

UBUNTU & CENTOS SERVER ADMINISTRATION

This is the keyword-rich, attention-grabbing subtitle

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To my niece Safiyah Nawar and Nujaira Zaynab

UBUNTU & CENTOS SERVER ADMINISTRATION

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INTRODUCTION

subtitle

An operating system is a software that runs on our computer. Handling all the instructions between a user and the Computer hardware .But the operating system is not just one software it also consists of a lot of other smaller program that runs on this operating system to that helps users to do their work. we run this smaller program on top of this operating system to do everything.

Liunix is just another operating system. Its a rock solid operating system. Linux work both as a server and Desktop operating system.

Linux operating system is great for a lot of reason . thease are the following

* **Multi user OS:** Linux is a multi user operating system. That means more than one user can work on a system at the same name

* **Multi tasking OS:** Linux is a multi taking operating system you can run multiple program at once .this allows the operating system to run several process all at once.

* **Multi Platform OS:** Linux can run currently more that 24 types of platform and 64-bit Intel based personal computer .All variants of Apple mac,Sun Spark and ipod ,even the Microsoft xbox.

* **Interoprable OS:** Linux can operate with most network protocols and also most Language it can easily interact with Windows OS,NOVEL,UNIX and other operating system that has a smaller market

* **Scalabel OS:** Linux operating system has support for even Raspberry pi which is a credit card size computer to Very powerful Server. Most of the server of the world is running Linux OS. They have also run in low power computer

* **Portable OS:** Linux is portable operating system. Linux is mostly written in C programming language .C is a language that is specially for writing operating system level software. And it can be ported to run on a new computer.

* **Flexible OS:** Linux operating system can be used to make a router, graphical workstation, home entertainment computer, file server, web server, mail server, cluster, just any computing purpose.

* **Stable:** Linux kernel is very mature. For being stable it is used for most of the server in the world.

* **Efficient:** The design of the Linux enables you to include on only the thing you needed that's why it can run on both raspberry pi to a big server.

* **Free :** Linux is a Free operating system.

GNU PROJECT

GNU Stands for (GNU is NOT UNIX). To make a free clone of the UNIX OS GNU project started 1984.To maintain the free software FSF(Free Software Foundation) is created. It Creates the GNU C compiler ,EMACS Text editor and many other software.

The GNU General Public License (GPL) is a very creative license that used to copyright to protected the freedom of the software user. When a software is licensed under the GPL recipients are bound by the copyright to respect freedom of anyone to use and share the software and also change the source code if necessary.

HISTORY OF LINUX

Linux is a clone of the UNIX based operating system. Unix is created at BEL LABS for AT&T corporation. To make a free clone of the unix Linus Trovalds created a minix .he wrote the kernel which is the heart of the linux .After that a lot of developer helped him to add more feature and functionality .and at that time the GNU Project was making free software for the computer and to make an OS they need a functional kernel which can communicate with the hardware .They took the linux kernel and add the GNU software on top of the kernel and made the GNU/LINUX Operating system.

Linux Trovalds is still considered as the dictator of the Linux kernel. He ultimately determines which feature will be added in the linux kernel and what features are not.

Packaging Linux:Distribution

A complete linux system is called distribution. A linux distribution contains the Linux kernel and the GNU project Tools and any number of software that can make the OS diverse functionality.

There are a lot of distribution on linux .Some of them specifically for servers and some of them are Desktop. Every customized distribution includes software packages for different users.

A single linux distribution often appears in different version .For example CENTOS distribution comes with a full core distribution and a LIVE CD version.

Ubuntu is based on Debian Distribution And Centos is community version of the Commercial RED HAT linux distribution.

Core Linux Distribution

Core linux distribution contains the Linux Kernel and GNU operating system one or more DE(Desktop Environment) and application that is available ready to install and run. The core linux Distribution are the compete linux distribution. These are the popular distribution

- * Red Hat linux
- * Fedora Core
- * Centos Linux
- * SUSE linux
- * Ubuntu Linux
- * Gentoo Linux
- * Debian Linux
- * Slackware Linux
- * Mandriva Linux
- * Turbo Linux
- * Puppy Linux

we use the ***UBUNTU linux*** and the ***CENTOS linux*** to illustrate how the servers work.

PRINCIPLE OF LINUX

- * Everything works as a file , even the system hardware
- * Small work is done by the individual program
- * Any complected work will be divided into smaller part and then process this by different different module.
- * All the configuration will be stored in a text file
- * linux OS use a standard hierarchical file structure in which the files/user files are arranged

* * *

UBUNTU SERVER

Ubuntu is built on the Debian architecture and comprised linux server and Dsktop. Ubuntu release updates every six months Ubuntu packages are based on packages from Debians unstable branch. Ubuntu is currently funded by the Canonical LTD.And GENOME 3 is the default GUI interface for the ubuntu from 17.10 version. We are goinf to use Ubuntu Server 18.04.3 LTS for our work.you can download the latest long term varsion of ubuntu server in this URL

<https://ubuntu.com/download/server>

CENTOS SERVER

Ubuntu is built on the Debian architecture and comprised linux server and Dsktop. Ubuntu release updates every six months Ubuntu packages are based on packages from Debians unstable branch. Ubuntu is currently funded by the Canonical LTD.And GENOME 3 is the default GUI interface for the ubuntu from 17.10 version. We are going to use Ubuntu Server 18.04.3 LTS for our work.you can download the latest long term varson of ubuntu server in this URL

<https://ubuntu.com/download/server>

VMWARE INSTALLATION

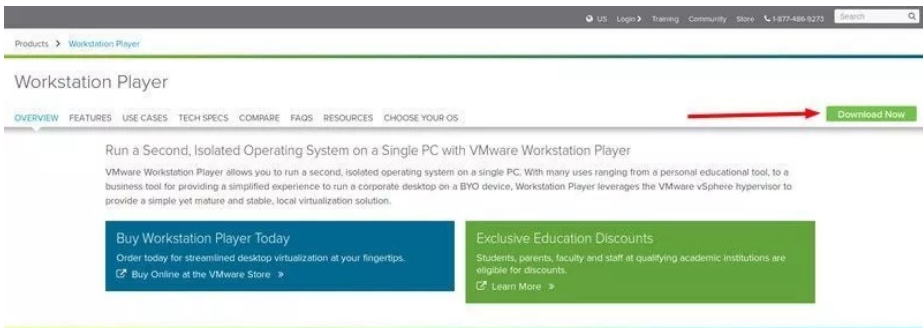
Step 1:

install the required build packages

=> **sudo apt install build-essential**

Step 2:

Download VMware workstation player from the website.



Step 3:

go to the installed directory make the file executable

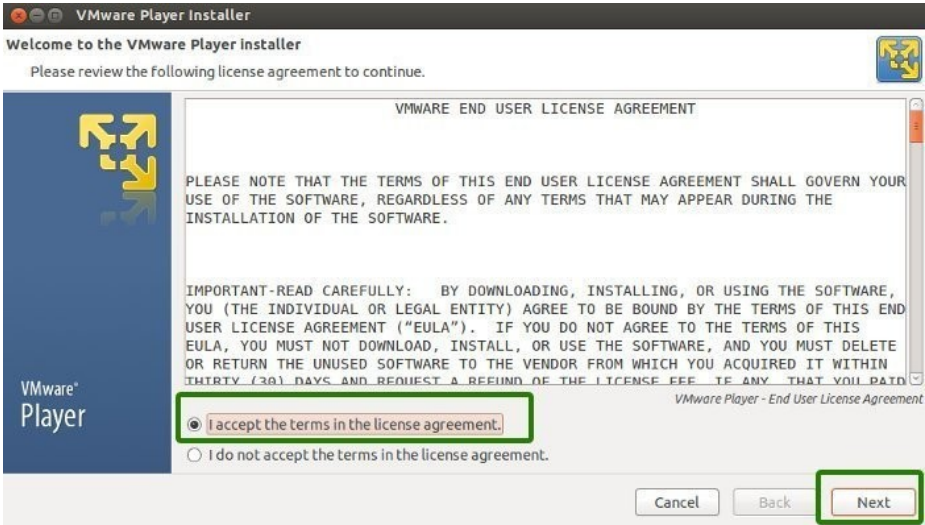
=> **chmod 777 Vmware-Player***

[we will talk about the **chmod 777** later for now just use it]

Step 4:

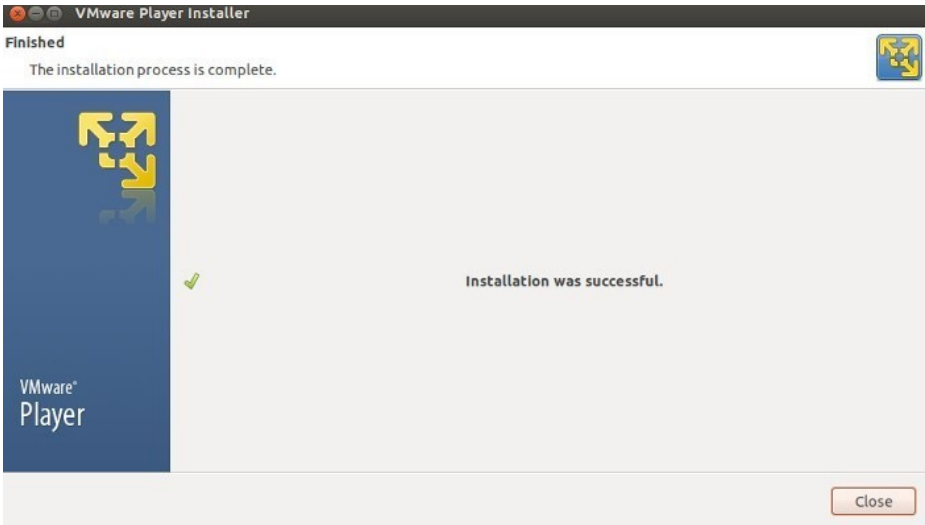
execute the program with **sudo**

=>sudo ./Vmware-Player*



[no license key is required .If you want to install vmware workstation instead of vmware player you need to have the license key]

after a successful installation screen will show to you



* * *

UBUNTU SERVER INSTALLATION

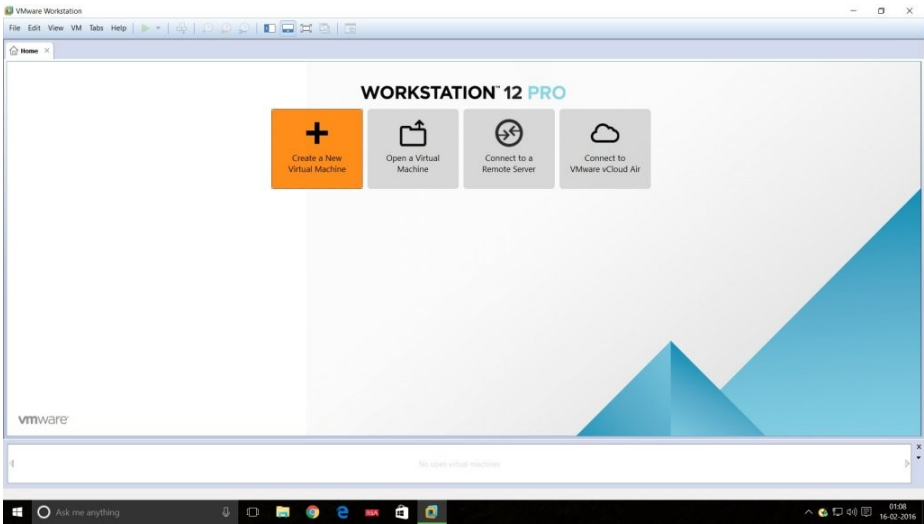
Ubuntu

REQUIREMENTS:

- 1)HOST PC WITH AT LEAST 4GB OF RAM
- 2)VMWARE WORKSTATION/VIRTUALBOX
- 3)UBUNTU SERVER ISO IMAGE

Step 1:

Lunch VMware Workstation New Virtual Machine Wizard



Step 2:

Select the installation media or source and choose the disk size.

Disk Size

The virtual machine's hard disk is stored as one or more files on the host computer's physical disk. These file(s) start small and become larger as you add applications, files, and data to your virtual machine.

