

ARM® DS-5™

Version 5.15

Using the Debugger

ARM®

ARM® DS-5™**Using the Debugger**

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Preface

This preface introduces the *ARM® DS-5™ Using the Debugger*.

It contains the following:

- *About this book on page 12.*

About this book

This book describes how to use the debugger to debug Linux applications, bare-metal, *Real-Time Operating System* (RTOS), Linux, and Android platforms.

Using this book

This book is organized into the following chapters:

Chapter 1 Getting started with DS-5™ Debugger

Gives an introduction to some of the debugger concepts and explains how to launch the debugger.

Chapter 2 Configuring and connecting to a target

Describes how to configure and connect to a debug target using ARM DS-5 Debugger in the Eclipse *Integrated Development Environment* (IDE).

Chapter 3 Working with the target configuration editor

Describes how to use the editor when developing a project for an ARM target.

Chapter 4 Controlling execution

Describes how to stop the target execution when certain events occur, and when certain conditions are met.

Chapter 5 Examining the target

Describes how to examining registers, variables, memory, and the call stack.

Chapter 6 Debugging embedded systems

Gives an introduction to debugging embedded systems.

Chapter 7 Controlling runtime messages

Describes semihosting and how to control runtime messages.

Chapter 8 Debugging with scripts

Describes how to use scripts containing debugger commands to enable you to automate debugging operations.

Chapter 9 Working with the Snapshot Viewer

Describes how to use the Snapshot Viewer.

Chapter 10 DS-5 Debug perspectives and views

Describes the DS-5 Debug perspective and related views in the Eclipse *Integrated Development Environment* (IDE).

Chapter 11 Troubleshooting

Describes how to diagnose problems when debugging applications using DS-5 Debugger.

Glossary

The ARM Glossary is a list of terms used in ARM documentation, together with definitions for those terms. The ARM Glossary does not contain terms that are industry standard unless the ARM meaning differs from the generally accepted meaning.

See the [ARM Glossary](#) for more information.

Typographic conventions

<i>italic</i>	Introduces special terminology, denotes cross-references, and citations.
bold	Highlights interface elements, such as menu names. Denotes signal names. Also used for terms in descriptive lists, where appropriate.
<code>monospace</code>	Denotes text that you can enter at the keyboard, such as commands, file and program names, and source code.
<u>monospace</u>	Denotes a permitted abbreviation for a command or option. You can enter the underlined text instead of the full command or option name.
<i>monospace italic</i>	Denotes arguments to monospace text where the argument is to be replaced by a specific value.
<code>monospace bold</code>	Denotes language keywords when used outside example code.
<and>	Encloses replaceable terms for assembler syntax where they appear in code or code fragments. For example: <code>MRC p15, 0 <Rd>, <CRn>, <CRm>, <Opcode_2></code>
SMALL CAPITALS	Used in body text for a few terms that have specific technical meanings, that are defined in the <i>ARM glossary</i> . For example, IMPLEMENTATION DEFINED, IMPLEMENTATION SPECIFIC, UNKNOWN, and UNPREDICTABLE.

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Chapter 1

Getting started with DS-5™ Debugger

Gives an introduction to some of the debugger concepts and explains how to launch the debugger. It contains the following:

- *About the debugger on page 1-15.*
- *Debugger concepts on page 1-16.*
- *Launching the debugger from Eclipse on page 1-18.*
- *Launching the debugger from the command-line console on page 1-19.*
- *DS-5 Debug perspective keyboard shortcuts on page 1-22.*
- *DS-5 Debugger command-line console keyboard shortcuts on page 1-23.*
- *Standards compliance in the DS-5 Debugger on page 1-24.*

1.1 About the debugger

Lists all the main features provided by DS-5™.

DS-5 Debugger provides a powerful tool for debugging applications on both hardware targets and models using ARM® architecture-based processors. You can have complete control over the flow of the execution so that you can quickly isolate and correct errors.

The following features are provided:

- Loading images and symbols.
- Running images.
- Breakpoints and watchpoints.
- Source and instruction level stepping.
- Accessing variables, and register values.
- Navigating the call stack.
- Support for handling exceptions and Linux signals.
- Debugging multi-threaded Linux applications.
- Debugging Linux kernel modules, boot code and kernel porting.
- Debugging bare-metal *Symmetric MultiProcessing* (SMP) systems.

The debugger supports a comprehensive set of DS-5 Debugger commands that can be executed in the Eclipse *Integrated Development Environment* (IDE), script files, or a command-line console. In addition there is a small subset of CMM-style commands sufficient for running target initialization scripts. CMM is a scripting language supported by some third-party debuggers. To execute CMM-style commands you must create a debugger script file containing the CMM-style commands and then use the DS-5 Debugger source command to run the script.

To help you get started, there are some tutorials that you can follow showing you how to run and debug applications using DS-5 tools.

Related References

Types of target connections on page 26.

Debugger concepts on page 16.

Related Information

ARM DS-5 tutorials.

DS-5 Debugger commands.

CMM-style commands supported by the debugger.

1.2 Debugger concepts

Lists the main concepts involved when debugging applications.

Debugger	A debugger is software running on a host computer that enables you to make use of a debug adapter to examine and control the execution of software running on a debug target.
Debug session	A debug session begins when you connect the debugger to a target or a model for debugging software running on the target and ends when you disconnect the host software from the target.
Debug target	<p>At an early stage of product development there might be no hardware so the expected behavior of the hardware is simulated by software. This is referred to in the debugger documentation as a model. Even though you might run a model on the same computer as the debugger, it is useful to think of the target as a separate piece of hardware.</p> <p>Alternatively, you can build a prototype product on a printed circuit board, including one or more processors on which you run and debug the application. This is referred to in the debugger documentation as a hardware target.</p>
Debug adapter	<p>A debug adapter performs the actions requested by the debugger on the target. For example:</p> <ul style="list-style-type: none">• Setting breakpoints.• Reading from memory.• Writing to memory. <p>The debug adapter is not the application being debugged, nor the debugger itself. Examples include:</p> <ul style="list-style-type: none">• Debug hardware adapter:<ul style="list-style-type: none">— ARM DSTREAM™ unit.— ARM RVI™ unit.— ARM VSTREAM™ unit.• Debug software adapter:<ul style="list-style-type: none">— <code>gdbserver</code>.
Contexts	<p>Each processor in the target can have a process currently in execution. Each process uses values stored in variables, registers, and other memory locations. These values can change during the execution of the process.</p> <p>The context of a process describes its current state, as defined principally by the call stack that lists all the currently active calls.</p> <p>The context changes when:</p> <ul style="list-style-type: none">• A function is called.• A function returns.• An interrupt or an exception occurs. <p>Because variables can have class, local, or global scope, the context determines which variables are currently accessible. Every process has its own context. When execution of a process stops, you can examine and change values in its current context.</p>

Scope

The scope of a variable is determined by the point within an application at which it is defined.

Variables can have values that are relevant within:

- A specific class only (class).
- A specific function only (local).
- A specific file only (static global).
- The entire application (global).

Related Tasks

[Configuring a connection to a Fixed Virtual Platform \(FVP\) on page 27.](#)

[Configuring a connection to a Linux target using gdbserver on page 29.](#)

[Configuring a connection to a Linux Kernel on page 31.](#)

[Configuring a connection to a bare-metal target on page 33.](#)

[Configuring an Event Viewer connection to a bare-metal target on page 35.](#)

Related Information

[Setting up the ARM DSTREAM Hardware.](#)

[Setting up the ARM RVI Hardware.](#)

1.3 Launching the debugger from Eclipse

Describes how to launch Eclipse and select the DS-5 Debug perspective.

Procedure

1. Launch Eclipse:
 - On Windows, select **Start > All Programs > ARM DS-5 > Eclipse for DS-5**.
 - On Linux:
 - If you installed the shortcut during installation, you can select **Eclipse for DS-5** in the **Applications** menu.
 - If you did not install the shortcut during installation:
 1. Add the `install_directory/bin` directory to your PATH environment variable. If it is already configured then you can skip this step.
 2. Open Unix bash shell.
 3. Enter `eclipse` at the prompt.
2. Select **Window > Open Perspective > DS-5 Debug** from the main menu.
3. To connect to the target:
 - If you have not run a debug session before then you must configure a connection between the debugger and the target before you can start any debugging tasks.
 - If you have run a debug session before then you can select a target connection in the **Debug Control** view and click on the **Connect to Target** toolbar icon.

Related Tasks

Launching the debugger from the command-line console on page 19.
Configuring a connection to a Fixed Virtual Platform (FVP) on page 27.
Configuring a connection to a Linux target using gdbserver on page 29.
Configuring a connection to a Linux Kernel on page 31.
Configuring a connection to a bare-metal target on page 33.
Configuring an Event Viewer connection to a bare-metal target on page 35.

Related References

Types of target connections on page 26.
Debug Configurations - Connection tab on page 259.
Debug Configurations - Files tab on page 262.
Debug Configurations - Debugger tab on page 266.
Debug Configurations - Arguments tab on page 270.
Debug Configurations - Environment tab on page 272.
Debug Configurations - Event Viewer tab on page 274.
DS-5 Debug perspectives and views on page 177.
Debug Control view on page 195.

1.4 Launching the debugger from the command-line console

Describes how to launch the debugger from a command-line console or a Unix bash shell with the required environment variables.

Procedure

1. Launch a command-line console:
 - On Windows, select **Start > All Programs > ARM DS-5 > DS-5 Command Prompt**.
 - On Linux:
 1. Add the `install_directory/bin` directory to your `PATH` environment variable. If it is already configured then you can skip this step.
 2. Open a Unix bash shell.
2. Launch the debugger using the following command-line syntax:

```
debugger --target [--target_device] [option]...
```

Where:

`--target=host:port | filename`

Specifies either the `host:port` for the connection between the debugger and **gdbserver** or a target configuration file such as an XML or RVC file.

A serial connection requires an XML file similar to the following example, `mySerialConfig.xml`:

```
<?xml version="1.0"?>
<RVConfigUtility>
  <rddi type="rddi-debug-gdb"/>
  <rddigdb>
    <connection>
      <serial>
        <port>COM1</port>
        <speed>115200</speed>
      </serial>
    </connection>
  </rddigdb>
</RVConfigUtility>
```

`--target_device=number | name`

Specifies the device number or name. You must launch the debugger with `--target_device` command-line option when configuring a connection to a target containing multiple devices. If you do not specify `--target_device` then the debugger lists all the available devices and quits.

and option can be any of the following:

`--continue_on_error=true | false`

Specifies whether the debugger stops the target and exits the current script when an error occurs. The default is `--continue_on_error=false`.

`--disable_semihosting`

Disables semihosting operations.

`--disable_semihosting_console`

Disables all semihosting operations to the debugger console.

`--enable_semihosting`

Enables semihosting operations.

`--help`

Displays a summary of the main command-line options.

`--image=filename`

Specifies the image file for the debugger to load when it connects to the target.

`--interactive`

Specifies interactive mode that redirects standard input and output to the debugger from the current command-line console, for example, Windows Command Prompt or Unix bash shell. This is the default if no script file is specified.

`--log_config=option`

Specifies the type of logging configuration to output runtime messages from the debugger.

Where:

option

Specifies a predefined logging configuration or a user-defined logging configuration file:

info

Output messages using the predefined INFO level configuration. This level does not output debug messages. This is the default.

debug

Output messages using the predefined DEBUG level configuration. This option outputs both INFO level and DEBUG level messages.

filename

Specifies a user-defined logging configuration file to customize the output of messages. The debugger supports log4j configuration files.

`--log_file=filename`

Specifies an output file to receive runtime messages from the debugger. If this option is not used then output messages are redirected to the console.

`--script=filename`

Specifies a script file containing debugger commands to control and debug your target. You can repeat this option if you have several script files. The scripts are run in the order specified and the debugger quits after the last script finishes. Add the `--interactive` option to the command-line if you want the debugger to remain in interactive mode after the last script finishes.

`--semihosting_error=filename`

Specifies a file to write `stderr` for semihosting operations.

`--semihosting_input=filename`

Specifies a file to read `stdin` for semihosting operations.

`--semihosting_output=filename`

Specifies a file to write `stdout` for semihosting operations.

`--stop_on_connect=true | false`

Specifies whether the debugger stops the target when it connects to the target device. To leave the target unmodified on connection you must specify `false`. The default is `--stop_on_connect=true`.

`--target_os=name`

Specifies the name of the target *Operating System* (OS), for example, `--target_os=linux`. This enables OS support within the debugger for example, shared library support. Available options are:

`linux`

OS support for debug of Linux applications.

`linux-kernel`

OS support for debug of a Linux kernel.

`--top_mem=address`

Specifies the stack base, also known as the top of memory. Top of memory is only used for semihosting operations.

Examples

```
debugger --target=beagleboard.rvc --target_device=Cortex-A8
debugger --target=My_FVP.xml --target_device=Cortex-A8 --image=gnometris
```

When connected, use the DS-5 debugger commands to access the target and start debugging. For example, **info registers** displays all application level registers.

Related Concepts

[About Log4j configuration files on page 150.](#)

Related Tasks

[Launching the debugger from Eclipse on page 18.](#)

Related References

[DS-5 Debugger command-line console keyboard shortcuts on page 23.](#)

[Exporting DS-5 Debugger commands generated during a debug session on page 155.](#)

[About semihosting and top of memory on page 145.](#)

Related Information

[Log4j in Apache Logging Services.](#)

[DS-5 Debugger commands.](#)

1.5 DS-5 Debug perspective keyboard shortcuts

Lists the keyboard shortcuts that you can use in the DS-5 Debug perspective.

In any view or dialog box you can access the dynamic help by using the following:

- On Windows, **F1** key
- On Linux for example, **Shift+F1** key combination.

The following keyboard shortcuts are available when you connect to a target:

Commands view

You can use:

- | | |
|-------------------|--|
| Ctrl+Space | Access the content assist for autocompletion of commands. |
| Enter | Execute the command that is entered in the adjacent field. |
| DOWN arrow | Navigate down through the command history. |
| UP arrow | Navigate up through the command history. |

Debug Control view

You can use:

- F5** Step at source or instruction level including stepping into all function calls where there is debug information. You can also use **ALT+F5** to step in the opposite mode. For example, if you are in source level stepping mode then using **ALT+F5** performs an instruction level step.
- F6** Step at source or instruction level but stepping over all function calls.
- F7** Continue running to the next instruction after the selected stack frame finishes.
- F8** Continue running the target.

———— Note ————

A **Connect only** connection might require setting the PC register to the start of the image before running it.

- F9** Interrupt the target and stop the current application if it is running.

Related Tasks

[Launching the debugger from Eclipse on page 18.](#)

Related References

[Commands view on page 192.](#)

[Debug Control view on page 195.](#)

1.6 DS-5 Debugger command-line console keyboard shortcuts

Lists the line editing features provided, including a command history and some common keyboard shortcuts

Each command you enter is stored in the command history. Use the UP and DOWN arrow keys to navigate through the command history, to find and reissue a previous command.

To make editing commands and navigating the command history easier, the following special keyboard shortcuts are available:

Ctrl+A	Move the cursor to the start of the line.
Ctrl+D	Quit the debugger console.
Ctrl+E	Move the cursor to the end of the line.
Ctrl+N	Search forward through the command history for the currently entered text.
Ctrl+P	Search back through the command history for the currently entered text.
Ctrl+W	Delete the last word.
DOWN arrow	Navigate down through the command history.
UP arrow	Navigate up through the command history.

Related Tasks

[Launching the debugger from the command-line console on page 19.](#)

1.7 Standards compliance in the DS-5 Debugger

Lists the level of compliance that DS-5 Debugger conforms to.

ELF	The debugger can read executable images in ELF format.
DWARF	The debugger can read debug information from ELF images in the DWARF 2, DWARF 3, and DWARF 4 formats.
Trace Protocols	The debugger can interpret trace that complies with the ETMv3.4, ETMv3.5, ETMv4, ITM and STM protocols.

Note

The DWARF 2 and DWARF 3 standard is ambiguous in some areas such as debug frame data. This means that there is no guarantee that the debugger can consume the DWARF produced by all third-party tools.

Related Information

[ELF for the ARM Architecture.](#)

[DWARF for the ARM Architecture.](#)

[The DWARF Debugging Standard.](#)

[International Organization for Standardization.](#)

Chapter 2

Configuring and connecting to a target

Describes how to configure and connect to a debug target using ARM DS-5 Debugger in the Eclipse *Integrated Development Environment* (IDE).
It contains the following:

- *Types of target connections on page 2-26.*
- *Configuring a connection to a Fixed Virtual Platform (FVP) on page 2-27.*
- *Configuring a connection to a Linux target using gdbserver on page 2-29.*
- *Configuring a connection to a Linux Kernel on page 2-31.*
- *Configuring a connection to a bare-metal target on page 2-33.*
- *Configuring an Event Viewer connection to a bare-metal target on page 2-35.*
- *About the target configuration import utility on page 2-37.*
- *Adding a new platform on page 2-39.*
- *Adding a new configuration database to DS-5 on page 2-41.*
- *Exporting an existing launch configuration on page 2-43.*
- *Importing an existing launch configuration on page 2-46.*
- *Disconnecting from a target on page 2-48.*

2.1 Types of target connections

Before you can debug an application you must set up a connection between the host workstation running the debugger and the target.

There are several types of connections supported by the debugger:

Linux application

To debug a Linux application you can use a TCP or serial connection:

- to **gdbserver** running on a model that is pre-configured to boot ARM Embedded Linux.
- to **gdbserver** running on a hardware target.

This type of development requires **gdbserver** to be installed and running on the target. If **gdbserver** is not installed on the target, either see the documentation for your Linux distribution or check with your provider. Alternatively, you might be able to use the **gdbserver** from the DS-5 installation at `install_directory/arm`.

Bare-metal and Linux kernel

To debug an application running on a bare-metal target, a Linux kernel, or a kernel device driver, you can use a debug hardware adapter connected to the host workstation and the target.

Snapshot Viewer

The Snapshot Viewer enables you to debug a read-only representation of your application using previously captured state.

————— Note —————

Currently DS-5 only supports DS-5 Debugger connections to the Snapshot Viewer using the command-line console.

Related Concepts

About the Snapshot Viewer on page 170.

Related Tasks

Configuring a connection to a Fixed Virtual Platform (FVP) on page 27.

Configuring a connection to a Linux target using gdbserver on page 29.

Configuring a connection to a Linux Kernel on page 31.

Configuring a connection to a bare-metal target on page 33.

Configuring an Event Viewer connection to a bare-metal target on page 35.

2.2 Configuring a connection to a *Fixed Virtual Platform* (FVP)

Describes how to configure a connection to a FVP and set up a *Virtual File System* (VFS).

DS-5 supports serial connections between a FVP and the host machine on both Windows and Linux platforms.

Procedure

1. Select **Window > Open Perspective > DS-5 Debug** from the main menu.
2. Select **Debug Configurations...** from the **Run** menu.
3. Select **DS-5 Debugger** from the configuration tree and then click on **New** to create a new configuration.
4. In the Name field, enter a suitable name for the new configuration.
5. Click on the **Connection** tab to configure a DS-5 Debugger target connection:
 - a) Select the required FVP platform, **Linux Application Debug** project type and the required debug operation. For example, if you are using a VFS then select **Debug target resident application**.
 - b) In the Connections panel, a serial connection is automatically configured.
 - c) If you are using VFS, select **Enable virtual file system support**. The default VFS mounting point maps the Eclipse workspace root directory to the `/writeable` directory on the model. Leave the default or change as required.

———— Note ————

VFS is only set-up on initialization of the model. Changes to the VFS directory structure might require restarting the model.

6. Click on the **Files** tab to define the target environment and select debug versions of the application file and libraries on the host that you want the debugger to use.
 - a) In the Target Configuration panel, specify the location of the application on the target. You can also specify the target working directory if required.
 - b) In the Files panel, select the files on the host that you want the debugger to use to load the debug information.

———— Note ————

Options in the **Files** tab are dependent on the type of debug operation that you select.

7. Click on the **Debugger** tab to configure the debugger settings.
 - a) Specify the actions that you want the debugger to do after connection to the target.
 - b) Configure the host working directory or use the default.
 - c) Configure the search paths on the host used by the debugger when it displays source code.
8. If required, click on the **Arguments** tab to enter arguments that are passed to the application when the debug session starts.
9. If required, click on the **Environment** tab to create and configure the target environment variables that are passed to the application when the debug session starts.
10. Click on **Apply** to save the configuration settings.
11. Click on **Debug** if you want to connect to the target and begin debugging immediately.

Alternatively, click on **Close** to close the Debug Configurations dialog box. Use the Debug Control view to connect to the target associated with this debug configuration.

12. Debugging requires the DS-5 Debug perspective. If the Confirm Perspective Switch dialog box opens, click on **Yes** to switch perspective.

When connected and the DS-5 Debug perspective opens you are presented with all the relevant views and editors.

For more information on these options, use the dynamic help.

Related Tasks

Exporting an existing launch configuration on page 43.

Importing an existing launch configuration on page 46.

Configuring a connection to a Linux target using gdbserver on page 29.

Configuring a connection to a Linux Kernel on page 31.

Configuring a connection to a bare-metal target on page 33.

Configuring an Event Viewer connection to a bare-metal target on page 35.

Related References

Debug Configurations - Connection tab on page 259.

Debug Configurations - Files tab on page 262.

Debug Configurations - Debugger tab on page 266.

Debug Configurations - OS Awareness tab on page 269.

Debug Configurations - Arguments tab on page 270.

Debug Configurations - Environment tab on page 272.

Debug Configurations - Event Viewer tab on page 274.

Types of target connections on page 26.

Related Information

Model Shell options for Fast Models.

2.3 Configuring a connection to a Linux target using gdbserver

Describes how to connect to a Linux target using **gdbserver**.

Prerequisites

Before connecting you must:

1. Set up the target with an *Operating System* (OS) installed and booted. See the documentation supplied with the target for more information.
2. Obtain the target IP address or name.
3. If required, set up a *Remote Systems Explorer* (RSE) connection to the target.

If you are connecting to an already running **gdbserver** you must ensure that you have:

1. **gdbserver** installed and running on the target.

To run **gdbserver** and the application on the target you can use:

```
gdbserver port path/myApplication
```

Where:

- *port* is the connection port between **gdbserver** and the application.
 - *path/myApplication* is the application that you want to debug.
2. An application image loaded and running on the target.

Procedure

1. Select **Window > Open Perspective > DS-5 Debug** from the main menu.
2. Select **Debug Configurations...** from the **Run** menu.
3. Select **DS-5 Debugger** from the configuration tree and then click on **New** to create a new configuration.
4. In the Name field, enter a suitable name for the new configuration.
5. Click on the **Connection** tab to configure a DS-5 Debugger target connection:
 - a) Select the required platform, **Linux Application Debug** project type and the required debug operation.
 - b) Configure the connection between the debugger and **gdbserver**.
6. Click on the **Files** tab to define the target environment and select debug versions of the application file and libraries on the host that you want the debugger to use.
 - a) In the Target Configuration panel, select the application on the host that you want to download to the target and specify the location on the target where you want to download the selected file.
 - b) In the Files panel, select the files on the host that you want the debugger to use to load the debug information. If required, you can also specify other files on the host that you want to download to the target.

———— **Note** ————

Options in the **Files** tab are dependent on the type of debug operation that you select.

7. Click on the **Debugger** tab to configure the debugger settings.
 - a) In the Run control panel, specify the actions that you want the debugger to do after connection to the target.
 - b) Configure the host working directory or use the default.
 - c) In the Paths panel, specify any source or library search directories on the host that the debugger uses when it displays source code.

8. If required, click on the **Arguments** tab to enter arguments that are passed to the application when the debug session starts.
9. If required, click on the **Environment** tab to create and configure the target environment variables that are passed to the application when the debug session starts.
10. Click on **Apply** to save the configuration settings.
11. Click on **Debug** to connect to the target.
12. Debugging requires the DS-5 Debug perspective. If the Confirm Perspective Switch dialog box opens, click **Yes** to switch perspective.

When connected and the DS-5 Debug perspective opens you are presented with all the relevant views and editors.

For more information on these options, use the dynamic help.

Related Tasks

Exporting an existing launch configuration on page 43.
Importing an existing launch configuration on page 46.
Configuring a connection to a Fixed Virtual Platform (FVP) on page 27.
Configuring a connection to a Linux Kernel on page 31.
Configuring a connection to a bare-metal target on page 33.
Configuring an Event Viewer connection to a bare-metal target on page 35.

Related References

Debug Configurations - Connection tab on page 259.
Debug Configurations - Files tab on page 262.
Debug Configurations - Debugger tab on page 266.
Debug Configurations - OS Awareness tab on page 269.
Debug Configurations - Arguments tab on page 270.
Debug Configurations - Environment tab on page 272.
Debug Configurations - Event Viewer tab on page 274.
Types of target connections on page 26.
Target management terminal for serial and SSH connections on page 283.
ARM Linux problems and solutions on page 292.
Target connection problems and solutions on page 294.

2.4 Configuring a connection to a Linux Kernel

Describes how to configure a connection to a Linux target, load the Linux Kernel into secure memory, and also how to add a pre-built loadable module to the target.

You can connect to running target using a debug hardware adapter.

Note

By default for this type of connection, all processor exceptions are handled by Linux on the target. You can use the Manage Signals dialog box in the Breakpoints view menu to modify the default handler settings.

Prerequisites

Before connecting you must ensure that you have the target IP address or name for the connection between the debugger and the debug hardware adapter.

Procedure

1. Select **Window > Open Perspective > DS-5 Debug** from the main menu.
2. Select **Debug Configurations...** from the **Run** menu.
3. Select **DS-5 Debugger** from the configuration tree and then click on **New** to create a new configuration.
4. In the Name field, enter a suitable name for the new configuration.
5. Click on the **Connection** tab to configure a DS-5 Debugger target connection:
 - a) Select the required platform, **Linux Kernel and/or Devices Driver Debug** project type and the required debug operation.
 - b) Configure the connection between the debugger and the debug hardware adapter.
6. Click on the **Debugger** tab to configure the debugger settings.
 - a) In the Run control panel, select **Connect only** and set up initialization scripts as required.

Note

Operating System (OS) support is automatically enabled when a Linux kernel image is loaded into the debugger from the DS-5 Debugger launch configuration. However, you can manually control this by using the **set os** command.

For example, if you want to delay the activation of OS support until after the kernel has booted and the *Memory Management Unit* (MMU) is initialized then you can configure a connection that uses a target initialization script to disable OS support. To debug the kernel, OS support must be enabled in the debugger.

-
- b) Select the **Execute debugger commands** checkbox.
 - c) In the field provided, enter the following commands:

```
add-symbol-file <path>/vmlinux S:0  
add-symbol-file <path>/modex.ko
```

Note

The path to the vmlinux must be the same as your build environment.

- d) Configure the host working directory or use the default.
- e) In the Paths panel, specify any source search directories on the host that the debugger uses when it displays source code.

7. Click on **Apply** to save the configuration settings.
8. Click on **Debug** to connect to the target.
9. Debugging requires the DS-5 Debug perspective. If the Confirm Perspective Switch dialog box opens, click **Yes** to switch perspective.

When connected and the DS-5 Debug perspective opens you are presented with all the relevant views and editors.

For more information on these options, use the dynamic help.

Related Concepts

About debugging a Linux kernel on page 137.

About debugging Linux kernel modules on page 139.

Related Tasks

Exporting an existing launch configuration on page 43.

Importing an existing launch configuration on page 46.

Configuring a connection to a Fixed Virtual Platform (FVP) on page 27.

Configuring a connection to a Linux target using gdbserver on page 29.

Configuring a connection to a bare-metal target on page 33.

Configuring an Event Viewer connection to a bare-metal target on page 35.

Related References

Debug Configurations - Connection tab on page 259.

Debug Configurations - Files tab on page 262.

Debug Configurations - Debugger tab on page 266.

Debug Configurations - OS Awareness tab on page 269.

Debug Configurations - Arguments tab on page 270.

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Debug Configurations - Event Viewer tab on page 274.

Types of target connections on page 26.

Target management terminal for serial and SSH connections on page 283.

ARM Linux problems and solutions on page 292.

Target connection problems and solutions on page 294.

Related Information

Debugging a loadable kernel module.

2.5 Configuring a connection to a bare-metal target

Describes how to download and connect to an application running on a target using a debug hardware adapter.

Prerequisites

Before connecting you must ensure that you have the target IP address or name for the connection between the debugger and the debug hardware adapter.

Procedure

1. Select **Window > Open Perspective > DS-5 Debug** from the main menu.
2. Select **Debug Configurations...** from the **Run** menu.
3. Select **DS-5 Debugger** from the configuration tree and then click on **New** to create a new configuration.
4. In the Name field, enter a suitable name for the new configuration.
5. Click on the **Connection** tab to configure a DS-5 Debugger target connection:
 - a) Select the required platform. For example, **ARM-Versatile Express A9x4, Bare Metal Debug, Debug and Trace Cortex-A9x4 SMP via DSTREAM**.
 - b) Configure the connection between the debugger and the debug hardware adapter.
6. Click on the **Files** tab to define the target environment and select debug versions of the application file and libraries on the host that you want the debugger to use.
 - a) In the Target Configuration panel, select the application on the host that you want to download to the target.
7. Click on the **Debugger** tab to configure the debugger settings.
 - a) In the Run control panel, specify the actions that you want the debugger to do after connection to the target.
 - b) Configure the host working directory or use the default.
 - c) In the Paths panel, specify any source search directories on the host that the debugger uses when it displays source code.
8. If required, click on the **Arguments** tab to enter arguments that are passed, using semihosting, to the application when the debug session starts.
9. Click on **Apply** to save the configuration settings.
10. Click on **Debug** to connect to the target.
11. Debugging requires the DS-5 Debug perspective. If the Confirm Perspective Switch dialog box opens, click **Yes** to switch perspective.

When connected and the DS-5 Debug perspective opens you are presented with all the relevant views and editors.

For more information on these options, use the dynamic help.

Related Tasks

Exporting an existing launch configuration on page 43.

Importing an existing launch configuration on page 46.

Configuring a connection to a Fixed Virtual Platform (FVP) on page 27.

Configuring a connection to a Linux target using gdbserver on page 29.

Configuring a connection to a Linux Kernel on page 31.

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Related References

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Debug Configurations - Debugger tab on page 266.
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Debug Configurations - Arguments tab on page 270.
Debug Configurations - Environment tab on page 272.
Debug Configurations - Event Viewer tab on page 274.
Types of target connections on page 26.

2.6 Configuring an Event Viewer connection to a bare-metal target

Describes how to connect to a bare-metal target.

The Event Viewer allows you to capture and view textual logging information from bare-metal applications. Logging is captured from your application using annotations that you must add to the source code.

Note

The **Event Viewer** tab in the Debug Configurations dialog box is only enabled for targets where *System Trace Macrocell* (STM) and *Instrumentation Trace Macrocell* (ITM) capture is supported.

Prerequisites

Before connecting you must ensure that you:

- Have the target IP address or name for the connection between the debugger and the debug hardware agent.
- Annotate your application source code with logging points and recompile it. See the ITM and Event Viewer Example for Versatile Express A9x4 provided with DS-5 for more information.

Procedure

1. Select **Window > Open Perspective > DS-5 Debug** from the main menu.
2. Select **Debug Configurations...** from the **Run** menu.
3. Select **DS-5 Debugger** from the configuration tree and then click on **New** to create a new configuration.
4. In the Name field, enter a suitable name for the new configuration.
5. Click on the **Connection** tab to configure a DS-5 Debugger target connection:
 - a) Select the required platform. For example, **ARM-Versatile Express A9x4, Bare Metal Debug, Debug and Trace Cortex-A9x4 SMP via DSTREAM**.
 - b) Configure the connection between the debugger and the debug hardware agent.
6. Click on the **Files** tab to define the target environment and select debug versions of the application file and libraries on the host that you want the debugger to use.
 - a) In the Target Configuration panel, select the application on the host that you want to download to the target.
7. Click on the **Debugger** tab to configure the debugger settings.
 - a) In the Run control panel, specify the actions that you want the debugger to do after connection to the target.
 - b) Configure the host working directory or use the default.
 - c) In the Paths panel, specify any source search directories on the host that the debugger uses when it displays source code.
8. If required, click on the **Arguments** tab to enter arguments that are passed, using semihosting, to the application when the debug session starts.
9. Click on the **Event Viewer** tab to configure the ITM capture settings.
 - a) Select **Enable Event Viewer for ITM events**.
 - b) Enter the maximum size of the trace buffer. For example, you can enter 100MB for a DSTREAM connection. Be aware that larger buffers have a performance impact by taking longer to process but collect more trace data.
10. Click on **Apply** to save the configuration settings.
11. Click on **Debug** to connect to the target.

12. Debugging requires the DS-5 Debug perspective. If the Confirm Perspective Switch dialog box opens, click **Yes** to switch perspective.

When connected and the DS-5 Debug perspective opens you are presented with all the relevant Channel editors for the Event Viewer.

For more information on these options, use the dynamic help.

Related Tasks

Exporting an existing launch configuration on page 43.

Importing an existing launch configuration on page 46.

Configuring a connection to a Fixed Virtual Platform (FVP) on page 27.

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Related References

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Types of target connections on page 26.

2.7 About the target configuration import utility

The import utility, **cdbimporter**, aims to provide an easy method to import platform information into DS-5, and so provide limited debug and trace support for the platform through RVI , DSTREAM , VSTREAM, or model connections.

A database holds the target configuration and connection settings in DS-5. The import utility creates platform entries in a new configuration database using information from:

- A configuration file created and saved using the Debug Hardware Configuration utility, **dbghwconfig** or **rviconfig**.

Note

DS-5 is not yet capable of creating a configuration file from within Eclipse.

- A model that provides a CADI server. The model can be already running or you can specify the path and filename to the executable file in the command-line options.

The import utility creates the following debug operations:

- Single processor and *Symmetric MultiProcessing* (SMP) bare-metal debug for hardware and models.
- Single processor and SMP Linux kernel debug for hardware.
- Linux application debug configurations for hardware.

For hardware targets where a trace subsystem is present, appropriate *Debug and Trace Services Layer* (DTSL) options are produced. These can include:

- Selection of on-chip (*Embedded Trace Buffer* (ETB), *Micro Trace Buffer* (MTB), *Trace Memory Controller* (TMC) or other on-chip buffer) or off-chip (DSTREAM trace buffer) trace capture
- Cycle-accurate trace capture
- Trace capture range
- Configuration and capture of *Instruction Trace Macrocell* (ITM) trace to be handled by the DS-5 Event Viewer.

The import utility does not create:

- debug operations that configure non-instruction trace macrocells other than ITM
- big.LITTLE™ configurations.

For SMP configurations, the *Cross Trigger Interface* (CTI) synchronization is used on targets where a suitable CTI is present. Using a CTI produces a much tighter synchronization with a very low latency in the order of cycles but the CTI must be fully implemented and connected in line with the ARM reference designs, and must not be used for any other purpose. Synchronization without using a CTI has a much higher latency, but makes no assumptions about implementation or usage.

You might have to manually configure off-chip TPIU trace for multiplexed pins and also perform calibrations to cope with signal timing issues.

If you experience any problems or need to produce other configurations, contact your support representative.

Assumptions

The import utility makes the following assumptions when creating debug operations:

- There is a linear mapping between trace macrocells and CoreSight™ trace funnel ports.
- The *Embedded Trace Macrocell* (ETM)/*Program Trace Macrocell* (PTM) versions are fixed for each type of processor.

Table 2-1 ETM/PTM versions for each type of processor

Processor Type	ETM/PTM
Cortex™-A15	PTM
Cortex-A7	ETM v3.5
Cortex-A5	ETM v3.5
Cortex-A8	ETM v3.3
Cortex-A9	PTM
Cortex-R4	ETM v3.3
Cortex-R5	ETM v3.3
Cortex-R7	ETM v4
Cortex-M3	ETM v3.4
Cortex-M4	ETM v3.4
ARM9 series	ETM v1.x is not supported.
ARM11 series	ETM v3.1

- The CTI devices are not used for other operations.
- In a target containing multiple CoreSight ETBs, TPIUs or trace funnels, the import utility produces configuration for the first example of each trace funnel, ETB, and TPIU with the lowest base address.

Limitations

It is only possible to import platforms that can be auto-configured using the Debug Hardware Configuration utility or from a model.

To see a list of the processors supported by DS-5 you can run the import utility with the `--list-cores` option (-1).

The import utility produces a basic configuration with appropriate processor and CP15 register sets.

Related Tasks

Adding a new platform on page 39.

Adding a new configuration database to DS-5 on page 41.

Related References

Configuration database panel on page 278.

2.8 Adding a new platform

Describes how to create a new configuration database containing a new platform for use with DS-5.

Procedure

1. Launch a command-line console:
 - On Windows, select **Start > All Programs > ARM DS-5 > DS-5 Command Prompt**.
 - On Linux:
 1. Add the *install_directory/bin* directory to your PATH environment variable. If it is already configured then you can skip this step.
 2. Open a Unix bash shell.

2. Launch the import utility using the following command-line syntax:

```
cdbimporter --help
cdbimporter [--cdb=cdbpath] --list-cores
cdbimporter [--cdb=cdbpath] [--target-cdb=targetpath] {file.rvc | --
model=modelpath}} [option]...
```

where:

--help

Displays a summary of the main command-line options.

--list-cores

lists all the processors defined by the database supplied in the **--cdb** option.

--cdb=cdbpath

Specifies a path to the source configuration database (as shipped in DS-5) containing processor and register definitions to identify the target.

--target-cdb=targetpath

Directory where the destination database is to reside. ARM recommends that you build separate configuration databases in your own workspace to avoid accidental loss of data when updating DS-5. You can specify multiple configuration databases in DS-5 using the **Preferences** dialog. This enables platforms in the new database to use existing processor and register definitions.

file.rvc

Imports from a configuration file (.rvc). You can use the Debug Hardware Configuration utility, **dbghwconfig** or **rviconfig** to connect to the target and save the information in a file. The resultant file contains limited debug and trace support for the platform that can be used to populate the DS-5 configuration database.

--model=modelpath

Imports from a model that provides a CADI server.

- If you supply the *modelpath* to the model executable, the utility launches the model for interrogation so that it can determine the connection settings that DS-5 uses to automatically launch the model on connection.
- If you do not supply the *modelpath* to the model executable, you can force the utility to search for a running model to interrogate. You can then manually enter the data for the connection to the model. For example, processors names, IDs, and processor definitions. If you use this option then you must launch the model manually before connecting DS-5 to it.

option

Where *option* can be any of the following:

--no-ctis

Disables the use of *Cross Trigger Interface* (CTI) synchronization in the resulting platform.

--no-trace

Disables the use of trace components in the resulting platform.

--use-defaults

Displays default input when the database requires a user input. This does not apply to the output database path.

--toolkit=*key*

Specifies a comma separated list of toolkits.

3. During the import process, the import utility enables you to modify details about the processors of the new platform. Follow the instructions in the command-line prompts.

On successful completion a new configuration database is created containing the new platform that can be added to DS-5.

Related Concepts

About the target configuration import utility on page 37.

Related Tasks

Adding a new configuration database to DS-5 on page 41.

Related References

Configuration database panel on page 278.

2.9 Adding a new configuration database to DS-5

Describes how to add a new configuration database to DS-5.

Procedure

1. Launch Eclipse.
2. Select **Preferences** from **Windows** menu.
3. Expand the **DS-5** configuration group.
4. Select **Configuration Database**.
5. Click **Add...** to locate the new database:
 - a) Select the entire directory.
 - b) Click **OK** to close the dialog box.
6. Position the new database:
 - a) Select the new database.
 - b) Click **Up** or **Down** as required.

Note

DS-5 provides built-in databases containing a default set of target configurations. You can enable or disable these but not delete them.

7. Click **Rebuild database...**
8. Click **OK** to close the dialog box and save the settings.

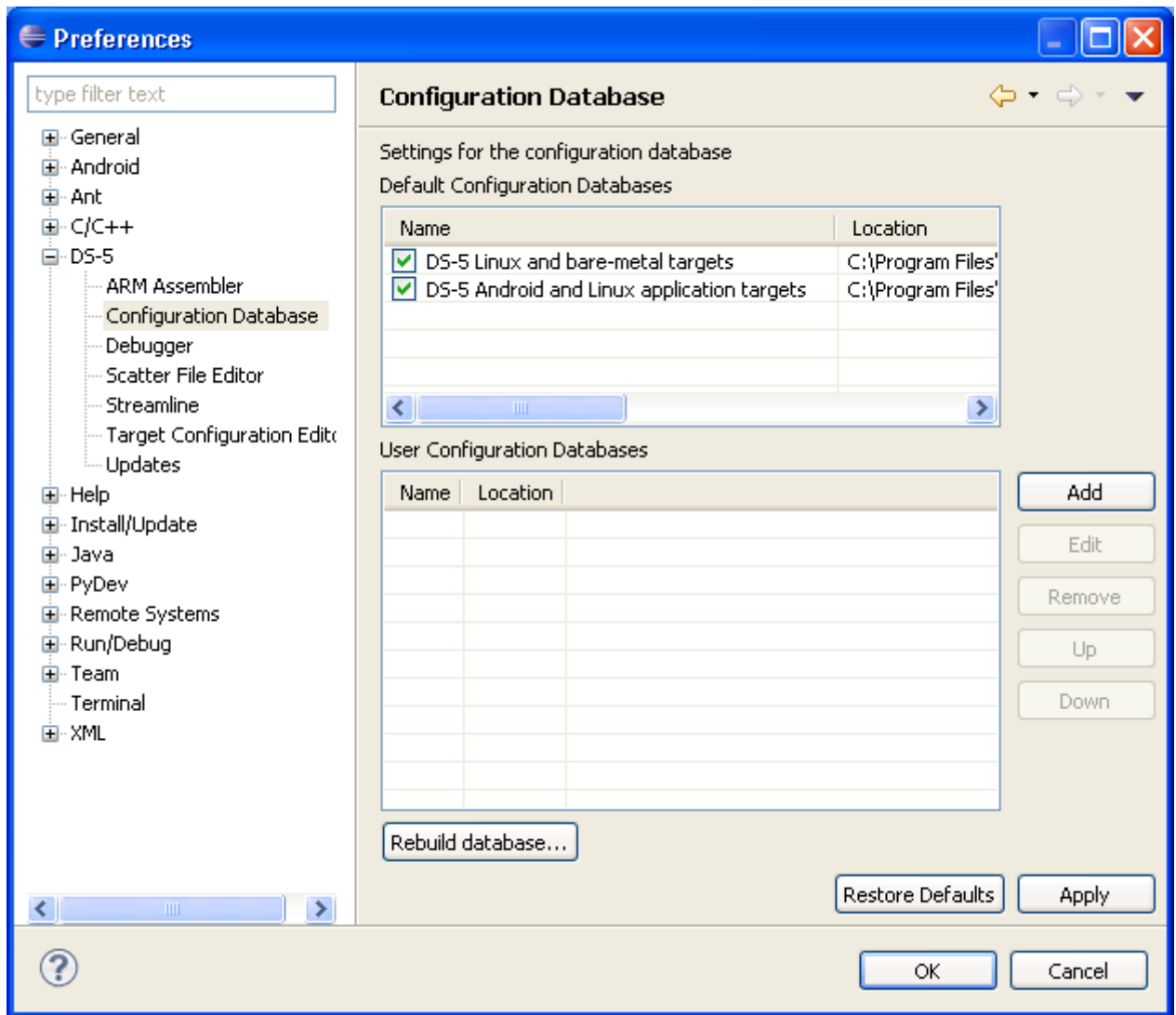


Figure 2-1 Adding a new configuration database

Note

DS-5 processes the databases from top to bottom with the information in the lower databases replacing information in the higher databases. For example, if you want to produce a modified Cortex-A15 processor definition with different registers then those changes can be added to a new database that resides lower down in the list.

Related Concepts

About the target configuration import utility on page 37.

Related Tasks

Adding a new platform on page 39.

Related References

Configuration database panel on page 278.

2.10 Exporting an existing launch configuration

Describes how to export an existing launch configuration.

Procedure

1. Select **Export...** from the **File** menu.
2. In the Export dialog box, expand the **Run/Debug** group and select **Launch Configurations**.

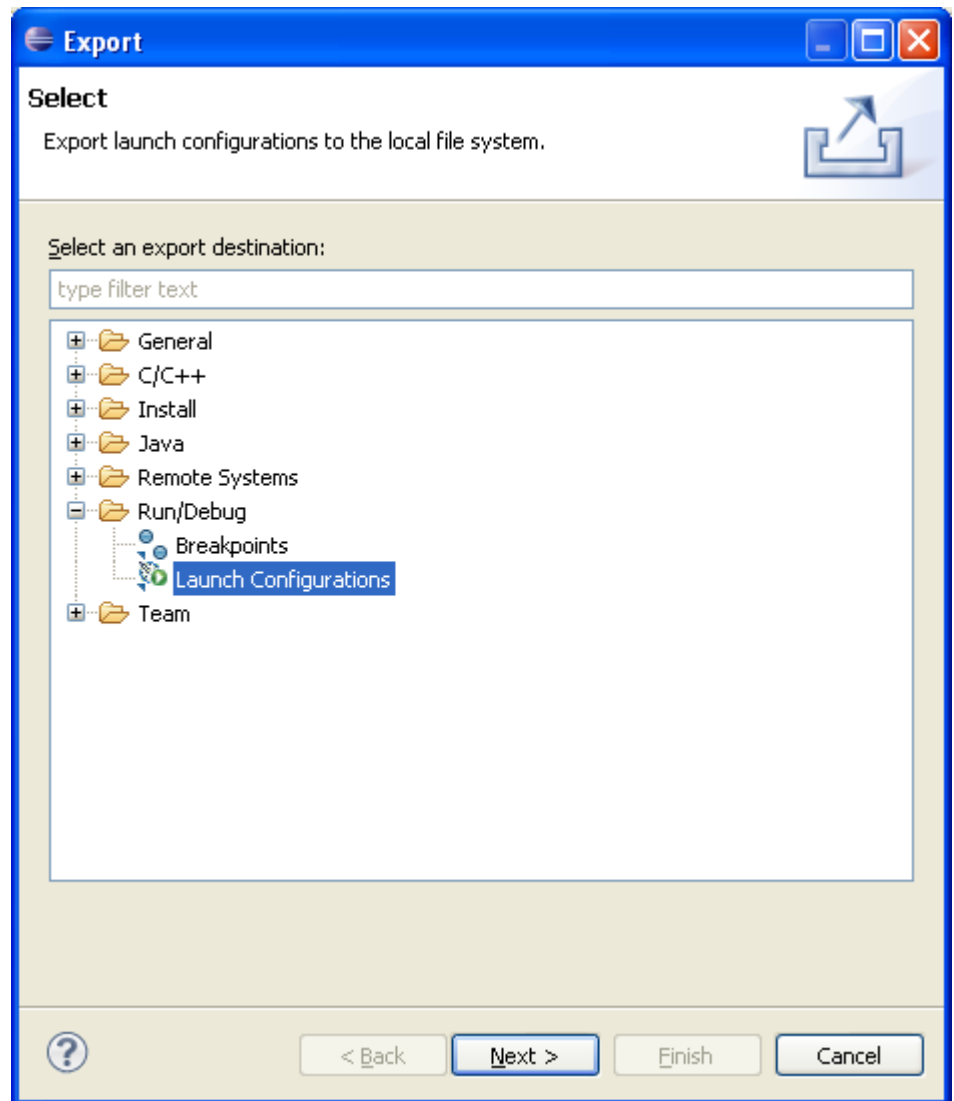


Figure 2-2 Export launch configuration dialog box

3. Click on **Next**.
4. In the Export Launch Configurations dialog box:
 - a) Expand the **DS-5 Debugger** group and then select one or more launch configurations.
 - b) Click on **Browse...** to select the required location in the local file system.
 - c) Select the folder and then click **OK**.

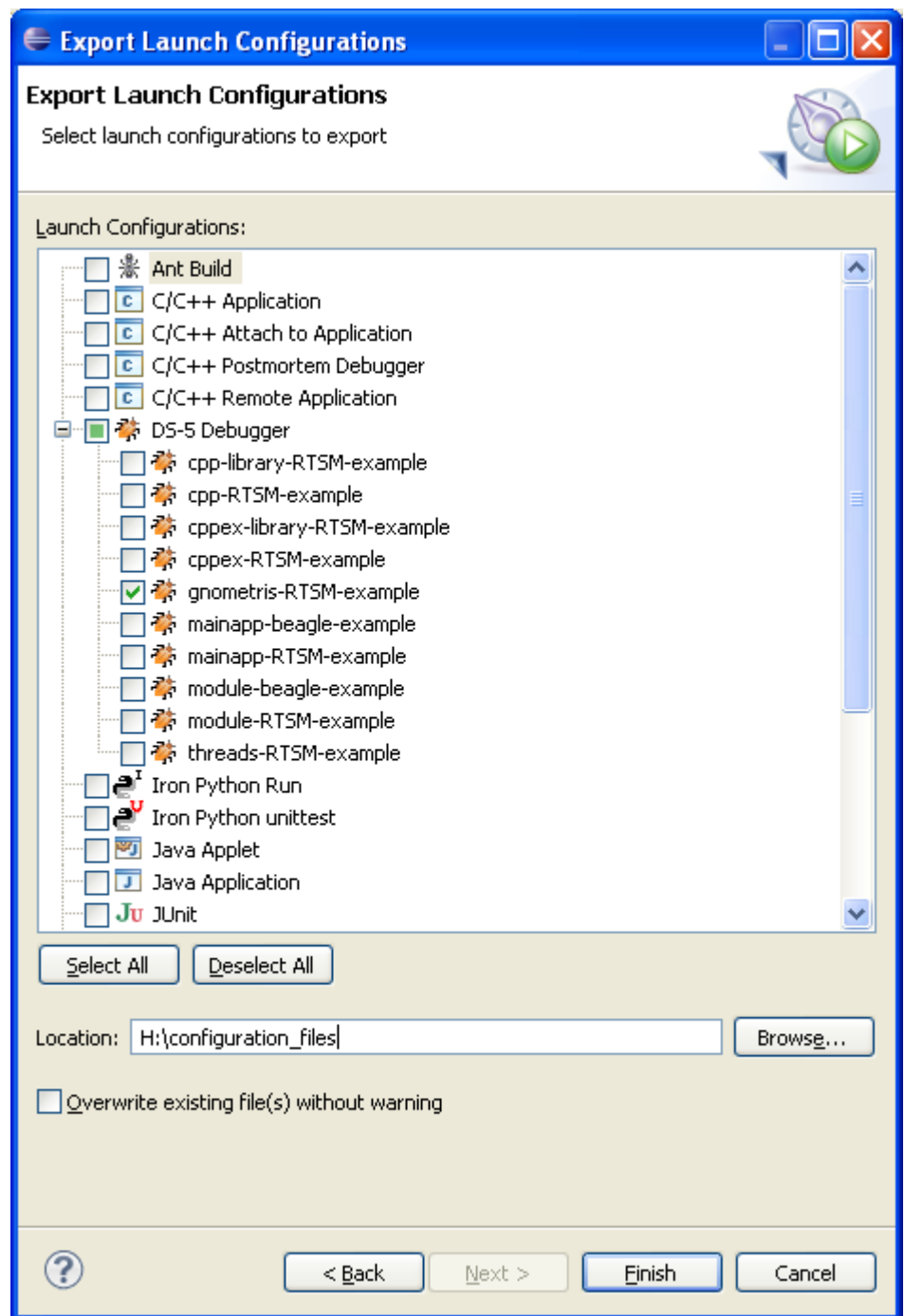


Figure 2-3 Launch configuration selection panels

5. If required, select **Overwrite existing file(s) without warning**.
6. Click on **Finish**.

Related Tasks

Importing an existing launch configuration on page 46.
Configuring a connection to a Fixed Virtual Platform (FVP) on page 27.
Configuring a connection to a Linux target using gdbserver on page 29.
Configuring a connection to a Linux Kernel on page 31.

Configuring a connection to a bare-metal target on page 33.

Configuring an Event Viewer connection to a bare-metal target on page 35.

2.11 Importing an existing launch configuration

Describes how to import an existing launch configuration into Eclipse.

Procedure

1. Select **Import...** from the **File** menu.
2. In the Import dialog box, expand the **Run/Debug** group and select **Launch Configurations**.

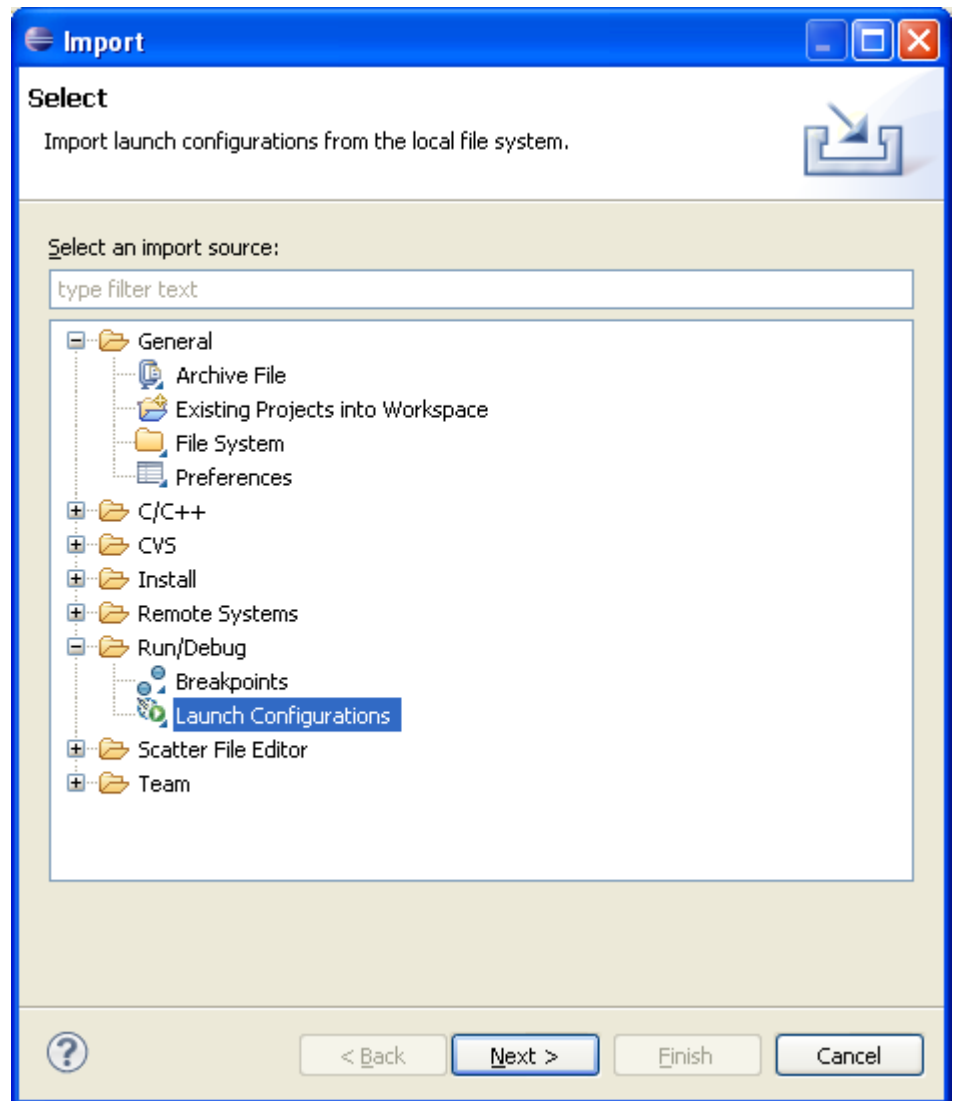


Figure 2-4 Import launch configuration dialog box

3. Click on **Next**.
4. Click on **Browse...** to select the required location in the local file system.
5. Select the folder containing the launch files and then click **OK**.
6. Select the checkboxes for the required folder and launch file(s).

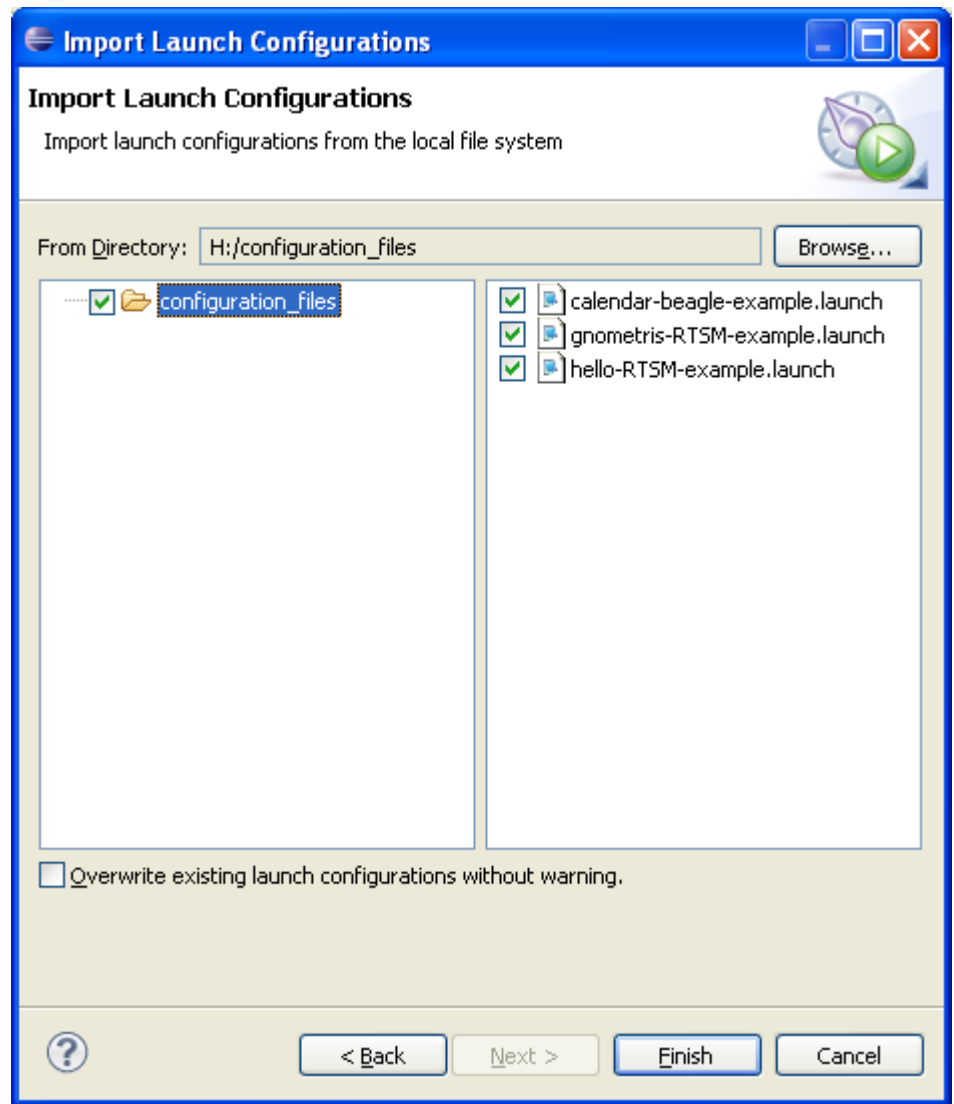


Figure 2-5 Launch configuration file selection panels

7. If you are replacing an existing configuration with the same name then select **Overwrite existing launch configurations without warning**.
8. Click on **Finish**.

Related Tasks

- Exporting an existing launch configuration on page 43.*
- Configuring a connection to a Fixed Virtual Platform (FVP) on page 27.*
- Configuring a connection to a Linux target using gdbserver on page 29.*
- Configuring a connection to a Linux Kernel on page 31.*
- Configuring a connection to a bare-metal target on page 33.*
- Configuring an Event Viewer connection to a bare-metal target on page 35.*

2.12 Disconnecting from a target

Describes how to disconnect from a target using the DS-5 Debug perspective.

Procedure

You can use either the **Debug Control** or **Commands** view as follows:

- Click on the **Disconnect from Target** toolbar icon in the **Debug Control** view.
- Alternatively, in the **Commands** view you can:
 1. Enter `quit` in the Command field.
 2. Click **Submit**.

Related References

Commands view on page 192.

Debug Control view on page 195.

DS-5 Debugger menu and toolbar icons on page 288.

Related Information

DS-5 Debugger commands.

Chapter 3

Working with the target configuration editor

Describes how to use the editor when developing a project for an ARM target. It contains the following:

- *About the target configuration editor on page 3-50.*
- *Target configuration editor - Overview tab on page 3-51.*
- *Target configuration editor - Memory tab on page 3-53.*
- *Target configuration editor - Peripherals tab on page 3-56.*
- *Target configuration editor - Registers tab on page 3-58.*
- *Target configuration editor - Group View tab on page 3-60.*
- *Target configuration editor - Enumerations tab on page 3-63.*
- *Target configuration editor - Configurations tab on page 3-65.*
- *Scenario demonstrating how to create a new target configuration file on page 3-67.*
- *Creating a power domain for a target on page 3-79.*
- *Creating a Group list on page 3-81.*
- *Importing an existing target configuration file on page 3-83.*
- *Exporting a target configuration file on page 3-85.*

3.1 About the target configuration editor

The target configuration editor provides forms and graphical views to easily create and edit *Target Configuration Files* (TCF) describing memory mapped peripheral registers present on a device. It also provides import and export wizards for compatibility with the file formats used in μ Vision System Viewer.

TCF files must have the file extension `.tcf` to invoke this editor.

If this is not the default editor, right-click on your source file in the **Project Explorer** view and select **Open With > Target Configuration Editor** from the context menu.

The target configuration editor also provides a hierarchical tree using the **Outline** view. Click on an entry in the **Outline** view to move the focus of the editor to the relevant tab and selected field. If this view is not visible, select **Window > Show View > Outline** from the main menu.

Directories containing TCF files can be specified in DS-5 Debugger launch configurations.

Related References

Target configuration editor - Overview tab on page 51.

Target configuration editor - Memory tab on page 53.

Target configuration editor - Peripherals tab on page 56.

Target configuration editor - Registers tab on page 58.

Target configuration editor - Group View tab on page 60.

Target configuration editor - Enumerations tab on page 63.

Target configuration editor - Configurations tab on page 65.

Debug Configurations - Files tab on page 262.

Scenario demonstrating how to create a new target configuration file on page 67.

3.2 Target configuration editor - Overview tab

A graphical view showing general information about the current target and summary information for all the tabs.

General Information	Unique Name	Unique board name (mandatory).
	Category	Name of the manufacturer.
	Inherits	Name of the board, memory region or peripheral to inherit data from. You must use the Includes panel to populate this drop-down menu.
	Endianness	Byte order of the target.
	TrustZone	TrustZone support for the target. If supported, the Memory and Peripheral tabs are displayed with a TrustZone Address Type field.
	Power Domain	Power Domain support for the target. If supported, the Memory and Peripheral tabs are displayed with a Power Domain Address Type field. Also, the Configurations tab includes an additional Power Domain Configurations group.
Description	Board description.	
Includes	Include files for use when inheriting target data that is defined in an external file. Populates the Inherits drop-down menu.	

The **Overview** tab also provides a summary of the other tabs available in this view, together with the total number of items defined in that view.

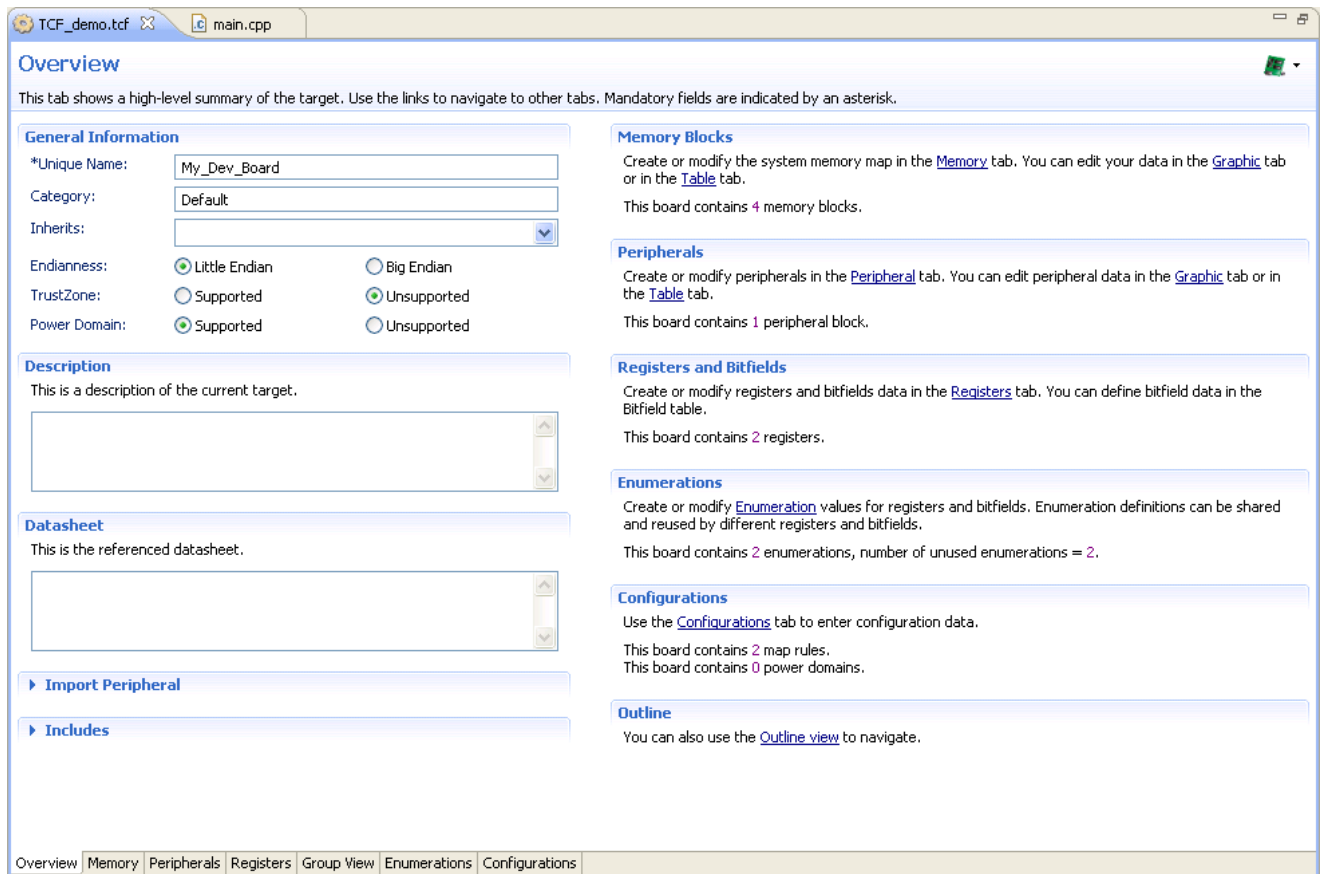


Figure 3-1 Target configuration editor - Overview tab

Mandatory fields are indicated by an asterisk. Toolbar buttons and error messages are displayed in the header panel as appropriate.

Related Concepts

About the target configuration editor on page 50.

Related Tasks

Creating a power domain for a target on page 79.

Related References

Target configuration editor - Memory tab on page 53.

Target configuration editor - Peripherals tab on page 56.

Target configuration editor - Registers tab on page 58.

Target configuration editor - Group View tab on page 60.

Target configuration editor - Enumerations tab on page 63.

Target configuration editor - Configurations tab on page 65.

Scenario demonstrating how to create a new target configuration file on page 67.

3.3 Target configuration editor - Memory tab

A graphical view or tabular view that enables you to define the attributes for each of the block of memory on your target. These memory blocks are used to ensure that your debugger accesses the memory on your target in the right way.

Graphical view

In the graphical view, the following display options are available:

View by Map Rule	Filter the graphical view based on the selected rule.
View by Address Type	Filter the graphical view based on secure or non-secure addresses. Available only when TrustZone is supported. You can select TrustZone support in the Overview tab.
View by Power Domain	Filter the graphical view based on the power domain. Available only when Power Domain is supported. You can select Power Domain support in the Overview tab.
Add button	Add a new memory region.
Remove button	Remove the selected memory region.

Graphical and tabular views

In both the graphical view and the tabular view, the following settings are available:

Unique Name	Name of the selected memory region (mandatory).
Name	User-friendly name for the selected memory region.
Description	Detailed description of the selected memory region.
Base Address	Absolute address or the Name of the memory region to use as a base address. The default is an absolute starting address of 0x0.
Offset	Offset that is added to the base address (mandatory).
Size	Size of the selected memory region in bytes (mandatory).
Width	Access width of the selected memory region.
Access	Access mode for the selected memory region.
Apply Map Rule (graphical view) Map Rule (tabular view)	Mapping rule to be applied to the selected memory region. You can use the Map Rules tab to create and modify rules for control registers.
More... (tabular view)	In the tabular view, the ... button is displayed when you select More... cell. Click the ... button to display the Context and Parameters dialog box.

Context

Debugger plug-in. If you want to pass parameters to a specific debugger, select a plug-in and enter the associated parameters.

Parameters

Parameters associated with the selected debugger plug-in. Select the required debugger plug-in from the **Context** drop-down menu to enter parameters for that debugger plug-in.

