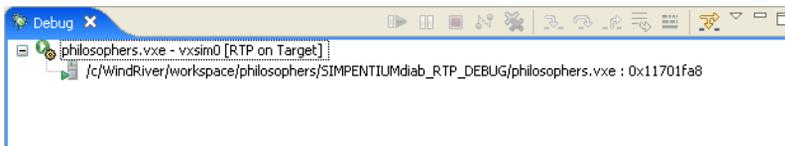
1. Connect to your target in the Target Manager view (see [Connect to the Target](#), p.236).
2. Launch one or more processes:
 - Using a launch configuration as described in [Relaunching Recently Run Programs](#), p.292.
 - By attaching to an already running process, as described in [Attaching the Debugger to a Running Task or Process](#), p.294
3. Once the debugger has attached to your process, it will appear in the Debug view as shown in [Figure 25-1](#).

Figure 25-1 Debug View



Additionally, the Debug view shows processes that were launched on the target using Workbench, but which were not attached by the debugger. These launches have a special entry in the Debug view, as shown in Figure 25-2, and are only available to help you locate and terminate the process.

Figure 25-2 Debug View Showing Process Not Under Debugger Control



25.2.1 Understanding the Debug View Display

When using the Debug view, it is crucial that you understand what is represented by each level in the hierarchical tree of the process you are debugging. This is because the level of the current selection in the Debug view affects the activities that you can perform on it and controls the information displayed in other views.

Below are examples from the kernel task in Figure 25-1 for what might appear at each level of the tree, with a general description of each level.

main -ball.out - vxsim0 [Kernel task] = launch level
launch name [launch type]

SIMNT: vxWorks 6.2 (Task Mode) = debug target level
core name:OS name OS version (debug mode), can also be process name

tMain (Stopped - Breakpoint Hit) = thread level
thread name (state - reason for state change)

main() - main.c:59 = stack frame level
function(args) - file : line #, can also be address

In Workbench 2.5, stack arguments and argument values are not displayed in the Debug view by default. This default setting was implemented to improve debugging performance.

To activate stack-level arguments in the Debug view, select **Window > Preferences > Run/Debug > Performance**, then select the **Retrieve stack arguments for stack frames in Debug View** and **Retrieve stack argument values for stack frames in Debug View** checkboxes. Click OK.



NOTE: The stack arguments reflect the current value of the stack argument variables, not the initial value of the stack arguments immediately after entering the function call.

How the Selection in the Debug View Affects Activities

Choosing a specific level of your debug target controls what you can do with it.

Selected Level	Action Allowed
launch	Terminate or disconnect from all processes/cores for the launch debug target.
debug target	Terminate or disconnect from the debug target. Perform run control that applies to the whole process: suspend/resume all threads. Assign color to the debug target and all its threads/tasks.
thread	Terminate or disconnect; terminates individual tasks/threads, if supported by process/core. Run control for thread: resume/suspend/step. Assign color to thread.
stack frame	Select of the stack frame causes the editor to display instruction pointer and source for stack frame. Perform same run control as on the thread. Assign color to thread. Assign corresponding color for parent thread.

Monitoring Multiple Processes

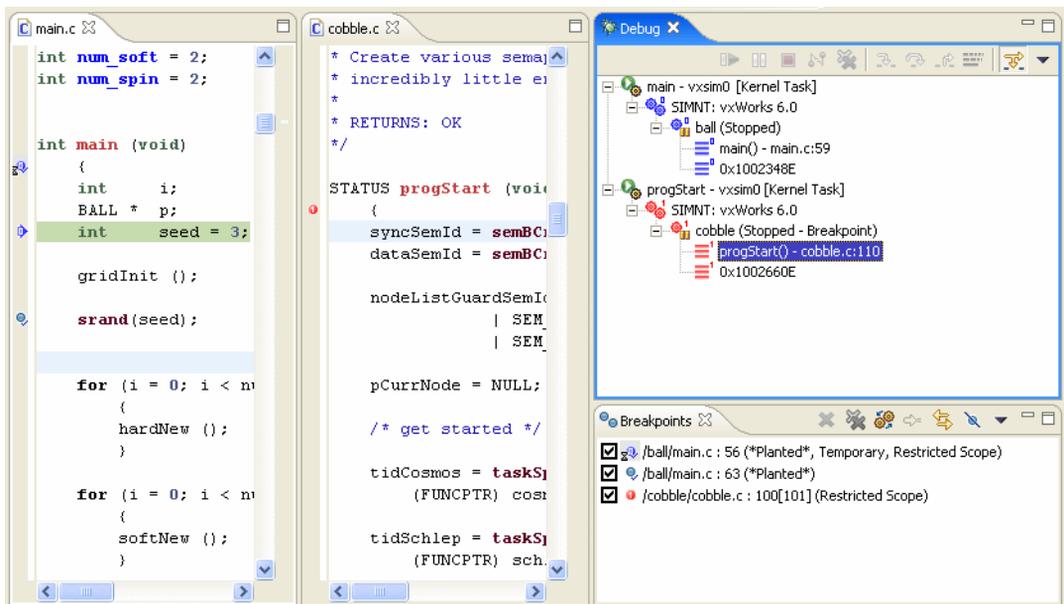
When you start processes under debugger control, or attach the debugger to running processes, they appear in the Debug view labeled with unique colors and numbers. Likewise, breakpoints that are restricted to a particular process display that process's color/number context in the Breakpoints and Editor views.

For example, in [Figure 25-3](#):

- The first breakpoint in **main.c** (a blue circle containing a 0) is restricted to ball, the blue process numbered 0 in the Debug view.
- The second breakpoint (a solid blue-green circle) is unrestricted.
- The breakpoint in **cobble.c** (a red circle containing a 1) is restricted to cobble, the red process numbered 1 in the Debug view.

The color assigned to a process or thread can be changed by right-clicking the process or thread and selecting **Color > specific color**.

Figure 25-3 Debug View with Breakpoint and Editor Views



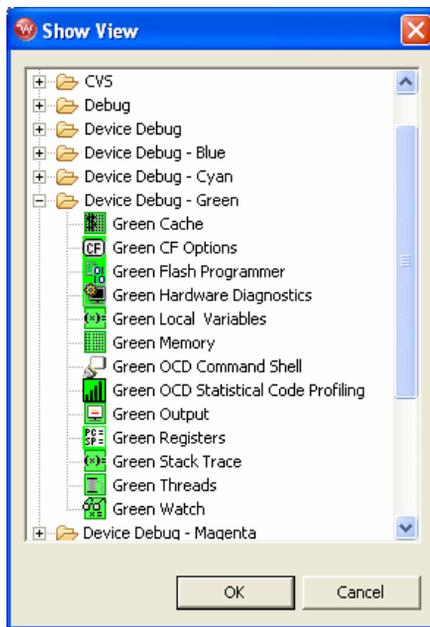
The Program Counter (the arrow in the left gutter in **main.c**) indicates the statement that will execute when the process resumes.

25.3 Coloring Views

The color context you assign to a process also carries through to other views whose scope is determined by the contents of the Debug view.

The data views that appear in the Device Debug perspective (such as the Threads or Stack Trace view) usually update to reflect whatever is currently selected in the Debug view. If you prefer, you can start colored views that are associated with a process of a particular color and update only when that process changes.

To open a view of a particular color, select **Window > Show View > Other > Device Debug - color > view**.



For more information about data views in the Device Debug perspective, see the *Wind River Workbench User Interface Reference* entries for those views.

25.4 Stepping Through a Program

Once a process has stopped under debugger control (most often, at a breakpoint), you can single-step through the code, jump over subroutine calls, or resume execution. What you can do depends on what you selected in the Debug view.

When the program is stopped, you can resume operation by clicking **Resume** on the toolbar of the Debug view. If there are no more remaining breakpoints, interrupts, or signals, the program will run to completion (unless you click **Suspend**).

To step through the code one line at a time, in the Debug view, click **Step Into**. If you have other data views open, such as the Registers or Local Variables views, they will update with current values as you step through the code.

The effect of **Step Into** is somewhat different if you click **Toggle Disassembly/Instruction Step Mode** in the Debug view, or when the current routine has no debugging information. When this mode is set, the step buttons cause instruction-level steps to be executed instead of source-level steps. Also, the Disassembly view will appear instead of the Editor view.

To single-step without going into other subroutines, click **Step Over** instead of **Step Into**.

While stepping through a program, you may conclude that the problem you are interested in lies in the current subroutine's caller, rather than at the stack level where your process is suspended. In this situation, if you click **Step Return in Debug**, execution continues until the current subroutine completes, then the debugger regains control in the calling statement.

These run control options, as well as others, are available from the **Run** menu as well as from the Debug view toolbar. For more information, see the *Wind River Workbench User Interface Reference: Debug View*.

25.5 Using Debug Modes

Depending on the type of connection you created between the debugger and the target, you may be able to operate the debugger in different modes. Different debug modes have different capabilities and limitations, which are mostly related to how the debugger interacts with the target and the processes that are being

debugged. You can also create multiple debug connections to the same target, allowing you to debug in multiple modes simultaneously.

Target

Connection Type Supported Modes

WDB agent on System Mode

VxWorks

- Supports debugging the entire system using a single execution context.
- Supports limited debugging of individual kernel tasks. The debugger can retrieve stack traces for individual tasks, but if any of the tasks is resumed and suspended, even when stepping, the entire system is resumed and suspended.

Task Mode

- Supports debugging of kernel tasks. It allows suspending, resuming, and stepping kernel tasks individually, without affecting other kernel tasks.
- Supports debugging of RTPs.

kgdb on Linux Kernel Mode

- Only supports debugging the kernel using a single execution context. When the system context is suspended, the kernel, kernel threads, and user processes are suspended also.

ptrace agent on User Mode

Linux

- Supports debugging user processes. Processes and threads within processes are suspended and resumed independently of each other.

Dual Mode on Linux *In dual mode, you must toggle between user and kernel mode depending on your debugging needs.*

Kernel Mode (also called System Mode)

- Only supports debugging the kernel using a single execution context. When the system context is suspended, the kernel, kernel threads, and user processes are suspended also.

User Mode

- Supports debugging user processes. Processes and threads within processes are suspended and resumed independently of each other.

OCD

System Mode

- Supports debugging the entire system using a single execution context.

OCD with OS Awareness for VxWorks

System Mode

- Supports debugging entire system using a single execution context, including retrieving the full stack trace when the system is suspended.
- Supports limited debugging of individual kernel tasks. The debugger can retrieve stack traces for individual tasks, but if any of the tasks is resumed and suspended, even when stepping, the entire system is resumed and suspended.
- Supports viewing of individual RTPs, but does not provide run control unless the target has been configured for one-to-one MMU virtual page mapping.

OCD with OS Awareness for Linux

System Mode

- Only supports debugging the kernel and kernel modules using a single execution context.
- Supports viewing of processes, but the debugger cannot be attached to them.
- Kernel objects are not available.

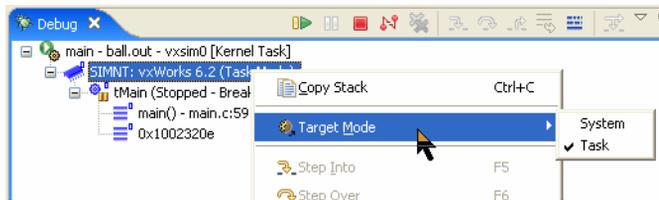
As a general rule, when you are debugging the target in user mode or task mode, the debugger interacts only with the process or processes being debugged. If you suspend this process, other processes keep running. This mode is less intrusive, as it allows you to control the selected process or thread while the rest of the system can continue to operate normally.

When you are debugging in system mode, the debugger interacts with the entire system at once, so if you suspend one task, all processes and kernel tasks running on the system are suspended as well. This gives you increased control and visibility into what is happening on the system, but it is also very disruptive.

For example, if the system maintains network connections with other systems, suspending it will cause the others to lose their network connections with the debugged system.

25.5.1 Setting and Recognizing the Debug Mode of a Connection

Right-clicking on a connection in the Target Manager or the Debug view and selecting **Target Mode** allows you to specify a debug mode for the connection. The currently active mode is indicated by a checkmark.

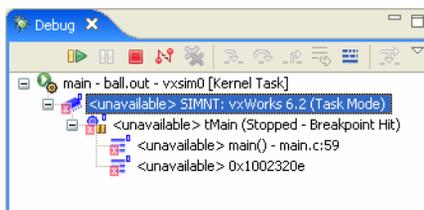


When you create a new debug connection through a launch, the connection debug mode (either system mode or task mode) is saved as a property of the launch. This mode is listed in parentheses at the end of the label of the target node in the Debug view.

