CHAPTER - 3

INSTALLATION OF LINUX

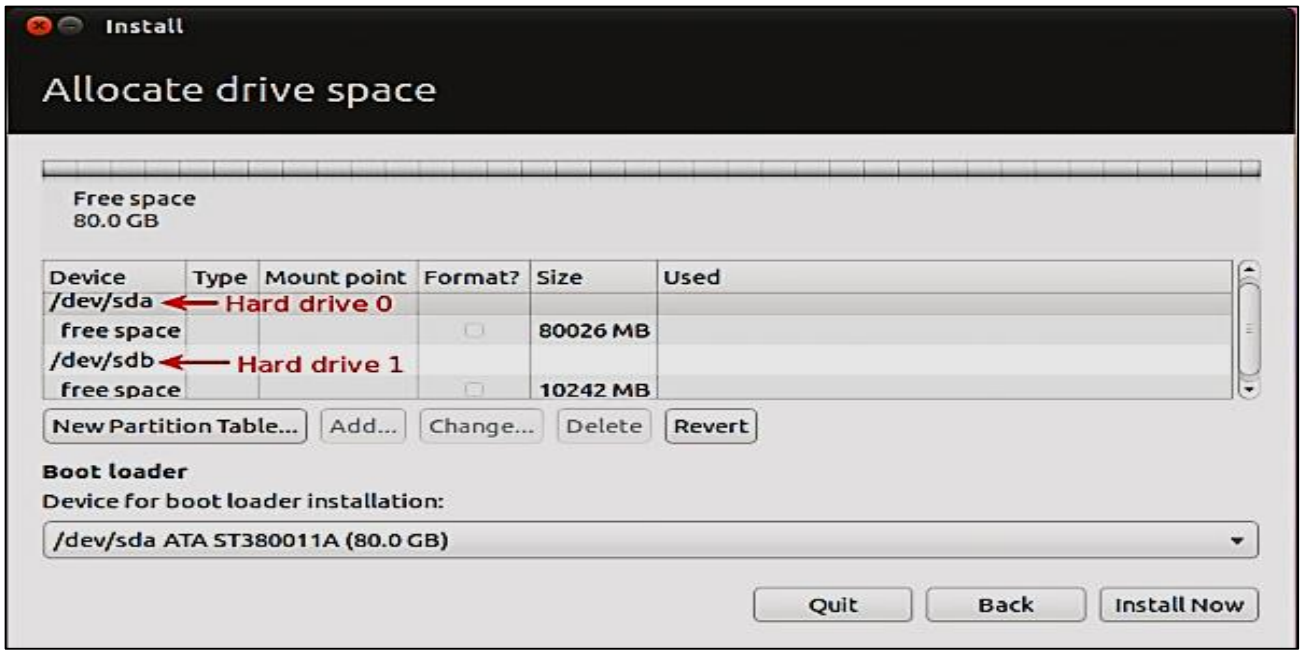
PARTITIONING:

Disk partitioning or disk slicing is the creation of one or more regions on a hard disk or other secondary storage, so that an operating system can manage information in each region separately. Partitioning is typically the first step of preparing a newly manufactured disk, before any files or directories have been created. The disk stores the information about the partitions' locations and sizes in an area known as the **partition table** that the operating system reads before any other part of the disk. Each partition then appears in the operating system as a distinct "logical" disk that uses part of the actual disk. System administrators use a program called a partition editor to create, resize, delete, and manipulate the partitions. When a hard drive is installed in a computer, it must be partitioned before we can format and use it. Partitioning a drive is when we divide the total storage of a drive into different pieces. These pieces are called partitions. Once a partition is created, it can then be formatted so that it can be used on a computer.

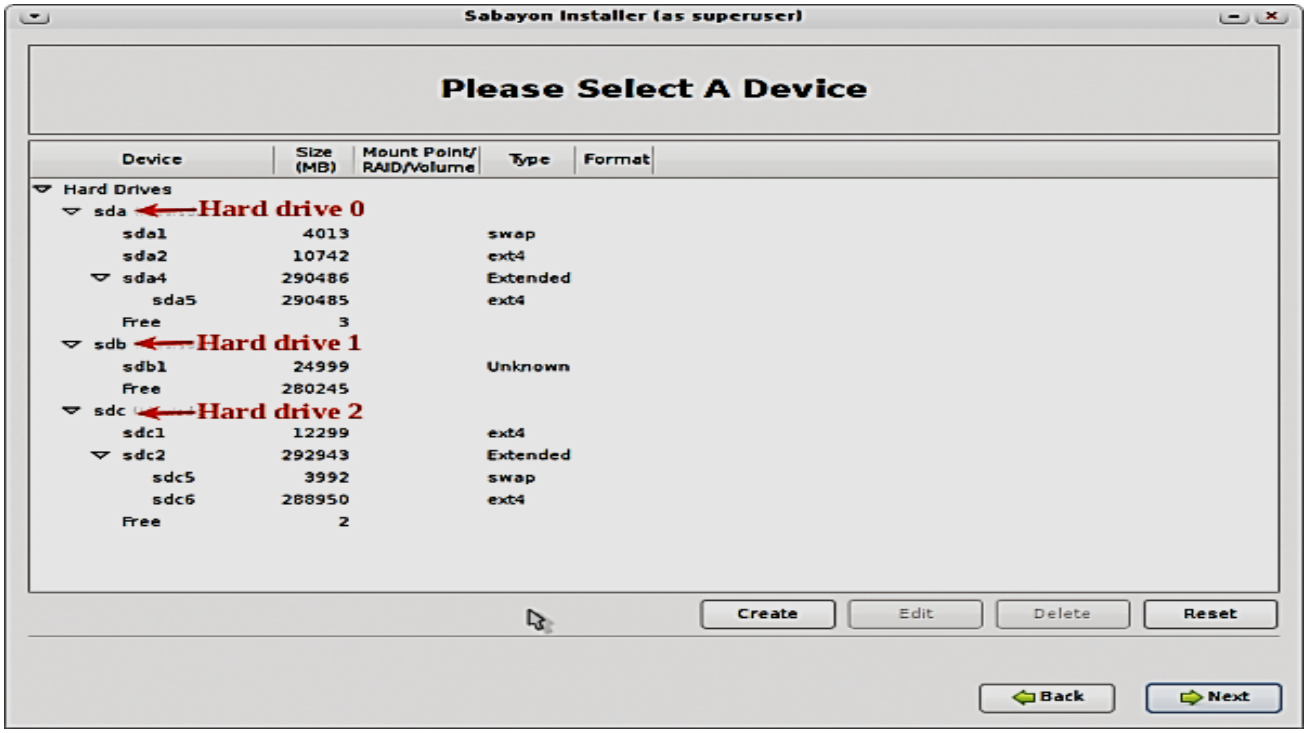
Hard Drive Naming Convention:

The first thing we need to know is there is no “C drive” or “D drive” in Linux. There are equivalents, but when we come across a reference to a hard drive in a modern Linux system, we will typically see something like /dev/sda, /dev/sdb, /dev/sdc, … etc. The “dev” is short for device, and in this case, a block storage device. The “sd” is short for SCSI mass-storage driver. **(SCSI stands for Small Computer System Interface.)**

The first hard drive detected by a Linux system carries the ***sda*** label. In numerical terms, it is hard drive 0 (zero; counting begins from 0, not 1). The second hard drive is ***sdb***, the third drive, ***sdc***, and so on. In the screenshot below, there are two hard drives: ***sda*** and ***sdb***, detected by the installer.



This screenshot comes from an installation attempt where three hard drives were attached to the system.



Partition Tables:

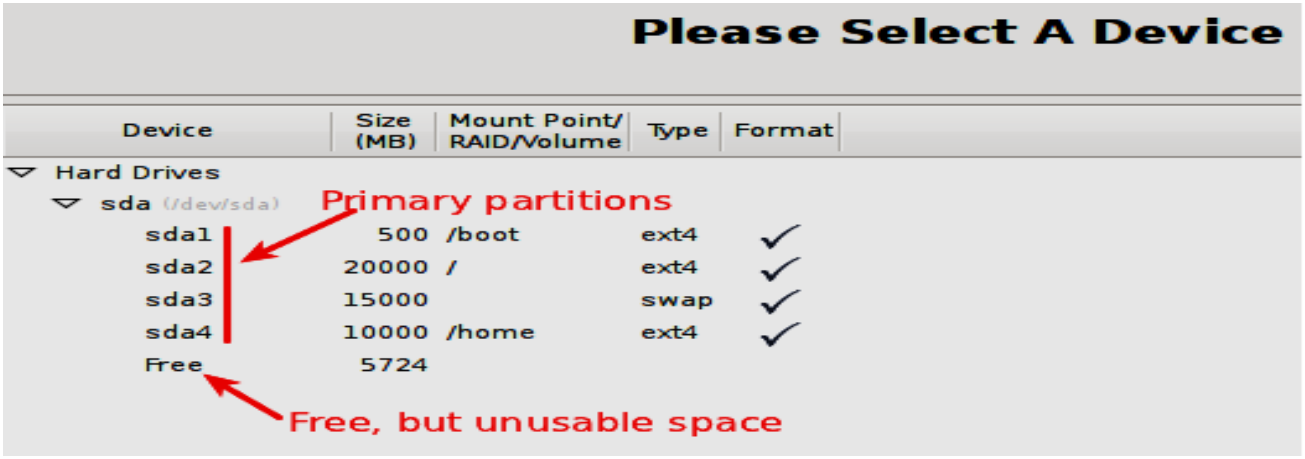
A partition table describes the partitions of a hard drive or any storage device. And there are two standards for the layout of the partition table: **MBR (Master Boot Record) and GPT (GUID Partition Table)**. MBR, also known as MS-DOS, is what we might call the first standard. GPT came much later. While MBR is still the most widely used partition table, it comes with two major limitations which led to the development of GPT. They are:

1. It does not allow the configuration of more than four main partitions. Those partitions are called primary partitions.
2. Disk partitions may not exceed 2TB

Partitions and Partition Numbering:

To install an operating system on a hard drive, it must first be subdivided into distinct storage units. Those storage units are called partitions. Under the MBR partitioning scheme, which is the default on virtually all Linux distributions, there are three different types of partitions: **Primary, Extended, and Logical.**

