



Targeting processors, floating-point units, and NEON

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1. Overview

Arm DS-5 Development Studio tutorial for selecting specific processors with Arm Compiler to maximize performance, selecting FPU and enabling NEON.

This tutorial assumes you have installed and licensed Arm DS-5 Development Studio. For more information, see [Getting Started with Arm DS-5 Development Studio](#).

2. Selecting the target processor

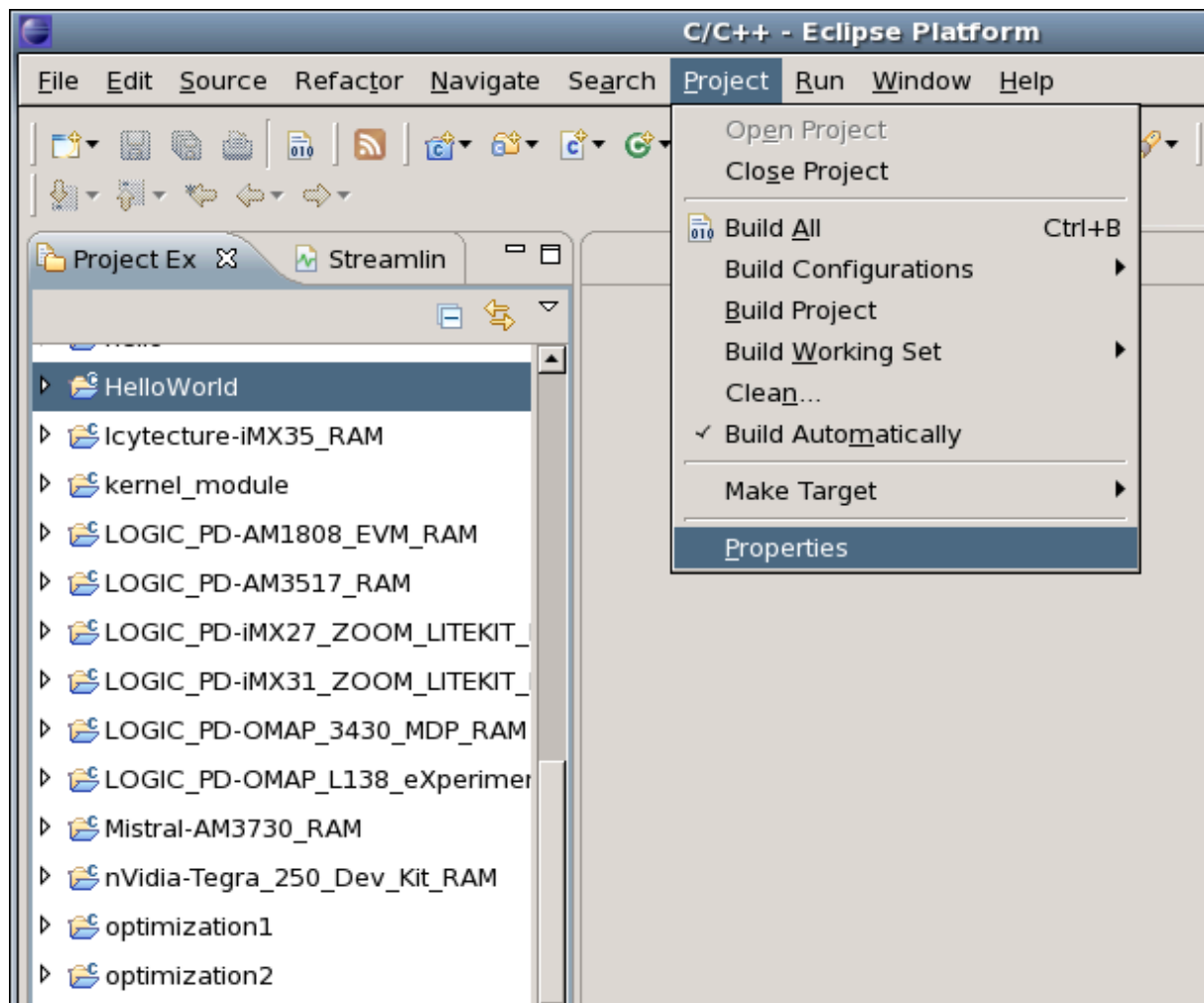
The Arm Compiler lets you target either an architecture or a specific processor target when generating code:

