
Sourcery G++ Lite
for ARM GNU/Linux version 2006q1-6
Getting Started



Sourcery G++ Lite: for ARM GNU/Linux version 2006q1-6: Getting Started

CodeSourcery, Inc.

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Preface

This preface introduces *Getting Started With Sourcery G++ Lite*. It explains the structure of this guide and lists other sources of information that relate to Sourcery G++ Lite.

1 Intended Audience

This guide is written for people who will install and/or use Sourcery G++ Lite. This guide provides a step-by-step guide to installing Sourcery G++ Lite and to building simple applications. Parts of this document assume that you have some familiarity with using the command-line interface. If you are an administrator installing Sourcery G++ Lite on a UNIX-like system for all of your users to use, you should also be familiar with the package-management software (such as the Red Hat Package Manager) for your system.

2 Organization

This document is organized into the following chapters and appendices:

Chapter 1, <i>Sourcery G++ Lite Licenses</i>	This chapter provides information about the software licenses that apply to Sourcery G++ Lite. Read this chapter to understand your legal rights and obligations as a user of Sourcery G++ Lite.
Chapter 2, <i>Sourcery G++ Lite Subscriptions</i>	This chapter provides information about Sourcery G++ Lite subscriptions. CodeSourcery customers with Sourcery G++ Lite subscriptions receive comprehensive support for Sourcery G++ Lite. Read this chapter to find out how to obtain and use a Sourcery G++ Lite subscription.
Chapter 3, <i>Sourcery G++ Lite for ARM GNU/Linux</i>	This chapter provides information about this release of Sourcery G++ Lite including any special installation instructions, recent improvements, or other similar information. You should read this chapter before building applications with Sourcery G++ Lite.
Chapter 4, <i>Installation and Configuration</i>	This chapter describes how to download, install and configure Sourcery G++ Lite. This section describes the available installation options and explains how to set up your environment so that you can build applications.
Chapter 5, <i>Using Sourcery G++ Lite with Eclipse</i>	This chapter explains how to install the Sourcery G++ Eclipse plugin so that you can use Sourcery G++ Lite with the Eclipse integrated development environment.
Chapter 6, <i>Using Sourcery G++ from the Command Line</i>	This chapter explains how to build applications with Sourcery G++ Lite using the command line. In the process of reading this chapter, you will build a simple application that you can use as a model for your own programs.
Appendix A, <i>GNU General Public License</i>	This appendix contains the full text of the GNU General Public License, the license that applies to certain components of Sourcery G++ Lite.

3 Typographical Conventions

The following typographical conventions are used in this guide:

<code>> command arg ...</code>	A command, typed by the user, and its output. The “>” character is the command prompt.
command	The name of a program, when used in a sentence, rather than in literal input or output.
<code>literal</code>	Text provided to or received from a computer program.
<i>placeholder</i>	Text that should be replaced with an appropriate value when typing a command.

Chapter 1

Sourcery G++ Lite Licenses

Sourcery G++ Lite contains software provided under a variety of licenses. Some components are "free" or "open source" software, while other components are proprietary. This chapter explains what licenses apply to your use of Sourcery G++ Lite. You should read this chapter to understand your legal rights and obligations as a user of Sourcery G++ Lite.

1.1 Overview

Sourcery G++ Lite may include any or all of the following components. Please consult the table below for the license terms applicable to each component.

Component	License
GNU Compiler Collection	GNU General Public License
GNU Binary Utilities	GNU General Public License
GNU Debugger	GNU General Public License
GNU Make	GNU General Public License
Newlib C Library	Newlib License
uClibc Library	GNU Lesser General Public License
Eclipse IDE	Eclipse Public License
Sourcery G++ Lite Plug-in for Eclipse IDE	CodeSourcery License
Sourcery G++ Lite Debug Stub for ColdFire	CodeSourcery License
Sourcery G++ Lite USB Debug Stub for Stellaris	CodeSourcery License

The GNU Public License is available in Appendix A, *GNU General Public License*. The GNU Lesser General Public License is available in Appendix B, *GNU Lesser General Public License*. The Newlib License is available at <http://sources.redhat.com/newlib/COPYING.NEWLIB>. The Eclipse Public License is available at <http://www.eclipse.org/org/documents/epl-v10.php>.

