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STM32 CubeIDE

User Manual
The GNU Binary Utilities

STM32 Cube

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(GNU Tools for STM32 7-2018-q2-update.20190328-1800)
Version 2.30.0

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Introduction

This brief manual contains documentation for the GNU binary utilities (GNU Tools for STM32 7-2018-q2-update.20190328-1800) version 2.30.0:

`ar` Create, modify, and extract from archives

`nm` List symbols from object files

`objcopy` Copy and translate object files

`objdump` Display information from object files

`ranlib` Generate index to archive contents

`readelf` Display the contents of ELF format files.

`size` List file section sizes and total size

`strings` List printable strings from files

`strip` Discard symbols

`elfedit` Update the ELF header of ELF files.

`c++filt` Demangle encoded C++ symbols (on MS-DOS, this program is named `cxxfilt`)

`addr2line`
Convert addresses into file names and line numbers

`nlmconv` Convert object code into a Netware Loadable Module

`windres` Manipulate Windows resources

`windmc` Generator for Windows message resources

`dlltool` Create the files needed to build and use Dynamic Link Libraries

1 ar

```
ar [-]p[mod] ['--plugin' name] ['--target' bfdname] [relpos] [count] archive [member...]
ar -M [ <mri-script ]
```

The GNU `ar` program creates, modifies, and extracts from archives. An *archive* is a single file holding a collection of other files in a structure that makes it possible to retrieve the original individual files (called *members* of the archive).

The original files' contents, mode (permissions), timestamp, owner, and group are preserved in the archive, and can be restored on extraction.

GNU `ar` can maintain archives whose members have names of any length; however, depending on how `ar` is configured on your system, a limit on member-name length may be imposed for compatibility with archive formats maintained with other tools. If it exists, the limit is often 15 characters (typical of formats related to a.out) or 16 characters (typical of formats related to coff).

`ar` is considered a binary utility because archives of this sort are most often used as *libraries* holding commonly needed subroutines.

`ar` creates an index to the symbols defined in relocatable object modules in the archive when you specify the modifier '`s`'. Once created, this index is updated in the archive whenever `ar` makes a change to its contents (save for the '`q`' update operation). An archive with such an index speeds up linking to the library, and allows routines in the library to call each other without regard to their placement in the archive.

You may use '`nm -s`' or '`nm --print-armap`' to list this index table. If an archive lacks the table, another form of `ar` called `ranlib` can be used to add just the table.

GNU `ar` can optionally create a *thin* archive, which contains a symbol index and references to the original copies of the member files of the archive. This is useful for building libraries for use within a local build tree, where the relocatable objects are expected to remain available, and copying the contents of each object would only waste time and space.

An archive can either be *thin* or it can be normal. It cannot be both at the same time. Once an archive is created its format cannot be changed without first deleting it and then creating a new archive in its place.

Thin archives are also *flattened*, so that adding one thin archive to another thin archive does not nest it, as would happen with a normal archive. Instead the elements of the first archive are added individually to the second archive.

The paths to the elements of the archive are stored relative to the archive itself.

GNU `ar` is designed to be compatible with two different facilities. You can control its activity using command-line options, like the different varieties of `ar` on Unix systems; or, if you specify the single command-line option '`-M`', you can control it with a script supplied via standard input, like the MRI "librarian" program.

1.1 Controlling ar on the Command Line

```
ar ['-X32_64'] ['-']p[mod] ['--plugin' name] ['--target' bfdname] [relpos] [count] archive [member...]
```

When you use `ar` in the Unix style, `ar` insists on at least two arguments to execute: one keyletter specifying the *operation* (optionally accompanied by other keyletters specifying *modifiers*), and the archive name to act on.

Most operations can also accept further *member* arguments, specifying particular files to operate on.

GNU `ar` allows you to mix the operation code *p* and modifier flags *mod* in any order, within the first command-line argument.

If you wish, you may begin the first command-line argument with a dash.

The *p* keyletter specifies what operation to execute; it may be any of the following, but you must specify only one of them:

'`d`' *Delete* modules from the archive. Specify the names of modules to be deleted as *member*...; the archive is untouched if you specify no files to delete.

If you specify the '`v`' modifier, `ar` lists each module as it is deleted.

'`m`' Use this operation to *move* members in an archive.

The ordering of members in an archive can make a difference in how programs are linked using the library, if a symbol is defined in more than one member.

If no modifiers are used with `m`, any members you name in the *member* arguments are moved to the *end* of the archive; you can use the '`a`', '`b`', or '`i`' modifiers to move them to a specified place instead.

'`p`' *Print* the specified members of the archive, to the standard output file. If the '`v`' modifier is specified, show the member name before copying its contents to standard output.

If you specify no *member* arguments, all the files in the archive are printed.

'`q`' *Quick append*; Historically, add the files *member*... to the end of *archive*, without checking for replacement.

The modifiers '`a`', '`b`', and '`i`' do *not* affect this operation; new members are always placed at the end of the archive.

The modifier '`v`' makes `ar` list each file as it is appended.

Since the point of this operation is speed, implementations of `ar` have the option of not updating the archive's symbol table if one exists. Too many different systems however assume that symbol tables are always up-to-date, so GNU `ar` will rebuild the table even with a quick append.

Note - GNU `ar` treats the command '`qs`' as a synonym for '`r`' - replacing already existing files in the archive and appending new ones at the end.

'`r`' Insert the files *member*... into *archive* (with *replacement*). This operation differs from '`q`' in that any previously existing members are deleted if their names match those being added.

If one of the files named in *member*... does not exist, `ar` displays an error message, and leaves undisturbed any existing members of the archive matching that name.

By default, new members are added at the end of the file; but you may use one of the modifiers '`a`', '`b`', or '`i`' to request placement relative to some existing member.

The modifier '`v`' used with this operation elicits a line of output for each file inserted, along with one of the letters '`a`' or '`r`' to indicate whether the file was appended (no old member deleted) or replaced.

'`s`' Add an index to the archive, or update it if it already exists. Note this command is an exception to the rule that there can only be one command letter, as it is possible to use it as either a command or a modifier. In either case it does the same thing.

'`t`' Display a *table* listing the contents of *archive*, or those of the files listed in *member*... that are present in the archive. Normally only the member name is shown; if you also want to see the modes (permissions), timestamp, owner, group, and size, you can request that by also specifying the '`v`' modifier.

If you do not specify a *member*, all files in the archive are listed.

If there is more than one file with the same name (say, '`fie`') in an archive (say '`b.a`'), '`ar t b.a fie`' lists only the first instance; to see them all, you must ask for a complete listing—in our example, '`ar t b.a`'.

'`x`' *Extract* members (named *member*) from the archive. You can use the '`v`' modifier with this operation, to request that `ar` list each name as it extracts it.

If you do not specify a *member*, all files in the archive are extracted.

Files cannot be extracted from a thin archive.

A number of modifiers (*mod*) may immediately follow the *p* keyletter, to specify variations on an operation's behavior:

'`a`' Add new files *after* an existing member of the archive. If you use the modifier '`a`', the name of an existing archive member must be present as the *relpos* argument, before the *archive* specification.

'`b`' Add new files *before* an existing member of the archive. If you use the modifier '`b`', the name of an existing archive member must be present as the *relpos* argument, before the *archive* specification. (same as '`i`').

'`c`' *Create* the archive. The specified *archive* is always created if it did not exist, when you request an update. But a warning is issued unless you specify in advance that you expect to create it, by using this modifier.

'`D`' Operate in *deterministic* mode. When adding files and the archive index use zero for UIDs, GIDs, timestamps, and use consistent file modes for all files. When this option is used, if `ar` is used with identical options and identical input files, multiple runs will create identical output files regardless of the input files' owners, groups, file modes, or modification times.

If '`binutils`' was configured with '`--enable-deterministic-archives`', then this mode is on by default. It can be disabled with the '`U`' modifier, below.

‘f’ Truncate names in the archive. GNU ar will normally permit file names of any length. This will cause it to create archives which are not compatible with the native ar program on some systems. If this is a concern, the ‘f’ modifier may be used to truncate file names when putting them in the archive.

‘i’ Insert new files *before* an existing member of the archive. If you use the modifier ‘i’, the name of an existing archive member must be present as the *relpos* argument, before the *archive* specification. (same as ‘b’).

‘l’ This modifier is accepted but not used.

‘N’ Uses the *count* parameter. This is used if there are multiple entries in the archive with the same name. Extract or delete instance *count* of the given name from the archive.

‘o’ Preserve the *original* dates of members when extracting them. If you do not specify this modifier, files extracted from the archive are stamped with the time of extraction.

‘P’ Use the full path name when matching names in the archive. GNU ar can not create an archive with a full path name (such archives are not POSIX complaint), but other archive creators can. This option will cause GNU ar to match file names using a complete path name, which can be convenient when extracting a single file from an archive created by another tool.

‘s’ Write an object-file index into the archive, or update an existing one, even if no other change is made to the archive. You may use this modifier flag either with any operation, or alone. Running ‘ar s’ on an archive is equivalent to running ‘ranlib’ on it.

‘S’ Do not generate an archive symbol table. This can speed up building a large library in several steps. The resulting archive can not be used with the linker. In order to build a symbol table, you must omit the ‘S’ modifier on the last execution of ‘ar’, or you must run ‘ranlib’ on the archive.

‘T’ Make the specified *archive* a *thin* archive. If it already exists and is a regular archive, the existing members must be present in the same directory as *archive*.

‘u’ Normally, ‘ar r’... inserts all files listed into the archive. If you would like to insert *only* those of the files you list that are newer than existing members of the same names, use this modifier. The ‘u’ modifier is allowed only for the operation ‘r’ (replace). In particular, the combination ‘qu’ is not allowed, since checking the timestamps would lose any speed advantage from the operation ‘q’.

‘U’ Do *not* operate in *deterministic* mode. This is the inverse of the ‘D’ modifier, above: added files and the archive index will get their actual UID, GID, timestamp, and file mode values.

This is the default unless ‘binutils’ was configured with ‘--enable-deterministic-archives’.

‘v’ This modifier requests the *verbose* version of an operation. Many operations display additional information, such as filenames processed, when the modifier ‘v’ is appended.

‘V’ This modifier shows the version number of ar.

The ar program also supports some command line options which are neither modifiers nor actions, but which do change its behaviour in specific ways:

‘--help’ Displays the list of command line options supported by ar and then exits.

‘--version’
Displays the version information of ar and then exits.

‘-X32_64’ ar ignores an initial option spelt ‘-X32_64’, for compatibility with AIX. The behaviour produced by this option is the default for GNU ar. ar does not support any of the other ‘-X’ options; in particular, it does not support ‘-X32’ which is the default for AIX ar.

‘--plugin *name*’
The optional command line switch ‘--plugin *name*’ causes ar to load the plugin called *name* which adds support for more file formats, including object files with link-time optimization information.

This option is only available if the toolchain has been built with plugin support enabled.

If ‘--plugin’ is not provided, but plugin support has been enabled then ar iterates over the files in ‘${libdir}/bfd-plugins’ in alphabetic order and the first plugin that claims the object in question is used.

Please note that this plugin search directory is *not* the one used by ld’s ‘-plugin’ option. In order to make ar use the linker plugin it must be copied into the ‘${libdir}/bfd-plugins’ directory. For GCC based compilations the linker plugin is called ‘liblto_plugin.so.0.0.0’. For Clang based compilations it is called ‘LLVMgold.so’. The GCC plugin is always backwards compatible with earlier versions, so it is sufficient to just copy the newest one.

‘--target *target*’
The optional command line switch ‘--target *bfdname*’ specifies that the archive members are in an object code format different from your system’s default format. See See Section 19.1 [Target Selection], page 79, for more information.

1.2 Controlling ar with a Script

```
ar -M [ <script ]
```

If you use the single command-line option ‘-M’ with ar, you can control its operation with a rudimentary command language. This form of ar operates interactively if standard input is coming directly from a terminal. During interactive use, ar prompts for input (the prompt is ‘AR >’), and continues executing even after errors. If you redirect standard input to a script file, no prompts are issued, and ar abandons execution (with a nonzero exit code) on any error.

The ar command language is *not* designed to be equivalent to the command-line options; in fact, it provides somewhat less control over archives. The only purpose of the command language is to ease the transition to GNU ar for developers who already have scripts written for the MRI “librarian” program.

The syntax for the `ar` command language is straightforward:

- commands are recognized in upper or lower case; for example, `LIST` is the same as `list`. In the following descriptions, commands are shown in upper case for clarity.
- a single command may appear on each line; it is the first word on the line.
- empty lines are allowed, and have no effect.
- comments are allowed; text after either of the characters '`*`' or '`;`' is ignored.
- Whenever you use a list of names as part of the argument to an `ar` command, you can separate the individual names with either commas or blanks. Commas are shown in the explanations below, for clarity.
- '`+`' is used as a line continuation character; if '`+`' appears at the end of a line, the text on the following line is considered part of the current command.

Here are the commands you can use in `ar` scripts, or when using `ar` interactively. Three of them have special significance:

`OPEN` or `CREATE` specify a *current archive*, which is a temporary file required for most of the other commands.

`SAVE` commits the changes so far specified by the script. Prior to `SAVE`, commands affect only the temporary copy of the current archive.

`ADDLIB` *archive*
`ADDLIB` *archive* (*module*, *module*, ... *module*)
: Add all the contents of *archive* (or, if specified, each named *module* from *archive*) to the current archive.

  Requires prior use of `OPEN` or `CREATE`.

`ADDMOD` *member*, *member*, ... *member*
: Add each named *member* as a module in the current archive.

  Requires prior use of `OPEN` or `CREATE`.

`CLEAR`
: Discard the contents of the current archive, canceling the effect of any operations since the last `SAVE`. May be executed (with no effect) even if no current archive is specified.

`CREATE` *archive*
: Creates an archive, and makes it the current archive (required for many other commands). The new archive is created with a temporary name; it is not actually saved as *archive* until you use `SAVE`. You can overwrite existing archives; similarly, the contents of any existing file named *archive* will not be destroyed until `SAVE`.

`DELETE` *module*, *module*, ... *module*
: Delete each listed *module* from the current archive; equivalent to '`ar -d` *archive module ... module*'.

  Requires prior use of `OPEN` or `CREATE`.

`DIRECTORY` *archive* (*module*, ... *module*)
`DIRECTORY` *archive* (*module*, ... *module*) *outputfile*
: List each named *module* present in *archive*. The separate command `VERBOSE` specifies the form of the output: when verbose output is off, output is like that

of '`ar -t archive module...`'. When verbose output is on, the listing is like '`ar -tv archive module...`'.

Output normally goes to the standard output stream; however, if you specify *outputfile* as a final argument, `ar` directs the output to that file.

`END` Exit from `ar`, with a `0` exit code to indicate successful completion. This command does not save the output file; if you have changed the current archive since the last `SAVE` command, those changes are lost.

`EXTRACT` *module*`,` *module*`, ...` *module*

Extract each named *module* from the current archive, writing them into the current directory as separate files. Equivalent to '`ar -x archive module...`'.

Requires prior use of `OPEN` or `CREATE`.

`LIST` Display full contents of the current archive, in "verbose" style regardless of the state of `VERBOSE`. The effect is like '`ar tv archive`'. (This single command is a GNU `ar` enhancement, rather than present for MRI compatibility.)

Requires prior use of `OPEN` or `CREATE`.

`OPEN` *archive*

Opens an existing archive for use as the current archive (required for many other commands). Any changes as the result of subsequent commands will not actually affect *archive* until you next use `SAVE`.

`REPLACE` *module*`,` *module*`, ...` *module*

In the current archive, replace each existing *module* (named in the `REPLACE` arguments) from files in the current working directory. To execute this command without errors, both the file, and the module in the current archive, must exist.

Requires prior use of `OPEN` or `CREATE`.

`VERBOSE` Toggle an internal flag governing the output from `DIRECTORY`. When the flag is on, `DIRECTORY` output matches output from '`ar -tv` '....

`SAVE` Commit your changes to the current archive, and actually save it as a file with the name specified in the last `CREATE` or `OPEN` command.

Requires prior use of `OPEN` or `CREATE`.

2 ld

The GNU linker `ld` is now described in a separate manual. See Section "Overview" in *Using LD: the GNU linker*.

3 nm

```
nm ['-A'|'-o'|'--print-file-name'] ['-a'|'--debug-syms']
   ['-B'|'--format=bsd'] ['-C'|'--demangle'[=style]]
   ['-D'|'--dynamic'] ['-f'format|'--format='format]
   ['-g'|'--extern-only'] ['-h'|'--help']
   ['-l'|'--line-numbers'] ['--inlines']
   ['-n'|'-v'|'--numeric-sort']
   ['-P'|'--portability'] ['-p'|'--no-sort']
   ['-r'|'--reverse-sort'] ['-S'|'--print-size']
   ['-s'|'--print-armap'] ['-t' radix|'--radix='radix]
   ['-u'|'--undefined-only'] ['-V'|'--version']
   ['-X 32_64'] ['--defined-only'] ['--no-demangle']
   ['--plugin' name] ['--size-sort'] ['--special-syms']
   ['--synthetic'] ['--with-symbol-versions'] ['--target='bfdname]
   [objfile...]
```

GNU `nm` lists the symbols from object files *objfile*.... If no object files are listed as arguments, `nm` assumes the file '`a.out`'.

For each symbol, `nm` shows:

- The symbol value, in the radix selected by options (see below), or hexadecimal by default.
- The symbol type. At least the following types are used; others are, as well, depending on the object file format. If lowercase, the symbol is usually local; if uppercase, the symbol is global (external). There are however a few lowercase symbols that are shown for special global symbols (`u`, `v` and `w`).

`A`
: The symbol's value is absolute, and will not be changed by further linking.

`B`
`b`
: The symbol is in the uninitialized data section (known as BSS).

`C`
: The symbol is common. Common symbols are uninitialized data. When linking, multiple common symbols may appear with the same name. If the symbol is defined anywhere, the common symbols are treated as undefined references. For more details on common symbols, see the discussion of –warn-common in Section "Linker options" in *The GNU linker*.

`D`
`d`
: The symbol is in the initialized data section.

`G`
`g`
: The symbol is in an initialized data section for small objects. Some object file formats permit more efficient access to small data objects, such as a global int variable as opposed to a large global array.