- Specifying an architecture provides the greatest code compatibility. The generated code can run on any processor supporting that architecture.
- Specifying a particular processor provides optimum performance. The compiler can use processor-specific features such as instruction scheduling to generate optimized code for that specific processor.

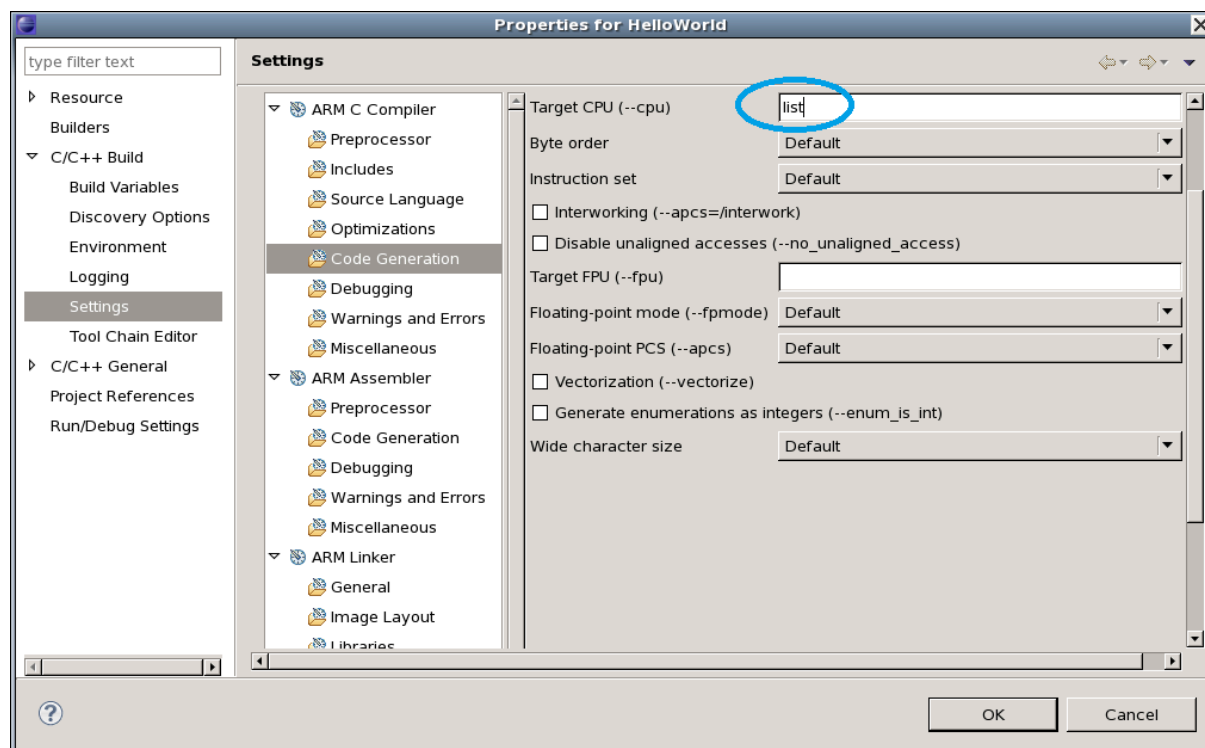
The **-cpu** [command-line option](#) lets you specify the name of either an architecture or a specific processor target.

