OS Fundamentals:   
Filesystems-Linux

# Instructions

Answer all questions directly in this document. You will upload this completed document as your homework assignment.

# Overview

In this lab you will explore the Linux file system.

# Setup

1. Download the following files and place them in your Virtual Machines folder.
   1. <http://lf.citwdd.net/labs/osfun/Secret.vmdk>
   2. <http://lf.citwdd.net/labs/osfun/FileSystems.vmdk>
2. Start your Virtual Machine
3. Make sure that student can use sudo. Enter the command  
   sudo -l
   1. If you see something like "Sorry, user student may not run sudo on debian." you will need to give student sudo access. If student does not have sudo access complete the following steps
      1. Add student to the sudo group  
         su  
         adduser student sudo  
         exit
      2. Log off then log back on for the changes to take effect.

# Task 1—Working with paths

1. In this step you will explore some features of pathnames. Filenames with spaces and crazy characters. To use a pathname with spaces or nonstandard characters you either need to reference the file as a string, or escape the special characters in the pathname on the command line

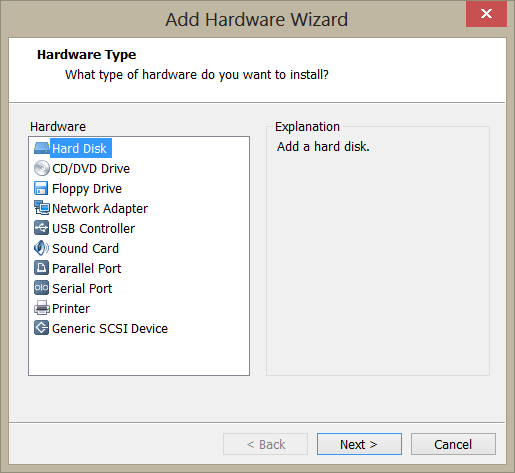
## Steps

1. Login as student.
2. Create a folder named **fileystemslab** off your home directory, then make it your current directory.  
   mkdir ~/filesystemslab  
   cd ~/filesystemslab
3. Attempt to create a file with spaces in the file name with the following command  
   touch file with spaces  
   Use the ls –l command to see the results. Describe what happened \_\_I created three different file called file,sapces and with\_\_
4. Try sending the file name as a string, enter the following command  
   touch "This file has spaces in its name"  
   Use the ls –l command to see the results. Describe what happened \_I created four different files called file, spaces, ‘This file has spaces in its name’ and with \_\_\_
5. Open the file with nano. On the command line enter the following characters (do not press enter)  
   nano This  
   now press the **tab** key  
   After pressing the tab key what was placed on the command line? \_file =This file has spaces in its name and spaces =with \_\_\_  
   The \ character is the escape character; the shell will interpret the character immediately following the \ character as a literal character in the filename.
6. Now press the enter key, this will open nano and allow you to edit the file.
   1. Add some data to the file
   2. Save and exit nano
7. Create a crazy filename using the escape character. Enter the following command  
   touch cra\>\|zy\ file  
   Use the ls -l command to view your files. What filename was created?\_\_cra>zy file\_\_
8. Change to your user’s home directory with ~. Enter the command  
   cd ~  
   Use the pwd command, what is your user’s home directory? \_\_/home/student\_
9. Now change to the user named bilbo’s home directory. Enter the command  
   cd ~bilbo  
   Use the pwd command what is bilbo’s home directory? \_/home/bilbo\_\_\_
10. You could discover frodo’s home directory without changing to it with the following command  
    echo ~frodo
11. With your current directory as bilbo’s home directory what command would you use, using a relative path to go to frodo’s home directory? \_/home/frodo\_\_\_
12. With your current directory as bilbo’s home directory what command would you use, using a relative path to go to students’s home directory? \_\_cd ~student\_\_
13. What command would you use to go to frodo’s home directory, using an absolute path and not using the special ~ path? \_\_cd /home/your-username\_\_
14. Change back to the filesystemlab directory with the command  
    cd ~/filesystemslab

# Task 2—Mounting Disks

In this task you will explore how disks are mounted to the filesystem.

