Project 6 预备知识

1.安装各种工具

a.安装 fuse

Ubuntu：

sudo apt install fuse libfuse-dev pkg-config -y

注意（一般内核会自带 fuse） 会出现如下内容。此时应检查 fuse 版本是否 >2.6

"

➜ p6-start sudo apt install fuse
Reading package lists... Done
Building dependency tree
Reading state information... Done
fuse is already the newest version (2.9.4-1ubuntu3.1)

"

以上版本为 2.9.4，符合要求

b.安装 filebench

wget https://github.com/filebench/filebench/archive/1.4.9.1.zip

sudo apt install automake libtool byacc flex bison

$ libtoolize
$ aclocal
$ autoheader
$ automake --add-missing
$ autoconf
$ ./configure
$ make
$ sudo make install

负载请见 /usr/local/share/filebench/workloads

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2.example 使用

a.使用 start-code 中的 Makefile 编译源码
make

b.在源码路径中创建挂载路径
mkdir mnt

c.挂载 example 文件系统 hello
./hello mnt

d.卸载 hello 文件系统
sudo umount mnt

注意：
c 步完成后，可 cd 到挂载点 mnt，ls 后可看见一个名为 hello 的文件，同时执行 cat hello 之后可以看见 hello world！
同时可以阅读并学习 example/hello.c。

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3.fuse 调试

以 example 中的 hello 为例，使用 gdb 进行调试

a. sudo gdb hello

b. list 与打断点
b hello_read
b hello_init
c. 由于 fuse_main 会自动 fork 子进程，可使用 set follow-fork-mode child 指令，自动 attach 到子进程上。
也可以使用 ps aux | grep hello 查看 hello 文件系统的 pid，然后手动 attach 到 hello 文件系统进程上

d 运行程序 run mnt， mnt 为在源码目录下 mkdir 创建出的挂载点
此时应该进入到断点 hello_init

e 输入 c，让程序继续运行，打开另外一个终端，cat mnt/hello
此时 gdb 进入断点 hello_read

以上分别为 init 与 read 的调试方法，其余接口同 read

f. gdb 中使用 detach 脱离进程，然后退出 gdb

g.使用 sudo umount mnt 卸载文件系统

```
→ p6-start sudo gdb hello
GNU gdb (Ubuntu 7.11.1-0ubuntu1~16.5) 7.11.1
Copyright (C) 2016 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.  Type "show copying"
and "show warranty" for details.
This GDB was configured as "x86_64-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
<http://www.gnu.org/software/gdb/documentation/>.
For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from hello...done.
(gdb) l
89              printf("Your FS is initializing...\n");
90              return NULL;
91      }
92
93      static struct fuse_operations hello_oper = {
94          .getattr    = hello_getattr,
95          .readdir    = hello_readdir,
96          .open       = hello_open,
97          .read       = hello_read,
98          .init       = hello_init,
(gdb) b hello_read
Breakpoint 1 at 0x400942: file example/hello.c, line 74.
(gdb) b hello_init
Breakpoint 2 at 0x4009e1: file example/hello.c, line 89.
(gdb) set follow-
follow-exec-mode  follow-fork-mode
(gdb) set follow-fork-mode child
(gdb) r mnt
Starting program: /home/lance/Desktop/p6-start/hello mnt
[Thread debugging using libthread_db enabled]
Using host libthread_db library "/lib/x86_64-linux-gnu/libthread_db.so.1".
[New process 4238]
[Thread debugging using libthread_db enabled]
Using host libthread_db library "/lib/x86_64-linux-gnu/libthread_db.so.1".
[New Thread 0x7f1f557ca700 (LWP 4243)]
[New Thread 0x7f1f54fc9700 (LWP 4244)]
[Switching to Thread 0x7f1f557ca700 (LWP 4243)]

Thread 2.2 "hello" hit Breakpoint 2, hello_init (conn=0x602754) at example/hello.c:89
89              printf("Your FS is initializing...\n");
(gdb)
```

打断点

这个设置会自动attach到fork出的进程

```
(gdb) [Switching to Thread 0x7f1f557ca700 (LWP 4243)]

Thread 2.2 "hello" hit Breakpoint 1, hello_read (path=0x7f1f50001b00 "/hello", buf=0x7f1f50001c60
    at example/hello.c:74
74          if(strcmp(path, hello_path) != 0)
n
77          len = strlen(hello_str);
(gdb) n
78          if (offset < len) {
(gdb) n
79              if (offset + size > len)
(gdb) n
80                  size = len - offset;
(gdb)
81              memcpy(buf, hello_str + offset, size);
(gdb)
85          return size;
(gdb)
86      }
(gdb) c
Continuing.
^CQuit
(gdb) detach
Detaching from program: /home/lance/Desktop/p6-start/hello, process 4238
(gdb) quit
→ p6-start sudo umount mnt
```

新开另外的终端，
cat mnt/hello触发断点

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4.FUSE 接口文档

http://libfuse.github.io/doxygen/index.html

注意我们使用的 high-level APIs,同时注意应是 2.6 版本的 fuse。

2.6 版本 fuse github 地址为　https://github.com/libfuse/libfuse/tree/fuse_2_6_0