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Basic Shell Commands and Text Manipulation Tools

[stextbox id='black' image='null'] **To do** - You are currently the root user in your terminal. Before proceeding further, type **exit** and hit the ↵ Enter key. [/stextbox]

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@ubuntu1604:~$ stty -a
speed 38400 baud; rows 26; columns 80; line = 0;
intr = ^C; quit = ^\; erase = ^?; kill = ^U; eof = ^D; eol = <undef>;
eol2 = <undef>; swtch = <undef>; start = ^Q; stop = ^S; susp = ^Z; rprnt = ^R;
werase = ^W; lnext = ^V; discard = ^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 -echoprt
echoctl echoke -flusho -extproc
```

[stextbox id='black' image='null'] The two most important combinations are **intr = ^C** and **susp = ^Z**. The former kills the process whilst the latter suspends its execution. [/stextbox]

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **stty** command to view the command line switches. [/stextbox]

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@ubuntu1604:~$ date
Fri 30 Sep 15:19:21 CEST 2016
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **date** command to view the command line switches. [/stextbox]

The who Command

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

```
trainee@ubuntu1604:~$ who
trainee  pts/0        2016-09-29 20:36 (10.0.2.2)
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **who** command to view the command line switches. [/stextbox]

The df Command

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

```
trainee@ubuntu1604:~$ df
Filesystem     1K-blocks    Used Available Use% Mounted on
udev              230832       0    230832   0% /dev
tmpfs              50028    2864     47164   6% /run
/dev/sda1        9480420 4269160   4706636  48% /
tmpfs             250124       0    250124   0% /dev/shm
tmpfs               5120       4      5116   1% /run/lock
tmpfs             250124       0    250124   0% /sys/fs/cgroup
tmpfs              50028       0     50028   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@ubuntu1604:~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
udev            226M     0  226M   0% /dev
tmpfs            49M  2.8M   47M   6% /run
/dev/sda1       9.1G  4.1G  4.5G  48% /
tmpfs           245M     0  245M   0% /dev/shm
tmpfs           5.0M  4.0K  5.0M   1% /run/lock
tmpfs           245M     0  245M   0% /sys/fs/cgroup
tmpfs            49M     0   49M   0% /run/user/1000
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **df** command to view the command line switches. [/stextbox]

The free Command

This command's output shows the memory usage:

```
trainee@ubuntu1604:~$ free
              total        used        free      shared  buff/cache   available
Mem:         500252       88116        8820        1460      403316      387464
Swap:       1997820       10604     1987216
```

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

```
trainee@ubuntu1604:~$ free -h
              total        used        free      shared  buff/cache   available
Mem:           488M         86M        8.5M        1.4M        393M        378M
Swap:          1.9G         10M        1.9G
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **free** command to view the command line switches. [/stextbox]

The whoami Command

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

```
trainee@ubuntu1604:~$ whoami
trainee
```

Now become the system administrator **root**:

```
trainee@ubuntu1604:~$ sudo su -
```

```
[sudo] password for trainee: trainee
root@ubuntu1604:~#
```

[stextbox id='black' image='null'] **Important** : Note that the password will not be visible. [/stextbox]

Now use the **whoami** command again:

```
root@ubuntu1604:~# whoami
root
root@ubuntu1604:~#
```

[stextbox id='black' image='null'] **Important** : Note the current effective user ID is root. [/stextbox]

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

```
root@ubuntu1604:~# exit
logout
trainee@ubuntu1604:~$
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **whoami** command to view the command line switches. [/stextbox]

The pwd Command

This command's output shows the current working directory:

```
trainee@ubuntu1604:~$ pwd
/home/trainee
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **help** command with **pwd** option to view the command line switches. [/stextbox]

The cd Command

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

```
trainee@ubuntu1604:~$ cd /tmp
trainee@ubuntu1604:/tmp$ pwd
/tmp
trainee@ubuntu1604:/tmp$
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **help** command with **cd** option to view the command line switches. [/stextbox]

The ls Command

This commands 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@ubuntu1604:/tmp$ ls
hsperfdata_root
inode
systemd-private-cd33d40e1d3a4e08a9cde3de3603311e-systemd-timesyncd.service-bxC1MJ
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **ls** command to view the command line switches. [/stextbox]

The lsof Command

This command's output shows information about open files:

```
trainee@ubuntu1604:/tmp$ sudo su -
[sudo] password for trainee: trainee
root@ubuntu1604:~# 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  1577232     325621 /lib/systemd/systemd
systemd       1                   root  mem       REG                8,1    18976     266610 /lib/x86_64-linux-
gnu/libuuid.so.1.3.0
systemd       1                   root  mem       REG                8,1   262408     266418 /lib/x86_64-linux-
gnu/libblkid.so.1.1.0
systemd       1                   root  mem       REG                8,1    14608     266450 /lib/x86_64-linux-
gnu/libdl-2.23.so
systemd       1                   root  mem       REG                8,1   456632     266555 /lib/x86_64-linux-
gnu/libpcre.so.3.13.2
systemd       1                   root  mem       REG                8,1  1864888     266426 /lib/x86_64-linux-
gnu/libc-2.23.so
systemd       1                   root  mem       REG                8,1   138744     266572 /lib/x86_64-linux-
gnu/libpthread-2.23.so
systemd       1                   root  mem       REG                8,1   286824     266502 /lib/x86_64-linux-
gnu/libmount.so.1.1.0
systemd       1                   root  mem       REG                8,1    64144     266408 /lib/x86_64-linux-
gnu/libapparmor.so.1.4.0
systemd       1                   root  mem       REG                8,1    92864     266489 /lib/x86_64-linux-
```

```
gnu/libkmod.so.2.3.0
systemd       1                  root  mem       REG                8,1   117288     266416 /lib/x86_64-linux-
gnu/libaudit.so.1.0.0
systemd       1                  root  mem       REG                8,1    55904     266542 /lib/x86_64-linux-
gnu/libpam.so.0.83.1
systemd       1                  root  mem       REG                8,1   252152     266583 /lib/x86_64-linux-
gnu/libseccomp.so.2.2.3
systemd       1                  root  mem       REG                8,1    31712     266580 /lib/x86_64-linux-
gnu/librt-2.23.so
systemd       1                  root  mem       REG                8,1    23128     266429 /lib/x86_64-linux-
gnu/libcap.so.2.24
systemd       1                  root  mem       REG                8,1   130224     266584 /lib/x86_64-linux-
gnu/libselinux.so.1
systemd       1                  root  mem       REG                8,1   162632     266398 /lib/x86_64-linux-
gnu/ld-2.23.so
systemd       1                  root    0u      CHR                1,3      0t0          6 /dev/null
systemd       1                  root    1u      CHR                1,3      0t0          6 /dev/null
systemd       1                  root    2u      CHR                1,3      0t0          6 /dev/null
--More--
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **lsof** command to view the command line switches. [/stextbox]

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@ubuntu1604:~# exit
logout
```

```
trainee@ubuntu1604:/tmp$ touch test
trainee@ubuntu1604:/tmp$ ls
hsperfdata_root
inode
systemd-private-cd33d40e1d3a4e08a9cde3de3603311e-systemd-timesyncd.service-bxC1MJ
test
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **touch** command to view the command line switches. [/stextbox]

The echo Command

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

```
trainee@ubuntu1604:/tmp$ echo fenestros
fenestros
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **help** command with **echo** option to view the command line switches. [/stextbox]

The cp Command

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

```
trainee@ubuntu1604:/tmp$ cp test ~
trainee@ubuntu1604:/tmp$ ls -l ~
total 48
```

```
drwxr-xr-x 2 trainee trainee 4096 mai    3 08:03 Desktop
drwxr-xr-x 2 trainee trainee 4096 mai    3 08:03 Documents
drwxr-xr-x 2 trainee trainee 4096 mai    3 08:03 Downloads
-rw-r--r-- 1 trainee trainee 8980 mai    3 07:27 examples.desktop
drwxr-xr-x 2 trainee trainee 4096 mai    3 08:03 Music
drwxr-xr-x 2 trainee trainee 4096 mai    3 08:03 Pictures
drwxr-xr-x 2 trainee trainee 4096 mai    3 08:03 Public
drwxr-xr-x 2 trainee trainee 4096 mai    3 08:03 Templates
-rw-rw-r-- 1 trainee trainee    0 oct.   4 13:31 test
drwxr-xr-x 2 trainee trainee 4096 mai    3 08:03 Videos
-rw-rw-r-- 1 trainee trainee  442 sept. 30 11:35 vitext
```

[stextbox id='black' image='null'] 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**. [/stextbox]

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **cp** command to view the command line switches. [/stextbox]

The file Command

This command determines a file type:

