The GNU Go Compiler

For GCC version 5.4.0

(GCC)

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Introduction

This manual describes how to use `gccgo`, the GNU compiler for the Go programming language. This manual is specifically about `gccgo`. For more information about the Go programming language in general, including language specifications and standard package documentation, see `http://golang.org/`.

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1 Invoking gccgo

The `gccgo` command is a frontend to `gcc` and supports many of the same options. See Section "Option Summary" in *Using the GNU Compiler Collection (GCC)*. This manual only documents the options specific to `gccgo`.

The `gccgo` command may be used to compile Go source code into an object file, link a collection of object files together, or do both in sequence.

Go source code is compiled as packages. A package consists of one or more Go source files. All the files in a single package must be compiled together, by passing all the files as arguments to `gccgo`. A single invocation of `gccgo` may only compile a single package.

One Go package may `import` a different Go package. The imported package must have already been compiled; `gccgo` will read the import data directly from the compiled package. When this package is later linked, the compiled form of the package must be included in the link command.

Go programs must generally be compiled with debugging information, and '`-g1`' is the default as described below. Stripping a Go program will generally cause it to misbehave or fail.

`-I`*dir* Specify a directory to use when searching for an import package at compile time.

`-L`*dir* When linking, specify a library search directory, as with `gcc`.

`-fgo-pkgpath=`*string*
: Set the package path to use. This sets the value returned by the PkgPath method of reflect.Type objects. It is also used for the names of globally visible symbols. The argument to this option should normally be the string that will be used to import this package after it has been installed; in other words, a pathname within the directories specified by the '`-I`' option.

`-fgo-prefix=`*string*
: An alternative to '`-fgo-pkgpath`'. The argument will be combined with the package name from the source file to produce the package path. If '`-fgo-pkgpath`' is used, '`-fgo-prefix`' will be ignored.

  Go permits a single program to include more than one package with the same name in the `package` clause in the source file, though obviously the two packages must be imported using different pathnames. In order for this to work with `gccgo`, either '`-fgo-pkgpath`' or '`-fgo-prefix`' must be specified when compiling a package.

  Using either '`-fgo-pkgpath`' or '`-fgo-prefix`' disables the special treatment of the `main` package and permits that package to be imported like any other.

`-fgo-relative-import-path=`*dir*
: A relative import is an import that starts with '`./`' or '`../`'. If this option is used, `gccgo` will use *dir* as a prefix for the relative import when searching for it.

`-frequire-return-statement`
`-fno-require-return-statement`
: By default `gccgo` will warn about functions which have one or more return parameters but lack an explicit `return` statement. This warning may be disabled using '`-fno-require-return-statement`'.

`-fgo-check-divide-zero`
: Add explicit checks for division by zero. In Go a division (or modulos) by zero causes a panic. On Unix systems this is detected in the runtime by catching the `SIGFPE` signal. Some processors, such as PowerPC, do not generate a SIGFPE on division by zero. Some runtimes do not generate a signal that can be caught. On those systems, this option may be used. Or the checks may be removed via '`-fno-go-check-divide-zero`'. This option is currently on by default, but in the future may be off by default on systems that do not require it.

`-fgo-check-divide-overflow`
: Add explicit checks for division overflow. For example, division overflow occurs when computing `INT_MIN / -1`. In Go this should be wrapped, to produce `INT_MIN`. Some processors, such as x86, generate a trap on division overflow. On those systems, this option may be used. Or the checks may be removed via '`-fno-go-check-divide-overflow`'. This option is currently on by default, but in the future may be off by default on systems that do not require it.

`-g`
: This is the standard `gcc` option (see Section "Debugging Options" in *Using the GNU Compiler Collection (GCC)*). It is mentioned here because by default `gccgo` turns on debugging information generation with the equivalent of the standard option '`-g1`'. This is because Go programs require debugging information to be available in order to get backtrace information. An explicit '`-g0`' may be used to disable the generation of debugging information, in which case certain standard library functions, such as `runtime.Callers`, will not operate correctly.

2 Import and Export

When `gccgo` compiles a package which exports anything, the export information will be stored directly in the object file. When a package is imported, `gccgo` must be able to find the file.

When Go code imports the package '*gopackage*', `gccgo` will look for the import data using the following filenames, using the first one that it finds.

