How to Partition and Format an External Disk for HamSCI Grape 1-DRF

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The external disk can be either a previously formatted disk or a new disk, and either a hard disk drive (HDD) or a solid state drive (SSD). We are going to remove any previous formatting and partitioning on the disk, and create a new partition table and new partition to contain HamSCI Grape 1-DRF observation data. If the disk contains any data that you wish to save, do that now, as the data will be deleted and the disk will be reformatted.

We are also assuming that all Grape 1-DRF USB devices (Leo Bodnar GPSDO, sound card) and a keyboard/mouse (connected by either wireless dongle or a USB hub) are plugged in properly and that no thumb drives or other storage devices are plugged into USB ports. The new disk should be plugged into the upper blue USB 3.0 port on the Raspberry Pi. The Pi should be using the Ubuntu 22.04 operating system provided by HamSCI.

Since you will be entering commands with OS root privileges, it is possible to damage the operating system or the gnuradio application if all steps are not followed precisely. Please go slowly and read ahead before executing each step.

Please begin with Step 1 on the next page.

1. Boot up the system and disable the /G1DRF automount

Starting from a powered-down state:

Plug in the USB external disk drive. If it is a hard disk drive with external power, power it up first and wait 30 sec for the disk to spin up. Then power up the Pi.

After a few minutes, the Pi should boot into emergency mode because it cannot find the /G1DRF file system. **DO NOT PRESS Control-D**:

```
[    0.885149] zswap: compressor zstd not available, using default lzo
[    0.890587] zswap: zpool z3fold not available, using default zbud
Thu Jan  1 00:00:10 UTC 1970
writable: clean, 353143/1930128 files, 4315967/7757563 blocks
You are in emergency mode. After logging in, type "journalctl -xb" to view
system logs, "systemctl reboot" to reboot, "systemctl default" or "exit"
to boot into default mode.
Press Enter for maintenance
(or press Control-D to continue):
root@ubuntu-desktop:~#
```

Press the **Enter key** to get to maintenance mode which will give you a command prompt as in the above picture (`root@ubuntu-desktop:~#`).

We are going to edit the file system table to disable the Pi's attempt to mount the /G1DRF file system so the OS can finish booting. Enter the following command (you are running as root user here):

```
nano /etc/fstab
```

If you are unfamiliar with the nano editor, read this: https://help.ubuntu.com/community/Nano.

Here's what the `/etc/fstab` file looks like before edits:

```
  GNU nano 6.2
LABEL=writable    /           ext4    discard,x-systemd.growfs    0    1
LABEL=system-boot             /boot/firmware  vfat    defaults    0    1
LABEL=G1DRF                   /G1DRF          ext4    defaults    0    2
```

Using the arrow keys, position to the line starting `LABEL=G1DRF` and comment-out the line by adding a "#" to the first of the line. It should now look like this:

```
  GNU nano 6.2
LABEL=writable    /           ext4    discard,x-systemd.growfs    0
LABEL=system-boot             /boot/firmware  vfat    defaults    0
#LABEL=G1DRF                  /G1DRF          ext4    defaults    0
```
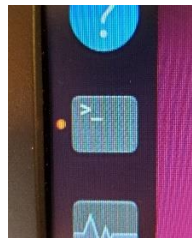
Save the file and exit (ctrl-o, Enter, ctrl-x).

Back at command prompt, type `exit` and hit Enter. The system will reboot into graphical mode. Wait for it, maybe a couple of minutes.

2. Unmount any existing /dev/sda partitions

When the graphical mode desktop comes up, you should see a terminal window with some gnuradio errors. Ignore the errors, and enter ctrl-c to cancel the terminal window and gnuradio_scheduler. Then open a new terminal window by left-clicking the icon showing >_ on the left taskbar as shown here:

Enter command:

```
lsblk
```

This will list all block devices on your system including the external drive. If no other storage devices are connected, the external drive should be listed as `sda`. The external drive's partitions, if any, will be indented under `sda` as `sda1`, `sda2`, etc.

If the external drive is listed as `sdb` or something else, power down the system and remove whatever other external storage device may be connected. We only want the one external drive to be connected during this procedure.

The following commands use the "`sudo`" prefix. This means you will be running the command with root privileges. So you will need to be very careful that you enter the commands exactly as specified and no others. The first time you run a `sudo` command in a new terminal window you will be prompted for your password. It is "`HamSCI2023!`" without the quotes.

If the external drive has been previously formatted, the boot process may have mounted its partition(s) under the file system path `/media/ubuntu`. These paths will be listed by the above `lsblk` command. Unmount those partitions now by using the command:

```
sudo umount /dev/sda1  <-- Note spelling of "umount"
sudo umount /dev/sda2
```
etc. for each partition listed. Ignore error messages.

3. Partition the external disk

Now use the `fdisk` command to delete any existing partitions. If only one partition exists, partition 1 is automatically selected. If more than one partition exists, `fdisk` prompts for the partition number. The words in parentheses () are comments, do not enter those. After every command, press the Enter key:

```
sudo fdisk /dev/sda
Command (m for help): m      (print command menu, optional)
Command (m for help): p      (print the partition table)
Command (m for help): d      (delete partition)
Selected partition 1
Partition 1 has been deleted.
Command (m for help): w      (write)
```

Delete all other partitions similarly.

