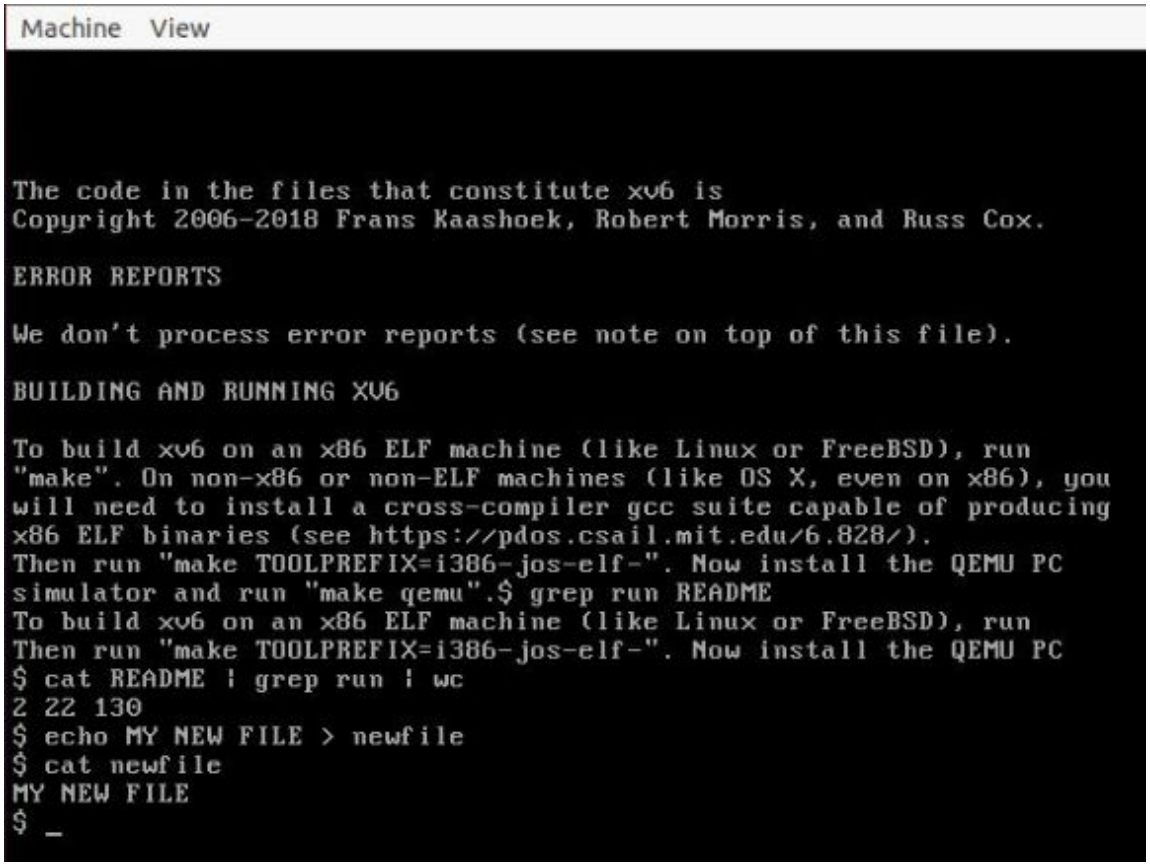
LAB ASSIGNMENT: xv6 SYSTEM CALL

ARPIT AGARWAL
IIT2019139

BOOTING xv6



Part I : System Call Tracing

The following is the code for syscall.c where changes are to be done.

```
#include "types.h"
#include "defs.h"
#include "param.h"
#include "memlayout.h"
#include "mmu.h"
#include "proc.h"
#include "x86.h"
#include "syscall.h"
```

```
// User code makes a system call with INT T_SYSCALL.
// System call number in %eax.
// Arguments on the stack, from the user call to the C
// library system call function. The saved user %esp points
// to a saved program counter, and then the first argument.

// Fetch the int at addr from the current process.
int
fetchint(uint addr, int *ip)
{
  struct proc *curproc = myproc();

  if(addr >= curproc->sz || addr+4 > curproc->sz)
    return -1;
  *ip = *(int*)(addr);
  return 0;
}

// Fetch the nul-terminated string at addr from the current process.
// Doesn't actually copy the string - just sets *pp to point at it.
// Returns length of string, not including nul.
int
fetchstr(uint addr, char **pp)
{
  char *s, *ep;
  struct proc *curproc = myproc();

  if(addr >= curproc->sz)
    return -1;
  *pp = (char*)addr;
  ep = (char*)curproc->sz;
  for(s = *pp; s < ep; s++){
    if(*s == 0)
      return s - *pp;
  }
  return -1;
}

// Fetch the nth 32-bit system call argument.
int
argint(int n, int *ip)
{
