ARM® DS-5 Community Edition

Version 5.26

Getting Started Guide

ARM® DS-5 Community Edition

Getting Started Guide

Release Information

Document History

Issue	Date	Confidentiality	Change
A	15 March 2016	Non-Confidential	First release for DS-5 Community Edition
B	15 July 2016	Non-Confidential	Update for DS-5 Community Edition version 5.25
C	18 November 2016	Non-Confidential	Update for DS-5 Community Edition version 5.26

Non-Confidential Proprietary Notice

Product Status

The information in this document is Final, that is for a developed product.

Web Address

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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.

`monospace`
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

Feedback on this product

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

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

Feedback on content

If you have comments on content then send an e-mail to *errata@arm.com*. Give:

- The title *ARM® DS-5 Community Edition Getting Started Guide*.
- The number ARM DUI0962C.
- If applicable, the page number(s) to which your comments refer.
- A concise explanation of your comments.

ARM also welcomes general suggestions for additions and improvements.

———— **Note** ————

ARM tests the PDF only in Adobe Acrobat and Acrobat Reader, and cannot guarantee the quality of the represented document when used with any other PDF reader.

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Other information

- *ARM Information Center*.
- *ARM Technical Support Knowledge Articles*.
- *Support and Maintenance*.
- *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

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) targets, one based on the ARM 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) 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 references

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 instruction-level 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

3.6 Debugging Gnometris on page 3-39.

1.4 About *Fixed Virtual Platform* (FVP)

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

When using an *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.

Related tasks

Loading the Gnometris application on a Fixed Virtual Platform (FVP).

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

3.7 Performance analysis of the threads application running on ARM® Linux on page 3-40.

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

To install and use DS-5 Community Edition, your workstation must have a minimum specification of a dual core 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 (64-bit only)
- Windows 7 (64-bit only) with Service Pack 1
- Red Hat Enterprise Linux 6 Workstation (64-bit only)
- Red Hat Enterprise Linux 7 Workstation (64-bit only)
- Ubuntu Desktop Edition 12.04 LTS (64-bit only)
- Ubuntu Desktop Edition 14.04 LTS (64-bit 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.

Note

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.

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`	For 64-bit version of Windows with DS-5 Community Edition installed: `C:\Program Files \DS-5 CE v`*`<version>`*	`~/DS-5_`*`CE_v<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

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 and earlier 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**.

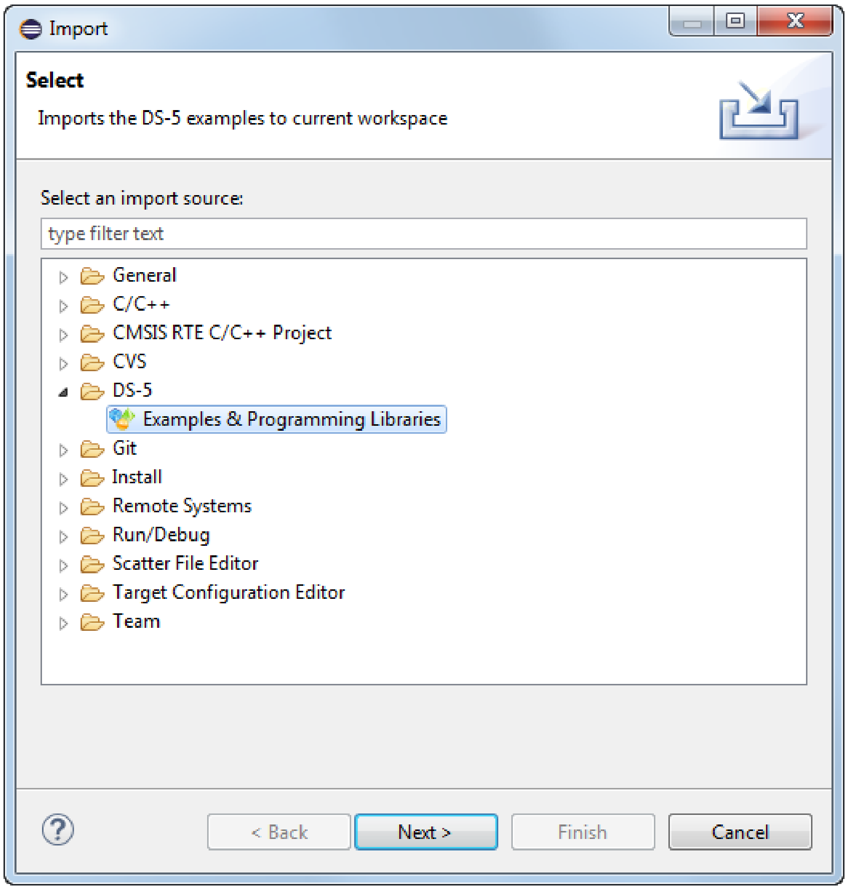
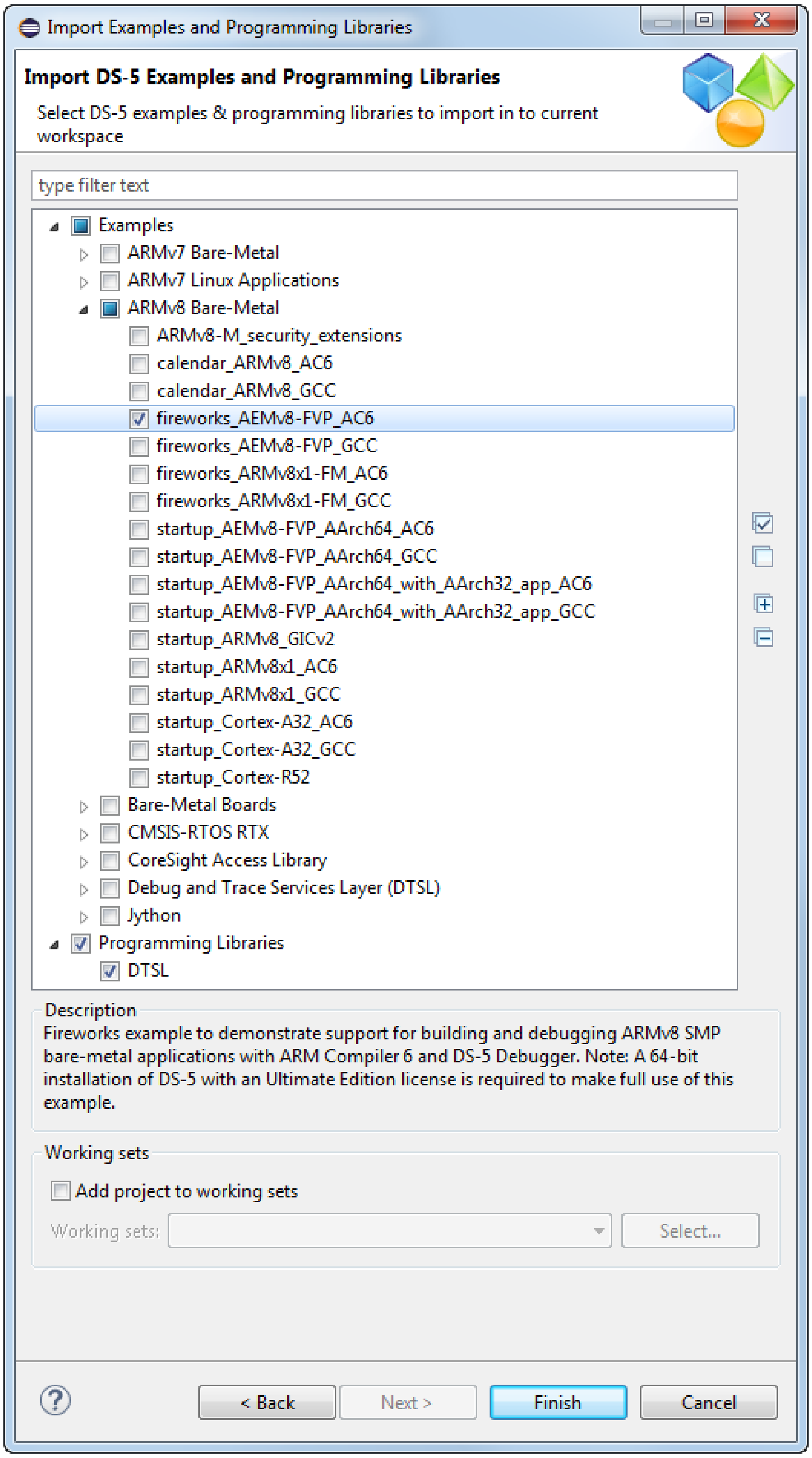


Figure 3-1 Import DS-5 Examples and Programming Libraries

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



Import DS-5 Examples and Programming Libraries

Select DS-5 examples & programming libraries to import in to current workspace

- Examples
  - ARMv7 Bare-Metal
  - ARMv7 Linux Applications
  - ARMv8 Bare-Metal
    - ARMv8-M_security_extensions
    - calendar_ARMv8_AC6
    - calendar_ARMv8_GCC
    - [✓] fireworks_AEMv8-FVP_AC6
    - fireworks_AEMv8-FVP_GCC
    - fireworks_ARMv8x1-FM_AC6
    - fireworks_ARMv8x1-FM_GCC
    - startup_AEMv8-FVP_AArch64_AC6
    - startup_AEMv8-FVP_AArch64_GCC
    - startup_AEMv8-FVP_AArch64_with_AArch32_app_AC6
    - startup_AEMv8-FVP_AArch64_with_AArch32_app_GCC
    - startup_ARMv8_GICv2
    - startup_ARMv8x1_AC6
    - startup_ARMv8x1_GCC
    - startup_Cortex-A32_AC6
    - startup_Cortex-A32_GCC
    - startup_Cortex-R52
  - Bare-Metal Boards
  - CMSIS-RTOS RTX
  - CoreSight Access Library
  - Debug and Trace Services Layer (DTSL)
  - Jython
- [✓] Programming Libraries
  - [✓] DTSL

Description
Fireworks example to demonstrate support for building and debugging ARMv8 SMP bare-metal applications with ARM Compiler 6 and DS-5 Debugger. Note: A 64-bit installation of DS-5 with an Ultimate Edition license is required to make full use of this example.

