

Problem 2: Recursive filesystem exploration

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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    caled   caled   1024   Mon Jan 30 18:25:20 2012 /tmp/test/dir/evilfs/C
3402/4100    -rw-r--r--  1    caled   caled    10   Mon Jan 30 18:25:21 2012 /tmp/test/dir/evilfs/C/3
3402/4098    drwxr-xr-x  4    caled   caled   1024   Mon Jan 30 18:45:34 2012 /tmp/test/dir/evilfs/C/1
3402/4103    drwxr-xr-x  2    caled   caled   1024   Mon Jan 30 18:45:34 2012 /tmp/test/dir/evilfs/C/1/z
3402/8195    drwxr-xr-x  5    caled   caled   1024   Mon Jan 30 18:45:05 2012 /tmp/test/dir/evilfs/C/1/z/3001
3402/8196    drwxr-xr-x  3    caled   caled   1024   Mon Jan 30 18:45:16 2012 /tmp/test/dir/evilfs/C/1/z/3001/c
3402/8193    drwxr-xr-x  4    caled   caled   1024   Mon Jan 30 18:44:59 2012 /tmp/test/dir/evilfs/C/1/z/3001/c
/1002
3402/8194    -rw-r--r--  1    caled   caled    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    caled   caled   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    caled   caled   1024   Mon Jan 30 18:45:16 2012 /tmp/test/dir/evilfs/C/1/z/3001/c
/1001
3402/8197    drwxr-xr-x  2    caled   caled   1024   Mon Jan 30 18:45:05 2012 /tmp/test/dir/evilfs/C/1/z/3001/d
3402/4098    drwxr-xr-x  4    caled   caled   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    caled   caled    10   Mon Jan 30 18:25:30 2012 /tmp/test/dir/evilfs/C/1/b
3402/4101    -rw-r--r--  1    caled   caled    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

```

2.4 Modify time limiting

```

$ ./walker -m -3000000 /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
3402/12289   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
walker: Found loop in filesystem.  Skipping already walked directory 102
(precise)caleb:src$ ./walker -m 3000000 /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
...
```