Switching Debug Modes

For target connections that support switching between modes, if you switch the debug mode while a debug connection is active, this debug connection will become unavailable in the Debug view, as shown in [Figure 25-4](#). When a debug connection is unavailable, no operations can be performed on it, except for disconnecting the debug connection.

Figure 25-4 Debug View Showing Unavailable Connections



In the Target Manager, if you switch the target to system mode, every node in the tree will have a system mode icon painted on top. If the system mode icon does not appear, then the node and processes are in task or user mode.

25.5.2 Debugging Multiple Target Connections

You can debug processes on the same target using multiple target connections simultaneously. An example of this setup is a Linux target that has a user mode **ptrace** agent installed for debugging processes, and an OCD connection for halting the system and debugging the kernel.

In this situation, if the system is halted using the OCD (system mode) target connection, the user mode **ptrace** agent will also be halted, and the user mode target connection will be lost. When the system is resumed, the user mode target connection will be re-established.

The Target Manager and the Debug view (if a debug session is active) both provide feedback in this scenario. The Target Manager hides all the process information that was visible for the target, and displays a label **back-end connection lost** next to the target node. The Debug view does not end the active debug session, but it shows it as being **unavailable**, in the same manner as if the debug mode was switched.

25.5.3 Disconnecting and Terminating Processes

Disconnecting from a process or core detaches the debugger, but leaves the process or core in its current state.

Terminating a process actually kills the process on the target.



NOTE: If the selected target supports terminating individual threads, you can select a thread and terminate only that thread.

25.6 Understanding Source Lookup Path Settings

Source Lookup Path settings allow you to map source file paths that the debugger retrieves from an executable's symbol data (also known as the **debugger path**) to

the correct location of the source files on the host file system and in your workspace.

The compiler generated these paths when the executable was built, but if you are debugging the executable on a different machine, then the paths to those files are no longer valid.

For information about how to set Source Lookup Path settings, see the *Wind River Workbench User Interface Reference: Source Lookup Path Dialog*.

25.7 Using the Disassembly View

Use the Disassembly view:

- To examine a program when you do not have full source code for it (such as when your code calls external libraries).
- To examine a program that was compiled without debug information.
- When you suspect that your compiler is generating bad code (the view displays exactly what the compiler generated for each block of code).

25.7.1 Opening the Disassembly View

Unlike other Wind River Workbench views, you cannot access the Disassembly view from the **Window > Show View** menu—it appears automatically if the Debug view cannot display the appropriate source code file in the Editor (it appears as a tab in the Editor, labeled with the target connection being debugged).

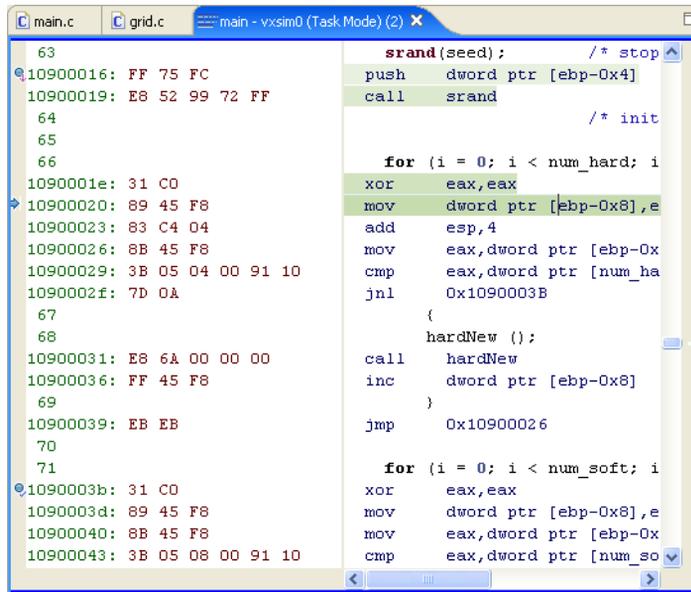
You can open the Disassembly view manually by clicking the Debug view's **Toggle Assembly Stepping Mode** toolbar icon, and by right-clicking in the Stack Trace view, then selecting **Go To Code**.

25.7.2 Understanding the Disassembly View Display

The Disassembly view shows source code from your file (when available), interspersed with instructions generated by the compiler. As you step through your code, the Disassembly view keeps track of the last four instructions where the

process was suspended. The current instruction is highlighted in the strongest color, with each previous step fading in color intensity.

Figure 25-5 Disassembly View



If the Disassembly view displays a color band at the top and bottom (here, the band is blue), then it is associated with the process with that color context in the Debug view; if no color band is displayed, then the view will update as you select different processes in the Debug view.

For more information, see *Wind River Workbench User Interface Reference: Disassembly View*.

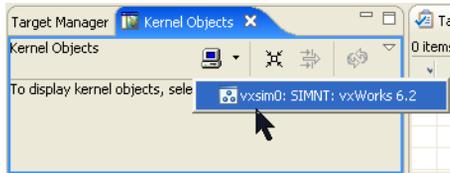
25.8 Using the Kernel Objects View

Use the Kernel Objects view to monitor and manipulate data structures such as kernel tasks, message queues, semaphores, and other operating system resources.

During multi-process debugging, you can use the Kernel Objects view to monitor a semaphore used to control a device that two processes are using. Or you can set an RTP that uses a system resource to watch that resource during **Step Over** system calls.

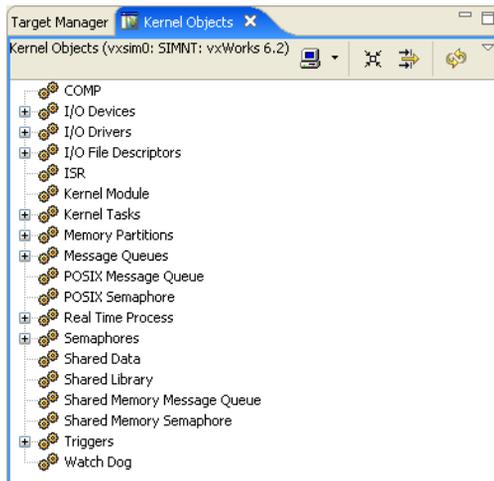
To examine a resource in the Kernel Objects view:

1. Connect to your target in the Target Manager view (see [19.6 Connect to the Target](#), p.236).
2. Click the **Kernel Objects** tab to bring it to the foreground, then click the pull-down arrow and select your target connection.



The Kernel Objects view appears.

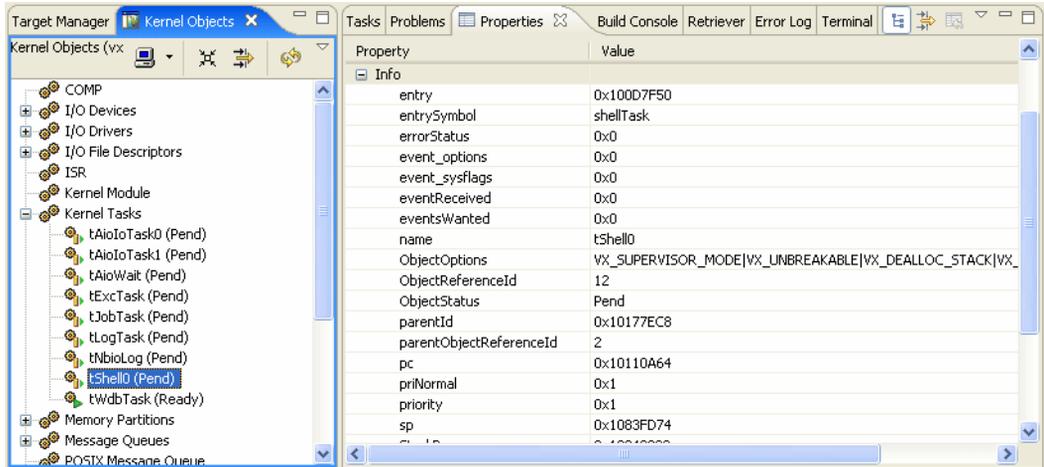
Figure 25-6 **Kernel Objects View**



25.8.1 Understanding the Kernel Objects View Display

System resources are displayed in a hierarchical tree. To see specific instances of each type of resource, click the plus sign to expand the tree.

Information about specific kernel objects is displayed in the Properties view.



For a guide to the icons in the Kernel Objects view, see *Wind River Workbench User Interface Reference: Kernel Objects View*.

25.9 Run/Debug Preferences

For information about how to set debug and run control preferences, see *Wind River Workbench User Interface Reference: Debug View*.

26

Troubleshooting

26.1 Introduction	321
26.2 Startup Problems	322
26.3 General Problems	325
26.4 Error Messages	327
26.5 Troubleshooting VxWorks Configuration Problems	339
26.6 Error Log View	342
26.7 Error Logs Generated by Workbench	342
26.8 Technical Support	349

26.1 Introduction

This chapter displays some of the errors or problems that may occur at different points in the development process, and what steps you can take to correct them. It also provides information about the log files that Workbench can collect, and how you can create a ZIP file of those logs to send to Wind River support.

26.2 Startup Problems

This section discusses some of the problems that might cause Workbench to have trouble starting.

Workspace Metadata is Corrupted

If Workbench crashes, some of your settings could get corrupted, preventing Workbench from restarting properly.

1. To test if your workspace is the source of the problem, start Workbench, specifying a different workspace name.

On Windows

Select **Start > Programs > Wind River > Wind River Workbench 2.5 > Wind River Workbench 2.5**, then when Workbench asks you to choose a workspace, enter a new name (**workspace2** or whatever you prefer).

Or, if the Workbench startup process does not get all the way to the Workspace Launcher dialog, or does not start at all, start it from a terminal window:

```
> installDir\workbench-2.3\wrwb\2.3\x86-win32\bin\wrwb.exe -data newWorkspace
```

On Linux or Solaris

Start Workbench from a terminal window, specifying a new workspace name:

```
> ./startWorkbench.sh -data newWorkspace
```

2. If Workbench starts successfully with a new workspace, exit Workbench, then delete the **.metadata** directory in your original Workbench installation (*installDir/workspace/.metadata*).
3. Restart Workbench using your original workspace. The **.metadata** directory will be recreated and should work correctly.
4. Because the **.metadata** directory contains project information, that information will be lost when you delete the directory.

To recreate your project settings, reimport your projects into Workbench (**File > Import > Existing Project into Workspace**). For more information about importing projects, see *Wind River Workbench User Interface Reference: Import File Dialog*.

.workbench-2.5 Directory is Corrupted

1. To test if your `%USERPROFILE%\workbench-2.5` directory is the source of the problem, rename it to a different name, then restart Workbench.



NOTE: Make sure you rename the `%USERPROFILE%\workbench-2.5` directory (for example, on Windows XP it could be `C:\Documents and Settings\username\workbench-2.4`).

Do not rename the `installDir/workbench-2.5` directory.

2. If Workbench starts successfully, exit Workbench, then delete the old version of your `%USERPROFILE%\workbench-2.5` directory (the one you renamed).
3. Restart Workbench. The `%USERPROFILE%\workbench-2.5` will be recreated and should work correctly.
4. Because the `.workbench-2.5` directory contains Eclipse configuration information, any information about manually configured Eclipse extensions or plug-ins will be lost when you delete the directory.

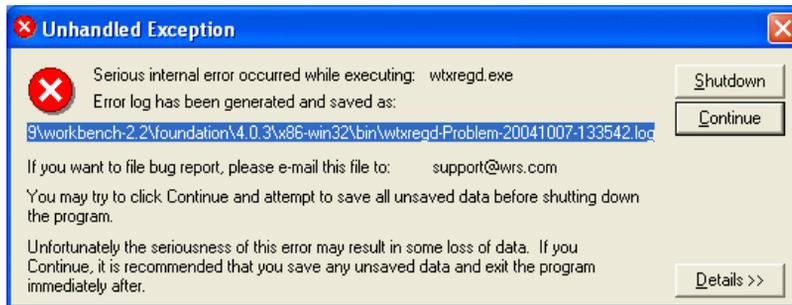
To make them available again within Workbench, you must re-register them (**Help > Software Updates > Manage Configuration**). For more information about registering plug-ins, see [Adding Plug-in Functionality to Workbench](#), p.356.

Registry Unreachable (Windows)

When Workbench starts and it does not detect a default Wind River registry, it launches one. After you quit Workbench, the registry is kept running since it is needed by all Wind River tools. You do not need to ever kill the registry.

If you do stop it, however, it stores its internal database in the file `installDir/wind/wtxregd.hostname`.