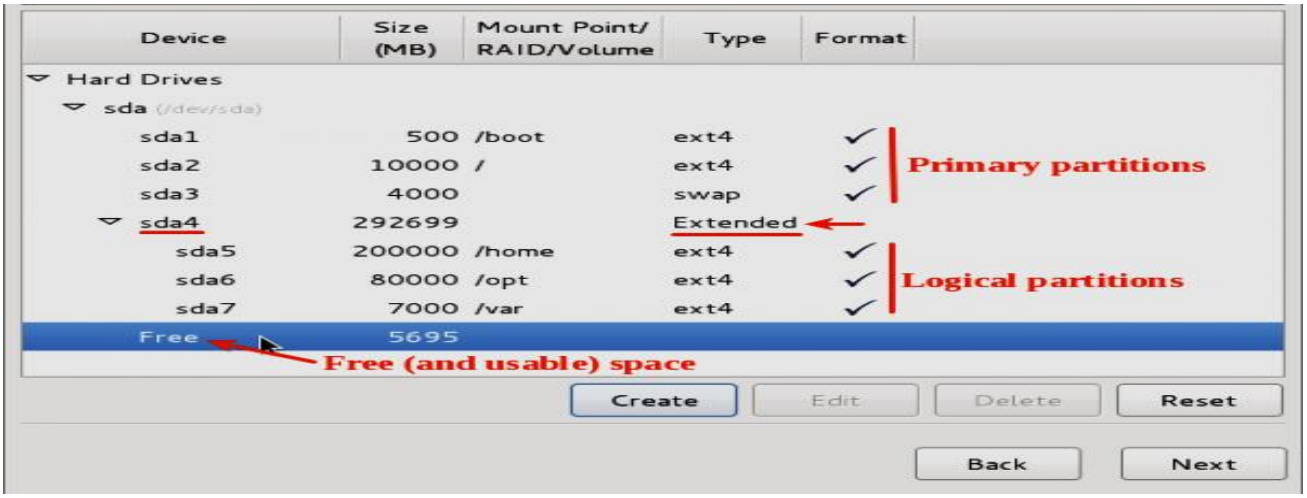
With MBR, any partition that is not explicitly created as an extended or logical partition, is a primary partition. And, as stated earlier, there can be no more than four primary partitions. The screenshot below was taken from an installation process where four primary partitions were created. If we observe closely, we will see that the first primary partition is *sda***1** and the last *sda***4**. Unlike hard drives, partition numbers start from 1, not 0 (zero). Any space not allocated to the primary partitions is shown as "Free." But while it may be free, it is, however, unusable. And that is because as far as the system is concerned, that free space does not exist.



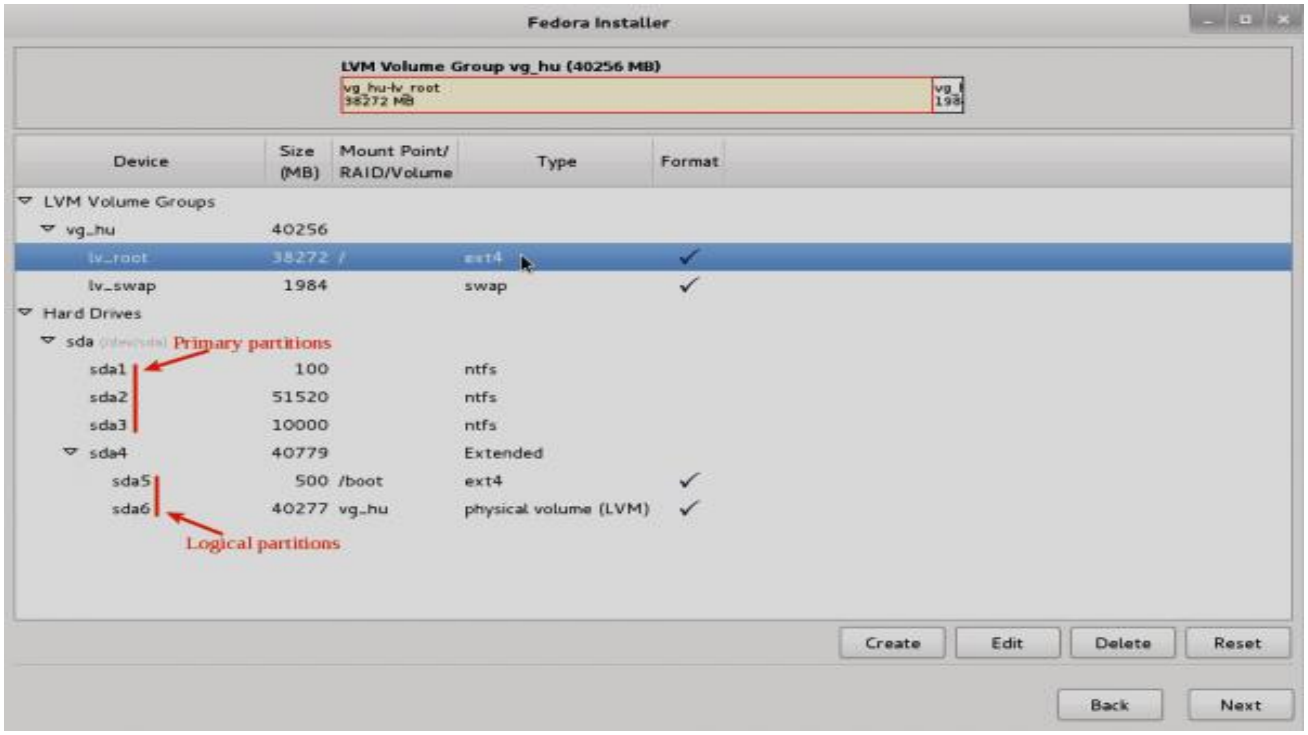
So if we attempt to create another partition using the free space, the installer will throw up the type of error message shown in this image. The error message will always say, "not enough free space," even when we know that there is space available. And it does not matter how much that free space is. It will be unusable.

To get around the four primary partitions limit of the MBR partition table, the smart guys involved came up with the concept of an extended partition. By tagging a partition as an extended partition, it is then possible to create many more partitions under the extended partition. Those partitions are called logical partitions. Theoretically, there is no limit to the number of logical partitions that we can create. ***Note: Only one extended partition may be configured on a single hard drive.***

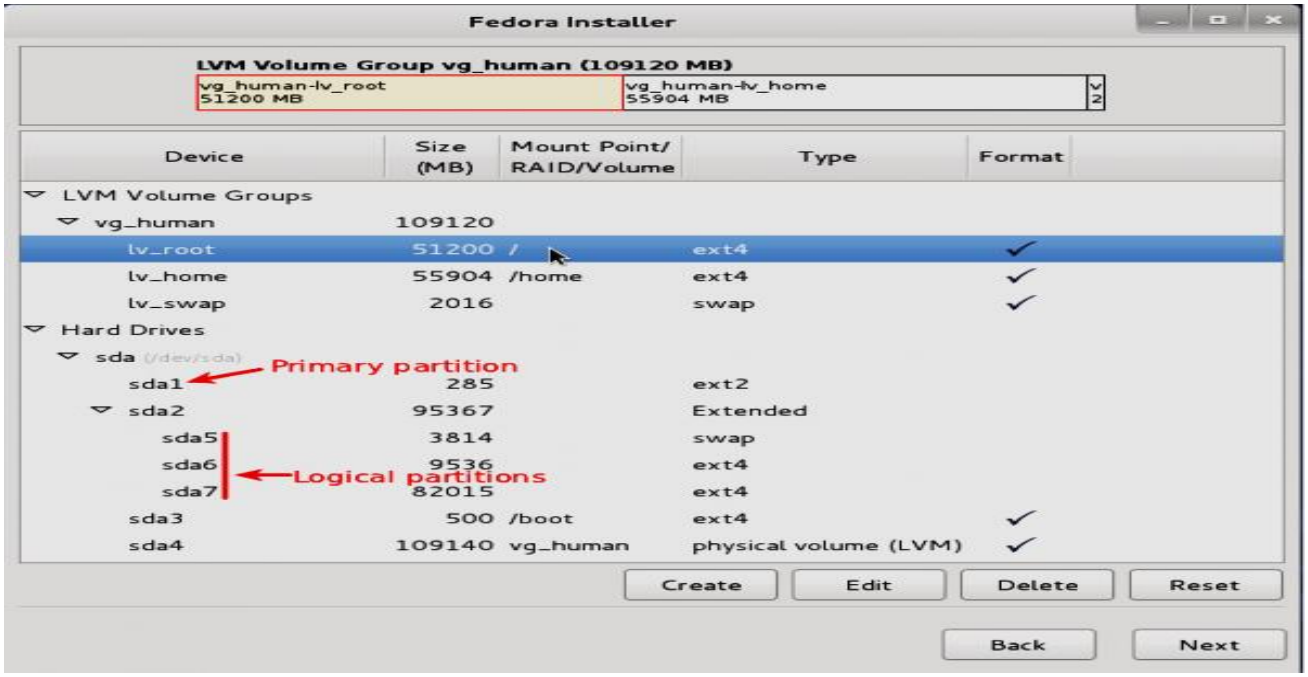
What the concept of extended partition brings to the table is illustrated in the screenshot below. We can see that there are three primary partitions (sda1, sda2 and sda3). And the fourth partition is an extended partition, which makes it possible to create more partitions (sda5, sda6 and sda7 in this example). Under an extended partition, we can have free space, and that free space will still be usable. So we do not have to allocate all the available free space to the logical partitions of an extended partition.



Being able to create logical partitions comes in handy when we have to dual-boot a Linux distribution with other operating systems like Windows, **PC-BSD** or even another Linux distribution, especially if that other operating system has used up three primary partitions. In the image below, which was taken while setting up a system to dual-boot Windows 7 and Fedora 15, three Windows 7 partitions already exist on the target hard drive. That meant there was just one primary partition to play with. Only by setting up the available free space as an extended partition was it possible to install the system. What this also shows is that Linux can boot from a logical partition.