Working sets
Add project to working sets
Working sets: Select...

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 on 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 **Linux**.

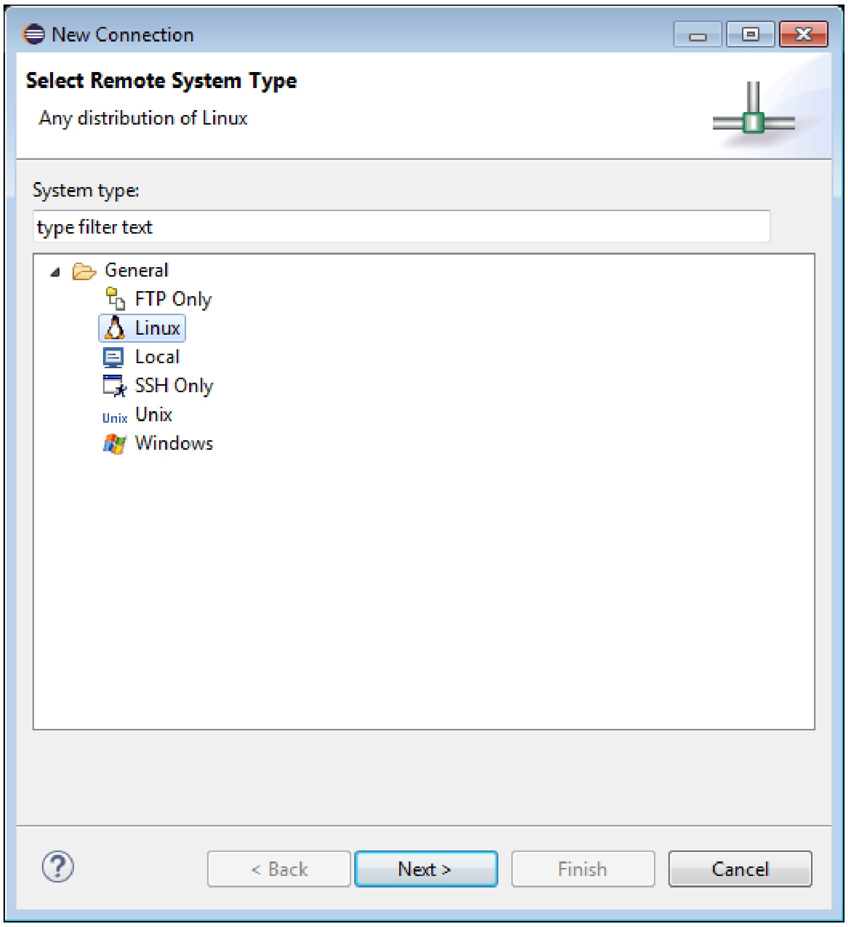
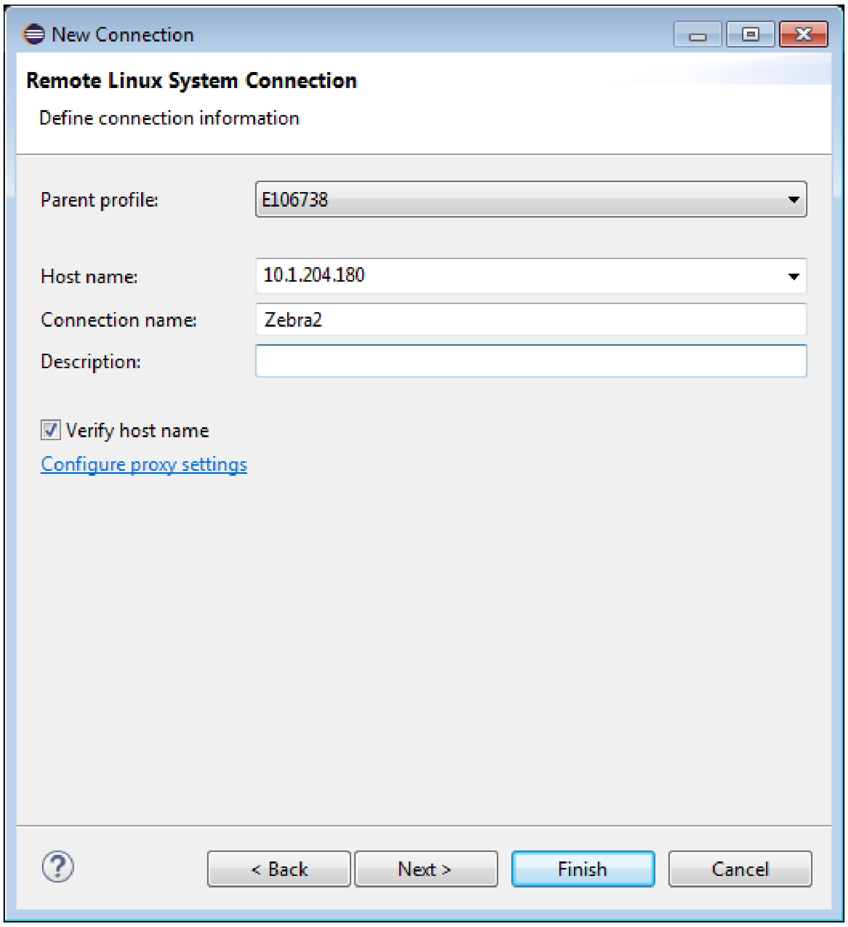


Figure 3-3 Selecting a connection type

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



Parent profile: E106738

Host name: 10.1.204.180

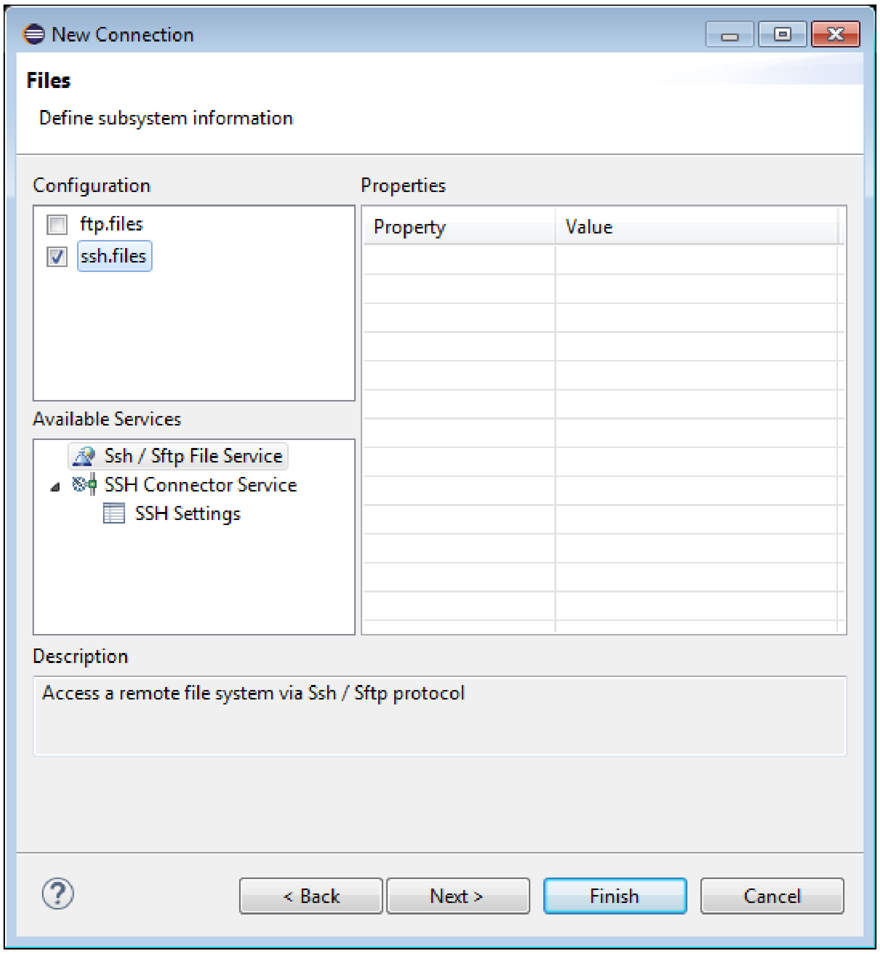
Connection name: Zebra2

Description:

[✓] Verify host name

Figure 3-4 Defining the connection information

5. Click **Next**.
6. Select SSH protocol file access.


New Connection

Files

Define subsystem information

Configuration
- [ ] ftp.files
- [✓] ssh.files

Available Services
- Ssh / Sftp File Service
- SSH Connector Service
  - SSH Settings