  return fetchint((myproc()->tf->esp) + 4 + 4*n, ip);
}

// Fetch the nth word-sized system call argument as a pointer
// to a block of memory of size bytes.  Check that the pointer
```

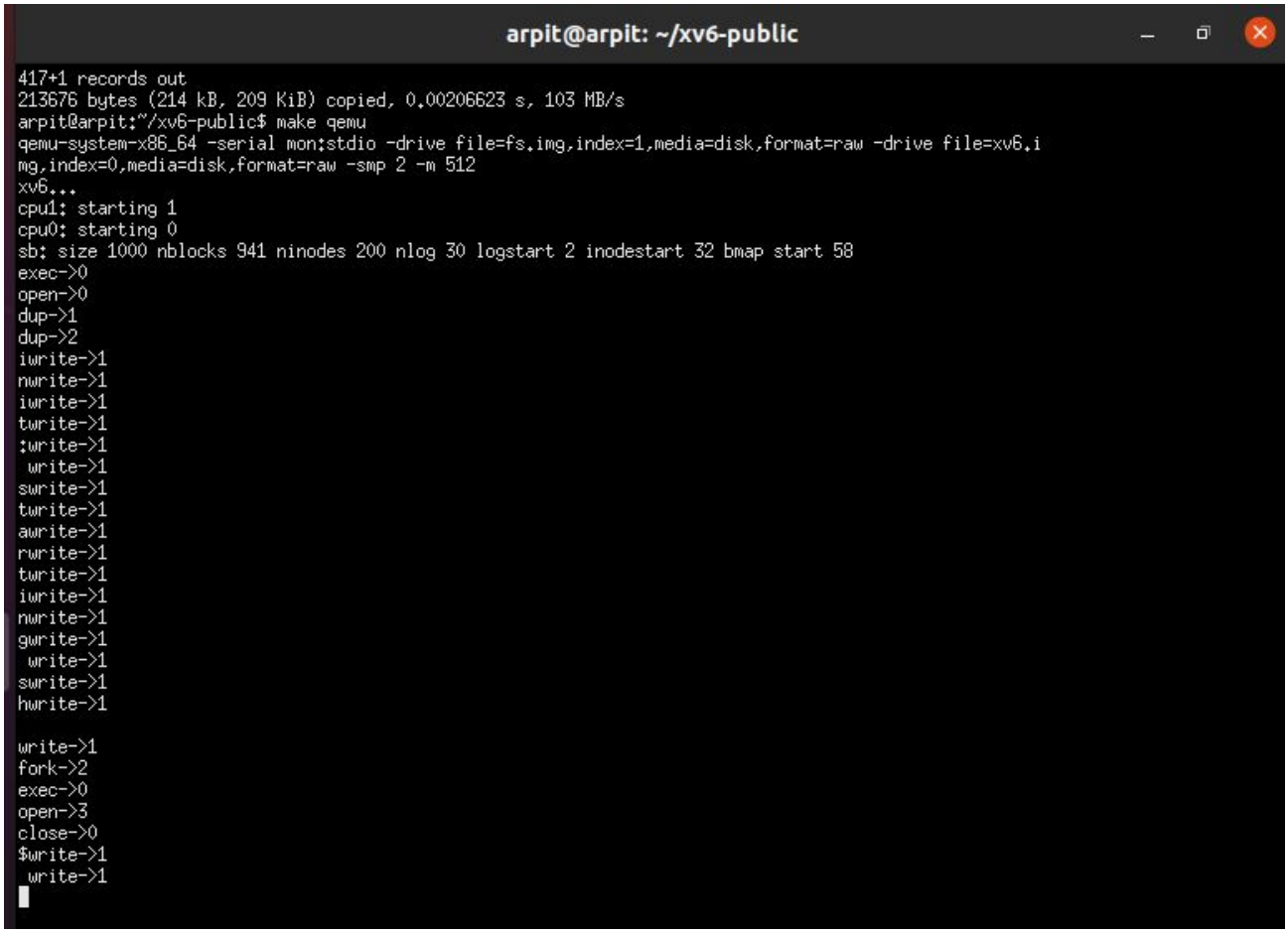
```
// lies within the process address space.
int
argptr(int n, char **pp, int size)
{
  int i;
  struct proc *curproc = myproc();

  if(argint(n, &i) < 0)
    return -1;
  if(size < 0 || (uint)i >= curproc->sz || (uint)i+size > curproc->sz)
    return -1;
  *pp = (char*)i;
  return 0;
}

// Fetch the nth word-sized system call argument as a string pointer.
// Check that the pointer is valid and the string is nul-terminated.
// (There is no shared writable memory, so the string can't change
// between this check and being used by the kernel.)
int
argstr(int n, char **pp)
{
  int addr;
  if(argint(n, &addr) < 0)
    return -1;
  return fetchstr(addr, pp);
}

extern int sys_chdir(void);
extern int sys_close(void);
extern int sys_dup(void);
extern int sys_exec(void);
extern int sys_exit(void);
extern int sys_fork(void);
extern int sys_fstat(void);
extern int sys_getpid(void);
extern int sys_kill(void);
extern int sys_link(void);
extern int sys_mkdir(void);
extern int sys_mknod(void);
extern int sys_open(void);
extern int sys_pipe(void);
extern int sys_read(void);
extern int sys_sbrk(void);
extern int sys_sleep(void);
extern int sys_unlink(void);
extern int sys_wait(void);
```

