
Sourcery G++

Getting Started



Sourcery G++: Getting Started

CodeSourcery, Inc.

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Preface

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

1 Intended Audience

This guide is written for people who will install and/or use Sourcery G++. This guide provides a step-by-step guide to installing Sourcery G++ 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++ 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++ Licenses</i>	This chapter provides information about the software licenses that apply to Sourcery G++. Read this chapter to understand your legal rights and obligations as a user of Sourcery G++.
Chapter 2, <i>Sourcery G++ Subscriptions</i>	This chapter provides information about Sourcery G++ subscriptions. CodeSourcery customers with Sourcery G++ subscriptions receive comprehensive support for Sourcery G++. Read this chapter to find out how to obtain and use a Sourcery G++ subscription.
Chapter 3, <i>Sourcery G++ for ARM SymbianOS</i>	This chapter provides information about this release of Sourcery G++ including any special installation instructions, recent improvements, or other similar information. You should read this chapter before building applications with Sourcery G++.
Chapter 4, <i>Installation and Configuration</i>	This chapter describes how to download, install and configure Sourcery G++. 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++ with Eclipse</i>	This chapter explains how to install the Sourcery G++ Eclipse plugin so that you can use Sourcery G++ 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++ 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++.

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++ Licenses

Sourcery G++ 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++. You should read this chapter to understand your legal rights and obligations as a user of Sourcery G++.

1.1 Overview

Sourcery G++ 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++ Plug-in for Eclipse IDE	CodeSourcery License
Sourcery G++ Debug Stub for ColdFire	CodeSourcery License
Sourcery G++ 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++ 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++. You can develop proprietary applications and libraries with Sourcery G++.

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.
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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++ Subscriptions

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

2.1 About Sourcery G++ Subscriptions

CodeSourcery offers Sourcery G++ subscriptions. Enterprise Edition subscriptions provide unlimited support, with no per-incident fees. CodeSourcery's support covers questions about installing and using Sourcery G++, the C and C++ programming languages, and all other topics relating to Sourcery G++. CodeSourcery provides updated versions of Sourcery G++ 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++. A Sourcery G++ 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++ subscriptions, including a price quote or information about evaluating Sourcery G++, please send email to <sales@codesourcery.com>.

2.2 Accessing your Sourcery G++ Subscription Account

If you have a Sourcery G++ 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++ for ARM SymbianOS

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

3.1 SymbianOS Runtime Libraries

Sourcery G++ does not include C or C++ runtime libraries for SymbianOS. These are provided separately by Symbian.

Chapter 4

Installation and Configuration

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

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

4.1 Terminology

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

If you are developing a workstation or server application to run on the same system that you are using to run Sourcery G++, 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++ 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++ 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++, 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++ for ARM SymbianOS* for requirements that apply to the target system.

4.3 Downloading an Installer

If you have received Sourcery G++ 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++".

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

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

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

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++ installer is provided as an executable, with the `.exe` extension. For GNU/Linux Solaris systems, Sourcery G++ 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++

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

4.4.1 Installing Sourcery G++ on Microsoft Windows

If you have received Sourcery G++ 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++, double-click on the installer.

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

Some versions of Sourcery G++ 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++ so that Sourcery G++ 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++, or you may manually modify your installation as follows. Navigate the `Start` until you find the `Sourcery G++ IDE`. Right click on `Sourcery G++ 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++ on GNU/Linux or Solaris

You do not need to be a system administrator to install Sourcery G++ on a GNU/Linux or Solaris system. You may install Sourcery G++ 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++ in the `code-sourcery` 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
```

³ <http://java.sun.com/j2se/>

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++ commands all begin with **arm-none-symbianelf** so that you can install Sourcery G++ for multiple target systems in the same directory.

4.5.1 Setting up the Environment on Microsoft Windows

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

```
> arm-none-symbianelf-g++
```

and verifying that you receive the message:

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

4.5.1.1 Working with Cygwin

Sourcery G++ does not require Cygwin or any other UNIX emulation environment. You can use Sourcery G++ directly from the Eclipse IDE or from the Windows command shell. You can also use Sourcery G++ 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++ is not a Cygwin application, it does not, by default, recognize Cygwin paths.

If you are using Sourcery G++ from Cygwin, you should set the `CYGPATH` environment variable. If this environment variable is set, Sourcery G++ 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++ relies on the **cygpath** utility provided with Cygwin. You must provide Sourcery G++ with the full path to `cygpath` if **cygpath** is not in your `PATH`. For example:

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

will direct Sourcery G++ 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++ you should add Sourcery G++ 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++ in an alternate location, you must replace the directory above with `bin` subdirectory of the directory in which you installed Sourcery G++.

You may also wish to set the `MANPATH` environment variable so that you can access the Sourcery G++ manual pages, which provide additional information about using Sourcery G++. 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-symbianelf-g++
```

and verifying that you receive the message:

```
arm-none-symbianelf-g++: no input files
```

Chapter 5

Using Sourcery G++ with Eclipse

This chapter explains how to use the Eclipse IDE to build a C or C++ application with Sourcery G++. This chapter assumes you have installed Sourcery G++ 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.

5.1 Overview

The Eclipse IDE is included with some releases of Sourcery G++. 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++ 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++ for ARM SymbianOS)" 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++ supports several debugging modes, as described below. Some modes are available only in certain versions of Sourcery G++, 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++ 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++ 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 breakpoints.

Server	On UNIX-like operating systems (including GNU/Linux) Sourcery G++ 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++ will use the instruction-set simulator provided with Sourcery G++. 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++ 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++ from the command line. This chapter assumes you have installed Sourcery G++ 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++ with Eclipse* instead.

6.1 Building an Application

This chapter explains how to build an application with Sourcery G++ using the command line. As elsewhere in this manual, this section assumes that your target system is `arm-none-symbianelf`. If you are using a different target system, you will have to replace commands that begin with **arm-none-symbianelf** 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-symbianelf-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-symbianelf-gcc** with **arm-none-symbianelf-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++ 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++ includes a simulator that can be used to run the program. To use the simulator run:

```
> arm-none-symbianelf-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-symbianelf-run' is not recognized as an internal or external command
```

or:

```
arm-none-sybianelf-run: command not found
```

Appendix A. GNU General Public License

Version 2, June 1991

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Free Software Foundation, Inc.

51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 USA

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Version 2, June 1991

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change free software - to make sure the software is free for all its users. This General Public License applies to most of the Free Software Foundation's software and to any other program whose authors commit to using it. (Some other Free Software Foundation software is covered by the GNU Library General Public License instead.) You can apply it to your programs, too.

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Version 2.1, February 1999

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We call this license the *Lesser* General Public License because it does Less to protect the user's freedom than the ordinary General Public License. It also provides other free software developers Less of an advantage over competing non-free programs. These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances.

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In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

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(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

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Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

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B.2.6 Section 5

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As an exception to the Sections above, you may also combine or link a “work that uses the Library” with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

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- c. Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.
- d. If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.
- e. Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the “work that uses the Library” must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

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B.2.17 Section 16

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