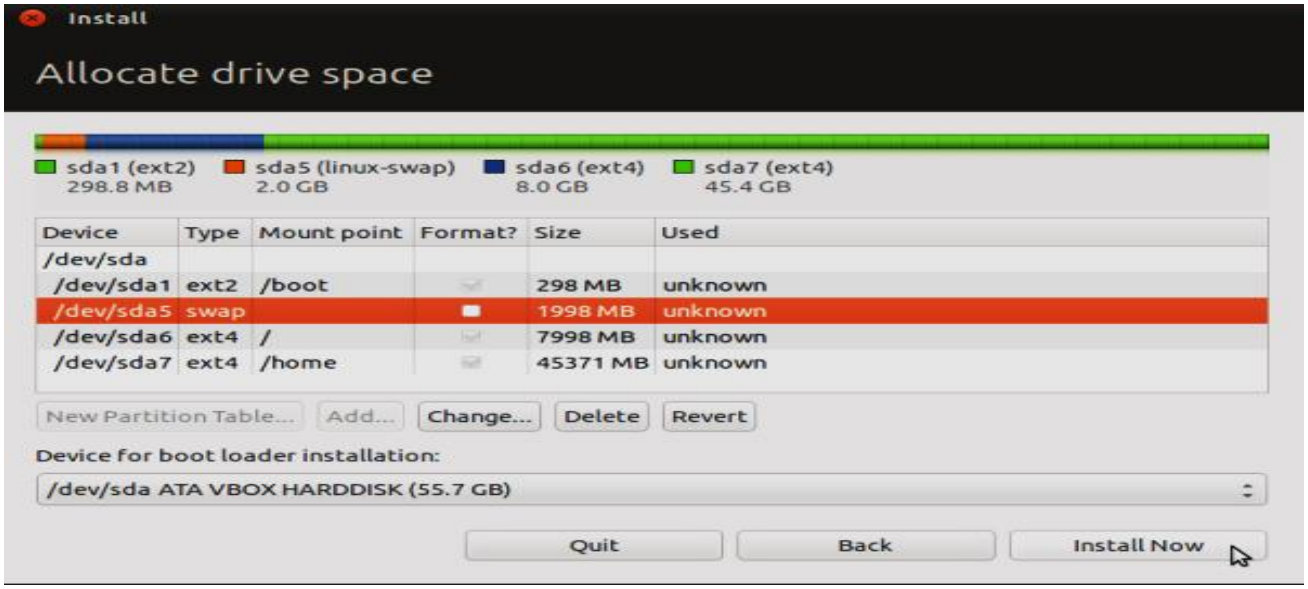


In the last two screenshots, the extended partitions were the last primary partitions (***sda4***). But it does not have to be. In this screenshot, for example, the extended partition is the second primary partition (***sda2***), and first logical partition number is still 5 (***sda5***). So whether an



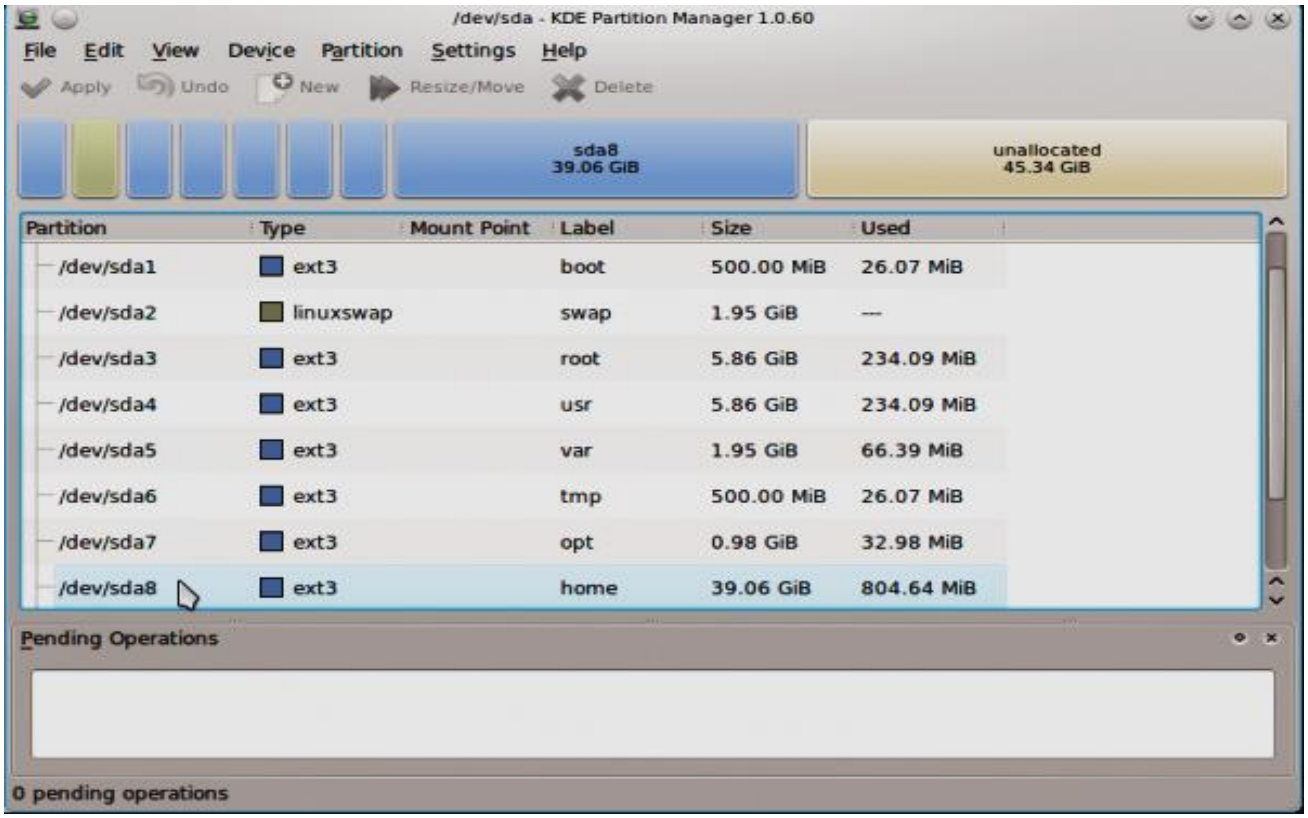
extended partition is the last primary partition or not, the logical partition number always starts with the number **5**.

Not all installation programs broadcast the presence of an extended partition. But if we know what to look for, we can tell if one exists. In the image below, for example, we can see the partition numbers go from 1, then 5, 6 and 7. The presence of partition number 5 and above, is the most obvious tell-tale sign of an extended partition. This image, by the way, was taken while installing **Ubuntu**.



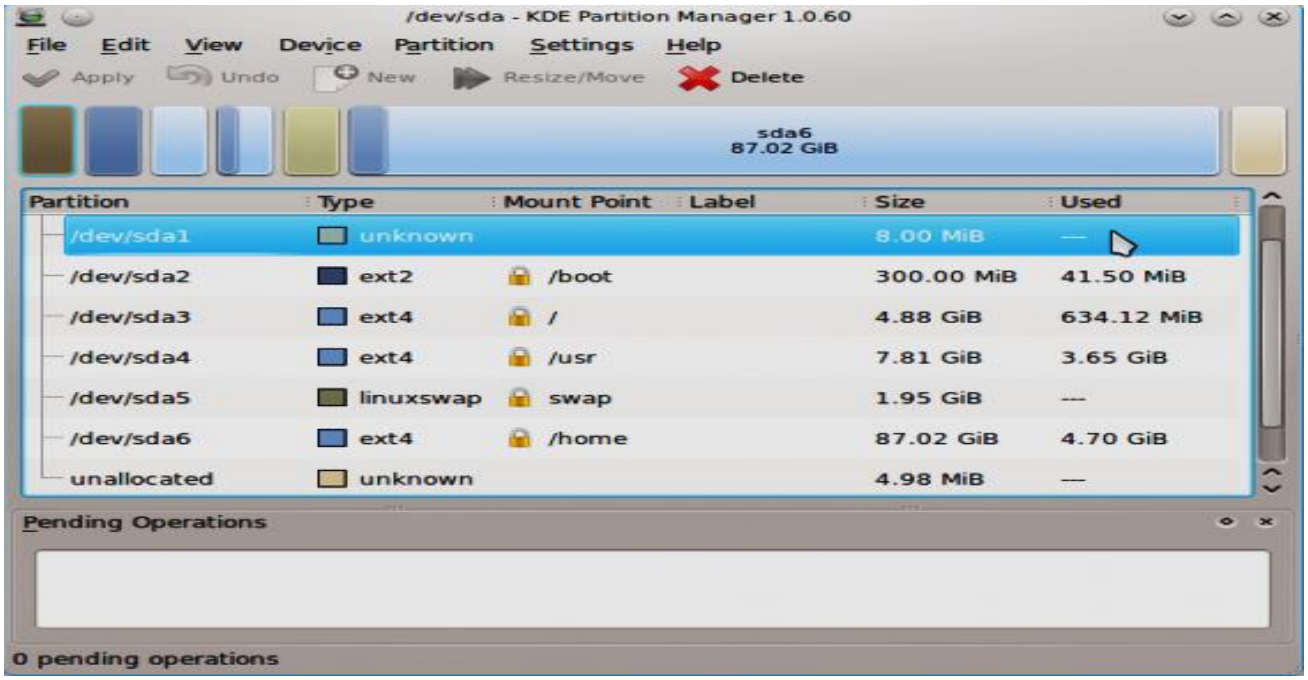
GPT:

As stated earlier, GPT, or GUID Partition Table, overcomes two limitations of the MBR scheme maximum of four primary partitions, and the 2TB limit to partition sizes. In the image below, for



example, you can see that there are eight partitions, with about 45GB still available. The most important point to note here is that all eight partitions are primary partitions, as the concept of extended and logical partitions is foreign to GPT.

With GPT, there can always be unallocated space at the end of existing partitions. And unlike the case with an MBR scheme that has no extended partition, that "unallocated" space can be used to create new or additional partitions, unless the maximum number of partitions possible with GPT has been reached. In the image below, for example, there are six partitions and a small unallocated space remaining. The unallocated space may be used to create a new partition.



