操作系统实验一
实验报告

57119101 王晨阳

2021年7月22日

实验目的

熟悉 Linux 内核文件结构，学会修改与增加系统调用，掌握进程控制和进程管理相关内容。

实验1 Linux 内核代码分析

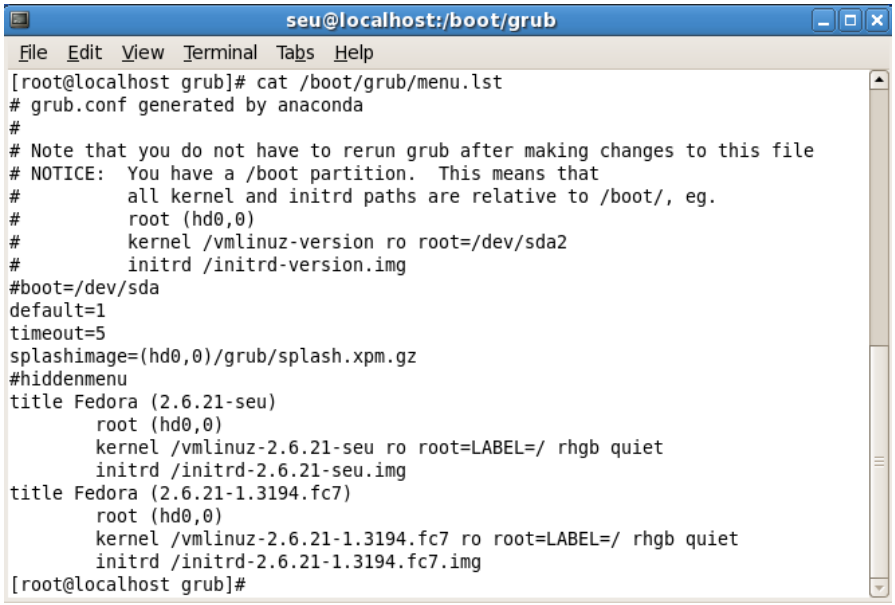
依次执行命令

```
cd Desktop
tar zxvf linux-2.6.21.tar.gz
cd linux-2.6.21
make mrproper
cp /boot/config-2.6.21-1.3194.fc7 ./config
make oldconfig
make all
su
make modules_install
make install
make headers_install
vi /boot/grub/menu.lst
```

将

```
hiddenmenu
```

注释掉，如下图所示。

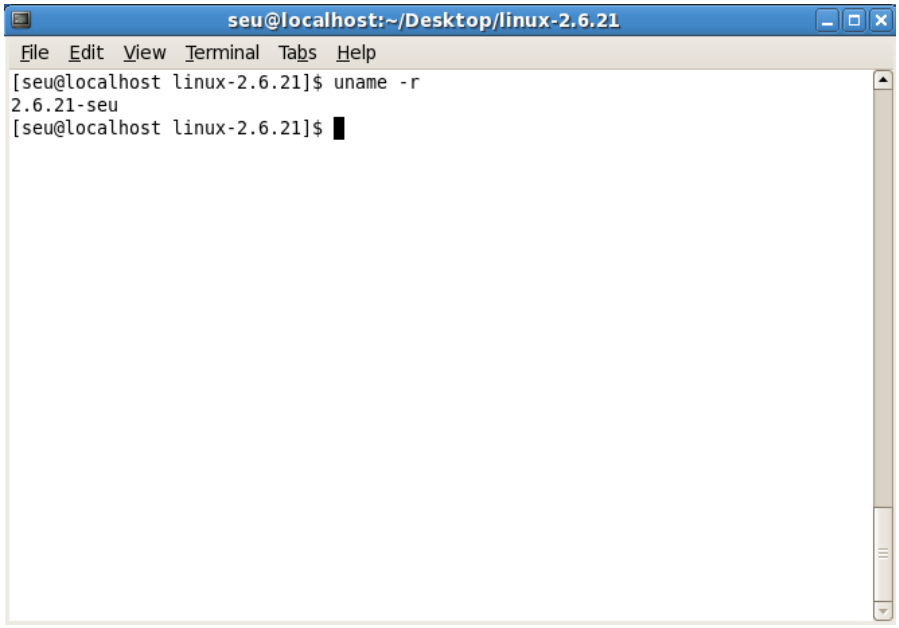


重启

```
reboot
```

看到引导菜单。

选择 seu，系统正常启动。



实验2 ： 新增系统调用

`./arch/i386/kernel/syscall_table.S` 最后添加一个系统调用

```
.long sys_psta
```

```
.long sys_tee                   /* 315 */
.long sys_vmsplice
.long sys_move_pages
.long sys_getcpu
.long sys_epoll_pwait
.long sys_psta                  /* 320 */
```

`./include/linux/psta.h` 编辑内容为

```
#ifndef _LINUX_PSTA_H
#define _LINUX_PSTA_H

struct pinfo {
    int nice;
    pid_t pid;
    uid_t uid;
};
#endif
```

```
#ifndef _LINUX_PSTA_H
#define _LINUX_PSTA_H

struct pinfo {
        int nice;
        pid_t pid;
        uid_t uid;
};
#endif
```