Maximum disk size (in GB): – +

Recommended size for Ubuntu 64-bit: 20 GB

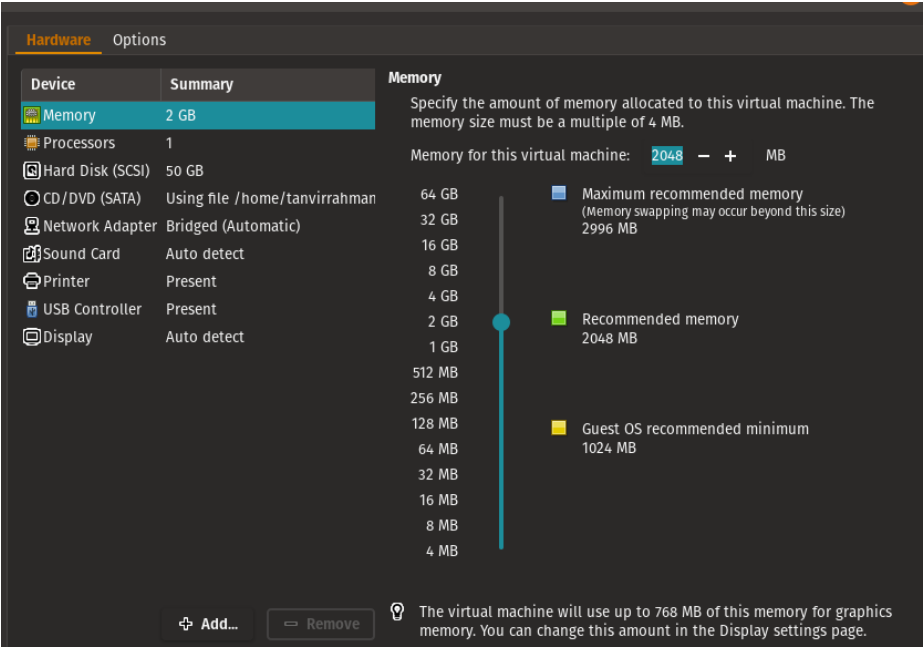
☐ Store virtual disk as a single file

☒ Split virtual disk into multiple files

Splitting the disk makes it easier to move the virtual machine to another computer but may reduce performance with very large disks.

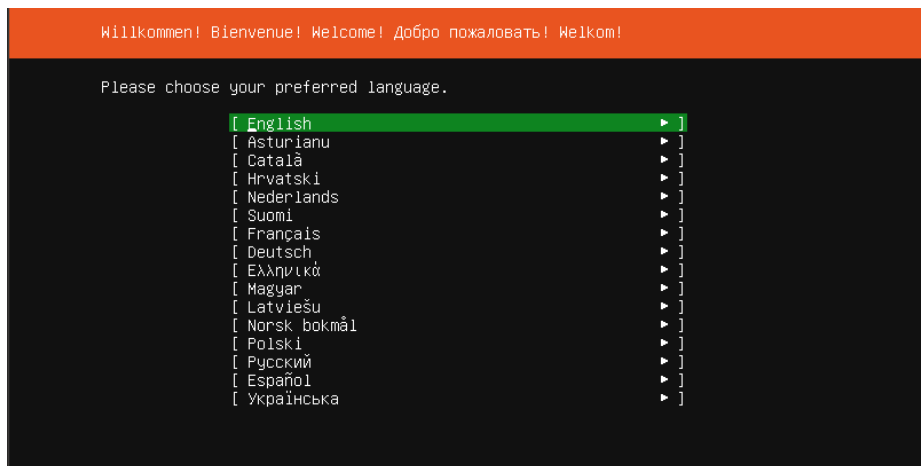
Step 3:

final configuration of the Vmware will be like this

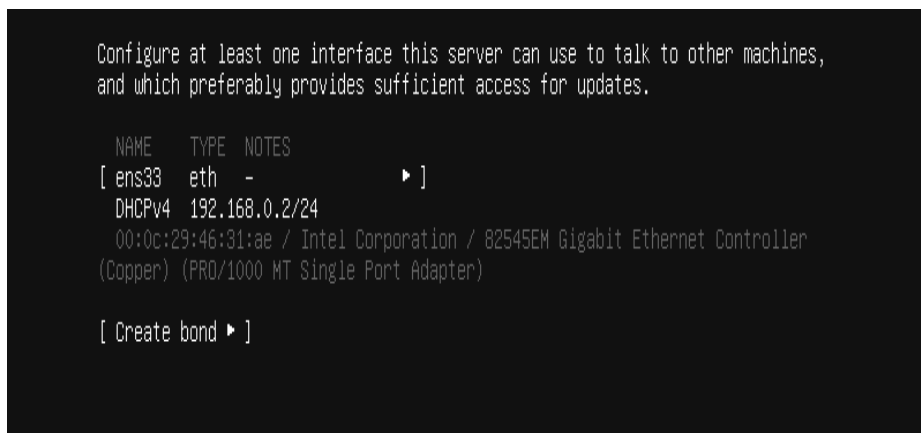


Step 4:

start the installation ,first set the language

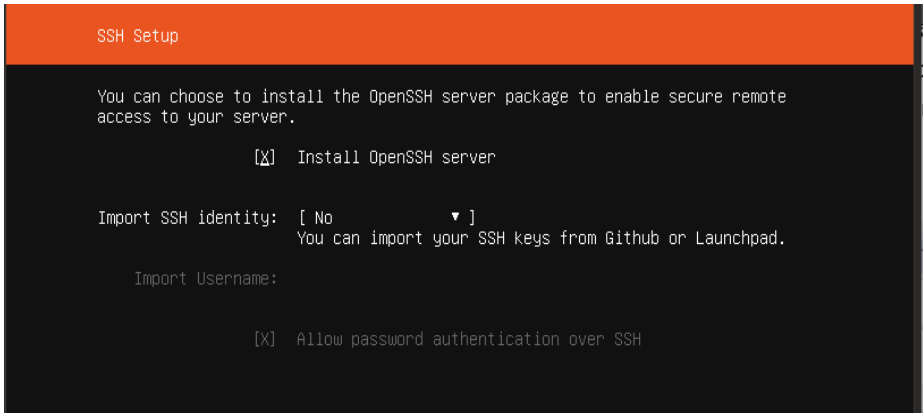
**Step 5:**

select DHCP for network for now .we change the ip address of the server later



Step 5:

Select “install openSSH server” so we can connect to the computer with our hosts



Step 6:

There are three types of partition

* **Guided** : use entire disk : it use the entire disk with guided partition system

* **Manual** : In manual partition user have to allocate the space manually.

For minimal settings three partition is a mandatory

1) /boot

2) /swap

3) /root

* **Guided** : on LVM :this option allow user to set a LVM based partition

Select the entire disk for installation .we select the Entire disk guided partition will talk about the other boot system later.



Step 7:

login to the system with your credential .

SUMMARY:

we learn how to set up a ubuntu server on Vmware Virtual machine with a dhcp network. Using guided partition.

* * *

CENTOS SERVER INSTALLATION

Centos

REQUIREMENTS:

- 1)HOST PC WITH AT LEAST 4GB OF RAM
- 2)VMWAREWORKSTATION/VIRTUALBOX
- 3)CENTOS7 SERVER ISO IMAGE

Step 1:

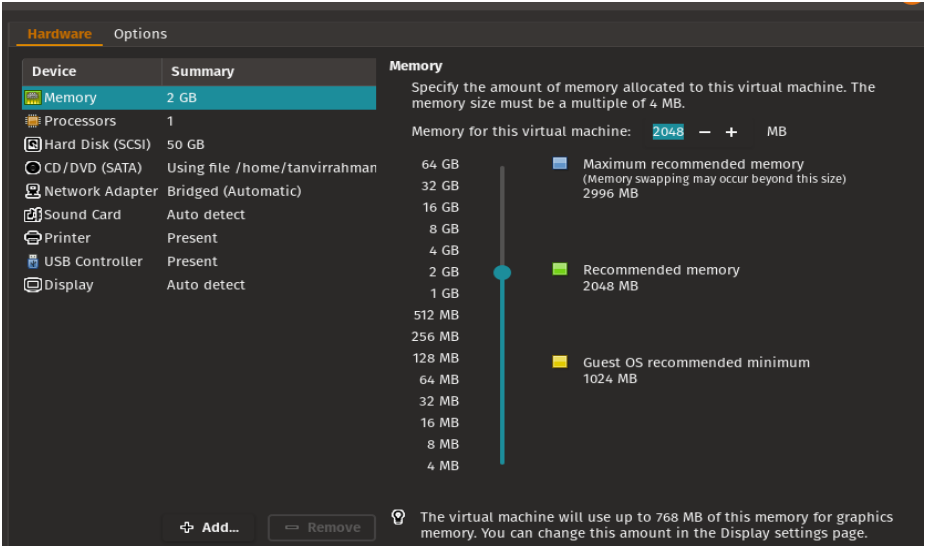
Lunch VMware Workstation New Virtual Machine Wizard

Step 2:

Select the installation media or source and choose the disk size.

Step 3:

final configuration of the VMware will be like this



Step 4:
start the installation , First set the language




Step 5:

From the **software selection** select server with a GUI

SOFTWARE SELECTION

Done

CENTOS 7 INSTALLATION

 us

Help! (F1)

Base Environment

☐ Minimal Install
Basic functionality.

☐ Compute Node
Installation for performing computation and processing.

☐ Infrastructure Server
Server for operating network infrastructure services.

☐ File and Print Server
File, print, and storage server for enterprises.

☐ Basic Web Server
Server for serving static and dynamic internet content.

☐ Virtualization Host
Minimal virtualization host.

☒ Server with GUI
Server for operating network infrastructure services, with a GUI.

☐ GNOME Desktop
GNOME is a highly intuitive and user friendly desktop environment.

☐ KDE Plasma Workspaces
The KDE Plasma Workspaces, a highly-configurable graphical user interface which includes a panel, desktop, system icons and desktop widgets, and many powerful KDE applications.

Add-Ons for Selected Environment

☐ Backup Server
Software to centralize your infrastructure's backups.

☐ DNS Name Server
This package group allows you to run a DNS name server (BIND) on the system.

☐ E-mail Server
Allows the system to act as a SMTP and/or IMAP e-mail server.

☐ FTP Server
Allows the system to act as an FTP server.

☐ File and Storage Server
CIFS, SMB, NFS, iSCSI, iSER, and iSNS network storage server.

☐ Hardware Monitoring Utilities
A set of tools to monitor server hardware.

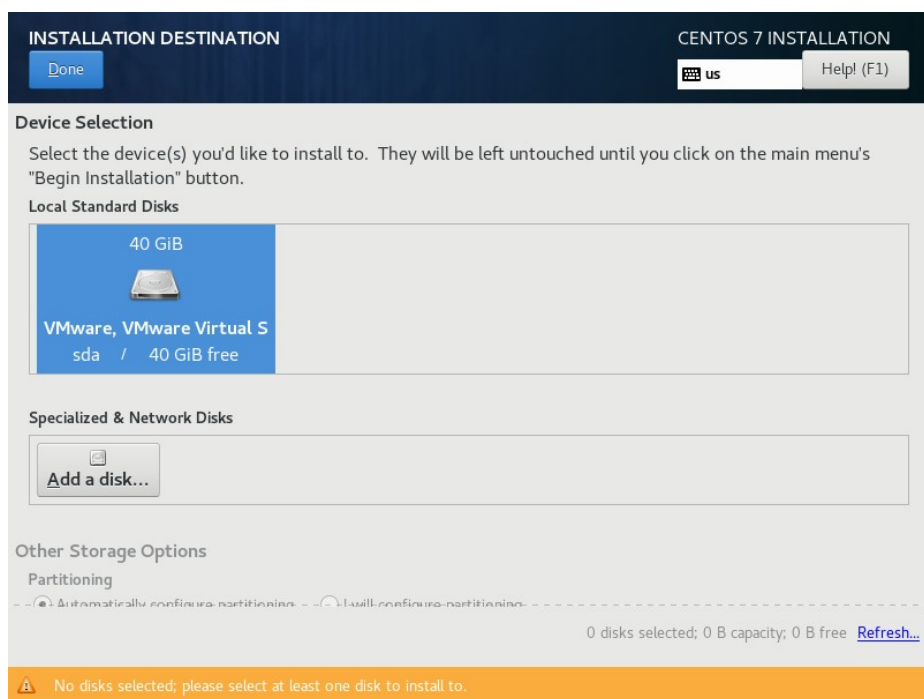
☐ High Availability
Infrastructure for highly available services and/or shared storage.

