

Task I (50 points): Build, install, and run new Linux kernel**Task I.1 (20 points): Build the new kernel**

Q. After successful completion of the build, report the three files that have the three most recent timestamp under the build directory (linux-2.6.18.2) with their size and timestamp.

The three files with most recent timestamps are "Sound", "lib", "Init"

Task I.2 (20 points): install the new kernel**1) report what have been added or changed in directory /boot;**

New "initrd" file for the new linux kernel has been added to the directory

New "System map" file for the new linux kernel has been added to this directory

New "vmlinuz" file has been added.

2) find two files under directory /boot that are related to two of the three files reported in Task I.1 and explain their relations

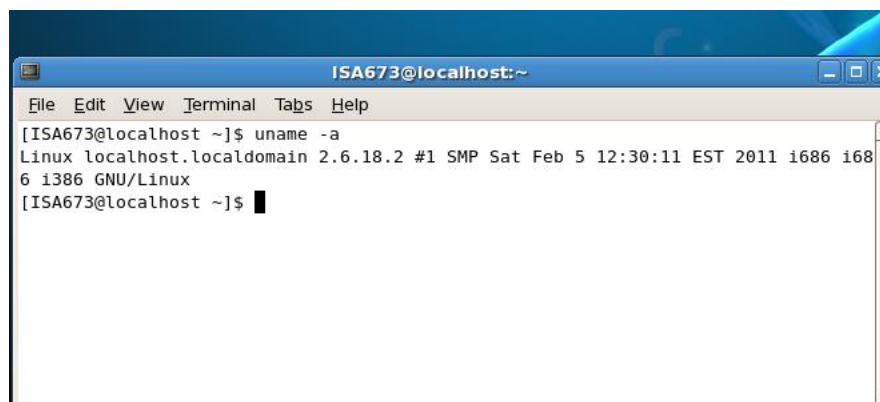
The two files under /boot directory that are related to two of the three in task I.1 are "initrd" and "symvers" files

"initrd" is mainly designed to allow system startup to occur. In the boot process, "initrd" invokes or executes "init" file we found in task I.1 on the new root filesystem.

The "lib" file we found in task I.1 is related to the "vmlinuz" file in /boot directory. The "lib" directory contains kernel modules and "vmlinuz" is the linux kernel executable file, hence "vmlinuz" has to contain "lib" file.

Task I.3 (10 points): run the newly built Linux kernel

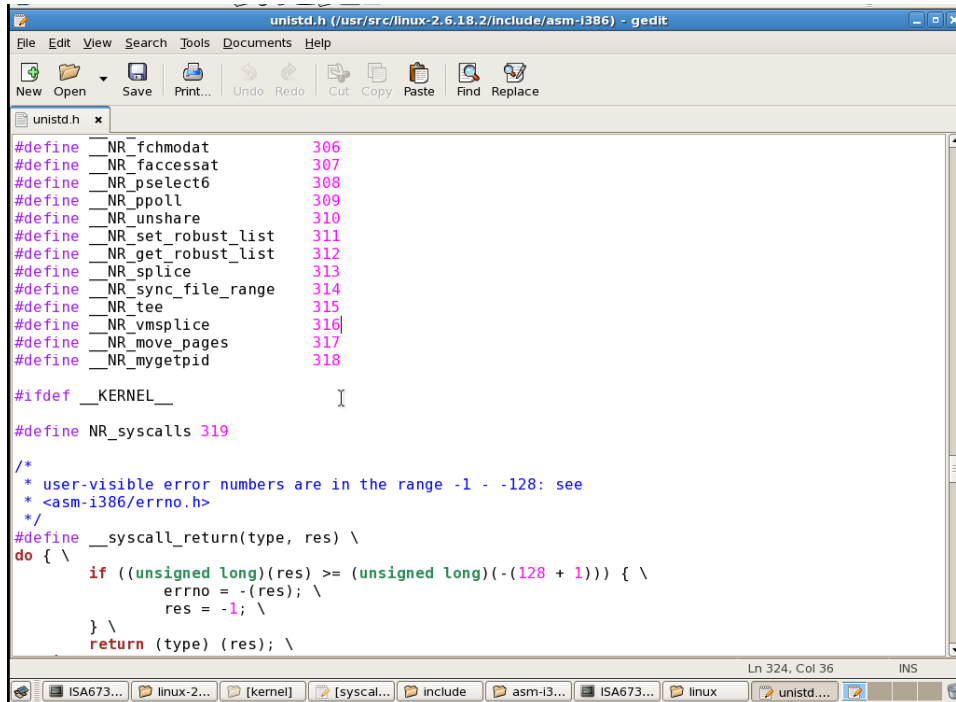
If the kernel 2.6.18.2 has been built and installed successfully, you will be able to boot with it. In a terminal, run command "uname -a", take a screenshot and submit the screenshot.



```
ISA673@localhost:~  
File Edit View Terminal Tabs Help  
[ISA673@localhost ~]$ uname -a  
Linux localhost.localdomain 2.6.18.2 #1 SMP Sat Feb 5 12:30:11 EST 2011 i686 i686  
6 i386 GNU/Linux  
[ISA673@localhost ~]$
```