`./include/linux/Kbuild` 添加一行头文件

```
header-y += psta.h
```

```
header-y += wireless.h
header-y += x25.h
header-y += psta.h

unifdef-y += acct.h
unifdef-y += adb.h
```

`./kernel/psta.c` 编辑内容为

```c
#include <linux/linkage.h>
#include <linux/types.h>
#include <linux/psta.h>
#include <linux/kernel.h>
asmlinkage int sys_psta(struct pinfo *buf) {
    printk("Hello world\n");
    return 0;
}
```

```c
#include <linux/linkage.h>
#include <linux/types.h>
#include <linux/psta.h>
#include <linux/kernel.h>
asmlinkage int sys_psta(struct pinfo *buf) {
        printk("Hello world\n");
        return 0;
}
```

`./kernel/Makefile` 增加目标文件 `psta.o`

```makefile
obj-y = psta.o sched.o fork.o exec_domain.o panic.o printk.o profile.o \
        exit.o itimer.o time.o softirq.o resource.o \
        sysctl.o capability.o ptrace.o timer.o user.o \
        signal.o sys.o kmod.o workqueue.o pid.o \
        rcupdate.o extable.o params.o posix-timers.o \
        kthread.o wait.o kfifo.o sys_ni.o posix-cpu-timers.o mutex.o \
        hrtimer.o rwsem.o latency.o nsproxy.o srcu.o
```

```makefile
obj-y     = psta.o sched.o fork.o exec_domain.o panic.o printk.o profile.o \
            exit.o itimer.o time.o softirq.o resource.o \
            sysctl.o capability.o ptrace.o timer.o user.o \
            signal.o sys.o kmod.o workqueue.o pid.o \
            rcupdate.o extable.o params.o posix-timers.o \
            kthread.o wait.o kfifo.o sys_ni.o posix-cpu-timers.o mutex.o \
            hrtimer.o rwsem.o latency.o nsproxy.o srcu.o
```

`./include/asm-i386/unistd.h` 增加宏

```c
#define __NR_psta 320
```

同时，将 `NR_syscalls` 修改为 321

```c
#define __NR_epoll_pwait        319
#define __NR_psta               320

#ifdef __KERNEL__

#define NR_syscalls 321
```

`./include/linux/syscalls.h` 增加头文件

```c
#include <linux/psta.h>
```

```c
#include <linux/types.h>
#include <linux/aio_abi.h>
#include <linux/capability.h>
#include <linux/list.h>
#include <linux/sem.h>
#include <asm/semaphore.h>
#include <asm/siginfo.h>
#include <asm/signal.h>
#include <linux/quota.h>
#include <linux/key.h>
#include <linux/psta.h>
```

并把函数的定义加进来

```c
asmlinkage int sys_psta(struct pinfo *buf)
```

```
asmlinkage int sys_psta(struct pinfo *buf);
```

`./Makefile` 修改内核编号为 seu2

```
EXTRAVERSION = -seu2
```

```
VERSION = 2
PATCHLEVEL = 6
SUBLEVEL = 21
EXTRAVERSION = -seu2
NAME = Nocturnal Monster Puppy
```

然后重新编译重启

```
make mrproper
cp /boot/config-2.6.21-1.3194.fc7 ./config
make oldconfig
make all
su
make modules_install
make install
make headers_install
reboot
```

看到引导菜单。

选择 seu2，系统正常启动。

`./test.c` 编辑内容为

```
#include <sys/syscall.h>
#include <unistd.h>
#include <linux/psta.h>

int main()
{
    struct pinfo info;
    int ret = syscall(320,&info);
    return 0;
}
```

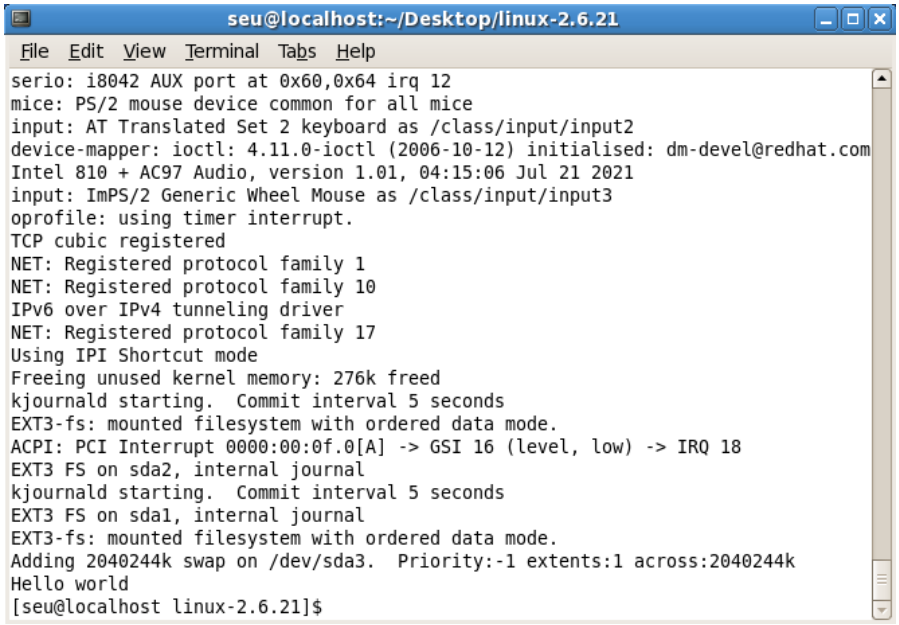
```c
#include <sys/syscall.h>
#include <unistd.h>
#include <linux/psta.h>

int main()
{
    struct pinfo info;
    int ret = syscall(320,&info);
    return 0;
}
```