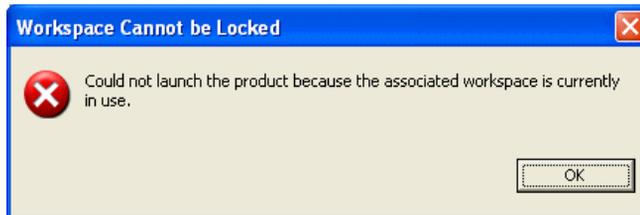
If this file later becomes unwritable, the registry cannot start, and Workbench will display an error.



This error may also occur if you install Workbench to a directory to which you do not have write access, such as installing Workbench as an administrator and then trying to run it as yourself.

Workspace Cannot be Locked (Linux and Solaris)

If you start Workbench and select a workspace, you may see a **Workspace Cannot be Locked** error.



There are three possible causes for this error:

1. Another user has opened the same workspace. A workspace can only be used by one user at a time.
2. You installed Workbench on a file system that does not support locking.

Use the following command at a terminal prompt to start Workbench so that it creates your workspace on a file system which does allow locking, such as a directory on a local disk:

```
./startWorkbench.sh -configuration directory that allows locking
```

For example:

```
./startWorkbench.sh -configuration /usr/local/yourName
```

3. On some window managers (e.g. gnome) you can close the window without closing the program itself and deleting all running processes. This results in running processes maintaining a lock on special files in the workspace that mark a workspace as open.

To solve the problem, kill all Workbench and Java processes that have open file handles in your workspace directory.

26.2.1 Pango Error on Linux

If the file **pango.modules** is not world readable for some reason, Workbench will not start and you may see an error in a terminal window similar to

```
** (<unknown>:21465): WARNING **: No builtin or dynamically loaded modules  
were found. Pango will not work correctly. This probably means there was an  
error in the creation of:
```

```
'/etc/pango/pango.modules'
```

You may be able to recreate this file by running `pango-querymodules`.

Changing the file's permissions to **644** will cause Workbench to launch properly.

26.3 General Problems

This section describes problems that are not associated with any particular Workbench component.

26.3.1 Java Development Tools (JDT) Dependency

Some third party plug-ins are dependent on JDT. If a plug-in you are interested in requires JDT, you should download it from the official Eclipse Web site:

<http://download.eclipse.org/eclipse/downloads/drops/R-3.0.1-200409161125/eclipse-JDT-3.0.1.zip>

A list of official mirror sites is here:

<http://www.eclipse.org/downloads>

26.3.2 Help System Does Not Display on Solaris or Linux

Eclipse comes preconfigured to use Mozilla on Solaris and Linux, and it expects it to be in your path. If Mozilla is not installed, or is not in your path, you must set the correct path to the browser or Workbench will not display help or other documentation.

To manually set the browser path in Workbench:

1. Select **Window > Preferences > Help**.
2. Click **Custom Browser (user defined program)**, then in the **Custom Browser command field** type or browse to your browser launch program. Click **OK**.
 - On Solaris, a sample Netscape browser launch command is `"/usr/dt/bin/netscape" %1`, though you should enter the command line that is appropriate for your browser.
 - On Linux, sample Mozilla browser launch commands are `"/usr/bin/mozilla" %1` and `kfmclient openURL %1`, though you should enter the command line that is appropriate for your browser.

26.3.3 Help System Does Not Display on Windows

The help system can sometimes fail to display help or other documentation due to a problem in McAfee VirusScan 8.0.0i (and possibly other virus scanners as well).

For McAfee VirusScan 8.0.0i, the problem is known to be resolved with patch10 which can be obtained from Network Associates. As a workaround, the problem can be avoided by making sure that McAfee on-access-scan is turned **on** and allowed to scan the **TEMP** directory as well as ***.jar** files.

More details regarding this issue have been collected by Eclipse Bugzilla #87371 at https://bugs.eclipse.org/bugs/show_bug.cgi?id=87371.

26.3.4 Removing Unwanted Target Connections

If you have trouble deleting a target connection session for any reason, use **wtxtcl**.

1. Start **wtxtcl** from a terminal window.

```
% wtxtcl
```

2. List all entries in the registry.

```
wtxtcl> wtxInfo
```

3. Unregister the offending entry or entries (the full entry name must be used).

```
wtxtcl> wtxUnregister tgt_localhost@manebogad
```

26.4 Error Messages

Some errors display an error dialog directly on the screen, while others that occurred during background processing only display this icon in the lower right corner of Workbench window.



Hovering your mouse over the icon displays a pop-up with a synopsis of the error. Later, if you closed the error dialog but want to see the entire error message again, double-click the icon to display the error dialog or look in the [Eclipse Log](#), p. 343.

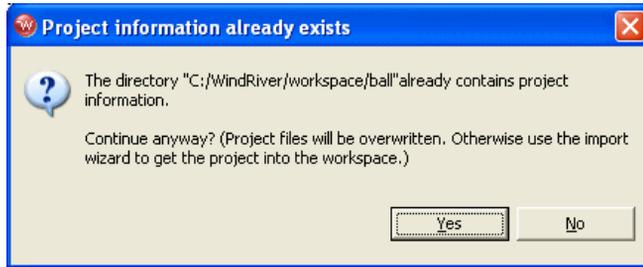
This section explains error messages that appear in each Workbench component.

26.4.1 Project System Errors

For general information about the Project System, see [4. Projects Overview](#).

Project Already Exists

If you deleted a project from the Project Navigator but chose not to delete the project contents from your workspace, then you try to create a new project with the same name as the old project, you will see this error:



If you click **Yes**, your old project contents will be overwritten with the new project. If you want to recreate the old project in Wind River Workbench, click **No**, then right-click in the Project Navigator, select **Import**, then select **Existing Project into Workspace**.

Type the name of your old project or browse to the old project directory in your workspace, click **OK**, then click **Finish**. Your old project will appear in the Project Navigator.

Cannot Create Project Files in Read-only Location

When Workbench creates a project, it creates a **.wrproject** file and other metadata files it needs to track settings, preferences, and other project-specific information. So if your source files are in a read-only location, Workbench cannot create your project there.

To work around this problem, you must create a new project in your workspace, link in your source files using one of the following options:

Option 1—Use the Eclipse linked resource mechanism.

1. Create a project in your workspace (user-defined or flexible managed build¹) by selecting **File > New > project type**.
 2. Type in a name for your project, select **Create project in workspace**, then click **Next**.
 3. Click **Next** to accept the default settings in the next dialogs, then click **Finish** to create your project.
-
1. Project types that offer a flexible managed build option are VxWorks Downloadable Kernel Module, Native Application, VxWorks Real-time Process, VxWorks Shared Library, and Standalone Application projects.

4. In the Project Navigator, right-click your new project and select **New > Folder**. The **Folder** dialog appears.
5. Type in a name for your folder, then click **Advanced** and select the **Link to folder in the file system** checkbox.
6. Type the path or click **Browse** and navigate to your source root directory, then click **OK** to create the new folder.
7. Click the plus next to the folder to open it, and you will see the source files from your read-only source directory. Eclipse calls items incorporated into projects in this way **linked resources**.



NOTE: This mechanism cannot be used for standard managed-build projects.

Option 2—Use Symbolic Links (Linux/Solaris only)

1. Create a new project in your workspace (any project type supports this).
2. In a command shell, create a symbolic link to the read-only directory in the project root directory.
3. In the Project Navigator, press **F5** to refresh the display. The directory and all sources in it appear.

26.4.2 Build System Errors

For general information about the Build System, see [16. Building Projects](#).

Building Projects While Connected to a Target

If you try to build a project while you have a target connection active in the Target Manager, you may see an error. This happens when any of the files that need to be built contain symbol information, and therefore have been locked by the debugger.

You can continue your build by clicking **OK**, but be advised that you will need to disconnect your target and restart the build if you see an Build Console error message similar to **dld: Can't create file XXX: Permission denied**.

To avoid this problem, Workbench loads files up to a certain size completely into memory so no file lock is needed. To specify the largest symbol file that can be loaded into memory, select **Window > Preferences > Target Manager > Debug Server Settings > Symbol File Handling Settings** and specify a file size up to 60M.

Workflow for Cases Where You Need to Continually Rebuild Objects in Use by Your Target

1. Create a launch configuration for your debugging task. When you need to disconnect your target in order to free your images for the build process, the launch configuration allows you to automatically connect, build, download, and run your process with a single click.

You can even specify that your project should be rebuilt before it is launched by selecting **Window > Preferences > Run/Debug > Launching**, and then selecting **Build (if necessary) before launching**. For more information about launch configurations, see [23. Launching Programs](#).

- When you work with processes or RTPs, make sure that your process is terminated before you rebuild or relaunch. You can then safely ignore the warning (and check the **Do not show this dialog again** box).
- When you work with Downloadable Kernel Modules or user-built kernel images, just let the build proceed. If the **Link error** message appears, either disconnect your target or unload all modules, then rebuild or relaunch.

Workflow for Using On-Chip Debugging to Debug Standalone Modules Loaded on Your Target

1. Create a **Reset & Download**-type launch configuration for your application, and enable the **Build before launch** option (by selecting **Window > Preferences > Run/Debug > Launching > Build (if required) before launching**).
2. Run the launch configuration to debug your code. Make any changes to the source files and save them. Note that saving before unloading the symbols allows the debugger to track your breakpoints.
3. Before relaunching or rebuilding, unload the modules from the target by selecting them in the Target Manager and pressing the **Delete** key (you can multi-select if there are multiple modules).
4. Press the **Debug** button to relaunch your application. It will automatically rebuild, redownload, reset, and attach the debugger.

Problems Building Workbench 2.x Projects Imported Into Workbench 2.5

If you have trouble building projects that you imported from a previous version of Workbench, check if the **.wrproject** file contains an entry for **platform**. If not, the project is not compatible and has to be patched to work with the newest version of Workbench.

To patch the **.wrproject** file:

1. Open the file with the Workbench text editor by right-clicking the file in the Project Navigator, then selecting **Open With > Text Editor**.

If the **.wrproject** file is not visible in the Project Navigator, click the downward arrow on the right side of the Project Navigator toolbar and select **Filters** to open the Project Navigator Filters dialog.

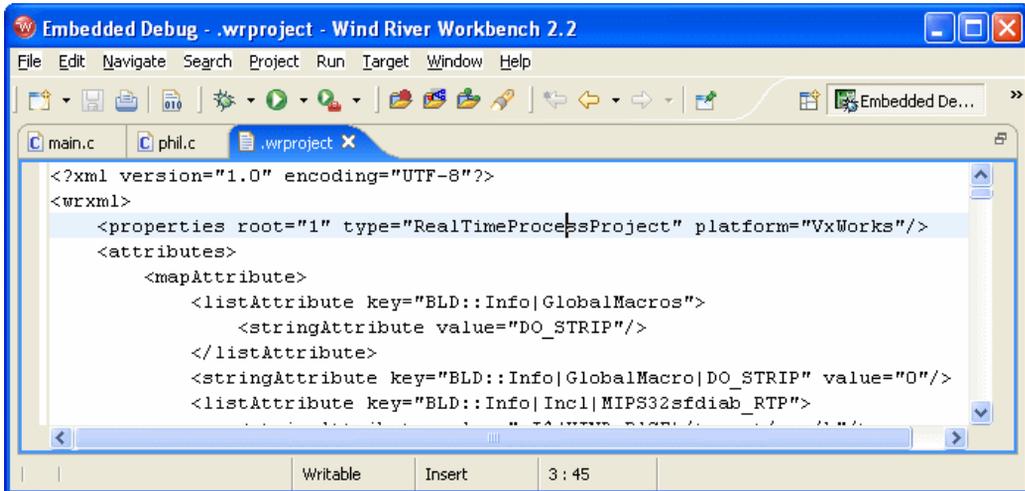


Select the checkbox next to **.wr***, then click **OK**. The **.wrproject** file should now appear in the Project Navigator.

2. Locate the line at the beginning of the file similar to:

```
<properties root="1" type="RealTimeProcessProject" />
```

3. Add **platform="projectplatform"** to the end of the line, with *projectplatform* replaced by one of **VxWorks**, **Linux**, or **Standalone**, depending on the platform to which the project type belongs.
4. The result should appear similar to the following:



5. Save and close the **.wrproject** file. Your project should now build properly.

Build All Command Builds Projects Whose Resources have not Changed

Workbench may enter a state where selecting **Project > Build All** builds projects whose resources have not changed since the last build.

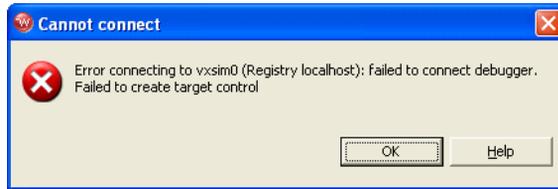
This happens only if Auto-Build (**Project > Build Automatically**) was previously enabled. If you switch this feature off, you must do a manual clean for all projects (**Project > Clean**) in order to re-enable building for previously built projects.