`i`
: For PE format files this indicates that the symbol is in a section specific to the implementation of DLLs. For ELF format files this indicates that the symbol is an indirect function. This is a GNU extension to the standard set of ELF symbol types. It indicates a symbol which if referenced by a relocation does not evaluate to its address, but instead must be invoked at runtime. The runtime execution will then return the value to be used in the relocation.

`I` The symbol is an indirect reference to another symbol.

`N` The symbol is a debugging symbol.

`p` The symbols is in a stack unwind section.

`R`
`r` The symbol is in a read only data section.

`S`
`s` The symbol is in an uninitialized data section for small objects.

`T`
`t` The symbol is in the text (code) section.

`U` The symbol is undefined.

`u` The symbol is a unique global symbol. This is a GNU extension to the standard set of ELF symbol bindings. For such a symbol the dynamic linker will make sure that in the entire process there is just one symbol with this name and type in use.

`V`
`v` The symbol is a weak object. When a weak defined symbol is linked with a normal defined symbol, the normal defined symbol is used with no error. When a weak undefined symbol is linked and the symbol is not defined, the value of the weak symbol becomes zero with no error. On some systems, uppercase indicates that a default value has been specified.

`W`
`w` The symbol is a weak symbol that has not been specifically tagged as a weak object symbol. When a weak defined symbol is linked with a normal defined symbol, the normal defined symbol is used with no error. When a weak undefined symbol is linked and the symbol is not defined, the value of the symbol is determined in a system-specific manner without error. On some systems, uppercase indicates that a default value has been specified.

`-` The symbol is a stabs symbol in an a.out object file. In this case, the next values printed are the stabs other field, the stabs desc field, and the stab type. Stabs symbols are used to hold debugging information.

`?` The symbol type is unknown, or object file format specific.

- The symbol name.

The long and short forms of options, shown here as alternatives, are equivalent.

`-A`
`-o`
`--print-file-name`
: Precede each symbol by the name of the input file (or archive member) in which it was found, rather than identifying the input file once only, before all of its symbols.

`-a`
`--debug-syms`
: Display all symbols, even debugger-only symbols; normally these are not listed.

`-B` The same as '`--format=bsd`' (for compatibility with the MIPS `nm`).

`-C`
`--demangle[=`*`style`*`]`
: Decode (*demangle*) low-level symbol names into user-level names. Besides removing any initial underscore prepended by the system, this makes C++ function names readable. Different compilers have different mangling styles. The optional demangling style argument can be used to choose an appropriate demangling style for your compiler. See Chapter 10 [c++filt], page 52, for more information on demangling.

`--no-demangle`
: Do not demangle low-level symbol names. This is the default.

`-D`
`--dynamic`
: Display the dynamic symbols rather than the normal symbols. This is only meaningful for dynamic objects, such as certain types of shared libraries.

`-f` *`format`*
`--format=`*`format`*
: Use the output format *format*, which can be `bsd`, `sysv`, or `posix`. The default is `bsd`. Only the first character of *format* is significant; it can be either upper or lower case.

`-g`
`--extern-only`
: Display only external symbols.

`-h`
`--help` Show a summary of the options to `nm` and exit.

`-l`
`--line-numbers`
: For each symbol, use debugging information to try to find a filename and line number. For a defined symbol, look for the line number of the address of the symbol. For an undefined symbol, look for the line number of a relocation entry which refers to the symbol. If line number information can be found, print it after the other symbol information.

`--inlines`
: When option '`-l`' is active, if the address belongs to a function that was inlined, then this option causes the source information for all enclosing scopes back to the first non-inlined function to be printed as well. For example, if `main` inlines `callee1` which inlines `callee2`, and address is from `callee2`, the source information for `callee1` and `main` will also be printed.

`-n`
`-v`
`--numeric-sort`
: Sort symbols numerically by their addresses, rather than alphabetically by their names.

`-p`
`--no-sort`
: Do not bother to sort the symbols in any order; print them in the order encountered.

`-P`
`--portability`
: Use the POSIX.2 standard output format instead of the default format. Equivalent to '`-f posix`'.

`-r`
`--reverse-sort`
: Reverse the order of the sort (whether numeric or alphabetic); let the last come first.

`-S`
`--print-size`
: Print both value and size of defined symbols for the `bsd` output style. This option has no effect for object formats that do not record symbol sizes, unless '`--size-sort`' is also used in which case a calculated size is displayed.

`-s`
`--print-armap`
: When listing symbols from archive members, include the index: a mapping (stored in the archive by `ar` or `ranlib`) of which modules contain definitions for which names.

`-t` *radix*
`--radix=`*radix*
: Use *radix* as the radix for printing the symbol values. It must be '`d`' for decimal, '`o`' for octal, or '`x`' for hexadecimal.

`-u`
`--undefined-only`
: Display only undefined symbols (those external to each object file).

`-V`
`--version`
: Show the version number of `nm` and exit.

`-X`
: This option is ignored for compatibility with the AIX version of `nm`. It takes one parameter which must be the string '`32_64`'. The default mode of AIX `nm` corresponds to '`-X 32`', which is not supported by GNU `nm`.

`--defined-only`
: Display only defined symbols for each object file.

`--plugin` *name*
: Load the plugin called *name* to add support for extra target types. This option is only available if the toolchain has been built with plugin support enabled.

  If '`--plugin`' is not provided, but plugin support has been enabled then `nm` iterates over the files in '`${libdir}/bfd-plugins`' in alphabetic order and the first plugin that claims the object in question is used.

Please note that this plugin search directory is *not* the one used by `ld`'s '`-plugin`' option. In order to make `nm` use the linker plugin it must be copied into the '`${libdir}/bfd-plugins`' directory. For GCC based compilations the linker plugin is called '`liblto_plugin.so.0.0.0`'. For Clang based compilations it is called '`LLVMgold.so`'. The GCC plugin is always backwards compatible with earlier versions, so it is sufficient to just copy the newest one.

`--size-sort`
: Sort symbols by size. For ELF objects symbol sizes are read from the ELF, for other object types the symbol sizes are computed as the difference between the value of the symbol and the value of the symbol with the next higher value. If the `bsd` output format is used the size of the symbol is printed, rather than the value, and '`-S`' must be used in order both size and value to be printed.

`--special-syms`
: Display symbols which have a target-specific special meaning. These symbols are usually used by the target for some special processing and are not normally helpful when included in the normal symbol lists. For example for ARM targets this option would skip the mapping symbols used to mark transitions between ARM code, THUMB code and data.

`--synthetic`
: Include synthetic symbols in the output. These are special symbols created by the linker for various purposes. They are not shown by default since they are not part of the binary's original source code.

`--with-symbol-versions`
: Enables the display of symbol version information if any exists. The version string is displayed as a suffix to the symbol name, preceeded by an `@` character. For example '`foo@VER_1`'. If the version is the default version to be used when resolving unversioned references to the symbol then it is displayed as a suffix preceeded by two `@` characters. For example '`foo@@VER_2`'.

`--target=`*`bfdname`*
: Specify an object code format other than your system's default format. See Section 19.1 [Target Selection], page 79, for more information.

4 objcopy

```
objcopy ['-F' bfdname|'--target='bfdname]
        ['-I' bfdname|'--input-target='bfdname]
        ['-O' bfdname|'--output-target='bfdname]
        ['-B' bfdarch|'--binary-architecture='bfdarch]
        ['-S'|'--strip-all']
        ['-g'|'--strip-debug']
        ['--strip-unneeded']
        ['-K' symbolname|'--keep-symbol='symbolname]
        ['-N' symbolname|'--strip-symbol='symbolname]
        ['--strip-unneeded-symbol='symbolname]
        ['-G' symbolname|'--keep-global-symbol='symbolname]
        ['--localize-hidden']
        ['-L' symbolname|'--localize-symbol='symbolname]
        ['--globalize-symbol='symbolname]
        ['-W' symbolname|'--weaken-symbol='symbolname]
        ['-w'|'--wildcard']
        ['-x'|'--discard-all']
        ['-X'|'--discard-locals']
        ['-b' byte|'--byte='byte]
        ['-i' [breadth]|'--interleave'[=breadth]]
        ['--interleave-width='width]
        ['-j' sectionpattern|'--only-section='sectionpattern]
        ['-R' sectionpattern|'--remove-section='sectionpattern]
        ['--remove-relocations='sectionpattern]
        ['-p'|'--preserve-dates']
        ['-D'|'--enable-deterministic-archives']
        ['-U'|'--disable-deterministic-archives']
        ['--debugging']
        ['--gap-fill='val]
        ['--pad-to='address]
        ['--set-start='val]
        ['--adjust-start='incr]
        ['--change-addresses='incr]
        ['--change-section-address' sectionpattern{=,+,-}val]
        ['--change-section-lma' sectionpattern{=,+,-}val]
        ['--change-section-vma' sectionpattern{=,+,-}val]
        ['--change-warnings'] ['--no-change-warnings']
        ['--set-section-flags' sectionpattern=flags]
        ['--add-section' sectionname=filename]
        ['--dump-section' sectionname=filename]
        ['--update-section' sectionname=filename]
        ['--rename-section' oldname=newname[,flags]]
        ['--long-section-names' {enable,disable,keep}]
        ['--change-leading-char'] ['--remove-leading-char']
        ['--reverse-bytes='num]
        ['--srec-len='ival] ['--srec-forceS3']
        ['--redefine-sym' old=new]
        ['--redefine-syms='filename]
        ['--weaken']
        ['--keep-symbols='filename]
        ['--strip-symbols='filename]
        ['--strip-unneeded-symbols='filename]
        ['--keep-global-symbols='filename]
        ['--localize-symbols='filename]
        ['--globalize-symbols='filename]
        ['--weaken-symbols='filename]
        ['--add-symbol' name=[section:]value[,flags]
```

```
['--alt-machine-code='index]
['--prefix-symbols='string]
['--prefix-sections='string]
['--prefix-alloc-sections='string]
['--add-gnu-debuglink='path-to-file]
['--keep-file-symbols']
['--only-keep-debug']
['--strip-dwo']
['--extract-dwo']
['--extract-symbol']
['--writable-text']
['--readonly-text']
['--pure']
['--impure']
['--file-alignment='num]
['--heap='size]
['--image-base='address]
['--section-alignment='num]
['--stack='size]
['--subsystem='which:major.minor]
['--compress-debug-sections']
['--decompress-debug-sections']
['--elf-stt-common=val']
['--merge-notes']
['--no-merge-notes']
['-v'|'--verbose']
['-V'|'--version']
['--help'] ['--info']
infile [outfile]
```

The GNU `objcopy` utility copies the contents of an object file to another. `objcopy` uses the GNU BFD Library to read and write the object files. It can write the destination object file in a format different from that of the source object file. The exact behavior of `objcopy` is controlled by command-line options. Note that `objcopy` should be able to copy a fully linked file between any two formats. However, copying a relocatable object file between any two formats may not work as expected.

`objcopy` creates temporary files to do its translations and deletes them afterward. `objcopy` uses BFD to do all its translation work; it has access to all the formats described in BFD and thus is able to recognize most formats without being told explicitly. See Section "BFD" in *Using LD*.

`objcopy` can be used to generate S-records by using an output target of '`srec`' (e.g., use '`-O srec`').

`objcopy` can be used to generate a raw binary file by using an output target of '`binary`' (e.g., use '`-O binary`'). When `objcopy` generates a raw binary file, it will essentially produce a memory dump of the contents of the input object file. All symbols and relocation information will be discarded. The memory dump will start at the load address of the lowest section copied into the output file.

When generating an S-record or a raw binary file, it may be helpful to use '`-S`' to remove sections containing debugging information. In some cases '`-R`' will be useful to remove sections which contain information that is not needed by the binary file.

Note—`objcopy` is not able to change the endianness of its input files. If the input format has an endianness (some formats do not), `objcopy` can only copy the inputs into file formats

that have the same endianness or which have no endianness (e.g., 'srec'). (However, see the '--reverse-bytes' option.)

infile
outfile The input and output files, respectively. If you do not specify *outfile*, objcopy creates a temporary file and destructively renames the result with the name of *infile*.

-I *bfdname*
--input-target=*bfdname*
Consider the source file's object format to be *bfdname*, rather than attempting to deduce it. See Section 19.1 [Target Selection], page 79, for more information.

-O *bfdname*
--output-target=*bfdname*
Write the output file using the object format *bfdname*. See Section 19.1 [Target Selection], page 79, for more information.

-F *bfdname*
--target=*bfdname*
Use *bfdname* as the object format for both the input and the output file; i.e., simply transfer data from source to destination with no translation. See Section 19.1 [Target Selection], page 79, for more information.

-B *bfdarch*
--binary-architecture=*bfdarch*
Useful when transforming a architecture-less input file into an object file. In this case the output architecture can be set to *bfdarch*. This option will be ignored if the input file has a known *bfdarch*. You can access this binary data inside a program by referencing the special symbols that are created by the conversion process. These symbols are called _binary_*objfile*_start, _binary_*objfile*_end and _binary_*objfile*_size. e.g. you can transform a picture file into an object file and then access it in your code using these symbols.

-j *sectionpattern*
--only-section=*sectionpattern*
Copy only the indicated sections from the input file to the output file. This option may be given more than once. Note that using this option inappropriately may make the output file unusable. Wildcard characters are accepted in *sectionpattern*.

If the first character of *sectionpattern* is the exclamation point (!) then matching sections will not be copied, even if earlier use of '--only-section' on the same command line would otherwise copy it. For example:

```
--only-section=.text.* --only-section=!.text.foo
```

will copy all sectinos maching '.text.*' but not the section '.text.foo'.

-R *sectionpattern*
--remove-section=*sectionpattern*
Remove any section matching *sectionpattern* from the output file. This option may be given more than once. Note that using this option inappropriately may

make the output file unusable. Wildcard characters are accepted in *sectionpattern*. Using both the '`-j`' and '`-R`' options together results in undefined behaviour.

If the first character of *sectionpattern* is the exclamation point (!) then matching sections will not be removed even if an earlier use of '`--remove-section`' on the same command line would otherwise remove it. For example:

```
--remove-section=.text.* --remove-section=!.text.foo
```

will remove all sections matching the pattern '.text.*', but will not remove the section '.text.foo'.

`--remove-relocations=`*sectionpattern*
: Remove relocations from the output file for any section matching *sectionpattern*. This option may be given more than once. Note that using this option inappropriately may make the output file unusable. Wildcard characters are accepted in *sectionpattern*. For example:

```
--remove-relocations=.text.*
```

will remove the relocations for all sections matching the patter '.text.*'.

If the first character of *sectionpattern* is the exclamation point (!) then matching sections will not have their relocation removed even if an earlier use of '`--remove-relocations`' on the same command line would otherwise cause the relocations to be removed. For example:

```
--remove-relocations=.text.* --remove-relocations=!.text.foo
```

will remove all relocations for sections matching the pattern '.text.*', but will not remove relocations for the section '.text.foo'.

`-S`
`--strip-all`
: Do not copy relocation and symbol information from the source file.

`-g`
`--strip-debug`
: Do not copy debugging symbols or sections from the source file.

`--strip-unneeded`
: Strip all symbols that are not needed for relocation processing.

`-K` *symbolname*
`--keep-symbol=`*symbolname*
: When stripping symbols, keep symbol *symbolname* even if it would normally be stripped. This option may be given more than once.

`-N` *symbolname*
`--strip-symbol=`*symbolname*
: Do not copy symbol *symbolname* from the source file. This option may be given more than once.

`--strip-unneeded-symbol=`*symbolname*
: Do not copy symbol *symbolname* from the source file unless it is needed by a relocation. This option may be given more than once.

`-G` *symbolname*
`--keep-global-symbol=`*symbolname*
: Keep only symbol *symbolname* global. Make all other symbols local to the file, so that they are not visible externally. This option may be given more than once.

`--localize-hidden`
: In an ELF object, mark all symbols that have hidden or internal visibility as local. This option applies on top of symbol-specific localization options such as '`-L`'.

`-L` *symbolname*
`--localize-symbol=`*symbolname*
: Convert a global or weak symbol called *symbolname* into a local symbol, so that it is not visible externally. This option may be given more than once. Note - unique symbols are not converted.

`-W` *symbolname*
`--weaken-symbol=`*symbolname*
: Make symbol *symbolname* weak. This option may be given more than once.

`--globalize-symbol=`*symbolname*
: Give symbol *symbolname* global scoping so that it is visible outside of the file in which it is defined. This option may be given more than once.

`-w`
`--wildcard`
: Permit regular expressions in *symbolname*s used in other command line options. The question mark (?), asterisk (*), backslash (\) and square brackets ([]) operators can be used anywhere in the symbol name. If the first character of the symbol name is the exclamation point (!) then the sense of the switch is reversed for that symbol. For example:

```
-w -W !foo -W fo*
```

  would cause objcopy to weaken all symbols that start with "fo" except for the symbol "foo".

`-x`
`--discard-all`
: Do not copy non-global symbols from the source file.

`-X`
`--discard-locals`
: Do not copy compiler-generated local symbols. (These usually start with '`L`' or '`.`'.)

`-b` *byte*
`--byte=`*byte*
: If interleaving has been enabled via the '`--interleave`' option then start the range of bytes to keep at the *byte*th byte. *byte* can be in the range from 0 to *breadth*-1, where *breadth* is the value given by the '`--interleave`' option.

`-i [`*breadth*`]`
`--interleave[=`*breadth*`]`
: Only copy a range out of every *breadth* bytes. (Header data is not affected). Select which byte in the range begins the copy with the '`--byte`' option. Select the width of the range with the '`--interleave-width`' option.

  This option is useful for creating files to program ROM. It is typically used with an `srec` output target. Note that `objcopy` will complain if you do not specify the '`--byte`' option as well.

  The default interleave breadth is 4, so with '`--byte`' set to 0, `objcopy` would copy the first byte out of every four bytes from the input to the output.

`--interleave-width=`*width*
: When used with the '`--interleave`' option, copy *width* bytes at a time. The start of the range of bytes to be copied is set by the '`--byte`' option, and the extent of the range is set with the '`--interleave`' option.

  The default value for this option is 1. The value of *width* plus the *byte* value set by the '`--byte`' option must not exceed the interleave breadth set by the '`--interleave`' option.