Currently, Chakra is the only Linux distribution that is configured to use GPT by default. We may read **GPT disk partitioning guide for Chakra** to see the steps involved. **Fedora** 16, which is slated for release in early November 2011, will support GPT. Test installations of the first beta release show that GPT will be the default in standalone installations. In dual-boot setups, MBR will be used if there is an existing operating system installed on MBR partitions on the target disk. We may read **feature preview of Fedora 16 installer** and **Fedora 16 KDE and GNOME alpha screenshots** for a few screenshots of GPT partitions in Anaconda, the Fedora system installer.

Advantages of Disk Partitions:

- ☑ Separation of the operating system (OS) and program files from user files.
- ☑ Having a separate area for operating system virtual memory swapping/paging.
- ☑ Keeping frequently used programs and data near each other.
- ☑ Having cache and log files separate from other files. These can change size dynamically and rapidly, potentially making a file system full.
- ☑ Protecting or isolating files, to make it easier to recover a corrupted file system or operating system installation. If one partition is corrupted, other file systems may not be affected.
- ☑ Raising overall computer performance on systems where smaller file systems are more efficient.

- ☑ Partitioning for significantly less than the full size available when disk space is not needed can reduce the time for diagnostic tools such as check disk to run or for full image backups to run.

Disadvantages of Disk Partitions:

- ☑ Reduces the total space available for user storage on the disk, as it forces the operating system to duplicate certain file system administration areas on the disk for each partition.
- ☑ Reduces overall disk performance on systems where data is accessed regularly and in parallel on multiple partitions, because it forces the disk's read/write head to move back and forth on the disk to access data on each partition and to maintain and update file system administration areas on each partition.
- ☑ Increases disk fragmentation because it lowers the average size of contiguous free blocks on each partition as compared to a single partition of the same overall size after the same amount of data has been written to them.
- ☑ May prevent using the whole disk capacity, because it may break free capacities apart.
- ☑ Hurts portability and might impose constraints on how entities might be linked together inside the file system.
- ☑ Moving files across volumes will require actual copying (of bytes), whereas moving files within a volume generally requires only the "meta-data" to be updated.

Command to Manage Linux Disk Partition:

fdisk stands (for “fixed disk or format disk“) is an most commonly used command-line based disk manipulation utility for a Linux/Unix systems. With the help of fdisk command we can view, create, resize, delete, change, copy and move partitions on a hard drive using its own user friendly text based menu driven interface.

This tool is very useful in terms of creating space for new partitions, organizing space for new drives, re-organizing an old drives and copying or moving data to new disks. It allows us to create a maximum of four new primary partition and number of logical (extended) partitions, based on size of the hard disk we have in our system.

1. View all Disk Partitions in Linux:

The following basic command list all existing disk partition on our system. The ‘-l‘ argument stand for (listing all partitions) is used with fdisk command to view all available partitions on Linux. The partitions are displayed by their device’s names. For example: /dev/sda, /dev/sdb or /dev/sdc.

```
[root@tecmint.com ~]# fdisk -l
Disk /dev/sda: 637.8 GB, 637802643456 bytes
255 heads, 63 sectors/track, 77541 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *           1          13      104391   83  Linux
/dev/sda2              14        2624    20972857+  83  Linux
/dev/sda3            2625        4582    15727635   83  Linux
/dev/sda4            4583       77541   586043167+   5  Extended
/dev/sda5            4583        5887    10482381   83  Linux
/dev/sda6            5888        7192    10482381   83  Linux
/dev/sda7            7193        7845     5245191   83  Linux
/dev/sda8            7846        8367     4192933+  82  Linux swap / Solari
/dev/sda9            8368       77541   555640123+  8e  Linux LVM
```

2. View Specific Disk Partition in Linux:

To view all partitions of specific hard disk use the option '-l' with device name. For example, the following command will display all disk partitions of device /dev/sda. If we've different device names, simple write device name as /dev/sdb or /dev/sdc.

```
[root@tecmint.com ~]# fdisk -l /dev/sda
Disk /dev/sda: 637.8 GB, 637802643456 bytes
255 heads, 63 sectors/track, 77541 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *           1          13      104391   83  Linux
/dev/sda2              14        2624    20972857+  83  Linux
/dev/sda3            2625        4582    15727635   83  Linux
/dev/sda4            4583       77541   586043167+   5  Extended
/dev/sda5            4583        5887    10482381   83  Linux
/dev/sda6            5888        7192    10482381   83  Linux
/dev/sda7            7193        7845     5245191   83  Linux
/dev/sda8            7846        8367     4192933+  82  Linux swap / Solari
/dev/sda9            8368       77541   555640123+  8e  Linux LVM
```

3. Check all Available fdisk Commands:

If we would like to view all commands which are available for fdisk. Simply use the following command by mentioning the hard disk name such as /dev/sda as shown below. The following command will give us output similar to below.

```
[root@tecmint ~]# fdisk /dev/sda
WARNING: DOS-compatible mode is deprecated. It's strongly recommended to
switch off the mode (command 'c') and change display units to
sectors (command 'u').
Command (m for help):
```

Type 'm' to see the list of all available commands of fdisk which can be operated on /dev/sda hard disk. After, I enter 'm' on the screen, we will see the all available options for fdisk that we can be used on the /dev/sda device.

```
[root@tecmint ~]# fdisk /dev/sda
WARNING: DOS-compatible mode is deprecated. It's strongly recommended to
switch off the mode (command 'c') and change display units to
sectors (command 'u').
Command (m for help): m
Command action
a   toggle a bootable flag
b   edit bsd disklabel
c   toggle the dos compatibility flag
d   delete a partition
l   list known partition types
m   print this menu
n   add a new partition
o   create a new empty DOS partition table
p   print the partition table
q   quit without saving changes
s   create a new empty Sun disklabel
t   change a partition's system id
u   change display/entry units
v   verify the partition table
w   write table to disk and exit
x   extra functionality (experts only)
Command (m for help):
```

4. Print all Partition Table in Linux:

To print all partition table of hard disk, we must be on command mode of specific hard disk say /dev/sda.

```
[root@tecmint ~]# fdisk /dev/sda
```

From the command mode, enter 'p' instead of 'm' as we did earlier. As I enter 'p', it will print the specific /dev/sda partition table.

```
Command (m for help): p
Disk /dev/sda: 637.8 GB, 637802643456 bytes
255 heads, 63 sectors/track, 77541 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *           1          13      104391   83  Linux
/dev/sda2              14        2624    20972857+  83  Linux
/dev/sda3            2625        4582    15727635   83  Linux
/dev/sda4            4583       77541   586043167+   5  Extended
/dev/sda5            4583        5887    10482381   83  Linux
/dev/sda6            5888        7192    10482381   83  Linux
/dev/sda7            7193        7845     5245191   83  Linux
/dev/sda8            7846        8367     4192933+  82  Linux swap / Solari
/dev/sda9            8368       77541   555640123+  8e  Linux LVM
Command (m for help):
```

5. How to Delete a Partition in Linux:

If we would like to delete a specific partition (i.e /dev/sda9) from the specific hard disk such as /dev/sda. We must be in fdisk command mode to do this.

```
[root@tecmint ~]# fdisk /dev/sda
```

Next, enter 'd' to delete any given partition name from the system. As I enter 'd', it will prompt me to enter partition number that I want to delete from /dev/sda hard disk. Suppose I enter number '4' here, then it will delete partition number '4' (i.e. /dev/sda4) disk and shows free space in partition table. Enter 'w' to write table to disk and exit after making new alterations to partition table. The new changes would only take place after next reboot of system. This can be easily understood from the below output.

```
[root@tecmint ~]# fdisk /dev/sda
WARNING: DOS-compatible mode is deprecated. It's strongly recommended to
switch off the mode (command 'c') and change display units to
sectors (command 'u').
Command (m for help): d
Partition number (1-4): 4
Command (m for help): w
The partition table has been altered!
Calling ioctl() to re-read partition table.
WARNING: Re-reading the partition table failed with error 16: Device or resource busy.
The kernel still uses the old table. The new table will be used at
the next reboot or after you run partprobe(8) or kpartx(8)
Syncing disks.
You have new mail in /var/spool/mail/root
```

Warning : Be careful, while performing this step, because using option ‘d‘ will completely delete partition from system and may lost all data in partition.

6. How to Create a New Partition in Linux:

If we’ve free space left on one of our device say /dev/sda and would like to create a new partition under it. Then we must be in fdisk command mode of /dev/sda. Type the following command to enter into command mode of specific hard disk.

```
[root@tecmint ~]# fdisk /dev/sda
```

After entering in command mode, now press “n” command to create a new partition under /dev/sda with specific size. This can be demonstrated with the help of following given output

```
[root@tecmint ~]# fdisk  /dev/sda
WARNING: DOS-compatible mode is deprecated. It's strongly recommended to
switch off the mode (command 'c') and change display units to
sectors (command 'u').
Command (m for help): n
Command action
e   extended
p   primary partition (1-4)
e
```

While creating a new partition, it will ask us two options ‘extended‘ or ‘primary‘ partition creation. Press ‘e‘ for extended partition and ‘p‘ for primary partition. Then it will ask us to enter following two inputs.

1. First cylinder number of the partition to be create.
2. Last cylinder number of the partition to be created (Last cylinder, +cylinders or +size).

We can enter the size of cylinder by adding “+5000M” in last cylinder. Here, ‘+‘ means addition and 5000M means size of new partition (i.e. 5000MB). Please keep in mind that after creating a new partition, we should run ‘w‘ command to alter and save new changes to partition table and finally reboot our system to verify newly created partition.

```
Command (m for help): w
The partition table has been altered!
Calling ioctl() to re-read partition table.
WARNING: Re-reading the partition table failed with error 16: Device or resource busy.
The kernel still uses the old table. The new table will be used at
the next reboot or after you run partprobe(8) or kpartx(8)
Syncing disks.
```

7. How to Format a Partition in Linux:

After the new partition is created, don’t skip to format the newly created partition using ‘mkfs‘ command. Type the following command in the terminal to format a partition. Here /dev/sda4 is my newly created partition.

```
[root@tecmint ~]# mkfs.ext4 /dev/sda4
```

8. How to Check Size of a Partition in Linux:

After formatting new partition, check the size of that partition using flag 's' (displays size in blocks) with fdisk command. This way you can check size of any specific device.

```
[root@tecmint ~]# fdisk -s /dev/sda2
5194304
```

9. How to Fix Partition Table Order:

If we've deleted a logical partition and again recreated it, we might notice 'partition out of order' problem or error message like 'Partition table entries are not in disk order'.