26.4.3 Target Manager Errors

For general information about the Target Manager, see [19. Connecting to Targets](#).

Troubleshooting Connecting to a Target

If you see the following error:



Or if you have other trouble connecting to your target, try these steps:

1. Check that the target is switched on and the network connection is active. In a terminal window on the host, type:

```
ping n.n.n.n
```

where **n.n.n.n** is the IP address of your target.
2. Verify the target **Name/IP address** in the **Edit the Target Connection** dialog (right-click the target connection in the Target Manager then select **Properties**.)
3. Choose the actual target CPU type from the drop-down list if the **CPU type** in the **Edit the Target Connection** dialog is set to **default from target**.
4. Verify that a target server is running. If it is not:
 - a. Open the Error Log view, then find and copy the message containing the command line used to launch the target server.
 - b. Paste the target server command line into a terminal window, then hit **ENTER**.
 - c. Check to see if the target server is now running. If not, check the Error Log view for any error messages.
5. Check if the **dfwserver** is running (on Linux and Solaris, use the **ps** command from a terminal window; on Windows, check the Windows Task Manager). If multiple **dfwserver**s are running, kill them all, then try to reconnect.
6. When starting the VxWorks simulator on Solaris, the path environment variable must include **/usr/openwin/bin** so that it can find **xterm**. If **xterm** is not in the path, the simulator connection will fail.
7. Check that the WDB connection to the target is fully operational by right-clicking a target in the Target Manager and selecting **Target Tools > Run WTX Connection Test**. This tool will verify that the communication link is correct. If there are errors, you can use the WTX and WDB logs to better track down what is wrong with the target.

Exception on Attach Errors

If you try to run a task or launch an RTP and the Target Manager is unable to comply, it will display an **Exception on Attach** error containing useful information.

Build errors can lead to a problem launching your task or process; if one of the following suggestions does not solve the problem, try launching one of the pre-built example projects delivered with Workbench.

If the host shell was running when you tried to launch your task or process, try closing the host shell and launching again.

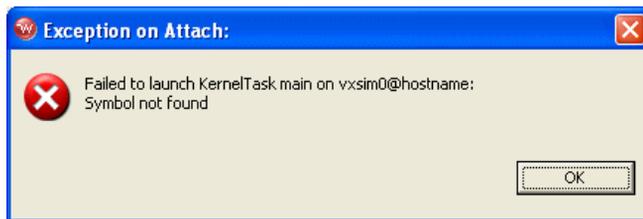
Error Launching a VxWorks Real-time Process on Linux

If you get an error when launching a VxWorks RTP from a Red Hat Workstation, update 3 host system, try these steps:

1. Delete **boothost:** from the beginning of the **Exec Path on Target** field of the **Run Real-time Process** dialog.
2. Add a new object path mapping to the target server connection properties that does not have **boothost:** in the host path.

Error When Running a Task Without Downloading First

You will see the following error if you try to run a kernel task without first downloading it to your target:



Processes can be run directly from the Project Navigator, but kernel tasks must be downloaded before running. Right-click the output file, select **Download**, fill in the Download dialog, then click **OK**.

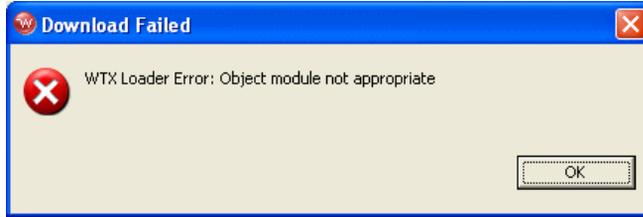
If you see this error and you did download the file, open a host shell for your connection, and try to run the task from the host shell. Type:

```
lkup entrypoint
```

to see if your entry point is there.

Downloading an Output File Built with the Wrong Build Spec

If you built a project with a build spec for one target, then try to download the output file to a different target (for example, you build the project for the simulator, but now you want to run it on a hardware target), you will see this error:

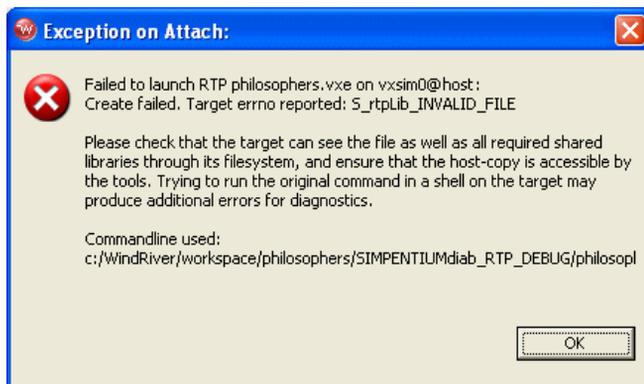


To select the correct build spec, right-click the output file in the Project Navigator, select **Set Active Build Spec**, select the appropriate build spec from the dialog, then rebuild your project.

Your project should now download properly.

Error if Exec Path on Target is Incorrect

If the **Exec Path on Target** field of the **Run Real-time Processes** dialog does not contain the correct target-side path to the executable file (if, for example, it contains the equivalent host-side path instead) you will see this error:



1. If the target-side path looks correct but you still get this error, check the following:
 - a. Recheck the path you gave.
Even if you used the **Browse** button to locate the file, it will be located in the host file system. The Object Path Mapping that is defined for your target connection will translate it to a path in the target file system, which is then visible in the Exec Path edit field. If your Object Path Mapping is wrong, the Exec Path will be wrong, so it is important to check.

Troubleshooting Running a Process

If you have trouble running your process from the **Run Process** or **Run Real-time Process** dialog, try these steps:

1. If the error **Cannot create context** appears, verify that the **Exec Path on Target** is a path that is actually visible on the target (and doesn't contain the equivalent host-side path instead).
 - a. Right-click the process executable in the Project Navigator or right-click **Processes** or **Real-time Processes** in the Target Manager and select **Run Real-time Process**.
 - b. Copy the exec path and paste it into the **Output View > Target Console Tab** (at the bottom of the view). Verify that the program runs directly on the target.
2. If the program runs but symbols are not found, manually load the symbols by right-clicking the process and selecting **Load Symbols**.

3. Check your **Object Path Mappings** to be sure that target paths are mapped to the correct host paths. See [20.2.3 Object Path Mappings Page](#), p.244 for details on setting up your Object Path Mappings.
 - a. Open a host shell and type:
`ls execpath`
If you have a target shell, type the same command.
 - b. In the host shell, type:
`devs`
to see if the prefix of the Exec Path (for example, **host:**) is correct.
4. If the Exec Path is correct, try increasing the back-end timeout value of your target server connection (see [Advanced Target Server Options](#), p.242 for details).
5. From a target shell or Linux console, try to launch the RTP or process.
6. Verify that the **vxWorks** node in the Target Manager view has a small **S** added to the icon, indicating that symbols have been loaded for the Kernel.
 - a. If not, verify that the last line of your **Object Path Mappings** table displays a target path of **<any>** corresponding to a host path of **<leave path unchanged>**.

26.4.4 Launch Configuration Errors

If a launch configuration is not working properly, delete it by clicking **Delete** below the **Debug** dialog **Configurations** list.

If you cannot delete the launch configuration using the **Delete** button, navigate to `installDir/workspace/.metadata/plugins/org.eclipse.debug.core/.launches` and delete the `.launch` file with the exact name of the problematic launch configuration



WARNING: Do *not* delete any of the `com.windriver.ide.*.launch` files.

Troubleshooting Launch Configurations

If you click the **Debug** icon (or click the **Debug** button from the **Launch Configuration** dialog) and get a “Cannot create context” error, check the **Exec Path** on the **Main** tab of the **Debug** dialog to be sure it is correct. Also check your **Object Path Mappings** (see [20.2.3 Object Path Mappings Page](#), p.244 for information about Object Path Mappings).

If you still get the error, check to be sure that the process you are trying to run is a Real-time Process, and not a Downloadable Kernel Module or some other type of executable.

For general information about launch configurations, see [23. Launching Programs](#).

26.4.5 Debugger Errors

Shared Library Problems

If you are having trouble working with shared libraries, try these steps:

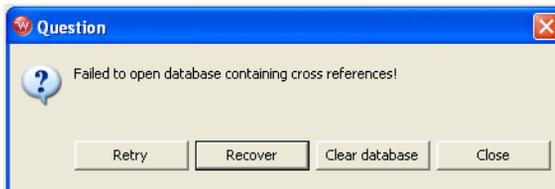
1. If you are trying to run an executable and shared libraries located on your host machine's disk, make sure you can see the host machine's disk and the location of the shared libraries from the target.

Use a target shell, or the `@ls` command from a host shell, to check this.

2. Set `SHAREDLIB_VERSION` to `1` in order to generate the proper versioned shared object.
3. Make sure that a copy of `libc.so.1` is located in a place where the RTP has access to it. By default it should be located with the executable files, but you may locate it elsewhere as long as you use the compiler's `-rpath` option or the environment variable `LD_LIBRARY_PATH`.

26.4.6 Static Analysis Errors

If at any point Workbench is unable to open the cross reference database, you will see this error:



There are many reasons the cross reference database may be inaccessible, including:

- The database was not closed properly at the end of the last Workbench session running within the same workspace. This happens if the process running Workbench crashed or was killed.
- Various problems with the file system, including wrong permissions, a network drive that is unavailable, or a disk that is full.

You have several choices for how to respond to this error dialog:

- **Retry**—the same operation is performed again, possibly with the same failure again.
- **Recover**—the database is opened and a repair operation is attempted. This may take some time but you may recover your cross reference data.
- **Clear Database**—the database is deleted and a new one is created. All your cross reference data is lost and your workspace will be reparsed the next time you open the call tree.
- **Close**—the database is closed. No cross reference data is available, nor will it be generated. At the beginning of the next Workbench session, an attempt to open the database will be made again.

26.5 Troubleshooting VxWorks Configuration Problems

If you encountered problems booting or exercising VxWorks, there are many possible causes. This section discusses the most common sources of error. Please read [26.5.1 What to Check](#), p.339 before contacting Wind River customer support. Often, you can locate the problem just by re-checking the installation steps, your hardware configuration, and so forth.

26.5.1 What to Check

Most often, a problem with running VxWorks can be traced to configuration errors in hardware or software. Consult the following checklist to locate a problem.

Hardware Configuration

- **If you are using an emulator**

See the *Wind River ICE for Wind River Workbench Hardware Reference* or the *Wind River Probe for Wind River Workbench Hardware Reference* for information on troubleshooting those connections.

- **Limit the number of variables**

Start with a minimal configuration of a single target.

- **Check that the RS-232 cables are correctly constructed**

In most cases, the documentation accompanying your target system describes its cabling requirements. A common problem—make sure your serial cable is a NULL modem cable, if that is what your target requires.



NOTE: If you need to use a gender converter to connect your serial cable, it is most likely not the right kind of cable. NULL modem cables tend to have same gender connectors on each end, such as both female or both male. Straight through cables tend to have one male and one female connector. Changing the gender of a cable rarely has the desired results.

- **Check the boot ROM(s) for correct insertion**

If the target seems completely dead when applying power (some have front panel LEDs) or shows some error condition (for example, red lights), the boot ROMs may be inserted incorrectly.

- **Press the RESET button if required**

Some system controller boards do not reset completely on power-on; you must reset them manually. Consult the target documentation if necessary.

- **Make sure all boards are jumpered properly**

Refer to the target information reference for your BSP and the target documentation to determine the correct dip switch and jumper settings for your target and Ethernet boards.

Booting Problems

- **Check the Ethernet transceiver site**

For example, connect a known working system to the Ethernet cable and check whether the network functions.

- **Verify IP addresses**

An IP address consists of a network number and a host number. There are several different classes of Internet addresses that assign different parts of the 32-bit Internet address to these two parts, but in all cases, the network number is given in the most significant bits and the host number is given in the least significant bits. The simple configuration described in [3.4 Booting VxWorks](#), p.49 assumes that the host and target are on the same network—they have the same network number. If the target Internet address is not on the same network as the host, the VxWorks boot program displays the following message:

```
Error loading file: errno = 0x33.
```

See the **errnoLib** reference entry for a discussion of VxWorks error status values.

- **Verify FTP server permissions**

Check the FTP server configuration. See [Configuring FTP on Windows](#), p.40 for more information on configuring the FTP server if you are using **WFTPD** (shipped by Wind River). Otherwise, consult your system documentation on the FTP Server shipped with it.