Properties

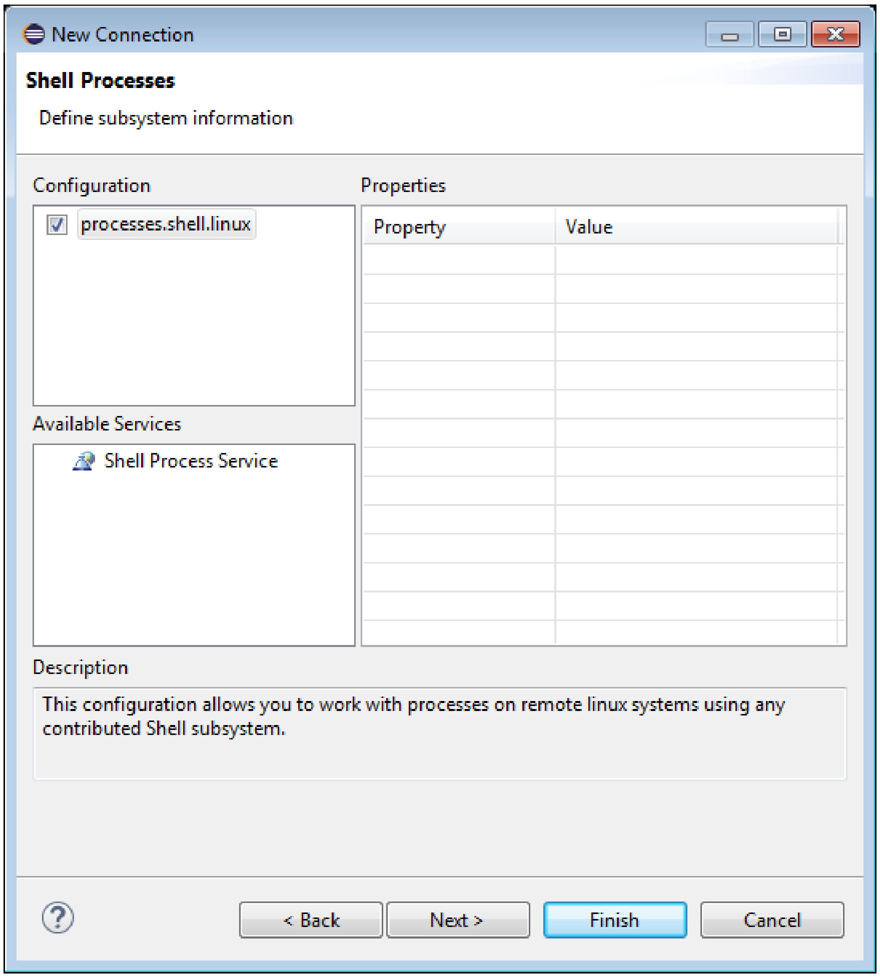
Property	Value

Description

Access a remote file system via Ssh / Sftp protocol

Figure 3-5 Defining the file system

7. Click **Next**.
8. Select the shell processes for Linux systems.

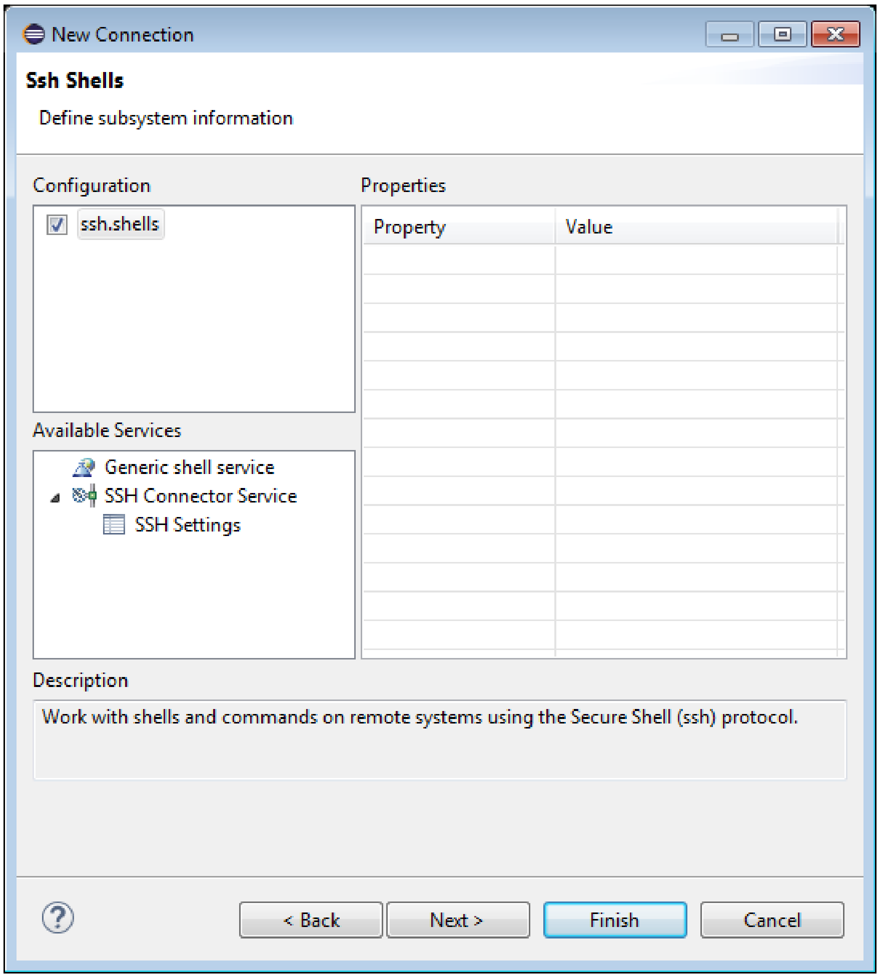


✓ processes.shell.linux

This configuration allows you to work with processes on remote linux systems using any contributed Shell subsystem.

Figure 3-6 Defining the processes

9. Click **Next**.
10. Select **SSH shells**.



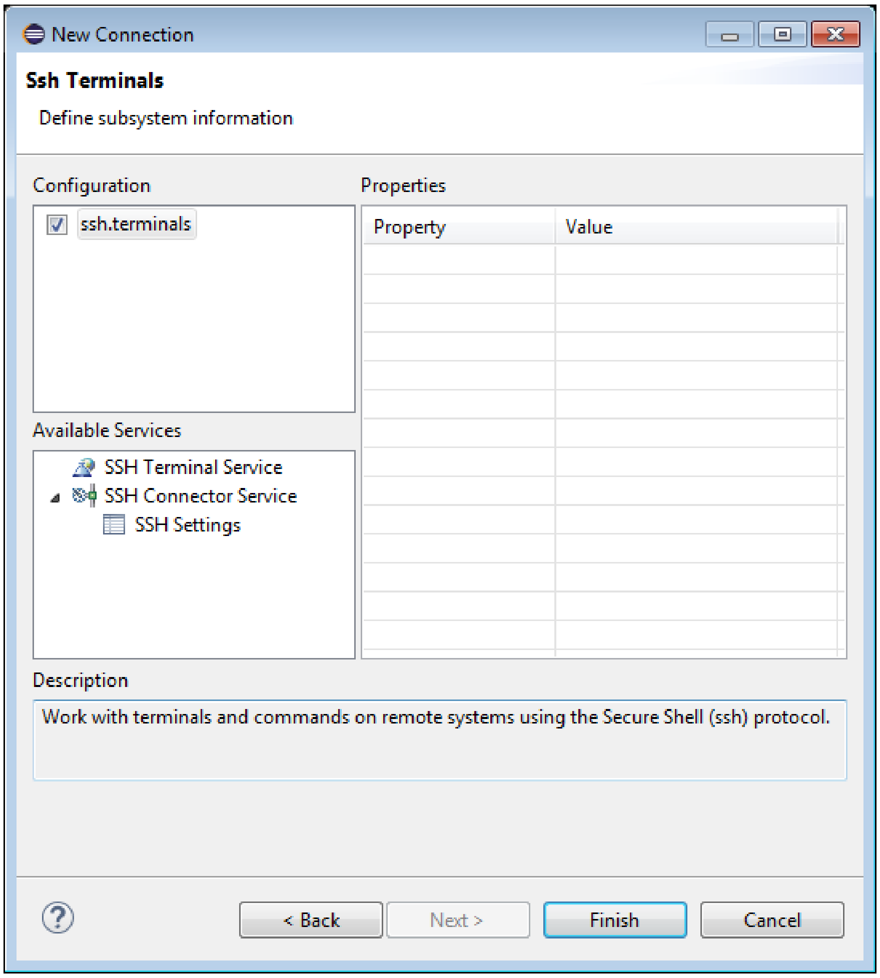
☑ ssh.shells

- Generic shell service
- SSH Connector Service
  - SSH Settings

Work with shells and commands on remote systems using the Secure Shell (ssh) protocol.