编译并运行，然后查看内核消息列表

```
gcc -o test test.c -I/home/seu/Desktop/linux-2.6.21/usr/include
./test
dmesg
```

在内核日志的最后看到了 `Hello world`



实验3：Linux进程管理及其扩展

做以下编辑：

./include/linux/sched.h

修改 `task_struct`

```
int cloak;
```

```c
struct task_struct {
        volatile long state;    /* -1 unrunnable, 0 runnable, >0 stopped */
        struct thread_info *thread_info;
        atomic_t usage;
        unsigned long flags;    /* per process flags, defined below */
        unsigned long ptrace;

        int lock_depth;         /* BKL lock depth */
        int cloak;
```

./kernel/fork.c

修改 `copy_process`

```
p->cloak = 0;
```

```
/*
 * Shared signal handlers imply shared VM. By way of the above,
 * thread groups also imply shared VM. Blocking this case allows
 * for various simplifications in other code.
 */
if ((clone_flags & CLONE_SIGHAND) && !(clone_flags & CLONE_VM))
        return ERR_PTR(-EINVAL);

retval = security_task_create(clone_flags);
if (retval)
        goto fork_out;

retval = -ENOMEM;
p = dup_task_struct(current);
if (!p)
        goto fork_out;

p->cloak = 0;

rt_mutex_init_task(p);
```

./fs/proc/base.c

添加语句

```
extern int hidden_flag;
```

```
extern int hidden_flag;
```

创建 `sys_hide`

```
asmlinkage int sys_hide(pid_t pid, int on){
    if (current->uid == 0){
        struct task_struct *task = find_task_by_pid(pid);
        if (on == 0 || hidden_flag == 0)
            task->cloak = 0;
        else
            task->cloak = 1;
        proc_flush_task(task);
    }
    return 0;
}
```

```
asmlinkage int sys_hide(pid_t pid, int on){
    if (current->uid == 0){
        struct task_struct *task = find_task_by_pid(pid);
        if (on == 0 || hidden_flag == 0)
            task->cloak = 0;
        else
            task->cloak = 1;
        proc_flush_task(task);
    }
    return 0;
}
```

修改 `proc_pid_readdir`

```
if (hidden_flag == 0 &&
    proc_pid_fill_cache(filp,dirent,filldir,task,tgid)<0){
    put_task_struct(task);
    goto out;
}
if (hidden_flag == 1 && task->cloak == 0 &&
    proc_pid_fill_cache(filp, dirent, filldir, task, tgid) < 0){
    put_task_struct(task);
    goto out;
}
```

```
for (task = next_tgid(tgid);
     task;
     put_task_struct(task), task = next_tgid(tgid + 1)) {
        tgid = task->pid;
        filp->f_pos = tgid + TGID_OFFSET;
        if (hidden_flag == 0 && proc_pid_fill_cache(filp,dirent,filldir,task,tgid)<0){
                put_task_struct(task);
                goto out;
        }
        if (hidden_flag == 1 && task->cloak == 0 &&
            proc_pid_fill_cache(filp, dirent, filldir, task, tgid) < 0){
                put_task_struct(task);
                goto out;
        }
}
```

修改 `proc_pid_lookup`

```
if (task->cloak == 1 && hidden_flag == 1)
    goto out;
```

```
rcu_read_lock();
task = find_task_by_pid(tgid);
if (task)
        get_task_struct(task);
rcu_read_unlock();
if (!task)
        goto out;
if (task->cloak == 1 && hidden_flag == 1)
        goto out;
```

创建 `sys_hide_user_processes`

```
asmlinkage int sys_hide_user_processes(uid_t uid, char *comm, int on){
    if (current->uid == 0){
        struct task_struct *task = NULL;
        for_each_process(task){
            char *s = task->comm;
            if (hidden_flag == 0 && task->uid == uid){ //judge hidden_flag
                task->cloak = 0;
            }
            else if (comm == NULL){ //hide all
                if (task->uid == uid){
                    task->cloak = on;
                }
            }
            else if (task->uid == uid && strcmp(s, comm) == 0){ //hide comm
                task->cloak = on;
            }
            proc_flush_task(task);
        }
    }
    return 0;
}
```

```
asmlinkage int sys_hide_user_processes(uid_t uid, char *comm, int on){
    if (current->uid == 0){
        struct task_struct *task = NULL;
        for_each_process(task){
            char *s = task->comm;
            if (hidden_flag == 0 && task->uid == uid){
                task->cloak = 0;
            }
            else if (comm == NULL){
                if (task->uid == uid){
                    task->cloak = on;
                }
            }
            else if (task->uid == uid && strcmp(s, comm) == 0){
                    task->cloak = on;
            }
            proc_flush_task(task);
        }
    }
    return 0;
}
```