Now create a new partition table (Hint: press the up-arrow key to recall the last command):
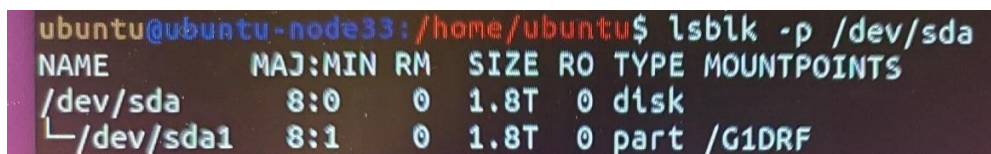
```
sudo fdisk /dev/sda
Command (m for help): g      (create empty GPT partition table)
Command (m for help): w      (write)
```

Now create a new partition:

```
sudo fdisk /dev/sda
Command (m for help): n      (create new partition)
Partition number (1-128, default 1): (press Enter to accept default)
First sector... : (press Enter to accept default)
Last sector... : (press Enter to accept default)
Command (m for help): p      (print the partition table to check size)
Command (m for help): w      (write)
```

Now list the drive info. You should see `/dev/sda` (device) and `/dev/sda1` (partition 1):

```
lsblk -p /dev/sda
```


Note: `MOUNTPOINTS` will be blank in your listing; it will show up after Step 4.

4. Format the new partition and mount it on /G1DRF

Now format the new partition:

```
sudo mkfs.ext4 -L G1DRF /dev/sda1
```

The `-L` option sets the volume label to `G1DRF`. Answer `Y` to any questions; since you deleted any previous partitions, you shouldn't get any questions and you can ignore any warnings.

There should already be an empty directory `/G1DRF` under the system root directory. Check to be sure it exists:

```
ll /G1DRF
```

If it does not exist, create it with:

```
sudo mkdir /G1DRF
```

Now, mount the new partition on this directory so you can set permissions:
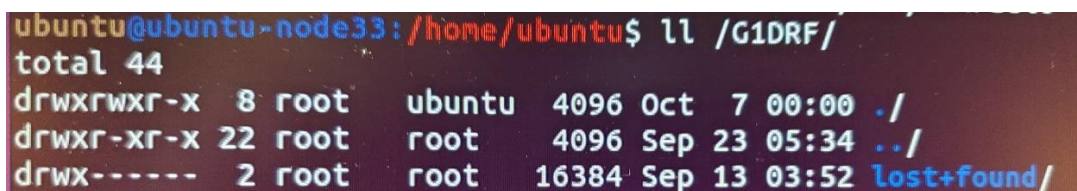
```
sudo mount /dev/sda1 /G1DRF
```

5. Set permissions

Set permissions on `/G1DRF`. This very important step grants permission for gnuradio, which runs as user ubuntu in group ubuntu, to create directories on the external disk. These commands set the directory's group to ubuntu and group permissions to read-write-execute:

```
cd /G1DRF
sudo chgrp ubuntu .      ← Note the dot!
sudo chmod 775 .         ← Note the dot!
```

Now list the `/G1DRF` directory to check permissions:

```
ll /G1DRF
```


Verify that the first line contains `drwxrwxr-x ... root ubuntu ...`

Now display the mounted filesystems:

```
df -h
```

```
ubuntu@ubuntu-node33:/home/ubuntu$ df -h
Filesystem              Size  Used Avail Use% Mounted on
tmpfs                   380M  3.9M  376M   2% /run
/dev/mmcblk0p2           59G   16G   41G  29% /
tmpfs                   1.9G     0  1.9G   0% /dev/shm
tmpfs                   5.0M  4.0K  5.0M   1% /run/lock
/dev/mmcblk0p1          253M  115M  138M  46% /boot/firmware
/dev/sda1               1.8T  156M  1.7T   1% /G1DRF
tmpfs                   380M  140K  379M   1% /run/user/1000
```

If you see the line above containing Filesystem `/dev/sda1` Mounted on `/G1DRF`, things are fine.

6. Set up and test automount

Now change to the home directory and unmount the file system:

```
cd
sudo umount /dev/sda1
```

Edit the file system table again to reenable the previously disabled `G1DRF` mount entry:

```
sudo nano /etc/fstab
```

Remove the "#" comment character before `LABEL=G1DRF`. Save file and exit.

Now test that the automount procedure reads the file system table correctly and mounts the file system again:

```
sudo mount -a
df -h
```

If `/dev/sda1` has been mounted again on `/G1DRF`, automount was successful and `/dev/sda1` will always be mounted on `/G1DRF` at startup.

7. Run gnuradio scheduler

Change to the `runGrape` directory and run the gnuradio scheduler:

```
cd ~/Documents/runGrape
python3 gnuradio_schedule.py
```

Look for any errors accessing `G1DRF`, etc. Unable to find the original observation file is normal and not an error.

8. Reboot

Reboot to test that the disk mounts again on startup and gnuradio scheduler runs with no errors. You can also navigate to the `/G1DRF` subdirectories and list data files as they are being written.

If your external disk is a hard drive, remember to shutdown the Pi before shutting down the disk, using the Power Off sequence; refer to the Grape 1-DRF Startup Guide. Wait for the green LED to stop flashing on the Pi, then power down the disk.

When restarting, power up the disk, wait 30 seconds, then power up the Pi. For SSD disks you do not have to worry about this.

Refer to this link for further info:
https://cloudinfrastructureservices.co.uk/how-to-create-partitions-in-ubuntu-linux-using-fdisk/

Author: Bill Blackwell AB1XB
Document filename: Grape1-DRF-ext-disk-init-V1.2.pdf

Corrections
V1.2: Page 1: Added Grant Acknowledgement.
         Step 6: Added `cd` command before `umount`.
V1.1: Step 2: Ignore gnuradio errors on the terminal window at this stage.
         Step 2: `lsblk` prints `sda`, not `/dev/sda`.
         Step 3: The command will show `MOUNTPOINTS` as blank for `/dev/sda1`.