Student Name: _____   **Lab Section:** _____

/3

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Disks, Partitions, and File Systems - Part 1 of 2

1   Due Date - Upload to Blackboard by 8:30am Monday April 2, 2012

Submit the completed lab to Blackboard following the Rules for submitting Online Labs and Assignments.

2   Commands, topics, and features covered

Use the on-line help (**man** command) for the commands listed below for more information.

➢ **fdisk** – to display, create, delete, and manage partitions; option **-l** is very useful
➢ **file** – determine what kind of thing a pathname is. Can show partition file system types using option **-s** and will follow (dereference) symbolic links using option **-L** (upper case)

3   Correct user, command lines, and command output

- All of this lab is done as the **root** user. Your prompt will tell you if you are the **root** user.
- Some answer blanks require you to enter **command lines**. Do **not** include the shell **prompt** with your command lines. Give only the part of the command line that you would type yourself.
- Make sure you know the difference between a command **line** (which is what you type into the shell) and command **output** (which is what the command displays on your screen).

1   Backup and Recovery

1. Take a snapshot of your virtual machine before you begin this lab so that you can recover if needed.

2   Creating a new virtual hard disk

1. **Shut down** your Fedora machine so it is **powered off** and not just suspended.
2. With your Fedora machine still powered off, add to it a VMware virtual **1GB** hard drive as shown in the Course Notes ("*Create a New VMware Virtual Hard Disk*"). Create it exactly **1 GB** in size.
3. Reboot (power on) your Fedora virtual machine. Check - the new disk should appear as **/dev/sdb**:
   a) **ls -l /dev/sd***   *(make sure the sdb disk is visible)*
   b) **cat /proc/partitions**   *(make sure the sdb disk is visible)*
4. Make sure you **only** change things on this new **sdb** disk in this lab! The **sda** disk is your Linux **ROOT** disk; if you damage it you will need to recover back to your snapshot. You do have a **snapshot**, right?

3   Obtain a root (super-user) prompt

For this lab, you will need to obtain a **root** (super-user) prompt so that you'll have the required **privilege** level to run the **file system maintenance** commands. The **root** account is the only account with sufficient **permissions** to use these file system utilities. To obtain a **root** prompt, use the **Substitute User** command, as follows:

1. Log in to Fedora Linux as your **regular** user account (non-root).
2. Open a terminal window running a shell (**Applications-->System Tools-->Terminal**).
3. On the shell command line, issue the Substitute User command **su** followed by a space and the option **--login** (there is a shorter synonym for **--login** that you can also use if you RTFM):

   [*user@host* ~]$ **su --login**

   Enter the **root** password for your Fedora machine **root** account when prompted. Your shell prompt will change from dollar "**$**" to number sign "**#**", indicating you now have **root super-user** privileges. Type the **whoami** command to confirm that you are now the **root** user; the output should be: **root**   After a full login, your home directory will also change to be the **root** home directory; type **pwd** to confirm.

4 Viewing Existing Partitions using fdisk

1. First, you must have added a new 1 GB hard drive in **VMware** and rebooted, as described above.
   DO NOT USE /dev/sda WHICH IS YOUR MAIN FEDORA INSTALLATION DRIVE!
2. Make sure you have **root (**super-user) privileges. (See Section above on obtaining a **root** prompt.)
3. At the **root** shell prompt, type "**cat /proc/partitions**" and verify that you have an **sdb** partition of 1GB (approx **1048576** blocks) and that you do not have any **sdb1** or **sdb2** partitions. If you have any **sdb1** or **sdb2** or other **sdbN** partitions, call over your instructor before you continue!
4. To manage partitions, use the **fdisk** command. The syntax of the **fdisk** command is:
   - ➢ **fdisk [options] device_name**
     A useful option (try it!) is "**-l**", e.g.: **fdisk -l ; fdisk -l /dev/sdb**
5. At the **root** shell prompt, type (make sure you use the disk device **sdb**!): **fdisk /dev/sdb**
   Make sure you use **sdb**. You will get several warning messages about a "**new DOS disklabel**" and an **invalid flag**. This is **normal**, since the new virtual disk has not been **initialized** yet. Continue:
6. The **fdisk** utility is now prompting you for input with a different **prompt**: **Command (m for help):**
   This prompt is the **fdisk** utility **prompt**. As it says, type **m** for a list of menu options for **fdisk**.
7. Read the list of **Command action** commands and record the (one-character) **fdisk** command to:

   a) display/list/**print** the **table** of all **partitions**:   _____
   b) create/**add** a **new partition**:   _____
   c) remove/**delete** a **partition**:   _____
   d) show/display/**list partition types** (system ids):   _____
   e) **change** a **partition's** type (**system id**):   _____
   f) save/**write** partition **table to disk** (**and exit**):   _____
   g) exit/**quit fdisk without saving changes**:   _____

8. Select the **fdisk** option that **lists** the **partition types**. (Partition types are also called "system identifiers".) Record the type (system id) number of the following partition types, making sure you read them correctly:

   a) "**Linux**":   _____
   b) "**Linux swap / So**":   _____   *(short for* **Linux swap / Solaris***)*

5 Creating Partitions using fdisk

Use the correct commands in the **fdisk** utility to create the following **six** new partitions on your **sdb** disk. Note that **fdisk** will adjust the size of each partition slightly to fit the DOS partition table disk geometry; don't be alarmed that the size that **fdisk** creates and displays to you isn't exactly the size you asked for. Display the partition table **after each change** to confirm that things are working.