```
trainee@ubuntu1604:/tmp$ file ~/test
/home/trainee/test: empty
```

[stextbox id='black' image='null'] **Important** - Note that in the case of the first line of the above output, tha command **file** is incapable of informing you of the type of file since **test** is empty. [/stextbox]

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

```
trainee@ubuntu1604:/tmp$ echo "fenestros" > ~/test
```

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

```
trainee@ubuntu1604:/tmp$ file ~/test
/home/trainee/test: ASCII text
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **file** command to view the command line switches. [/stextbox]

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@ubuntu1604:/tmp$ cat ~/test
fenestros
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **cat** command to view the command line switches. [/stextbox]

The mv Command

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

```
trainee@ubuntu1604:/tmp$ mv ~/test .
```

```
trainee@ubuntu1604:/tmp$ ls -l ~
total 48
drwxr-xr-x 2 trainee trainee 4096 mai    3 08:03 Desktop
drwxr-xr-x 2 trainee trainee 4096 mai    3 08:03 Documents
drwxr-xr-x 2 trainee trainee 4096 mai    3 08:03 Downloads
-rw-r--r-- 1 trainee trainee 8980 mai    3 07:27 examples.desktop
drwxr-xr-x 2 trainee trainee 4096 mai    3 08:03 Music
drwxr-xr-x 2 trainee trainee 4096 mai    3 08:03 Pictures
drwxr-xr-x 2 trainee trainee 4096 mai    3 08:03 Public
drwxr-xr-x 2 trainee trainee 4096 mai    3 08:03 Templates
drwxr-xr-x 2 trainee trainee 4096 mai    3 08:03 Videos
-rw-rw-r-- 1 trainee trainee  442 sept. 30 11:35 vitext
trainee@ubuntu1604:/tmp$ mv test TeSt
trainee@ubuntu1604:/tmp$ ls -l
total 16
drwxr-xr-x 2 root    root    4096 sept. 28 10:34 hsperfdata_root
drwxr-xr-x 2 root    root    4096 sept. 29 10:32 inode
drwx------ 3 root    root    4096 sept. 29 10:19 systemd-private-cd33d40e1d3a4e08a9cde3de3603311e-systemd-
timesyncd.service-bxC1MJ
-rw-rw-r-- 1 trainee trainee   10 oct.   4 13:36 TeSt
```

[stextbox id='black' image='null'] Note the use of the shortcut **.** which indicates the current working directory. [/stextbox]

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **mv** command to view the command line switches. [/stextbox]

The mkdir Command

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

```
trainee@ubuntu1604:/tmp$ cd ~
trainee@ubuntu1604:~$ mkdir testdir
trainee@ubuntu1604:~$ ls
Desktop    Downloads         Music     Public     testdir  vitext
Documents  examples.desktop  Pictures  Templates  Videos
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **mkdir** command to view the command line switches. [/stextbox]

The rmdir Command

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

```
trainee@ubuntu1604:~$ rmdir testdir
trainee@ubuntu1604:~$ ls
Desktop    Downloads         Music     Public     Videos
Documents  examples.desktop  Pictures  Templates  vitext
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **rmdir** command to view the command line switches. [/stextbox]

The rm Command

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

```
trainee@ubuntu1604:~$ mkdir testdir1
```

```
trainee@ubuntu1604:~$ cd /tmp
trainee@ubuntu1604:/tmp$ echo "fenestros" > TeSt
trainee@ubuntu1604:/tmp$ cd ~
trainee@ubuntu1604:~$ mv /tmp/TeSt ~/testdir1
trainee@ubuntu1604:~$ ls -lR testdir1/
testdir1/:
total 4
-rw-rw-r-- 1 trainee trainee 10 oct.   4 14:17 TeSt
trainee@ubuntu1604:~$ rmdir testdir1/
rmdir: failed to remove 'testdir1/': Directory not empty
trainee@ubuntu1604:~$ rm -rf testdir1/
trainee@ubuntu1604:~$ ls
Desktop    Downloads         Music     Public     Videos
Documents  examples.desktop  Pictures  Templates  vitext
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **rm** command to view the command line switches. [/stextbox]

The sort Command

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

```
trainee@ubuntu1604:~$ touch aac abc bca xyz
trainee@ubuntu1604:~$ ls
aac  bca      Documents  examples.desktop  Pictures  Templates  vitext
abc  Desktop  Downloads  Music             Public    Videos     xyz
trainee@ubuntu1604:~$ ls | sort
aac
abc
bca
```

```
Desktop
Documents
Downloads
examples.desktop
Music
Pictures
Public
Templates
Videos
vitext
xyz
trainee@ubuntu1604:~$ ls | sort -r
xyz
vitext
Videos
Templates
Public
Pictures
Music
examples.desktop
Downloads
Documents
Desktop
bca
abc
aac
```

[stextbox id='black' image='null'] **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. [/stextbox]

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **sort** command to view the command line switches. [/stextbox]

The more Command

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

```
trainee@ubuntu1604:~$ 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%)
```

[stextbox id='black' image='null'] **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. [/stextbox]

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **more** command to view the command line switches. [/stextbox]

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@ubuntu1604:~$ 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

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **less** command to view the command line switches. [/stextbox]

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@ubuntu1604:~$ find acc
find: ‘acc’: No such file or directory
trainee@ubuntu1604:~$ find aac
aac
```

[stextbox id='black' image='null'] **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. [/stextbox]

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **find** command to view the command line switches. [/stextbox]

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@ubuntu1604:~$ sudo su -
[sudo] password for trainee: trainee
```

[stextbox id='black' image='null'] **Important** : Note that the password will not be visible. [/stextbox]

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **su** command to view the command line switches. [/stextbox]

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@ubuntu1604:~# ls -l /var/lib/mlocate/mlocate.db
-rw-r----- 1 root mlocate 5293946 oct.   2 07:35 /var/lib/mlocate/mlocate.db
```

[stextbox id='black' image='null'] **Important** : For information concerning the database format, please see **man 5 locatedb**. [/stextbox]

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

```
root@ubuntu1604:~# cat /etc/updatedb.conf
PRUNE_BIND_MOUNTS="yes"
# PRUNENAMES=".git .bzr .hg .svn"
PRUNEPATHS="/tmp /var/spool /media /home/.ecryptfs /var/lib/schroot"
PRUNEFS="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 ecryptfs fusesmb devtmpfs"
```

Use of these two commands is very simple:

```
root@ubuntu1604:~# updatedb
root@ubuntu1604:~# locate aac
/home/trainee/aac
/lib/modules/4.4.0-21-generic/kernel/drivers/scsi/aacraid
/lib/modules/4.4.0-21-generic/kernel/drivers/scsi/aacraid/aacraid.ko
/lib/modules/4.4.0-38-generic/kernel/drivers/scsi/aacraid
/lib/modules/4.4.0-38-generic/kernel/drivers/scsi/aacraid/aacraid.ko
/usr/share/app-install/desktop/krita-data:kde4__calligraactive.desktop
/usr/share/mime/audio/aac.xml
/usr/src/linux-headers-4.4.0-21/drivers/scsi/aacraid
/usr/src/linux-headers-4.4.0-21/drivers/scsi/aacraid/Makefile
/usr/src/linux-headers-4.4.0-21-generic/include/config/scsi/aacraid.h
/usr/src/linux-headers-4.4.0-38/drivers/scsi/aacraid
/usr/src/linux-headers-4.4.0-38/drivers/scsi/aacraid/Makefile
/usr/src/linux-headers-4.4.0-38-generic/include/config/scsi/aacraid.h
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **updatedb** and **locate** commands to view their command line switches. [/stextbox]

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@ubuntu1604:~# whereis passwd
passwd: /usr/bin/passwd /etc/passwd /usr/share/man/man5/passwd.5.gz /usr/share/man/man1/passwd.1.gz
/usr/share/man/man1/passwd.1ssl.gz
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **whereis** command to view the command line switches. [/stextbox]

The which Command

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

```
root@ubuntu1604:~# which passwd
/usr/bin/passwd
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **which** command to view the command line switches. [/stextbox]