To configure the **-cpu** option in DS-5:

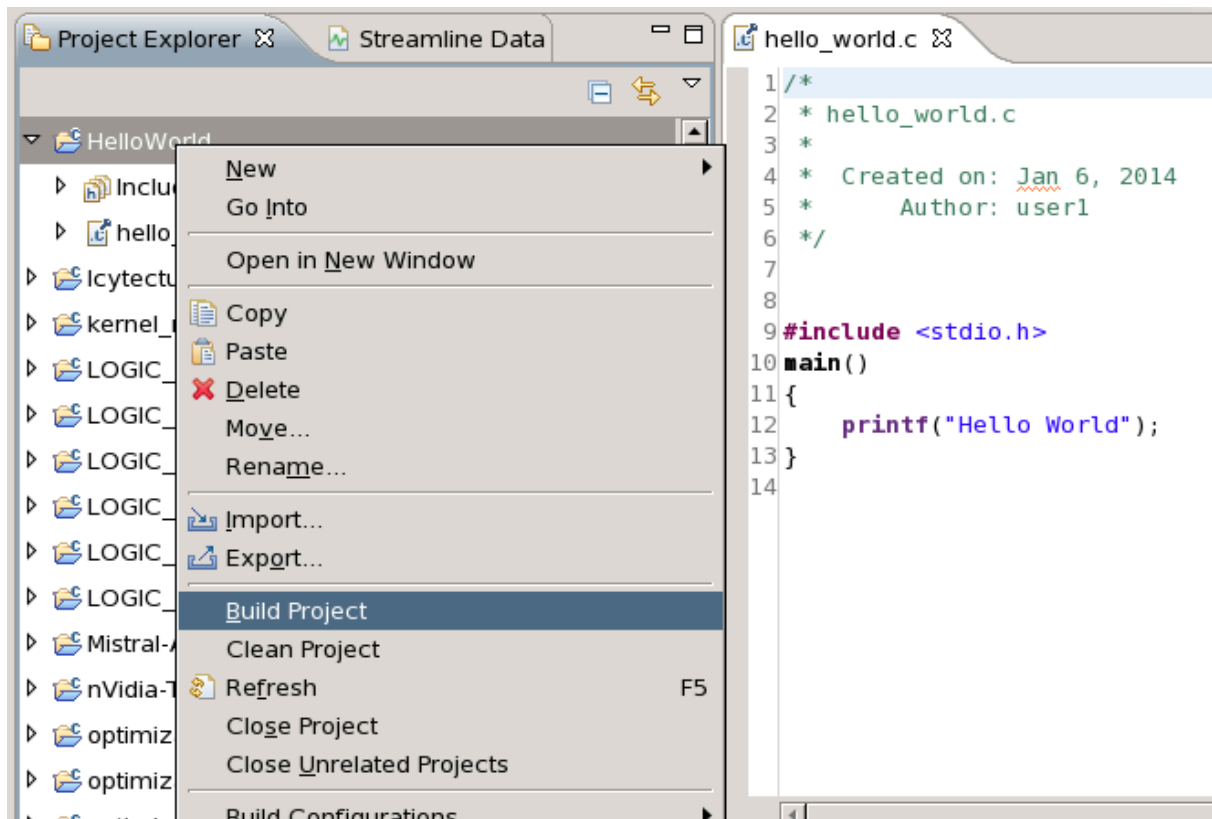
1. Select your project in the **Project Explorer** view.
2. Select **Project > Properties** from the main menu to display the **Properties** dialog box.

Figure 2-1: Project properties menu option

3. Expand **C/C++ Build**, then **Settings** in the **Properties** dialog box.
4. On the **Tool Settings** tab, select **Arm C Compiler > Code Generation** to display the code generation settings.
5. Enter a value for **Target CPU (-cpu)**.

