NAME

libexplain – Explain errno values returned by libc functions

DESCRIPTION

The *libexplain* package provides a library which may be used to explain Unix and Linux system call errors. This will make your application's error messages much more informative to your users.

The library is not quite a drop-in replacement for *strerror*(3), but it comes close. Each system call has a dedicated libexplain function, for example

```
fd = open(path, flags, mode);
if (fd < 0)
{
    fprintf(stderr, "%s\n", explain_open(path, flags, mode));
    exit(EXIT_FAILURE);
}
```

If, for example, you were to try to open `no-such-dir/some-file`, you would see a message like

```
open(pathname = "no-such-dir/some-file", flags = O_RDONLY) failed,
No such file or directory (2, ENOENT) because there is no "no-
such-dir" directory in the current directory
```

The good new is that for each of these functions there is a wrapper function, in this case *explain_open_or_die*(3), that includes the above code fragment. Adding good error reporting is as simple as using a different, but similarly named, function. The library also provides thread safe variants of each explanation function.

Coverage includes 221 system calls and 547 ioctl requests.

Tutorial Documentation

There is a paper available in PDF format (http://libexplain.sourceforge.net/lca2010/lca2010.pdf) that describes the library and how to use LibExplain. The paper can also be accessed as *explain_lca2010*(1), which also appears in the reference manual (see below).

HOME PAGE

The latest version of *libexplain* is available on the Web from:

URL:	http://libexplain.sourceforge.net/	
File:	index.html	# the libexplain page
File:	libexplain.1.4.README	# Description, from the tar file
File:	libexplain.1.4.lsm	# Description, LSM format
File:	libexplain.1.4.tar.gz	# the complete source
File:	libexplain.1.4.pdf	# Reference Manual

BUILDING LIBEXPLAIN

Full instructions for building *libexplain* may be found in the *BUILDING* file included in this distribution.

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libexplain version 1.4

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RELEASE NOTES

This section details the various features and bug fixes of the various releases. For excruciating and complete detail, and also credits for those of you who have generously sent me suggestions and bug reports, see the *etc/CHANGES.** files.

Coverage includes 221 system calls and 547 ioctl requests.

Version 1.4 (2014-Mar-03)

- Numerous false negative test results, have been fixed on FreeBSD.
- When building on FreeBSD some interesting flags need to be specified
  `CC=gvc46 \ CPPFLAGS=-I/usr/local/include \ LDFLAGS=-L/usr/local/lib \`

  Also care must be taken if an earlier version of libexplain is installed, and can be found on $LD_LIBRARY_PATH, this may cause false negatives.
- This change set adds mor efixes for FreeBSD compilation.
- Some problems discovered using the clang compiler have been fixed. This is a work in progress.
- My thanks to Vinxxe <vinxxe@gmail.com> for reporting a problem compiling from source.
- Explanations are now available for errors reported by the *lchownat*(2), *linkat*(2), *mount*(2), *nanosleep*(3), *settimeofday*(2), *sleep*(3), *uname*(2), *usleep*(3), system calls.
- Added a work-around for gethostname *on* Darwin/OSX.
- This change set borrows some of the glib nanosleep fixes.

Version 1.3 (2013-Nov-19)

- Explanations are now available or errors reported by the *acl_from_text*(3), *acl_get_fd*(3), *acl_get_file*(3), *acl_set_fd*(3), *acl_set_file*(3), *acl_to_text*(3), *asprintf*(3), *avasprintf*(3), *endgrent*(3), *fchownat*(2), *fseek*(3), *fstatat*(2), *ftello*(3), *futimensat*(2), *futimens*(3), *getgrent*(3), *getgrouplist*(3), *gethostid*(3), *getprioriy*(2), *iconv_close*(3), *iconv*(3), *iconv_open*(3), *lutimes*(2), *openat*(2), *pipe2*(2), *setgrent*(3), *setpriority*(2) and *strcoll*(3) system calls.
- The *malloc*(3), *et a*, diagnostics are now more aware of *getrlimi*(2) and *getrusage*(2), in order to give more informative messages.
- YunQiang Su <wzssyqa@gmail.com> build problem where a symbol is #defined, but it's empty, throwing a warning about uninitialized members.
  Debian: Closes: #723409
- Chris Leick <c.leick@vollbio.de> contributed a German message translation.
- Eric Smith <brouhaha@fedoraproject.org> discovered that test 555 could give a false negative if process 666 exists when the test is run.