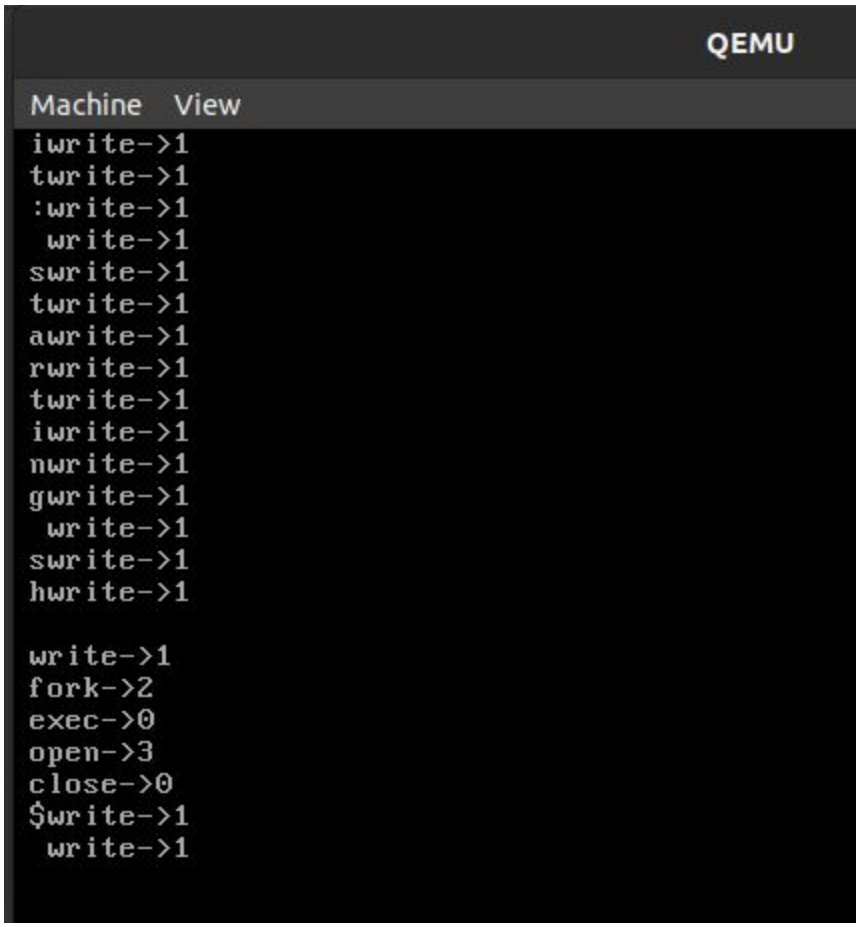
```
extern int sys_write(void);
extern int sys_uptime(void);
extern int sys_cps(void);

static int (*syscalls[])(void) = {
[SYS_fork]    sys_fork,
[SYS_exit]    sys_exit,
[SYS_wait]    sys_wait,
[SYS_pipe]    sys_pipe,
[SYS_read]    sys_read,
[SYS_kill]    sys_kill,
[SYS_exec]    sys_exec,
[SYS_fstat]   sys_fstat,
[SYS_chdir]   sys_chdir,
[SYS_dup]     sys_dup,
[SYS_getpid]  sys_getpid,
[SYS_sbrk]    sys_sbrk,
[SYS_sleep]   sys_sleep,
[SYS_uptime]  sys_uptime,
[SYS_open]    sys_open,
[SYS_write]   sys_write,
[SYS_mknod]   sys_mknod,
[SYS_unlink]  sys_unlink,
[SYS_link]    sys_link,
[SYS_mkdir]   sys_mkdir,
[SYS_close]   sys_close,
[SYS_cps]     sys_cps,
};

// Declaring array of char pointer
static char* syscallnames[] = {
[SYS_fork]    "fork",
[SYS_exit]    "exit",
[SYS_wait]    "wait",
[SYS_pipe]    "pipe",
[SYS_read]    "read",
[SYS_kill]    "kill",
[SYS_exec]    "exec",
[SYS_fstat]   "fstat",
[SYS_chdir]   "chdir",
[SYS_dup]     "dup",
[SYS_getpid]  "getpid",
[SYS_sbrk]    "sbrk",
[SYS_sleep]   "sleep",
[SYS_uptime]  "uptime",
[SYS_open]    "open",
[SYS_write]   "write",
```

```
[SYS_mknod]   "mknod",
[SYS_unlink]  "unlink",
[SYS_link]    "link",
[SYS_mkdir]   "mkdir",
[SYS_close]   "close",
[SYS_cps]     "cps"
};

void
syscall(void)
{
  int num;
  struct proc *curproc = myproc();

  num = curproc->tf->eax;
  if(num > 0 && num < NELEM(syscalls) && syscalls[num]) {

        curproc->tf->eax = syscalls[num]();
        cprintf("%s->%d\n",syscallnames[num], curproc->tf->eax);
  } else {
    cprintf("%d %s: unknown sys call %d\n",
            curproc->pid, curproc->name, num);
    curproc->tf->eax = -1;
  }

}
```

