

An Introduction to GCC

for the GNU Compilers `gcc` and `g++`

Brian Gough

Foreword by Richard M. Stallman

A catalogue record for this book is available from the British Library.

First printing, March 2004 (7/3/2004).

Published by Network Theory Limited.

15 Royal Park
Bristol
BS8 3AL
United Kingdom

Email: info@network-theory.co.uk

ISBN 0-9541617-9-3

Further information about this book is available from
<http://www.network-theory.co.uk/gcc/intro/>

Cover Image: From a layout of a fast, energy-efficient hardware stack.⁽¹⁾ Image created with the free Electric VLSI design system by Steven Rubin of Static Free Software (www.staticfreesoft.com). Static Free Software provides support for Electric to the electronics design industry.

Copyright © 2004 Network Theory Ltd.

Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.2 or any later version published by the Free Software Foundation; with no Invariant Sections, with the Front-Cover Texts being “A Network Theory Manual”, and with the Back-Cover Texts as in (a) below. A copy of the license is included in the section entitled “GNU Free Documentation License”.

(a) The Back-Cover Text is: “The development of this manual was funded entirely by Network Theory Ltd. Copies published by Network Theory Ltd raise money for more free documentation.”

The Texinfo source for this manual may be obtained from:

<http://www.network-theory.co.uk/gcc/intro/src/>

⁽¹⁾ “A Fast and Energy-Efficient Stack” by J. Ebergen, D. Finchelstein, R. Kao, J. Lexau and R. Hopkins.

Table of Contents

Foreword	1
1 Introduction	3
1.1 A brief history of GCC	3
1.2 Major features of GCC	4
1.3 Programming in C and C+	4
1.4 Conventions used in this manual	5
2 Compiling a C program	7
2.1 Compiling a simple C program	7
2.2 Finding errors in a simple program	8
2.3 Compiling multiple source files	9
2.4 Compiling files independently	10
2.4.1 Creating object files from source files	11
2.4.2 Creating executables from object files	11
2.4.3 Link order of object files	12
2.5 Recompiling and relinking	13
2.6 Linking with external libraries	14
2.6.1 Link order of libraries	15
2.7 Using library header files	16
3 Compilation options	19
3.1 Setting search paths	19
3.1.1 Search path example	20
3.1.2 Environment variables	21
3.1.3 Extended search paths	22
3.2 Shared libraries and static libraries	23
3.3 C language standards	25
3.3.1 ANSI/ISO	26
3.3.2 Strict ANSI/ISO	28
3.3.3 Selecting specific standards	28
3.4 Warning options in <code>-Wall</code>	29
3.5 Additional warning options	30

4	Using the preprocessor	35
4.1	Defining macros	35
4.2	Macros with values	36
4.3	Preprocessing source files	38
5	Compiling for debugging	41
5.1	Examining core files	41
5.2	Displaying a backtrace	43
6	Compiling with optimization	45
6.1	Source-level optimization	45
6.1.1	Common subexpression elimination	45
6.1.2	Function inlining	46
6.2	Speed-space tradeoffs	47
6.2.1	Loop unrolling	47
6.3	Scheduling	49
6.4	Optimization levels	49
6.5	Examples	50
6.6	Optimization and debugging	52
6.7	Optimization and compiler warnings	53
7	Compiling a C++ program	55
7.1	Compiling a simple C++ program	55
7.2	Using the C++ standard library	56
7.3	Templates	57
7.3.1	Using C++ standard library templates	57
7.3.2	Providing your own templates	58
7.3.3	Explicit template instantiation	60
7.3.4	The <code>export</code> keyword	61
8	Platform-specific options	63
8.1	Intel and AMD x86 options	63
8.2	DEC Alpha options	64
8.3	SPARC options	65
8.4	POWER/PowerPC options	65
8.5	Multi-architecture support	66
9	Troubleshooting	69
9.1	Help for command-line options	69
9.2	Version numbers	69
9.3	Verbose compilation	70

10	Compiler-related tools	73
10.1	Creating a library with the GNU archiver	73
10.2	Using the profiler <code>gprof</code>	75
10.3	Coverage testing with <code>gcov</code>	77
11	How the compiler works	81
11.1	An overview of the compilation process	81
11.2	The preprocessor	81
11.3	The compiler	82
11.4	The assembler	83
11.5	The linker	83
12	Examining compiled files	85
12.1	Identifying files	85
12.2	Examining the symbol table	86
12.3	Finding dynamically linked libraries	86
13	Getting help	89
	Further reading	91
	Acknowledgements	93
	Other books from the publisher	95
	Free software organizations	97
	GNU Free Documentation License	99
	ADDENDUM: How to use this License for your documents	104
	Index	105

[Click here to download full PDF material](#)