Figure 3-7 Defining the shell services

11. Click **Next**.
12. Select **SSH terminals**.

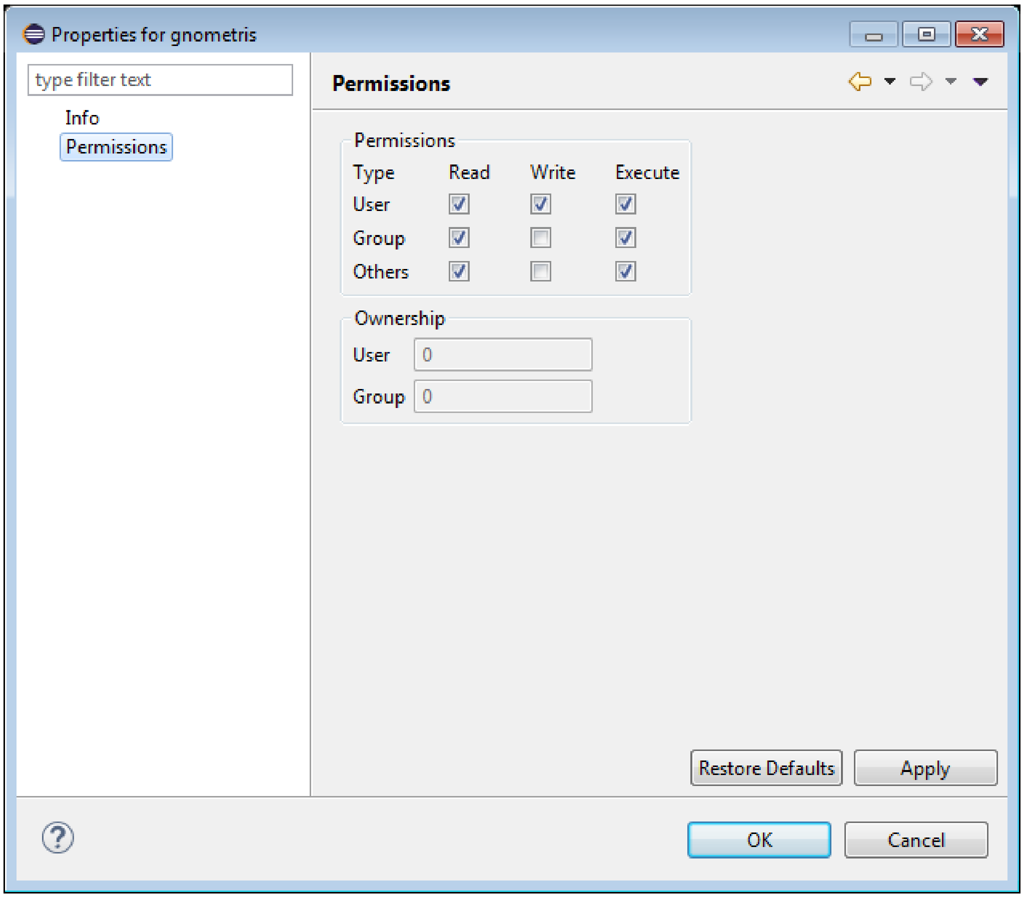


Work with terminals and commands on remote systems using the Secure Shell (ssh) protocol.

Figure 3-8 Defining the terminal services

13. Click **Finish**.
14. In the **Remote Systems** view:
    a. Right-click on the Linux 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.
    d. Copy the 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.

       This example uses Gnometris which requires copying the stripped version of the Gnometris application, `gnometris`, and the `libgames-support.so` library.
    e. Ensure that the files on the target have execute permissions. To do this, right-click on each file, select **Properties** from the context menu and select the checkboxes as required.



Permissions			
Type	Read	Write	Execute
User	✓	✓	✓
Group	✓		✓
Others	✓		✓

Ownership
User 0
Group 0

Figure 3-9 Modifying file properties from the Remote Systems view

15. Open a terminal shell that is connected to the target and launch `gdbserver` with the application:
    a. In the **Remote Systems** view, right-click on **Ssh Terminals**.
    b. Select **Launch Terminal** to open a terminal shell.
    c. 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.

This section contains the following subsections:
- *3.5.1 Launching gdbserver with an application* on page 3-35.
- *3.5.2 Connecting to the Gnometris application that is already running on an ARM® Linux target* on page 3-35.

3.5.1 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.

   ————————————

3.5.2 Connecting to the Gnometris application that is already running on an ARM® Linux target

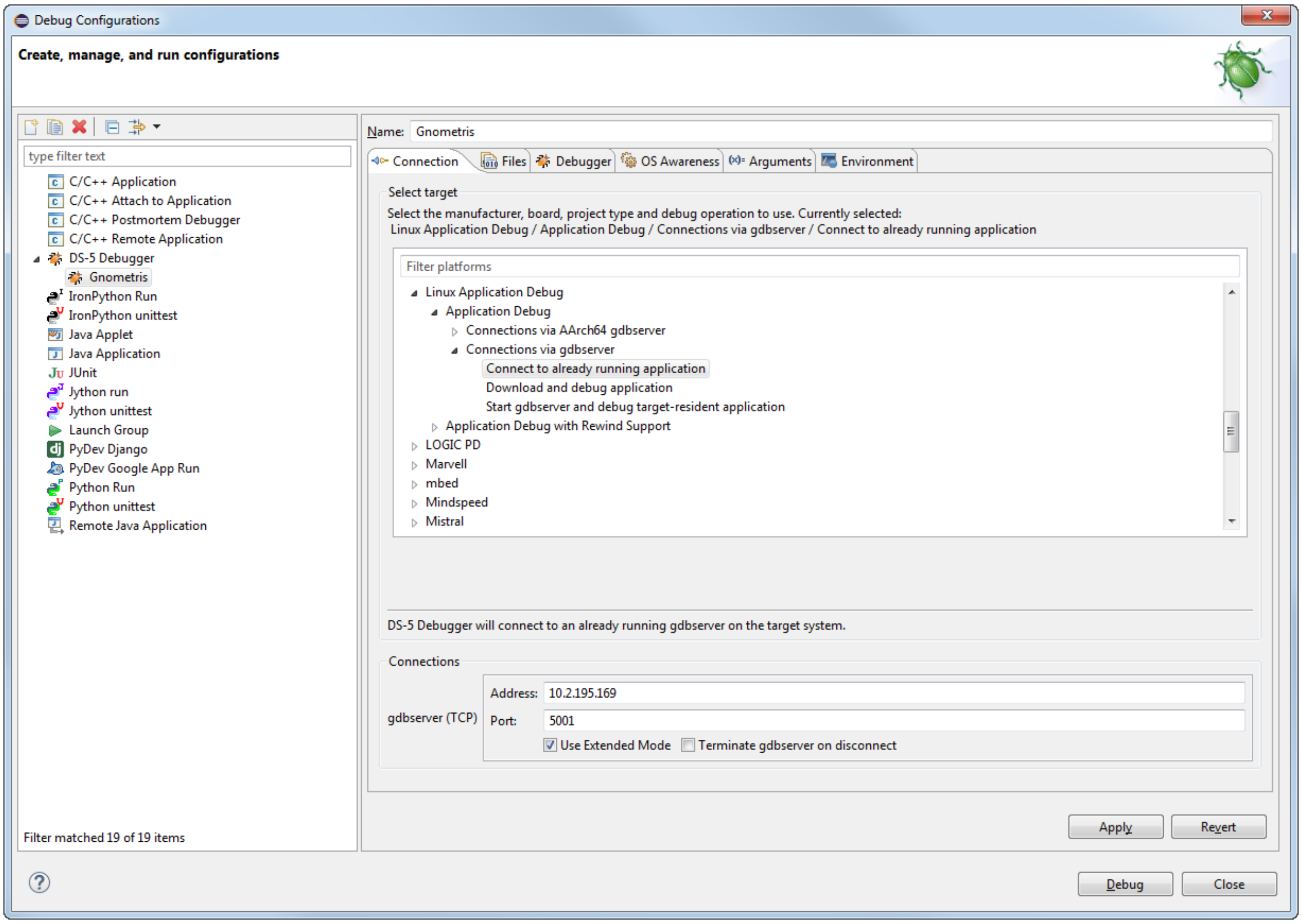
Describes how to connect to the Gnometris application that is already running on a ARM Linux target.

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

type filter text

- C/C++ Application
- C/C++ Attach to Application
- C/C++ Postmortem Debugger
- C/C++ Remote Application
- DS-5 Debugger
  - Gnometris
- IronPython Run
- IronPython unittest
- Java Applet
- Java Application
- JUnit
- Jython run
- Jython unittest
- Launch Group
- PyDev Django
- PyDev Google App Run
- Python Run
- Python unittest
- Remote Java Application

Filter matched 19 of 19 items

Name: Gnometris

Connection | Files | Debugger | OS Awareness | Arguments | Environment

Select target

Select the manufacturer, board, project type and debug operation to use. Currently selected:
Linux Application Debug / Application Debug / Connections via gdbserver / Connect to already running application

Filter platforms

- Linux Application Debug
  - Application Debug
    - Connections via AArch64 gdbserver
    - Connections via gdbserver
      - Connect to already running application
      - Download and debug application
      - Start gdbserver and debug target-resident application
  - Application Debug with Rewind Support
- LOGIC PD
- Marvell
- mbed
- Mindspeed
- Mistral

DS-5 Debugger will connect to an already running gdbserver on the target system.