/* The line in bold is to be added in syscall.c (void syscall(void) function) */

***** Screenshots of output are on NEXT page*****


arpit@arpit: ~/xv6-public
417+1 records out
213676 bytes (214 kB, 209 KiB) copied, 0.00206623 s, 103 MB/s
arpit@arpit:~/xv6-public$ make qemu
qemu-system-x86_64 -serial mon:stdio -drive file=fs.img,index=1,media=disk,format=raw -drive file=xv6.i
mg,index=0,media=disk,format=raw -smp 2 -m 512
xv6...
cpu1: starting 1
cpu0: starting 0
sb: size 1000 nblocks 941 ninodes 200 nlog 30 logstart 2 inodestart 32 bmap start 58
exec->0
open->0
dup->1
dup->2
iwrite->1
nwrite->1
iwrite->1
twrite->1
:write->1
write->1
swrite->1
twrite->1
awrite->1
rwrite->1
twrite->1
iwrite->1
nwrite->1
gwrite->1
write->1
swrite->1
hwrite->1
write->1
fork->2
exec->0
open->3
close->0
$write->1
write->1


QEMU
Machine View
iwrite->1
twrite->1
:write->1
write->1
swrite->1
twrite->1
awrite->1
rwrite->1
twrite->1
iwrite->1
nwrite->1
gwrite->1
write->1
swrite->1
hwrite->1
write->1
fork->2
exec->0
open->3
close->0
$write->1
write->1

