Arm[®] DS-5 Community Edition

Getting Started Guide



Arm[®] DS-5 Community Edition

Getting Started Guide

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Preface

This preface introduces the Arm® DS-5 Community Edition Getting Started Guide.

It contains the following:

• *About this book* on page 9.

About this book

This book gives an overview of Arm[®] DS-5 Community Edition. It describes the installation and system requirements. It also explains how to work with examples provided with DS-5 Community Edition.

Using this book

This book is organized into the following chapters:

Chapter 1 Arm[®] DS-5 Community Edition Product Overview

Gives an overview of the main features of Arm DS-5 Community Edition.

Chapter 2 Arm[®] DS-5 Community Edition installation and system requirements

This chapter provides information on the installation and system requirements for Arm DS-5 Community Edition.

Chapter 3 Working with Arm® DS-5 Community Edition

This chapter explains how to run and debug applications using Arm DS-5 tools. It also provides information about the examples and documentation provided with DS-5 Community Edition.

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

italic

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.

monospace

Denotes text that you can enter at the keyboard, such as commands, file and program names, and source code.

<u>mono</u>space

Denotes a permitted abbreviation for a command or option. You can enter the underlined text instead of the full command or option name.

monospace italic

Denotes arguments to monospace text where the argument is to be replaced by a specific value.

monospace bold

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:

MRC p15, 0, <Rd>, <CRn>, <CRm>, <Opcode_2>

SMALL CAPITALS

Used in body text for a few terms that have specific technical meanings, that are defined in the *Arm*[®] *Glossary*. For example, IMPLEMENTATION DEFINED, IMPLEMENTATION SPECIFIC, UNKNOWN, and UNPREDICTABLE.

Feedback

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If you have any comments or suggestions about this product, contact your supplier and give:

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- The product revision or version.
- An explanation with as much information as you can provide. Include symptoms and diagnostic procedures if appropriate.

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Other information

- Arm[®] Developer.
- Arm[®] Information Center.
- Arm[®] Technical Support Knowledge Articles.
- Technical Support.
- Arm[®] Glossary.

Chapter 1 Arm[®] DS-5 Community Edition Product Overview

Gives an overview of the main features of Arm DS-5 Community Edition.

It contains the following sections:

- 1.1 About DS-5 Community Edition on page 1-12.
- *1.2 About Eclipse for DS-5* on page 1-13.
- *1.3 About DS-5 Debugger* on page 1-14.
- 1.4 About Fixed Virtual Platform (FVP) Models on page 1-15.
- 1.5 About Arm[®] Streamline Performance Analyzer on page 1-16.
- 1.6 Debug options supported by DS-5 Community Edition on page 1-17.

1.1 About DS-5 Community Edition

DS-5 Community Edition is a free software development solution based on our professional tool chain.

It provides support for:

- Linux-based application development on a target platform of your choice.
- Bare-metal or Linux kernel development on one of two Fixed Virtual Platform (FVP) model targets, one based on the Armv7-A architecture and one on the Armv8-A architecture.

It includes:

- Eclipse for DS-5, is an *Integrated Development Environment* (IDE) that combines the Eclipse IDE from the Eclipse Foundation with the debug technology of the Arm tools.
- DS-5 Debugger, a graphical debugger supporting software development on Arm processor-based targets and *Fixed Virtual Platform* (FVP) targets.
- *Fixed Virtual Platform* (FVP) model targets for architectures Armv7-A and Armv8-A, enabling development of software without the requirement for actual hardware.
- Arm Streamline, a graphical performance analysis tool.
- Dedicated examples, applications, and supporting documentation to help you get started with using the DS-5 tools.

Some third-party compilers are compatible with DS-5. For example, the GNU Compiler tools enable you to compile bare-metal, Linux kernel, and Linux applications for Arm targets.

Related reference

2.1 System requirements on page 2-19

- 2.2 Installing DS-5 Community Edition on page 2-20
- 2.3 Installation directories on page 2-21
- 3.1 Documentation provided with DS-5 on page 3-23
- 3.2 Examples provided with DS-5 Community Edition on page 3-24

Related information

DS-5 Developer Resources

1.2 About Eclipse for DS-5

Eclipse for DS-5 is an *Integrated Development Environment* (IDE) that combines the Eclipse IDE from the Eclipse Foundation with the compilation and debug technology of the Arm tools.

It includes:

Project manager

The project manager enables you to perform various project tasks such as adding or removing files and dependencies to projects, importing, exporting, or creating projects, and managing build options.

Editors

Editors enable you to read, write, or modify C/C++ or Arm assembly language source files.

Perspectives and views

Perspectives provide customized views, menus, and toolbars to suit a particular type of environment. DS-5 uses the C/C++, DS-5 Debug, and DS-5 Configuration perspectives. To switch perspectives, from the main menu, select Window > Open Perspective.

