《AFL 模糊测试》实验报告

姓名：汤清云 学号：2013536 班级： 1075

实验名称：

AFL 模糊测试实验

实验要求：

复现 AFL 在 KALI 下的安装、应用；理解覆盖引导和文件变异的概念和含义

实验过程：

1. AFL 在 KALI 下的安装

使用语句 sudo apt-get update 更新系统：

```
┌──(kali㉿kali)-[~/Chapter7_AFL]
└─$ sudo apt-get update
Get:1 http://kali.download/kali kali-rolling InRelease [30.6 kB]
Get:2 http://kali.download/kali kali-rolling/main amd64 Packages [18.2
Get:3 http://kali.download/kali kali-rolling/main amd64 Contents (deb)
MB]
Get:4 http://kali.download/kali kali-rolling/contrib amd64 Packages [11
Get:5 http://kali.download/kali kali-rolling/contrib amd64 Contents (de
5 kB]
Get:6 http://kali.download/kali kali-rolling/non-free amd64 Packages [2
Get:7 http://kali.download/kali kali-rolling/non-free amd64 Contents (d
,005 kB]
Fetched 61.3 MB in 39s (1,567 kB/s)
Reading package lists... Done
```

使用语句 sudo apt-get install afl 安装 AFL：

```
┌──(kali㉿kali)-[~/Chapter7_AFL]
└─$ sudo apt-get install afl
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  afl++ afl++-doc clang-13 gcc-11-base gcc-12-base icu-devtools libasan6
  libatomic1 libc-bin libc-dev-bin libc-l10n libc6 libc6-dev libc6-i386
  libclang-common-13-dev libclang-cpp13 libclang1-13 libffi8 libgcc-11-dev
  libgcc-s1 libgomp1 libicu-dev libicu67 libitm1 libllvm13 liblsan0
  libobjc-11-dev libobjc4 libpython3.10 libpython3.10-minimal
  libpython3.10-stdlib libquadmath0 libstdc++-11-dev libstdc++6 libtsan0
  libubsan1 libxml2 libxml2-dev libz3-4 libz3-dev llvm-13 llvm-13-dev
  llvm-13-linker-tools llvm-13-runtime llvm-13-tools locales rpcsvc-proto
Suggested packages:
  gnuplot clang-13-doc glibc-doc libnss-nis libnss-nisplus manpages-dev
  icu-doc libstdc++-11-doc pkg-config llvm-13-doc
Recommended packages:
  manpages-dev libc-devtools
The following NEW packages will be installed:
```

使用语句 ls /usr/bin/afl*打开查看 afl 目录下文件。

```
┌──(kali㉿kali)-[~/Chapter7_AFL]
└─$ ls /usr/bin/afl*
/usr/bin/afl-analyze        /usr/bin/afl-gcc
/usr/bin/afl-c++            /usr/bin/afl-gotcpu
/usr/bin/afl-cc             /usr/bin/afl-network-client
/usr/bin/afl-clang          /usr/bin/afl-network-server
/usr/bin/afl-clang++        /usr/bin/afl-persistent-config
/usr/bin/afl-clang-fast     /usr/bin/afl-plot
/usr/bin/afl-clang-fast++   /usr/bin/afl-showmap
/usr/bin/afl-cmin           /usr/bin/afl-system-config
/usr/bin/afl-cmin.bash      /usr/bin/afl-tmin
/usr/bin/afl-fuzz           /usr/bin/afl-whatsup
/usr/bin/afl-g++
```

2. AFL 在 KALI 下的应用

添加空白 c 语言文件命名为 test.c，复制所给代码并保存，

使用语句 afl-gcc -o test test.c 编译

```
┌──(kali㉿kali)-[~/Chapter7_AFL]
└─$ afl-gcc -o test test.c
afl-cc++4.00c by Michal Zalewski, Laszlo Szekeres, Marc Heuse - mode: GCC-GCC
[!] WARNING: You are using outdated instrumentation, install LLVM and/or gcc-
plugin and use afl-clang-fast/afl-clang-lto/afl-gcc-fast instead!
afl-as++4.00c by Michal Zalewski
[+] Instrumented 14 locations (64-bit, non-hardened mode, ratio 100%).
```