Connections

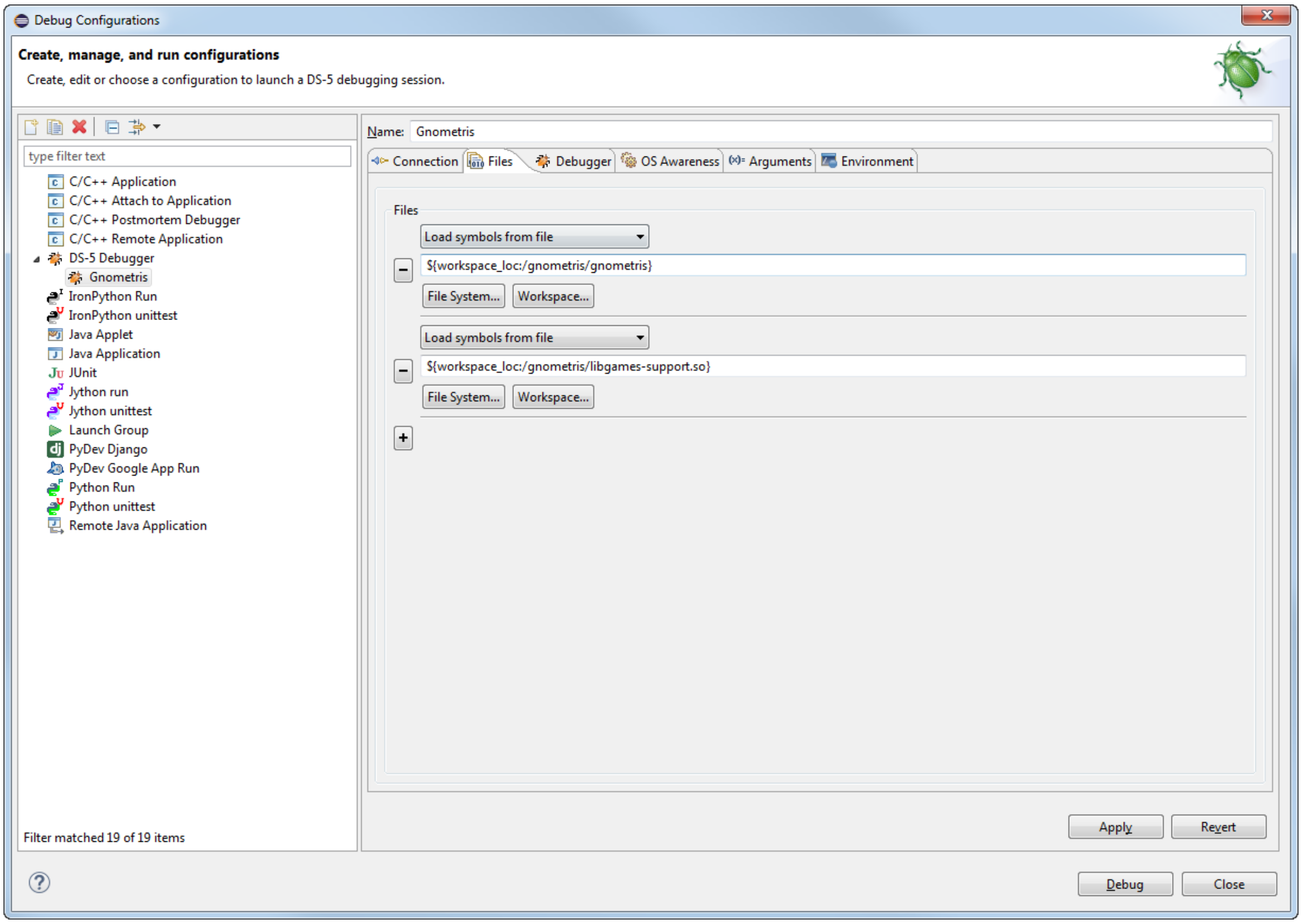
gdbserver (TCP)
Address: 10.2.195.169
Port: 5001
[✓] Use Extended Mode [ ] Terminate gdbserver on disconnect

Apply | Revert

Debug | Close

Figure 3-10 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 debugging session.

type filter text

- C/C++ Application
- C/C++ Attach to Application
- C/C++ Postmortem Debugger
- C/C++ Remote Application
- DS-5 Debugger
  - Gnometris
- IronPython Run
- IronPython unittest
- Java Applet
- Java Application
- JUnit
- Jython run
- Jython unittest
- Launch Group
- PyDev Django
- PyDev Google App Run
- Python Run
- Python unittest
- Remote Java Application

Filter matched 19 of 19 items

Name: Gnometris

Connection | Files | Debugger | OS Awareness | Arguments | Environment

Files

Load symbols from file
${workspace_loc:/gnometris/gnometris}
File System... Workspace...

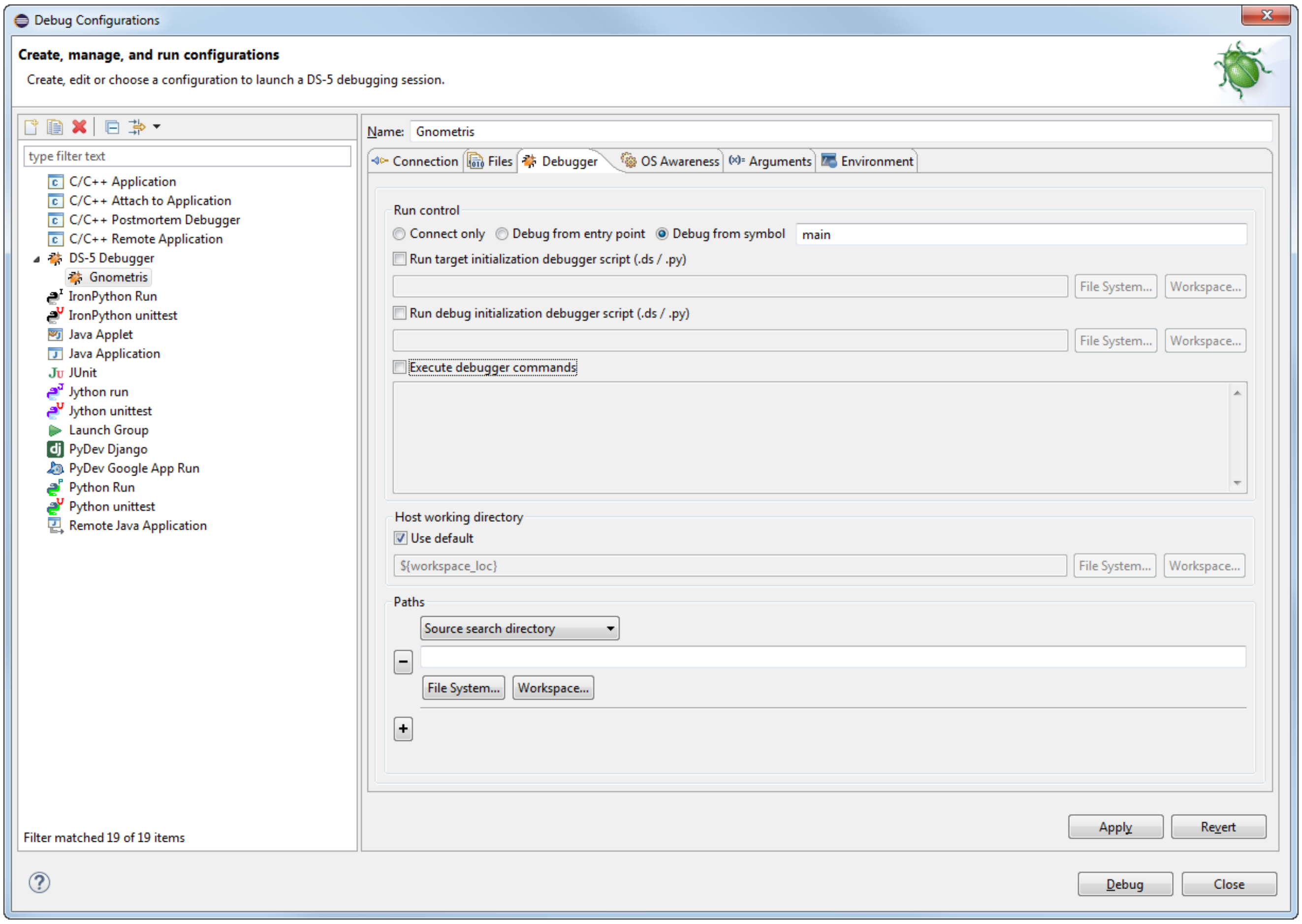
Load symbols from file
${workspace_loc:/gnometris/libgames-support.so}
File System... Workspace...

Apply Revert

Debug Close

Figure 3-11 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 debugging session.

type filter text

- C/C++ Application
- C/C++ Attach to Application
- C/C++ Postmortem Debugger
- C/C++ Remote Application
- DS-5 Debugger
  - Gnometris
- IronPython Run
- IronPython unittest
- Java Applet
- Java Application
- JUnit
- Jython run
- Jython unittest
- Launch Group
- PyDev Django
- PyDev Google App Run
- Python Run
- Python unittest
- Remote Java Application

Filter matched 19 of 19 items

Name: Gnometris

Connection | Files | Debugger | OS Awareness | Arguments | Environment

Run control

Connect only | Debug from entry point | [✓ Debug from symbol] main

☐ Run target initialization debugger script (.ds / .py)

☐ Run debug initialization debugger script (.ds / .py)

☐ Execute debugger commands

Host working directory

☑ Use default

${workspace_loc}

Paths

Source search directory

Figure 3-12 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.

3.6 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 sourcefile. All the views update as you step through the source code.
10. 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.