./fs/proc/proc_misc.c

添加以下变量和函数

```
int hidden_flag = 0;
EXPORT_SYMBOL(hidden_flag);

static int proc_read_hidden(char *page, char **start,
                            off_t off, int count, int *eof, void *data)
{
    int len = 0;
    len = sprintf(page,"%d",hidden_flag);
    return len;
}

static int proc_write_hidden(struct file *file, const char *buffer,
                             unsigned long count, void *data)
{
    hidden_flag = buffer[0] - '0';
    return count;
}

static int proc_read_hidden_processes(char *page, char **start, off_t off,
                                      int count, int *eof, void *data){
    static char buf[1024*8]="";
    char tmp[128];
    struct task_struct *p;
    if (off>0)
        return 0;
    sprintf(buf,"%s","");
    for_each_process(p){
        if (p->cloak == 1){
            sprintf(tmp, "%d", p->pid);
            strcat(buf,tmp);
        }
    }
    sprintf(page, "%s", buf);
    return strlen(buf);
}
```

```c
int hidden_flag = 0;
EXPORT_SYMBOL(hidden_flag);

static int proc_read_hidden(char *page, char **start,
                            off_t off, int count, int *eof, void *data)
{
    int len = 0;
    len = sprintf(page,"%d",hidden_flag);
    return len;
}

static int proc_write_hidden(struct file *file, const char *buffer,
                             unsigned long count, void *data)
{
    hidden_flag = buffer[0] - '0';
    return count;
}

static int proc_read_hidden_processes(char *page, char **start, off_t off, int count, int *eof, void *data){
        static char buf[1024*8]="";
        char tmp[128];
        struct task_struct *p;
        if (off>0)
                return 0;
        sprintf(buf,"%s","");
        for_each_process(p){
                if (p->cloak == 1){
                        sprintf(tmp, "%d", p->pid);
                        strcat(buf,tmp);
                }
        }
        sprintf(page, "%s", buf);
        return strlen(buf);
}
```

在 `proc_misc_init` 最后添加

```c
struct proc_dir_entry *ptr = create_proc_entry("hidden", 0644, NULL);
ptr->read_proc = proc_read_hidden;
ptr->write_proc = proc_write_hidden;
struct proc_dir_entry *hideprocessfile =
    create_proc_entry("hidden_process", 0644, NULL);
hideprocessfile->read_proc=proc_read_hidden_processes;
```

```c
struct proc_dir_entry *ptr = create_proc_entry("hidden", 0644, NULL);
ptr->read_proc = proc_read_hidden;
ptr->write_proc = proc_write_hidden;
struct proc_dir_entry *hideprocessfile = create_proc_entry("hidden_process", 0644, NULL);
hideprocessfile->read_proc=proc_read_hidden_processes;
```

`./arch/i386/kernel/syscall_table.S` 最后添加系统调用

```
.long sys_hide
.long sys_hide_user_process
```

```
.long sys_tee                   /* 315 */
.long sys_vmsplice
.long sys_move_pages
.long sys_getcpu
.long sys_epoll_pwait
.long sys_psta                  /* 320 */
.long sys_hide
.long sys_hide_user_processes
```

`./include/asm-i386/unistd.h` 增加宏

```
#define __NR_hide 321
#define __NR_hide_user_processes 322
```

同时，将 `NR_syscalls` 修改为 323

```
#define __NR_getcpu             318
#define __NR_epoll_pwait        319
#define __NR_psta               320
#define __NR_hide               321
#define __NR_hide_user_processes 322

#ifdef __KERNEL__

#define NR_syscalls 323
```

`./include/linux/syscalls.h` 把函数的定义加进来

```
asmlinkage int sys_hide(pid_t pid, int on);
asmlinkage int sys_hide_user_processes(uid_t uid, char *comm, int on);
```

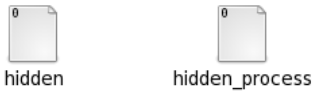
```
asmlinkage int sys_hide(pid_t pid, int on);

asmlinkage int sys_hide_user_processes(uid_t uid, char *comm, int on);
```

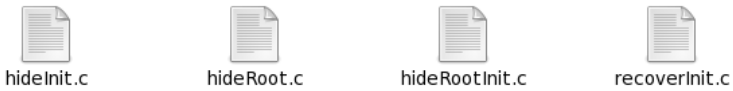
然后重新编译重启

```
make mrproper
cp /boot/config-2.6.21-1.3194.fc7 ./config
make oldconfig
make all
su
make modules_install
make install
make headers_install
reboot
```

启动后在 `/proc` 文件夹下看到了 hidden 和 hidden_process



创建 4 个测试文件



内容分别为

```
//hideInit.c
#include <stdlib.h>
#include <stdio.h>
#include <unistd.h>
#include <sys/syscall.h>

int main()
{
    syscall(321, 1, 1);
    return 0;
}
```

```c
//recoverInit.c
#include <stdlib.h>
#include <stdio.h>
#include <unistd.h>
#include <sys/syscall.h>

int main()
{
    syscall(321, 1, 0);
    return 0;
}
```

```c
//hideRootInit.c
#include <stdlib.h>
#include <stdio.h>
#include <unistd.h>
#include <sys/syscall.h>

int main()
{
    syscall(322, 0, "init", 1);
    return 0;
}
```

```c
//hideRoot.c
#include <stdlib.h>
#include <stdio.h>
#include <unistd.h>
#include <sys/syscall.h>

int main()
{
    syscall(322, 0, NULL, 1);
    return 0;
}
```