使用语句 readelf -s ./test | grep afl 查看插桩符号

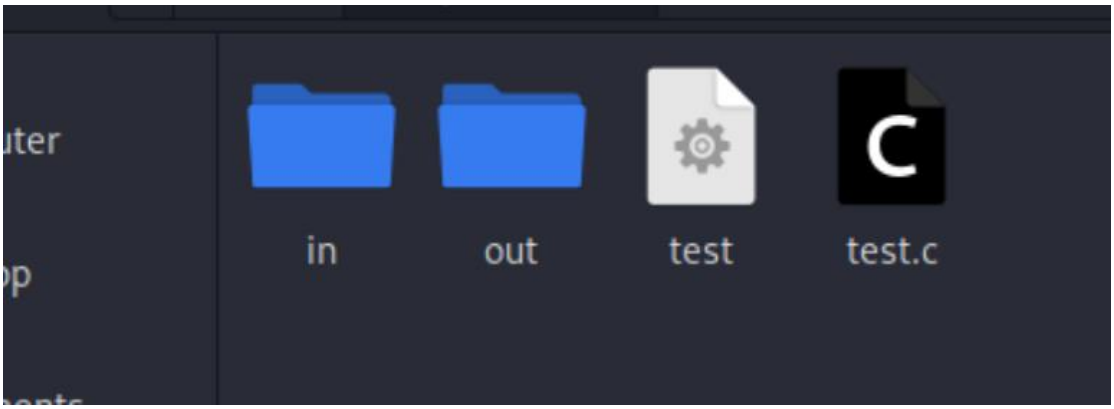
```
┌──(kali㉿kali)-[~/Chapter7_AFL]
└─$ readelf -s ./test | grep afl
    38: 0000000000001628     0 NOTYPE  LOCAL  DEFAULT   15 __afl_maybe_log
    40: 00000000000040b0     8 OBJECT  LOCAL  DEFAULT   26 __afl_area_ptr
    41: 0000000000001660     0 NOTYPE  LOCAL  DEFAULT   15 __afl_setup
    42: 0000000000001638     0 NOTYPE  LOCAL  DEFAULT   15 __afl_store
    43: 00000000000040b8     8 OBJECT  LOCAL  DEFAULT   26 __afl_prev_loc
    44: 0000000000001655     0 NOTYPE  LOCAL  DEFAULT   15 __afl_return
    45: 00000000000040c8     1 OBJECT  LOCAL  DEFAULT   26 __afl_setup_failur
e
    46: 0000000000001681     0 NOTYPE  LOCAL  DEFAULT   15 __afl_setup_first
    48: 0000000000001949     0 NOTYPE  LOCAL  DEFAULT   15 __afl_setup_abort
    49: 000000000000179e     0 NOTYPE  LOCAL  DEFAULT   15 __afl_forkserver
    50: 00000000000040c4     4 OBJECT  LOCAL  DEFAULT   26 __afl_temp
    51: 000000000000185c     0 NOTYPE  LOCAL  DEFAULT   15 __afl_fork_resume
    52: 00000000000017c4     0 NOTYPE  LOCAL  DEFAULT   15 __afl_fork_wait_lo
op
    53: 0000000000001941     0 NOTYPE  LOCAL  DEFAULT   15 __afl_die
    54: 00000000000040c0     4 OBJECT  LOCAL  DEFAULT   26 __afl_fork_pid
   101: 00000000000040d0     8 OBJECT  GLOBAL DEFAULT   26 __afl_global_area_
ptr
```

使用语句 echo core > /proc/sys/kernel/ore_pattern，将信息输出到 core_pattern 位置

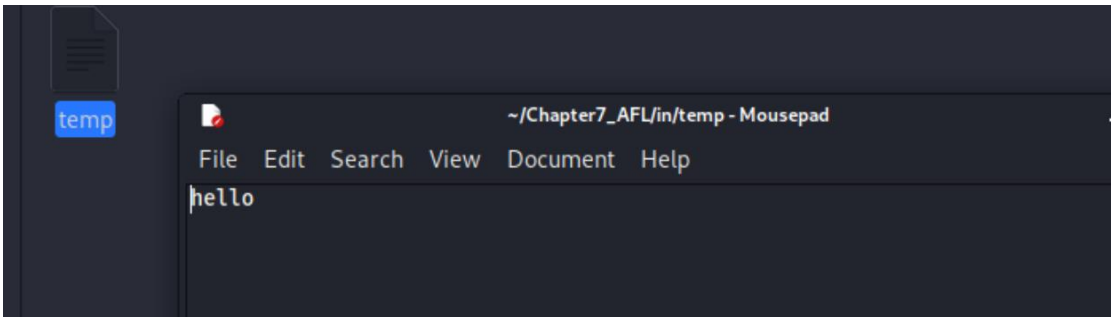
```
┌──(kali㉿kali)-[~/Chapter7_AFL]
└─$ echo core> /proc/sys/kernel/core_pattern
zsh: permission denied: /proc/sys/kernel/core_pattern
```