- **Helpful troubleshooting tools**

When tracking down configuration problems, **ping**, **arp -a**, and **netstat -r** are useful tools. For more information, see [B. Glossary](#).

Target Server Problems

- **Check back end serial port**

If you use a WDB Serial connection to the target, make sure you have connected the serial cable to a port on the target system that matches your target-agent configuration. The agent uses serial channel 1 by default, which is different from the channel used by VxWorks as a default console (channel 0). Your target's ports may be numbered starting at one; in that situation, VxWorks channel one corresponds to the port labeled "serial 2."

- **Verify path to VxWorks image**

The target server requires a host-resident image of the VxWorks run-time system. By default, it obtains a path for this image from the target agent (as recorded in the target boot parameters). In some cases (for example, if the target boots from a local device), this default is not useful.

In that situation, create a new Target Server Connection definition in the Target Manager, and use the **-c filename** option in the **Advanced Target Server Options** field to specify the path to a host-resident copy of the VxWorks image.

Check the WFTPD Server Log

The WFTPD server log displays very helpful plain text messages. For information about how to enable logging FTP activities, see [Configuring FTP on Windows](#), p.40.

26.6 Error Log View

Some errors direct you to the Error Log view, which displays internal errors thrown by the platform or your code. For more information about the Error Log, see *Wind River Workbench User Interface Reference: Error Log View*.

26.7 Error Logs Generated by Workbench

Workbench has the ability to generate a variety of useful log files. Some Workbench logs are always enabled, some can be enabled using options within Workbench, and some must be enabled by adding options to the executable command when you start Workbench.

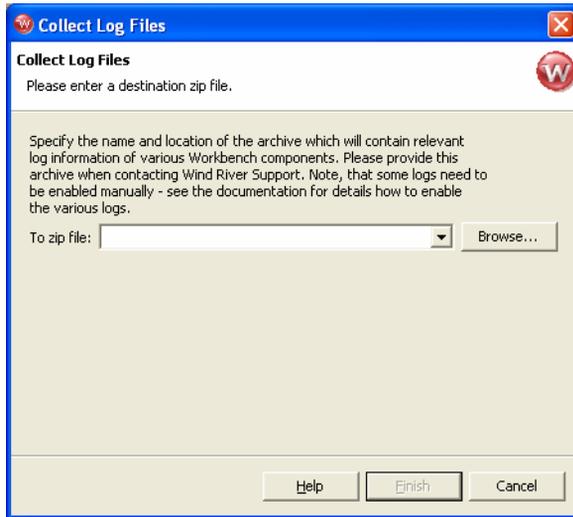
This section describes the logs, tells you how to enable them (if necessary), and how to collect them into a ZIP file you can send to Wind River support representatives.

26.7.1 Creating a ZIP file of Logs

Once all the logs you are interested in have been enabled, Workbench automatically collects the information as you work.

To create a ZIP file to send to a Wind River support representative:

1. Select **Help > Collect Log Files**. The dialog opens.



2. Type the full path and filename of the ZIP file you want to create (or browse to a location and enter a filename) then click **Finish**. The ZIP file is created in the specified location, and contains all information collected to that point.
3. To discontinue logging (for those logs that are not always enabled) uncheck the boxes on the Target Server Options tab, or restart Workbench without the additional options.

26.7.2 Eclipse Log

The information displayed in the Error Log view is a subset of this log's contents.

How to Enable Log

This log is always enabled.

What is Logged

- All uncaught exceptions thrown by Eclipse Java code.
- Most errors and warnings that display an error dialog in Workbench.
- Additional warnings and informational messages.

What it Can Help Troubleshoot

- Unexpected error popups.
- Bugs in Workbench Java code.
- Bugs involving inter-component communication.

26.7.3 DFW GDB/MI and Debug Tracing Logs

The DFW logs are a record of all communication and state changes between the debugger back end (the “debugger framework”, or DFW) and other views within Workbench, including the Target Manager, debugger views, and OCD views.

How to Enable Log

These logs are always enabled.

To change the maximum debug server log file size, select **Window > Preferences > Target Manager > Debug Server Settings**. In the **Maximum Debug Server Log File Size** field, change the default size to the size you prefer (or to the size requested by a Wind River support representative).

Changing this field to **0** disables the collecting of **dfwserver.log** information.

What is Logged

Internal exceptions in the debugger back end, as well as all commands sent between Workbench and the debugger back end.

What it Can Help Troubleshoot

Debugger, Target Manager, and debugger back end-related bugs.

26.7.4 Debugger Views GDB/MI Log

This log shows the same information as reported in the [DFW GDB/MI and Debug Tracing Logs](#), p.344.

How to Enable Log

You must enable this log before you start Workbench. Do this by adding these parameters to the Workbench executable command:

```
-vmargs -DDFE.Debug=true
```

What is Logged

Same as [DFW GDB/MI and Debug Tracing Logs](#), p.344, except with Workbench time-stamps.

What it Can Help Troubleshoot

Debugger and Target Manager-related bugs.

26.7.5 Debugger Views Internal Errors Log

How to Enable Log

You must enable this log before you start Workbench. Do this by adding these parameters to the Workbench executable command:

```
-vmargs -DDFE.Debug=true
```

What is Logged

Exceptions caught by the Debugger views messaging framework.

What it Can Help Troubleshoot

Debugger views bugs.

26.7.6 Debugger Views Broadcast Message Debug Tracing Log

How to Enable Log

You must enable this log before you start Workbench. Do this by adding these parameters to the Workbench executable command:

```
-vmargs -DDFE.Debug=true
```

What is Logged

Debugger views internal broadcast messages.

What it Can Help Troubleshoot

Debugger views bugs.

26.7.7 Target Server Output Log

This log contains the messages printed by the target server while running. These messages typically indicate errors during various requests sent to it, such as load operations. Upon startup, if a fatal error occurs (such as a corefile checksum mismatch) then this error will be printed before the target server exits.

How to Enable Log

- Enable this log from the Target Manager by right-clicking the target connection, selecting **Properties**, selecting the **Target Server Options** tab, then clicking **Edit**.
Select the **Logging** tab, then check the box next to **Enable output logging** and provide a filename and maximum file size for the log. Click **OK**.
- Enable this log from the command line using the **-l path/filename** and **-lm maximumFileSize** options to the target server executable. For more information about target server commands, see **Wind River Documentation > References > Host API and Command References > Wind River Host Tools API Reference > tgtsvr**.

What is Logged

- Fatal errors on startup, such as library mismatches and errors during exchange with the registry.
- Standard errors, such as load failure and RPC timeout.

What it Can Help Troubleshoot

- Debugger back end
- Target Server
- Target Agent

26.7.8 Target Server Back End Log

This log records all requests sent to the WDB agent.

How to Enable Log

- Enable this log from the Target Manager by right-clicking the target connection, selecting **Properties**, selecting the **Target Server Options** tab, then clicking **Edit**.
Select the **Logging** tab, then check the box next to **Enable backend logging** and provide a filename and maximum file size for the log. Click **OK**.
- Enable this log from the command line using the **-Bd** *path/filename* and **-Bm** *maximumFileSize* options to the target server executable. For more information about target server commands, see **Wind River Documentation > References > Host API and Command References > Wind River Host Tools API Reference > tgtsvr**.

What is Logged

Each WDB request sent to the agent. For more information about WDB services, see **Wind**

River Documentation > References > Host API and Command References > Wind River WDB Protocol API Reference.

What it Can Help Troubleshoot

- Debugger back end
- Target Server
- Target Agent

26.7.9 Target Server WTX Log

This log records all requests sent to the target server.

How to Enable Log

- Enable this log from the Target Manager by right-clicking the target connection, selecting **Properties**, selecting the **Target Server Options** tab, then clicking **Edit**.

Select the **Logging** tab, then check the box next to **Enable WTX logging** and provide a filename and maximum file size for the log. Click **OK**.

- Enable this log from the command line using the **-Wd *path/filename*** and **-Wm *maximumFileSize*** options to the target server executable. For more information about target server commands, see **Wind River Documentation > References > Host API and Command References > Wind River Host Tools API Reference > tgtsvr**.

What is Logged

Each WTX request sent to the target server. For more information about WTX services, see **Wind River Documentation > References > Host API and Command References > WTX C Library Reference > wtxMsg**.

What it Can Help Troubleshoot

- Debugger back end
- Target Server
- Target Agent

26.7.10 Target Manager Debug Tracing Log

This log prints useful information about creation and modification of Target Manager internal structures, as well as inconsistencies or warning conditions in the subsystems the Target Manager interoperates with.

How to Enable Log

You must enable this log before you start Workbench. Do this by adding these parameters to the Workbench executable command:

```
-debug -vmargs -Dcom.windriver.ide.target.DEBUG=1.
```

What is Logged

Target Manager internal debug errors.

What it Can Help Troubleshoot

Inconsistencies in the debugger back end.

26.7.11 **Static Analysis Parser Logs**

These logs contain information that can help a Wind River technical support representative to resolve problems with the source code parsers.

How to Enable Logs

Enable these logs by right-clicking a resource or resources in the Project Navigator or the Editor and selecting **Static Analysis > Generate Parser Logs**. From the list of logs that appears, select the logs that were requested by a technical support representative (the **jobs** log and the **performance** log are selected by default). Click **OK**.

What is Logged

- The **jobs** log describes what the parsers were instructed to do.
- The **performance** log lists the source files the parsers spent the most time with.
- The **PI4** interface and **symbols** logs contains the result of parsing.
- The **debug** log shows how the cpp-parser uses internal caching strategies.
- The **tokens** log lists every token processed by the cpp-parser.

What it Can Help Troubleshoot

Problems related to excessive parsing time. The performance log can help pinpoint if there are single files that require more parsing time, or if there are simply many resources to parse.

In a case where results of the analysis are different from what you expect but Wind River support cannot reproduce the problem, the PI4 and symbol logs are crucial in helping support representatives see the raw data the parsers are generating.

The debug and tokens logs are needed very seldom, but are useful to Wind River developers working on the parsers themselves.

26.8 **Technical Support**

If you have questions or problems with Workbench or with VxWorks after completing the above troubleshooting section, or if you think you have found an

error in the software, please see the *Wind River Workbench Release Notes* for your platform for any additional information. Contact information for the Wind River Technical Support organization is also listed in the release notes. Your comments and suggestions are welcome.

PART VI
Updating

27 **Integrating Plug-ins 353**

27

Integrating Plug-ins

- 27.1 Introduction 353
- 27.2 Finding New Plug-ins 354
- 27.3 Incorporating New Plug-ins into Workbench 354
- 27.4 Disabling Plug-in Functionality 357
- 27.5 Using Workbench with ClearCase Views 357
- 27.6 Downloading and Installing Java Development Tools (JDT) 360
- 27.7 Managing Multiple Plug-in Configurations 361
- 27.8 Using Workbench in an Eclipse Environment 362

27.1 Introduction

Because Wind River Workbench is based on Eclipse, you can incorporate new modules into Workbench without having to recompile or reinstall it. These new modules are called *plug-ins*, and they can deliver new functionality and tools to your copy of Wind River Workbench.

Many developers enjoy creating new plug-ins and sharing their creations with other Eclipse users, so you will find many Web sites with interesting tools and programs available for you to download and incorporate into your Workbench installation.

Some plug-ins are dependent on Java Development Tools (JDT). This chapter will show you how to download and install it.

27.2 Finding New Plug-ins

In addition to the Eclipse Web site, <http://www.eclipse.org>, many other Web sites offer a wide variety of Eclipse plug-ins. Here are a few:

<http://www.eclipse-plugins.info/eclipse/plugins.jsp>

<http://www.eclipseplugincentral.com/>

<http://eclipse-plugins.2y.net/eclipse/>

<http://www.sourceforge.net/>

27.3 Incorporating New Plug-ins into Workbench

Many developers who download plug-ins prefer to create a new directory for each one, rather than unzipping the files directly into their Workbench installation directory. There are many advantages to this approach:

- The default Workbench installation does not change.
- You do not lose any of your plug-ins if you update or reinstall Workbench.
- Plug-ins do not overwrite each other's files.
- You know which files to replace when an update to the plug-in is available.

27.3.1 Creating a Plug-in Directory Structure

To make your plug-ins easier to manage, create a directory structure for them outside your Workbench installation directory.

1. Create a directory to hold your plug-ins. It can have any descriptive name you want, for example, **eclipseplugins**.

2. Inside this directory, create a directory for each plug-in you want to install. These directories can also have any descriptive name you want, for example, **clearcase**.



NOTE: Before continuing, download the plug-in's **.zip** or other archive file and look at its contents. Some plug-ins provide the **eclipse** directory structure and the **.eclipseextension** file for you, others do not.