☐ Identity Management Server
Centralized management of users, servers and authentication policies.

☐ Infiniband Support
Software designed for supporting clustering and grid

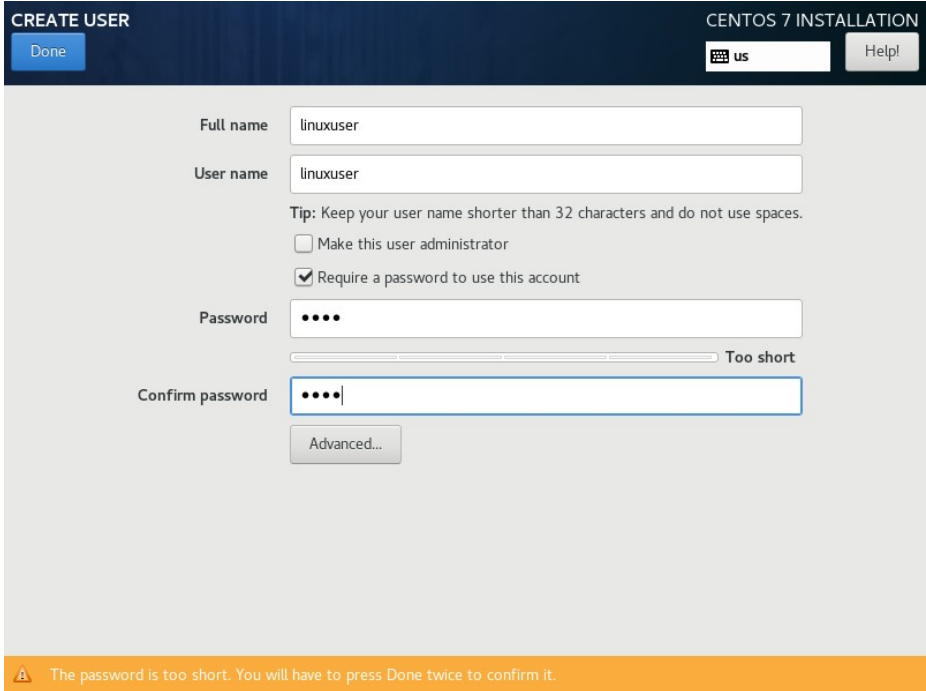
Step 6:

Select the volume for installing .in this installation we go for the entire disk guided partition



Step 7 :

Enter the root password and confirm it. and create a user and set password for the user



The image shows the 'CREATE USER' screen in the CentOS 7 installation environment. The header bar is dark blue with 'CREATE USER' on the left, 'CENTOS 7 INSTALLATION' on the right, and a 'Done' button. Below the header, there are input fields for 'Full name' (linuxuser) and 'User name' (linuxuser). A tip message states: 'Tip: Keep your user name shorter than 32 characters and do not use spaces.' There are two checkboxes: 'Make this user administrator' (unchecked) and 'Require a password to use this account' (checked). The 'Password' field contains four dots, and a progress bar below it indicates 'Too short'. The 'Confirm password' field also contains four dots. An 'Advanced...' button is located below the confirm password field. At the bottom, an orange banner displays a warning icon and the message: 'The password is too short. You will have to press Done twice to confirm it.'

Step 7 :

wait for the installation to finished. After that reboot the system

Step 8 :

login with root credentials

SUMMARY:

we learn how to set up a Centos server on Vmware Virtual machine with Using guided partition.

COMMAND LINE IN LINUX

Every workstation version of linux has a Beautiful GUI(Graphical User Interface) but most of the server Ubuntu or CENTOS run on command line mode.you can add graphical user interface to that but without the command line you cant manage the server properly. Once you learn Command line you will find that it is more powerful and flexible for user to manage your server than a graphical mode.

WORKING AS ROOT

By default every linux OS creates a user root.Many operating system like CENTOS ask for a root password .But Ubuntu server don't do that .There is a very good reason behind that .in Linux OS root has a limitless power .root can do anything ,change anything even can delete anything from the server .so it is very important to be careful when you work as

root .Thats why in ubuntu server every time you do anything that need superuser privileges you use the command '***sudo***' .This command allows the normal user so they can peform task that needs superuser privileges.you type sudo then your command it may ask for password after providing the password it will perform the action with the superuser privileges . But if you want the root shell then type this command

=> sudo su

But it is not recommended to work with the root shell .Do not use the root shell unless it is absolutely necessary . work with sudo if you need superuser privilege.

TERMINAL & SHELL

What is Terminal:

Terminal is a program that opens a window and lets you play with the shell. There are a bunch of different terminal emulators that you can see in the linux Distribution. such as Gnome terminal, konsole ,xterm, rxvt ,nxterm ,eterm, Tilix etc. Terminal lets you interact with the shell

What is shell :

Shell itself is a program that takes command from the keyboard and gives them to the operating system to perform. You can work with the graphical user interface but if the server you are using has no graphical user interface this will be the only interface you got and you have to do all of your work in the CLI interface

there are different types of shell

* ***tsh*** → ***tsh*** is a shell with a scripting language similar to the C programming language

* ***sash*** → stand alone shell .its a very minimal shell runs almost

every system .it is basically popular for troubleshooting the system

* ***zsh*** → ***zsh*** is a shell which is compatible with bash but has a lot of extra functionality

* ***fish*** → ***fish*** stands for friendly interactive shell .mostly popular in desktop. It has a very good auto completion feature

* ***Bash*** → ***bash*** stands for Bourne Again Shell that is the enhanced version of the original UNIX program ***sh*** .it is written by the Steve Bourne. It is the most popular shell and the default shell of the most linux operating system.

We will use the Bash all over the example.

BASIC LINUX COMMANDS

These are the basic command to operate a linux operating system

*Command name: **ls***

description:

ls command used to see the files and folder inside a directory . it is the most used command in linux.

syntax:

***ls** -[option] <directory>*

1) ***ls -m*** will show the files and folder with comma

2) ***ls -a*** show the hidden files also

3) **ls -l** will show the files and folder in a listing format

4) **ls -lh** will show the file with listing and size

5) **ls -i** will show the list of files and folders with Inode

6) **ls -t** will show the modification time with directory listing

example:

[pic]

Command name: *more*

description:

It works like the more command .it also give scrolling options

syntax:

More <options> <file_name>

1) **less -E** : automatically exit the first time it reaches end

of file.

- 2) **less -f** : forces non-regular file to open.
- 3) **less -F** : exit if entire file can be displayed on first screen
- 4) **less -g** : highlight the string which was found by last search command
- 5) **less -G** : suppresses all highlighting of strings found by search commands
- 6) **less -i** : cause sears line numbers
- 7) **less -p <pattern>** : it tells less to start at the first occurrence of pattern in the file
- 8) **less -s** : causes consecutive blank lines to be squeezed into a single blank line to ignore case
- 9) **less -n** : suppresses line numbers
- 10) **less -p <pattern>** : it tells less to start at the first occurrence of pattern in the file
- 11) **less -s** : causes consecutive blank lines to be squeezed
- 12) **less -N** : shows line number

example:

[pic]

Command name: *strings*

description:

To display the content of the file

syntax:

strings <filename>

example:

[pic]

Command name: *tree*

description:

To display the Directory stricture in a tree format

syntax:

Tree <directory>

[you may have to tool with package manager]

example:

[pic]

Command name: *dir*

description:

To display the files and folder inside the directory

syntax:

dir <directory_name>

[you have to install 'tree' tools before using this command]

example:

[pic]

Command name: cal

description:

To display the calendar

syntax:

Cal

cal <year>

cal <month> <year> command]

example:

[pic]

Command name: clear

description:

clear the screen

syntax:

clear

example:

[pic]

Command name: *bc*

description:

basic calculator

syntax:

bc

example:

[pic]

Command name: *mkdir*

description:

making directory

syntax:

mkdir <directory> : for making single directory

mkdir -p <directory/directory>:

for making recursive directory

example:

[pic]

Command name: *rmdir*

description:

Remove empty directory

[you cant remove any directory which has file in it with

this command]

syntax:

rmdir <empty_directory>

example:

[pic]

Command name: *file*

description:

display the file type

syntax:

file <filename>

example:

[pic]

Command name: *ln*

description:

Create a link of the source filename. In case of a hard link if you delete the main file the link won't be removed but in case of a soft link if you delete the main file the linked file will be removed.

syntax:

ln <option> <source_file> <shortcut_file>

ln -s : for creating soft link

ln -P : for creating hard link

example:

[pic]

*Command name: **history***

description:

Shows users command history it will show the last 1000 command of the user you can set the limit if you like

syntax:

history

example:

[pic]

*Command name: **locate***

description:

It will search the entire system for that file [you need to apply the command '**updatedb**' for getting latest entry]

syntax:

Locate <file_name>

example:

[pic]

Command name: *uname*

description:

Show all the information about the kernel , OS and hardware-platform

syntax:

uname -a : all information, in the following order

uname -s :print the kernel name

uname -n : print host name

uname -r : print the kernel release

uname -v : print the kernel version

uname -m : print the machine hardware name

uname -p : print the processor type

uname -i : print the hardware platform

uname -o : print the operating system

example:

[pic]

Command name: *tar*

description:

For creating archive and extracting archive hardware-platform

syntax:

tar -cvf <archive_name> <source> : for creating archive

tar -xvf : for extracting archive

example:

[pic]

Command name: **gzip**

description:

For compressing normal file or archive file

syntax:

gzip <file_name>

example:

[pic]

Command name: **gunzip**

description:

It is used for uncompromising a compressed file

syntax:

gunzip <compressed_file>

example:

[pic]

Command name: *lsmod*

description:

Show a list of the modules used by the kernel

syntax:

lsmod

example:

[pic]

Command name: *rmmod*

description:

Delete any module used by the kernel

[not Recommended . don't do it unless you are absolutely sure what you are doing]

syntax:

mmmod <module_name>

[you need to be a root user to perform this action]

rmmod-f, forces a module unload and may crash your machine. This requires Forced Module Removal option in your kernel. DANGEROUS

rmmod -v, enables more messages

rmmod -V, show version

example:

[pic]

Command name: **modprobe**

description:

Adding new module to the system

syntax:

modprobe <module_name>

example:

[pic]

Command name: **ps**

description:

See the current running process of the system

syntax:

ps

example:

[pic]

Command name: *top*

description:

Top command is used for process monitoring.
[more information about top in Process management]

syntax:

top

example:

[pic]

Command name: *renice*

description:

Used for changing the priority of a process running on a system. [more info in process management chapter]

syntax:

renice -n <priority> -p <pid>

example:

[pic]

Command name: *kill*

description:

Used for terminating process for this purpose

syntax:

Kill -<sigterm> -p pid

example:

[pic]

Command name: uptime

description:

Shows the system's running time. and load averages of previous 1 minute ,5 minute and 15 minute.

[this information can be found in top and htop command also]

syntax:

uptime

example:

[pic]

Command name: iostat

description:

Shows the Cpu and I/O information

[more information in process management Devices]

syntax:

- 1) ***Iostat -c*** : generate cpu status only
- 2) ***iostat -d*** : generate I/O statistics for all the devices
- 3) ***iostat -x*** : generate detail I/O statistics

- 4) **iostat -x** : generate detail I/O statistics and CPU information
- 5) **iostat -p <devices>** : generate details for that specific devices
- 6) **iostat -m** : generate statistics in Megabyte
- 7) **iostat -k** : generate statistics in Kilobyte
- 8) **iostat -N** : generate LVM options
- 9) **iostat -t** : generate statistics with timestamp
- 10) **nfsiostat** : Shows information of NFS devices

example:

[pic]

Command name: *hostnamectl*

description:

Display hostname and its related settings also change hostname and its related settings

syntax:

Hostnamectl : provide information about current host and its properties

hostnamectl set-hostname <hostname> :It will change the hostname

example:

[pic]

Command name: *pwd*

description:

Print the current directory path

syntax:

pwd

example:

[pic]

Command name: *dmesg*

description:

Display the detected hardware status during boot time

[the file location is '*var/log/dmesg*']

syntax:

dmesg

example:

[pic]

Command name: *init*

description:

Display the detected hardware status during boot time

[the file location is '*var/log/dmesg*']

syntax:

Init <run_lavel>

0 :Power-off the machine

6 :Reboot the machine

2, 3, 4,5 :start runlevel X.