## Steps

1. Open a **root** terminal. Since many of these commands require root permissions you will use a root terminal. (either su or sudo
2. View the disks/partitions on your machine using the special file /proc/partitions. Enter the command:  
   cat /proc/partitions  
   List the partition entries on your system? \_\_,sda1,sda2,sda5\_\_  
   List the physical disks that are on your system? \_sr0,sda\_\_\_
3. Adding a disk to your system. The two files you downloaded in the setup portion are VMWare virtual disks, attaching a virtual disk to your system is the same as plugging a physical disk into your computer. Now you will attach a new disk to your VM.
   1. Open your virtual machine settings, from VMWare **VM🡪Settings**.
   2. Click the **Add…** button to add new hardware.
   3. From the list of hardware select **Hard Disk** then click **Next**.  
      
   4. Select the **SCSI** virtual disk type then click **Next**.
   5. Select the **use and existing virtual disk** radio button the click **Next**.
   6. Browse to the location you saved the file **filesystems.vmdk** then open. This will attach the virtual disk to your Virtual machine’s scsi controller.
   7. Click **Finish**
   8. Click **OK** to save your new VM settings.
   9. Finally, you need to tell Linux to rescan the scsi bus to find the new disk. Enter the following command:  
      rescan-scsi-bus
   10. Use the /proc/partitions file to view your system’s partitions, what new disks/partitions do you have? \_\_sdb1,sdb2,sdb3,sda\_\_
   11. The third column in /proc/partitions is the partition size in bytes. Do you notice anything odd? \_\_sda2 if so what? \_\_\_The number is only 1\_
4. Mounting disks to the filesystem. Just because a disk is in your computer does not mean that it is attached to the filesystem. Before you can access the data on a disk/partion you must mount it to the filesystem. You can mount the disk/partition anyplace you would like in the filesystem, a common location is /mnt.
   1. The first thing you need is a place to mount the new partition to. Create a directory under /mnt named newdisk  
      mkdir /mnt/newdisk
   2. Now you can attach the disk to the mount location with the mount command. You will use the first partition on the new disk for this operation. Enter the command:  
      mount /dev/sdb1 /mnt/newdisk
   3. If the mount was successful you can explore the disk using the ls command. Enter the command   
      ls /mnt/newdisk  
      Explore the disk using commands such as ls. Describe what is on this disk(partition)? \_it contains bin lost+found scripting\_\_\_
5. Viewing what is mounted with mount. Enter the command:  
   mount  
   You will see a list of the disks that are mounted. At the bottom of the list you should see the partition you just mounted along with its mount type (the type is the filesystem used for that disk) you will also see if the disk is Read Only (ro) or Read Write (rw). What filesystem is used for this disk? \_ext4\_\_\_ Is it writable? \_rw\_\_\_
6. What happens when you reboot?
   1. Reboot your VM
   2. open a root shell
   3. Is the physical disk still attached to your system (hint /proc/partitions)? \_\_yes\_
   4. Is the new disk still mounted (hint use ls or mount)? \_yes\_\_
7. Making mounts persistent. If you want the new disk to be permanently mounted you need to add mounting instructions in /etc/fstab.
   1. Edit fstab with the following command  
      nano /etc/fstab
   2. Add the following line to the bottom of the fileyes  
      /dev/sdb1 /mnt/newdisk auto rw
   3. Save the file and exit nano.
   4. Reboot your VM.
   5. Open a root shell
   6. Verify the disk mounted automatically. What command did you use to verify?\_mount\_\_\_
8. Unmounting a disk. You can also remove mounted disk from your system with the umount command.
   1. Unmout the newdisk with the following command.  
      umount /mnt/newdisk
   2. Verify the disk was unmounted. What command did you use to verify the disk was unmounted? \_\_mount\_\_
9. Mounting disks that have entries in /etc/fstab. Since the mount point /mnt/newdisk has an entry in fstab you can mount the disk by just using the mount point as the only argument to the mount command.
   1. Enter the command:  
      mount /mnt/newdisk
   2. Verify the disk was mounted.
10. What’s using the disk? Sometimes you will want to unmount a disk but the disk is in use, you can use the fuser command to determine what is using the disk so you and take corrective action before unmounting the disk.
    1. Make /mnt/newdisk/bin your current directory.  
       cd /mnt/newdisk/bin
    2. Attempt to unmount the disk.  
       umount /mnt/newdisk  
       what message did you get? \_Target is busy\_\_\_
    3. Use the fuser command to see what is using the disk. Enter the command:  
       fuser -c /mnt/newdisk
    4. You should see the mount point, then the process ID of the process causing the lock, and finally a letter code why the process is using the resource. What process ID is using the mount? \_1199\_\_\_ what is the reason code? \_\_\_c\_
    5. You can get more detailed information from fuser by adding the v option. Enter the command:  
       fuser -cv /mnt/newdisk  
       What user is causing the disk to not unmount? \_\_root\_\_