For example, when three logical partitions such as (sda4, sda5 and sda6) are deleted, and new partition created, we might expect the new partition name would be sda4. But, the system would create it as sda5. This happens because of, after the partition are deleted, sda7 partition had been moved as sda4 and free space shift to the end.

To fix such partition order problems, and assign sda4 to the newly created partition, issue the 'x' to enter an extra functionality section and then enter 'f' expert command to fix the order of partition table as shown below.

```
[root@tecmint ~]# fdisk  /dev/sda
WARNING: DOS-compatible mode is deprecated. It's strongly recommended to
switch off the mode (command 'c') and change display units to
sectors (command 'u').
Command (m for help): x
Expert command (m for help): f
Done.
Expert command (m for help): w
The partition table has been altered!
Calling ioctl() to re-read partition table.
WARNING: Re-reading the partition table failed with error 16: Device or resource busy.
The kernel still uses the old table. The new table will be used at
the next reboot or after you run partprobe(8) or kpartx(8)
Syncing disks.
```

After, running 'f' command, don't forget to run 'w' command to save and exit from fdisk command mode. Once it fixed partition table order, we will no longer get error messages.

10. How to Disable Boot Flag (*) of a Partition:

By default, fdisk command shows the boot flag (i.e. '*') symbol on each partition. If we want to enable or disable boot flag on a specific partition, do the following steps.

```
[root@tecmint ~]# fdisk /dev/sda
```

Press 'p' command to view the current partition table, you see there is a boot flag (asterisk (*) symbol in orange color) on /dev/sda1 disk as shown below.

```
[root@tecmint ~]# fdisk /dev/sda
WARNING: DOS-compatible mode is deprecated. It's strongly recommended to
switch off the mode (command 'c') and change display units to
sectors (command 'u').
Command (m for help): p
Disk /dev/sda: 637.8 GB, 637802643456 bytes
255 heads, 63 sectors/track, 77541 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *           1          13      104391   83  Linux
/dev/sda2              14        2624    20972857+  83  Linux
/dev/sda3            2625        4582    15727635   83  Linux
/dev/sda4            4583       77541   586043167+   5  Extended
/dev/sda5            4583        5887    10482381   83  Linux
/dev/sda6            5888        7192    10482381   83  Linux
/dev/sda7            7193        7845     5245191   83  Linux
/dev/sda8            7846        8367     4192933+  82  Linux swap / Solaris
/dev/sda9            8368       77541   555640123+  8e  Linux LVM
```

Next enter command ‘a‘ to disable boot flag, then enter partition number ‘1‘ as (i.e. /dev/sda1) in my case. This will disable boot flag on the partition /dev/sda1. This will remove the asterisk (*) flag.

```
Command (m for help): a
Partition number (1-9): 1
Command (m for help): p
Disk /dev/sda: 637.8 GB, 637802643456 bytes
255 heads, 63 sectors/track, 77541 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Device Boot      Start         End      Blocks   Id  System
/dev/sda1               1          13      104391   83  Linux
/dev/sda2              14        2624    20972857+  83  Linux
/dev/sda3            2625        4582    15727635   83  Linux
/dev/sda4            4583       77541   586043167+   5  Extended
/dev/sda5            4583        5887    10482381   83  Linux
/dev/sda6            5888        7192    10482381   83  Linux
/dev/sda7            7193        7845     5245191   83  Linux
/dev/sda8            7846        8367     4192933+  82  Linux swap / Solaris
/dev/sda9            8368       77541   555640123+  8e  Linux LVM
Command (m for help):
```

Installation of Linux:

1. **Make Sure That Computer Can Run Linux.**

Our computer must meet the following system requirements:

- 2 GHz processor
- 2 gigabytes of RAM (system memory)
- 5 gigabytes of hard drive space (25 gigabytes recommended)
- A DVD drive or a USB port to install Linux

2. **Find A Blank DVD Disc Or A Flash Drive.**

To install Ubuntu Linux on our computer, we'll first need to create an installer by placing the Ubuntu ISO file on a disc or flash drive. If we get a DVD, make sure that it is a DVD-R that has never been used before. We'll need a standard 4.5 gigabyte DVD. If we choose to use a flash drive, make sure it can hold at least 2 gigabytes of information.

3. **Download The Ubuntu Linux ISO File. To Do So:**

- Go to https://www.ubuntu.com/download/desktop
- Scroll down and click Download to the right of your preferred version (the latest release is 17.10, though the latest long-term support release is 16.04.3).
- Scroll down and click the Not now, take me to the download link.
- Wait for the download to start or click the download now link.

4. **Burn the ISO File Onto A DVD.**

We can also use a flash drive, but we'll need to format it for either FAT32 (Windows) or MS-DOS (FAT) (Mac) and then use UNetBootin, Rufus, Universal USB Installer (recommended) to make the flash drive recognizable by our computer's operating system.

5. **Partition Computer's Hard Drive.**

Creating a partition sections off a determined part of our hard drive, allowing that part to function as a separate hard drive. This is what we'll install Linux onto, so our partition will need to be at least five gigabytes in size. **The Ubuntu support page recommends at least 25 gigabytes of free space.**

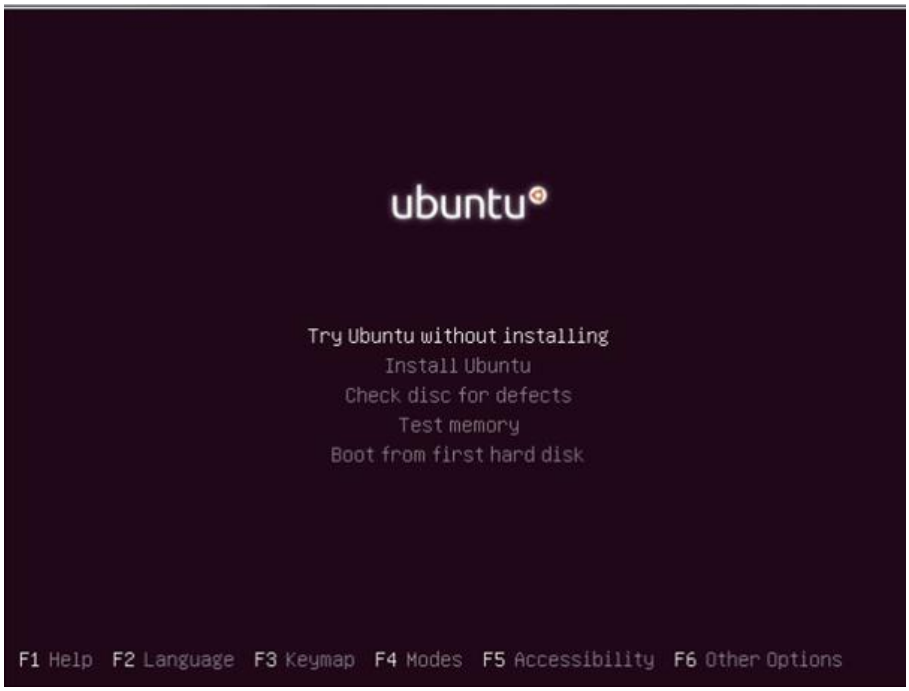
6. **Make Sure That Our Installer Is Inserted.**

Our DVD or flash drive should be inserted into or attached to our computer. Once we're certain that the installer is connected and we've performed the rest of the steps in this section, we can proceed to installing Ubuntu Linux on our Windows or Mac computer.

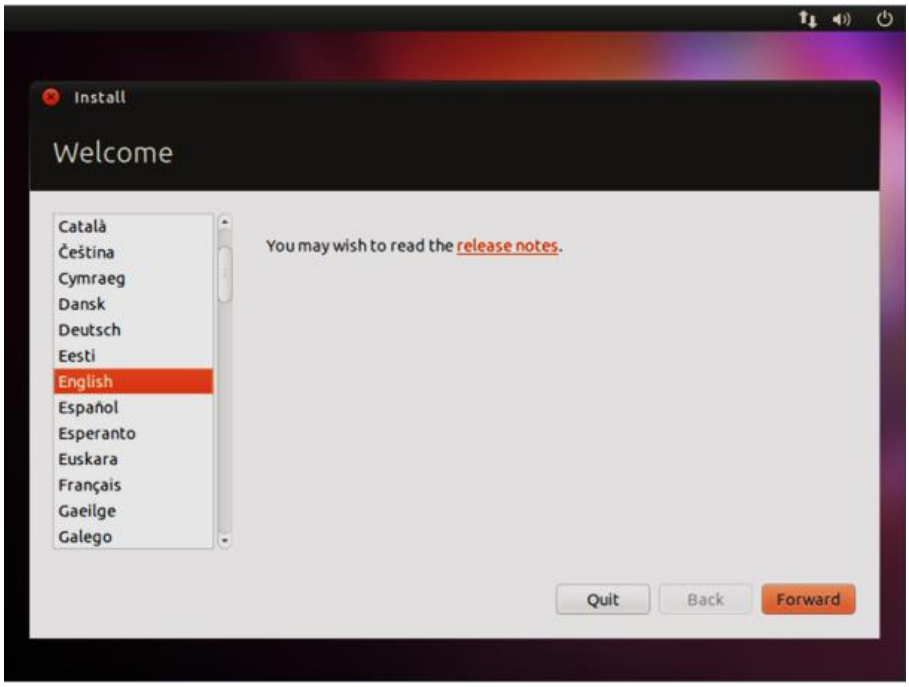
Installation Process:

Step 1: Insert the ubuntu cd or flash driver and boot the computer from cd or flash driver. First of all we will be prompted to select language English or other language according to our preferences.

Step 2: Now we will see ubuntu menu, we can choose **Try ubuntu without installing** option to try ubuntu without actually installing it on our hard drive. For installing ubuntu choose the second option **Install Ubuntu**.