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@ubuntu1604:~# uptime
 15:18:02 up 1 day, 13:10,  1 user,  load average: 0,00, 0,03, 0,0
```

Command Line Switches

The switches associated with this command are:

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **uptime** command to view the command line switches. [/stextbox]

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@ubuntu1604:~# w
 15:27:17 up 1 day, 13:19,  1 user,  load average: 0,10, 0,06, 0,06
USER     TTY      FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
trainee  pts/0    10.0.2.2         lun.17    0.00s  0.11s  0.00s 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

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **w** command to view the command line switches. [/stextbox]

The uname Command

This command prints system information to the standard output:

```
root@ubuntu1604:~# uname -a
Linux ubuntu1604 4.4.0-21-generic #37-Ubuntu SMP Mon Apr 18 18:33:37 UTC 2016 x86_64 x86_64 x86_64 GNU/Linux
root@ubuntu1604:~# uname -s
Linux
root@ubuntu1604:~# uname -n
ubuntu1604
root@ubuntu1604:~# uname -r
4.4.0-21-generic
```

```
root@ubuntu1604:~# uname -v
#37-Ubuntu SMP Mon Apr 18 18:33:37 UTC 2016
root@ubuntu1604:~# uname -m
x86_64
root@ubuntu1604:~# uname -p
x86_64
root@ubuntu1604:~# uname -i
x86_64
root@ubuntu1604:~# uname -o
GNU/Linux
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **uname** command to view the command line switches. [/stextbox]

The du Command

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

```
root@ubuntu1604:~# du -sh /* 2>/dev/null
13M /bin
100M    /boot
4,0K    /cdrom
0   /dev
13M /etc
1,7M    /home
0   /initrd.img
0   /initrd.img.old
584M    /lib
4,0K    /lib64
16K /lost+found
```

```
4,0K    /media
4,0K    /mnt
155M    /opt
0   /proc
6,1M    /root
4,1M    /run
13M /sbin
4,0K    /snap
4,0K    /srv
0   /sys
72K /tmp
2,9G    /usr
341M    /var
0   /vmlinuz
0   /vmlinuz.old
```

[stextbox id='black' image='null'] **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. [/stextbox]

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **du** command to view the command line switches. [/stextbox]

The clear Command

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

```
root@ubuntu1604:~# clear

root@ubuntu1604:~#
```

The exit Command

This command exits the current shell:

```
root@ubuntu1604:~# exit
logout
trainee@ubuntu1604:~$
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **help** command with **exit** option to view the command line switches. [/stextbox]

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

[stextbox id='black' image='null'] **To do** : Use the **help** command with **logout** option to view the command line switches. [/stextbox]

The sleep Command

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

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **sleep** command to view the command line switches. [/stextbox]

The wall Command

The wall command 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@ubuntu1604:~$ sudo su -
[sudo] password for trainee: trainee
root@ubuntu1604:~# wall this is a message from root
Broadcast message from trainee@ubuntu1604 (pts/0) (Fri Oct  7 10:18:21 2016):
this is a message from root
root@ubuntu1604:~#
```

In the second session you should see the following message :

```
Broadcast message from trainee@ubuntu1604 (pts/0) (Fri Oct  7 10:18:21 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@ubuntu1604:~# seq 10
1
2
3
4
5
6
7
8
9
10
root@ubuntu1604:~# seq 20 30
20
21
22
23
24
25
26
27
28
29
30
root@ubuntu1604:~# seq 20 10 90
20
30
40
50
60
70
80
90
```

```
root@ubuntu1604:~#
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **seq** command to view the command line switches. [/stextbox]

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 Ubuntu 16.04 LTS. Use the apt-get to install it:

```
root@ubuntu1604:~# which screen
root@ubuntu1604:~# apt-get install screen
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libpango1.0-0 libpangox-1.0-0
Use 'apt autoremove' to remove them.
Suggested packages:
  iselect | screenie | byobu
The following NEW packages will be installed:
  screen
0 upgraded, 1 newly installed, 0 to remove and 1 not upgraded.
Need to get 560 kB of archives.
After this operation, 972 kB of additional disk space will be used.
Get:1 http://fr.archive.ubuntu.com/ubuntu xenial/main amd64 screen amd64 4.3.1-2build1 [560 kB]
```

```
Fetched 560 kB in 0s (2 306 kB/s)
Selecting previously unselected package screen.
(Reading database ... 207619 files and directories currently installed.)
Preparing to unpack .../screen_4.3.1-2build1_amd64.deb ...
Unpacking screen (4.3.1-2build1) ...
Processing triggers for systemd (229-4ubuntu10) ...
Processing triggers for ureadahead (0.100.0-19) ...
Processing triggers for install-info (6.1.0.dfsg.1-5) ...
Processing triggers for man-db (2.7.5-1) ...
Setting up screen (4.3.1-2build1) ...
Processing triggers for systemd (229-4ubuntu10) ...
Processing triggers for ureadahead (0.100.0-19) ...
root@ubuntu1604:~# which screen
/usr/bin/screen
```

Create a session with screen:

```
root@ubuntu1604:~# screen -S mysession
```

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@ubuntu1604:~# screen -ls
There is a screen on:
        1745.mysession  (07/10/2016 11:00:55)   (Attached)
1 Socket in /var/run/screen/S-root
```

Now enter the following commands:

```
root@ubuntu1604:~# sleep 9999 &
[1] 9699
```

```
root@ubuntu1604:~# jobs
[1]+  Running                 sleep 9999 &
root@ubuntu1604:~#
```

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

```
root@ubuntu1604:~# screen -S mysession
[detached from 1745.mysession]
root@ubuntu1604:~#
```

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

```
root@ubuntu1604:~# screen -r
```

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

```
root@ubuntu1604:~# 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@ubuntu1604:~# screen -S mysession
[detached from 1745.mysession]
root@ubuntu1604:~#
```

Now create a new, non-nested screen:

```
root@ubuntu1604:~# screen -S mysession1
```

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

```
root@ubuntu1604:~# screen -ls
There are screens on:
        15800.mysession1        (07/10/2016 13:58:29)   (Attached)
        1745.mysession  (07/10/2016 11:00:55)   (Detached)
2 Sockets in /var/run/screen/S-root.
```

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

```
root@ubuntu1604:~# screen -r 1745
```

Finally, check out what has happened:

```
root@ubuntu1604:~# sleep 9999 &
[1] 9699
root@ubuntu1604:~# jobs
[1]+  Running                 sleep 9999 &
root@ubuntu1604:~# jobs
[1]+  Running                 sleep 9999 &
root@ubuntu1604:~# screen -ls
There are screens on:
        15800.mysession1        (07/10/2016 13:58:29)   (Attached)
        1745.mysession  (07/10/2016 11:00:55)   (Attached)
2 Sockets in /var/run/screen/S-root.
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **screen** command to view the command line switches. [/stextbox]

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@ubuntu1604:~# ls -lai /tmp
total 40
390918 drwxrwxrwt 10 root root 4096 oct.   7 16:31 .
     2 drwxr-xr-x 24 root root 4096 sept. 28 10:40 ..
521792 drwxrwxrwt  2 root root 4096 sept. 28 10:31 .font-unix
522570 drwxr-xr-x  2 root root 4096 sept. 28 10:34 hsperfdata_root
521777 drwxrwxrwt  2 root root 4096 sept. 28 10:31 .ICE-unix
521308 drwxr-xr-x  2 root root 4096 sept. 29 10:32 inode
395765 srw-------  1 root root    0 sept. 28 10:34 .java_pid2124
521306 drwx------  3 root root 4096 sept. 29 10:19 systemd-private-cd33d40e1d3a4e08a9cde3de3603311e-systemd-
timesyncd.service-bxC1MJ
521801 drwxrwxrwt  2 root root 4096 sept. 28 10:31 .Test-unix
521757 drwxrwxrwt  2 root root 4096 sept. 28 10:31 .X11-unix
521785 drwxrwxrwt  2 root root 4096 sept. 28 10:31 .XIM-unix
root@ubuntu1604:~# ls -ali /tmp
total 40
390918 drwxrwxrwt 10 root root 4096 oct.   7 16:31 .
     2 drwxr-xr-x 24 root root 4096 sept. 28 10:40 ..
521792 drwxrwxrwt  2 root root 4096 sept. 28 10:31 .font-unix
522570 drwxr-xr-x  2 root root 4096 sept. 28 10:34 hsperfdata_root
521777 drwxrwxrwt  2 root root 4096 sept. 28 10:31 .ICE-unix
521308 drwxr-xr-x  2 root root 4096 sept. 29 10:32 inode
395765 srw-------  1 root root    0 sept. 28 10:34 .java_pid2124
```

```
521306 drwx------  3 root root 4096 sept. 29 10:19 systemd-private-cd33d40e1d3a4e08a9cde3de3603311e-systemd-
timesyncd.service-bxC1MJ
521801 drwxrwxrwt  2 root root 4096 sept. 28 10:31 .Test-unix
521757 drwxrwxrwt  2 root root 4096 sept. 28 10:31 .X11-unix
521785 drwxrwxrwt  2 root root 4096 sept. 28 10:31 .XIM-unix
```