Part II : ps System Call

Modifications to be done in the files written below. We are making a new syscall call with the name of **cps** and it is to be added in these files.
Suppose the syscall that we make is called "**cps**" which prints out **current process states** (**PID**) in the system

```
// syscall.h
// defs.h
// user.h
// sysproc.c
```

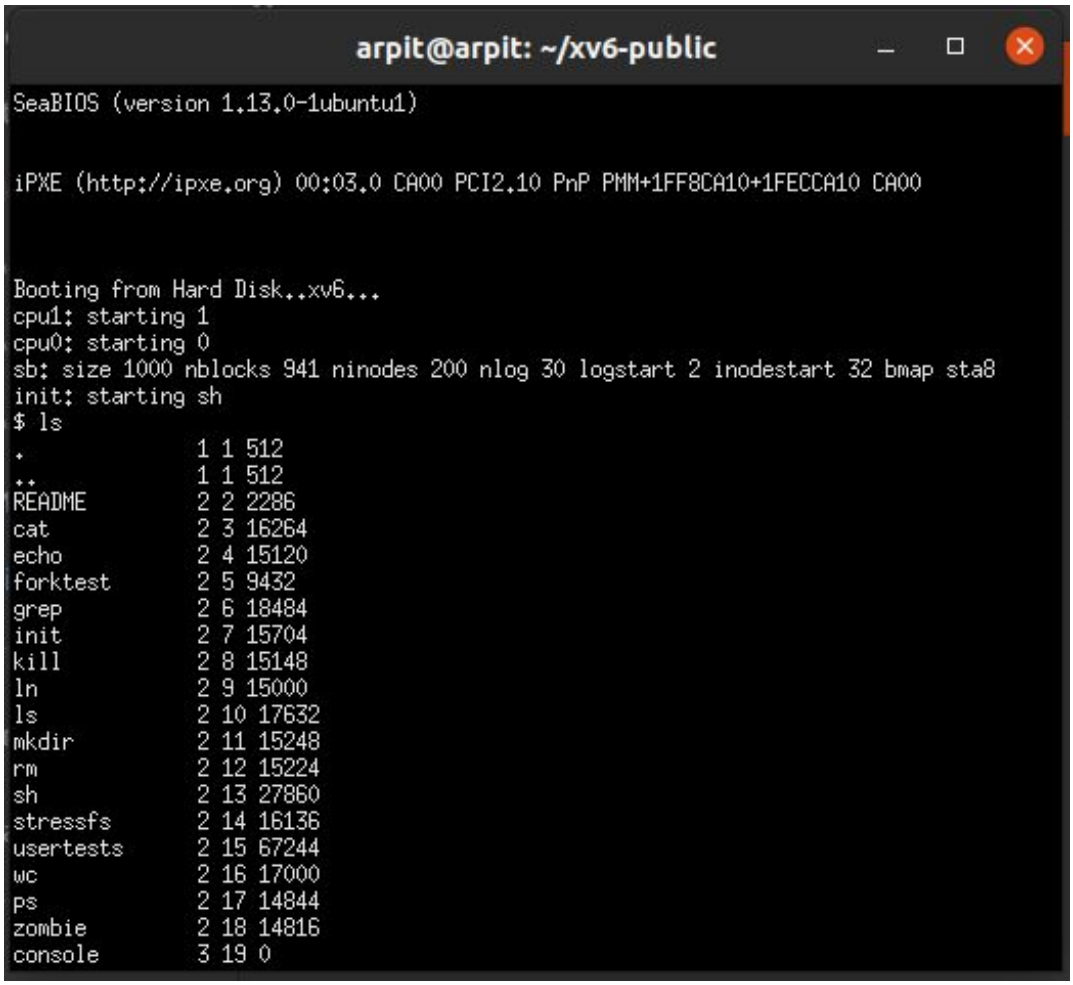
Now we have to add this function call to sysproc.c

```
int
sys_cps (void)
{
      return cps();
}

// usys.S
// syscall.c
// proc.c -> the function below is to be added...

// current process status
int
cps(){
      struct proc *p;
      // enable interrupts on this processor.
      sti();

      // loop over process table looking for process with pid.
      acquire(&ptable.lock);
      cprintf("Name \t PID \t State \t \n");
      for(p = ptable.proc; p < &ptable.proc[NPROC]; p++){
            if(p->state == SLEEPING)
                  cprintf("%s \t %d \t SLEEPING \t \n ", p->name, p->pid);
            else if (p->state == RUNNING)
                  cprintf("%s \t %d \t RUNNING \t \n ", p->name, p->pid);
            else if (p->state == RUNNABLE)
                  cprintf("%s \t %d \t RUNNABLE \t \n", p->name, p->pid);
      }

      release(&ptable.lock);

      return 22;
}
```