1, s, S :Enter rescue mode

q, Q : Reload init daemon configuration

u, U :Reexecute init daemon

example:

[pic]

Command name: mkswap

description:

Used to format the partition used for swap space

syntax:

mkswap <file_system>

example:

[pic]

Command name: swapon

description:

To activate the swap space

syntax:

swapon -a <file_system>:

[enable all swaps from */etc/fstab*]

example:

[pic]

Command name: swapon***description:***

To deactivate the swap partition

syntax:

swapoff <file_system>

example:

[pic]

Command name: mkfs***description:***

To format the partition this tools is used

[more information about file system]

syntax:

mkfs -t <fs_type> <file_system>

To format the partition this tools is used
[more information about file system]

- 1) ***mkfs.ext2 /dev/sdx***: for ext2 file system
- 2) ***mkfs.ext3 /dev/sdx***:for ext3 file system
- 3) ***mkfs.ext4 /dev/sdx***: for ext3 file system
- 4) ***mkfs.minix /dev/sdx*** :for minix file system
- 5) ***mkfs.xfs /dev/sdx*** :for xfs file system

example:

[pic]

*Command name: **poweroff***

description:

power off the machine

syntax:

poweroff

example:

[pic]

*Command name: **whoami***

description:

Display the username which is currently logged in

syntax:

whoami***example:******[pic]******Command name: WC******description:***

Used to find out number of lines, word count, byte and characters count in the files specified in the file arguments

syntax:

- 1) ***wc <file_names>***
- 2) ***wc -m <file>*** : print the character in in the file
- 3) ***wc -w <file>*** : print the word in in the file
- 4) ***wc -l <file>*** : print the line in in the file

example:***[pic]******Command name: W******description:***

Used to show who is logged in to the computer and what they are doing

syntax:

w

example:

[pic]

Command name: **arch**

description:

Display the computer architecture

syntax:

arch

example:

[pic]

Command name: **alias**

description:

Instructs the shell to replace one string with another string while executing the commands

syntax:

Alias <string>='<target string>'

example:

[pic]

Command name: *bg*

description:

Used to send any foreground job to background

syntax:

bg

example:

[pic]

Command name: *cp*

description:

Used to copy a file or a group file from one destination to other

syntax:

cp <source_file> <target_destination>

example:

[pic]

Command name: *echo*

description:

Used to display line of text/string that are passed as an argument

syntax:

echo <arguments>

example:

[pic]

Command name: *fdisk*

description:

Format disk as well as creating and manipulating disk partition table

[more information in disk management chapter]

syntax:

fdisk <file_system>

example:

[pic]

Command name: *cfdisk*

description:

Format disk as well as creating and manipulating disk partition table using a text based GUI interface

[more information in disk management chapter]

syntax:

sudo cfdisk

example:

[pic]

Command name: *lsblk*

description:

Displays the total amount of free space available along with the amount of memory used and swap memory in the system

syntax:

lsblk

example:

[pic]

Command name: *lsmod*

description:

List the current kernel modules that are currently loaded

[it actually print the content of the '/proc/modules' with a nice format]

syntax:

lsmod

example:

[pic]

Command name: *lspci*

description:

Display the information about the currently connected PCI Buses .

[list of devices that are connected to the computer]

syntax:

lspci

example:

[pic]

Command name: *lshw*

description:

List all the Details information of the hardware of the computer

syntax:

lshw

example:

[pic]

Command name: *lshcpu*

description:

Display the detailed information about the CPU

syntax:

lscpu

example:

[pic]

*Command name: **man***

description:

Display the reference of the tools or command that are you using

syntax:

***man** <command>*

example:

[pic]

*Command name: **sudo***

description:

give you the superuser privileges

syntax:

***sudo** <command>*

example:

[pic]

*Command name: **ip***

description:

Used for performing several network administration

tasks

syntax:

Ip <option> <command>

example:

[pic]

Command name: *touch*

description:

Create an empty file

syntax:

touch <file_name>

example:

[pic]

Command name: *ifconfig*

description:

shows the ip address related information

syntax:

ifconfig

example:

[pic]

Command name: *gerp*

description:

global regular expression used for searching keyword

syntax:

ls | grep initrd

example:

[pic]

Command name: wget

description:

interactive cli based downloader

syntax

wget <download_url>

example:

[pic]

Command name: reboot

description:

reboot the system

syntax

reboot

example:

[pic]

Command name: ping

description:

test any host or network which is alive physically and logically

syntax

ping <pi_address/domain_name>

example:

[pic]

These are the basic commands to run a linux system .There are a lot of command more to maintain the server.

* * *

IP ADDRESSING

COMPUTER NETWORK

A computer network is a group of computer and other computing peripherals that linked together through some kind of communication channels to communicate with each other and share their resources among a width range of users.

Their jobs are

- 1) Facilitate communication via email, file server, web server, instant messaging etc
- 2) Share resources of the hardware like printer or scanner
- 3) Enable File sharing
- 4) create a centralized control among the total network

TYPES OF COMPUTER NETWORK

Network Basically divided into three groups:

- 1) Local Area Network (LAN)**
- 2) Metropolitan Area Network (MAN)**
- 3) Wide Area Network (WAN)**

LAN

A local area network (LAN) within a small area like home, school, office or group of buildings. They can share their resources and device like printer and scanner and data storage. Most of them are centrally organized. And because of the type of the communication the data transfer rate is very high. And local area network does not need any leased communication line

MAN

A metropolitan area network (MAN) spans an entire campus by connecting multiple LAN. MAN is larger than the LAN, because it consists of a number of LAN. MAN works like more of a ISP but it does not owned by a single organization. instead MAN provides a shared network connection to all its users

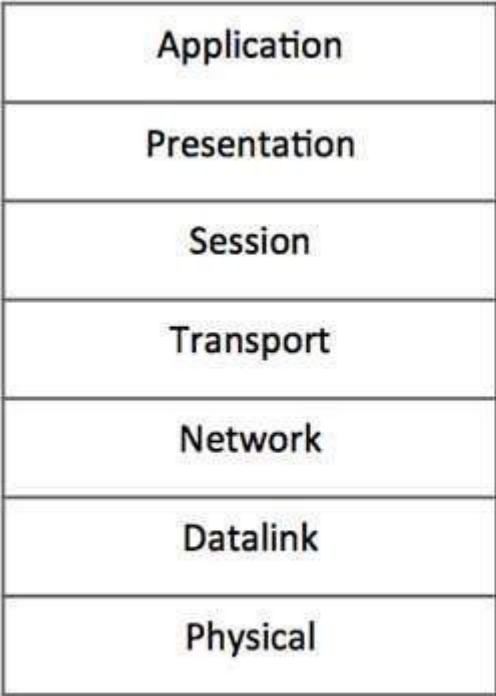
WAN

A wide area network (WAN) within a large scale of geographical area is called WAN. It is created by connecting different LAN from a long distance. And the transmission speed generally is slower than the LAN or MAN but the data transfer rate is increasing .

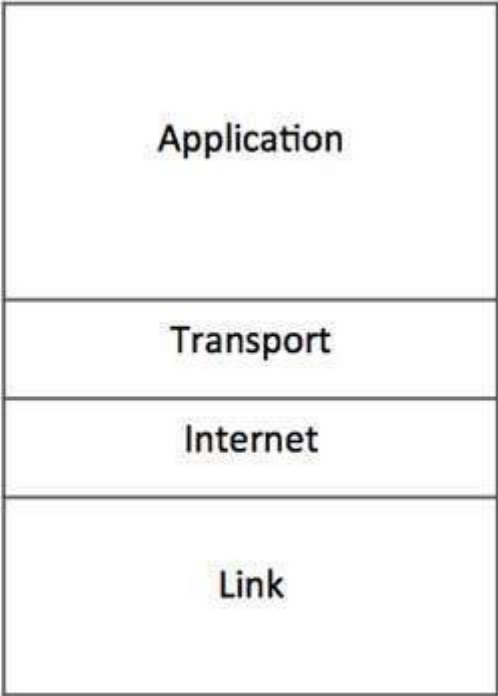
TCP/IP PROTOCOL SUITE

A majority of the internet users use a protocol suite called Internet protocol suite which is also known as the TCP/IP protocol suite. The two protocols are *TCP* (Transmission

control protocol) & IP (internet protocol).In here TCP is a connection oriented protocol means it transmit data in a sequence and it has a acknowledgment process. If the acknowledgment are not recived

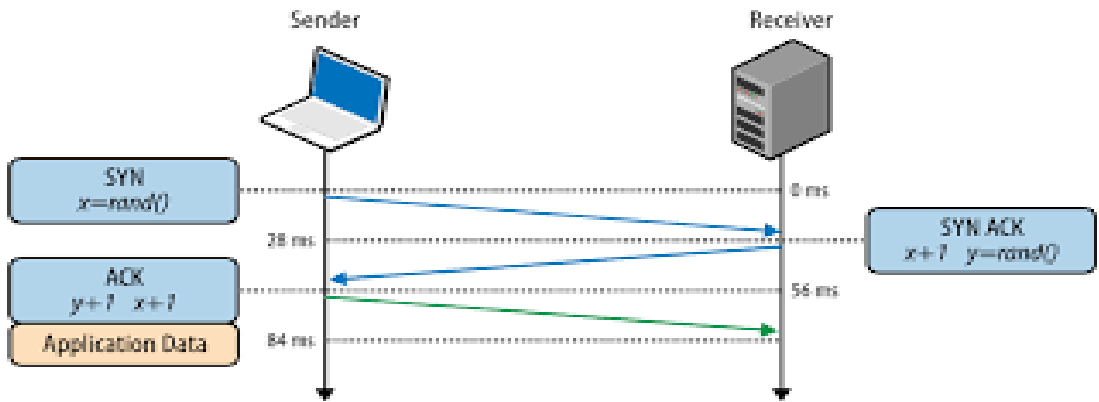


OSI Reference Model



TCP/IP Reference Model

then the data will be re transmitted it can guarantee the delivery of the data to the host and IP is used to maintain the address of the specific host.



IP Addressing

IP addressing is the most important topic in the networking. ip address is basically a numeric identifier that used to identify a Machine .Ip address is a software address not a hardware address that means it can change depending on the network you are connected. The hardware address is the NIC address thats called the Physical address that cant be changed.

Important Clement of a IP address

Bit: Bit is one digit either 0 or 1

Byte: made up with 8 bits its just a ordinary 8 bit binary number.

Network Address : Network address is used send packets to the network .for example 10.0.0.0,192.168.0.0 etc

Broadcast Address : It is used by the host to send information to all the nodes on a network. The address are like
192.168.0.255,172.166.255.255

Every ip address there are two different parts

1) Network part

2) Host Part

Every ip address gives the information about the network and the hosts

Subnet Mask

A subnet mask is a 32 bit umber that masks an ip address and devides the ip address to a network address and hosts address.

Is is done by setting all the network bits to '1' and setting hosts bit to '0'

[Two host ip address are reserved for special purpose The '0'

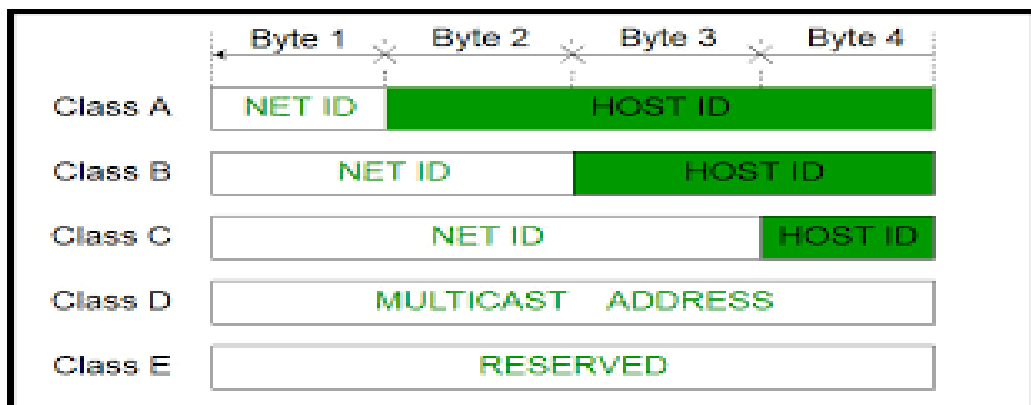
address and the '255' address.the '0' address is reserved for the Network .so if any ip address have a '0' on its last its a network address. and '255' is the broadcast address they cant be assign to a host]

5 types of IP address:

- 1) class A ip address
- 2) class B ip address
- 3) class C ip address
- 4) class D ip address
- 5) class E ip address

Class A ip address:

In class A ip address the first byte is reserved for the network address and three remaining bytes are for the hosts.
[it starts with 0.0.0.0 and ends with 127.255.255.255]
subnet mask: 255.0.0.0



It has a small network with huge number hosts.