Related tasks

3.3 Importing the example projects into Eclipse on page 3-25 Building the gnometris project from Eclipse **Related information** Eclipse for Arm DS-5 User Guide

1.3 About DS-5 Debugger

DS-5 Debugger, a graphical debugger supporting software development on Arm processor-based targets and *Fixed Virtual Platform* (FVP) targets.

It makes it easy to debug bare-metal and Linux applications with comprehensive and intuitive views, including synchronized source and disassembly, call stack, memory, registers, expressions, variables, threads, and breakpoints.

Using the **Debug Control** view, you can single-step through applications at source-level or instructionlevel and see the other views update as the code is executed. Setting breakpoints or watchpoints can assist you by stopping the application and enabling you to explore the behavior of the application.

You can also debug using the DS-5 Command Prompt command-line console.

Related tasks

3.8 Debugging Gnometris on page 3-38

1.4 About Fixed Virtual Platform (FVP) Models

Fixed Virtual Platform (FVP) targets enable development of software without the requirement for actual hardware. The functional behavior of a *Fixed Virtual Platform* (FVP) is equivalent to real hardware from a programmer's view.

When using a *Fixed Virtual Platform* (FVP), absolute timing accuracy is sacrificed to achieve fast simulated execution speed. This means that you can use a model for confirming software functionality, but you must not rely on the accuracy of cycle counts, low-level component interactions, or other hardware-specific behavior.

DS-5 Community Edition provides a single-core Cortex®-A9 and a Foundation Platform model executable.

The executables are located in <tools_directory>. You can use them to run your applications from either the command-line or within Eclipse. See 2.3 Installation directories on page 2-21 for more information about various directories that are installed with DS-5.

1.5 About Arm[®] Streamline Performance Analyzer

Arm Streamline is a graphical performance analysis tool that enables you to transform sampling data and system trace into reports that present the data in both visual and statistical forms.

Streamline uses hardware performance counters with kernel metrics to provide an accurate representation of system resources.

Related tasks

3.9 Performance analysis of the threads application running on Arm® Linux on page 3-39

1.6 Debug options supported by DS-5 Community Edition

DS-5 Community Edition supports various debug options.

Debug adapters vary in complexity and capability but, combined with software debug agents, they provide high-level debug functionality for the target that is being debugged, for example:

- Reading/writing registers.
- Setting breakpoints.
- Reading from memory.
- Writing to memory.

Supported debug connections include:

- CADI (debug interface for models).
- Ethernet to gdbserver.

Chapter 2 Arm[®] DS-5 Community Edition installation and system requirements

This chapter provides information on the installation and system requirements for Arm DS-5 Community Edition.

It contains the following sections:

- 2.1 System requirements on page 2-19.
- 2.2 Installing DS-5 Community Edition on page 2-20.
- 2.3 Installation directories on page 2-21.

2.1 System requirements

To install and use DS-5 Community Edition, your workstation must have a minimum specification of a dual core x86 2GHz processor (or equivalent) and 2GB of RAM.

To improve performance when debugging large images, using models with large simulated memory maps, or when using Arm Streamline Performance Analyzer, 4GB of RAM, or more is recommended.

A full installation also requires approximately 1GB of hard disk space.

Host platform requirements

DS-5 Community Edition is supported on the following host platforms and service packs.

- Windows 10
- Windows 7 with Service Pack 1
- Red Hat Enterprise Linux 6 Workstation
- Red Hat Enterprise Linux 7 Workstation
- Ubuntu Desktop Edition 14.04 LTS
- Ubuntu Desktop Edition 16.04 LTS

----- Note -----

DS-5 is supported on 64-bit x86 host platforms only.

Debug system requirements

Linux application debug requires gdbserver on your target. The recommended version of gdbserver is 7.0 or later.

— Note —

DS-5 Debugger is unable to provide reliable multi-threaded debug support with gdbserver versions prior to 6.8.

DS-5 support for Linux application debug depends on infrastructure and features that are introduced in specific kernel versions:

- DS-5 Debugger supports debugging Arm Linux kernel versions 2.6.28 and later.
- Application debug on *Symmetric MultiProcessing* (SMP) systems requires Arm Linux kernel version 2.6.36 or later.
- Access to VFP and NEON registers require Arm Linux kernel version 2.6.30 or later and gdbserver version 7.0 or later.
- Arm Streamline Performance Analyzer supports Arm Linux kernel versions 3.4 and later.

2.2 Installing DS-5 Community Edition

You can install DS-5 Community Edition on 64-bit Windows and Linux platforms.

Installing on Linux

To install DS-5 on Linux, run (not source) install.sh and follow the on-screen instructions.