  This option can be used to create images for two 16-bit flashes interleaved in a 32-bit bus by passing '`-b 0 -i 4 --interleave-width=2`' and '`-b 2 -i 4 --interleave-width=2`' to two `objcopy` commands. If the input was '12345678' then the outputs would be '1256' and '3478' respectively.

`-p`
`--preserve-dates`
: Set the access and modification dates of the output file to be the same as those of the input file.

`-D`
`--enable-deterministic-archives`
: Operate in *deterministic* mode. When copying archive members and writing the archive index, use zero for UIDs, GIDs, timestamps, and use consistent file modes for all files.

  If '`binutils`' was configured with '`--enable-deterministic-archives`', then this mode is on by default. It can be disabled with the '`-U`' option, below.

`-U`
`--disable-deterministic-archives`
: Do *not* operate in *deterministic* mode. This is the inverse of the '`-D`' option, above: when copying archive members and writing the archive index, use their actual UID, GID, timestamp, and file mode values.

  This is the default unless '`binutils`' was configured with '`--enable-deterministic-archives`'.

`--debugging`
: Convert debugging information, if possible. This is not the default because only certain debugging formats are supported, and the conversion process can be time consuming.

`--gap-fill` *val*
: Fill gaps between sections with *val*. This operation applies to the *load address* (LMA) of the sections. It is done by increasing the size of the section with the lower address, and filling in the extra space created with *val*.

`--pad-to` *address*
: Pad the output file up to the load address *address*. This is done by increasing the size of the last section. The extra space is filled in with the value specified by '`--gap-fill`' (default zero).

`--set-start` *val*
: Set the start address of the new file to *val*. Not all object file formats support setting the start address.

`--change-start` *incr*
`--adjust-start` *incr*
: Change the start address by adding *incr*. Not all object file formats support setting the start address.

`--change-addresses` *incr*
`--adjust-vma` *incr*
: Change the VMA and LMA addresses of all sections, as well as the start address, by adding *incr*. Some object file formats do not permit section addresses to be changed arbitrarily. Note that this does not relocate the sections; if the program expects sections to be loaded at a certain address, and this option is used to change the sections such that they are loaded at a different address, the program may fail.

`--change-section-address` *sectionpattern*`{=,+,-}`*val*
`--adjust-section-vma` *sectionpattern*`{=,+,-}`*val*
: Set or change both the VMA address and the LMA address of any section matching *sectionpattern*. If '`=`' is used, the section address is set to *val*. Otherwise, *val* is added to or subtracted from the section address. See the comments under '`--change-addresses`', above. If *sectionpattern* does not match any sections in the input file, a warning will be issued, unless '`--no-change-warnings`' is used.

`--change-section-lma` *sectionpattern*`{=,+,-}`*val*
: Set or change the LMA address of any sections matching *sectionpattern*. The LMA address is the address where the section will be loaded into memory at program load time. Normally this is the same as the VMA address, which is the address of the section at program run time, but on some systems, especially those where a program is held in ROM, the two can be different. If '`=`' is used, the section address is set to *val*. Otherwise, *val* is added to or subtracted from the section address. See the comments under '`--change-addresses`', above. If *sectionpattern* does not match any sections in the input file, a warning will be issued, unless '`--no-change-warnings`' is used.

`--change-section-vma` *sectionpattern*`{=,+,-}`*val*
: Set or change the VMA address of any section matching *sectionpattern*. The VMA address is the address where the section will be located once the program

has started executing. Normally this is the same as the LMA address, which is the address where the section will be loaded into memory, but on some systems, especially those where a program is held in ROM, the two can be different. If '=' is used, the section address is set to *val*. Otherwise, *val* is added to or subtracted from the section address. See the comments under '`--change-addresses`', above. If *sectionpattern* does not match any sections in the input file, a warning will be issued, unless '`--no-change-warnings`' is used.

`--change-warnings`
`--adjust-warnings`
: If '`--change-section-address`' or '`--change-section-lma`' or '`--change-section-vma`' is used, and the section pattern does not match any sections, issue a warning. This is the default.

`--no-change-warnings`
`--no-adjust-warnings`
: Do not issue a warning if '`--change-section-address`' or '`--adjust-section-lma`' or '`--adjust-section-vma`' is used, even if the section pattern does not match any sections.

`--set-section-flags` *`sectionpattern=flags`*
: Set the flags for any sections matching *sectionpattern*. The *flags* argument is a comma separated string of flag names. The recognized names are '`alloc`', '`contents`', '`load`', '`noload`', '`readonly`', '`code`', '`data`', '`rom`', '`share`', and '`debug`'. You can set the '`contents`' flag for a section which does not have contents, but it is not meaningful to clear the '`contents`' flag of a section which does have contents–just remove the section instead. Not all flags are meaningful for all object file formats.

`--add-section` *`sectionname=filename`*
: Add a new section named *sectionname* while copying the file. The contents of the new section are taken from the file *filename*. The size of the section will be the size of the file. This option only works on file formats which can support sections with arbitrary names. Note - it may be necessary to use the '`--set-section-flags`' option to set the attributes of the newly created section.

`--dump-section` *`sectionname=filename`*
: Place the contents of section named *sectionname* into the file *filename*, overwriting any contents that may have been there previously. This option is the inverse of '`--add-section`'. This option is similar to the '`--only-section`' option except that it does not create a formatted file, it just dumps the contents as raw binary data, without applying any relocations. The option can be specified more than once.

`--update-section` *`sectionname=filename`*
: Replace the existing contents of a section named *sectionname* with the contents of file *filename*. The size of the section will be adjusted to the size of the file. The section flags for *sectionname* will be unchanged. For ELF format files the

section to segment mapping will also remain unchanged, something which is not possible using '`--remove-section`' followed by '`--add-section`'. The option can be specified more than once.

Note - it is possible to use '`--rename-section`' and '`--update-section`' to both update and rename a section from one command line. In this case, pass the original section name to '`--update-section`', and the original and new section names to '`--rename-section`'.

`--add-symbol` *name*`=[`*section*`:]`*value*`[,`*flags*`]`

Add a new symbol named *name* while copying the file. This option may be specified multiple times. If the *section* is given, the symbol will be associated with and relative to that section, otherwise it will be an ABS symbol. Specifying an undefined section will result in a fatal error. There is no check for the value, it will be taken as specified. Symbol flags can be specified and not all flags will be meaningful for all object file formats. By default, the symbol will be global. The special flag 'before=*othersym*' will insert the new symbol in front of the specified *othersym*, otherwise the symbol(s) will be added at the end of the symbol table in the order they appear.

`--rename-section` *oldname*`=`*newname*`[,`*flags*`]`

Rename a section from *oldname* to *newname*, optionally changing the section's flags to *flags* in the process. This has the advantage over using a linker script to perform the rename in that the output stays as an object file and does not become a linked executable.

This option is particularly helpful when the input format is binary, since this will always create a section called .data. If for example, you wanted instead to create a section called .rodata containing binary data you could use the following command line to achieve it:

```
objcopy -I binary -O <output_format> -B <architecture> \
 --rename-section .data=.rodata,alloc,load,readonly,data,contents \
 <input_binary_file> <output_object_file>
```

`--long-section-names {enable,disable,keep}`

Controls the handling of long section names when processing `COFF` and `PE-COFF` object formats. The default behaviour, '`keep`', is to preserve long section names if any are present in the input file. The '`enable`' and '`disable`' options forcibly enable or disable the use of long section names in the output object; when '`disable`' is in effect, any long section names in the input object will be truncated. The '`enable`' option will only emit long section names if any are present in the inputs; this is mostly the same as '`keep`', but it is left undefined whether the '`enable`' option might force the creation of an empty string table in the output file.

`--change-leading-char`

Some object file formats use special characters at the start of symbols. The most common such character is underscore, which compilers often add before every symbol. This option tells `objcopy` to change the leading character of every symbol when it converts between object file formats. If the object file formats

use the same leading character, this option has no effect. Otherwise, it will add a character, or remove a character, or change a character, as appropriate.

`--remove-leading-char`
: If the first character of a global symbol is a special symbol leading character used by the object file format, remove the character. The most common symbol leading character is underscore. This option will remove a leading underscore from all global symbols. This can be useful if you want to link together objects of different file formats with different conventions for symbol names. This is different from '`--change-leading-char`' because it always changes the symbol name when appropriate, regardless of the object file format of the output file.

`--reverse-bytes=`*num*
: Reverse the bytes in a section with output contents. A section length must be evenly divisible by the value given in order for the swap to be able to take place. Reversing takes place before the interleaving is performed.

  This option is used typically in generating ROM images for problematic target systems. For example, on some target boards, the 32-bit words fetched from 8-bit ROMs are re-assembled in little-endian byte order regardless of the CPU byte order. Depending on the programming model, the endianness of the ROM may need to be modified.

  Consider a simple file with a section containing the following eight bytes: `12345678`.

  Using '`--reverse-bytes=2`' for the above example, the bytes in the output file would be ordered `21436587`.

  Using '`--reverse-bytes=4`' for the above example, the bytes in the output file would be ordered `43218765`.

  By using '`--reverse-bytes=2`' for the above example, followed by '`--reverse-bytes=4`' on the output file, the bytes in the second output file would be ordered `34127856`.

`--srec-len=`*ival*
: Meaningful only for srec output. Set the maximum length of the Srecords being produced to *ival*. This length covers both address, data and crc fields.

`--srec-forceS3`
: Meaningful only for srec output. Avoid generation of S1/S2 records, creating S3-only record format.

`--redefine-sym` *old=new*
: Change the name of a symbol *old*, to *new*. This can be useful when one is trying link two things together for which you have no source, and there are name collisions.

`--redefine-syms=`*filename*
: Apply '`--redefine-sym`' to each symbol pair "*old new*" listed in the file *filename*. *filename* is simply a flat file, with one symbol pair per line. Line comments may be introduced by the hash character. This option may be given more than once.

`--weaken` Change all global symbols in the file to be weak. This can be useful when building an object which will be linked against other objects using the '`-R`' option to the linker. This option is only effective when using an object file format which supports weak symbols.

`--keep-symbols=`*filename*
: Apply '`--keep-symbol`' option to each symbol listed in the file *filename*. *filename* is simply a flat file, with one symbol name per line. Line comments may be introduced by the hash character. This option may be given more than once.

`--strip-symbols=`*filename*
: Apply '`--strip-symbol`' option to each symbol listed in the file *filename*. *filename* is simply a flat file, with one symbol name per line. Line comments may be introduced by the hash character. This option may be given more than once.

`--strip-unneeded-symbols=`*filename*
: Apply '`--strip-unneeded-symbol`' option to each symbol listed in the file *filename*. *filename* is simply a flat file, with one symbol name per line. Line comments may be introduced by the hash character. This option may be given more than once.

`--keep-global-symbols=`*filename*
: Apply '`--keep-global-symbol`' option to each symbol listed in the file *filename*. *filename* is simply a flat file, with one symbol name per line. Line comments may be introduced by the hash character. This option may be given more than once.

`--localize-symbols=`*filename*
: Apply '`--localize-symbol`' option to each symbol listed in the file *filename*. *filename* is simply a flat file, with one symbol name per line. Line comments may be introduced by the hash character. This option may be given more than once.

`--globalize-symbols=`*filename*
: Apply '`--globalize-symbol`' option to each symbol listed in the file *filename*. *filename* is simply a flat file, with one symbol name per line. Line comments may be introduced by the hash character. This option may be given more than once.

`--weaken-symbols=`*filename*
: Apply '`--weaken-symbol`' option to each symbol listed in the file *filename*. *filename* is simply a flat file, with one symbol name per line. Line comments may be introduced by the hash character. This option may be given more than once.

`--alt-machine-code=`*index*
: If the output architecture has alternate machine codes, use the *index*th code instead of the default one. This is useful in case a machine is assigned an official code and the tool-chain adopts the new code, but other applications still depend on the original code being used. For ELF based architectures if the *index* alternative does not exist then the value is treated as an absolute number to be stored in the e_machine field of the ELF header.

`--writable-text`
: Mark the output text as writable. This option isn't meaningful for all object file formats.

`--readonly-text`
: Make the output text write protected. This option isn't meaningful for all object file formats.

`--pure`
: Mark the output file as demand paged. This option isn't meaningful for all object file formats.

`--impure`
: Mark the output file as impure. This option isn't meaningful for all object file formats.

`--prefix-symbols=`*`string`*
: Prefix all symbols in the output file with *string*.

`--prefix-sections=`*`string`*
: Prefix all section names in the output file with *string*.

`--prefix-alloc-sections=`*`string`*
: Prefix all the names of all allocated sections in the output file with *string*.

`--add-gnu-debuglink=`*`path-to-file`*
: Creates a .gnu_debuglink section which contains a reference to *path-to-file* and adds it to the output file. Note: the file at *path-to-file* must exist. Part of the process of adding the .gnu_debuglink section involves embedding a checksum of the contents of the debug info file into the section.

  If the debug info file is built in one location but it is going to be installed at a later time into a different location then do not use the path to the installed location. The '`--add-gnu-debuglink`' option will fail because the installed file does not exist yet. Instead put the debug info file in the current directory and use the '`--add-gnu-debuglink`' option without any directory components, like this:

```
objcopy --add-gnu-debuglink=foo.debug
```

  At debug time the debugger will attempt to look for the separate debug info file in a set of known locations. The exact set of these locations varies depending upon the distribution being used, but it typically includes:

  * The same directory as the executable.
  * A sub-directory of the directory containing the executable called .debug
  * A global debug directory such as /usr/lib/debug.

  As long as the debug info file has been installed into one of these locations before the debugger is run everything should work correctly.

`--keep-file-symbols`
: When stripping a file, perhaps with '`--strip-debug`' or '`--strip-unneeded`', retain any symbols specifying source file names, which would otherwise get stripped.

`--only-keep-debug`

Strip a file, removing contents of any sections that would not be stripped by '`--strip-debug`' and leaving the debugging sections intact. In ELF files, this preserves all note sections in the output.

Note - the section headers of the stripped sections are preserved, including their sizes, but the contents of the section are discarded. The section headers are preserved so that other tools can match up the debuginfo file with the real executable, even if that executable has been relocated to a different address space.

The intention is that this option will be used in conjunction with '`--add-gnu-debuglink`' to create a two part executable. One a stripped binary which will occupy less space in RAM and in a distribution and the second a debugging information file which is only needed if debugging abilities are required. The suggested procedure to create these files is as follows:

1. Link the executable as normal. Assuming that is is called `foo` then...
2. Run `objcopy --only-keep-debug foo foo.dbg` to create a file containing the debugging info.
3. Run `objcopy --strip-debug foo` to create a stripped executable.
4. Run `objcopy --add-gnu-debuglink=foo.dbg foo` to add a link to the debugging info into the stripped executable.

Note—the choice of `.dbg` as an extension for the debug info file is arbitrary. Also the `--only-keep-debug` step is optional. You could instead do this:

1. Link the executable as normal.
2. Copy `foo` to `foo.full`
3. Run `objcopy --strip-debug foo`
4. Run `objcopy --add-gnu-debuglink=foo.full foo`

i.e., the file pointed to by the '`--add-gnu-debuglink`' can be the full executable. It does not have to be a file created by the '`--only-keep-debug`' switch.

Note—this switch is only intended for use on fully linked files. It does not make sense to use it on object files where the debugging information may be incomplete. Besides the gnu_debuglink feature currently only supports the presence of one filename containing debugging information, not multiple filenames on a one-per-object-file basis.

`--strip-dwo`

Remove the contents of all DWARF .dwo sections, leaving the remaining debugging sections and all symbols intact. This option is intended for use by the compiler as part of the '`-gsplit-dwarf`' option, which splits debug information between the .o file and a separate .dwo file. The compiler generates all debug information in the same file, then uses the '`--extract-dwo`' option to copy the .dwo sections to the .dwo file, then the '`--strip-dwo`' option to remove those sections from the original .o file.

`--extract-dwo`

Extract the contents of all DWARF .dwo sections. See the '`--strip-dwo`' option for more information.

`--file-alignment` *num*
: Specify the file alignment. Sections in the file will always begin at file offsets which are multiples of this number. This defaults to 512. [This option is specific to PE targets.]

`--heap` *reserve*
`--heap` *reserve*`,`*commit*
: Specify the number of bytes of memory to reserve (and optionally commit) to be used as heap for this program. [This option is specific to PE targets.]

`--image-base` *value*
: Use *value* as the base address of your program or dll. This is the lowest memory location that will be used when your program or dll is loaded. To reduce the need to relocate and improve performance of your dlls, each should have a unique base address and not overlap any other dlls. The default is 0x400000 for executables, and 0x10000000 for dlls. [This option is specific to PE targets.]

`--section-alignment` *num*
: Sets the section alignment. Sections in memory will always begin at addresses which are a multiple of this number. Defaults to 0x1000. [This option is specific to PE targets.]

`--stack` *reserve*
`--stack` *reserve*`,`*commit*
: Specify the number of bytes of memory to reserve (and optionally commit) to be used as stack for this program. [This option is specific to PE targets.]

`--subsystem` *which*
`--subsystem` *which*`:`*major*
`--subsystem` *which*`:`*major*`.`*minor*
: Specifies the subsystem under which your program will execute. The legal values for *which* are `native`, `windows`, `console`, `posix`, `efi-app`, `efi-bsd`, `efi-rtd`, `sal-rtd`, and `xbox`. You may optionally set the subsystem version also. Numeric values are also accepted for *which*. [This option is specific to PE targets.]

`--extract-symbol`
: Keep the file's section flags and symbols but remove all section data. Specifically, the option:

  - removes the contents of all sections;
  - sets the size of every section to zero; and
  - sets the file's start address to zero.

  This option is used to build a '`.sym`' file for a VxWorks kernel. It can also be a useful way of reducing the size of a '`--just-symbols`' linker input file.

`--compress-debug-sections`
: Compress DWARF debug sections using zlib with SHF_COMPRESSED from the ELF ABI. Note - if compression would actually make a section *larger*, then it is not compressed.

`--compress-debug-sections=none`
`--compress-debug-sections=zlib`
`--compress-debug-sections=zlib-gnu`
`--compress-debug-sections=zlib-gabi`
: For ELF files, these options control how DWARF debug sections are compressed. '`--compress-debug-sections=none`' is equivalent to '`--decompress-debug-sections`'. '`--compress-debug-sections=zlib`' and '`--compress-debug-sections=zlib-gabi`' are equivalent to '`--compress-debug-sections`'. '`--compress-debug-sections=zlib-gnu`' compresses DWARF debug sections using zlib. The debug sections are renamed to begin with '`.zdebug`' instead of '`.debug`'. Note - if compression would actually make a section *larger*, then it is not compressed nor renamed.