Class B ip address:

In class A ip address the first two bytes is reserved for the network address and two remaining bytes are for the hosts.

More network less hosts

[it starts with 128.0.0.0 and ends with 191.255.255.255]

subnet mask : 255.255.0.0

Class C ip address:

class C ip address the first three bytes is reserved for the network address and remaining one bytes are for the hosts. If you need a lot of network and small number of hosts in every networks class C ip address is used.

[it starts with 192.0.0.0 and ends with 223.255.255.255]

subnet mask : 255.255.255.0

Class D ip address:

class D ip address is a special address. Its called a multicast address. It is basically used for finding router [it starts with 224.0.0.0 and ends with 239.255.255.255]

Class E ip address:

Reserved for the Scientific Experiment

Private IP address:

Not all the address of these class is used for public network .some are not routable through the internet.private ip address is used in the Localy and a local ip address can connect to the internet through a public ip address with NAT (Network address translation).NAT allows a public address to the internet

<u>Class</u>	<u>Address Range</u>	<u>Default Subnet Mask</u>
A	10.0.0.0 - 10.255.255.255	255.0.0.0
B	172.16.0.0 - 172.31.255.255	255.255.0.0
C	192.168.0.0 – 192.168.255.255	255.255.255.0

Loopback address

Loopback address is used to test the communication on a local NIC (Network Interface Card) .Data packets are sent by the node in the loopback address are re-routed back into the same node.It is used for testing the connected physical network. it also enables the user to test an application with an instance of server and client on the same machine.we call it ***localhost***

it starts with 127.0.0.0 and ends 127.255.255.255

Ping

ping stands for ***Packet Internet Gopher*** is a ICMP echo request and reply message that used to check the physical and logical connectivity of the machine on a internet network.

Traceroute

Traceroute is used to find the path of the packet traverses through the internet.

SETTING STATIC IP IN CENTOS7

EASY WAY

Every Server needs to have a network connection. without a static ip address you cant run a server .Giving a server a static ip address is the most important thing to do.

When you install a server the most of the time your installer automatically configure your server network and gets the ip address from a DHCP server. But to run a server you need a static ip address. So we need to change its network from DHCP to static and give the server a static ip address .Here we talk about how to give static ip address to a centos7/Redhat7 server.

There are multiple way to give server static address ,Here we talk about easy method

first step

you need to select a static ip address , subnet mask and the gateway that you give your machine .according to your network specifications.

In his example we used a virtual centos7 box . And we give the following ip address subnet mask ,gate way and DNS

IP ADDRESS : 192.168.0.10

SUBNET MASK: 255.255.255.0

GATEWAY:192.168.0.1

DNS: 8.8.8.8

second step

you need to find the network interface that you give the static ip address

A Server can have multiple network interface.

In our virtual machine there are two network interface. We can see the interface from this command

=>*ifconfig*

or

=> *ip address show*

result:

```
[vagrant@tanvir ~]$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
    inet 10.0.2.15  netmask 255.255.255.0  broadcast 10.0.2.255
    inet6 fe80::5054:ff:fe8a:fee6  prefixlen 64  scopeid 0x20<link>
    ether 52:54:00:8a:fe:e6  txqueuelen 1000  (Ethernet)
    RX packets 1110  bytes 135804 (132.6 KiB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 940  bytes 149277 (145.7 KiB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
    inet 192.168.0.5  netmask 255.255.255.0  broadcast 192.168.0.255
    inet6 fe80::a00:27ff:fe8d:5aa3  prefixlen 64  scopeid 0x20<link>
    ether 08:00:27:cd:5a:a3  txqueuelen 1000  (Ethernet)
    RX packets 13  bytes 1362 (1.3 KiB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 16  bytes 1826 (1.7 KiB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
    inet 127.0.0.1  netmask 255.0.0.0
    inet6 ::1  prefixlen 128  scopeid 0x10<host>
    loop txqueuelen 1000  (Local Loopback)
    RX packets 32  bytes 2592 (2.5 KiB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 32  bytes 2592 (2.5 KiB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

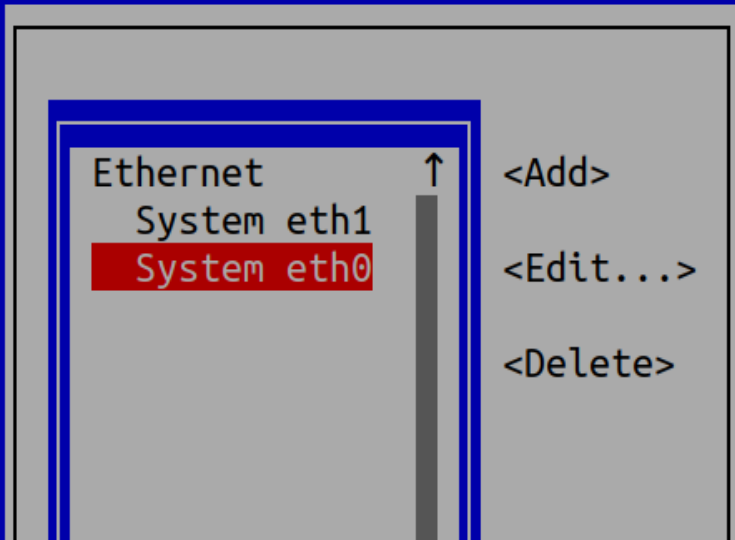
we are currently connected to the server with a ssh connection through eth0. So we can't change the ip address to eth0. This will disconnect the ssh connectivity. We are going to give the static ip address to the eth1 interface

Third step

use the `nmtui` command and you have to be root to give this command

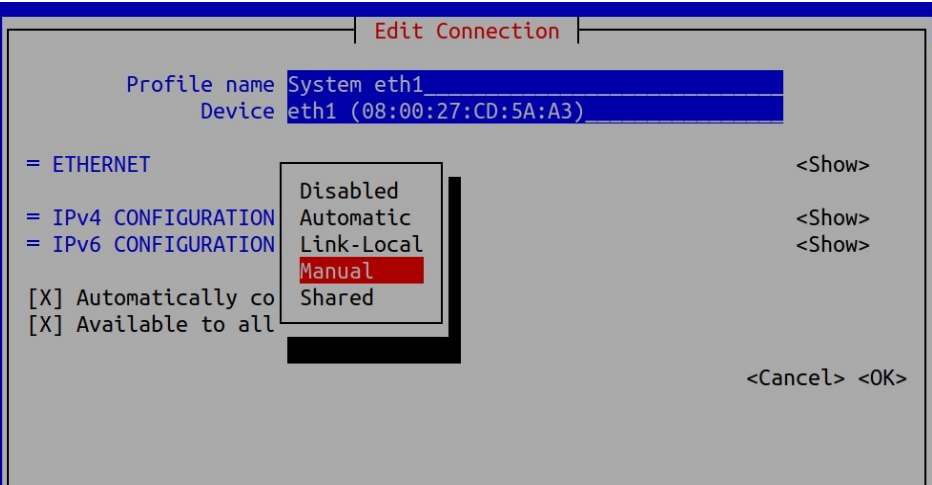
=>`sudo nmtui`

After giving this command this screen appear. From there Select The ***“Edit a connection”***



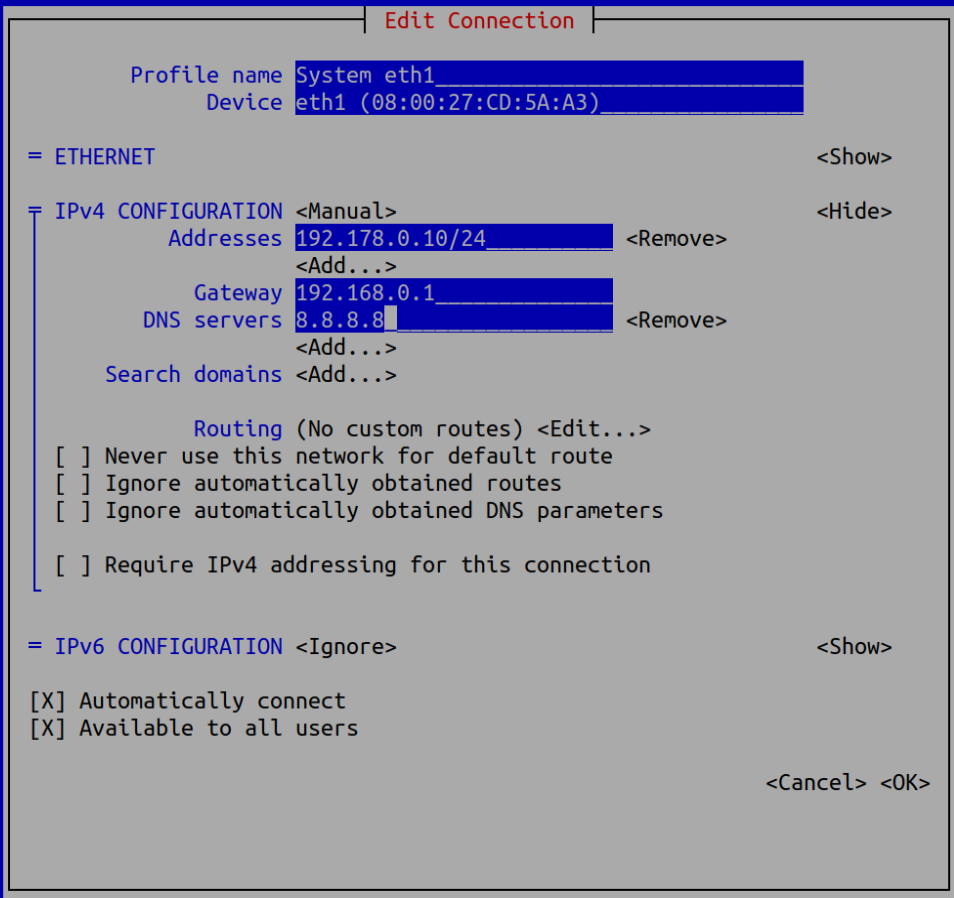
Fourth step

it will show you all the interface .choose your interface in this case we will choose eth1.



Fifth step

we choose the ipv4 and from the option we choose 'manual' and Edit the menu



Sixth step

we give the ip address.we have to give the subnet mask with CIDR notation.

Gateway and the The DNS address and click ok. Then quit the program.

Seventh step

if we see our ip address we can see the the ip address still dont change.to make the change we need to restart the interface.

We shutdown the interface with this command

=>sudo ifdown eth1

Then we start the interface again

=>sudo ifup eth1

```
[vagrant@tanvir ~]$ sudo ifdown eth1
Device 'eth1' successfully disconnected.
[vagrant@tanvir ~]$ sudo ifup eth1
Connection successfully activated (D-Bus active path: /org/freedesktop/NetworkManager/ActiveConnection/3)
[vagrant@tanvir ~]$ █
```

Eighth step

Then if we check ip address using

=>ifconfig eth1

```
[vagrant@tanvir ~]$ ifconfig eth1
eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.178.0.10 netmask 255.255.255.0 broadcast 192.178.0.255
    inet6 fe80::a00:27ff:fe0d:5aa3 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:cd:5a:a3 txqueuelen 1000 (Ethernet)
    RX packets 62 bytes 5854 (5.7 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 24 bytes 2452 (2.3 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

[vagrant@tanvir ~]$ █
```

we can see the ip address changed .

Ninth step

We have to test the connection via pinging a network.

=>**ping 8.8.8.8**

```
[vagrant@tanvir ~]$ ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=63 time=80.2 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=63 time=102 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=63 time=123 ms
^C
--- 8.8.8.8 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2005ms
rtt min/avg/max/mdev = 80.248/101.916/123.156/17.519 ms
[vagrant@tanvir ~]$ █
```

So the connection is up and running. That's the easy way of giving an ip address to a CentOS/Redhat7 server a static address.

TRADITIONAL WAY

first step

you need to select a static ip address , subnet mask and the gateway that you give your machine .according to your network specifications.

we give the following ip address subnet mask ,gate way and Dns

IP ADDRESS : 192.168.0.10

SUBNET MASK: 255.255.255.0

GATEWAY:192.168.0.1

DNS: 8.8.8.8

second step

you need to find the network interface that you give the static ip address

A Server can have multiple network interface.

In our virtual machine there are two network interface. We can see the interface from this command

=>*ifconfig*

or

=> *ip address show*