On Linux, you can use suite_exec to configure the environment variables correctly for DS-5. For example, run *DS-5_install_directory/bin/suite_exec <shell>* to open a shell with the PATH and other environment variables correctly configured. Run suite_exec with no arguments for more help.

Installing on Windows

To install DS-5 on Windows, run setup.exe and follow the on-screen instructions.

Command-line installation on Windows

Command-line installation and uninstallation are possible on Windows by opening a command prompt, with administrative privileges, and running Microsoft's installer, msiexec.exe. You must provide the location of the .msi file as an argument to msiexec. You can get a full list of options for using msiexec by running msiexec /? on the command-line. An example of how to install DS-5 using msiexec is:

msiexec.exe /i installer_location\data\install.msi EULA=1 /qn /l*v install.log

Where:

/i

This option is to perform the installation.

installer_location\data\install.msi

This specifies the full pathname of the .msi file to install.

/EULA=1

This is an Arm specific option. Setting EULA to 1 means you accept the End User License Agreement (EULA). You must read the EULA in the GUI installer before accepting it on the command-line.

/qn

This option specifies quiet mode, so that the installation does not require user interaction.

/l*v install.log

This option specifies the log file to log all output from the installation.

Related information

Installing the USB drivers for the DSTREAM unit Installing the USB drivers for the DSTREAM-ST unit

2.3 Installation directories

Various directories are installed with DS-5 that contain example code and documentation. The DS-5 documentation refers to these directories as required.

The main installation, examples, and documentation directories are identified in the following table. The *DS-5_install_directory* shown is the default installation directory. The DS-5 version number, *<version>*, is part of the default installation directory name. If you installed the product in a different directory, then the path names are relative to your chosen directory.

Table 2-1 DS-5 default directories

Directory	Windows	Linux
DS-5_install_directory	C:\Program Files\DS-5 CE v <version></version>	~/DS-5_CE_v <version></version>
examples_directory	DS-5_install_directory\examples\	DS-5_install_directory/examples/
tools_directory	DS-5_install_directory\bin\	DS-5_install_directory/bin/

Chapter 3 Working with Arm[®] DS-5 Community Edition

This chapter explains how to run and debug applications using Arm DS-5 tools. It also provides information about the examples and documentation provided with DS-5 Community Edition.

It contains the following sections:

- 3.1 Documentation provided with DS-5 on page 3-23.
- 3.2 Examples provided with DS-5 Community Edition on page 3-24.
- 3.3 Importing the example projects into Eclipse on page 3-25.
- 3.4 Loading the Gnometris application on to an Arm[®] Linux target on page 3-27.
- 3.5 Configuring an RSE connection to work with an Arm[®] Linux target on page 3-28.
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- 3.7 Connecting to the Gnometris application that is already running on an Arm[®] Linux target on page 3-34.
- 3.8 Debugging Gnometris on page 3-38.
- 3.9 Performance analysis of the threads application running on Arm[®] Linux on page 3-39.
- *3.10 About registering a new compiler toolchain* on page 3-41.
- 3.11 Registering a compiler toolchain from Eclipse on page 3-42.
- 3.12 Registering a compiler toolchain from the DS-5 command prompt on page 3-44.
- 3.13 Configuring a compiler toolchain for the DS-5 command prompt on page 3-48.

3.1 Documentation provided with DS-5

DS-5 includes example projects and documentation.

To access the documentation from within DS-5, from the main menu, select **Help** > **Help Contents** and navigate to **Arm DS-5 Documentation**.

Documentation on using the examples is available in *DS-5_install_directory*\examples\docs.

Related information DS-5 Developer Documentation

3.2 Examples provided with DS-5 Community Edition

DS-5 Community Edition provides a selection of examples to help you get started:

- Bare-metal software development examples for Armv7 that illustrate:
 - Compilation with GCC bare-metal compiler.
 - Armv7 bare-metal debug.

The code is located in the archive file <examples_directory>\Bare-metal_examples_Armv7.zip. Bare-metal software development examples for Armv8 that illustrate:

- Compilation with GCC bare-metal compiler.
- Armv8 bare-metal debug.

The code is located in the archive file <examples_directory>\Bare-metal_examples_Armv8.zip.

• Arm Linux examples built with GCC Linux compiler that illustrate build, debug, and performance analysis of simple C/C++ console applications, shared libraries, and multi-threaded applications. These examples run on Arm Linux targets using gdbserver. The files are located in the archive file, <examples_directory>\Linux_examples.zip.

You can extract these examples to a working directory and build them from the command-line, or you can import them into Eclipse using the import wizard. All examples provided with DS-5 contain a preconfigured Eclipse launch script that enables you to easily load and debug example code on a target.

Each example provides instructions on how to build, run, and debug the example code. You can access the instructions from the main index, <examples_directory>\docs\index.html.