`--decompress-debug-sections`
: Decompress DWARF debug sections using zlib. The original section names of the compressed sections are restored.

`--elf-stt-common=yes`
`--elf-stt-common=no`
: For ELF files, these options control whether common symbols should be converted to the `STT_COMMON` or `STT_OBJECT` type. '`--elf-stt-common=yes`' converts common symbol type to `STT_COMMON`. '`--elf-stt-common=no`' converts common symbol type to `STT_OBJECT`.

`--merge-notes`
`--no-merge-notes`
: For ELF files, attempt (or do not attempt) to reduce the size of any SHT_NOTE type sections by removing duplicate notes.

`-V`
`--version`
: Show the version number of `objcopy`.

`-v`
`--verbose`
: Verbose output: list all object files modified. In the case of archives, '`objcopy -V`' lists all members of the archive.

`--help` Show a summary of the options to `objcopy`.

`--info` Display a list showing all architectures and object formats available.

5 objdump

```
objdump ['-a'|'--archive-headers']
        ['-b' bfdname|'--target=bfdname']
        ['-C'|'--demangle'[=style] ]
        ['-d'|'--disassemble']
        ['-D'|'--disassemble-all']
        ['-z'|'--disassemble-zeroes']
        ['-EB'|'-EL'|'--endian='{big | little }]
        ['-f'|'--file-headers']
        ['-F'|'--file-offsets']
        ['--file-start-context']
        ['-g'|'--debugging']
        ['-e'|'--debugging-tags']
        ['-h'|'--section-headers'|'--headers']
        ['-i'|'--info']
        ['-j' section|'--section='section]
        ['-l'|'--line-numbers']
        ['-S'|'--source']
        ['-m' machine|'--architecture='machine]
        ['-M' options|'--disassembler-options='options]
        ['-p'|'--private-headers']
        ['-P' options|'--private='options]
        ['-r'|'--reloc']
        ['-R'|'--dynamic-reloc']
        ['-s'|'--full-contents']
        ['-W[lLiaprmfFsoRtUuTgAckK]'|
         '--dwarf'[=rawline,=decodedline,=info,=abbrev,=pubnames,=aranges,=macro,=frames,=frames-
interp,=str,=loc,=Ranges,=pubtypes,=trace_info,=trace_abbrev,=trace_aranges,=gdb_index,=addr,=cu_index,=l
links]
        ['-G'|'--stabs']
        ['-t'|'--syms']
        ['-T'|'--dynamic-syms']
        ['-x'|'--all-headers']
        ['-w'|'--wide']
        ['--start-address='address]
        ['--stop-address='address]
        ['--prefix-addresses']
        ['--[no-]show-raw-insn']
        ['--adjust-vma='offset]
        ['--dwarf-depth=n']
        ['--dwarf-start=n']
        ['--special-syms']
        ['--prefix='prefix]
        ['--prefix-strip='level]
        ['--insn-width='width]
        ['-V'|'--version']
        ['-H'|'--help']
        objfile...
```

`objdump` displays information about one or more object files. The options control what particular information to display. This information is mostly useful to programmers who are working on the compilation tools, as opposed to programmers who just want their program to compile and work.

objfile... are the object files to be examined. When you specify archives, `objdump` shows information on each of the member object files.

The long and short forms of options, shown here as alternatives, are equivalent. At least one option from the list '`-a,-d,-D,-e,-f,-g,-G,-h,-H,-p,-P,-r,-R,-s,-S,-t,-T,-V,-x`' must be given.

`-a`
`--archive-header`
: If any of the *objfile* files are archives, display the archive header information (in a format similar to '`ls -l`'). Besides the information you could list with '`ar tv`', '`objdump -a`' shows the object file format of each archive member.

`--adjust-vma=`*offset*
: When dumping information, first add *offset* to all the section addresses. This is useful if the section addresses do not correspond to the symbol table, which can happen when putting sections at particular addresses when using a format which can not represent section addresses, such as a.out.

`-b` *bfdname*
`--target=`*bfdname*
: Specify that the object-code format for the object files is *bfdname*. This option may not be necessary; *objdump* can automatically recognize many formats.

  For example,

  ```
  objdump -b oasys -m vax -h fu.o
  ```

  displays summary information from the section headers ('`-h`') of '`fu.o`', which is explicitly identified ('`-m`') as a VAX object file in the format produced by Oasys compilers. You can list the formats available with the '`-i`' option. See Section 19.1 [Target Selection], page 79, for more information.

`-C`
`--demangle[=`*style*`]`
: Decode (*demangle*) low-level symbol names into user-level names. Besides removing any initial underscore prepended by the system, this makes C++ function names readable. Different compilers have different mangling styles. The optional demangling style argument can be used to choose an appropriate demangling style for your compiler. See Chapter 10 [c++filt], page 52, for more information on demangling.

`-g`
`--debugging`
: Display debugging information. This attempts to parse STABS and IEEE debugging format information stored in the file and print it out using a C like syntax. If neither of these formats are found this option falls back on the '`-W`' option to print any DWARF information in the file.

`-e`
`--debugging-tags`
: Like '`-g`', but the information is generated in a format compatible with ctags tool.

`-d`
`--disassemble`
: Display the assembler mnemonics for the machine instructions from *objfile*. This option only disassembles those sections which are expected to contain instructions.

`-D`
`--disassemble-all`
: Like '`-d`', but disassemble the contents of all sections, not just those expected to contain instructions.

  This option also has a subtle effect on the disassembly of instructions in code sections. When option '`-d`' is in effect objdump will assume that any symbols present in a code section occur on the boundary between instructions and it will refuse to disassemble across such a boundary. When option '`-D`' is in effect however this assumption is supressed. This means that it is possible for the output of '`-d`' and '`-D`' to differ if, for example, data is stored in code sections.

  If the target is an ARM architecture this switch also has the effect of forcing the disassembler to decode pieces of data found in code sections as if they were instructions.

`--prefix-addresses`
: When disassembling, print the complete address on each line. This is the older disassembly format.

`-EB`
`-EL`
`--endian={big|little}`
: Specify the endianness of the object files. This only affects disassembly. This can be useful when disassembling a file format which does not describe endianness information, such as S-records.

`-f`
`--file-headers`
: Display summary information from the overall header of each of the *objfile* files.

`-F`
`--file-offsets`
: When disassembling sections, whenever a symbol is displayed, also display the file offset of the region of data that is about to be dumped. If zeroes are being skipped, then when disassembly resumes, tell the user how many zeroes were skipped and the file offset of the location from where the disassembly resumes. When dumping sections, display the file offset of the location from where the dump starts.

`--file-start-context`
: Specify that when displaying interlisted source code/disassembly (assumes '`-S`') from a file that has not yet been displayed, extend the context to the start of the file.

`-h`
`--section-headers`
`--headers`
: Display summary information from the section headers of the object file.

  File segments may be relocated to nonstandard addresses, for example by using the '`-Ttext`', '`-Tdata`', or '`-Tbss`' options to `ld`. However, some object file formats, such as a.out, do not store the starting address of the file segments. In those situations, although `ld` relocates the sections correctly, using '`objdump -h`' to list the file section headers cannot show the correct addresses. Instead, it shows the usual addresses, which are implicit for the target.

  Note, in some cases it is possible for a section to have both the READONLY and the NOREAD attributes set. In such cases the NOREAD attribute takes precedence, but `objdump` will report both since the exact setting of the flag bits might be important.

`-H`
`--help`
: Print a summary of the options to `objdump` and exit.

`-i`
`--info`
: Display a list showing all architectures and object formats available for specification with '`-b`' or '`-m`'.

`-j` *name*
`--section=`*name*
: Display information only for section *name*.

`-l`
`--line-numbers`
: Label the display (using debugging information) with the filename and source line numbers corresponding to the object code or relocs shown. Only useful with '`-d`', '`-D`', or '`-r`'.

`-m` *machine*
`--architecture=`*machine*
: Specify the architecture to use when disassembling object files. This can be useful when disassembling object files which do not describe architecture information, such as S-records. You can list the available architectures with the '`-i`' option.

  If the target is an ARM architecture then this switch has an additional effect. It restricts the disassembly to only those instructions supported by the architecture specified by *machine*. If it is necessary to use this switch because the input file does not contain any architecture information, but it is also desired to disassemble all the instructions use '`-marm`'.

`-M` *options*
`--disassembler-options=`*options*
: Pass target specific information to the disassembler. Only supported on some targets. If it is necessary to specify more than one disassembler option then multiple '`-M`' options can be used or can be placed together into a comma separated list.

For ARC, '`dsp`' controls the printing of DSP instructions, '`spfp`' selects the printing of FPX single precision FP instructions, '`dpfp`' selects the printing of FPX double precision FP instructions, '`quarkse_em`' selects the printing of special QuarkSE-EM instructions, '`fpuda`' selects the printing of double precision assist instructions, '`fpus`' selects the printing of FPU single precision FP instructions, while '`fpud`' selects the printing of FPU souble precision FP instructions. Additionally, one can choose to have all the immediates printed in hexadecimal using '`hex`'. By default, the short immediates are printed using the decimal representation, while the long immediate values are printed as hexadecimal.

'`cpu=...`' allows to enforce a particular ISA when disassembling instructions, overriding the '`-m`' value or whatever is in the ELF file. This might be useful to select ARC EM or HS ISA, because architecture is same for those and disassembler relies on private ELF header data to decide if code is for EM or HS. This option might be specified multiple times - only the latest value will be used. Valid values are same as for the assembler '`-mcpu=...`' option.

If the target is an ARM architecture then this switch can be used to select which register name set is used during disassembler. Specifying '`-M reg-names-std`' (the default) will select the register names as used in ARM's instruction set documentation, but with register 13 called 'sp', register 14 called 'lr' and register 15 called 'pc'. Specifying '`-M reg-names-apcs`' will select the name set used by the ARM Procedure Call Standard, whilst specifying '`-M reg-names-raw`' will just use '`r`' followed by the register number.

There are also two variants on the APCS register naming scheme enabled by '`-M reg-names-atpcs`' and '`-M reg-names-special-atpcs`' which use the ARM/Thumb Procedure Call Standard naming conventions. (Either with the normal register names or the special register names).

This option can also be used for ARM architectures to force the disassembler to interpret all instructions as Thumb instructions by using the switch '`--disassembler-options=force-thumb`'. This can be useful when attempting to disassemble thumb code produced by other compilers.

For the x86, some of the options duplicate functions of the '`-m`' switch, but allow finer grained control. Multiple selections from the following may be specified as a comma separated string.

`x86-64`
`i386`
`i8086` Select disassembly for the given architecture.

`intel`
`att` Select between intel syntax mode and AT&T syntax mode.

`amd64`
`intel64` Select between AMD64 ISA and Intel64 ISA.

`intel-mnemonic`
`att-mnemonic`
: Select between intel mnemonic mode and AT&T mnemonic mode. Note: `intel-mnemonic` implies `intel` and `att-mnemonic` implies `att`.

`addr64`
`addr32`
`addr16`
`data32`
`data16`
: Specify the default address size and operand size. These four options will be overridden if `x86-64`, `i386` or `i8086` appear later in the option string.

`suffix`
: When in AT&T mode, instructs the disassembler to print a mnemonic suffix even when the suffix could be inferred by the operands.

For PowerPC, the '`-M`' argument '`raw`' selects disasssembly of hardware insns rather than aliases. For example, you will see `rlwinm` rather than `clrlwi`, and `addi` rather than `li`. All of the '`-m`' arguments for `gas` that select a CPU are supported. These are: '`403`', '`405`', '`440`', '`464`', '`476`', '`601`', '`603`', '`604`', '`620`', '`7400`', '`7410`', '`7450`', '`7455`', '`750cl`', '`821`', '`850`', '`860`', '`a2`', '`booke`', '`booke32`', '`cell`', '`com`', '`e200z4`', '`e300`', '`e500`', '`e500mc`', '`e500mc64`', '`e500x2`', '`e5500`', '`e6500`', '`efs`', '`power4`', '`power5`', '`power6`', '`power7`', '`power8`', '`power9`', '`ppc`', '`ppc32`', '`ppc64`', '`ppc64bridge`', '`ppcps`', '`pwr`', '`pwr2`', '`pwr4`', '`pwr5`', '`pwr5x`', '`pwr6`', '`pwr7`', '`pwr8`', '`pwr9`', '`pwrx`', '`titan`', and '`vle`'. '`32`' and '`64`' modify the default or a prior CPU selection, disabling and enabling 64-bit insns respectively. In addition, '`altivec`', '`any`', '`htm`', '`vsx`', and '`spe`' add capabilities to a previous *or later* CPU selection. '`any`' will disassemble any opcode known to binutils, but in cases where an opcode has two different meanings or different arguments, you may not see the disassembly you expect. If you disassemble without giving a CPU selection, a default will be chosen from information gleaned by BFD from the object files headers, but the result again may not be as you expect.

For MIPS, this option controls the printing of instruction mnemonic names and register names in disassembled instructions. Multiple selections from the following may be specified as a comma separated string, and invalid options are ignored:

`no-aliases`
: Print the 'raw' instruction mnemonic instead of some pseudo instruction mnemonic. I.e., print 'daddu' or 'or' instead of 'move', 'sll' instead of 'nop', etc.

`msa`
: Disassemble MSA instructions.

`virt`
: Disassemble the virtualization ASE instructions.

`xpa`
: Disassemble the eXtended Physical Address (XPA) ASE instructions.

`gpr-names=`*ABI*
: Print GPR (general-purpose register) names as appropriate for the specified ABI. By default, GPR names are selected according to the ABI of the binary being disassembled.

`fpr-names=`*ABI*
: Print FPR (floating-point register) names as appropriate for the specified ABI. By default, FPR numbers are printed rather than names.

`cp0-names=`*ARCH*
: Print CP0 (system control coprocessor; coprocessor 0) register names as appropriate for the CPU or architecture specified by *ARCH*. By default, CP0 register names are selected according to the architecture and CPU of the binary being disassembled.

`hwr-names=`*ARCH*
: Print HWR (hardware register, used by the `rdhwr` instruction) names as appropriate for the CPU or architecture specified by *ARCH*. By default, HWR names are selected according to the architecture and CPU of the binary being disassembled.

`reg-names=`*ABI*
: Print GPR and FPR names as appropriate for the selected ABI.

`reg-names=`*ARCH*
: Print CPU-specific register names (CP0 register and HWR names) as appropriate for the selected CPU or architecture.

For any of the options listed above, *ABI* or *ARCH* may be specified as '`numeric`' to have numbers printed rather than names, for the selected types of registers. You can list the available values of *ABI* and *ARCH* using the '`--help`' option.

For VAX, you can specify function entry addresses with '`-M entry:0xf00ba`'. You can use this multiple times to properly disassemble VAX binary files that don't contain symbol tables (like ROM dumps). In these cases, the function entry mask would otherwise be decoded as VAX instructions, which would probably lead the rest of the function being wrongly disassembled.

`-p`
`--private-headers`
: Print information that is specific to the object file format. The exact information printed depends upon the object file format. For some object file formats, no additional information is printed.

`-P` *options*
`--private=`*options*
: Print information that is specific to the object file format. The argument *options* is a comma separated list that depends on the format (the lists of options is displayed with the help).

For XCOFF, the available options are:

`header`

`aout`

`sections`

`syms`

`relocs`

`lineno,`

`loader`

`except`

`typchk`

`traceback`
`toc`

`ldinfo`

Not all object formats support this option. In particular the ELF format does not use it.

`-r`
`--reloc` Print the relocation entries of the file. If used with '`-d`' or '`-D`', the relocations are printed interspersed with the disassembly.

`-R`
`--dynamic-reloc`
Print the dynamic relocation entries of the file. This is only meaningful for dynamic objects, such as certain types of shared libraries. As for '`-r`', if used with '`-d`' or '`-D`', the relocations are printed interspersed with the disassembly.

`-s`
`--full-contents`
Display the full contents of any sections requested. By default all non-empty sections are displayed.

`-S`
`--source` Display source code intermixed with disassembly, if possible. Implies '`-d`'.

`--prefix=`*prefix*
Specify *prefix* to add to the absolute paths when used with '`-S`'.

`--prefix-strip=`*level*
Indicate how many initial directory names to strip off the hardwired absolute paths. It has no effect without '`--prefix=`'*prefix*.

`--show-raw-insn`
When disassembling instructions, print the instruction in hex as well as in symbolic form. This is the default except when '`--prefix-addresses`' is used.

`--no-show-raw-insn`
When disassembling instructions, do not print the instruction bytes. This is the default when '`--prefix-addresses`' is used.

`--insn-width=`*width*
: Display *width* bytes on a single line when disassembling instructions.

`-W[lLiaprmfFsoRtUuTgAckK]`
`--dwarf[=rawline,=decodedline,=info,=abbrev,=pubnames,=aranges,=macro,=frames,=frames-interp,=trace_abbrev,=trace_aranges,=gdb_index,=addr,=cu_index,=links,=follow-links]`
: Displays the contents of the DWARF debug sections in the file, if any are present. Compressed debug sections are automatically decompressed (temporarily) before they are displayed. If one or more of the optional letters or words follows the switch then only those type(s) of data will be dumped. The letters and words refer to the following information:

  `a`
  `=abbrev` Displays the contents of the '`.debug_abbrev`' section.

  `A`
  `=addr` Displays the contents of the '`.debug_addr`' section.

  `c`
  `=cu_index`
  : Displays the contents of the '`.debug_cu_index`' and/or '`.debug_tu_index`' sections.

  `f`
  `=frames` Display the raw contents of a '`.debug_frame`' section.

  `F`

  `=frame-interp`
  : Display the interpreted contents of a '`.debug_frame`' section.

  `g`
  `=gdb_index`
  : Displays the contents of the '`.gdb_index`' and/or '`.debug_names`' sections.

  `i`
  `=info` Displays the contents of the '`.debug_info`' section. Note: the output from this option can also be restricted by the use of the '`--dwarf-depth`' and '`--dwarf-start`' options.