```
[vagrant@tanvir ~]$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
    inet6 fe80::5054:ff:fe8a:fee6 prefixlen 64 scopeid 0x20<link>
    ether 52:54:00:8a:fe:e6 txqueuelen 1000 (Ethernet)
    RX packets 1110 bytes 135804 (132.6 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 940 bytes 149277 (145.7 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.0.5 netmask 255.255.255.0 broadcast 192.168.0.255
    inet6 fe80::a00:27ff:fe8d:5aa3 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:cd:5a:a3 txqueuelen 1000 (Ethernet)
    RX packets 13 bytes 1362 (1.3 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 16 bytes 1826 (1.7 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 32 bytes 2592 (2.5 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 32 bytes 2592 (2.5 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

we are currently connected to the server with a ssh connection through eth0. So we can't change the ip address to eth0. This will disconnect the ssh connectivity. We are going to give the static ip address to the eth1 interface

Third step

we have to do to the *'/etc/sysconfig/network-scripts'*

□

directory

=> ***cd /etc/sysconfig/network-scripts***

In this directory There are a lot of files .From there we have to select the '***ifcfg-eth1***' [yours can be different .select the file based on your interface it will be like ifcfg-<interface>]

```
[vagrant@tanvir ~]$ cd /etc/sysconfig/network-scripts/
[vagrant@tanvir network-scripts]$ ls
ifcfg-eth0  ifdown-ipp  ifdown-sit  ifup-bnep  ifup-plusb  ifup-TeamPort
ifcfg-eth1  ifdown-ipv6 ifdown-Team  ifup-eth    ifup-post    ifup-tunnel
ifcfg-lo    ifdown-isdn ifdown-TeamPort ifup-ipp  ifup-ppp    ifup-wireless
ifdown      ifdown-post ifdown-tunnel ifup-ipv6  ifup-routes  init.ipv6-global
ifdown-bnep ifdown-ppp  ifup         ifup-isdn  ifup-sit     network-functions
ifdown-eth  ifdown-routes ifup-aliases ifup-plip  ifup-Team    network-functions-ipv6
[vagrant@tanvir network-scripts]$
```

Fourth step

we have to edit the file with a text editor with root privileges.

In that file we have to change the

BOOTPROTO=static

*ONBOOT=yes**IPADDR=192.168.0.10**PREFIX=24**GATEWAY=192.168.0.1**DNS1=8.8.8.8*

```

#VAGRANT-BEGIN
# The contents below are automatically generated by Vagrant. Do not modify.
BOOTPROTO=static
ONBOOT=yes
DEVICE=eth1
NM_CONTROLLED=yes
#VAGRANT-END
TYPE=Ethernet
PROXY_METHOD=none
BROWSER_ONLY=no
IPADDR=192.178.0.10
PREFIX=24
GATEWAY=192.168.0.1
DNS1=8.8.8.8
DEFROUTE=yes
IPV4_FAILURE_FATAL=no
IPV6INIT=no
NAME="System eth1"
UUID=9c92fad9-6ecb-3e6c-eb4d-8a47c6f50c04

```

fifth step

if we see our ip address we can see the the ip address still dont change.to make the change we need to restart the interface.

We shutdown the interface with this command

=>*sudo ifdown eth1*

Then we start the interface again

=>*sudo ifup eth1*

```
[vagrant@tanvir ~]$ sudo ifdown eth1
Device 'eth1' successfully disconnected.
[vagrant@tanvir ~]$ sudo ifup eth1
Connection successfully activated (D-Bus active path: /org/freedesktop/NetworkManager/ActiveConnection/3)
[vagrant@tanvir ~]$
```

Sixth step

Then if we check ip address using

=>*ifconfig eth1*

```
[vagrant@tanvir ~]$ ifconfig eth1
eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.178.0.10 netmask 255.255.255.0 broadcast 192.178.0.255
    inet6 fe80::a00:27ff:fe80:5aa3 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:cd:5a:a3 txqueuelen 1000 (Ethernet)
    RX packets 62 bytes 5854 (5.7 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 24 bytes 2452 (2.3 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

[vagrant@tanvir ~]$
```


we can see the ip address changed .

Seventh step

We have to test the connection via pinging a network.

=>*ping 8.8.8.8*

```
[vagrant@tanvir ~]$ ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=63 time=80.2 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=63 time=102 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=63 time=123 ms
^C
--- 8.8.8.8 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2005ms
rtt min/avg/max/mdev = 80.248/101.916/123.156/17.519 ms
[vagrant@tanvir ~]$ █
```

So the connection is up and running. That's another way of giving an ip address to a CentOS7/Redhat7 server a static address.

* * *

SETTING STATIC IP IN UBUNTU

EASY WAY

Setting the ip address in a debian machine with a easy method
You have to follow these steps

first step

you need to select a static ip address , subnet mask and the gateway that you give your machine . according to your network specifications.

In his example we used a virtual debian box . And we give the following ip address subnet mask , gateway and Dns

IP ADDRESS : 192.168.0.10

SUBNET MASK: 255.255.255.0

GATEWAY:192.168.0.1

DNS: 8.8.8.8

second step

you need to find the network interface that you give the static ip address A Server can have multiple network interface.

In our virtual machine there are two network interface. We can see the interface from this command

=>*ifconfig*

or

=> *ip address show*

result:

```
[vagrant@tanvir ~]$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
    inet6 fe80::5054:ff:fe8a:fee6 prefixlen 64 scopeid 0x20<link>
    ether 52:54:00:8a:fe:e6 txqueuelen 1000 (Ethernet)
    RX packets 1110 bytes 135804 (132.6 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 940 bytes 149277 (145.7 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.0.5 netmask 255.255.255.0 broadcast 192.168.0.255
    inet6 fe80::a00:27ff:fedc:5aa3 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:cd:5a:a3 txqueuelen 1000 (Ethernet)
    RX packets 13 bytes 1362 (1.3 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 16 bytes 1826 (1.7 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 32 bytes 2592 (2.5 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 32 bytes 2592 (2.5 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

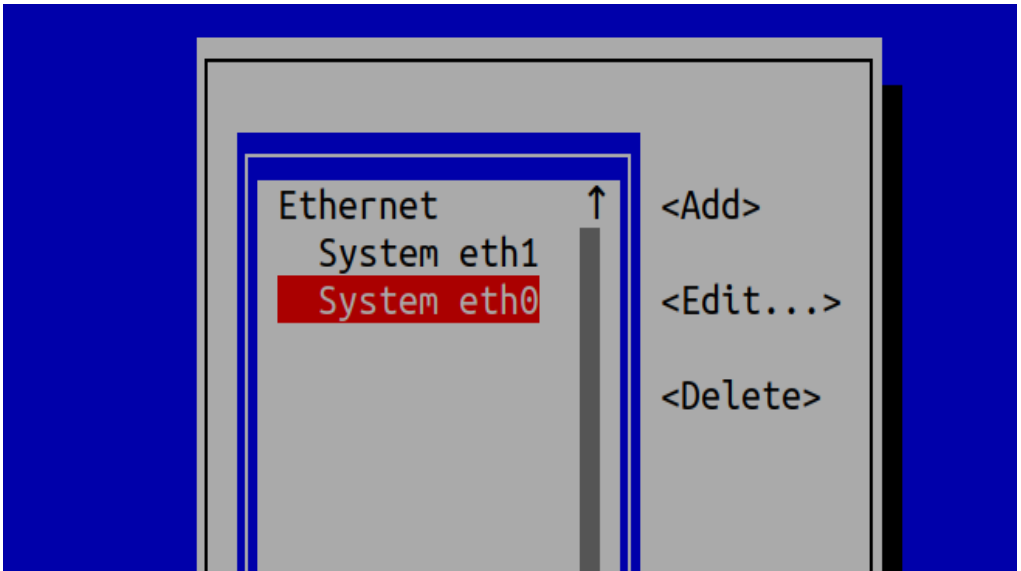
we are currently connected to the server with a ssh connection through eth0. So we can't change the ip address to eth0. This will disconnect the ssh connectivity. We are going to give the static ip address to the eth1 interface

Third step

use the ***nmtui*** command and you have to be root to give this command

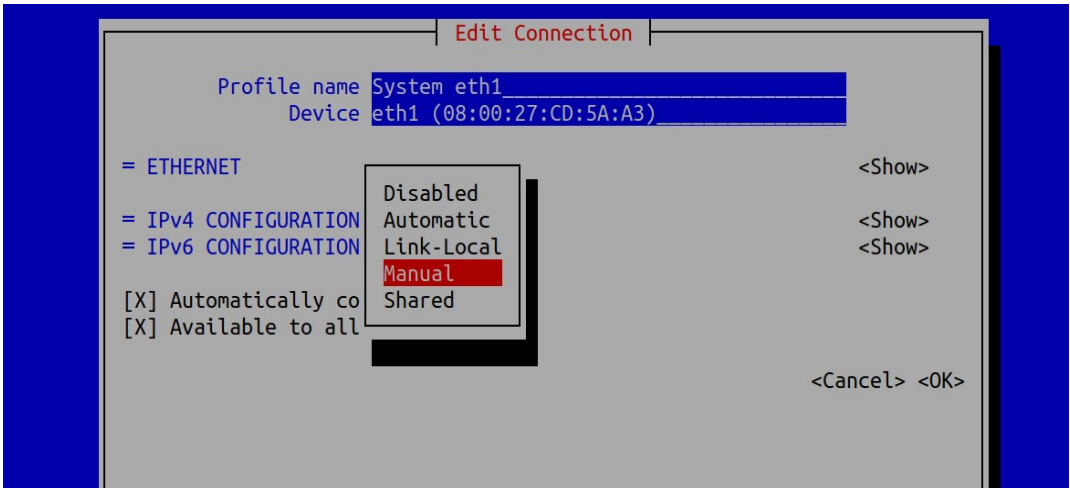
=>***sudo nmtui***

After giving this command this screen appear. From there Select The “Edit a connection”



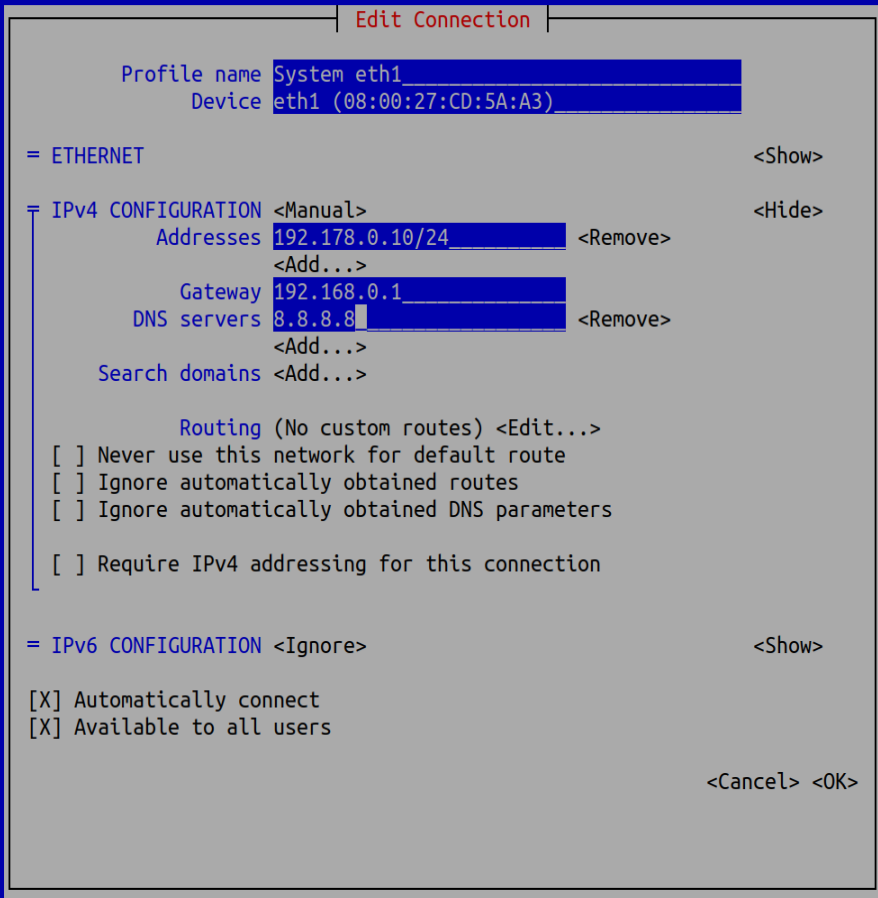
Fourth step

it will show you all the interface .choose your interface in this case we will choose eth1.



Fifth step

we choose the ipv4 and from the option we choose 'manual' and Edit the menu



Sixth step

we give the ip address.we have to give the subnet mask with CIDR notation.

Gateway and the The DNS address and click ok. Then quit the program.

Seventh step

if we see our ip address we can see the the ip address still dont change. to make the change we need to restart the interface.

We shutdown the interface with this command

=>sudo ifdown eth1

or

=>nmcli connection down eth1

Then we start the interface again

=>sudo ifup eth1

or

=>nmcli connection up eth1

