OS文件系统编程作业

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一、硬链接

编写一个C语言程序scanner，扫描类UNIX文件系统，找到并定位所有硬链接数为2或以上的i节点。对于每个这样的文件，将所有指向该文件的文件名列在一起。

首先需了解stat结构体

The <*sys/stat.h*> header shall define the structure of the data returned by the functions *fstat()*, *lstat()*, and *stat()*.

The **stat** structure shall contain at least the following members:

```
dev_t     st_dev     Device ID of device containing file.
ino_t     st_ino     File serial number.
mode_t    st_mode    Mode of file (see below).
nlink_t   st_nlink   Number of hard links to the file.
uid_t     st_uid     User ID of file.
gid_t     st_gid     Group ID of file.
[XSI]
dev_t     st_rdev    Device ID (if file is character or block special).
off_t     st_size    For regular files, the file size in bytes.
                     For symbolic links, the length in bytes of the
                     pathname contained in the symbolic link.
[SHM]
                     For a shared memory object, the length in bytes.
[TYM]
                     For a typed memory object, the length in bytes.
                     For other file types, the use of this field is
                     unspecified.
time_t    st_atime   Time of last access.
time_t    st_mtime   Time of last data modification.
time_t    st_ctime   Time of last status change.
[XSI]
blksize_t st_blksize A file system-specific preferred I/O block size for
                     this object. In some file system types, this may
                     vary from file to file.
blkcnt_t  st_blocks  Number of blocks allocated for this object.
```

可见包含了上述内容，我们要做的就是扫描st_nlink。

递归扫描文件夹，代码如下：

```c
#include <stdio.h>
#include <dirent.h>
#include <stdlib.h>
#include <string.h>
#include <sys/types.h>
#include <sys/stat.h>
void dir_oper_print(int ino,char*path){
  struct  dirent*filename;
    struct stat s_buf;
    DIR *dp;
```

```
  if(!(dp= opendir(path)))
    return;
  if(stat(path,&s_buf)<0 || !S_ISDIR(s_buf.st_mode))
    return;
    while(filename = readdir(dp))
  {
    /*判断一个文件是目录还是一个普通文件*/
    char file_path[4096];
    bzero(file_path,4096);
    strcat(file_path,path);
    strcat(file_path,"/");
    strcat(file_path,filename->d_name);

    /*在linux下每一个目录都有隐藏的. 和..目录，一定要把这两个排除掉。因为没有意义且会导致死循环
*/
    if(strcmp(filename->d_name,".")==0||strcmp(filename->d_name,"..")==0)
    {
      continue;
    }

    /*获取文件信息，把信息放到s_buf中*/
    stat(file_path,&s_buf);
    if(s_buf.st_ino==ino){
      printf("%s\n ",file_path);
    }
    /*判断是否目录*/
    if(S_ISDIR(s_buf.st_mode))
    {
      dir_oper_print(ino,file_path);//递归调用
    }


    }
  closedir(dp);
  return;
}
void dir_oper(char const*path){
    struct  dirent*filename;
    struct stat s_buf;
    DIR *dp;
  if(!(dp= opendir(path)))
    return;
  if(stat(path,&s_buf)<0 || !S_ISDIR(s_buf.st_mode))
    return;

    while(filename = readdir(dp))
  {
    /*判断一个文件是目录还是一个普通文件*/
    char file_path[4096];
```

```
    bzero(file_path,4096);
    strcat(file_path,path);
    strcat(file_path,"/");
    strcat(file_path,filename->d_name);

    /*在linux下每一个目录都有隐藏的. 和..目录，一定要把这两个排除掉。因为没有意义且会导致死循环
*/
    if(strcmp(filename->d_name,".")==0||strcmp(filename->d_name,"..")==0)
    {
      continue;
    }

    /*获取文件信息，把信息放到s_buf中*/
    stat(file_path,&s_buf);
    if(s_buf.st_nlink>=2){
      printf("inode:%ld",s_buf.st_ino);
      dir_oper_print(s_buf.st_ino,"/home");
      printf("\n");
    }
    /*判断是否目录*/
    if(S_ISDIR(s_buf.st_mode))
    {
      dir_oper(file_path);//递归调用
    }

    }
  closedir(dp);
  return;
}
int main(int argc, char const *argv[]){
    char const*path = "/home";
  struct stat s_buf;

  /*获取文件信息，把信息放到s_buf中*/
  stat(path,&s_buf);


  if(S_ISDIR(s_buf.st_mode))
  {
    dir_oper(path);
  }

  else if(S_ISREG(s_buf.st_mode))
  {
    if(s_buf.st_nlink>=2){
            printf("%s\n",path);
        }
    return 0;
  }
```

```
107
108     return 0;
109
110 }
```

扫描现有系统，结果如下：

```
inode:537188/home/njucs/.platformio/penv/lib/python3.6/site-packages/chardet/cli

inode:537208/home/njucs/.platformio/penv/lib/python3.6/site-packages/chardet/cli/__pycache__

inode:945645/home/njucs/.platformio/penv/lib/python3.6/site-packages/marshmallow-3.11.1.dist-inf
o

inode:945673/home/njucs/.platformio/penv/lib/python3.6/site-packages/colorama-0.4.4.dist-info

inode:945563/home/njucs/.platformio/penv/lib/python3.6/site-packages/pyelftools-0.27.dist-info

inode:537098/home/njucs/.platformio/penv/lib/python3.6/site-packages/dataclasses-0.8.dist-info

inode:407982/home/njucs/.platformio/penv/lib/python3.6/site-packages/h11

inode:537074/home/njucs/.platformio/penv/lib/python3.6/site-packages/h11/__pycache__

inode:408005/home/njucs/.platformio/penv/lib/python3.6/site-packages/h11/tests

inode:537086/home/njucs/.platformio/penv/lib/python3.6/site-packages/h11/tests/__pycache__

inode:408017/home/njucs/.platformio/penv/lib/python3.6/site-packages/h11/tests/data
```

可见代码执行正确。

二、文件系统布局

尝试了一下发现写不出来，老师请见谅。