# Task 3—Exploring Access Control Lists (ACL)

Often the basic Unix permissions do not offer fine enough control for the security of a file. In that case you can use Access Control Lists to provide finer grained security on your files.

## Steps

1. Open a normal terminal as student and change to the filesystemslab directory.  
   cd ~/filesystemslab
2. create a file name acl  
   touch acl
3. View the standard Unix permissions.  
   ls –l acl  
   Who is the owner of the file? \_student\_\_\_  
   Who is the owner group for the file? \_\_student\_\_  
   What permissions does the owner have? \_rw\_\_\_  
   What permission does the group have? \_\_r\_\_  
   What permissions do Others have? \_\_r\_\_
4. View the ACL for the file acl  
   getfacl acl  
   Record the output \_file: acl, owner;student, Group : student, user : rw, Group :r, Other :r\_  
   Do the three permissions in the ACL for User, Group and Others correspond to the Unix permissions? \_\_Yes
5. Add some Access Control Entries. Enter the following command:  
   setfacl -m user:pipin:r,user:bilbo:rw,group:wizards:rw acl
6. View the new ACLs. Record the output here \_\_\_YesFile : acl, Owner :student, Group : student, User:rwx, User: bilbo:rw,User: pipin:r, Group:r, Groupwizards: rw, Mask:rw, Other: r \_
7. \_Other : r\_
8. How do the Unix permissions and ACLs interact?
   1. Change the Unix permission with chmod  
      chmod 777 acl
   2. View the new Unix permissions  
      ls -l acl  
      Record the Unix permissions \_rwxrwxrwx\_\_\_
9. View the acl entries again. Record them here \_\_\_YesFile : acl, Owner :student, Group : student, User:rwx, User: bilbo:rw,User: pipin:r, Group:r, Groupwizards: rw, Mask:rw, Other: r \_
   1. \_\_\_
   2. Do the acl entries match the Unix permissions for the User, Group, and Others? \_\_no\_ Explain the results. \_The group permission is different being that it is only (r) while the others match\_\_\_

# Task 4—Exploring the remaining partitions and disk

Now you will use what you have learned to explore the remaining disk and partitions on the disk you already added to the system.

1. Mount the remaining partitions on the disk you already attached. Create mount points, explore the partitions and record the mount point you used, the filesystem type for each partition and describe the contents of each partition.

|  |  |  |  |
| --- | --- | --- | --- |
| Partition | Mount Point | Filesystem Type | Description |
| 1 sdb | /mnt/ | Newdisk rw | Given read write permission |
| 2 sdb2 | /mnt/ | Newdisk rw | Same |
| 3 sdb3 | /mnt/ | Newdisk rw | Same |
| 4 sdb4 | /mnt/ | Newdisk rw | same |

1. Attach the second disk (Secret.vmdk) to your virtual machine. Mount the partition
   1. What partitions are on the disk? \_\_Sdc, sdc1\_
   2. What type is the filesystem? \_rw\_\_\_
   3. What is the secret information on the disk? \_yellowsnailshoes\_\_\_

# Deliverable

Upload this document with completed answers to canvas.