- If the destination path for the files begins with **eclipse**, and you see an **.eclipseextension** file in the list, you may skip the rest of this section and extract the plug-in's files into the directory you created in step 2.
- If the destination path begins with **plugins** and **features**, then you must complete the rest of the steps in this section.

3. Inside each plug-in directory, create a directory named **eclipse**. This directory *must* be named **eclipse**, and a separate **eclipse** directory is required inside each plug-in directory.
4. Inside each **eclipse** directory, create an empty file named **.eclipseextension**. This file *must* be named **.eclipseextension** (with no **.txt** or any other file extension), and a separate **.eclipseextension** file is required inside each **eclipse** directory.
5. Extract your plug-in into the **eclipse** directory. Two directories, called **features** and **plugins**, appear in the directory alongside the **.eclipseextension** file.



NOTE: For any plug-in to work properly, its **features** and **plugins** directories as well as an empty file called **.eclipseextension** *must* be located inside a directory called **eclipse**.

27.3.2 Installing a ClearCase Plug-in

Once you have created a plug-in directory structure and have found a plug-in you want to use with Workbench, download and install it according to the instructions provided by the plug-in's developer (almost every plug-in comes with release notes containing installation instructions).

This section will show you how to download and install a plug-in on Windows.

Downloading the IBM Rational ClearCase Plug-in

Wind River recommends the IBM Rational ClearCase plug-in.

1. Follow steps 1 and 2 in *27.3.1 Creating a Plug-in Directory Structure*, p.354 (the IBM ClearCase plug-in creates the **eclipse** directory and the **.eclipseextension** file for you.)

For the purposes of this example, name the top-level directory **eclipseplugins**, and name the plug-in directory **clearcaseIBM**.

2. Navigate to <http://www-128.ibm.com/developerworks/rational/library/1376.html> and click the **Plug-ins** link under **ClearCase**. The Rational ClearCase Plug-ins page opens.
3. Click the **Download** link to the right of the appropriate version of the package file. For this example, select **IBM Rational ClearCase SCM adapter for Eclipse 3.1: Windows**.
4. Extract the **.zip** file to your **/eclipseplugins/clearcaseIBM** directory. The **eclipse** directory is created for you, and inside are two directories, called **features** and **plugins**, alongside the **.eclipseextension** file.

Adding Plug-in Functionality to Workbench

1. Before starting Workbench, make sure that **/usr/atria/bin** (where the ClearCase tools are installed) is in your path.
2. Start Workbench, then select **Help > Software Updates > Manage Configuration**. The **Product Configuration** dialog appears.
3. Select **Add an Extension Location** in the Wind River Workbench pane.
4. Navigate to your **eclipseplugins/plugin/eclipse** directory. Click **OK**.
5. Workbench will ask if you want to restart. To properly incorporate ClearCase functionality, click **Yes**.

Incorporating the IBM Rational Plug-in

1. When Workbench restarts, activate the plug-in by selecting **Window > Customize Perspective**.
2. In the **Customize Perspective** dialog, switch to the **Commands** tab.

3. Select the **ClearCase** option in the **Available command groups** column, then click **OK**. A new **ClearCase** menu and icons appear on the main Workbench toolbar.
4. From the **ClearCase** menu, select **Connect to Rational ClearCase** to activate ClearCase functionality.

To configure the ClearCase plug-in, select **Window > Preferences > Team > ClearCase SCM Adapter**.

For more information about using the ClearCase plug-in, see **Help > Help Contents > Rational ClearCase SCM Adapter**.

For more information about ClearCase functionality, refer to your ClearCase product documentation.

27.4 Disabling Plug-in Functionality

You can disable plug-in functionality without uninstalling the downloaded files. This gives you the opportunity to re-enable them at a later time if you want.

1. To disable a plug-in, select **Help > Software Updates > Manage Configuration**. The **Product Configuration** dialog appears.
2. In the left column, open the folder of the plug-in you want to uninstall, select the plug-in itself, then click **Disable**.
3. Workbench will ask if you want to restart. To properly disable the plug-in's functionality, click **Yes**.

27.5 Using Workbench with ClearCase Views

When using Workbench with ClearCase dynamic views, create your workspace on your local file system for best performance. For recommendations about setting up your workspaces and views, see **Help > Help Contents > Rational ClearCase SCM Adapter > Concepts > Managing workspaces**.

Wind River does not recommend that you place the Eclipse workspace directory in a view-private directory. If you create projects in the default location under the workspace directory, ClearCase prompts you to add the project to source control. This process requires all parent directories to be under source control, including the workspace directory.

Instead, create workspace directories outside of a ClearCase view. If you want to create projects under source control, you should unselect the **Create project in workspace** checkbox in the project creation dialog and then navigate to a path in a VOB.

In addition, you should also redirect all build output files to the local file system by changing the **Redirection root directory** in the **Build Properties > Build Paths** tab of your product. All build output files such as object files and generated Makefiles will be redirected.

For more information about the redirecting build output and the redirection root directory, see the *Build Paths* section of *Wind River Workbench User Interface Reference: Build Properties*.

27.5.1 Adding Workbench Project Files to Version Control

To add Workbench project files to version control without putting your workspace into a ClearCase view, check-in the following automatically generated files along with your source files:

Project File	Description
.project	Eclipse platform project file containing general information about the project.
.wrproject	Workbench project file containing mostly general build properties.
.wrfolder	Workbench project file containing folder-level build properties (located in subfolders of your projects).
.wrmakefile	Workbench managed build makefile template used to generate Makefiles.
*.makefile	Workbench managed build extension makefile fragments (e.g. for VxWorks Image projects or some Platform projects)
*.wpj	VxWorks Image project file containing specific data not managed directly by Workbench but by the TCL engine.

For user-defined projects, all Makefile files need to be version controlled, too.

For VxWorks Image projects, it could occur that absolute paths are stored in the **.wpj** file, which breaks any team support. You should avoid manually adding source files to a VxWorks Image project that are referenced by absolute paths. The same is true for any build macro in any project type containing absolute paths—they should be substituted by environment variables (provided by **wrenv** for example) wherever possible.



NOTE: The **.metadata** directory should not be version controlled, as it contains mostly user- and workspace-specific information with absolute paths in it.

For more information about IBM Rational ClearCase, see <http://www-130.ibm.com/developerworks/rational/products/clearcase>.

Choosing Not to Add Build Output Files to ClearCase

After installing the ClearCase plugin, you may be prompted to add any build output files to ClearCase.

There are two ways to avoid this if you wish:

1. Using Workbench Preferences.
 - a. Open the **Window > Preferences > Team > ClearCase SCM Adapter** preferences page.
 - b. From the **When new resources are added** pull-down list, select **Do nothing**.
2. Using **Derived Resource** option.
 - a. Configure your build so the build output goes into one (or a few) well-known directories such as **bin** or **output**.
 - b. Check in the empty **bin** or **output** directories into ClearCase.
 - c. In the Project Navigator, right-click the directory you checked in, select **Properties**, and on the **Info** page, select **Derived**.
 - d. From now on, the Clearcase plug-in will not prompt you about **Derived** resources.



NOTE: If you use Workbench managed builds, they will automatically mark the build output directories as derived so ClearCase will not try to add the build output files to source control. If you use a different builder, you may have to configure it to mark resources as derived.

27.6 Downloading and Installing Java Development Tools (JDT)

If you find that one of your plug-ins has a dependency on JDT, this section will show you how to download and install it.

27.6.1 Creating a JDT Directory Structure

1. Follow steps 1 and 2 in [27.3.1 Creating a Plug-in Directory Structure](#), p.354.

In this example, the directory to hold your plug-ins is called **eclipseplugins**, and the plug-in directory is called **JDT**.



NOTE: JDT creates the **eclipse** directory for you, so you do not need to create it manually.

27.6.2 Downloading the JDT SDK

1. Navigate to <http://download.eclipse.org/eclipse/downloads>, then select the appropriate Eclipse release (for example, under **Latest Releases**, select **3.1.2**). The Release Build page appears.
2. Scroll down until you see the JDT SDK section of the page, then select the drop for your platform. A page of mirror sites appears.
3. Select the mirror site closest to you to start the download.
4. When the file is finished downloading, extract it to your **JDT** directory.

27.6.3 Making JDT Available to Workbench

1. In your `/eclipseplugins/JDT/eclipse` directory, create a file named `.eclipseextension` (with no `.txt` or any other file extension).
2. In this file, type the following information:

```
name=Eclipse Java Development Tools
Id=com.eclipse.jdt
Version=version you downloaded, such as 3.1.2
```
3. In Workbench, select **Help > Software Updates > Manage Configuration**. The Product Configuration window appears.
4. Click the **Add an Extension Location** link in the Wind River Workbench pane.
5. The Browse for Folder dialog prompts you to choose an extension location. Navigate to your `/eclipseplugins/JDT/eclipse` directory, then click **OK**.
6. The **Install/Update** dialog prompts you to restart Workbench. Click **Yes**.
JDT should now be available to any plug-in that requires it.

27.7 Managing Multiple Plug-in Configurations

If you have many plug-ins installed, you may find it useful to create different configurations that include or exclude specific plug-ins.

When you make a plug-in available to Workbench using the process shown in section 27.6.3, its extension location is stored in the Eclipse configuration area.

When starting Workbench, you can specify which configuration you want to start by using the `-configuration path` option, where `path` represents your Eclipse configuration directory.

On Windows:

From a shell, type:

```
% cd installdir\workbench-2.5\wrwb\platform\eclipse\x86-win32\bin
% .\wrwb.exe -configuration path
```

On Linux and Solaris:

Use the option as a parameter to the `startWorkbench.sh` script:

```
% ./startWorkbench.sh -configuration path &
```

For more information about using **-configuration** and other Eclipse startup parameters, see **Help > Help Contents > Wind River Partners Documentation > Eclipse Workbench User Guide > Tasks > Running Eclipse**.

27.8 Using Workbench in an Eclipse Environment

It is possible to install Workbench in a standard Eclipse environment, though some fixes and improvements that Wind River has made to Workbench will not be available.

27.8.1 Recommended Software Versions and Limitations

Java Runtime Version

Wind River tests, supports, and recommends using the JRE 1.4.2_08 for Workbench plug-ins.

Wind River adds a package to that JRE version, and not having that package will make the Terminal view inoperable.

Eclipse Version

Workbench 2.5 is based on Eclipse 3.1.2. Wind River patches Eclipse 3.1.2 to fix some Eclipse debugger bugs. These fixes will be lost when using a standard Eclipse environment.

See the getting started for your platform for supported and recommended host requirements for Workbench 2.5.

Defaults and Branding

Eclipse uses different default preferences from those set by Workbench. The script described in *Setting Up Workbench*, p.363 replaces Eclipse preferences with Workbench preferences.

In a standard Eclipse environment, the Eclipse branding (splash screen, welcome screen, etc.) is used instead of the Wind River branding.

27.8.2 Setting Up Workbench

1. This setup requires a complete Eclipse and Workbench installation. Follow the respective installation instructions for each product.
2. Call the appropriate link-script from a command shell (such as the VxWorks Development Shell), substituting your Workbench installation directory for `WORKBENCH_INST` and your Eclipse installation directory for `ECLIPSE_INST`:

Windows:

```
% WORKBENCH_INST/workbench-2.5/x86-win32/bin/wrregisterwbtoeclipse.bat  
--eclipseDir ECLIPSE_INST
```

Linux:

```
% WORKBENCH_INST/workbench-2.5/x86-linux2/bin/wrregisterwbtoeclipse.sh  
--eclipseDir ECLIPSE_INST
```

Solaris:

```
% WORKBENCH_INST/workbench-2.5/sun4-solaris2/bin/wrregisterwbtoeclipse.s  
h --eclipseDir ECLIPSE_INST
```

3. Check the output of the script in the command shell. If you see the message
`Link operation was successful, start Eclipse to see the result.`
then Workbench will be available the next time you launch Eclipse.

Sample Script Output

To help you understand what the script does, below is sample output (run on Windows) with an explanation of each line.