3.7 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` example application to show how to use Streamline to capture and analyze profiling data from a Linux target. `threads` is one of the ARMv7 Linux application examples that are provided with DS-5. Before capturing the data, ensure that:

1. You have built the `threads` 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 in the **Streamline Data** view.
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.
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:

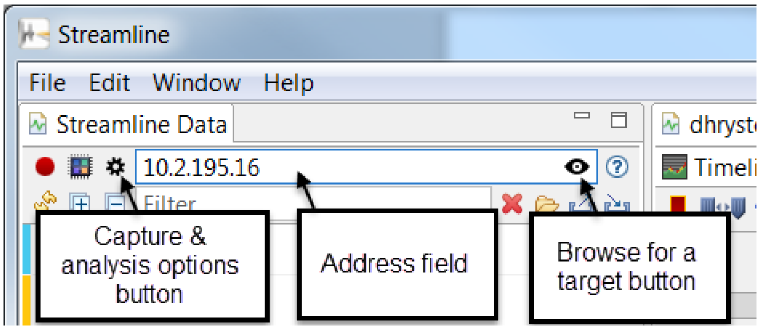


Figure 3-13 Streamline Data view

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**.

8. 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, press **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:

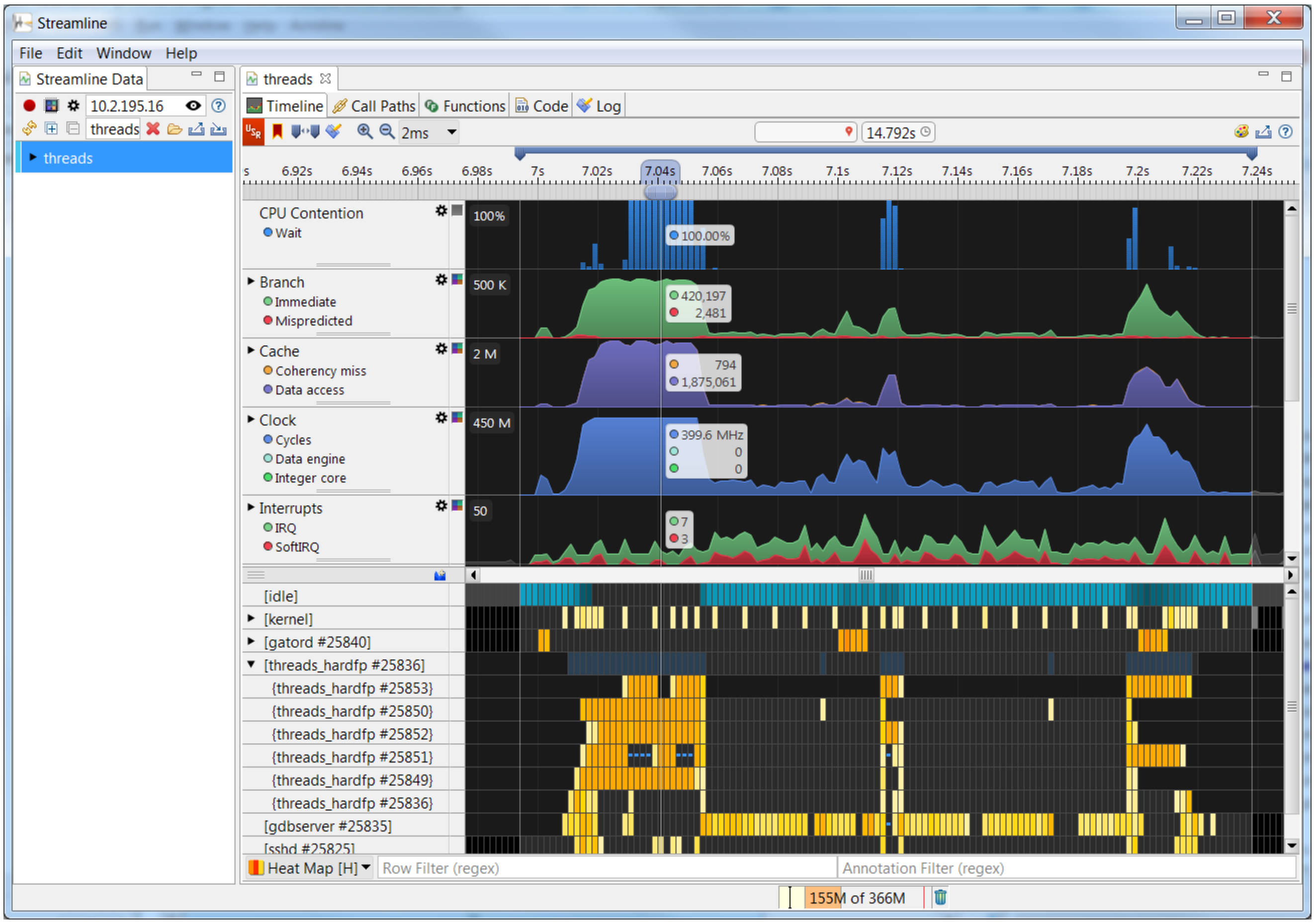


Figure 3-14 Streamline analysis report for the threads application

3.8 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.

———————

3.9 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:

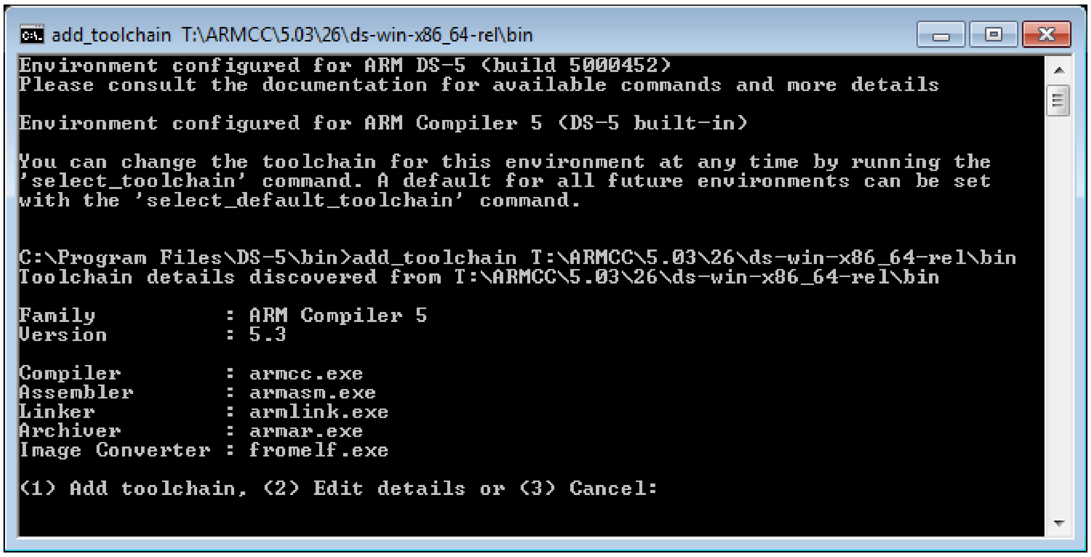
Procedure

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

   Note

   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`



add_toolchain T:\ARMCC\5.03\26\ds-win-x86_64-rel\bin

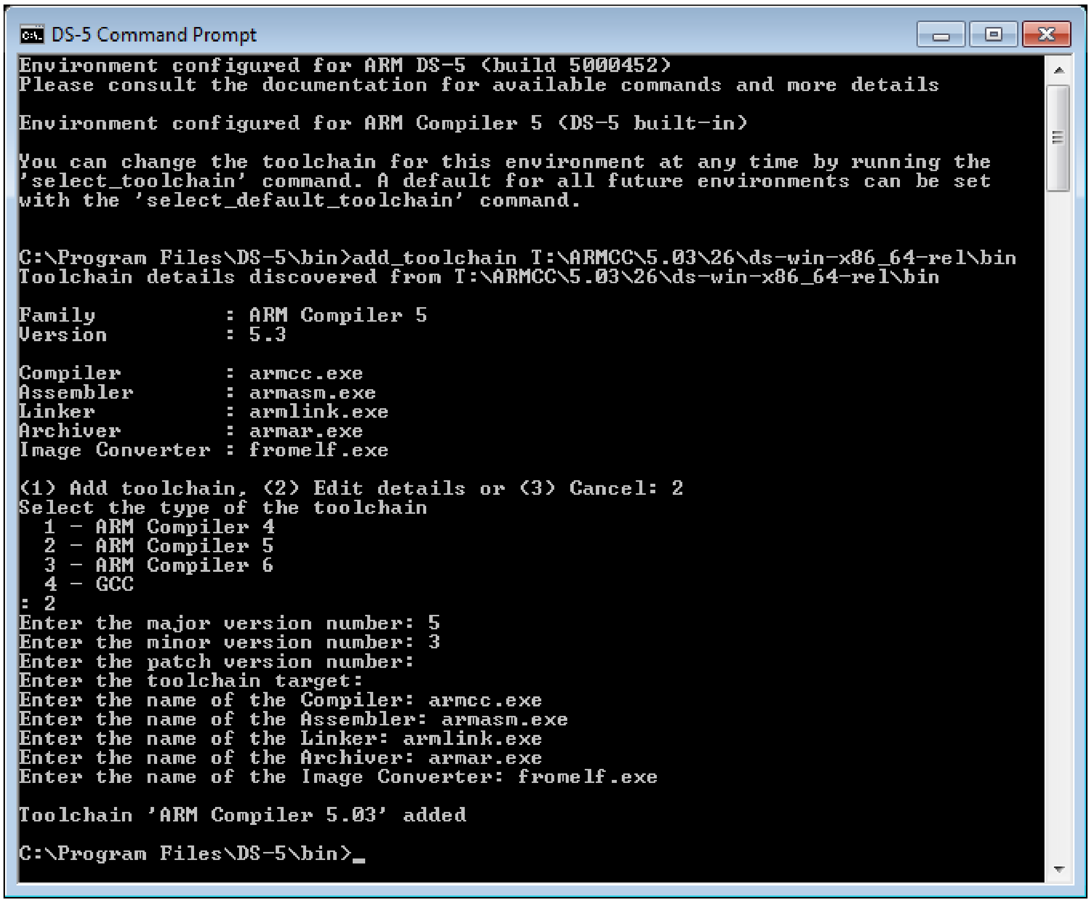
```
Environment configured for ARM DS-5 (build 5000452)
Please consult the documentation for available commands and more details

Environment configured for ARM Compiler 5 (DS-5 built-in)

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          : ARM Compiler 5
Version         : 5.3

Compiler        : armcc.exe
Assembler       : armasm.exe
Linker          : armlink.exe
Archiver        : armar.exe
Image Converter : fromelf.exe

(1) Add toolchain, (2) Edit details or (3) Cancel:
```