3.3 Importing the example projects into Eclipse

To use the example projects provided with DS-5, you must first import them.

Procedure

- 1. Launch Eclipse:
 - On Windows, select Start > All Programs > Arm DS-5 > Eclipse for DS-5.
 - On Linux, enter eclipse in the Unix bash shell.
- 2. Arm recommends that you create a workspace for example projects so that they remain separate from your own projects. To do this, you can either:
 - Create a workspace directory during the startup of Eclipse.
 - If Eclipse is already open, select File > Switch Workspace > Other from the main menu.
- 3. In the main menu, select **File** > **Import...**.
- 4. Expand the **DS-5** group.
- 5. Select Examples and Programming Libraries and click Next.

Figure 3-1 Import DS-5 Examples and Programming Libraries

6. Select the examples and programming libraries you want to import. If descriptions exist for examples, you can view it in the **Description** pane.

3 Working with Arm[®] DS-5 Community Edition 3.3 Importing the example projects into Eclipse

Import Examples and Programming Libraries	\times
Import DS-5 Examples and Programming Libraries Select DS-5 examples & programming libraries to import in to current	
workspace	
type filter text]
 Examples Armv7 Bare-Metal Armv8 Bare-Metal Elinux Applications gnometris hello_linux threads_v7A threads_v8A xaos Streamline Linux Examples 	
Description DS-5 provides tools that support Arm Linux application development and debug, including shared libraries. This example, based on the "Gnometris" game, illustrates su support. Working sets	ıch
Add project to working sets New	
Working sets: VSelect	
? < <u>B</u> ack <u>N</u> ext > <u>F</u> inish Cance	

Figure 3-2 Select DS-5 Examples and Programming Libraries

- 7. If necessary, select Add project to working sets to add projects to a working set.
- 8. Click Finish.

You can browse the imported examples in the **Project Explorer**.

Each example contains a readme.html which explains how you can work with each example.

3.4 Loading the Gnometris application on to an Arm[®] Linux target

You can load the Gnometris application on to a target that is running Arm Linux. DS-5 provides preconfigured target connection settings that connect the debugger to gdbserver running on supported Arm architecture-based platforms.

Procedure

- 1. Obtain the IP address of the target. You can use the ifconfig application in a Linux console. The IP address is denoted by the **inet addr**.
- 2. Boot the appropriate Linux distribution on the target.
- 3. Launch Eclipse.
- 4. Transfer the application and related files to the Arm Linux target, run the application, and then connect the debugger. There are several ways to do this:
 - Use a *Secure SHell* (SSH) connection with the *Remote System Explorer* (RSE) provided with DS-5 to set up the target and run the application. When the application is running you can then connect the debugger to the running target.
 - Use an external file transfer utility such as PuTTY.

3.5 Configuring an RSE connection to work with an Arm[®] Linux target

On some targets, you can use a *Secure SHell* (SSH) connection with the *Remote System Explorer* (RSE) provided with DS-5.

Procedure

- 1. In the **Remote Systems** view, click the **Define a connection to remote system** option on the toolbar.
- 2. In the Select Remote System Type dialog box, expand the General group and select SSH Only.

New Connection	
Select Remote System Type Connection for SSH access to remote systems	_6_
System type:	
type filter text	
▲ 🗁 General the FTP Only The SSH Only	
? < Back Next > Fi	nish Cancel

Figure 3-3 Selecting a connection type

- 3. Click Next.
- 4. In **Remote SSH Only System Connection**, enter the remote target IP address or name in the **Host name** field.

3 Working with Arm® DS-5 Community Edition 3.5 Configuring an RSE connection to work with an Arm® Linux target

New Connection					
Remote SSH Only System Connection					
Define connection inform	nation				
Parent profile:	E107767	•			
Host name:	10.2.195.169	-			
Connection name:	10.2.195.169				
Description:					
Verify host name					
Configure proxy settings					
?	< <u>B</u> ack Next > <u>F</u> inish	Cancel			

5. Click Next.

- Figure 3-4 Enter connection information
- 6. Verify if the Sftp Files Configuration and Available Services are what you require.

New Connection						
Sftp Files						
Define subsystem information						
Configuration	Properties					
✓ ssh.files	Property	Value				
Available Services Available Service Ssh / Sftp File Service SSH Connector Service SSH Settings						
Description						
Description Access a remote file system via Ssh / Sftp protocol						
(?) < <u>B</u> ack	<u>N</u> ext >	<u> </u>	Cancel			

- 7. Click Next.
- 8. Verify if the Ssh Shells Configuration and Available Services are what you require.