  `k`
  `=links` Displays the contents of the '`.gnu_debuglink`' and/or '`.gnu_debugaltlink`' sections. Also displays the link to a separate dwarf object file (dwo), if one is specified by the DW_AT_GNU_dwo_name or DW_AT_dwo_name attributes in the '`.debug_info`' section.

  `K`
  `=follow-links`
  : Display the contents of any selected debug sections that are found in a linked, separate debug info file. This can result in multiple

versions of the same debug section being displayed if both the main file and the separate debug info file contain sections with the same name.

In addition, when displaying DWARF attributes, if a form is found that references the separate debug info file, then the referenced contents will also be displayed.

`l`
`=rawline` Displays the contents of the '`.debug_line`' section in a raw format.

`L`
`=decodedline`
Displays the interpreted contents of the '`.debug_line`' section.

`m`
`=macro` Displays the contents of the '`.debug_macro`' and/or '`.debug_macinfo`' sections.

`o`
`=loc` Displays the contents of the '`.debug_loc`' and/or '`.debug_loclists`' sections.

`p`
`=pubnames`
Displays the contents of the '`.debug_pubnames`' and/or '`.debug_gnu_pubnames`' sections.

`r`
`=aranges` Displays the contents of the '`.debug_aranges`' section.

`R`
`=Ranges` Displays the contents of the '`.debug_ranges`' and/or '`.debug_rnglists`' sections.

`s`
`=str` Displays the contents of the '`.debug_str`', '`.debug_line_str`' and/or '`.debug_str_offsets`' sections.

`t`
`=pubtype` Displays the contents of the '`.debug_pubtypes`' and/or '`.debug_gnu_pubtypes`' sections.

`T`
`=trace_aranges`
Displays the contents of the '`.trace_aranges`' section.

`u`
`=trace_abbrev`
Displays the contents of the '`.trace_abbrev`' section.

`U`
`=trace_info`
Displays the contents of the '`.trace_info`' section.

Note: displaying the contents of '`.debug_static_funcs`', '`.debug_static_vars`' and '`debug_weaknames`' sections is not currently supported.

`--dwarf-depth=`*n*

Limit the dump of the `.debug_info` section to *n* children. This is only useful with '`--debug-dump=info`'. The default is to print all DIEs; the special value 0 for *n* will also have this effect.

With a non-zero value for *n*, DIEs at or deeper than *n* levels will not be printed. The range for *n* is zero-based.

`--dwarf-start=`*n*

Print only DIEs beginning with the DIE numbered *n*. This is only useful with '`--debug-dump=info`'.

If specified, this option will suppress printing of any header information and all DIEs before the DIE numbered *n*. Only siblings and children of the specified DIE will be printed.

This can be used in conjunction with '`--dwarf-depth`'.

`--dwarf-check`

Enable additional checks for consistency of Dwarf information.

`-G`

`--stabs` Display the full contents of any sections requested. Display the contents of the .stab and .stab.index and .stab.excl sections from an ELF file. This is only useful on systems (such as Solaris 2.0) in which `.stab` debugging symbol-table entries are carried in an ELF section. In most other file formats, debugging symbol-table entries are interleaved with linkage symbols, and are visible in the '`--syms`' output.

`--start-address=`*address*

Start displaying data at the specified address. This affects the output of the '`-d`', '`-r`' and '`-s`' options.

`--stop-address=`*address*

Stop displaying data at the specified address. This affects the output of the '`-d`', '`-r`' and '`-s`' options.

`-t`

`--syms` Print the symbol table entries of the file. This is similar to the information provided by the '`nm`' program, although the display format is different. The format of the output depends upon the format of the file being dumped, but there are two main types. One looks like this:

```
[  4](sec  3)(fl 0x00)(ty   0)(scl   3) (nx 1) 0x00000000 .bss
[  6](sec  1)(fl 0x00)(ty   0)(scl   2) (nx 0) 0x00000000 fred
```

where the number inside the square brackets is the number of the entry in the symbol table, the *sec* number is the section number, the *fl* value are the symbol's flag bits, the *ty* number is the symbol's type, the *scl* number is the symbol's storage class and the *nx* value is the number of auxilary entries associated with the symbol. The last two fields are the symbol's value and its name.

The other common output format, usually seen with ELF based files, looks like this:

```
00000000 l    d  .bss   00000000 .bss
00000000 g       .text  00000000 fred
```

Here the first number is the symbol's value (sometimes refered to as its address). The next field is actually a set of characters and spaces indicating the flag bits that are set on the symbol. These characters are described below. Next is the section with which the symbol is associated or **ABS** if the section is absolute (ie not connected with any section), or **UND** if the section is referenced in the file being dumped, but not defined there.

After the section name comes another field, a number, which for common symbols is the alignment and for other symbol is the size. Finally the symbol's name is displayed.

The flag characters are divided into 7 groups as follows:

`l`
`g`
`u`
`!`
: The symbol is a local (l), global (g), unique global (u), neither global nor local (a space) or both global and local (!). A symbol can be neither local or global for a variety of reasons, e.g., because it is used for debugging, but it is probably an indication of a bug if it is ever both local and global. Unique global symbols are a GNU extension to the standard set of ELF symbol bindings. For such a symbol the dynamic linker will make sure that in the entire process there is just one symbol with this name and type in use.

`w`
: The symbol is weak (w) or strong (a space).

`C`
: The symbol denotes a constructor (C) or an ordinary symbol (a space).

`W`
: The symbol is a warning (W) or a normal symbol (a space). A warning symbol's name is a message to be displayed if the symbol following the warning symbol is ever referenced.

`I`

`i`
: The symbol is an indirect reference to another symbol (I), a function to be evaluated during reloc processing (i) or a normal symbol (a space).

`d`
`D`
: The symbol is a debugging symbol (d) or a dynamic symbol (D) or a normal symbol (a space).

`F`

`f`

`O`
: The symbol is the name of a function (F) or a file (f) or an object (O) or just a normal symbol (a space).

`-T`
`--dynamic-syms`
: Print the dynamic symbol table entries of the file. This is only meaningful for dynamic objects, such as certain types of shared libraries. This is similar to the information provided by the '`nm`' program when given the '`-D`' ('`--dynamic`') option.

  The output format is similar to that produced by the '`--syms`' option, except that an extra field is inserted before the symbol's name, giving the version information associated with the symbol. If the version is the default version to be used when resolving unversioned references to the symbol then it's displayed as is, otherwise it's put into parentheses.

`--special-syms`
: When displaying symbols include those which the target considers to be special in some way and which would not normally be of interest to the user.

`-V`
`--version`
: Print the version number of `objdump` and exit.

`-x`
`--all-headers`
: Display all available header information, including the symbol table and relocation entries. Using '`-x`' is equivalent to specifying all of '`-a -f -h -p -r -t`'.

`-w`
`--wide`
: Format some lines for output devices that have more than 80 columns. Also do not truncate symbol names when they are displayed.

`-z`
`--disassemble-zeroes`
: Normally the disassembly output will skip blocks of zeroes. This option directs the disassembler to disassemble those blocks, just like any other data.

6 ranlib

```
ranlib ['--plugin' name] ['-DhHvVt'] archive
```

`ranlib` generates an index to the contents of an archive and stores it in the archive. The index lists each symbol defined by a member of an archive that is a relocatable object file.

You may use '`nm -s`' or '`nm --print-armap`' to list this index.

An archive with such an index speeds up linking to the library and allows routines in the library to call each other without regard to their placement in the archive.

The GNU `ranlib` program is another form of GNU `ar`; running `ranlib` is completely equivalent to executing '`ar -s`'. See Chapter 1 [ar], page 2.

`-h`
`-H`
`--help` Show usage information for `ranlib`.

`-v`
`-V`
`--version`
Show the version number of `ranlib`.

`-D` Operate in *deterministic* mode. The symbol map archive member's header will show zero for the UID, GID, and timestamp. When this option is used, multiple runs will produce identical output files.

If '`binutils`' was configured with '`--enable-deterministic-archives`', then this mode is on by default. It can be disabled with the '`-U`' option, described below.

`-t` Update the timestamp of the symbol map of an archive.

`-U` Do *not* operate in *deterministic* mode. This is the inverse of the '`-D`' option, above: the archive index will get actual UID, GID, timestamp, and file mode values.

If '`binutils`' was configured *without* '`--enable-deterministic-archives`', then this mode is on by default.

7 size

```
size ['-A'|'-B'|'--format='compatibility]
     ['--help']
     ['-d'|'-o'|'-x'|'--radix='number]
     ['--common']
     ['-t'|'--totals']
     ['--target='bfdname] ['-V'|'--version']
     [objfile...]
```

The GNU `size` utility lists the section sizes—and the total size—for each of the object or archive files *objfile* in its argument list. By default, one line of output is generated for each object file or each module in an archive.

objfile... are the object files to be examined. If none are specified, the file `a.out` will be used.

The command line options have the following meanings:

`-A`
`-B`
`--format=`*compatibility*

Using one of these options, you can choose whether the output from GNU `size` resembles output from System V `size` (using '`-A`', or '`--format=sysv`'), or Berkeley `size` (using '`-B`', or '`--format=berkeley`'). The default is the one-line format similar to Berkeley's.

Here is an example of the Berkeley (default) format of output from `size`:

```
$ size --format=Berkeley ranlib size
text    data    bss     dec     hex     filename
294880  81920   11592   388392  5ed28   ranlib
294880  81920   11888   388688  5ee50   size
```

This is the same data, but displayed closer to System V conventions:

```
$ size --format=SysV ranlib size
ranlib  :
section         size         addr
.text         294880         8192
.data          81920       303104
.bss           11592       385024
Total         388392


size  :
section         size         addr
.text         294880         8192
.data          81920       303104
.bss           11888       385024
Total         388688
```

`--help` Show a summary of acceptable arguments and options.

`-d`
`-o`
`-x`
`--radix=`*number*

Using one of these options, you can control whether the size of each section is given in decimal ('`-d`', or '`--radix=10`'); octal ('`-o`', or '`--radix=8`'); or hex-

adecimal (‘`-x`’, or ‘`--radix=16`’). In ‘`--radix=`*`number`*’, only the three values (8, 10, 16) are supported. The total size is always given in two radices; decimal and hexadecimal for ‘`-d`’ or ‘`-x`’ output, or octal and hexadecimal if you’re using ‘`-o`’.

`--common` Print total size of common symbols in each file. When using Berkeley format these are included in the bss size.

`-t`
`--totals` Show totals of all objects listed (Berkeley format listing mode only).

`--target=`*`bfdname`*
Specify that the object-code format for *objfile* is *bfdname*. This option may not be necessary; `size` can automatically recognize many formats. See Section 19.1 [Target Selection], page 79, for more information.

`-V`
`--version`
Display the version number of `size`.

8 strings

```
strings ['-afovV'] ['-'min-len]
        ['-n' min-len] ['--bytes='min-len]
        ['-t' radix] ['--radix='radix]
        ['-e' encoding] ['--encoding='encoding]
        ['-'] ['--all'] ['--print-file-name']
        ['-T' bfdname] ['--target='bfdname]
        ['-w'] ['--include-all-whitespace']
        ['-s'] ['--output-separator'sep_string]
        ['--help'] ['--version'] file...
```

For each *file* given, GNU `strings` prints the printable character sequences that are at least 4 characters long (or the number given with the options below) and are followed by an unprintable character.

Depending upon how the strings program was configured it will default to either displaying all the printable sequences that it can find in each file, or only those sequences that are in loadable, initialized data sections. If the file type in unrecognizable, or if strings is reading from stdin then it will always display all of the printable sequences that it can find.

For backwards compatibility any file that occurs after a command line option of just '`-`' will also be scanned in full, regardless of the presence of any '`-d`' option.

`strings` is mainly useful for determining the contents of non-text files.

`-a`
`--all`
`-` Scan the whole file, regardless of what sections it contains or whether those sections are loaded or initialized. Normally this is the default behaviour, but strings can be configured so that the '`-d`' is the default instead.

The '`-`' option is position dependent and forces strings to perform full scans of any file that is mentioned after the '`-`' on the command line, even if the '`-d`' option has been specified.

`-d`
`--data` Only print strings from initialized, loaded data sections in the file. This may reduce the amount of garbage in the output, but it also exposes the strings program to any security flaws that may be present in the BFD library used to scan and load sections. Strings can be configured so that this option is the default behaviour. In such cases the '`-a`' option can be used to avoid using the BFD library and instead just print all of the strings found in the file.

`-f`
`--print-file-name`
Print the name of the file before each string.

`--help` Print a summary of the program usage on the standard output and exit.

`-`*`min-len`*
`-n` *`min-len`*
`--bytes=`*`min-len`*
Print sequences of characters that are at least *min-len* characters long, instead of the default 4.

`-o`
: Like '`-t o`'. Some other versions of `strings` have '`-o`' act like '`-t d`' instead. Since we can not be compatible with both ways, we simply chose one.

`-t` *radix*
`--radix=`*radix*
: Print the offset within the file before each string. The single character argument specifies the radix of the offset—'`o`' for octal, '`x`' for hexadecimal, or '`d`' for decimal.

`-e` *encoding*
`--encoding=`*encoding*
: Select the character encoding of the strings that are to be found. Possible values for *encoding* are: '`s`' = single-7-bit-byte characters (ASCII, ISO 8859, etc., default), '`S`' = single-8-bit-byte characters, '`b`' = 16-bit bigendian, '`l`' = 16-bit littleendian, '`B`' = 32-bit bigendian, '`L`' = 32-bit littleendian. Useful for finding wide character strings. ('`l`' and '`b`' apply to, for example, Unicode UTF-16/UCS-2 encodings).

`-T` *bfdname*
`--target=`*bfdname*
: Specify an object code format other than your system's default format. See Section 19.1 [Target Selection], page 79, for more information.

`-v`
`-V`
`--version`
: Print the program version number on the standard output and exit.

`-w`
`--include-all-whitespace`
: By default tab and space characters are included in the strings that are displayed, but other whitespace characters, such a newlines and carriage returns, are not. The '`-w`' option changes this so that all whitespace characters are considered to be part of a string.

`-s`
`--output-separator`
: By default, output strings are delimited by a new-line. This option allows you to supply any string to be used as the output record separator. Useful with –include-all-whitespace where strings may contain new-lines internally.

9 strip

```
strip ['-F' bfdname |'--target='bfdname]
      ['-I' bfdname |'--input-target='bfdname]
      ['-O' bfdname |'--output-target='bfdname]
      ['-s'|'--strip-all']
      ['-S'|'-g'|'-d'|'--strip-debug']
      ['--strip-dwo']
      ['-K' symbolname|'--keep-symbol='symbolname]
      ['-M'|'--merge-notes'][--no-merge-notes']
      ['-N' symbolname |'--strip-symbol='symbolname]
      ['-w'|'--wildcard']
      ['-x'|'--discard-all'] ['-X' |'--discard-locals']
      ['-R' sectionname |'--remove-section='sectionname]
      ['--remove-relocations='sectionpattern]
      ['-o' file] ['-p'|'--preserve-dates']
      ['-D'|'--enable-deterministic-archives']
      ['-U'|'--disable-deterministic-archives']
      ['--keep-file-symbols']
      ['--only-keep-debug']
      ['-v' |'--verbose'] ['-V'|'--version']
      ['--help'] ['--info']
      objfile...
```

GNU `strip` discards all symbols from object files *objfile*. The list of object files may include archives. At least one object file must be given.

`strip` modifies the files named in its argument, rather than writing modified copies under different names.

`-F` *bfdname*
`--target=`*bfdname*
: Treat the original *objfile* as a file with the object code format *bfdname*, and rewrite it in the same format. See Section 19.1 [Target Selection], page 79, for more information.

`--help`
: Show a summary of the options to `strip` and exit.

`--info`
: Display a list showing all architectures and object formats available.

`-I` *bfdname*
`--input-target=`*bfdname*
: Treat the original *objfile* as a file with the object code format *bfdname*. See Section 19.1 [Target Selection], page 79, for more information.

`-O` *bfdname*
`--output-target=`*bfdname*
: Replace *objfile* with a file in the output format *bfdname*. See Section 19.1 [Target Selection], page 79, for more information.

`-R` *sectionname*
`--remove-section=`*sectionname*
: Remove any section named *sectionname* from the output file, in addition to whatever sections would otherwise be removed. This option may be given more than once. Note that using this option inappropriately may make the output file unusable. The wildcard character '`*`' may be given at the end of *sectionname*. If so, then any section starting with *sectionname* will be removed.

If the first character of *sectionpattern* is the exclamation point (!) then matching sections will not be removed even if an earlier use of '`--remove-section`' on the same command line would otherwise remove it. For example:

```
--remove-section=.text.* --remove-section=!.text.foo
```

will remove all sections matching the pattern '.text.*', but will not remove the section '.text.foo'.

`--remove-relocations=`*sectionpattern*
: Remove relocations from the output file for any section matching *sectionpattern*. This option may be given more than once. Note that using this option inappropriately may make the output file unusable. Wildcard characters are accepted in *sectionpattern*. For example:

```
--remove-relocations=.text.*
```

will remove the relocations for all sections matching the patter '.text.*'.

If the first character of *sectionpattern* is the exclamation point (!) then matching sections will not have their relocation removed even if an earlier use of '`--remove-relocations`' on the same command line would otherwise cause the relocations to be removed. For example:

```
--remove-relocations=.text.* --remove-relocations=!.text.foo
```

will remove all relocations for sections matching the pattern '.text.*', but will not remove relocations for the section '.text.foo'.

`-s`
`--strip-all`
: Remove all symbols.

`-g`
`-S`
`-d`
`--strip-debug`
: Remove debugging symbols only.

`--strip-dwo`
: Remove the contents of all DWARF .dwo sections, leaving the remaining debugging sections and all symbols intact. See the description of this option in the `objcopy` section for more information.

`--strip-unneeded`
: Remove all symbols that are not needed for relocation processing.

`-K` *symbolname*
`--keep-symbol=`*symbolname*
: When stripping symbols, keep symbol *symbolname* even if it would normally be stripped. This option may be given more than once.

`-M`
`--merge-notes`
`--no-merge-notes`
: For ELF files, attempt (or do not attempt) to reduce the size of any SHT_NOTE type sections by removing duplicate notes. The default is to attempt this reduction.

`-N` *symbolname*
`--strip-symbol=`*symbolname*
: Remove symbol *symbolname* from the source file. This option may be given more than once, and may be combined with strip options other than '`-K`'.