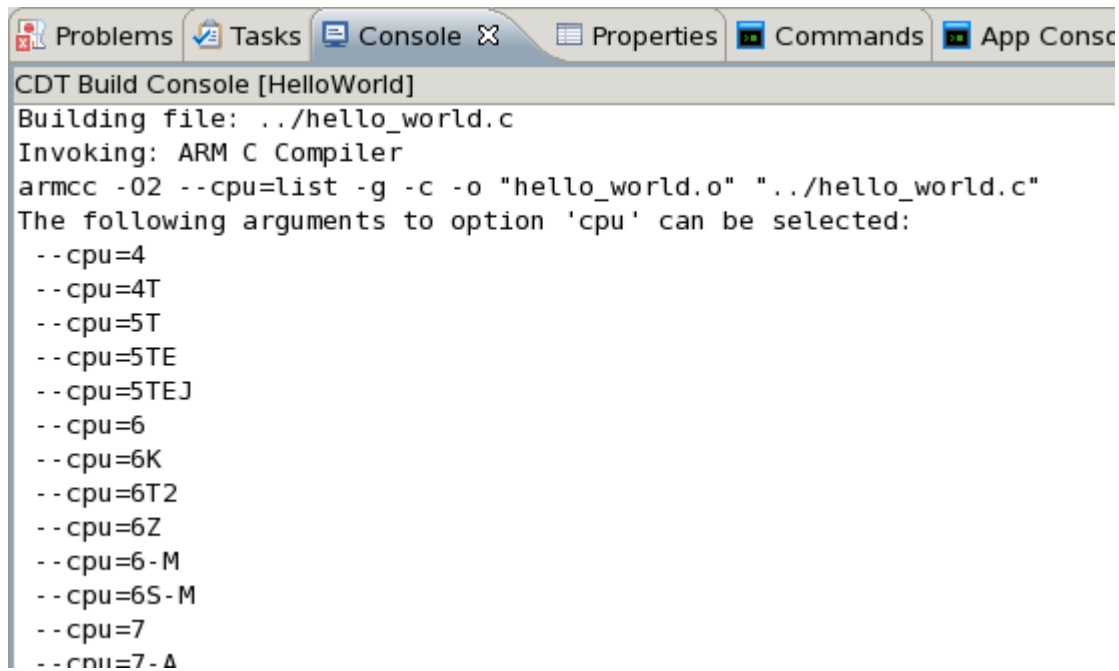
Figure 2-2: Enter a value for the Target CPU

6. Click **OK** to save the settings.

Figure 2-3: Build the project

The **Target CPU (-cpu)** setting lets you configure the **-cpu** option.

You can see a list of all supported architecture and processor names by specifying `list` for the **Target CPU (-cpu)** setting, then building your project. The console (**Window > Show View > Console**) shows the list of architecture and processor names.

Figure 2-4: Console window view

```
CDT Build Console [HelloWorld]
Building file: ../hello_world.c
Invoking: ARM C Compiler
armcc -O2 --cpu=list -g -c -o "hello_world.o" "../hello_world.c"
The following arguments to option 'cpu' can be selected:
--cpu=4
--cpu=4T
--cpu=5T
--cpu=5TE
--cpu=5TEJ
--cpu=6
--cpu=6K
--cpu=6T2
--cpu=6Z
--cpu=6-M
--cpu=6S-M
--cpu=7
--cpu=7-A
```

If the compiled program is to run on a specific Arm architecture-based processor, select the target processor. For example, to compile code to run on a Cortex-A9 processor use the **Target CPU (-cpu)** setting **Cortex-A9**.

