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Basic Shell Commands and Text Manipulation Tools



To do - You are currently the root user in your terminal. Before proceeding further, type **exit** and hit the `↵ Enter` key.

Use of Basic Shell Commands

The stty Command

Using this command with the **-a** switch allows you to identify which combination of keys should be used to control a foreground process:

```
trainee@debian8:~$ stty -a
speed 38400 baud; rows 23; columns 80; line = 0;
intr = ^C; quit = ^\; erase = ^?; kill = ^U; eof = ^D; eol = <undef>;
eol2 = <undef>; swch = <undef>; start = ^Q; stop = ^S; susp = ^Z; rprnt = ^R;
werase = ^W; lnext = ^V; flush = ^O; min = 1; time = 0;
-parenb -parodd -cmspar cs8 -hupcl -cstopb cread -clocal -crtscts
-ignbrk -brkint -ignpar -parmrk -inpck -istrip -inlcr -igncr icrnl ixon -ixoff
-iuclc -ixany -imaxbel -iutf8
opost -olcuc -ocrnl onlcr -onocr -onlret -ofill -ofdel nl0 cr0 tab0 bs0 vt0 ff0
isig icanon iexten echo echoe echok -echonl -noflsh -xcase -tostop -echopr
echoctl echoke
```



The two most important combinations are **intr = ^C** and **susp = ^Z**. The former kills the



process whilst the latter suspends its execution.

Command Line Switches



To do : Use the **-help** option of the **stty** command to view the command line switches.

The date command

This command's output gives the current system date and time. The command can also be used to set the system date:

```
trainee@debian8:~$ date  
Fri 19 Aug 04:44:26 BST 2016
```

Command Line Switches



To do : Use the **-help** option of the **date** command to view the command line switches.

The who Command

This command's output shows who is currently connected to the system:

```
trainee@debian8:~$ who
```

```
trainee pts/0          2016-08-18 23:33 (10.0.2.2)
```

Command Line Switches



To do : Use the **-help** option of the **who** command to view the command line switches.

The df Command

This command's output shows the free space on each mounted block device:

```
trainee@debian8:~$ df
Filesystem      1K-blocks    Used Available Use% Mounted on
/dev/sda1       9947060 3386724   6031956  36% /
udev            10240         0     10240   0% /dev
tmpfs           101256     4796     96460   5% /run
tmpfs           253132         0     253132  0% /dev/shm
tmpfs           5120         4       5116   1% /run/lock
tmpfs           253132         0     253132  0% /sys/fs/cgroup
tmpfs           50628         0     50628  0% /run/user/1000
```

The units are shown as **blocks**. In order to **humanize** the output, it is possible to use the **-h** switch (also known as a **parameter, option** or **flag**):

```
trainee@debian8:~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/sda1       9.5G  3.3G  5.8G  36% /
udev            10M   0    10M   0% /dev
tmpfs           99M   4.7M  95M   5% /run
tmpfs           248M   0    248M  0% /dev/shm
tmpfs           5.0M  4.0K  5.0M  1% /run/lock
```

```
tmpfs          248M    0  248M   0% /sys/fs/cgroup
tmpfs          50M     0   50M   0% /run/user/1000
```

Command Line Switches



To do : Use the **-help** option of the **df** command to view the command line switches.

The free Command

This command's output shows the memory usage:

```
trainee@debian8:~$ free
              total        used         free       shared    buffers     cached
Mem:          506268      499724         6544         3048     125976     121412
-/+ buffers/cache:    252336       253932
Swap:        2046972         1756      2045216
```

The units are shown as **blocks**. In order to **humanize** the output, it is possible to use the **-h** switch:

```
trainee@debian8:~$ free -h
              total        used         free       shared    buffers     cached
Mem:           494M       488M         6.3M         3.0M       123M       118M
-/+ buffers/cache:    246M       247M
Swap:          2.0G         1.7M         2.0G
```

Command Line Switches





To do : Use the **-help** option of the **free** command to view the command line switches.

The whoami Command

This command's output indicates the user name associated with the current effective user ID:

```
trainee@debian8:~$ whoami
trainee
```

Now become the system administrator **root**:

```
trainee@debian8:~$ su -
Password: fenestros
root@debian8:~#
```



Important : Note that the password will not be visible.

Now use the **whoami** command again:

```
root@debian8:~# whoami
root
root@debian8:~#
```



Important : Note the current effective user ID is root.

Finally execute the **exit** command to return to **trainee**:

```
root@debian8:~# exit
logout
trainee@debian8:~
```

Command Line Switches



To do : Use the **-help** option of the **whoami** command to view the command line switches.

The pwd Command

This command's output shows the current working directory:

```
trainee@debian8:~$ pwd
/home/trainee
```

Command Line Switches



To do : Use the **help** command with **pwd** option to view the command line switches.

The cd Command

This command's output changes the current working directory to that specified by the **argument**:

```
trainee@debian8:~$ cd /tmp
trainee@debian8:/tmp$ pwd
/tmp
trainee@debian8:/tmp$
```

Command Line Switches



To do : Use the **help** command with **cd** option to view the command line switches.

The ls Command

This command's output lists information about the files in directory specified as an argument. If no argument is specified, the output lists the files in the current working directory:

```
trainee@debian8:/tmp$ ls
hsperfdata_root  inode  pulse-PKdhtXMmr18n
```

Command Line Switches



To do : Use the **-help** option of the **ls** command to view the command line switches.

The lsof Command

This command's output shows information about open files:

```
trainee@debian8:/tmp$ su -
Password: fenestros
root@debian8:~# lsof | more
COMMAND      PID   TID     USER   FD      TYPE          DEVICE  SIZE/OFF      NODE NAME
systemd       1     root   cwd     DIR        8,1       4096          2 /
systemd       1     root   rtd     DIR        8,1       4096          2 /
systemd       1     root   txt     REG        8,1    1309064      26423 /lib/systemd/systemd
systemd       1     root   mem     REG        8,1     18640      26081 /lib/x86_64-linux-
gnu/libattr.so.1.1.0
systemd       1     root   mem     REG        8,1     14664      26064 /lib/x86_64-linux-
gnu/libdl-2.19.so
systemd       1     root   mem     REG        8,1    448440      26091 /lib/x86_64-linux-
gnu/libpcr.so.3.13.1
systemd       1     root   mem     REG        8,1     31784      26076 /lib/x86_64-linux-
gnu/librt-2.19.so
systemd       1     root   mem     REG        8,1     92888      26135 /lib/x86_64-linux-
gnu/libkmod.so.2.2.8
systemd       1     root   mem     REG        8,1     19016      26113 /lib/x86_64-linux-
gnu/libcap.so.2.24
systemd       1     root   mem     REG        8,1    113024      26093 /lib/x86_64-linux-
gnu/libaudit.so.1.0.0
systemd       1     root   mem     REG        8,1     64024      26096 /lib/x86_64-linux-
gnu/libpam.so.0.83.1
systemd       1     root   mem     REG        8,1    142728      26137 /lib/x86_64-linux-
gnu/libselinux.so.1
systemd       1     root   mem     REG        8,1   1738176      26061 /lib/x86_64-linux-
gnu/libc-2.19.so
systemd       1     root   mem     REG        8,1    137440      26041 /lib/x86_64-linux-
gnu/libpthread-2.19.so
```

```
systemd      1          root mem      REG          8,1  140928    26058 /lib/x86_64-linux-  
gnu/ld-2.19.so  
systemd      1          root 0u        CHR          1,3    0t0      5593 /dev/null  
systemd      1          root 1u        CHR          1,3    0t0      5593 /dev/null  
systemd      1          root 2u        CHR          1,3    0t0      5593 /dev/null  
systemd      1          root 3w        CHR          1,11   0t0      5599 /dev/kmsg  
systemd      1          root 4u       0000         0,9      0       5589 anon_inode  
systemd      1          root 5u       0000         0,9      0       5589 anon_inode  
systemd      1          root 6r        DIR          0,20    0         1 /sys/fs/cgroup/systemd  
--More--
```

Command Line Switches



To do : Use the **-help** option of the **lsdf** command to view the command line switches.

The touch Command

This command updates the access and modification times of one or several file(s) to the current time. If the file does not exist, the system creates an empty file:

```
root@debian8:~# exit  
logout  
trainee@debian8:/tmp$ touch test  
trainee@debian8:/tmp$ ls  
hsperfdata_root  inode  pulse-PKdhtXMmr18n  test
```

Command Line Switches



To do : Use the **-help** option of the **touch** command to view the command line switches.

The echo Command

This command writes the arguments to the standard output (i.e. the screen):

```
trainee@debian8:/tmp$ echo fenestros
fenestros
```

Command Line Switches



To do : Use the **help** command with **echo** option to view the command line switches.

The cp Command

This command is used to copy a source to a destination or multiple sources to a directory:

```
trainee@debian8:/tmp$ cp test ~
trainee@debian8:/tmp$ ls -l ~
total 36
drwxr-xr-x 2 trainee trainee 4096 May  1 20:42 Desktop
drwxr-xr-x 2 trainee trainee 4096 May  1 20:42 Documents
drwxr-xr-x 2 trainee trainee 4096 May  1 20:42 Downloads
```

```
drwxr-xr-x 2 trainee trainee 4096 May  1 20:42 Music
drwxr-xr-x 2 trainee trainee 4096 May  1 20:42 Pictures
drwxr-xr-x 2 trainee trainee 4096 May  1 20:42 Public
drwxr-xr-x 2 trainee trainee 4096 May  1 20:42 Templates
-rw-r--r-- 1 trainee trainee    0 Aug 19 16:14 test
drwxr-xr-x 2 trainee trainee 4096 May  1 20:42 Videos
-rw-r--r-- 1 trainee trainee  391 Aug 18 23:34 vitext
```



Note the use of the ~ (tilde) character which is a shortcut to the current user's home directory. In the case of this example : **/home/trainee**.

Command Line Switches



To do : Use the **-help** option of the **cp** command to view the command line switches.

The file Command

This command determines a file type:

```
trainee@debian8:/tmp$ file ~/test
/home/trainee/test: empty
```



Important - Note that in the case of the first line of the above output, the command **file** is incapable of informing you of the type of file since **test** is empty.

Using the `>` key, redirect the output of **echo fenestros** into the **/home/trainee/test** file as follows:

```
trainee@debian8:/tmp$ echo "fenestros" > ~/test
```

Now use the **file** command once again to determine the file type:

```
trainee@debian8:/tmp$ file ~/test
/home/trainee/test: ASCII text
```

Command Line Switches



To do : Use the **-help** option of the **file** command to view the command line switches.

The cat Command

This commands concatenate files, or standard input, to standard output. In the case of only one file as an argument, the effective result is to print the file contents to the screen:

```
trainee@debian8:/tmp$ cat ~/test
fenestros
```

Command Line Switches



To do : Use the **-help** option of the **cat** command to view the command line switches.

The mv Command

This command renames a source to a destination or moves sources to a directory:

```
trainee@debian8:/tmp$ mv ~/test .
trainee@debian8:/tmp$ ls -l ~
total 36
drwxr-xr-x 2 trainee trainee 4096 May  1 20:42 Desktop
drwxr-xr-x 2 trainee trainee 4096 May  1 20:42 Documents
drwxr-xr-x 2 trainee trainee 4096 May  1 20:42 Downloads
drwxr-xr-x 2 trainee trainee 4096 May  1 20:42 Music
drwxr-xr-x 2 trainee trainee 4096 May  1 20:42 Pictures
drwxr-xr-x 2 trainee trainee 4096 May  1 20:42 Public
drwxr-xr-x 2 trainee trainee 4096 May  1 20:42 Templates
drwxr-xr-x 2 trainee trainee 4096 May  1 20:42 Videos
-rw-r--r-- 1 trainee trainee  391 Aug 18 23:34 vitext
trainee@debian8:/tmp$ mv test TeSt
trainee@debian8:/tmp$ ls -l
total 16
drwxr-xr-x 2 root    root    4096 Aug 18 11:33 hsuperdata_root
drwxr-xr-x 2 root    root    4096 Aug 18 13:36 inode
drwx----- 2 root    root    4096 Aug 18 11:29 pulse-PKdhtXMmr18n
-rw-r--r-- 1 trainee trainee  10 Aug 19 16:20 TeSt
```



Note the use of the shortcut `.` which indicates the current working directory.

Command Line Switches





To do : Use the **-help** option of the **mv** command to view the command line switches.

The mkdir Command

This command creates the directory(ies) if it (they) does (do) not exist:

```
trainee@debian8:/tmp$ cd ~
trainee@debian8:~$ mkdir testdir
trainee@debian8:~$ ls
Desktop  Documents  Downloads  Music  Pictures  Public  Templates  testdir  Videos  vitext
```

Command Line Switches



To do : Use the **-help** option of the **mkdir** command to view the command line switches.

