Problem 2: Recursive filesystem exploration

Caleb Zulawski

September 24, 2015

1 Character/Block device problem

Since the getdents system call provides filenames and not full paths, I opted to use openat(2). This allowed me to open each file and directory, then use fstat(2), then continue recursively with openat. An unexpected problem was that opening more "interesting" files became problematic. Opening named pipes was possible with the O_NONBLOCK flag. I was unable to find a way to open character and block devices (that did not correspond to an actual device or address). If I had the time I could have reworked the program to use full paths and pass the full path to stat(2). It is possible that there is a more elegant way that still uses file descriptors.

2 Example output

2.1 Full walk

```
$ ./walker /tmp/test/dir/evilfs
3402/4097    drwxr-xr-x  4     caleb    caleb    1024    Mon Jan 30 18:25:20 2012 /tmp/test/dir/evilfs/C
3402/4100    -rw-r--r--  1     caleb    caleb    10      Mon Jan 30 18:25:21 2012 /tmp/test/dir/evilfs/C/3
3402/4098    drwxr-xr-x  4     caleb    caleb    1024    Mon Jan 30 18:45:34 2012 /tmp/test/dir/evilfs/C/1
3402/4103    drwxr-xr-x  2     caleb    caleb    1024    Mon Jan 30 18:45:34 2012 /tmp/test/dir/evilfs/C/1/z
3402/8195    drwxr-xr-x  5     caleb    caleb    1024    Mon Jan 30 18:45:05 2012 /tmp/test/dir/evilfs/C/1/z/3001
3402/8196    drwxr-xr-x  3     caleb    caleb    1024    Mon Jan 30 18:45:16 2012 /tmp/test/dir/evilfs/C/1/z/3001/c
3402/8193    drwxr-xr-x  4     caleb    caleb    1024    Mon Jan 30 18:44:59 2012 /tmp/test/dir/evilfs/C/1/z/3001/c
    /1002
3402/8194    -rw-r--r--  1     caleb    caleb    12      Mon Jan 30 18:25:50 2012 /tmp/test/dir/evilfs/C/1/z/3001/c
    /1002/101
3402/8195    drwxr-xr-x  5     caleb    caleb    1024    Mon Jan 30 18:45:05 2012 /tmp/test/dir/evilfs/C/1/z/3001/c
    /1002/102
walker: Found loop in filesystem.  Skipping already walked directory 102
3402/8198    drwxr-xr-x  2     caleb    caleb    1024    Mon Jan 30 18:45:16 2012 /tmp/test/dir/evilfs/C/1/z/3001/c
    /1001
3402/8197    drwxr-xr-x  2     caleb    caleb    1024    Mon Jan 30 18:45:05 2012 /tmp/test/dir/evilfs/C/1/z/3001/d
3402/4098    drwxr-xr-x  4     caleb    caleb    1024    Mon Jan 30 18:45:34 2012 /tmp/test/dir/evilfs/C/1/z/3001/d
    /2001
walker: Found loop in filesystem.  Skipping already walked directory 2001
3402/4102    -rw-r--r--  1     caleb    caleb    10      Mon Jan 30 18:25:30 2012 /tmp/test/dir/evilfs/C/1/b
3402/4101    -rw-r--r--  1     caleb    caleb    10      Mon Jan 30 18:25:27 2012 /tmp/test/dir/evilfs/C/1/a
```

```
3402/4099    -rw-r--r--  1     caleb    caleb    10     Mon Jan 30 18:25:18 2012 /tmp/test/dir/evilfs/C/2
3402/4097    drwxr-xr-x  4     caleb    caleb    1024   Mon Jan 30 18:25:20 2012 /tmp/test/dir/evilfs/A
walker: Found loop in filesystem.  Skipping already walked directory A
3402/11      drwx------  2     caleb    caleb    12288  Mon Jan 30 18:24:56 2012 /tmp/test/dir/evilfs/lost+found
3402/12289   drwxr-xr-x  2     caleb    caleb    1024   Tue Sep  8 18:47:37 2015 /tmp/test/dir/evilfs/D
3402/12294   lrwxrwxrwx  1     caleb    caleb    12     Tue Sep  8 01:50:44 2015 /tmp/test/dir/evilfs/D/symlink ->
    ../././B/./101
type_13: Input/output error
3402/12292   prw-r--r--  1     caleb    caleb    0      Tue Sep  8 01:34:11 2015 /tmp/test/dir/evilfs/D/npipe
cdev: No such device or address
bdev: No such device or address
3402/8193    drwxr-xr-x  4     caleb    caleb    1024   Mon Jan 30 18:44:59 2012 /tmp/test/dir/evilfs/B
3402/8194    -rw-r--r--  1     caleb    caleb    12     Mon Jan 30 18:25:50 2012 /tmp/test/dir/evilfs/B/101
3402/8195    drwxr-xr-x  5     caleb    caleb    1024   Mon Jan 30 18:45:05 2012 /tmp/test/dir/evilfs/B/102
walker: Found loop in filesystem.  Skipping already walked directory 102
```

2.2 Remaining in single filesystem

```
$ ./walker -x /tmp/test/dir/
3402/2       drwxr-xr-x  6     caleb    caleb    1024   Tue Sep  8 01:32:45 2015 /tmp/test/dir/evilfs
walker (-x): not crossing mountpoint at /tmp/test/dir/evilfs
```

2.3 Symlink option

```
$ ./walker -l /tmp/test/dir/evilfs/B/101 /tmp/test/dir/evilfs
walker: Found loop in filesystem.  Skipping already walked directory 102
walker: Found loop in filesystem.  Skipping already walked directory 2001
walker: Found loop in filesystem.  Skipping already walked directory A
3402/12294   lrwxrwxrwx  1     caleb    caleb    12     Tue Sep  8 01:50:44 2015 /tmp/test/dir/evilfs/D/symlink ->
    ../././B/./101
type_13: Input/output error
cdev: No such device or address
bdev: No such device or address
walker: Found loop in filesystem.  Skipping already walked directory 102
```