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

```
root@ubuntu1604:~# ls -l --all --inode /tmp
total 40
390918 drwxrwxrwt 10 root root 4096 oct.   7 16:31 .
     2 drwxr-xr-x 24 root root 4096 sept. 28 10:40 ..
521792 drwxrwxrwt  2 root root 4096 sept. 28 10:31 .font-unix
522570 drwxr-xr-x  2 root root 4096 sept. 28 10:34 hsperfdata_root
521777 drwxrwxrwt  2 root root 4096 sept. 28 10:31 .ICE-unix
521308 drwxr-xr-x  2 root root 4096 sept. 29 10:32 inode
395765 srw-------  1 root root    0 sept. 28 10:34 .java_pid2124
521306 drwx------  3 root root 4096 sept. 29 10:19 systemd-private-cd33d40e1d3a4e08a9cde3de3603311e-systemd-
timesyncd.service-bxC1MJ
521801 drwxrwxrwt  2 root root 4096 sept. 28 10:31 .Test-unix
521757 drwxrwxrwt  2 root root 4096 sept. 28 10:31 .X11-unix
521785 drwxrwxrwt  2 root root 4096 sept. 28 10:31 .XIM-unix

root@ubuntu1604:~# ls -l --allinode /tmp
ls: unrecognized option '--allinode'
Try 'ls --help' for more information.
```

[stextbox id='black' image='null'] **Important** - You should **not** combine any short options that take an argument. [/stextbox]

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

BREs

Certain Metacharacters are specific to BREs:

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

EREs

Certain Metacharacters are specific to EREs:

Metacharacter	Description
{x,y}	Match from **x** to **y** occurrences of the preceeding element
{x}	Match exactly **x** occurrences of the preceeding element
{x,}	
?	Matches 0 or 1 occurrence of the preceeding element
+	Matches 1 or more occurrence(s) of the preceeding element
|	Matches either the expression before or the expression after the operator
()	Combines the Reguler 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

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **grep** command to view the command line switches. [/stextbox]

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

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **egrep** command to view the command line switches. [/stextbox]

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.

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **fgrep** command to view the command line switches. [/stextbox]

LAB #1 - Using grep, egrep and fgrep

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

greptest

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

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

```
root@ubuntu1604:~# mv /home/trainee/Downloads/greptest /tmp/greptest
```

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

```
root@ubuntu1604:~# grep '[a-zA-Z]' /tmp/greptest
fenestrOS
fenestros
f
.fenestros
.fe
```

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

```
root@ubuntu1604:~# grep '[a-zA-Z0-9]' /tmp/greptest
fenestrOS
fenestros
555-5555
f
.fenestros
.fe
```

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

```
root@ubuntu1604:~# 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@ubuntu1604:~# grep '^.$' /tmp/greptest
f
£
```

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

```
root@ubuntu1604:~# grep '^\.' /tmp/greptest
.fenestros
.fe
```

[stextbox id='black' image='null'] **Important** - 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"**. [/stextbox]

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

greptest

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

.fenestros

.fe

£
# End comment
```

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

```
root@ubuntu1604:~# 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@ubuntu1604:~# grep -E -v '^(#|$)' /tmp/greptest
fenestrOS
fenestros
555-5555
f
.fenestros
.fe
£
```

[stextbox id='black' image='null'] The expression **'^(#|$)'** matches all lines beginning with the **#** character OR all lines with zero characters between the start and the end of the line. [/stextbox]

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

```
root@ubuntu1604:~# egrep -v '^(#|$)'  /tmp/greptest > /tmp/greptest1
root@ubuntu1604:~# cat /tmp/greptest1
fenestrOS
fenestros
555-5555
f
.fenestros
.fe
£
```

[stextbox id='black' image='null'] **Important**: The above command is very useful when you want to quickly ascertain which directives are active in a very long configuration file. [/stextbox]

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

greptest

```
# Starting comment
```

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

.fenestros

.fe

£
# End comment
```

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

```
root@ubuntu1604:~# mv /home/trainee/Downloads/greptest /tmp/greptest
```

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

```
root@ubuntu1604:~# 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@ubuntu1604:~# grep '^' /tmp/greptest
# Starting comment
^ This line will be used to demonstrate the use of fgrep
fenestrOS
fenestros
# Another comment
555-5555
f
```

```
.fenestros

.fe

£
# 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@ubuntu1604:~# 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

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **fgrep** command to view the command line switches. [/stextbox]

LAB #2 - Using sed

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

```
root@ubuntu1604:~# 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@ubuntu1604:~# 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--
```

[stextbox id='black' image='null'] **Important**: Note that the BRE is preceeded and followed by the **/** character. [/stextbox]

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

```
root@ubuntu1604:~# 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
...
```

[stextbox id='black' image='null'] **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. [/stextbox]

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

```
root@ubuntu1604:~# 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@ubuntu1604:~# sed -n '/^#/!w /tmp/sedtest' /etc/services
root@ubuntu1604:~# 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%)
```

[stextbox id='black' image='null'] **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. [/stextbox]

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

```
root@ubuntu1604:~# echo "user1,user2,user3" > /tmp/sedtest1
root@ubuntu1604:~# cat /tmp/sedtest1 | sed 's/,/ /g'
user1 user2 user3
```

[stextbox id='black' image='null'] **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 occurences that match. If **g** is not stipulated, only the first matching occurence is replaced. [/stextbox]

The Text Processor AWK

Presentation

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

```
awk [-F seperator] '[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@ubuntu1604:~# ls -l | awk '{print $8 $3 $4}'

10:40rootroot
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@ubuntu1604:~# ls -l | awk '{print $8 " " $3 " " $4}'
10:40 root root
2016 root root
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@ubuntu1604:~# 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@ubuntu1604:~# 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=c27fce7f-cc8a-4c6f-b19b-d929a4d570f2 /               ext4    errors=remount-ro 0       1
# swap was on /dev/sda5 during installation
UUID=68f67549-63f1-4833-b792-3566455bbe95 none            swap    sw              0       0
=========================================
```

[stextbox id='black' image='null'] **Important**: Note the use of the **-f** switch which instructs awk to use the script. [/stextbox]

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

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **awk** command to view the command line switches. [/stextbox]

LAB #3 - Using awk

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

sales.txt

```
# FenestrOs.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 seperator 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@ubuntu1604:~# awk -f /home/trainee/Downloads/sales.awk /home/trainee/Downloads/sales.txt
PC Type :  Servers   Sales (06+13+83) :         41
PC Type :  Portables     Sales (06+13+83) :        175
PC Type :  Ipads     Sales (06+13+83) :         76
PC Type :  Desktops      Sales (06+13+83) :        329
```

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
un  deux    trois    quatre    cinq
un  deux    trois    quatre    cinq
un  deux    trois    quatre    cinq
un  deux    trois    quatre    cinq
un  deux    trois    quatre    cinq
un  deux    trois    quatre    cinq
un  deux    trois    quatre    cinq
un  deux    trois    quatre    cinq
```

Move the file to the /root folder:

```
root@ubuntu1604:~# mv /home/trainee/Downloads/expand.txt /root/expand
```

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

```
root@ubuntu1604:~# cat expand
un  deux    trois    quatre    cinq
un  deux    trois    quatre    cinq
un  deux    trois    quatre    cinq
un  deux    trois    quatre    cinq
un  deux    trois    quatre    cinq
un  deux    trois    quatre    cinq
un  deux    trois    quatre    cinq
un  deux    trois    quatre    cinq
un  deux    trois    quatre    cinq
un  deux    trois    quatre    cinq
```

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

```
root@ubuntu1604:~# 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$
```

[stextbox id='black' image='null'] **Important** : As you can see the tabulations are shown as **^I** and the end o each line as a **$**. [/stextbox]