The rmdir Command

This command removes the directory(ies) if it (they) is (are) **empty**:

```
trainee@debian8:~$ rmdir testdir
trainee@debian8:~$ ls
Desktop  Documents  Downloads  Music  Pictures  Public  Templates  Videos  vitext
```

Command Line Switches



To do : Use the **-help** option of the **rmdir** command to view the command line switches.

The rm Command

This command removes a directory, empty or not, as well as files:

```
trainee@debian8:~$ mkdir testdir1
trainee@debian8:~$ cd /tmp
trainee@debian8:/tmp$ echo "fenestros" > TeSt
trainee@debian8:/tmp$ cd ~
trainee@debian8:~$ mv /tmp/TeSt ~/testdir1
trainee@debian8:~$ ls -lR testdir1/
testdir1/:
total 4
-rw-r--r-- 1 trainee trainee 10 Aug 19 17:01 TeSt
trainee@debian8:~$ rmdir testdir1/
rmdir: failed to remove 'testdir1/': Directory not empty
trainee@debian8:~$ rm -rf testdir1/
trainee@debian8:~$ ls
Desktop  Documents  Downloads  Music  Pictures  Public  Templates  Videos  vitext
```

Command Line Switches



To do : Use the **-help** option of the **rm** command to view the command line switches.

The sort Command

This command writes a sorted concatenation of all files to standard output:

```
trainee@debian8:~$ touch aac abc bca xyz
trainee@debian8:~$ ls
aac bca Documents Music Public Videos xyz
abc Desktop Downloads Pictures Templates vitext
trainee@debian8:~$ ls | sort
aac
abc
bca
Desktop
Documents
Downloads
Music
Pictures
Public
Templates
Videos
vitext
xyz
trainee@debian8:~$ ls | sort -r
xyz
vitext
Videos
Templates
Public
Pictures
Music
Downloads
Documents
Desktop
```

```
bca  
abc  
aac
```



Important - Note the use of the | character, called a **pipe**. A pipe is used to channel the standard output of the command that precedes it into the standard input of the command that follows it.

Command Line Switches



To do : Use the **-help** option of the **sort** command to view the command line switches.

The more Command

This command is used to display a long file page by page:

```
trainee@debian8:~$ more /etc/services  
# Network services, Internet style  
#  
# Note that it is presently the policy of IANA to assign a single well-known  
# port number for both TCP and UDP; hence, officially ports have two entries  
# even if the protocol doesn't support UDP operations.  
#  
# Updated from http://www.iana.org/assignments/port-numbers and other  
# sources like http://www.freebsd.org/cgi/cvsweb.cgi/src/etc/services .  
# New ports will be added on request if they have been officially assigned
```

```
# by IANA and used in the real-world or are needed by a debian package.
# If you need a huge list of used numbers please install the nmap package.

tcpmux      1/tcp          # TCP port service multiplexer
echo        7/tcp
echo        7/udp
discard     9/tcp          sink null
discard     9/udp          sink null
systat      11/tcp          users
daytime     13/tcp
daytime     13/udp
netstat     15/tcp
qotd        17/tcp          quote
msp         18/tcp          # message send protocol
--More-- (4%)
```



Important - The `↵ Enter` key scrolls down line by line, the `Space Bar` key scrolls down page by page and the `Q` key comes back to the command line prompt.

Command Line Switches



To do : Use the `-help` option of the `more` command to view the command line switches.

The less Command

The `less` command produces a similar result to that of the `more` command. Practice using the less command and refer to the help using `less -help`.

Which command seems the most powerful and versatile ?

```
trainee@debian8:~$ less /etc/services
# Network services, Internet style
#
# Note that it is presently the policy of IANA to assign a single well-known
# port number for both TCP and UDP; hence, officially ports have two entries
# even if the protocol doesn't support UDP operations.
#
# Updated from http://www.iana.org/assignments/port-numbers and other
# sources like http://www.freebsd.org/cgi/cvsweb.cgi/src/etc/services .
# New ports will be added on request if they have been officially assigned
# by IANA and used in the real-world or are needed by a debian package.
# If you need a huge list of used numbers please install the nmap package.

tcpmux      1/tcp                # TCP port service multiplexer
echo        7/tcp
echo        7/udp
discard     9/tcp                sink null
discard     9/udp                sink null
systat      11/tcp                users
daytime     13/tcp
daytime     13/udp
netstat     15/tcp
qotd        17/tcp                quote
msp         18/tcp                # message send protocol
/etc/services
```

Command Line Switches



To do : Use the **-help** option of the **less** command to view the command line switches.

The find Command

This command is used to search for a specific file or directory. The default path is the **current directory** and default expression is **-print**:

```
trainee@debian8:~$ find acc
find: `acc': No such file or directory
trainee@debian8:~$ find aac
aac
```



Important : Note that when the file cannot be found, the find command informs you clearly. However when the file is found, the find command just prints the name of the file to standard output.

Command Line Switches



To do : Use the **-help** option of the **find** command to view the command line switches.

The su Command

This command is used to change the effective user id and group id to that of the user passed as an argument. When executed with no argument, the system assumes the destination user is **root**:

```
trainee@debian8:~$ su -
Password: fenestros
```

Command Line Switches



To do : Use the **-help** option of the **su** command to view the command line switches.

The updatedb and locate Commands

The **locate** command is used to list files in databases that match a pattern supplied as an argument to the command. The **locate** command uses a database. This database needs to be created using the **updatedb** command before using the **locate** command.

The default database is **/var/lib/mlocate/mlocate.db**:

```
root@debian8:~# ls -l /var/lib/mlocate/mlocate.db
-rw-r----- 1 root mlocate 2067895 Aug 19 07:35 /var/lib/mlocate/mlocate.db
```

The **updatedb** command is configured by editing the **/etc/updatedb.conf** file:

```
root@debian8:~# cat /etc/updatedb.conf
PRUNE_BIND_MOUNTS="yes"
# PRUNENAMES=".git .bzip .hg .svn"
PRUNEPATHS="/tmp /var/spool /media"
PRUNEFSS="NFS nfs nfs4 rpc_pipefs afs binfmt_misc proc smbfs autofs iso9660 ncpfs coda devpts ftpfs devfs mfs shfs
sysfs cifs lustre tmpfs usbfs udf fuse.glusterfs fuse.sshfs curlftpfs"
```

Use of these two commands is very simple:

```
root@debian8:~# updatedb
root@debian8:~# locate aac
/home/trainee/aac
/lib/modules/3.16.0-4-amd64/kernel/drivers/scsi/aacraid
/lib/modules/3.16.0-4-amd64/kernel/drivers/scsi/aacraid/aacraid.ko
```

```
/usr/lib/x86_64-linux-gnu/libaacs.so.0
/usr/lib/x86_64-linux-gnu/libaacs.so.0.4.1
/usr/share/doc/libaacs0
/usr/share/doc/libaacs0/KEYDB.cfg.gz
/usr/share/doc/libaacs0/changelog.Debian.amd64.gz
/usr/share/doc/libaacs0/changelog.Debian.gz
/usr/share/doc/libaacs0/changelog.gz
/usr/share/doc/libaacs0/copyright
/usr/share/mime/audio/aac.xml
/var/cache/apt/archives/libaacs0_0.7.1-1+b1_amd64.deb
/var/lib/dpkg/info/libaacs0:amd64.list
/var/lib/dpkg/info/libaacs0:amd64.md5sums
/var/lib/dpkg/info/libaacs0:amd64.postinst
/var/lib/dpkg/info/libaacs0:amd64.postrm
/var/lib/dpkg/info/libaacs0:amd64.shlibs
```

Command Line Switches



To do : Use the **-help** option of the **updatedb** and **locate** commands to view their command line switches.

The whereis Command

This command is used to show the full paths of the executable, the configuration files and the manuals associated with the argument:

```
root@debian8:~# whereis passwd
passwd: /usr/bin/passwd /etc/passwd /usr/share/man/man1/passwd.1ssl.gz /usr/share/man/man1/passwd.1.gz
/usr/share/man/man5/passwd.5.gz
```

Command Line Switches



To do : Use the **-help** option of the **whereis** command to view the command line switches.

The which Command

This command searches the PATH variable and returns to standard output the first full path associated with the argument:

```
root@debian8:~# which passwd
/usr/bin/passwd
```

Command Line Switches



To do : Use the **-help** option of the **which** command to view the command line switches.

The uptime Command

This command prints to standard output the current time, the length of time the system has been up, the number of users on the system and the average number of jobs in the run queue over the last 1, 5 and 15 minutes:

```
root@debian8:~# uptime
18:02:14 up 1 day, 6:33, 1 user, load average: 0.00, 0.01, 0.05
```

Command Line Switches

The switches associated with this command are:



To do : Use the **-help** option of the **uptime** command to view the command line switches.

The w Command

This command outputs the same data as the **uptime** command on the first line and then complements this information with the details of each user connected to the system, including what each user is currently doing. This is the replacement under Linux for the Unix command **whodo**:

```
root@debian8:~# w
18:11:31 up 1 day, 6:42, 1 user, load average: 0.00, 0.01, 0.05
USER      TTY      FROM          LOGIN@   IDLE   JCPU   PCPU WHAT
trainee   pts/0    10.0.2.2      14:16    0.00s  0.13s  0.03s sshd: trainee [priv]
```

The JCPU time is the time used by all processes attached to the tty. It does not include past background jobs, but does include currently running background jobs.

The PCPU time is the time used by the current process, named in the **what** field.

Command Line Switches



To do : Use the **-help** option of the **w** command to view the command line switches.

The uname Command

This command prints system information to the standard output:

```
root@debian8:~# uname -a
Linux debian8 3.16.0-4-amd64 #1 SMP Debian 3.16.7-ckt25-2 (2016-04-08) x86_64 GNU/Linux
root@debian8:~# uname -s
Linux
root@debian8:~# uname -n
debian8
root@debian8:~# uname -r
3.16.0-4-amd64
root@debian8:~# uname -v
#1 SMP Debian 3.16.7-ckt25-2 (2016-04-08)
root@debian8:~# uname -m
x86_64
root@debian8:~# uname -p
unknown
root@debian8:~# uname -i
unknown
root@debian8:~# uname -o
GNU/Linux
```

Command Line Switches



To do : Use the **-help** option of the **uname** command to view the command line switches.

The du Command

This command summarizes disk usage of each file, recursively for directories:

```
root@debian8:~# du -sh /* 2>/dev/null
12M /bin
31M /boot
0 /dev
6.9M /etc
1.9M /home
0 /initrd.img
207M /lib
4.0K /lib64
16K /lost+found
8.0K /media
4.0K /mnt
152M /opt
0 /proc
59M /root
4.7M /run
8.5M /sbin
4.0K /srv
0 /sys
100K /tmp
2.0G /usr
767M /var
0 /vmlinuz
```



Important : Note the use of the **2>/dev/null** redirection. This sends all eventual errors in the **file descriptor** 2 directly to **/dev/null** so that they do not appear in the output. File descriptors are covered in the **The Command Line Interface** unit.

Command Line Switches



To do : Use the **-help** option of the **du** command to view the command line switches.

The clear Command

This command is used to clear the current screen of the terminal:

```
root@debian8:~# clear
root@debian8:~#
```

The exit Command

This command exits the current shell:

```
root@debian8:~# exit
logout
trainee@debian8:~$
```

Command Line Switches



To do : Use the **help** command with **exit** option to view the command line switches.

The logout Command

This command logs out a user from a login shell writing the utmp and wtmp entries in the log files.

Command Line Switches



To do : Use the **help** command with **logout** option to view the command line switches.

The sleep Command

This command pauses for a number seconds. The number is specified as the first argument.

Command Line Switches



To do : Use the **-help** option of the **sleep** command to view the command line switches.

The wall Command

When using Debian 8, wall displays a message, or the contents of a file, or otherwise its standard input, on the terminals of all currently logged in users. The command will wrap lines that are longer than 79 characters. Short lines are whitespace padded to have 79 characters. The command will always put a carriage return and new line at the end of each line. Only the superuser can write on the terminals of users who have chosen to deny messages or are using a program which automatically denies messages. Reading from a file is refused when the invoker is not superuser and the program is suid or sgid.