分别编译

```bash
cd Desktop
gcc -o hideInit hideInit.c
gcc -o recoverInit recoverInit.c
gcc -o hideRootInit hideRootInit.c
gcc -o hideRoot hideRoot.c
```

然后进行测试

```bash
cd /proc
su
echo "1" > hidden
```

```
[root@localhost proc]# echo "1" > hidden
[root@localhost proc]# cat < hidden
1[root@localhost proc]#
```

然后 `top`

```
[seu@localhost Desktop]$ top

top - 10:15:48 up 51 min,  2 users,  load average: 0.00, 0.01, 0.00
Tasks: 111 total,   2 running, 109 sleeping,   0 stopped,   0 zombie
Cpu(s):  0.0%us,  0.0%sy,  0.0%ni,100.0%id,  0.0%wa,  0.0%hi,  0.0%si,  0.0%st
Mem:   2074028k total,   310892k used,  1763136k free,    19036k buffers
Swap:  2040244k total,        0k used,  2040244k free,   166600k cached

  PID USER      PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
 3722 root      15   0  3136  864  748 S    0  0.0   0:00.37 hald-addon-stor
    1 root      15   0  2132  624  540 S    0  0.0   0:00.56 init
```

测试 `./hideInit`

```
[seu@localhost Desktop]$ ./hideInit
[seu@localhost Desktop]$ top

top - 10:16:25 up 52 min,  2 users,  load average: 0.00, 0.01, 0.00
Tasks: 111 total,   2 running, 109 sleeping,   0 stopped,   0 zombie
Cpu(s):  0.0%us,  0.0%sy,  0.0%ni,100.0%id,  0.0%wa,  0.0%hi,  0.0%si,  0.0%st
Mem:   2074028k total,   311088k used,  1762940k free,    19060k buffers
Swap:  2040244k total,        0k used,  2040244k free,   166608k cached

  PID USER      PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
 3878 root      15   0  149m  12m 6420 S    0  0.6   0:07.86 Xorg
 5054 seu       15   0 38348  11m 8436 R    0  0.6   0:00.24 gnome-terminal
    1 root      15   0  2132  624  540 S    0  0.0   0:00.56 init
```

没有成功。

进入 root 权限重新测试

```
[seu@localhost Desktop]$ su
Password:
[root@localhost Desktop]# ./hideInit
[root@localhost Desktop]# top

top - 10:18:05 up 53 min,  2 users,  load average: 0.07, 0.02, 0.00
Tasks: 112 total,   2 running, 110 sleeping,   0 stopped,   0 zombie
Cpu(s):  0.2%us,  0.1%sy,  0.0%ni, 99.6%id,  0.1%wa,  0.0%hi,  0.0%si,  0.0%st
Mem:   2074028k total,   315300k used,  1758728k free,    19100k buffers
Swap:  2040244k total,        0k used,  2040244k free,   166612k cached

  PID USER      PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
 3878 root      15   0  151m  15m 6420 R    2  0.8   0:08.01 Xorg
    2 root      RT   0     0    0    0 S    0  0.0   0:00.01 migration/0
    3 root      34  19     0    0    0 S    0  0.0   0:00.00 ksoftirqd/0
    4 root      RT   0     0    0    0 S    0  0.0   0:00.00 watchdog/0
    5 root      RT   0     0    0    0 S    0  0.0   0:00.06 migration/1
    6 root      34  19     0    0    0 S    0  0.0   0:00.00 ksoftirqd/1
    7 root      RT   0     0    0    0 S    0  0.0   0:00.00 watchdog/1
    8 root      10  -5     0    0    0 S    0  0.0   0:00.00 events/0
    9 root      10  -5     0    0    0 S    0  0.0   0:00.00 events/1
   10 root      20  -5     0    0    0 S    0  0.0   0:00.00 khelper
   11 root      10  -5     0    0    0 S    0  0.0   0:00.00 kthread
   75 root      16  -5     0    0    0 S    0  0.0   0:00.09 kblockd/0
   76 root      10  -5     0    0    0 S    0  0.0   0:00.12 kblockd/1
   77 root      15  -5     0    0    0 S    0  0.0   0:00.00 kacpid
  245 root      13  -5     0    0    0 S    0  0.0   0:00.00 ata/0
  246 root      14  -5     0    0    0 S    0  0.0   0:00.00 ata/1
  247 root      13  -5     0    0    0 S    0  0.0   0:00.00 ata_aux
  248 root      13  -5     0    0    0 S    0  0.0   0:00.00 ksuspend_usbd
  251 root      10  -5     0    0    0 S    0  0.0   0:00.00 khubd
  253 root      15  -5     0    0    0 S    0  0.0   0:00.00 kseriod
  264 root      13  -5     0    0    0 S    0  0.0   0:00.00 khpsbpkt
  291 root      17   0     0    0    0 S    0  0.0   0:00.00 pdflush
  292 root      15   0     0    0    0 S    0  0.0   0:00.02 pdflush
  293 root      12  -5     0    0    0 S    0  0.0   0:00.00 kswapd0
  294 root      12  -5     0    0    0 S    0  0.0   0:00.00 aio/0
  295 root      12  -5     0    0    0 S    0  0.0   0:00.00 aio/1
  958 root      11  -5     0    0    0 S    0  0.0   0:00.00 scsi_eh_0
 1051 root      11  -5     0    0    0 S    0  0.0   0:00.00 kpsmoused
 1056 root      11  -5     0    0    0 S    0  0.0   0:00.00 kondemand/0
 1057 root      12  -5     0    0    0 S    0  0.0   0:00.00 kondemand/1
 1067 root      10  -5     0    0    0 S    0  0.0   0:00.13 kjournald
 1130 root      21  -4  2352  632  384 S    0  0.0   0:00.04 udevd
 2382 root      10  -5     0    0    0 S    0  0.0   0:00.00 kjournald
```

```
[root@localhost Desktop]# cat /proc/hidden_process
1[root@localhost Desktop]#
```