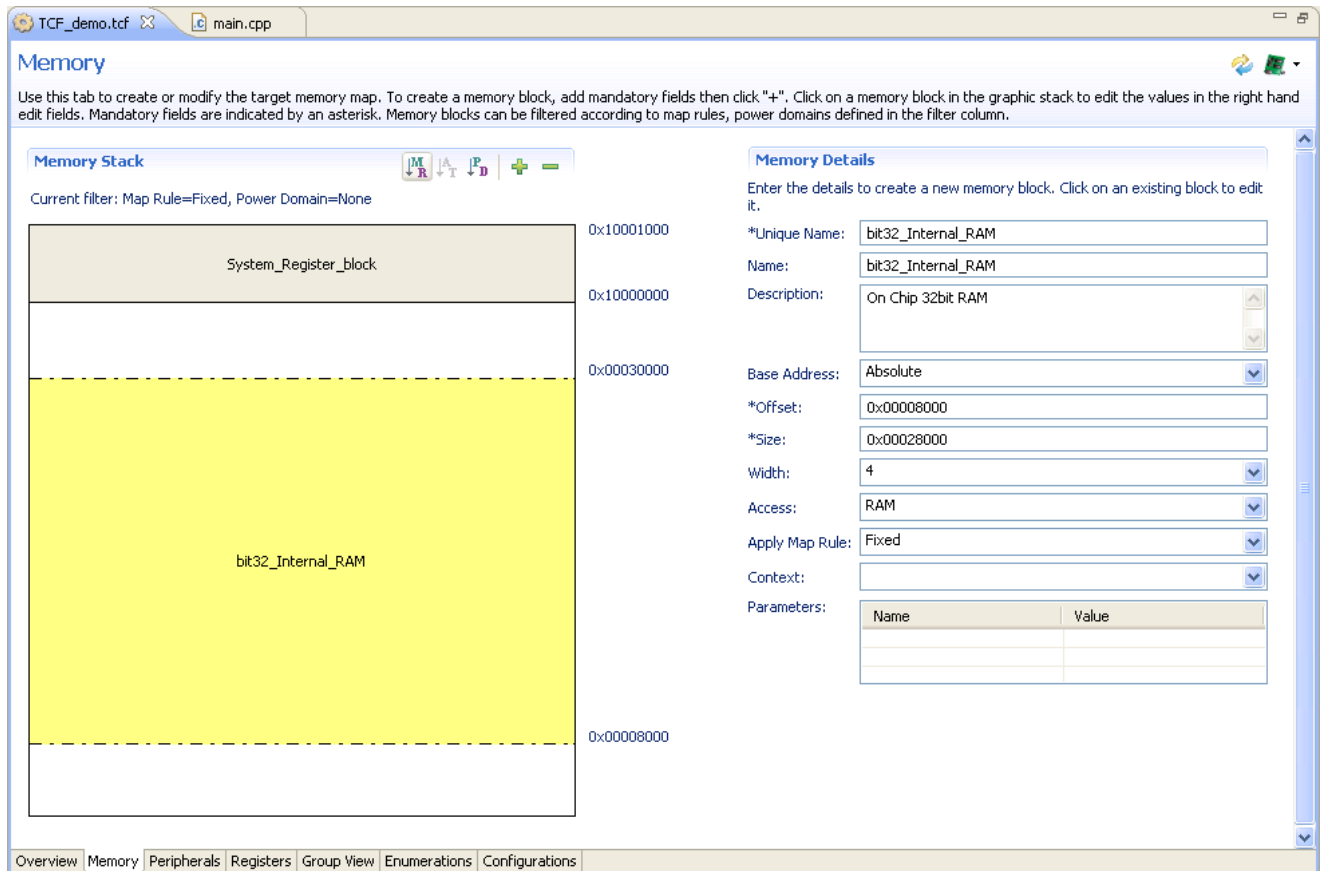


Figure 3-2 Target configuration editor - Memory tab

Mandatory fields are indicated by an asterisk. Toolbar buttons and error messages are displayed in the header panel as appropriate.

Related Concepts

About the target configuration editor on page 50.

Related Tasks

Creating a memory map on page 68.

Creating a memory region for remapping by a control register on page 75.

Applying the map rules to the overlapping memory regions on page 76.

Related References

Target configuration editor - Overview tab on page 51.

Target configuration editor - Peripherals tab on page 56.

Target configuration editor - Registers tab on page 58.

Target configuration editor - Group View tab on page 60.

Target configuration editor - Enumerations tab on page 63.
Target configuration editor - Configurations tab on page 65.

3.4 Target configuration editor - Peripherals tab

A graphical view or tabular view that enables you to define peripherals on your target. They can then be mapped in memory, for display and control, and accessed for block data, when available. You define the peripheral in terms of the area of memory it occupies.

Graphical view

In the graphical view, the following display options are available:

View by Address Type	Filter the graphical view based on secure or non-secure addresses. Available only when TrustZone is supported. You can select TrustZone support in the Overview tab.
View by Power Domain	Filter the graphical view based on the power domain. Available only when Power Domain is supported. You can select Power Domain support in the Overview tab.
Add button	Add a new peripheral.
Remove button	Remove the selected peripheral and, if required, the associated registers.

Graphical and tabular views

In both the graphical view and the tabular view, the following settings are available:

Unique Name	Name of the selected peripheral (mandatory).
Name	User-friendly name for the selected peripheral.
Description	Detailed description of the selected peripheral.
Base Address	Absolute address or the Name of the memory region to use as a base address. The default is an absolute starting address of 0x0.
Offset	Offset that is added to the base address (mandatory).
Size	Size of the selected peripheral in bytes.
Width	Access width of the selected peripheral in bytes.
Access	Access mode for the selected peripheral.

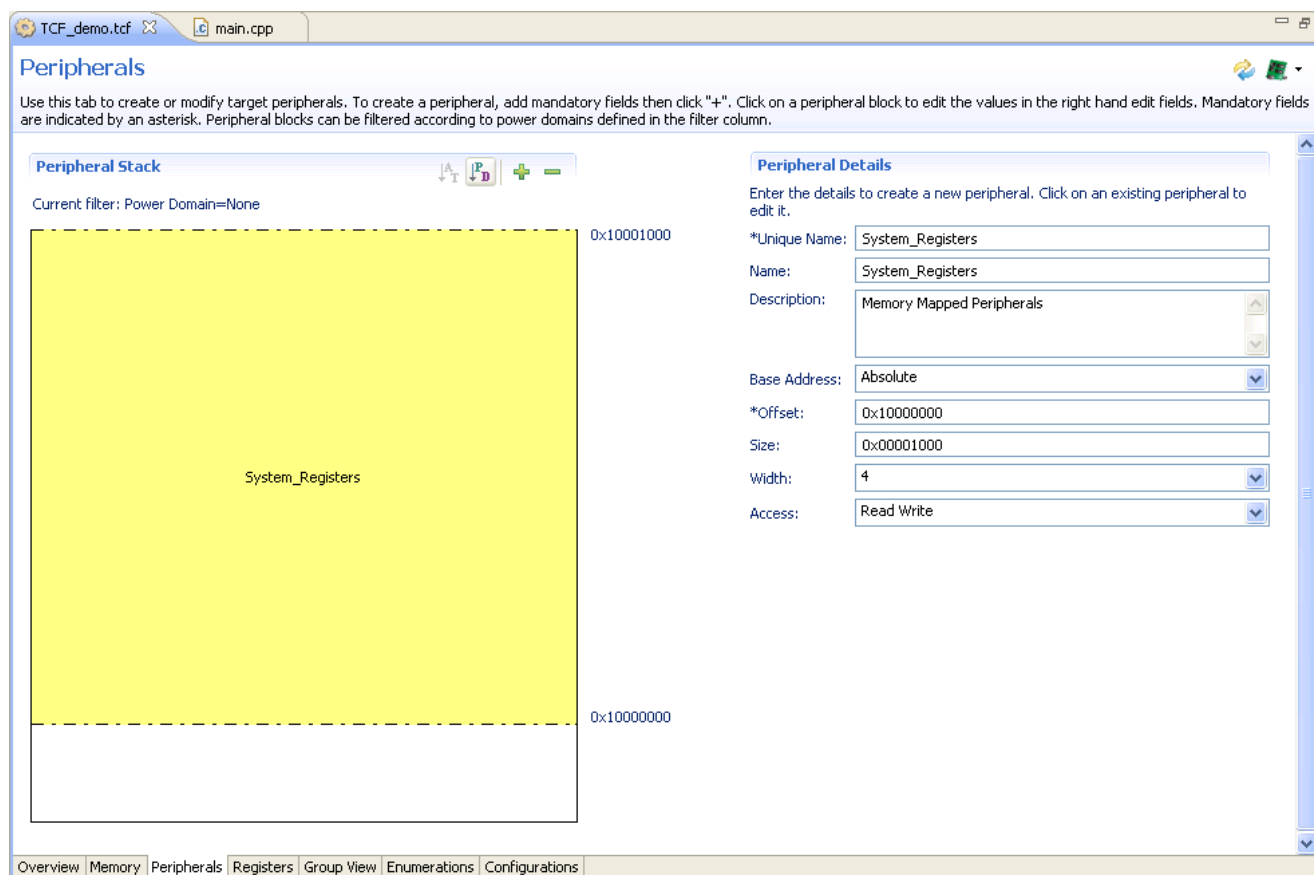


Figure 3-3 Target configuration editor - Peripherals tab

Mandatory fields are indicated by an asterisk. Toolbar buttons and error messages are displayed in the header panel as appropriate.

Related Concepts

About the target configuration editor on page 50.

Related Tasks

Creating a peripheral on page 69.

Related References

Target configuration editor - Overview tab on page 51.

Target configuration editor - Memory tab on page 53.

Target configuration editor - Registers tab on page 58.

Target configuration editor - Group View tab on page 60.

Target configuration editor - Enumerations tab on page 63.

Target configuration editor - Configurations tab on page 65.

3.5 Target configuration editor - Registers tab

A tabular view that enables you to define memory mapped registers for your target. Each register is named and typed and can be subdivided into bit fields (any number of bits) which act as subregisters.

Unique Name	Name of the register (mandatory).
Name	User-friendly name for the register.
Base Address	Absolute address or the Name of the memory region to use as a base address. The default is an absolute starting address of <code>0x0</code> .
Offset	Offset that is added to the base address (mandatory).
Size	Size of the register in bytes (mandatory).
Access size	Access width of the register in bytes.
Access	Access mode for the selected register.
Description	Detailed description of the register.
Peripheral	Associated peripheral, if applicable.

The **Bitfield** button opens a table displaying the following information:

Unique Name	Name of the selected bitfield (mandatory).
Name	User-friendly name for the selected bitfield.
Low Bit	Zero indexed low bit number for the selected bitfield (mandatory).
High Bit	Zero indexed high bit number for the selected bitfield (mandatory).
Access	Access mode for the selected bitfield.
Description	Detailed description of the selected bitfield.
Enumeration	Associated enumeration for the selected bitfield, if applicable.

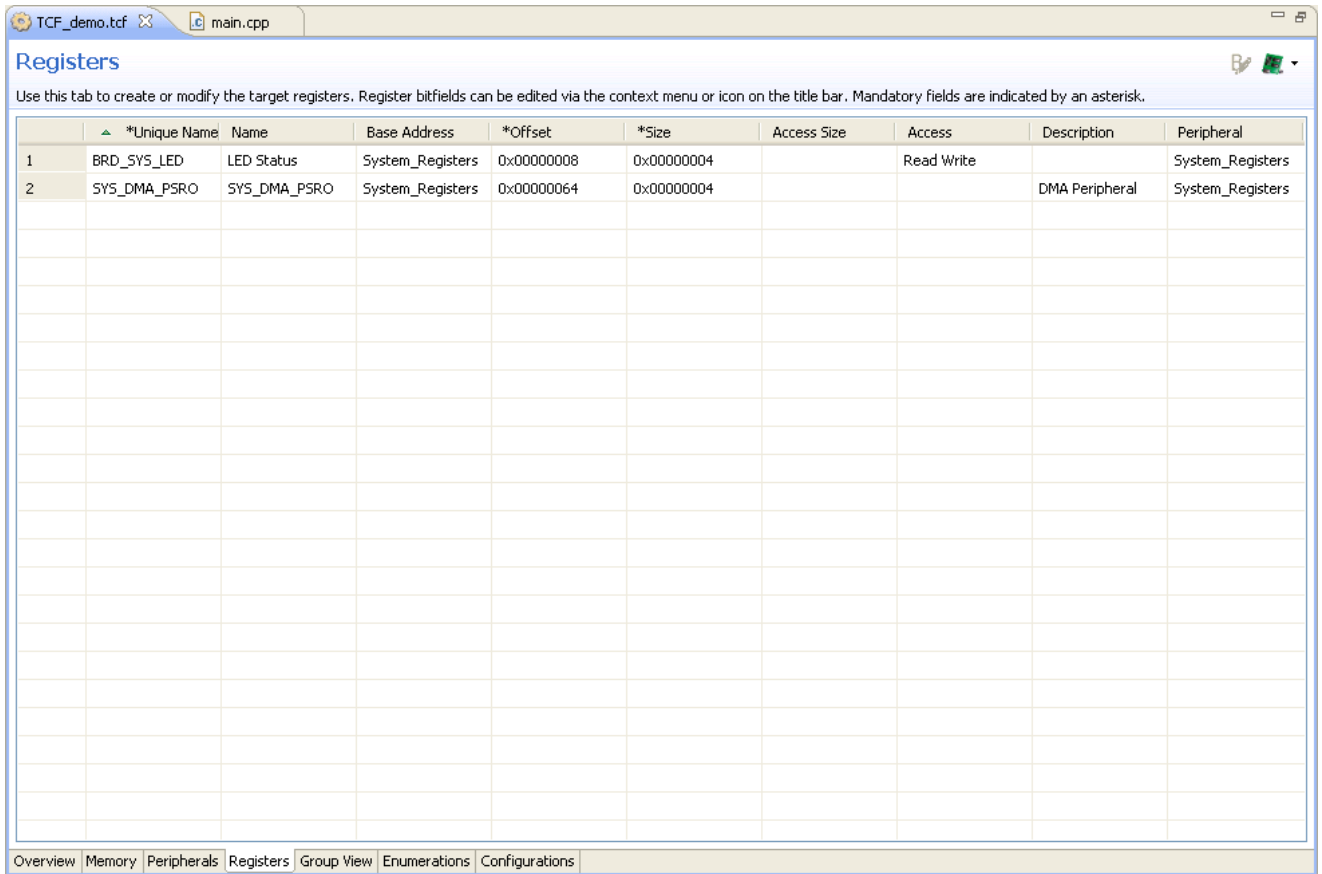


Figure 3-4 Target configuration editor - Registers tab

Mandatory fields are indicated by an asterisk. Toolbar buttons and error messages are displayed in the header panel as appropriate.

Related Concepts

About the target configuration editor on page 50.

Related Tasks

Creating a standalone register on page 70.

Creating a peripheral register on page 71.

Assigning enumerations to a peripheral register on page 73.

Creating enumerations for use with a peripheral register on page 72.

Assigning enumerations to a peripheral register on page 73.

Related References

Target configuration editor - Overview tab on page 51.

Target configuration editor - Memory tab on page 53.

Target configuration editor - Peripherals tab on page 56.

Target configuration editor - Group View tab on page 60.

Target configuration editor - Enumerations tab on page 63.

Target configuration editor - Configurations tab on page 65.

3.6 Target configuration editor - Group View tab

A list view that enables you to select peripherals for use by the debugger.

Group View List	Empty list that enables you to add frequently used peripherals to the debugger.	
	Add a new group	Creates a group that you can personalize with peripherals.
	Remove the selected group	Removes a group from the list.
Available Peripheral List	A list of the available peripherals. You can select peripherals from this view to add to the Group View List .	

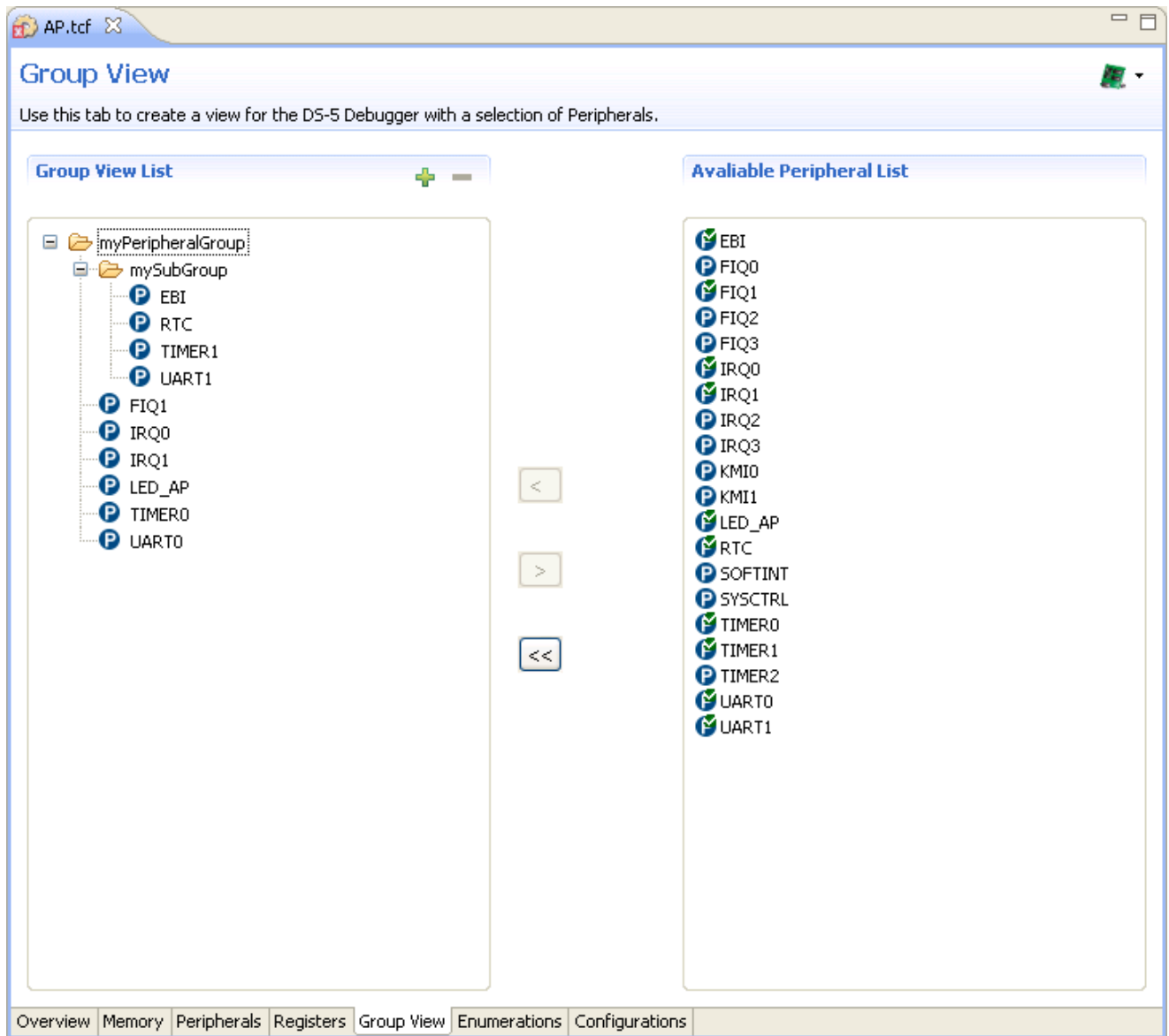


Figure 3-5 Target configuration editor - Group View tab

Mandatory fields are indicated by an asterisk. Toolbar buttons and error messages are displayed in the header panel as appropriate.

Related Concepts

About the target configuration editor on page 50.

Related Tasks

Creating a Group list on page 81.

Related References

Target configuration editor - Overview tab on page 51.

Target configuration editor - Memory tab on page 53.

Target configuration editor - Peripherals tab on page 56.

Target configuration editor - Registers tab on page 58.

Target configuration editor - Enumerations tab on page 63.

Target configuration editor - Configurations tab on page 65.

3.7 Target configuration editor - Enumerations tab

A tabular view that enables you to assign values to meaningful names for use by registers you have defined. Enumerations can be used, instead of values, when a register is displayed in the **Registers** view. This setting enables you to define the names associated with different values. Names defined in this group are displayed in the **Registers** view, and can be used to change register values.

Register bit fields are numbered 0, 1, 2,... regardless of their position in the register.

For example, you might want to define **ENABLED** as 1 and **DISABLED** as 0.

The following settings are available:

Unique Name Name of the selected enumeration (mandatory).

Value Definitions specified as comma separated values for selection in the **Registers** tab (mandatory).

Description Detailed description of the selected enumeration.

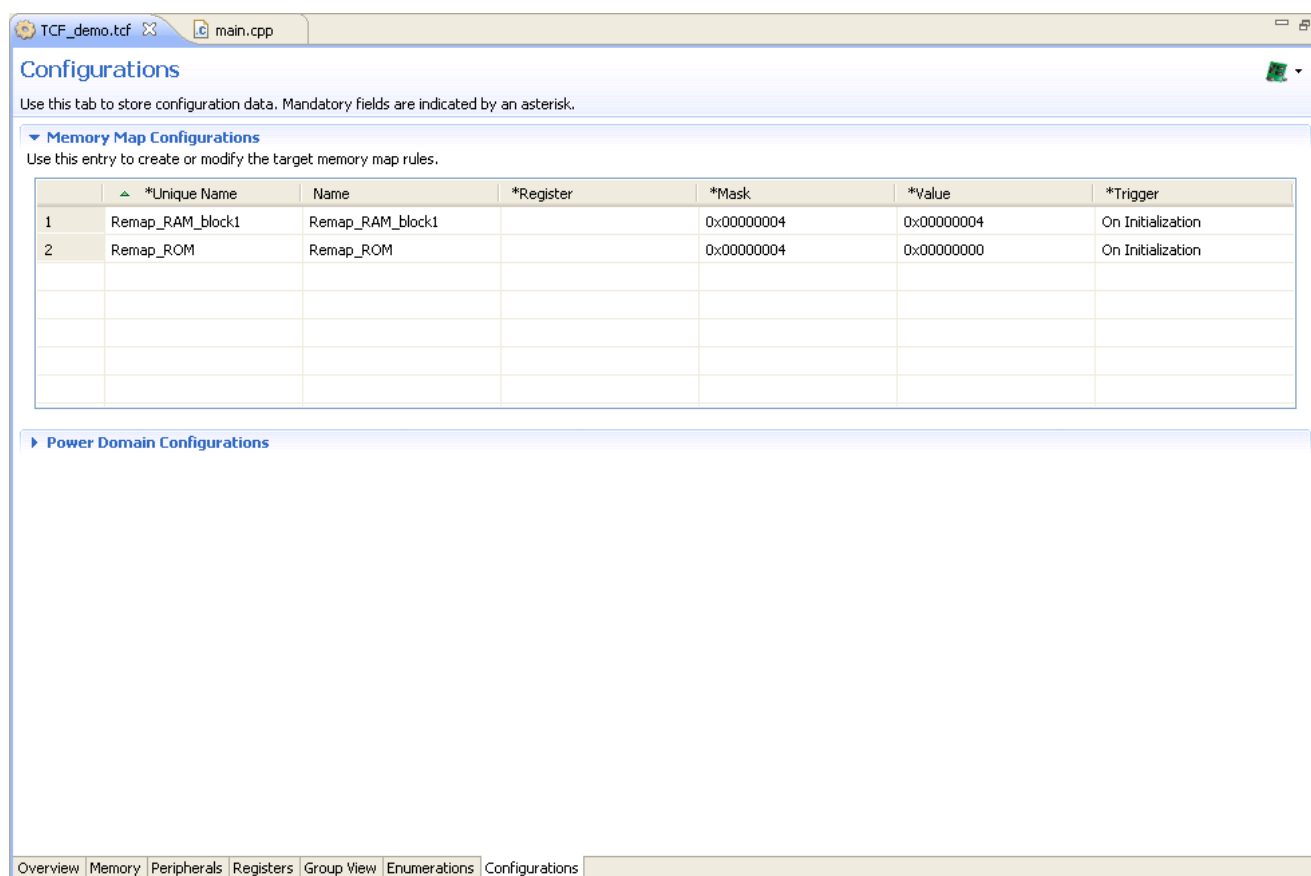


Figure 3-6 Target configuration editor - Enumerations tab

Mandatory fields are indicated by an asterisk. Toolbar buttons and error messages are displayed in the header panel as appropriate.

Related Concepts

About the target configuration editor on page 50.

Related Tasks

Creating enumerations for use with a peripheral register on page 72.

Assigning enumerations to a peripheral register on page 73.

Related References

Target configuration editor - Overview tab on page 51.

Target configuration editor - Memory tab on page 53.

Target configuration editor - Peripherals tab on page 56.

Target configuration editor - Registers tab on page 58.

Target configuration editor - Group View tab on page 60.

Target configuration editor - Configurations tab on page 65.

3.8 Target configuration editor - Configurations tab

A tabular view that enables you to:

- Define rules to control the enabling and disabling of memory blocks using target registers. You specify a register to be monitored, and when the contents match a given value, a set of memory blocks is enabled. You can define several map rules, one for each of several memory blocks.
- Define power domains that are supported on your target.

Memory Map Configurations group

The following settings are available in the **Memory Map Configurations** group:

Unique Name	Name of the rule (mandatory).
Name	User-friendly name for the rule.
Register	Associated control register (mandatory).
Mask	Mask value (mandatory).
Value	Value for a condition (mandatory).
Trigger	Condition that changes the control register mapping (mandatory).

Power Domain Configurations group

The **Power Domain Configurations** group

The following settings are available in this group, and all are mandatory:

Unique Name	Name of the power domain.
Wake-up Conditions	User-friendly name for the rule:
Register	An associated control register that you have previously created.
Mask	Mask value.
Value	Value for a condition.
Power State	The power state of the power domain: <ul style="list-style-type: none"> • Active. • Inactive. • Retention. • Off.

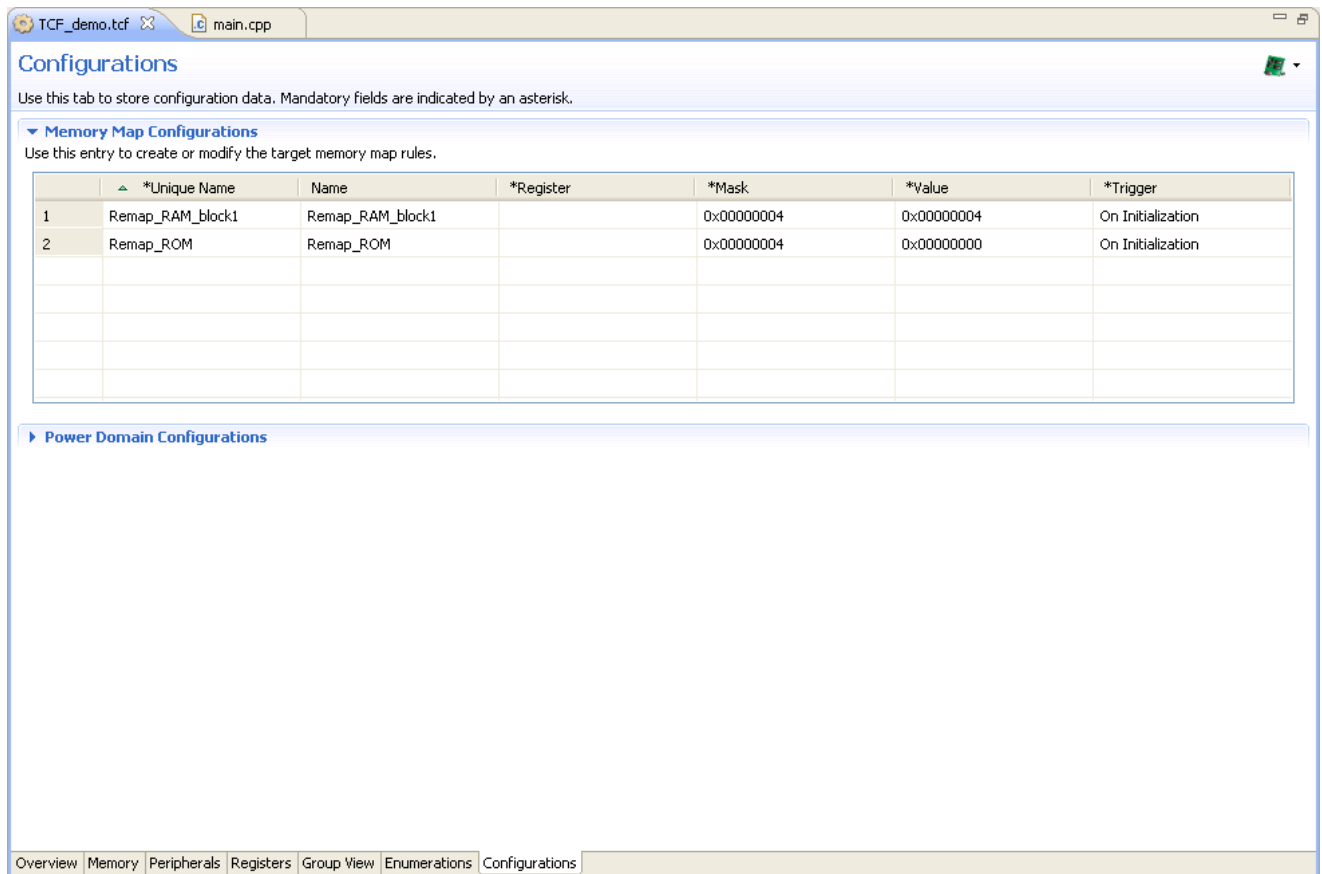


Figure 3-7 Target configuration editor - Configuration tab

Mandatory fields are indicated by an asterisk. Toolbar buttons and error messages are displayed in the header panel as appropriate.

Related Concepts

About the target configuration editor on page 50.

Related Tasks

Creating a standalone register on page 70.

Creating remapping rules for a control register on page 74.

Creating a power domain for a target on page 79.

Related References

Target configuration editor - Overview tab on page 51.

Target configuration editor - Memory tab on page 53.

Target configuration editor - Peripherals tab on page 56.

Target configuration editor - Registers tab on page 58.

Target configuration editor - Group View tab on page 60.

Target configuration editor - Enumerations tab on page 63.

3.9 Scenario demonstrating how to create a new target configuration file

This is a fictitious scenario to demonstrate how to create a new Target Configuration File (TCF) containing the following memory map and register definitions. The individual tasks required to complete each step of this tutorial are listed below.

- Boot ROM: 0x0 - 0x8000
- SRAM: 0x0 - 0x8000
- Internal RAM: 0x8000 - 0x28000
- System Registers that contain memory mapped peripherals:

0x10000000 - 0x10001000.

— A basic standalone LED register. This register is located at 0x10000008 and is used to write a hexadecimal value that sets the corresponding bits to 1 to illuminate the respective LEDs.

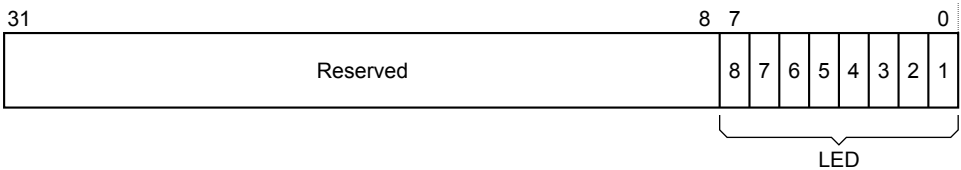


Figure 3-8 LED register and bitfields

— DMA map register. This register is located at 0x10000064 and controls the mapping of external peripheral DMA request and acknowledge signals to DMA channel 0.

Table 3-1 DMA map register SYS_DMPSR0

Bits [31:8]	-	Reserved. Use read-modify-write to preserve value
Bit [7]	Read/Write	Set to 1 to enable mapping of external peripheral DMA signals to the DMA controller channel.
Bits [6:5]	-	Reserved. Use read-modify-write to preserve value
Bits [4:0]	Read/Write	FPGA peripheral mapped to this channel

b00000 = AACI Tx
b00001 = AACI Rx
b00010 = USB A
b00011 = USB B
b00100 = MCI 0

— The core module and LCD control register. This register is located at 0x1000000c and controls a number of user-configurable features of the core module and the display interface on the baseboard.

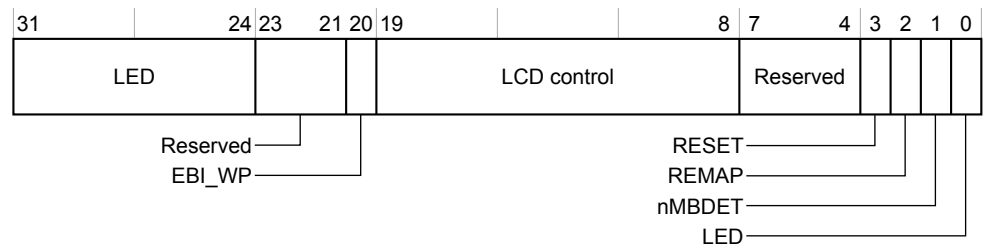


Figure 3-9 Core module and LCD control register

This register uses bit 2 to control the remapping of an area of memory as shown in the following table.

Table 3-2 Control bit that remaps an area of memory

Bits	Name	Access	Function
[2]	REMAP	Read/Write	0 = Flash ROM at address 0 1 = SRAM at address 0.

- Clearing bit 2 (CM_CTRL = 0) generates the following memory map:

0x0000 - 0x8000	Boot_ROM
0x8000 - 0x28000	32bit_RAM

- Setting bit 2 (CM_CTRL = 1) generates the following memory map:

0x0000 - 0x8000	32bit_RAM_block1_alias
0x8000 - 0x28000	32bit_RAM

It contains the following:

- [Creating a memory map on page 3-68.](#)
- [Creating a peripheral on page 3-69.](#)
- [Creating a standalone register on page 3-70.](#)
- [Creating a peripheral register on page 3-71.](#)
- [Creating enumerations for use with a peripheral register on page 3-72.](#)
- [Assigning enumerations to a peripheral register on page 3-73.](#)
- [Creating remapping rules for a control register on page 3-74.](#)
- [Creating a memory region for remapping by a control register on page 3-75.](#)
- [Applying the map rules to the overlapping memory regions on page 3-76.](#)

3.9.1 Creating a memory map

Describes how to create a new memory map.

Procedure

- Add a new file with the .tcf file extension to an open project.
The editor opens with the **Overview** tab activated.
- Click on the **Overview** tab, enter a unique board name, for example: My-Dev-Board.
- Click on the **Memory** tab.
- Click the **Switch to table** button in the top right of the view.
- Enter the data as shown in the following figure.

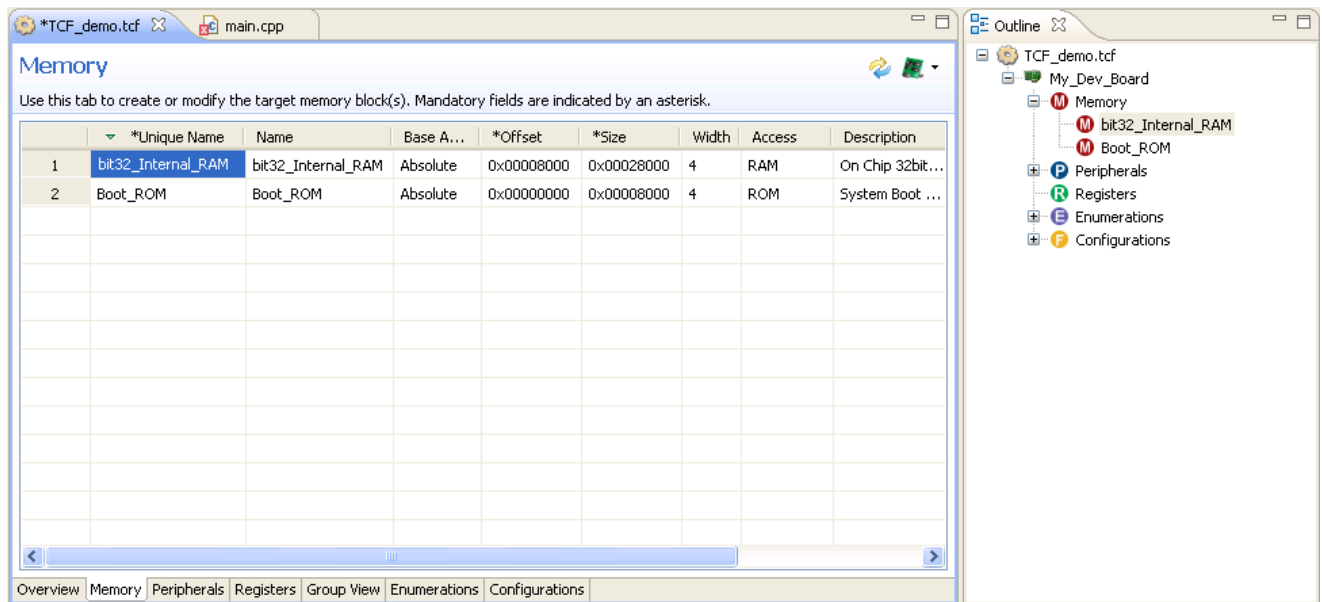


Figure 3-10 Creating a Memory map

On completion, you can switch back to the graphical view to see the color coded stack of memory regions.

Related Tasks

- [Creating a peripheral on page 69.](#)
- [Creating a standalone register on page 70.](#)
- [Creating a peripheral register on page 71.](#)
- [Creating enumerations for use with a peripheral register on page 72.](#)
- [Assigning enumerations to a peripheral register on page 73.](#)
- [Creating remapping rules for a control register on page 74.](#)
- [Creating a memory region for remapping by a control register on page 75.](#)
- [Applying the map rules to the overlapping memory regions on page 76.](#)

Related References

- [Scenario demonstrating how to create a new target configuration file on page 67.](#)
- [Target configuration editor - Memory tab on page 53.](#)

3.9.2 Creating a peripheral

Describes how to create a peripheral.

Procedure

1. Click on the **Peripherals** tab.
2. Click the **Switch to table** button in the top right of the view.
3. Enter the data as shown in the following figure.

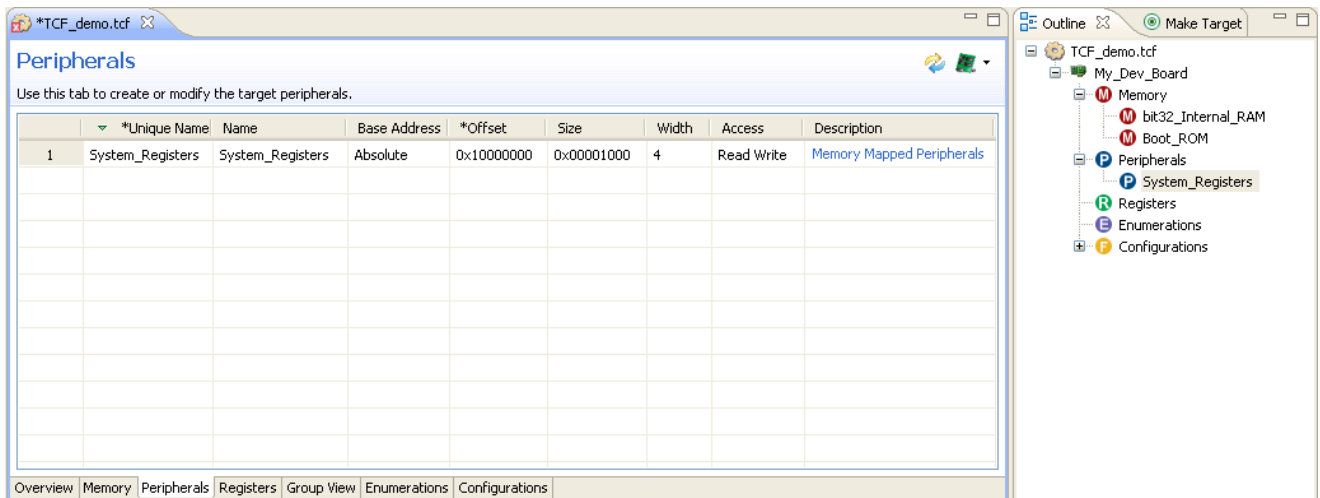


Figure 3-11 Creating a peripheral

On completion, you can switch back to the graphical view to see the color coded stack of peripherals.

Related Tasks

- [Creating a memory map on page 68.](#)
- [Creating a standalone register on page 70.](#)
- [Creating a peripheral register on page 71.](#)
- [Creating enumerations for use with a peripheral register on page 72.](#)
- [Assigning enumerations to a peripheral register on page 73.](#)
- [Creating remapping rules for a control register on page 74.](#)
- [Creating a memory region for remapping by a control register on page 75.](#)
- [Applying the map rules to the overlapping memory regions on page 76.](#)

Related References

- [Scenario demonstrating how to create a new target configuration file on page 67.](#)
- [Target configuration editor - Peripherals tab on page 56.](#)

3.9.3 Creating a standalone register

Describes how to create a basic standalone register.

Procedure

1. Click on the **Registers** tab.
2. Enter the register data as shown in the following figure.
3. Bitfield data is entered in a floating table associated with the selected register. Select the Unique name field containing the register name, BRD_SYS_LED.
4. Click on the **Edit Bitfield** button in the top right corner of the view.
5. In the floating Bitfield table, enter the data as shown in the following figure. If required, you can dock this table below the register table by clicking on the title bar of the Bitfield table and dragging it to the base of the register table.

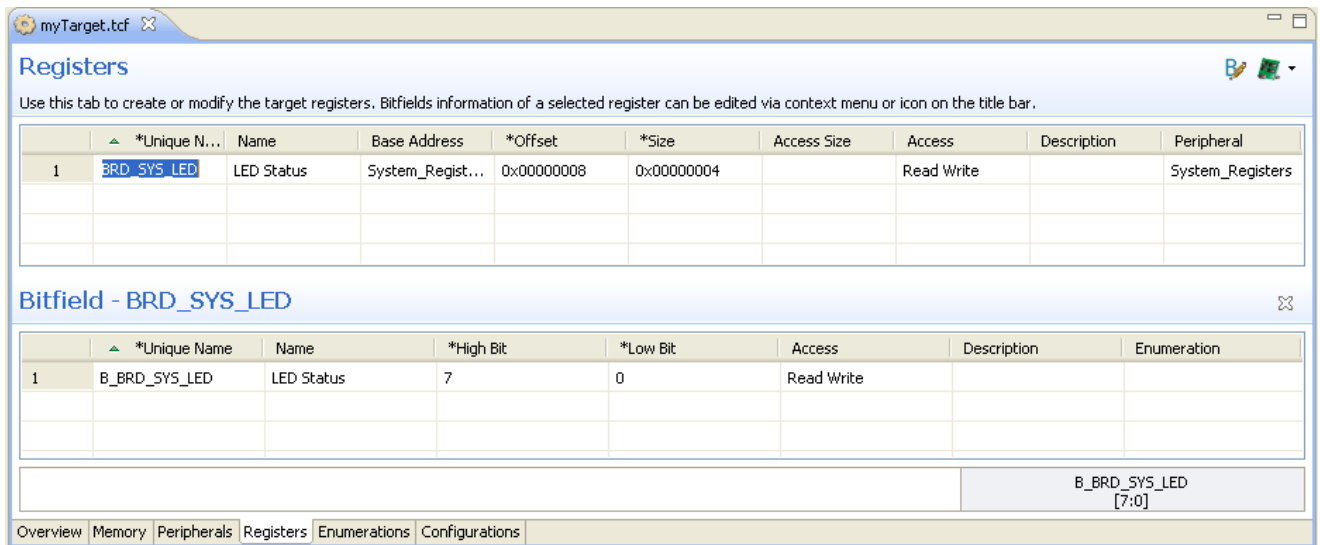


Figure 3-12 Creating a standalone register

On completion, close the floating table.

Related Tasks

- Creating a memory map on page 68.*
- Creating a peripheral on page 69.*
- Creating a peripheral register on page 71.*
- Creating enumerations for use with a peripheral register on page 72.*
- Assigning enumerations to a peripheral register on page 73.*
- Creating remapping rules for a control register on page 74.*
- Creating a memory region for remapping by a control register on page 75.*
- Applying the map rules to the overlapping memory regions on page 76.*

Related References

- Scenario demonstrating how to create a new target configuration file on page 67.*
- Target configuration editor - Registers tab on page 58.*
- Target configuration editor - Configurations tab on page 65.*

3.9.4 Creating a peripheral register

Describes how to create a peripheral register.

Procedure

1. Click on the **Registers** tab, if it is not already active.
2. Enter the peripheral register and associated bitfield data as shown in the following figure.

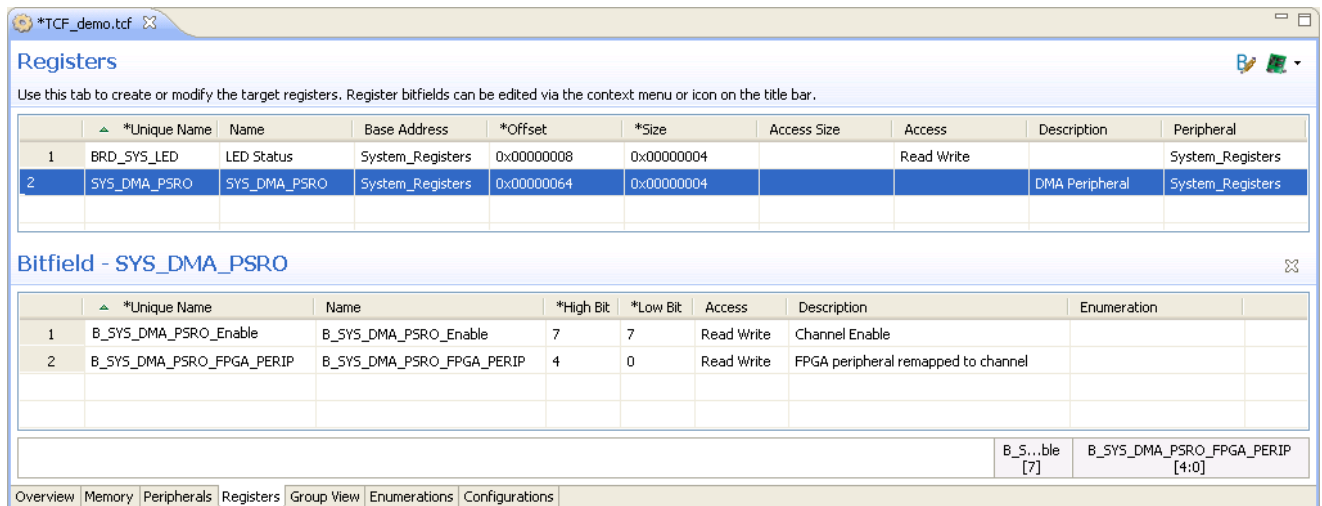


Figure 3-13 Creating a peripheral register

Related Tasks

- [Creating a memory map on page 68.](#)
- [Creating a peripheral on page 69.](#)
- [Creating a standalone register on page 70.](#)
- [Creating enumerations for use with a peripheral register on page 72.](#)
- [Assigning enumerations to a peripheral register on page 73.](#)
- [Creating remapping rules for a control register on page 74.](#)
- [Creating a memory region for remapping by a control register on page 75.](#)
- [Applying the map rules to the overlapping memory regions on page 76.](#)

Related References

- [Scenario demonstrating how to create a new target configuration file on page 67.](#)
- [Target configuration editor - Registers tab on page 58.](#)

3.9.5 Creating enumerations for use with a peripheral register

Describes how to create enumerations for use with a peripheral.

With more complex peripherals it can be useful to create and assign enumerations to particular peripheral bit patterns so that you can select from a list of enumerated values rather than write the equivalent hexadecimal value. (For example: Enabled/Disabled, On/Off).

Procedure

1. Click on the **Enumerations** tab.
2. Enter the data as shown in the following figure.

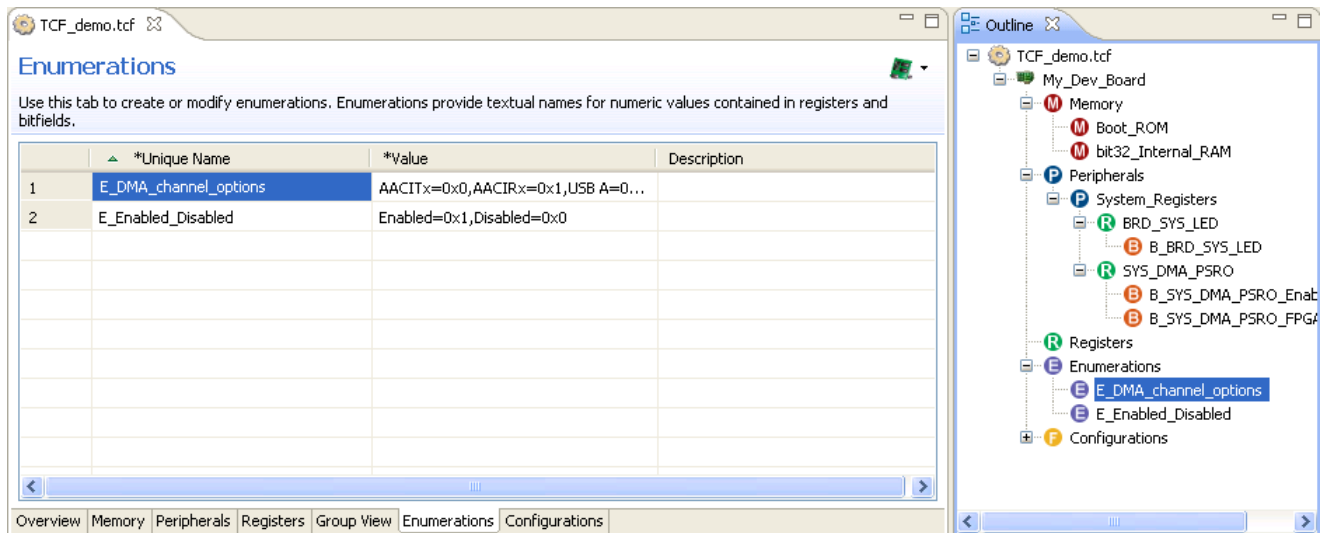


Figure 3-14 Creating enumerations

Related Tasks

- [Creating a memory map on page 68.](#)
- [Creating a peripheral on page 69.](#)
- [Creating a standalone register on page 70.](#)
- [Creating a peripheral register on page 71.](#)
- [Assigning enumerations to a peripheral register on page 73.](#)
- [Creating remapping rules for a control register on page 74.](#)
- [Creating a memory region for remapping by a control register on page 75.](#)
- [Applying the map rules to the overlapping memory regions on page 76.](#)

Related References

- [Scenario demonstrating how to create a new target configuration file on page 67.](#)
- [Target configuration editor - Registers tab on page 58.](#)
- [Target configuration editor - Enumerations tab on page 63.](#)

3.9.6 Assigning enumerations to a peripheral register

Describes how to assign enumerations to a peripheral register.

Procedure

1. Click on the **Registers** tab
2. Open the relevant Bitfield table for the DMA peripheral.
3. Assign enumerations as shown in the following figure.

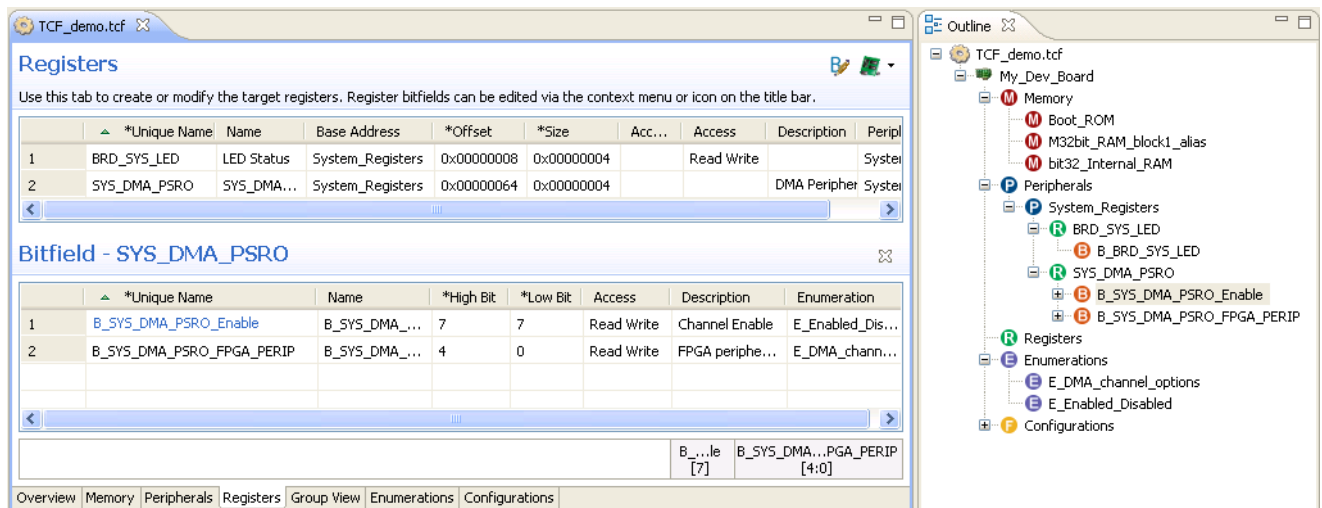


Figure 3-15 Assigning enumerations

Related Tasks

- [Creating a memory map on page 68.](#)
- [Creating a peripheral on page 69.](#)
- [Creating a standalone register on page 70.](#)
- [Creating a peripheral register on page 71.](#)
- [Creating enumerations for use with a peripheral register on page 72.](#)
- [Creating remapping rules for a control register on page 74.](#)
- [Creating a memory region for remapping by a control register on page 75.](#)
- [Applying the map rules to the overlapping memory regions on page 76.](#)

Related References

- [Scenario demonstrating how to create a new target configuration file on page 67.](#)
- [Target configuration editor - Registers tab on page 58.](#)
- [Target configuration editor - Registers tab on page 58.](#)
- [Target configuration editor - Enumerations tab on page 63.](#)

3.9.7 Creating remapping rules for a control register

Describes how to create remapping rules for the core module and LCD control register.

Procedure

1. Click on the **Configurations** tab.
2. Enter the data as shown in the following figure.

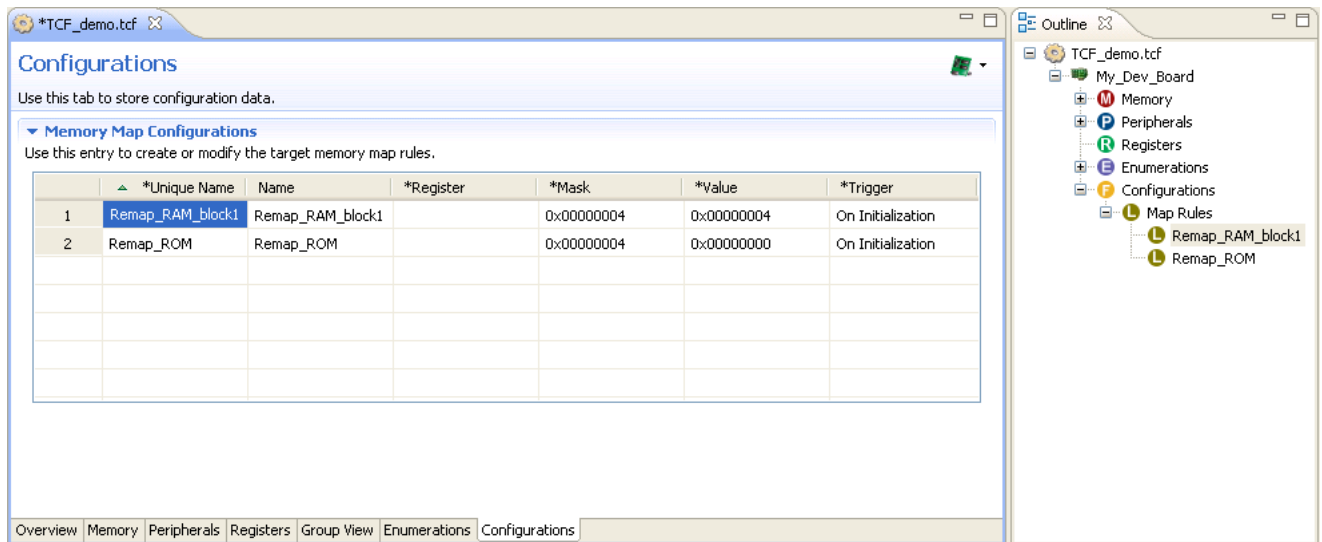


Figure 3-16 Creating remapping rules

Related Tasks

- Creating a memory map on page 68.*
- Creating a peripheral on page 69.*
- Creating a standalone register on page 70.*
- Creating a peripheral register on page 71.*
- Creating enumerations for use with a peripheral register on page 72.*
- Assigning enumerations to a peripheral register on page 73.*
- Creating a memory region for remapping by a control register on page 75.*
- Applying the map rules to the overlapping memory regions on page 76.*

Related References

- Scenario demonstrating how to create a new target configuration file on page 67.*
- Target configuration editor - Configurations tab on page 65.*

3.9.8 Creating a memory region for remapping by a control register

Describes how to create a new memory region that can be used for remapping when bit 2 of the control register is set.

Procedure

1. Click on the **Memory** tab.
2. Switch to the table view by clicking on the relevant button in the top corner.
3. Enter the data as shown in the following figure.

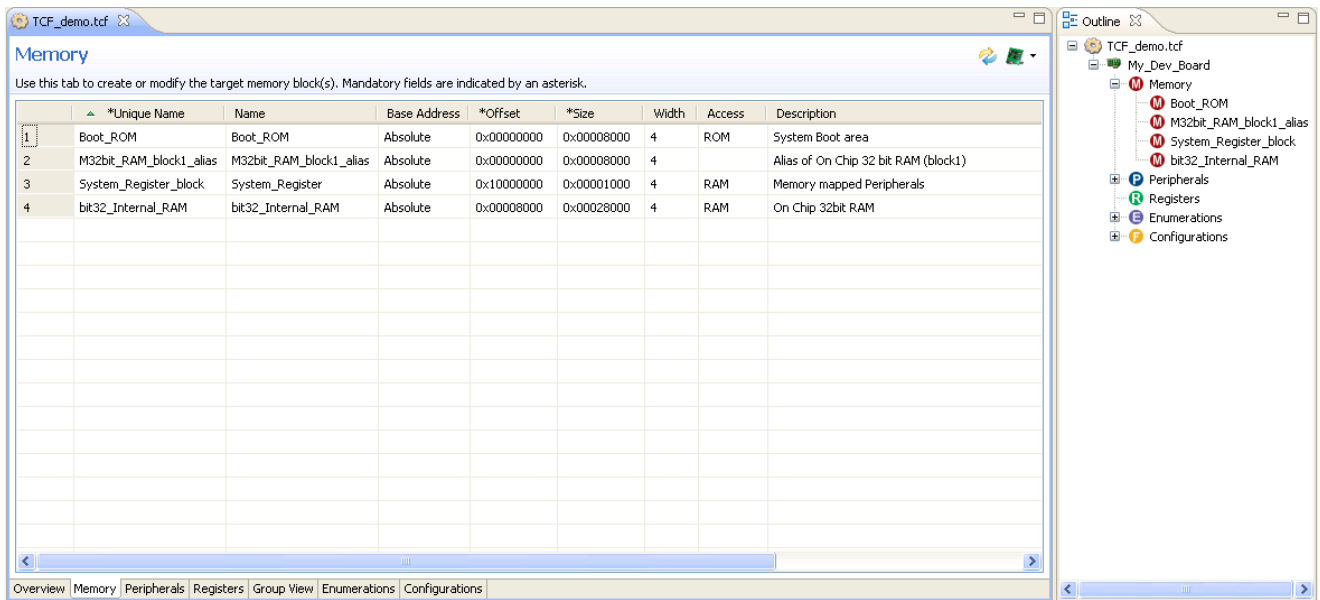


Figure 3-17 Creating a memory region for remapping by a control register

Related Tasks

- Creating a memory map on page 68.*
- Creating a peripheral on page 69.*
- Creating a standalone register on page 70.*
- Creating a peripheral register on page 71.*
- Creating enumerations for use with a peripheral register on page 72.*
- Assigning enumerations to a peripheral register on page 73.*
- Creating remapping rules for a control register on page 74.*
- Applying the map rules to the overlapping memory regions on page 76.*

Related References

- Scenario demonstrating how to create a new target configuration file on page 67.*
- Target configuration editor - Memory tab on page 53.*

3.9.9 Applying the map rules to the overlapping memory regions

Describes how to apply the map rules to the overlapping memory regions.

Procedure

1. Switch back to the graphic view by clicking on the relevant button in the top corner.
2. Select the overlapping memory region **M32bit_RAM_block1_alias** and then select **Remap_RAM_block1** from the Apply Map Rule drop-down menu as shown in the following figure.

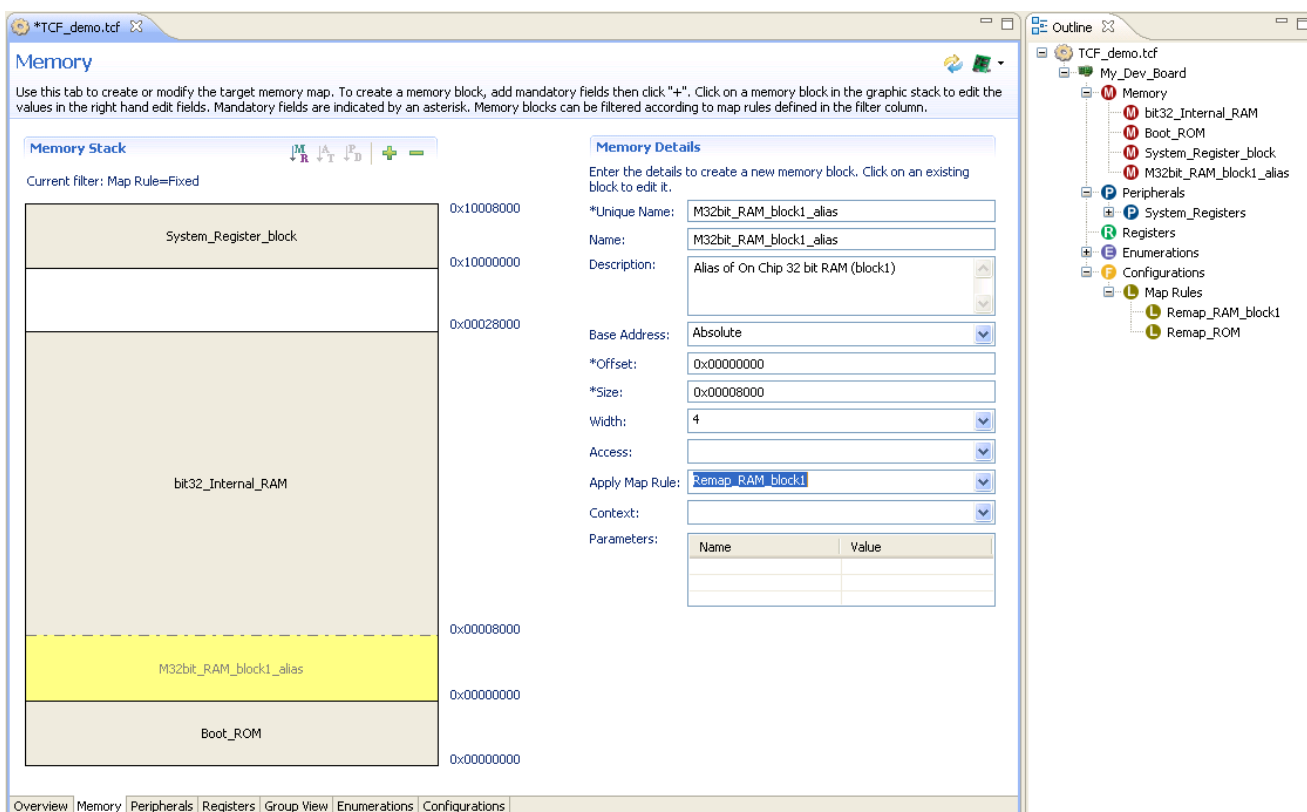


Figure 3-18 Applying the Remap_RAM_block1 map rule

3. To apply the other map rule you must select **Remap_ROM** in the the View by Map Rule drop-down menu at the top of the stack view.
4. Select the overlapping memory region **Boot_ROM** and then select **Remap_ROM** from the Apply Map Rule drop-down menu as shown in the following figure.

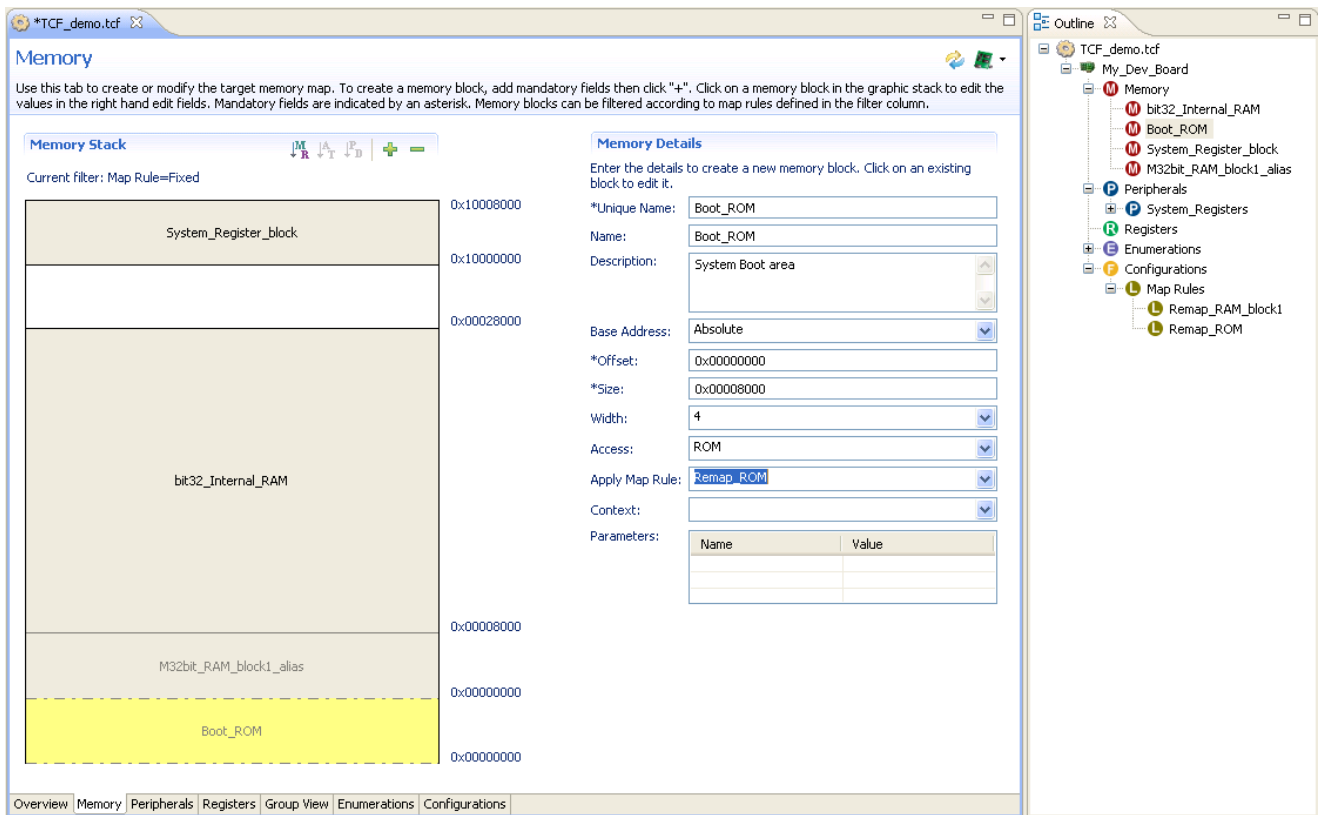


Figure 3-19 Applying the Remap_ROM map rule

5. Save the file.

Related Tasks

- [Creating a memory map on page 68.](#)
- [Creating a peripheral on page 69.](#)
- [Creating a standalone register on page 70.](#)
- [Creating a peripheral register on page 71.](#)
- [Creating enumerations for use with a peripheral register on page 72.](#)
- [Assigning enumerations to a peripheral register on page 73.](#)
- [Creating remapping rules for a control register on page 74.](#)
- [Creating a memory region for remapping by a control register on page 75.](#)

Related References

- [Scenario demonstrating how to create a new target configuration file on page 67.](#)
- [Target configuration editor - Memory tab on page 53.](#)

3.10 Creating a power domain for a target

Describes how to create a power domain configuration for your target.

Prerequisites

Before you create a power domain configuration, you must first create a control register.

Procedure

1. Click on the **Overview** tab.
2. Select **Supported** for the Power Domain setting.
3. Click on the **Configurations** tab.
4. Expand the **Power Domain Configurations** group.

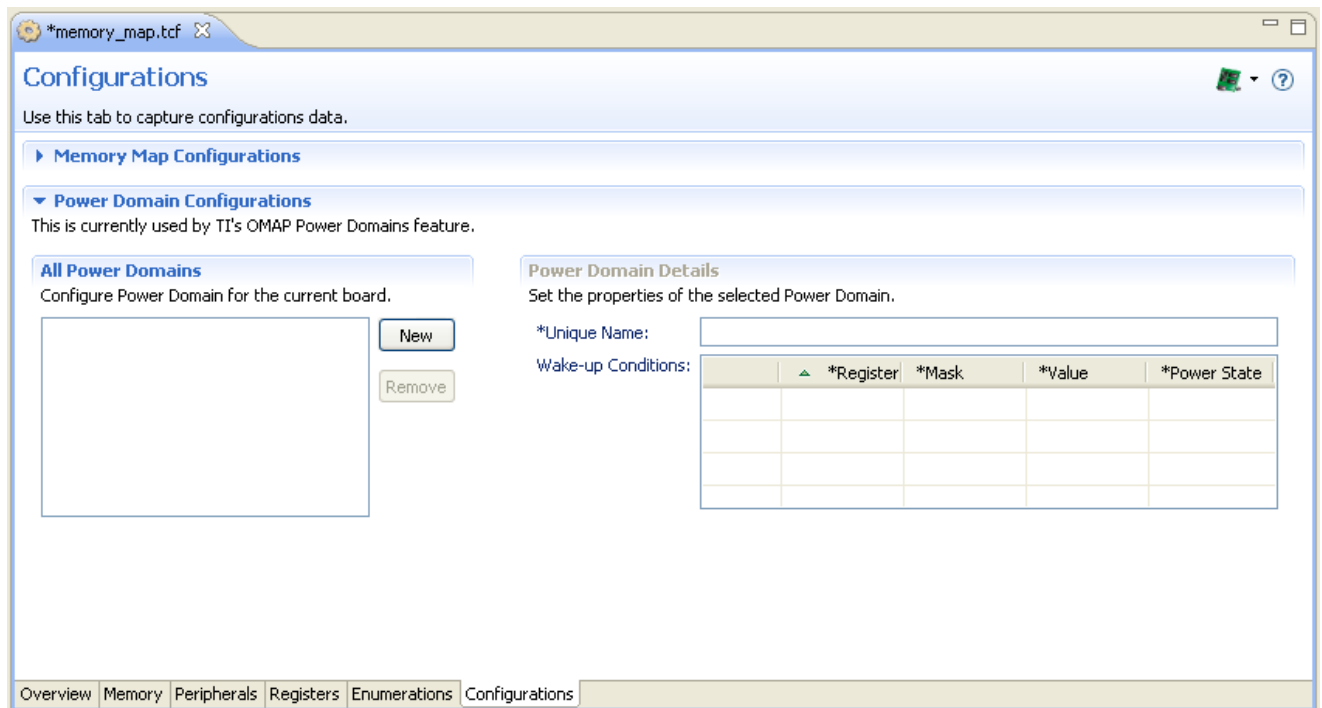


Figure 3-20 Power Domain Configurations

5. Click **New** to create a new power domain.
6. Enter a name in the **Unique Name** field.
7. Set the following **Wake-up Conditions** for the power domain:
 - **Register** - a list of registers you have previously created
 - **Mask**
 - **Value**
 - **Power State**.