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

```
root@ubuntu1604:~# expand expand > expand1
```

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

```
root@ubuntu1604:~# cat -vet expand1
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
```

[stextbox id='black' image='null'] **Important** : As you can see, the tabulations have been changed into spaces. [/stextbox]

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **expand** command to view the command line switches. [/stextbox]

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@ubuntu1604:~# cat -vet expand1
un      deux    trois   quatre  cinq$
```

```
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
un      deux    trois   quatre  cinq$
root@ubuntu1604:~# unexpand -a expand1 > expand2
root@ubuntu1604:~# 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$
```

[stextbox id='black' image='null'] **Important** : Note that the spaces have been replaced by tabulations. [/stextbox]

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **unexpand** command to view the command line switches. [/stextbox]

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 seperator is a tablulation. The default seperator can be changed by using the **-d** switch.

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

```
root@ubuntu1604:~# 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
syslog:
_apt:x:
message
uuidd:x
lightdm
whoopsi
avahi-a
```

```
avahi:x
dnsmasq
colord:
speech-
hplip:x
kernoop
pulse:x
rtkit:x
saned:x
usbmux:
trainee
sshd:x:
```

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

```
root@ubuntu1604:~# cut -c1-5,10-15,30- /etc/passwd
root:0:rootsh
daemo1:1: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:/vasr/sbin/nologin
mail:8:mailr/sbin/nologin
news:9:newsws:/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
```

```
systeimesynstemd Time Synchronization,,,:/run/systemd:/bin/false
systeetworktemd Network Management,,,:/run/systemd/netif:/bin/false
systeesolvetemd Resolver,,,:/run/systemd/resolve:/bin/false
systeus-proystemd Bus Proxy,,,:/run/systemd:/bin/false
syslo104:10g:/bin/false
_apt:5:6553t:/bin/false
messas:x:10n/dbus:/bin/false
uuidd07:111bin/false
light:108:1ay Manager:/var/lib/lightdm:/bin/false
whoopx:109:ent:/bin/false
avahioipd:x autoip daemon,,,:/var/lib/avahi-autoipd:/bin/false
avahi11:120emon,,,:/var/run/avahi-daemon:/bin/false
dnsma:112:6,:/var/lib/misc:/bin/false
color113:12r management daemon,,,:/var/lib/colord:/bin/false
speecspatcheech Dispatcher,,,:/var/run/speech-dispatcher:/bin/false
hplip15:7:Her,,,:/var/run/hplip:/bin/false
kernox:116:ops Tracking Daemon,,,:/:/bin/false
pulse17:124emon,,,:/var/run/pulse:/bin/false
rtkit18:126,:/proc:/bin/false
saned19:127ed:/bin/false
usbmu120:46,,,:/var/lib/usbmux:/bin/false
train:1000:,:/home/trainee:/bin/bash
sshd:1:6553hd:/usr/sbin/nologin
```

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

```
root@ubuntu1604:~# 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:102:/run/systemd
x:103:/run/systemd/netif
x:104:/run/systemd/resolve
x:105:/run/systemd
x:108:/home/syslog
x:65534:/nonexistent
x:110:/var/run/dbus
x:111:/run/uuidd
x:114:/var/lib/lightdm
x:116:/nonexistent
x:119:/var/lib/avahi-autoipd
x:120:/var/run/avahi-daemon
x:65534:/var/lib/misc
x:123:/var/lib/colord
x:29:/var/run/speech-dispatcher
x:7:/var/run/hplip
x:65534:/
x:124:/var/run/pulse
x:126:/proc
x:127:/var/lib/saned
x:46:/var/lib/usbmux
x:1000:/home/trainee
x:65534:/var/run/sshd
```

[stextbox id='black' image='null'] **Important**: Note the use of the **-d** switch to change the default seperator. [/stextbox]

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **cut** command to view the command line switches. [/stextbox]

The uniq Command

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

```
root@ubuntu1604:~# 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
102
103
```

```
104
105
108
110
111
114
116
119
120
123
124
126
127
1000
65534
```

[stextbox id='black' image='null'] **Important**: Note the use of the **uniq** command to remove duplicates from the list. [/stextbox]

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **uniq** command to view the command line switches. [/stextbox]

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@ubuntu1604:~# 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/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:100:102:SYSTEMD TIME SYNCHRONIZATION,,,:/RUN/SYSTEMD:/BIN/FALSE
SYSTEMD-NETWORK:X:101:103:SYSTEMD NETWORK MANAGEMENT,,,:/RUN/SYSTEMD/NETIF:/BIN/FALSE
SYSTEMD-RESOLVE:X:102:104:SYSTEMD RESOLVER,,,:/RUN/SYSTEMD/RESOLVE:/BIN/FALSE
SYSTEMD-BUS-PROXY:X:103:105:SYSTEMD BUS PROXY,,,:/RUN/SYSTEMD:/BIN/FALSE
SYSLOG:X:104:108::/HOME/SYSLOG:/BIN/FALSE
_APT:X:105:65534::/NONEXISTENT:/BIN/FALSE
MESSAGEBUS:X:106:110::/VAR/RUN/DBUS:/BIN/FALSE
UUIDD:X:107:111::/RUN/UUIDD:/BIN/FALSE
LIGHTDM:X:108:114:LIGHT DISPLAY MANAGER:/VAR/LIB/LIGHTDM:/BIN/FALSE
WHOOPSIE:X:109:116::/NONEXISTENT:/BIN/FALSE
AVAHI-AUTOIPD:X:110:119:AVAHI AUTOIP DAEMON,,,:/VAR/LIB/AVAHI-AUTOIPD:/BIN/FALSE
AVAHI:X:111:120:AVAHI MDNS DAEMON,,,:/VAR/RUN/AVAHI-DAEMON:/BIN/FALSE
DNSMASQ:X:112:65534:DNSMASQ,,,:/VAR/LIB/MISC:/BIN/FALSE
COLORD:X:113:123:COLORD COLOUR MANAGEMENT DAEMON,,,:/VAR/LIB/COLORD:/BIN/FALSE
SPEECH-DISPATCHER:X:114:29:SPEECH DISPATCHER,,,:/VAR/RUN/SPEECH-DISPATCHER:/BIN/FALSE
HPLIP:X:115:7:HPLIP SYSTEM USER,,,:/VAR/RUN/HPLIP:/BIN/FALSE
KERNOOPS:X:116:65534:KERNEL OOPS TRACKING DAEMON,,,:/:/BIN/FALSE
PULSE:X:117:124:PULSEAUDIO DAEMON,,,:/VAR/RUN/PULSE:/BIN/FALSE
RTKIT:X:118:126:REALTIMEKIT,,,:/PROC:/BIN/FALSE
SANED:X:119:127::/VAR/LIB/SANED:/BIN/FALSE
```

```
USBMUX:X:120:46:USBMUX DAEMON,,,:/VAR/LIB/USBMUX:/BIN/FALSE
TRAINEE:X:1000:1000:TRAINEE,,,:/HOME/TRAINEE:/BIN/BASH
SSHD:X:121:65534::/VAR/RUN/SSHD:/USR/SBIN/NOLOGIN
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **tr** command to view the command line switches. [/stextbox]

The paste Command

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

```
root@ubuntu1604:~# paste -d: /etc/passwd /etc/shadow
root:x:0:0:root:/root:/bin/bash:root:!:16924:0:99999:7:::
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin:daemon:*:16911:0:99999:7:::
bin:x:2:2:bin:/bin:/usr/sbin/nologin:bin:*:16911:0:99999:7:::
sys:x:3:3:sys:/dev:/usr/sbin/nologin:sys:*:16911:0:99999:7:::
sync:x:4:65534:sync:/bin:/bin/sync:sync:*:16911:0:99999:7:::
games:x:5:60:games:/usr/games:/usr/sbin/nologin:games:*:16911:0:99999:7:::
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin:man:*:16911:0:99999:7:::
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin:lp:*:16911:0:99999:7:::
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin:mail:*:16911:0:99999:7:::
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin:news:*:16911:0:99999:7:::
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin:uucp:*:16911:0:99999:7:::
proxy:x:13:13:proxy:/bin:/usr/sbin/nologin:proxy:*:16911:0:99999:7:::
www-data:x:33:33:www-data:/var/www:/usr/sbin/nologin:www-data:*:16911:0:99999:7:::
backup:x:34:34:backup:/var/backups:/usr/sbin/nologin:backup:*:16911:0:99999:7:::
list:x:38:38:Mailing List Manager:/var/list:/usr/sbin/nologin:list:*:16911:0:99999:7:::
irc:x:39:39:ircd:/var/run/ircd:/usr/sbin/nologin:irc:*:16911:0:99999:7:::
gnats:x:41:41:Gnats Bug-Reporting System (admin):/var/lib/gnats:/usr/sbin/nologin:gnats:*:16911:0:99999:7:::
nobody:x:65534:65534:nobody:/nonexistent:/usr/sbin/nologin:nobody:*:16911:0:99999:7:::
```