Task II (50 points): Add a new system call in Linux kernel 2.6.18.2**Task II.1 (10 points): Please report the new system call number in your homework submission.**

New system call number is 318



```

unistd.h (/usr/src/linux-2.6.18.2/include/asm-i386) - gedit
File Edit View Search Tools Documents Help
New Open Save Print... Undo Redo Cut Copy Paste Find Replace

unistd.h
#define __NR_fchmodat 306
#define __NR_faccessat 307
#define __NR_pselect6 308
#define __NR_ppoll 309
#define __NR_unshare 310
#define __NR_set_robust_list 311
#define __NR_get_robust_list 312
#define __NR_splice 313
#define __NR_sync_file_range 314
#define __NR_tee 315
#define __NR_vmsplice 316
#define __NR_move_pages 317
#define __NR_mygetpid 318

#ifdef __KERNEL__

#define NR_syscalls 319

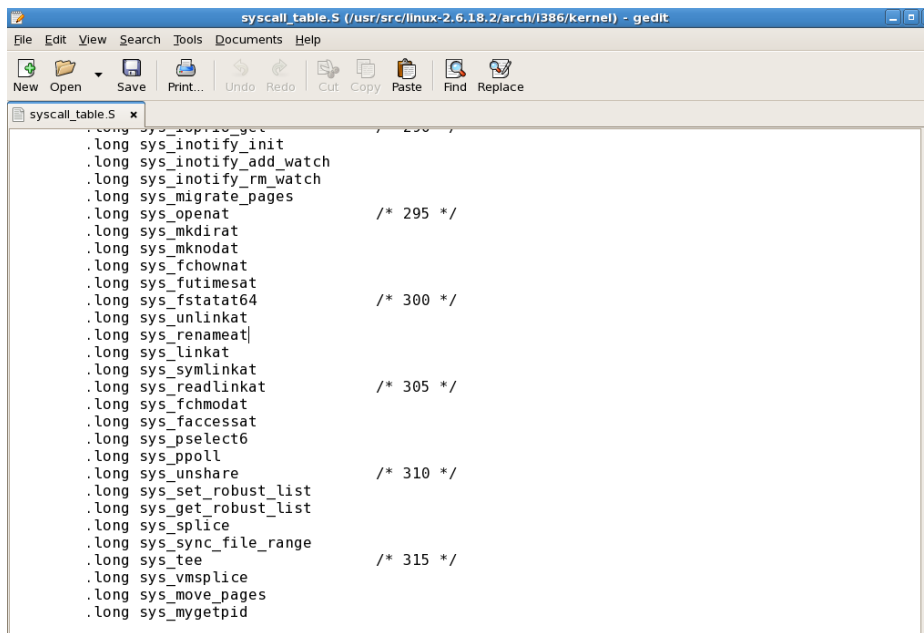
/*
 * user-visible error numbers are in the range -1 - -128: see
 * <asm-i386/errno.h>
 */
#define __syscall_return(type, res) \
do { \
    if ((unsigned long)(res) >= (unsigned long)(-(128 + 1))) { \
        errno = -(res); \
        res = -1; \
    } \
    return (type) (res); \
} while (0)

```

Task II.2 (20 points): Please report where you have added any file or have changed what files, and submit all the added files and the changed parts. You need to include everything that allows the TA to reproduce what you have.