All settings are mandatory.

Related Tasks

[Creating a standalone register on page 70.](#)

Related References

Target configuration editor - Overview tab on page 51.

Target configuration editor - Configurations tab on page 65.

3.11 Creating a Group list

Describes how to create a new group list.

Procedure

1. Click on the **Group View** tab.
2. Click **Add a new group** in the **Group View List**.
3. Select the new group.

———— **Note** ————

You can create a subgroup by selecting a group and clicking **Add**.

4. Select peripherals and registers from the **Available Peripheral List**.
5. Press the << **Add** button to add the selected peripherals to the **Group View List**.
6. Click the **Save** icon in the toolbar.

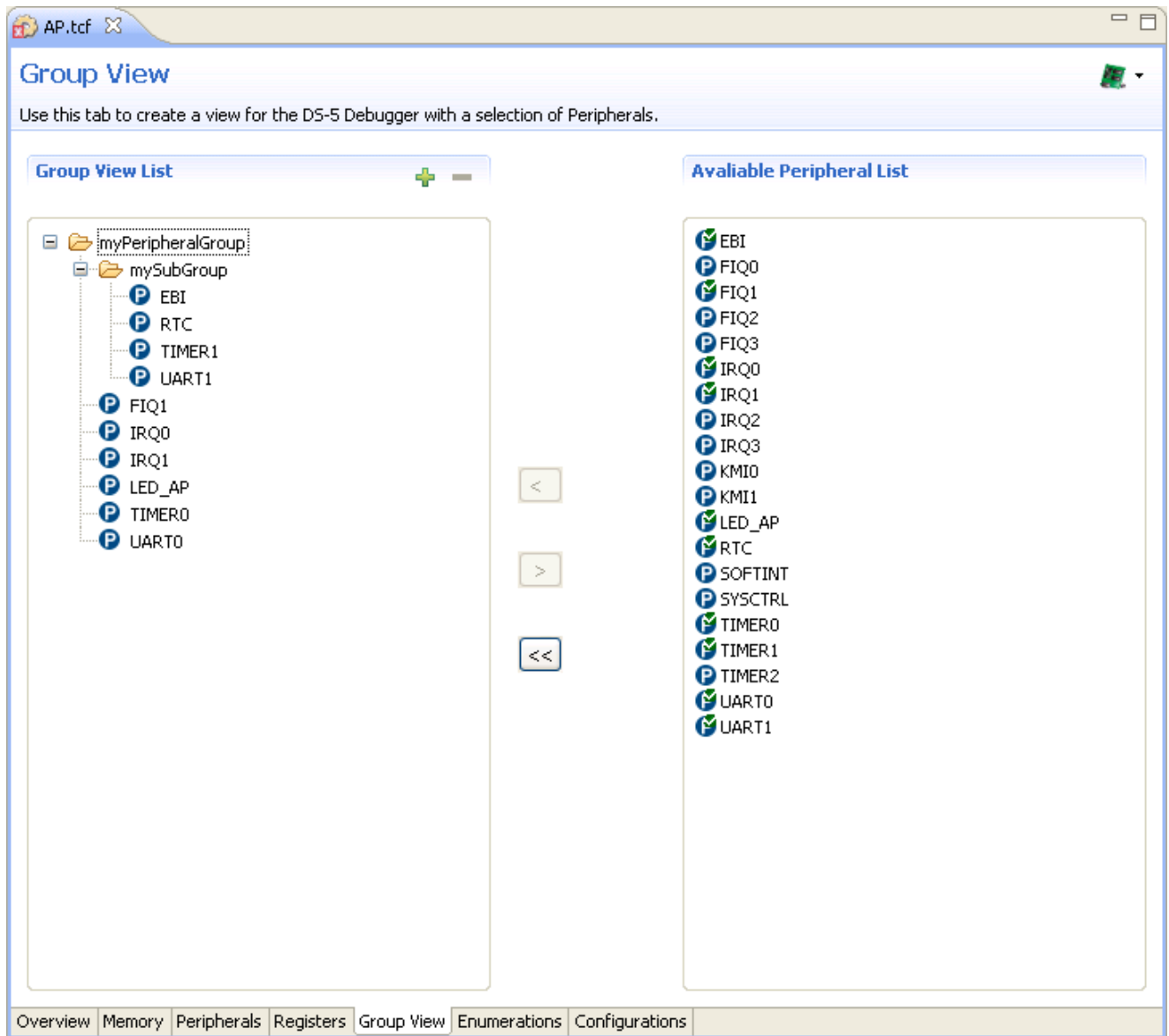


Figure 3-21 Creating a group list

Related References

Target configuration editor - Group View tab on page 60.

3.12 Importing an existing target configuration file

Describes how to import an existing target configuration file into the workspace.

Procedure

1. Select **Import** from the **File** menu.
2. Expand the **Target Configuration Editor** group.
3. Select the required file type.

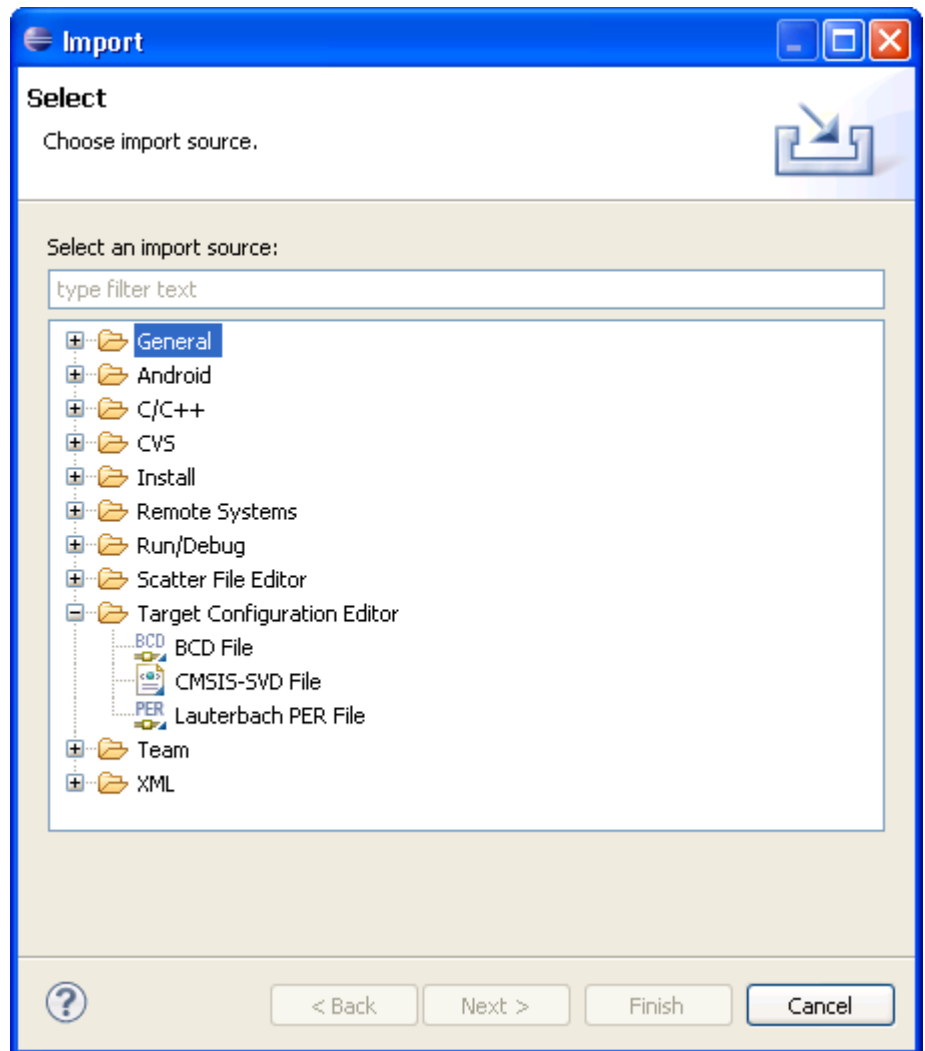


Figure 3-22 Selecting an existing target configuration file

4. Click on **Next**.
5. In the Import dialog box, click **Browse...** to select the folder containing the file.

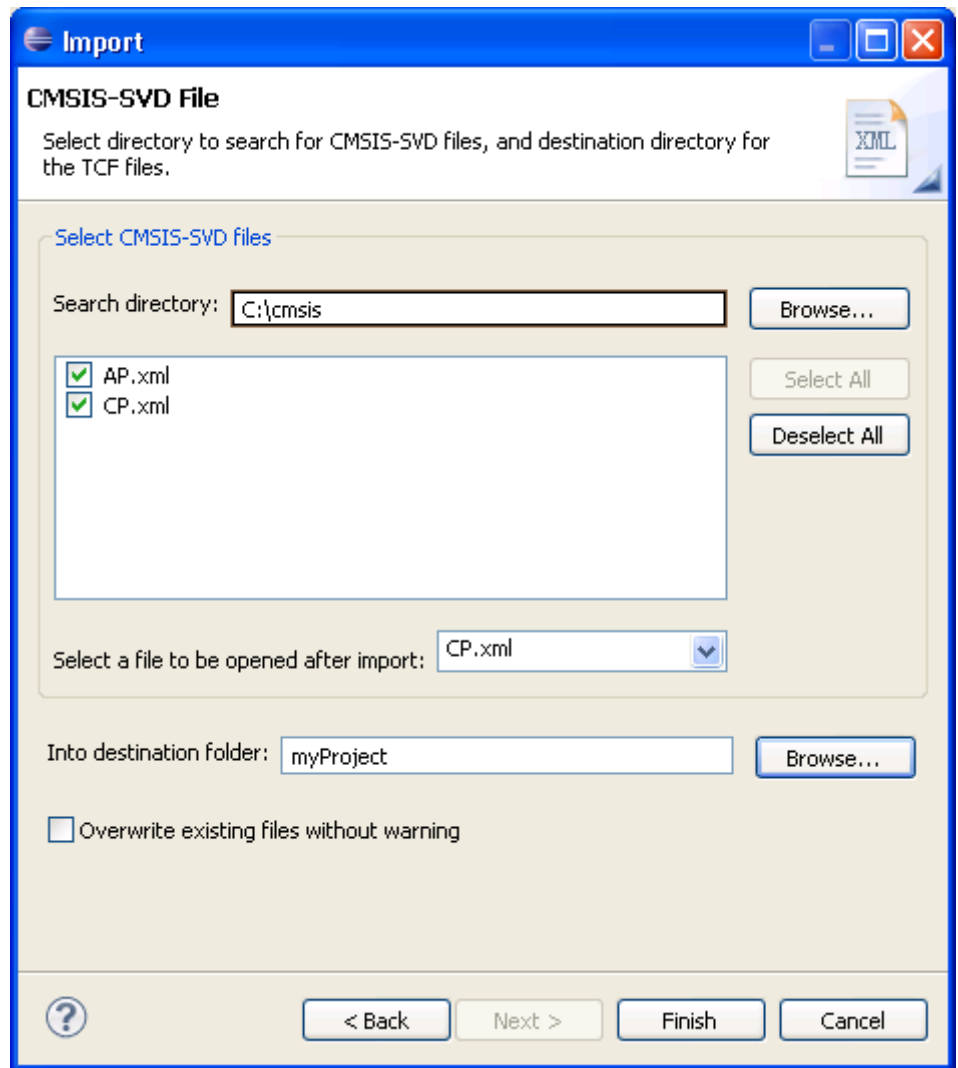


Figure 3-23 Importing the target configuration file

6. By default, all the files that can be imported are displayed. If the selection panel shows more than one file, select the files that you want to import.
7. Select the file that you want to automatically open in the editor.
8. In the Into destination folder field, click **Browse...** to select an existing project.
9. Click **Finish**.

The new *Target Configuration Files* (TCF) is visible in the **Project Explorer** view.

Related Tasks

[Exporting a target configuration file on page 85.](#)

3.13 Exporting a target configuration file

Describes how to export a target configuration file from a project in the workspace to a C header file.

———— **Note** ————

Before using the export wizard, you must ensure that the Target Configuration File (TCF) is open in the editor view.

Procedure

1. Select **Export** from the **File** menu.
2. Expand the **Target Configuration Editor** group.
3. Select **C Header file**.

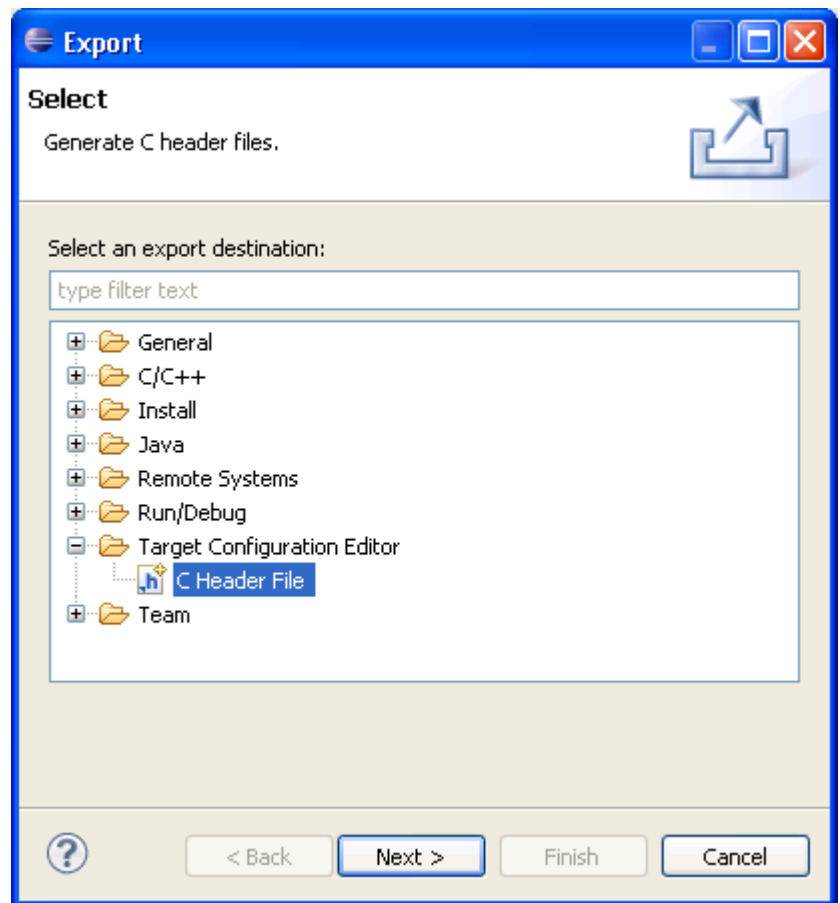


Figure 3-24 Exporting to C header file

4. Click on **Next**.
5. By default, the active files that are open in the editor are displayed. If the selection panel shows more than one file, select the files that you want to export.
6. Click **Browse...** to select a destination path.
7. If required, select **Overwrite existing files without warning**.
8. Click on **Next**.

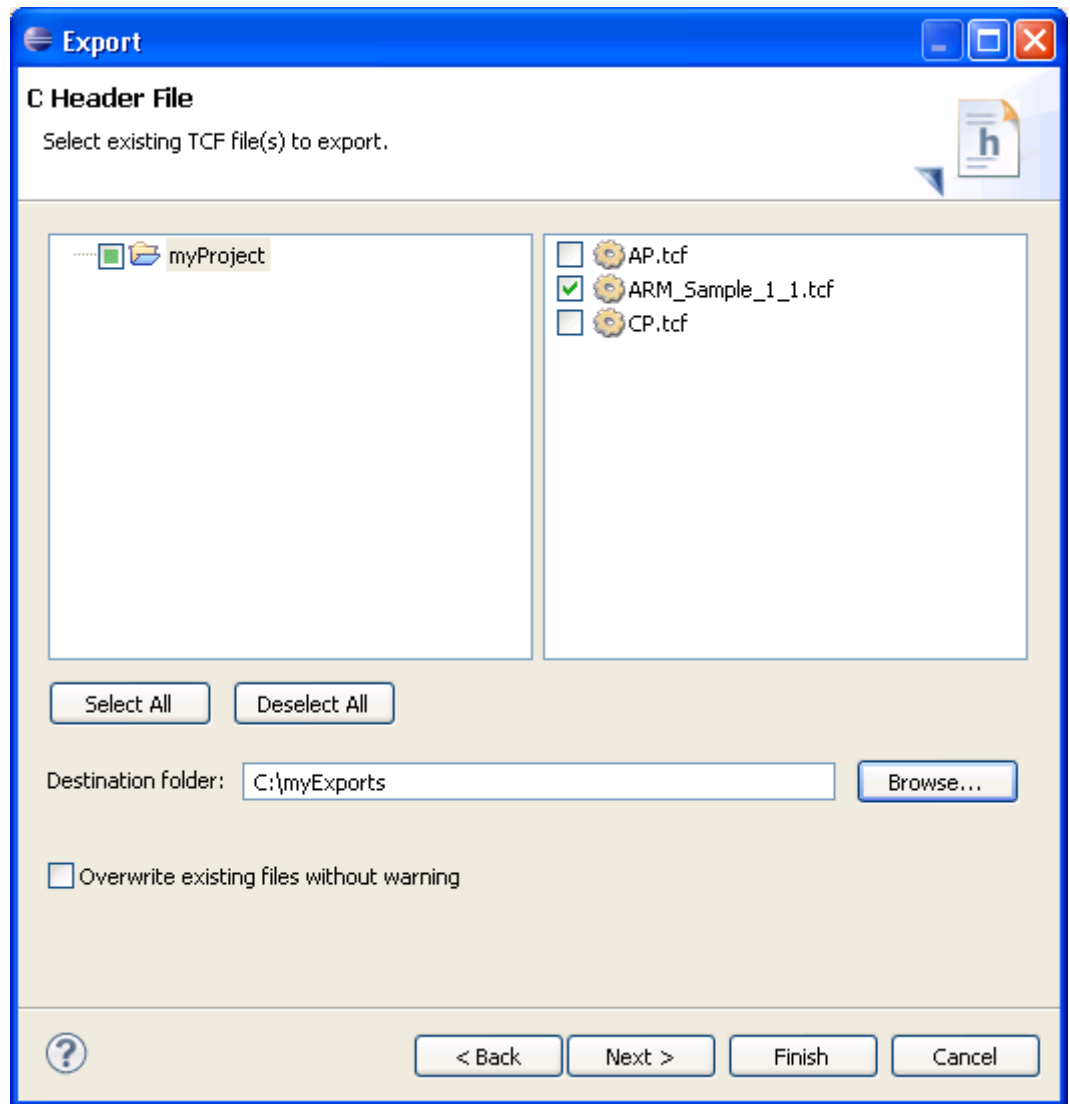


Figure 3-25 Selecting the files

9. If the TCF file has multiple boards, select the board that you want to configure the data for.
10. Select the data that you want to export.
11. Select required export options.
12. Click **Finish** to create the C header file.

Related Tasks

Importing an existing target configuration file on page 83.

Chapter 4

Controlling execution

Describes how to stop the target execution when certain events occur, and when certain conditions are met.

It contains the following:

- *About loading an image on to the target on page 4-88.*
- *About loading debug information into the debugger on page 4-90.*
- *About passing arguments to main() on page 4-92.*
- *Running an image on page 4-93.*
- *About breakpoints and watchpoints on page 4-94.*
- *Setting an execution breakpoint on page 4-96.*
- *Setting a data watchpoint on page 4-98.*
- *Setting a tracepoint on page 4-100.*
- *Setting Streamline start and stop points on page 4-101.*
- *Setting a conditional breakpoint on page 4-102.*
- *Setting a breakpoint on a specific thread on page 4-105.*
- *Pending breakpoints and watchpoints on page 4-108.*
- *Exporting DS-5 breakpoint settings to a file on page 4-109.*
- *Importing DS-5 breakpoint settings from a file on page 4-110.*
- *Stepping through an application on page 4-111.*
- *Handling Unix signals on page 4-113.*
- *Handling processor exceptions on page 4-115.*
- *Configuring the debugger path substitution rules on page 4-117.*

4.1 About loading an image on to the target

Before you can start debugging your application image, you must load the files on to the target. The files on your target must be the same as those on your local host workstation. The code layout must be identical, but the files on your target do require debug information.

You can manually load the files on to the target or you can configure a debugger connection to automatically do this after a connection is established. Some target connections do not support load operations and the relevant menu options are therefore disabled.

After connecting to the target you can also use the **Debug Control** view menu entry **Load...** to load files as required. The following options for loading an image are available:

- Load Image Only** Loads the application image on to the target.
- Load Image and Debug Info** Loads the application image on to the target and debug information from the same image into the debugger.
- Load Offset** Specifies a decimal or hexadecimal offset that is added to all addresses within the image. A hexadecimal offset must be prefixed with 0x.
- Enable on-demand loading** Specifies how you want the debugger to load debug information. Enabling this option can provide a faster load and use less memory but debugging might be slower.

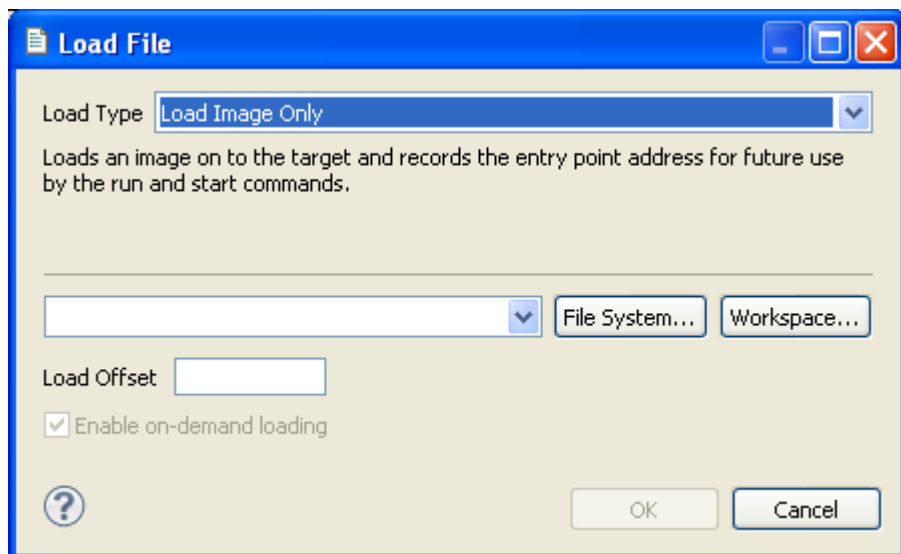


Figure 4-1 Load File dialog box

Related Concepts

About loading debug information into the debugger on page 90.

Related Tasks

Configuring a connection to a Fixed Virtual Platform (FVP) on page 27.

Configuring a connection to a Linux target using gdbserver on page 29.

Configuring a connection to a Linux Kernel on page 31.

Configuring a connection to a bare-metal target on page 33.

Configuring an Event Viewer connection to a bare-metal target on page 35.

Related References

Commands view on page 192.

Debug Control view on page 195.

Related Information

DS-5 Debugger commands.

4.2 About loading debug information into the debugger

An executable image contains symbolic references, such as function and variable names, in addition to the application code and data. These symbolic references are generally referred to as debug information. Without this information the debugger is unable to debug at the source level.

To debug an application at source level, the image file and shared object files must be compiled with debug information, and a suitable level of optimization. For example, when compiling with either the ARM or the GNU compiler you can use the following options:

```
-g -O0
```

Debug information is not loaded when a file is loaded, but is a separate action. A typical load sequence is:

1. Load the main application image.
2. Load any shared objects.
3. Load the symbols for the main application image
4. Load the symbols for shared objects on-demand.

Images and shared objects might be preloaded onto the target, such as an image in a ROM device or an OS-aware target. The corresponding image file and any shared object files must contain debug information, and be accessible from your local host workstation. You can then configure a connection to the target loading only the debug information from these files. Use the **Load symbols from file** option on the debug configuration **Files** tab as appropriate for the target environment.

After connecting to the target you can also use the view menu entry **Load...** in the **Debug Control** view to load files as required. The following options for loading debug information are available:

Add Symbols File	Loads additional debug information into the debugger.
Load Debug Info	Loads debug information into the debugger.
Load Image and Debug Info	Loads the application image on to the target and debug information from the same images into the debugger.
Load Offset	Specifies a decimal or hexadecimal offset that is added to all addresses within the image. A hexadecimal offset must be prefixed with 0x.
Enable on-demand loading	Specifies how you want the debugger to load debug information. Enabling this option can provide a faster load and use less memory but debugging might be slower.

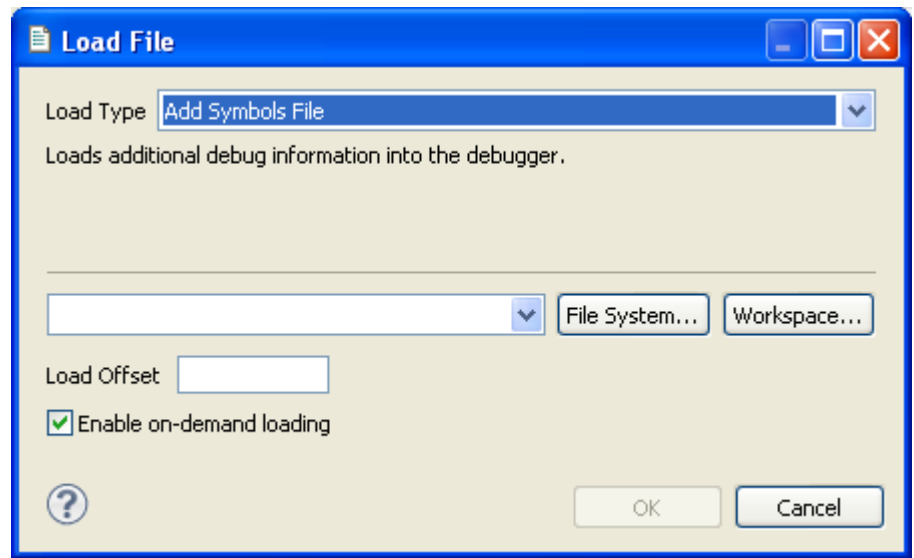


Figure 4-2 Load additional debug information dialog box

The debug information in an image or shared object also contains the path of the sources used to build it. When execution stops at an address in the image or shared object, the debugger attempts to open the corresponding source file. If this path is not present or the required source file is not found, then you must inform the debugger where the source file is located. You do this by setting up a substitution rule to associate the path obtained from the image with the path to the required source file that is accessible from your local host workstation.

Related Concepts

About loading an image on to the target on page 88.

Related Tasks

Configuring a connection to a Fixed Virtual Platform (FVP) on page 27.

Configuring a connection to a Linux target using gdbserver on page 29.

Configuring a connection to a Linux Kernel on page 31.

Configuring a connection to a bare-metal target on page 33.

Configuring an Event Viewer connection to a bare-metal target on page 35.

Related References

Commands view on page 192.

Debug Control view on page 195.

Configuring the debugger path substitution rules on page 117.

Related Information

DS-5 Debugger commands.

4.3 About passing arguments to main()

ARM DS-5 Debugger enables you to pass arguments to the `main()` function of your application with one of the following methods:

- using the **Arguments** tab in the **Debug Configuration** dialog box.
- on the command-line (or in a script), you can use either:
 - `set semihosting args <arguments>`
 - `run <arguments>`.

Note

Semihosting must be active for these to work with bare-metal images.

Related References

[About semihosting and top of memory on page 145.](#)

[Working with semihosting on page 146.](#)

[Enabling automatic semihosting support in the debugger on page 147.](#)

[Controlling semihosting messages using the command-line console on page 148.](#)

[Debug Configurations - Arguments tab on page 270.](#)

Related Information

[DS-5 Debugger commands.](#)

4.4 Running an image

Describes how to run an application image so that you can monitor how it executes on a target.

Use the Debug Configurations dialog box to set up a connection and define the run control options that you want the debugger to do after connection. To do this select **Debug Configurations...** from the **Run** menu.

After connection, you can control the debug session by using the toolbar icons in the **Debug Control** view.

Prerequisites

Before you can run an image it must be loaded onto the target. An image can either be preloaded on a target or loaded onto the target as part of the debug session.

Note

The files that reside on the target do not have to contain debug information, however, to be able to debug them you must have the corresponding files with debug information on your local host workstation.

Related References

Commands view on page 192.

Debug Control view on page 195.

Debug Configurations - Connection tab on page 259.

Debug Configurations - Files tab on page 262.

Debug Configurations - Debugger tab on page 266.

Debug Configurations - Arguments tab on page 270.

Debug Configurations - Environment tab on page 272.

Debug Configurations - Event Viewer tab on page 274.

Related Information

DS-5 Debugger commands.

4.5 About breakpoints and watchpoints

Breakpoints and watchpoints enable you to stop the target when certain events occur, and when certain conditions are met. When execution stops you can then choose to examine the contents of memory, registers, or variables, or you might have specified other actions to be taken before execution resumes.

The debugger provides the following types:

Breakpoints A breakpoint enables you to interrupt your application when execution reaches a specific address. A breakpoint is always related to a particular memory address, regardless of what might be stored there. When execution reaches the breakpoint, normal execution stops before any instruction stored there is performed.

You can set:

- software breakpoints that trigger when a particular instruction is executed at a specific address
- hardware breakpoints that trigger when the processor attempts to execute an instruction that is fetched from a specific memory address
- conditional breakpoints that trigger when an expression evaluates to true or when an ignore counter is reached
- temporary software or hardware breakpoints that are subsequently deleted when the breakpoint is hit.

The type of breakpoints you can set depends on the:

- memory region and the related access attributes
- hardware support provided by your target processor
- debug interface used to maintain the target connection
- running state if you are debugging an OS-aware application.

Watchpoints A watchpoint is similar to a breakpoint, but it is the address or value of a data access that is monitored rather than an instruction being executed from a specific address. You specify a register or a memory address to identify a location that is to have its contents tested. Watchpoints are sometimes known as data breakpoints, emphasizing that they are data dependent. Execution of your application stops when the address being monitored is accessed by your application.

You can set:

- watchpoints that trigger when a particular memory location is accessed in a particular way
- conditional watchpoints that trigger when an expression evaluates to true or when an ignore counter is reached.

Considerations when setting breakpoints and watchpoints

Be aware of the following when setting breakpoints and watchpoints:

- The number of hardware breakpoints available depends on the target.
- If an image is compiled with a high optimization level or perhaps contains C++ templates then the effect of setting a breakpoint in the source code depends on where you set the breakpoint. For example, if you set a breakpoint on an inlined function or a C++ template, then a

breakpoint is created for each instance of that function or template. Therefore the target can run out of breakpoint resources.

- Enabling a *Memory Management Unit* (MMU) might set a memory region to read-only. If that memory region contains a software breakpoint, then that software breakpoint cannot be removed. Therefore, make sure you clear software breakpoints before enabling the MMU.
- Watchpoints are only supported on global/static data symbols because they are always in scope. Local variables are not available when you step out of a function.
- Some targets do not support watchpoints. Currently you can only use watchpoint commands on a hardware target using a debug hardware adapter.
- The address of the instruction that triggers the watchpoint might not be the address shown in the PC register. This is because of pipelining effects in the processor.
- When debugging an application that uses shared objects, breakpoints that are set within a shared object are re-evaluated when the shared object is unloaded. Those with addresses that can be resolved are set and the others remain pending.
- If a breakpoint is set by function name then only inline instances that have been already demand loaded are found. To find all the inline instances of a function you must disable on-demand loading.

Related References

Setting an execution breakpoint on page 96.

Setting a data watchpoint on page 98.

Setting a tracepoint on page 100.

Setting Streamline start and stop points on page 101.

Setting a conditional breakpoint on page 102.

Setting a breakpoint on a specific thread on page 105.

Pending breakpoints and watchpoints on page 108.

Exporting DS-5 breakpoint settings to a file on page 109.

Importing DS-5 breakpoint settings from a file on page 110.

Related Information

DS-5 Debugger commands.

4.6 Setting an execution breakpoint

The debugger enables you to set software or hardware breakpoints, depending on your target memory type. Software breakpoints are implemented by the debugger replacing the instruction at the breakpoint address with a special instruction opcode. Because the debugger requires write access to application memory, software breakpoints can only be set in RAM. Hardware breakpoints are implemented by EmbeddedICE® logic that monitors the address and data buses of your processor. For simulated targets, hardware breakpoints are implemented by your simulator software.

To set an execution breakpoint double-click in the left-hand marker bar of the C/C++ editor or the **Disassembly** view at the position where you want to set the breakpoint. To delete a breakpoint, double-click on the breakpoint marker.

The following figure shows an example of breakpoints, in the C/C++ editor and in the **Disassembly** view. These are also visible in the **Breakpoints** view.

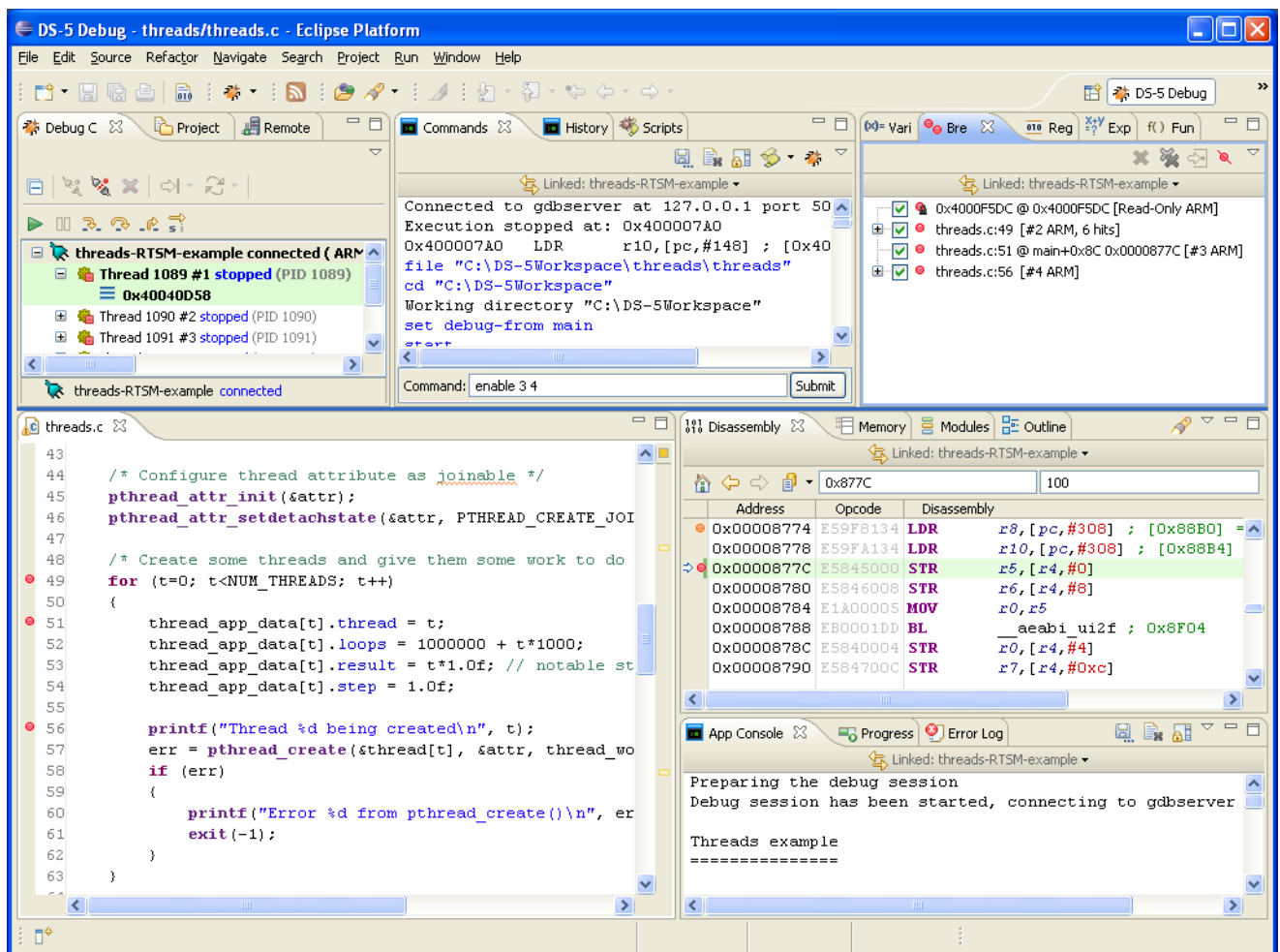


Figure 4-3 Setting an execution breakpoint

Related References

About breakpoints and watchpoints on page 94.
Setting a data watchpoint on page 98.

Setting a tracepoint on page 100.
Setting Streamline start and stop points on page 101.
Setting a conditional breakpoint on page 102.
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Related Information

DS-5 Debugger commands.

4.7 Setting a data watchpoint

There are times when you want to monitor the values of specific variables or expressions in your source code when running an application. You can do this by setting watchpoints.

In the **Variables** view, right-click on a data symbol, select **Toggle Watchpoint**, select the required access type, and then click **OK**. The watchpoint is visible in the **Variables** view and also in the **Breakpoints** view.

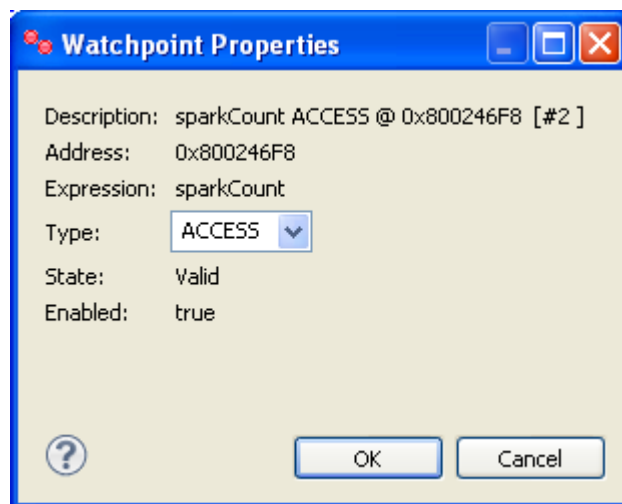


Figure 4-4 Setting a data watchpoint

Note

Watchpoints are only supported on scalar values.

Some targets do not support watchpoints. Currently you can only set a watchpoint on a hardware target using a debug hardware adapter.

The address of the instruction that triggers the watchpoint might not correspond with the instruction at the address shown in the PC register. This is because of pipelining effects.

Related References

About breakpoints and watchpoints on page 94.
Setting an execution breakpoint on page 96.
Setting a tracepoint on page 100.
Setting Streamline start and stop points on page 101.
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Memory view on page 212.

Registers view on page 220.

Variables view on page 237.

Related Information

DS-5 Debugger commands.

4.8 Setting a tracepoint

Tracepoints are memory locations that are used to trigger behavior in a trace capture device when running an application. A tracepoint is hit when the processor executes an instruction at a specific address. Depending on the type, trace capture is either enabled or disabled.

Tracepoints can be set from the following:

- ARM Assembler editor.
- C/C++ editor.
- Disassembly view.
- Functions view.
- Memory view.
- Disassembly panel of the Trace view.

To set a tracepoint, right-click in the left-hand marker bar at the position where you want to set the tracepoint and select either **Toggle Trace Start Point**, **Toggle Trace Stop Point**, or **Toggle Trace Trigger Point** from the context menu. To remove a tracepoint, repeat this procedure on the same tracepoint or delete it from the **Breakpoints** view.

Tracepoints are stored on a per connection basis. If the active connection is disconnected then tracepoints can only be created from the source editor.

All tracepoints are visible in the **Breakpoints** view.

Related References

About breakpoints and watchpoints on page 94.
Setting an execution breakpoint on page 96.
Setting a data watchpoint on page 98.
Setting Streamline start and stop points on page 101.
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Variables view on page 237.

Related Information

DS-5 Debugger commands.

4.9 Setting Streamline start and stop points

Streamline start and stop points are locations in source or assembly code that are used to enable or disable Streamline capture in a running application. A Streamline start and stop point is hit when the processor executes an instruction at a specific address.

Streamline start and stop points can be set from the following views:

- ARM Assembler editor.
- C/C++ editor.

To set a Streamline start and stop point, right-click in the left-hand marker bar at the position where you want to set the start and stop point and select either **Toggle Streamline Start** or **Toggle Streamline Stop** from the **DS-5 Breakpoints** context menu. To remove a start and stop point, repeat this procedure on the same start and stop point.

Related References

About breakpoints and watchpoints on page 94.
Setting an execution breakpoint on page 96.
Setting a data watchpoint on page 98.
Setting a tracepoint on page 100.
Setting a conditional breakpoint on page 102.
Setting a breakpoint on a specific thread on page 105.
Pending breakpoints and watchpoints on page 108.
Exporting DS-5 breakpoint settings to a file on page 109.
Importing DS-5 breakpoint settings from a file on page 110.
ARM assembler editor on page 182.
C/C++ editor on page 189.

Related Information

DS-5 Debugger commands.
Using ARM Streamline.

4.10 Setting a conditional breakpoint

Conditional breakpoints have properties assigned to test for conditions that must be satisfied to trigger the breakpoint. For example, you can:

- Test a variable for a given value.
- Execute a function a set number of times.
- Trigger a breakpoint only on a specific thread or processor.

Conditional breakpoints can be very intrusive and lower the performance if they are hit frequently. This is because the debugger stops the target every time the breakpoint triggers. The specified condition is checked and if it evaluates to true then the target remains in the stopped state, otherwise execution resumes.

Note

You must not assign a script to a breakpoint that has sub-breakpoints. If you do, the debugger attempts to execute the script for each sub-breakpoint. If this happens, an error message is displayed.

You can assign conditions to an existing breakpoint in the Breakpoint Properties dialog box:

1. In the **Breakpoints** view, right-click on the breakpoint that you want modify to display the context menu.
2. Select **Properties...** to display the Breakpoint Properties dialog box.
3. If you want to set a conditional expression for a specific breakpoint then enter a C-style expression in the **Stop Condition** field. For example, if your application has a variable `x`, then you can specify: `x == 10`
4. If you want the debugger to delay hitting the breakpoint until a specific number of passes has occurred, then enter the number of passes in the **Ignore Count** field. For example, if you have a loop that performs 100 iterations, and you want a breakpoint in that loop to be hit after 50 passes, then enter 50.
5. If you want to run a script when the selected breakpoint is triggered then specify the script file in the **On break, run script** field:
 - Enter the location and file name in the field provided.
 - Click on **File System...** to locate the file in an external directory from the workspace.
 - Click on **Workspace...** to locate the file in a project directory or sub-directory within the workspace.

Note

Take care with the commands used in a script file that is attached to a breakpoint. For example, if the script file contains the `quit` command, the debugger disconnects from the target when the breakpoint is hit.

-
6. If you want to enable the debugger to automatically continue running the application on completion of all the breakpoint actions then select the **Continue Execution** checkbox.

Alternatively you can enter the `continue` command as the last command in a script file, that is attached to a breakpoint.

7. If you want to set a breakpoint in one or more threads or processors:
 - a. Select **Break on Selected Threads or Cores** to enable the selection panel.
 - b. Select the checkbox for each thread or processor that you want to assign the breakpoint to.

8. Click **OK** to save the changes.

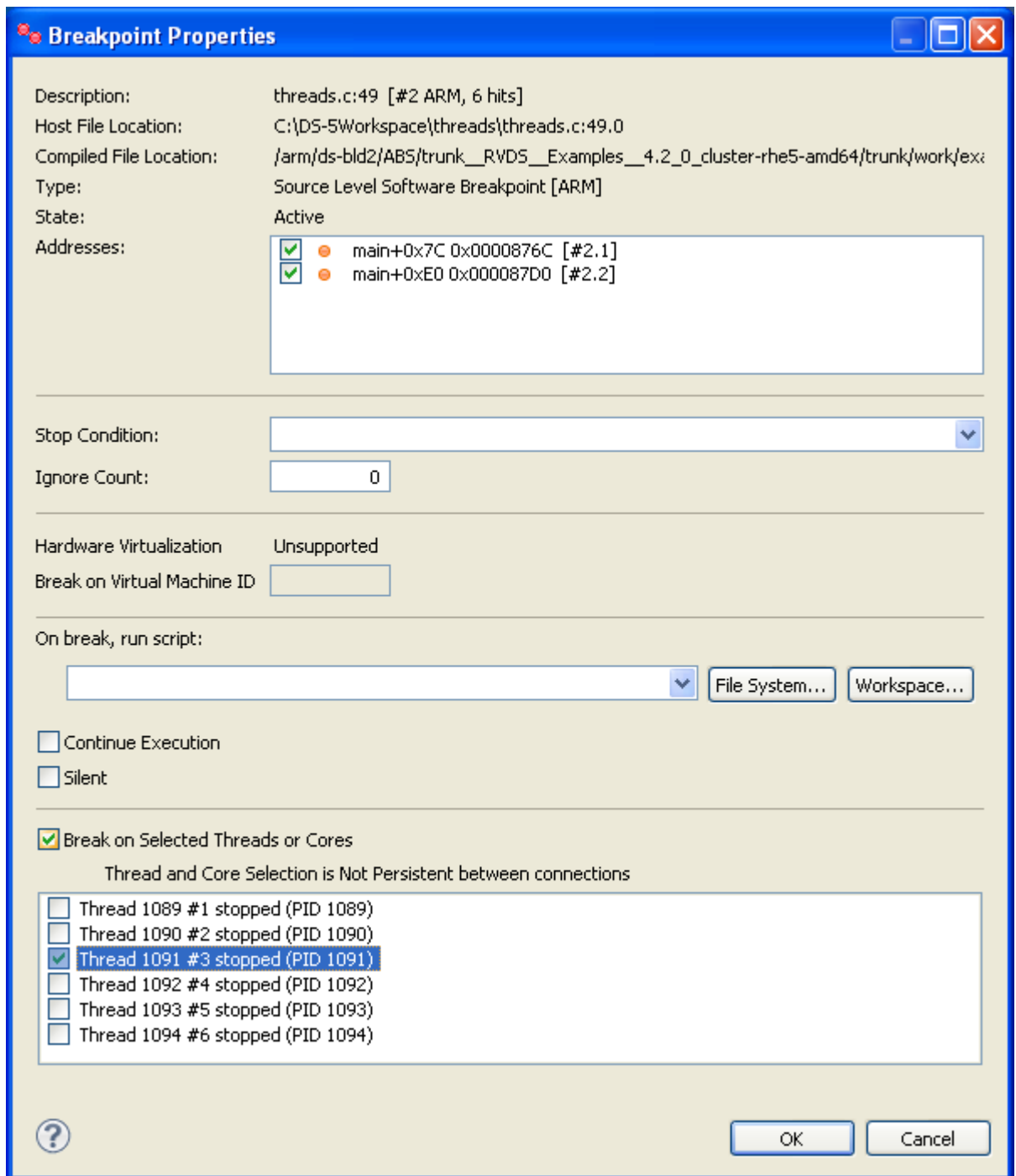


Figure 4-5 Setting a conditional breakpoint

Breakpoints that are set on a single line of source code with multiple statements are assigned as sub-breakpoints to a parent breakpoint. You can enable, disable, and view the properties of each sub-breakpoint in the same way as a single statement breakpoint. Conditions are assigned to top level breakpoints only and therefore affect both the parent breakpoint and sub-breakpoints.

Considerations when setting multiple conditions on a breakpoint

Be aware of the following when setting multiple conditions on a breakpoint:

- If you set a Stop Condition and an Ignore Count, then the Ignore Count is not decremented until the Stop Condition is met. For example, you might have a breakpoint in a loop that is controlled by the variable `c` and has 10 iterations. If you set the Stop Condition `c==5` and the Ignore Count to 3, then the breakpoint might not activate until it has been hit with `c==5` for the fourth time. It subsequently activates every time it is hit with `c==5`.
- If you choose to break on selected thread or processor, then the Stop Condition and Ignore Count are checked only for the selected thread or processor.
- Conditions are evaluated in the following order:
 1. thread or processor
 2. condition
 3. ignore count.

Related References

About breakpoints and watchpoints on page 94.
Setting an execution breakpoint on page 96.
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Related Information

DS-5 Debugger commands.

4.11 Setting a breakpoint on a specific thread

Breakpoints apply to all threads by default, but you can modify the properties for a breakpoint to restrict it to a specific thread:

1. In the **Breakpoints** view, right-click on the breakpoint that you want modify to display the context menu.
2. Select **Properties...** to display the Breakpoint Properties dialog box.
3. Assign breakpoint conditions as required.
4. Select the **Break on Selected Threads** checkbox to enable thread selection.
5. Select the checkbox for each thread that you want to assign the breakpoint to.
6. Click **OK** to save the changes.

Note

If you set a breakpoint for a specific thread, then any conditions you set for the breakpoint are checked only for that thread.

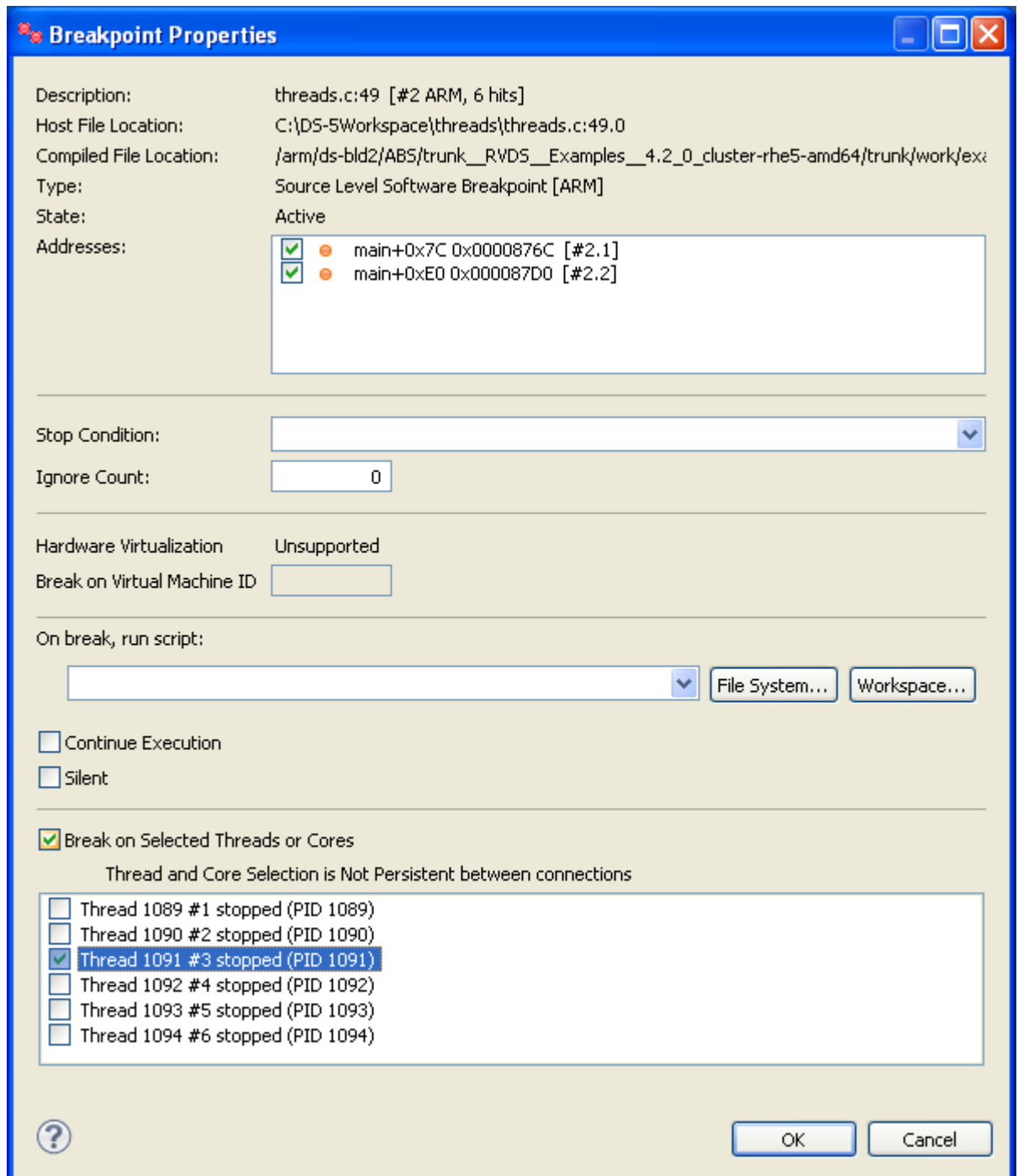


Figure 4-6 Setting a breakpoint on a specific thread

Related References

About breakpoints and watchpoints on page 94.
Setting an execution breakpoint on page 96.
Setting a data watchpoint on page 98.
Setting a tracepoint on page 100.
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Related Information

DS-5 Debugger commands.

4.12 Pending breakpoints and watchpoints

Breakpoints and watchpoints can be set when debug information is available. Pending breakpoints and watchpoints however, enable you to set breakpoints and watchpoints before the associated debug information is available.

The debugger automatically re-evaluates all pending breakpoints and watchpoints when debug information changes. Those with addresses that can be resolved are set and the others remain pending.

In the **Breakpoints** view you can force the resolution of a pending breakpoint or watchpoint. For example, this might be useful if you have manually modified the shared library search paths. To do this:

1. Right-click on the pending breakpoint or watchpoint that you want to resolve.
2. Click on **Resolve** to attempt to find the address and set the breakpoint or watchpoint.

Examples

To manually set a pendable breakpoint or watchpoint you can use the `-p` option with any of these commands, `advance`, `awatch`, `break`, `hbreak`, `rwatch`, `tbreak`, `thbreak`, and `watch`. You can enter debugger commands in the **Commands** view.

```
break -p lib.c:20      # Sets a pending breakpoint at line 20 in lib.c
awatch -p *0x80D4      # Sets a pending read/write watchpoint on address 0x80D4
```

Related References

[About breakpoints and watchpoints on page 94.](#)
[Setting an execution breakpoint on page 96.](#)
[Setting a data watchpoint on page 98.](#)
[Setting a tracepoint on page 100.](#)
[Setting Streamline start and stop points on page 101.](#)
[Setting a conditional breakpoint on page 102.](#)
[Setting a breakpoint on a specific thread on page 105.](#)
[Exporting DS-5 breakpoint settings to a file on page 109.](#)
[Importing DS-5 breakpoint settings from a file on page 110.](#)
[ARM assembler editor on page 182.](#)
[Breakpoints view on page 185.](#)
[C/C++ editor on page 189.](#)
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[Disassembly view on page 199.](#)
[Expressions view on page 204.](#)
[Memory view on page 212.](#)
[Registers view on page 220.](#)
[Variables view on page 237.](#)

Related Information

[DS-5 Debugger commands.](#)

4.13 Exporting DS-5 breakpoint settings to a file

To export DS-5 breakpoint settings to a file:

1. Ensure that you are in the DS-5 Debug perspective.
2. Select **Export Breakpoints** from the **Breakpoints** view menu.
3. Select the required location in the local file system and enter a filename.
4. Click **Save**.

Note

All breakpoints and watchpoints shown in the DS-5 **Breakpoints** view are saved.

Related References

About breakpoints and watchpoints on page 94.
Setting an execution breakpoint on page 96.
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Disassembly view on page 199.
Expressions view on page 204.
Memory view on page 212.
Registers view on page 220.
Variables view on page 237.

Related Information

DS-5 Debugger commands.

4.14 Importing DS-5 breakpoint settings from a file

To import DS-5 breakpoint settings from a file:

1. Ensure that you are in the DS-5 Debug perspective.
2. Select **Import Breakpoints** from the **Breakpoints** view menu.
3. Select the file containing the breakpoint settings from the local file system.
4. Click **Open**.

Note

Existing settings for the current connection are deleted and replaced by the DS-5 breakpoint and watchpoint settings from the imported file.

Related References

About breakpoints and watchpoints on page 94.
Setting an execution breakpoint on page 96.
Setting a data watchpoint on page 98.
Setting a tracepoint on page 100.
Setting Streamline start and stop points on page 101.
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Related Information

DS-5 Debugger commands.

4.15 Stepping through an application

The debugger enables you to finely control the execution of an image by sequentially stepping through an application at the source level or the instruction level.

————— Note —————

You must compile your code with debug information to use the source level stepping commands. By default, source level calls to functions with no debug information are stepped over. Use the `set step-mode` command to change the default setting.

There are several ways to step through an application. You can choose to step:

- Into or over all function calls.
- At source level or instruction level.
- Through multiple statements in a single line of source code, for example a for loop.

Be aware that when stepping at the source level, the debugger uses temporary breakpoints to stop execution at the specified location. These temporary breakpoints might require the use of hardware breakpoints, especially when stepping through code in ROM or Flash. If there are not enough hardware breakpoint resources available, then the debugger displays an error message.

You can use the stepping toolbar in the **Debug Control** view to step through the application either by source line or instruction.

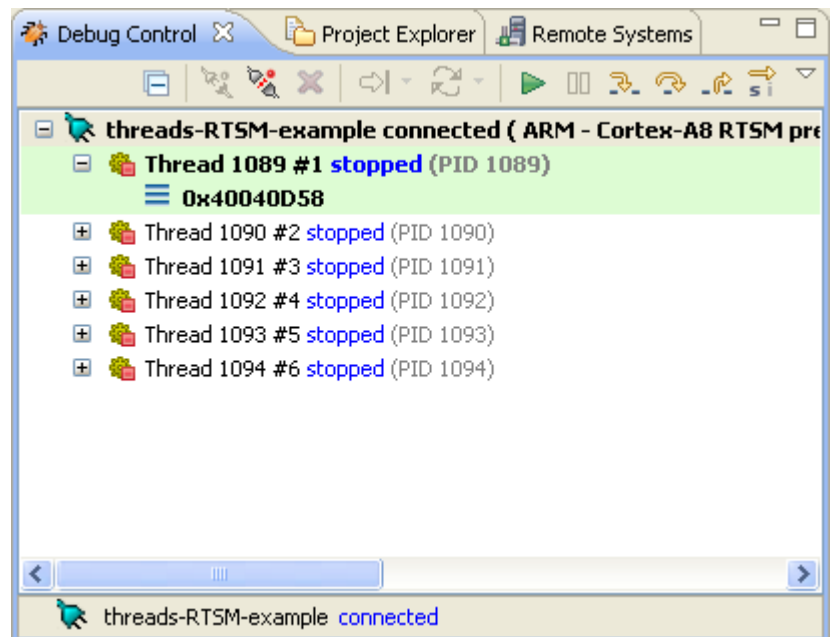


Figure 4-7 Debug Control view

Examples

To step a specified number of times you must use the **Commands** view to manually execute one of the stepping commands with a number. For example:

<code>steps 5</code>	# Execute five source statements
<code>stepi 5</code>	# Execute five instructions

Related Concepts

About debugging shared libraries on page 135.
About debugging a Linux kernel on page 137.
About debugging Linux kernel modules on page 139.

Related References

Examining the target execution environment on page 120.
Examining the call stack on page 122.
Handling Unix signals on page 113.
Handling processor exceptions on page 115.

4.16 Handling Unix signals

For Linux applications, ARM processors have the facility to trap Unix signals. These are managed in the debugger by selecting **Manage Signals** from the **Breakpoints** view menu or you can use the `handle` command. You can also use the `info signals` command to display the current handler settings.

The default handler settings are dependent on the type of debug activity. For example, by default on a Linux kernel connection, all signals are handled by Linux on the target.

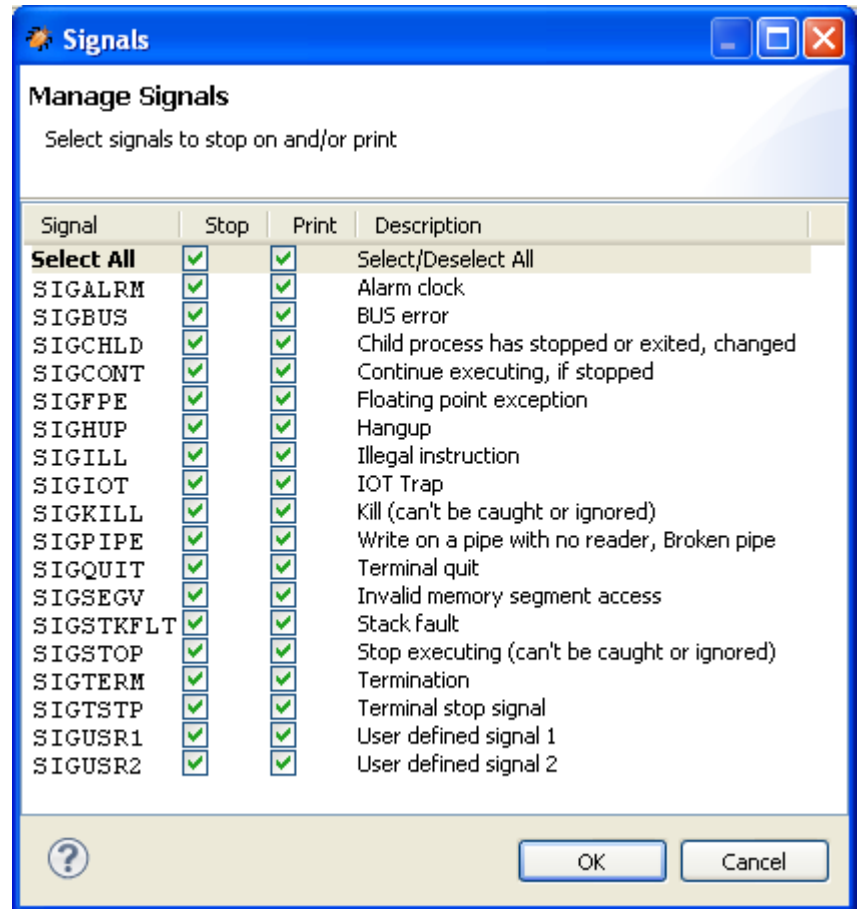


Figure 4-8 Managing signal handler settings

———— **Note** ————

Unix signals `SIGINT` and `SIGTRAP` cannot be debugged in the same way as other signals because they are used internally by the debugger for asynchronous stopping of the process and breakpoints respectively.

Examples

If you want the application to ignore a signal but log the event when it is triggered then you must enable stopping on a signal. In the following example, a `SIGHUP` signal occurs causing the debugger to stop and print a message. No signal handler is invoked when using this setting and the application being debugged ignores the signal and continues.

Ignoring a SIGHUP signal	handle SIGHUP stop print on SIGHUP signal	# Enable stop and print
---------------------------------	--	-------------------------

The following example shows how to debug a signal handler. To do this you must disable stopping on a signal and then set a breakpoint in the signal handler. This is because if stopping on a signal is disabled then the handling of that signal is performed by the process that passes signal to the registered handler. If no handler is registered then the default handler runs and the application generally exits.

Debugging a SIGHUP signal	handle SIGHUP nostop noprint print on SIGHUP signal	# Disable stop and
----------------------------------	--	--------------------

Related Concepts

About debugging shared libraries on page 135.
About debugging a Linux kernel on page 137.
About debugging Linux kernel modules on page 139.

Related References

Stepping through an application on page 111.
Examining the target execution environment on page 120.
Examining the call stack on page 122.
Handling processor exceptions on page 115.
Breakpoints view on page 185.
Commands view on page 192.
Manage Signals dialog box on page 254.

Related Information

DS-5 Debugger commands.

4.17 Handling processor exceptions

ARM processors handle exceptional events by jumping to one of a set of fixed addresses known as exception vectors. Except for a *Supervisor Call* (SVC), these events are not part of normal program flow and can happen unexpectedly because of a software bug. For this reason most ARM processors include a vector catch feature to trap these exceptions. This is most useful for bare-metal projects, or projects at an early stage of development. When an OS is running it might use these exceptions for legitimate purposes, for example virtual memory.

When vector catch is enabled, the effect is similar to placing a breakpoint on the selected vector table entry, except that vector catches use dedicated hardware in the processor and do not use up valuable breakpoint resources. To manage vector catch in the debugger either select **Manage Signals** from the **Breakpoints** view menu or use the `handle` command. You can also use the `info signals` command to display the current handler settings.

The vector catch events that are available are dependent on the exact processor that you are connected to.

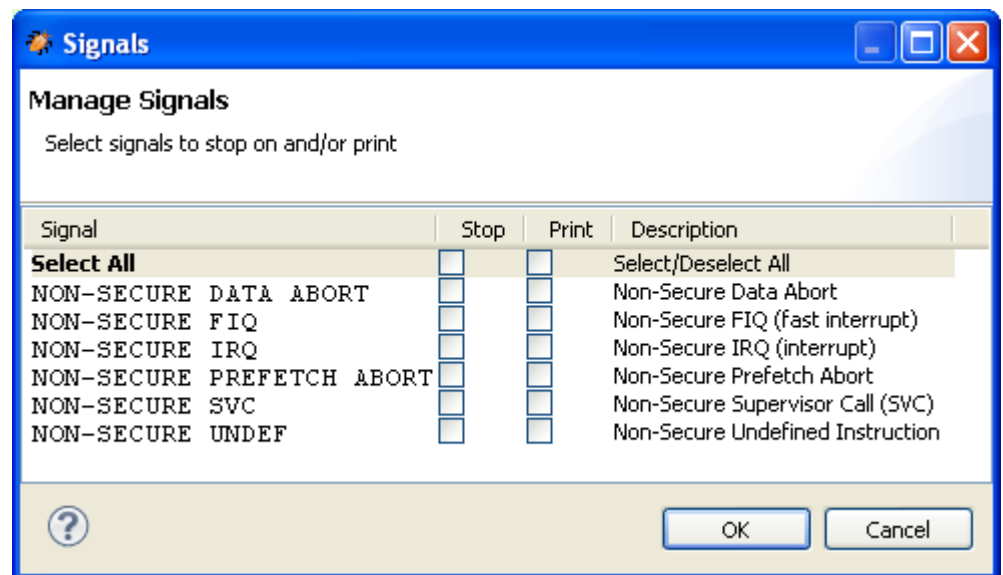


Figure 4-9 Manage exception handler settings

Examples

If you want the debugger to catch the exception, log the event, and stop the application when the exception occurs then you must enable stopping on an exception. In the following example, a `NON-SECURE_FIQ` exception occurs causing the debugger to stop and print a message. You can then step or run to the handler, if present.

Debugging an exception handler

```
handle NON-SECURE_FIQ stop      # Enable stop and
print on a NON-SECURE_FIQ exception
```

If you want the exception to invoke the handler without stopping then you must disable stopping on an exception.

Ignoring an exception

```
handle NON-SECURE_FIQ nostop    # Disable stop on a NON-
SECURE_FIQ exception
```

Related Concepts

About debugging shared libraries on page 135.
About debugging a Linux kernel on page 137.
About debugging Linux kernel modules on page 139.

Related References

Stepping through an application on page 111.
Examining the target execution environment on page 120.
Examining the call stack on page 122.
Handling Unix signals on page 113.
Breakpoints view on page 185.
Commands view on page 192.
Manage Signals dialog box on page 254.

Related Information

DS-5 Debugger commands.

4.18 Configuring the debugger path substitution rules

The debugger might not be able to locate the source file when debug information is loaded because:

- The path specified in the debug information is not present on your workstation, or that path does not contain the required source file.
- The source file is not in the same location on your workstation as the image containing the debug information. The debugger attempts to use the same path as this image by default.

Therefore, you must modify the search paths used by the debugger when it executes any of the commands that look up and display source code.

To modify the search paths:

1. Open the Path Substitution dialog box:
 - If a source file cannot be located, a warning is displayed in the C/C++ editor. Click on **Set Path Substitution**.
 - In the **Debug Control** view, select **Path Substitution** from the view menu.

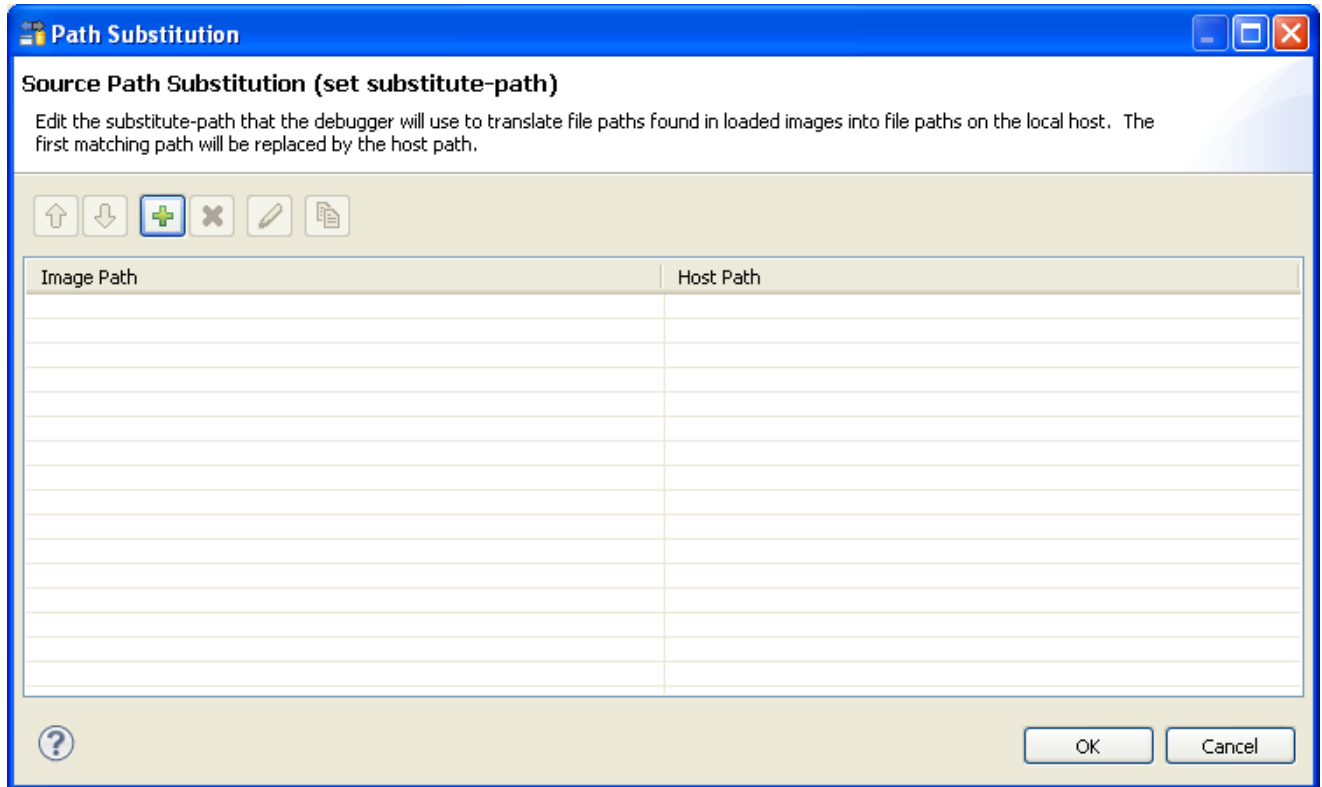


Figure 4-10 Path Substitution dialog box

2. Click on the toolbar icons in the Path Substitution dialog box to add, edit, or duplicate substitution rules:
 - a. Enter the original path for the source files in the Image Path field or click on **Select...** to select from the compilation paths.
 - b. Enter the current location of the source files in the Host Path field or click on:
 - **File System...** to locate the source files in an external folder.
 - **Workspace...** to locate the source files in a workspace project.