```
systemd-timesync:x:100:102:systemd Time Synchronization,,,:/run/systemd:/bin/false:systemd-
timesync:*:16911:0:99999:7:::
systemd-network:x:101:103:systemd Network Management,,,:/run/systemd/netif:/bin/false:systemd-
network:*:16911:0:99999:7:::
systemd-resolve:x:102:104:systemd Resolver,,,:/run/systemd/resolve:/bin/false:systemd-
resolve:*:16911:0:99999:7:::
systemd-bus-proxy:x:103:105:systemd Bus Proxy,,,:/run/systemd:/bin/false:systemd-bus-proxy:*:16911:0:99999:7:::
syslog:x:104:108::/home/syslog:/bin/false:syslog:*:16911:0:99999:7:::
_apt:x:105:65534::/nonexistent:/bin/false:_apt:*:16911:0:99999:7:::
messagebus:x:106:110::/var/run/dbus:/bin/false:messagebus:*:16911:0:99999:7:::
uuidd:x:107:111::/run/uuidd:/bin/false:uuidd:*:16911:0:99999:7:::
lightdm:x:108:114:Light Display Manager:/var/lib/lightdm:/bin/false:lightdm:*:16911:0:99999:7:::
whoopsie:x:109:116::/nonexistent:/bin/false:whoopsie:*:16911:0:99999:7:::
avahi-autoipd:x:110:119:Avahi autoip daemon,,,:/var/lib/avahi-autoipd:/bin/false:avahi-
autoipd:*:16911:0:99999:7:::
avahi:x:111:120:Avahi mDNS daemon,,,:/var/run/avahi-daemon:/bin/false:avahi:*:16911:0:99999:7:::
dnsmasq:x:112:65534:dnsmasq,,,:/var/lib/misc:/bin/false:dnsmasq:*:16911:0:99999:7:::
colord:x:113:123:colord colour management daemon,,,:/var/lib/colord:/bin/false:colord:*:16911:0:99999:7:::
speech-dispatcher:x:114:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/false:speech-
dispatcher:!:16911:0:99999:7:::
hplip:x:115:7:HPLIP system user,,,:/var/run/hplip:/bin/false:hplip:*:16911:0:99999:7:::
kernoops:x:116:65534:Kernel Oops Tracking Daemon,,,:/:/bin/false:kernoops:*:16911:0:99999:7:::
pulse:x:117:124:PulseAudio daemon,,,:/var/run/pulse:/bin/false:pulse:*:16911:0:99999:7:::
rtkit:x:118:126:RealtimeKit,,,:/proc:/bin/false:rtkit:*:16911:0:99999:7:::
saned:x:119:127::/var/lib/saned:/bin/false:saned:*:16911:0:99999:7:::
usbmux:x:120:46:usbmux daemon,,,:/var/lib/usbmux:/bin/false:usbmux:*:16911:0:99999:7:::
trainee:x:1000:1000:trainee,,,:/home/trainee:/bin/bash:trainee:$6$cloNcVp0$4BFXvmH./lvuhem.pWND1.XgChp/BuT4tHukwv
FR9ykdQM1Yt.WbMO60lHdUR/E6D2bqUJ/n.BwX4gCMle/671:16924:0:99999:7:::
sshd:x:121:65534::/var/run/sshd:/usr/sbin/nologin:sshd:*:16924:0:99999:7:::
```

[stextbox id='black' image='null'] **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. [/stextbox]

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **paste** command to view the command line switches. [/stextbox]

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@ubuntu1604:~# dd if=/dev/zero of=/file bs=1024k count=250
250+0 records in
250+0 records out
262144000 bytes (262 MB, 250 MiB) copied, 2,57217 s, 102 MB/s
```

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

```
root@ubuntu1604:~# split -b 50m /file filepart
root@ubuntu1604:~# ls -l | grep filepart
-rw-r--r-- 1 root root 52428800 déc.  17 11:31 filepartaa
-rw-r--r-- 1 root root 52428800 déc.  17 11:31 filepartab
-rw-r--r-- 1 root root 52428800 déc.  17 11:31 filepartac
-rw-r--r-- 1 root root 52428800 déc.  17 11:31 filepartad
-rw-r--r-- 1 root root 52428800 déc.  17 11:31 filepartae
```

[stextbox id='black' image='null'] **Important**: Note that the 5 files were created in the current working directory. [/stextbox]

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

```
root@ubuntu1604:~# cat fileparta* > newfile
root@ubuntu1604:~# ls -l | grep newf
-rw-r--r-- 1 root root 262144000 déc.  17 11:32 newfile
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **split** command to view the command line switches. [/stextbox]

The diff Command

The diff command compares two fles 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@ubuntu1604:~# 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@ubuntu1604:~# diff /etc/passwd /root/passwd
8d7
< lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
40c39
< trainee:x:1000:1000:trainee,,,:/home/trainee:/bin/bash
---
> trainee10:x:1000:1000:trainee,,,:/home/trainee:/bin/bash
```

```
41a41
> Linux is great!
```

In this output you will notice the **<** and **>** characters. The first makes reference to the first file, /etc/passwd, whist 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 **40c39** means that at line 40 in /etc/passwd needs to be modified in order to be the same as line 39 in /root/passwd.

The output **41a41** means that at line 41 in /root/passwd line 41 in /etc/passwd needs to be added because it is missing.

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **diff** command to view the command line switches. [/stextbox]

The cmp Command

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

```
root@ubuntu1604:~# 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@ubuntu1604:~# 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

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **cmp** command to view the command line switches. [/stextbox]

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@ubuntu1604:~# cat /tmp/greptest
# Starting comment
^ This line will be used to demonstrate the use of fgrep
fenestrOS
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@ubuntu1604:~# cat /tmp/greptest1
fenestrOS
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@ubuntu1604:~# cd /tmp
```

```
root@ubuntu1604:/tmp# diff -u greptest greptest1 > greptest.patch
```

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

```
root@ubuntu1604:/tmp# cat /tmp/greptest.patch
--- greptest    2016-12-09 15:47:38.836983792 +0100
+++ greptest1   2016-12-09 15:46:15.976860968 +0100
@@ -1,14 +1,7 @@
-# Starting comment
-^ This line will be used to demonstrate the use of fgrep
 fenestrOS
 fenestros
-# Another comment
 555-5555
 f
-
 .fenestros
-
 .fe
-
 £
-# End comment
```

Now apply the patch file:

```
root@ubuntu1604:/tmp# patch < greptest.patch
patching file greptest
```

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

```
root@ubuntu1604:/tmp# cat greptest
fenestrOS
fenestros
555-5555
```

```
f
.fenestros
.fe
£
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **patch** command to view the command line switches. [/stextbox]

The strings Command

The **strings** Command is used to extract any printable string in one or more object files or executables. An object fie 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.

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

```
root@ubuntu1604:/tmp# strings /usr/bin/passwd | more
/lib64/ld-linux-x86-64.so.2
kgUa
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
libselinux.so.1
_init
is_selinux_enabled
security_getenforce
context_user_get
security_compute_av
matchpathcon
freecon
context_free
setfscreatecon
--More--
```

Print the offset within the file before each string:

```
root@ubuntu1604:/tmp# strings -t d /usr/bin/passwd | more
    568 /lib64/ld-linux-x86-64.so.2
    823 kgUa
   4241 libpam.so.0
   4253 _ITM_deregisterTMCloneTable
   4281 __gmon_start__
   4296 _Jv_RegisterClasses
   4316 _ITM_registerTMCloneTable
   4342 pam_start
   4352 pam_strerror
   4365 pam_chauthtok
   4379 pam_end
   4387 libpam_misc.so.0
   4404 misc_conv
   4414 libselinux.so.1
   4430 _init
```