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.

   Note

   - 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

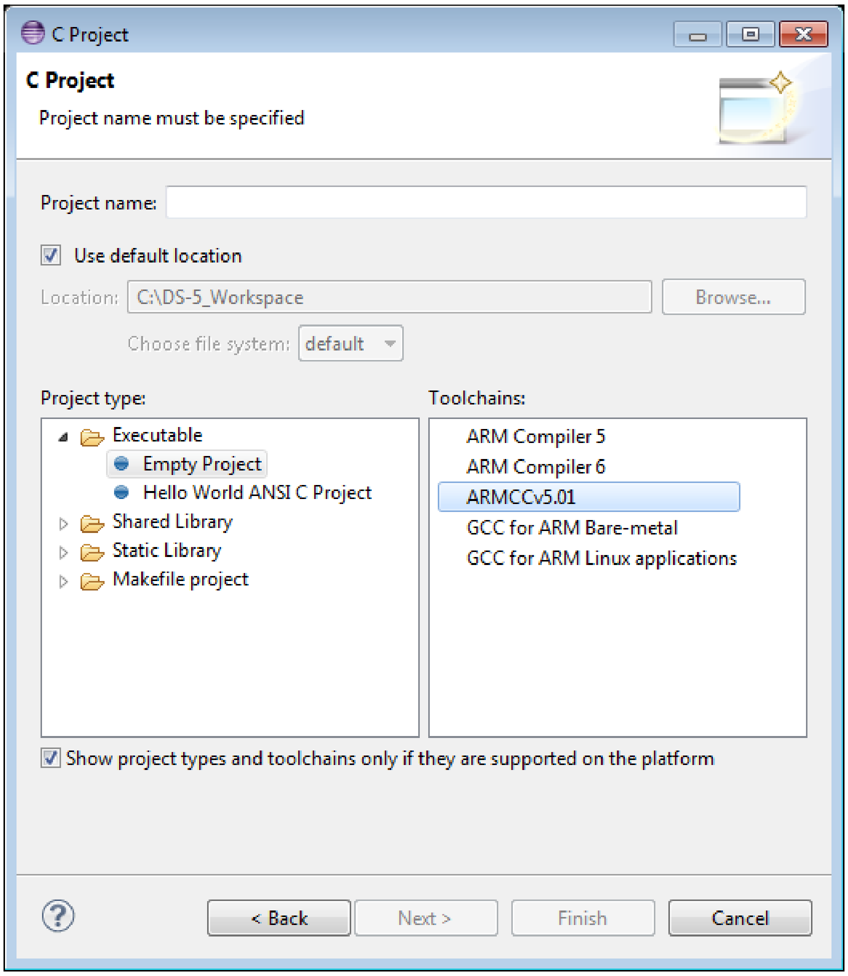
```
Environment configured for ARM DS-5 (build 5000452)
Please consult the documentation for available commands and more details

Environment configured for ARM Compiler 5 (DS-5 built-in)

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          : ARM Compiler 5
Version         : 5.3

Compiler        : armcc.exe
Assembler       : armasm.exe
Linker          : armlink.exe
Archiver        : armar.exe
Image Converter : fromelf.exe

(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 - 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

Note

You must manually enter the toolchain properties if:
- 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.


C Project

C Project

Project name must be specified

Project name:

[✓] Use default location

Location: C:\DS-5_Workspace Browse...

Choose file system: default

Project type:
- Executable
  - Empty Project
  - Hello World ANSI C Project
- Shared Library
- Static Library
- Makefile project

Toolchains:
- ARM Compiler 5
- ARM Compiler 6
- ARMCCv5.01
- GCC for ARM Bare-metal
- GCC for ARM Linux applications

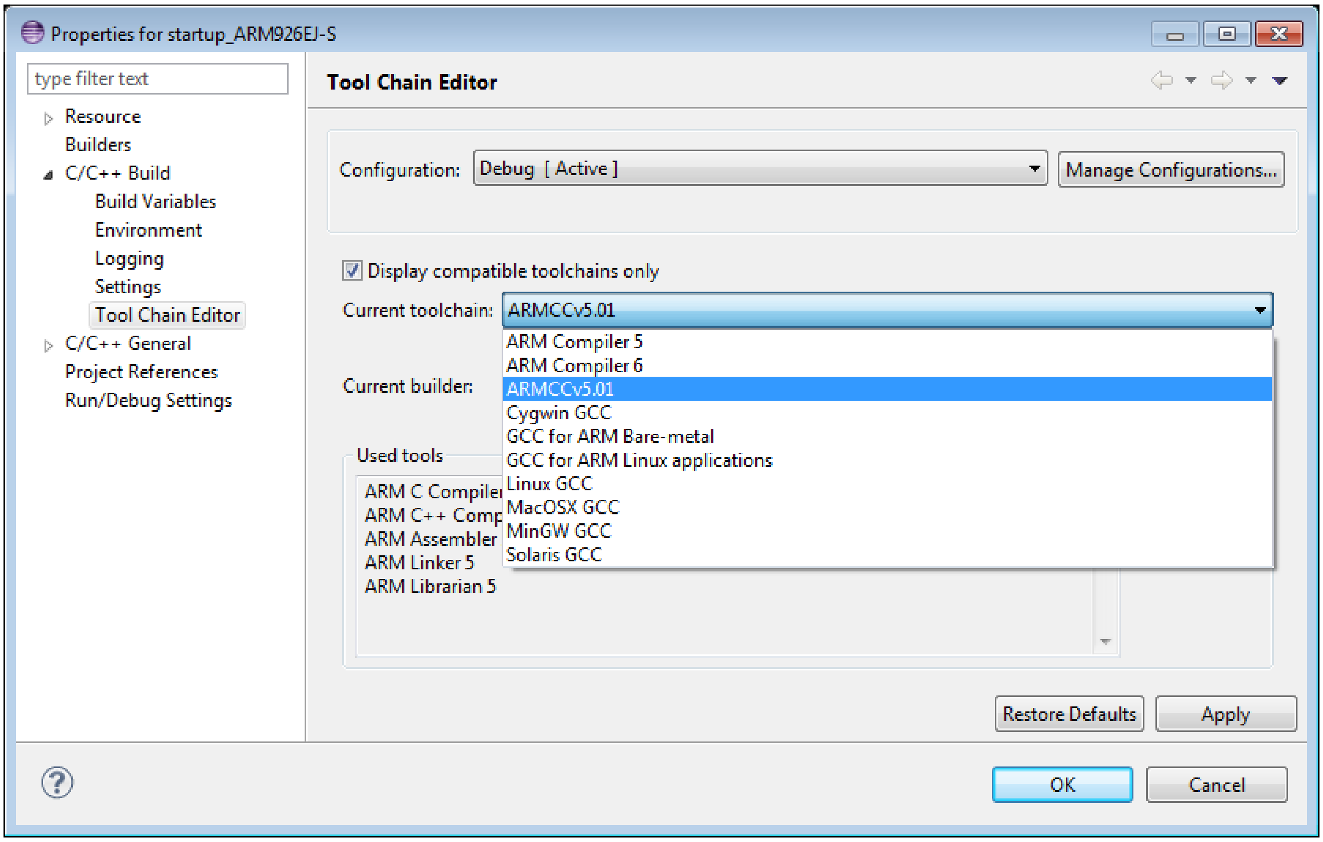
[✓] Show project types and toolchains only if they are supported on the platform

< Back Next > Finish Cancel

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**



Configuration: Debug [Active]

[✓] Display compatible toolchains only

Current toolchain: 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

Current builder:

Used tools

- ARM C Compiler
- ARM C++ Comp
- ARM Assembler
- ARM Linker 5
- ARM Librarian 5

Figure 3-18 Changing the toolchain for a project

3.10 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.

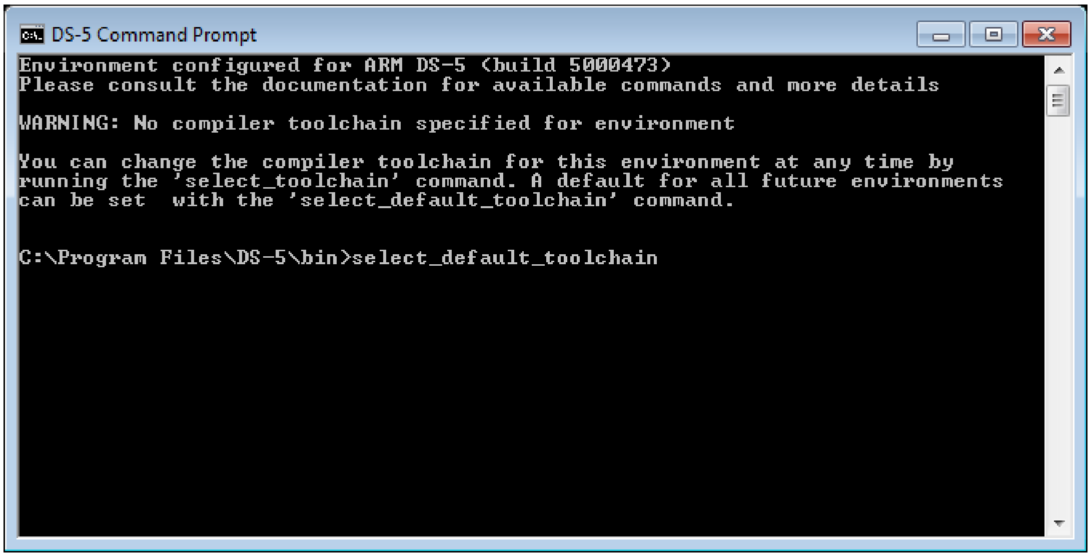
For example, to use the ARM Compiler 5 toolchain included in DS-5, run:

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

The following procedure describes the steps for using `select_default_toolchain` on Windows.

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.