- c. Click **OK**.

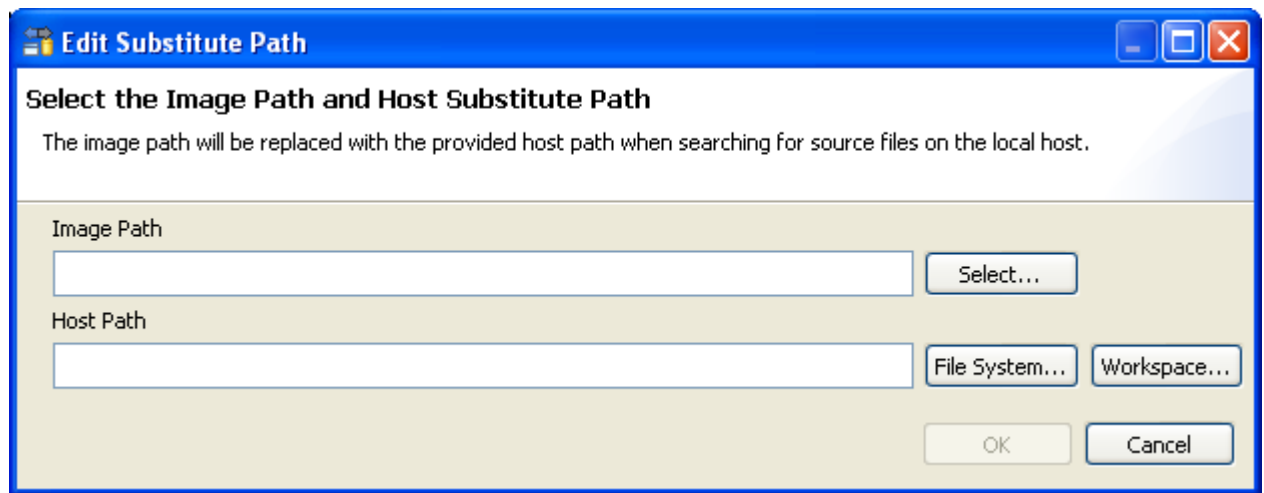


Figure 4-11 Edit Substitute Path dialog box

3. If required, you can use the toolbar icons in the Path Substitution dialog box to change the order of the substitution rules or delete rules that are no longer required.
4. Click **OK** to pass the substitution rules to the debugger and close the dialog box.

Related Concepts

About loading debug information into the debugger on page 90.

Chapter 5

Examining the target

Describes how to examining registers, variables, memory, and the call stack.
It contains the following:

- *Examining the target execution environment on page 5-120.*
- *Examining the call stack on page 5-122.*
- *About trace support on page 5-123.*

5.1 Examining the target execution environment

During a debug session you might want to display , the value of a register or variable, the address of a symbol, the data type of a variable, or the content of memory.

The DS-5 Debug perspective provides the essential debugger views showing the current values. All the views are associated with the active connection and are updated as you step through the application. You can move any of the views to a different position in the perspective by clicking on the tab and dragging to a new position. You can also double-click on a tab to maximize or reset a view for closer analysis of the view content.

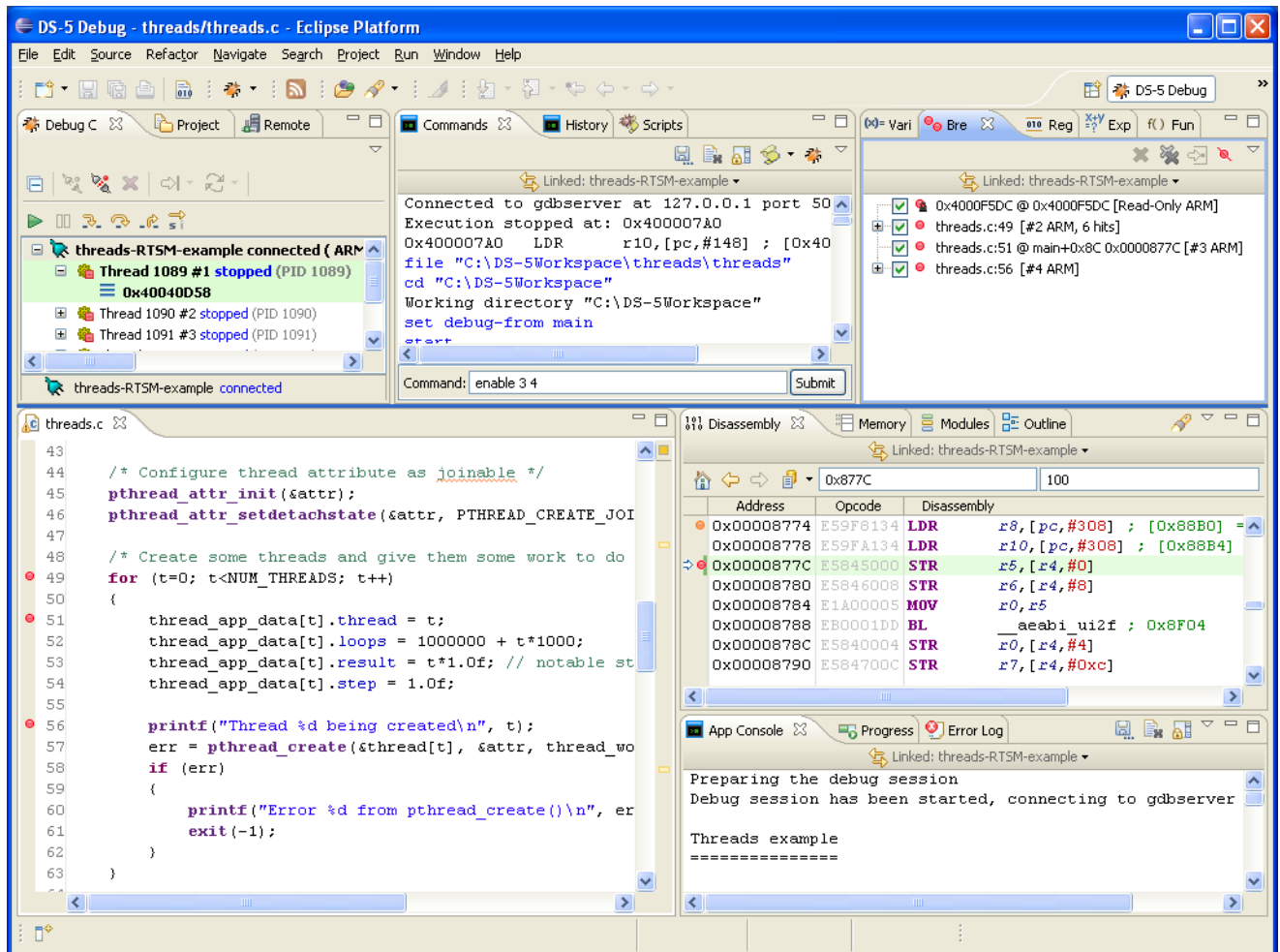


Figure 5-1 Examine the target execution

Alternatively you can use debugger commands to display the required information. In the Commands view you can execute individual commands or you can execute a sequence of commands by using a script file.

Related Concepts

[About debugging shared libraries on page 135.](#)

[About debugging a Linux kernel on page 137.](#)

[About debugging Linux kernel modules on page 139.](#)

Related References

Stepping through an application on page 111.

Examining the call stack on page 122.

Handling Unix signals on page 113.

Handling processor exceptions on page 115.

5.2 Examining the call stack

The call stack, or runtime stack, is an area of memory used to store function return information and local variables. As each function is called, a record is created on the call stack. This record is commonly known as a stack frame.

The debugger can display the calling sequence of any functions that are still in the execution path because their calling addresses are still on the call stack. However:

- When a function completes execution the associated stack frame is removed from the call stack and the information is no longer available to the debugger.
- If the call stack contains a function for which there is no debug information, the debugger might not be able to trace back up the calling stack frames. Therefore you must compile all your code with debug information to successfully view the full call stack.

If you are debugging multi-threaded applications, a separate call stack is maintained for each thread.

All the views in the DS-5 Debug perspective are associated with the current stack frame and are updated when you select another frame. The current stack frame is shown in bold text.

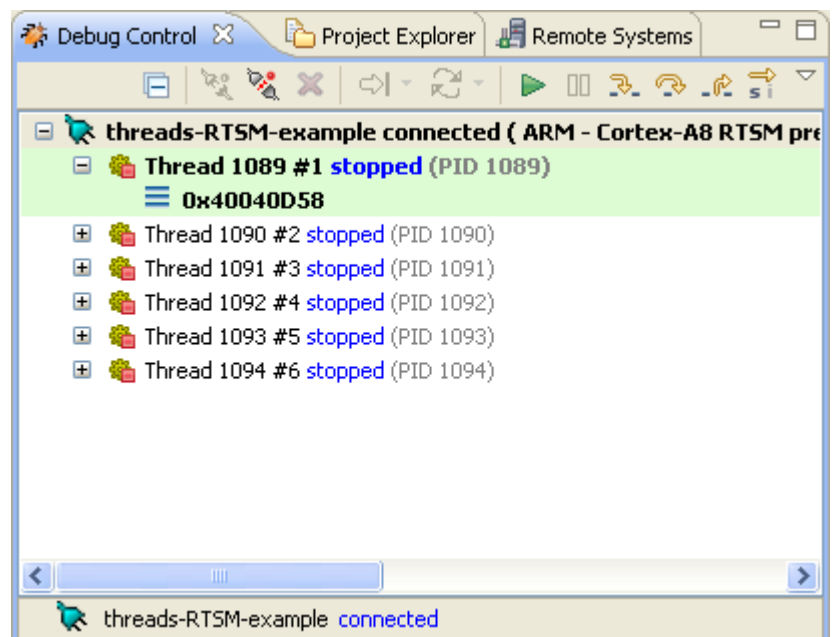


Figure 5-2 Debug Control view

Related Concepts

About debugging shared libraries on page 135.
About debugging a Linux kernel on page 137.
About debugging Linux kernel modules on page 139.

Related References

Stepping through an application on page 111.
Examining the target execution environment on page 120.
Handling Unix signals on page 113.
Handling processor exceptions on page 115.

5.3 About trace support

ARM DS-5 enables you to perform tracing on your application or system. Tracing is the ability to capture in real-time a historical, non-invasive debug of instructions and data accesses. It is a powerful tool that enables you to investigate problems while the system runs at full speed. These problems can be intermittent, and are difficult to identify through traditional debugging methods that require starting and stopping the processor. Tracing is also useful when trying to identify potential bottlenecks or to improve performance-critical areas of your application.

Before the debugger can trace function executions in your application you must ensure that:

- you have a debug hardware agent, such as an ARM DSTREAM \VSTREAM unit with a connection to a trace stream
- the debugger is connected to the debug hardware agent.

Trace hardware

Trace is typically provided by an external hardware block connected to the processor. This is known as an *Embedded Trace Macrocell* (ETM) or *Program Trace Macrocell* (PTM) and is an optional part of an ARM architecture-based system. System-on-chip designers might omit this block from their silicon to reduce costs. These blocks observe (but do not affect) the processor behavior and are able to monitor instruction execution and data accesses.

There are two main problems with capturing trace. The first is that with very high processor clock speeds, even a few seconds of operation can mean billions of cycles of execution. Clearly, to look at this volume of information would be extremely difficult. The second, related problem is that modern processors could potentially perform one or more 64-bit cache accesses per cycle and to record both the data address and data values might require large bandwidth. This presents a problem in that typically, only a few pins are provided on the chip and these outputs might be able to be switched at significantly lower rates than the processor can be clocked at. It is very easy to exceed the capacity of the trace port. To solve this latter problem, the trace macrocell tries to compress information to reduce the bandwidth required. However, the main method to deal with these issues is to control the trace block so that only selected trace information is gathered. For example, trace only execution, without recording data values, or trace only data accesses to a particular peripheral or during execution of a particular function.

In addition, it is common to store trace information in an on-chip memory buffer, the *Embedded Trace Buffer* (ETB). This alleviates the problem of getting information off-chip at speed, but has an additional cost in terms of silicon area and also provides a fixed limit on the amount of trace that can be captured.

The ETB stores the compressed trace information in a circular fashion, continuously capturing trace information until stopped. The size of the ETB varies between chip implementations, but a buffer of 8 or 16kB is typically enough to hold a few thousand lines of program trace.

When a program fails, and the trace buffer is enabled, you can see a portion of program history. With this program history, it is easier to walk back through your program to see what happened just before the point of failure. This is particularly useful for investigating intermittent and real-time failures, which can be difficult to identify through traditional debug methods that require stopping and starting the processor. The use of hardware tracing can significantly reduce the amount of time required to find these failures, because the trace shows exactly what was executed.

Trace Ranges

Trace ranges enable you to restrict the capture of trace to a linear range of memory. A trace range has a start and end address in virtual memory, and any execution within this address range is captured. In contrast to trace start and end points, any function calls made within a trace range are

only captured if the target of the function call is also within the specified address range. The number of trace ranges that can be enabled is determined by the debug hardware in your processor.

Trace capture is enabled by default when no trace ranges are set. Trace capture is disabled by default when any trace ranges are set, and is only enabled when within the defined ranges.

You can configure trace ranges using the **Ranges** tab in the Trace view. The start and end address for each range can either be an absolute address or an expression, such as the name of a function. Be aware that optimizing compilers might rearrange or minimize code in memory from that in the associated source code. This can lead to code being unexpectedly included or excluded from the trace capture.

Trace Points

Trace points enable you to control precisely where in your program trace is captured. Trace points are non-intrusive and do not require stopping the system to process. The maximum number of trace points that can be set is determined by the debug hardware in your processor. The following types of trace points are available: To set trace points in the source view, right-click in the margin and select the required option from the **DS-5 Breakpoints** context menu. To set trace points in the Disassembly view, right-click on an instruction and select the required option from the **DS-5 Breakpoints** context menu. Trace points are listed in the Breakpoints view.

Trace Start Point Enables trace capture when execution reaches the selected address.

Trace Stop Point Disables trace capture when execution reaches the selected address

Trace Trigger Point Marks this point in the trace so that you can more easily locate it in the Trace view.

Trace Start Points and Trace Stop Points enable and disable capture of trace respectively. Trace points do not take account of nesting. For example, if you hit two Trace Start Points in a row, followed by two Trace Stop Points, then the trace is disabled immediately when the first Trace Stop Point is reached, not the second. With no Trace Start Points set then trace is enabled all the time by default. If you have any Trace Start Points set, then trace is disabled by default and is only enabled when the first Trace Start Point is hit.

Trace trigger points enable you to mark interesting locations in the trace so that you can easily find them later in the Trace view. The first time a Trigger Point is hit a Trace Trigger Event record is inserted into the trace buffer. Only the first Trigger Point to be hit inserts the trigger event record. To configure the debugger so that it stops collecting trace when a trace trigger point is hit, use the **Stop Trace Capture On Trigger** checkbox in the **Properties** tab of the Trace view.

Note

This does not stop the target. It only stops the trace capture. The target continues running normally until it hits a breakpoint or until you click the **Interrupt** icon in the Debug Control view.

When this is set you can configure the amount of trace that is captured before and after a trace trigger point using the Post-Trigger Capture Size field in the **Properties** tab of the Trace view. If you set this field to:

0% The trace capture stops as soon as possible after the first trigger point is hit. The trigger event record can be found towards the end of the trace buffer.

- 50%** The trace capture stops after the first trigger point is hit and an additional 50% of the buffer is filled. The trigger event record can be found towards the middle of the trace buffer.
- 99%** The trace capture stops after the first trigger point is hit and an additional 99% of the buffer is filled. The trigger event record can be found towards the beginning of the trace buffer.

Note

Due to target timing constraints the trigger event record might get pushed out of the trace buffer.

Being able to limit trace capture to the precise areas of interest is especially helpful when using a capture device such as an ETB, where the quantity of trace that can be captured is very small.

Select the **Find Trigger Event record** option in the view menu to locate Trigger Event record in the trace buffer.

Note

Trace trigger functionality is dependent on the target platform being able to signal to the trace capture hardware, such as ETB or VSTREAM, that a trigger condition has occurred. If this hardware signal is not present or not configured correctly then it might not be possible to automatically stop trace capture around trigger points.

Chapter 6

Debugging embedded systems

Gives an introduction to debugging embedded systems.
It contains the following:

- *About endianness on page 6-127.*
- *About accessing AHB, APB, and AXI buses on page 6-128.*
- *About virtual and physical memory on page 6-129.*
- *About debugging hypervisors on page 6-130.*
- *About debugging big.LITTLE systems on page 6-131.*
- *About debugging bare-metal symmetric multiprocessing systems on page 6-132.*
- *About debugging multi-threaded applications on page 6-134.*
- *About debugging shared libraries on page 6-135.*
- *About debugging a Linux kernel on page 6-137.*
- *About debugging Linux kernel modules on page 6-139.*
- *About debugging TrustZone enabled targets on page 6-141.*
- *About debugging an Unified Extensible Firmware Interface (UEFI) on page 6-143.*

6.1 About endianness

The term endianness is used to describe the ordering of individually addressable quantities, which means bytes and halfwords in the ARM architecture. The term byte-ordering can also be used rather than endian.

If an image is loaded to the target on connection, the debugger automatically selects the endianness of the image otherwise it selects the current endianness of the target. If the debugger detects a conflict then a warning message is generated.

You can use the `set endian` command to modify the default debugger setting.

Related Information

[*DS-5 Debugger commands.*](#)

6.2 About accessing AHB, APB, and AXI buses

ARM-based systems connect the processors, memories and peripherals using buses. Examples of common bus types include AMBA High-performance Bus (AHB), Advanced Peripheral Bus (APB), and Advanced eXtensible Interface (AXI).

In some systems these buses are accessible from the debug interface. Where this is the case then DS-5 Debugger provides access to these buses when performing bare-metal or kernel debugging. Buses are exposed within the debugger as additional address spaces. Accesses to these buses are available when the processor is running.

Within a debug session in DS-5 Debugger you can discover which buses are available using the `info memory` command. The address and description columns in the output of this command explain what each address space represents and how the debugger accesses it.

You can use `AHB:`, `APB:`, and `AXI:` address prefixes for these buses anywhere in the debugger where you normally enter an address or expression. For example, assuming that the debugger provides an APB address space, then you can print the contents of address zero using the following command:

```
x/1 APB:0x0
```

The exact topology of the buses and their connection to the debug interface is dependent on your system. See the CoreSight specifications for your hardware for more information. Typically, the debug access to these buses bypass the processor, and so does not take into account memory mappings or caches within the processor itself. It is implementation dependent on whether access to the buses occur before or after any other caches in the system, such as L2 or L3 caches. The debugger does not attempt to achieve coherency between caches in your system when accessing these buses and it is your responsibility to take this into account and manually perform any clean or flush operations as required.

For example, to achieve cache coherency when debugging an image with the processors level 1 cache enabled, you must clean and invalidate portions of the L1 cache prior to modifying any of your application code or data using the AHB address space. This ensures that any existing changes in the cache are written out to memory before writing to that address space, and that the processor correctly reads your modification when execution resumes.

The behavior when accessing unallocated addresses is undefined, and depending on your system can lead to locking up the buses. It is recommended that you only access those specific addresses that are defined in your system. You can use the `memory` command to redefine the memory regions within the debugger and modifying access rights to control the addresses. You can use the `x` command with the `count` option to limit the amount of memory that is read.

Related References

[Commands view on page 192.](#)

[Debug Control view on page 195.](#)

Related Information

[DS-5 Debugger commands.](#)

6.3 About virtual and physical memory

Processors that contain a Memory Management Unit (MMU) provide two views of memory, virtual and physical. The virtual address is the address prior to address translation in the MMU and the physical address is the address after translation. Normally when the debugger accesses memory, it uses virtual addresses. However, if the MMU is disabled then the mapping is flat and the virtual address is the same as the physical address. To force the debugger to use physical addresses prefix an addresses with P:. For example:

```
P:0x8000
P:0+main creates a physical address with the address offset of main()
```

If your processor additionally contains TrustZone technology, then you have access to Secure and Normal worlds, each with their own separate virtual and physical address mappings. In this case, the address prefix P: is not available, and instead you must use NP: for normal physical and SP: for secure physical.

————— Note —————

Physical address access is not enabled for all operations. For example, the ARM hardware does not provide support for setting breakpoints via a physical address.

When memory is accessed via a physical address the caches are not flushed. Hence, results might differ depending on whether you view memory through the physical or virtual addresses (assuming they are addressing the same memory addresses).

Related References

[Commands view on page 192.](#)

[Debug Control view on page 195.](#)

Related Information

[DS-5 Debugger commands.](#)

6.4 About debugging hypervisors

ARM processors that support virtualization extensions have the ability to run multiple guest operating systems beneath a hypervisor. The hypervisor is the software that arbitrates amongst the guest operating systems and controls access to the hardware.

DS-5 Debugger provides basic support for bare-metal hypervisor debugging. When connected to a processor that supports virtualization extensions, the debugger enables you to distinguish between hypervisor and guest memory, and to set breakpoints that only apply when in hypervisor mode or within a specific guest operating system.

A hypervisor typically provides separate address spaces for itself as well as for each guest operating system. Unless informed otherwise, all memory accesses by the debugger occur in the current context. If you are stopped in hypervisor mode then memory accesses use the hypervisor memory space, and if stopped in a guest operating system then memory accesses use the address space of the guest operating system. To force access to a particular address space you must prefix the address with either `H:` for hypervisor or `N:` for guest operating system. Note that it is only possible to access the address space of the guest operating system that is currently scheduled to run within the hypervisor. It is not possible to specify a different guest operating system.

Similarly, hardware and software breakpoints can be configured to match on hypervisor or guest operating systems using the same address prefixes. If no address prefix is used then the breakpoint applies to the address space that is current when the breakpoint is first set. For example, if a software breakpoint is set in memory that is shared between hypervisor and a guest operating system, then the possibility exists for the breakpoint to be hit from the wrong mode, and in this case the debugger may not recognize your breakpoint as the reason for stopping.

For hardware breakpoints only, not software breakpoints, you can additionally configure them to match only within a specific guest operating system. This feature uses the architecturally defined Virtual Machine ID (VMID) register to spot when a specific guest operating system is executing. The hypervisor is responsible for assigning unique VMIDs to each guest operating system setting this in the VMID register when that guest operating system executes. In using this feature, it is your responsibility to understand which VMID is associated with each guest operating system that you want to debug. Assuming a VMID is known, you can apply a breakpoint to it within the **Breakpoints** view or by using the `break-stop-on-vmid` command.

When debugging a system that is running multiple guest operating systems, you can optionally enable the `set print current-vmid` setting to receive notifications in the console when the debugger stops and the current VMID changes. You can also obtain the VMID within DS-5 scripts using the `$vmid` debugger variable.

Related References

[Commands view on page 192.](#)

[Debug Control view on page 195.](#)

Related Information

[DS-5 Debugger commands.](#)

6.5 About debugging big.LITTLE systems

A big.LITTLE system is designed to optimize both high performance and low power consumption over a wide variety of workloads. It achieves this by including one or more high performance processors alongside one or more low power processors. The system transitions the workload between the processors as necessary to achieve this goal.

big.LITTLE systems are typically configured in a *Symmetric MultiProcessing* (SMP) configuration. An operating system or hypervisor controls which processors are powered up or down at any given time and assists in migrating tasks between them.

For bare-metal debugging on big.LITTLE systems, you can establish an SMP connection within DS-5 Debugger. In this case all the processors in the system are brought under the control of the debugger. The debugger monitors the power state of each processor as it runs and displays it in the **Debug Control** view and on the command -line. Processors that are powered-down are visible to the debugger but cannot be accessed.

For Linux application debugging on big.LITTLE systems, you can establish a **gdbserver** connection within DS-5 Debugger. Linux applications are typically unaware of whether they are running on a big processor or a little processor because this is hidden by the operating system. There is therefore no difference within the debugger when debugging a Linux application on a big.LITTLE system as compared to application debug on any other system.

Related Concepts

[About debugging bare-metal symmetric multiprocessing systems on page 132.](#)

Related References

[Commands view on page 192.](#)

[Debug Control view on page 195.](#)

Related Information

[DS-5 Debugger commands.](#)

6.6 About debugging bare-metal symmetric multiprocessing systems

DS-5 Debugger supports debugging bare-metal *Symmetric MultiProcessing* (SMP) systems. The debugger expects an SMP system to meet the following requirements:

- The same ELF image running on all processors.
- All processors must have identical debug hardware. For example, the number of hardware breakpoint and watchpoint resources must be identical.
- Breakpoints and watchpoints must only be set in regions where all processors have identical memory maps, both physical and virtual. Processors with different instance of identical peripherals mapped at the same address are considered to meet this requirement, as in the case of the private peripherals of ARM multicore processors.

Configuring and connecting

To enable SMP support in the debugger you must first configure a debug session in the Debug Configurations dialog. Targets that support SMP debugging are identified by having SMP mentioned in the Debug operation drop-down list.

Configuring a single SMP connection is all you require to enable SMP support in the debugger. On connection, you can then debug all of the SMP processors in your system by selecting them in the **Debug Control** view.

Image and symbol loading

When debugging an SMP system, image and symbol loading operations apply to all the SMP processors. For image loading, this means that the image code and data are written to memory once through one of the processors, and are assumed to be accessible through the other processors at the same address because they share the same memory. For symbol loading, this means that debug information is loaded once and is available when debugging any of the processors.

Running, stopping and stepping

When debugging an SMP system, attempting to run one processor automatically starts running all the other processors in the system. Similarly, when one processor stops (either because you requested it or because of an event such as a breakpoint being hit), then all processors in the system stop.

For instruction level single-stepping (`stepi` and `nexti` commands), then the currently selected processor steps one instruction. The exception to this is when a `nexti` operation is required to step over a function call in which case the debugger sets a breakpoint and then runs all processors. All other stepping commands affect all processors.

Depending on your system, there might be a delay between one processor running or stopping and another processor running or stopping. This delay can be very large because the debugger must manually run and stop all the processors individually.

In rare cases, one processor might stop and one or more of the others fails to stop in response. This can occur, for example, when a processor running code in secure mode has temporarily disabled debug ability. When this occurs, the **Debug Control** view displays the individual state of each processor (running or stopped), so that you can see which ones have failed to stop. Subsequent run and step operations might not operate correctly until all the processors stop.

Breakpoints, watchpoints, and signals

By default, when debugging an SMP system, breakpoint, watchpoint, and signal (vector catch) operations apply to all processors. This means that you can set one breakpoint to trigger when any of the processors execute code that meets the criteria. When the debugger stops due to a

breakpoint, watchpoint, or signal, then the processor that causes the event is listed in the **Commands** view.

Breakpoints or watchpoints can be configured for one or more processors by selecting the required processor in the relevant Properties dialog box. Alternatively, you can use the `break-stop-on-cores` command. This feature is not available for signals.

Examining target state

Views of the target state, including registers, call stack, memory, disassembly, expressions, and variables contain content that is specific to a processor.

Views such as breakpoints, signals and commands are shared by all the processors in the SMP system, and display the same contents regardless of which processor is currently selected.

Trace

When you are using a connection that enables trace support then you are able to view trace for each of the processors in your system. By default, the **Trace** view shows trace for the processor that is currently selected in the **Debug Control** view. Alternatively, you can choose to link a **Trace** view to a specific processor by using the **Linked: context** toolbar option for that **Trace** view. Creating multiple **Trace** views linked to specific processors enables you to view the trace from multiple processors at the same time. The indexes in the **Trace** views do not necessarily represent the same point in time for different processors.

Related Concepts

[About debugging big.LITTLE systems on page 131.](#)

[About loading an image on to the target on page 88.](#)

[About loading debug information into the debugger on page 90.](#)

Related References

[About breakpoints and watchpoints on page 94.](#)

[Setting an execution breakpoint on page 96.](#)

[Setting a data watchpoint on page 98.](#)

[Setting a tracepoint on page 100.](#)

[Setting Streamline start and stop points on page 101.](#)

[Setting a conditional breakpoint on page 102.](#)

[Setting a breakpoint on a specific thread on page 105.](#)

[Pending breakpoints and watchpoints on page 108.](#)

[Stepping through an application on page 111.](#)

[Breakpoints view on page 185.](#)

[Commands view on page 192.](#)

[Debug Control view on page 195.](#)

[Disassembly view on page 199.](#)

[Memory view on page 212.](#)

[Modules view on page 216.](#)

[Registers view on page 220.](#)

[Variables view on page 237.](#)

Related Information

[DS-5 Debugger commands.](#)

6.7 About debugging multi-threaded applications

The debugger tracks the current thread using the debugger variable, \$thread. You can use this variable in print commands or in expressions. Threads are displayed in the **Debug Control** view with a unique ID that is used by the debugger and a unique ID from the *Operating System* (OS) :

Thread 1086 #1 stopped (PID 1086)

where #1 is the unique ID used by the debugger and PID 1086 is the ID from the OS.

A separate call stack is maintained for each thread and the selected stack frame is shown in bold text. All the views in the DS-5 Debug perspective are associated with the selected stack frame and are updated when you select another frame.

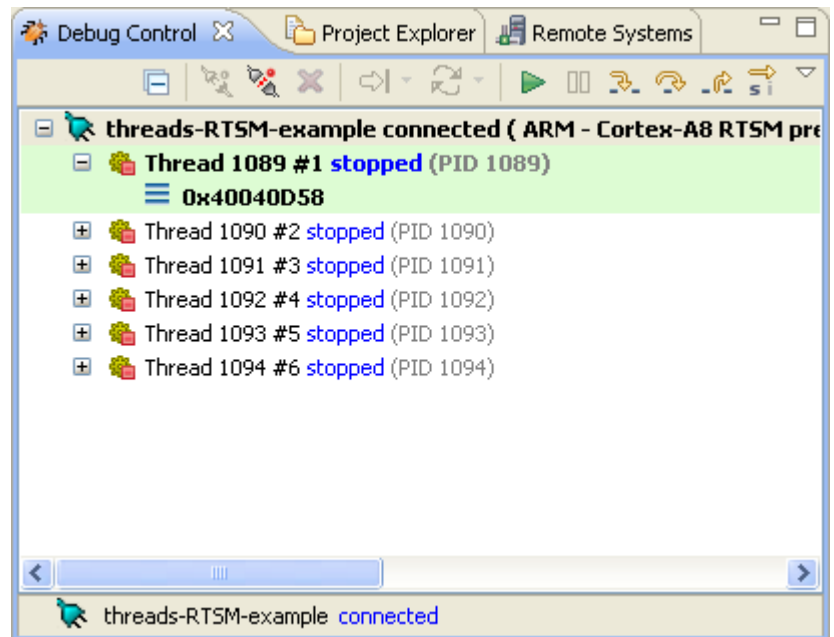


Figure 6-1 Threading call stacks in the Debug Control view

Related References

Breakpoints view on page 185.
Commands view on page 192.
Debug Control view on page 195.
Disassembly view on page 199.
Memory view on page 212.
Modules view on page 216.
Registers view on page 220.
Variables view on page 237.

6.8 About debugging shared libraries

Shared libraries enable parts of your application to be dynamically loaded at runtime. You must ensure that the shared libraries on your target are the same as those on your host. The code layout must be identical, but the shared libraries on your target do not require debug information.

You can set standard execution breakpoints in a shared library but not until it is loaded by the application and the debug information is loaded into the debugger. Pending breakpoints however, enable you to set execution breakpoints in a shared library before it is loaded by the application.

When a new shared library is loaded the debugger re-evaluates all pending breakpoints, and those with addresses that it can resolve are set as standard execution breakpoints. Unresolved addresses remain as pending breakpoints.

The debugger automatically changes any breakpoints in a shared library to a pending breakpoint when the library is unloaded by your application.

You can load shared libraries in the Debug Configurations dialog box. If you have one library file then you can use the **Load symbols from file** option in the **Files** tab.

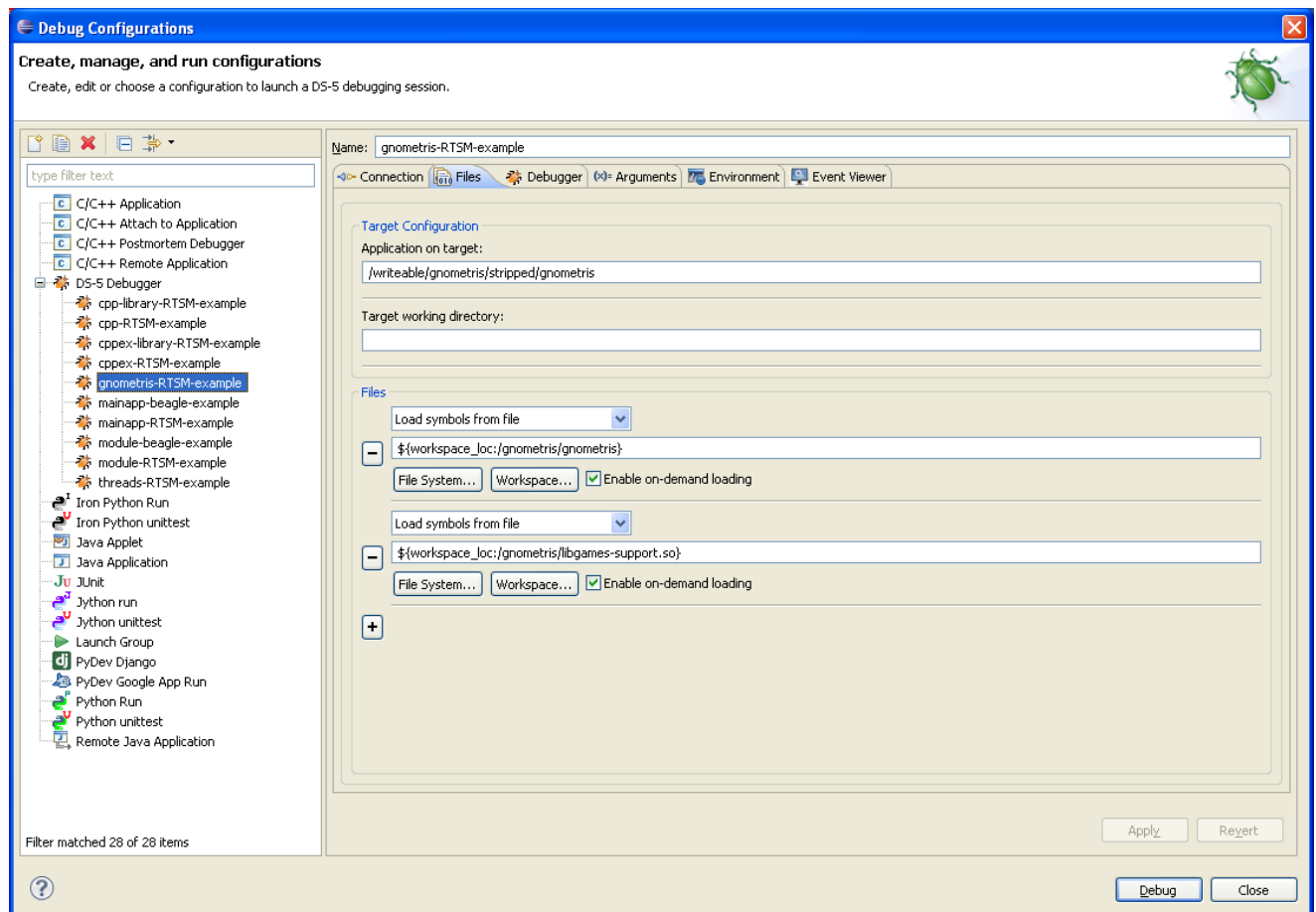


Figure 6-2 Adding individual shared library files

Alternatively if you have multiple library files then it is probably more efficient to modify the search paths in use by the debugger when searching for shared libraries. To do this you can use the **Shared library search directory** option in the **Paths** panel of the **Debugger** tab.

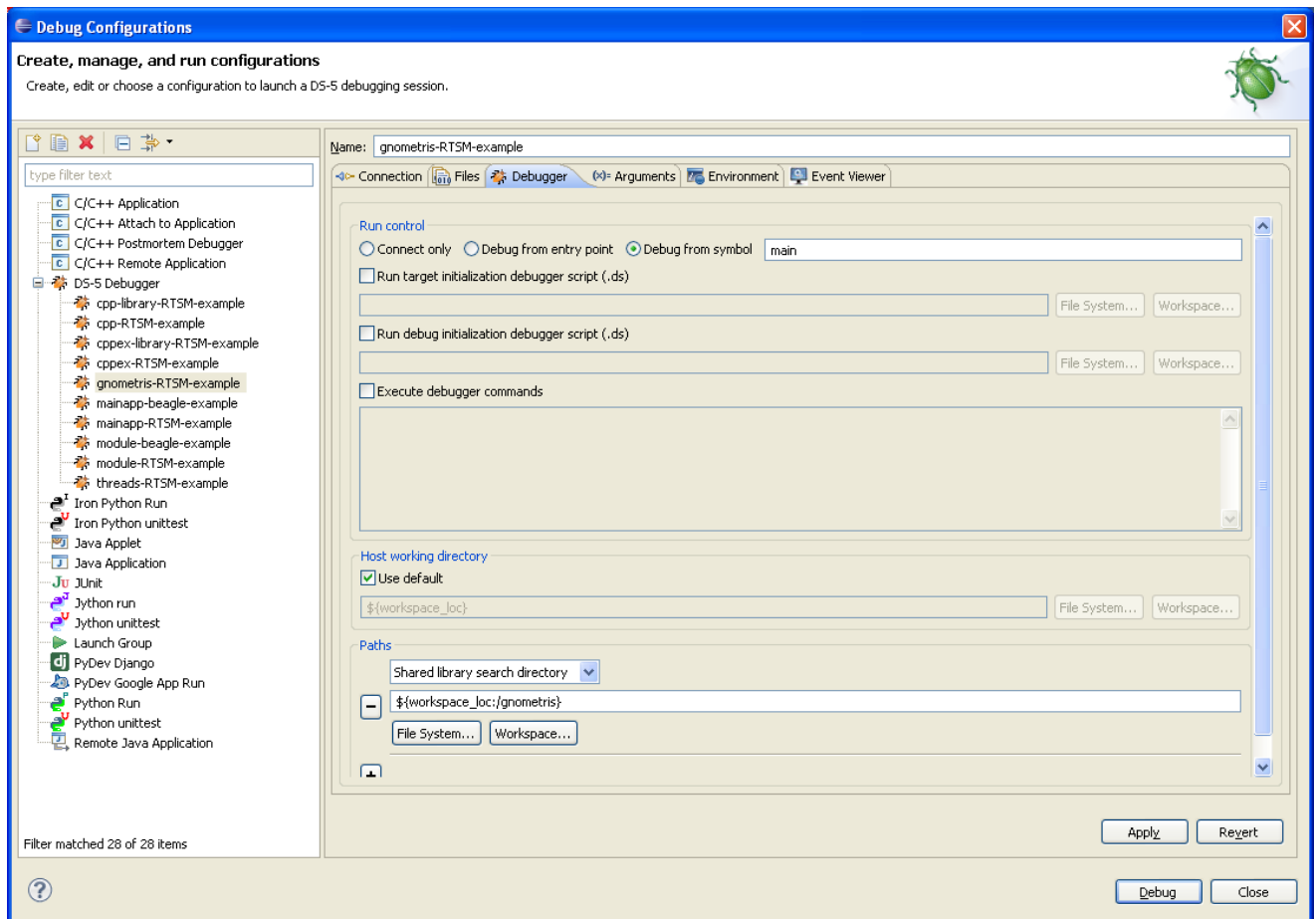


Figure 6-3 Modifying the shared library search paths

For more information on the options in the Debug Configurations dialog box, use the dynamic help.

Related References

Stepping through an application on page 111.
Examining the target execution environment on page 120.
Examining the call stack on page 122.
Handling Unix signals on page 113.
Handling processor exceptions on page 115.
Breakpoints view on page 185.
Commands view on page 192.
Debug Control view on page 195.
Disassembly view on page 199.
Memory view on page 212.
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Registers view on page 220.
Variables view on page 237.

6.9 About debugging a Linux kernel

DS-5 supports source level debugging of a Linux kernel. The Linux kernel (and associated device drivers) can be debugged in the same way as a standard ELF format executable. For example, you can set breakpoints in the kernel code, step through the source, inspect the call stack, and watch variables.

Note

User space parameters (marked `__user`) that are not currently mapped in cannot be read by the debugger.

To debug the kernel:

1. Compile the kernel source using the following options:

- `CONFIG_DEBUG_KERNEL=y`
- `CONFIG_DEBUG_INFO=y`
- Other options might be required depending on the type of debugging you want to perform.

Compiling the kernel source generates a Linux kernel image and symbol files containing debug information.

Note

Be aware that a Linux kernel is always compiled with full optimizations and inlining enabled, therefore:

- stepping through code might not work as expected due to the possible reordering of some instructions
- some variables might be optimized out by the compiler and therefore not be available for the debugger.

-
2. Load the Linux kernel on to the target
 3. Load kernel debug information into the debugger
 4. Debug the kernel as required.

Related Concepts

[About debugging Linux kernel modules on page 139.](#)

Related Tasks

[Configuring a connection to a Linux Kernel on page 31.](#)

Related References

[Stepping through an application on page 111.](#)
[Examining the target execution environment on page 120.](#)
[Examining the call stack on page 122.](#)
[Handling Unix signals on page 113.](#)
[Handling processor exceptions on page 115.](#)
[Debug Configurations - Files tab on page 262.](#)
[Debug Configurations - Debugger tab on page 266.](#)
[Breakpoints view on page 185.](#)
[Commands view on page 192.](#)

Debug Control view on page 195.

Disassembly view on page 199.

Memory view on page 212.

Modules view on page 216.

Registers view on page 220.

Variables view on page 237.

Related Information

Debugging a loadable kernel module.

6.10 About debugging Linux kernel modules

Linux kernel modules provide a way to extend the functionality of the kernel, and are typically used for things such as device and file system drivers. Modules can either be built into the kernel or can be compiled as a loadable module and then dynamically inserted and removed from a running kernel during development without having to frequently recompile the kernel. However, some modules must be built into the kernel and are not suitable for loading dynamically. An example of a built-in module is one that is required during kernel boot and must be available prior to the root file system being mounted.

You can set source-level breakpoints in a module provided that the debug information is loaded into the debugger. Attempts to set a breakpoint in a module before it is inserted into the kernel results in the breakpoint being pended.

When debugging a module, you must ensure that the module on your target is the same as that on your host. The code layout must be identical, but the module on your target does not require debug information.

Built-in module

To debug a module that has been built into the kernel, the procedure is the same as for debugging the kernel itself:

1. Compile the kernel together with the module.
2. Load the kernel image on to the target.
3. Load the related kernel image with debug information into the debugger
4. Debug the module as you would for any other kernel code.

Built-in (statically linked) modules are indistinguishable from the rest of the kernel code, so are not listed by the `info os-modules` command and do not appear in the **Modules** view.

Loadable module

The procedure for debugging a loadable kernel module is more complex. From a Linux terminal shell, you can use the `insmod` and `rmmod` commands to insert and remove a module. Debug information for both the kernel and the loadable module must be loaded into the debugger. When you insert and remove a module the debugger automatically resolves memory locations for debug information and existing breakpoints. To do this, the debugger intercepts calls within the kernel to insert and remove modules. This introduces a small delay for each action whilst the debugger stops the kernel to interrogate various data structures. For more information on debugging a loadable kernel module, see the tutorial in *Getting Started with DS-5*.

————— Note —————

A connection must be established and *Operating System* (OS) support enabled within the debugger before a loadable module can be detected. OS support is automatically enabled when a Linux kernel image is loaded into the debugger. However, you can manually control this by using the `set os` command.

Related Concepts

[About debugging a Linux kernel on page 137.](#)

Related Tasks

[Configuring a connection to a Linux Kernel on page 31.](#)

Related References

Stepping through an application on page 111.
Examining the target execution environment on page 120.
Examining the call stack on page 122.
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Breakpoints view on page 185.
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Disassembly view on page 199.
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Modules view on page 216.
Registers view on page 220.
Variables view on page 237.

Related Information

Debugging a loadable kernel module.

6.11 About debugging TrustZone enabled targets

ARM TrustZone® is a security technology designed into some ARM processors. For example, the Cortex-A class processors. It segments execution and resources such as memory and peripherals into secure and normal worlds.

When connected to a target that supports TrustZone and where access to the secure world is permitted, then the debugger provides access to both secure and normal worlds. In this case, all addresses and address-related operations are specific to a single world. This means that any commands you use that require an address or expression must also specify the world that they apply to. : 0x1000

Where:

- N:** For an address in Normal World memory.
- S:** For an address in Secure World memory.

If you want to specify an address in the current world, then you can omit the prefix.

When loading images and debug information it is important that you load them into the correct world. The debug launcher panel does not provide a way to directly specify an address world for images and debug information, so to achieve this you must use scripting commands instead. The **Debugger** tab in the debugger launcher panel provides an option to run a debug initialization script or a set of arbitrary debugger commands on connection. Here are some example commands:

- Load image only to normal world (applying zero offset to addresses in the image)

```
load myimage.axf N:0
```

- Load debug information only to secure world (applying zero offset to addresses in the debug information)

```
file myimage.axf S:0
```

- Load image and debug information to secure world (applying zero offset to addresses)

```
loadfile myimage.axf S:0
```

When an operation such as loading debug symbols or setting a breakpoint needs to apply to both normal and secure worlds then you must perform the operation twice, once for the normal world and once for the secure world.

Registers such as \$PC have no world. To access the content of memory from an address in a register that is not in the current world, you can use an expression, N:0+\$PC. This is generally not necessary for expressions involving debug information, because these are associated with a world when they are loaded.

Related References

[Breakpoints view on page 185.](#)
[Commands view on page 192.](#)
[Debug Control view on page 195.](#)
[Disassembly view on page 199.](#)
[Memory view on page 212.](#)
[Modules view on page 216.](#)
[Registers view on page 220.](#)
[Variables view on page 237.](#)

Related Information

DS-5 Debugger commands.

ARM Security Technology Building a Secure System using TrustZone Technology.

Technical Reference Manual.

Architecture Reference Manual.

6.12 About debugging an Unified Extensible Firmware Interface (UEFI)

UEFI defines a software interface to control the start-up of complex microprocessor systems. UEFI on ARM allows you to control the booting of ARM -based servers and client computing devices.

DS-5 provides a complete UEFI development environment which enables you to:

- Fetch the UEFI source code via the Eclipse Git plug-in (available as a separate download from the Eclipse website).
- Build the source code using the ARM Compiler.
- Download the executables to a software model (a Cortex-A9x4 FVP is provided with DS-5) or to a hardware target (available separately).
- Run/debug the code using the DS-5 Debugger.
- Debug dynamically loaded modules (DLLs) at source-level using Jython scripts.

The UEFI source code and Jython scripts are available for download from: <http://sourceforge.net/apps/mediawiki/tianocore/index.php?title=ArmPlatformPkg/ArmVExpressPkg>

For more information, see this blog: <http://blogs.arm.com/software-enablement/884-uefi-debug-made-easy/>

Chapter 7

Controlling runtime messages

Describes semihosting and how to control runtime messages.
It contains the following:

- *About semihosting and top of memory on page 7-145.*
- *Working with semihosting on page 7-146.*
- *Enabling automatic semihosting support in the debugger on page 7-147.*
- *Controlling semihosting messages using the command-line console on page 7-148.*
- *Controlling the output of logging messages on page 7-149.*
- *About Log4j configuration files on page 7-150.*
- *Customizing the output of logging messages from the debugger on page 7-151.*

7.1 About semihosting and top of memory

Describes a typical memory layout for an ARM target.

Semihosting is typically used when debugging an application that is using the C library and running without an operating system. This enables functions in the C library, such as `printf()` and `scanf()`, to use the screen and keyboard on the host workstation instead of having a screen and keyboard on the target system.

Semihosting uses stack base and heap base addresses to determine the location and size of the stack and heap.

The stack base, also known as the top of memory, is an address that is by default 64K from the end of the heap base.

The heap base is by default contiguous to the application code.

The following figure shows a typical layout for an ARM target.

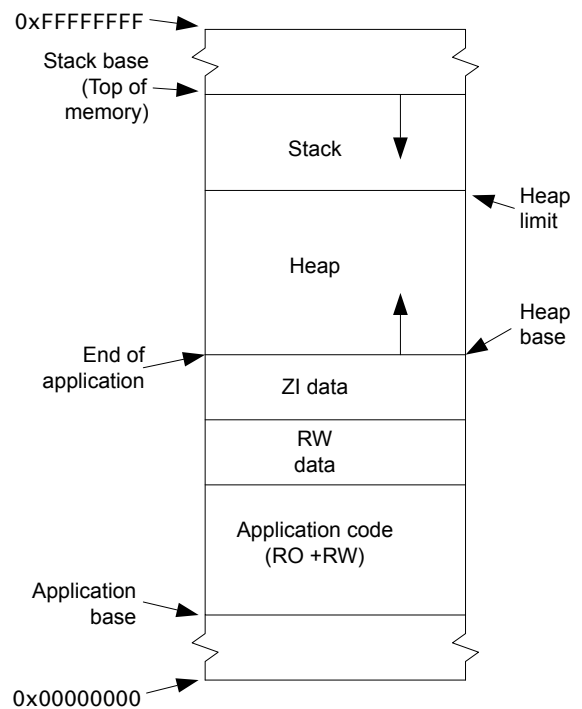


Figure 7-1 Typical layout between top of memory, stack, and heap

Related References

About passing arguments to main() on page 92.
Working with semihosting on page 146.
Enabling automatic semihosting support in the debugger on page 147.
Controlling semihosting messages using the command-line console on page 148.
Debug Configurations - Arguments tab on page 270.
App Console view on page 179.

Related Information

DS-5 Debugger commands.

7.2 Working with semihosting

Gives an overview of semihosting support in the debugger.

Semihosting is supported by the debugger in both the command-line console and in Eclipse.

Command-line console

By default all semihosting messages (`stdout` and `stderr`) are output to the console. When using this console interactively with debugger commands you must use the `stdin` command to send input messages (`stdin`) to the application.

Alternatively, you can disable semihosting in the console and use a separate telnet session to interact directly with the application. During start up, the debugger creates a semihosting server socket and displays the port number to use for the telnet session.

Eclipse

The **App Console** view within the DS-5 Debug perspective controls all the semihosting input/output requests (`stdin`, `stdout`, and `stderr`) between the application code and the debugger.

Related References

About passing arguments to `main()` on page 92.

About semihosting and top of memory on page 145.

Enabling automatic semihosting support in the debugger on page 147.

Controlling semihosting messages using the command-line console on page 148.

Debug Configurations - Arguments tab on page 270.

App Console view on page 179.

Related Information

DS-5 Debugger commands.

7.3 Enabling automatic semihosting support in the debugger

Describes how create an ELF symbol to enable semihosting support in the debugger.

By default, semihosting support is disabled in the debugger. However, the debugger can automatically enable semihosting on supported targets when you load debug information that contains the ELF symbol `__auto_semihosting`.

In C code you can easily create the ELF symbol by defining a function with the name `__auto_semihosting`. To prevent this function generating any additional code or data in your image you can define it as an alias of another function. This places the required ELF symbol in the debug information but does not affect the code and data in the application image.

———— Note —————

Creating a special semihosting ELF symbol is not required if you build your application image using ARM Compiler 5.0 and later. The linker automatically adds this symbol if required.

Create a special semihosting ELF symbol with an alias to `main()`

```
#include <stdio.h>
void __auto_semihosting(void) __attribute__((alias("main")));
                                     //mark as alias for main() to declare
                                     //semihosting ELF symbol in debug information only

int main(void)
{
    printf("Hello world\n");
    return 0;
}
```

Related References

[About passing arguments to `main\(\)` on page 92.](#)

[About semihosting and top of memory on page 145.](#)

[Working with semihosting on page 146.](#)

[Controlling semihosting messages using the command-line console on page 148.](#)

[Debug Configurations - Arguments tab on page 270.](#)

[App Console view on page 179.](#)

Related Information

[DS-5 Debugger commands.](#)

7.4 Controlling semihosting messages using the command-line console

Describes the debugger commands you can use to control semihosting messages.

You can control input/output requests from application code to a host workstation running the debugger. These are called semihosting messages.

By default, all messages are output to the command-line console but you can choose to redirect them when launching the debugger by using one or more of the following:

--disable_semihosting

Disables all semihosting operations.

--disable_semihosting_console

Disables all semihosting operations to the debugger console.

--semihosting_error=filename

Specifies a file to write stderr for semihosting operations.

--semihosting_input=filename

Specifies a file to read stdin for semihosting operations.

--semihosting_output=filename

Specifies a file to write stdout for semihosting operations.

Related References

[About passing arguments to main\(\) on page 92.](#)

[About semihosting and top of memory on page 145.](#)

[Working with semihosting on page 146.](#)

[Enabling automatic semihosting support in the debugger on page 147.](#)

[Debug Configurations - Arguments tab on page 270.](#)

[App Console view on page 179.](#)

Related Information

[DS-5 Debugger commands.](#)

7.5 Controlling the output of logging messages

Describes the debugger commands you can use to control logging messages.

You can control logging messages from the debugger. By default, all messages are output to the **App Console** view but you can control the output and redirection of logging messages by using the `log config` and `log file` debugger commands:

`log config=option`

Specifies the type of logging configuration to output runtime messages from the debugger:

Where:

option

Specifies a predefined logging configuration or a user-defined logging configuration file:

info

Output messages using the predefined INFO level configuration. This is the default.

debug

Output messages using the predefined DEBUG level configuration.

filename

Specifies a user-defined logging configuration file to customize the output of messages. The debugger supports log4j configuration files.

`log file=filename`

Output messages to a file in addition to the console.

Related Concepts

[About Log4j configuration files on page 150.](#)

Related Tasks

[Customizing the output of logging messages from the debugger on page 151.](#)

Related Information

[Log4j in Apache Logging Services.](#)

7.6 About Log4j configuration files

Lists the log4j logging levels you can use to control messages.

In general, the predefined logging configurations provided by the debugger are sufficient for most debugging tasks. However, if you want finer control then you can specify your own customized logging configuration by creating a log4j configuration file. Log4j is an open source logging system for the Java platform and the debugger currently uses version 1.2.

Log4j uses a hierarchy of logging levels to control messages with each level inheriting all lower levels. The following logging levels are currently supported by the debugger:

- DEBUG
- INFO
- WARN
- ERROR
- FATAL

Messages are assigned to a specific logging level and can be redirected to different output locations using one or more of the following log4j components:

Table 7-1 Log4j Components

Component	Description
Logger	Defines the level of logging.
Appender	Defines the output destination.
Layout	Defines the message format.

Related Tasks

[Customizing the output of logging messages from the debugger on page 151.](#)

Related References

[Controlling the output of logging messages on page 149.](#)

Related Information

[Log4j in Apache Logging Services.](#)

7.7 Customizing the output of logging messages from the debugger

Describes how to create a customized log4j configuration file.

Procedure

1. Create an Appender instance for the required logging type. The following types are supported:
 - ConsoleAppender
 - RollingFileAppender.
2. Suppress the Threshold logging level, if required.
3. If the Appender instance outputs to a file, define the layout for the Appender instance. The following layouts are supported:

PatternLayout

Textual format.

HTMLLayout

HTML format.

4. If the Appender instance outputs to a file, define the file components. The following components are supported:

File

File name

MaxFileSize

Long integer or string, 10KB.

MaxBackupIndex

Maximum number of log files to use. The default is 1.

5. If you use the layout PatternLayout, you can enhance the format of a message by using an additional ConversionPattern component. The following patterns are supported:

%c

Logging category

%C

Class name

%d

Date

%F

Filename

%l

Caller location

%L

Line number

%m

Logging message

<code>%M</code>	Method name
<code>%n</code>	End of line character
<code>%p</code>	Logging level. For alignment, you can also supply the number of characters, for example: <code>%-5p</code> .
<code>%r</code>	Elapsed time (milliseconds)
<code>%t</code>	Thread name.

6. Define the name component for the Appender instance, if required.
7. Define the logging level for the rootLogger and assign to the required Appender instance.
8. To pass the log4j configuration file to the debugger you can use:
 - `--log_config=filename` command-line option when launching the debugger from the command-line console.
 - `log config filename` debugger command if the debugger is already running.

Example showing how to log messages to the console

The following example shows how to log messages to the console. This sets the default logging level to DEBUG. All the logging for this example is output to the console. However the output of error and warning messages are sent to the error stream, and debug and info messages are sent to the output stream.

```
# Setup logConsole to be a ConsoleAppender
log4j.appender.logConsole=org.apache.log4j.ConsoleAppender
log4j.appender.logConsole.layout=org.apache.log4j.PatternLayout
log4j.appender.logConsole.layout.ConversionPattern=%m%n
log4j.appender.logConsole.name=Console
# Send all DEBUG level logs to the console
log4j.rootLogger=DEBUG, console
```

Example showing how to log messages to a file

The following example shows how to log messages to a file. This sets the default logging level to DEBUG. However some packages only write logs at the INFO level. All the logging for this example is output to a file. When the file reaches 10MB, it is renamed by adding .1 file extension and logging continues to write to a new file with the original name. This happens multiple times, but only ten backup files are stored.

```
# Setup logFile to be a RollingFileAppender
log4j.appender.logFile=org.apache.log4j.RollingFileAppender
log4j.appender.logFile.File=output.log
log4j.appender.logFile.MaxFileSize=10MB
log4j.appender.logFile.MaxBackupIndex=10
log4j.appender.logFile.layout=org.apache.log4j.PatternLayout
log4j.appender.logFile.layout.ConversionPattern=%d %-5p %t %c - %m%n
# Send all DEBUG level logs to a file: logFile
log4j.rootLogger=DEBUG, logFile
# Send all INFO level logs in the debug packages to the file: logFile
log4j.logger.com.arm.debug.logging=INFO, logFile
```

Example showing how to combine the logging of messages to the console and a file

The following example shows a combination of the previous examples. This sets the default logging level to INFO. All the INFO level logging for this example is output to the console. However, a selection of messages are also sending output to two files.


```
# Setup logConsole to be a ConsoleAppender
log4j.appender.logConsole=org.apache.log4j.ConsoleAppender
# Suppress all logs to the console that are lower than the threshold
log4j.appender.logConsole.Threshold=INFO
log4j.appender.logConsole.layout=org.apache.log4j.PatternLayout
log4j.appender.logConsole.layout.ConversionPattern=%m%n
log4j.appender.logConsole.name=Console
# Setup logConnFile to be a RollingFileAppender
log4j.appender.logConnFile=org.apache.log4j.RollingFileAppender
# Suppress all logs to the file that are lower than the threshold
log4j.appender.logConnFile.Threshold.DEBUG
log4j.appender.logConnFile.File=connection.log
log4j.appender.logConnFile.MaxFileSize=10MB
log4j.appender.logConnFile.MaxBackupIndex=10
log4j.appender.logConnFile.layout=org.apache.log4j.PatternLayout
log4j.appender.logConnFile.layout.ConversionPattern=%d %-5p %t %c - %m%n
# Setup logTAccessFile to be a RollingFileAppender
log4j.appender.logTAccessFile=org.apache.log4j.RollingFileAppender
# Suppress all logs to the file that are lower than the threshold
log4j.appender.logTAccessFile.Threshold.DEBUG
log4j.appender.logTAccessFile.File=target_access.log
log4j.appender.logTAccessFile.MaxFileSize=10MB
log4j.appender.logTAccessFile.MaxBackupIndex=10
log4j.appender.logTAccessFile.layout=org.apache.log4j.PatternLayout
log4j.appender.logTAccessFile.layout.ConversionPattern=%d %-5p %t %c - %m%n
# Send all INFO logs to the console
log4j.rootLogger=INFO, logConsole
# Send all DEBUG logs in the connection package to the file: logConnFile
log4j.logger.com.arm.debug.core.engine.connection=DEBUG, logConnFile
# Send all DEBUG logs in the targetaccess package to the file: logTAccessFile
log4j.logger.com.arm.debug.core.targetaccess.rvi=DEBUG, logTAccessFile
```

Related Concepts

[About Log4j configuration files on page 150.](#)

Related References

[Controlling the output of logging messages on page 149.](#)

Related Information

[Log4j in Apache Logging Services.](#)

Chapter 8

Debugging with scripts

Describes how to use scripts containing debugger commands to enable you to automate debugging operations.

It contains the following:

- *Exporting DS-5 Debugger commands generated during a debug session on page 8-155.*
- *Creating a DS-5 Debugger script on page 8-156.*
- *Creating a CMM-style script on page 8-157.*
- *About Jython scripts on page 8-158.*
- *Jython script concepts and interfaces on page 8-160.*
- *Configuring a Jython project in Eclipse on page 8-161.*
- *Creating a Jython script on page 8-165.*
- *Running a script on page 8-167.*

8.1 Exporting DS-5 Debugger commands generated during a debug session

Shows a typical example of the commands generated by the debugger during a debug sessions.

You can work through a debug session using all the toolbar icons and menu options as required. A full list of all the DS-5 Debugger commands generated during the current debug session is recorded in the **History** view. Before closing Eclipse, you can select the commands that you want in your script file and click on **Export the selected lines as a script file** to save them to a file.

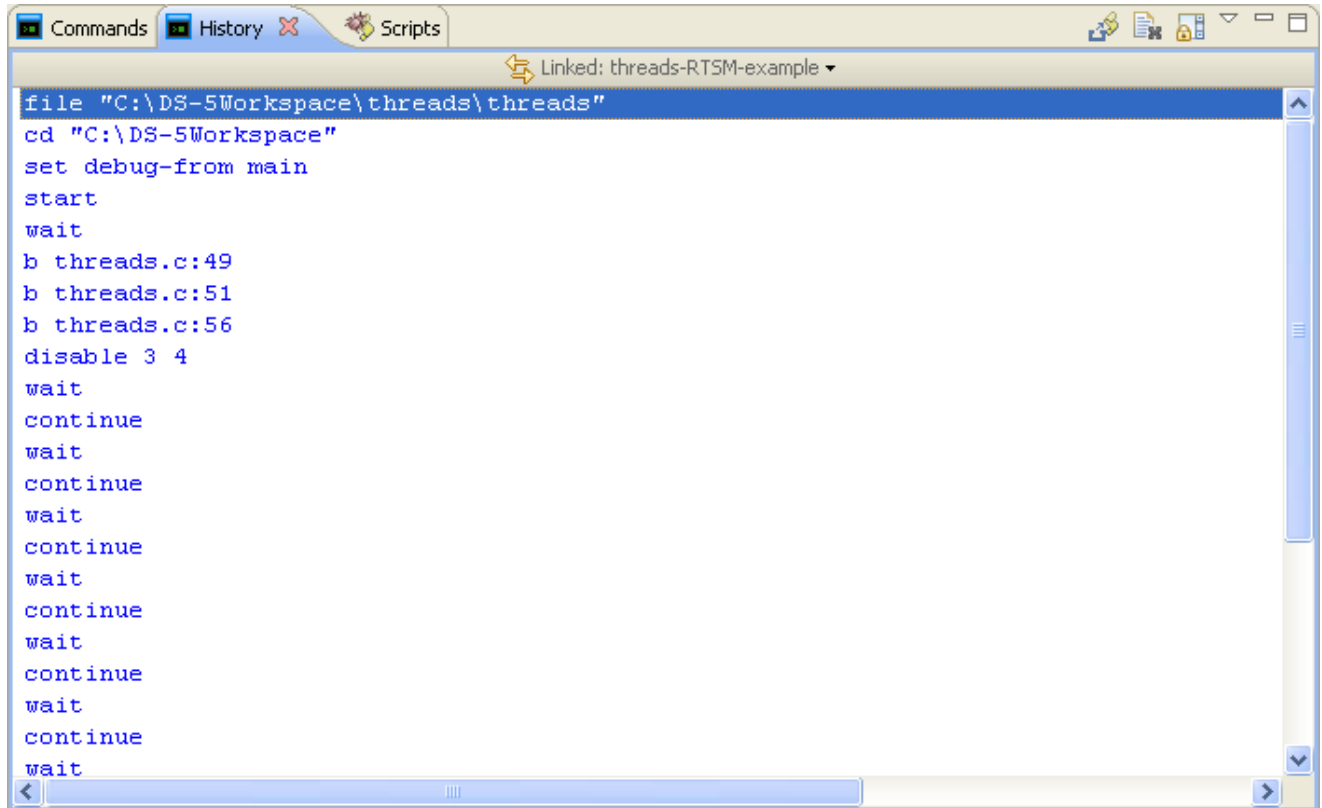


Figure 8-1 Commands generated during a debug session

8.2 Creating a DS-5 Debugger script

Shows a typical example of a DS-5 Debugger script.

The script file must contain only one command on each line. Each command can be identified with comments if required. The .ds file extension must be used to identify this type of script.

```
# Filename: myScript.ds
# Initialization commands
load "struct_array.axf"      # Load image
file "struct_array.axf"     # Load symbols
break main                  # Set breakpoint at main()
break *0x814C               # Set breakpoint at address 0x814C
# Run to breakpoint and print required values
run                          # Start running device
wait 0.5s                   # Wait or time-out after half a second
info stack                  # Display call stack
info registers              # Display info for all registers
# Continue to next breakpoint and print required values
continue                    # Continue running device
wait 0.5s                   # Wait or time-out after half a second
info functions              # Displays info for all functions
info registers              # Display info for all registers
x/3wx 0x8000                # Display 3 words of memory from 0x8000 (hex)
...
# Shutdown commands
delete 1                    # Delete breakpoint assigned number 1
delete 2                    # Delete breakpoint assigned number 2
```

8.3 Creating a CMM-style script

Shows a typical example of a CMM-style script.

The script file must contain only one command on each line. Each command can be identified with comments if required. The `.cmm` or `.t32` file extension must be used to identify this type of script.

```
// Filename: myScript.cmm
system.up                ; Connect to target and device
data.load.elf "hello.axf" ; Load image and symbols
// Setup breakpoints and registers
break.set main /disable  ; Set breakpoint and immediately disabled
break.set 0x8048          ; Set breakpoint at specified address
break.set 0x8060          ; Set breakpoint at specified address
register.set R0 15         ; Set register R0
register.set PC main       ; Set PC register to symbol address
...
break.enable main         ; Enable breakpoint at specified symbol
// Run to breakpoint and display required values
go                        ; Start running device
var.print "Value is: " myVar ; Display string and variable value
print %h r(R0)            ; Display register R0 in hexadecimal
// Run to breakpoint and print stack
go                        ; Run to next breakpoint
var.frame /locals /caller ; Display all variables and function callers
...
// Shutdown commands
break.delete main         ; Delete breakpoint at address of main()
break.delete 0x8048       ; Delete breakpoint at address
break.delete 0x8060       ; Delete breakpoint at specified address
system.down              ; Disconnect from target
```

8.4 About Jython scripts

Shows a typical example of a Jython script.

Jython is a Java implementation of the Python scripting language. It provides extensive support for data types, conditional execution, loops and organization of code into functions, classes and modules, as well as access to the standard Jython libraries. Jython is an ideal choice for larger or more complex scripts. These are important concepts that are required in order to write a debugger Jython script.

The .py file extension must be used to identify this type of script.

```
# Filename: myScript.py
import sys
from arm_ds.debugger_v1 import Debugger
from arm_ds.debugger_v1 import DebugException
# Debugger object for accessing the debugger
debugger = Debugger()
# Initialisation commands
ec = debugger.getCurrentExecutionContext()
ec.getExecutionService().stop()
ec.getExecutionService().waitForStop()
# in case the execution context reference is out of date
ec = debugger.getCurrentExecutionContext()
# load image if provided in script arguments
if len(sys.argv) == 2:
    image = sys.argv[1]
    ec.getImageService().loadImage(image)
    ec.getExecutionService().setExecutionAddressToEntryPoint()
    ec.getImageService().loadSymbols(image)
    # we can use all the DS commands available
    print "Entry point: ",
    print ec.executeDSCommand("print $ENTRYPOINT")
    # Sample output:
    #      Entry point: $8 = 32768
else:
    pass # assuming image and symbols are loaded
# sets a temporary breakpoint at main and resumes
ec.getExecutionService().resumeTo("main") # this method is non-blocking
try:
    ec.getExecutionService().waitForStop(500) # wait for 500ms
except DebugException, e:
    if e.getErrorCode() == "JYI31": # code of "Wait for stop timed out" message
        print "Waiting timed out!"
        sys.exit()
    else:
        raise # re-raise the exception if it is a different error
ec = debugger.getCurrentExecutionContext()
def getRegisterValue(executionContext, name):
    """Get register value and return string with unsigned hex and signed
    integer, possibly string "error" if there was a problem reading
    the register.
    """
    try:
        value = executionContext.getRegisterService().getValue(name)
        # the returned value behaves like a numeric type,
        # and even can be accessed like an array of bytes, e.g. 'print value[:]'
        return "%s (%d)" % (str(value), int(value))
    except DebugException, e:
        return "error"
# print Core registers on all execution contexts
for i in range(debugger.getExecutionContextCount()):
    ec = debugger.getExecutionContext(i)
    # filter register names starting with "Core:."
    coreRegisterNames = filter(lambda name: name.startswith("Core:."),
                               ec.getRegisterService().getRegisterNames())
    # using Jython list comprehension get values of all these registers
    registerInfo = ["%s = %s" % (name, getRegisterValue(ec, name))
                    for name in coreRegisterNames]
    registers = ", ".join(registerInfo[:3]) # only first three
    print "Identifier: %s, Registers: %s" % (ec.getIdentifier(), registers)
# Output:
#      Identifier: 1, Registers: Core::R0 = 0x00000010 (16), Core::R1 = 0x00000000
```

```
(0), Core::R2 = 0x0000A4A4 (42148)  
# ...
```

Related Tasks

[Configuring a Jython project in Eclipse on page 161.](#)

[Creating a Jython script on page 165.](#)

[Running a script on page 167.](#)

Related References

[Jython script concepts and interfaces on page 160.](#)

[Scripts view on page 228.](#)

[Jython Script Parameters dialog box on page 258.](#)

8.5 Jython script concepts and interfaces

Summary of the important debugger interfaces and concepts.