```
[vagrant@tanvir ~]$ sudo ifdown eth1
Device 'eth1' successfully disconnected.
[vagrant@tanvir ~]$ sudo ifup eth1
Connection successfully activated (D-Bus active path: /org/freedesktop/NetworkManager/ActiveConnection/3)
[vagrant@tanvir ~]$ █
```

Eighth step

Then if we check ip address using

=>*ifconfig eth1*

```
[vagrant@tanvir ~]$ ifconfig eth1
eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.178.0.10 netmask 255.255.255.0 broadcast 192.178.0.255
    inet6 fe80::a00:27ff:fed:5aa3 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:cd:5a:a3 txqueuelen 1000 (Ethernet)
    RX packets 62 bytes 5854 (5.7 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 24 bytes 2452 (2.3 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

[vagrant@tanvir ~]$
```

we can see the ip address changed .

Ninth step

We have to test the connection via pinging a network.

=>*ping 8.8.8.8*

```
[vagrant@tanvir ~]$ ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=63 time=80.2 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=63 time=102 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=63 time=123 ms
^C
--- 8.8.8.8 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2005ms
rtt min/avg/max/mdev = 80.248/101.916/123.156/17.519 ms
[vagrant@tanvir ~]$ █
```

So the connection is up and running. That's the easy way of giving a static ip address to a Ubuntu/Debian server

NETPLAN

New version of ubuntu linux has a new tools for setting ip address .This is called netplan. now its a little bit hard because you have to maintain indentation and certain rules to give it.and the main challenge is you have to do it by editing a file

First step

The network configuration stored in '*etc/netplan*' directory

Second step

There are different '*yaml*' configuration file for different interface .in my VM there are two different interfaces. so there are two different interfaces. you have to configure the configuration file based on what interface you want to configure

```
vagrant@localhost:/etc/netplan$ ls
01-netcfg.yaml  99-vagrant.yaml
vagrant@localhost:/etc/netplan$
```

Third step [very very important !!!]

you must take backup before you edit the file

```
=>cp 99-vagrant.yaml 99-vagrant.yaml.bak
```

[this is very very important cause if you make mistake in the indentation you have to]

Fourth step

Edit the file

```
=>sudo vim 99-vagrant.yaml
```

the file format will be like this

```
# the datasource.  Changes to it will not persist across
an instance.
# To disable cloud-init's network configuration
capabilities, write a file
# /etc/cloud/cloud.cfg.d/99-disable-network-config.cfg
with the following:
# network: {config: disabled}
```

```
network:
  ethernets:
    eth1:
      addresses: []
      dhcp4: true
  version: 2
```

the ip address we assign will be

IP ADDRESS : 192.168.0.102

SUBNETMASK : 255.255.255.0

GATEWAY : 192.168.0.1

DNS : 8.8.8.8,8.8.8.4

Fifth step

Fill like this

```
# the datasource. Changes to it will not persist across
an instance.
# To disable cloud-init's network configuration
capabilities, write a file
# /etc/cloud/cloud.cfg.d/99-disable-network-config.cfg
with the following:
# network: {config: disabled}
network:
  ethernets:
```

```
eth1:
  addresses: [192.168.0.102/24]
  gateway4: 192.168.0.1
  nameservers:
    addresses: [8.8.8.8,8.8.4.4]
  dhcp4: no
version: 2
```

Sixth step

find error

=>*sudo netplan -debug apply*

Seventh step

apply the changes

=>*sudo netplan apply*

that is the new way of giving static ip address

P A C K A G E M A N A G E M E N T I N L I N U X

As a server administrator you will need to install different software on your server on different occasion .Most of the Linux operating system(Ubuntu Server/Centos server/Open SUSE server) has two different ways of installing software. First are the software packages that contain the programs that are ready to install and that integrate with the server easily. The server keeps the list of installed packages in the database that makes maintaining very easy. The second option to install software in via tarball. Which basically just an archive of the software. Archive can be anything (can be any record of the data) but it can b also used to deliver software. The first method is proffered most of the time Because server can keep track of the software that are installed via packages .Software installed via tarball are not tracked. There is a second difference between packages and tarballs that some software need other packages for working properly (this is called dependency).both tarball and packages have program installed that check if the

dependencies are met but only the software packages interact with the package manager. And in that way it can install the missing dependencies which other installation system cant do. So now a days software packages are preferred. Software packages mostly made in two different formats .On Red Hat and openSUSE and similar distribution rpm packages is used .And debian based operating system like ubuntu server deb package is used.But this packages can be converted. And the other advantage is software can be install by compiling the source code too.

High level and Low level Pckage management Tools

in order to interact with the software packages there are two types of available tools. low level package management also known as local package management system. and the high level tools are known as online package management tools.

Distribution	Low-Level Tools	High Level Tools
Debian based distribution	dpkg	apt/aptitude
Centos/Red Hat	rpm	yum
Open SUSE	rpm	zypper

[do not use red hat rpm file in openSUSE system]

If you already download or create your own .deb package you can manage it with ***dpkg*** command.

UBUNTU PACKAGE MANAGEMENT

Installing package with dpkg

For installing packages with dpkg . command is

=>dpkg -i <package_name>

List of current package:

To list all the current packages that are currently installed in Ubuntu server the command is

=>`dpkg -L`

it will show the name,version,architecture and a small description

Check packages installation status

if you need to know any packages installed or not then following command can show if the package installed or not

=>`dpkg --get-selections <package_name>`

```
root@ubuntu-bionic:~# dpkg --get-selections git
git                                install
root@ubuntu-bionic:~# dpkg --get-selections postgresql
postgresql                        install
root@ubuntu-bionic:~# dpkg --get-selections java
dpkg: no packages found matching java
root@ubuntu-bionic:~#
```

Check Details information about packages:

To check details about a installed packages use this command

=>***sudo dpkg -s <package_name>***

Disadvantage of dpkg:

suppose we want to install a downloaded packages ***webmin.deb***. We will show some dependency problem like this and it install the program without the dependency and the program wont run you have to install dependency manually the other dependencies that's a big complexity .If you remove the program it still create the problem if you try to install other program.

```
root@ubuntu-bionic:~# ls
webmin_1.920_all.deb
root@ubuntu-bionic:~# dpkg -i webmin_1.920_all.deb
Selecting previously unselected package webmin.
(Reading database ... 65008 files and directories currently installed.)
Preparing to unpack webmin_1.920_all.deb ...
Unpacking webmin (1.920) ...
dpkg: dependency problems prevent configuration of webmin:
 webmin depends on libnet-ssleay-perl; however:
  Package libnet-ssleay-perl is not installed.
 webmin depends on libauthen-pam-perl; however:
  Package libauthen-pam-perl is not installed.
 webmin depends on libio-pty-perl; however:
  Package libio-pty-perl is not installed.
 webmin depends on apt-show-versions; however:
  Package apt-show-versions is not installed.
 webmin depends on python; however:
  Package python is not installed.

dpkg: error processing package webmin (--install):
 dependency problems - leaving unconfigured
Processing triggers for ureadahead (0.100.0-21) ...
Processing triggers for systemd (237-3ubuntu10.23) ...
Errors were encountered while processing:
 webmin
root@ubuntu-bionic:~#
```

[To fix this problem we can use the online package management system

=>sudo apt-get install -f

it will search the dependencies and install them

Remove packages:

to remove packages from the system this command is used

=>*dpkg -r <package_name>*

Completely remove package and configuration file:

to completely remove package and the related configuration file this command is used

=>*dpkg -P <package_name>*

If you find a file and want to know which package it belongs to use this command

=>*dpkg -S <file_path>*

```
root@ubuntu-bionic:~# dpkg -S /bin/cp
coreutils: /bin/cp
root@ubuntu-bionic:~# dpkg -S /bin/cat
coreutils: /bin/cat
root@ubuntu-bionic:~# dpkg -S /bin/ping
iputils-ping: /bin/ping
root@ubuntu-bionic:~#
```

Reconfigure packages:

if you face any problem in your package configuration. You can reconfigure the package with this command

=>***dpkg-reconfigure <package_name>***

But to do this you need to know the exact name of the package. It will automatically rewind the installation process and give you chance to reconfigure.

```
root@ubuntu-bionic:~# dpkg-reconfigure webmin
Webmin install complete. You can now login to https://ubuntu-bionic:10000/
as root with your root password, or as any user who can use sudo
to run commands as root.
root@ubuntu-bionic:~#
```

Installing packages with apt

The **apt** utility is a powerful and free package management command line program, that is used to work with Ubuntu's APT (Advanced Packaging Tool) library to perform installation of new software packages, removing existing software packages, upgrading of existing software packages and even

used to upgrading the entire operating system

On ubuntu server or any debian based OS there is a list repository url which is populated during the installation in *'/etc/apt/sources.list'* but you can add repository.

Update repository:

Before installing any package you need to update the software repository.

Command

=>***sudo apt update***

[you need to be root to perform the action]

Upgrade existing Software:

To upgrade every package in the latest version use this command

=>***sudo apt upgrade***

Update OS distribution

to upgrade the distribution for example upgrading ubuntu 16.0 to ubuntu latest version this command is used

=>***sudo apt dist-upgrade***

Install Packages

for installing packages this command is used

=>***sudo apt install <package_name>***

for example

to install vim editor we use this command

=>***sudo apt install vim***

Remove Packages

for removing packages this command is used

=>***sudo apt remove <package_name>***

for example

to remove vim editor we use this command

=>***sudo apt remove vim***

[this command will remove the packages but not the dependencies .To remove this command is used

=>***sudo apt autoremove***

apt-cache command

The apt-cache command line tool is used for searching apt software package cache. In simple words, this tool is used to search software packages, collects information of packages and also used to search for what available packages are ready for installation on Ubuntu based systems.

Apt-cache search command

=>***sudo apt-cache search <package_name>***

This command show all the program will show all the program that depends on the packages. suppose you install gmail packages this command

=>***sudo apt-cache search gmail***

will show all the packages that are depends on this packages like 'thunderbird'

Package Details

You can also see the details of any packages with apt just like the ***dpkg -s*** command

=>***sudo apt-cache show vim***

Find Unmet Dependencies:

This command will find all the unmet dependencies of the system

=>***sudo apt-cache unmet***

Find Specific Dependency of Packages:

=>***sudo apt-cache depends <package_name>***

This command will give all the dependencies of the Packages.

Find Reverse Dependencies:

=>sudo apt-cache rdepends <package_name>

This command will find the reverse dependencies of the program. That means it will show all the packages that depends on that packages.

For example:

=>sudo apt-cache rdepends git

this command will show all the other program that depends on the git program.

Aptitude package management tool:

There is a new package management tools called aptitude. to use that first you have to install it with this command

=>sudo apt install aptitude

Install package via aptitude:

installing command with aptitude is

=>***sudo aptitude install <package_name>***

example:

=>***sudo aptitude install emacs***

Search package via aptitude

For searching any packages this command is used

=>***sudo aptitude search <package_name>***

The main advantage of the aptitude is when you run the aptitude program without any flag

=>***aptitude***

this will open a menu based installer inside the terminal. That means you will get almost a gui based installer inside a terminal.

Graphical Package management System:

If you want to use a graphical Package management system you can use synaptic package management software. its very easy to install,remove,and upgrade packages with synaptic package management.

Apt Repository:

when we install or search a package with apt command it will search some online repository for that packages. The list of that url is stored in a file

'/etc/apt/sources.list' and the file contained in *'/etc/apt/sources.list.d'*

if we see the *'sources.list'* file with this command

=>cat /etc/apt/sources.list

we will see something like this

the information available from the configured sources is acquired by ‘apt update’ or equivalent command from another apt frontend.

Users can manually add repository url in that file. after adding repository you have to issue ‘apt update’ command to make it available for using.

Or you can just create a file in ***/etc/apt/sources.list.d*** directory. The file must be end with .list extension. The apt package manager also read repository configuration from there

for example:

first open a file with vim editor inside the ***sources.list.d*** repo

=>***vim /etc/apt/sources.list.d/games.list***

add the repository path in that file

deb http://archive.getdeb.net/ubuntu wily-getdeb games

Or user can add repository by interactive command.

Use the add-apt-repository (or symlink apt-add-repository) command to add repository. You just need to provide reference address as the following command.

=>***add-apt-repository 'deb http://archive.getdeb.net/ubuntu wily-***

getdeb games'

to remove any repository from by using this following command

=>add-apt-repository -r 'deb http://archive.getdeb.net/ubuntu wily-getdeb games'

[every time you make a change to repository you must apply 'apt update' command to make the change on effect]

C E N T O S P A C K A G E M A N A G E M E N T

Rpm (Red Hat Package Manager)and Yum(Yellowdog Updater Modified) package management tools are basically Centos/Redhat,fedora like Operating system.

Like dpkg in debian based OS. Rpm is the local package management tool(low level package management tool).and Yum is the online package management tool(high level package management tool).Yum is like apt in ubuntu OS.

[just like the dpkg the rpm command may face dependency problem while installing software .and yum search the dependency automatically and install them.]

rpm package management

Install package:

For install package with rpm this command is used

=>**rpm -i <package_name>**

remove package

For remove this package with rpm this command is used

=>***rpm -e <package_name>***

[if one package depends on the other package you cant remove it with rpm command unless you remove the other packages that depends on it. For example if you want to remove the ‘openssh’ package because the ‘open-ssh client’ packages depends on it .First you have to remove this. But if you use the yum command to remove the any packages this will happen automatically.]

Force Install package:

if you want to install a packages with or without the dependency (force install) you can do it with this command

=>*rpm -i -nodeps <package_man>*

[its not recommended because it leaves you a broken dependency problem]

Verbosity:

if we want to see whats happening when installing or removing we can use the verbosity flag.

Install package with verbosity flag

=>*rpm -i -v <package_name>*

Remove package with verbosity flag

=>*rpm -e -v <package_name>*

Check Package install Status:

if you want to check is a package is installed or not .you can do with this command

=>*rpm -Vv <package_name>*

for example