Version 1.2 (2013-Mar-14)

- Explanations are now available for errors reported by the gethostbyname and getrusage system calls.
- Emanuel Haupt <ehaupt@FreeBSD.org> discovered that libexplain coped poorly with different versions of bison emitting code chunks in different orders. `=======`
- getrusage system call. Explanations are now available for errors reported by the *gethostbynam*(3) and*getrusage*(2) system calls.
- Emanuel Haupt <ehaupt@FreeBSD.org> discovered that libexplain coped poorly with different versions of bison emitting code chunks in different orders.
- This change set copes with the absence of a v4l2_buffer member, which recently happened in Ubuntu Raring. My thanks to the LaunchPad PPA build farm for finding this problem.

Version 1.1 (2012-Nov-20)

- Explanations are now available for errors reported by the *execv*(3), *getresgid*(2), *getresuid*(2), *lchmod*(2), *setgid*(2) *setregid*(2), *setresgid*(2), *setresuid*(2), *setreuid*(2), *setuid*(2) and *utimens*(2) system calls.
- Emanuel Haupt <ehaupt@critical.ch> discovered that the error handling for *shmat*(2) on BSD needed more portability work.
- There are new `explain_filename_from_stream` and `explain_filename_from_fildes` functions to the public API. This gives library clients access to libexplain's idea of the filename.
- Michael Cree <mcree@orcon.net.nz> discovered that there was a problem building libexplain on alpha architecture.
  Debian: Closes: #661440

Version 1.0 (2012-May-19)

• Several testing false negative has been fix, concerning EACCES when executed by root.

Version 0.52 (2012-Mar-04)

• A false negative in test 76, where Linux security modules change the *rename*(2) semantics.

• A problem on sparc64 has been fixed. Libexplain can now cope with a missing O_LARGEFILE declaration, and yet file flags returned by the kernel have the flag set.

• A build problem on Debian alpha has been fixed, the name of an include file was incorrect.

Version 0.51 (2012-Jan-26)

- The *ptrace*(2) support has been improved with more conditionals determined by the ./configure script when building.
  Debian: Closes: #645745

Version 0.50 (2012-Jan-16)

• SpepS <spepsforge@users.sf.net> and Eric Smith <eric@brouhaha.com> discovered that _PC_MIN_HOLE_SIZE isn't supported for all Linux. Some more #ifdef was added.

• Several false negatives from tests have been fixed.
Debian: Closes: 654199

• The tarball now includes a libexplain.spec file for building an RPM package using *rpmbuild*(1).

• This change set makes the exe(readlink) string search less particular, so that it works in more cases. In this instance, on Fedora 14.

• Explanations are nowe available for errors reported by the *realpath*(3) system call.

Version 0.49 (2011-Nov-10)

- Explanations are now available for errors reported by the *shmctl*(2) system call.
- Some build problems (discovered by the LaunchPad PPA buid farm) have been fixed.

Version 0.48 (2011-Nov-08)

- Explanations are now available for errors reported by the *shmat*(2) system call.
- Several build problems on Solaris have been fixed.
- Dagobert Michelsen <dam@opencsw.org> found the test 625 was throwing a false negative in his test environment. It can now cope with stdin being closed.
- Dagobert Michelsen <dam@opencsw.org> discovered that, on Solaris, test false negatives were caused by the need for a space before the width in a "`fmt -w 800`" command.
- Eric Smith <eric@brouhaha.com> discovered that *lsof*(1) could report errors as executable names, when it couldn't read the symlink. These non-results are now filtered out.
- Eric Smith <eric@brouhaha.com> discovered three false negatives from tests of the *kill*(2) system call.
- Better explanations are now available when a user attempts to execute a directory.

Version 0.47 (2011-Sep-27)

- Explanations are now available for errors reported by the *setsid*(2) system call.
- The Ubuntu PPA build farm found several Hardy build problems. These have been fixed.
- Code has been added to detect those cases where a file descriptor may be open for reading and writing, but the I/O stream it is accessed by is only open for one of them.
- Code has been added to cope with false negatives when *lsof*(1) is not as helpful as could be desired.
- Michael Bienia <geser@ubuntu.com> discovered a build problem with the SIOCSHWTSTAMP ioctl request, and sent a patch.

Version 0.46 (2011-Aug-24)

• LibExplain has been ported to Solaris 8, 9 and 10. My thanks to Dagobert Michelsen and `http://opencsw.org/` for assistance with this port.

• Several more Linux *ioctl*(2) requests are supported.