```
Environment configured for ARM DS-5 (build 5000473)
Please consult the documentation for available commands and more details

WARNING: No compiler toolchain specified for environment

You can change the compiler 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>select_default_toolchain
```

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.

   ———— **Note** ————

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

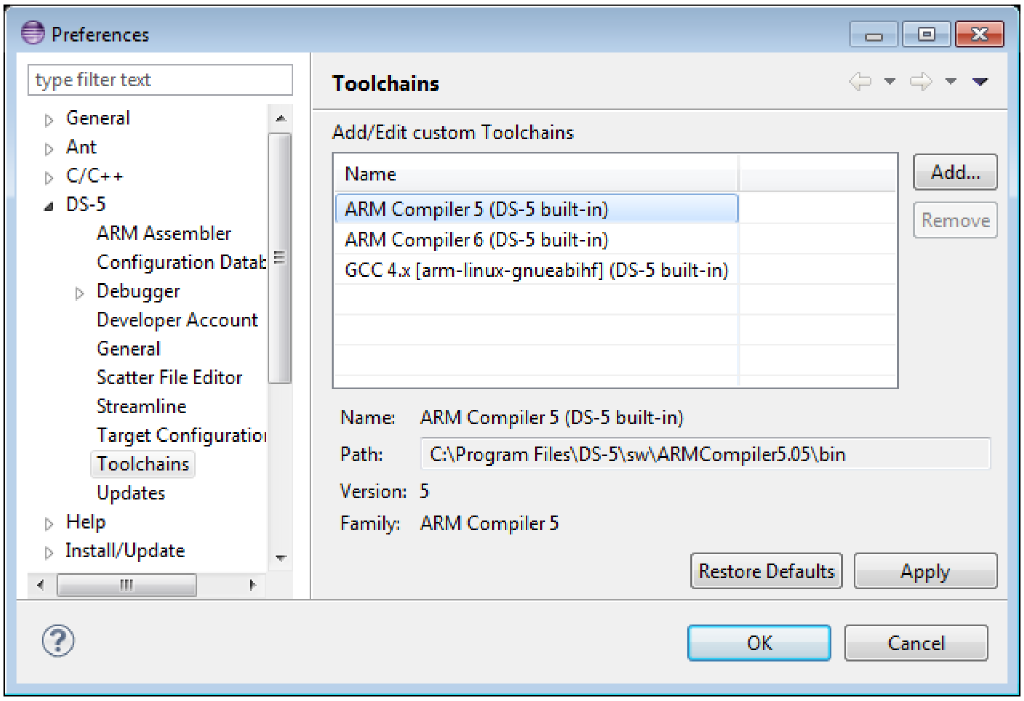
   ————————————

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

- General
- Ant
- C/C++
- DS-5
  - ARM Assembler
  - Configuration Datab
  - Debugger
  - Developer Account
  - General
  - Scatter File Editor
  - Streamline
  - Target Configuratio
  - Toolchains
  - Updates
- Help
- Install/Update

Toolchains

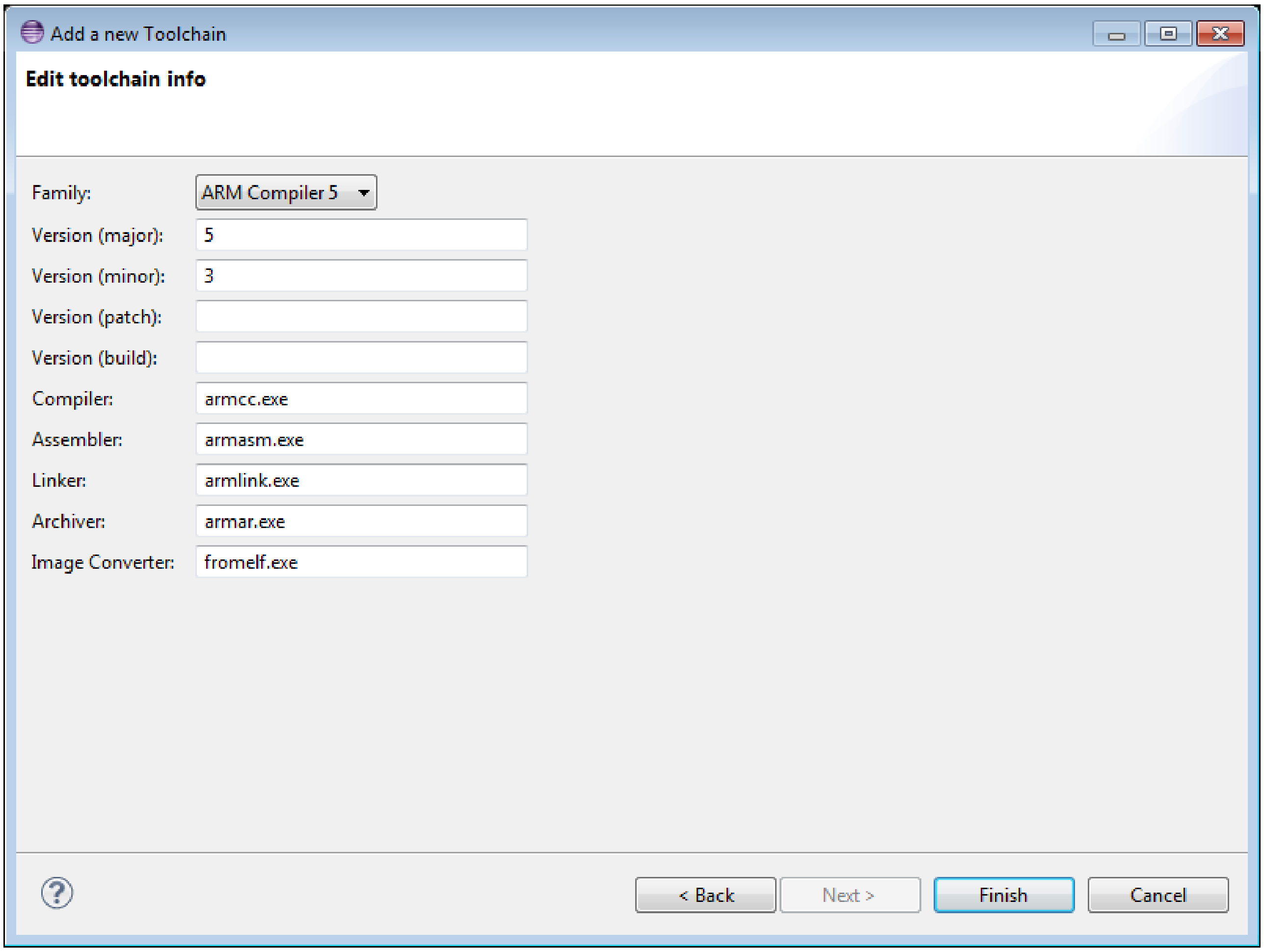
Add/Edit custom Toolchains

Name	
ARM Compiler 5 (DS-5 built-in)	
ARM Compiler 6 (DS-5 built-in)	
GCC 4.x [arm-linux-gnueabihf] (DS-5 built-in)	

Name: ARM Compiler 5 (DS-5 built-in)
Path: C:\Program Files\DS-5\sw\ARMCompiler5.05\bin
Version: 5
Family: ARM Compiler 5

Figure 3-20 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**.



Edit toolchain info

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

Figure 3-21 Properties for the new toolchain

——— **Note** ———

You must manually enter the toolchain properties if:

- 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.