`-o` *file*
: Put the stripped output in *file*, rather than replacing the existing file. When this argument is used, only one *objfile* argument may be specified.

`-p`
`--preserve-dates`
: Preserve the access and modification dates of the file.

`-D`
`--enable-deterministic-archives`
: Operate in *deterministic* mode. When copying archive members and writing the archive index, use zero for UIDs, GIDs, timestamps, and use consistent file modes for all files.

  If '`binutils`' was configured with '`--enable-deterministic-archives`', then this mode is on by default. It can be disabled with the '`-U`' option, below.

`-U`
`--disable-deterministic-archives`
: Do *not* operate in *deterministic* mode. This is the inverse of the '`-D`' option, above: when copying archive members and writing the archive index, use their actual UID, GID, timestamp, and file mode values.

  This is the default unless '`binutils`' was configured with '`--enable-deterministic-archives`'.

`-w`
`--wildcard`
: Permit regular expressions in *symbolname*s used in other command line options. The question mark (?), asterisk (*), backslash (\) and square brackets ([]) operators can be used anywhere in the symbol name. If the first character of the symbol name is the exclamation point (!) then the sense of the switch is reversed for that symbol. For example:

  ```
  -w -K !foo -K fo*
  ```

  would cause strip to only keep symbols that start with the letters "fo", but to discard the symbol "foo".

`-x`
`--discard-all`
: Remove non-global symbols.

`-X`
`--discard-locals`
: Remove compiler-generated local symbols. (These usually start with '`L`' or '`.`'.)

`--keep-file-symbols`
: When stripping a file, perhaps with '`--strip-debug`' or '`--strip-unneeded`', retain any symbols specifying source file names, which would otherwise get stripped.

`--only-keep-debug`

Strip a file, emptying the contents of any sections that would not be stripped by '`--strip-debug`' and leaving the debugging sections intact. In ELF files, this preserves all the note sections in the output as well.

Note - the section headers of the stripped sections are preserved, including their sizes, but the contents of the section are discarded. The section headers are preserved so that other tools can match up the debuginfo file with the real executable, even if that executable has been relocated to a different address space.

The intention is that this option will be used in conjunction with '`--add-gnu-debuglink`' to create a two part executable. One a stripped binary which will occupy less space in RAM and in a distribution and the second a debugging information file which is only needed if debugging abilities are required. The suggested procedure to create these files is as follows:

1. Link the executable as normal. Assuming that is is called `foo` then...
2. Run `objcopy --only-keep-debug foo foo.dbg` to create a file containing the debugging info.
3. Run `objcopy --strip-debug foo` to create a stripped executable.
4. Run `objcopy --add-gnu-debuglink=foo.dbg foo` to add a link to the debugging info into the stripped executable.

Note—the choice of `.dbg` as an extension for the debug info file is arbitrary. Also the `--only-keep-debug` step is optional. You could instead do this:

1. Link the executable as normal.
2. Copy `foo` to `foo.full`
3. Run `strip --strip-debug foo`
4. Run `objcopy --add-gnu-debuglink=foo.full foo`

i.e., the file pointed to by the '`--add-gnu-debuglink`' can be the full executable. It does not have to be a file created by the '`--only-keep-debug`' switch.

Note—this switch is only intended for use on fully linked files. It does not make sense to use it on object files where the debugging information may be incomplete. Besides the gnu_debuglink feature currently only supports the presence of one filename containing debugging information, not multiple filenames on a one-per-object-file basis.

`-V`
`--version`

Show the version number for `strip`.

`-v`
`--verbose`

Verbose output: list all object files modified. In the case of archives, '`strip -v`' lists all members of the archive.

10 c++filt

```
c++filt [‘-_’|‘--strip-underscore’]
        [‘-n’|‘--no-strip-underscore’]
        [‘-p’|‘--no-params’]
        [‘-t’|‘--types’]
        [‘-i’|‘--no-verbose’]
        [‘-s’ format|‘--format=’format]
        [‘--help’]  [‘--version’]  [symbol...]
```

The C++ and Java languages provide function overloading, which means that you can write many functions with the same name, providing that each function takes parameters of different types. In order to be able to distinguish these similarly named functions C++ and Java encode them into a low-level assembler name which uniquely identifies each different version. This process is known as *mangling*. The `c++filt`[1] program does the inverse mapping: it decodes (*demangles*) low-level names into user-level names so that they can be read.

Every alphanumeric word (consisting of letters, digits, underscores, dollars, or periods) seen in the input is a potential mangled name. If the name decodes into a C++ name, the C++ name replaces the low-level name in the output, otherwise the original word is output. In this way you can pass an entire assembler source file, containing mangled names, through `c++filt` and see the same source file containing demangled names.

You can also use `c++filt` to decipher individual symbols by passing them on the command line:

```
c++filt symbol
```

If no *symbol* arguments are given, `c++filt` reads symbol names from the standard input instead. All the results are printed on the standard output. The difference between reading names from the command line versus reading names from the standard input is that command line arguments are expected to be just mangled names and no checking is performed to separate them from surrounding text. Thus for example:

```
c++filt -n _Z1fv
```

will work and demangle the name to “f()” whereas:

```
c++filt -n _Z1fv,
```

will not work. (Note the extra comma at the end of the mangled name which makes it invalid). This command however will work:

```
echo _Z1fv, | c++filt -n
```

and will display “f(),”, i.e., the demangled name followed by a trailing comma. This behaviour is because when the names are read from the standard input it is expected that they might be part of an assembler source file where there might be extra, extraneous characters trailing after a mangled name. For example:

```
.type   _Z1fv, @function
```

`-_`
`--strip-underscore`
: On some systems, both the C and C++ compilers put an underscore in front of every name. For example, the C name `foo` gets the low-level name `_foo`.

[1] MS-DOS does not allow `+` characters in file names, so on MS-DOS this program is named `CXXFILT`.

This option removes the initial underscore. Whether `c++filt` removes the underscore by default is target dependent.

`-n`
`--no-strip-underscore`
: Do not remove the initial underscore.

`-p`
`--no-params`
: When demangling the name of a function, do not display the types of the function's parameters.

`-t`
`--types`
: Attempt to demangle types as well as function names. This is disabled by default since mangled types are normally only used internally in the compiler, and they can be confused with non-mangled names. For example, a function called "a" treated as a mangled type name would be demangled to "signed char".

`-i`
`--no-verbose`
: Do not include implementation details (if any) in the demangled output.

`-s` *format*
`--format=`*format*
: `c++filt` can decode various methods of mangling, used by different compilers. The argument to this option selects which method it uses:

`auto`	Automatic selection based on executable (the default method)
`gnu`	the one used by the GNU C++ compiler (g++)
`lucid`	the one used by the Lucid compiler (lcc)
`arm`	the one specified by the C++ Annotated Reference Manual
`hp`	the one used by the HP compiler (aCC)
`edg`	the one used by the EDG compiler
`gnu-v3`	the one used by the GNU C++ compiler (g++) with the V3 ABI.
`java`	the one used by the GNU Java compiler (gcj)
`gnat`	the one used by the GNU Ada compiler (GNAT).

`--help`
: Print a summary of the options to `c++filt` and exit.

`--version`
: Print the version number of `c++filt` and exit.

Warning: `c++filt` is a new utility, and the details of its user interface are subject to change in future releases. In particular, a command-line option may be required in the future to decode a name passed as an argument on the command line; in other words,

```
c++filt symbol
```

may in a future release become

```
c++filt option symbol
```

11 addr2line

```
addr2line ['-a'|'--addresses']
          ['-b' bfdname|'--target='bfdname]
          ['-C'|'--demangle'[=style]]
          ['-e' filename|'--exe='filename]
          ['-f'|'--functions'] ['-s'|'--basename']
          ['-i'|'--inlines']
          ['-p'|'--pretty-print']
          ['-j'|'--section='name]
          ['-H'|'--help'] ['-V'|'--version']
          [addr addr ...]
```

`addr2line` translates addresses into file names and line numbers. Given an address in an executable or an offset in a section of a relocatable object, it uses the debugging information to figure out which file name and line number are associated with it.

The executable or relocatable object to use is specified with the '`-e`' option. The default is the file '`a.out`'. The section in the relocatable object to use is specified with the '`-j`' option.

`addr2line` has two modes of operation.

In the first, hexadecimal addresses are specified on the command line, and `addr2line` displays the file name and line number for each address.

In the second, `addr2line` reads hexadecimal addresses from standard input, and prints the file name and line number for each address on standard output. In this mode, `addr2line` may be used in a pipe to convert dynamically chosen addresses.

The format of the output is '`FILENAME:LINENO`'. By default each input address generates one line of output.

Two options can generate additional lines before each '`FILENAME:LINENO`' line (in that order).

If the '`-a`' option is used then a line with the input address is displayed.

If the '`-f`' option is used, then a line with the '`FUNCTIONNAME`' is displayed. This is the name of the function containing the address.

One option can generate additional lines after the '`FILENAME:LINENO`' line.

If the '`-i`' option is used and the code at the given address is present there because of inlining by the compiler then additional lines are displayed afterwards. One or two extra lines (if the '`-f`' option is used) are displayed for each inlined function.

Alternatively if the '`-p`' option is used then each input address generates a single, long, output line containing the address, the function name, the file name and the line number. If the '`-i`' option has also been used then any inlined functions will be displayed in the same manner, but on separate lines, and prefixed by the text '`(inlined by)`'.

If the file name or function name can not be determined, `addr2line` will print two question marks in their place. If the line number can not be determined, `addr2line` will print 0.

The long and short forms of options, shown here as alternatives, are equivalent.

`-a`
`--addresses`

Display the address before the function name, file and line number information. The address is printed with a '`0x`' prefix to easily identify it.

`-b` *bfdname*
`--target=`*bfdname*
: Specify that the object-code format for the object files is *bfdname*.

`-C`
`--demangle[=`*style*`]`
: Decode (*demangle*) low-level symbol names into user-level names. Besides removing any initial underscore prepended by the system, this makes C++ function names readable. Different compilers have different mangling styles. The optional demangling style argument can be used to choose an appropriate demangling style for your compiler. See Chapter 10 [c++filt], page 52, for more information on demangling.

`-e` *filename*
`--exe=`*filename*
: Specify the name of the executable for which addresses should be translated. The default file is '`a.out`'.

`-f`
`--functions`
: Display function names as well as file and line number information.

`-s`
`--basenames`
: Display only the base of each file name.

`-i`
`--inlines`
: If the address belongs to a function that was inlined, the source information for all enclosing scopes back to the first non-inlined function will also be printed. For example, if `main` inlines `callee1` which inlines `callee2`, and address is from `callee2`, the source information for `callee1` and `main` will also be printed.

`-j`
`--section`
: Read offsets relative to the specified section instead of absolute addresses.

`-p`
`--pretty-print`
: Make the output more human friendly: each location are printed on one line. If option '`-i`' is specified, lines for all enclosing scopes are prefixed with '`(inlined by)`'.

12 nlmconv

`nlmconv` converts a relocatable object file into a NetWare Loadable Module.

Warning: `nlmconv` is not always built as part of the binary utilities, since it is only useful for NLM targets.

```
nlmconv [‘-I’ bfdname|‘--input-target=’bfdname]
        [‘-O’ bfdname|‘--output-target=’bfdname]
        [‘-T’ headerfile|‘--header-file=’headerfile]
        [‘-d’|‘--debug’] [‘-l’ linker|‘--linker=’linker]
        [‘-h’|‘--help’] [‘-V’|‘--version’]
        infile outfile
```

`nlmconv` converts the relocatable ‘`i386`’ object file *infile* into the NetWare Loadable Module *outfile*, optionally reading *headerfile* for NLM header information. For instructions on writing the NLM command file language used in header files, see the ‘`linkers`’ section, ‘`NLMLINK`’ in particular, of the *NLM Development and Tools Overview*, which is part of the NLM Software Developer’s Kit (“NLM SDK”), available from Novell, Inc. `nlmconv` uses the GNU Binary File Descriptor library to read *infile*; see Section “BFD” in *Using LD*, for more information.

`nlmconv` can perform a link step. In other words, you can list more than one object file for input if you list them in the definitions file (rather than simply specifying one input file on the command line). In this case, `nlmconv` calls the linker for you.

`-I` *bfdname*
`--input-target=`*bfdname*
: Object format of the input file. `nlmconv` can usually determine the format of a given file (so no default is necessary). See Section 19.1 [Target Selection], page 79, for more information.

`-O` *bfdname*
`--output-target=`*bfdname*
: Object format of the output file. `nlmconv` infers the output format based on the input format, e.g. for a ‘`i386`’ input file the output format is ‘`nlm32-i386`’. See Section 19.1 [Target Selection], page 79, for more information.

`-T` *headerfile*
`--header-file=`*headerfile*
: Reads *headerfile* for NLM header information. For instructions on writing the NLM command file language used in header files, see see the ‘`linkers`’ section, of the *NLM Development and Tools Overview*, which is part of the NLM Software Developer’s Kit, available from Novell, Inc.

`-d`
`--debug` Displays (on standard error) the linker command line used by `nlmconv`.

`-l` *linker*
`--linker=`*linker*
: Use *linker* for any linking. *linker* can be an absolute or a relative pathname.

`-h`
`--help` Prints a usage summary.

`-V`
`--version`
: Prints the version number for `nlmconv`.

13 windmc

`windmc` may be used to generator Windows message resources.

> *Warning:* `windmc` is not always built as part of the binary utilities, since it is only useful for Windows targets.

```
windmc [options] input-file
```

`windmc` reads message definitions from an input file (.mc) and translate them into a set of output files. The output files may be of four kinds:

`h` A C header file containing the message definitions.

`rc` A resource file compilable by the `windres` tool.

`bin` One or more binary files containing the resource data for a specific message language.

`dbg` A C include file that maps message id's to their symbolic name.

The exact description of these different formats is available in documentation from Microsoft.

When `windmc` converts from the `mc` format to the `bin` format, `rc`, `h`, and optional `dbg` it is acting like the Windows Message Compiler.

`-a`
`--ascii_in`
: Specifies that the input file specified is ASCII. This is the default behaviour.

`-A`
`--ascii_out`
: Specifies that messages in the output `bin` files should be in ASCII format.

`-b`
`--binprefix`
: Specifies that `bin` filenames should have to be prefixed by the basename of the source file.

`-c`
`--customflag`
: Sets the customer bit in all message id's.

`-C` *codepage*
`--codepage_in` *codepage*
: Sets the default codepage to be used to convert input file to UTF16. The default is ocdepage 1252.

`-d`
`--decimal_values`
: Outputs the constants in the header file in decimal. Default is using hexadecimal output.

`-e` *ext*
`--extension` *ext*
: The extension for the header file. The default is .h extension.

`-F` *target*
`--target` *target*
: Specify the BFD format to use for a bin file as output. This is a BFD target name; you can use the '`--help`' option to see a list of supported targets. Normally `windmc` will use the default format, which is the first one listed by the '`--help`' option. Section 19.1 [Target Selection], page 79.

`-h` *path*
`--headerdir` *path*
: The target directory of the generated header file. The default is the current directory.

`-H`
`--help`
: Displays a list of command line options and then exits.

`-m` *characters*
`--maxlength` *characters*
: Instructs `windmc` to generate a warning if the length of any message exceeds the number specified.

`-n`
`--nullterminate`
: Terminate message text in `bin` files by zero. By default they are terminated by CR/LF.

`-o`
`--hresult_use`
: Not yet implemented. Instructs `windmc` to generate an OLE2 header file, using HRESULT definitions. Status codes are used if the flag is not specified.

`-O` *codepage*
`--codepage_out` *codepage*
: Sets the default codepage to be used to output text files. The default is ocdepage 1252.

`-r` *path*
`--rcdir` *path*
: The target directory for the generated `rc` script and the generated `bin` files that the resource compiler script includes. The default is the current directory.

`-u`
`--unicode_in`
: Specifies that the input file is UTF16.

`-U`
`--unicode_out`
: Specifies that messages in the output `bin` file should be in UTF16 format. This is the default behaviour.

`-v`

`--verbose`
: Enable verbose mode.

`-V`

`--version`
: Prints the version number for `windmc`.

`-x` *path*
`--xdgb` *path*
: The path of the `dbg` C include file that maps message id's to the symbolic name. No such file is generated without specifying the switch.

14 windres

`windres` may be used to manipulate Windows resources.

> *Warning:* `windres` is not always built as part of the binary utilities, since it is only useful for Windows targets.

```
windres [options] [input-file] [output-file]
```

`windres` reads resources from an input file and copies them into an output file. Either file may be in one of three formats:

`rc` A text format read by the Resource Compiler.

`res` A binary format generated by the Resource Compiler.

`coff` A COFF object or executable.

The exact description of these different formats is available in documentation from Microsoft.

When `windres` converts from the `rc` format to the `res` format, it is acting like the Windows Resource Compiler. When `windres` converts from the `res` format to the `coff` format, it is acting like the Windows `CVTRES` program.

When `windres` generates an `rc` file, the output is similar but not identical to the format expected for the input. When an input `rc` file refers to an external filename, an output `rc` file will instead include the file contents.

If the input or output format is not specified, `windres` will guess based on the file name, or, for the input file, the file contents. A file with an extension of '`.rc`' will be treated as an `rc` file, a file with an extension of '`.res`' will be treated as a `res` file, and a file with an extension of '`.o`' or '`.exe`' will be treated as a `coff` file.

If no output file is specified, `windres` will print the resources in `rc` format to standard output.

The normal use is for you to write an `rc` file, use `windres` to convert it to a COFF object file, and then link the COFF file into your application. This will make the resources described in the `rc` file available to Windows.

`-i` *filename*
`--input` *filename*
: The name of the input file. If this option is not used, then `windres` will use the first non-option argument as the input file name. If there are no non-option arguments, then `windres` will read from standard input. `windres` can not read a COFF file from standard input.

`-o` *filename*
`--output` *filename*
: The name of the output file. If this option is not used, then `windres` will use the first non-option argument, after any used for the input file name, as the output file name. If there is no non-option argument, then `windres` will write to standard output. `windres` can not write a COFF file to standard output. Note, for compatibility with `rc` the option '`-fo`' is also accepted, but its use is not recommended.

`-J` *format*
`--input-format` *format*
: The input format to read. *format* may be '`res`', '`rc`', or '`coff`'. If no input format is specified, `windres` will guess, as described above.