• A segfault has been fixed in the output tee filter when handling exit.

Version 0.45 (2011-Jul-17)

- Dagobert Michelsen <dam@opencsw.org> discoversed several build problems on OpenSolaris; these have been fixed.
- Explanations are now available for errors reported by the Linux *ioctl*(2) V4L1 system calls.

Version 0.44 (2011-Jul-03)

- Several build problem to do with older Linux kernels have been fixed.

Version 0.42 (2011-Jul-02)

- Explanations are now available for errors reported by the V4L2 ioctl requests.
- The Debian package no longer installs the libtool *.la file.
  Debian: Closes: 621621
- The call arguments printed for ioctl(2) now include the type of the third argument.
- The error messages now include more information about block and character special devices, when printing file types.

Version 0.42 (2011-May-26)

- This change set adds an “ldconfig” hint to the BUILDING instructions. My thanks to Blake McBride <blake@arahant.com> for this suggestion.
- Emanuel Haupt <ehaupt@critical.ch> reported several problems building libexplain on FreeBSD. These have been fixed.

Version 0.41 (2011-Mar-15)

- There were some C++ keywords in the unclude files, which caused problems for C++ users. They have been replaced.
- Explanations are now availaible for errors reported by the *getpgid*(2), *getpgrp*(2), *ptrace*(2), *setgpid*(2) and *setpgrp*(2) system calls.

Version 0.40 (2010-Oct-05)

- The code now builds and tests successfully on FreeBSD.
- Explanations are now available for errors reported by the *calloc*(3) and *poll*(2) system calls.

Version 0.39 (2010-Sep-12)

- A build problem has been fixed on Ubuntu Hardy, a number of symbols are absent from older versions of <linux/cdrom.h>, conditional code has been added for them.
- A bug has been fixed in one of the documentation files, it was missing the conditional around the `.XX` macro, causing *rpmlint*(1) and *lintian*(1) to complain.

Version 0.38 (2010-Sep-08)

- Some build problems on Fedora 13 have been fixed.

Version 0.37 (2010-Aug-27)

- The library source files are supposed to be LGPL, however over 1000 of them were GPL (about 20%). This has been fixed.
- A couple of problems building on Fedora 13 have been fixed.

Version 0.36 (2010-Aug-25)

- Several false negative reported by tests on the Linux “alpha” and “ia64” architectures have been fixed.

Version 0.35 (2010-Aug-15)

- A number of falve negatives from tests have been fixed, primarily due to random differences between Linux architectures.
- The BUILDING document goes into more detail about things that can cause false negatives when testing.
- The man pages have been fixed so that they no longer contain unescaped hyphen characters, as warned about by the *lintian*(1) program.

Version 0.34 (2010-Aug-07)

- Another test 33 false negative has been fixed.
- There is a new “hanging-indent” option, that can be set from the `EXPLAIN_OPTION` environment variable. It defaults to zero for backwards compatibility. Applications may set it using the *explain_option_hanging_indent_set*(3) function.

Version 0.33 (2010-Jul-04)

- A number of testing false negatives (found by the Debian build farm) have been fixed.
- There are new *explain_output_error*(3) and *explain_output_error_and_die*(3) functions for printing formatted error messages.
- Some systems have *mmap*(2) report `(void*)(-1)` instead of NULL for errors. This is now understood.

Version 0.32 (2010-Jun-22)

- Explanations are now available for errors reported by the *mmap*(2), *munmap*(2) and *utimes*(2) system calls.
- A number of false negatives for tests on some less common architectures have been fixed.
- Some build problems relating to *ioctl*(2) support have been fixed.
- A bug has been fixed in the `libexplain/output.h` file, it was missing the C++ insulation.

Version 0.31 (2010-May-01)

- A number of build problems have been fixed.

Version 0.30 (2010-Apr-28)
- Several test false negatives have been fixed, on various Debian architectures.

Version 0.29 (2010-Apr-25)
- A number of build problems, discovered by the Debian build farm, have been fixed. Who would of thought that there could be some much inconsistency between Linux architectures?

Version 0.28 (2010-Apr-19)
- Several architecture-specific build problems, found by the Debian build farm, have been fixed.

Version 0.27 (2010-Apr-17)
- Several architecture-specific build problems, found by the Debian build farm, have been fixed.

Version 0.26 (2010-Apr-06)
- A build problem has been fixed on systems where `va_list` is not compatible with `const void *`
- This change set removes the unused-result warning form *explain_lseek_or_die*(3), because it is very common to ignore the result.
- Explanations are now available for errors reported by the *socketpair*(2) system call.