看到 1 号进程成功屏蔽

测试 `./recoverInit`

```
[root@localhost Desktop]# ./recoverInit
[root@localhost Desktop]# top

top - 10:19:44 up 55 min,  2 users,  load average: 0.04, 0.02, 0.00
Tasks: 113 total,   2 running, 111 sleeping,   0 stopped,   0 zombie
Cpu(s):  0.7%us,  1.3%sy,  0.0%ni, 97.3%id,  0.0%wa,  0.7%hi,  0.0%si,  0.0%st
Mem:   2074028k total,   313428k used,  1760600k free,    19136k buffers
Swap:  2040244k total,        0k used,  2040244k free,   166608k cached

  PID USER      PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
 3878 root      15   0  149m  12m 6420 S    2  0.6   0:08.32 Xorg
 5054 seu       15   0 38604  12m 8436 S    1  0.6   0:00.41 gnome-terminal
 4137 seu       15   0 16368 3948 3156 R    1  0.2   0:00.18 gnome-screensav
 3701 haldaemo  15   0  5620 3616 2496 S    0  0.2   0:00.06 hald
    1 root      15   0  2132  624  540 S    0  0.0   0:00.56 init
```

```
[root@localhost Desktop]# cat /proc/hidden_process
[root@localhost Desktop]#
```

init 又回来了

测试 `./hideRootInit`

```
[root@localhost Desktop]# ./hideRootInit
[root@localhost Desktop]# top

top - 12:26:25 up 2 min,  2 users,  load average: 0.04, 0.04, 0.01
Tasks: 110 total,   2 running, 108 sleeping,   0 stopped,   0 zombie
Cpu(s):  0.0%us,  0.0%sy,  0.0%ni,100.0%id,  0.0%wa,  0.0%hi,  0.0%si,  0.0%st
Mem:   2074020k total,   281508k used,  1792512k free,    15208k buffers
Swap:  2040244k total,        0k used,  2040244k free,   150392k cached

  PID USER      PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
    2 root      RT   0     0    0    0 S    0  0.0   0:00.05 migration/0
    3 root      34  19     0    0    0 S    0  0.0   0:00.00 ksoftirqd/0
    4 root      RT   0     0    0    0 S    0  0.0   0:00.00 watchdog/0
    5 root      RT   0     0    0    0 S    0  0.0   0:00.06 migration/1
    6 root      34  19     0    0    0 S    0  0.0   0:00.00 ksoftirqd/1
    7 root      RT   0     0    0    0 S    0  0.0   0:00.00 watchdog/1
    8 root      10  -5     0    0    0 S    0  0.0   0:00.00 events/0
    9 root      10  -5     0    0    0 S    0  0.0   0:00.00 events/1
   10 root      20  -5     0    0    0 S    0  0.0   0:00.00 khelper
   11 root      10  -5     0    0    0 S    0  0.0   0:00.00 kthread
   75 root      10  -5     0    0    0 S    0  0.0   0:00.07 kblockd/0
   76 root      10  -5     0    0    0 S    0  0.0   0:00.11 kblockd/1
   77 root      15  -5     0    0    0 S    0  0.0   0:00.00 kacpid
  245 root      13  -5     0    0    0 S    0  0.0   0:00.00 ata/0
  246 root      14  -5     0    0    0 S    0  0.0   0:00.00 ata/1
  247 root      13  -5     0    0    0 S    0  0.0   0:00.00 ata_aux
  248 root      13  -5     0    0    0 S    0  0.0   0:00.00 ksuspend_usbd
  251 root      10  -5     0    0    0 S    0  0.0   0:00.00 khubd
  253 root      15  -5     0    0    0 S    0  0.0   0:00.00 kseriod
  264 root      13  -5     0    0    0 S    0  0.0   0:00.00 khpsbpkt
  291 root      17   0     0    0    0 S    0  0.0   0:00.00 pdflush
  292 root      15   0     0    0    0 S    0  0.0   0:00.01 pdflush
  293 root      12  -5     0    0    0 S    0  0.0   0:00.00 kswapd0
  294 root      12  -5     0    0    0 S    0  0.0   0:00.00 aio/0
  295 root      12  -5     0    0    0 S    0  0.0   0:00.00 aio/1
  958 root      11  -5     0    0    0 S    0  0.0   0:00.00 scsi_eh_0
 1051 root      11  -5     0    0    0 S    0  0.0   0:00.00 kpsmoused
 1056 root      11  -5     0    0    0 S    0  0.0   0:00.00 kondemand/0
 1057 root      12  -5     0    0    0 S    0  0.0   0:00.00 kondemand/1
 1067 root      10  -5     0    0    0 S    0  0.0   0:00.05 kjournald
 1130 root      21  -4  2352  628  384 S    0  0.0   0:00.02 udevd
 2384 root      11  -5     0    0    0 S    0  0.0   0:00.00 kjournald
 2863 root      15   0 27988 3900 3220 S    0  0.2   0:00.01 vmtoolsd
 3182 root      16   0  1800  596  496 S    0  0.0   0:00.00 syslogd
 3185 root      25   0  1740  404  332 S    0  0.0   0:00.00 klogd
```

```
[root@localhost Desktop]# cat /proc/hidden_process
1[root@localhost Desktop]#
```