// We have to make a new file named “ps.c”

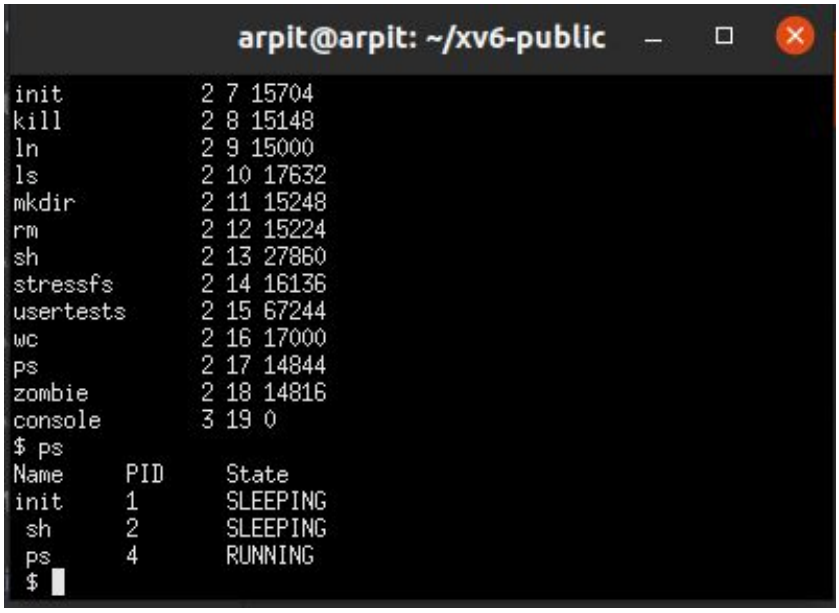
```
#include "types.h"
#include "stat.h"
#include "user.h"
#include "fcntl.h"

int
main(int argc, char *argv[])
{
      cps();

      exit();
}
```

// Finally modify MAKEFILE to add ps there…



In the output we can see that ps syscall has been added

***** Now executing ps we gather the number of processes running their current state along with their PID *****

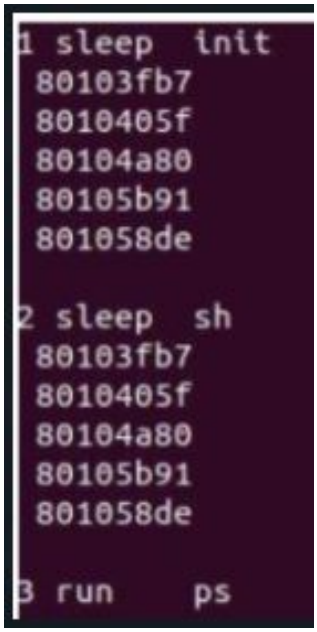


ALITER:

getprocinfo is defined as follows

```
static char *states[] = {
[UNUSED] "unused",
[EMBRYO] "embryo",
[SLEEPING] "sleep ",
[RUNNABLE] "runnable",
[RUNNING] "run ",
[ZOMBIE] "zombie"
};

int i;
struct proc *p;
char *state;
uint pc[10];
for(p = ptable.proc; p < &ptable.proc[NPROC]; p++){

      if(p->state == UNUSED)
      continue;

      if(p->state >= 0 && p->state < NELEM(states) && states[p->state])
      state = states[p->state];
```

```
      else
      state = "N/A";

      cprintf("%d %s %s \n", p->pid, state, p->name);

      if(p->state == SLEEPING){
      getcallerpcs((uint*)p->context->ebp+2, pc);

      for(i=0; i<10 && pc[i] != 0; i++)
            cprintf(" %p \n", pc[i]);
      }

cprintf("\n");
```



***** THE END *****