Important

Although some of the licenses that apply to Sourcery G++ Lite are "free software" or "open source software" licenses, none of these licenses impose any obligation on you to reveal the source code of applications you build with Sourcery G++ Lite. You can develop proprietary applications and libraries with Sourcery G++ Lite.

The CodeSourcery License refers to either the CodeSourcery Evaluation License Agreement (see Section 1.2, "CodeSourcery Evaluation License Agreement") or to a license agreement subsequently entered into between you and CodeSourcery, Inc. regarding these components.

1.2 CodeSourcery Evaluation License Agreement

Important

PLEASE READ THIS AGREEMENT CAREFULLY BEFORE USING SOURCERY G++. BY USING THE CODESOURCERY-OWNED COMPONENTS OF SOURCERY G++, YOU AGREE TO ACCEPT AND BE BOUND BY THE TERMS OF THIS AGREEMENT. IF YOU ARE ACTING ON BEHALF OF AN ENTITY, THEN YOU REPRESENT THAT YOU HAVE THE AUTHORITY TO ENTER INTO THIS AGREEMENT ON BEHALF OF THAT ENTITY. IF YOU DO NOT ACCEPT THE TERMS OF THIS AGREEMENT, THEN YOU MUST NOT INSTALL OR USE THE CODESOURCERY-OWNED COMPONENTS OF SOURCERY G++.

This CodeSourcery Evaluation License Agreement (the "Agreement") is made by and between CodeSourcery, Inc. and the user of Sourcery G++ ("Customer") as of the date the Customer installs Sourcery G++ (the "Effective Date").

1. **Evaluation Period.** The Evaluation Period for this Agreement is the thirty (30) day period starting on the Effective Date.
2. **Licensed Software.** The Licensed Software includes any component listed as subject to the CodeSourcery License in the table above.
3. **Evaluation License.** CodeSourcery grants to the Customer a non-transferable and non-exclusive license during the Evaluation Period to: (a) install the Licensed Software on one computer; and (b) to use the Licensed Software with Sourcery G++ solely for the purpose of evaluating Sourcery G++. Customer may not otherwise copy or distribute the Licensed Software or use the Licensed Software for any other commercial purpose. Customer may not reverse engineer, reverse compile, or disassemble the Licensed Software. CodeSourcery shall have no obligation to correct any defects in the Licensed Software or to otherwise support the Licensed Software.
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8. **Assignment.** Customer may not assign this Agreement without the prior written consent of CodeSourcery.
9. **Entire Agreement.** This is the entire agreement between the parties that supercedes any prior agreement, whether written or oral, relating to the subject matter of the Agreement.

Chapter 2

Sourcery G++ Lite Subscriptions

CodeSourcery provides support contracts for Sourcery G++ Lite. This chapter describes these contracts and explains how CodeSourcery customers can access their support accounts.

2.1 About Sourcery G++ Lite Subscriptions

CodeSourcery offers Sourcery G++ Lite subscriptions. Enterprise Edition subscriptions provide unlimited support, with no per-incident fees. CodeSourcery's support covers questions about installing and using Sourcery G++ Lite, the C and C++ programming languages, and all other topics relating to Sourcery G++ Lite. CodeSourcery provides updated versions of Sourcery G++ Lite to resolve critical problems. Personal Edition subscriptions do not include support, but do include free upgrades as long as the subscription remains active.

CodeSourcery's support is provided by the same engineers who build Sourcery G++ Lite. A Sourcery G++ Lite subscription is like having a team of compiler engineers and programming language experts available as consultants!

If you would like more information about Sourcery G++ Lite subscriptions, including a price quote or information about evaluating Sourcery G++ Lite, please send email to <sales@codesourcery.com>.