Start a second session as trainee via ssh on your VM. Return to your first session as root and type :

```
trainee@debian8:~$ su -  
Password: fenestros  
root@debian8:~# wall this is a message from root  
Broadcast message from trainee@debian8 (pts/0) (Sat Aug 20 03:23:20 2016):  
this is a message from root  
root@debian8:~#
```

In the second session you should see the following message :

```
Broadcast message from trainee@debian8 (pts/0) (Sat Aug 20 03:23:20 2016):  
this is a message from root
```

The seq Command

The **seq** command prints numbers from FIRST to LAST, in steps of INCREMENT:

- seq [OPTION]... LAST
- seq [OPTION]... FIRST LAST
- seq [OPTION]... FIRST INCREMENT LAST

For example :

```
root@debian8:~# seq 10  
1  
2  
3  
4  
5  
6  
7  
8
```

```
9
10
root@debian8:~# seq 20 30
20
21
22
23
24
25
26
27
28
29
30
root@debian8:~# seq 20 10 90
20
30
40
50
60
70
80
90
root@debian8:~#
```

Command Line Switches



To do : Use the **-help** option of the **seq** command to view the command line switches.

The screen Command

Screen is a full-screen window manager that multiplexes a physical terminal between several processes (typically interactive shells). Each virtual terminal provides the functions of a DEC VT100 terminal and, in addition, several control functions from the ISO 6429 (ECMA 48, ANSI X3.64) and ISO 2022 standards (e.g. insert/delete line and support for multiple character sets). There is a scrollback history buffer for each virtual terminal and a copy-and-paste mechanism that allows moving text regions between windows.

The screen command is not installed by default under Debian 8, Ubuntu 16.04 LTS and RHEL/CentOS 7. Use the appropriate package manager to install it:

```
root@debian8:~# which screen
root@debian8:~# apt-get install screen
Reading package lists... Done
Building dependency tree
Reading state information... Done
Suggested packages:
  iselect screenie byobu
The following NEW packages will be installed:
  screen
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 569 kB of archives.
After this operation, 930 kB of additional disk space will be used.
Get:1 http://ftp.fr.debian.org/debian/ jessie/main screen amd64 4.2.1-3+deb8u1 [569 kB]
Fetched 569 kB in 0s (3,163 kB/s)
Selecting previously unselected package screen.
(Reading database ... 82450 files and directories currently installed.)
Preparing to unpack .../screen_4.2.1-3+deb8u1_amd64.deb ...
Unpacking screen (4.2.1-3+deb8u1) ...
Processing triggers for systemd (215-17+deb8u4) ...
Processing triggers for install-info (5.2.0.dfsg.1-6) ...
Processing triggers for man-db (2.7.0.2-5) ...
Setting up screen (4.2.1-3+deb8u1) ...
Processing triggers for systemd (215-17+deb8u4) ...
```

```
root@debian8:~# which screen
/usr/bin/screen
```

Now press the **CTRL** and **A** keys, release the **A** key and press the **C** key in order to create a second **nested** screen.

To return to the first screen, use the **CTRL** **A** **A** keys. This allows you to toggle between the last two screens used.

To see the status of all active screens, use the **screen -ls** command:

```
root@debian8:~# screen -ls
There is a screen on:
      27309.mysession (20/08/16 04:20:08)      (Attached)
1 Socket in /var/run/screen/S-root.
```

Now enter the following commands:

```
root@debian8:~# sleep 9999 &
[1] 2941
root@debian8:~# jobs
[1]+  Running                  sleep 9999 &
root@debian8:~#
```

In order to detach the current screen press the **CTRL** and **A** keys, release the **A** key and press the **D** key:

```
root@debian8:~# screen -S mysession
[detached from 27309.mysession]
root@debian8:~#
```

To re-attach the screen, execute the following command:

```
root@debian8:~# screen -r
```

Using the jobs command, check if the process created by the sleep command is still running:unit

```
root@debian8:~# jobs
[1]+  Running                  sleep 9999 &
```

To move forward or backwards between screens press the **CTRL** and **A** keys, release the **A** key and press the **N** key or press the **CTRL** and **A** keys, release the **A** key and press the **P** key.

Once again detach the current screen by pressing the **CTRL** **A** keys, releasing the **A** key and then pressing **D**:

```
root@debian8:~# screen -S mysession
[detached from 27309.mysession] key
root@debian8:~#
```

Now create a new, non-nested screen:

```
root@debian8:~# screen -S mysession1
```

Use the **screen -ls** command to see what has happened:

```
root@debian8:~# screen -ls
There are screens on:
  10234.mysession1      (20/08/16 07:17:19)   (Attached)
  27309.mysession      (20/08/16 04:20:08)   (Detached)
2 Sockets in /var/run/screen/S-root.
```

To re-attach a specific screen, reference it by it's number:

```
root@debian8:~# screen -r 27309
```

Finally, check out what has happened:

```
root@debian8:~# sleep 9999 &
[1] 2941
root@debian8:~# jobs
```

```
[1]+  Running                  sleep 9999 &unit
root@debian8:~# jobs
[1]+  Running                  sleep 9999 &
root@debian8:~# screen -ls
There are screens on:
  10234.myssesion1            (20/08/16 07:17:20)    (Attached)
  27309.myssesion (20/08/16 04:20:09)    (Attached)
2 Sockets in /var/run/screen/S-root.
```

Command Line Switches



To do : Use the **-help** option of the **screen** command to view the command line switches.

Switches and Arguments

Switches under Linux can either be short or long. Several differences are important to note.

Firstly short options are generally preceded by a single dash -, whilst long options are preceded by a double dash - -.

An example is the help option used with most commands:

- -h
- -help

Secondly, Linux short switches can be combined whereas long switches cannot be combined. For example **ls -l -a -i** can also be written as **ls -lai**, **ls -lia** or **ls -ali**:

```
root@debian8:~# ls -lai /tmp
total 40
```

```
130564 drwxrwxrwt 10 root root 4096 Aug 20 09:17 .
      2 drwxr-xr-x 22 root root 4096 Aug  1 12:38 ..
130572 drwxrwxrwt  2 root root 4096 Aug 18 11:28 .font-unix
134332 drwxr-xr-x  2 root root 4096 Aug 18 11:33 hsperfdata_root
130570 drwxrwxrwt  2 root root 4096 Aug 18 11:28 .ICE-unix
140612 drwxr-xr-x  2 root root 4096 Aug 18 13:36 inode
140574 srw-----  1 root root    0 Aug 18 11:32 .java_pid1704
140611 srw-----  1 root root    0 Aug 18 11:33 .java_pid2098
134331 drwx-----  2 root root 4096 Aug 18 11:29 pulse-PKdhtXMmr18n
130573 drwxrwxrwt  2 root root 4096 Aug 18 11:28 .Test-unix
130569 drwxrwxrwt  2 root root 4096 Aug 18 11:28 .X11-unix
130571 drwxrwxrwt  2 root root 4096 Aug 18 11:28 .XIM-unix
root@debian8:~# ls -ali /tmp
total 40
130564 drwxrwxrwt 10 root root 4096 Aug 20 09:17 .
      2 drwxr-xr-x 22 root root 4096 Aug  1 12:38 ..
130572 drwxrwxrwt  2 root root 4096 Aug 18 11:28 .font-unix
134332 drwxr-xr-x  2 root root 4096 Aug 18 11:33 hsperfdata_root
130570 drwxrwxrwt  2 root root 4096 Aug 18 11:28 .ICE-unix
140612 drwxr-xr-x  2 root root 4096 Aug 18 13:36 inode
140574 srw-----  1 root root    0 Aug 18 11:32 .java_pid1704
140611 srw-----  1 root root    0 Aug 18 11:33 .java_pid2098
134331 drwx-----  2 root root 4096 Aug 18 11:29 pulse-PKdhtXMmr18n
130573 drwxrwxrwt  2 root root 4096 Aug 18 11:28 .Test-unix
130569 drwxrwxrwt  2 root root 4096 Aug 18 11:28 .X11-unix
130571 drwxrwxrwt  2 root root 4096 Aug 18 11:28 .XIM-unix
```

However **ls -l -all -inode** cannot be written **ls -l -allinode**:

```
root@debian8:~# ls -l --all --inode /tmp
total 40
130564 drwxrwxrwt 10 root root 4096 Aug 20 09:17 .
      2 drwxr-xr-x 22 root root 4096 Aug  1 12:38 ..
130572 drwxrwxrwt  2 root root 4096 Aug 18 11:28 .font-unix
```

```
134332 drwxr-xr-x  2 root root 4096 Aug 18 11:33 hperfdata_root
130570 drwxrwxrwt  2 root root 4096 Aug 18 11:28 .ICE-unix
140612 drwxr-xr-x  2 root root 4096 Aug 18 13:36 inode
140574 srw-----  1 root root    0 Aug 18 11:32 .java_pid1704
140611 srw-----  1 root root    0 Aug 18 11:33 .java_pid2098
134331 drwx-----  2 root root 4096 Aug 18 11:29 pulse-PKdhtXMmr18n
130573 drwxrwxrwt  2 root root 4096 Aug 18 11:28 .Test-unix
130569 drwxrwxrwt  2 root root 4096 Aug 18 11:28 .X11-unix
130571 drwxrwxrwt  2 root root 4096 Aug 18 11:28 .XIM-unix
```

```
root@debian8:~# ls -l --allinode /tmp
ls: unrecognized option '--allinode'
Try 'ls --help' for more information.
```



Important - You should **not** combine any short options that take an argument.

Manipulating Text Files

Text files play a very important role under Linux. For example, almost all configuration files are simple text files and being able to manipulate them is of great importance. Manipulating text files is essentially achieved by using **Regular Expressions**. There are two types of Regular Expressions:

- The IEEE POSIX Basic Regular Expressions (**BRE**) understood by the commands **vi**, **grep**, **expr** and **sed**,
- The IEEE POSIX Extended Regular Expressions (**ERE**) understood by the commands **egrep** (**grep -E**) and **awk**.

Regular Expressions

Regular Expressions use **Metacharacters**. Certain are common to both BREs and EREs:

Metacharacter	Description
<code>^string</code>	Match lines beginning with <i>string</i>
<code>string\$</code>	Match lines ending with <i>string</i>
<code>\Metacharacter</code>	Cancel any special effect associated with <i>Metacharacter</i>
<code>[string]</code>	Match any of the characters within <i>string</i>
<code>[^string]</code>	Exclude any of the characters in <i>string</i>
<code>.</code>	Match any character except when at the end of a line
<code>character*</code>	Match 0 or more occurrences of <i>character</i>
<code>\<</code>	Match <i>string</i> at the beginning of a word
<code>\></code>	Match <i>string</i> at the end of a word

BREs

Certain Metacharacters are specific to BREs:

Metacharacter	Description
<code>\{x,y\}</code>	Match from x to y occurrences of the preceding element
<code>\{x\}</code>	Match exactly x occurrences of the preceding element
<code>\{x,\}</code>	Match x or more occurrences of the preceding element
<code>\(BRE)</code>	Commit to memory the BRE
<code>\1</code>	Recall the first BRE committed to memory
<code>\2, \3 ...</code>	Recall the second BRE committed to memory, recall the third BRE committed to memory ...

EREs

Certain Metacharacters are specific to EREs:

Metacharacter	Description
<code>{x,y}</code>	Match from x to y occurrences of the preceding element
<code>{x}</code>	Match exactly x occurrences of the preceding element
<code>{x,}</code>	

Metacharacter	Description
?	Matches 0 or 1 occurrence of the preceding element
+	Matches 1 or more occurrence(s) of the preceding element
	Matches either the expression before or the expression after the operator
()	Combines the Regular Expressions between the parentheses

Text-search Utilities

The grep Command

The **grep** command can be used to find lines containing a string of characters in a group of files. The **-v** or **-invert-case** option can be stipulated to find lines that do **not** contain the specified string.

The grep command is case sensitive. The **-i** or **-ignore-case** option can be specified in order to use grep in a non case sensitive search.

The grep command can also use **BREs**.

Command Line Switches



To do : Use the **-help** option of the **grep** command to view the command line switches.

The egrep Command

The **egrep** command is identical to the **grep** command when used with the **-E** switch. Both can use EREs.

Command Line Switches



To do : Use the **-help** option of the **egrep** command to view the command line switches.

The fgrep Command

The **fgrep** command is identical to the **grep** command when used with the **-F** switch. Both have no knowledge of Regular Expressions.



To do : Use the **-help** option of the **fgrep** command to view the command line switches.