Imports	<p>The debugger module provides a <code>Debugger</code> class for initial access to the DS-5 Debugger, with further classes, known as services, to access registers and memory. Here is an example showing the full set of module imports that are typically placed at the top of the jython script:</p> <pre>from arm_ds.debugger_v1 import Debugger from arm_ds.debugger_v1 import DebugException</pre>
Execution Contexts	<p>Most operations on DS-5 Debugger Jython interfaces require an execution context. The execution context represents the state of the target system. Separate execution contexts exist for each process, thread, or processor that is accessible in the debugger. You can obtain an execution context from the <code>Debugger</code> class instance, for example:</p> <pre># Obtain the first execution context debugger = Debugger() ec = debugger.getCurrentExecutionContext()</pre>
Registers	<p>You can access processor registers, coprocessor registers and peripheral registers using the debugger Jython interface. To access a register you must know its name. The name can be obtained from the Registers view in the graphical debugger. The <code>RegisterService</code> enables you to read and write register values, for a given execution context, for example:</p> <pre># Print the Program Counter (PC) from execution context ec value = ec.getRegisterService().getValue('PC') print 'The PC is %s' %value</pre>
Memory	<p>You can access memory using the debugger Jython interface. You must specify an address and the number of bytes to access. The address and size can be an absolute numeric value or a string containing an expression to be evaluated within the specified execution context. Here is an example:</p> <pre># Print 16 bytes at address 0x0 from execution context ec print ec.getMemoryService().read(0x0, 16)</pre>
DS Commands	<p>The debugger jython interface enables you to execute arbitrary DS-5 commands. This is useful when the required functionality is not directly provided in the Jython interface. You must specify the execution context, the command and any arguments that you want to execute. The return value includes the textual output from the command and any errors. Here is an example:</p> <pre># Execute the DS-5 command 'print \$ENTRYPOINT' and print the result print ec.executeDSCommand('print \$ENTRYPOINT')</pre>
Error Handling	<p>The methods on the debugger Jython interfaces throw <code>DebugException</code> whenever an error occurs. You can catch exceptions to handle errors in order to provide more information. Here is an example:</p> <pre># Catch a DebugException and print the error message try: ec.getRegisterService().getValue('ThisRegisterDoesNotExist') except DebugException, de: print "Caught DebugException: %s" % (de.getMessage())</pre>

For more information on the DS-5 Debugger Jython API documentation select **Help Contents** from the **Help** menu.

8.6 Configuring a Jython project in Eclipse

Describes how to use Eclipse to create or edit Jython scripts.

Eclipse for DS-5 provides auto-completion features and built-in documentation for Jython.

Procedure

1. Create a new project:
 - a) Select **File > New > Project...** from the main menu.
 - b) Expand the **PyDev** group.
 - c) Select **PyDev Project**.
 - d) Click **Next**.

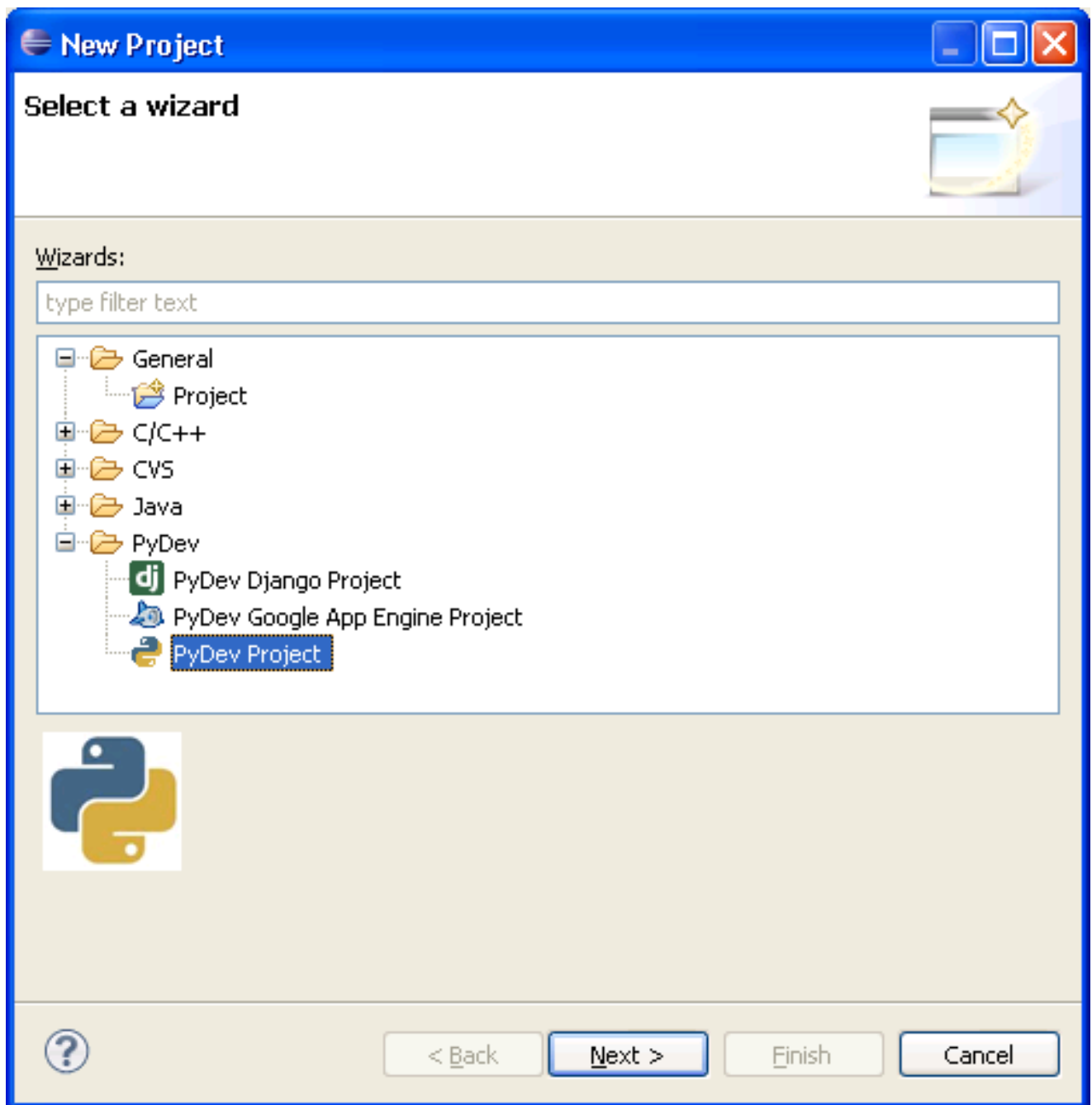


Figure 8-2 PyDev project wizard

- e) Enter a suitable name for the project.
- f) Select **Jython** as the project type.
- g) Select **DS-5 Jython** as the interpreter.
- h) Click **Finish** to create the project.

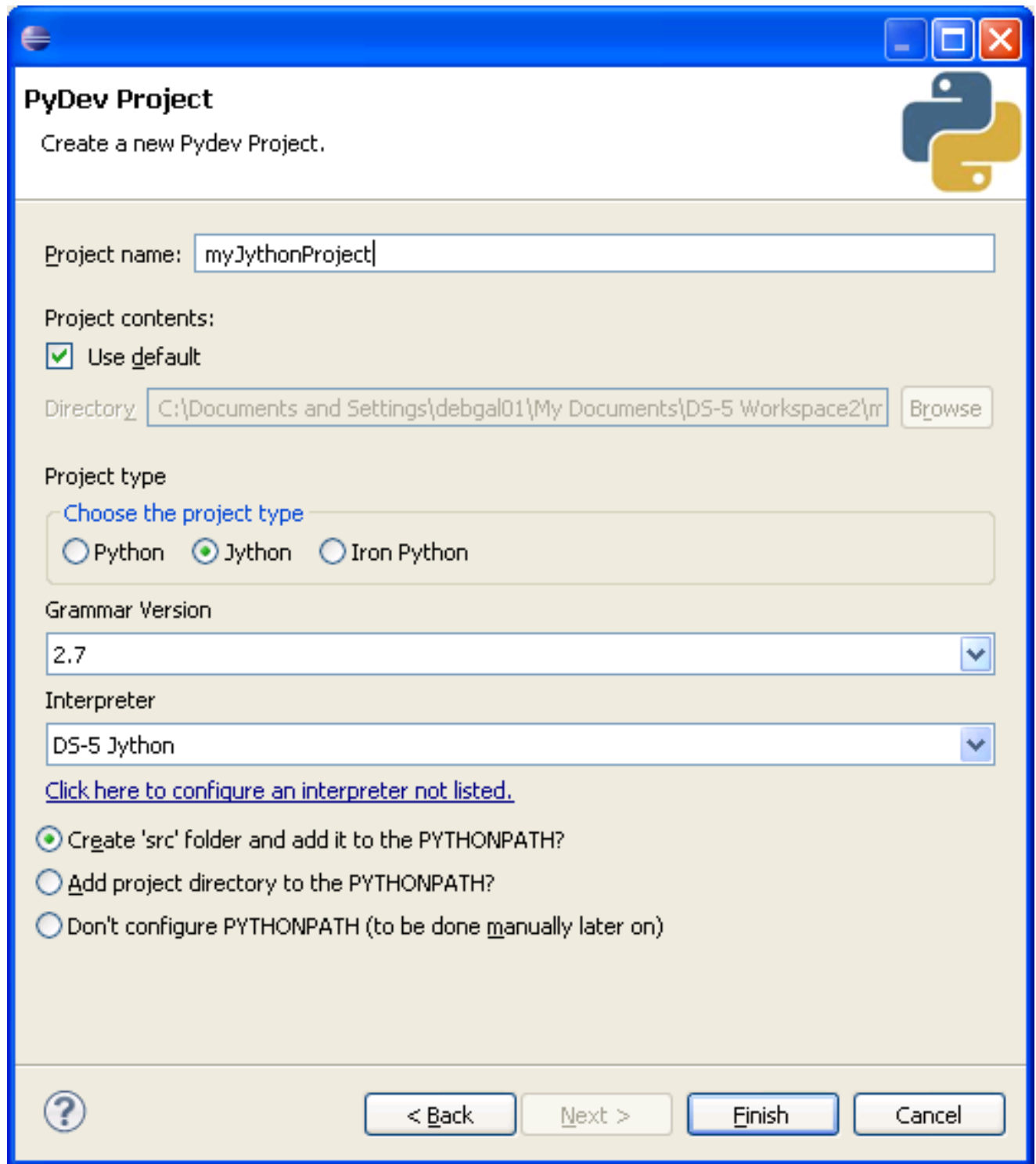


Figure 8-3 PyDev project settings

- i) If this is the first time you have created a PyDev project then a dialog box appears informing you that the Python interpreter is not configured. Jython, however, is configured so you can ignore this message. Click **Don't ask again** to proceed.

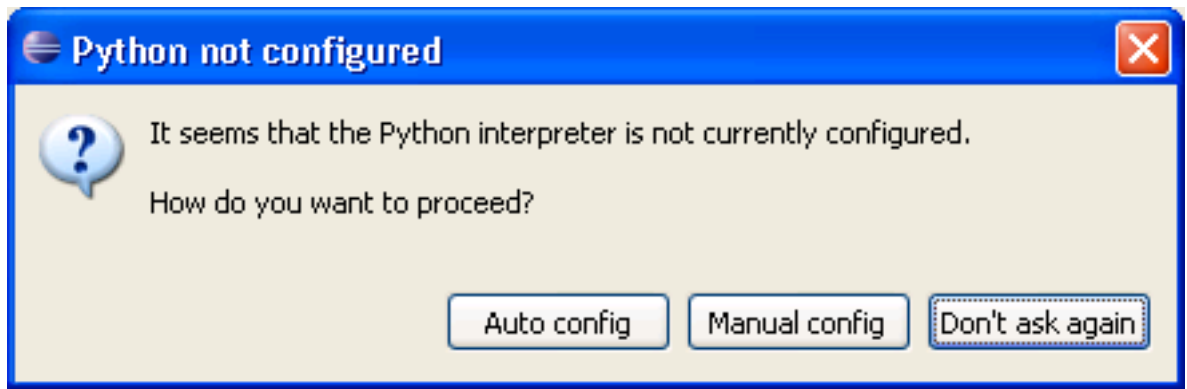


Figure 8-4 Python interpreter warning dialog box

2. Alternatively you can configure an existing project for Jython:
 - a) Right-click on the project in the **Project Explorer** view and select **PyDev > Set as PyDev Project** from the context menu.
 - b) Click **Don't ask again** if the Python not configured dialog box appears.
 - c) Select **Properties** from the **Project** menu.
 - d) Select **PyDev - Interpreter/Grammar** from the Properties dialog box.
 - e) Select **Jython** as the project type.
 - f) Select **DS-5 Jython** as the interpreter.
 - g) Click **OK** to apply these settings and close the dialog box.
3. Add a Python source file to the project. The .py file extension must be used to identify this type of script.

Related Concepts

About Jython scripts on page 158.

Related Tasks

Creating a Jython script on page 165.

Running a script on page 167.

Related References

Jython script concepts and interfaces on page 160.

Scripts view on page 228.

Jython Script Parameters dialog box on page 258.

8.7 Creating a Jython script

Shows a typical workflow for creating and running a Jython script in the debugger.

Procedure

1. Create an empty Jython script file.
2. Right-click the Jython script file and select **Open**.
3. Add the following code to your file in the editor:

```
from arm_ds.debugger_v1 import Debugger
from arm_ds.debugger_v1 import DebugException
```

Note

With this minimal code saved in the file you have access to auto-completion list and online help. ARM recommends the use of this code to explore the Jython interface.

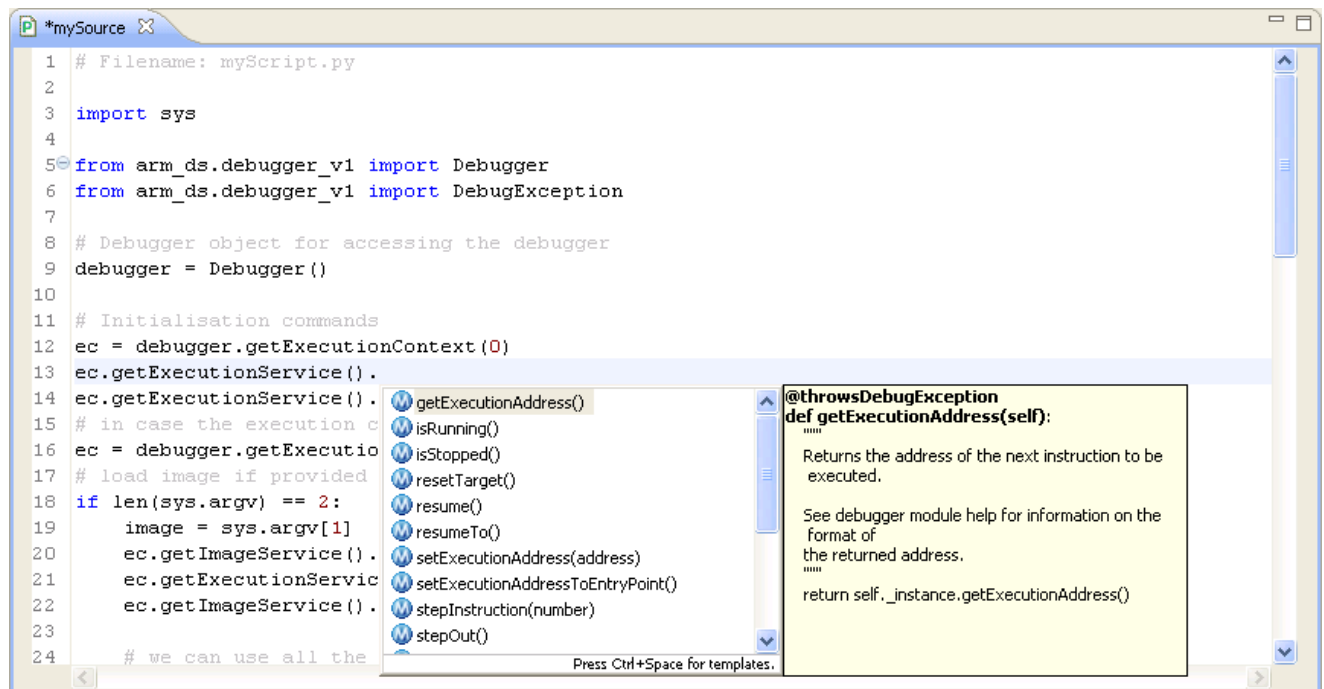


Figure 8-5 Jython auto-completion and help

4. Edit the file to contain the desired scripting commands.
5. Run the script in the debugger.

You can also view an entire Jython interface in the debugger by selecting a debugger object or interface followed by the keyboard and mouse combination **Ctrl+Click**. This opens the source code that implements it.

Related Concepts

[About Jython scripts on page 158.](#)

Related Tasks

[Configuring a Jython project in Eclipse on page 161.](#)

[Running a script on page 167.](#)

Related References

Jython script concepts and interfaces on page 160.

Scripts view on page 228.

Jython Script Parameters dialog box on page 258.

8.8 Running a script

Describes how to run a script from Eclipse.

Procedure

To run a script from Eclipse:

- You can run a script file immediately after the debugger connects to the target.
 1. Launch Eclipse.
 2. Configure a connection to the target. A DS-5 Debugger configuration can include the option to run a script file immediately after the debugger connects to the target. To do this select the script file in the **Debugger** tab of the DS-5 Debug configuration dialog box.
 3. Connect to the target.
- Run a script file whilst a debug session is in progress.
 - In the **Scripts** view you can use script files:
 1. Import one or more script files in the order that you want them to be executed.
 2. Select the scripts that you want to execute.
 3. Click on the **Execute Selected Scripts** toolbar icon.

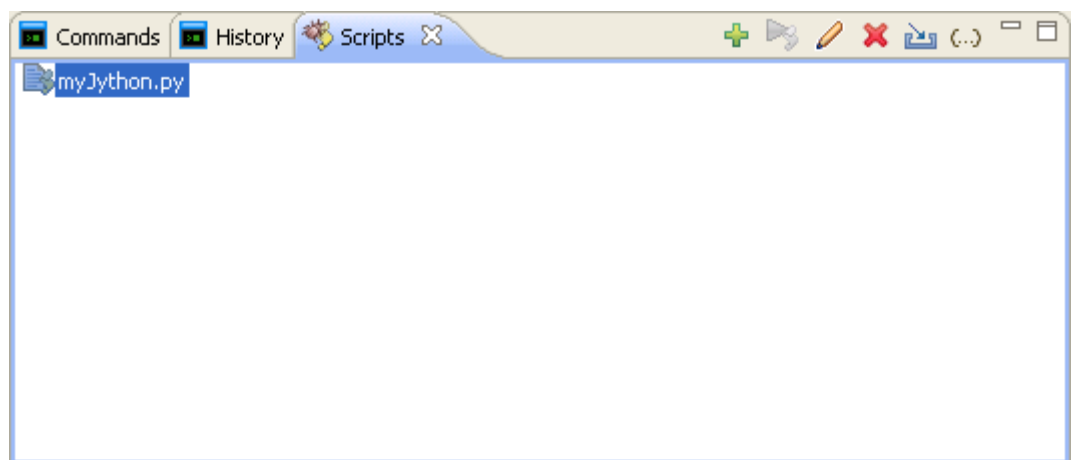


Figure 8-6 Scripts view

— In the **Commands** view you can use the DS-5 Debugger source command.

Related Concepts

About Jython scripts on page 158.

Related Tasks

Configuring a Jython project in Eclipse on page 161.

Creating a Jython script on page 165.

Related References

Exporting DS-5 Debugger commands generated during a debug session on page 155.

Creating a DS-5 Debugger script on page 156.

Creating a CMM-style script on page 157.

Commands view on page 192.

History view on page 210.

Scripts view on page 228.

Jython script concepts and interfaces on page 160.

Scripts view on page 228.

Jython Script Parameters dialog box on page 258.

Related Information

DS-5 Debugger commands.

Chapter 9

Working with the Snapshot Viewer

Describes how to use the Snapshot Viewer.
It contains the following:

- *About the Snapshot Viewer on page 9-170.*
- *Components of a Snapshot Viewer initialization file on page 9-172.*
- *Connecting to the Snapshot Viewer on page 9-175.*
- *Considerations when creating debugger scripts for the Snapshot Viewer on page 9-176.*

9.1 About the Snapshot Viewer

Summary of the important rules for the Snapshot Viewer.

The Snapshot Viewer can be used to analyze a snapshot representation of the application state of a single processor in scenarios where interactive debugging is not possible.

Note

Currently DS-5 only supports DS-5 Debugger connections to the Snapshot Viewer using the command-line console.

To enable debugging of an application using the Snapshot Viewer, you must have the following data:

- register values
- memory values
- debug symbols.

If you are unable to provide all of this data then the level of debug that is available is compromised. Capturing this data is specific to your application, and no tools are provided to help with this. You might have to install exception or signal handlers to catch erroneous situations in your application and dump the required data out.

You must also consider how to get the dumped data from your device onto a workstation that is accessible by the debugger. Some suggestions on how to do this are to:

- write the data to a file on the host workstation using semihosting
- send the data over a UART to a terminal
- send the data over a socket using TCP/IP.

Register values

Register values are used to emulate the state of the original system at a particular point in time. The most important registers are those in the current processor mode. For example, on an ARMv4 architecture processor these registers are R0-R15 and also the Program Status Registers (PSRs):

- Current Program Status Register (CPSR)
- Application Program Status Register (APSR)
- Saved Program Status Register (SPSR).

Be aware that on many ARM processors, an exception, a data abort, causes a switch to a different processor mode. In this case you must ensure that the register values you use reflect the correct mode in which the exception occurred, rather than the register values within your exception handler.

If your application uses floating-point data and your device contains vector floating-point hardware, then you must also provide the Snapshot Viewer with the contents of the vector floating-point registers. The important registers to capture are:

- Floating-point Status and Control Register (FPSCR)
- Floating-Point EXception register (FPEXC)
- Single precision registers (S_n)
- Double precision registers (D_n)
- Quad precision registers (Q_n).

Memory values

The majority of the application state is usually stored in memory in the form of global variables, the heap and the stack. Due to size constraints, it is often difficult to provide the Snapshot Viewer with a copy of the entire contents of memory. In this case you must carefully consider the areas of memory that are of particular importance.

If you are debugging a crash, the most useful information to find out is often the call stack, because this shows the calling sequence of each function prior to the exception and the values of all the respective function parameters. To show the call stack the debugger must know the current stack pointer and have access to the contents of the memory that contains the stack. By default, on ARM processors the stack grows downwards, you must provide the memory starting from the current stack pointer and going up in memory until the beginning of the stack is reached. If you are unable to provide the entire contents of the stack, then a smaller portion starting at the current stack pointer is still useful because it provides the most recent function calls.

If your application uses global (extern or file static) data, then providing the corresponding memory values enables you to view the variables within the debugger.

If you have local or global variables that point to heap data, then you might want to follow the relevant pointers in the debugger to examine the data. To do this you must have provided the contents of the heap to the Snapshot Viewer. Be aware that heaps can often occupy a large memory range, so it might not be possible to capture the entire heap. The layout of the heap in memory and the data structures that control heap allocation are often specific to the application or the C library, see the relevant documentation for more information.

To debug at the disassembly level, the debugger must have access to the memory values where the application code is located. It is often not necessary to capture the contents of the memory containing the code, because identical data can often be extracted directly from the image using processing tools such as `fromelf`. However, some complications to be aware of are:

- self-modifying code where the values in the image and memory can vary
- dynamic relocation of the memory address within the image at runtime.

Debug symbols

The debugger require debug information to display high-level information about your application, for example:

- source code
- variable values and types
- structures
- call stack.

This information is stored by the compiler and linker within the application image, so you must ensure that you have a local debug copy of the same image that you are running on your device. The amount of debug information that is stored in the image, and therefore the resulting quality of your debug session, can be affected by the debug and optimization settings passed to the compiler and linker.

It is common to strip out as much of the debug information as possible when running an image on an embedded device. In such cases, try to use the original unstripped image for debugging purposes.

Related Tasks

[Connecting to the Snapshot Viewer on page 175.](#)

Related References

[Components of a Snapshot Viewer initialization file on page 172.](#)

[Considerations when creating debugger scripts for the Snapshot Viewer on page 176.](#)

9.2 Components of a Snapshot Viewer initialization file

Describes the groups and sections used to create a Snapshot Viewer initialization file.

The Snapshot Viewer initialization file is a simple text file consisting of one or more sections that emulate the state of the original system. Each section uses an *option=value* structure.

Note

Currently DS-5 only supports DS-5 Debugger connections to the Snapshot Viewer using the command-line console.

Before creating a Snapshot Viewer initialization file you must ensure that you have:

- One or more binary files containing a snapshot of the application that you want to analyze.

Note

The binary files must be formatted correctly in accordance with the following restrictions.

-
- Details of the type of processor.
 - Details of the memory region addresses and offset values.
 - Details of the last known register values.

To create a Snapshot Viewer initialization file, you must add grouped sections as required from the following list and save the file with `.ini` for the file extension.

[global]

A section for global settings. The following option can be used:

`core`

The selected processor, for example, `core=Cortex-M3`.

[dump]

One or more sections for contiguous memory regions stored in a binary file. The following options can be used:

`file`

Location of the binary file.

`address`

Memory start address for the specified region.

`length`

Length of the region. If none specified then the default is the rest of file from the offset value.

`offset`

Offset of the specified region from the start of the file. If none specified then the default is zero.

[regs]

A section for standard ARM register names and values, for example, 0x0.

Banked registers can be explicitly specified using their names from the *ARM Architecture Reference Manual*, for example, R13_fiq. In addition, the current mode is determined from the Program Status Registers (PSRs), enabling register names without mode suffixes to be identified with the appropriate banked registers.

The values of the PSRs and PC registers must always be provided. The values of other registers are only required if it is intended to read them from the debugger.

Consider:

```
[regs]
CPSR=0x600000D2 ; IRQ
SP=0x8000
R14_irq=0x1234
```

Reading the registers named SP, R13, or R13_irq all yield the value 0x8000.

Reading the registers named LR, R14, or R14_irq all yield the value 0x1234.

Note

All registers are 32-bits.

Restrictions

The following restrictions apply:

- If you require a global section then it must be the first in the file.
- Consecutive bytes of memory must appear as consecutive bytes in one or more dump files.
- Address ranges representing memory regions must not overlap.

Examples

```
; All sections are optional
[global]
core=Cortex-M3 ; Selected processor
; Location of a contiguous memory region stored in a dump file
[dump]
file="path/dumpfile1.bin" ; File location (full path must be specified)
address=0x8000 ; Memory start address for specific region
length=0x0090 ; Length of region
; (optional, default is rest of file from offset)
; Location of another contiguous memory region stored in a dump file
[dump]
file="path/dumpfile2.bin" ; File location
address=0x8090 ; Memory start address for specific region
offset=0x0024 ; Offset of region from start of file
; (optional, default is 0)

; ARM registers
[regs]
R0=0x000080C8
R1=0x0007C000
R2=0x0007C000
R3=0x0007C000
R4=0x0000363
R5=0x00008EEC
R6=0x00000000
R7=0x00000000
R8=0x00000000
R9=0xB3532737
R10=0x00008DE8
R11=0x00000000
R12=0x00000000
SP=0x0007FFF8
LR=0x0000808D
PC=0x000080B8
```

Related Concepts

About the Snapshot Viewer on page 170.

Related Tasks

Connecting to the Snapshot Viewer on page 175.

Related References

Considerations when creating debugger scripts for the Snapshot Viewer on page 176.

Related Information

ARM Architecture Reference Manual.

9.3 Connecting to the Snapshot Viewer

Describes how to launch the debugger from a command-line console and connect to the Snapshot Viewer.

A Snapshot Viewer provides a virtual target that you can use to analyze a snapshot of a known system state using the debugger.

Prerequisites

Before connecting you must ensure that you have a Snapshot Viewer initialization file containing static information about a target at a specific point in time. For example, the contents of registers, memory and processor state.

Procedure

- Launch the debugger in the command-line console using `--target` command-line option to pass the Snapshot Viewer initialization file to the debugger.

```
debugger --target=int.ini --script=int.cmm
```

Note

Currently DS-5 only supports DS-5 Debugger connections to the Snapshot Viewer using the command-line console.

Related Concepts

About the Snapshot Viewer on page 170.

Related Tasks

Launching the debugger from the command-line console on page 19.

Related References

Components of a Snapshot Viewer initialization file on page 172.

Considerations when creating debugger scripts for the Snapshot Viewer on page 176.

DS-5 Debugger command-line console keyboard shortcuts on page 23.

9.4 Considerations when creating debugger scripts for the Snapshot Viewer

Shows a typical example of an initialization file for use with the Snapshot Viewer.

The Snapshot Viewer uses an initialization file that emulates the state of the original system. The symbols are loaded from the image using the `data.load.elf` command with the `/nocode /noreg` arguments.

The snapshot data and registers are read-only and so the commands you can use are limited.

———— Note ————

Currently DS-5 only supports DS-5 Debugger connections to the Snapshot Viewer using the command-line console.

The following example shows a script using CMM-style commands to analyze the contents of the `types_m3.axf` image.

```
var.print "Connect and load symbols:"
system.up
data.load.elf "types_m3.axf" /nocode /noreg
;Arrays and pointers to arrays
var.print ""
var.print "Arrays and pointers to arrays:"
var.print "Value of i_array[9999] is " i_array[9999]
var.print "Value of *(i_array+9999) is " *(i_array+9999)
var.print "Value of d_array[1][5] is " d_array[1][5]
var.print "Values of *((*d_array)+9) is " *((*d_array)+9)
var.print "Values of *((*d_array)) is " *((*d_array))
var.print "Value of &d_array[5][5] is " &d_array[5][5]
;Display 0x100 bytes from address in register PC
var.print ""
var.print "Display 0x100 bytes from address in register PC:"
data.dump r(PC)+0x100
;Structures and bit-fields
var.print ""
var.print "Structures and bit-fields:"
var.print "Value of values2.no is " values2.no
var.print "Value of ptr_values->no is " ptr_values->no
var.print "Value of values2.name is " values2.name
var.print "Value of ptr_values->name is " ptr_values->name
var.print "Value of values2.name[0] is " values2.name[0]
var.print "Value of (*ptr_values).name is " (*ptr_values).name
var.print "Value of values2.f1 is " values2.f1
var.print "Value of values2.f2 is " values2.f2
var.print "Value of ptr_values->f1 is " ptr_values->f1
var.print ""
var.print "Disconnect:"
system.down
```

Related Concepts

[About the Snapshot Viewer on page 170.](#)

Related Tasks

[Connecting to the Snapshot Viewer on page 175.](#)

Related References

[Components of a Snapshot Viewer initialization file on page 172.](#)

Chapter 10

DS-5 Debug perspectives and views

Describes the DS-5 Debug perspective and related views in the Eclipse *Integrated Development Environment* (IDE).

It contains the following:

- *App Console view on page 10-179.*
- *ARM Asm Info view on page 10-181.*
- *ARM assembler editor on page 10-182.*
- *Breakpoints view on page 10-185.*
- *C/C++ editor on page 10-189.*
- *Commands view on page 10-192.*
- *Debug Control view on page 10-195.*
- *Disassembly view on page 10-199.*
- *Events view on page 10-203.*
- *Expressions view on page 10-204.*
- *Functions view on page 10-207.*
- *History view on page 10-210.*
- *Memory view on page 10-212.*
- *Modules view on page 10-216.*
- *Registers view on page 10-220.*
- *RTOS Data view on page 10-223.*
- *Screen view on page 10-225.*
- *Scripts view on page 10-228.*
- *Target Console view on page 10-230.*
- *Target view on page 10-231.*

- *Trace view on page 10-233.*
- *Variables view on page 10-237.*
- *Auto Refresh Properties dialog box on page 10-240.*
- *Memory Exporter dialog box on page 10-241.*
- *Memory Importer dialog box on page 10-242.*
- *Fill Memory dialog box on page 10-244.*
- *Export trace report dialog box on page 10-245.*
- *Breakpoint properties dialog box on page 10-247.*
- *Watchpoint properties dialog box on page 10-252.*
- *Tracepoint properties dialog box on page 10-253.*
- *Manage Signals dialog box on page 10-254.*
- *Event Viewer dialog box on page 10-256.*
- *Functions Filter dialog box on page 10-257.*
- *Jython Script Parameters dialog box on page 10-258.*
- *Debug Configurations - Connection tab on page 10-259.*
- *Debug Configurations - Files tab on page 10-262.*
- *Debug Configurations - Debugger tab on page 10-266.*
- *Debug Configurations - OS Awareness tab on page 10-269.*
- *Debug Configurations - Arguments tab on page 10-270.*
- *Debug Configurations - Environment tab on page 10-272.*
- *Debug Configurations - Event Viewer tab on page 10-274.*
- *DTSL Configuration Editor dialog box on page 10-276.*
- *Configuration database panel on page 10-278.*
- *About the Remote System Explorer on page 10-280.*
- *Remote Systems view on page 10-281.*
- *Remote System Details view on page 10-282.*
- *Target management terminal for serial and SSH connections on page 10-283.*
- *Remote Scratchpad view on page 10-284.*
- *Remote Systems terminal for SSH connections on page 10-285.*
- *New Terminal Connection dialog box on page 10-286.*
- *DS-5 Debugger menu and toolbar icons on page 10-288.*

10.1 App Console view

Describes the view content.

This view enables you to interact with the console I/O capabilities provided by the semihosting implementation in the ARM C libraries. To use this feature, semihosting support must be enabled in the debugger.

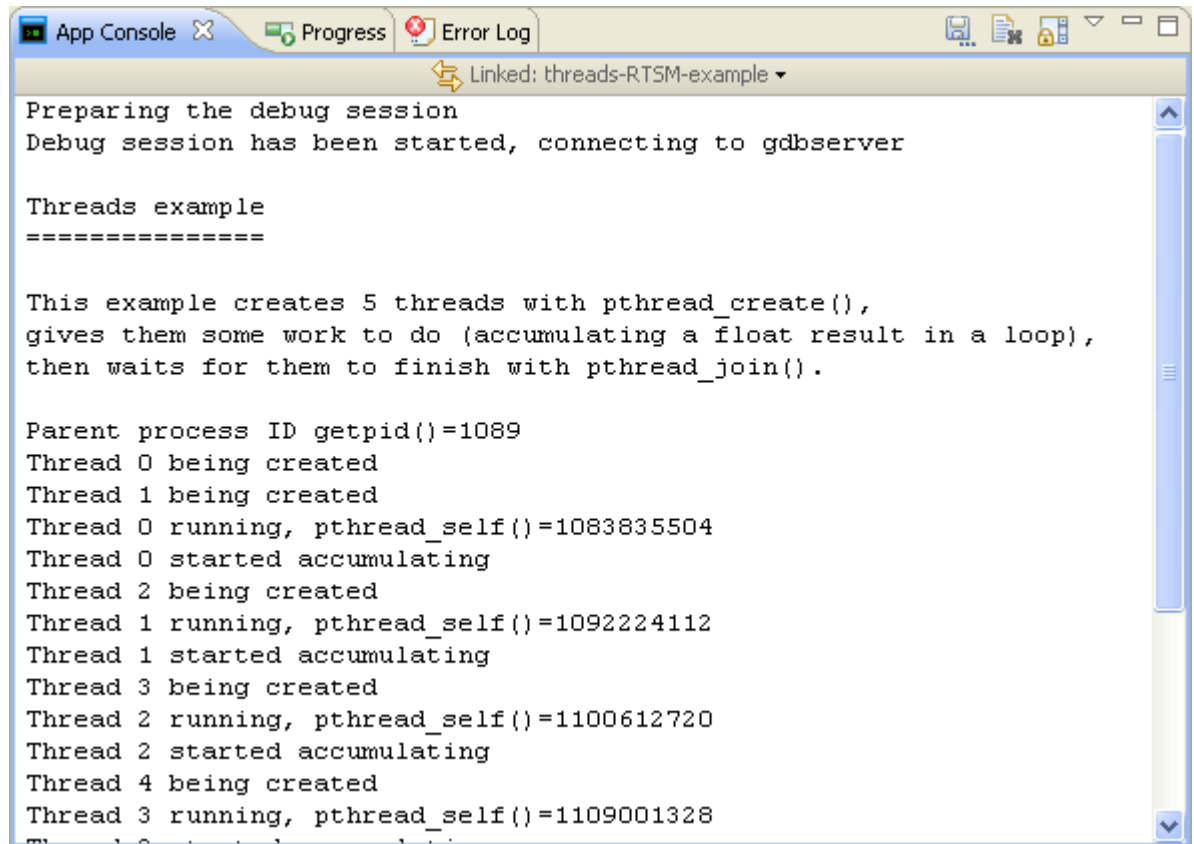


Figure 10-1 App Console view

————— Note —————

Default settings for this view are controlled by a DS-5 Debugger setting in the Preferences dialog box. For example, default locations for specific files or the maximum number of lines to display. You can access these settings by selecting **Preferences** from the **Window** menu.

Toolbar and context menu options

The following options are available from the toolbar or context menu:

- | | |
|----------------------------------|---|
| Linked:
<i>context</i> | Links this view to the selected connection in the Debug Control view. This is the default. Alternatively you can link the view to a specific connection. If the connection you want is not shown in the drop-down list you might have to select it first in the Debug Control view. |
| Save Console Buffer | Saves the contents of the App Console view to a text file. |

Clear Console	Clears the contents of the App Console view.	
Scroll Lock	Enables or disables the automatic scrolling of messages in the App Console view.	
View Menu	This menu contains the following option:	
	New App Console View	Displays a new instance of the App Console view.
	Bring to Front for Write	If enabled, the debugger automatically changes the focus to this view when a semihosting application prompts for input.
Copy	Copies the selected text.	
Paste	Pastes text that you have previously copied. You can paste text only when the application displays a semihosting prompt.	
Select All	Selects all text.	

Related References

[About semihosting and top of memory on page 145.](#)

[Working with semihosting on page 146.](#)

[Enabling automatic semihosting support in the debugger on page 147.](#)

[DS-5 Debug perspectives and views on page 177.](#)

10.2 ARM Asm Info view

Describes the view content.

This view enables you to view more information on an ARM or Thumb® instruction or directive.

When you are editing assembly language source files (.s) using the ARM assembler editor, you can access more information by:

1. selecting an instruction or directive
2. pressing **F3**.

The related documentation is displayed in the **ARM Asm Info** view. The **ARM Asm Info** view is automatically displayed when you press **F3**.

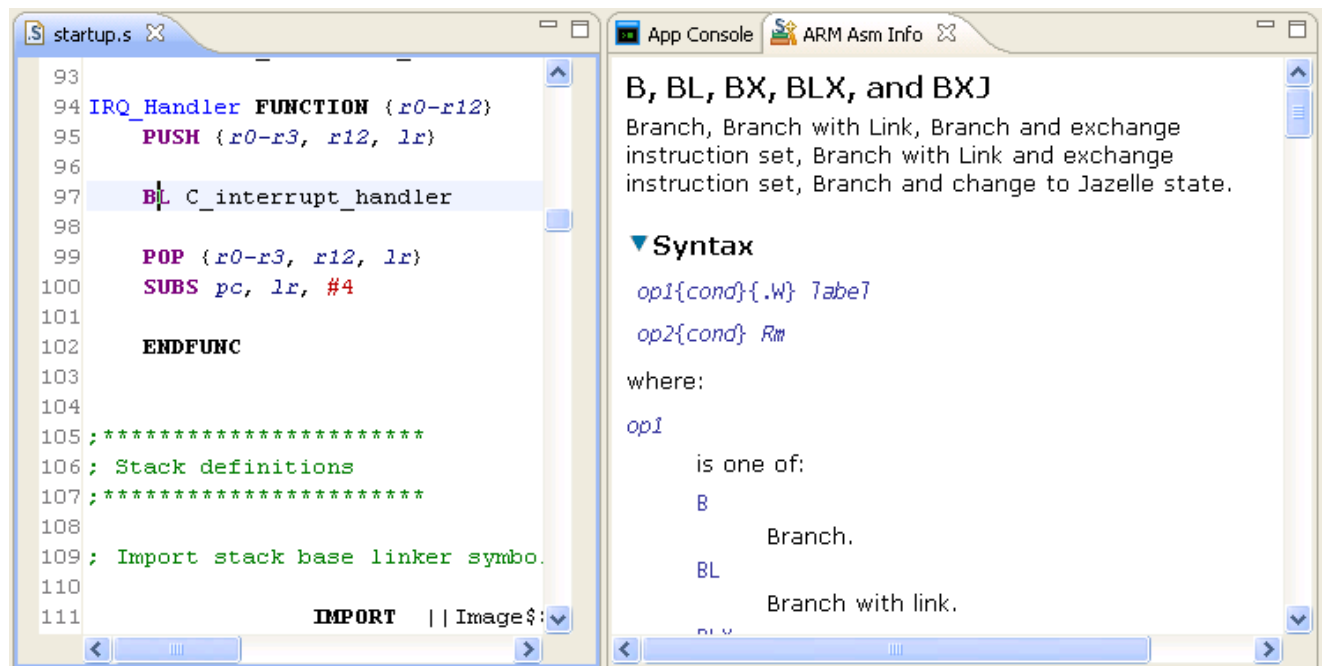


Figure 10-2 ARM Asm Info view

To manually add this view:

1. Ensure that you are in the DS-5 Debug perspective.
2. Select **Window > Show View > Other...** to open the Show View dialog box.
3. Select the **ARM Asm Info** view from the **DS-5 Debugger** group.

Related References

[DS-5 Debug perspectives and views on page 177.](#)

[ARM assembler editor on page 182.](#)

10.3 ARM assembler editor

Describes the view content.

The ARM assembler editor provides syntax highlighting, formatting of code and content assistance for labels in ARM assembly language source files. This editor enables you to:

- edit source code
- view the syntax highlighting
- select an instruction or directive and press **F3** to view the related ARM assembler reference information
- use content assist for auto-completion
- set, remove, enable or disable a breakpoint
- set or remove a trace start or stop point
- set or remove a Streamline start or stop capture.

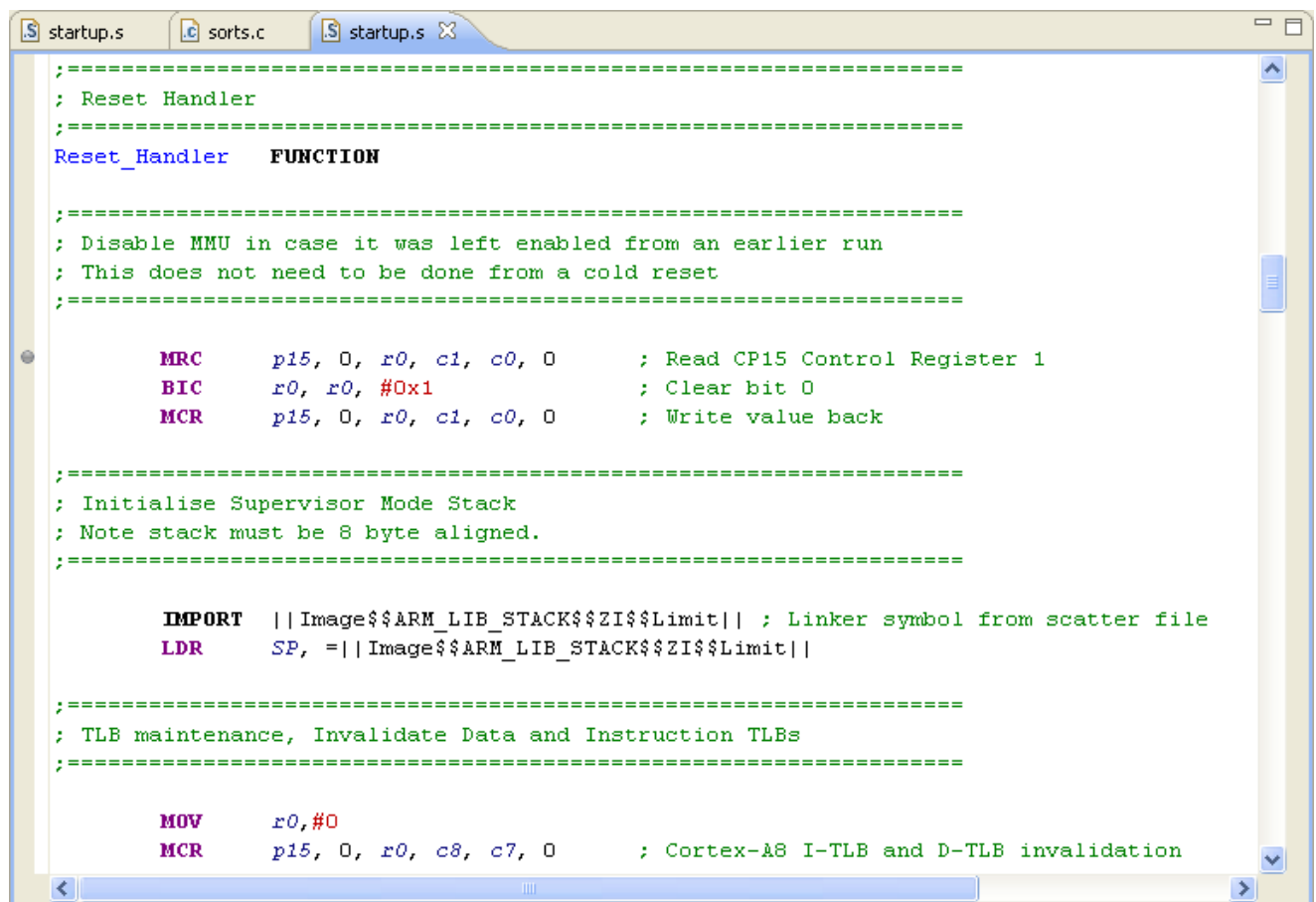


Figure 10-3 ARM assembler editor

In the left-hand margin of each editor tab you can find a marker bar that displays view markers associated with specific lines in the source code.

To set a breakpoint, double-click in the marker bar at the position where you want to set the breakpoint. To delete a breakpoint, double-click on the breakpoint marker.

Action context menu options

Right-click in the marker bar, or the line number column if visible, to display the action context menu for the ARM assembler editor. The options available include:

DS-5 Breakpoints menu

The following breakpoint options are available:

Toggle Breakpoint	Adds a new breakpoint, or remove a selected breakpoint.
Disable Breakpoint, Enable Breakpoint	Disables or enables the selected breakpoint.
Breakpoint Properties...	Displays the Breakpoint Properties dialog box for the selected breakpoint. This enables you to control breakpoint activation.
Toggle Trace Start Point	Sets or removes a trace start point at the selected address.
Toggle Trace Stop Point	Sets or removes a trace stop point at the selected address.
Toggle Trace Trigger Point	Starts a trace trigger point at the selected address.
Toggle Streamline Start	Sets or removes a Streamline start capture at the selected address.
Toggle Streamline Stop	Sets or removes a Streamline stop capture at the selected address.

Default Breakpoint Type

The following breakpoint options are available:

C/C++ Breakpoints	Select to use the C/C++ perspective breakpoint scheme.
DS-5 C/C++ Breakpoint	Select to use the DS-5 Debug perspective breakpoint scheme. This is the default for the DS-5 Debug perspective. DS-5 breakpoint markers are red to distinguish them from the blue C/C++ perspective breakpoint markers.

————— Note —————

The **Default Breakpoint Type** selected causes the top-level **Toggle Breakpoint** menu in this context menu and the double-click action in the left-hand ruler to toggle either CDT Breakpoints or DS-5 Breakpoints. This menu is also available from the **Run** menu in the main menu bar at the top of the C/C++, Debug, and DS-5 Debug perspectives.

The menu options under **DS-5 Breakpoints** do not honor this setting and always refer to DS-5 Breakpoints.

Show Line Numbers Show or hide line numbers.

For more information on the other options not listed here, see the dynamic help.

Related References

Setting an execution breakpoint on page 96.
Setting a data watchpoint on page 98.
Setting a tracepoint on page 100.
Setting a conditional breakpoint on page 102.
Setting a breakpoint on a specific thread on page 105.
Pending breakpoints and watchpoints on page 108.
Exporting DS-5 breakpoint settings to a file on page 109.
Importing DS-5 breakpoint settings from a file on page 110.
Setting Streamline start and stop points on page 101.
DS-5 Debug perspectives and views on page 177.
Examining the target execution environment on page 120.
Examining the call stack on page 122.
ARM Asm Info view on page 181.

10.4 Breakpoints view

Describes the view content.

This view enables you to:

- disable, enable, or delete breakpoints and watchpoints
- import or export a list of breakpoints and watchpoints
- display the source file containing the line of code where the selected breakpoint is set
- display the disassembly where the selected breakpoint is set
- display the memory where the selected watchpoint is set
- delay breakpoint activation by setting properties for the breakpoint
- control the handling and output of messages for all Unix signals and processor exception handlers
- change the access type for the selected watchpoint.

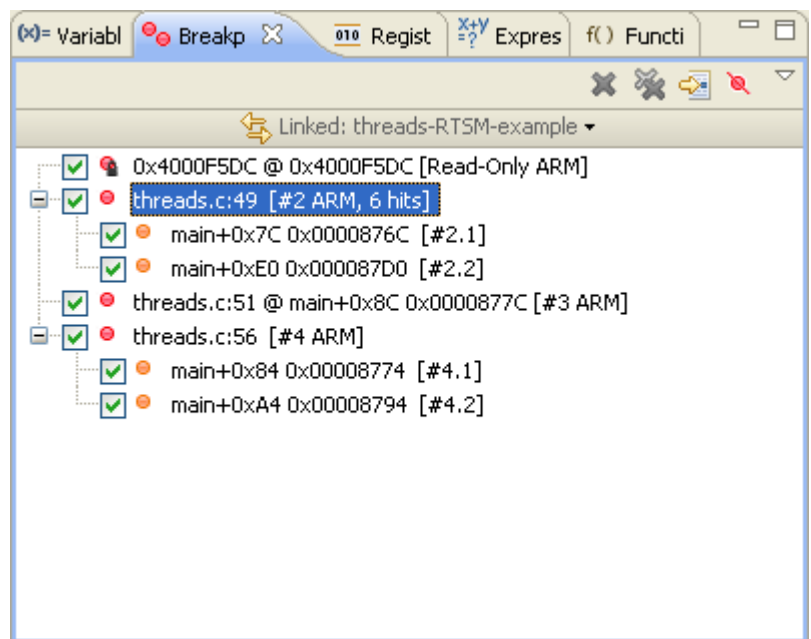


Figure 10-4 Breakpoints view

Syntax

Syntax of a breakpoint entry

A breakpoint entry has the following syntax:

```
source_file:linenum @ function+offset address [#ID instruction_type, ignore = num/count, nHits hits, (condition)]
```

where:

source_file:linenum If the source file is available, the file name and line number in the file where the breakpoint is set, threads.c:115.

function+offset The name of the function in which the breakpoint is set and the number of bytes from the start of the function. For example, accumulate()+52 shows that the breakpoint is 52 bytes from the start of the accumulate() function.

address	The address where the breakpoint is set.
ID	The breakpoint ID number, # <i>N</i> . In some cases, such as in a <code>for</code> loop, a breakpoint might comprise a number of sub-breakpoints. These are identified as <i>N.n</i> , where <i>N</i> is the number of the parent. The description of a sub-breakpoint in this dialog box is shown as main()+132sub-breakpoint ofmain()+132 @ threads.c:56 [#14 ARM] (threads)
instruction_type	The type of instruction at the address of the breakpoint, ARM or Thumb.
ignore = num/count	An ignore count if set, where: num equals count initially, and decrements on each pass until it reaches zero. count is the value you have specified for the ignore count.
nHits hits	A counter that increments each time the breakpoint is hit. This is not displayed until the first hit. If you set an ignore count, hits count does not start incrementing until the ignore count reaches zero.
condition	The stop condition you have specified, (<i>i</i> ==3).

Syntax

Syntax of a watchpoint entry

A watchpoint entry has the following syntax:

name type[#*ID*]

where:

name	The name of the variable where the watchpoint is set.
type	The access type of the watchpoint.
ID	The watchpoint ID number.

Syntax

Syntax of a tracepoint entry

A tracepoint entry has the following syntax:

source_file:linenum address

where:

address	The address where the tracepoint is set.
source_file:linenum	If the source file is available, the file name and line number in the file where the tracepoint is set, 0x80000A72.

Toolbar and context menu options

The following options are available from the toolbar or context menu:

Linked: context	Links this view to the selected connection in the Debug Control view. This is the default. Alternatively you can link the view to a specific connection. If the connection you want is not shown in the drop-down list you might have to select it first in the Debug Control view.				
Delete	Removes the selected breakpoints and watchpoints.				
Delete All	Removes all breakpoints and watchpoints.				
Go to File	Displays the source file containing the line of code where the selected breakpoint is set. This option is disabled for a watchpoint.				
Go to Disassembly	Displays the disassembly where the selected breakpoint is set. This option is disabled for a watchpoint.				
Go to Memory	Displays the memory where the selected watchpoint is set. This option is disabled for a breakpoint.				
Skip All Breakpoints	Deactivates all breakpoints or watchpoints that are currently set. The debugger remembers the enabled and disabled state of each breakpoint or watchpoint, and restores that state when you reactivate them again.				
Enable Breakpoints	Enables the selected breakpoints and watchpoints.				
Disable Breakpoints	Disables the selected breakpoints and watchpoints.				
Resolve	Re-evaluates the address of the selected breakpoint or watchpoint. If the address can be resolved the breakpoint or watchpoint is set, otherwise it remains pending.				
Properties...	Displays the Properties dialog box for the selected breakpoint, watchpoint or tracepoint. This enables you to control activation or change the access type for the selected watchpoint.				
Copy	Copies the selected breakpoints and watchpoints. You can also use the standard keyboard shortcut to do this.				
Paste	Pastes the copied breakpoints and watchpoints. The breakpoints or watchpoints are enabled by default. You can also use the standard keyboard shortcut to do this.				
Select all	Selects all breakpoints or watchpoints. You can also use the standard keyboard shortcut to do this.				
View Menu	The following View Menu options are available: <table> <tr> <td>New Breakpoints View</td><td>Displays a new instance of the Breakpoints view.</td></tr> <tr> <td>Export Breakpoints</td><td>Exports the current list of breakpoints and watchpoints to a file.</td></tr> </table>	New Breakpoints View	Displays a new instance of the Breakpoints view.	Export Breakpoints	Exports the current list of breakpoints and watchpoints to a file.
New Breakpoints View	Displays a new instance of the Breakpoints view.				
Export Breakpoints	Exports the current list of breakpoints and watchpoints to a file.				

Import Breakpoints	Imports a list of breakpoints and watchpoints from a file.
Alphanumeric Sort	Sorts the list alphanumerically based on the string displayed in the view.
Ordered Sort	Sorts the list in the order they have been set.
Manage Signals	Displays the Manage Signal dialog box.

Related Concepts

About debugging multi-threaded applications on page 134.
About debugging shared libraries on page 135.
About debugging a Linux kernel on page 137.
About debugging Linux kernel modules on page 139.
About debugging TrustZone enabled targets on page 141.

Related References

Setting an execution breakpoint on page 96.
Setting a data watchpoint on page 98.
Setting a tracepoint on page 100.
Setting a conditional breakpoint on page 102.
Setting a breakpoint on a specific thread on page 105.
Pending breakpoints and watchpoints on page 108.
Exporting DS-5 breakpoint settings to a file on page 109.
Importing DS-5 breakpoint settings from a file on page 110.
DS-5 Debug perspectives and views on page 177.
Examining the target execution environment on page 120.
Examining the call stack on page 122.

10.5 C/C++ editor

Describes the view content.

This editor enables you to:

- Edit source code.
- View the syntax highlighting.
- View interactive help when hovering over C library functions. For example, `printf()`.
- Use content assist (**Ctrl+Space**) for auto-completion.
- Set, remove, enable or disable a breakpoint.
- Set or remove a trace start or stop point.
- Set or remove a Streamline start or stop capture.

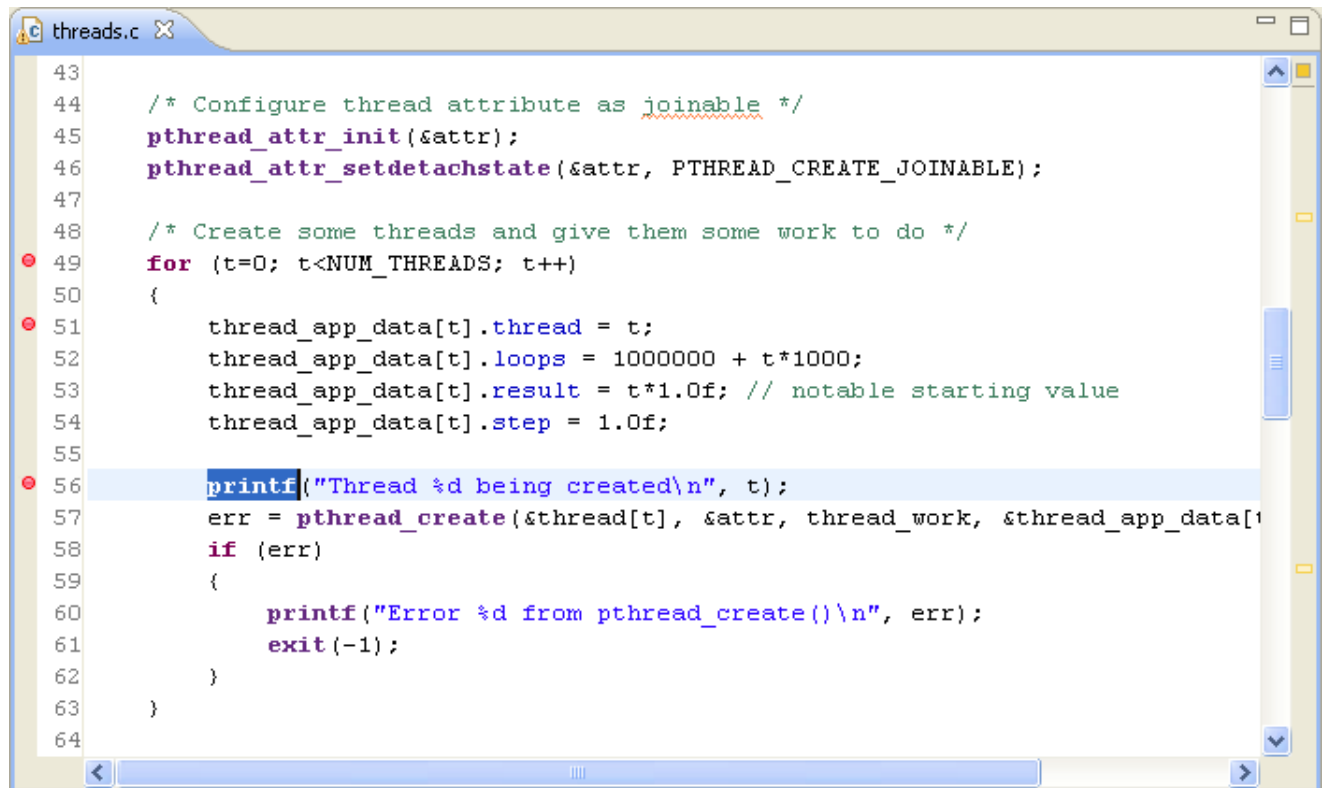


Figure 10-5 C/C++ editor

In the left-hand margin of each editor tab you can find a marker bar that displays view markers associated with specific lines in the source code.

To set a breakpoint, double-click in the marker bar at the position where you want to set the breakpoint. To delete a breakpoint, double-click on the breakpoint marker.

———— Note ————

If you have sub-breakpoints to a parent breakpoint then double-clicking on the marker also deletes the related sub-breakpoints.

Action context menu options

Right-click in the marker bar, or the line number column if visible, to display the action context menu for the C/C++ editor. The options available include:

DS-5 Breakpoints menu	The following breakpoint options are available:	
	Toggle Breakpoint	Sets or removes a breakpoint at the selected address.
	Toggle Hardware Breakpoint	Sets or removes a hardware breakpoint at the selected address.
	Resolve Breakpoint	Resolves a pending breakpoint at the selected address.
	Enable Breakpoint	Enables the breakpoint at the selected address.
	Disable Breakpoint	Disables the breakpoint at the selected address.
	Breakpoint Properties...	Displays the Breakpoint Properties dialog box for the selected breakpoint. This enables you to control breakpoint activation.
	Toggle Trace Start Point	Sets or removes a trace start point at the selected address.
	Toggle Trace Stop Point	Sets or removes a trace stop point at the selected address.
	Toggle Trace Trigger Point	Starts a trace trigger point at the selected address.
Default Breakpoint Type	Toggle Streamline Start	Sets or removes a Streamline start capture at the selected address.
	Toggle Streamline Stop	Sets or removes a Streamline stop capture at the selected address.
Show Line Numbers	The default type causes the top-level context menu entry, Toggle Breakpoint and the double-click action in the marker bar to toggle either CDT Breakpoints or DS-5 Breakpoints. When using DS-5 Debugger you must select DS-5 C/C++ + Breakpoint . DS-5 breakpoint markers are red to distinguish them from the blue CDT breakpoint markers.	
	Shows or hides line numbers.	

For more information on the other options not listed here, see the dynamic help.

Editor context menu

Right-click on any line of source to display the editor context menu for the C/C++ editor. The following options are enabled when you connect to a target:

Set PC to Selection	Sets the PC to the address of the selected source line.
----------------------------	---

Run to Selection Runs to the selected source line.

Show in Disassembly This option:

1. Opens a new instance of the Disassembly view.
2. Highlights the addresses and instructions associated with the selected source line. A vertical bar and shaded highlight shows the related disassembly.

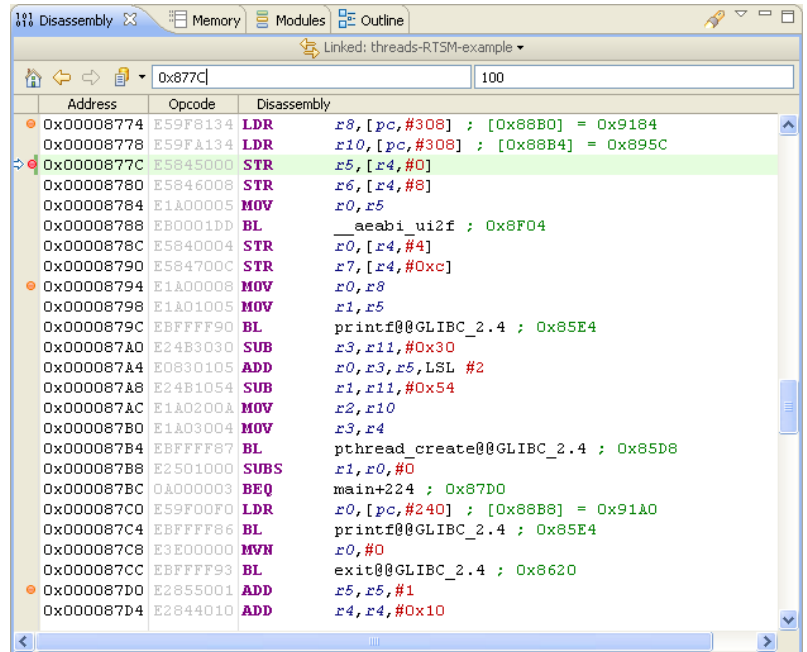


Figure 10-6 Show disassembly for selected source line

For more information on the other options not listed here, see the dynamic help.

Related References

- [Setting an execution breakpoint on page 96.](#)
- [Setting a data watchpoint on page 98.](#)
- [Setting a tracepoint on page 100.](#)
- [Setting a conditional breakpoint on page 102.](#)
- [Setting a breakpoint on a specific thread on page 105.](#)
- [Pending breakpoints and watchpoints on page 108.](#)
- [Exporting DS-5 breakpoint settings to a file on page 109.](#)
- [Importing DS-5 breakpoint settings from a file on page 110.](#)
- [Setting Streamline start and stop points on page 101.](#)
- [DS-5 Debug perspectives and views on page 177.](#)

10.6 Commands view

Describes the view content.

This view enables you to:

- Enter debugger commands.
- Run command scripts.
- See messages output by the debugger.
- Save the contents to a text file.

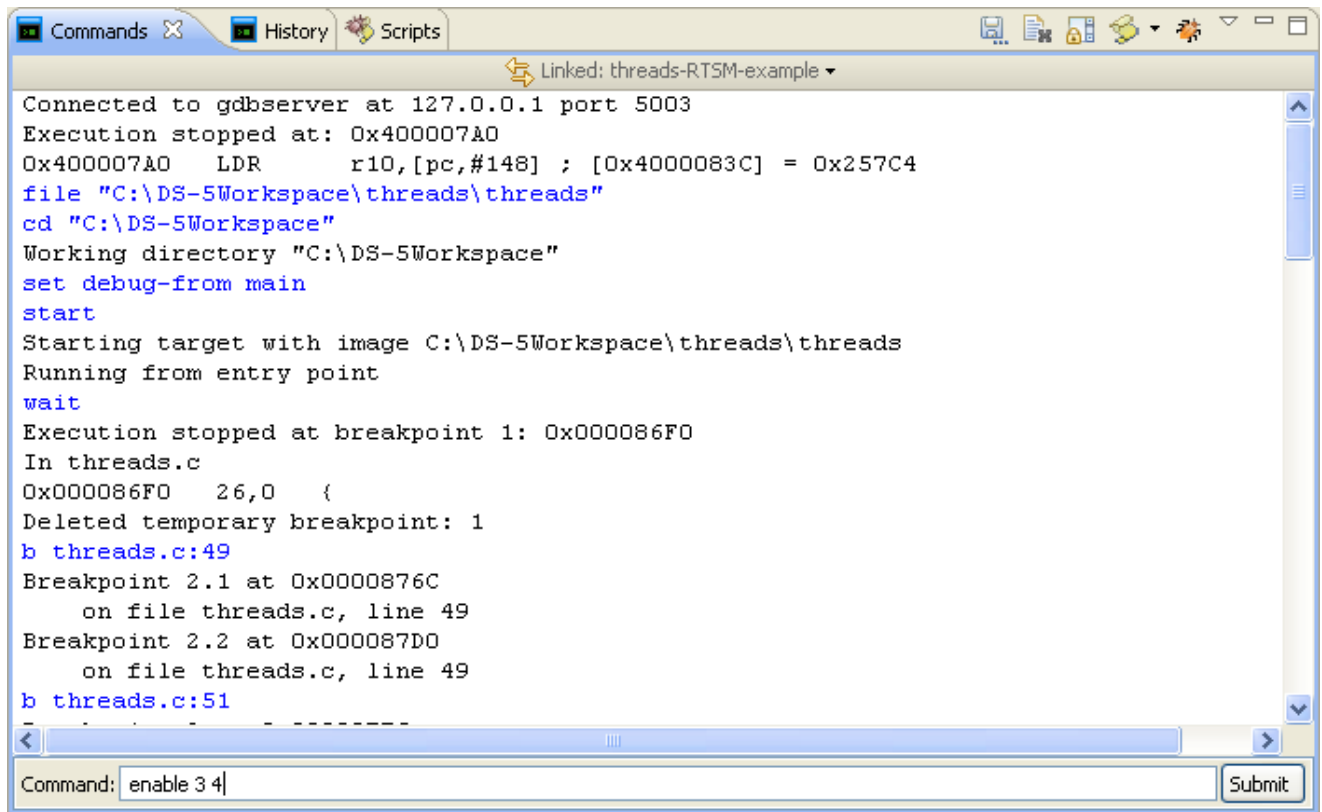


Figure 10-7 Commands view

You can execute DS-5 Debugger commands by entering the command in the field provided, then click **Submit**. This feature is not available until you connect to a target.

You can use the content assist keyboard combination **Ctrl+Space** in the Command field to display a list of DS-5 Debugger commands. Filtering is also possible by entering a partial command. For example, enter `pr` followed by the keyboard combination **Ctrl+Space** to search for the `print` command.

To display sub-commands you must filter on the top level command. For example, enter `info` followed by the keyboard combination **Ctrl+Space** to display all the `info` sub-commands.

———— Note ————

Default settings for this view are controlled by a DS-5 Debugger setting in the Preferences dialog box. For example, default locations for specific files or the maximum number of lines to display. You can access these settings by selecting **Preferences** from the **Window** menu.

Toolbar and context menu options

The following options are available from the toolbar or context menu:

Linked: context	Links this view to the selected connection in the Debug Control view. This is the default. Alternatively you can link the view to a specific connection. If the connection you want is not shown in the drop-down list you might have to select it first in the Debug Control view.
Save Console Buffer	Saves the contents of the Commands view to a text file.
Clear Console	Clears the contents of the Commands view.
Scroll Lock	Enables or disables the automatic scrolling of messages in the Commands view.
Script menu	A menu of options that enable you to manage and run command scripts: <ul style="list-style-type: none"> <Recent scripts list> A list of the recently run scripts. <Recent favorites list> A list of the scripts you have added to your favorites list. Run Script File... Displays the Open dialog box to select and run a script file. Organize Favorites... Displays the Scripts view, where you can organize your scripts.
Show Command History View	Displays the History view.
Copy	Copies the selected commands. You can also use the standard keyboard shortcut to do this.
Paste	Pastes the command that you have previously copied into the Command field. You can also use the standard keyboard shortcut to do this.
Select all	Selects all output in the Commands view. You can also use the standard keyboard shortcut to do this.
Save the selected lines as a script...	Displays the Save As dialog box to save the selected commands to a script file. When you click Save on the Save As dialog box, you are given the option to add the script file to your favorites list. Click OK to add the script to your favorites list. Favorites are displayed in the Scripts view.
Execute selected lines	Runs the selected commands.
New Commands View	Displays a new instance of the Commands view.

Related Concepts

About debugging multi-threaded applications on page 134.

About debugging shared libraries on page 135.
About debugging a Linux kernel on page 137.
About debugging Linux kernel modules on page 139.
About debugging TrustZone enabled targets on page 141.

Related References

DS-5 Debug perspective keyboard shortcuts on page 22.
Debug Control view on page 195.
Setting an execution breakpoint on page 96.
Setting a data watchpoint on page 98.
Setting a tracepoint on page 100.
Setting a conditional breakpoint on page 102.
Setting a breakpoint on a specific thread on page 105.
Pending breakpoints and watchpoints on page 108.
Exporting DS-5 breakpoint settings to a file on page 109.
Importing DS-5 breakpoint settings from a file on page 110.
DS-5 Debug perspectives and views on page 177.

Related Information

DS-5 Debugger commands.

10.7 Debug Control view

Describes the view content.

This view enables you to: The **Debug Control** view displays target connections with a hierarchical layout of running threads, user space processes, and related call stacks. Call stack information is gathered when the system is stopped.