2.2 Accessing your Sourcery G++ Lite Subscription Account

If you have a Sourcery G++ Lite subscription, including an evaluation subscription, you can access your support account by visiting the Sourcery G++ support site¹. If you have a support account, but are unable to log in, send email to <support@codesourcery.com>.

¹ <https://support.codesourcery.com/GNUToolchain/>

Chapter 3

Sourcery G++ Lite for ARM GNU/Linux

This chapter contains information about using Sourcery G++ Lite on your target system. This chapter also contains information about changes in this release of Sourcery G++ Lite. You should read this chapter to learn how to best use Sourcery G++ Lite on your target system.

3.1 New Features

Based on GCC 4.1.0, the latest released version of GCC.

Support for ARMv7.

Assembler support for NEON and VFPv3, including unified NEON/VFP syntax.

3.2 Target Kernel Requirements

The GNU C library supplied with Sourcery G++ Lite uses the new EABI based kernel syscall interface. This means applications compiled with Sourcery G++ Lite require at least a 2.6.16 kernel with EABI syscalls enabled.

Chapter 4

Installation and Configuration

This chapter explains how to install Sourcery G++ Lite. You will learn how to:

1. Verify that you can install Sourcery G++ Lite on your system.
2. Download the appropriate Sourcery G++ Lite installer.
3. Install Sourcery G++ Lite.
4. Configure your environment so that you can use Sourcery G++ Lite.

4.1 Terminology

Throughout this document, the term *host system* refers to the system on which you run Sourcery G++ Lite while the term *target system* refers to the system on which the code produced by Sourcery G++ Lite runs. The target system for this version of Sourcery G++ Lite is "arm-none-linux-gnueabi".

If you are developing a workstation or server application to run on the same system that you are using to run Sourcery G++ Lite, then the host and target systems will be the same. On the other hand, if you are developing an application for an embedded system, then the host and target systems will probably be different.

4.2 System Requirements

4.2.1 Host Operating System Requirements

Sourcery G++ Lite supports the following host operating systems:

- Microsoft Windows NT 4, Windows 2000, and Windows XP systems using IA32, AMD64, and EM64T processors.
- GNU/Linux systems using the IA32, AMD64, or EM64T processors, including Debian 3.0 (and later), Red Hat Enterprise Linux 3 (and later), SuSE Enterprise Linux 8 (and later).
- Solaris 2.8 (and later) systems using SPARC processors.

Not all combinations of host and target systems are available. Therefore, Sourcery G++ Lite for your target system may not be available on all of the above host systems.

4.2.2 Host Hardware Requirements

In order to install and use Sourcery G++ Lite, you must have:

- At least 200MB of free disk space.
- At least 64MB of available memory.

4.2.3 Target System Requirements

See Chapter 3, *Sourcery G++ Lite for ARM GNU/Linux* for requirements that apply to the target system.

4.3 Downloading an Installer

If you have received Sourcery G++ Lite on a CD, or other physical media, then you do not need to download an installer. You may skip ahead to Section 4.4, "Installing Sourcery G++ Lite".

If you have a Sourcery G++ Lite subscription (or evaluation), then you can log into the Sourcery G++ support site¹ to download your Sourcery G++ Lite toolchain(s). CodeSourcery also makes some

¹ <https://support.codesourcery.com/GNUToolchain/>

toolchains available to the general public from Sourcery G++ web site². These publicly available toolchains do not include all the functionality of CodeSourcery's product releases.

Once you have navigated to the appropriate web site, download the installer that corresponds to your host operating system. For Microsoft Windows systems, the Sourcery G++ Lite installer is provided as an executable, with the `.exe` extension. For GNU/Linux Solaris systems, Sourcery G++ Lite is provided as a compressed tape archive file, with the `.tar.bz2` extension.

On Microsoft Windows systems, save the installer to the desktop. On GNU/Linux and Solaris systems, save the download package in any location that is convenient.

4.4 Installing Sourcery G++ Lite

The method used to install Sourcery G++ Lite depends on your host system.