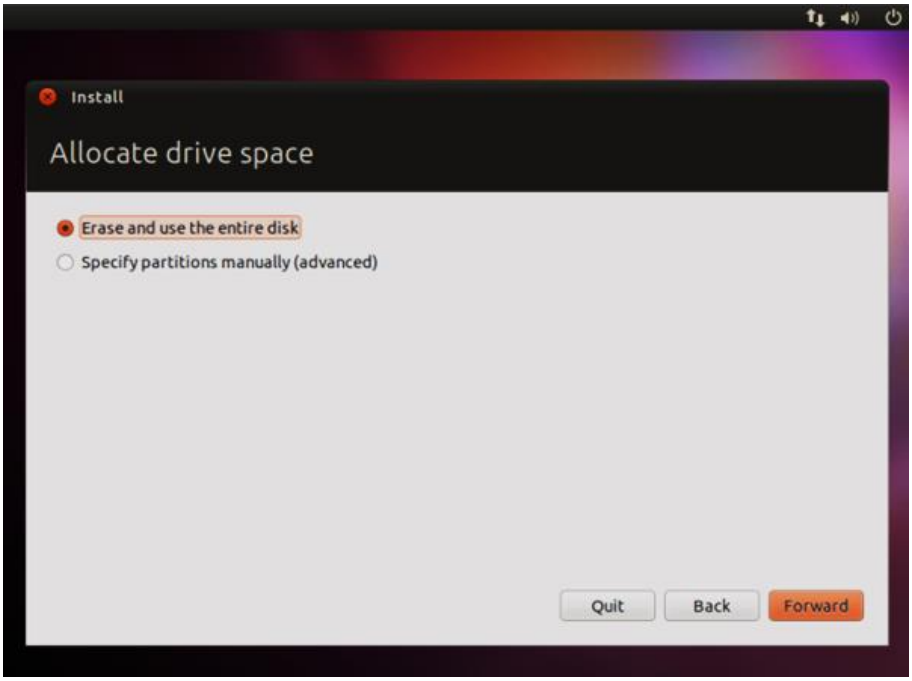


Step 3: Ubuntu will start now initialize and after few minutes we can see the installation wizard.

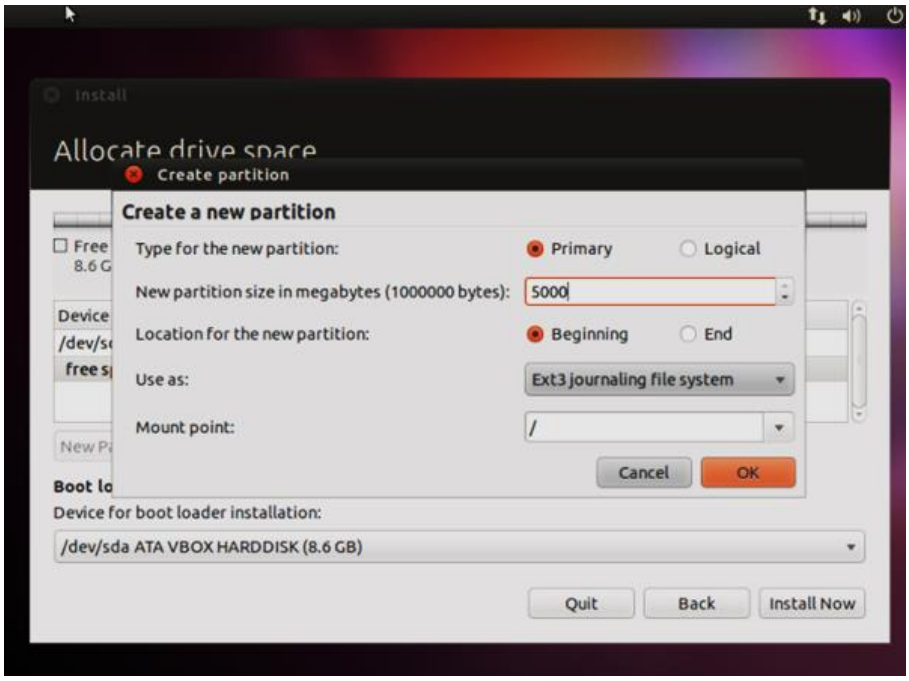


Step 4: Click Forward and it will check the **minimum requirements for running ubuntu** on our PC. If everything is fine we can see green colored tick marks. We can also select to download updates while installing and install some third party software. After selecting the things we want click forward.

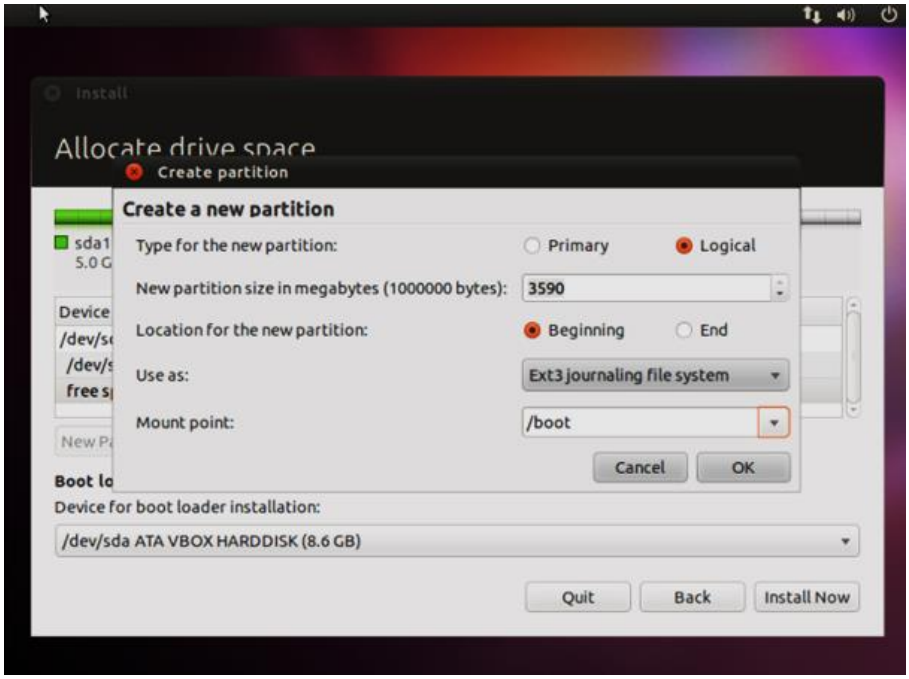
Step 5: Now we can choose either erase and use entire disk option or s**pecify partitions manually** option. We can choose the 1st option if we just want Linux to exist in our system. Else select second option. Now it will display the free space available for our pc.



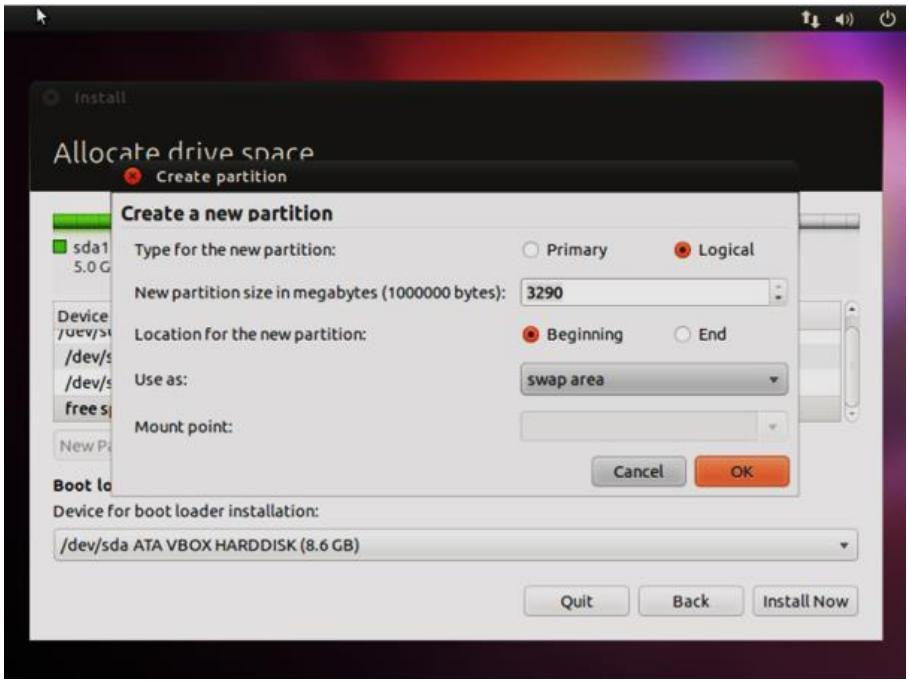
Select free space and click on Add option to create a new partition and choose partition type as primary, size around 70% of the free space available or choose anything like 10,000 or 20,000mb, use as ext3 journaling file system and select mount point as /.

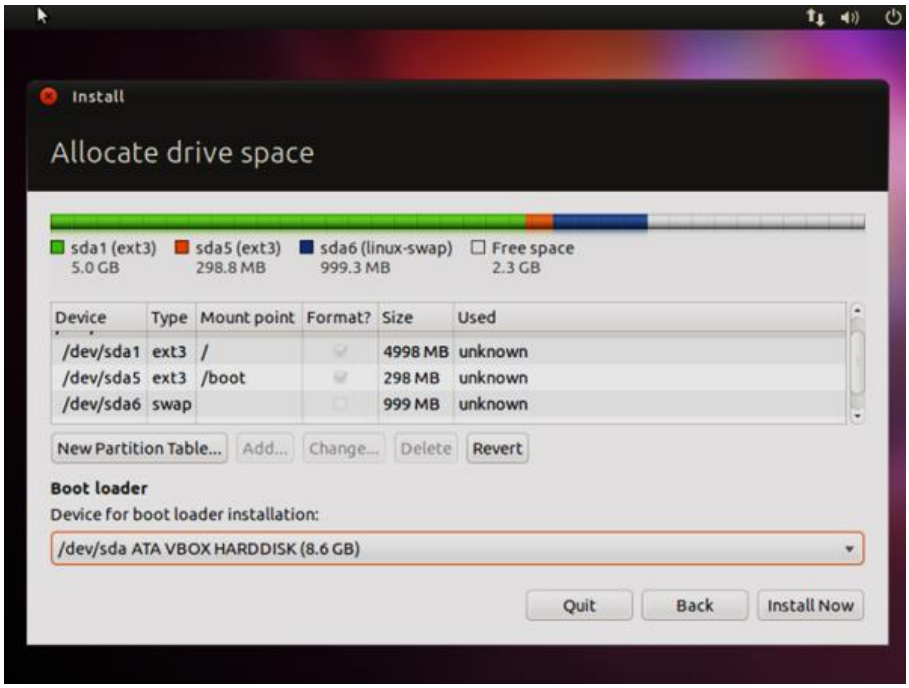


Now again select free space from the table and click add option. Now select size to be around 300mb, use as ext3 journaling file system and select mount point as /boot.