Version 0.25 (2010-Mar-22)
- Portability of the code has been improved.
- The *explain*(3) man page now mentions AC_SYS_LARGEFILE in the building requirements.
- Coverage now includes the *fprintf*(3), *printf*(3), *snprintf*(3), *sprintf*(3), *vfprintf*(3), *vprintf*(3), *vsnprintf*(3) and *vsprintf*(3) system calls.

Version 0.24 (2010-Mar-03)
- It is now possible to redirected libexplain output. For example, it is now possible to redirect all output to *syslog*(3).
- Coverage now includes the *fstatvfs*(2) and *statvfs*(2) system call.
- A number of problems found while building and testing on Solaris have been fixed.

Version 0.23 (2010-Feb-21)
- It turns out that on alpha architecture, you can't disambiguate the FIBMAP vs BMP_IOCTL case in the pre-processor. The code now uses a disambiguate function. This problem was discovered by the Debian build farm.

Version 0.22 (2010-Feb-12)
- This change set fixes a false negative found by the Debian automated build system.

Version 0.21 (2010-Feb-09)

- Explanations are now available for errors reported by the *fpurge*(3), *getw*(3) and *putw*(3) system calls.
- Some build problems have been fixed.

Version 0.20 (2010-Jan-20)

- Several lintian warnings relating to the man pages have been fixed.
- The LIBEXPLAIN_OPTIONS environment variable now understands a new symbolic-mode-bits=true option. It defaults to false, for shorter error explanations.
- There is a new *explain_lca2010*(1) man page. This is a gentle introduction to libexplain, and the paper accompanying my LCA 2010 talk.
- When process ID (pid) values are printed, they are now accompanied by the name of the process executable, when available.
- Numerous build bugs and niggles have been fixed.
- Explanations are now available for errors reported by the *execlp*(3), *fdopendir*(3), *feof*(3), *fgetpos*(3), *fputs*(3), *fseek*(3), *fsetpos*(3), *fsync*(2), *ftell*(3), *mkdtemp*(3), *mknod*(2), *mkostemp*(3), *mkstemp*(3), *mktemp*(3), *putenv*(3), *puts*(3), *raise*(3), *setbuf*(3), *setbuffer*(3), *setenv*(3), *setlinebuf*(3), *setvbuf*(3), *stime*(2), *tempnam*(3), *tmpfile*(3), *tmpnam*(3), *ungetc*(3), *unsetenv*(3) and *vfork*(2) system calls.
- The ioctl requests from linux/sockios.h, linux/ext2_fs.h, linux/if_eql.h, PPP, linux/lp.h, and linux/vt.h are now understood. Several of the ioctl explanations have been improved.

Version 0.19 (2009-Sep-07)

- The ioctl requests from linux/hdreg.h are now understood.
- Some build problems on Debian Lenny have been fixed.

Version 0.18 (2009-Sep-05)

- More ioctl requests are understood.
- Explanations are now available for errors reported by the *tcsendbreak*(3), *tcsetattr*(3), *tcgetattr*(3), *tcflush*(3), *tcdrain*(3), system calls.

Version 0.17 (2009-Sep-03)

- Explanations are now available for errors reported by the *telldir*(3) system call.
- A number of Linux build problems have been fixed.
- Explanations for a number of corner-cases of the *open*(2) system call have been improved, where flags values interact with file types and mount options.
- A number of BSD build problems have been fixed.
- More *ioctl*(2) commands are understood.
- A bug has been fixed in the way absolute symbolic links are processed by the path_resolution code.

Version 0.16 (2009-Aug-03)

- The EROFS and ENOMEDIUM explanations now greatly improved.
- A number of build problems and false negatives have been fixed on x86_64 architecture.
- The Linux floppy disk and CD-ROM ioctl requests are now supported.
- Explanations are now available for the errors reported by the *getdomainname*(2), *readv*(2), *setdomainname*(2), *ustat*(2) and *writev*(2) system calls.

Version 0.15 (2009-Jul-26)

- A number of build errors and warnings on amd64 have been fixed. The problems were only detectable on 64-bit systems.