4.4.1 Installing Sourcery G++ Lite on Microsoft Windows

If you have received Sourcery G++ Lite on CD, insert the CD in your computer. On most computers, the installer will start automatically. If your computer has been configured not to automatically run CDs, open My Computer, and double click on the CD. If you downloaded Sourcery G++ Lite, double-click on the installer.

After the installer starts, follow the on-screen dialogs to install Sourcery G++ Lite.

Some versions of Sourcery G++ Lite include the Eclipse Integrated Development Environment. Because Eclipse is an optional component, the installer will allow you to choose whether or not to install it. Eclipse is a Java application, so it requires the Java Runtime Environment (JRE). The Java Runtime Environment is available at no charge from Sun Microsystems Java website³. You may download either the Java Runtime Environment (JRE) or the Java Development Kit (JDK). (The JDK includes the JRE.)

Caution

You should install the JRE before you install Sourcery G++ Lite so that Sourcery G++ Lite can automatically determine the location of your JRE. If you do not install the JRE first, Eclipse may not be able to find the JRE. In this case, you may reinstall Sourcery G++ Lite, or you may manually modify your installation as follows. Navigate the `Start` until you find the `Sourcery G++ Lite IDE`. Right click on `Sourcery G++ Lite IDE` and select `Properties`. Click the `Shortcut` tab and click in the `Target` field. Press the **End** key to move to the end of the field and adjust the path for `javaw` to contain the full path to the directory in which your JRE was installed. If you accepted the default installation directory, the correct value will be similar to `C:\Program Files\Java\jre1.5.0_06\bin\javaw`. The entire path name should be enclosed in quotation marks.

4.4.2 Installing Sourcery G++ Lite on GNU/Linux or Solaris

You do not need to be a system administrator to install Sourcery G++ Lite on a GNU/Linux or Solaris system. You may install Sourcery G++ Lite using any user account and in any directory to which you have write access. This guide assumes that you have decided to install Sourcery G++ Lite in the

² http://www.codesourcery.com/gnu_toolchains/

³ <http://java.sun.com/j2se/>

codesourcery subdirectory of your home directory and that the filename of the package you have downloaded is `/path/to/package.tar.bz2`.

First, uncompress the package file:

```
> bunzip2 /path/to/package.tar.bz2
```

Next, create the directory in which you wish to install the package:

```
> mkdir -p $HOME/codesourcery
```

Change to the installation directory:

```
> cd $HOME/codesourcery
```

Unpack the package:

```
> tar xf /path/to/package.tar
```

4.5 Setting up the Environment

As with the installation process itself, the steps required to set up your environment depend on your host operating system. The name of the Sourcery G++ Lite commands all begin with **arm-none-linux-gnueabi** so that you can install Sourcery G++ Lite for multiple target systems in the same directory.

4.5.1 Setting up the Environment on Microsoft Windows

The installer automatically adds Sourcery G++ Lite to your `PATH`. You can test that your `PATH` is set up correctly by using the following command:

```
> arm-none-linux-gnueabi-g++
```

and verifying that you receive the message:

```
arm-none-linux-gnueabi-g++.exe: no input files
```

4.5.1.1 Working with Cygwin

Sourcery G++ Lite does not require Cygwin or any other UNIX emulation environment. You can use Sourcery G++ Lite directly from the Eclipse IDE or from the Windows command shell. You can also use Sourcery G++ Lite from within the Cygwin environment, if you prefer.

The Cygwin emulation environment translates Windows path names into UNIX path names. For example, the Cygwin path `/home/user/hello.c` corresponds to the Windows path `c:\cygwin\home\user\hello.c`. Because Sourcery G++ Lite is not a Cygwin application, it does not, by default, recognize Cygwin paths.

