GNU Gnulib

This manual is for GNU Gnulib (updated $Date: 2004/09/29 10:58:47 $), which is a library of common routines intended to be shared at the source level.

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1 Gnulib

This is not a real manual. It's just a place to store random notes until someone (you?) gets around to actually writing a manual.

Getting started:

- Gnulib is hosted at Savannah: http://savannah.gnu.org/projects/gnulib. Get the sources through CVS from there.
- The Gnulib home page: http://www.gnu.org/software/gnulib/.

1.1 Comments

Where to put comments describing functions: Because of risk of divergence, we prefer to keep most function describing comments in only one place: just above the actual function definition. Some people prefer to put that documentation in the .h file. In any case, it should appear in just one place unless you can ensure that the multiple copies will always remain identical.

1.2 Header files

It is a tradition to use CPP tricks to avoid parsing the same header file more than once, which might cause warnings. The trick is to wrap the content of the header file (say, 'foo.h') in a block, as in:

```
#ifndef FOO_H
# define FOO_H
...
body of header file goes here
...
#endif /* FOO_H */
```

Whether to use `FOO_H` or `_FOO_H` is a matter of taste and style. The C89 and C99 standards reserve all identifiers that begin with an underscore and either an uppercase letter or another underscore, for any use. Thus, in theory, an application might not safely assume that `_FOO_H` has not already been defined by a library. On the other hand, using `FOO_H` will likely lead the higher risk of collisions with other symbols (e.g., `KEY_H`, `XK_H`, `BPF_H`, which are CPP macro constants, or `COFF_LONG_H`, which is a CPP macro function). Your preference may depend on whether you consider the header file under discussion as part of the application (which has its own namespace for CPP symbols) or a supporting library (that shouldn't interfere with the application's CPP symbol namespace).

Adapting C header files for use in C++ applications can use another CPP trick, as in:

```
# ifdef __cplusplus
extern "C"
{
# endif
...
body of header file goes here
...
# ifdef __cplusplus
```

```
    }
    # endif
```

The idea here is that `__cplusplus` is defined only by C++ implementations, which will wrap the header file in an 'extern "C"' block. Again, whether to use this trick is a matter of taste and style. While the above can be seen as harmless, it could be argued that the header file is written in C, and any C++ application using it should explicitly use the 'extern "C"' block itself. Your preference might depend on whether you consider the API exported by your header file as something available for C programs only, or for C and C++ programs alike.

1.3 ctime

The `ctime` function need not be reentrant, and consequently is not required to be thread safe. Implementations of `ctime` typically write the time stamp into static buffer. If two threads call `ctime` at roughly the same time, you might end up with the wrong date in one of the threads, or some undefined string. There is a re-entrant interface `ctime_r`, that take a pre-allocated buffer and length of the buffer, and return `NULL` on errors. The input buffer should be at least 26 bytes in size. The output string is locale-independent. However, years can have more than 4 digits if `time_t` is sufficiently wide, so the length of the required output buffer is not easy to determine. Increasing the buffer size when `ctime_r` return `NULL` is not necessarily sufficient. The `NULL` return value could mean some other error condition, which will not go away by increasing the buffer size.

A more flexible function is `strftime`. However, note that it is locale dependent.

1.4 inet_ntoa

The `inet_ntoa` function need not be reentrant, and consequently is not required to be thread safe. Implementations of `inet_ntoa` typically write the time stamp into static buffer. If two threads call `inet_ntoa` at roughly the same time, you might end up with the wrong date in one of the threads, or some undefined string. Further, `inet_ntoa` is specific for IPv4 addresses.

A protocol independent function is `inet_ntop`.

1.5 Out of memory handling

The GSS API does not have a standard error code for the out of memory error condition. Instead of adding a non-standard error code, this library has chosen to adopt a different strategy. Out of memory handling happens in rare situations, but performing the out of memory error handling after almost all API function invocations pollute your source code and might make it harder to spot more serious problems. The strategy chosen improve code readability and robustness.

For most applications, aborting the application with an error message when the out of memory situation occur is the best that can be wished for. This is how the library behaves by default.

However, we realize that some applications may not want to have the GSS library abort execution in any situation. The GSS library support a hook to let the application regain control and perform its own cleanups when an out of memory situation has occured. The

application can define a function (having a `void` prototype, i.e., no return value and no parameters) and set the library variable `xalloc_fail_func` to that function. The variable should be declared as follows.

```
extern void (*xalloc_fail_func) (void);
```

The GSS library will invoke this function if an out of memory error occurs. Note that after this the GSS library is in an undefined state, so you must unload or restart the application to continue call GSS library functions. The hook is only intended to allow the application to log the situation in a special way. Of course, care must be taken to not allocate more memory, as that will likely also fail.

2 Invoking gnulib-tool

Run 'gnulib-tool --help', and use the source. gnulib-tool is the way to import Gnulib
modules.

2.1 Initial import

Gnulib assumes your project uses Autoconf and Automake. Invoking 'gnulib-tool
--import' will copy source files, create a 'Makefile.am' to build them, and generate a
'gnulib.m4' with Autoconf M4 macro declarations used by 'configure.ac'.