- view a list of running threads and user space processes as applicable
- view the call stack showing stack elements for each thread or process as applicable
- connect to and disconnect from a target
- load an application image on to the target
- load debug information when required by the debugger
- start the application
- run the application
- stop the application
- reset the target
- continue running the application after a breakpoint is hit or the target is suspended
- control the execution of an image by sequentially stepping through an application at the source or instruction level
- modify the search paths used by the debugger when it executes any of the commands that look up and display source code
- set the current working directory.

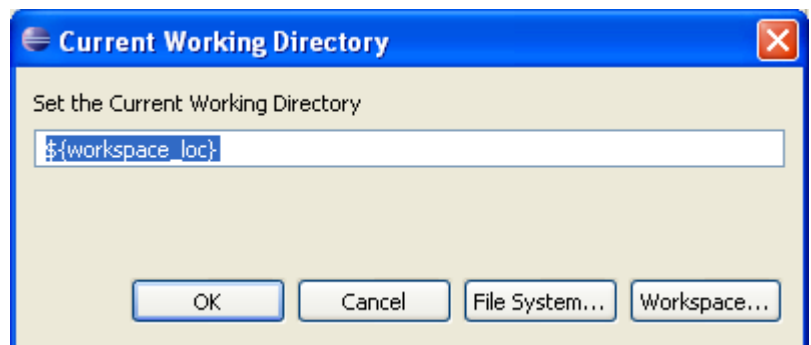


Figure 10-8 Set the current working directory

On Linux Kernel connections, the hierarchical nodes **Active Threads** and **All Threads** are displayed. **Active Threads** shows each thread that is currently scheduled on a processor. **All Threads** shows every thread in the system, including those presently scheduled on a processor. On **gdbserver** connections, the hierarchical nodes **Active Threads** and **All Threads** are displayed, but the scope is limited to the application under debug. **Active Threads** shows only application threads that are currently scheduled. **All Threads** shows all application threads, including ones that are currently scheduled.

Some of the views in the DS-5 Debug perspective are associated with the currently selected stack frame. Other views are associated with editors or target connections. Each associated view is synchronized accordingly.

Connection states are identified with different icons and background highlighting and are also displayed in the view status bar. The following example shows a connection in the connected state. If you want to add another configuration to the view then you can use the **Debug Control** view menu.

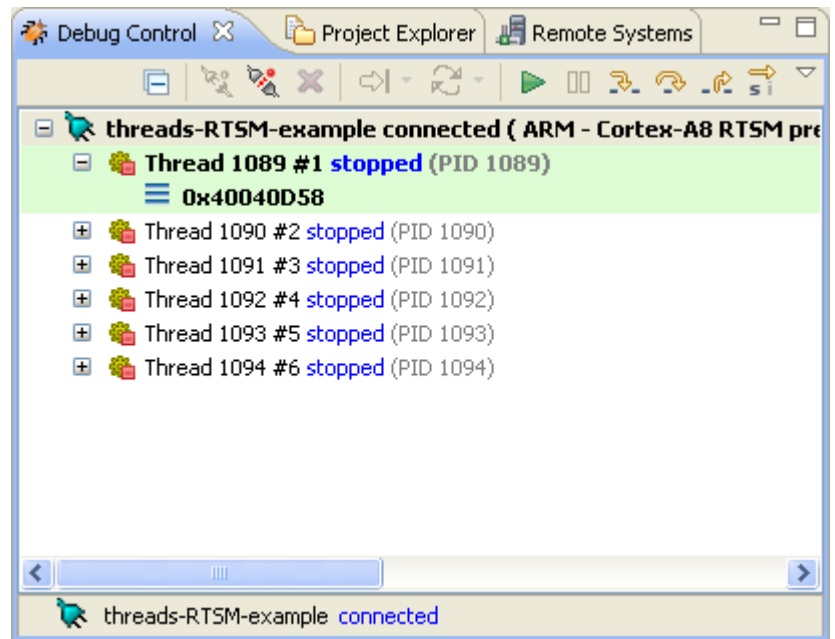


Figure 10-9 Debug Control view

Toolbar and context menu options

The following options are available from the toolbar or context menu:

Collapse All	Collapses all expanded stack trace configurations.
Connect to Target	Connects to the selected target using the same launch configuration settings as the previous connection.
Disconnect from Target	Disconnects from the selected target.
Debug Configurations...	Displays the Debug Configurations dialog box, with the configuration for the selected connection displayed.
Launch in background	Displays the Progress Information dialog box if disabled.
Remove Connection	Removes the selected target connection from the Debug Control view.
Debug from menu	This menu lists the different types of actions that you can perform when a connection is established.
Reset menu	This menu lists the different types of reset that are available on your target.
Continue	Continues running the target.

————— Note —————

A **Connect only** connection might require setting the PC register to the start of the image before running it.

Interrupt	Interrupts the target and stops the current application.
Step Source Line	This option depends on the stepping mode selected:
Step Instruction	<ul style="list-style-type: none"> • If source line mode is selected, steps at the source level including stepping into all function calls where there is debug information. • If instruction mode is selected, steps at the instruction level including stepping into all function calls.
Step Over Source Line	This option depends on the stepping mode selected:
Step Over Instruction	<ul style="list-style-type: none"> • If source line mode is selected, steps at the source level but stepping over all function calls. • If instruction mode is selected, steps at the instruction level but stepping over all function calls.
Step Out	Continues running to the next instruction after the selected stack frame finishes.
Stepping by Source Line (press to step by instruction)	Toggles the stepping mode between source line and instruction.
Stepping by Instruction (press to step by source line)	The Disassembly view and the source editor view are automatically displayed when you step in instruction mode. The source editor view is automatically displayed when you step in source line mode. If the target stops in code such as a shared library, and the corresponding source is not available, then the source editor view is not displayed.
Step Out to This Frame	Continues running to the selected stack frame.
Change Connection Color	Enables you to change the color of the connection icon.
View Menu	The following options are available:
Add Configuration (without connecting)...	<p>Displays the Add Launch Configuration dialog box. The dialog box lists any configurations that are not already listed in the Debug Control view.</p> <p>Select one or more configurations, then click OK. The selected configurations are added to the Debug Control view, but remain unconnected.</p>
Load...	Displays a dialog box where you can select whether to load an image, debug information, an image and debug information, or additional debug information. This option might be disabled for targets where this functionality is not supported.
Set Working Directory...	Displays the Current Working Directory dialog box. Enter a new location for the current working directory, then click OK .

Path Substitution...	<p>Displays the Path Substitution and Edit Substitute Path dialog box.</p> <p>Use the Edit Substitute Path dialog box to associate the image path with a source file path on the host. Click OK. The image and host paths are added to the Path Substitution dialog box. Click OK when finished.</p>
Reset DS-5 Views to 'Linked'	Resets DS-5 views to link to the selected connection in the Debug Control view.
Threads Presentation	Displays either a flat or hierarchical presentation of the threads in the stack trace.
Auto Expand Stack	Controls whether to automatically display an expanded stack when selecting a connection.
Always Show Cores	Displays the available processors.

Related Concepts

About debugging multi-threaded applications on page 134.
About debugging shared libraries on page 135.
About debugging a Linux kernel on page 137.
About debugging Linux kernel modules on page 139.
About debugging TrustZone enabled targets on page 141.

Related References

DS-5 Debug perspective keyboard shortcuts on page 22.
Commands view on page 192.
DS-5 Debug perspectives and views on page 177.

10.8 Disassembly view

Describes the view content.

This view enables you to:

- See a disassembly of the target memory
- Specify the start address for the **Disassembly** view. You can use expressions in this field, \$r3, or drag and drop a register from the **Registers** view into the **Disassembly** view to see the disassembly at the address in that register.
- Select the instruction set for the **Disassembly** view
- Create, delete, enable or disable a breakpoint or watchpoint at a memory location
- Freeze the selected view to prevent the values being updated by a running target.

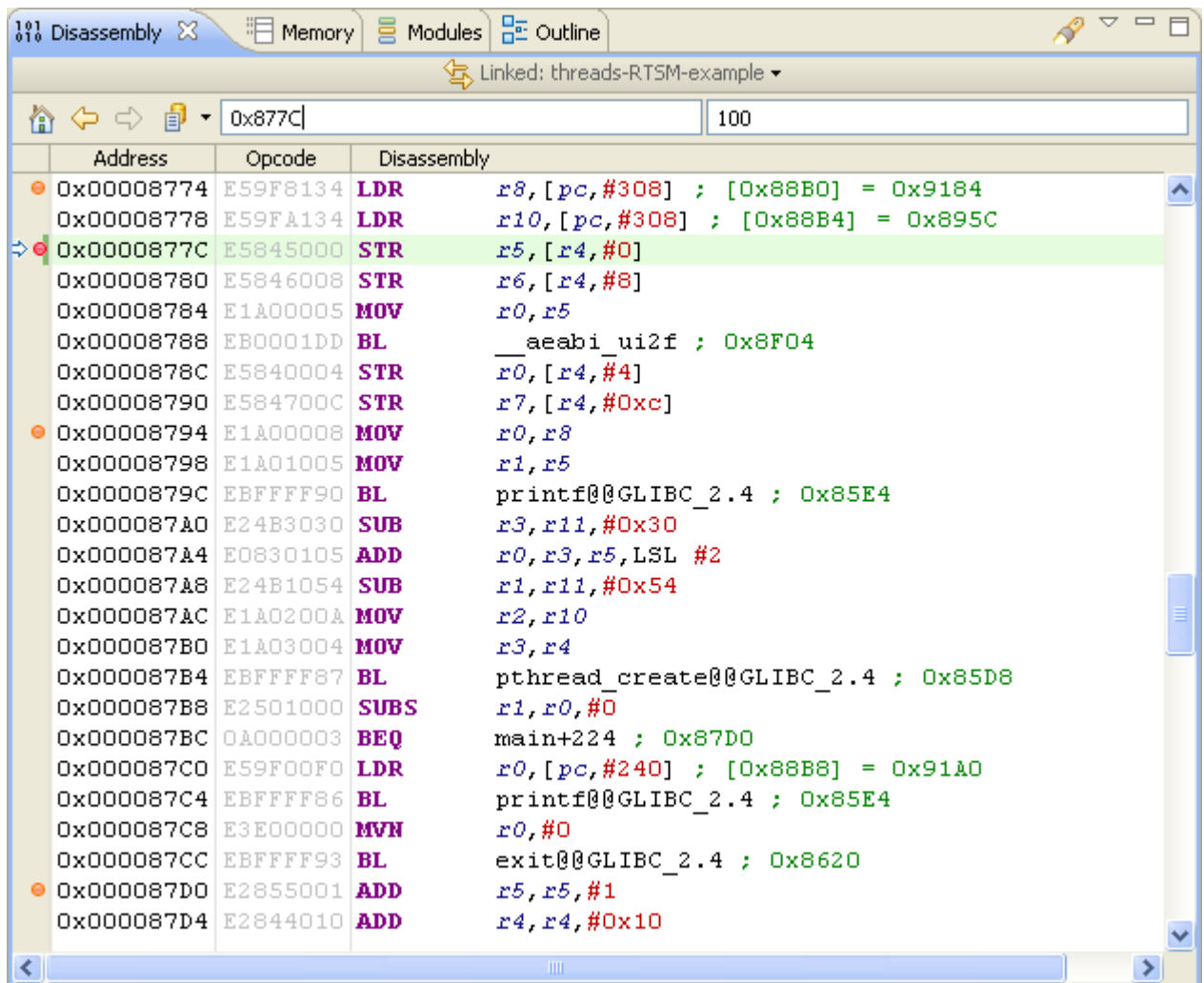


Figure 10-10 Disassembly view

Gradient shading in the **Disassembly** view shows the start of each function.

Solid shading in the **Disassembly** view shows the instruction at the address of the current PC register followed by any related instructions that correspond to the current source line.

In the left-hand margin of the **Disassembly** view you can find a marker bar that displays view markers associated with specific locations in the disassembly code.

To set a breakpoint, double-click in the marker bar at the position where you want to set the breakpoint. To delete a breakpoint, double-click on the breakpoint marker.

———— **Note** ————

If you have sub-breakpoints to a parent breakpoint then double-clicking on the marker also deletes the related sub-breakpoints.

Toolbar and context menu options

The following options are available from the toolbar or context menu:

Linked: context	Links this view to the selected connection in the Debug Control view. This is the default. Alternatively you can link the view to a specific connection. If the connection you want is not shown in the drop-down list you might have to select it first in the Debug Control view.								
Back, Forward	Navigates through the history list.								
<Next Instruction>	Navigates to the selected stack frame in the Debug Control view.								
\$LR	Navigates to the LR register.								
expression	Navigates to the address specified by an expression. \$PC+256.								
address	Navigates to the specified address.								
History	Addresses and expressions you specify in the Address field are added to the drop down box, and persist until you clear the history list or exit Eclipse. If you want to keep an expression for later use, add it to the Expressions view.								
Address field	Enter the address where you want to view the disassembly. Context menu options are available for editing this field.								
Size field	The number of instructions to display before and after the location pointed to by the program counter. Context menu options are available for editing this field.								
Search	Searches through debug information for symbols.								
View Menu	The following View Menu options are available: <table border="0" data-bbox="638 1533 1493 1839"> <tr> <td>New Disassembly View</td><td>Displays a new instance of the Disassembly view.</td></tr> <tr> <td>Instruction Set</td><td>The instruction set to show in the view by default. Select one of the following: <table border="0" data-bbox="861 1701 1493 1839"> <tr> <td>[AUTO]</td><td>Auto detect the instruction set from the image.</td></tr> <tr> <td>ARM</td><td>ARM instruction set.</td></tr> </table> </td></tr> </table>	New Disassembly View	Displays a new instance of the Disassembly view.	Instruction Set	The instruction set to show in the view by default. Select one of the following: <table border="0" data-bbox="861 1701 1493 1839"> <tr> <td>[AUTO]</td><td>Auto detect the instruction set from the image.</td></tr> <tr> <td>ARM</td><td>ARM instruction set.</td></tr> </table>	[AUTO]	Auto detect the instruction set from the image.	ARM	ARM instruction set.
New Disassembly View	Displays a new instance of the Disassembly view.								
Instruction Set	The instruction set to show in the view by default. Select one of the following: <table border="0" data-bbox="861 1701 1493 1839"> <tr> <td>[AUTO]</td><td>Auto detect the instruction set from the image.</td></tr> <tr> <td>ARM</td><td>ARM instruction set.</td></tr> </table>	[AUTO]	Auto detect the instruction set from the image.	ARM	ARM instruction set.				
[AUTO]	Auto detect the instruction set from the image.								
ARM	ARM instruction set.								

	Thumb	Thumb instruction set.
	Byte Order	Selects the byte order of the memory. The default is Auto(LE) .
	Clear History	Clears the list of addresses and expressions in the History drop-down box.
	Refresh	Refreshes the view.
	Freeze Data	Toggles the freezing of data in the current view. This also disables and enables the Size and Type fields and the Refresh option.
Action context menu	When you right-click in the left margin, the corresponding address and instruction is selected and this context menu is displayed. The available options are:	
	Copy	Copies the selected address.
	Paste	Pastes into the Address field the last address that you copied.
	Select All	Selects all disassembly in the range specified by the Size field. If you want to copy the selected lines of disassembly, you cannot use the Copy option on this menu. Instead, use the copy keyboard shortcut for your host, Ctrl+C on Windows.
	Run to Selection	Runs to the selected address
	Set PC to Selection	Sets the PC register to the selected address.
	Show in source	If source code is available: 1. Opens the corresponding source file in the C/C++ source editor view, if necessary. 2. Highlights the line of source associated with the selected address.
	Show in registers	If the memory address corresponds to a register, then displays the Registers view with the related register selected.
	Show in functions	If the memory address corresponds to a function, then displays the Functions view with the related function selected.
	Toggle Breakpoint	Sets or removes a breakpoint at the selected address.

Toggle Hardware Breakpoint	Sets or removes a hardware breakpoint at the selected address.
Resolve Breakpoint	Resolves a pending breakpoint at the selected address.
Enable Breakpoint	Enables the breakpoint at the selected address.
Disable Breakpoint	Disables the breakpoint at the selected address.
Toggle Trace Start Point	Sets or removes a trace start point at the selected address.
Toggle Trace Stop Point	Sets or removes a trace stop point at the selected address.
Toggle Trace Trigger Point	Starts a trace trigger point at the selected address.
Editing context menu options	The following options are available on the context menu when you select the Address field or Size field for editing:
Cut	Copies and deletes the selected text.
Copy	Copies the selected text.
Paste	Pastes text that you previously cut or copied.
Delete	Deletes the selected text.
Undo	Reverts the last change.
Select All	Selects all the text.

Related Concepts

About debugging multi-threaded applications on page 134.
About debugging shared libraries on page 135.
About debugging a Linux kernel on page 137.
About debugging Linux kernel modules on page 139.
About debugging TrustZone enabled targets on page 141.

Related References

Setting an execution breakpoint on page 96.
Setting a data watchpoint on page 98.
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DS-5 Debug perspectives and views on page 177.

10.9 Events view

Describes the view content.

This editor enables you to view the output generated by the *System Trace Macrocell* (STM) and *Instruction Trace Macrocell* (ITM) events.

Data is captured from your application only when it runs. However, no data appears in the view until you stop the application. You can stop the target by clicking the **Interrupt** icon in the **Debug Control** view, or by entering the stop command in the **Commands** view. When your application stops then any captured logging information is automatically appended to the open views.

The Configuration dialog enables you to select a trace source as well as masters and channels to display in the view.

Toolbar and context menu options

The following options are available from the toolbar or context menu:

Linked: context	Links this view to the selected connection in the Debug Control view. This is the default. Alternatively you can link the view to a specific connection. If the connection you want is not shown in the drop-down list you might have to select it first in the Debug Control view.	
Search by Timestamp	Searches through debug information for the nearest record to a given time stamp.	
Configure Masters and Channels	Enables you to select a trace source in addition to masters and channels to display in the view.	
View Menu	The following View Menu options are available:	
	New Events View	Displays a new instance of the Events view.
	Refresh	Refreshes the view.
	Freeze Data	Toggles the freezing of data in the current view.
	Display Format	Select the display format of the events.
	Data	Displays data in the data column as hex values with widths depending on the underlying data packets. This is the default.
	Text	Displays character wrapped text data.

Related References

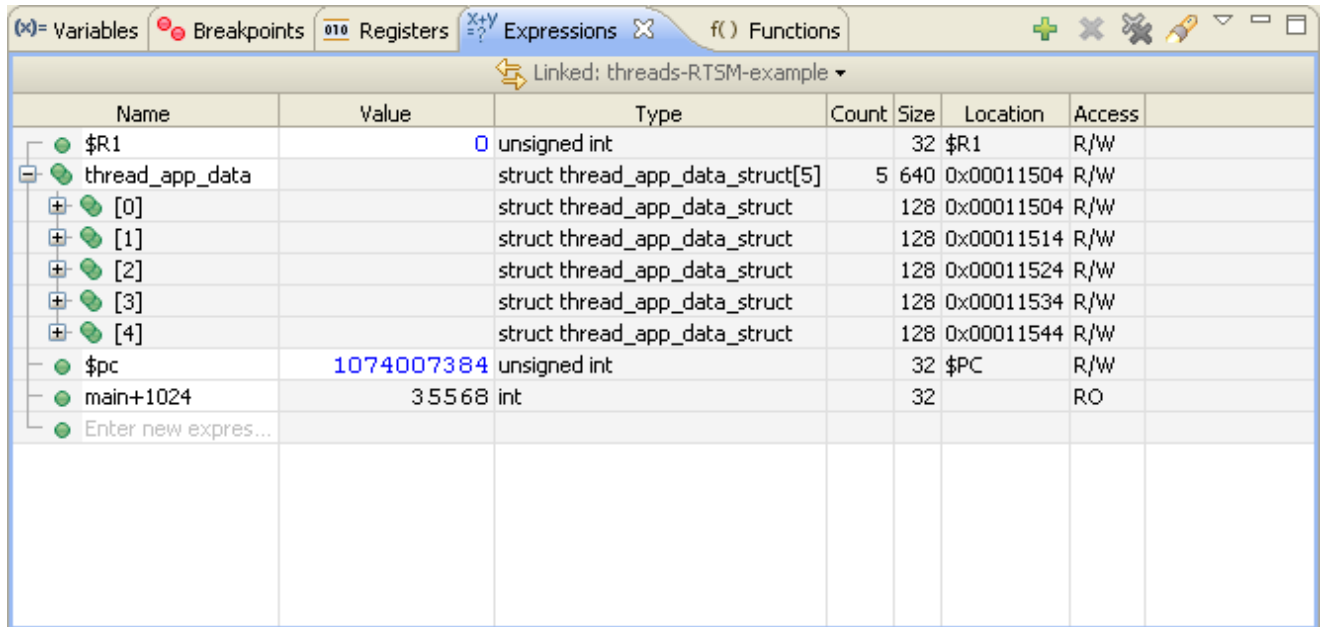
[DS-5 Debug perspectives and views on page 177.](#)

10.10 Expressions view

Describes the view content.

This view enables you to:

- add expressions that you use regularly or that you want to examine in more detail
- edit, and delete expressions
- freeze the selected view to prevent the values being updated by a running target.



Name	Value	Type	Count	Size	Location	Access
\$R1		unsigned int		32	\$R1	R/W
thread_app_data		struct thread_app_data_struct[5]	5	640	0x00011504	R/W
[0]		struct thread_app_data_struct		128	0x00011504	R/W
[1]		struct thread_app_data_struct		128	0x00011514	R/W
[2]		struct thread_app_data_struct		128	0x00011524	R/W
[3]		struct thread_app_data_struct		128	0x00011534	R/W
[4]		struct thread_app_data_struct		128	0x00011544	R/W
\$pc	1074007384	unsigned int		32	\$PC	R/W
main+1024	35568	int		32		RO
Enter new expres...						

Figure 10-11 Expressions view

Note

If your expression contains side-effects when evaluating the expression, the results are unpredictable. Side-effects occur when the state of one or more inputs to the expression changes when the expression is evaluated.

For example, instead of `x++` or `x+=1` you must use `x+1`.

Right-click on the column headers to select the columns that you want displayed:

Name	An expression that resolves to an address, such as <code>main+1024</code> .
Value	The value of the expression. You can modify a value that has a white background. A yellow background indicates the value has changed. If you freeze the view, then you cannot change a value.
Type	The type associated with the value at the address identified by the expression.
Count	The number of array or pointer elements. You can edit a pointer element count.
Size	The size of expression in bits.

Location The address in hexadecimal identified by the expression, or the name of a register, if expression contains only a single register name.

Access The access type of expression.

All columns are displayed by default.

Toolbar and context menu options

The following options are available from the toolbar or context menu:

Linked: context	Links this view to the selected connection in the Debug Control view. This is the default. Alternatively you can link the view to a specific connection. If the connection you want is not shown in the drop-down list you might have to select it first in the Debug Control view.
Add New Expression	Adds a new expression to the expression list.
Remove Selected Expression	Removes the selected expression from the list.
Remove All Expressions	Removes all expressions from the list.
Search	Searches the data in the current view for an expression.
Cut	Copies and removes the selected expression.
Copy	Copies the selected expression. To copy an expression for use in the Disassembly view or Memory view, first select the expression in the Name field.
Paste	Pastes expressions that you have previously cut or copied.
Delete	Deletes the selected expression.
Select All	Selects all expressions.
Show in memory view	Where enabled, displays the Memory view with the address set to either: <ul style="list-style-type: none"> the value of the selected expression, if the expression translates to an address, the address of an array, &name the location of the expression, the name of an array, name. The memory size is set to the size of the variable, using the <code>sizeof</code> keyword.
Show in register view	If the expression corresponds to a register, then displays the Registers view with that register selected. This might be: <ul style="list-style-type: none"> an expression that consists only of a single register, <code>\$pc</code> a variable that is currently held in a register, For example, the variable <code>t</code> might be held in register <code>R5</code>.
Send to Selection	Enables you to add register filters to an Expression view. Displays a sub menu that enables you to add to a specific Expressions view.

format list	A list of formats you can use for the expression value.	
View Menu	The following View Menu options are available:	
	New Expression View	Displays a new instance of the Expressions view.
	Refresh	Refreshes the view.
	Freeze Data	Toggles the freezing of data in the current view. This also disables and enables the Refresh option.

Related References

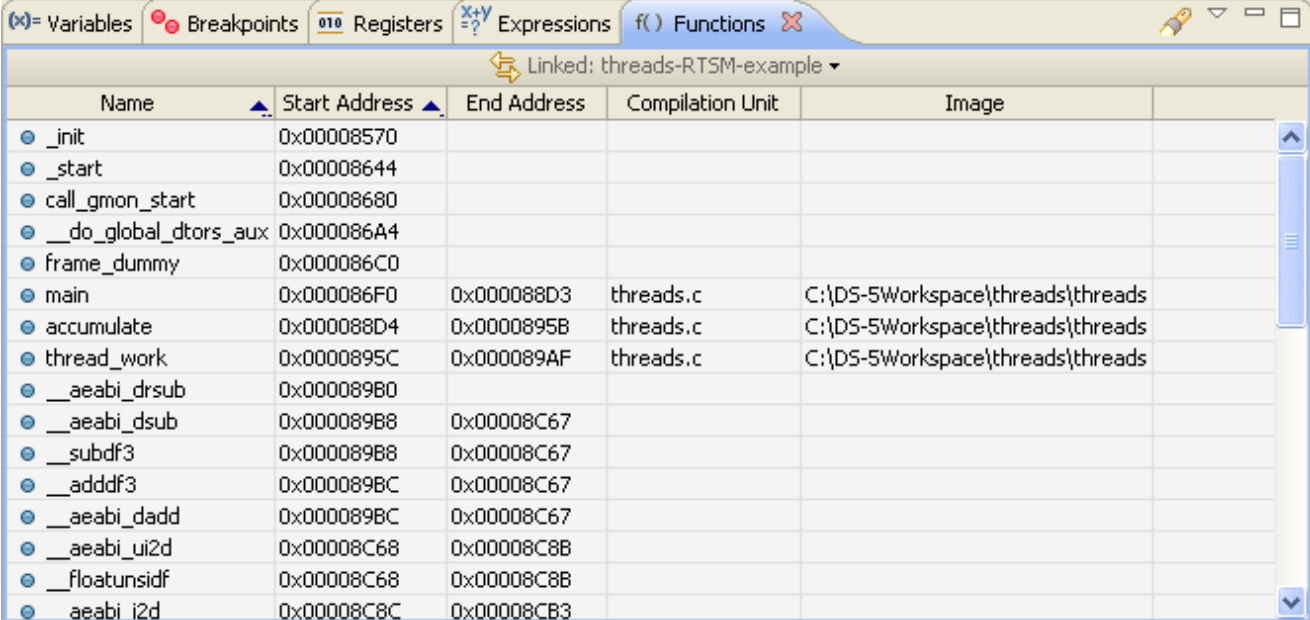
Setting an execution breakpoint on page 96.
Setting a data watchpoint on page 98.
Setting a tracepoint on page 100.
Setting a conditional breakpoint on page 102.
Setting a breakpoint on a specific thread on page 105.
Pending breakpoints and watchpoints on page 108.
Exporting DS-5 breakpoint settings to a file on page 109.
Importing DS-5 breakpoint settings from a file on page 110.
DS-5 Debug perspectives and views on page 177.

10.11 Functions view

Describes the view content.

This view enables you to:

- see the ELF data associated with function symbols for all loaded images
- freeze the selected view to prevent the information being updated by a running target.



Name	Start Address	End Address	Compilation Unit	Image
._init	0x00008570			
._start	0x00008644			
call_gmon_start	0x00008680			
__do_global_ctors_aux	0x000086A4			
frame_dummy	0x000086C0			
main	0x000086F0	0x000088D3	threads.c	C:\D5-5Workspace\threads\threads
accumulate	0x000088D4	0x0000895B	threads.c	C:\D5-5Workspace\threads\threads
thread_work	0x0000895C	0x000089AF	threads.c	C:\D5-5Workspace\threads\threads
__aeabi_drsub	0x000089B0			
__aeabi_dsub	0x000089B8	0x00008C67		
__subdf3	0x000089B8	0x00008C67		
__adddf3	0x000089BC	0x00008C67		
__aeabi_dadd	0x000089BC	0x00008C67		
__aeabi_ui2d	0x00008C68	0x00008C8B		
__floatunsidf	0x00008C68	0x00008C8B		
__aeabi_i2d	0x00008C8C	0x00008CB3		

Figure 10-12 Functions view

Right-click on the column headers to select the columns that you want displayed:

Name	The name of the function.
Mangled Name	The C++ mangled name of the function.
Base Address	The function entry point.
Start Address	The start address of the function.
End Address	The end address of the function.
Size	The size of the function in bytes.
Compilation Unit	The location of the compilation unit containing the function.
Image	The location of the ELF image containing the function.

The Name, Start Address, End Address, Compilation Unit, and Image columns are displayed by default.

Toolbar and context menu options

The following options are available from the toolbar or context menu:

Linked: context	Links this view to the selected connection in the Debug Control view. This is the default. Alternatively you can link the view to a specific connection. If the connection you want is not shown in the drop-down list you might have to select it first in the Debug Control view.								
Search	Searches the data in the current view for a function.								
Copy	Copies the selected functions.								
Select All	Selects all the functions in the view.								
Run to Selection	Runs to the selected address								
Set PC to Selection	Sets the PC register to the start address of the selected function.								
Show in Source	If source code is available: <ul style="list-style-type: none"> 1. Opens the corresponding source file in the C/C++ editor view, if necessary. 2. Highlights the line of source associated with the selected address. 								
Show in Memory	Displays the Memory view starting at the address of the selected function.								
Show in Disassembly	Displays the Disassembly view starting at the address of the selected function.								
Toggle Breakpoint	Sets or removes a breakpoint at the selected address.								
Resolve Breakpoint	Resolves a pending breakpoint at the selected address.								
Enable Breakpoint	Enables the breakpoint at the selected address.								
Disable Breakpoint	Disables the breakpoint at the selected address.								
Toggle Trace Start Point	Sets or removes a trace start point at the selected address.								
Toggle Trace Stop Point	Sets or removes a trace stop point at the selected address.								
Toggle Trace Trigger Point	Starts a trace trigger point at the selected address.								
View Menu	The following View Menu options are available: <table border="0" style="margin-left: 20px;"> <tr> <td>New Function View</td><td>Displays a new instance of the Functions view.</td></tr> <tr> <td>Refresh</td><td>Refreshes the view.</td></tr> <tr> <td>Freeze Data</td><td>Toggles the freezing of data in the current view. This also disables or enables the Refresh option.</td></tr> <tr> <td>Filter...</td><td>Displays the Filter dialog box.</td></tr> </table>	New Function View	Displays a new instance of the Functions view.	Refresh	Refreshes the view.	Freeze Data	Toggles the freezing of data in the current view. This also disables or enables the Refresh option.	Filter...	Displays the Filter dialog box.
New Function View	Displays a new instance of the Functions view.								
Refresh	Refreshes the view.								
Freeze Data	Toggles the freezing of data in the current view. This also disables or enables the Refresh option.								
Filter...	Displays the Filter dialog box.								

Related References

[DS-5 Debug perspectives and views on page 177.](#)

10.12 History view

Describes the view content.

This view enables you to:

- See a full list of commands generated during the current debug session.
- Clear the contents of the view.
- Save the selected commands to a script file. You can also add the script file to your favorites list when you click **Save**. Favorites are displayed in the **Scripts** view.
- Enable or disable the automatic scrolling of messages in the **History** view.

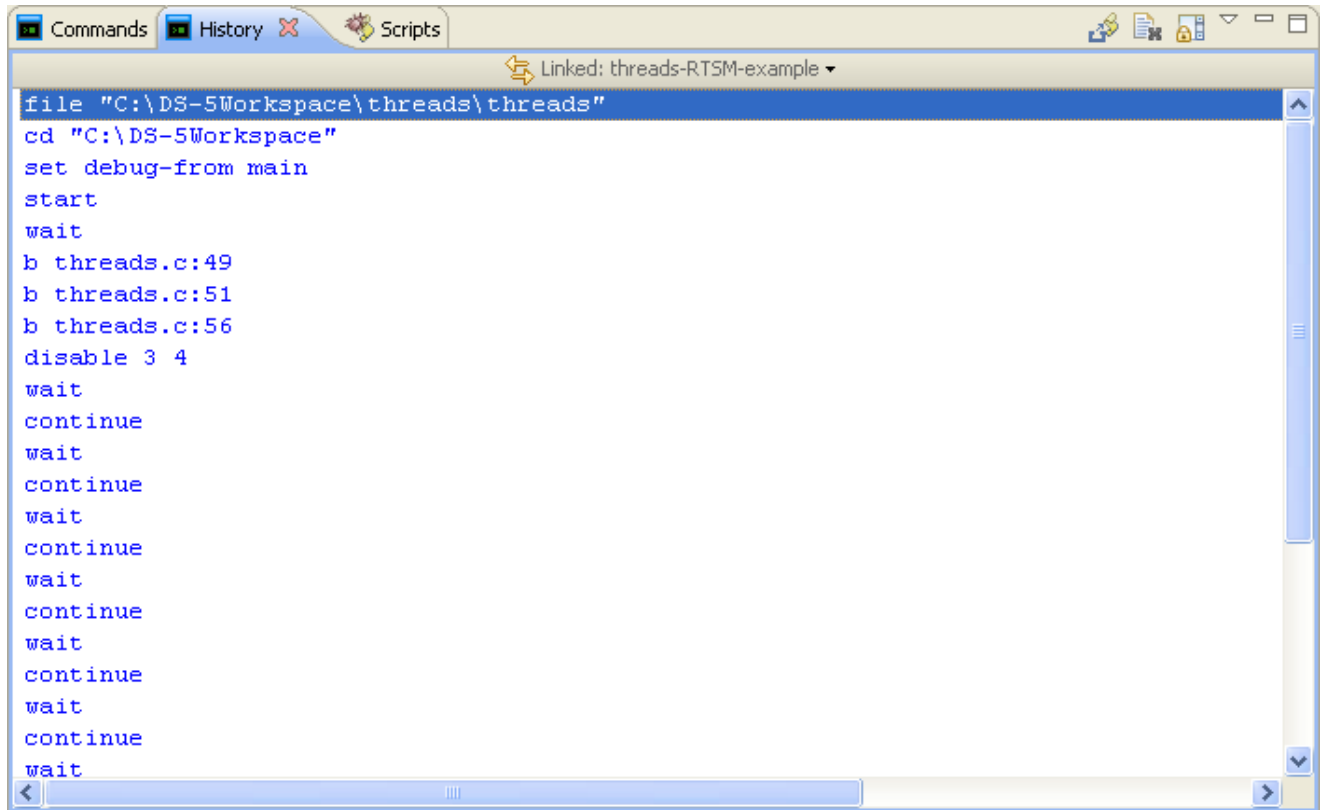


Figure 10-13 History view

———— Note ————

Default settings for this view are controlled by a DS-5 Debugger setting in the Preferences dialog box. For example, default locations for specific files. You can access these settings by selecting **Preferences** from the **Window** menu.

Toolbar and context menu options

The following options are available from the toolbar or context menu:

- Linked: context** Links this view to the selected connection in the **Debug Control** view. This is the default. Alternatively you can link the view to a specific connection. If the connection you want is not shown in the drop-down list you might have to select it first in the **Debug Control** view.

Exports the selected lines as a script	<p>Displays the Save As dialog box to save the selected commands to a script file.</p> <p>When you click Save on the Save As dialog box, you are given the option to add the script file to your favorites list. Click OK to add the script to your favorites list. Favorites are displayed in the Scripts view.</p>
Clear Console	<p>Clears the contents of the History view.</p>
Toggles Scroll Lock	<p>Enables or disables the automatic scrolling of messages in the History view.</p>
Copy	<p>Copies the selected commands.</p>
Select All	<p>Selects all commands.</p>
Save the selected lines as a script...	<p>Displays the Save As dialog box to save the selected commands to a script file.</p> <p>When you click Save on the Save As dialog box, you are given the option to add the script file to your favorites list. Click OK to add the script to your favorites list. Favorites are displayed in the Scripts view.</p>
Execute selected lines	<p>Runs the selected commands.</p>
New History View	<p>Displays a new instance of the History view.</p>

Related References

[DS-5 Debug perspectives and views on page 177.](#)

10.13 Memory view

Describes the view content.

This view enables you to:

- Modify memory content.
- Specify the start address for the **Memory** view, either as an absolute address or as an expression, \$pc. Previous entries are listed in the drop-down list. This list is cleared when you exit Eclipse.
- Specify the display size of the **Memory** view in bytes, either as an offset value from the start address, or as an address held in a register by dragging and dropping the register from the **Registers** view into the **Memory** view.
- Specify the format of the memory cell values. The default is hexadecimal.
- Set the width of the memory cells in the **Memory** view. The default is four bytes.
- Display the ASCII character equivalent of the memory values.
- Freeze the selected view to prevent the view being updated by a running target.

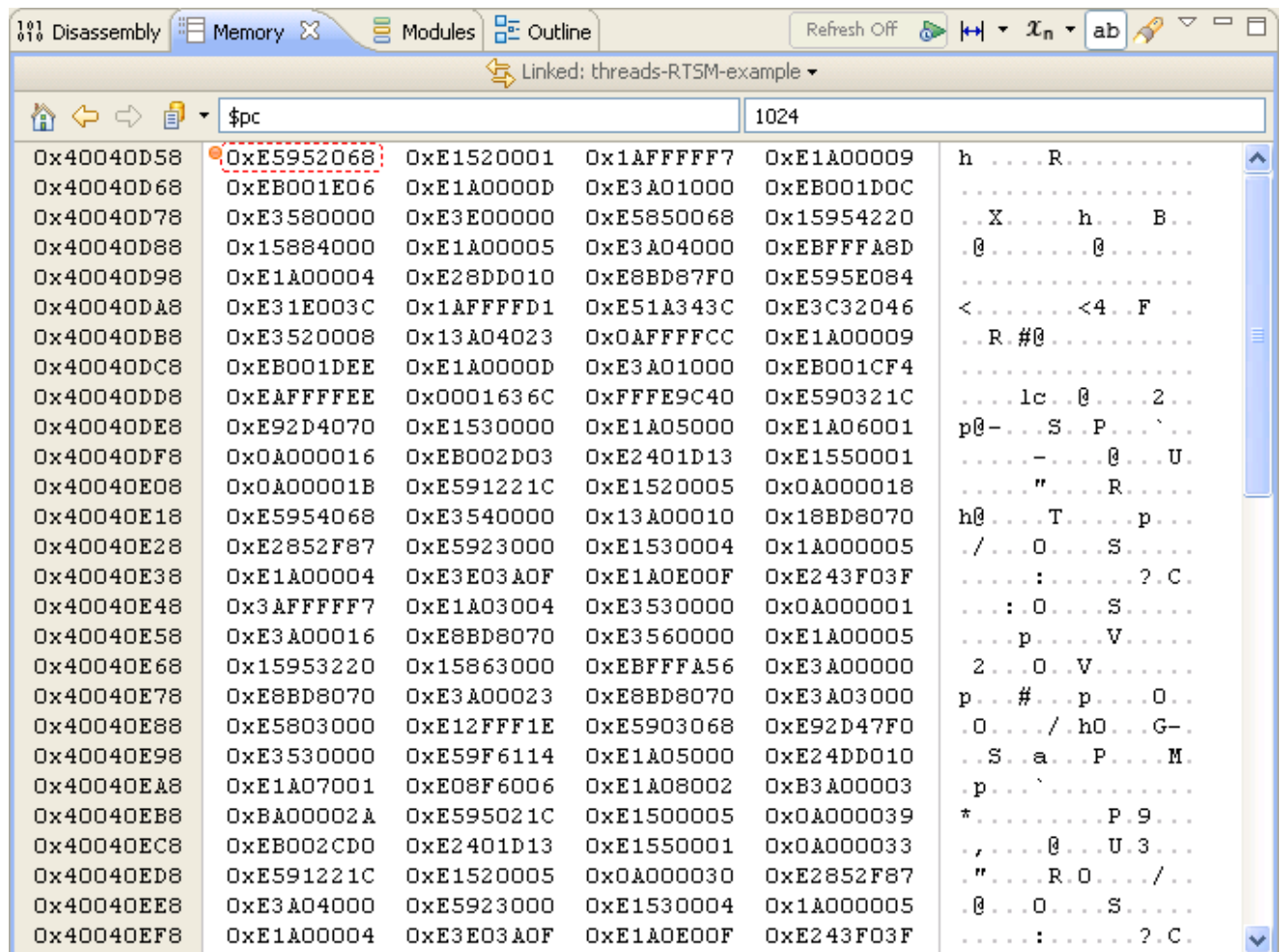


Figure 10-14 Memory view

The **Memory** view only provides the facility to modify how memory is displayed in this view. It is not possible to specify the use of byte, half-word, word or double read/write instructions to access memory from the **Memory** view. To control the memory access width you can use:

- the `memory` command to configure access widths for a region of memory, followed by the `x` command to read memory according to those access widths and display the contents
- the `memory set` command to write to memory with an explicit access width.

Toolbar and context menu options

The following options are available from the toolbar or context menu:

Linked: context	Links this view to the selected connection in the Debug Control view. This is the default. Alternatively you can link the view to a specific connection. If the connection you want is not shown in the drop-down list you might have to select it first in the Debug Control view.
Back, Forward	Navigates through the history list.
History	Addresses and expressions you specify in the Address field are added to the drop down box, and persist until you clear the history list or exit Eclipse. If you want to keep an expression for later use, add it to the Expressions view.
Timed auto refresh is off	This option opens a dialog box where you can specify refresh intervals:
Cannot update	<ul style="list-style-type: none"> • If timed auto refresh is off mode is selected, the auto refresh is off. • If the cannot update mode is selected , the auto refresh is blocked.
Display Width	Click to cycle through the memory cell widths in the Memory view, or select a width from the drop-down menu. The default is four bytes.
Format	Click to cycle through the memory cell formats, or select a format from the drop-down menu. The default is hexadecimal.
Showing characters - click to hide the character display	Toggles the display of ASCII character equivalents for the memory values.
Not showing characters - click to show the character display	
Address field	<p>Enter the address where you want to start viewing the target memory. Alternatively, you can enter an expression that evaluates to an address. \$PC +256.</p> <p>Addresses and expressions you specify are added to the drop down list, and persist until you exit Eclipse. If you want to keep an expression for later use, add it to the Expressions view.</p> <p>Context menu options are available for editing this field.</p>
Size field	<p>The number of bytes to display.</p> <p>Context menu options are available for editing this field.</p>
Search	Searches through debug information for symbols.

View Menu	The following View Menu options are available:
New Memory View	Displays a new instance of the Memory view.
Show Tooltips	Toggles the display of tooltips on memory cell values.
Byte Order	Selects the byte order of the memory. The default is Auto(LE) .
Clear History	Clears the list of addresses and expressions in the History drop-down box.
Import Memory	Reads data from a file and writes it to memory.
Export Memory	Reads data from memory and writes it to a file.
Fill Memory	Writes a specific pattern of bytes to memory.
Refresh	Refreshes the view.
Freeze Data	Toggles the freezing of data in the current view. This also disables or enables the Address and Size fields and the Refresh option.

Editing context menu options	The following options are available on the context menu when you select a memory cell value, the Address field, or the Size field for editing:
Cut	Copies and deletes the selected value.
Copy	Copies the selected value.
Paste	Pastes a value that you have previously cut or copied into the selected memory cell or field.
Delete	Deletes the selected value.
Undo	Reverts the last change you made to the selected memory cell or field. This is disabled for the Address field.
Select All	Selects all the address.
Toggle Breakpoint	Sets or removes a breakpoint at the selected address.
Resolve Breakpoint	Resolves a pending breakpoint at the selected address.
Enable Breakpoint	Enables the breakpoint at the selected address.
Disable Breakpoint	Disables the breakpoint at the selected address.
Toggle Trace Start Point	Sets or removes a trace start point at the selected address.

Toggle Trace Stop Point	Sets or removes a trace stop point at the selected address.
Toggle Trace Trigger Point	Starts a trace trigger point at the selected address.

Related Concepts

About debugging multi-threaded applications on page 134.
About debugging shared libraries on page 135.
About debugging a Linux kernel on page 137.
About debugging Linux kernel modules on page 139.
About debugging TrustZone enabled targets on page 141.

Related References

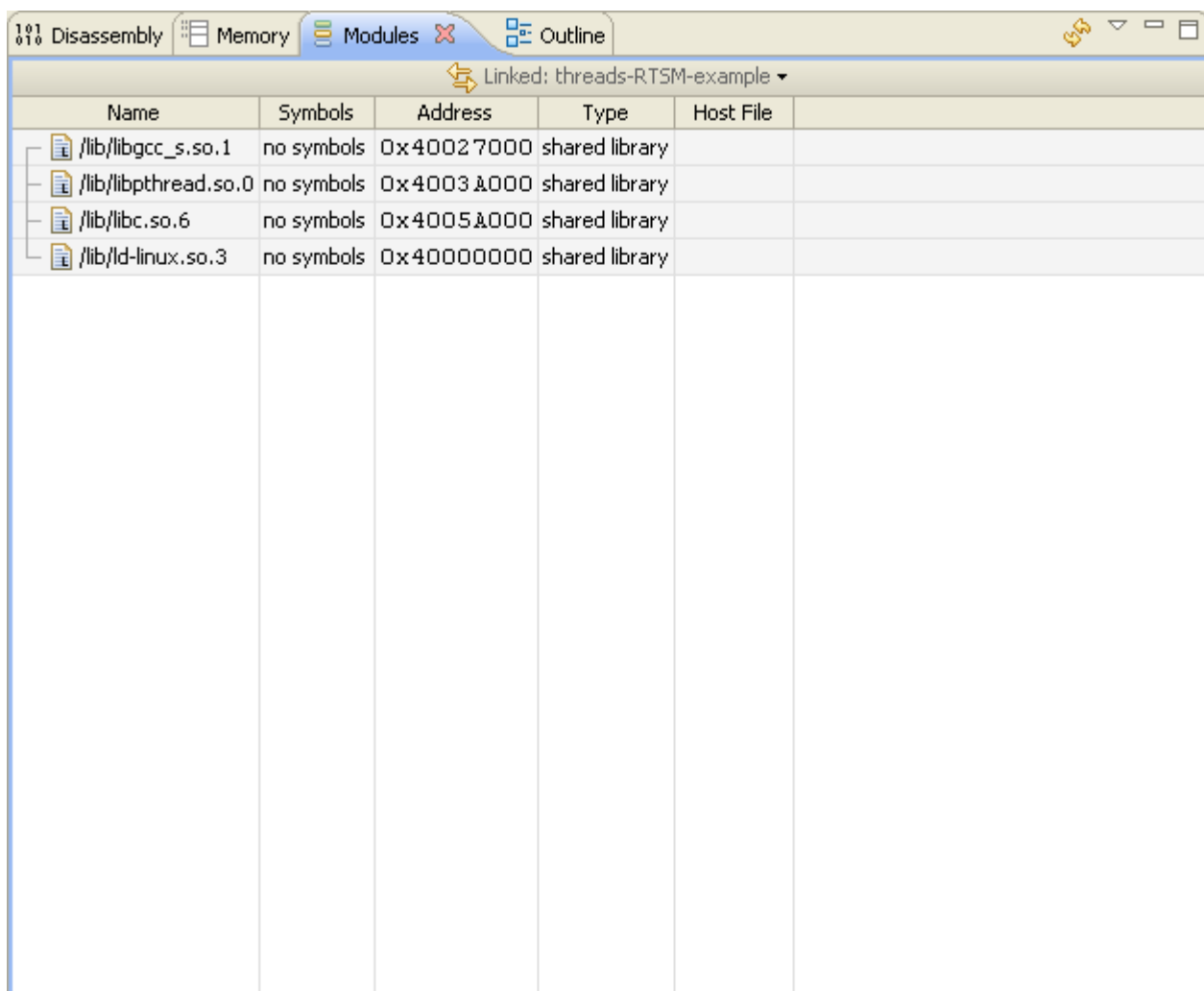
Setting an execution breakpoint on page 96.
Setting a data watchpoint on page 98.
Setting a tracepoint on page 100.
Setting a conditional breakpoint on page 102.
Setting a breakpoint on a specific thread on page 105.
Pending breakpoints and watchpoints on page 108.
Exporting DS-5 breakpoint settings to a file on page 109.
Importing DS-5 breakpoint settings from a file on page 110.
DS-5 Debug perspectives and views on page 177.

10.14 Modules view

Describes the view content.

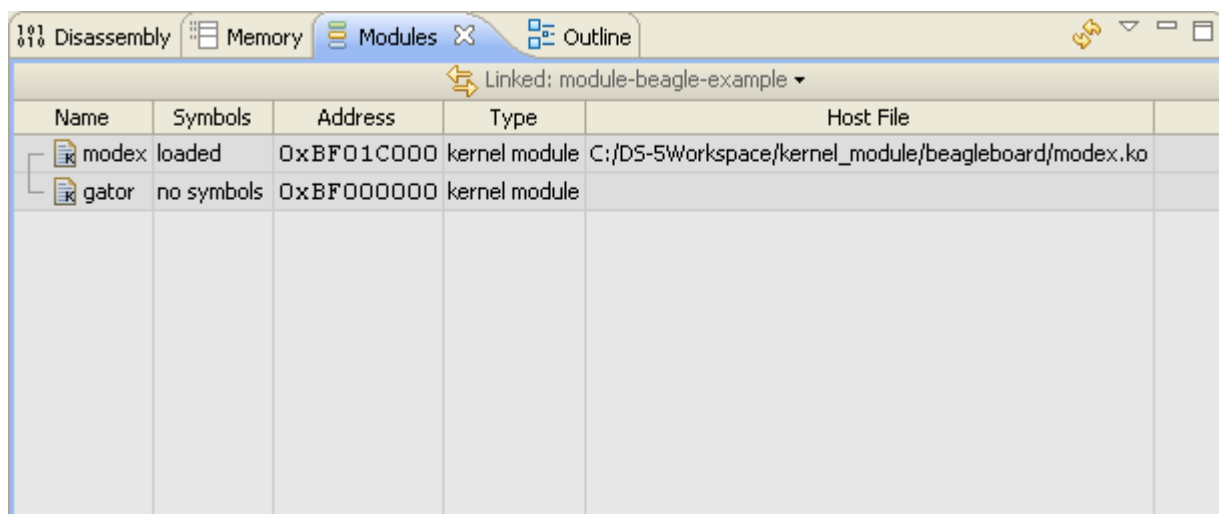
This view is only populated when connected to a Linux target. It enables you to:

- see a tabular view of the shared libraries used by the application
- see a tabular view of dynamically loaded *Operating System* (OS) modules
- load and unload debug information for a specific module or shared library.



Name	Symbols	Address	Type	Host File
/lib/libgcc_s.so.1	no symbols	0x40027000	shared library	
/lib/libpthread.so.0	no symbols	0x4003A000	shared library	
/lib/libc.so.6	no symbols	0x4005A000	shared library	
/lib/ld-linux.so.3	no symbols	0x40000000	shared library	

Figure 10-15 Modules view showing shared libraries



Name	Symbols	Address	Type	Host File
modex	loaded	0xBF01C000	kernel module	C:/DS-5Workspace/kernel_module/beagleboard/modex.ko
gator	no symbols	0xBF000000	kernel module	

Figure 10-16 Modules view showing operating system modules

————— Note —————

A connection must be established and OS support enabled within the debugger before a loadable module can be detected. OS support is automatically enabled when a Linux kernel image is loaded into the debugger. However, you can manually control this by using the `set os` command.

Right-click on the column headers to select the columns that you want displayed:

Name	Displays the name and location of the component on the target.
Symbols	Displays whether the symbols are currently loaded for each object.
Address	Displays the load address of the object.
Size	Displays the size of the object.
Kind	Displays the component type. For example, shared library or OS module.
Host File	Displays the name and location of the component on the host workstation.

The Name, Symbols, Address, Kind, and Host File columns are displayed by default.

Toolbar and context menu options

The following options are available from the toolbar or context menu:

Linked: context	Links this view to the selected connection in the Debug Control view. This is the default. Alternatively you can link the view to a specific connection. If the connection you want is not shown in the drop-down list you might have to select it first in the Debug Control view.
Refresh	Refreshes the view.
Copy	Copies the selected data.
Select All	Selects all the displayed data.
Load Symbols	Loads debug information into the debugger from the source file displayed in the Host File column. This option is disabled if the host file is unknown. before the file is loaded.
Add Symbol File...	Opens a dialog box where you can select a file from the host workstation containing the debug information required by the debugger.
Discard Symbols	Discards debug information relating to the selected file.
Show in Memory	Displays the Memory view starting at the load address of the selected object.
Show in Disassembly	Displays the Disassembly view starting at the load address of the selected object.

Related Concepts

[About debugging multi-threaded applications on page 134.](#)

[About debugging shared libraries on page 135.](#)

[About debugging a Linux kernel on page 137.](#)

About debugging Linux kernel modules on page 139.

About debugging TrustZone enabled targets on page 141.

Related References

DS-5 Debug perspectives and views on page 177.

10.15 Registers view

Describes the view content.

This view enables you to:

- See the contents of target registers.
- Change the values for registers that have write access. When a register value changes, the register value background changes to yellow.
- Change the display format of register values. The *Program Status Registers* (PSRs) also enable you to set the format using individual bits.
- Freeze the selected view to prevent the values being updated by a running target.
- Drag and drop an address held in a register, such as R3, from the **Registers** view either into the **Memory** view to see the memory at that address, or into the **Disassembly** view to disassemble from that address.

Name	Display Name	Value	Size	Access
Core				
R0	R0	0xFFFFFE00	32	R/W
R1	R1	0x00000000	32	R/W
R2	R2	0x00000442	32	R/W
R3	R3	0x00000000	32	R/W
R4	R4	0x00000000	32	R/W
R5	R5	0x409A0470	32	R/W
R6	R6	0xBEAB1C68	32	R/W
R7	R7	0x000000F0	32	R/W
R8	R8	0x00000000	32	R/W
R9	R9	0x00000000	32	R/W
R10	R10	0x4019F980	32	R/W
R11	R11	0xBEAB1CEC	32	R/W
R12	R12	0x409A04D8	32	R/W
SP	SP	0xBEAB1C68	32	R/W
LR	LR	0x40040D20	32	R/W

Figure 10-17 Registers view

Right-click on the column headers to select the columns that you want displayed:

Name The name of the register.

Use `$register_name` to reference a register. To refer to a register that has bitfields, such as a PSR, specify `$register_name.bitfield_name`. For example, to print the value of the `M` bitfield of `$CPSR`, enter the following command in the **Commands** view:

```
print $CPSR.M
$1 = USR
```

Value The value of the register. A shaded background indicates the value has changed.
If you freeze the view, then you cannot change a register value.

Type The type of the register value.

Count The number of array or pointer elements.

Size	The size of the register in bits.
Location	The name of the register or the bitmap of the bitfield of a PSR. For example, bitfield M of the CPSR is displayed as \$CPSR[0..4].

The Name, Value, and Size columns are displayed by default.

Toolbar and context menu options

The following options are available from the toolbar or context menu:

Linked: context	Links this view to the selected connection in the Debug Control view. This is the default. Alternatively you can link the view to a specific connection. If the connection you want is not shown in the drop-down list you might have to select it first in the Debug Control view.						
Search	Searches the data in the current view for a register.						
Copy	Copies the selected registers. To copy the bitfields of a PSR, you must first expand the PSR. This is useful if you want to copy the selected registers to a text editor and compare the values when execution stops at another location.						
Select All	Selects all registers currently expanded in the view.						
Show Memory Pointed to By <i>register_name</i>	Where enabled, displays the Memory view starting at the address held in the register.						
Show Disassembly Pointed to By <i>register_name</i>	Where enabled, displays the Disassembly view starting at the address held in the register.						
Send to Selection	Enables you to add register filters to an Expression view. Displays a sub menu that enables you to add to a specific Expressions view.						
<i>format List</i>	A list of formats you can use for the register values. The default is Hexadecimal .						
View Menu	The following View Menu options are available: <table> <tr> <td>New Register View</td><td>Creates a new instance of the Registers view.</td></tr> <tr> <td>Refresh</td><td>Refreshes the view.</td></tr> <tr> <td>Freeze Data</td><td>Toggles the freezing of data in the current view. This also disables or enables the Refresh option.</td></tr> </table>	New Register View	Creates a new instance of the Registers view.	Refresh	Refreshes the view.	Freeze Data	Toggles the freezing of data in the current view. This also disables or enables the Refresh option.
New Register View	Creates a new instance of the Registers view.						
Refresh	Refreshes the view.						
Freeze Data	Toggles the freezing of data in the current view. This also disables or enables the Refresh option.						
Editing context menu options	The following options are available on the context menu when you select a register value for editing: <table> <tr> <td>Cut</td><td>Copies and deletes the selected value.</td></tr> <tr> <td>Copy</td><td>Copies the selected value.</td></tr> </table>	Cut	Copies and deletes the selected value.	Copy	Copies the selected value.		
Cut	Copies and deletes the selected value.						
Copy	Copies the selected value.						

- Paste** Pastes a value that you have previously cut or copied into the selected register value.
- Delete** Deletes the selected value.
- Undo** Reverts the last change you made to the selected value.

Related Concepts

About debugging multi-threaded applications on page 134.
About debugging shared libraries on page 135.
About debugging a Linux kernel on page 137.
About debugging Linux kernel modules on page 139.
About debugging TrustZone enabled targets on page 141.

Related References

Setting an execution breakpoint on page 96.
Setting a data watchpoint on page 98.
Setting a tracepoint on page 100.
Setting a conditional breakpoint on page 102.
Setting a breakpoint on a specific thread on page 105.
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DS-5 Debug perspectives and views on page 177.

10.16 RTOS Data view

Describes the view content.

This view enables you to display system information about the *Operating System* (OS).

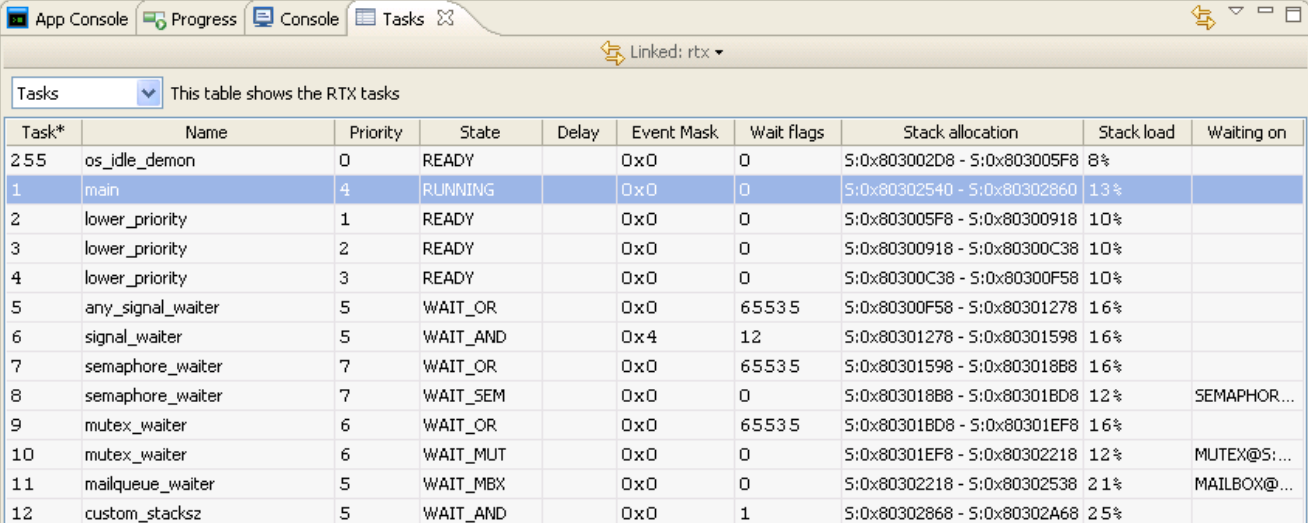
———— **Note** ————

Options and rows in the **RTOS Data** view are dependent on the type of table that you select.

Multiple tables are available in the drop-down box and its content is controlled by the OS support currently active.

Examples

The following is an example showing tasks specific to the current OS.



Task*	Name	Priority	State	Delay	Event Mask	Wait flags	Stack allocation	Stack load	Waiting on
255	os_idle_demon	0	READY		0x0	0	S:0x803002D8 - S:0x803005F8	8%	
1	main	4	RUNNING		0x0	0	S:0x80302540 - S:0x80302860	13%	
2	lower_priority	1	READY		0x0	0	S:0x803005F8 - S:0x80300918	10%	
3	lower_priority	2	READY		0x0	0	S:0x80300918 - S:0x80300C38	10%	
4	lower_priority	3	READY		0x0	0	S:0x80300C38 - S:0x80300F58	10%	
5	any_signal_waiter	5	WAIT_OR		0x0	65535	S:0x80300F58 - S:0x80301278	16%	
6	signal_waiter	5	WAIT_AND		0x4	12	S:0x80301278 - S:0x80301598	16%	
7	semaphore_waiter	7	WAIT_OR		0x0	65535	S:0x80301598 - S:0x803018B8	16%	
8	semaphore_waiter	7	WAIT_SEM		0x0	0	S:0x803018B8 - S:0x80301BD8	12%	SEMAPHOR...
9	mutex_waiter	6	WAIT_OR		0x0	65535	S:0x80301BD8 - S:0x80301EF8	16%	
10	mutex_waiter	6	WAIT_MUT		0x0	0	S:0x80301EF8 - S:0x80302218	12%	MUTEX@S:...
11	mailqueue_waiter	5	WAIT_MBX		0x0	0	S:0x80302218 - S:0x80302538	21%	MAILBOX@...
12	custom_stacksz	5	WAIT_AND		0x0	1	S:0x80302868 - S:0x80302A68	25%	

Figure 10-18 Typical RTOS view for a RTX table

Toolbar and context menu options

The following options are available from the toolbar or context menu:

Linked: context	Links this view to the selected connection in the Debug Control view. This is the default. Alternatively you can link the view to a specific connection. If the connection you want is not shown in the drop-down list you might have to select it first in the Debug Control view.				
Show linked data in other Data views	Shows selected data in a view that is linked to another view.				
View Menu	This menu contains the following option: <table> <tr> <td>New RTOS Data View</td><td>Displays a new instance of the RTOS Data view.</td></tr> <tr> <td>Refresh</td><td>Refreshes the view.</td></tr> </table>	New RTOS Data View	Displays a new instance of the RTOS Data view.	Refresh	Refreshes the view.
New RTOS Data View	Displays a new instance of the RTOS Data view.				
Refresh	Refreshes the view.				

Freeze Data	Toggles the freezing of data in the current view. Also, the value of a variable cannot change if the data is frozen.
Editing context menu options	The following options are available on the context menu when you select a variable value for editing:
Copy	Copies the selected value.
Select All	Selects all text.

10.17 Screen view

Describes the view content.

This view enables you to:

- See the contents of the screen buffer on the target. This view only updates when the target stops.
- Set the screen buffer parameters appropriate for the target. :

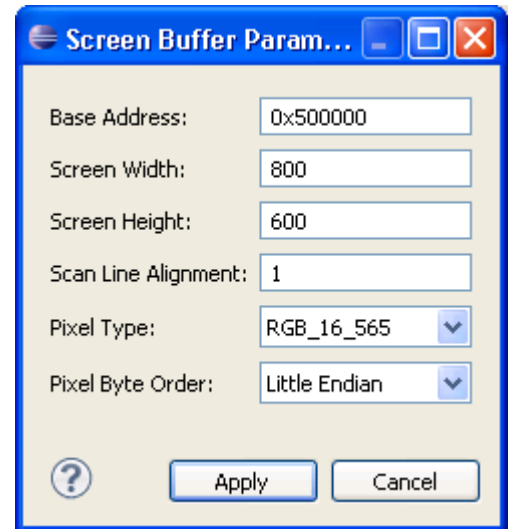


Figure 10-19 Screen buffer parameters for the Fireworks example running on a BeagleBoard

- Freeze the selected view to prevent the screen display being updated by the running target when it next stops.

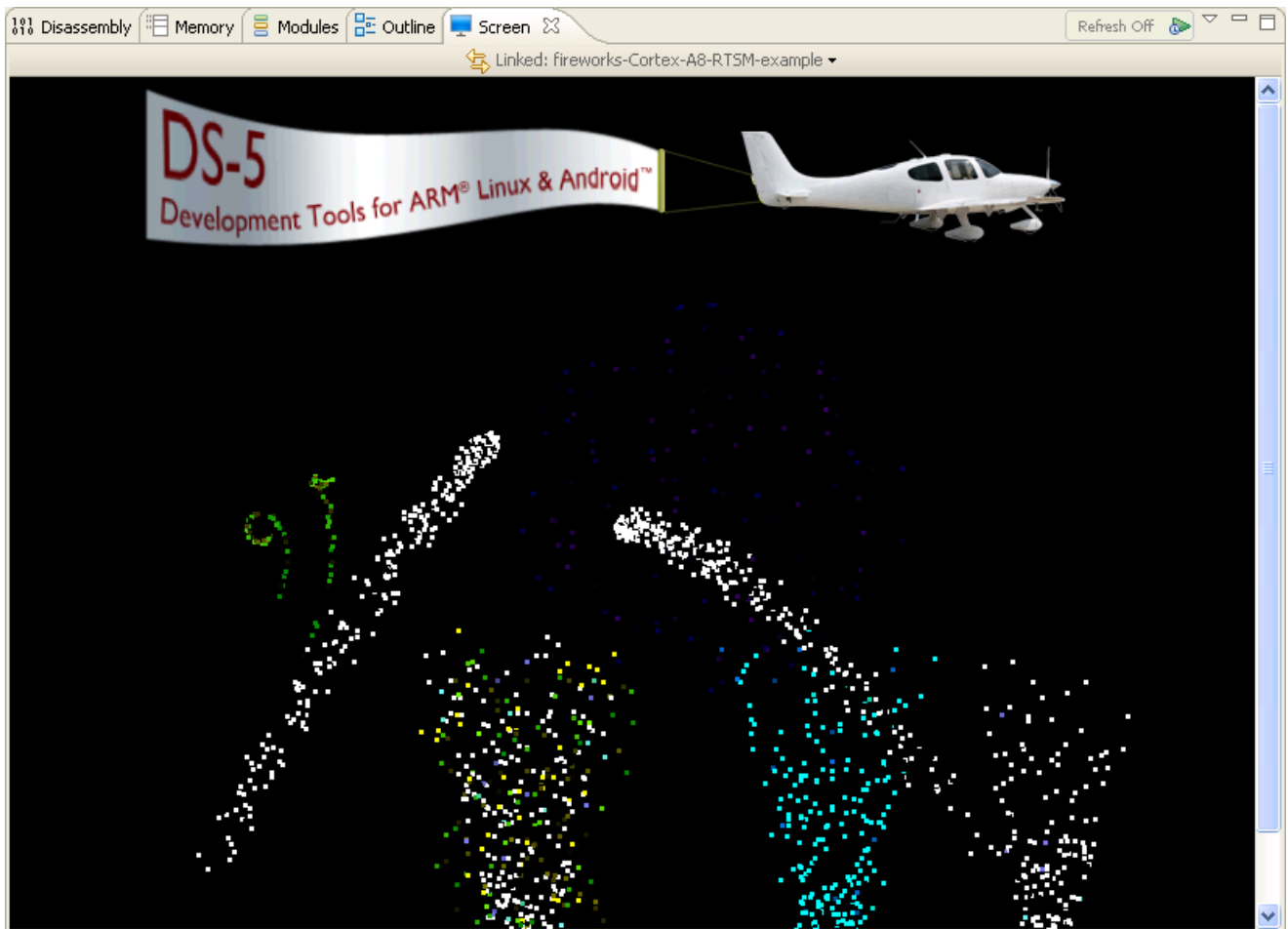


Figure 10-20 Screen view

Toolbar options

The following toolbar options are available:

Linked: context	Links this view to the selected connection in the Debug Control view. This is the default. Alternatively you can link the view to a specific connection. If the connection you want is not shown in the drop-down list you might have to select it first in the Debug Control view.
Timed auto refresh is off	This option opens a dialog box where you can specify refresh intervals:
Cannot update	<ul style="list-style-type: none"> • If timed auto refresh is off mode is selected, the auto refresh is off. • If the cannot update mode is selected , the auto refresh is blocked.
Refresh	Refreshes the view.
Set Screen Buffer Parameters	Displays the Screen Buffer Parameters dialog box. The dialog box contains the following parameters:
Base Address	Sets the base address of the screen buffer.
Screen Width	Sets the width of the screen in pixels.

Screen Height	Sets the height of the screen in pixels.
Scan Line Alignment	Sets the byte alignment required for each scan line.
Pixel Type	Selects the pixel type.
Pixel Byte Order	Selects the byte order of the pixels within the data.

Click **Apply** to save the settings and close the dialog box.

Click **Cancel** to close the dialog box without saving.

Freeze Data Toggles the freezing of data in the current view. This also disables or enables the **Refresh** option.

New Screen Buffer View Creates a new instance of the **Screen** view.

The Screen view is not visible by default. To add this view:

1. Ensure that you are in the DS-5 Debug perspective.
2. Select **Window > Show View** to open the Show View dialog box.
3. Select **Screen** view.

Related References

[DS-5 Debug perspectives and views on page 177.](#)

10.18 Scripts view

Describes the view content.

This view contains your favorite scripts. You can run, edit, or remove one or more of your favorite scripts. Scripts can be added to this view when you save commands in the **History** view.

Multiple selections are executed in the order listed in the view. To change the order, remove the scripts from the view and import them in the required order.

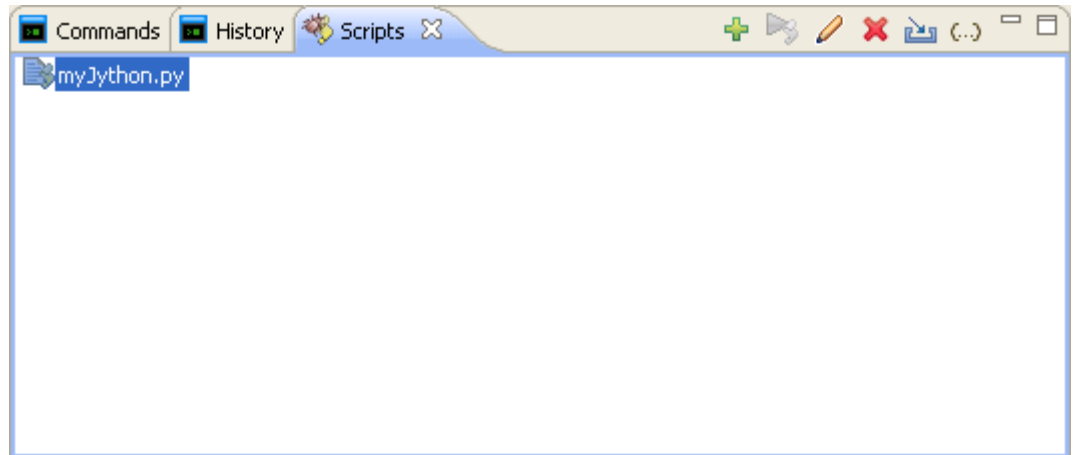


Figure 10-21 Scripts view

Note

Default settings for this view are controlled by a DS-5 Debugger setting in the Preferences dialog box. For example, default locations for script files. You can access these settings by selecting **Preferences** from the **Window** menu.