使用语句 mkdir in out 创建文件夹 in 和 out

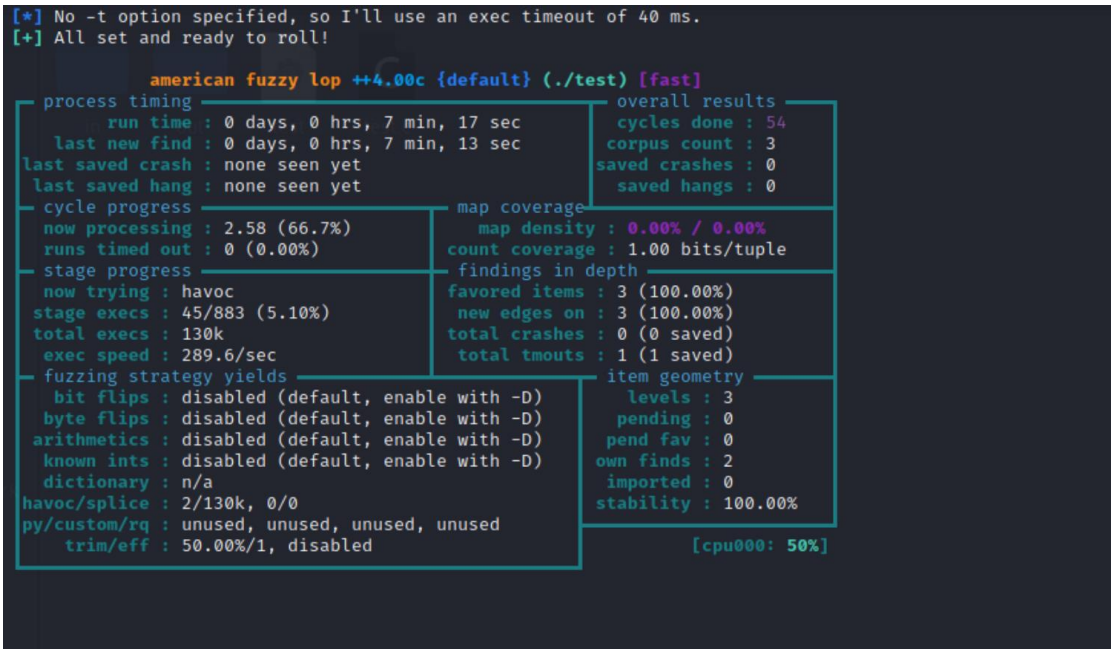
```
┌──(kali㉿kali)-[~/Chapter7_AFL]
└─$ mkdir in out
```



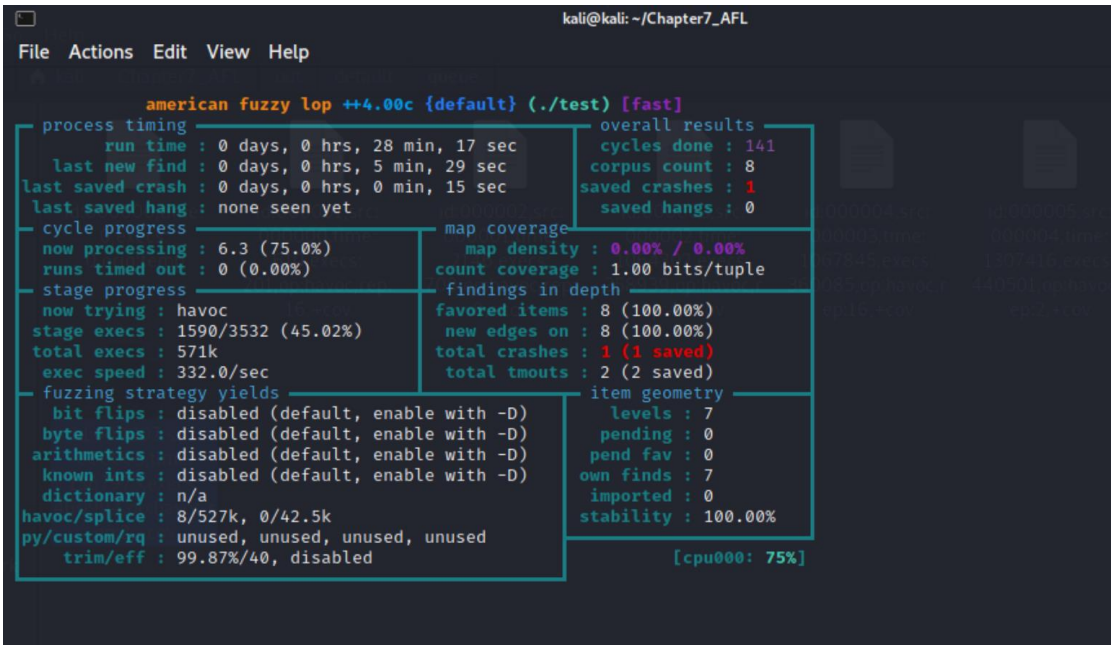
使用语句 echo hello> in/temp 在 in 文件夹中添加文件 temp，并输入 hello 到 temp 文件中：