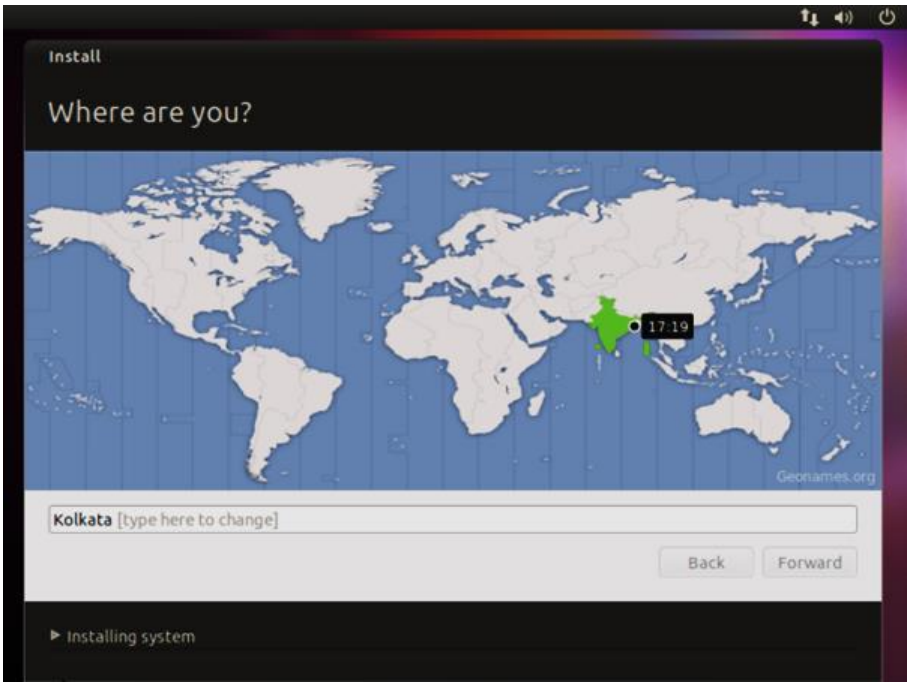


Now again select free space from the table and click add option. Now select size to be around twice the size of our ram that is around 1000 mb if our ram size is 512mb and select use as swap area and click ok.

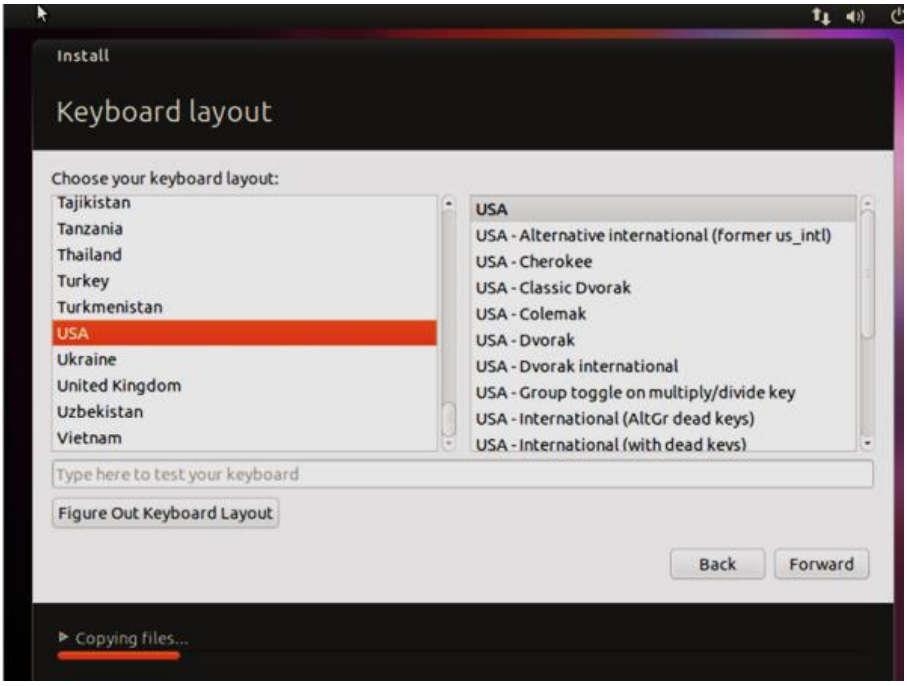




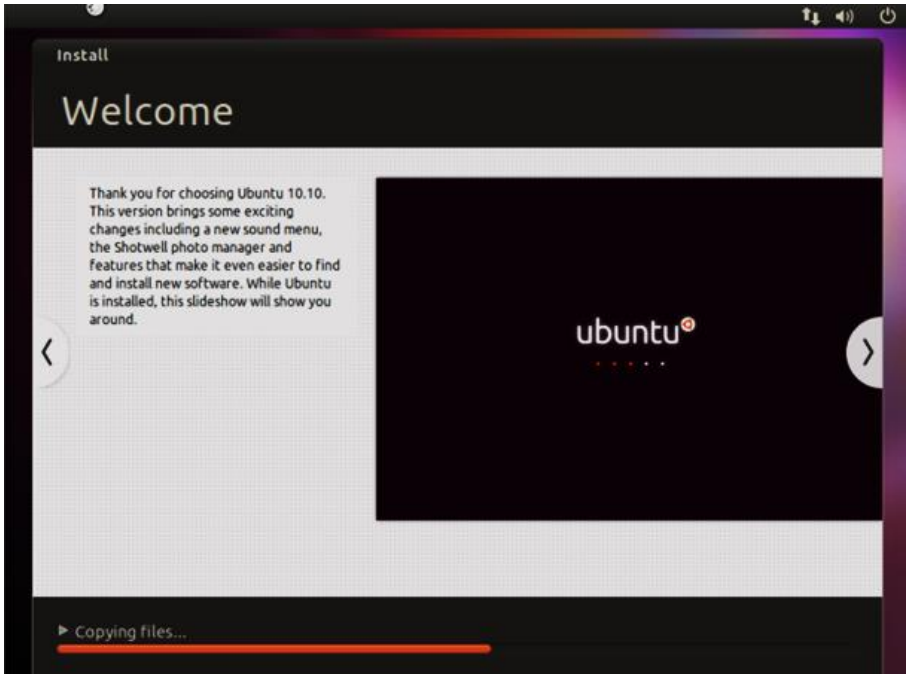
Step 6: Click Install now button and then the wizard will ask us location. Select our location and click forward.



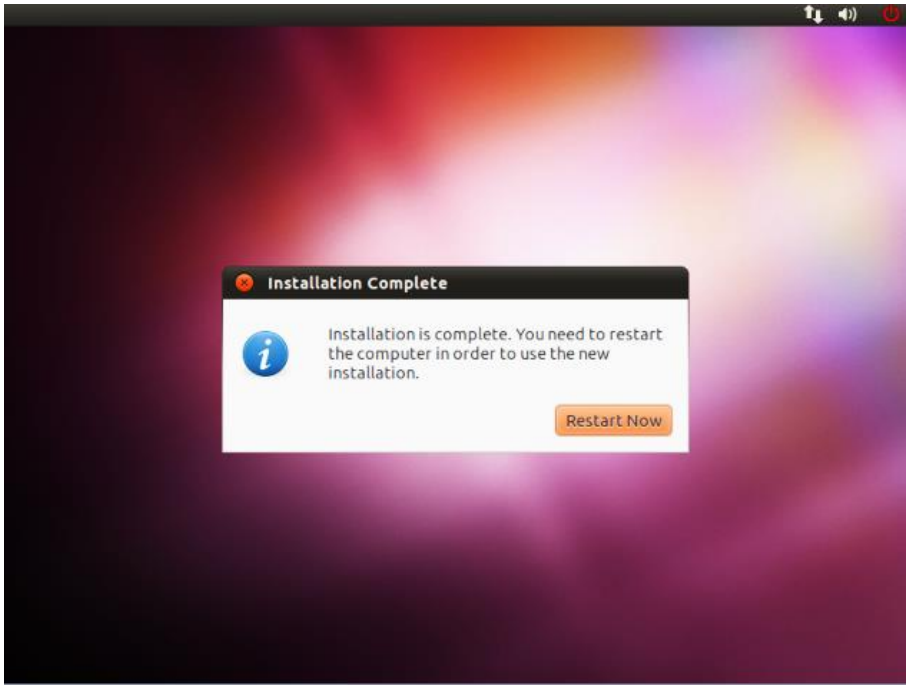
Step 7: While we are selecting these options wizard will continue to copy files. Now select desired keyboard layout and click forward.



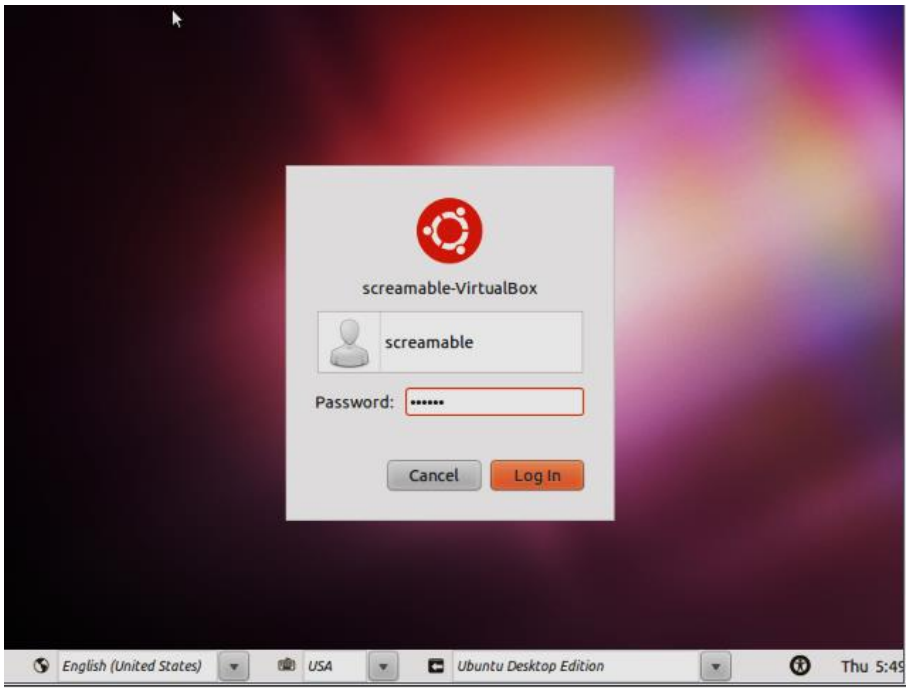
Step 8: Now fill in the details. Fill name, computer name, choose a username and create a password and click forward and let ubuntu copy all the essential files.