1. Create a **primary** partition of **200 MB**. The type (system id) will default to type "**Linux**".
2. Create another **primary** partition of **100 MB**. Leave the type as default.
3. Create an **extended** partition large enough to host the following three **logical** partitions that total **600MB**. You must make the extended partition large enough to hold **all three** logical partitions described in the next step. NOTE: You cannot create it *exactly* **600MB**. You need to make it a bit **larger** to accommodate the logical partition information. Experiment to see how much "a bit" means. The end of the extended partition must be **less than** cylinder 130. (130 is the end of the disk.)
4. **Create** these three **logical** partitions inside the **extended** partition that you created in the previous step:

   a) The size of the **first logical** partition is **200MB**. Leave the partition type set as "**Linux**".
   b) The size of the **second logical** partition is **100 MB**. Change the partition type to "**Linux swap**".
   c) The size of the **third logical** partition is **300MB**. Change the partition type to "**HPFS/NTFS**".

   If you **run out of space** creating the logical partitions inside the extended partition, you can **delete the partitions** and start over as many times as needed. (You can also start over by exiting **fdisk** without saving/writing any of your partition changes.) Make the extended partition just big enough, no bigger.
5. Did you remember to set the correct partition **types** (system id) on each of the six partitions?

6. **Save** your changes (six partitions) to disk and exit **fdisk**. You will return to your **root** shell prompt.
7. Verify the creation of six new **sdb** partitions using both command lines "**ls -l /dev/sd***" and "**cat /proc/partitions**" again. You should have exactly **six** partitions on this second disk.
8. Use **fdisk** to show the partition table, listing the **six** new partitions that you just created (**sdb1, sdb2, sdb3, sdb5, sdb6, sdb7**) and answer these questions:

a) Give the **full** *device name, blocks, a*nd *ID* of the two **Primary** Partitions on the new 1.0GB Drive:	_____ , _____ , ___ _____ , _____ , ___
b) Give the **full** *device name, blocks,* and *ID* of the one **Extended** partition on the new 1.0GB Drive:	_____ , _____ , ___
c) *Give* the **full** *device names, blocks,* and *ID* of the three **Logical** partitions on the new 1.0GB Drive:	_____ , _____ , ___ _____ , _____ , ___ _____ , _____ , ___
d) How many more **Primary** Partitions could you create on the new 1.0GB Drive, and explain **Why**:	_
e) If you had enough disk space, how many more **Logical** partitions could you create on the new 1.0GB Drive, and explain **Why**:	_

6   Deleting a Partition using `fdisk`

1. You have **six** partitions on your second hard disk. Create a **VMware** backup **snapshot** of this virtual machine, so you can return here if things go wrong.
2. Use **fdisk** to delete the first **logical** (not primary) partition that has size **200MB**.
3. How has the partition numbering changed for the five remaining partitions, after the deletion?

        _____
        _____
        _____

4. **Save** (write) the partition changes (now only **five** partitions) to disk and exit **fdisk**.
5. You now have **five** remaining partitions. Check them in the next step. Verify that they have exactly the same **Device** numbers, exactly the same **Id** and **System**, and approximately the same number of **Blocks**.

7   Use your 1 GB disk and five partitions from the previous steps

To continue with the next sections of this lab (Part Two), you must have successfully created these **five** (remaining) partitions on the 1GB disk:

```
# fdisk -l /dev/sdb
   Device Boot    Start         End      Blocks   Id  System
/dev/sdb1             1          26      208813+  83  Linux
/dev/sdb2            27          40      112455   83  Linux
/dev/sdb3            41         119      634567+   5  Extended
/dev/sdb5            67          80      112423+  82  Linux swap / Solaris
/dev/sdb6            81         119      313236    7  HPFS/NTFS
```

Do not proceed until you have the above five partitions created. The sizes may vary *slightly*. The System ID must match. The **end** of the **Extended** partition must be **less than** cylinder 130. (130 is the end of the disk). All file system commands in the next part of this lab referring to a hard disk will **use one of the above partitions**.

1. Create a **back-up** of your **5**-partition system now using the VMware **snapshot** function. You can return to this back-up if anything goes wrong during this lab, or if you want to repeat the lab for practice.

2. Use **fdisk** to delete all the partitions and then re-create them again, **without** writing out your changes. Would you remember how to do this when asked to demonstrate it at a job interview? Practice!

8 The useful `file` command - what is that thing?

1. The Unix/Linux **file** command is very useful for identifying things in the file system, such as directories, programs, images, files, and special files such as disk partitions. Run the **file** command and give it as a single argument the full **absolute** path name of the **device file** of the **Extended** partition on your new 1.0 GB disk. Record the command line and the output here:

   _____
   _____

2. Repeat the above command line and add the option that makes **file** examine *special files* (e.g. block devices) and give the new command line and new extended (x86 boot sector) output here:

   _____
   _____
   _____
   _____

3. Use **file** (and the correct special file option) on the Linux **swap** partition device file and record the (not very useful) output here. (You will note that an empty new partition isn't very interesting.)

   _____

4. Use **file** (using the correct special file option) on the **first** partition of the **first** disk (**not** your new disk) and record the more useful information printed about the type of file system stored in the partition. Record that command line (using the absolute path of the device file of the first partition of the first disk) and record the output (about an **ext4** filesystem and journal) here:

   _____
   _____
   _____

5. Try using the **file** command on various other pathnames and see what it says. Try your **ODT** files, the password file, the **/bin/ls** program, the **vmlinuz** file under **/boot**. Lastly, use **file** on **/etc/favicon.png** and then add the option to **dereference** (follow) the symbolic link and give the full command line (use the full absolute pathname) and record the (PNG image) output here:

   _____
   _____
   _____

To Be Continued in Part 2
Make sure you have a 5-partition snapshot saved!