Figure 3-5 Sftp Files options

3 Working with Arm® DS-5 Community Edition 3.5 Configuring an RSE connection to work with an Arm® Linux target

Figure 3-6 Defining the shell services

New Connection					
Ssh Shells					
Define subsystem information					
Configuration	Properties				
✓ ssh.shells	Property	Value			
Available Services	J				
 					
Description					
Work with shells and commands on remote systems using the Secure Shell (ssh) protocol.					
? < Back	Next >	Finish Cancel			

9. Click Next.

10. Verify if the Ssh Terminals Configuration and Available Services are what you require.

3 Working with Arm® DS-5 Community Edition 3.5 Configuring an RSE connection to work with an Arm® Linux target

New Connection		- • •
Ssh Terminals		
Define subsystem information		
Configuration	Properties	
✓ ssh.terminals	Property	Value
Available Services		
SSH Connector Service SSH Settings		
Description		
Work with terminals and commands	on remote systems usir	ng the Secure Shell (ssh) protocol.
? < Back	Next >	Finish Cancel

Figure 3-7 Defining the terminal services

11. Click Finish.

12. In the Remote Systems view:

- a. Right-click on the target and select **Connect** from the context menu.
- b. In the Enter Password dialog box, enter a UserID and Password if required.
- c. Click **OK** to close the dialog box.

Your SSH connection is now set up. You can copy any required files from the local file system on to the target file system. You can do this by dragging and dropping the relevant files in the **Remote Systems** view.

3.6 Launching gdbserver with an application

To launch gdbserver with the application:

Procedure

- 1. Open a terminal shell that is connected to the target.
- 2. In the Remote Systems view, right-click on Ssh Terminals.
- 3. Select Launch Terminal to open a terminal shell.
- 4. In the terminal shell, navigate to the directory where you copied the application, then execute the required commands.

For example, to launch Gnometris:

```
export DISPLAY=ip:0.0
gdbserver :port gnometris
```

where:

ip

is the IP address of the host to display the Gnometris game

port

is the connection port between gdbserver and the application, for example 5000.

------ Note ------

If the target has a display connected to it then you do not need to use the export DISPLAY command.

3.7 Connecting to the Gnometris application that is already running on an Arm[®] Linux target

Describes how to connect to the Gnometris application that is already running on an Arm Linux target.

Prerequisites

- *gdbserver* and the Gnometris application running on the target and awaiting a connection on the appropriate port.
- The Gnometris application files available in your host workspace.

Procedure

- 1. Select **Debug Configurations...** from the **Run** menu.
- 2. Select **DS-5 Debugger** from the configuration tree and then click on **New** to create a new configuration. Alternatively you can select an existing DS-5 Debugger configuration and then click on **Duplicate** from the toolbar.
- 3. In the Name field, enter a suitable name for the new configuration.
- 4. Click on the **Connection** tab and:
 - a. In the Select target panel, browse and select Linux Application Debug > Connections via gdbserver > Connect to already running application.
 - b. In the **Connections** panel, enter the TCP **Address** and **Port** details of the *gdbserver* running on the target system.

Debug Configurations		— ×			
Create, manage, and run configurations (2) [Debugger]: Debugging from a symbol or entry point, but no symbol files defined in the Files tab					
Image: Second Secon	Name: gnometris Connection Arguments Connection Arguments Connections Arguments Connections Arguments Connections Arguments Connections Arguments Connections Arguments Connections Arguments Arguments Connections Arguments Arguments Arguments Connections Arguments Argument Argu				
← Ⅲ ► Filter matched 19 of 19 items	Revert App	ly			
?	Debug	lose			

Figure 3-8 Typical connection configuration for Linux application debug

- 5. Click on the **Files** tab and:
 - a. Select **Load symbols from file** and then select the application image containing debug information. For example: H:\workspace\gnometris\gnometris.
 - b. Click Add a new resource to the list to add another file entry.
 - c. Select **Load symbols from file** and then select the shared library that is required by the Gnometris application. For example: H:\workspace\gnometris\libgames-support.so.

Debug Configurations		×
Create, manage, and run configurations Create, edit or choose a configuration to launch a DS-5 debu	igging session.	Ť.
Image: Second Secon	Name: Gnometris Connection i Files Cobugger i S OS Awareness i Arguments i Environment Files Stworkspace.loc/gnometris/informetris/ File System	
Filter matched 19 of 19 items	Apply R	e <u>v</u> ert
0	<u>D</u> ebug	Close

Figure 3-9 Typical file selection for Linux application debug

- 6. Click on the **Debugger** tab, and:
 - a. In the Run control panel, select Debug from symbol.
 - b. Enter **main** in the field provided.
- 7. In the Host working directory panel, select Use default.