Step 9: After all files have been copied and installed ubuntu will display a message saying that installation complete and click on restart button to restart computer. Remove the cd from the cd drive or pen drive.



Step 10: After restarting pc wait for the ubuntu to load and then it will display the login screen. Choose the user and enter password and click login.



Troubleshooting of Installation:

1. CD-ROM Reliability:

Sometimes, especially with older CD-ROM drives, the installer may fail to boot from a CD-ROM. The installer may also even after booting successfully from CD-ROM fail to recognize the CD-ROM or return errors while reading from it during the installation.

There are many different possible causes for these problems. Here is the only list of some common issues and provide general suggestions on how to deal with them. The rest is up to us.

There are two very simple things that we should try first.

a. If the CD-ROM does not boot, check that it was inserted correctly and that it is not dirty.
b. If the installer fails to recognize a CD-ROM, try just running the option Detect and mount CD-ROM a second time. Some DMA related issues with very old CD-ROM drives are known to be resolved in this way.

If this does not work, then try the suggestions in the subsections below. Most, but not all, suggestions discussed there are valid for both CD-ROM and DVD, but we'll use the term CD-ROM for simplicity.

If you cannot get the installation working from CD-ROM, try one of the other installation methods that are available.

Common Issues:

- Some older CD-ROM drives do not support reading from discs that were burned at high speeds using a modern CD writer.
- Some very old CD-ROM drives do not work correctly if “direct memory access” (DMA) is enabled for them.

How To Investigate And Maybe Solve Issues:

If the CD-ROM fails to boot, try the suggestions listed below.

- Check BIOS actually supports booting from CD-ROM (only an issue for very old systems) and that CD booting is enabled in the BIOS.
- If downloaded an ISO image, check that the md5sum of that image matches the one listed for the image in the **MD5SUMS** file that should be present in the same location as where WE downloaded the image from.

```
$ md5sum debian-testing-i386-netinst.iso
a20391b12f7ff22ef705cee4059c6b92  debian-testing-i386-netinst.iso
```

Next, check that the md5sum of the burned CD-ROM matches as well. The following command should work. It uses the size of the image to read the correct number of bytes from the CD-ROM.

```
$ dd if=/dev/cdrom | \
> head -c `stat --format=%s debian-testing-i386-netinst.iso` | \
> md5sum
a20391b12f7ff22ef705cee4059c6b92  -
262668+0 records in
262668+0 records out
134486016 bytes (134 MB) copied, 97.474 seconds, 1.4 MB/s
```

If, after the installer has been booted successfully, the CD-ROM is not detected, sometimes simply trying again may solve the problem. If we have more than one CD-ROM drive, try changing the CD-ROM to the other drive. If that does not work or if the CD-ROM is recognized but there are errors when reading from it, try the suggestions listed below. Some basic knowledge of Linux is required for this. To execute any of the commands, we should first switch to the second virtual console (VT2) and activate the shell there.

- Switch to VT4 or view the contents of **/var/log/syslog** (use **nano** as editor) to check for any specific error messages. After that, also check the output of **dmesg**.
- Check in the output of **dmesg** if your CD-ROM drive was recognized. You should see something like (the lines do not necessarily have to be consecutive):

```
Probing IDE interface ide1...
hdc: TOSHIBA DVD-ROM SD-R6112, ATAPI CD/DVD-ROM drive
ide1 at 0x170-0x177,0x376 on irq 15
hdc: ATAPI 24X DVD-ROM DVD-R CD-R/RW drive, 2048kB Cache, UDMA(33)
Uniform CD-ROM driver Revision: 3.20
```

If we don't see something like that, chances are the controller our CD-ROM is connected to was not recognized or may be not supported at all. If we know what driver is needed for the controller, we can try loading it manually using **modprobe**.

- Check that there is a device node for our CD-ROM drive under **/dev/**. In the example above, this would be **/dev/hdc**. There should also be a **/dev/cdrom**.
- Use the **mount** command to check if the CD-ROM is already mounted; if not, try mounting it manually:

```
$ mount /dev/hdc /cdrom
```

Check if there are any error messages after that command.

```
$ cd /proc/ide/hdc
$ grep using_dma settings
using_dma       1       0       1       rw
```

A "1" in the first column after **using_dma** means it is enabled. If it is, try disabling it:

```
$ echo -n "using_dma:0" >settings
```

Make sure that we are in the directory for the device that corresponds to our CD-ROM drive.

If there are any problems during the installation, try checking the integrity of the CD-ROM using the option near the bottom of the installer's main menu. This option can also be used as a general test if the CD-ROM can be read reliably.

2. Boot Configuration:

If we have problems and the kernel hangs during the boot process, doesn't recognize peripherals we actually have, or drives are not recognized properly, the first thing to check is the boot parameters. In some cases, malfunctions can be caused by missing device firmware.

3. Software Speech Synthesis:

If software speech synthesis does not work, there is most probably an issue with our sound board, usually because either the driver for it is not included in the installer, or because it has unusual mixer level names which are set to mute by default. We should thus submit a bug report which includes the output of the following commands, run on the same machine from a Linux system which is known to have sound working (e.g., a live CD).

- ✓ **dmesg**
- ✓ **lspci**
- ✓ **lsmod**
- ✓ **amixer**

4. Common 32-bit PC Installation Problems:

There are some common installation problems that can be solved or avoided by passing certain boot parameters to the installer.

If our screen begins to show a weird picture while the kernel boots, e.g. pure white, pure black or colored pixel garbage, our system may contain a problematic video card which does not switch to the frame buffer mode properly. Then we can use the boot parameter **fb=false** to disable the frame buffer console. Only a reduced set of languages will be available during the installation due to limited console features.

System Freeze During the PCMCIA Configuration Phase:

Some very old laptop models produced by Dell are known to crash when PCMCIA device detection tries to access some hardware addresses. Other laptops may display similar problems. If we experience such a problem and we don't need PCMCIA support during the installation, we can disable PCMCIA using the **hw-detect/start_pcmcia=false** boot parameter. We can then

configure PCMCIA after the installation is completed and exclude the resource range causing the problems.

Alternatively, we can boot the installer in expert mode. We will then be asked to enter the resource range options our hardware needs. For example, if we have one of the Dell laptops mentioned above, we should enter **exclude port 0x800-0x8ff** here. There is also a list of some common resource range options in the System resource settings section of the PCMCIA HOWTO. Note that we have to omit the commas, if any, when we enter this value in the installer.

5. Interpreting the Kernel Startup Messages:

During the boot sequence, we may see many messages in the form **can't find *something***, or ***something* not present**, **can't initialize *something***, or even **this driver release depends on *something***. Most of these messages are harmless. We see them because the kernel for the installation system is built to run on computers with many different peripheral devices. Obviously, no one computer will have every possible peripheral device, so the operating system may emit a few complaints while it looks for peripherals we don't own. We may also see the system pause for a while. This happens when it is waiting for a device to respond, and that device is not present on our system. If we find the time it takes to boot the system unacceptably long, we can create a custom kernel later.

6. Reporting Installation Problems:

If we get through the initial boot phase but cannot complete the install, the menu option Save debug logs may be helpful. It lets us store system error logs and configuration information from the installer to a floppy, or download them using a web browser. This information may provide clues as to what went wrong and how to fix it. If we are submitting a bug report, we may want to attach this information to the bug report.

Other pertinent installation messages may be found in **/var/log/** during the installation, and **/var/log/installer/** after the computer has been booted into the installed system.

7. Submitting Installation Reports:

If we still have problems, we can submit an installation report. We also encourage installation reports to be sent even if the installation is successful, so that we can get as much information as possible on the largest number of hardware configurations.

Note that our installation report will be published in the Debian Bug Tracking System (BTS) and forwarded to a public mailing list. Make sure that we use an e-mail address that we do not mind being made public.

If we have a working Ubuntu system, the easiest way to send an installation report is to install the **installation-report** and **reportbug** packages (**aptitude install installation-report reportbug**), configure **reportbug**, and run the command **reportbug installation-reports**.

Alternatively we can use this template when filling out installation reports, and send the report to**<ubuntu-users@lists.ubuntu.com>**.

```
Package: installation-reports

Boot method: <How did you boot the installer? CD? floppy? network?>
Image version: <Full URL to image you downloaded is best>
Date: <Date and time of the install>

Machine: <Description of machine (eg, IBM Thinkpad R32)>
Processor:
Memory:
Partitions: <df -Tl will do; the raw partition table is preferred>

Output of lspci -knn (or lspci -nn):

Base System Installation Checklist:
[O] = OK, [E] = Error (please elaborate below), [ ] = didn't try it

Initial boot:           [ ]
Detect network card:    [ ]
Configure network:      [ ]
Detect CD:              [ ]
Load installer modules: [ ]
Detect hard drives:     [ ]
Partition hard drives:  [ ]
Install base system:    [ ]
Clock/timezone setup:   [ ]
User/password setup:    [ ]
Install tasks:          [ ]
Install boot loader:    [ ]
Overall install:        [ ]

Comments/Problems:

<Description of the install, in prose, and any thoughts, comments
      and ideas you had during the initial install.>
```

In the bug report, describe what the problem is, including the last visible kernel messages in the event of a kernel hang. Describe the steps that we did which brought the system into the problem state.