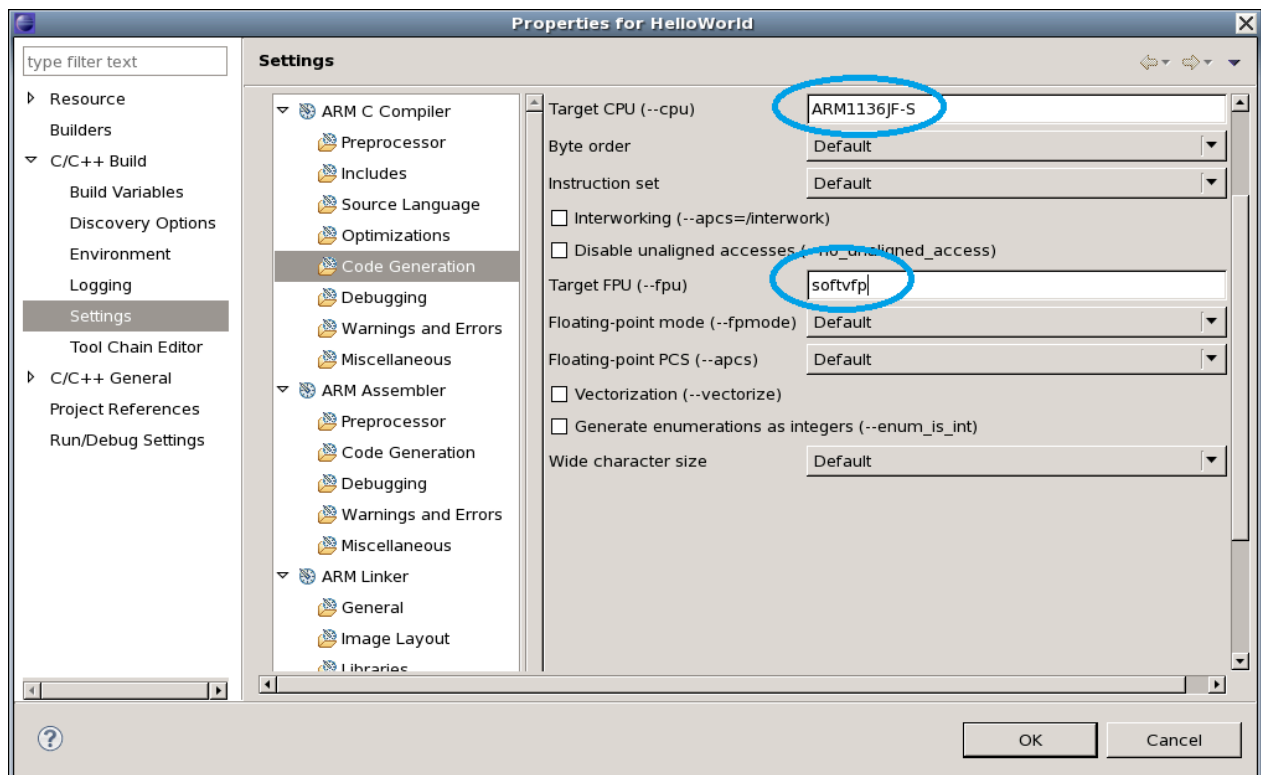
Alternatively, if the compiled program is to run on different Arm processors, choose the lowest common denominator architecture appropriate for the application and then specify that architecture in place of the processor name. For example, to compile code for processors supporting the Armv7 architecture use the **Target CPU (-cpu)** setting **7**.

3. Selecting the target FPU

Every `-cpu` target has an associated implicit Floating-Point Unit (FPU). A full list is available in [Processors and their implicit Floating-Point Units \(FPUs\)](#) in the [Arm Compiler armcc User Guide](#).

However, you can use the `-fpu` [command-line option](#) to override the implicit FPU. For example, the option `-cpu=ARM1136JF-S -fpu=softvfp` generates code that uses the software floating-point library `fp111b`, even though the choice of processor implies the use of architecture VFPv2.

Figure 3-1: Target CPU options



To configure the `-fpu` option in DS-5, use the “**Target FPU (--fpu)**” setting. This setting is in the same location on the Properties dialog box as the “**Target CPU (--cpu)**” setting discussed above.

You can see a list of all supported FPU architectures by specifying `list` for the “**Target FPU (--fpu)**” setting, then building your project. The console (**Window** > **Show View** > **Console**) shows the list of FPU architectures.