Debug Configurations					
Create, manage, and run configurations Create, edit or choose a configuration to launch a DS-5 debu	gging session.				
Image: Second	Name: Gnometris Connection Files Run control Connect only Debug from entry point Run target initialization debugger script (ds / .py) File System Workspace Execute debugger commands Source search directory Paths Source search directory File System Paths Source search directory The System Workspace The System Workspace The System Workspace The System Source search directory The System				
Filter matched 19 of 19 items	Appy neger				
0	Debug Close				

Figure 3-10 Typical debugger settings for Linux application debug

- 8. Click on **Debug** to start the debugger and run to the main() function.
- 9. Debugging requires the DS-5 Debug perspective. If the **Confirm Perspective Switch** dialog box opens, click **Yes** to switch perspective.

3.8 Debugging Gnometris

Debugging the Gnometris application using the example project containing the image binaries and libraries provided with DS-5.

Procedure

- 1. Ensure that you are connected to the target, Gnometris is running, and the debugger is waiting at the main() function.
- 2. In the **Project Explorer** view, open the Gnometris directory to see a list of all the source files.
- 3. Double-click on the file blockops-noclutter.cpp to open the file.
- 4. In the blockops-noclutter.c file, find the line BlockOps::rotateBlock(), and double click in the vertical bar on the left-hand side of the C/C++editor to add a breakpoint. A marker is placed in the vertical bar of the editor and the **Breakpoints** view updates to display the new information.
- 5. Click on Continue in the Debug Control view to continue running the program.
- 6. Start a new Gnometris game on the target. When a block arrives, press the up cursor key to hit the breakpoint.
- 7. Select the **Registers** view to see the values of the registers.
- 8. Select the **Disassembly** view to see the disassembly instructions. You can also double click in the vertical bar on the left-hand side of this view to set breakpoints on individual instructions.
- 9. In the **Debug Control** view, click on **Step Over Source Line** to move to the next line in the source file. All the views update as you step through the source code.

—— Тір —

Select the History view to see a list of all the debugger commands generated during the current debug session. You can select one or more commands and then click on Exports the selected lines as a script to create a script file for future use.

3.9 Performance analysis of the threads application running on Arm[®] Linux

Arm Streamline is a graphical performance analysis tool. It captures a wide variety of statistics about code running on the target and uses them to generate analysis reports. You can use these to identify problem areas at system, process, and thread level, in addition to hot spots in the code.

Prerequisites

This tutorial uses the threads_v7A example application to show how to use Streamline to capture and analyze profiling data from a Linux target. threads_v7A and threads_v8A are two of the Arm Linux application examples that are provided with DS-5.

Before capturing the data, ensure that:

- 1. You have built the threads_v7A application.
- 2. You know the IP address or network name of the target. To find the IP address, you can use the ifconfig application in a Linux console. The IP address is denoted by the **inet addr**.
- 3. The Linux kernel on the target is configured to work with Streamline.
- 4. The gator daemon, gatord, is running on the target. If not, the simplest way to install and run gatord on the target is to use the Setup Target... button in the Connection Browser dialog. The Connection Browser dialog is accessible through the Streamline Data view by clicking on the Browse for a target button.
- 5. SSH and gdbserver are running on the target.

_____ Note -____

- For more information about building and running the threads application on a Linux target see the readme.html supplied in the same directory as the source code for the example.
- For more information about how to configure your target for Streamline, see the Streamline User Guide.

Procedure

- 1. Launch Eclipse for DS-5 and open the **DS-5 Debug** perspective.
- 2. In the **Remote Systems** view, define a connection to the target using the **Define a connection to** remote system button **a**.
- 3. Launch the **Streamline** application.
- 4. Specify the IP address or network name of the target in the **Address** field. Alternatively, use the **Browse for a target** button, as shown in the following screenshot:



Figure 3-11 Streamline Data view

- 5. Click the **Capture & analysis options** button. In the **Program Images** section, select the threads image from the workspace, then select **Save**.
- 6. In Eclipse for DS-5, select **Run** > **Debug configurations...** then select the threads-gdbserver debug configuration. This configuration downloads the application to the target, starts gdbserver on the target and starts executing the application, stopping at main().

- 7. Connect to the target either by clicking on **Debug** in the **Debug Configurations** dialog, or by right clicking on the connection in the **Debug Control** and selecting **Connect to target**.
- The program stops at main(). To start capturing data, switch to the Streamline application and click the Start capture button

 Give the capture file a unique name. The Live view opens in Streamline, displaying the capture data in real time.
- 9. In Eclipse for DS-5, click **Continue** to continue executing the code.
- 10. When the application terminates, stop the capture in Streamline by clicking the **Stop capture and analyze** button **•**.

Streamline automatically analyzes the capture data and produces a report, which it displays in the **Timeline** view, as shown in the following screenshot:



Figure 3-12 Streamline analysis report for the threads application

3.10 About registering a new compiler toolchain

If you want to build projects using a toolchain that is not installed with DS-5, you must first register the toolchain you want to use. You can register toolchains:

- Using the **Preferences** dialog in Eclipse for DS-5.
- Using the add_toolchain utility from the DS-5 Command Prompt.