LAB #1 - Using grep, egrep and fgrep

Download the following file by clicking on it's title:

[greptest](#)

```
fenestr0S
fenestros
555-5555
f
.fenestros
.fe
£
```

Move the file to the **/tmp** directory:

```
root@debian8:~# mv /home/trainee/Downloads/greptest /tmp/greptest
```

Now use `grep` to search for lines containing at least one uppercase or lowercase letter:

```
root@debian8:~# grep '[a-zA-Z]' /tmp/greptest
fenestr0S
fenestros
f
.fenestros
.fe
```

Next use `grep` to search for lines containing at least one uppercase or lowercase letter or a number:

```
root@debian8:~# grep '[a-zA-Z0-9]' /tmp/greptest
fenestr0S
fenestros
555-5555
f
.fenestros
.fe
```

To search for the NNN-NNNN pattern where N is a number, use the following command:

```
root@debian8:~# grep '[0-9]\{3\}-[0-9]\{4\}' /tmp/greptest
555-5555
```

Lines containing just one character have that character both at the beginning (^) and at the end (\$) of the line:

```
root@debian8:~# grep '^.$' /tmp/greptest
f
£
```

To search for a line containing a special character such as `.`, that character needs to be preceded by `\`:

```
root@debian8:~# grep '^\. ' /tmp/greptest
.fenestros
.fe
```



The `grep` command can also be used to search for a string in all the files within a specific directory as follows **`grep -rnw 'directory' -e "pattern"`**. You can also search only within certain files by specifying the files extensions: **`grep -include={*.doc,*.xls} -rnw 'directory' -e "pattern"`**. Finally you can exclude certain file extensions as follows: **`grep -exclude=*.doc -rnw 'directory' -e "pattern"`**.

Download the following file by clicking on it's title:

[greptest](#)

```
# Starting comment
fenestr0S
fenestros
# Another comment
555-5555
f

.fenestros

.fe

£
# End comment
```

Move the file to the **/tmp** directory:

```
root@debian8:~# mv /home/trainee/Downloads/greptest /tmp/greptest
```

Now use the **grep** command with the **-E** switch to remove all the comments and empty lines:

```
root@debian8:~# grep -E -v '^(#|$)' /tmp/greptest
fenestr0S
fenestros
555-5555
f
.fenestros
.fe
£
```



The expression **'^(#|\$)'** matches all lines beginning with the **#** character OR all lines with zero characters between the start and the end of the line.

Now use the **egrep** command to do the same thing, this time redirecting the output to the file **/tmp/greptest1**:

```
root@debian8:~# egrep -v '^(#|$)' /tmp/greptest > /tmp/greptest1
root@debian8:~# cat /tmp/greptest1
fenestr0S
fenestros
555-5555
f
.fenestros
.fe
£
```



Important: The above command is very useful when you want to quickly ascertain which directives are active in a very long configuration file.

Download the following file by clicking on it's title:

[greptest](#)

```
# Starting comment
^ This line will be used to demonstrate the use of fgrep
fenestr0S
fenestros
# Another comment
555-5555
f

.fenestros

.fe

f
# End comment
```

Move the file to the **/tmp** directory:

```
root@debian8:~# mv /home/trainee/Downloads/greptest /tmp/greptest
```

Now use fgrep to match the line starting with the ^ character:

```
root@debian8:~# fgrep '^' /tmp/greptest
```

```
^ This line will be used to demonstrate the use of fgrep
```

Compare the above output to that when using the grep command:

```
root@debian8:~# grep '^' /tmp/greptest
# Starting comment
^ This line will be used to demonstrate the use of fgrep
fenestr0S
fenestros
# Another comment
555-5555
f

.fenestros

.fe

f
# End comment
```

As you can see, grep matched **every** line that had a *beginning*. In order to get the same result as the grep command, you need to use the following command:

```
root@debian8:~# grep '^\\^' /tmp/greptest
^ This line will be used to demonstrate the use of fgrep
```

The Stream Editor SED

sed is an abbreviation of *Stream Editor* and is a non-interactive text editor. sed's basic syntax is as follows:

```
sed [address] command [arguments] file
```

The specified commands are applied to each line in the file unless an *address* is specified. Sed prints all results to standard output and does not modify the source file. The address therefore specifies which lines are concerned by the command.

sed's addresses are as follows:

address	Matching lines
x	Line number x
\$	The last line of the file
/BRE/	Lines matching the specified BRE
x,y	From line x to line y
/ERb1/, /ERb2/	All lines from the first line that matches the first BRE to the first line that matches the second BRE

sed's commands are as follows:

command	Description
d	Do not show the matching line(s) on standard output
p	Show the matching line(s) on standard output
s	Do a substitution upon match
w	Write the matching line(s) to a file
=	Print the matching line's number
!	Exclude the line(s) matching the address

Command Line Switches



To do : Use the **-help** option of the **fgrep** command to view the command line switches.

LAB #2 - Using sed

Start by displaying the contents of the file **/etc/services** whilst inhibiting the display of the first 10 lines:

```
root@debian8:~# sed '1,10d' /etc/services | more
# If you need a huge list of used numbers please install the nmap package.

tcpmux      1/tcp          # TCP port service multiplexer
echo        7/tcp
echo        7/udp
discard     9/tcp          sink null
discard     9/udp          sink null
systat      11/tcp         users
daytime     13/tcp
daytime     13/udp
netstat     15/tcp
qotd        17/tcp         quote
msp         18/tcp         # message send protocol
msp         18/udp
chargen     19/tcp         ttytst source
chargen     19/udp         ttytst source
ftp-data    20/tcp
ftp         21/tcp
fsp         21/udp         fspd
ssh         22/tcp         # SSH Remote Login Protocol
ssh         22/udp
telnet      23/tcp
smtp        25/tcp         mail
--More--
```

Now display the same file without any commented lines:

```
root@debian8:~# sed '/^#/d' /etc/services | more

tcpmux      1/tcp          # TCP port service multiplexer
echo        7/tcp
echo        7/udp
discard     9/tcp          sink null
```

```
discard    9/udp      sink null
systat     11/tcp      users
daytime    13/tcp
daytime    13/udp
netstat    15/tcp
qotd       17/tcp      quote
msp        18/tcp      # message send protocol
msp        18/udp
chargen    19/tcp      ttytst source
chargen    19/udp      ttytst source
ftp-data   20/tcp
ftp        21/tcp
fsp        21/udp      fspd
ssh        22/tcp      # SSH Remote Login Protocol
ssh        22/udp
telnet     23/tcp
smtp       25/tcp      mail
time       37/tcp      timserver
--More--
```



Important: Note that the BRE is preceeded and followed by the / character.

Continue by trying to just display the first two lines of **/etc/passwd**:

```
root@debian8:~# sed '1,2p' /etc/passwd
root:x:0:0:root:/root:/bin/bash
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
```

```
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
...
```



Important: As you can see in the above output, the command used displays not only the first two lines but **also** the entire file. As a result the first two lines are displayed twice.

To force sed to **only** display the lines you specify, use the **-n** switch:

```
root@debian8:~# sed -n '1,2p' /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
```

Now you want to use sed to strip out the comments from **/etc/services** and save the result to **/tmp/sedtest** without displaying anything on standard output:

```
root@debian8:~# sed -n '/^#!/w /tmp/sedtest' /etc/services
root@debian8:~# more /tmp/sedtest

tcpmux      1/tcp          # TCP port service multiplexer
echo        7/tcp
echo        7/udp
discard     9/tcp          sink null
discard     9/udp          sink null
systat      11/tcp         users
daytime     13/tcp
daytime     13/udp
netstat     15/tcp
qotd        17/tcp         quote
```

```
msp      18/tcp      # message send protocol
msp      18/udp
chargen  19/tcp      ttytst source
chargen  19/udp      ttytst source
ftp-data 20/tcp
ftp      21/tcp
fsp      21/udp      fspd
ssh      22/tcp      # SSH Remote Login Protocol
ssh      22/udp
telnet   23/tcp
smtp     25/tcp      mail
time     37/tcp      timserver
--More-- (2%)
```



Important: In the above command, we start by matching all lines in the `/etc/services` file that start with a `#`. We then tell `sed` to write all non-matching lines to the file `/tmp/sedtest`.

Finally, create a file containing **user1,user2,user3**. Replace the commas by spaces:

```
root@debian8:~# echo "user1,user2,user3" > /tmp/sedtest1
root@debian8:~# cat /tmp/sedtest1 | sed 's/,/ /g'
user1 user2 user3
```



Important: The above `sed` command has the following format **s/what is to be replaced (character, string or BRE)/replacement/g**. The use of the **g** character forces `sed` to replace all occurrences that match. If **g** is not stipulated, only the first matching occurrence is replaced.

The Text Processor AWK

Presentation

The **awk** command acts as a **filter** and uses the following syntax:

```
awk [-F separator] '[condition] {action}' [file]
```

Field Separation

A file or a text stream is treated by awk as a sequence of records. By default each line is a record. Awk analyzes each record, separating that record into fields and then storing the record and fields in variables:

- \$0 contains the record,
- \$1 contains the first field,
- \$2 contains the second field,
- e.t.c.

Awk interprets a space as a separator between fields unless a different separator is specified with the **-F** option.

Awk then checks if the condition is met for each record and if so, executes the action.

For example, the following command takes the standard output of **ls -l** and prints fields 8, 3 and 4 to standard output:

```
root@debian8:~# ls -l | awk '{print $8 $3 $4}'
```

```
2016rootroot  
2016rootroot  
2016rootroot  
2016rootroot  
2016rootroot
```

Since there is no condition, the action is applied to every record.

To make the output easier to read, you can include spaces between each field:

```
root@debian8:~# ls -l | awk '{print $8 " " $3 " " $4}'
2016 root root
```

Conditions

A regular expression applied to a record

- Format:
 - /regular expression/ {action}
- Exemple:
 - /hello/ {print \$0}

A regular expression applied to a field

- Format:
 - \$n ~/regular expression/ {action}
 - \$n!~/regular expression/ {action}
- Examples:
 - \$1 ~/hello/ {print \$0}
 - \$1!~/hello/ {print \$0}

Comparisons

- Format:
 - `$n operator criteria {action}`
- Example:
 - `$1 > 20 {print $0}`

Operators

Operator	Condition
<	Less than
≤	Less than or equal to
==	Equal to
!=	Different
>	Greater than
≥	Greater than or equal to

Logical Operators

- Format:
 - `test1 logical operator test2 {action}`
- Example:
 - `$1 ~/hello/ && $2 > 20 {print $0}`

Operators

Operator	Condition
	OR
&&	AND
!	NO

Built-in Variables

- Format:
 - expression1, expression2 {instruction}
- Example:
 - NR==7, NR==10 {print \$0}

Variables

Variable	Description
NR	Total number of records
NF	Total number of fields
FILENAME	Name of current input file
FS	The field separator, by default a space or tab
RS	The record separator, by default newline
OFS	Output field separator, by default a space
ORS	Output record separator, by default newline
OFMT	Numeric output format, by default "%.6g"

Awk Scripts

To combine several *clauses* composed of *conditions* and *actions* in the same statement, it is advisable to create an *awk script*. Awk scripts are comprised of three sections:

- **BEGIN**
 - This section is executed once, prior to executing the body of the script
- **BODY**
 - This sections contains the clauses to be applied to each line
- **END**
 - This section is executed once, after executing the body of the script

For example:

```
root@debian8:~# cat > awkscript
BEGIN {
    print "List of the currently mounted file systems"
}
{print $0}
END {
    print "====="
}
[^\D]
```

Now apply the awk script to **/etc/fstab** :

```
root@debian8:~# awk -f awkscript /etc/fstab
List of the currently mounted file systems
# /etc/fstab: static file system information.
#
# Use 'blkid' to print the universally unique identifier for a
# device; this may be used with UUID= as a more robust way to name devices
# that works even if disks are added and removed. See fstab(5).
#
# <file system> <mount point> <type> <options> <dump> <pass>
# / was on /dev/sda1 during installation
UUID=4a230056-285f-42f4-bfe0-5a73dbc5b745 / ext4 errors=remount-ro 0 1
# swap was on /dev/sda5 during installation
UUID=da5a77e9-344d-42aa-aed6-a38d381ba436 none swap sw 0 0
/dev/sr0 /media/cdrom0 udf,iso9660 user,noauto 0 0
=====
```



Important: Note the use of the **-f** switch which instructs awk to use the script.

The printf function

The integrated function **printf** is used to format output and has the following syntax:

```
printf ("string",expression1,expression2,...,expressionn)
```

string contains as many formats as there are expressions.

Examples of formats commonly used are:

Format	Description
%30s	Displays a right-justified string of 30 characters
%-30s	Displays a left-justified string of 30 characters
%4d	Displays a right-justified decimal number of 4 digits
%-4d	Displays a left-justified decimal number of 4 digits

Control Statements

awk can use the following control statements:

if

```
if condition {  
    command  
    command  
    ...  
}  
  
else {
```

```
    command
    command
    ...
}
```

or:

```
if condition
    command
else
    command
```

for

```
for variable in list {
    command
    command
    ...
}
```

or:

```
for variable in list
    command
```

or in the case of a table:

```
for key in table {  
    print key , table[key]  
}
```

while

```
while condition {  
    command  
    command  
    ...  
}
```

do-while

```
do {  
    command  
    command  
    ...  
} while condition
```

Command Line Switches



To do : Use the **-help** option of the **awk** command to view the command line switches.