Version 0.14 (2009-Jul-19)

- Coverage now includes another 29 system calls: *accept4*(2), *acct*(2), *adjtime*(3), *adjtimex*(2), *chroot*(2), *dirfd*(3), *eventfd*(2), *fflush*(3), *fileno*(3), *flock*(2), *fstatfs*(2), *ftime*(3), *getgroups*(2), *gethostname*(2), *kill*(2), *nice*(2), *pread*(2), *pwrite*(2), *sethostname*(2), *signalfd*(2), *strdup*(3), *strtod*(3), *strtof*(3), *strtol*(3), *strtold*(3), *strtoll*(3), *strtoul*(3), *strtoull*(3), and *timerfd_create*(2). A total of 110 system calls are now supported
- The ./configure script no longer demands *lsof*(1). The Linux libexplain code doesn't need *lsof*(1). On systems not supported by *lsof*(1), the error messages aren't quite as useful, but libexplain still works.
- There is now an `explain_*_on_error` function for each system call, each reports errors but still returns the original return value to the caller.

Version 0.13 (2009-May-17)

- The web site now links to a number of services provided by SourceForge.
- Several problems have been fixed with compiling libexplain on 64-bit systems.

Version 0.12 (2009-May-04)

- A build problem has been fixed on hosts that didn't need to do anything special for large file support.

Version 0.11 (2009-Mar-29)

- The current directory is replaced in messages with an absolute path in cases where the user's idea of the current directory may differ from that of the current process.

Version 0.10 (2009-Mar-24)

- The name prefix on all of the library functions has been changed from "libexplain_" to just "explain_". This was *the* most requested change. You will need to change your code and recompile. Apologies for the inconvenience.

Version 0.9 (2009-Feb-27)

- Two false negatives in the tests have been fixed.
- The ./configure script now explicitly looks for *bison*(1), and complains if it cannot be found.
- The *socket*(7) address family is now decoded.

Version 0.8 (2009-Feb-14)

- A problem with the Debian packaging has been fixed.
- The decoding of IPv4 sockaddr structs has been improved.

Version 0.7 (2009-Feb-10)

- Coverage has been extended to include *getsockopt*(2), *getpeername*(2), *getsockname*(2) and *setsockopt*(2).
- Build problems on Debian Sid have been fixed.
- More magnetic tape ioctl controls, from operating systems other than Linux, have been added.

Version 0.6 (2009-Jan-16)

- Coverage has been extended to include *execvp*(3), *ioctl*(2), *malloc*(3), *pclose*(3), *pipe*(2), *popen*(3) and *realloc*(3) system calls.
- The coverage for *ioctl*(2) includes linux console controls, magnetic tape controls, socket controls, and terminal controls.
- A false negative from test 31 has been fixed.

Version 0.5 (2009-Jan-03)

- A build problem on Debian sid has been fixed.
- There is a new *explain_system_success*(3) function, that performs all that *explain_system_success_or_die*(3) performs, except that it does not call *exit*(2).
- There is more i18n support.
- A bug with the *pkg-config*(1) support has been fixed.

Version 0.4 (2008-Dec-24)

- Coverage now includes *accept*(2), *bind*(2), *connect*(2), *dup2*(2), *fchown*(2), *fdopen*(3), *fpathconf*(2), *fputc*(2), *futimes*(2), *getaddrinfo*(2), *getcwd*(2), *getrlimit*(2), *listen*(2), *pathconf*(2), *putc*(2), *putchar*(2), *select*(2).
- Internationalization has been improved.
- The thread safety of the code has been improved.
- The code is now able to be compiled on OpenBSD. The test suite still gives many false negatives, due to differences in *strerror*(3) results.

Version 0.3 (2008-Nov-23)

- Cover has been extended to include *closedir*(3), *execve*(2), *ferror*(3), *fgetc*(3), *fgets*(3), *fork*(2), *fread*(3), *getc*(3), *gettimeofday*(2), *lchown*(2), *socket*(2), *system*(3), *utime*(2), *wait3*(2), *wait4*(2), *wait*(2), *waitpid*(2),
- More internationalization support has been added.
- A bug has been fixed in the C++ insulation.

Version 0.2 (2008-Nov-11)

- Coverage now includes *chmod*(2), *chown*(2), *dup*(2), *fchdir*(2), *fchmod*(2), *fstat*(2), *ftruncate*(2), *fwrite*(3), *mkdir*(2), *readdir*(3), *readlink*(2), *remove*(3), *rmdir*(2) and *truncate*(2).
- The *lsof*(1) command is used to obtain supplementary file information on those systems with limited `/proc` implementations.
- The explanations now understand Linux capabilities.

Version 0.1 (2008-Oct-26)

First public release.