You might want to register a compiler toolchain if:

- You upgrade your version of DS-5 but you want to use an earlier version of the toolchain that was previously installed.
- You install a newer version or older version of the toolchain without re-installing DS-5.

When you register a toolchain, the toolchain is available for new and existing projects in DS-5.

- Note -

You can only register Arm or GCC toolchains.

3.11 Registering a compiler toolchain from Eclipse

You can register compiler toolchains using the Preferences dialog in Eclipse for DS-5.

Procedure

1. To view the compiler toolchains that DS-5 currently knows about, select **Windows** > **Preferences**. And then select **DS-5** > **Toolchains**.

Preferences		
type filter text	Toolchains	⇔ • ⇔ • •
b General ▲	Add/Edit custom Toolchains	
▷ C/C++	Name	Add
⊿ DS-5	ARM Compiler 5 (DS-5 built-in)	Permaya
ARM Assembler	ARM Compiler 6 (DS-5 built-in)	Kemove
Configuration Datak	GCC 4.x [arm-linux-gnueabihf] (DS-5 built-in)	
Debugger		
General		
Scatter File Editor		
Streamline	Name: ARM Compiler 5 (DS-5 built-in)	
Target Configuration	Path: C:\Program Files\DS-5\sw\ARMCompiler5.05\bi	in
Toolchains	Version: 5	
	Family APM Compiler 5	
▷ Install/Update		
< III +	Restore Defaults	S Apply
?	ОК	Cancel

Figure 3-13 Toolchains Preferences dialog

- 2. To add a toolchain, select Add. This displays the Add a new Toolchain dialog.
- 3. Enter the path to the toolchain binaries that you want to use. Then click **Next** to autodetect the toolchain properties.
- 4. When the toolchain properties have been autodetected, you can select **Finish** to register the toolchain. Alternatively, select **Next** to manually enter or change the toolchain properties, and then select **Finish**.

🖨 Add a new Toolo	hain				
Edit toolchain in	fo				
Family:	ARM Compiler 5 👻				
Version (major):	5				
Version (minor):	3				
Version (patch):					
Version (build):					
Compiler:	armcc.exe				
Assembler:	armasm.exe				
Linker:	armlink.exe				
Archiver:	armar.exe				
Image Converter:	fromelf.exe				
?		< Back	Next >	Finish	Cancel

Figure 3-14 Properties for the new toolchain

You must manually enter the toolchain properties if:

- Note -

- The toolchain properties were not autodetected.
- The family, major version, and minor version of the new toolchain are identical to a toolchain that DS-5 already knows about.
- 5. Select **Apply** from the **Toolchains** preferences dialog. The new toolchain has now been registered into DS-5. You must restart DS-5 before you can use the new toolchain in the DS-5 environment.

3.12 Registering a compiler toolchain from the DS-5 command prompt

Use the add_toolchain utility from the command prompt to register a new toolchain.

To register a toolchain using the DS-5 command prompt:

Procedure

1. Enter add_toolchain *path*, where *path* is the directory containing the toolchain binaries. The utility automatically detects the toolchain properties.

— Note -

- Note ·

By default, the add_toolchain utility is an interactive tool. To use the add_toochain utility as a non-interactive tool, add the --non-interactive option to the command.

For example: add_toolchain C:\ARMCC\5.03\26\ds-win-x86_64-rel\bin --non-interactive



Figure 3-15 Registering a new toolchain

- 2. The utility prompts whether you want to register the toolchain with the details it has detected. If you want to change the details, the utility prompts for the details of the toolchain.
 - The toolchain type must be one of Arm Compiler 4, Arm Compiler 5, Arm Compiler 6, or GCC.
 - The toolchain target only applies to GCC toolchains. It indicates what target platform the GCC toolchain builds for. For example, if your compiler toolchain binary is named arm-linux-gnueabihf-gcc, then the target name is the prefix arm-linux-gnueabihf. The target field allows DS-5 to distinguish different toolchains that otherwise have the same version.

```
- • ·
DS-5 Command Prompt
Environment configured for ARM DS-5 (build 5000452)
Please consult the documentation for available commands and more details
                                                                                                                                                                             *
Environment configured for ARM Compiler 5 (DS-5 built-in)
                                                                                                                                                                             Ξ
You can change the toolchain for this environment at any time by running the
'select_toolchain' command. A default for all future environments can be set
with the 'select_default_toolchain' command.
C:\Program Files\DS-5\bin>add_toolchain T:\ARMCC\5.03\26\ds-win-x86_64-rel\bin
Toolchain details discovered from T:\ARMCC\5.03\26\ds-win-x86_64-rel\bin
Family
Version
                                  : ARM Compiler 5
 Compiler
                                      armcc.exe
  lssembler
                                      armasm.exe
Linker
Archiver
                                      armlink.exe
                                     armar.exe
fromelf.exe
 Image Converter :
(1) Add toolchain, (2) Edit details or (3) Cancel: 2
Select the type of the toolchain
1 - ARM Compiler 4
2 - ARM Compiler 5
3 - ARM Compiler 6
4 - CCC
             GCC
: 2
Enter the major version number: 5
Enter the minor version number: 3
Enter the patch version number:
Enter the toolchain target:
Enter the name of the Compiler: armcc.exe
Enter the name of the Assembler: armasm.exe
Enter the name of the Linker: armlink.exe
Enter the name of the Archiver: armar.exe
Enter the name of the Image Converter: fromelf.exe
Toolchain 'ARM Compiler 5.03' added
 C:\Program Files\DS-5\bin>_
```