'*gopackage*`.gox`'
'`lib`*gopackage*`.so`'
'`lib`*gopackage*`.a`'
'*gopackage*`.o`'

The compiler will search for these files in the directories named by any '`-I`' options, in order in which the directories appear on the command line. The compiler will then search several standard system directories. Finally the compiler will search the current directory (to search the current directory earlier, use '`-I.`').

The compiler will extract the export information directly from the compiled object file. The file '*gopackage*`.gox`' will typically contain nothing but export data. This can be generated from '*gopackage*`.o`' via

```
objcopy -j .go_export gopackage.o gopackage.gox
```

For example, it may be desirable to extract the export information from several different packages into their independent '*gopackage*`.gox`' files, and then to combine the different package object files together into a single shared library or archive.

At link time you must explicitly tell `gccgo` which files to link together into the executable, as is usual with `gcc`. This is different from the behaviour of other Go compilers.

3 C Interoperability

When using `gccgo` there is limited interoperability with C, or with C++ code compiled using `extern "C"`.

This information is provided largely for documentation purposes. For ordinary use it is best to build programs with the go tool and then use `import "C"`, as described at `http://golang.org/cmd/cgo`.

3.1 C Type Interoperability

Basic types map directly: an `int` in Go is an `int` in C, etc. Go `byte` is equivalent to C `unsigned char`. Pointers in Go are pointers in C. A Go `struct` is the same as C `struct` with the same field names and types.

The Go `string` type is currently defined as a two-element structure:

```
struct __go_string {
  const unsigned char *__data;
  int __length;
};
```

You can't pass arrays between C and Go. However, a pointer to an array in Go is equivalent to a C pointer to the equivalent of the element type. For example, Go `*[10]int` is equivalent to C `int*`, assuming that the C pointer does point to 10 elements.

A slice in Go is a structure. The current definition is:

```
struct __go_slice {
  void *__values;
  int __count;
  int __capacity;
};
```

The type of a Go function with no receiver is equivalent to a C function whose parameter types are equivalent. When a Go function returns more than one value, the C function returns a struct. For example, these functions have equivalent types:

```
func GoFunction(int) (int, float)
struct { int i; float f; } CFunction(int)
```

A pointer to a Go function is equivalent to a pointer to a C function when the functions have equivalent types.

Go `interface`, `channel`, and `map` types have no corresponding C type (`interface` is a two-element struct and `channel` and `map` are pointers to structs in C, but the structs are deliberately undocumented). C `enum` types correspond to some integer type, but precisely which one is difficult to predict in general; use a cast. C `union` types have no corresponding Go type. C `struct` types containing bitfields have no corresponding Go type. C++ `class` types have no corresponding Go type.

Memory allocation is completely different between C and Go, as Go uses garbage collection. The exact guidelines in this area are undetermined, but it is likely that it will be permitted to pass a pointer to allocated memory from C to Go. The responsibility of eventually freeing the pointer will remain with C side, and of course if the C side frees the pointer while the Go side still has a copy the program will fail. When passing a pointer from Go to C, the Go function must retain a visible copy of it in some Go variable. Otherwise the Go garbage collector may delete the pointer while the C function is still using it.

3.2 Function Names

Go code can call C functions directly using a Go extension implemented in `gccgo`: a function declaration may be preceded by a comment giving the external name. The comment must be at the beginning of the line and must start with `//extern`. This must be followed by a space and then the external name of the function. The function declaration must be on the line immediately after the comment. For example, here is how the C function `open` can be declared in Go:

```
//extern open
func c_open(name *byte, mode int, perm int) int
```

The C function naturally expects a nul terminated string, which in Go is equivalent to a pointer to an array (not a slice!) of `byte` with a terminating zero byte. So a sample call from Go would look like (after importing the `os` package):

```
var name = [4]byte{'f', 'o', 'o', 0};
i := c_open(&amp;name[0], os.O_RDONLY, 0);
```

Note that this serves as an example only. To open a file in Go please use Go's `os.Open` function instead.

The name of Go functions accessed from C is subject to change. At present the name of a Go function that does not have a receiver is `prefix.package.Functionname`. The prefix is set by the '`-fgo-prefix`' option used when the package is compiled; if the option is not used, the default is simply `go`. To call the function from C you must set the name using the `gcc __asm__` extension.

```
extern int go_function(int) __asm__ ("myprefix.mypackage.Function");
```

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