Toolbar and context menu options

The following options are available from the toolbar or context menu:

Creates a new script	Creates a new empty script. To specify the script contents after it is created, select the script and click Edit Selected Script .
Execute Selected Scripts	Runs the selected scripts. If you select multiple scripts, the debugger runs them in the order listed in the Scripts view.
Edit Selected Scripts	Enables you to edit the selected scripts. The scripts are opened in the C/C++ editor view.
Delete Selected Scripts	Deletes the selected scripts from the favorites list. You are also prompted to delete the script from the file system.
Import Script...	Imports a script file and add it to the favorites list.

Jython Script Parameters	Enables you to add parameters to the script. ———— Note ———— This icon enables when a script is selected. —————
Cut	Copies and removes the selected script filename. You are also prompted to delete the script from file system.
Copy	Copies the selected script.
Paste	Pastes a script filename that you have previously cut or copied. If you deleted the file from the file system as part of a cut operation, the file contents are not restored. You must edit the file to add new commands. If you did not delete the file as part of a cut operation, the debugger links the filename to the file in the file system.
Delete	Deletes the selected script from the favorites list. You are also prompted to delete the script from file system.
Select All	Selects all script files.

Related References

[DS-5 Debug perspectives and views on page 177.](#)

10.19 Target Console view

Describes the view content.

This view enables you to receive messages from the target setup scripts.

Note

Default settings for this view are controlled by a DS-5 Debugger setting in the Preferences dialog box. For example, default locations for specific files or the maximum number of lines to display. You can access these settings by selecting **Preferences** from the **Window** menu.

Toolbar and context menu options

The following options are available from the toolbar or context menu:

Linked: context	Links this view to the selected connection in the Debug Control view. This is the default. Alternatively you can link the view to a specific connection. If the connection you want is not shown in the drop-down list you might have to select it first in the Debug Control view.	
Save Console Buffer	Saves the contents of the Target Console view to a text file.	
Clear Console	Clears the contents of the Target Console view.	
Scroll Lock	Enables or disables the automatic scrolling of messages in the Target Console view.	
View Menu	This menu contains the following option:	
	New Target Console	Displays a new instance of the Target Console view.
	Bring to Front for Write	If enabled, the debugger automatically changes the focus to this view when a target script prompts for input.
Copy	Copies the selected text.	
Paste	Pastes text that you have previously copied.	
Select All	Selects all text.	

Related References

DS-5 Debug perspectives and views on page 177.

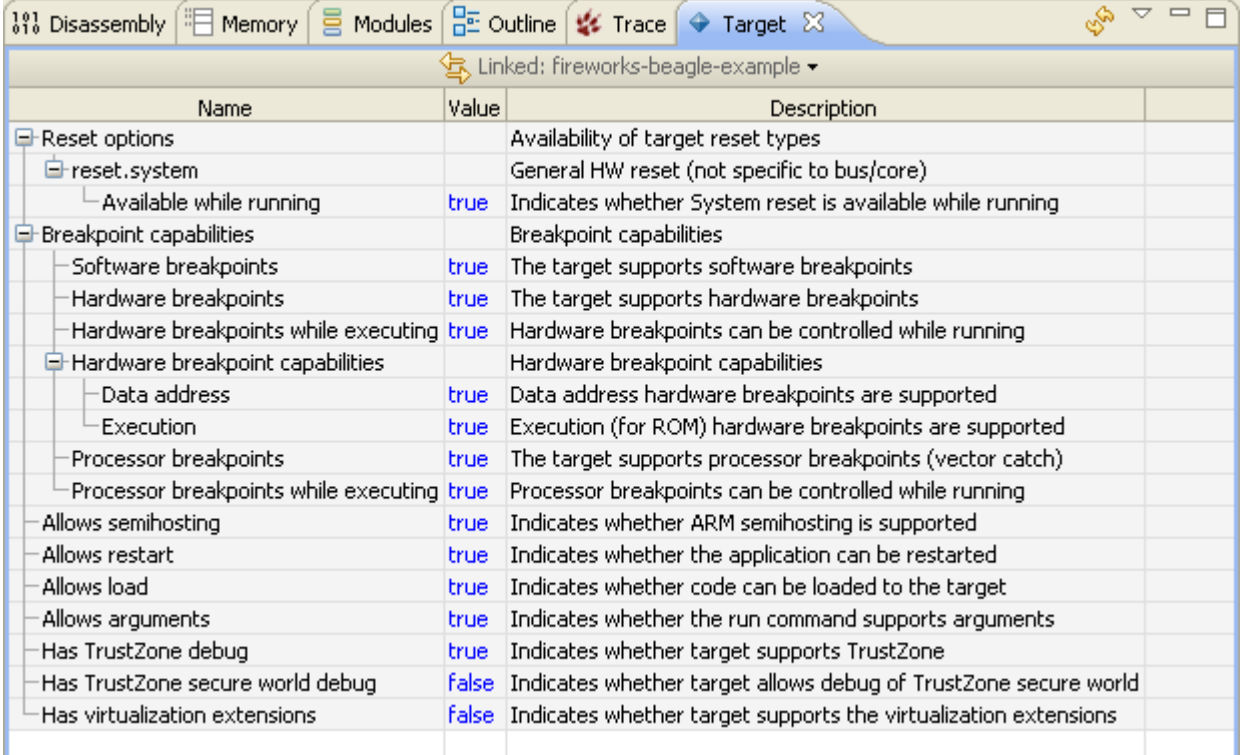
10.20 Target view

Describes the view content.

This view enables you to examine the debug capabilities supported by the target, such as:

- breakpoint types supported
- reset types supported
- memory access types supported.

All capabilities are read-only.



The screenshot shows the DS-5 Target view window. The title bar includes tabs for Disassembly, Memory, Modules, Outline, Trace, and Target. The Target tab is active. Below the tabs, there is a dropdown menu showing 'Linked: fireworks-beagle-example'. The main area displays a table with three columns: Name, Value, and Description. The table is organized into a tree structure with expandable nodes.

Name	Value	Description
Reset options		Availability of target reset types
reset.system		General HW reset (not specific to bus/core)
Available while running	true	Indicates whether System reset is available while running
Breakpoint capabilities		Breakpoint capabilities
Software breakpoints	true	The target supports software breakpoints
Hardware breakpoints	true	The target supports hardware breakpoints
Hardware breakpoints while executing	true	Hardware breakpoints can be controlled while running
Hardware breakpoint capabilities		Hardware breakpoint capabilities
Data address	true	Data address hardware breakpoints are supported
Execution	true	Execution (for ROM) hardware breakpoints are supported
Processor breakpoints	true	The target supports processor breakpoints (vector catch)
Processor breakpoints while executing	true	Processor breakpoints can be controlled while running
Allows semihosting	true	Indicates whether ARM semihosting is supported
Allows restart	true	Indicates whether the application can be restarted
Allows load	true	Indicates whether code can be loaded to the target
Allows arguments	true	Indicates whether the run command supports arguments
Has TrustZone debug	true	Indicates whether target supports TrustZone
Has TrustZone secure world debug	false	Indicates whether target allows debug of TrustZone secure world
Has virtualization extensions	false	Indicates whether target supports the virtualization extensions

Figure 10-22 Target view

Right-click on the column headers to select the columns that you want displayed:

Name	The name of the target capability.
Value	The value of the target capability.
Key	The name of the target capability. This is used by some commands in the Commands view.
Description	A brief description of the target capability.

The Name, Value, and Description columns are displayed by default.

The **Target** view is not visible by default. To add this view:

1. Ensure that you are in the DS-5 Debug perspective.
2. Select **Window > Show View** to open the Show View dialog box.
3. Select **Target** view.

Toolbar and context menu options

The following options are available from the toolbar or context menu:

Linked: context	Links this view to the selected connection in the Debug Control view. This is the default. Alternatively you can link the view to a specific connection. If the connection you want is not shown in the drop-down list you might have to select it first in the Debug Control view.
Refresh the Target Capabilities	Refreshes the view.
Copy	<p>Copies the selected capabilities. To copy the capabilities in a group such as <i>Memory capabilities</i>, you must first expand that group.</p> <p>This is useful if you want to copy the selected capabilities to a text editor and save them for future reference.</p>
Select All	Selects all capabilities currently expanded in the view.

Related References

[DS-5 Debug perspectives and views on page 177.](#)

10.21 Trace view

Describes the view content.

When the trace has been captured the debugger extracts the information from the trace stream and decompresses it to provide a full disassembly, with symbols, of the executed code.

This view shows a graphical navigation chart that displays function executions with a navigational timeline. In addition, the disassembly trace shows function calls with associated addresses and if selected, instructions. Clicking on a specific time in the chart synchronizes the **Disassembly** view.

In the left-hand column of the chart, percentages are shown for each function of the total trace. For example, if a total of 1000 instructions are executed and 300 of these instructions are associated with `myFunction()` then this function is displayed with 30%.

In the navigational timeline, the color coding is a "heat" map showing the executed instructions and the amount of instructions each function executes in each timeline. The darker red color showing more instructions and the lighter yellow color showing less instructions. At a scale of 1:1 however, the color scheme changes to display memory access instructions as a darker red color, branch instructions as a medium orange color, and all the other instructions as a lighter green color.

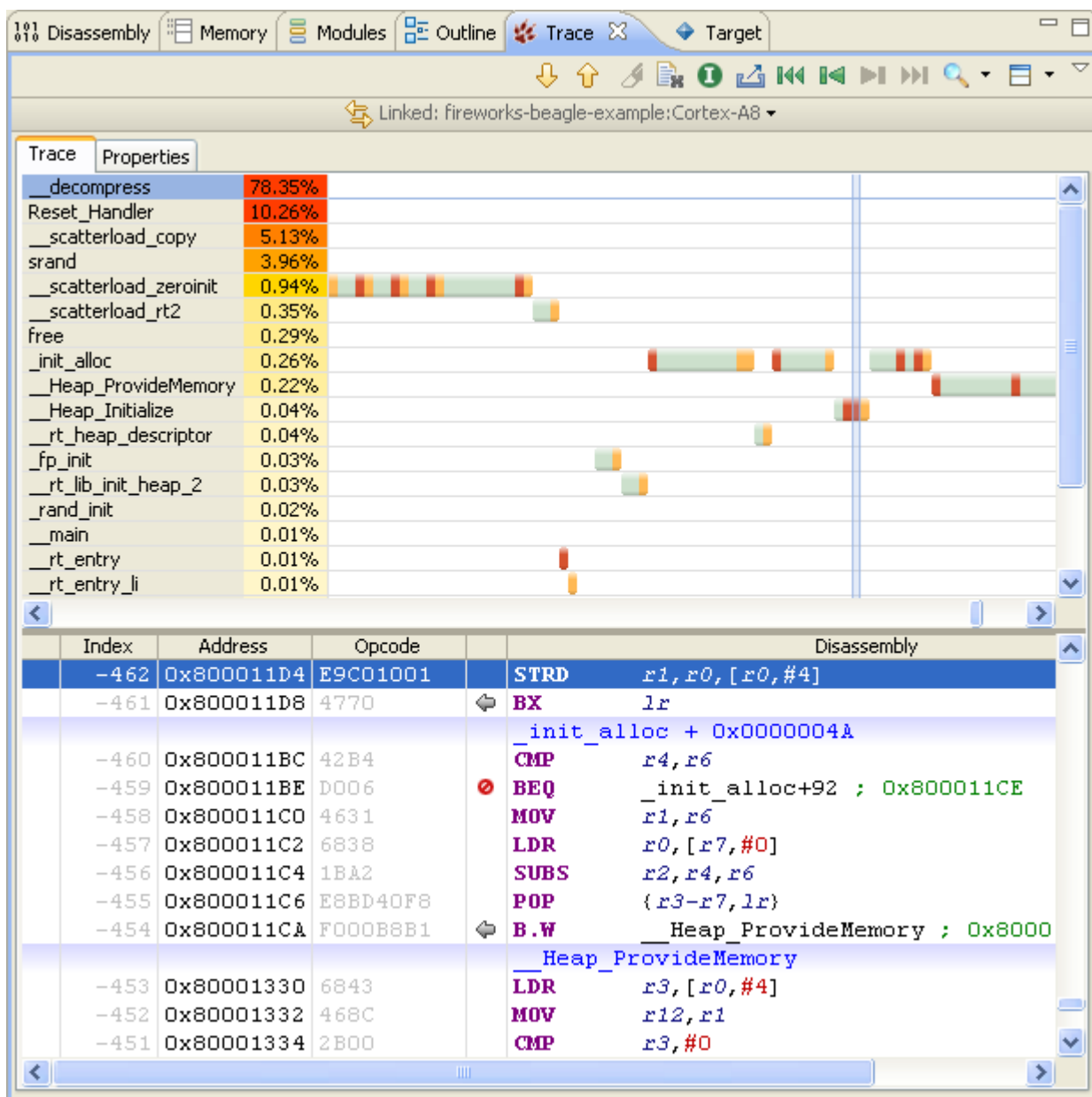


Figure 10-23 Trace view with a scale of 1:1

The **Trace** view might not be visible by default. To add this view:

1. Ensure that you are in the DS-5 Debug perspective.
2. Select **Window > Show View** to open the Show View dialog box.
3. Select **Trace** view.

The **Trace** view contains several tabs:

- Trace tab showing the graphical timeline and disassembly.

Right-click on the column headers to select the columns that you want displayed.

The Breakpoint, Index, Address, Opcode, Info and Disassembly columns are displayed by default.

Toolbar and context menu options

The following options are available from the toolbar or context menu:

Linked: context	Links this view to the selected connection in the Debug Control view. This is the default. Alternatively you can link the view to a specific connection or processor in an <i>Symmetric MultiProcessing</i> (SMP) connection. If the connection you want is not shown in the drop-down list you might have to select it first in the Debug Control view.
Show Next Match	Moves the focus of the navigation chart and disassembly trace to the next matching occurrence for the selected function or instruction.
Show Previous Match	Moves the focus of the navigation chart and disassembly trace to the previous matching occurrence for the selected function or instruction.
Don't mark other occurrences - click to start marking, Mark other occurrences - click to stop marking	When function trace is selected, marks all occurrences of the selected function with a shaded highlight. This is disabled when instruction trace is selected.
Clear Trace	Clears the raw trace data that is currently contained in the trace buffer and the trace view.
Showing instruction trace - click to switch to functions, Showing function trace - click to switch to instructions	Toggles the disassembly trace between instruction trace or function trace.
Export Trace Report	Displays the Export Trace Report dialog box to save the trace data to a file.
Home	Where enabled, moves the trace view to the beginning of the trace buffer. Changes might not be visible if the trace buffer is too small.
Page Back	Where enabled, moves the trace view back one page. You can change the page size by modifying the Set Maximum Instruction Depth setting.
Page Forward	Where enabled, moves the trace view forward one page. You can change the page size by modifying the Set Maximum Instruction Depth setting.
End	Where enabled, moves the trace view to the end of the trace buffer. Changes might not be visible if the trace buffer is too small.
Switch between navigation resolutions	Changes the timeline resolution in the navigation chart.
Switch between alternate views	Changes the view to display the navigation chart, disassembly trace or both.

Focus Here	At the top of the list, displays the function being executed in the selected time slot. The remaining functions are listed in the order that they are executed after the selected point in time. Any functions that do not appear after that point in time are placed at the bottom and ordered by total time.
Order By Total Time	Displays the functions ordered by the total time spent within the function. This is the default ordering.
View Menu	The following View Menu options are available: <ul style="list-style-type: none"> New Trace View Displays a new instance of the Trace view. Set Trace Page Size... Displays a dialog box where you can enter the maximum number of instructions to display in the disassembly trace. The number must be within the range of one thousand to one million instructions. Find Trace Trigger Event Enables you to search for trigger events in the trace capture buffer. Find Timestamp... Displays a dialog box where you can enter either a numeric timestamp as a 64 bit value or in the h:m:s format. DTSL Options... Displays a dialog box where you can add, edit or choose a DTSL configuration. <p>———— Note ————</p> <p>This will clear the trace buffer.</p> <p>—————</p> Refresh Discards all the data in the view and rereads it from the current trace buffer. Freeze Data Toggles the freezing of data in the current view. Trace Filter Settings... Displays a dialog box where you can select the trace record types that you want to see in the Trace view.

Related References

[DS-5 Debug perspectives and views on page 177.](#)

10.22 Variables view

Describes the view content.

This view enables you to:

- see the contents of variables that are currently in scope
- change the values for variables that are currently in scope
- freeze the selected view to prevent the values being updated by a running target.

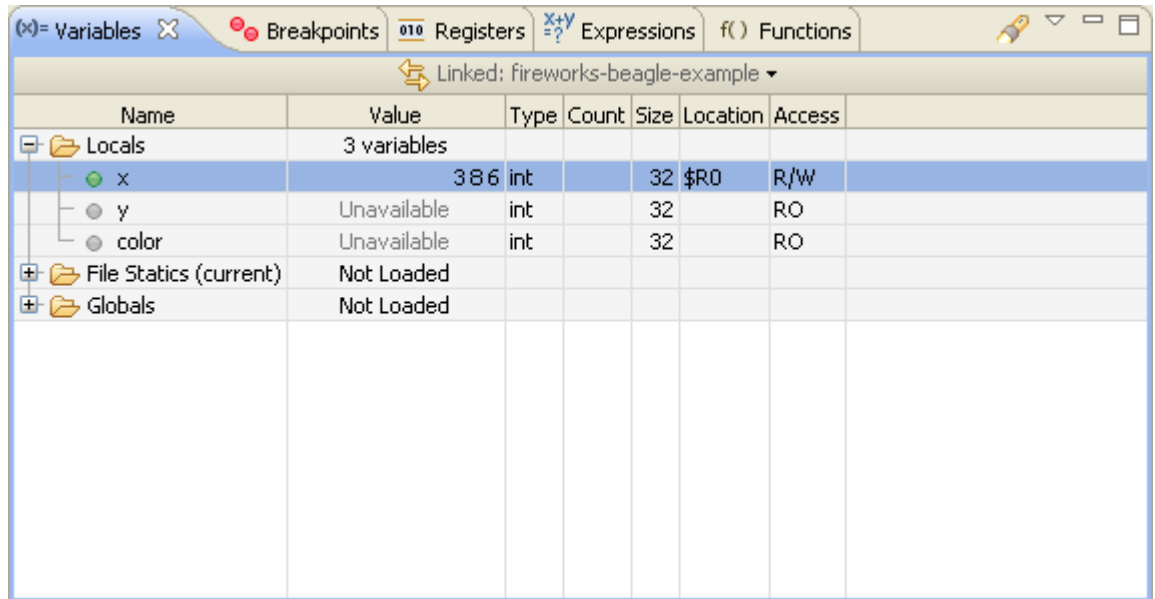


Figure 10-24 Variables view

Right-click on the column headers to select the columns that you want displayed:

Name The name of the variable.

Value The value of the variable.

Read-only values are displayed with a grey background. Any other color means that you can edit the value.

A value that you can edit is initially shown with a white background. If the value changes, either by performing a debug action such as stepping or by you editing the value directly, the background changes to yellow.

If you freeze the view, then you cannot change a value.

Type The type of the variable.

Count The number of array or pointer elements.

Size The size of the variable in bits.

Location The address of the variable.

All columns are displayed by default.

Toolbar and context menu options

The following options are available from the toolbar or context menu:

Linked: context	Links this view to the selected connection in the Debug Control view. This is the default. Alternatively you can link the view to a specific connection. If the connection you want is not shown in the drop-down list you might have to select it first in the Debug Control view.						
Search	Searches the data in the current view for a variable.						
Copy	<p>Copies the selected variables. To copy the contents of an item such as a structure or an array, you must first expand that item.</p> <p>This is useful if you want to copy the selected variables to a text editor and compare the values when execution stops at another location.</p>						
Select All	Selects all capabilities currently expanded in the view.						
Show in Memory	<p>Where enabled, displays the Memory view with the address set to either:</p> <ul style="list-style-type: none"> the value of the selected variable, if the variable translates to an address, the address of an array, &name the location of the variable, the name of an array, name. <p>The memory size is set to the size of the variable, using the <code>sizeof</code> keyword.</p>						
Show in Registers	If the selected variable is currently held in a register, then displays the Registers view with that register selected. For example, the variable <code>t</code> might be held in register R5.						
Show Dereference in Memory	If the selected variable is a pointer, then displays the Memory view with the address where the variable is pointing to in memory, selected.						
Send to Selection	Enables you to add variable filters to an Expressions view. Displays a sub menu that enables you to add to a specific Expressions view.						
format list	A list of formats you can use for the variable value. The default is Unsigned Decimal .						
View Menu	<p>The following View Menu options are available:</p> <table> <tr> <td>New Variable View</td><td>Displays a new instance of the Variables view.</td></tr> <tr> <td>Refresh</td><td>Refreshes the view.</td></tr> <tr> <td>Freeze Data</td><td> <p>Toggles the freezing of data in the current view. This also disables or enables the Refresh Variable View option. Also, you cannot modify the value of a variable if the data is frozen.</p> <p>If you freeze the data before you expand an item, such as an array, for the first time, the view might show Pending... items. Unfreeze the data to see the items.</p> </td></tr> </table>	New Variable View	Displays a new instance of the Variables view.	Refresh	Refreshes the view.	Freeze Data	<p>Toggles the freezing of data in the current view. This also disables or enables the Refresh Variable View option. Also, you cannot modify the value of a variable if the data is frozen.</p> <p>If you freeze the data before you expand an item, such as an array, for the first time, the view might show Pending... items. Unfreeze the data to see the items.</p>
New Variable View	Displays a new instance of the Variables view.						
Refresh	Refreshes the view.						
Freeze Data	<p>Toggles the freezing of data in the current view. This also disables or enables the Refresh Variable View option. Also, you cannot modify the value of a variable if the data is frozen.</p> <p>If you freeze the data before you expand an item, such as an array, for the first time, the view might show Pending... items. Unfreeze the data to see the items.</p>						

Editing context menu options	The following options are available on the context menu when you select a variable value for editing:	
Cut		Copies and deletes the selected value.
Copy		Copies the selected value.
Paste		Pastes a value that you have previously cut or copied into the selected variable value.
Delete		Deletes the selected value.
Undo		Reverts the last change you made to the selected value.
Right to left reading order		Sets the reading order for the selected variable value to be left or right justified.
Show unicode control characters		Shows any unicode control characters in the selected variable value.
Insert unicode control character		Selects the unicode control character to insert into the selected variable value.

Related Concepts

About debugging multi-threaded applications on page 134.
About debugging shared libraries on page 135.
About debugging a Linux kernel on page 137.
About debugging Linux kernel modules on page 139.
About debugging TrustZone enabled targets on page 141.

Related References

Setting an execution breakpoint on page 96.
Setting a data watchpoint on page 98.
Setting a tracepoint on page 100.
Setting a conditional breakpoint on page 102.
Setting a breakpoint on a specific thread on page 105.
Pending breakpoints and watchpoints on page 108.
Exporting DS-5 breakpoint settings to a file on page 109.
Importing DS-5 breakpoint settings from a file on page 110.
DS-5 Debug perspectives and views on page 177.

10.23 Auto Refresh Properties dialog box

Describes the dialog box content.

The dialog box enables you to modify the update intervals settings.

Refresh Off/Blocked	Enables you to modify the stop/block auto refresh.
Update Interval	Specifies the auto refresh interval in seconds.
Update When	Enables you to specify when you want auto refresh to update:
Running	Refreshes the Memory view while the target is running.
Stopped	Refreshes the Memory view while the target is stopped.
Always	Always refreshes the Memory view.

Note

When using the **Running** or **Always** selections, the **Memory** and **Screen** views are only updated if the target supports access to that memory when running. For example, some CoreSight targets support access to physical memory at any time via the *Debug Access Port (DAP)* to the *Advanced High-performance Bus Access Port (AHB-AP)* bridge. In those cases, add the **AHB:** prefix to the address selected in the **Memory** or **Screen** views. This type of access bypasses any cache on the CPU core, so the memory content returned might be different to the value that the core reads.

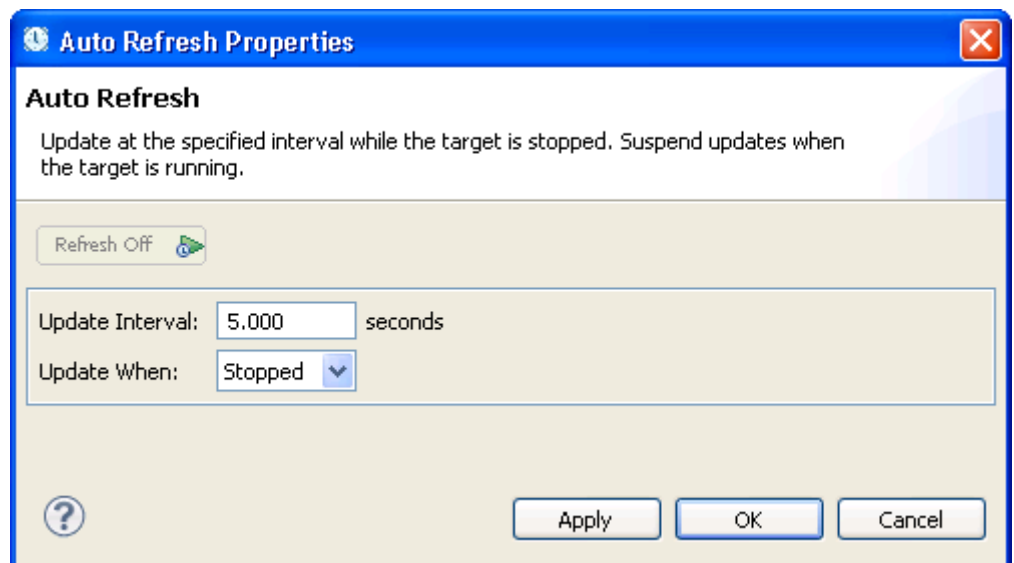


Figure 10-25 Auto Refresh properties dialog box

10.24 Memory Exporter dialog box

Describes the dialog box content.

This dialog box enables you to generate a text file containing the data from a specific region of memory.

Memory Bounds Specifies the memory region:

Start Address

Specifies the start address for the memory.

End Address

Specifies the inclusive end address for the memory.

Length in Bytes

Specifies the number of bytes.

Output Format Specifies the output format:

- Binary. This is the default.
- Intel Hex-32.
- Motorola 32-bit (S-records).
- Byte oriented hexadecimal (Verilog Memory Model).

Export Filename Enter the current location of the output file in the field provided or click on:

- **File System...** to locate the output file in an external folder
- **Workspace...** to locate the output file in a workspace project.

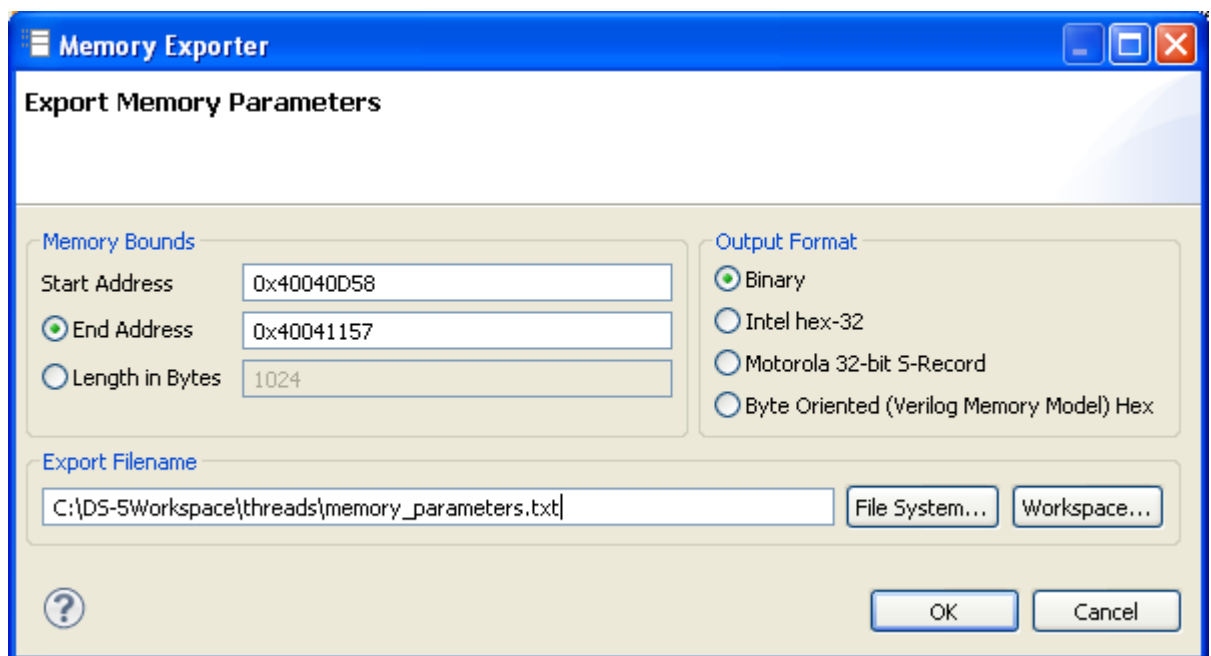


Figure 10-26 Memory Exporter dialog box

10.25 Memory Importer dialog box

Describes the dialog box content.

This dialog box enables you to generate a a text file containing the data from a specific region of memory.

Offset to Embedded Address	Specifies an offset that is added to all addresses in the image prior to writing to memory. Some image formats do not contain embedded addresses and in this case the offset is the absolute address where the image is restored	
Memory Limit	Enables you to define a specific region of memory that you want to import:	
	Limit to memory range	Select to specify an address range.
	Start	Specifies the minimum address that can be written to. Any data prior to this address is not written. If no address is given then the default is address zero.
	End	Specifies the maximum address that can be written to. Any data after this address is not written. If no address is given then the default is the end of the address space.
Import Filename	<p>Select Import file as binary image if the file format is a binary file.</p> <p>Enter the current location of the output file in the field provided or click on:</p> <ul style="list-style-type: none"> • File System... to locate the output file in an external folder • Workspace... to locate the output file in a workspace project. 	

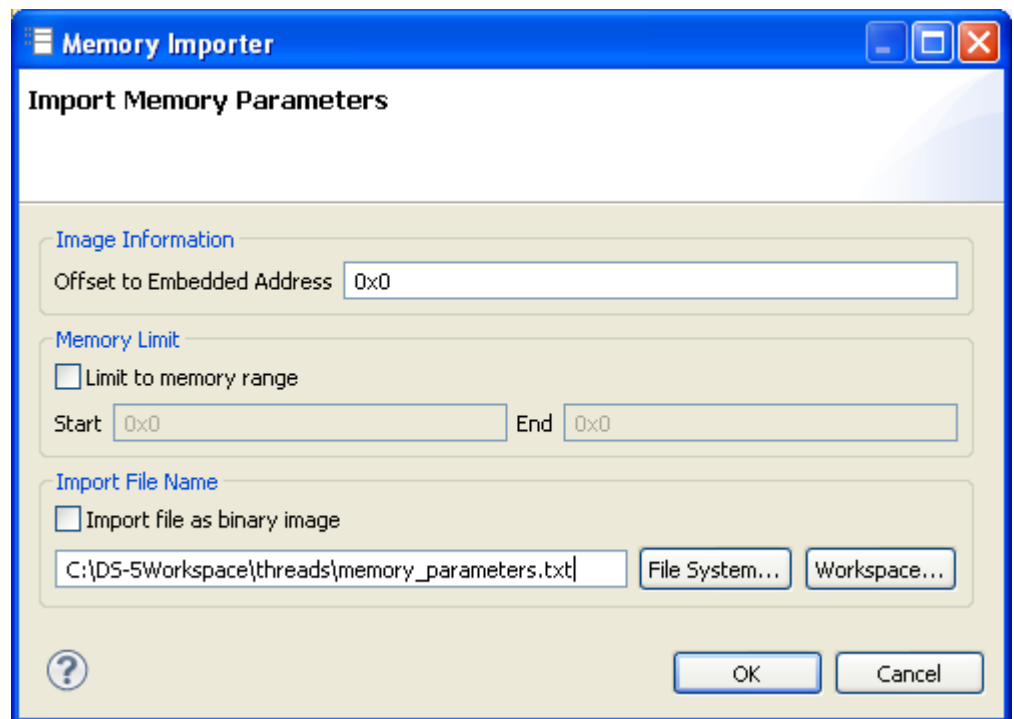


Figure 10-27 Memory Importer dialog box

10.26 Fill Memory dialog box

Describes the dialog box content.

This dialog box enables you to write a specific pattern of bytes to memory.

Memory Bounds	Specifies the memory region:
Start Address	Specifies the start address for the memory.
End Address	Specifies the inclusive end address for the memory.
Length in Bytes	Specifies the number of bytes.
Data Pattern	Specifies the fill size and pattern of bytes.
Fill size	Specifies the fill size in bytes.
Pattern	Enter the specific pattern of bytes.

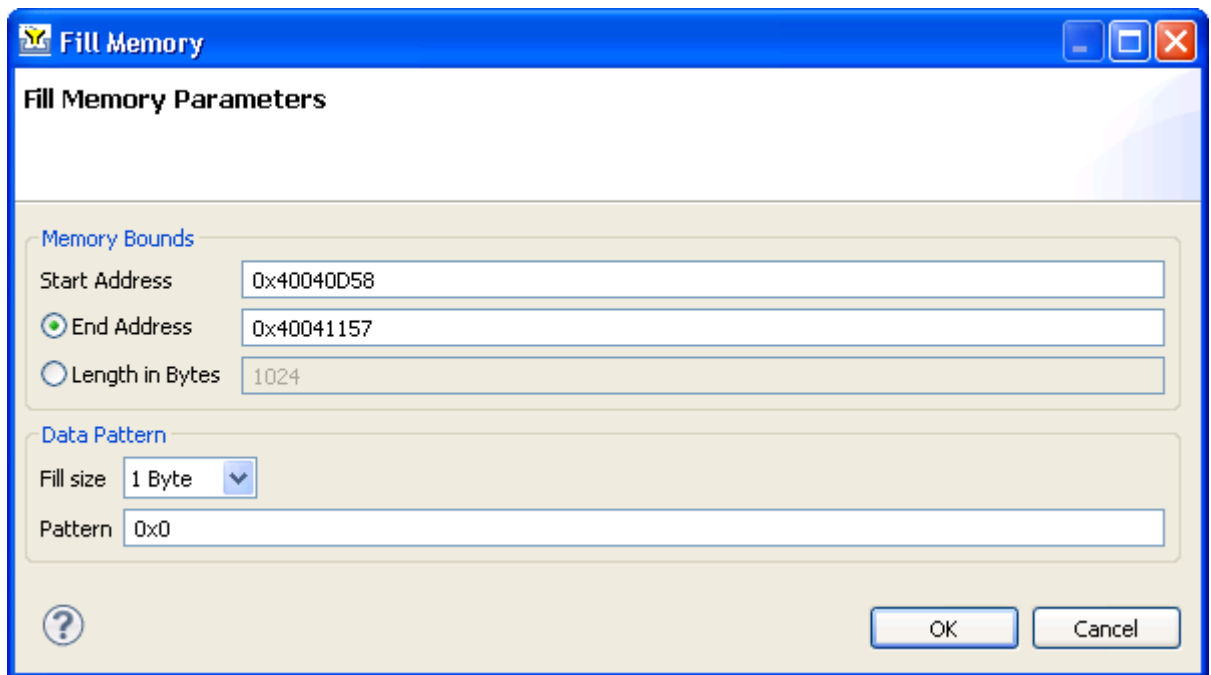


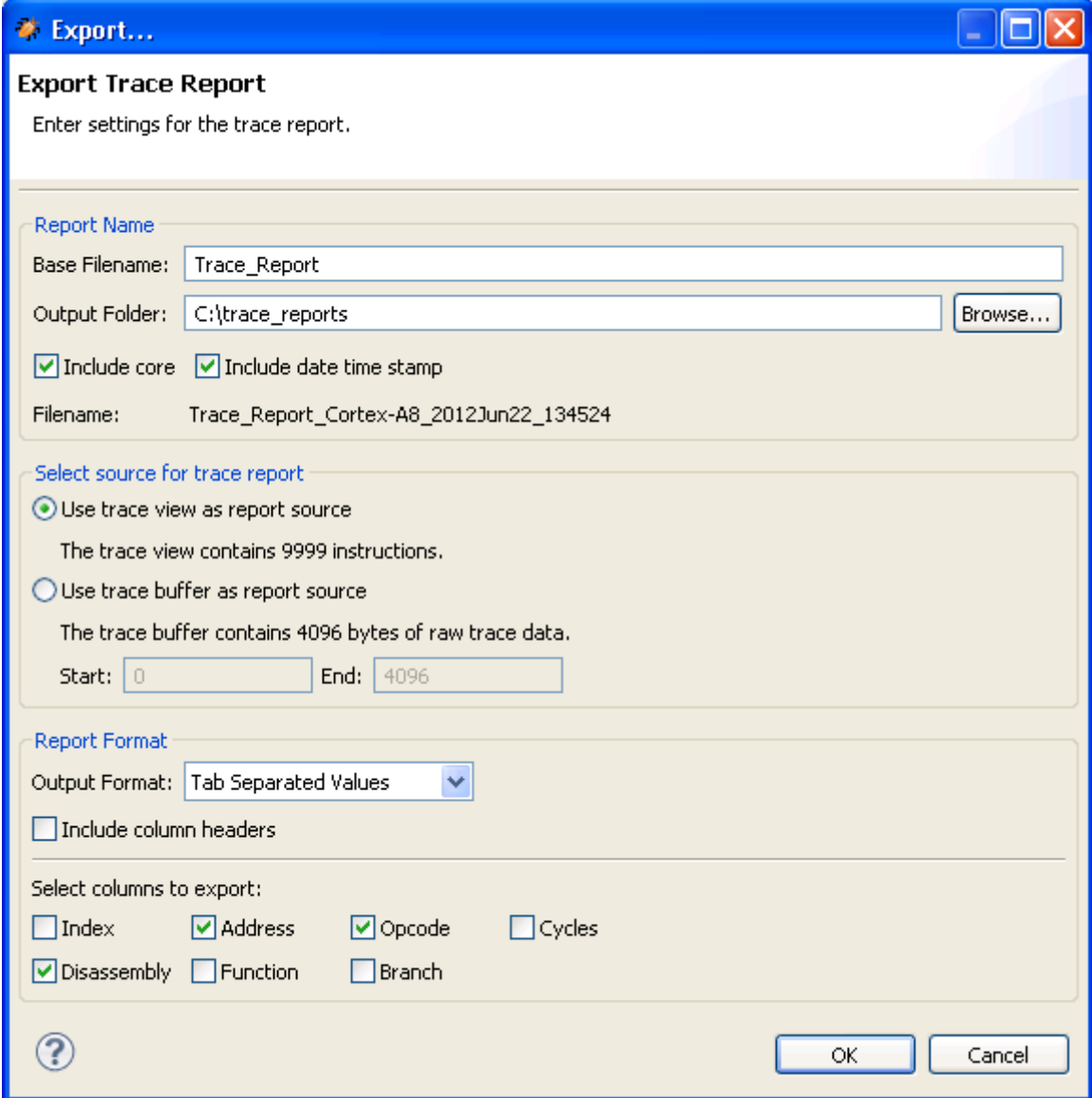
Figure 10-28 Memory Fill dialog box

10.27 Export trace report dialog box

Describes the dialog box content.

This dialog box enables you to generate a trace report.

Report Name	Enter the report location and name.	
	Base Filename	Enter the report name.
	Output Folder	Enter the report folder location.
	Browse	Selects the report location in the file system.
	Include core	Enables you to add the core name in the report filename.
	Include date time stamp	Enables you to add the date time stamp to the report filename.
Select source for trace report	Selects the required trace data:	
	Use trace view as report source	Instructions that are currently visible in the trace view.
	Use trace buffer as report source	Trace data that is currently contained in the trace buffer.
<p>———— Note —————</p> <p>When specifying a range, ensure that the range is large enough otherwise you might not get any trace output. This is due to the trace packing format used in the buffer.</p> <p>_____</p>		
Report Format	Configures the report:	
	Output Format	Selects the output format.
	Include column headers	Enables you to add column headers in the first line of the report.
	Select columns to export	Enables you to filter the trace data in the report.
Record Filters	Enables or disables trace filters.	
	Check All	Enables you to select all the trace filters.
	Uncheck All	Enables you to unselect all the trace filters.



Export...

Export Trace Report

Enter settings for the trace report.

Report Name

Base Filename:

Output Folder:

☒ Include core ☒ Include date time stamp

Filename:

Select source for trace report

☒ Use trace view as report source
 The trace view contains 9999 instructions.

☐ Use trace buffer as report source
 The trace buffer contains 4096 bytes of raw trace data.

Start: End:

Report Format

Output Format:

☐ Include column headers

Select columns to export:

<input type="checkbox"/> Index	<input checked="" type="checkbox"/> Address	<input checked="" type="checkbox"/> Opcode	<input type="checkbox"/> Cycles
<input checked="" type="checkbox"/> Disassembly	<input type="checkbox"/> Function	<input type="checkbox"/> Branch	

Figure 10-29 Export trace report dialog box

10.28 Breakpoint properties dialog box

Describes the dialog box content.

This dialog box enables you to:

- display the properties of a selected breakpoint
- set a conditional expression for a specific breakpoint
- set an ignore counter for a specific breakpoint
- specify a script file to run when the selected breakpoint is hit
- enable the debugger to automatically continue running on completion of all the breakpoint actions
- assign a breakpoint action to a specific thread or processor, if available.

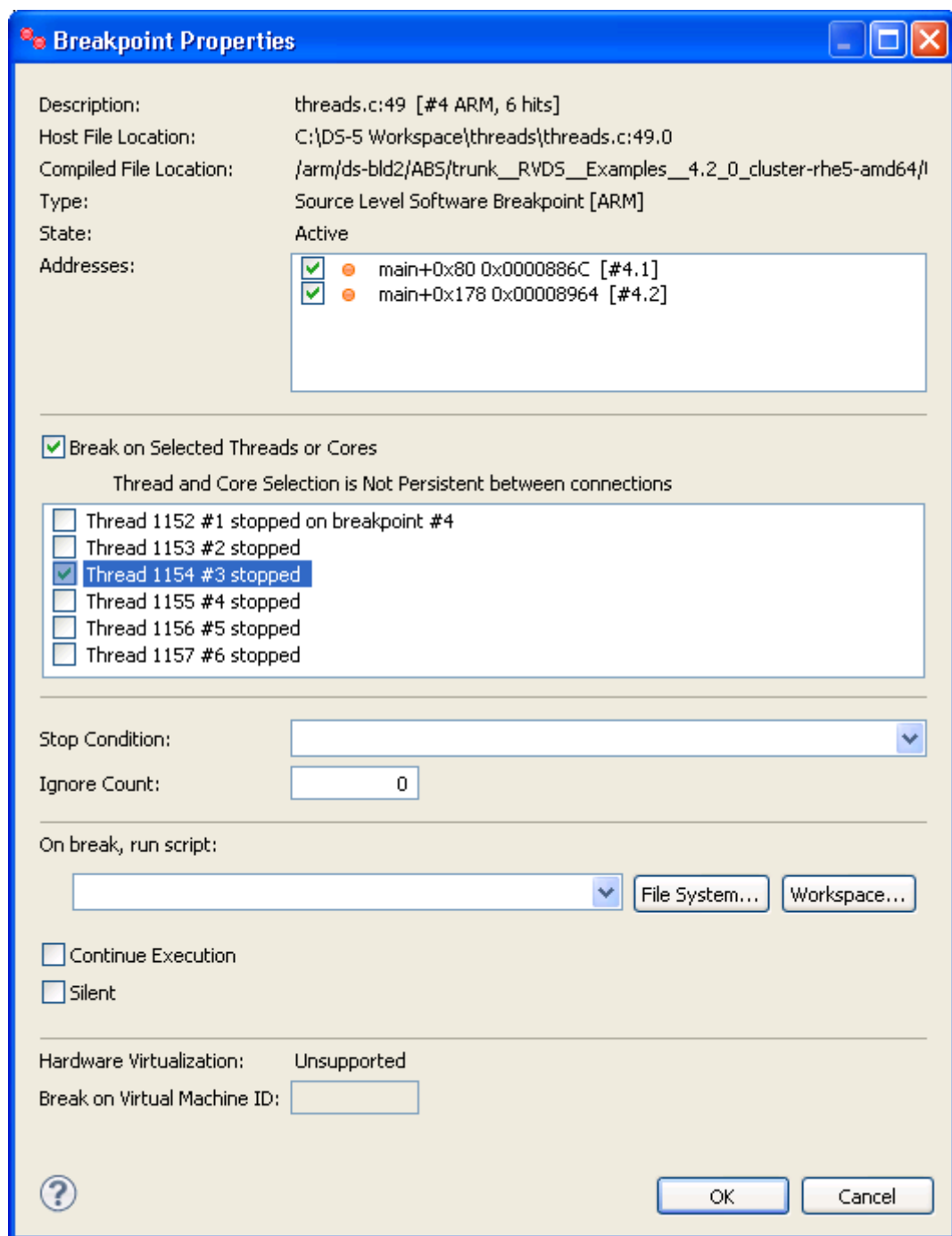


Figure 10-30 Breakpoint properties dialog box

Breakpoint information

The breakpoint information shows the basic properties of a breakpoint:

Description	<p>A description of the breakpoint as displayed in the Breakpoints view. This comprises:</p> <ul style="list-style-type: none"> • The name of the function in which the breakpoint is set and the number of bytes from the start of the function. For example, <code>accumulate()+52</code> shows that the breakpoint is 52 bytes from the start of the <code>accumulate()</code> function. • If the source file is available, the file name and line number in the file where the breakpoint is set, <code>threads.c:115</code>. • A breakpoint ID number, <code>#N</code>. In some cases, such as in a <code>for</code> loop, a breakpoint might comprise a number of sub-breakpoints. These are identified as <code>N.n</code>, where <code>N</code> is the number of the parent. The description of a sub-breakpoint in this dialog box is shown as <code>main()+132sub-breakpoint ofmain()+132 @ threads.c:56 [#14 ARM] (threads)</code> • The type of instruction at the address of the breakpoint, ARM or Thumb. • An ignore count, if set. The display format is: <code>ignore = num/count</code> <code>num</code> equals count initially, and decrements on each pass until it reaches zero. <code>count</code> is the value you have specified for the ignore count. • A hits count that increments each time the breakpoint is hit. This is not displayed until the first hit. If you set an ignore count, hits count does not start incrementing until the ignore count reaches zero. • The stop condition you have specified, <code>(i==3)</code>. • The name of the image. <p>:</p>
Location	<p>The location of the source file containing the address where the breakpoint is set, for example:</p> <p><code>C:/Myprojects/Eclipse/workspace_ds5/threads/threads.c:115.0</code></p> <p>If no source file is available, then Unknown is displayed.</p>
Type	<p>This shows:</p> <ul style="list-style-type: none"> • whether or not the source file is available for the code at the breakpoint address, <code>Source Level</code> if available or <code>Address Level</code> if not available • if the breakpoint is on code in a shared object, <code>Auto</code> indicates that the breakpoint is automatically set when that shared object is loaded • if the breakpoint is <code>Active</code>, the type of breakpoint, either <code>Software Breakpoint</code> or <code>Hardware Breakpoint</code> • the type of instruction at the address of the breakpoint, ARM or Thumb. <p>:</p> <p><code>Source Level Software Breakpoint [ARM]</code></p>
State	<p>Indicates one of the following:</p> <p>Active The image or shared object containing the address of the breakpoint is loaded, and the breakpoint is set.</p>

No Connection	The breakpoint is in an application on a target that is not connected.
Pending	The image or shared object containing the address of the breakpoint has not yet been loaded. The breakpoint becomes active when the image or shared object is loaded.

Address A dialog box that displays one or more breakpoint or sub-breakpoint addresses with check boxes where you can enable or disable them.

Temporary Shows `true` if this is a temporary breakpoint. Otherwise, shows `false`.

Breakpoint options

The following options are available for you to set:

Stop Condition	Specify a C-style conditional expression for the selected breakpoint. For example, to activate the breakpoint when the value of <code>x</code> equals <code>10</code> , specify <code>x==10</code> .
Ignore Count	<p>Specify the number of times the selected breakpoint is ignored before it is activated.</p> <p>The debugger decrements the counter on each pass until it reaches zero, for example:</p> <pre>main()+140 @ threads.c:51 [#1 ARM, ignore = 2/3] (threads)</pre> <p>When the value reaches zero the breakpoint activates. Each subsequent pass causes the breakpoint to activate.</p> <p>Select the Reset Ignore Count option from the context menu to reset the counter to the value you have set and delay activation again.</p>
On break, run script	<p>Specify a script file to run when the selected breakpoint is activated.</p> <p>———— Note —————</p> <p>Take care with the commands you use in a script that is attached to a breakpoint. For example, if you use the <code>quit</code> command in a script, the debugger disconnects from the target when the breakpoint is hit.</p> <p>—————</p>
Continue Execution	Select this option if you want to continue running the target after the breakpoint is activated.
Silent	Controls the printing of stop messages for the selected breakpoint.
Break on Selected Threads or Cores	Select this option if you want to set a breakpoint for a specific thread or processor. This option is disabled if none are available.

When a breakpoint activates, the debugger does the following:

- displays a message in the **Commands** view, for example:

```
Execution stopped at breakpoint 1: 0x00008850  
In thread 1 (OS thread id 1078)  
0x00008850 51,0 thread_app_data[t].thread = t;
```

- increments a hit count for the breakpoint, for example:

```
main()+140 @ threads.c:51 [#1 ARM, ignore = 0/3, 2 hits] (threads)
```

10.29 Watchpoint properties dialog box

Describes the dialog box content.

This dialog box enables you to:

- display the properties of a selected watchpoint
- change the watchpoint type.

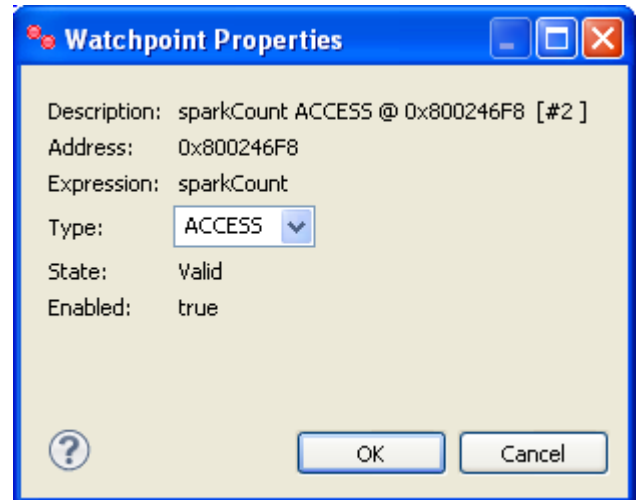


Figure 10-31 Watchpoint properties dialog box

The following types are available:

- | | |
|---------------|---|
| READ | The debugger stops the target when the memory is read |
| WRITE | The debugger stops the target when the memory is written |
| ACCESS | The debugger stops the target when the memory is read or written. |

10.30 Tracepoint properties dialog box

Describes the dialog box content.

This dialog box enables you to display the properties of a selected tracepoint.

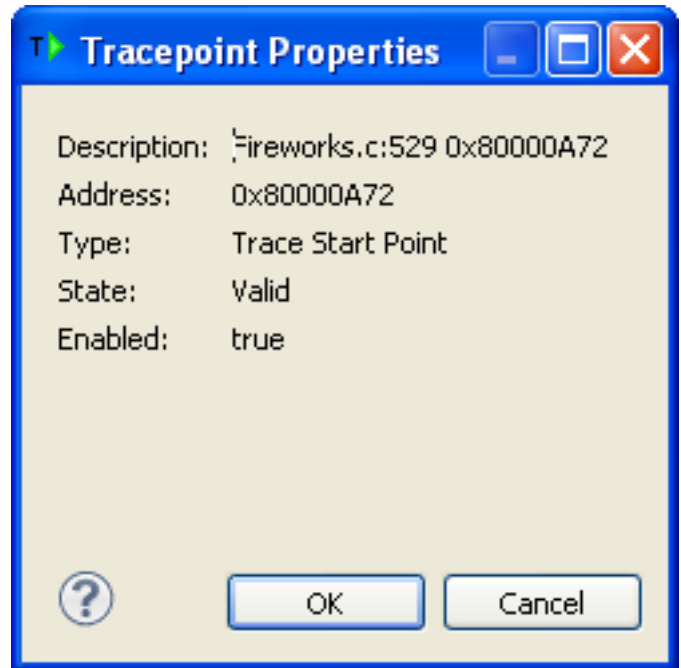


Figure 10-32 Tracepoint properties dialog box

The following types are available:

Trace Start Point	Enables trace capture when it is hit.
Trace Stop Point	Disables trace capture when it is hit.
Trace Trigger Point	Starts trace capture when it is hit.

Note

Tracepoint behavior might vary depending on the selected target.

10.31 Manage Signals dialog box

Describes the dialog box content.

This dialog box enables you to control the handler (vector catch) settings for one or more signals or processor exceptions. When a signal or processor exception occurs you can choose to stop execution, print a message, or both. **Stop** and **Print** are selected for all signals by default.

———— **Note** —————

When connected to an application running on a remote target using gdbserver, the debugger handles Unix signals but on bare-metal targets with no operating system it handles processor exceptions.

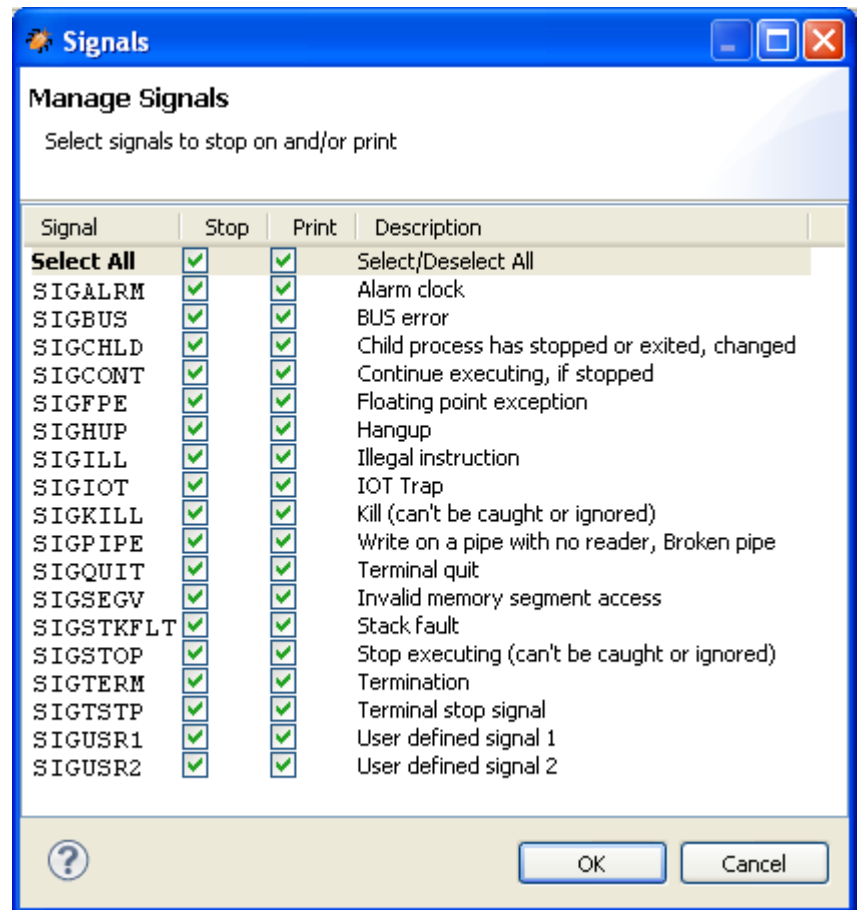


Figure 10-33 Managing signal handler settings

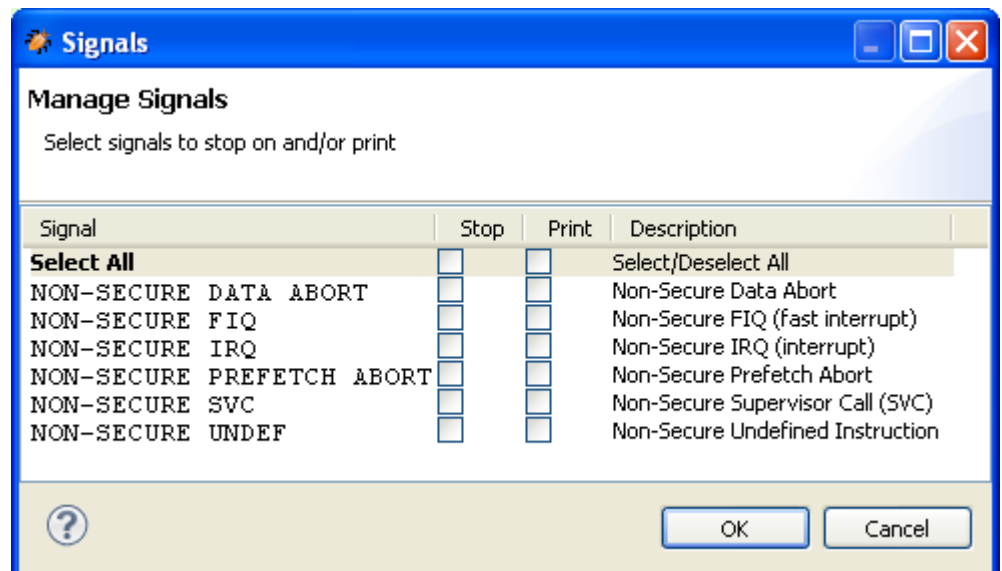


Figure 10-34 Manage exception handler settings

10.32 Event Viewer dialog box

Describes the dialog box content.

This dialog box enables you to select a trace source in addition to masters and channels to display in the view.

Select a Trace Source Enables you to select a trace source.

Masters Enables you to select the Masters that you want to display in the **Events** view. Masters are only available for STM trace.

All Masters Selects all the masters.

Clear Masters Discards all the masters.

———— **Note** —————

These options do not modify the data in the channels field.

Channels Enables you to provide a list or group of channels.

Add All Sets the channels of the selected master to the default value.

Clear Clears the channels of the selected master.

———— **Note** —————

A master with zero channels displays no data.

Apply Reorganizes the current channels into a canonical form.

Import Enables you to import an existing configuration.

Export Enables you to save an existing configuration for use with a different launch configuration.

Reset to Defaults Resets the configuration to the default configuration.

OK Reorganizes the current channels into a canonical form, saves the settings, and closes the dialog box.

Cancel Enables you to cancel unsaved changes.

10.33 Functions Filter dialog box

Describes the dialog box content.

This dialog box enables you to filter the list of symbols that are displayed in the **Functions** view.

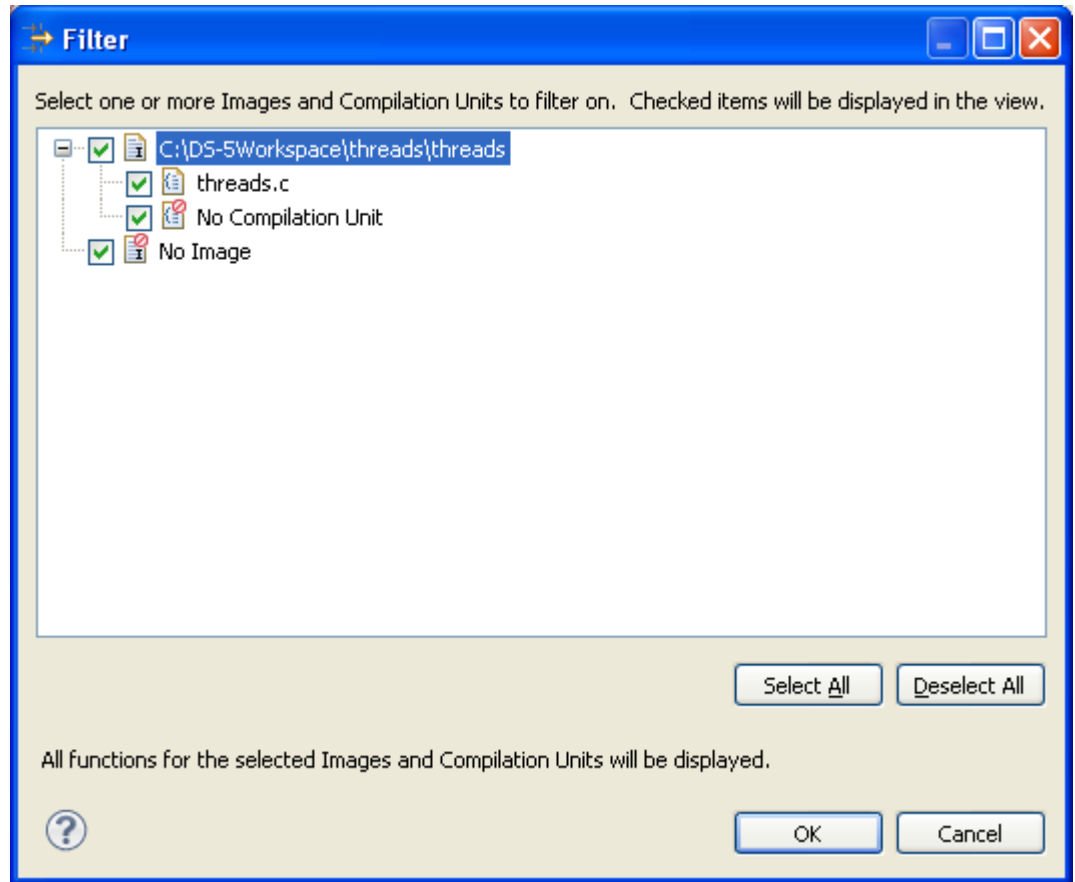


Figure 10-35 Function filter dialog box

10.34 Jython Script Parameters dialog box

Describes the dialog box content.

This dialog box enables you to specify script parameters.

Script Parameters	Enter parameters for the selected script in the text field. Parameters must be space delimited.
Variables...	This button opens the Select Variable dialog box where you can select variables that are passed to the application when the debug session starts. For more information on Eclipse variables, use the dynamic help.
OK	Saves the current parameters and closes the Jython Script Parameters dialog box.
Cancel	Closes the Jython Script Parameters dialog box without saving the parameters.

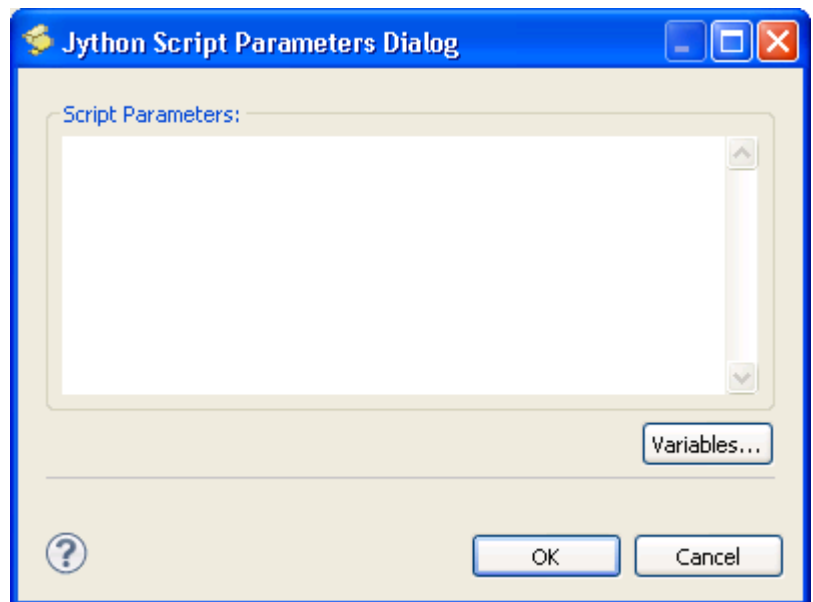


Figure 10-36 Jython Script Parameters dialog box

10.35 Debug Configurations - Connection tab

Describes the tab content.

The **Connection** tab in the Debug Configurations dialog box enables you to configure DS-5 Debugger target connections. Each configuration you create is associated with a single target processor.

If the development platform has multiple processors, then you must create a separate configuration for each processor. Be aware that when connecting to multiple targets you cannot perform synchronization or cross-triggering operations.

Note

Options in the **Connection** tab are dependent on the type of platform that you select.

Select target	These options enable you to select the target manufacturer, board, project type, and debug operation.								
DTSL Options	Select Edit... to open a dialog box to configure additional debug and trace settings.								
Connections	These options enable you to configure the connection between the debugger and the target: <table> <tr> <td>RSE connection</td><td>A list of <i>Remote Systems Explorer</i> (RSE) configurations that you have previously set up. Select the required RSE configuration that you want to use for this debug configuration.</td></tr> <tr> <td>Android devices</td><td>A list of Android devices that you have previously configured. Select the required device that you want to use for this debug configuration.</td></tr> <tr> <td>Connect as root</td><td>Select to give root access when starting gdbserver. This option is dependent on the selected debug operation and might not be available.</td></tr> <tr> <td>gdbserver (TCP)</td><td>Specify the target IP address or name and the associated port number for the connection between the debugger and gdbserver. The following options might also be available, depending on the debug operation you selected: <ul style="list-style-type: none"> • Select the Use Extended Mode checkbox if you want to restart an application under debug. Be aware that this might not be fully implemented by gdbserver on all targets. • Select the Terminate gdbserver on disconnect checkbox to terminate gdbserver when you disconnect from the target. • Select the Use RSE Host checkbox to connect to gdbserver using the RSE configured host. </td></tr> </table>	RSE connection	A list of <i>Remote Systems Explorer</i> (RSE) configurations that you have previously set up. Select the required RSE configuration that you want to use for this debug configuration.	Android devices	A list of Android devices that you have previously configured. Select the required device that you want to use for this debug configuration.	Connect as root	Select to give root access when starting gdbserver. This option is dependent on the selected debug operation and might not be available.	gdbserver (TCP)	Specify the target IP address or name and the associated port number for the connection between the debugger and gdbserver. The following options might also be available, depending on the debug operation you selected: <ul style="list-style-type: none"> • Select the Use Extended Mode checkbox if you want to restart an application under debug. Be aware that this might not be fully implemented by gdbserver on all targets. • Select the Terminate gdbserver on disconnect checkbox to terminate gdbserver when you disconnect from the target. • Select the Use RSE Host checkbox to connect to gdbserver using the RSE configured host.
RSE connection	A list of <i>Remote Systems Explorer</i> (RSE) configurations that you have previously set up. Select the required RSE configuration that you want to use for this debug configuration.								
Android devices	A list of Android devices that you have previously configured. Select the required device that you want to use for this debug configuration.								
Connect as root	Select to give root access when starting gdbserver. This option is dependent on the selected debug operation and might not be available.								
gdbserver (TCP)	Specify the target IP address or name and the associated port number for the connection between the debugger and gdbserver. The following options might also be available, depending on the debug operation you selected: <ul style="list-style-type: none"> • Select the Use Extended Mode checkbox if you want to restart an application under debug. Be aware that this might not be fully implemented by gdbserver on all targets. • Select the Terminate gdbserver on disconnect checkbox to terminate gdbserver when you disconnect from the target. • Select the Use RSE Host checkbox to connect to gdbserver using the RSE configured host. 								

gdbserver (serial)	<p>Specify the local serial port and connection speed for the serial connection between the debugger and gdbserver.</p> <p>For model connections, details for gdbserver are obtained automatically from the target.</p> <p>Select the Use Extended Mode checkbox if you want to restart an application under debug. Be aware that this might not be fully implemented by gdbserver on all targets.</p>
Bare Metal Debug	<p>Specify the target IP address or name of the debug hardware adapter. You can also click on Browse... to display all the available debug hardware adapters on your local subnet or USB connections.</p>
Model parameters	<p>Specify the parameter for launching the model.</p>
Model parameters (pre-configured to boot ARM Embedded application)	<p>These options are only enabled for the pre-configured option that boots an ARM Embedded <i>Fixed Virtual Platform</i>.</p> <p>You can configure a <i>Virtual File System</i> (VFS) that enables a model to run an application and related shared library files from a directory on the local host. Alternatively, you can disable VFS and manually transfer the files to a directory on the model.</p>
Enable Virtual File System support	<p>Enable or disable the use of VFS.</p>
Host mount point	<p>Specify the location of the file system on the local host; you can select the workspace root directory.</p> <ul style="list-style-type: none"> • enter the location in the field provided • click on File System... to locate the directory in an external location from the workspace • click on Workspace... to locate the directory within the workspace.
Remote target mount point	<p>Displays the default location of the file system on the model. The default is the <code>/writeable</code> directory.</p>
Apply	<p>Save the current configuration. This does not connect to the target.</p>
Revert	<p>Undo any changes and revert to the last saved configuration.</p>
Debug	<p>Connect to the target and close the Debug Configurations dialog box.</p>
Close	<p>Close the Debug Configurations dialog box.</p>

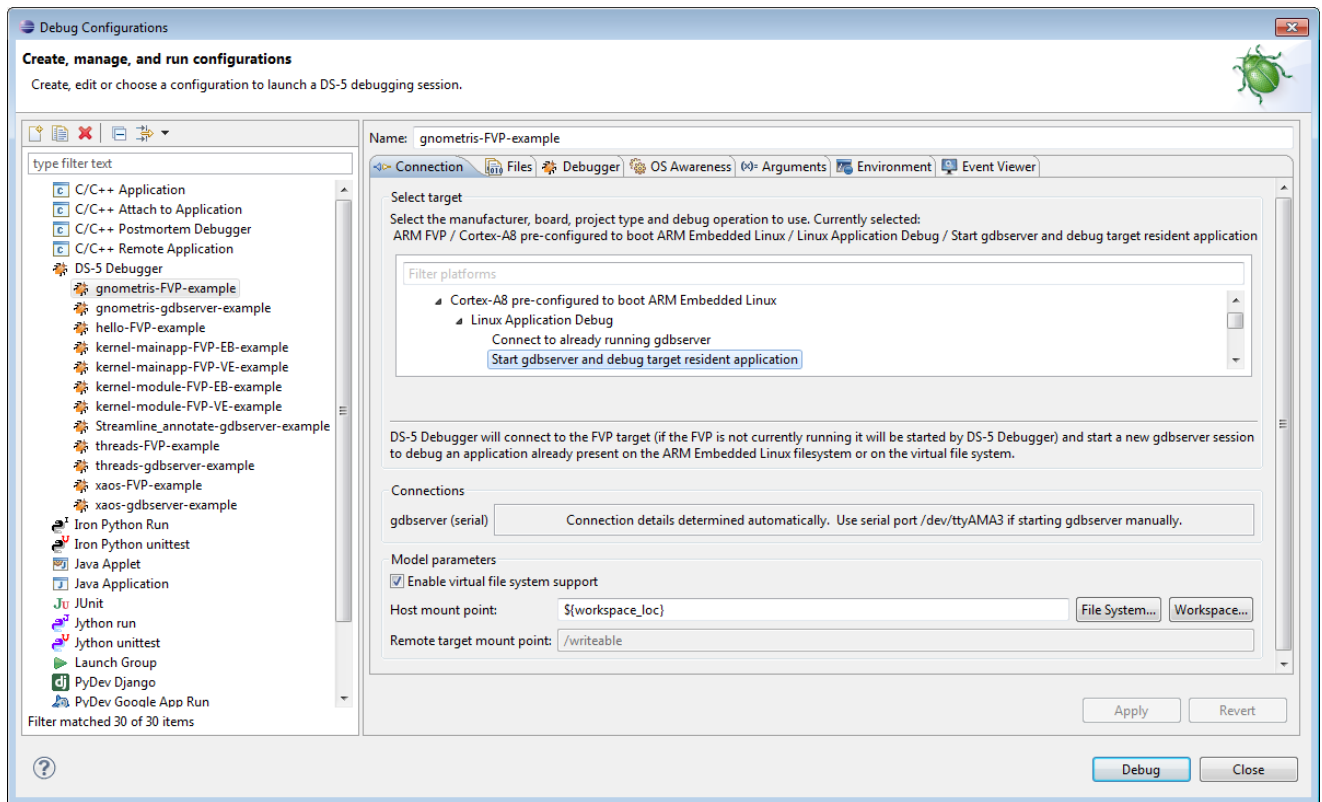


Figure 10-37 Connection configuration for a model using VFS

10.36 Debug Configurations - Files tab

Describes the tab content.