`-O` *format*
`--output-format` *format*
: The output format to generate. *format* may be '`res`', '`rc`', or '`coff`'. If no output format is specified, `windres` will guess, as described above.

`-F` *target*
`--target` *target*
: Specify the BFD format to use for a COFF file as input or output. This is a BFD target name; you can use the '`--help`' option to see a list of supported targets. Normally `windres` will use the default format, which is the first one listed by the '`--help`' option. Section 19.1 [Target Selection], page 79.

`--preprocessor` *program*
: When `windres` reads an `rc` file, it runs it through the C preprocessor first. This option may be used to specify the preprocessor to use, including any leading arguments. The default preprocessor argument is `gcc -E -xc-header -DRC_INVOKED`.

`--preprocessor-arg` *option*
: When `windres` reads an `rc` file, it runs it through the C preprocessor first. This option may be used to specify additional text to be passed to preprocessor on its command line. This option can be used multiple times to add multiple options to the preprocessor command line.

`-I` *directory*
`--include-dir` *directory*
: Specify an include directory to use when reading an `rc` file. `windres` will pass this to the preprocessor as an '`-I`' option. `windres` will also search this directory when looking for files named in the `rc` file. If the argument passed to this command matches any of the supported *formats* (as described in the '`-J`' option), it will issue a deprecation warning, and behave just like the '`-J`' option. New programs should not use this behaviour. If a directory happens to match a *format*, simple prefix it with '`./`' to disable the backward compatibility.

`-D` *target*
`--define` *sym*`[=`*val*`]`
: Specify a '`-D`' option to pass to the preprocessor when reading an `rc` file.

`-U` *target*
`--undefine` *sym*
: Specify a '`-U`' option to pass to the preprocessor when reading an `rc` file.

`-r`
: Ignored for compatibility with rc.

`-v`
: Enable verbose mode. This tells you what the preprocessor is if you didn't specify one.

`-c` *val*

`--codepage` *val*
: Specify the default codepage to use when reading an `rc` file. *val* should be a hexadecimal prefixed by '`0x`' or decimal codepage code. The valid range is from zero up to 0xffff, but the validity of the codepage is host and configuration dependent.

`-l` *val*

`--language` *val*
: Specify the default language to use when reading an `rc` file. *val* should be a hexadecimal language code. The low eight bits are the language, and the high eight bits are the sublanguage.

`--use-temp-file`
: Use a temporary file to instead of using popen to read the output of the preprocessor. Use this option if the popen implementation is buggy on the host (eg., certain non-English language versions of Windows 95 and Windows 98 are known to have buggy popen where the output will instead go the console).

`--no-use-temp-file`
: Use popen, not a temporary file, to read the output of the preprocessor. This is the default behaviour.

`-h`

`--help` Prints a usage summary.

`-V`

`--version`
: Prints the version number for `windres`.

`--yydebug`
: If `windres` is compiled with `YYDEBUG` defined as `1`, this will turn on parser debugging.

15 dlltool

`dlltool` is used to create the files needed to create dynamic link libraries (DLLs) on systems which understand PE format image files such as Windows. A DLL contains an export table which contains information that the runtime loader needs to resolve references from a referencing program.

The export table is generated by this program by reading in a '`.def`' file or scanning the '`.a`' and '`.o`' files which will be in the DLL. A '`.o`' file can contain information in special '`.drectve`' sections with export information.

> *Note:* `dlltool` is not always built as part of the binary utilities, since it is only useful for those targets which support DLLs.

```
dlltool ['-d'|'--input-def' def-file-name]
        ['-b'|'--base-file' base-file-name]
        ['-e'|'--output-exp' exports-file-name]
        ['-z'|'--output-def' def-file-name]
        ['-l'|'--output-lib' library-file-name]
        ['-y'|'--output-delaylib' library-file-name]
        ['--export-all-symbols'] ['--no-export-all-symbols']
        ['--exclude-symbols' list]
        ['--no-default-excludes']
        ['-S'|'--as' path-to-assembler] ['-f'|'--as-flags' options]
        ['-D'|'--dllname' name] ['-m'|'--machine' machine]
        ['-a'|'--add-indirect']
        ['-U'|'--add-underscore'] ['--add-stdcall-underscore']
        ['-k'|'--kill-at'] ['-A'|'--add-stdcall-alias']
        ['-p'|'--ext-prefix-alias' prefix]
        ['-x'|'--no-idata4'] ['-c'|'--no-idata5']
        ['--use-nul-prefixed-import-tables']
        ['-I'|'--identify' library-file-name] ['--identify-strict']
        ['-i'|'--interwork']
        ['-n'|'--nodelete'] ['-t'|'--temp-prefix' prefix]
        ['-v'|'--verbose']
        ['-h'|'--help'] ['-V'|'--version']
        ['--no-leading-underscore'] ['--leading-underscore']
        [object-file ...]
```

`dlltool` reads its inputs, which can come from the '`-d`' and '`-b`' options as well as object files specified on the command line. It then processes these inputs and if the '`-e`' option has been specified it creates a exports file. If the '`-l`' option has been specified it creates a library file and if the '`-z`' option has been specified it creates a def file. Any or all of the '`-e`', '`-l`' and '`-z`' options can be present in one invocation of dlltool.

When creating a DLL, along with the source for the DLL, it is necessary to have three other files. `dlltool` can help with the creation of these files.

The first file is a '`.def`' file which specifies which functions are exported from the DLL, which functions the DLL imports, and so on. This is a text file and can be created by hand, or `dlltool` can be used to create it using the '`-z`' option. In this case `dlltool` will scan the object files specified on its command line looking for those functions which have been specially marked as being exported and put entries for them in the '`.def`' file it creates.

In order to mark a function as being exported from a DLL, it needs to have an '`-export:<name_of_function>`' entry in the '`.drectve`' section of the object file. This can be done in C by using the asm() operator:

```
asm (".section .drectve");
asm (".ascii \"-export:my_func\"");

int my_func (void) { ... }
```

The second file needed for DLL creation is an exports file. This file is linked with the object files that make up the body of the DLL and it handles the interface between the DLL and the outside world. This is a binary file and it can be created by giving the '`-e`' option to `dlltool` when it is creating or reading in a '`.def`' file.

The third file needed for DLL creation is the library file that programs will link with in order to access the functions in the DLL (an 'import library'). This file can be created by giving the '`-l`' option to dlltool when it is creating or reading in a '`.def`' file.

If the '`-y`' option is specified, dlltool generates a delay-import library that can be used instead of the normal import library to allow a program to link to the dll only as soon as an imported function is called for the first time. The resulting executable will need to be linked to the static delayimp library containing __delayLoadHelper2(), which in turn will import LoadLibraryA and GetProcAddress from kernel32.

`dlltool` builds the library file by hand, but it builds the exports file by creating temporary files containing assembler statements and then assembling these. The '`-S`' command line option can be used to specify the path to the assembler that dlltool will use, and the '`-f`' option can be used to pass specific flags to that assembler. The '`-n`' can be used to prevent dlltool from deleting these temporary assembler files when it is done, and if '`-n`' is specified twice then this will prevent dlltool from deleting the temporary object files it used to build the library.

Here is an example of creating a DLL from a source file '`dll.c`' and also creating a program (from an object file called '`program.o`') that uses that DLL:

```
gcc -c dll.c
dlltool -e exports.o -l dll.lib dll.o
gcc dll.o exports.o -o dll.dll
gcc program.o dll.lib -o program
```

`dlltool` may also be used to query an existing import library to determine the name of the DLL to which it is associated. See the description of the '`-I`' or '`--identify`' option.

The command line options have the following meanings:

`-d` *filename*
`--input-def` *filename*
: Specifies the name of a '`.def`' file to be read in and processed.

`-b` *filename*
`--base-file` *filename*
: Specifies the name of a base file to be read in and processed. The contents of this file will be added to the relocation section in the exports file generated by dlltool.

`-e` *filename*
`--output-exp` *filename*
: Specifies the name of the export file to be created by dlltool.

`-z` *filename*
`--output-def` *filename*
: Specifies the name of the '`.def`' file to be created by dlltool.

`-l` *filename*
`--output-lib` *filename*
: Specifies the name of the library file to be created by dlltool.

`-y` *filename*
`--output-delaylib` *filename*
: Specifies the name of the delay-import library file to be created by dlltool.

`--export-all-symbols`
: Treat all global and weak defined symbols found in the input object files as symbols to be exported. There is a small list of symbols which are not exported by default; see the '`--no-default-excludes`' option. You may add to the list of symbols to not export by using the '`--exclude-symbols`' option.

`--no-export-all-symbols`
: Only export symbols explicitly listed in an input '`.def`' file or in '`.drectve`' sections in the input object files. This is the default behaviour. The '`.drectve`' sections are created by '`dllexport`' attributes in the source code.

`--exclude-symbols` *list*
: Do not export the symbols in *list*. This is a list of symbol names separated by comma or colon characters. The symbol names should not contain a leading underscore. This is only meaningful when '`--export-all-symbols`' is used.

`--no-default-excludes`
: When '`--export-all-symbols`' is used, it will by default avoid exporting certain special symbols. The current list of symbols to avoid exporting is '`DllMain@12`', '`DllEntryPoint@0`', '`impure_ptr`'. You may use the '`--no-default-excludes`' option to go ahead and export these special symbols. This is only meaningful when '`--export-all-symbols`' is used.

`-S` *path*
`--as` *path*
: Specifies the path, including the filename, of the assembler to be used to create the exports file.

`-f` *options*
`--as-flags` *options*
: Specifies any specific command line options to be passed to the assembler when building the exports file. This option will work even if the '`-S`' option is not used. This option only takes one argument, and if it occurs more than once on the command line, then later occurrences will override earlier occurrences. So if it is necessary to pass multiple options to the assembler they should be enclosed in double quotes.

`-D` *name*
`--dll-name` *name*
: Specifies the name to be stored in the '`.def`' file as the name of the DLL when the '`-e`' option is used. If this option is not present, then the filename given to the '`-e`' option will be used as the name of the DLL.

`-m` *machine*
`-machine` *machine*
: Specifies the type of machine for which the library file should be built. `dlltool` has a built in default type, depending upon how it was created, but this option can be used to override that. This is normally only useful when creating DLLs for an ARM processor, when the contents of the DLL are actually encode using Thumb instructions.

`-a`
`--add-indirect`
: Specifies that when `dlltool` is creating the exports file it should add a section which allows the exported functions to be referenced without using the import library. Whatever the hell that means!

`-U`
`--add-underscore`
: Specifies that when `dlltool` is creating the exports file it should prepend an underscore to the names of *all* exported symbols.

`--no-leading-underscore`
`--leading-underscore`
: Specifies whether standard symbol should be forced to be prefixed, or not.

`--add-stdcall-underscore`
: Specifies that when `dlltool` is creating the exports file it should prepend an underscore to the names of exported *stdcall* functions. Variable names and non-stdcall function names are not modified. This option is useful when creating GNU-compatible import libs for third party DLLs that were built with MS-Windows tools.

`-k`
`--kill-at`
: Specifies that '`@<number>`' suffixes should be omitted from the names of stdcall functions that will be imported from the DLL. This is useful when creating an import library for a DLL which exports stdcall functions but without the usual '`@<number>`' symbol name suffix.

  This does not change the naming of symbols provided by the import library to programs linked against it, but only the entries in the import table (ie the .idata section).

`-A`
`--add-stdcall-alias`
: Specifies that when `dlltool` is creating the exports file it should add aliases for stdcall symbols without '`@ <number>`' in addition to the symbols with '`@ <number>`'.

`-p`
`--ext-prefix-alias` *prefix*
: Causes `dlltool` to create external aliases for all DLL imports with the specified prefix. The aliases are created for both external and import symbols with no leading underscore.

`-x`
`--no-idata4`
: Specifies that when `dlltool` is creating the exports and library files it should omit the `.idata4` section. This is for compatibility with certain operating systems.

`--use-nul-prefixed-import-tables`
: Specifies that when `dlltool` is creating the exports and library files it should prefix the `.idata4` and `.idata5` by zero an element. This emulates old gnu import library generation of `dlltool`. By default this option is turned off.

`-c`
`--no-idata5`
: Specifies that when `dlltool` is creating the exports and library files it should omit the `.idata5` section. This is for compatibility with certain operating systems.

`-I` *filename*
`--identify` *filename*
: Specifies that `dlltool` should inspect the import library indicated by *filename* and report, on `stdout`, the name(s) of the associated DLL(s). This can be performed in addition to any other operations indicated by the other options and arguments. `dlltool` fails if the import library does not exist or is not actually an import library. See also '`--identify-strict`'.

`--identify-strict`
: Modifies the behavior of the '`--identify`' option, such that an error is reported if *filename* is associated with more than one DLL.

`-i`
`--interwork`
: Specifies that `dlltool` should mark the objects in the library file and exports file that it produces as supporting interworking between ARM and Thumb code.

`-n`
`--nodelete`
: Makes `dlltool` preserve the temporary assembler files it used to create the exports file. If this option is repeated then dlltool will also preserve the temporary object files it uses to create the library file.

`-t` *prefix*
`--temp-prefix` *prefix*
: Makes `dlltool` use *prefix* when constructing the names of temporary assembler and object files. By default, the temp file prefix is generated from the pid.

`-v`
`--verbose`
: Make dlltool describe what it is doing.

`-h`
`--help` Displays a list of command line options and then exits.

`-V`
`--version`
: Displays dlltool's version number and then exits.

15.1 The format of the `dlltool` '`.def`' file

A '`.def`' file contains any number of the following commands:

`NAME` *name* `[ ,` *base* `]`
: The result is going to be named *name*`.exe`.

`LIBRARY` *name* `[ ,` *base* `]`
: The result is going to be named *name*`.dll`. Note: If you want to use LIBRARY as name then you need to quote. Otherwise this will fail due a necessary hack for libtool (see PR binutils/13710 for more details).

`EXPORTS ( (` *name1* `[ =` *name2* `] ) | (` *name1* `=` *module-name* `.` *external-name* `) ) [ ==` *its_name* `]`
`[` *integer* `] [ NONAME ] [ CONSTANT ] [ DATA ] [ PRIVATE ] ) *`
: Declares *name1* as an exported symbol from the DLL, with optional ordinal number *integer*, or declares *name1* as an alias (forward) of the function *external-name* in the DLL. If *its_name* is specified, this name is used as string in export table. *module-name*. Note: The `EXPORTS` has to be the last command in .def file, as keywords are treated - beside `LIBRARY` - as simple name-identifiers. If you want to use LIBRARY as name then you need to quote it.

`IMPORTS ( (` *internal-name* `=` *module-name* `.` *integer* `) | [` *internal-name* `= ]`
module-name `.` *external-name* `) [ == )` *its_name* `] *`
: Declares that *external-name* or the exported function whose ordinal number is *integer* is to be imported from the file *module-name*. If *internal-name* is specified then this is the name that the imported function will be referred to in the body of the DLL. If *its_name* is specified, this name is used as string in import table. Note: The `IMPORTS` has to be the last command in .def file, as keywords are treated - beside `LIBRARY` - as simple name-identifiers. If you want to use LIBRARY as name then you need to quote it.

`DESCRIPTION` *string*
: Puts *string* into the output '`.exp`' file in the `.rdata` section.

`STACKSIZE` *number-reserve* `[,` *number-commit* `]`
`HEAPSIZE` *number-reserve* `[,` *number-commit* `]`
: Generates `--stack` or `--heap` *number-reserve*,*number-commit* in the output `.drectve` section. The linker will see this and act upon it.

`CODE` *attr* `+`
`DATA` *attr* `+`
`SECTIONS (` *section-name attr* `+ ) *`
: Generates `--attr` *section-name attr* in the output `.drectve` section, where *attr* is one of `READ`, `WRITE`, `EXECUTE` or `SHARED`. The linker will see this and act upon it.

16 readelf

```
readelf ['-a'|'--all']
        ['-h'|'--file-header']
        ['-l'|'--program-headers'|'--segments']
        ['-S'|'--section-headers'|'--sections']
        ['-g'|'--section-groups']
        ['-t'|'--section-details']
        ['-e'|'--headers']
        ['-s'|'--syms'|'--symbols']
        ['--dyn-syms']
        ['-n'|'--notes']
        ['-r'|'--relocs']
        ['-u'|'--unwind']
        ['-d'|'--dynamic']
        ['-V'|'--version-info']
        ['-A'|'--arch-specific']
        ['-D'|'--use-dynamic']
        ['-x' <number or name>|'--hex-dump='<number or name>]
        ['-p' <number or name>|'--string-dump='<number or name>]
        ['-R' <number or name>|'--relocated-dump='<number or name>]
        ['-z'|'--decompress']
        ['-c'|'--archive-index']
        ['-w[lLiaprmfFsoRtUuTgAckK]'|
         '--debug-dump'[=rawline,=decodedline,=info,=abbrev,=pubnames,=aranges,=macro,=frames,=frames-
interp,=str,=loc,=Ranges,=pubtypes,=trace_info,=trace_abbrev,=trace_aranges,=gdb_index,=addr,=cu_index,=l
links]]
        ['--dwarf-depth=n']
        ['--dwarf-start=n']
        ['-I'|'--histogram']
        ['-v'|'--version']
        ['-W'|'--wide']
        ['-H'|'--help']
        elffile...
```

`readelf` displays information about one or more ELF format object files. The options control what particular information to display.

elffile... are the object files to be examined. 32-bit and 64-bit ELF files are supported, as are archives containing ELF files.

This program performs a similar function to `objdump` but it goes into more detail and it exists independently of the BFD library, so if there is a bug in BFD then readelf will not be affected.

The long and short forms of options, shown here as alternatives, are equivalent. At least one option besides '`-v`' or '`-H`' must be given.

`-a`
`--all`
: Equivalent to specifying '`--file-header`', '`--program-headers`', '`--sections`', '`--symbols`', '`--relocs`', '`--dynamic`', '`--notes`', '`--version-info`', '`--arch-specific`', '`--unwind`', '`--section-groups`' and '`--histogram`'.

  Note - this option does not enable '`--use-dynamic`' itself, so if that option is not present on the command line then dynamic symbols and dynamic relocs will not be displayed.

`-h`
`--file-header`
: Displays the information contained in the ELF header at the start of the file.