If you are using Sourcery G++ Lite from Cygwin, you should set the `CYGPATH` environment variable. If this environment variable is set, Sourcery G++ Lite will automatically translate Cygwin path names into Windows path names. To set this environment variable, type the following command in a Cygwin shell:

```
> export CYGPATH=
```

To resolve Cygwin path names, Sourcery G++ Lite relies on the **cygpath** utility provided with Cygwin. You must provide Sourcery G++ Lite with the full path to `cygpath` if **cygpath** is not in your `PATH`. For example:

```
> export CYGPATH=/path/to/cygpath
```

will direct Sourcery G++ Lite to use `/path/to/cygpath` as the path conversion utility.

4.5.2 Setting up the Environment on GNU/Linux or Solaris

Before using Sourcery G++ Lite you should add Sourcery G++ Lite to your `PATH`. The command you must use varies with the particular command shell that you are using. If you are using the C Shell (**csh** or **tcsh**), use the command:

```
> setenv PATH $HOME/codesourcery/bin:$PATH
```

If you are using Bourne Shell (**sh**), the Korn Shell (**ksh**), or another shell, use:

```
> export PATH=$HOME/codesourcery/bin:$PATH
```

If you are not sure which shell you are using, try both commands. In both cases, if you have installed Sourcery G++ Lite in an alternate location, you must replace the directory above with `bin` subdirectory of the directory in which you installed Sourcery G++ Lite.

You may also wish to set the `MANPATH` environment variable so that you can access the Sourcery G++ Lite manual pages, which provide additional information about using Sourcery G++ Lite. To set the `MANPATH` environment variable, follow the same steps shown above, replacing `PATH` with `MANPATH`, and `bin` with `man`.

You can test that your `PATH` is set up correctly by using the following command:

```
> arm-none-linux-gnueabi-g++
```

and verifying that you receive the message:

```
arm-none-linux-gnueabi-g++: no input files
```

Chapter 5

Using Sourcery G++ Lite with Eclipse

This chapter explains how to use the Eclipse IDE to build a C or C++ application with Sourcery G++ Lite. This chapter assumes you have installed Sourcery G++ Lite as described in Chapter 4, *Installation and Configuration*. If you would prefer to use the command line to build your applications, you may refer to Chapter 6, *Using Sourcery G++ from the Command Line* instead.

The Eclipse IDE is not included in Sourcery G++ Lite. If you are using Sourcery G++ Lite, you can skip this chapter.

5.1 Overview

If you have installed the Eclipse IDE, you can use it to build and debug your applications.

5.2 Building Applications

Start Eclipse and create a Sourcery G++ Lite project by selecting **Project** from the **New** submenu of the **File** menu. Expand the **C++** label and select **Managed Make C++ Project**. (To build a C application, expand the **C** label instead.) Click the **Next** button. Give the project the name "hello" and click the **Next** button. From the **Project Type** menu select "Executable (Sourcery G++ Lite for ARM GNU/Linux)" and click **Finish**. If you are asked whether or not to open a new perspective, click the **Yes** button.

Next, select **Source File** from the **New** submenu of the **File** to add a C++ source file to your project. Name the source file `hello.cc` and click **Finish**. Paste the following code into the file:

```
#include <iostream>

int main () {
    std::cout << "Hello, world!" << std::endl;
}
```

As soon as you save the file, Eclipse will build the program. The executable itself will be located in a subdirectory of the Eclipse workspace directory named `hello`. Of course, the executable will run on the target system, so if you are targeting an embedded system, you will have to upload the executable to the target system before running the application.

5.3 Debugging Applications

5.3.1 Choosing a Debugging Mode

Before you can use Eclipse to debug your application, you must decide which debugging mode to use. The debugging mode to use depends on your choice of target system, and, in some cases, on the way that you have built your application.

Sourcery G++ Lite supports several debugging modes, as described below. Some modes are available only in certain versions of Sourcery G++ Lite, so there may be modes listed in this section that are not available to you.

Embedded The Embedded mode is designed for use with target systems that have no operating system support for debugging. In the Embedded mode, Sourcery G++ Lite connects to a "GDB stub" running on either the target system or on a host system. You must start the stub manually.