LAB #3 - Using awk

Download the file **sales.txt** by clicking on the title below:

[sales.txt](#)

```
# Fenestr0s.com
# Annual sales by French department
# 83
Desktops$100
Portables$50
Servers$21
Ipads$4

# 06
Desktops$99
Portables$60
Servers$8
Ipads$16

# 13
Desktops$130
Portables$65
Servers$12
Ipads$56
```

Now download the awk script **sales.awk** by clicking on the title below:

[sales.awk](#)

```
# BEGIN
BEGIN {
```

```
    FS="$@"
}
# TABLE
$1 !~ /^#/ && $1 !~ /^$/ {
    sales[$1]+=$2
}
# END
END {
    for (pc in sales)
        printf("PC Type :  %s \t Sales (06+13+83) : %10d\n",pc,sales[pc]);
}
```

This script contains 13 lines. The purpose of this script is to calculate the total number of computers sold in the three French departments from the data present in the **sales** file:

```
1 # BEGIN
2 BEGIN {
3     FS="$@"
4 }
5 # TABLE
6 $1 !~ /^#/ && $1 !~ /^$/ {
7     sales[$1]+=$2
8 }
9 # END
10 END {
11     for (pc in sales)
12         printf("PC Type :  %s \t Sales (06+13+83) : %10d\n",pc,sales[pc]);
13 }
```

It is important that you understand the key lines in the above script:

- Line **3**,
 - Defines a new field separator in a BEGIN section.

- Line **6**,
 - Discards all commented and empty lines.
- Line **7**,
 - The table's key is **\$1**, in other words the different types of computers. Against each key, the number of each type of computer sold is stored in **\$2**. The **+=** characters indicate that the value stored in **\$2** is incremental.
- Line **12**,
 - Uses `printf` to format the output of each line in the table.

Now execute the script and check the output is correct:

```
root@debian8:~# awk -f /home/trainee/Downloads/sales.awk /home/trainee/Downloads/sales.txt
PC Type : Portables      Sales (06+13+83) :      175
PC Type : Ipads          Sales (06+13+83) :       76
PC Type : Desktops      Sales (06+13+83) :     329
PC Type : Servers        Sales (06+13+83) :       41
```

Other Useful Commands

The `expand` Command

The **`expand`** command converts tabulations in a file to spaces and prints the results to `STDOUT`. With no file as an argument or with the `-` character as an argument, the command takes it's input from `STDIN`.

Download the following file:

[expand.txt](#)

```
un  deux    trois    quatre   cinq
```

```
un deux trois quatre cinq
```

Move the file to the /root folder:

```
root@debian8:~# mv /home/trainee/Downloads/expand.txt /root/expand
```

Use the **cat** command to view the contents of the file:

```
root@debian8:~# cat expand
un deux trois quatre cinq
```

Now use the **-vet** switches of the **cat** command to view the non-printable characters:

```
root@debian8:~# cat -vet expand
un^Ideux^Itrois^Iquatre^Icinq$
un^Ideux^Itrois^Iquatre^Icinq$
un^Ideux^Itrois^Iquatre^Icinq$
un^Ideux^Itrois^Iquatre^Icinq$
un^Ideux^Itrois^Iquatre^Icinq$
un^Ideux^Itrois^Iquatre^Icinq$
```

```
un^Ideux^Itrois^Iquatre^Icinq$  
un^Ideux^Itrois^Iquatre^Icinq$  
un^Ideux^Itrois^Iquatre^Icinq$  
un^Ideux^Itrois^Iquatre^Icinq$
```



Important : As you can see the tabulations are shown as `^I` and the end of each line as a `$`.

Now use the **expand** command to convert the tabulations into spaces and send the result to the **expand1** file:

```
root@debian8:~# expand expand > expand1
```

View the resulting **expand1** file with the **cat** command and the **-vet** switches:

```
root@debian8:~# cat -vet expand1  
un    deux    trois    quatre   cinq$  
un    deux    trois    quatre   cinq$
```



Important : As you can see, the tabulations have been changed into spaces.

Command Line Switches



To do : Use the **-help** option of the **expand** command to view the command line switches.

La Commande unexpand

The **expand** command converts spaces in a file to tabulations and prints the results to STDOUT. With no file as an argument or with the **-** character as an argument, the command takes it's input from STDIN.

Now use the **expand** command to convert the spaces in the **expand1** file into tabulations and send the result to the **expand2** file:

```
root@debian8:~# cat -vet expand1
un      deux      trois      quatre     cinq$
root@debian8:~# unexpand -a expand1 > expand2
root@debian8:~# cat -vet expand2
un^Ideux^Itrois^Iquatre^Icinq$
un^Ideux^Itrois^Iquatre^Icinq$
un^Ideux^Itrois^Iquatre^Icinq$
un^Ideux^Itrois^Iquatre^Icinq$
un^Ideux^Itrois^Iquatre^Icinq$
```

```
un^Ideux^Itrois^Iquatre^Icinq$  
un^Ideux^Itrois^Iquatre^Icinq$  
un^Ideux^Itrois^Iquatre^Icinq$  
un^Ideux^Itrois^Iquatre^Icinq$  
un^Ideux^Itrois^Iquatre^Icinq$
```



Important : Note that the spaces have been replaced by tabulations.

Command Line Switches



To do : Use the **-help** option of the **unexpand** command to view the command line switches.

The cut command

The cut command splits each line of a file into columns starting with column 1. Each column contains one character. The command can also be used to split lines into fields where the default separator is a tabulation. The default separator can be changed by using the **-d** switch.

Select the first 7 columns of the **/etc/passwd** file:

```
root@debian8:~# cut -c1-7 /etc/passwd  
root:x:  
daemon:  
bin:x:2  
sys:x:3  
sync:x:
```

```
games:x
man:x:6
lp:x:7:
mail:x:
news:x:
uucp:x:
proxy:x
www-dat
backup:
list:x:
irc:x:3
gnats:x
nobody:
systemd
systemd
systemd
systemd
trainee
sshd:x:
Debian-
message
statd:x
avahi-a
avahi:x
colord:
dnsmasq
speech-
pulse:x
rtkit:x
saned:x
usbmux:
lightdm
```

In order to select columns 1 to 5, columns 10 to 15 and columns 30 and higher, us the following command:

```
root@debian8:~# cut -c1-5,10-15,30- /etc/passwd
root:0:rootsh
daemon:1:da:/usr/sbin/nologin
bin:x:bin:/nologin
sys:x:sys:/nologin
sync:65534:/sync
games:60:ga:/usr/sbin/nologin
man:x2:man:./usr/sbin/nologin
lp:x:lp:/usr/sbin/nologin
mail:8:mailr/sbin/nologin
news:9:news:/usr/sbin/nologin
uucp::10:uuuucp:/usr/sbin/nologin
proxy3:13:p/sbin/nologin
www-dx:33:3r/www:/usr/sbin/nologin
backu34:34:ckups:/usr/sbin/nologin
list::38:Maager:/var/list:/usr/sbin/nologin
irc:x39:ircd:/usr/sbin/nologin
gnats1:41:Gting System (admin):/var/lib/gnats:/usr/sbin/nologin
nobod65534:nonexistent:/usr/sbin/nologin
systemd Time Synchronization,,,:/run/systemd:/bin/false
systemd Network Management,,,:/run/systemd/netif:/bin/false
systemd Resolver,,,:/run/systemd/resolve:/bin/false
systemd Bus Proxy,,,:/run/systemd:/bin/false
train:1000:./home/trainee:/bin/bash
sshd:4:6553hd:/usr/sbin/nologin
Debian:x:1pool/exim4:/bin/false
messaging:10n/dbus:/bin/false
statd07:655fs:/bin/false
avahi-autoipd:x autoip daemon,,,:/var/lib/avahi-autoipd:/bin/false
avahi09:115emon,,,:/var/run/avahi-daemon:/bin/false
color110:11r management daemon,,,:/var/lib/colord:/bin/false
dnsmasq:111:6,./var/lib/misc:/bin/false
speech-dispatcher:119emon,,,:/var/run/speech-dispatcher:/bin/sh
pulse13:119emon,,,:/var/run/pulse:/bin/false
```

```
rkit14:121,./proc:/bin/false
saned15:122ed:/bin/false
usbmu116:46,,./var/lib/usbmux:/bin/false
light:117:lay Manager:/var/lib/lightdm:/bin/false
```

In order to select the 2nd, 4th and 6th column, use the following command:

```
root@debian8:~# cut -d: -f2,4,6 /etc/passwd
x:0:/root
x:1:/usr/sbin
x:2:/bin
x:3:/dev
x:65534:/bin
x:60:/usr/games
x:12:/var/cache/man
x:7:/var/spool/lpd
x:8:/var/mail
x:9:/var/spool/news
x:10:/var/spool/uucp
x:13:/bin
x:33:/var/www
x:34:/var/backups
x:38:/var/list
x:39:/var/run/ircd
x:41:/var/lib/gnats
x:65534:/nonexistent
x:103:/run/systemd
x:104:/run/systemd/netif
x:105:/run/systemd/resolve
x:106:/run/systemd
x:1000:/home/trainee
x:65534:/var/run/sshd
x:110:/var/spool/exim4
x:111:/var/run/dbus
```

```
x:65534:/var/lib/nfs
x:113:/var/lib/avahi-autoipd
x:115:/var/run/avahi-daemon
x:117:/var/lib/colord
x:65534:/var/lib/misc
x:29:/var/run/speech-dispatcher
x:119:/var/run/pulse
x:121:/proc
x:122:/var/lib/saned
x:46:/var/lib/usbmux
x:124:/var/lib/lightdm
```



Important: Note the use of the **-d** switch to change the default separator.

Command Line Switches



To do : Use the **-help** option of the **cut** command to view the command line switches.

The uniq Command

The following command is used to extract the Primary Group GIDs from the **/etc/passwd** file:

```
root@debian8:~# cut -d: -f4 /etc/passwd | sort -n | uniq
0
1
2
```

```
3
7
8
9
10
12
13
29
33
34
38
39
41
46
60
103
104
105
106
110
111
113
115
117
119
121
122
124
1000
65534
```



Important: Note the use of the **uniq** command to remove duplicates from the list.

Command Line Switches



To do : Use the **-help** option of the **uniq** command to view the command line switches.