The **Files** tab in the Debug Configurations dialog box enables you to select debug versions of the application file and libraries on the host that you want the debugger to use. You can also specify the target file system folder to which files can be transferred if required.

————— **Note** —————

Options in the **Files** tab depend on the type of platform and debug operation that you select.

Files These options enable you to configure the target file system and select files on the host that you want to download to the target or use by the debugger. The **Files** tab options available for each **Debug operation** are:

Table 10-1 Files tab options available for each Debug operation

	Download and debug application	Debug target resident application	Connect to already running gdbserver	Debug via DSTREAM \RVI	Debug and ETB Trace via DSTREAM \RVI
Application on host to download	Yes	-	-	Yes	Yes
Application on target	-	Yes	-	-	-
Target download directory	Yes	-	-	-	-
Target working directory	Yes	Yes	-	-	-
Load symbols from file	Yes	Yes	Yes	Yes	Yes
Other file on host to download	Yes	-	-	-	-
Path to target system root directory	Yes	Yes	Yes	-	-

Apply Save the current configuration. This does not connect to the target.

Revert Undo any changes and revert to the last saved configuration.

Debug Connect to the target and close the Debug Configurations dialog box.

Close Close the Debug Configurations dialog box.

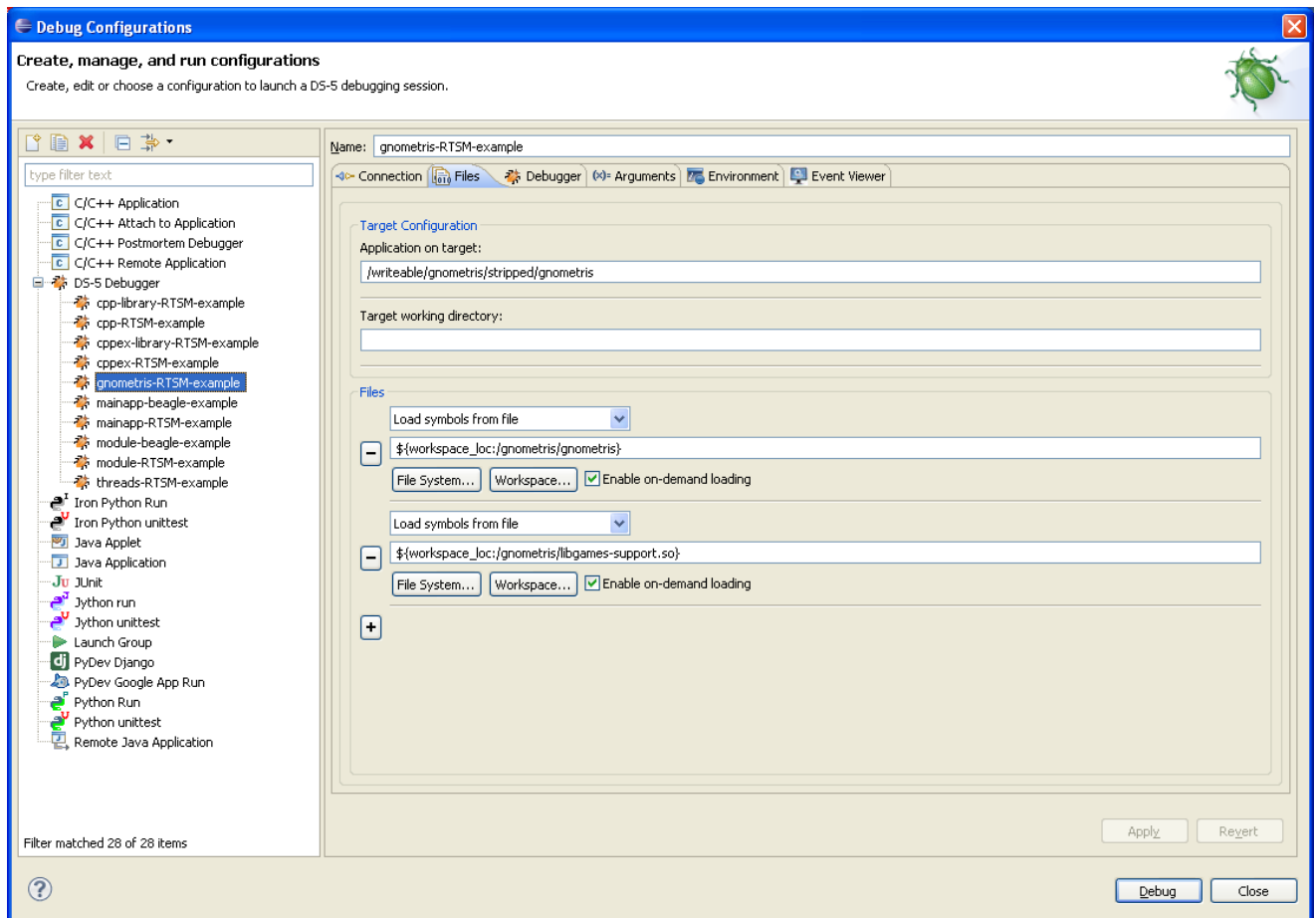


Figure 10-38 File system configuration for an application on a model

Files options summary

The Files options available depend on the debug operation you selected on the **Connection** tab. The possible Files options are:

Application on host to download	<p>Specify the application image file on the host that you want to download to the target:</p> <ul style="list-style-type: none">• enter the host location and file name in the field provided• click on File System... to locate the file in an external directory from the Eclipse workspace• click on Workspace... to locate the file in an project directory or sub-directory within the Eclipse workspace. <p>For example, to download the stripped (no debug) Gnometriz application image select the <code>gnometris/stripped/gnometriz</code> file.</p> <p>Select Load symbols to load the debug symbols from the specified image.</p> <p>Select Enable on-demand loading to specify how you want the debugger to load debug information. Enabling this option can provide a faster load and use less memory but debugging might be slower.</p>
Project directory	<p>Specify the Android project directory on the host:</p> <ul style="list-style-type: none">• enter the host location in the field provided• click on File System... to locate the project directory in an external location from the Eclipse workspace• click on Workspace... to locate the project directory from within the Eclipse workspace.
APK file	<p>Specify the Android APK file on the host that you want to download to the target:</p> <ul style="list-style-type: none">• enter the host location and file name in the field provided• click on File System... to locate the file in an external directory from the Eclipse workspace• click on Workspace... to locate the file in an project directory or sub-directory within the Eclipse workspace.
Process	<p>This field is automatically populated from the <code>AndroidManifest.xml</code> file.</p>
Activity	<p>This field is automatically populated from the <code>AndroidManifest.xml</code> file.</p>
Application on target	<p>Specify the location of the application on the target. <code>gdbserver</code> uses this to launch the application.</p> <p>For example, to use the stripped (no debug) Gnometriz application image when using a model and VFS is configured to mount the host workspace as <code>/writeable</code> on the target, specify the following in the field provided:</p> <p><code>/writeable/gnometriz/stripped/gnometriz</code>.</p>
Target download directory	<p>If the target has a preloaded image, then you might have to specify the location of the corresponding image on your host.</p> <p>The debugger uses the location of the application image on the target as the default current working directory. To change the default setting for the application that you are debugging, enter the location in the field provided. The current working directory is used whenever the application references a file using a relative path.</p>

Load symbols	<p>Specify the application image containing the debug information to load:</p> <ul style="list-style-type: none"> • enter the host location and file name in the field provided • click on File System... to locate the file in an external directory from the workspace • click on Workspace... to locate the file in a project directory or sub-directory within the workspace. <p>For example, to load the debug version of Gnometriz you must select the gnometriz application image that is available in the gnometriz project root directory.</p> <p>Although you can specify shared library files here, the usual method is to specify a path to your shared libraries with the Shared library search directory option on the Debugger tab.</p> <p>———— Note ————</p> <p>Load symbols is ticked by default.</p>
Add peripheral description files from directory	<p>A directory with configuration files defining peripherals that must be added before connecting to the target.</p>
Other file on host to download	<p>Specify other files that you want to download to the target:</p> <ul style="list-style-type: none"> • Enter the host location and file name in the field provided. • Click on File System... to locate the file in an external directory from the workspace. • Click on Workspace... to locate the file in a project directory or sub-directory within the workspace. <p>For example, to download the stripped (no debug) Gnometriz shared library to the target you can select the gnometriz/stripped/libgames-support.so file.</p>
Path to target system root directory	<p>Specifies the system root directory to search for shared library symbols.</p> <p>The debugger uses this directory to search for a copy of the debug versions of target shared libraries. The system root on the host workstation must contain an exact representation of the libraries on the target root filesystem.</p>
Target working directory	<p>If this field is not specified, the debugger uses the location of the application image on the target as the default current working directory. To change the default setting for the application that you are debugging, enter the location in the field provided. The current working directory is used whenever the application refers to a file using a relative path.</p>
Remove this resource from the list	<p>To remove a resource from the configuration settings, click this button next to the resource that you want to remove.</p>
Add a new resource to the list	<p>To add a new resource to the file settings, click this button and then configure the options as required.</p>

Related Concepts

[About debugging a Linux kernel on page 137.](#)

10.37 Debug Configurations - Debugger tab

Describes the tab content.

The **Debugger** tab in the Debug Configurations dialog box enables you to specify the actions that you want the debugger to do after connection to the target.

Run Control

These options enable you to define the running state of the target when you connect:

Connect only

Connect to the target, but do not run the application.

Note

The PC register is not set and pending breakpoints or watchpoints are subsequently disabled when a connection is established.

Debug from entry point

Run the application when a connection is established, then stop at the image entry point.

Debug from symbol

Run the application when a connection is established, then stop at the address of the specified symbol. The debugger must be able to resolve the symbol. If you specify a C or C++ function name, then do not use the () suffix.

If the symbol can be resolved, execution stops at the address of that symbol.

If the symbol cannot be resolved, a message is displayed in the **Commands** view warning that the symbol cannot be found. The debugger then attempts to stop at the image entry point.

Run target initialization debugger script (.ds)

Select this option to execute target initialization scripts (a file containing debugger commands) immediately after connection. To select a file:

- enter the location and file name in the field provided
- click on **File System...** to locate the file in an external directory from the workspace
- click on **Workspace...** to locate the file in a project directory or sub-directory within the workspace.

Run debug initialization debugger script (.ds)

Select this option to execute debug initialization scripts (a file containing debugger commands) after execution of any target initialization scripts and also running to an image entry point or symbol, if selected. To select a file:

- enter the location and file name in the field provided
- click on **File System...** to locate the file in an external directory from the workspace
- click on **Workspace...** to locate the file in a project directory or sub-directory within the workspace.

———— **Note** —————

You might have to insert a `wait` command before a `run` or `continue` command to enable the debugger to connect and run the application to the specified function.

Execute debugger commands

Enter debugger commands in the field provided if you want to automatically execute specific debugger commands that run on completion of any initialization scripts. Each line must contain only one debugger command.

Host working directory

The debugger uses the Eclipse workspace as the default working directory on the host. To change the default setting for the application that you are debugging, deselect the **Use default** check box and then:

- enter the location in the field provided
- click on **File System...** to locate the external directory
- click on **Workspace...** to locate the project directory.

Paths

You can modify the search paths on the host used by the debugger when it displays source code.

Source search directory

Specify a directory to search for source files:

- enter the location and file name in the field provided
- click on **File System...** to locate the directory in an external location from the workspace
- click on **Workspace...** to locate the directory within the workspace.

Shared library search directory

Specify a directory to search for shared libraries:

- enter the location in the field provided
- click on **File System...** to locate the directory in an external location from the workspace
- click on **Workspace...** to locate the directory within the workspace.

Remove this resource from the list

To remove a search path from the configuration settings, click this button next to the resource that you want to remove.

- | | |
|---------------------------------------|---|
| Add a new resource to the list | To add a new search path to the configuration settings, click this button and then configure the options as required. |
| Apply | Save the current configuration. This does not connect to the target. |
| Revert | Undo any changes and revert to the last saved configuration. |
| Debug | Connect to the target and close the Debug Configurations dialog box. |
| Close | Close the Debug Configurations dialog box. |

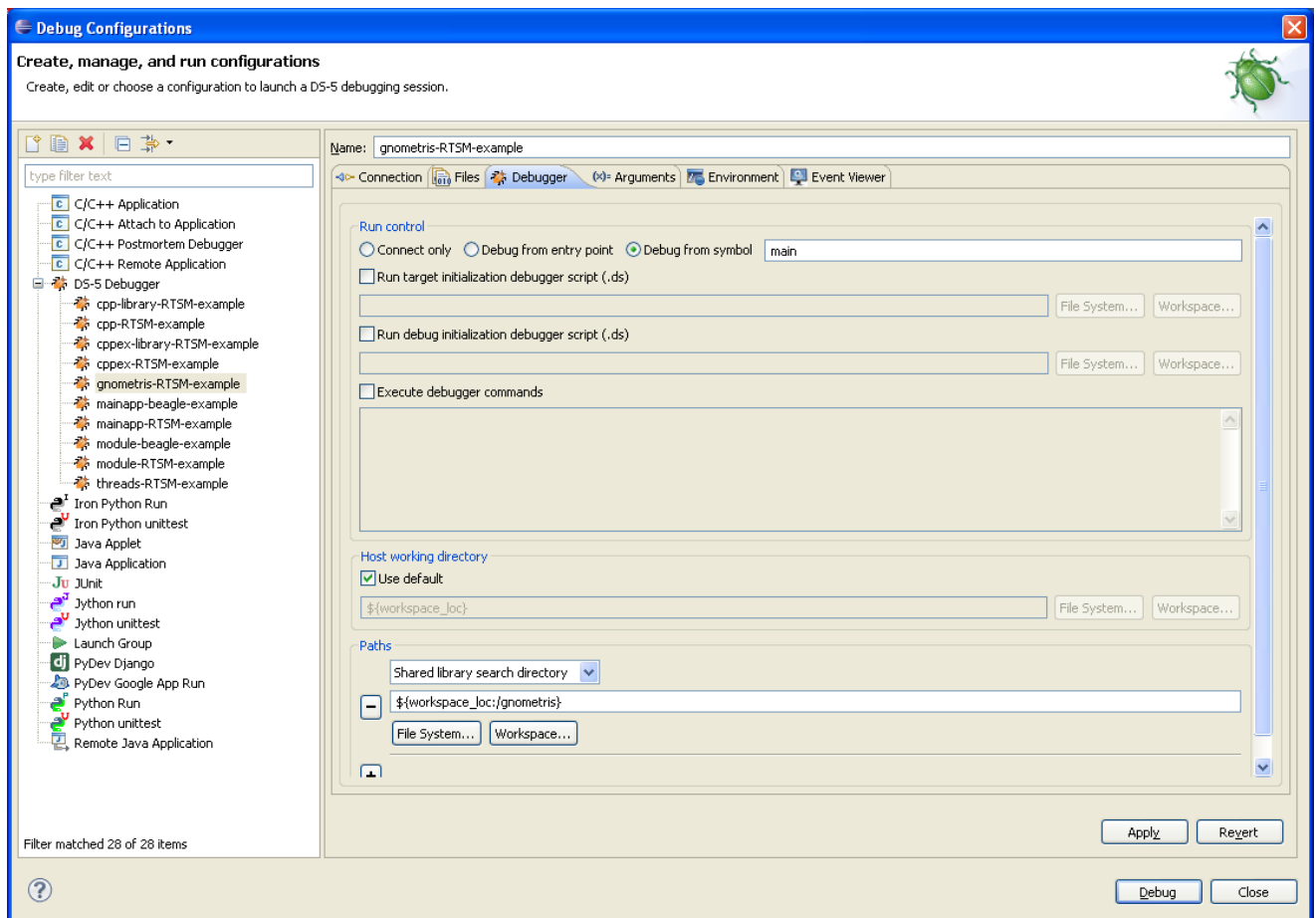


Figure 10-39 Debugger configuration to set application starting point and search paths

Related Concepts

About debugging a Linux kernel on page 137.

10.38 Debug Configurations - OS Awareness tab

Describes the OS Awareness tab content.

The **OS Awareness** tab in the Debug Configurations dialog box enables you to inform the debugger of the *Operating system* (OS) the target is running. This enables the debugger to provide additional functionality specific to the selected OS.

Multiple options are available in the drop-down box and its content is controlled by the selected platform and connection type in the **Connection** tab. OS awareness depends on having debug symbols for the OS loaded within the debugger.

———— **Note** ————

Linux OS awareness is not currently available in this tab, and remains in the **Connection** tab as a separate debug operation.

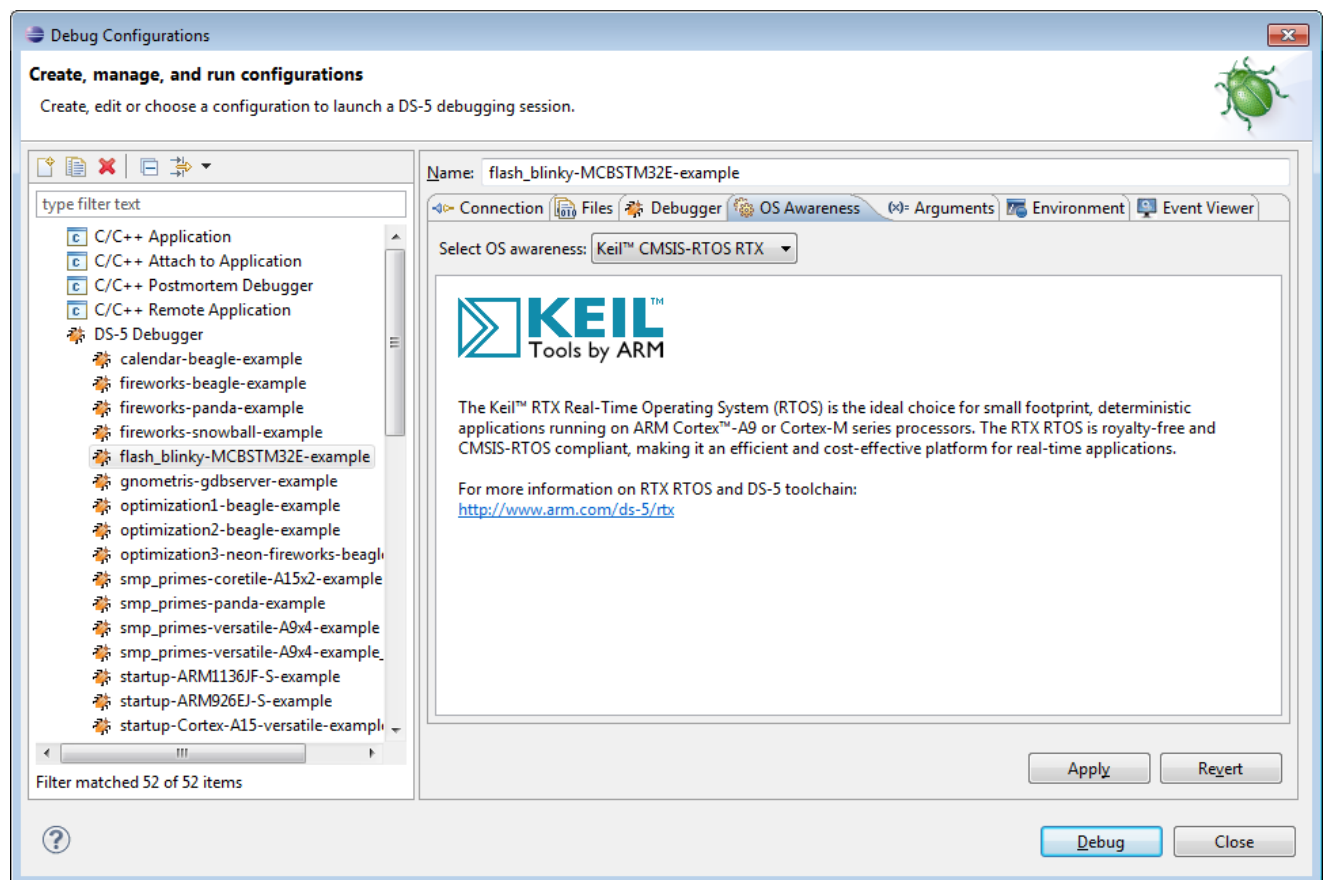


Figure 10-40 OS Awareness tab

10.39 Debug Configurations - Arguments tab

Describes the tab content.

If your application accepts command-line arguments to `main()`, you can specify the values to pass to the application when execution starts.

The **Arguments** tab in the Debug Configurations dialog box enables you to enter arguments that are passed to the application.

Note

These settings only apply if the target supports semihosting and they cannot be changed while the target is running.

The **Arguments** tab contains the following elements:

Program Arguments	<p>This panel enables you to enter the arguments. Arguments are passed to the target application unmodified except when the text is an eclipse argument variable of the form <code>\${var_name}</code> where Eclipse replaces it with the related value.</p> <p>For a Linux target you might have to escape some characters using a backslash (<code>\</code>) character. For example, the <code>@</code>, <code>(</code>, <code>)</code>, <code>"</code>, and <code>#</code> characters must be escaped.</p>
Variables...	<p>This button opens the Select Variable dialog box where you can select variables that are passed to the application when the debug session starts. For more information on variables, use the dynamic help.</p>
Apply	<p>Save the current configuration. This does not connect to the target.</p>
Revert	<p>Undo any changes and revert to the last saved configuration.</p>
Debug	<p>Connect to the target and close the Debug Configurations dialog box.</p>
Close	<p>Close the Debug Configurations dialog box.</p>

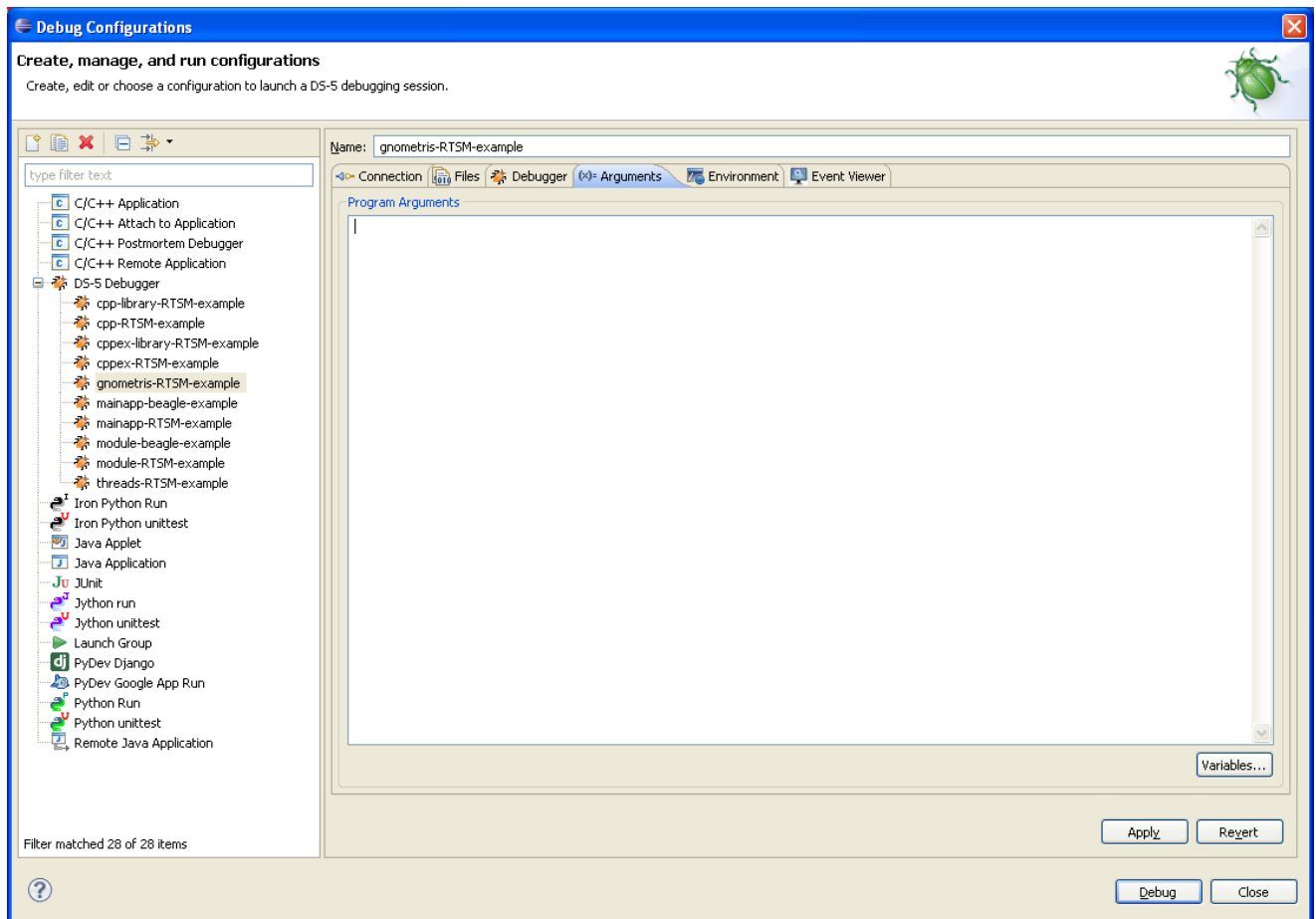


Figure 10-41 Application arguments configuration

Related References

- [About passing arguments to main\(\) on page 92.](#)
- [About semihosting and top of memory on page 145.](#)
- [Working with semihosting on page 146.](#)
- [Enabling automatic semihosting support in the debugger on page 147.](#)
- [Controlling semihosting messages using the command-line console on page 148.](#)

Related Information

- [DS-5 Debugger commands.](#)

10.40 Debug Configurations - Environment tab

Describes the tab content.

The **Environment** tab in the Debug Configurations dialog box enables you to create and configure the target environment variables that are passed to the application when the debug session starts.

———— Note —————

The settings in this tab are not used for connections that use the **Connect to already running gdbserver** debug operation.

The **Environment** tab contains the following elements:

Target environment variables to set

This panel displays the current target environment variables in use by the debugger.

New...

This button opens the New Environment Variable dialog box where you can create a new target environment variable.

For example, to debug the Gnometriz application on a model you must create a target environment variable for the DISPLAY setting.

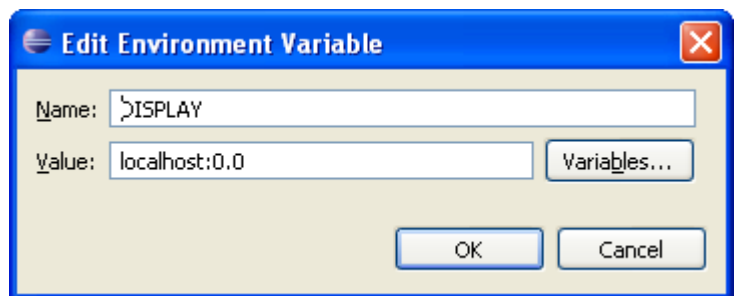


Figure 10-42 Setting up target environment variables

Edit...

This button opens the Edit Environment Variable dialog box where you can edit the properties for the selected target environment variable.

Remove

This button removes the select target environment variables from the list.

Apply

Save the current configuration. This does not connect to the target.

Revert

Undo any changes and revert to the last saved configuration.

Debug

Connect to the target and close the Debug Configurations dialog box.

Close

Close the Debug Configurations dialog box.

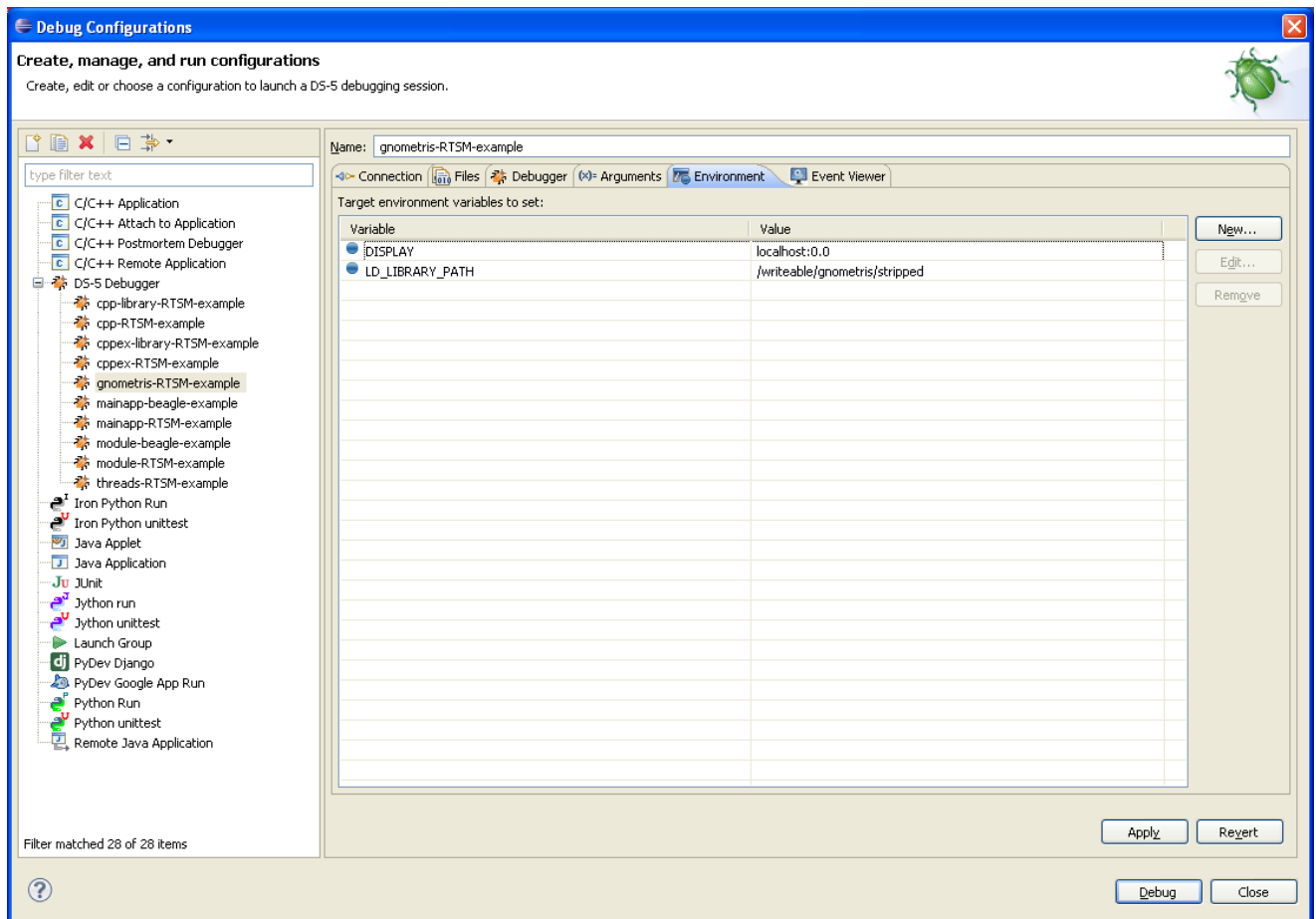


Figure 10-43 Environment configuration for a model

10.41 Debug Configurations - Event Viewer tab

Describes the tab content.

The **Event Viewer** tab in the Debug Configurations dialog box enables you to configure the *Instruction Trace Macrocell* (ITM) channels and the *System Trace Macrocell* (STM) channels that you want the debugger to use when capturing event data.

———— **Note** ————

The settings in this tab are only enabled for targets where ITM or STM capture is supported.

The **Event Viewer** tab contains the following:

ITM Enables you to configure the ITM settings.

Enable ITM capture Enable or disable trace collection from the ITM unit. Ensure that you also configure the *Debug and Trace Services Layer* (DTS�) options in the **Connections** tab.

Max analysis trace depth Specify the size of the trace buffer. The maximum is 4GB but you can choose to use only a portion of the buffer in order to minimize data transfer and processing times. The data stored in the buffer is encoded as ITM packets, and might be interleaved with other trace data. Therefore the actual amount of your own data that can be recovered from the buffer might be less than the configured buffer size.

STM Enables you to configure the STM settings.

Enable STM capture Enable or disable trace collection from the STM unit.

Max analysis trace depth Specify the size of the trace buffer.

Apply Save the current configuration. This does not connect to the target.

Revert Undo any changes and revert to the last saved configuration.

Debug Connect to the target and close the Debug Configurations dialog box.

Close Close the Debug Configurations dialog box.

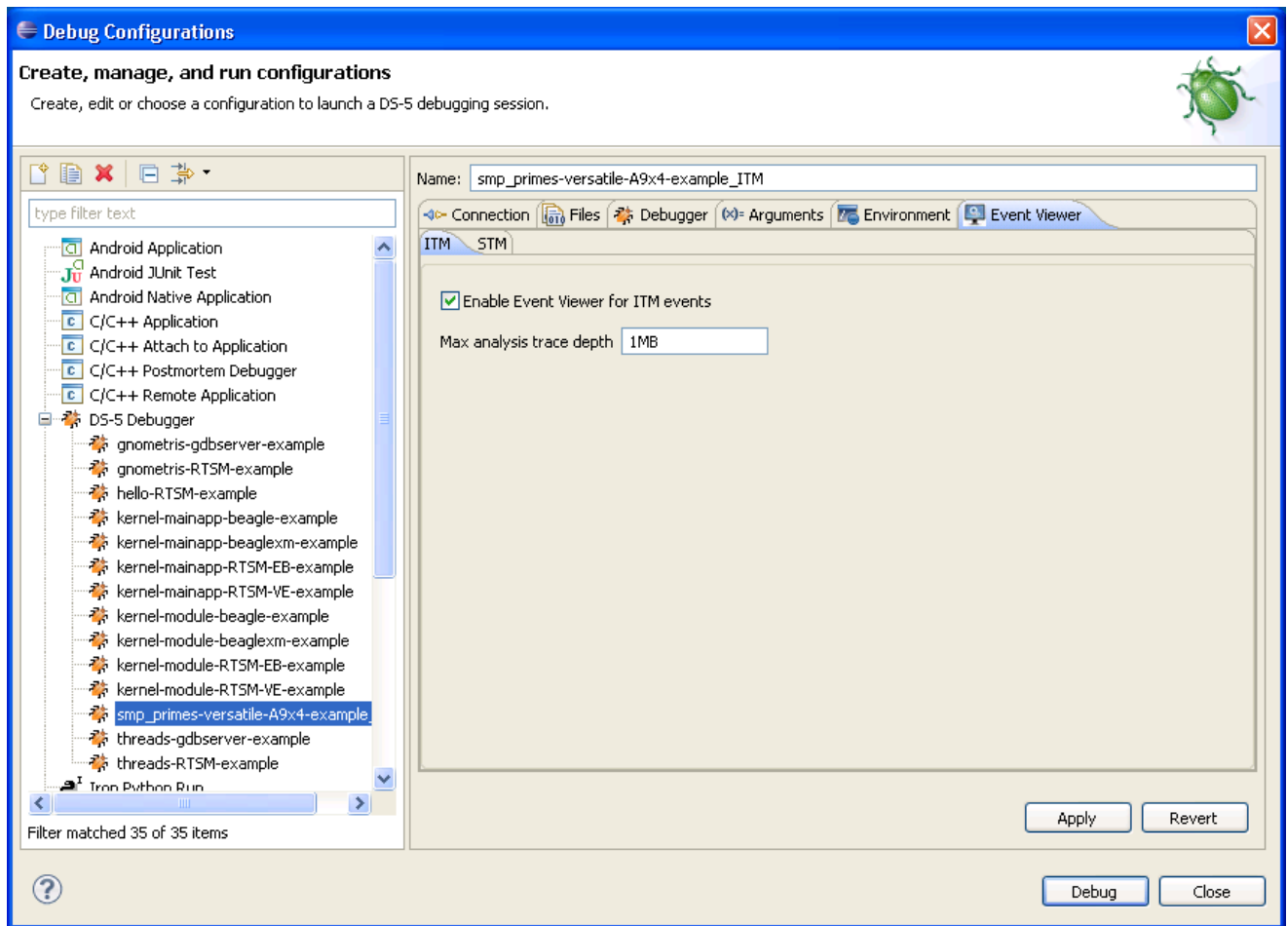


Figure 10-44 Event Viewer configuration

10.42 DTSL Configuration Editor dialog box

Describes the dialog box content.

The *Debug and Trace Services Layer* (DTSL) configuration editor enables you to configure additional debug and trace settings. The available configuration options depend on the capabilities of the target, and typically enable configuration of the trace collection method and the trace that is generated. A typical set of configuration options might include:

- Trace capture method** Select the collection method that you want to use for this debug configuration. The available trace collection methods depend on the target and trace capture unit but can include *Embedded Trace Buffer* (ETB)/*Micro Trace Buffer* (MTB) (trace collected from an on-chip buffer) or *DSTREAM* (trace collected from the DSTREAM trace buffer). If no trace collection method is selected then no trace can be collected, even if the trace capture for processors and *Instruction Trace Macrocell* (ITM) are enabled.
- Enable core trace** Enable or disable trace collection. If enabled then the following options are available:
 - Enable core *n* trace** Specify trace capture for specific processors.
 - Cycle accurate** Enable or disable cycle accurate trace.
 - Trace capture range** Specify an address range to limit the trace capture.
- Enable ITM trace** Enable or disable trace collection from the ITM unit.

Named DTSL configuration profiles can be saved for later use.

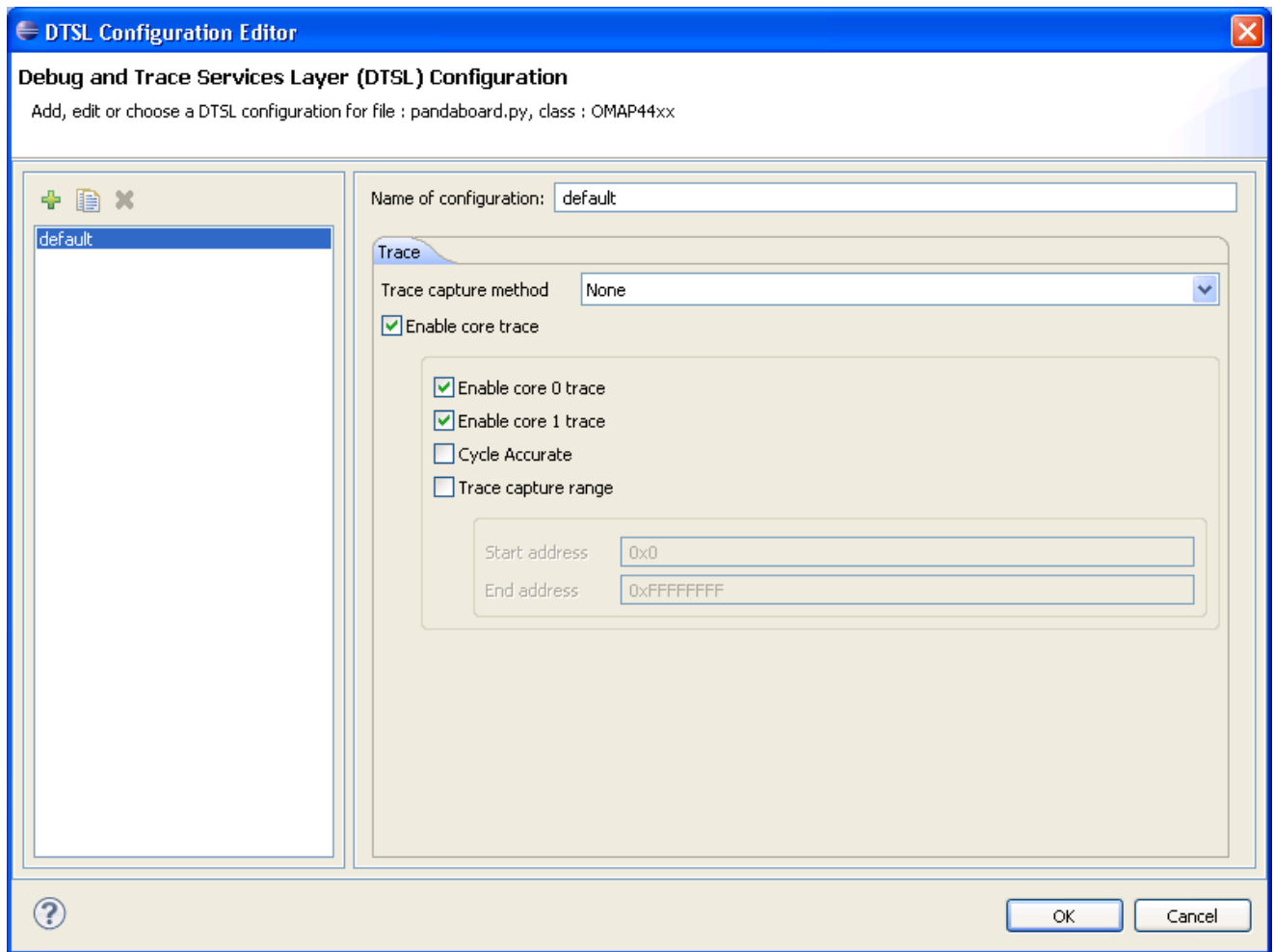


Figure 10-45 DTSL configuration editor

10.43 Configuration database panel

Describes the dialog box content.

This panel enables you to manage the configuration database settings.

Default Target Database

Provides you with the default DS-5 configuration databases.

———— **Note** ————

ARM recommends that you do not disable these.

User Target Database

Enables you to add your own configuration database.

Add...

Opens a dialog box where you can select the new configuration database folder.

Edit

Opens a dialog box where you can modify the existing name and location for the selected configuration database.

Remove

Removes the selected configuration database.

Up

Moves the selected configuration database up the list.

Down

Moves the selected configuration database down the list.

———— **Note** ————

Databases process from top to bottom with information in the lower databases replacing information in higher databases. For example, if you produced a modified core definition with different registers, you would add it to the database at the bottom of the list so that the database uses it instead of the core definitions in the shipped database.

Rebuild database...

Rebuild the configuration database.

Restore Defaults

Removes all the configuration databases from the field text that do not belong to the DS-5 default system.

Apply

Saves the current configuration database configuration settings.

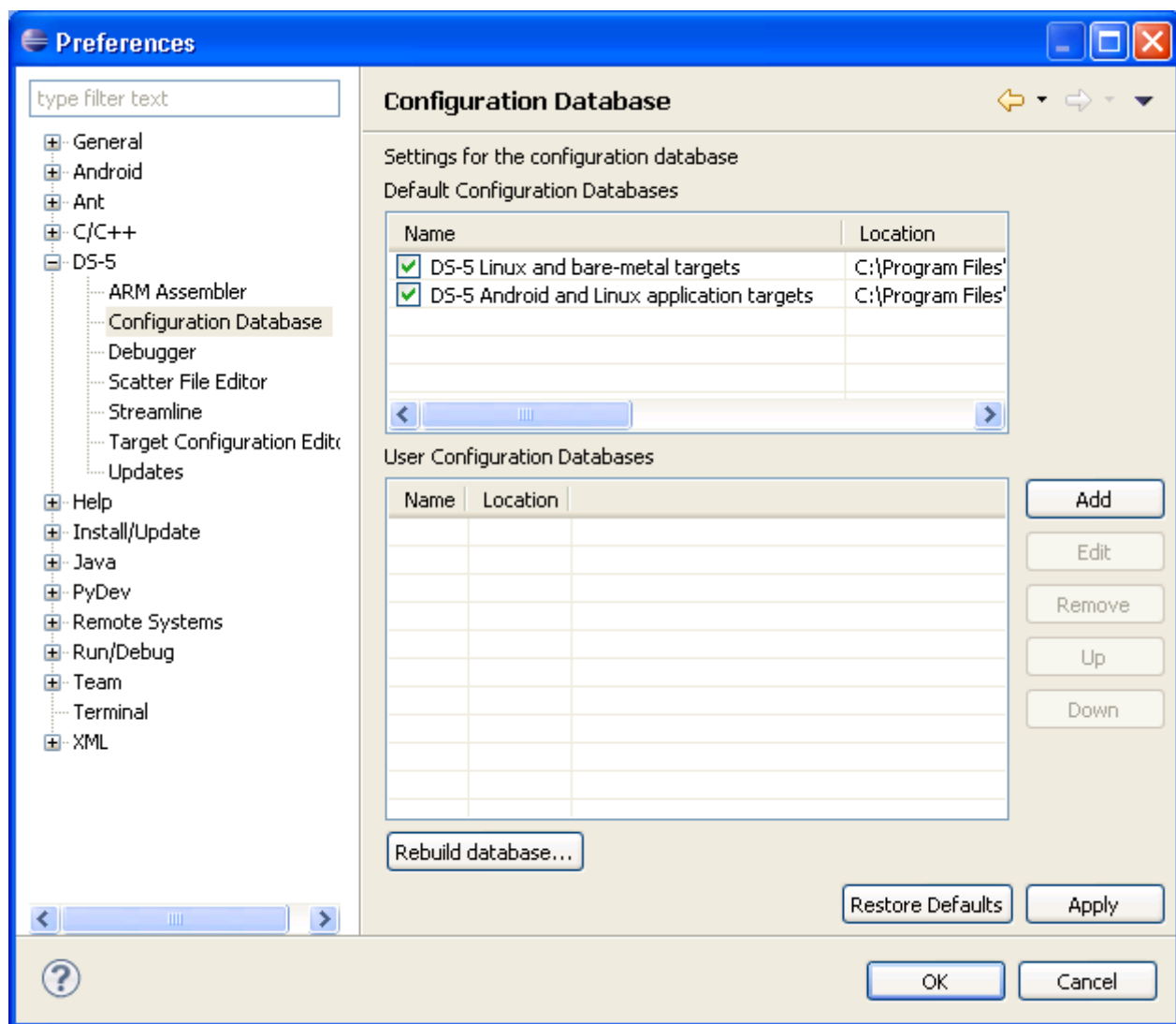


Figure 10-46 Configuration Database panel

Related Concepts

About the target configuration import utility on page 37.

Related Tasks

Adding a new platform on page 39.

Adding a new configuration database to DS-5 on page 41.

10.44 About the Remote System Explorer

Describes the tab content.

The *Remote Systems Explorer* (RSE) enables you to:

- set up Linux SSH connections to remote targets using TCP/IP
- create, copy, delete, and rename resources
- set the read, write, and execute permissions for resources
- edit files by double-clicking to open in the C/C++ editor view
- execute commands on the remote target
- view and kill running processes
- transfer files between the host workstation and remote targets
- launch terminal views.

Useful RSE views that can be added to the DS-5 Debug perspective are:

- Remote Systems
- Remote System Details
- Remote Scratchpad
- Terminals.

To add a view to the DS-5 Debug perspective:

1. Ensure that you are in the DS-5 perspective. You can change perspective by using the perspective toolbar or you can select **Window > Open perspective** from the main menu.
2. Select **Window > Show View > Other...** to open the Show View dialog box.
3. Select the required view from the **Remote Systems** group.
4. Click **OK**.

10.45 Remote Systems view

Describes the tab content.

This hierarchical tree view enables you to:

- set up a Linux connection to a remote target using the *Secure SHell* (SSH) protocol
- access resources on the host workstation and remote targets
- display a selected file in the C/C++ editor view
- open the **Remote System Details** view and show the selected connection configuration details in a table
- open the **Remote Monitor view** and show the selected connection configuration details
- import and export the selected connection configuration details
- connect to the selected target
- delete all passwords for the selected connection
- open the Properties dialog box and display the current connection details for the selected target.

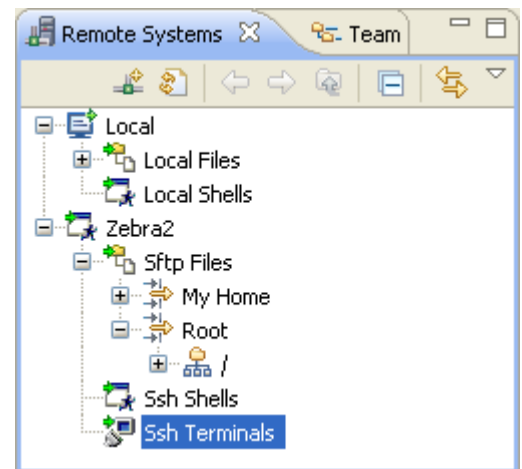


Figure 10-47 Remote Systems view

10.46 Remote System Details view

Describes the tab content.

This tabular view enables you to:

- set up a Linux connection to a remote target using the *Secure SHell* (SSH) protocol
- access resources on the host workstation and remote targets
- display a selected file in the C/C++ editor view
- open the **Remote Systems** view and show the selected connection configuration details in a hierarchical tree
- open the **Remote Monitor** view and show the selected connection configuration details
- import and export the selected connection configuration details
- connect to the selected target
- delete all passwords for the selected connection
- open the Properties dialog box and display the current connection details for the selected target.

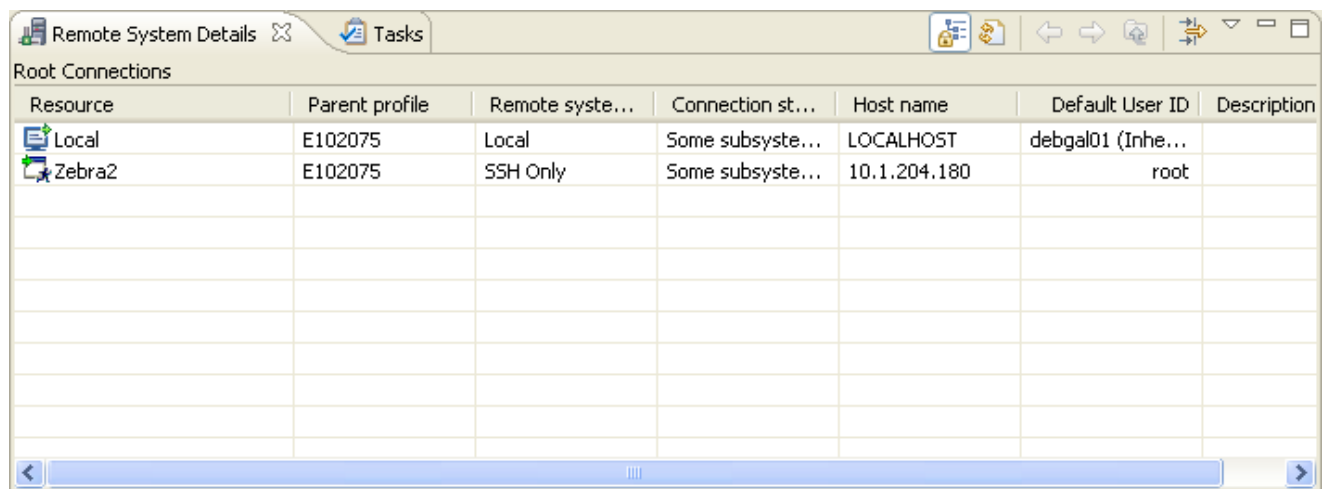


Figure 10-48 Remote System Details view

The **Remote System Details** view is not visible by default. To add this view:

1. Select **Window > Show View > Other...** to open the Show View dialog box.
2. Expand the **Remote Systems** group and select **Remote System Details**.
3. Click **OK**.

10.47 Target management terminal for serial and SSH connections

Describes the tab content.

The target management terminal enables you to enter shell commands directly on the target without launching any external application. For example you can browse remote files and folders by entering the `ls` or `pwd` commands in the same way as you would in a Linux terminal.

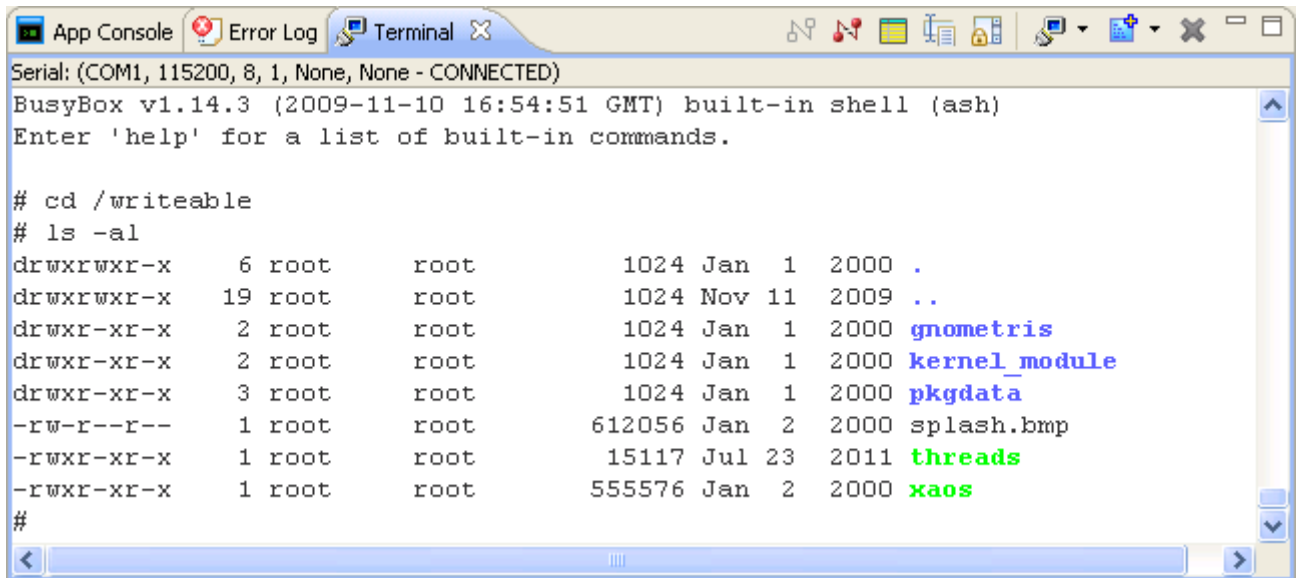


Figure 10-49 Terminal view

The **Terminal** view is not visible by default. To add this view:

1. Select **Window > Show View > Other...** to open the Show View dialog box.
2. Expand the **Terminal** group and select **Terminal**
3. Click **OK**.
4. In the **Terminal** view, click on the **Settings**
5. Select the required connection type.
6. Enter the appropriate information in the Settings dialog box
7. Click **OK**.

Related Tasks

[Configuring a connection to a Linux target using gdbserver on page 29.](#)

[Configuring a connection to a Linux Kernel on page 31.](#)

10.48 Remote Scratchpad view

Describes the tab content.

The **Remote Scratchpad** view is an electronic clipboard where you can copy and paste or drag and drop useful files and folders into this view for use at a later point in time. This enables you to keep a list of resources from any connection in one place.

———— **Note** —————

Be aware that although the scratchpad only shows links, any changes made to a linked resource also changes it in the original file system.

—————

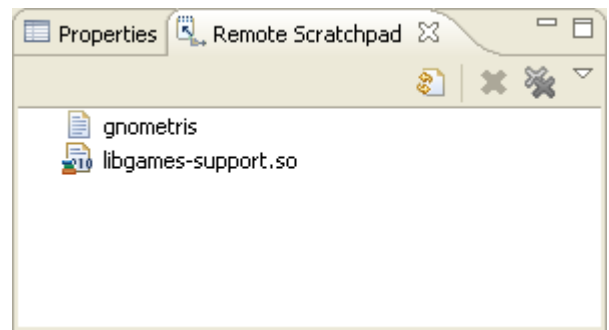


Figure 10-50 Remote Scratchpad

The **Remote Scratchpad** view is not visible by default. To add this view:

1. Select **Window > Show View > Other...** to open the Show View dialog box.
2. Expand the **Remote Systems** group and select **Remote Scratchpad**.
3. Click **OK**.

10.49 Remote Systems terminal for SSH connections

Describes the tab content.

The Remote Systems terminal enables you to enter shell commands directly on the target without launching any external application. For example you can browse remote files and folders by entering the `ls` or `pwd` commands in the same way as you would in a Linux terminal.

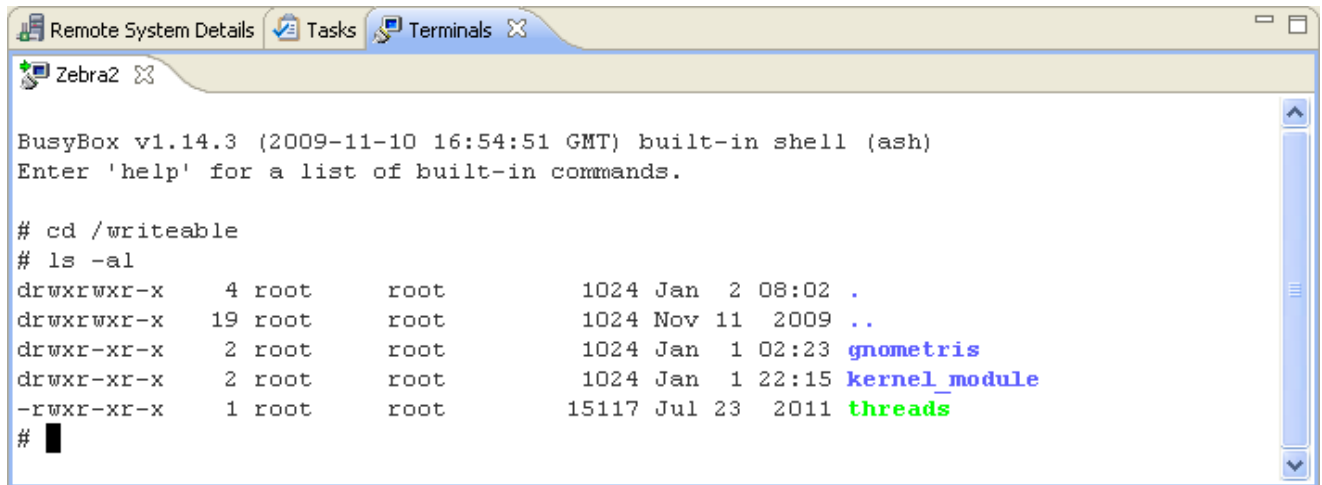


Figure 10-51 Remote Systems Terminals view

The **Terminals** view is not visible by default. To add this view:

1. Select **Window > Show View > Other...** to open the Show View dialog box.
2. Expand the **Remote Systems** group and select **Remote Systems**.
3. Click **OK**.
4. In the **Remote Systems** view:
 - a. Click on the toolbar icon **Define a connection to a remote system** and configure an *Secure SHell* (SSH) connection to the target.
 - b. Right-click on the connection and select **Connect** from the context menu.
 - c. Enter the User ID and password in the relevant fields.
 - d. Click **OK** to connect to the target.
 - e. Right-click on **Ssh Terminals**.
5. Select **Launch Terminal** to open a terminal shell that is connected to the target.

10.50 New Terminal Connection dialog box

Describes the dialog box content.

The dialog box enables you to:

- change the view title
- select the connection type
- set the connection settings.

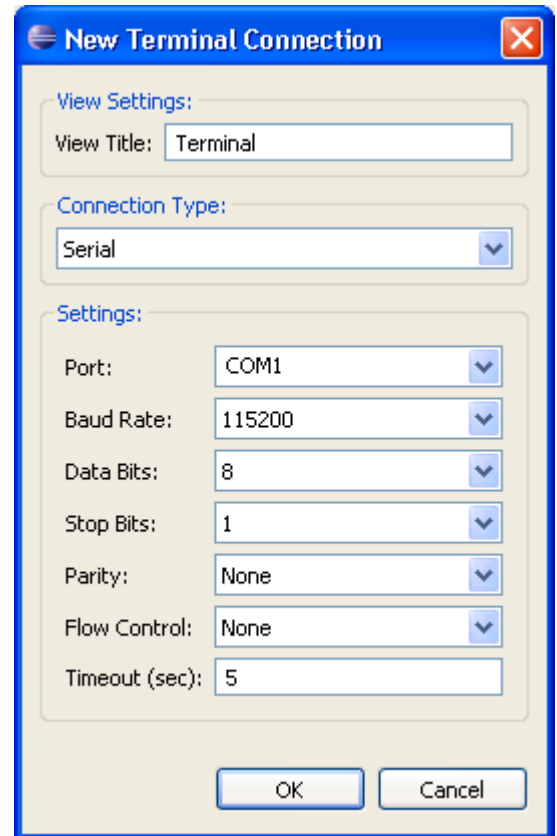


Figure 10-52 Terminal Settings dialog box

View Settings	Enables you to give a name to the Terminal view.
View Title	Enter a name for the Terminal view.
Connection Type	Specifies a connection type. Either Serial or <i>Secure SHell</i> (SSH).
Settings	Enables you to configure the connection settings.
Port	Specifies the port that the target is connected to.
Baud Rate	Specifies the connections baud rate.
Data Bits	Specifies the number of data bits.
Stop Bits	Specifies the number of stop bits for each character.

Parity	Specifies the parity type: <ul style="list-style-type: none">• None. This is the default.• Even.• Odd.• Mark.• Space.
Flow Control	Specifies the flow control of the connection: <ul style="list-style-type: none">• None. This is the default.• RTS/CTS.• Xon/Xoff.
Timeout (sec)	Specifies the connections timeout in seconds.

10.51 DS-5 Debugger menu and toolbar icons

Describes the menus and toolbar icons used in the DS-5 Debug perspective.

These tables list the most common menu and toolbar icons available for use with DS-5 Debugger. For information on icons, markers, and buttons not listed in the following tables, see the standard *Workbench User Guide* or the *C/C++ Development User Guide* in the **Help > Help Contents** window.

If you leave the mouse pointer positioned on a toolbar icon for a few seconds without clicking, a tooltip appears informing you of the purpose of the icon.

Table 10-2 DS-5 Debugger icons
























































Icon	Description	Icon	Description
	Connect to target		Connected to target
	Disconnect from target		Delete connection
	Start application and run to main		Start application and run to entry point
	Run application from entry point		Restart the application
	Continue running application		Stop application
	Step into		Step over
	Step out		Toggle stepping mode
	Collapse all configurations in stack trace		Call stack
	Thread		Process
	Kernel module		Define a new RSE connection
	Refresh the RSE resource tree		Save view contents to a file
	Clear view contents		Switch to History view
	Synchronize view contents		Toggle scroll lock
	Run commands from a script file		Export commands to a script file
	Remove selected breakpoint, watchpoints, or expression (view dependent)		Remove all breakpoints, watchpoints, or expressions (view dependent)
	Display breakpoint location in source file		Deactivate all breakpoints and watchpoints
	Import from a file		Export to a file
	Create new script file or add new expression (view dependent)		Run select script file
	Open selected file for editing		Delete the selected files
	Set display width		Set display format
	Toggle the display of ASCII characters		Toggle freeze mode
	Edit Screen view parameters		Add new Screen view

Table 10-2 DS-5 Debugger icons (continued)

Icon	Description	Icon	Description
	Add new Disassembly view		Add new Variables view
	Add new Registers view		Add new Memory view
	Add new Expression view		Add new Trace view
	Add Functions view		View update in progress
	Toggle trace marker		Show next match
	Show previous match		Show instruction trace
	Show function trace		Toggle navigation resolution
	Toggle the views		







Perspective icons

Table 10-3 Perspective icons

Icon	Description	Icon	Description
	Open new perspective		C/C++ perspective
	DS-5 Debug perspective		Fast view bar

View icons

Table 10-4 View icons

Button	Description	Button	Description
	Display drop-down menu		Synchronize view contents
	Minimize		Maximize
	Restore		Close

View markers

Table 10-5 View markers






































Icon	Description	Icon	Description
	Software breakpoint enabled		Hardware breakpoint enabled
	Access watchpoint enabled		Read watchpoint enabled
	Write watchpoint enabled		Software breakpoint disabled
	Hardware breakpoint disabled		Access watchpoint disabled
	Read watchpoint disabled		Write watchpoint disabled

Table 10-5 View markers (continued)

Icon	Description	Icon	Description
	Software breakpoint pending		Hardware breakpoint pending
	Access watchpoint pending		Read watchpoint pending
	Write watchpoint pending		Software breakpoint disconnected
	Hardware breakpoint disconnected		Access watchpoint disconnected
	Read watchpoint disconnected		Write watchpoint disconnected
	Multiple-statement software breakpoint enabled		Multiple-statement software breakpoint disabled
	Error		Current location
	Warning		Bookmark
	Information		Task
	Search result		

Miscellaneous icons

Table 10-6 Miscellaneous icons

Icon	Description	Icon	Description
	Open a new resource wizard		Open new project wizard
	Open new folder wizard		Open new file wizard
	Open search dialog box		Display context-sensitive help
	Open import wizard		Open export wizard

Chapter 11

Troubleshooting

Describes how to diagnose problems when debugging applications using DS-5 Debugger. It contains the following:

- *ARM Linux problems and solutions on page 11-292.*
- *Enabling internal logging from the debugger on page 11-293.*
- *Target connection problems and solutions on page 11-294.*

11.1 ARM Linux problems and solutions

Lists possible problems when debugging a Linux application.

You might encounter the following problems when debugging a Linux application.

ARM Linux permission problem

If you receive a permission denied error message when starting an application on the target then you might have to change the execute permissions on the application. :

```
chmod +x myImage
```

A breakpoint is not being hit

You must ensure that the application and shared libraries on your target are the same as those on your host. The code layout must be identical, but the application and shared libraries on your target do not require debug information.

Operating system support is not active

When Operating System (OS) support is required, the debugger activates it automatically where possible. If OS support is required but cannot be activated, the debugger produces an error. :

```
ERROR(CMD16-LKN36):
! Failed to load image "gator.ko"
! Unable to parse module because the operating system support is not active
```

OS support cannot be activated if:

- debug information in the `vmlinux` file does not correctly match the data structures in the kernel running on the target
- it is manually disabled by using the `set os enabled off` command.

To determine whether the kernel versions match:

- stop the target after loading the `vmlinux` image
- enter the `print init_nsproxy.uts_ns->name` command
- verify that the `$1` output is correct. :

```
$1 = {sysname = "Linux", nodename = "(none)", release = "3.4.0-rc3",
version = "#1 SMP Thu Jan 24 00:46:06 GMT 2013", machine = "arm",
domainname = "(none)"}
```

Related Tasks

[Configuring a connection to a Linux target using `gdbserver` on page 29.](#)

[Configuring a connection to a Linux Kernel on page 31.](#)

11.2 Enabling internal logging from the debugger

Describes how to enable internal logging to help diagnose error messages.

On rare occasions an internal error might occur causing the debugger to generate an error message suggesting that you report it to your local support representatives. You can help to improve the debugger by giving feedback with an internal log that captures the stacktrace and shows where in the debugger the error occurs. To obtain the current version of DS-5, you can select **About ARM DS-5** from the **Help** menu in Eclipse or open the product release notes.

To enable internal logging within Eclipse, enter the following in the Commands view of the **DS-5 Debug** perspective:

1. To enable the output of logging messages from the debugger using the predefined DEBUG level configuration:

```
log config debug
```

2. To redirect all logging messages from the debugger to a file:

```
log file debug.Log
```

———— **Note** —————

Enabling internal logging can produce very large files and slow down the debugger significantly. Only enable internal logging when there is a problem.

Related References

[Feedback on page 13.](#)

[Commands view on page 192.](#)

[Controlling the output of logging messages on page 149.](#)

11.3 Target connection problems and solutions

Lists possible problems when connecting to a target.

Failing to make a connection

The debugger might fail to connect to the selected debug target because of the following reasons:

- you do not have a valid license to use the debug target
- the debug target is not installed or the connection is disabled
- the target hardware is in use by another user
- the connection has been left open by software that exited incorrectly
- the target has not been configured, or a configuration file cannot be located
- the target hardware is not powered up ready for use
- the target is on a scan chain that has been claimed for use by something else
- the target hardware is not connected
- you want to connect through gdbserver but the target is not running **gdbserver**
- there is no ethernet connection from the host to the target
- the port number in use by the host and the target are incorrect

Check the target connections and power up state, then try and reconnect to the target.

Debugger connection settings

When debugging a bare-metal target the debugger might fail to connect because of the following reasons:

- **Heap Base** address is incorrect
- **Stack Base** (top of memory) address is incorrect
- **Heap Limit** address is incorrect
- Incorrect vector catch settings.

Check that the memory map settings are correct for the selected target. If set incorrectly, the application might crash because of stack corruption or because the application overwrites its own code.

Related Tasks

[Configuring a connection to a Linux target using gdbserver on page 29.](#)

[Configuring a connection to a Linux Kernel on page 31.](#)