```
   4436 is_selinux_enabled
   4455 security_getenforce
   4475 context_user_get
   4492 security_compute_av
   4512 matchpathcon
   4525 freecon
   4533 context_free
   4546 setfscreatecon
--More--
```

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

Argument	**Numbering System**
d	Decimal
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@ubuntu1604:/tmp# strings -t d -n 15 /usr/bin/passwd | more
    568 /lib64/ld-linux-x86-64.so.2
   4253 _ITM_deregisterTMCloneTable
   4296 _Jv_RegisterClasses
   4316 _ITM_registerTMCloneTable
   4387 libpam_misc.so.0
   4414 libselinux.so.1
   4436 is_selinux_enabled
   4455 security_getenforce
   4475 context_user_get
   4492 security_compute_av
   4774 __stack_chk_fail
   4942 __errno_location
   5405 __libc_start_main
   5537 LIBPAM_MISC_1.0
```

```
  34456 Usage: %s [options] [LOGIN]
  34496   -a, --all                     report password status on all accounts
  34568   -d, --delete                  delete the password for the named accoun
t
  34648   -e, --expire                  force expire the password for the named
account
  34736   -h, --help                    display this help message and exit
  34808   -k, --keep-tokens             change password only if expired
  34880   -i, --inactive INACTIVE       set password inactive after expiration
--More--
```

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

```
root@ubuntu1604:/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) 2011-2015 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

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **strings** command to view the command line switches. [/stextbox]

The comm Command

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

```
root@ubuntu1604:/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:100:102:systemd Time Synchronization,,,:/run/systemd:/bin/false
        systemd-network:x:101:103:systemd Network Management,,,:/run/systemd/netif:/bin/false
        systemd-resolve:x:102:104:systemd Resolver,,,:/run/systemd/resolve:/bin/false
        systemd-bus-proxy:x:103:105:systemd Bus Proxy,,,:/run/systemd:/bin/false
        syslog:x:104:108::/home/syslog:/bin/false
        _apt:x:105:65534::/nonexistent:/bin/false
        messagebus:x:106:110::/var/run/dbus:/bin/false
        uuidd:x:107:111::/run/uuidd:/bin/false
        lightdm:x:108:114:Light Display Manager:/var/lib/lightdm:/bin/false
        whoopsie:x:109:116::/nonexistent:/bin/false
        avahi-autoipd:x:110:119:Avahi autoip daemon,,,:/var/lib/avahi-autoipd:/bin/false
        avahi:x:111:120:Avahi mDNS daemon,,,:/var/run/avahi-daemon:/bin/false
        dnsmasq:x:112:65534:dnsmasq,,,:/var/lib/misc:/bin/false
        colord:x:113:123:colord colour management daemon,,,:/var/lib/colord:/bin/false
        speech-dispatcher:x:114:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/false
        hplip:x:115:7:HPLIP system user,,,:/var/run/hplip:/bin/false
        kernoops:x:116:65534:Kernel Oops Tracking Daemon,,,:/:/bin/false
        pulse:x:117:124:PulseAudio daemon,,,:/var/run/pulse:/bin/false
        rtkit:x:118:126:RealtimeKit,,,:/proc:/bin/false
        saned:x:119:127::/var/lib/saned:/bin/false
        usbmux:x:120:46:usbmux daemon,,,:/var/lib/usbmux:/bin/false
    trainee10:x:1000:1000:trainee,,,:/home/trainee:/bin/bash
    sshd:x:121:65534::/var/run/sshd:/usr/sbin/nologin
    Linux is great!
trainee:x:1000:1000:trainee,,,:/home/trainee:/bin/bash
sshd:x:121:65534::/var/run/sshd:/usr/sbin/nologin
```

[stextbox id='black' image='null'] **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. [/stextbox]

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

```
root@ubuntu1604:/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:100:102:systemd Time Synchronization,,,:/run/systemd:/bin/false
systemd-network:x:101:103:systemd Network Management,,,:/run/systemd/netif:/bin/false
systemd-resolve:x:102:104:systemd Resolver,,,:/run/systemd/resolve:/bin/false
systemd-bus-proxy:x:103:105:systemd Bus Proxy,,,:/run/systemd:/bin/false
syslog:x:104:108::/home/syslog:/bin/false
_apt:x:105:65534::/nonexistent:/bin/false
messagebus:x:106:110::/var/run/dbus:/bin/false
uuidd:x:107:111::/run/uuidd:/bin/false
lightdm:x:108:114:Light Display Manager:/var/lib/lightdm:/bin/false
whoopsie:x:109:116::/nonexistent:/bin/false
avahi-autoipd:x:110:119:Avahi autoip daemon,,,:/var/lib/avahi-autoipd:/bin/false
avahi:x:111:120:Avahi mDNS daemon,,,:/var/run/avahi-daemon:/bin/false
```

```
dnsmasq:x:112:65534:dnsmasq,,,:/var/lib/misc:/bin/false
colord:x:113:123:colord colour management daemon,,,:/var/lib/colord:/bin/false
speech-dispatcher:x:114:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/false
hplip:x:115:7:HPLIP system user,,,:/var/run/hplip:/bin/false
kernoops:x:116:65534:Kernel Oops Tracking Daemon,,,:/:/bin/false
pulse:x:117:124:PulseAudio daemon,,,:/var/run/pulse:/bin/false
rtkit:x:118:126:RealtimeKit,,,:/proc:/bin/false
saned:x:119:127::/var/lib/saned:/bin/false
usbmux:x:120:46:usbmux daemon,,,:/var/lib/usbmux:/bin/false
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **comm** command to view the command line switches. [/stextbox]

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@ubuntu1604:/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@ubuntu1604:/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@ubuntu1604:/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/noloroot@ubuntu1604:/tmp#
```

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

```
root@ubuntu1604:/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/noloroot@ubuntu1604:/tmp#
root@ubuntu1604:/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:100:102:systemd Time Synchronization,,,:/run/systemd:/bin/false
systemd-network:x:101:103:systemd Network Management,,,:/run/systemd/netif:/bin/false
systemd-resolve:x:102:104:systemd Resolver,,,:/run/systemd/resolve:/bin/false
systemd-bus-proxy:x:103:105:systemd Bus Proxy,,,:/run/systemd:/bin/false
syslog:x:104:108::/home/syslog:/bin/false
_apt:x:105:65534::/nonexistent:/bin/false
messagebus:x:106:110::/var/run/dbus:/bin/false
uuidd:x:107:111::/run/uuidd:/bin/false
lightdm:x:108:114:Light Display Manager:/var/lib/lightdm:/bin/false
whoopsie:x:109:116::/nonexistent:/bin/false
avahi-autoipd:x:110:119:Avahi autoip daemon,,,:/var/lib/avahi-autoipd:/bin/false
avahi:x:111:120:Avahi mDNS daemon,,,:/var/run/avahi-daemon:/bin/false
dnsmasq:x:112:65534:dnsmasq,,,:/var/lib/misc:/bin/false
colord:x:113:123:colord colour management daemon,,,:/var/lib/colord:/bin/false
speech-dispatcher:x:114:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/false
hplip:x:115:7:HPLIP system user,,,:/var/run/hplip:/bin/false
kernoops:x:116:65534:Kernel Oops Tracking Daemon,,,:/:/bin/false
```

```
pulse:x:117:124:PulseAudio daemon,,,:/var/run/pulse:/bin/false
rtkit:x:118:126:RealtimeKit,,,:/proc:/bin/false
saned:x:119:127::/var/lib/saned:/bin/false
usbmux:x:120:46root@ubuntu1604:/tmp#
```

Both x and y can accept multipliers:

```
root@ubuntu1604:/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@ubuntu1604:/tmp#
root@ubuntu1604:/tmp#
root@ubuntu1604:/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@ubuntu1604:/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

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **head** command to view the command line switches. [/stextbox]

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@ubuntu1604:/tmp# tail /etc/passwd
colord:x:113:123:colord colour management daemon,,,:/var/lib/colord:/bin/false
speech-dispatcher:x:114:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/false
hplip:x:115:7:HPLIP system user,,,:/var/run/hplip:/bin/false
kernoops:x:116:65534:Kernel Oops Tracking Daemon,,,:/:/bin/false
pulse:x:117:124:PulseAudio daemon,,,:/var/run/pulse:/bin/false
rtkit:x:118:126:RealtimeKit,,,:/proc:/bin/false
saned:x:119:127::/var/lib/saned:/bin/false
usbmux:x:120:46:usbmux daemon,,,:/var/lib/usbmux:/bin/false
trainee:x:1000:1000:trainee,,,:/home/trainee:/bin/bash
```