看到 root 的 init 进程成功屏蔽

测试 `./hideRoot`

```
[root@localhost Desktop]# ./hideRoot
[root@localhost Desktop]# top

top - 11:55:19 up 4 min,  2 users,  load average: 0.01, 0.06, 0.02
Tasks:  49 total,   1 running,  48 sleeping,   0 stopped,   0 zombie
Cpu(s):  0.7%us,  0.7%sy,  0.0%ni, 98.2%id,  0.3%wa,  0.1%hi,  0.0%si,  0.0%st
Mem:   2074020k total,   295068k used,  1778952k free,    15512k buffers
Swap:  2040244k total,        0k used,  2040244k free,   154084k cached

  PID USER      PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
 3217 rpc       15   0  2196  700  536 S    0  0.0   0:00.00 rpcbind
 3288 dbus      15   0  2948  900  616 S    0  0.0   0:00.01 dbus-daemon
 3506 smmsp     25   0  7988 1472  644 S    0  0.1   0:00.00 sendmail
 3623 xfs       15   0  3868 1652  780 S    0  0.1   0:00.00 xfs
 3689 avahi     25   0  2640 1304 1140 S    0  0.1   0:00.00 avahi-daemon
 3690 avahi     25   0  2640  312  184 S    0  0.0   0:00.00 avahi-daemon
 3701 haldaemo  15   0  5756 3752 2496 S    0  0.2   0:00.03 hald
 3712 haldaemo  25   0  2072  788  700 S    0  0.0   0:00.00 hald-addon-keyb
 3713 haldaemo  15   0  2072  788  700 S    0  0.0   0:00.00 hald-addon-keyb
 3728 haldaemo  25   0  2068  784  696 S    0  0.0   0:00.00 hald-addon-acpi
 3900 seu       15   0 31044 5760 4848 S    0  0.3   0:00.02 gnome-session
 3991 seu       18   0  4480  516  260 S    0  0.0   0:00.00 ssh-agent
 3994 seu       22   0  2832  492  392 S    0  0.0   0:00.00 dbus-launch
 3995 seu       17   0  2816  832  592 S    0  0.0   0:00.02 dbus-daemon
 4001 seu       17   0  7340 3704 1708 S    0  0.2   0:00.12 gconfd-2
 4004 seu       25   0  2772  776  676 S    0  0.0   0:00.00 gnome-keyring-d
 4006 seu       15   0 37868  12m 6220 S    0  0.6   0:00.09 gnome-settings-
 4010 seu       15   0 17864 8484 6236 S    0  0.4   0:00.20 metacity
 4012 seu       15   0 34992  12m 9132 S    0  0.6   0:00.14 gnome-panel
 4014 seu       15   0 80516  20m  11m S    0  1.0   0:00.33 nautilus
 4018 seu       15   0 22544 4232 3344 S    0  0.2   0:00.00 gnome-volume-ma
 4020 seu       18   0 41644 2740 1988 S    0  0.1   0:00.05 bonobo-activati
 4022 seu       15   0 14424 4488 3844 S    0  0.2   0:00.01 bluetooth-apple
 4026 seu       15   0 57844  13m  11m S    0  0.6   0:00.12 vmtoolsd
 4038 seu       15   0 39344 9060 7380 S    0  0.4   0:00.02 nm-applet
 4055 seu       22   0 11188 2960 2552 S    0  0.1   0:00.00 gnome-vfs-daemo
 4058 seu       15   0 24132  12m 7652 S    0  0.6   0:00.02 puplet
 4059 seu       17   0 10768 5292 2904 S    0  0.3   0:00.02 python
 4063 seu       25   0 15352 2088 1756 S    0  0.1   0:00.00 escd
 4065 seu       15   0 13096 2564 2176 S    0  0.1   0:00.00 pam-panel-icon
 4066 seu       15   0 24792 5252 3968 S    0  0.3   0:00.01 gnome-power-man
 4071 root      15   0  1912  616  520 S    0  0.0   0:00.00 pam_timestamp_c
 4074 seu       15   0 34292  10m 7668 S    0  0.5   0:00.08 wnck-applet
 4082 seu       15   0 65408 9136 7016 S    0  0.4   0:00.01 trashapplet
 4094 seu       18   0  2496 1032  852 S    0  0.0   0:00.00 gam_server
```

```
[root@localhost Desktop]# cat /proc/hidden_process
1234567891011757677245246247248251253264291292293294295958105110561057106711302384286331823185319732483346337333923406350035203579364636683679370437283799380438053806380838113816381938743878387942 62[root@localhost Desktop]#
```