4. Enabling NEON

Arm NEON technology is the implementation of the Advanced SIMD architecture extension. It is a 64 and 128-bit hybrid SIMD technology targeted at advanced media and signal processing applications and embedded processors.

Specific NEON instructions let you use the NEON unit to perform operations in parallel on multiple lanes of data.

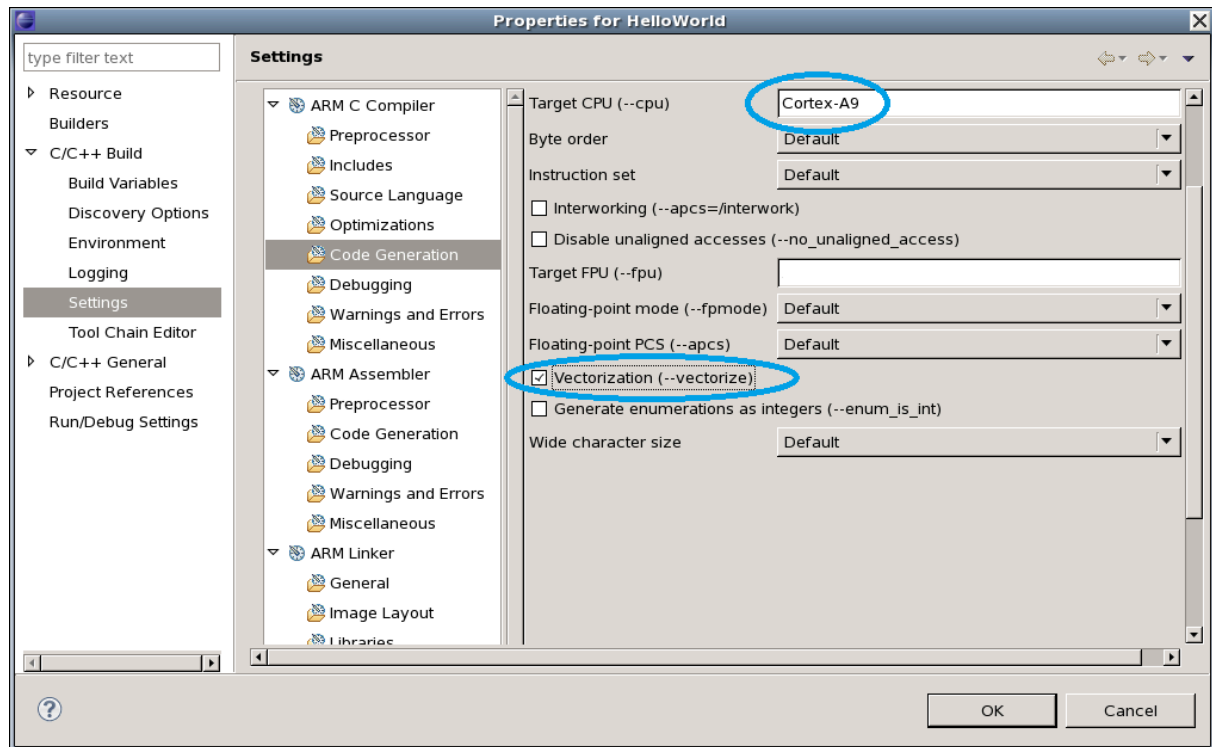
There are a number of different methods of creating code that uses NEON instructions:

- Write assembly language, or use embedded assembly language in C, and use the NEON instructions directly.
- Write in C or C++ using the NEON intrinsics.
- Call a library routine that has been optimized to use NEON instructions.
- Have the compiler use automatic vectorization to optimize loops for NEON.

To enable automatic vectorization you must target a processor that has a NEON unit. The required command line options are:

1. A target **-cpu** that has NEON capability, for example Cortex-A7, Cortex-A8, Cortex-A9, Cortex-A12, or Cortex-A15.

To configure this in DS-5, use **Target CPU (-cpu)** on the **Arm C Compiler > Code Generation** settings in the **Properties** dialog box.