The tr Command

The **tr** command is used to substitute certain characters by other characters. This command **only** accepts data from standard input (hence the pipe):

```
root@debian8:~# cat /etc/passwd | tr "[a-z]" "[A-Z]"
ROOT:X:0:0:ROOT:/ROOT:/BIN/BASH
DAEMON:X:1:1:DAEMON:/USR/SBIN:/USR/SBIN/NOLOGIN
BIN:X:2:2:BIN:/BIN:/USR/SBIN/NOLOGIN
SYS:X:3:3:SYS:/DEV:/USR/SBIN/NOLOGIN
SYNC:X:4:65534:SYNC:/BIN:/BIN/SYNC
GAMES:X:5:60:GAMES:/USR/GAMES:/USR/SBIN/NOLOGIN
MAN:X:6:12:MAN:/VAR/CACHE/MAN:/USR/SBIN/NOLOGIN
LP:X:7:7:LP:/VAR/POOL/LPD:/USR/SBIN/NOLOGIN
MAIL:X:8:8:MAIL:/VAR/MAIL:/USR/SBIN/NOLOGIN
NEWS:X:9:9:NEWS:/VAR/POOL/NEWS:/USR/SBIN/NOLOGIN
UUCP:X:10:10:UUCP:/VAR/POOL/UUCP:/USR/SBIN/NOLOGIN
PROXY:X:13:13:PROXY:/BIN:/USR/SBIN/NOLOGIN
WWW-DATA:X:33:33:WWW-DATA:/VAR/WWW:/USR/SBIN/NOLOGIN
BACKUP:X:34:34:BACKUP:/VAR/BACKUPS:/USR/SBIN/NOLOGIN
LIST:X:38:38:MAILING LIST MANAGER:/VAR/LIST:/USR/SBIN/NOLOGIN
IRC:X:39:39:IRCD:/VAR/RUN/IRCD:/USR/SBIN/NOLOGIN
GNATS:X:41:41:GNATS BUG-REPORTING SYSTEM (ADMIN):/VAR/LIB/GNATS:/USR/SBIN/NOLOGIN
NOBODY:X:65534:65534:NOBODY:/NONEXISTENT:/USR/SBIN/NOLOGIN
SYSTEMD-TIMESYNC:X:100:103:SYSTEMD TIME SYNCHRONIZATION,,,:/RUN/SYSTEMD:/BIN/FALSE
SYSTEMD-NETWORK:X:101:104:SYSTEMD NETWORK MANAGEMENT,,,:/RUN/SYSTEMD/NETIF:/BIN/FALSE
SYSTEMD-RESOLVE:X:102:105:SYSTEMD RESOLVER,,,:/RUN/SYSTEMD/RESOLVE:/BIN/FALSE
```

```
SYSTEMD-BUS-PROXY:X:103:106:SYSTEMD BUS PROXY,,,:/RUN/SYSTEMD:/BIN/FALSE
TRAINEE:X:1000:1000:TRAINEE,,,:/HOME/TRAINEE:/BIN/BASH
SSHD:X:104:65534::/VAR/RUN/SSHD:/USR/SBIN/NOLOGIN
DEBIAN-EXIM:X:105:110::/VAR/SPool/EXIM4:/BIN/FALSE
MESSAGEBUS:X:106:111::/VAR/RUN/DBUS:/BIN/FALSE
STATD:X:107:65534::/VAR/LIB/NFS:/BIN/FALSE
AVAHI-AUTOIPD:X:108:113:AVAHI AUTOIP DAEMON,,,:/VAR/LIB/AVAHI-AUTOIPD:/BIN/FALSE
AVAHI:X:109:115:AVAHI MDNS DAEMON,,,:/VAR/RUN/AVAHI-DAEMON:/BIN/FALSE
COLORD:X:110:117:COLORD COLOUR MANAGEMENT DAEMON,,,:/VAR/LIB/COLORD:/BIN/FALSE
DNSSMASQ:X:111:65534:DNSSMASQ,,,:/VAR/LIB/MISC:/BIN/FALSE
SPEECH-DISPATCHER:X:112:29:SPEECH DISPATCHER,,,:/VAR/RUN/SPEECH-DISPATCHER:/BIN/SH
PULSE:X:113:119:PULSEAUDIO DAEMON,,,:/VAR/RUN/PULSE:/BIN/FALSE
RTKIT:X:114:121:REALTIMEKIT,,,:/PROC:/BIN/FALSE
SANED:X:115:122::/VAR/LIB/SANED:/BIN/FALSE
USBMUX:X:116:46:USBMUX DAEMON,,,:/VAR/LIB/USBMUX:/BIN/FALSE
LIGHTDM:X:117:124:LIGHT DISPLAY MANAGER:/VAR/LIB/LIGHTDM:/BIN/FALSE
```

Command Line Switches



To do : Use the **-help** option of the **tr** command to view the command line switches.

The paste Command

The **paste** command concatenates lines from n files. For example:

```
root@debian8:~# paste -d: /etc/passwd /etc/shadow
root:x:0:0:root:/root:/bin/bash:root:$6$jxZolPSj$yHWmlcj8imvAXDzAoxZG3KEILb3ITQJgTPhqqlsUqjIuUrfc5Yhzrfl9KrVARr16
U0MZWTdqhb.FaSSRpfRRC1:16922:0:99999:7:::
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin:daemon:*:16922:0:99999:7:::
```

```
bin:x:2:2:bin:/bin:/usr/sbin/nologin:bin:*:16922:0:99999:7:::
sys:x:3:3:sys:/dev:/usr/sbin/nologin:sys:*:16922:0:99999:7:::
sync:x:4:65534:sync:/bin:/bin/sync:sync:*:16922:0:99999:7:::
games:x:5:60:games:/usr/games:/usr/sbin/nologin:games:*:16922:0:99999:7:::
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin:man:*:16922:0:99999:7:::
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin:lp:*:16922:0:99999:7:::
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin:mail:*:16922:0:99999:7:::
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin:news:*:16922:0:99999:7:::
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin:uucp:*:16922:0:99999:7:::
proxy:x:13:13:proxy:/bin:/usr/sbin/nologin:proxy:*:16922:0:99999:7:::
www-data:x:33:33:www-data:/var/www:/usr/sbin/nologin:www-data:*:16922:0:99999:7:::
backup:x:34:34:backup:/var/backups:/usr/sbin/nologin:backup:*:16922:0:99999:7:::
list:x:38:38:Mailing List Manager:/var/list:/usr/sbin/nologin:list:*:16922:0:99999:7:::
irc:x:39:39:ircd:/var/run/ircd:/usr/sbin/nologin:irc:*:16922:0:99999:7:::
gnats:x:41:41:Gnats Bug-Reporting System (admin):/var/lib/gnats:/usr/sbin/nologin:gnats:*:16922:0:99999:7:::
nobody:x:65534:65534:nobody:/nonexistent:/usr/sbin/nologin:nobody:*:16922:0:99999:7:::
systemd-timesync:x:100:103:systemd Time Synchronization,,,:/run/systemd:/bin/false:systemd-
timesync:*:16922:0:99999:7:::
systemd-network:x:101:104:systemd Network Management,,,:/run/systemd/netif:/bin/false:systemd-
network:*:16922:0:99999:7:::
systemd-resolve:x:102:105:systemd Resolver,,,:/run/systemd/resolve:/bin/false:systemd-
resolve:*:16922:0:99999:7:::
systemd-bus-proxy:x:103:106:systemd Bus Proxy,,,:/run/systemd:/bin/false:systemd-bus-proxy:*:16922:0:99999:7:::
trainee:x:1000:1000:trainee,,,:/home/trainee:/bin/bash:trainee:$6$7S60reWb$t92JjORxWDcNyF.DtQVAotCxsWfRsvIQUaWj cN
fKX30oFh2GLX2dhtx.oeA0xEjqbff20Pb51VeVjBgwdPU4R0:16922:0:99999:7:::
sshd:x:104:65534::/var/run/sshd:/usr/sbin/nologin:sshd:*:16922:0:99999:7:::
Debian-exim:x:105:110::/var/spool/exim4:/bin/false:Debian-exim!:16922:0:99999:7:::
messagebus:x:106:111::/var/run/dbus:/bin/false:messagebus:*:16922:0:99999:7:::
statd:x:107:65534::/var/lib/nfs:/bin/false:statd:*:16922:0:99999:7:::
avahi-autoipd:x:108:113:Avahi autoip daemon,,,:/var/lib/avahi-autoipd:/bin/false:avahi-
autoipd:*:16922:0:99999:7:::
avahi:x:109:115:Avahi mDNS daemon,,,:/var/run/avahi-daemon:/bin/false:avahi:*:16922:0:99999:7:::
colord:x:110:117:colord colour management daemon,,,:/var/lib/colord:/bin/false:colord:*:16922:0:99999:7:::
dnsmasq:x:111:65534:dnsmasq,,,:/var/lib/misc:/bin/false:dnsmasq:*:16922:0:99999:7:::
```

```
speech-dispatcher:x:112:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/sh:speech-  
dispatcher:!:16922:0:99999:7:::  
pulse:x:113:119:PulseAudio daemon,,,:/var/run/pulse:/bin/false:pulse*:16922:0:99999:7:::  
rtkit:x:114:121:RealtimeKit,,,:/proc:/bin/false:rtkit*:16922:0:99999:7:::  
saned:x:115:122::/var/lib/saned:/bin/false:saned*:16922:0:99999:7:::  
usbmux:x:116:46:usbmux daemon,,,:/var/lib/usbmux:/bin/false:usbmux*:16922:0:99999:7:::  
lightdm:x:117:124:Light Display Manager:/var/lib/lightdm:/bin/false:lightdm*:16922:0:99999:7:::
```



Important: Note that you need to become root to be able to execute this command. The reason is that normal users do not have the right to read the **/etc/shadow** file.

Command Line Switches



To do : Use the **-help** option of the **paste** command to view the command line switches.

The split Command

The split command is used to divide a large file into smaller segments. Create an empty 250 MB file as follows:

```
root@debian8:~# dd if=/dev/zero of=/file bs=1024k count=250  
250+0 records in  
250+0 records out  
262144000 bytes (262 MB) copied, 0.57181 s, 458 MB/s
```

Now use the split command to divide the file into 5 smaller files each of 50:

```
root@debian8:~# split -b 50m /file filepart
root@debian8:~# ls -l | grep filepart
-rw-r--r-- 1 root root 52428800 Nov 30 18:41 filepartaa
-rw-r--r-- 1 root root 52428800 Nov 30 18:41 filepartab
-rw-r--r-- 1 root root 52428800 Nov 30 18:41 filepartac
-rw-r--r-- 1 root root 52428800 Nov 30 18:41 filepartad
-rw-r--r-- 1 root root 52428800 Nov 30 18:41 filepartae
```



Important: Note that the 5 files were created in the current working directory.

You can re-construct the original file by using the **cat** command:

```
root@debian8:~# cat fileparta* > newfile
root@debian8:~# ls -l | grep newf
-rw-r--r-- 1 root root 262144000 Nov 30 18:42 newfile
```

Command Line Switches



To do : Use the **-help** option of the **split** command to view the command line switches.

The diff Command

The diff command compares two files and indicates what changes need to be made to the first file in order that it be identical to the second file.

Copy the **/etc/passwd** file to the **/root** directory:

```
root@debian8:~# cp /etc/passwd /root
```

Edit the ***/root/passwd** file as shown:

```
...  
trainee10:x:1000:1000:trainee:/home/trainee:/bin/bash  
...
```

Delete the **lp** entry and add the following line to the end of **/root/passwd**:

```
...  
Linux is great!
```

Now compare the two files:

```
root@debian8:~# diff /etc/passwd /root/passwd  
8d7  
< lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin  
23c22  
< trainee:x:1000:1000:trainee,,,:/home/trainee:/bin/bash  
---  
> trainee10:x:1000:1000:trainee,,,:/home/trainee:/bin/bash  
37a37  
> Linux is great!
```

In this output you will notice the **<** and **>** characters. The first makes reference to the first file, **/etc/passwd**, whilst the second makes reference to the second file, **/root/passwd**.

The output **8d7** means that line 8 needs to be deleted in **/etc/passwd** because it is missing in **/root/passwd**.

The output **23c22** means that at line 23 in **/etc/passwd** needs to be modified in order to be the same as line 22 in **/root/passwd**.

The output **37a37** means that line 37 in **/root/passwd** needs to be added after line 37 in **/etc/passwd**.

Command Line Switches



To do : Use the **-help** option of the **diff** command to view the command line switches.

The cmp Command

The **cmp** command compares two files character by character. By default, the command stops after finding the first difference:

```
root@debian8:~# cmp /root/passwd /etc/passwd
/root/passwd /etc/passwd differ: byte 286, line 8
```

The **-l** switch shows all of the differences in a three column format:

```
root@debian8:~# cmp -l /root/passwd /etc/passwd | more
cmp: EOF on /root/passwd
286 155 154
287 141 160
288 151 72
289 154 170
291 170 67
293 70 67
295 70 154
296 72 160
297 155 72
298 141 57
299 151 166
300 154 141
301 72 162
303 166 163
304 141 160
```

```
305 162 157
306  57 157
307 155 154
308 141  57
309 151 154
310 154 160
311  72 144
312  57  72
--More--
```

The first column represents the character **number**, the second column represents the **ASCII octal value** of the character in the **/root/passwd** file and the third column represents the **ASCII octal value** of the character in the **/etc/passwd** file.

Command Line Switches



To do : Use the **-help** option of the **cmp** command to view the command line switches.

The patch Command

The **patch** command is used to apply modifications contained within a patch file to an older version of a file so that it becomes the newer version of the file.

If you recall, you made some changes to the original **greptest** file that you downloaded:

```
root@debian8:~# cat /tmp/greptest
# Starting comment
^ This line will be used to demonstrate the use of fgrep
fenestr0S
fenestros
```

```
# Another comment
555-5555
f

.fenestros

.fe

£
# End comment
```

You also used `egrep` to remove all the comments and empty lines and save the result to **/tmp/greptest1**:

```
[root@centos ~]# cat /tmp/greptest1
fenestr0S
fenestros
555-5555
f
.fenestros
.fe
£
```

Now create a patch file containing the modifications that need to be applied to `/tmp/greptest` in order for it to be identical to `/tmp/greptest1`:

```
root@debian8:~# cd /tmp
root@debian8:/tmp# diff -u greptest greptest1 > greptest.patch
```

A look at the patch file shows the changes that need to be made to the **greptest** file:

```
root@debian8:/tmp# cat /tmp/greptest.patch
--- greptest      2016-11-30 18:54:52.732000000 +0000
+++ greptest1    2016-11-30 18:55:28.392000000 +0000
@@ -1,14 +1,7 @@
-# Starting comment
```

```
- ^ This line will be used to demonstrate the use of fgrep
  fenestr0S
  fenestros
-# Another comment
  555-5555
  f
-
  .fenestros
-
  .fe
-
  £
-# End comment
```

Now apply the patch file:

```
root@debian8:/tmp# patch < greptest.patch
patching file greptest
```

Finally, check the contents of the patched **greptest** file:

```
root@debian8:/tmp# cat greptest
fenestr0S
fenestros
555-5555
f
.fenestros
.fe
£
```

Command Line Switches



To do : Use the **-help** option of the **patch** command to view the command line switches.