看到 root 的进程全部被屏蔽

编写程序调用 `syscall(322, 0, NULL, 0);` 恢复 hidden_process。

然后修改 hidden 为 0

```
echo "0" > hidden
```

重新测试 `./hideRoot`

```
[root@localhost Desktop]# ./hideRoot
[root@localhost Desktop]# top

top - 12:43:46 up 19 min,  3 users,  load average: 0.03, 0.04, 0.00
Tasks: 114 total,   1 running, 113 sleeping,   0 stopped,   0 zombie
Cpu(s):  0.2%us,  0.2%sy,  0.0%ni, 99.7%id,  0.0%wa,  0.0%hi,  0.0%si,  0.0%st
Mem:   2074020k total,   303256k used,  1770764k free,    16784k buffers
Swap:  2040244k total,        0k used,  2040244k free,   157372k cached

  PID USER      PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
 3728 root      15   0  3132  864  748 S    0  0.0   0:00.14 hald-addon-stor
 3879 root      15   0  149m  13m 6800 S    0  0.6   0:04.53 Xorg
    1 root      15   0  2136  628  540 S    0  0.0   0:00.57 init
    2 root      RT   0     0    0    0 S    0  0.0   0:00.06 migration/0
    3 root      34  19     0    0    0 S    0  0.0   0:00.00 ksoftirqd/0
    4 root      RT   0     0    0    0 S    0  0.0   0:00.00 watchdog/0
    5 root      RT   0     0    0    0 S    0  0.0   0:00.06 migration/1
    6 root      34  19     0    0    0 S    0  0.0   0:00.00 ksoftirqd/1
    7 root      RT   0     0    0    0 S    0  0.0   0:00.00 watchdog/1
    8 root      10  -5     0    0    0 S    0  0.0   0:00.00 events/0
    9 root      10  -5     0    0    0 S    0  0.0   0:00.00 events/1
   10 root      20  -5     0    0    0 S    0  0.0   0:00.00 khelper
   11 root      10  -5     0    0    0 S    0  0.0   0:00.00 kthread
   75 root      10  -5     0    0    0 S    0  0.0   0:00.07 kblockd/0
   76 root      10  -5     0    0    0 S    0  0.0   0:00.11 kblockd/1
   77 root      15  -5     0    0    0 S    0  0.0   0:00.00 kacpid
  245 root      13  -5     0    0    0 S    0  0.0   0:00.00 ata/0
  246 root      14  -5     0    0    0 S    0  0.0   0:00.00 ata/1
  247 root      13  -5     0    0    0 S    0  0.0   0:00.00 ata_aux
  248 root      13  -5     0    0    0 S    0  0.0   0:00.00 ksuspend_usbd
  251 root      10  -5     0    0    0 S    0  0.0   0:00.00 khubd
  253 root      15  -5     0    0    0 S    0  0.0   0:00.00 kseriod
  264 root      13  -5     0    0    0 S    0  0.0   0:00.00 khpsbpkt
  291 root      17   0     0    0    0 S    0  0.0   0:00.00 pdflush
  292 root      15   0     0    0    0 S    0  0.0   0:00.04 pdflush
  293 root      12  -5     0    0    0 S    0  0.0   0:00.00 kswapd0
  294 root      12  -5     0    0    0 S    0  0.0   0:00.00 aio/0
  295 root      12  -5     0    0    0 S    0  0.0   0:00.00 aio/1
  958 root      11  -5     0    0    0 S    0  0.0   0:00.00 scsi_eh_0
 1051 root      11  -5     0    0    0 S    0  0.0   0:00.00 kpsmoused
 1056 root      11  -5     0    0    0 S    0  0.0   0:00.00 kondemand/0
 1057 root      12  -5     0    0    0 S    0  0.0   0:00.00 kondemand/1
 1067 root      10  -5     0    0    0 S    0  0.0   0:00.08 kjournald
 1130 root      21  -4  2352  628  384 S    0  0.0   0:00.02 udevd
 2384 root      11  -5     0    0    0 S    0  0.0   0:00.00 kjournald
```

```
[root@localhost Desktop]# cat /proc/hidden_process
[root@localhost Desktop]#
```

可以看到，屏蔽不起效果了。

实验总结

本实验 1 和 2 很容易，依葫芦画瓢即可。实验 3 其实也不难，但我在 hide_user_processes 上花了整整 5 个小时：先是 `==` 写成了 `=`，查 bug 查了两个小时；然后，本应该比较两个指针内容的地方，我写成了比较两个指针，又 debug 了两个小时😭

通过本次实验，熟悉了 Linux 内核文件结构，学会了修改与增加系统调用，掌握了进程控制和进程管理相关内容。