`-l`
`--program-headers`
`--segments`
: Displays the information contained in the file's segment headers, if it has any.

`-S`
`--sections`
`--section-headers`
: Displays the information contained in the file's section headers, if it has any.

`-g`
`--section-groups`
: Displays the information contained in the file's section groups, if it has any.

`-t`
`--section-details`
: Displays the detailed section information. Implies '`-S`'.

`-s`
`--symbols`
`--syms`
: Displays the entries in symbol table section of the file, if it has one. If a symbol has version information associated with it then this is displayed as well. The version string is displayed as a suffix to the symbol name, preceeded by an `@` character. For example '`foo@VER_1`'. If the version is the default version to be used when resolving unversioned references to the symbol then it is displayed as a suffix preceeded by two `@` characters. For example '`foo@@VER_2`'.

`--dyn-syms`
: Displays the entries in dynamic symbol table section of the file, if it has one. The output format is the same as the format used by the '`--syms`' option.

`-e`
`--headers`
: Display all the headers in the file. Equivalent to '`-h -l -S`'.

`-n`
`--notes`
: Displays the contents of the NOTE segments and/or sections, if any.

`-r`
`--relocs`
: Displays the contents of the file's relocation section, if it has one.

`-u`
`--unwind`
: Displays the contents of the file's unwind section, if it has one. Only the unwind sections for IA64 ELF files, as well as ARM unwind tables (`.ARM.exidx` / `.ARM.extab`) are currently supported.

`-d`
`--dynamic`
: Displays the contents of the file's dynamic section, if it has one.

`-V`
`--version-info`
: Displays the contents of the version sections in the file, it they exist.

`-A`
`--arch-specific`
: Displays architecture-specific information in the file, if there is any.

`-D`
`--use-dynamic`
: When displaying symbols, this option makes `readelf` use the symbol hash tables in the file's dynamic section, rather than the symbol table sections.

  When displaying relocations, this option makes `readelf` display the dynamic relocations rather than the static relocations.

`-x <number or name>`
`--hex-dump=<number or name>`
: Displays the contents of the indicated section as a hexadecimal bytes. A number identifies a particular section by index in the section table; any other string identifies all sections with that name in the object file.

`-R <number or name>`
`--relocated-dump=<number or name>`
: Displays the contents of the indicated section as a hexadecimal bytes. A number identifies a particular section by index in the section table; any other string identifies all sections with that name in the object file. The contents of the section will be relocated before they are displayed.

`-p <number or name>`
`--string-dump=<number or name>`
: Displays the contents of the indicated section as printable strings. A number identifies a particular section by index in the section table; any other string identifies all sections with that name in the object file.

`-z`
`--decompress`
: Requests that the section(s) being dumped by '`x`', '`R`' or '`p`' options are decompressed before being displayed. If the section(s) are not compressed then they are displayed as is.

`-c`
`--archive-index`
: Displays the file symbol index information contained in the header part of binary archives. Performs the same function as the '`t`' command to `ar`, but without using the BFD library. See Chapter 1 [ar], page 2.

`-w[lLiaprmfFsoRtUuTgAckK]`
`--debug-dump[=rawline,=decodedline,=info,=abbrev,=pubnames,=aranges,=macro,=frames,=frames-info,=trace_abbrev,=trace_aranges,=gdb_index,=addr,=cu_index,=links,=follow-links]`
: Displays the contents of the DWARF debug sections in the file, if any are present. Compressed debug sections are automatically decompressed (tem-

porarily) before they are displayed. If one or more of the optional letters or words follows the switch then only those type(s) of data will be dumped. The letters and words refer to the following information:

`a`
`=abbrev` Displays the contents of the '`.debug_abbrev`' section.

`A`
`=addr` Displays the contents of the '`.debug_addr`' section.

`c`
`=cu_index`
Displays the contents of the '`.debug_cu_index`' and/or '`.debug_tu_index`' sections.

`f`
`=frames` Display the raw contents of a '`.debug_frame`' section.

`F`

`=frame-interp`
Display the interpreted contents of a '`.debug_frame`' section.

`g`
`=gdb_index`
Displays the contents of the '`.gdb_index`' and/or '`.debug_names`' sections.

`i`
`=info` Displays the contents of the '`.debug_info`' section. Note: the output from this option can also be restricted by the use of the '`--dwarf-depth`' and '`--dwarf-start`' options.

`k`
`=links` Displays the contents of the '`.gnu_debuglink`' and/or '`.gnu_debugaltlink`' sections. Also displays the link to a separate dwarf object file (dwo), if one is specified by the DW_AT_GNU_dwo_name or DW_AT_dwo_name attributes in the '`.debug_info`' section.

`K`
`=follow-links`
Display the contents of any selected debug sections that are found in a linked, separate debug info file. This can result in multiple versions of the same debug section being displayed if both the main file and the separate debug info file contain sections with the same name.

In addition, when displaying DWARF attributes, if a form is found that references the separate debug info file, then the referenced contents will also be displayed.

`l`
`=rawline` Displays the contents of the '`.debug_line`' section in a raw format.

`L`

`=decodedline`
: Displays the interpreted contents of the '`.debug_line`' section.

`m`
`=macro`
: Displays the contents of the '`.debug_macro`' and/or '`.debug_macinfo`' sections.

`o`
`=loc`
: Displays the contents of the '`.debug_loc`' and/or '`.debug_loclists`' sections.

`p`
`=pubnames`
: Displays the contents of the '`.debug_pubnames`' and/or '`.debug_gnu_pubnames`' sections.

`r`
`=aranges`
: Displays the contents of the '`.debug_aranges`' section.

`R`
`=Ranges`
: Displays the contents of the '`.debug_ranges`' and/or '`.debug_rnglists`' sections.

`s`
`=str`
: Displays the contents of the '`.debug_str`', '`.debug_line_str`' and/or '`.debug_str_offsets`' sections.

`t`
`=pubtype`
: Displays the contents of the '`.debug_pubtypes`' and/or '`.debug_gnu_pubtypes`' sections.

`T`
`=trace_aranges`
: Displays the contents of the '`.trace_aranges`' section.

`u`
`=trace_abbrev`
: Displays the contents of the '`.trace_abbrev`' section.

`U`
`=trace_info`
: Displays the contents of the '`.trace_info`' section.

Note: displaying the contents of '`.debug_static_funcs`', '`.debug_static_vars`' and '`debug_weaknames`' sections is not currently supported.

`--dwarf-depth=`*n*
: Limit the dump of the `.debug_info` section to *n* children. This is only useful with '`--debug-dump=info`'. The default is to print all DIEs; the special value 0 for *n* will also have this effect.

With a non-zero value for *n*, DIEs at or deeper than *n* levels will not be printed. The range for *n* is zero-based.

`--dwarf-start=`*n*
: Print only DIEs beginning with the DIE numbered *n*. This is only useful with '`--debug-dump=info`'.

  If specified, this option will suppress printing of any header information and all DIEs before the DIE numbered *n*. Only siblings and children of the specified DIE will be printed.

  This can be used in conjunction with '`--dwarf-depth`'.

`-I`
`--histogram`
: Display a histogram of bucket list lengths when displaying the contents of the symbol tables.

`-v`
`--version`
: Display the version number of readelf.

`-W`
`--wide`
: Don't break output lines to fit into 80 columns. By default `readelf` breaks section header and segment listing lines for 64-bit ELF files, so that they fit into 80 columns. This option causes `readelf` to print each section header resp. each segment one a single line, which is far more readable on terminals wider than 80 columns.

`-H`
`--help`
: Display the command line options understood by `readelf`.

17 elfedit

```
elfedit [‘--input-mach=’machine]
        [‘--input-type=’type]
        [‘--input-osabi=’osabi]
        ‘--output-mach=’machine
        ‘--output-type=’type
        ‘--output-osabi=’osabi
        [‘-v’|‘--version’]
        [‘-h’|‘--help’]
        elffile...
```

`elfedit` updates the ELF header of ELF files which have the matching ELF machine and file types. The options control how and which fields in the ELF header should be updated.

elffile... are the ELF files to be updated. 32-bit and 64-bit ELF files are supported, as are archives containing ELF files.

The long and short forms of options, shown here as alternatives, are equivalent. At least one of the ‘`--output-mach`’, ‘`--output-type`’ and ‘`--output-osabi`’ options must be given.

`--input-mach=`*machine*
: Set the matching input ELF machine type to *machine*. If ‘`--input-mach`’ isn't specified, it will match any ELF machine types.

  The supported ELF machine types are, *i386*, *IAMCU*, *L1OM*, *K1OM* and *x86-64*.

`--output-mach=`*machine*
: Change the ELF machine type in the ELF header to *machine*. The supported ELF machine types are the same as ‘`--input-mach`’.

`--input-type=`*type*
: Set the matching input ELF file type to *type*. If ‘`--input-type`’ isn't specified, it will match any ELF file types.

  The supported ELF file types are, *rel*, *exec* and *dyn*.

`--output-type=`*type*
: Change the ELF file type in the ELF header to *type*. The supported ELF types are the same as ‘`--input-type`’.

`--input-osabi=`*osabi*
: Set the matching input ELF file OSABI to *osabi*. If ‘`--input-osabi`’ isn't specified, it will match any ELF OSABIs.

  The supported ELF OSABIs are, *none*, *HPUX*, *NetBSD*, *GNU*, *Linux* (alias for *GNU*), *Solaris*, *AIX*, *Irix*, *FreeBSD*, *TRU64*, *Modesto*, *OpenBSD*, *OpenVMS*, *NSK*, *AROS* and *FenixOS*.

`--output-osabi=`*osabi*
: Change the ELF OSABI in the ELF header to *osabi*. The supported ELF OSABI are the same as ‘`--input-osabi`’.

`-v`
`--version`
: Display the version number of `elfedit`.

`-h`
`--help` Display the command line options understood by `elfedit`.

18 Common Options

The following command-line options are supported by all of the programs described in this manual.

`@`*file*
: Read command-line options from *file*. The options read are inserted in place of the original `@`*file* option. If *file* does not exist, or cannot be read, then the option will be treated literally, and not removed.

  Options in *file* are separated by whitespace. A whitespace character may be included in an option by surrounding the entire option in either single or double quotes. Any character (including a backslash) may be included by prefixing the character to be included with a backslash. The *file* may itself contain additional `@`*file* options; any such options will be processed recursively.

`--help`
: Display the command-line options supported by the program.

`--version`
: Display the version number of the program.

19 Selecting the Target System

You can specify two aspects of the target system to the GNU binary file utilities, each in several ways:

- the target
- the architecture

In the following summaries, the lists of ways to specify values are in order of decreasing precedence. The ways listed first override those listed later.

The commands to list valid values only list the values for which the programs you are running were configured. If they were configured with '`--enable-targets=all`', the commands list most of the available values, but a few are left out; not all targets can be configured in at once because some of them can only be configured *native* (on hosts with the same type as the target system).

19.1 Target Selection

A *target* is an object file format. A given target may be supported for multiple architectures (see Section 19.2 [Architecture Selection], page 80). A target selection may also have variations for different operating systems or architectures.

The command to list valid target values is '`objdump -i`' (the first column of output contains the relevant information).

Some sample values are: '`a.out-hp300bsd`', '`ecoff-littlemips`', '`a.out-sunos-big`'.

You can also specify a target using a configuration triplet. This is the same sort of name that is passed to '`configure`' to specify a target. When you use a configuration triplet as an argument, it must be fully canonicalized. You can see the canonical version of a triplet by running the shell script '`config.sub`' which is included with the sources.

Some sample configuration triplets are: '`m68k-hp-bsd`', '`mips-dec-ultrix`', '`sparc-sun-sunos`'.

`objdump` Target

Ways to specify:

1. command line option: '`-b`' or '`--target`'
2. environment variable `GNUTARGET`
3. deduced from the input file

`objcopy` and `strip` Input Target

Ways to specify:

1. command line options: '`-I`' or '`--input-target`', or '`-F`' or '`--target`'
2. environment variable `GNUTARGET`
3. deduced from the input file

`objcopy` and `strip` Output Target

Ways to specify:

1. command line options: '`-O`' or '`--output-target`', or '`-F`' or '`--target`'
2. the input target (see "`objcopy` and `strip` Input Target" above)
3. environment variable `GNUTARGET`
4. deduced from the input file

`nm`, `size`, and `strings` Target

Ways to specify:

1. command line option: '`--target`'
2. environment variable `GNUTARGET`
3. deduced from the input file

19.2 Architecture Selection

An *architecture* is a type of CPU on which an object file is to run. Its name may contain a colon, separating the name of the processor family from the name of the particular CPU.

The command to list valid architecture values is '`objdump -i`' (the second column contains the relevant information).

Sample values: '`m68k:68020`', '`mips:3000`', '`sparc`'.

`objdump` Architecture

Ways to specify:

1. command line option: '`-m`' or '`--architecture`'
2. deduced from the input file

`objcopy`, `nm`, `size`, `strings` Architecture

Ways to specify:

1. deduced from the input file

20 Reporting Bugs

Your bug reports play an essential role in making the binary utilities reliable.

Reporting a bug may help you by bringing a solution to your problem, or it may not. But in any case the principal function of a bug report is to help the entire community by making the next version of the binary utilities work better. Bug reports are your contribution to their maintenance.

In order for a bug report to serve its purpose, you must include the information that enables us to fix the bug.

20.1 Have You Found a Bug?

If you are not sure whether you have found a bug, here are some guidelines:

- If a binary utility gets a fatal signal, for any input whatever, that is a bug. Reliable utilities never crash.
- If a binary utility produces an error message for valid input, that is a bug.
- If you are an experienced user of binary utilities, your suggestions for improvement are welcome in any case.

20.2 How to Report Bugs

A number of companies and individuals offer support for GNU products. If you obtained the binary utilities from a support organization, we recommend you contact that organization first.

You can find contact information for many support companies and individuals in the file '`etc/SERVICE`' in the GNU Emacs distribution.

In any event, we also recommend that you send bug reports for the binary utilities to `http://www.sourceware.org/bugzilla/`.

The fundamental principle of reporting bugs usefully is this: **report all the facts**. If you are not sure whether to state a fact or leave it out, state it!

Often people omit facts because they think they know what causes the problem and assume that some details do not matter. Thus, you might assume that the name of a file you use in an example does not matter. Well, probably it does not, but one cannot be sure. Perhaps the bug is a stray memory reference which happens to fetch from the location where that pathname is stored in memory; perhaps, if the pathname were different, the contents of that location would fool the utility into doing the right thing despite the bug. Play it safe and give a specific, complete example. That is the easiest thing for you to do, and the most helpful.

Keep in mind that the purpose of a bug report is to enable us to fix the bug if it is new to us. Therefore, always write your bug reports on the assumption that the bug has not been reported previously.

Sometimes people give a few sketchy facts and ask, "Does this ring a bell?" This cannot help us fix a bug, so it is basically useless. We respond by asking for enough details to enable us to investigate. You might as well expedite matters by sending them to begin with.

To enable us to fix the bug, you should include all these things:

- The version of the utility. Each utility announces it if you start it with the '`--version`' argument.

  Without this, we will not know whether there is any point in looking for the bug in the current version of the binary utilities.
- Any patches you may have applied to the source, including any patches made to the `BFD` library.
- The type of machine you are using, and the operating system name and version number.
- What compiler (and its version) was used to compile the utilities—e.g. "`gcc-2.7`".
- The command arguments you gave the utility to observe the bug. To guarantee you will not omit something important, list them all. A copy of the Makefile (or the output from make) is sufficient.

  If we were to try to guess the arguments, we would probably guess wrong and then we might not encounter the bug.
- A complete input file, or set of input files, that will reproduce the bug. If the utility is reading an object file or files, then it is generally most helpful to send the actual object files.

  If the source files were produced exclusively using GNU programs (e.g., `gcc`, `gas`, and/or the GNU `ld`), then it may be OK to send the source files rather than the object files. In this case, be sure to say exactly what version of `gcc`, or whatever, was used to produce the object files. Also say how `gcc`, or whatever, was configured.
- A description of what behavior you observe that you believe is incorrect. For example, "It gets a fatal signal."

  Of course, if the bug is that the utility gets a fatal signal, then we will certainly notice it. But if the bug is incorrect output, we might not notice unless it is glaringly wrong. You might as well not give us a chance to make a mistake.

  Even if the problem you experience is a fatal signal, you should still say so explicitly. Suppose something strange is going on, such as your copy of the utility is out of sync, or you have encountered a bug in the C library on your system. (This has happened!) Your copy might crash and ours would not. If you told us to expect a crash, then when ours fails to crash, we would know that the bug was not happening for us. If you had not told us to expect a crash, then we would not be able to draw any conclusion from our observations.
- If you wish to suggest changes to the source, send us context diffs, as generated by `diff` with the '`-u`', '`-c`', or '`-p`' option. Always send diffs from the old file to the new file. If you wish to discuss something in the `ld` source, refer to it by context, not by line number.

  The line numbers in our development sources will not match those in your sources. Your line numbers would convey no useful information to us.

Here are some things that are not necessary:

- A description of the envelope of the bug.

  Often people who encounter a bug spend a lot of time investigating which changes to the input file will make the bug go away and which changes will not affect it.

This is often time consuming and not very useful, because the way we will find the bug is by running a single example under the debugger with breakpoints, not by pure deduction from a series of examples. We recommend that you save your time for something else.

Of course, if you can find a simpler example to report *instead* of the original one, that is a convenience for us. Errors in the output will be easier to spot, running under the debugger will take less time, and so on.

However, simplification is not vital; if you do not want to do this, report the bug anyway and send us the entire test case you used.

- A patch for the bug.

  A patch for the bug does help us if it is a good one. But do not omit the necessary information, such as the test case, on the assumption that a patch is all we need. We might see problems with your patch and decide to fix the problem another way, or we might not understand it at all.

  Sometimes with programs as complicated as the binary utilities it is very hard to construct an example that will make the program follow a certain path through the code. If you do not send us the example, we will not be able to construct one, so we will not be able to verify that the bug is fixed.

  And if we cannot understand what bug you are trying to fix, or why your patch should be an improvement, we will not install it. A test case will help us to understand.

- A guess about what the bug is or what it depends on.

  Such guesses are usually wrong. Even we cannot guess right about such things without first using the debugger to find the facts.

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Version 1.3, 3 November 2008

0. PREAMBLE

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