Figure 3-16 Registering a new toolchain

You must manually enter the toolchain properties if:

– Note –

- The toolchain properties were not autodetected.
- The type, major version, and minor version of the new toolchain are identical to a toolchain that DS-5 already knows about.
- 3. After you register a new toolchain, you must restart DS-5 before you can use the toolchain in the DS-5 environment.
- 4. When you create a new project, DS-5 shows the new toolchain in the available list of toolchains. In this example, ARMCCv5.01 is the newly registered toolchain.

3 Working with Arm[®] DS-5 Community Edition 3.12 Registering a compiler toolchain from the DS-5 command prompt

🖨 C Project				
C Project Project name must be specified				
Project name: Image: C:\DS-5_Workspace Choose file system:	Browse			
Project type: Executable Empty Project Hello World ANSI C Project Hello World ANSI C Project Shared Library Makefile project	Toolchains: ARM Compiler 5 ARM Compiler 6 ARMCCv5.01 GCC for ARM Bare-metal GCC for ARM Linux applications			
Show project types and toolchains only if they are supported on the platform				

Figure 3-17 Using a new toolchain for a new project

For an existing project, if you want to change the toolchain to the newly registered toolchain, use the **Tool Chain Editor** dialog.

- Right-click the project and select Properties to show the Properties dialog.
- Select C/C++ Build > Tool Chain Editor

Properties for startup_ARM926	EJ-S		- • •
type filter text	Tool Chain Editor		⇒ → → ▼
 ▷ Resource Builders ▲ C/C++ Build Build Variables Environment Logging 	Configuration: De	bug [Active]	▼ Manage Configurations
Settings	Display compation	ible toolchains only	
Settings Tool Chain Editor Current t ▷ C/C++ General Project References Current t Run/Debug Settings Used to ARM C ARM C ARM L ARM L	Current toolchain: Current builder: Used tools ARM C Compile ARM C++ Comj ARM Assembler ARM Linker 5 ARM Librarian 5	ARMCCv5.01 ARM Compiler 5 ARM Compiler 6 ARMCCv5.01 Cygwin GCC GCC for ARM Bare-metal GCC for ARM Linux applications Linux GCC MacOSX GCC MinGW GCC Solaris GCC	-
			Restore Defaults Apply
?			OK Cancel

Figure 3-18 Changing the toolchain for a project

3.13 Configuring a compiler toolchain for the DS-5 command prompt

When you want to compile or build from the DS-5 command prompt, you can select the compiler toolchain you want to use. You can set this as the default toolchain so that you do not need to select a toolchain every time you start the DS-5 command prompt.

_____ Note ____

By default, the DS-5 command prompt is not configured with a compiler toolchain.

On Linux, run suite_exec with the --toolchain *name* option to configure a compiler toolchain for the DS-5 environment. Run suite_exec with no arguments for the list of available toolchains.

For example, to use the Arm Compiler 5 toolchain included in DS-5, run:

DS-5_install_directory/bin/suite_exec --toolchain "ARM Compiler 5 (DS-5 built-in)"
bash --norc

On Windows, use the following procedure:

— Note -

Procedure

- 1. Open the DS-5 command prompt, by selecting Start > All Programs > DS-5 Command Prompt.
- 2. Enter select_default_toolchain on the DS-5 command prompt. This lists the available compiler toolchains.



Figure 3-19 Configuring a default toolchain

3. Select your default compiler toolchain. For example, enter 1 to select the Arm Compiler 5 that is built-in with DS-5. This configures the DS-5 command prompt for the selected toolchain. When you open a new DS-5 command prompt, the environment is still configured for your selected toolchain.

To configure a compiler toolchain for the current DS-5 command prompt, without changing the default toolchain, use the select_toolchain command.