```
=>rpm -Vv nano-2.3.1-10.el7.x86_64.rpm
```

[if you want to find out that your package is intact you can find it by checking the output flag. Because if you change any configuration and run the command again it will show you different result. That proves that file is changed]

Check Package Checksum:

To check the file checksum this command is used

```
=>rpm -vK <package_name>
```

Find Package Description:

To find the description of any installed package this command is used

```
=>rpm -qi <installed_package>
```

for example

=>***rpm -qi nano***

Query All Packages:

To query all the packages this command is used

=>***rpm -q -a***

you can find any installed packages with this command

=>***rpm -q -a | grep <packages_name>***

example

=>***rpm -q -a | grep dhcp***

Yum package management:

yum(Yellowdog Updater Modified) is more advance package management tools you can do everything with yum that can be done with rpm.yum uses a lot of third party repository to install packages automatically by resolving their dependency issue

Find Package information:

To find detail information about any packages this command is

used .it will search the repository and give detail information about the packages.

=>***yum info <package_name>***

Search package:

To search the packages in the repository this command is used

=>***yum search <package_name>***

Install package:

To install packages this command is used.it will install the packages with the dependency

=>***yum install <package_name>***

This command will ask for confirmation. to install automatically. Just add a `-y` option .

=>***yum install -y <package_name>***

Remove package:

To remove package with all its dependencies this command is used.

```
=>yum remove <package_name>
```

This command will ask for confirmation. to install automatically. Just add a `-y` option .

```
=>yum remove -y <package_name>
```

or

```
=>yum erase -y <package_name>
```

Update package:

If you have any outdated version of any packages and you need to update it. you can use the update command to update to its latest stable version. If it needs any additional dependency it will automatically resolve them

```
=>yum update <package_name>
```


List packages:

To list all the available packages in the Yum repository this command is used

=>***yum list / more***

To list all the installed packages this command is used

=>***yum list installed***

you can use the list function as a searching purpose .for searching packages this command is used

=>***yum list <package_name>***

Yum provides function:

if you find any program or any files and want to find out which packages it belongs to. You can find it with this command

=>***yum provides <file_name/program_names>***

Check update packages:

If you want to check whether any update is available for your installed packages you can check using this command

=>***yum check-update***

Update system:

If you want to update all your packages and system and install all the latest patches and security updates in your system this command is used

=>***yum update***

[one of the main advantages of the yum over the apt command is before installing any packages yum will automatically update the repository]

List all the group packages:

Number of packages are bundled up to make a particular group.

Instead of installing individual packages you can install the whole particular group. To list all the group this command is used

=>***yum grouplist***

Install group packages:

To install a particular package group we use the `groupinstall`.

=>***yum groupinstall '<group package name>'***

for example

=>***yum groupinstall 'Basic Web Server'***

Update group packages:

To update a particular package group we use the `groupupdate`.

=>***yum groupupdate '<group package name>'***

for example

=>***yum groupupdate 'Basic Web Server'***

Remove group packages:

To remove a particular package group we use the groupremove.

=>*yum groupremove <group package name>*

for example

=>*yum groupremove 'Basic Web Server'*

List Enabled yum repository:

To list all the enabled yum repository this command is used

=>*yum repolist*

List All yum repository

To list all the enabled and disabled yum repository this command is used

=>*yum repolist all*

List packages from a particular repository:

To install a packages from a particular repository this command is used

=>***yum -enablerepo=epel install java***

[This command wont enable the repository parmanently.its only for the current command]

Permanently Enable/Disable a particular repository:

To enable a repository permanently this command is used

=>***yum-config-manager -enable <repo_name>***

[This command will enable the repository permanently]

To disable a repository permanently this command is used

=>***yum-config-manager -disable <repo_name>***

[This command will disabled the repository permanently]

Clean yum Cache

To clean all the cached files from enabled repository this following command is used.

=>***yum clean all***

View History

To view all the past transactions of the yum command this following command is used

=>***yum history***

Yumdownlaoder

there is another tools called ‘yumdownloader’ in the redhat/centos based system. The job of this tools is to

download the rpm file. Means it just download the rpm file but doesn't install it. The following command is used to download rpm file

=>**yumdownloader <package_name>**

for example

=>**yumdownloader git**

it will install the **git.rpm** file but it wont download the dependency. To download any package with the dependencies this command is used

=>**yumdownloader --resolve <package_name>**

for example

=>**yumdownloader --resolve git**

Yum Repository

just like the '**sources.list**' file in the ubuntu package management there is also a place where the repository files stored.its in the '**/etc/yum.repos.d**'

we can list all the files with the 'ls -s' command.you will see something like this

there can be more than one .repo file if you look inside the file with this command

=>***cat repofile.repo***

example

=>***cat CentOS-Base.repo***

if you look inside the file it will like the '***sources.list***'. Just a little bit different

There are different different mirror list for '***base***', '***updates***', '***extras***' and additional '***packages***' and every section has a

1) name for the mirror list

2) baseurl for that mirror

3) gpgcheck option

4) enable option

5) gpgkey

if you want you can disable the gpgcheck cause the the repository may not be encrypted.

there is a configuration file in /etc/yum.conf .By changing the configuration you can customize the operation of the yum tools.

- =>**keepcache=0** will not keep the cache file
- =>**logfile='/var/log/yum/log'** will store the log file in that file
- =>**obsolete=1** delete the obsolete packages
- =>**gpgcheck=1** will check gpg every time it install packages
- =>**plugins=1** will allow yum to install plugins

[yum uses different plugins. one of them is fastest mirror.it finds the fastest mirror so the user find the packages as fast as possible]

COMPARISON BETWEEN TWO PACKAGE MANAGEMENT SYSTEM

Operation	Debian package management	Centos package Management
Show package information	<code>sudo apt show <pkg></code> <code>sudo dpkg -s <pkg></code>	<code>sudo yum info <pkg></code> <code>sudo rpm -qi <pkg></code>
List all the packages	<code>Sudo apt list</code> <code>sudo dpkg -L</code>	<code>Sudo yum list</code> <code>sudo rpm -q -a</code>
Download Packages	<code>sudo apt download <pkg></code>	<code>Yumdownloader <pkg></code> <code>Yumdownloader - resolve <pkg></code>
Search packages	<code>sudo apt search <pkg></code>	<code>Sudo Yum search <pkg></code>

Install packages	<i>sudo aptitude</i>	
	<i>search <pkg></i>	
	<i>Sudo apt install</i>	<i>Sudo yum install</i>
	<i><pkg></i>	<i><pkg></i>
Remove Packages	<i>sudo aptitude</i>	<i>sudo rpm -i <pkg></i>
	<i>install <pkg></i>	
	<i>sudo dpkg -i <pkg></i>	
	<i>Sudo apt remove</i>	<i>Sudo yum remove</i>
Check integrity	<i><pkg></i>	<i><pkg></i>
	<i>sudo dpkg -r <pkg></i>	<i>sudo yum erase</i>
	<i>sudo aptitude</i>	
	<i>remove <pkg></i>	<i>sudo rpm -e <pkg></i>
Update packages/system	<i>Sudo dpkg -V <pkg></i>	
	<i>Sudo apt update</i>	<i>Sudo rpm -V <pkg></i>
		<i>Sudo yum update</i>
	<i>Sudo apt upgrade</i>	<i>Sudo yum upgrade</i>
Upgrade System		

Y U M S E R V E R

A P T S E R V E R

5

could be a subtitle

ENAS PORTITOR ANTE. Pellentesque tincidunt
metus vel congue hendrerit. Aenean vehicula, odio nec dapibus
auctor, mi nibh rutrum felis, nec molestie ipsum nisi nec purus.
Ut felis mauris, volutpat at vulputate et, sodales sed arcu. Nunc
ac velit condimentum, imperdiet turpis id, accumsan dolor. Ut
ornare velit in tempus ullamcorper. Vivamus mauris velit,
congue eget ultrices eu, pharetra id nisi. Curabitur eget lacus
quis justo ultricies consequat id ultricies lacus. Donec et tempor
augue, at consequat ipsum. Donec sapien urna, feugiat id
interdum vitae, pretium vel nisi. Nullam suscipit consectetur
pulvinar. Aliquam ac libero nisl. Ut pretium nisi cursus
scelerisque dictum. Sed vitae bibendum tortor.

Cras a dui at quam fringilla conse- quat. Vestibulum ante
ipsum primis in faucibus orci luctus et ultrices posuere cubilia
Curae; Duis at ornare libero. Nunc rutrum volutpat tortor, a
faucibus augue congue non. Integer ultricies et magna nec
iaculis. Sed tincidunt quis felis vel euismod. Nam pretium elit
elementum est ullamcorper dic- tum. Praesent dapibus dolor
ut lorem hendrerit volutpat. Curabitur vulputate placerat
turpis at luctus. Suspendisse vel aliquam nulla. Nam tristique
sed ipsum eget cursus. Aliquam in adipiscing magna. In quis elit
nisi. Donec eu lorem ut nisl adipiscing suscipit eget eu libero.

*The rest of this **TEMPLATE** is just dummy text that you can
replace or delete.*

Maecenas scelerisque felis sed diam pretium, ac adipiscing neque elementum. Quisque mi sapien, tristique et tristique a, euismod vitae lectus. Aenean sed cursus neque. Etiam molestie luctus egestas. Sed molestie iaculis consequat. Quisque euismod erat est, sed vehicula mi convallis viverra. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Cras et odio iaculis, eleifend justo at, pretium elit. Phasellus tincidunt sit amet nibh quis gravida. Quisque auctor aliquet justo et volutpat. Aenean a felis in tortor ultricies feugiat non et eros. Phasellus sapien justo, congue sit amet diam ut, euismod ornare arcu. Proin mollis justo ut nulla lacinia, at pellentesque sem fringilla. Donec vel feugiat odio, vel viverra sapien. Curabitur sed lacus enim.

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