In this example, `WORKBENCH_INST` is `C:\workbench.` and `ECLIPSE_INST` is `C:\eclipse.`

1. Launch the **wregisterwbtoeclipse** batch file with the **--eclipseDir** set correctly.

```
C:\>.\workbench\workbench-2.5\x86-win32\bin\wregisterwbtoeclipse.bat  
--eclipseDir C:\eclipse
```

2. The first output line tells you that echo of the batch file is turned off, so output won't be verbose.

```
C:\>echo off
```

3. The script reports that Workbench is linked to Eclipse.

```
Linking Workbench from C:\workbench\workbench-2.5\wrwb\platform\eclipse  
into Eclipse installation C:\eclipse!
```

4. The script changes an Eclipse property, making the Workbench perspective the default if you create a new workspace.

```
Changed the org.eclipse.ui/defaultPerspectiveId property value from  
org.eclipse.jdt.ui.JavaPerspective to com.windriver.ide.perspective.ADE.
```

5. It creates a backup of the changed file for your convenience.

```
Created backup:  
"C:\eclipse\plugins\org.eclipse.sdk_3.1.2\plugin_customization.ini.bak"!
```

6. Status is SUCCESS.

```
Link operation was successful, start Eclipse to see the result!
```

7. The script creates a log file for later reference, and then exits.

```
See log file C:\workbench\WRLinkWBIntoEclipse.log for details!
```

You can also run the script with **--help** or **-h** to retrieve more information about other possible options.

Launching Eclipse with Workbench

No special steps are necessary to launch Eclipse.

PART VII
Reference

A **Updating Workspaces on the Command-line .. 367**

B **Glossary 371**

A

Updating Workspaces on the Command-line

[A.1 Overview 367](#)

[A.2 wrws_update Reference 368](#)

A.1 Overview

The Workbench installation includes a **wrws_update** script that allows you to update workspaces from the command-line. This can be used, for example, to update workspaces in a nightly build script. The following section provides a reference page for the command.

A.2 wrws_update Reference

A script for updating an existing workspace is available in the Workbench installation and is named:

wrws_update.bat (Windows only)

wrws_update.sh (Windows, Linux, and Solaris)

This script launches a GUI-less Eclipse application that can be used to update makefiles, symbols (static analysis), and the retriever index.

Execution

Specify the location of the **wrws_update** script or add it to your path and execute it with optional parameters, for example:

```
$ wrws_update.sh -data workspace_dir
```

The workspace must be closed for the command to execute. If you do not specify any options to the command, all update operations are performed (**-refresh**, **-all projects**, **-generate makefiles**, **--update symbols**, **-update index**).

Options

-data workspace_dir

The script uses the default workspace (if known), but it can also update other workspaces by specifying the **-data workspace_dir** option, just as Workbench does. (The script accepts the same command-line options as Workbench. For example, to increase virtual memory specify **-vmargs -Xmxmem_size**.)

-refresh

Refresh workspace (this option should always be specified to ensure correct information is generated).

--all-projects

Update all projects in the workspace. Closed projects will be opened before any operation and closed afterwards to restore the initial state of the workspace.

--generate-makefiles

Trigger a regeneration of all makefiles that use IDE-managed build (including kernel makefiles).

--update-symbols

Trigger an update of static analysis data (symbols and cross references).

--update-index

Trigger an update of the retriever index (text search).

Output

Any errors that might occur during the updates are printed out to **stderr**. Other information (for example, status, what has been done, and so on) are printed out to **stdout**.

Build Information

Note that no actual builds are executed within this script and the launched application, only the needed makefiles will be generated when specifying the **--generate-makefiles** option.



NOTE: No configuration management-specific actions or commands are executed within this script and the launched application. Configuration management specific synchronizations or updates relevant to the workspace (for example, **cvs-update**, ClearCase view synchronization, and so on) have to be done before this script is started.

B

Glossary

This glossary contains terms used in Wind River Workbench.

If the term you want is not listed here, you can search for it throughout all installed documentation.

1. At the top of the **Help > Help Contents** window, type your term into the **Search** field.
2. Click **Go**. Topics containing the term will appear in the Search Results list.
3. To open a topic in the list, click it.

To switch from the Search Results list back to the help Table of Contents, click the **Show in Table of Contents** icon in the upper right corner of the help view.

Refining a Search

If the result set is very large, the information you are looking for might not appear in the top 10 or 15 results.

To refine a search to reduce the number of results:

1. Click the **Search Scope** link to open the search scope dialog.
2. Select **Search only the following topics** then click **New**.
3. In the working set content tree, select the topics to which you want to narrow the search, for instance **Wind River Documentation > References**.
4. Type a descriptive name in the **List name** field (such as **WR References**) then click **OK**.

5. Click **OK** to return to the help browser, where your new search scope appears next to the **Search scope** link.
6. Click **Go**. The results will be shown in the Search Results list.

For more information about online help, see **Help > Help Contents > Wind River Partner Documentation > Eclipse Workbench User Guide > Tasks > Using the help system**.

active view

The view that is currently selected, as shown by its highlighted title bar. Many menus change based on which is the active view, and the active view is the focus of keyboard and mouse input.

back end

Functionality configured into a target server on the host determines how it will communicate with a particular target agent on the target (for example, you use a **wdbrpc** back end for Ethernet connections, **wdbpipe** for VxWorks simulators, **wdbserial** for serial connections, and **wdbproxy** for UDP, TCP, and TIPC connections).

The target server *must* be configured with a back end that matches the target agent interface with which VxWorks has been configured and built.

board support package (BSP)

A *Board Support Package (BSP)* consists primarily of the hardware-specific VxWorks code for a particular target board. A BSP includes facilities for hardware initialization, interrupt handling and generation, hardware clock and timer management, mapping of local and bus memory space, and so on.

build spec

A particular set of build settings appropriate for a specific target board.

color context

The color assigned to a particular process in the Debug view; this color carries over to breakpoints in the Editor and to other views that derive their context from the Debug view.

cross-development

The process of writing code on one system, known as the host, that will run on another system, known as the target.

editor

An editor is a special type of view that is used to edit or browse a file or other resource. Each Workbench perspective displays an editor area even when no files are open.

Modifications made in an Editor follow an open-save-close life cycle model. Multiple instances of an editor type may exist within a Workbench window.

gutter

The left vertical border of the editor view where breakpoints and the program counter appear.

kernel configuration editor

The editor that allows you to configure the kernel of a VxWorks Image project.

kernel module

A piece of code, such as a device driver, that can be loaded and unloaded without the need to rebuild and reboot the kernel.

launch configuration

A run-mode launch configuration is a set of instructions that causes Workbench to connect to your target and launch a process or application. A debug-mode launch configuration completes these actions and then attaches the debugger.

overview ruler

The right vertical border of the editor view where bookmarks and other indicators appear.

perspective

A perspective is a specific grouping of an editor and views that are useful when working on a particular task.

Default Workbench perspectives include the Application Development and Device Debug perspectives, but if you click **Window > Open Perspective > Other**,

additional perspectives (such as those installed with ScopeTools) are available to you.

plug-in

An independent module, available from Wind River, the Eclipse Foundation, or from many Internet Web sites, that delivers new functionality to Workbench without the need to recompile or reinstall it.

program counter

The address of the current instruction when a process is suspended.

project

A collection of source code files, build settings, and binaries that are used to create a VxWorks system image, a kernel or RTP application, and so on.

Projects can be linked together in a hierarchical structure (displayed as a project/subproject tree in the Project Navigator) that reflects their inner dependencies, and therefore the order in which they should be compiled and linked.

real-time process (RTP)

A VxWorks process that is specifically designed for real-time systems.

registry

The registry associates a target server's name with the network address needed to connect to that target server, thereby allowing you to select a target server by a convenient name.

system mode

When in system mode, the debugger is focused on kernel processes and threads. When a process is suspended, all processes stop. Compare with user mode.

target agent

The target agent runs on the target, and is the interface between VxWorks and all other Wind River Workbench tools running on the host or target.

target server

The target server runs on the host, and connects Wind River Workbench tools to the target agent. There is one server for each target; all host tools access the target through this server.

title bar

A view's title bar contains the view name, its icon, and the view toolbar. A highlighted title bar denotes the active view.

toolbar

A view's toolbar contains actions that apply only to that view (e.g. **Step Over** in the Debug view). The toolbar also contains a context menu that contains other actions for that view.

The main Workbench toolbar contains actions that apply to Workbench as a whole (e.g. **Search**) or that reflect the components that are installed (e.g. **Launch TraceScope**).

user mode

When in user mode, the debugger is focused on user applications and processes. When a process is suspended, other processes continue to run. Compare with system mode.

view

A view is a pane within the Workbench window that allows you to display, navigate, and manipulate the resources in your workspace. Only one view has focus (is active) at a time.

window

The term window refers to the desktop development environment as a whole—the space Workbench takes up on your screen. A Workbench window can contain more than one perspective, but only one is displayed at a time.

working set

A working set is a group of resources you select because you want to view them or perform an operation on them as a group. For example, creating a working set allows you to speed up a search by restricting its scope. A working set can also help you focus by reducing the number of projects visible in the Project Navigator, the number of symbols displayed in the Outline view, and so on.

workspace

A workspace is the central location for all the resources you see in Workbench: your projects, folders, and files.

Workbench also uses the workspace to store settings that describe your working environment: which projects and views are currently open, how you have your views arranged within the perspective, whether you have breakpoints set, and so on.

The default location of the workspace is *installDir*/**workspace**, but it can be located anywhere. To keep your projects completely isolated from each other, you can create more than one workspace.

Index

A

- adding
 - application code to projects 138
 - application initialization routines to VIPs 94
 - applications to VIPs 94
 - new files to projects 139
 - subprojects 77
- applications
 - adding to VIPs 94
 - creating, for VxWorks 130
 - initialization stubs 91
 - projects, configuring 118
- Attach to Target launches 293

B

- back end, target server 240
- ball sample program 15
- basename mappings 247
- board support package 95
 - creating 95
 - customizing manually 96
 - migrating 95
 - simulator 95
 - Wind River Workbench 95
- Bookmarks view 28
- boot

- loader project 97
 - build specs 99
 - creating 98
 - makefile 100
 - overview 73
 - project nodes 99
 - target nodes 99
- mechanism, setting up 48
- programs
 - creating new 59
 - serial connection, configuring for 64
- ROMs
 - emulators, substituting ROM 49
- booting
 - command line parameters 58
 - parameters
 - displaying current, at boot time 51
 - nonvolatile RAM, effect of 59
 - setting 51
 - VxWorks 57
 - rebooting VxWorks 59
 - TFTP, requiring 59
 - troubleshooting 341
 - VxWorks
 - commands 52
- breakpoints
 - conditional 299
 - converting to hardware 300
 - creating
 - expression 299

- hardware 300
- line 298
- data 299
- disabling 302
- exporting 302
- expression 299
- hardware 299
- importing 301
- line 298
- refreshing 302
- removing 302
- restricted 298
- unrestricted 298
- Breakpoints view 297
- BSP
 - See board support package
- build
 - applications for different boards 198
 - architecture-specific functions 202
 - complete product image 150
 - executables to dynamically link to shared libraries 203
 - failure due to locked files 329
 - flexible managed 179
 - adding build targets 182
 - build output 187
 - configuring 182
 - library for test and release 199
 - make rule in Project Navigator 206
 - managed
 - comparison of standard and flexible 181
 - flexible, using with linked resources 328
 - management 179
 - output
 - disabling prompt to add to ClearCase 359
 - folders 90
 - properties
 - accessing 188
 - dialog 188
 - global 189
 - project-specific 189
 - remote 212
 - connection 212
 - setting up environment 211
 - spec 190

- creating 207
- customizing 80
 - for new compilers, other tools 207
- standard managed 179
 - configuring 182
- support 179
 - disabled 180
- target
 - excluding with regular expressions 185
- troubleshooting
 - imported projects 330
- user-defined 180

C

- cables, connecting 45
- ClearCase
 - disabling prompt to add build output files 359
 - installing plug-ins 355
 - using with Workbench 357
- colored views 310
- command line
 - parameters 58
 - registry 231
 - update workspaces (wrws_update) 367
- communication settings 256
 - configuring manually 257
 - configuring through a serial port 258
- compiler
 - flags, add 196
 - new build spec 207
- complex project structures 148
- conditional breakpoints 299
- configuring
 - application projects 118
 - file system project 165
 - flexible managed build 182
 - jumpers 45
 - kernel components 93
 - shared library projects 118
 - standard managed build 182
 - target
 - file system 103
 - hardware 45

- VxWorks image project 94, 165
- container
 - project
 - creating 151
 - per project type and external headers 152
 - subprojects 162
- core dump
 - connecting to a VxWorks 5.5.x 33
- customize build specs, shared subprojects 80

D

- data breakpoints 299
- debug modes 311
- Debug view 306
- debugger
 - debugging a VxWorks 5.5 application 30
 - disconnecting and terminating processes 315
 - single-stepping through code 311
- deleting
 - breakpoints 302
 - flexible build targets 185
 - nodes
 - project 144
 - target 144
- derived resource, not adding to ClearCase 359
- development 155
- disabled build support 180
- Disassembly view 316
 - opening automatically 316
 - opening manually 316
- Domain Name Service (DNS) 40
- downloadable kernel module
 - application code 124
 - in Project Navigator 122
 - project
 - build specs 123
 - creating 120
 - files 124
 - nodes 123
 - target nodes 123
- dual mode 38