The strings Command

The **strings** command is used to extract any printable string in one or more object files or executables. An object file is an intermediary file used when compiling.

The format of an object file is **ELF** (Executable and Linkable Format). This same format is also used for:

- executables,
- shared libraries,
- core dumps.

The strings command is not installed by default in Debian 8 :

```
root@debian8:/tmp# apt-get install binutils
Reading package lists... Done
Building dependency tree
Reading state information... Done
Suggested packages:
  binutils-doc
The following NEW packages will be installed:
  binutils
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 3,516 kB of archives.
After this operation, 21.1 MB of additional disk space will be used.
Get:1 http://ftp.fr.debian.org/debian/ jessie/main binutils amd64 2.25-5 [3,516 kB]
Fetched 3,516 kB in 0s (7,674 kB/s)
Selecting previously unselected package binutils.
(Reading database ... 82508 files and directories currently installed.)
```

```
Preparing to unpack .../binutils_2.25-5_amd64.deb ...
Unpacking binutils (2.25-5) ...
Processing triggers for man-db (2.7.0.2-5) ...
Setting up binutils (2.25-5) ...
Processing triggers for libc-bin (2.19-18+deb8u4) ...
root@debian8:/tmp# which strings
/usr/bin/strings
```

Used as is, the command extracts all strings greater than 4 characters in length:

```
root@debian8:/tmp# strings /usr/bin/passwd | more
/lib64/ld-linux-x86-64.so.2
libpam.so.0
_ITM_deregisterTMCloneTable
__gmon_start__
_Jv_RegisterClasses
_ITM_registerTMCloneTable
pam_start
pam_strerror
pam_chauthtok
pam_end
libpam_misc.so.0
misc_conv
libaudit.so.1
_fini
_init
libselinux.so.1
is_selinux_enabled
security_getenforce
context_user_get
security_compute_av
matchpathcon
freecon
context_free
```

```
--More--
```

Print the offset within the file before each string:

```
root@debian8:/tmp# strings -t d /usr/bin/passwd | more
 568 /lib64/ld-linux-x86-64.so.2
3985 libpam.so.0
3997 _ITM_deregisterTMCloneTable
4025 __gmon_start__
4040 _Jv_RegisterClasses
4060 _ITM_registerTMCloneTable
4086 pam_start
4096 pam_strerror
4109 pam_chauthtok
4123 pam_end
4131 libpam_misc.so.0
4148 misc_conv
4158 libaudit.so.1
4172 _fini
4178 _init
4184 libselinux.so.1
4200 is_selinux_enabled
4219 security_getenforce
4239 context_user_get
4256 security_compute_av
4276 matchpathcon
4289 freecon
4297 context_free
--More--
```

The **-t** switch can take one of three arguments that specify the numbering system to use:

Argument	Numbering System
d	Decimal

Argument	Numbering System
o	Octal
x	Hexadecimal

The **-n** switch prints sequences of characters that are at least **min-len** characters long, instead of the default 4:

```
root@debian8:/tmp# strings -t d -n 15 /usr/bin/passwd | more
 568 /lib64/ld-linux-x86-64.so.2
3997 _ITM_deregisterTMCloneTable
4040 _Jv_RegisterClasses
4060 _ITM_registerTMCloneTable
4131 libpam_misc.so.0
4184 libselinux.so.1
4200 is_selinux_enabled
4219 security_getenforce
4239 context_user_get
4256 security_compute_av
4532 __stack_chk_fail
4693 __errno_location
5150 __libc_start_main
5246 LIBPAM_MISC_1.0
34104 Usage: %s [options] [LOGIN]
34144  -a, --all          report password status on all accounts
34216  -d, --delete      delete the password for the named account
t
34296  -e, --expire      force expire the password for the named
account
34384  -h, --help        display this help message and exit
34456  -k, --keep-tokens change password only if expired
34528  -i, --inactive INACTIVE set password inactive after expiration
--More--
```

The **-f** switch prints the name of the file before each string:

```
root@debian8:/tmp# strings -f /bin/* | grep "(c)"
/bin/ntfscat: Copyright (c) 2003-2005 Richard Russon
/bin/ntfscat: Copyright (c) 2003-2005 Anton Altaparmakov
/bin/ntfscat: Copyright (c) 2003-2005 Szabolcs Szakacsits
/bin/ntfscat: Copyright (c) 2007      Yura Pakhuchiy
/bin/ntfscluster: Copyright (c) 2002-2003 Richard Russon
/bin/ntfscluster: Copyright (c) 2005 Anton Altaparmakov
/bin/ntfscluster: Copyright (c) 2005-2006 Szabolcs Szakacsits
/bin/ntfsfallocate: Copyright (c) 2013-2014 Jean-Pierre Andre
/bin/ntfsfix: Copyright (c) 2000-2006 Anton Altaparmakov
/bin/ntfsfix: Copyright (c) 2002-2006 Szabolcs Szakacsits
/bin/ntfsfix: Copyright (c) 2007      Yura Pakhuchiy
/bin/ntfsfix: Copyright (c) 2011-2014 Jean-Pierre Andre
/bin/ntfsinfo: Copyright (c)
/bin/ntfsls: Copyright (c) 2003-2005 Anton Altaparmakov
/bin/ntfsls: Copyright (c) 2003 Richard Russon
/bin/ntfsls: Copyright (c) 2004 Carmelo Kintana
/bin/ntfsls: Copyright (c) 2004 Giang Nguyen
/bin/ntfsls: Copyright (c) 2003 Lode Leroy
/bin/ntfsmove: Copyright (c) 2003 Richard Russon
/bin/ntfstruncate: Copyright (c) 2002-2005 Anton Altaparmakov
/bin/ntfstruncate: Copyright (c) 2003 Richard Russon
/bin/ntfswipe: Copyright (c) 2002-2005 Richard Russon
/bin/ntfswipe: Copyright (c) 2004 Yura Pakhuchiy
/bin/ping: @(#) Copyright (c) 1989 The Regents of the University of California.
/bin/ping6: @(#) Copyright (c) 1989 The Regents of the University of California.
```

Command Line Switches



To do : Use the **-help** option of the **strings** command to view the command line switches.

The comm Command

This command compares two text files and prints the differences to standard output:

```
root@debian8:/tmp# comm /etc/passwd /root/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
comm: file 1 is not in sorted order
comm: file 2 is not in sorted order
proxy:x:13:13:proxy:/bin:/usr/sbin/nologin
www-data:x:33:33:www-data:/var/www:/usr/sbin/nologin
backup:x:34:34:backup:/var/backups:/usr/sbin/nologin
list:x:38:38:Mailing List Manager:/var/list:/usr/sbin/nologin
irc:x:39:39:ircd:/var/run/ircd:/usr/sbin/nologin
gnats:x:41:41:Gnats Bug-Reporting System (admin):/var/lib/gnats:/usr/sbin/nologin
nobody:x:65534:65534:nobody:/nonexistent:/usr/sbin/nologin
systemd-timesync:x:100:103:systemd Time Synchronization,,,:/run/systemd:/bin/false
systemd-network:x:101:104:systemd Network Management,,,:/run/systemd/netif:/bin/false
systemd-resolve:x:102:105:systemd Resolver,,,:/run/systemd/resolve:/bin/false
systemd-bus-proxy:x:103:106:systemd Bus Proxy,,,:/run/systemd:/bin/false
trainee10:x:1000:1000:trainee,,,:/home/trainee:/bin/bash
sshd:x:104:65534:./var/run/sshd:/usr/sbin/nologin
Debian-exim:x:105:110:./var/spool/exim4:/bin/false
messagebus:x:106:111:./var/run/dbus:/bin/false
```

```
statd:x:107:65534::/var/lib/nfs:/bin/false
avahi-autoipd:x:108:113:Avahi autoip daemon,,,:/var/lib/avahi-autoipd:/bin/false
avahi:x:109:115:Avahi mDNS daemon,,,:/var/run/avahi-daemon:/bin/false
colord:x:110:117:colord colour management daemon,,,:/var/lib/colord:/bin/false
dnsmasq:x:111:65534:dnsmasq,,,:/var/lib/misc:/bin/false
speech-dispatcher:x:112:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/sh
pulse:x:113:119:PulseAudio daemon,,,:/var/run/pulse:/bin/false
rtkit:x:114:121:RealtimeKit,,,:/proc:/bin/false
saned:x:115:122::/var/lib/saned:/bin/false
trainee:x:1000:1000:trainee,,,:/home/trainee:/bin/bash
sshd:x:104:65534::/var/run/sshd:/usr/sbin/nologin
Debian-exim:x:105:110::/var/spool/exim4:/bin/false
messagebus:x:106:111::/var/run/dbus:/bin/false
statd:x:107:65534::/var/lib/nfs:/bin/false
avahi-autoipd:x:108:113:Avahi autoip daemon,,,:/var/lib/avahi-autoipd:/bin/false
avahi:x:109:115:Avahi mDNS daemon,,,:/var/run/avahi-daemon:/bin/false
colord:x:110:117:colord colour management daemon,,,:/var/lib/colord:/bin/false
dnsmasq:x:111:65534:dnsmasq,,,:/var/lib/misc:/bin/false
speech-dispatcher:x:112:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/sh
pulse:x:113:119:PulseAudio daemon,,,:/var/run/pulse:/bin/false
rtkit:x:114:121:RealtimeKit,,,:/proc:/bin/false
saned:x:115:122::/var/lib/saned:/bin/false
    usbmux:x:116:46:usbmux daemon,,,:/var/lib/usbmux:/bin/false
    lightdm:x:117:124:Light Display Manager:/var/lib/lightdm:/bin/false
Linux is great!
```



Important: The lines to the left are those that only appear in the first file. The lines on the right are those that exist in both files. The lines in the middle are those that only exist in the second file.

If you only want to see the lines common to both files, use the following command:

```
root@debian8:/tmp# comm -12 /etc/passwd /root/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
comm: file 1 is not in sorted order
comm: file 2 is not in sorted order
proxy:x:13:13:proxy:/bin:/usr/sbin/nologin
www-data:x:33:33:www-data:/var/www:/usr/sbin/nologin
backup:x:34:34:backup:/var/backups:/usr/sbin/nologin
list:x:38:38:Mailing List Manager:/var/list:/usr/sbin/nologin
irc:x:39:39:ircd:/var/run/ircd:/usr/sbin/nologin
gnats:x:41:41:Gnats Bug-Reporting System (admin):/var/lib/gnats:/usr/sbin/nologin
nobody:x:65534:65534:nobody:/nonexistent:/usr/sbin/nologin
systemd-timesync:x:100:103:systemd Time Synchronization,,,:/run/systemd:/bin/false
systemd-network:x:101:104:systemd Network Management,,,:/run/systemd/netif:/bin/false
systemd-resolve:x:102:105:systemd Resolver,,,:/run/systemd/resolve:/bin/false
systemd-bus-proxy:x:103:106:systemd Bus Proxy,,,:/run/systemd:/bin/false
usbmux:x:116:46:usbmux daemon,,,:/var/lib/usbmux:/bin/false
lightdm:x:117:124:Light Display Manager:/var/lib/lightdm:/bin/false
```

Command Line Switches



To do : Use the **-help** option of the **comm** command to view the command line switches.