Figure 4-1: Code generation settings

2. **-vectorize** to enable NEON vectorization.

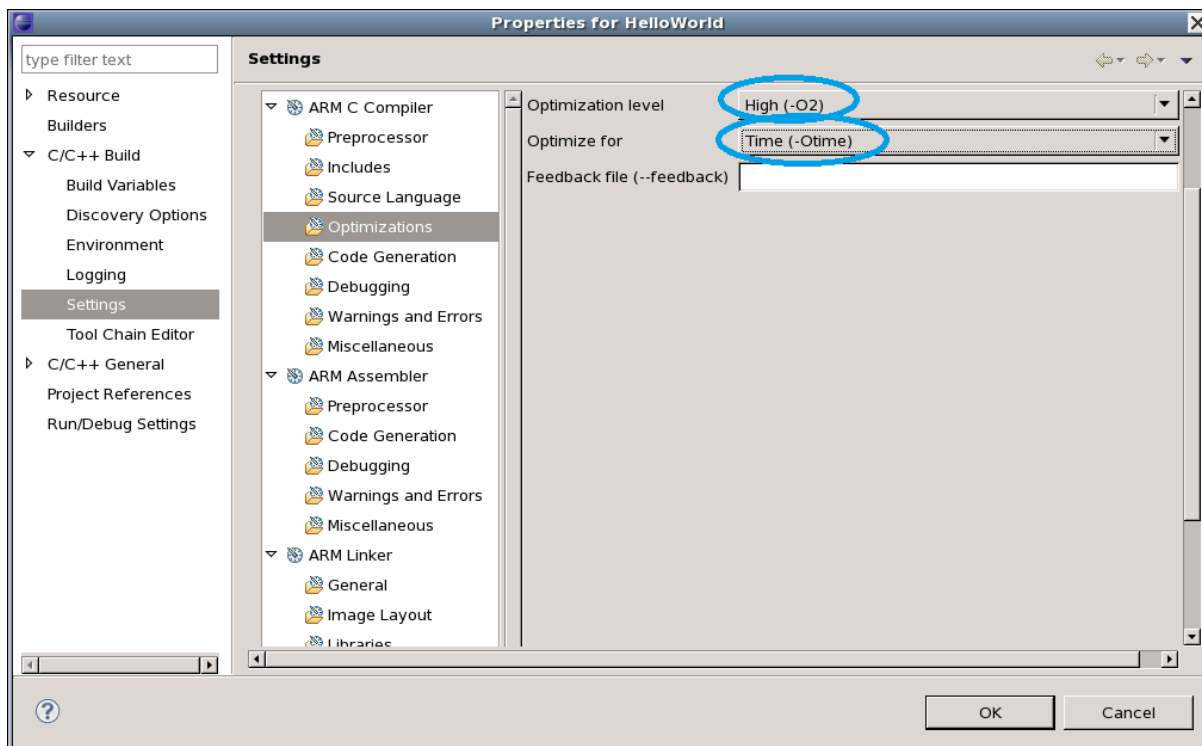
To configure this in DS-5, use **Vectorization (--vectorize)** on the **Arm C Compiler > Code Generation** settings in the **Properties** dialog box.

3. **-O2** (default) or **-O3** optimization level.

To configure this in DS-5, use **Optimization level** on the **Arm C Compiler > Optimizations** settings in the **Properties** dialog box.

4. **-Otime** to optimize for performance instead of code size.

To configure this in DS-5, use **Optimize for** on the **Arm C Compiler > Optimizations** settings in the **Properties** dialog box.

Figure 4-2: Optimization settings**Note**

You may need to [enable the NEON unit](#) before you can use NEON instructions.

5. Further reading

Here are some resources related to material in this guide:

- [Arm Compiler armcc User Guide](#)
- [Using the NEON Vectorizing Compiler](#)