Our example will be a library that uses Autoconf, Automake and Libtool. It calls
strdup, and you wish to use gnulib to make the package portable to C89 (which doesn't
have strdup).

```
~/src/libfoo$ gnulib-tool --import strdup
Module list with included dependencies:
  strdup
File list:
  lib/strdup.c
  lib/strdup.h
  m4/onceonly_2_57.m4
  m4/strdup.m4
Creating ./lib/Makefile.am...
Creating ./m4/gnulib.m4...
Finished.

Don't forget to add "lib/Makefile"
to AC_CONFIG_FILES in "./configure.ac" and to mention
"lib" in SUBDIRS in some Makefile.am.
~/src/libfoo$
```

By default, the source code is copied into 'lib/' and the M4 macros in 'm4/'. You can
override these paths by using --source-base=DIRECTORY and --m4-base=DIRECTORY,
or by adding 'gl_SOURCE_BASE(DIRECTORY)' and 'gl_M4_BASE(DIRECTORY)' to your
'configure.ac'.

gnulib-tool will overwrite any pre-existing files, in particular 'Makefile.am'. Unfortu-
nately, separating the generated 'Makefile.am' content (for building the gnulib library) into
a separate file, say 'gnulib.mk', that could be included by your handwritten 'Makefile.am'
is not possible, due to how variable assignments are handled by Automake.

Consequently, it can be a good idea to chose directories that are not already used by
your projects, to separate gnulib imported files from your own files. This approach can also
be useful if you want to avoid conflicts between other tools (e.g., getextize that also copy
M4 files into your package. Simon Josefsson successfully uses a source base of 'gl/', and a
M4 base of 'gl/m4/', in several packages.

A few manual steps are required to finish the initial import.

First, you need to make sure Autoconf can find the macro definitions in 'gnulib.m4'.
Use the ACLOCAL_AMFLAGS specifier in your top-level 'Makefile.am' file, as in:

```
ACLOCAL_AMFLAGS = -I m4
```

Naturally, replace 'm4' with the value from `--m4-base` or `gl_M4_BASE`. If the M4 base is 'gl/m4' you would use:

```
ACLOCAL_AMFLAGS = -I gl/m4
```

You are now ready to call the M4 macros in `gnulib.m4` from '`configure.ac`'. The macro `gl_EARLY` must be called as soon as possible after verifying that the C compiler is working. Typically, this is immediately after `AC_PROG_CC`, as in:

```
...
AC_PROG_CC
gl_EARLY
...
```

The core part of the gnulib checks are done by the macro `gl_INIT`. Place it further down in the file, typically where you normally check for header files or functions. Or in a separate section with other gnulib statements, such as `gl_SOURCE_BASE`. For example:

```
...
# For gnulib.
gl_INIT
...
```

You must also make sure that the gnulib library is built. Add the `Makefile` in the gnulib source base directory to `AC_CONFIG_FILES`, as in:

```
AC_CONFIG_FILES(... lib/Makefile ...)
```

If your gnulib source base is 'gl', you would use:

```
AC_CONFIG_FILES(... gl/Makefile ...)
```

You must also make sure that `make` work in the gnulib directory. Add the gnulib source base directory to a `SUBDIRS` Makefile.am statement, as in:

```
SUBDIRS = lib
```

or if you, more likely, already have a few entries in `SUBDIRS`, you can add something like:

```
SUBDIRS += lib
```

If you are using a gnulib source base of `gl`, you would use:

```
SUBDIRS += gl
```

Finally, you have add C flags and LD flags, so that you can make use of the gnulib library. For example:

```
...
AM_CPPFLAGS = -I$(top_srcdir)/lib
...
LIBADD = lib/libgnu.la
...
```

Don't forget to `#include` the various header files. In this example, you would need to make sure that '`#include <strdup.h>`' is evaluated when compiling all source code files, that want to make use of `strdup`.

2.2 Importing updated files

From time to time, you may want to invoke 'gnulib-tool --import' to update the files in
your package. Once you have set up your package for gnulib, this step is quite simple. For
example:

```
~/src/libfoo$ gnulib-tool --import --source-base gl --m4-base gl/m4 strdup
Module list with included dependencies:
  strdup
File list:
  lib/strdup.c
  lib/strdup.h
  m4/onceonly_2_57.m4
  m4/strdup.m4
Creating ./lib/Makefile.am...
Creating ./m4/gnulib.m4...
Finished.

Don't forget to add "lib/Makefile"
to AC_CONFIG_FILES in "./configure.ac" and to mention
"lib" in SUBDIRS in some Makefile.am.
~/src/libfoo$
```

If you don't recall how you invoked the tool last time, the commands used (and the
operations it resulted in) are placed in comments within the generated 'Makefile.am' and
'gnulib.m4', as in:

```
...
# Invoked as: gnulib-tool --import strdup
# Reproduce by: gnulib-tool --import --dir=. --lib=libgnu --source-base=lib --m4-base=
...
```

2.3 Finishing touches

Invoking 'gnulib-tool --import' with the proper parameters (e.g., '--m4-base gl/m4')
and list of modules (e.g., 'strdup snprintf getline minmax') can be tedious. To simplify
this procedure, you may put the command line parameters in your 'configure.ac'. For
example:

```
...
AC_PROG_CC
gl_EARLY
...
# For gnulib.
gl_SOURCE_BASE(gl)
gl_M4_BASE(gl/m4)
gl_LIB(libgl)
gl_MODULES(getopt progname strdup dummy exit error getpass-gnu getaddrinfo)
gl_INIT
...
```

This illustrate all macros defined in 'gnulib.m4'. With the above, importing new files are as simple as running 'gnulib-tool --import' with no additional parameters.

The macros gl_EARLY, gl_INIT, gl_SOURCE_BASE, and gl_M4_BASE have been discussed earlier. The gl_LIB macro can be used if you wish to change the library name (by default 'libgnu.a' or 'libgnu.la' if you use libtool). The gl_MODULES macro is used to specify which modules to import.

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