Add the function “.long sys_mygetpid” at the end of the file,

/usr/src/linux-2.6.18.2/arch/i386/kernel/syscall_table.S



```

syscall_table.S (/usr/src/linux-2.6.18.2/arch/i386/kernel) - gedit
File Edit View Search Tools Documents Help
New Open Save Print... Undo Redo Cut Copy Paste Find Replace

syscall_table.S
.long sys_fchmodat
.long sys_fchmodat
.long sys_faccessat
.long sys_faccessat
.long sys_pselect6
.long sys_pselect6
.long sys_ppoll
.long sys_ppoll
.long sys_unshare
.long sys_unshare
.long sys_set_robust_list
.long sys_set_robust_list
.long sys_get_robust_list
.long sys_get_robust_list
.long sys_splice
.long sys_splice
.long sys_sync_file_range
.long sys_sync_file_range
.long sys_tee
.long sys_tee
.long sys_vmsplice
.long sys_vmsplice
.long sys_move_pages
.long sys_move_pages
.long sys_mygetpid

```

Add a new line “#define __NR_mygetpid 318”, after the last line in the list and subsequently update NR_syscalls by one i.e. “#define NR_syscalls 319” in the file,

/usr/src/linux-2.6.18.2/include/asm-i386/unistd.h

```

unistd.h (/usr/src/linux-2.6.18.2/include/asm-i386) - gedit
File Edit View Search Tools Documents Help
New Open Save Print... Undo Redo Cut Copy Paste Find Replace
unistd.h x
#define __NR_fchmodat 306
#define __NR_faccessat 307
#define __NR_pselect6 308
#define __NR_ppoll 309
#define __NR_unshare 310
#define __NR_set_robust_list 311
#define __NR_get_robust_list 312
#define __NR_splice 313
#define __NR_sync_file_range 314
#define __NR_tee 315
#define __NR_vmsplice 316
#define __NR_move_pages 317
#define __NR_mygetpid 318

#ifdef __KERNEL__
#define NR_syscalls 319
/*
 * user-visible error numbers are in the range -1 - -128: see
 * <asm-i386/errno.h>
 */
#define __syscall_return(type, res) \
do { \
    if ((unsigned long)(res) >= (unsigned long)(-128 + 1)) { \
        errno = -(res); \
        res = -1; \
    } \
    return (type) (res); \
} while (0)

```

Add the function below to the end of the file, /usr/src/linux-2.6.18.2/kernel/timer.c

```

asm__linkage long sys_mygetpid(void)
{
    printk("ISA673: mygetpid called");
    return current->pid;
}

```

```

timer.c (/usr/src/linux-2.6.18.2/kernel) - gedit
File Edit View Search Tools Documents Help
New Open Save Print... Undo Redo Cut Copy Paste Find Replace
timer.c x
unsigned long timeout = msecs_to_jiffies(msecs) + 1;
while (timeout)
    timeout = schedule_timeout_uninterruptible(timeout);
}

EXPORT_SYMBOL(msleep);

/**
 * msleep_interruptible - sleep waiting for signals
 * @msecs: Time in milliseconds to sleep for
 */
unsigned long msleep_interruptible(unsigned int msecs)
{
    unsigned long timeout = msecs_to_jiffies(msecs) + 1;

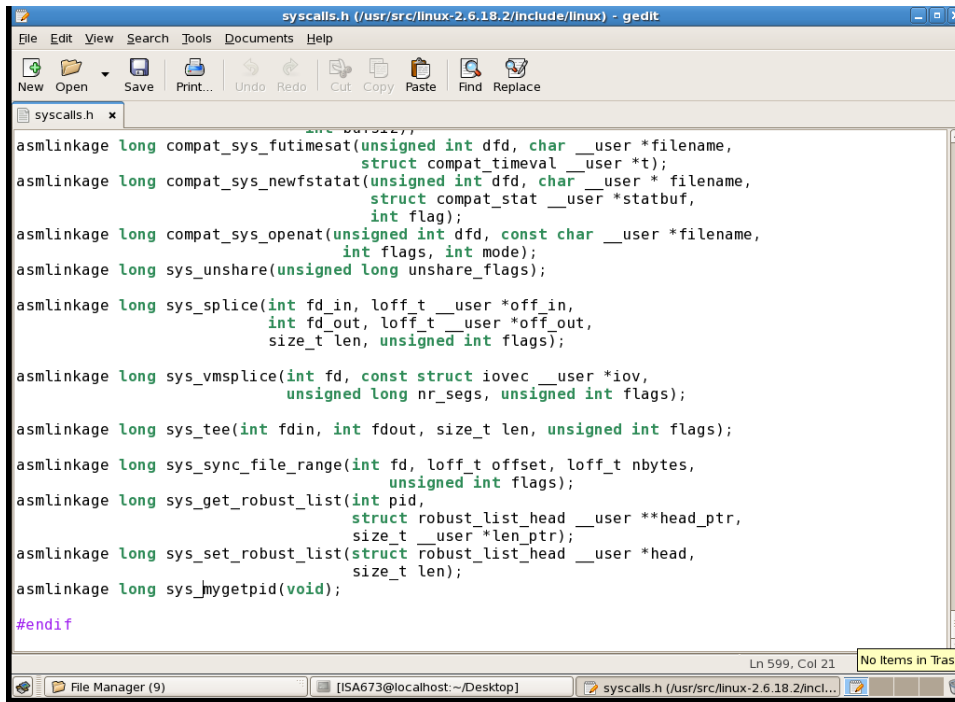
    while (timeout && !signal_pending(current))
        timeout = schedule_timeout_interruptible(timeout);
    return jiffies_to_msecs(timeout);
}

EXPORT_SYMBOL(msleep_interruptible);

asm__linkage long sys_mygetpid(void)
{
    printk("ISA673: mygetpid called");
    return current->tid;
}