```
sshd:x:121:65534::/var/run/sshd:/usr/sbin/nolog
```

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

```
root@ubuntu1604:/tmp# tail -n 15 /etc/passwd
lightdm:x:108:114:Light Display Manager:/var/lib/lightdm:/bin/false
whoopsie:x:109:116::/nonexistent:/bin/false
avahi-autoipd:x:110:119:Avahi autoip daemon,,,:/var/lib/avahi-autoipd:/bin/false
avahi:x:111:120:Avahi mDNS daemon,,,:/var/run/avahi-daemon:/bin/false
dnsmasq:x:112:65534:dnsmasq,,,:/var/lib/misc:/bin/false
colord:x:113:123:colord colour management daemon,,,:/var/lib/colord:/bin/false
speech-dispatcher:x:114:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/false
hplip:x:115:7:HPLIP system user,,,:/var/run/hplip:/bin/false
kernoops:x:116:65534:Kernel Oops Tracking Daemon,,,:/:/bin/false
pulse:x:117:124:PulseAudio daemon,,,:/var/run/pulse:/bin/false
rtkit:x:118:126:RealtimeKit,,,:/proc:/bin/false
saned:x:119:127::/var/lib/saned:/bin/false
usbmux:x:120:46:usbmux daemon,,,:/var/lib/usbmux:/bin/false
trainee:x:1000:1000:trainee,,,:/home/trainee:/bin/bash
sshd:x:121:65534::/var/run/sshd:/usr/sbin/nologin
```

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

```
root@ubuntu1604:/tmp# tail -c 150 /etc/passwd
:usbmux daemon,,,:/var/lib/usbmux:/bin/false
trainee:x:1000:1000:trainee,,,:/home/trainee:/bin/bash
sshd:x:121:65534::/var/run/sshd:/usr/sbin/nologin
```

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

```
root@ubuntu1604:/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:100:102:systemd Time Synchronization,,,:/run/systemd:/bin/false
systemd-network:x:101:103:systemd Network Management,,,:/run/systemd/netif:/bin/false
systemd-resolve:x:102:104:systemd Resolver,,,:/run/systemd/resolve:/bin/false
systemd-bus-proxy:x:103:105:systemd Bus Proxy,,,:/run/systemd:/bin/false
syslog:x:104:108::/home/syslog:/bin/false
_apt:x:105:65534::/nonexistent:/bin/false
messagebus:x:106:110::/var/run/dbus:/bin/false
uuidd:x:107:111::/run/uuidd:/bin/false
lightdm:x:108:114:Light Display Manager:/var/lib/lightdm:/bin/false
whoopsie:x:109:116::/nonexistent:/bin/false
avahi-autoipd:x:110:119:Avahi autoip daemon,,,:/var/lib/avahi-autoipd:/bin/false
avahi:x:111:120:Avahi mDNS daemon,,,:/var/run/avahi-daemon:/bin/false
dnsmasq:x:112:65534:dnsmasq,,,:/var/lib/misc:/bin/false
colord:x:113:123:colord colour management daemon,,,:/var/lib/colord:/bin/false
speech-dispatcher:x:114:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/false
hplip:x:115:7:HPLIP system user,,,:/var/run/hplip:/bin/false
kernoops:x:116:65534:Kernel Oops Tracking Daemon,,,:/:/bin/false
pulse:x:117:124:PulseAudio daemon,,,:/var/run/pulse:/bin/false
rtkit:x:118:126:RealtimeKit,,,:/proc:/bin/false
saned:x:119:127::/var/lib/saned:/bin/false
usbmux:x:120:46:usbmux daemon,,,:/var/lib/usbmux:/bin/false
trainee:x:1000:1000:trainee,,,:/home/trainee:/bin/bash
```

```
sshd:x:121:65534::/var/run/sshd:/usr/sbin/nologin
```

Both x and y can accept multipliers:

```
root@ubuntu1604:/tmp# tail -c 1b /etc/passwd
:114:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/false
hplip:x:115:7:HPLIP system user,,,:/var/run/hplip:/bin/false
kernoops:x:116:65534:Kernel Oops Tracking Daemon,,,:/:/bin/false
pulse:x:117:124:PulseAudio daemon,,,:/var/run/pulse:/bin/false
rtkit:x:118:126:RealtimeKit,,,:/proc:/bin/false
saned:x:119:127::/var/lib/saned:/bin/false
usbmux:x:120:46:usbmux daemon,,,:/var/lib/usbmux:/bin/false
trainee:x:1000:1000:trainee,,,:/home/trainee:/bin/bash
sshd:x:121:65534::/var/run/sshd:/usr/sbin/nologin
root@ubuntu1604:/tmp#
root@ubuntu1604:/tmp# tail -c 512 /etc/passwd
:114:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/false
hplip:x:115:7:HPLIP system user,,,:/var/run/hplip:/bin/false
kernoops:x:116:65534:Kernel Oops Tracking Daemon,,,:/:/bin/false
pulse:x:117:124:PulseAudio daemon,,,:/var/run/pulse:/bin/false
rtkit:x:118:126:RealtimeKit,,,:/proc:/bin/false
saned:x:119:127::/var/lib/saned:/bin/false
usbmux:x:120:46:usbmux daemon,,,:/var/lib/usbmux:/bin/false
trainee:x:1000:1000:trainee,,,:/home/trainee:/bin/bash
sshd:x:121:65534::/var/run/sshd:/usr/sbin/nologin
```

The common multipliers are:

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

Multiplier	Number of bytes
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@ubuntu1604:/tmp# tail -f /var/log/syslog
Dec 17 13:22:35 ubuntu1604 sh[870]: Sleeping '888' '888'
Dec 17 14:16:59 ubuntu1604 sh[870]: message repeated 465 times: [ Sleeping '888' '888']
Dec 17 14:17:01 ubuntu1604 CRON[17224]: (root) CMD (   cd / && run-parts --report /etc/cron.hourly)
Dec 17 14:17:06 ubuntu1604 sh[870]: Sleeping '888' '888'
Dec 17 15:17:00 ubuntu1604 sh[870]: message repeated 512 times: [ Sleeping '888' '888']
Dec 17 15:17:01 ubuntu1604 CRON[30516]: (root) CMD (   cd / && run-parts --report /etc/cron.hourly)
Dec 17 15:17:07 ubuntu1604 sh[870]: Sleeping '888' '888'
Dec 17 15:30:00 ubuntu1604 sh[870]: message repeated 110 times: [ Sleeping '888' '888']
Dec 17 15:30:00 ubuntu1604 systemd[1]: snapd.refresh.timer: Adding 4h 29min 43.172868s random time.
Dec 17 15:30:07 ubuntu1604 sh[870]: Sleeping '888' '888'
^C
```

Command Line Switches

[stextbox id='black' image='null'] **To do** : Use the **–help** option of the **head** command to view the command line switches. [/stextbox]

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

```
root@ubuntu1604:/tmp# ifconfig enp0s3
enp0s3    Link encap:Ethernet  HWaddr 08:00:27:20:4b:97
          inet addr:10.0.2.15  Bcast:10.0.2.255  Mask:255.255.255.0
          inet6 addr: fe80::c4db:2b29:aedd:e7ed/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
```

```
          RX packets:230127 errors:0 dropped:0 overruns:0 frame:0
          TX packets:149877 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:238004530 (238.0 MB)  TX bytes:10864892 (10.8 MB)

root@ubuntu1604:/tmp# ifconfig enp0s3 | grep "inet"
          inet addr:10.0.2.15  Bcast:10.0.2.255  Mask:255.255.255.0
          inet6 addr: fe80::c4db:2b29:aedd:e7ed/64 Scope:Link

root@ubuntu1604:/tmp# ifconfig enp0s3 | grep "inet" | grep -v "inet6"
          inet addr:10.0.2.15  Bcast:10.0.2.255  Mask:255.255.255.0

root@ubuntu1604:/tmp# ifconfig enp0s3 | grep "inet" | grep -v "inet6" | tr -s " " ":"
:inet:addr:10.0.2.15:Bcast:10.0.2.255:Mask:255.255.255.0

root@ubuntu1604:/tmp# ifconfig enp0s3 | grep "inet" | grep -v "inet6" | tr -s " " ":" | cut -d: -f4
10.0.2.15
```

[stextbox id='black' image='null'] **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. [/stextbox]

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