When you debug your application in the Embedded mode, Eclipse will load the application on your target system, set the program counter to the address of the `_start` function, and then begin execution.

ROM The ROM mode is like the Embedded mode, but should be used for applications that are stored in ROM (or flash memory) on the target system. In this mode, Sourcery G++ Lite will use hardware breakpoints, since the program image cannot be modified. Therefore, there will probably be a limit on the total number of breakpoints you can create.

Some debugger operations (such as stepping over a function call) will not work correctly in the ROM mode because the debugger is unable to set software break-points.

Server	On UNIX-like operating systems (including GNU/Linux) Sourcery G++ Lite includes a program called gdbserver which can be used for remote debugging. The Server mode allows you to connect to an already-executing gdbserver .
Simulator	In the Simulator mode, Sourcery G++ Lite will use the instruction-set simulator provided with Sourcery G++ Lite. You do not need target hardware in order to use this mode.

5.3.2 Starting the Debugger

After you build your application, choose `Debug...` from the `Run` menu. Select the `C/C++ Local Application` label in the `Configurations` pane and click `New`.

On the `Main` tab, use the `Browse` button to select your project, if it is not already selected. Use the `Search Project...` button to select your application. Then, switch to the `Debugger` tab. Select the Sourcery G++ Lite debugger appropriate for your target. Then, click the `Debug` button.

You do not need to repeat this process the next time you launch the debugger. Instead, you can select `Debug Last Launched` from the `Run` menu to start the debugger.

5.4 Learning More About Eclipse

Eclipse has many features and capabilities. For more information about Eclipse in general visit the Eclipse web site¹. For more information about the C and C++ application development with Eclipse, visit the CDT web site².

¹ <http://www.eclipse.org>

² <http://www.eclipse.org/cdt/>

Chapter 6

Using Sourcery G++ from the Command Line

This chapter demonstrates the use of Sourcery G++ Lite from the command line. This chapter assumes you have installed Sourcery G++ Lite as described in Chapter 4, *Installation and Configuration*. If you would prefer to use an integrated development environment to build your applications, you may refer to Chapter 5, *Using Sourcery G++ Lite with Eclipse* instead.

6.1 Building an Application

This chapter explains how to build an application with Sourcery G++ Lite using the command line. As elsewhere in this manual, this section assumes that your target system is `arm-none-linux-gnueabi`. If you are using a different target system, you will have to replace commands that begin with **arm-none-linux-gnueabi** with the name of your target system.

Using an editor (such as **notepad** on Microsoft Windows or **vi** on UNIX-like systems), create a file named `hello.c` containing the following simple program:

```
#include <stdio.h>

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

Compile and link this program using the command:

```
> arm-none-linux-gnueabi-gcc -o hello hello.c
```

There will be no output from the compiler. (If you were building a C++ application, instead of a C application, you would replace **arm-none-linux-gnueabi-gcc** with **arm-none-linux-gnueabi-g++**.)

6.2 Running an Application

If the target system is the same as the host system (e.g., if you are running Sourcery G++ Lite on IA32 GNU/Linux to build an application for IA32 GNU/Linux), then you can just run the resulting application. On a Microsoft Windows system, you may use the command:

```
> hello
```

On a GNU/Linux or Solaris system, use the slightly more complex:

```
> ./hello
```

command. In either case, you should see:

```
Hello world!
```

If the target system is not the same as the host system, then you cannot run the application directly. Instead, you will have to run the application on the target system. You should consult the manuals for your target system to determine the exact procedures required to run the application.

On some systems, Sourcery G++ Lite includes a simulator that can be used to run the program. To use the simulator run:

```
> arm-none-linux-gnueabi-run hello
```

The simulator is available if you see the expected output:

```
Hello, world!
```

There is no simulator for your target system if you see a message like:

```
'arm-none-linux-gnueabi-run' is not recognized as an internal or external command
```

or:

```
arm-none-linux-gnueabi-run: command not found
```

Appendix A. GNU General Public License

Version 2, June 1991

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Version 2, June 1991

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