```

Add the line “asmlinkage long sys_mygetpid(void)” at the end of the file
/usr/src/linux-2.6.18.2/include/linux/syscalls.h



```
asmlinkage long compat_sys_futimesat(unsigned int dfd, char __user *filename,
                                     struct compat_timeval __user *t);
asmlinkage long compat_sys_newfstatat(unsigned int dfd, char __user * filename,
                                     struct compat_stat __user *statbuf,
                                     int flag);
asmlinkage long compat_sys_openat(unsigned int dfd, const char __user *filename,
                                  int flags, int mode);
asmlinkage long sys_unshare(unsigned long unshare_flags);

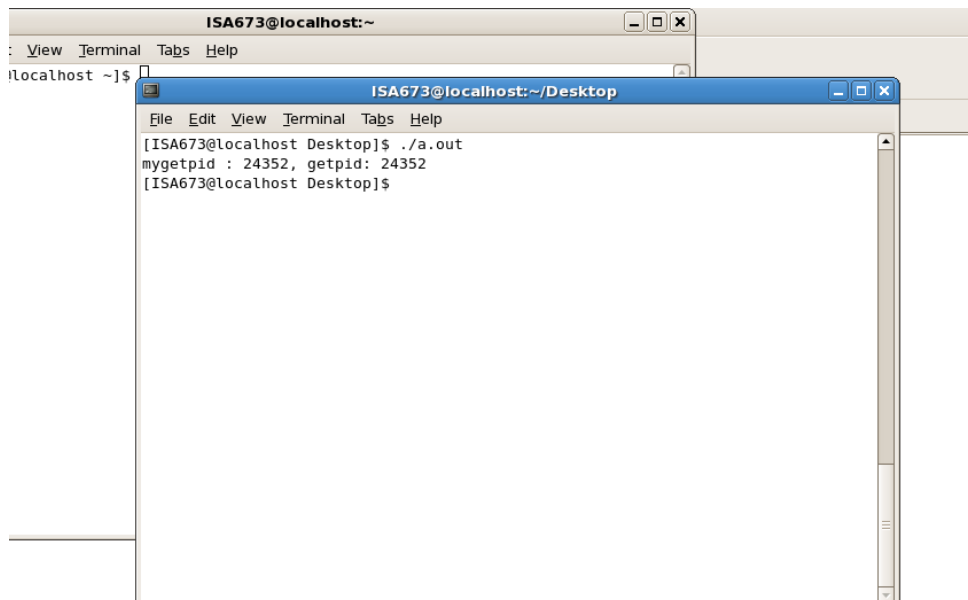
asmlinkage long sys_splice(int fd_in, loff_t __user *off_in,
                           int fd_out, loff_t __user *off_out,
                           size_t len, unsigned int flags);

asmlinkage long sys_vmsplice(int fd, const struct iovec __user *iov,
                              unsigned long nr_segs, unsigned int flags);

asmlinkage long sys_tee(int fdin, int fdout, size_t len, unsigned int flags);
asmlinkage long sys_sync_file_range(int fd, loff_t offset, loff_t nbytes,
                                     unsigned int flags);
asmlinkage long sys_get_robust_list(int pid,
                                     struct robust_list_head __user **head_ptr,
                                     size_t __user *len_ptr);
asmlinkage long sys_set_robust_list(struct robust_list_head __user *head,
                                     size_t len);
asmlinkage long sys_mygetpid(void);

#endif
```

Run the ‘syscall-test.c’ file provided by the professor and it will give this output



```
ISA673@localhost:~
: View Terminal Tabs Help
localhost ~]$

ISA673@localhost:~/Desktop
[ISA673@localhost Desktop]$ ./a.out
mygetpid : 24352, getpid: 24352
[ISA673@localhost Desktop]$
```

Task II.3 (20 points): Show the kernel message by running `dmesg` from a terminal, take a screenshot and submit the screenshot.