E

- Eclipse
 - basic concepts 7
 - log 343
 - using Workbench in 362
- Editor 173
 - Kernel 93
 - program counter 309
- environment variables
 - LD_LIBRARY_PATH 206
- Error Log view 342
- Exec Path on Target, troubleshooting
 - Linux 334
 - RTPs 335
- exporting
 - breakpoints 302
 - object path mappings 245
- expression
 - breakpoints 299
- external files
 - linking to 128
- external headers 159

F

- file
 - system
 - configuring the target 103
 - project files 103
 - project nodes 103
 - project, VxWorks 75
- File Navigator view 172
- File Transfer Protocol
 - See FTP server
- files
 - manipulating 142
- find and replace 175
- flexible managed build
 - using with linked resources 328
- folders, build output 90
- FTP server
 - configuring 40
 - WFTPD 40

G

go into project 140

H

hardware breakpoints 299

headers, external 159

help system

accessing 12

display problems

Linux 326

Solaris 326

Windows 326

I

importing

breakpoints 301

build settings 139

object path mappings 245

resources 138

VxWorks image project 84

Include Browser view 172

initialization stubs, application 91

J

jumpers 45

K

kernel

configuration 89, 103

back ends 249

editor 93

image and symbols 241

shell 237

Kernel Editor 93

Kernel Objects view 317

multi-process debugging 318

L

launch configurations

creating 284

native applications 290

LD_LIBRARY_PATH environment variable 206

library, shared

project structure 157

project, configuring 118

line breakpoints 298

linked resources, path variable 183

linking project nodes, moving and 143

linking to external sources 129

projects for read-only file locations 328

location, resource 146

logical nodes 141

logs

creating a ZIP of 343

debugger back end

debug tracing 344

GDB/MI 344

debugger views

broadcast message debug tracing 345

GDB/MI 345

internal errors 345

Eclipse 343

static analysis parser 349

target manager debug tracing 348

target server

back end 347

output 346

WTX 347

M

make rule in Project Navigator 206

makefile

boot loader project 100

build properties 191

- nodes
 - downloadable kernel modules 123
 - native application 135
 - RTP 109
 - shared libraries 117
 - VIP 91
- managed build
 - flexible 179
 - configuring 182
 - using with linked resources 328
 - standard 179
 - configuring 182
- memory
 - target server cache size 243
- menu, Navigate 141
- multiple
 - processes, monitoring 308
 - software systems 147
 - target operating systems or versions 190
- multi-process debugging
 - Kernel Objects view 318

N

- native application
 - launching 290
 - project 131
 - application code 136
 - build specs 134
 - creating 132
 - files 136
 - nodes 134
 - target nodes 134
- Navigate menu 141
- navigation 140
- New Connection wizard 232
- nodes
 - moving and (un-)linking project 143
 - resources and logical 141

O

- object path mappings
 - creating automatically 244
 - examples 245
 - exporting 245
 - for remote hosts 245
 - importing 245
 - why they are required 244
- opening
 - build properties dialog 188
 - new window 140
 - project, in new window 140
- operating systems, multiple 190
- output folders, build 90

P

- pango error 325
- path variable 183
- pathname prefix mappings 244
- plug-ins
 - activating 357
 - adding an extension location 356
 - creating a directory structure 354
 - creating a Workbench plug-in for Eclipse 362
 - installing ClearCase 355
 - web sites 354
- polled mode 38
- preconfigured project types, overview 71
- processes
 - Attach to Target launches 293
 - disconnecting debugger 315
 - RTPs, running 289
- profiles 87
 - VxWorks 5.5 compatible 87
 - VxWorks scalability levels 87
- program counter 309
- project
 - application code 71
 - boot loader 73, 97
 - creating 98
 - bsp, getting a functioning 95

- build
 - properties, accessing 188
 - remote 212
 - system 79
- closing 139, 140
- configuring application 118
- creating 138
 - for read-only sources 328
- creating new 70
- creating, boot loader 98
- customizing VxWorks image 89
- files, version control of 358
- go into 140
- headers 152
- importing Tornado 2 33
- infrastructure design 150
- linking application projects to VxWorks image 94
- linking to external sources 129
- native application 131
- nodes
 - manipulating 143
 - moving and (un-)linking 143
- opening 139
- preconfigured, overview 71
- project structures 77
- real-time process 74
- sample 72
- scoping 140
- shared library 75, 118
- sharing subprojects 80
- structure
 - and build system 79
 - and host directory structure 78
- structures, complex 148
- troubleshooting imported 330
- user-defined 180
 - linking to external files 128
 - overview 76
- VxWorks
 - file system 75
 - image 72
 - kernel configuration profiles 87
 - scalable 86

- Project Navigator
 - boot loader projects 99
 - DOSFS file system projects 102
 - move, copy, delete 141
 - moving and (un-)linking project nodes 143
 - native application projects 134
 - real-time process projects 108
 - shared libraries 116
 - target nodes, manipulating 144
 - user-defined build-targets 206
 - VxWorks image projects 88

R

- read-only sources
 - creating projects for 328
- real-time process
 - and shared library 215
 - project 74
 - application code 111
 - build specs 109
 - creating 106
 - files 110
 - nodes 109
 - target nodes 109
 - See also* RTPs
- rebooting VxWorks 59
- redirection root directory
 - with ClearCase 358
- registry 233
 - changing daemon default behavior 43
 - changing default 235
 - command line 231
 - data storage 234
 - error, unreachable 323
 - launching the default 234
 - remote, creating 234
 - shutting down 235
 - wtxregd 234
 - changing default options 43
- regular expressions
 - to exclude contents of build target 185

- remote
 - build 212
 - setting up environment 211
 - connection 212
- removing breakpoints 302
- replacing text, using Retriever 175
- resource locations 146
- resources and logical nodes 141
- Retriever 175
- RTPs
 - and shared library 215
 - attaching to running 294
 - running 289

S

- sample
 - ball program 15
 - projects 72
- searching for text, using Retriever 175
- serial lines
 - target server back end connection, as 63
 - testing 64
- set, working 140
- setting breakpoints
 - restricted 298
 - unrestricted 298
- shared library 157
 - and real-time process 215
 - LD_LIBRARY_PATH environment variable 206
- project
 - configuring 118
 - creating 114
 - nodes 116
 - project file 117
 - troubleshooting problems 338
- simulator
 - adjusting priority of 252
 - establishing a new connection 251
 - VxWorks 95
- software systems, multiple 147
- source lookup path
 - adding sources 288

- editing 315
- source mode build 86
- spec, build 190
- static analysis, description 169
- structures, complex project 148
- stubs, application initialization 91
- subprojects 165
 - adding 77
 - container 162
- symbol
 - file, specifying maximum size 329
 - table
 - configuring target server 241
- Symbol Browser 171
- symbolic links to files, creating 128
- symbols and kernel image 241
- system mode 38
 - compared with task mode 311

T

- target
 - agent
 - communication modes 38
 - introduction 36
 - board
 - configuring 45
 - establishing a connection 236
 - jumpers, setting 45
 - serial port 45
 - Terminal view 45
 - file system 103
 - name (tn) (boot parameter) 56
 - operating systems, multiple versions 190
 - server
 - back end settings 240
 - connecting
 - ethernet 60
 - serial 65
 - connections
 - establishing new 239
 - network 60
 - serial line 63
 - Tornado 29

- core file 241
- file system (TSFS) 242
 - making writable 243
- introduction 36
- kernel configuration back ends 249
- memory cache size 243
- symbol table 241
- timeout options 243
- troubleshooting 341
- WDB Pipe back end 240
- WDB Proxy back end 240
- WDB Serial back end 240
- Target Manager view 232
 - basename mappings 247
 - defining a new Wind River Probe
 - connection 271
 - defining a VxWorks Simulator connection 251
 - New Connection wizard 232
 - object path mappings 244
 - examples 245
 - for remote hosts 245
 - pathname prefix mappings 244
 - shared connection configuration 248
 - Wind River ICE
 - connection configuration, shared 266
 - Wind River Probe
 - connection configuration, shared 278
- tasks
 - attaching to running 294
 - state 294
- team, defining a path variable 183
- Terminal view 45
- text search 175
- tgtsvr options 242
- TIPC target server backend 240
- Tornado
 - creating a target server connection 29
 - importing Tornado 2 projects 33
 - Workbench finding an installation of 28
- troubleshooting
 - booting problems 341
 - building imported projects 330
 - creating a ZIP of log files 343
 - downloading 335
 - exception on attach 334
 - Exec Path on Target 335
 - hardware configuration 340
 - help system display problems
 - Linux 326
 - Solaris 326
 - Windows 326
 - Java Development Tools (JDT)
 - dependency 325
 - launch configurations 337
 - logs
 - debugger back end 344
 - debugger views
 - broadcast message debug tracing 345
 - GDB/MI 345
 - internal errors 345
 - Eclipse 343
 - Error Log 342
 - generated by Workbench 342
 - static analysis parser 349
 - target manager debug tracing 348
 - target server
 - back end 347
 - output 346
 - WTX 347
 - pango error 325
 - registry unreachable 323
 - removing unwanted target connections 326
 - running a process 336
 - shared library problems 338
 - startup errors 322
 - target connection 332
 - target server problems 341
 - VxWorks 339
 - workspace cannot be locked 324
- TSFS
 - See target server, file system 242
- tutorial
 - ball sample program 15
 - debugging a VxWorks 5.5 target 28
 - editing and debugging source files 22
 - Editor code assist 24
- Type Hierarchy view 172

U

- user mode 38
- user-defined
 - build 180
 - project 76
 - creating 128
 - linking to external files 128
- usrappinit.c 91
- usrtpappinit.c 92

V

- version control, adding Workbench project files to 358
- views
 - See* Workbench views
- VIP
 - See* VxWorks image project
- VxWorks
 - boot loader project 73
 - booting 49
 - core dump, connecting to a VxWorks 5.5 33
 - file system project 75
 - creating 102
 - image
 - customizing 89
 - pre-built 51
 - image project 72
 - build specs 89
 - creating 85
 - files 91
 - in Project Navigator 88
 - kernel configuration profiles 87
 - linking application projects to 94
 - project nodes 89
 - source mode build 86
 - target nodes 89
 - rebooting 59
 - shared library project 75
 - simulator 95
 - defining a new connection 251
 - target server connection, 5.5.x 29
 - tutorial, VxWorks 5.5 28

W

- WDB back end
 - Pipe 240
 - Proxy 240
 - Serial 240
- WFTPD FTP server 40
- Wind River
 - ICE
 - shared connection configuration 266
 - Probe
 - defining a new connection 271
 - shared connection configuration 278
 - System Viewer
 - support libraries, excluding 86
 - writable target server file system 243
- Workbench
 - Application Development perspective 15
 - bookmarks
 - creating 27
 - viewing 28
 - breakpoints
 - modifying 22
 - running to 21
 - setting 21
 - build errors 23
 - comparing files 24
 - connection definition, creating 17
 - creating a project 15
 - Editor
 - bracket matching 27
 - code completion 24
 - Eclipse functionality 11
 - parameter hints 26
 - finding a Tornado installation 28
 - help system
 - accessing 12
 - display problems
 - Linux 326
 - Solaris 326
 - Windows 326
 - moving and sizing views 11
 - perspectives 8
 - project files, adding to version control 358
 - project source

- bookmarks
 - creating [27](#)
 - viewing [28](#)
- bracket matching [27](#)
- breakpoints
 - modifying [22](#)
 - running to [21](#)
 - setting [21](#)
- code completion [24](#)
- file history, viewing [24](#)
- parameter hints [26](#)
- running ball sample program from build
 - output [18](#)
- starting [14](#)
- target, connecting to
 - connection definition [17](#)
- using in an Eclipse environment [362](#)
- using with ClearCase [357](#)
- views [10](#)
 - Breakpoints [297](#)
 - colored [310](#)
 - Debug [306](#)
 - Disassembly [316](#)
 - Editor [173](#)
 - Error Log [342](#)
 - File Navigator [172](#)
 - Include Browser [172](#)
 - Kernel Objects [317](#)
 - Symbol Browser [171](#)
 - Type Hierarchy [172](#)
- working sets [170](#)
 - using [140](#)
- workspace
 - project location [70](#)
 - starting Workbench with a new [322](#)
 - switching to a different [147](#)
 - using one for multiple projects [148](#)
- wrws_update
 - reference page [368](#)
 - script [367](#)
- wtxregd
 - changing default options [43](#)
 - how to find API [231](#)
 - using a remote registry [234](#)