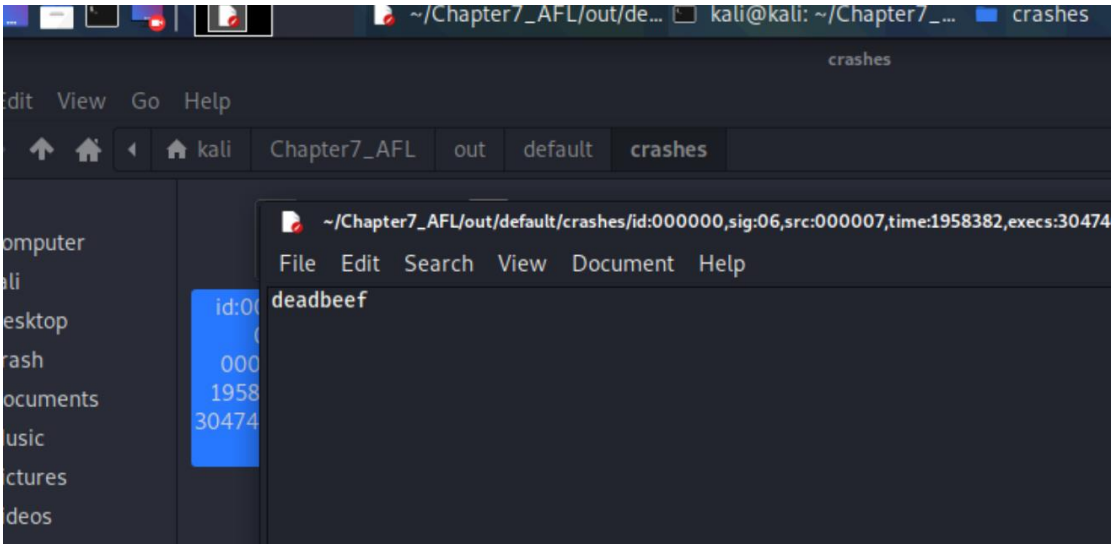
使用语句 afl-fuzz -i in -o out -- ./test @@查看系统运行



运行结果为：

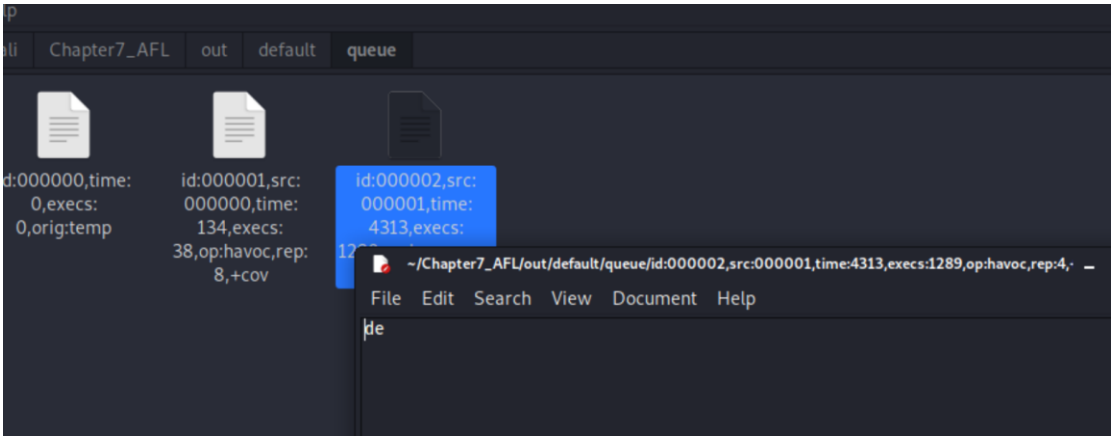


打开 crashes 得：



3. 覆盖引导和文件变异的概念以及含义

变异字符存放在/out/default/queue 文件夹下的文档中。



覆盖引导：将文件按照一定策略进行“突变”，如果这些突变了的文件能够更新覆盖

范围，则保留在队列中。

文件变异：1.按位翻转；2.从 8bit 级别开始进行加减操作；3。使用 1 过程中产生的重要的额外重要数据信息替换文件内容；4.使用 token 替换要进行变异的文件内容；5.对源文件进行大量变异：随机选择 bit 翻转；随机选择 byte 构成随机的重要信息；6.拼接两个文件，如果两个文件差别不大则重新选择，否则就随机选取位置将两个文件切割，将当前文件的头与随机文件的尾拼接得到新文件；7.下一轮继续变异。

心得体会：

对 kali 系统下的 AFL 模糊测试进行初步了解；

在老师的引导下复现了文件变异实验；

查阅资料了解了更多 AFL 在 kali 下的应用；

了解了覆盖引导和文件变异的概念以及含义。