The head Command

The **head** command is used to display the first **x** lines of a file. The default value of x is 10:

```
root@debian8:/tmp# head /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
```

You can change the default value of x by using the **-n** switch:

```
root@debian8:/tmp# head -n 15 /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
proxy:x:13:13:proxy:/bin:/usr/sbin/nologin
www-data:x:33:33:www-data:/var/www:/usr/sbin/nologin
backup:x:34:34:backup:/var/backups:/usr/sbin/nologin
```

```
list:x:38:38:Mailing List Manager:/var/list:/usr/sbin/nologin
```

The command can also be used to display the first **y** bytes of a file by using the **-c** switch:

```
root@debian8:/tmp# head -c 150 /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
root@debian8:/tmp#
```

If the value of **y** is negative, head displays all bytes in the file **except** the last y bytes:

```
root@debian8:/tmp# head -c -150 /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
proxy:x:13:13:proxy:/bin:/usr/sbin/nologin
www-data:x:33:33:www-data:/var/www:/usr/sbin/nologin
backup:x:34:34:backup:/var/backups:/usr/sbin/nologin
list:x:38:38:Mailing List Manager:/var/list:/usr/sbin/nologin
irc:x:39:39:ircd:/var/run/ircd:/usr/sbin/nologin
gnats:x:41:41:Gnats Bug-Reporting System (admin):/var/lib/gnats:/usr/sbin/nologin
nobody:x:65534:65534:nobody:/nonexistent:/usr/sbin/nologin
systemd-timesync:x:100:103:systemd Time Synchronization,,,:/run/systemd:/bin/false
systemd-network:x:101:104:systemd Network Management,,,:/run/systemd/netif:/bin/false
systemd-resolve:x:102:105:systemd Resolver,,,:/run/systemd/resolve:/bin/false
```

```
systemd-bus-proxy:x:103:106:systemd Bus Proxy,,,:/run/systemd:/bin/false
trainee:x:1000:1000:trainee,,,:/home/trainee:/bin/bash
sshd:x:104:65534:./var/run/sshd:/usr/sbin/nologin
Debian-exim:x:105:110:./var/spool/exim4:/bin/false
messagebus:x:106:111:./var/run/dbus:/bin/false
statd:x:107:65534:./var/lib/nfs:/bin/false
avahi-autoipd:x:108:113:Avahi autoip daemon,,,:/var/lib/avahi-autoipd:/bin/false
avahi:x:109:115:Avahi mDNS daemon,,,:/var/run/avahi-daemon:/bin/false
colord:x:110:117:colord colour management daemon,,,:/var/lib/colord:/bin/false
dnsmasq:x:111:65534:dnsmasq,,,:/var/lib/misc:/bin/false
speech-dispatcher:x:112:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/sh
pulse:x:113:119:PulseAudio daemon,,,:/var/run/pulse:/bin/false
rtkit:x:114:121:RealtimeKit,,,:/proc:/bin/false
```

Both x and y can accept multipliers:

```
root@debian8:/tmp# head -c 1b /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
proxy:x:13:13:proxy:/bin:/usr/sbin/nroot@debian8:/tmp#
root@debian8:/tmp#
root@debian8:/tmp# head -c 512 /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
```

```
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
proxy:x:13:13:proxy:/bin:/usr/sbin/nroot@debian8:/tmp#
```

The common multipliers are:

Multiplier	Number of bytes
b	512
KB	1000
K	1024
MB	1000*1000
M	1024*1024
GB	1000*1000*1000
G	1024*1024*1024

Command Line Switches



To do : Use the **-help** option of the **head** command to view the command line switches.

The tail Command

The **tail** command is used to display the last **x** lines of a file. The default value of **x** is 10:

```
root@debian8:/tmp# tail /etc/passwd
avahi-autoipd:x:108:113:Avahi autoip daemon,,,:/var/lib/avahi-autoipd:/bin/false
avahi:x:109:115:Avahi mDNS daemon,,,:/var/run/avahi-daemon:/bin/false
colord:x:110:117:colord colour management daemon,,,:/var/lib/colord:/bin/false
dnsmasq:x:111:65534:dnsmasq,,,:/var/lib/misc:/bin/false
speech-dispatcher:x:112:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/sh
pulse:x:113:119:PulseAudio daemon,,,:/var/run/pulse:/bin/false
rtkit:x:114:121:RealtimeKit,,,:/proc:/bin/false
saned:x:115:122:./var/lib/saned:/bin/false
usbmux:x:116:46:usbmux daemon,,,:/var/lib/usbmux:/bin/false
lightdm:x:117:124:Light Display Manager:/var/lib/lightdm:/bin/false
```

You can change the default value of x by using the **-n** switch:

```
root@debian8:/tmp# tail -n 15 /etc/passwd
trainee:x:1000:1000:trainee,,,:/home/trainee:/bin/bash
sshd:x:104:65534:./var/run/sshd:/usr/sbin/nologin
Debian-exim:x:105:110:./var/spool/exim4:/bin/false
messagebus:x:106:111:./var/run/dbus:/bin/false
statd:x:107:65534:./var/lib/nfs:/bin/false
avahi-autoipd:x:108:113:Avahi autoip daemon,,,:/var/lib/avahi-autoipd:/bin/false
avahi:x:109:115:Avahi mDNS daemon,,,:/var/run/avahi-daemon:/bin/false
colord:x:110:117:colord colour management daemon,,,:/var/lib/colord:/bin/false
dnsmasq:x:111:65534:dnsmasq,,,:/var/lib/misc:/bin/false
speech-dispatcher:x:112:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/sh
pulse:x:113:119:PulseAudio daemon,,,:/var/run/pulse:/bin/false
rtkit:x:114:121:RealtimeKit,,,:/proc:/bin/false
saned:x:115:122:./var/lib/saned:/bin/false
usbmux:x:116:46:usbmux daemon,,,:/var/lib/usbmux:/bin/false
lightdm:x:117:124:Light Display Manager:/var/lib/lightdm:/bin/false
```

The command can also be used to display the last **y** bytes of a file by using the **-c** switch:

```
root@debian8:/tmp# tail -c 150 /etc/passwd
```

```
/lib/saned:/bin/false
usbmux:x:116:46:usbmux daemon,,,:/var/lib/usbmux:/bin/false
lightdm:x:117:124:Light Display Manager:/var/lib/lightdm:/bin/false
```

If the value of **y** is positive, tail displays all bytes in the file after the yth byte:

```
root@debian8:/tmp# tail -c +150 /etc/passwd
ogin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
proxy:x:13:13:proxy:/bin:/usr/sbin/nologin
www-data:x:33:33:www-data:/var/www:/usr/sbin/nologin
backup:x:34:34:backup:/var/backups:/usr/sbin/nologin
list:x:38:38:Mailing List Manager:/var/list:/usr/sbin/nologin
irc:x:39:39:ircd:/var/run/ircd:/usr/sbin/nologin
gnats:x:41:41:Gnats Bug-Reporting System (admin):/var/lib/gnats:/usr/sbin/nologin
nobody:x:65534:65534:nobody:/nonexistent:/usr/sbin/nologin
systemd-timesync:x:100:103:systemd Time Synchronization,,,:/run/systemd:/bin/false
systemd-network:x:101:104:systemd Network Management,,,:/run/systemd/netif:/bin/false
systemd-resolve:x:102:105:systemd Resolver,,,:/run/systemd/resolve:/bin/false
systemd-bus-proxy:x:103:106:systemd Bus Proxy,,,:/run/systemd:/bin/false
trainee:x:1000:1000:trainee,,,:/home/trainee:/bin/bash
sshd:x:104:65534::/var/run/sshd:/usr/sbin/nologin
Debian-exim:x:105:110::/var/spool/exim4:/bin/false
messagebus:x:106:111::/var/run/dbus:/bin/false
statd:x:107:65534::/var/lib/nfs:/bin/false
avahi-autoipd:x:108:113:Avahi autoip daemon,,,:/var/lib/avahi-autoipd:/bin/false
avahi:x:109:115:Avahi mDNS daemon,,,:/var/run/avahi-daemon:/bin/false
colord:x:110:117:colord colour management daemon,,,:/var/lib/colord:/bin/false
```

```
dnsmasq:x:111:65534:dnsmasq,,,:/var/lib/misc:/bin/false
speech-dispatcher:x:112:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/sh
pulse:x:113:119:PulseAudio daemon,,,:/var/run/pulse:/bin/false
rtkit:x:114:121:RealtimeKit,,,:/proc:/bin/false
saned:x:115:122::/var/lib/saned:/bin/false
usbmux:x:116:46:usbmux daemon,,,:/var/lib/usbmux:/bin/false
lightdm:x:117:124:Light Display Manager:/var/lib/lightdm:/bin/false
```

Both x and y can accept multipliers:

```
root@debian8:/tmp# tail -c 1b /etc/passwd
:/bin/false
colord:x:110:117:colord colour management daemon,,,:/var/lib/colord:/bin/false
dnsmasq:x:111:65534:dnsmasq,,,:/var/lib/misc:/bin/false
speech-dispatcher:x:112:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/sh
pulse:x:113:119:PulseAudio daemon,,,:/var/run/pulse:/bin/false
rtkit:x:114:121:RealtimeKit,,,:/proc:/bin/false
saned:x:115:122::/var/lib/saned:/bin/false
usbmux:x:116:46:usbmux daemon,,,:/var/lib/usbmux:/bin/false
lightdm:x:117:124:Light Display Manager:/var/lib/lightdm:/bin/false
root@debian8:/tmp#
root@debian8:/tmp# tail -c 512 /etc/passwd
:/bin/false
colord:x:110:117:colord colour management daemon,,,:/var/lib/colord:/bin/false
dnsmasq:x:111:65534:dnsmasq,,,:/var/lib/misc:/bin/false
speech-dispatcher:x:112:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/sh
pulse:x:113:119:PulseAudio daemon,,,:/var/run/pulse:/bin/false
rtkit:x:114:121:RealtimeKit,,,:/proc:/bin/false
saned:x:115:122::/var/lib/saned:/bin/false
usbmux:x:116:46:usbmux daemon,,,:/var/lib/usbmux:/bin/false
lightdm:x:117:124:Light Display Manager:/var/lib/lightdm:/bin/false
```

The common multipliers are:

Multiplier	Number of bytes
b	512
KB	1000
K	1024
MB	1000*1000
M	1024*1024
GB	1000*1000*1000
G	1024*1024*1024

A useful switch to use with the tail command is **-f**. This switch continually updates the output:

```
root@debian8:/tmp# tail -f /var/log/messages
Nov 30 16:19:14 debian8 kernel: [182064.453711] usb 2-1: new full-speed USB device number 4 using ohci-pci
Nov 30 16:19:14 debian8 kernel: [182064.716207] usb 2-1: New USB device found, idVendor=80ee, idProduct=0021
Nov 30 16:19:14 debian8 kernel: [182064.716213] usb 2-1: New USB device strings: Mfr=1, Product=3, SerialNumber=0
Nov 30 16:19:14 debian8 kernel: [182064.716215] usb 2-1: Product: USB Tablet
Nov 30 16:19:14 debian8 kernel: [182064.716217] usb 2-1: Manufacturer: VirtualBox
Nov 30 16:19:14 debian8 kernel: [182064.732384] input: VirtualBox USB Tablet as
/devices/pci0000:00/0000:00:06.0/usb2/2-1/2-1:1.0/0003:80EE:0021.0003/input/input9
Nov 30 16:19:14 debian8 mtp-probe: checking bus 2, device 4: "/sys/devices/pci0000:00/0000:00:06.0/usb2/2-1"
Nov 30 16:19:14 debian8 mtp-probe: bus: 2, device: 4 was not an MTP device
Nov 30 16:19:14 debian8 kernel: [182064.734594] hid-generic 0003:80EE:0021.0003: input,hidraw0: USB HID v1.10
Mouse [VirtualBox USB Tablet] on usb-0000:00:06.0-1/input0
Nov 30 16:19:20 debian8 kernel: [182070.401997] e1000: eth0 NIC Link is Up 1000 Mbps Full Duplex, Flow Control:
RX
^C
```

Command Line Switches



To do : Use the **-help** option of the **head** command to view the command line switches.

LAB #4 - Use the grep, tr and cut to extract your IP address from the output of ifconfig

```
root@debian8:/tmp# ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 08:00:27:c4:c9:56
          inet addr:10.0.2.15  Bcast:10.0.2.255  Mask:255.255.255.0
          inet6 addr: fe80::a00:27ff:fec4:c956/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:68601 errors:0 dropped:0 overruns:0 frame:0
          TX packets:140516 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:8392325 (8.0 MiB)  TX bytes:10525989 (10.0 MiB)

root@debian8:/tmp# ifconfig eth0 | grep "inet"
          inet addr:10.0.2.15  Bcast:10.0.2.255  Mask:255.255.255.0
          inet6 addr: fe80::a00:27ff:fec4:c956/64 Scope:Link

root@debian8:/tmp# ifconfig eth0 | grep "inet" | grep -v "inet6"
          inet addr:10.0.2.15  Bcast:10.0.2.255  Mask:255.255.255.0

root@debian8:/tmp# ifconfig eth0 | grep "inet" | grep -v "inet6" | tr -s " " ":"
:inet:addr:10.0.2.15:Bcast:10.0.2.255:Mask:255.255.255.0

root@debian8:/tmp# ifconfig eth0 | grep "inet" | grep -v "inet6" | tr -s " " ":" | cut -d: -f4
10.0.2.15
```



Important : Note the use of the **-s** switch with the **tr** command. This switch replaces a string of x identical characters with a single character.

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