

RECORD

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Computer Hardware and Software

Every computer is composed of two basic components: Hardware and Software

- **Hardware** includes the Physical features, which are every part that you can either see or touch.
Eg: Monitor, case, keyboard, mouse and printer
- The part which activates the physical components called **Software**. It includes the features that responsible for directing the work to the hardware. Software can be divided into the programs and data.

Application Software

An application software is a computer program designed to perform a group of coordinated functions, task, or activities. Example of an application include a word processor, a spreadsheet, an accounting application, a web browser, a media player or a console game. Applications may be connected with the computer and its system software or may be published separately, and may be coded as proprietary or open-source.

Operating System

Operating system is defined as a system software that manages computer hardware and software resources and provides common services for computer programs. All application software computer programs required an operating system to function. Operating system controls computer's hardware, run the computer's programs and organizes files.

CPU

Central processing unit. Unit that bring the instruction from memory to be executed and decodes.

Storing Device

Any hardware that can hold information, temporarily or permanently. We distinguish two types of storage: a primary storage device (RAM), and a

secondary storage device (hard drive). Secondary storage can be removable, internal, or external storage.

Examples of permanent computer storage:

1. Magnetic storage device: hard drive, floppy diskette etc
2. Optical: Blu-ray disc, CD-ROM disc etc
3. Flash memory devices: memory card, memory stick, SSD

RAM

It stands for random access memory, it keeps the data and general purpose program that the computer is executing at the moment. RAM is not permanent, its contain can be changed and it is erased when the computer is off.

Motherboard

It is the physical arrangement in a computer that contains the computer's basic circuitry and components. It has a socket for the CPU, RAM and expansion part and also connects together the CPU, memory, hard drives, video card and more.

Bits and Bytes

Bit is the smallest storage unit in the computer. A bit can store just 0 or 1, which is called binary, and therefore can be stored by physical devices that has two separate states. For example 2 positions, or states of an electrical switch, the two states being 'on' and 'off'. A bit can also be described as true/ false, no/ yes etc. Notice that a bit has only two coding options, or 2 values. One bit is too small to be used, and thus computers use a larger storage unit called bytes.

Bytes- are made of bits. 8 bits are used to create 1 byte. Notice that a Byte has 2^8 coding options, 256 values. RAM, hard drives and flash drives, are all types of storages measured by Bytes.

Data

Data is any set of characters that has been gathered and translated for some purpose, usually analysis. It can be any character, including text and numbers, pictures, sound or video. If data is not put into context, it doesn't do anything to

a human or computer. Within a computer's storage, data is a collection of numbers represented as bytes that are in turn composed of bits.

Operating System

Operating system contain and manage all the programs and applications that a computer or mobile device is able to run, which means managing the device's software and hardware functions. The functions of an OS include:

- Booting: Booting is the process of turning on the computer and powering up the system.
- Memory management: This feature controls and coordinates the computer applications while allocating space for programs.
- Loading and execution: Your OS will load, or start up, a program and then execute the program so that it opens and runs.
- Data security: A good OS includes features that keep your data safe and computer programs secure. Security features are set up to keep unwanted cyberattacker at bay.
- Disk management: This manages all the drives installed in a computer, including hard drives, optical disk drives, and flash drives. Disk management can also be used to divide disks, format drives, and more.
- Process management: Your OS is designed to allocate resources to different computer processes, enable the processes to share information, protect them, and synchronize them.
- Device controlling: Your OS will allow you to open or block access to devices like removable devices, CD/DVDs, data transfer devices, USBs, and more.
- Printing controlling: As an extension of device controlling, your OS takes control of printers that are connected to the computer, and the materials that need to be printed.
- User interface: Also referred to as a UI, this is the part of the OS that allows a user to enter and receive information. This can be done with typed commands, code, and other formats.

The Five Most Popular Operating Systems

There are five main types of operating systems. These five OS types are likely what run your phone, computer, or other mobile devices like a tablet. Whether you're just a normal computer and phone user or someone hoping to get involved in an IT career, knowledge of applications, and much more.

Microsoft Windows

The windows OS has been around since the 1980s and has had several versions and updates. Microsoft Windows is one of the popular operating system types and is preloaded on most new PC hardware. With each new Windows update or release, Microsoft continues to work on improving their users' experience, hardware, and software, making Windows more accessible and easier to use.

Microsoft Windows contains a control panel, a desktop and desktop assistant, disk clean-up, event viewer, and more. Many users prefer Microsoft Windows because they say it's compatible with many other kinds of software. Many kinds of computer programs run best on Microsoft Windows because they're developed by Microsoft.

Apple macOS

Head-to-head in the competition with Microsoft Windows is Apple's macOS. macOS and Windows are both examples of proprietary operating system, meaning that the company conceptualized, designed, developed, and now sells their own OS. They're designed and sold by the companies and aren't meant to be tampered with or tweaked by users. Apple and Macintosh computers run on the proprietary macOS and OS X system, the first of which launched 20 years ago.

Googles Android OS

The OS that companies including Google use to run its Android mobile smartphones and tablets is based on Linux distribution and other open-source software. Android OS is the primary OS for Google mobile device like smartphones and tablets. Android has gained increasing popularity since its

release as an alternative to Apple's iOS for smartphone users and is continuing to increase in popularity with new updates and exciting features.

Apple iOS

Apple's iOS another mobile operating system used exclusively for iPhones, some of the most popular mobile devices on the market. iOS integrations have regular updates, new expansions to software, and continually are offering new features for users even if they have older devices.

Many users appreciate the unique user interface with touch gestures, and the ease of use that iOS offers. This operating system also allows other Apple devices to connect, giving users easy connections to other devices or people.

Linux Operating System

- Linux is different from Windows and Apple in that it's not a proprietary software, but rather a family of open-source systems. In other words, anyone can modify and distribute it. Linux may be the least known on his list, but it's free and available in many different open-source versions. Linux is popular because of its ease of customization and offers a variety of options to those who understand how to use it. If you know how to customize and work with operating system, Linux is an ideal choice. And if this kind of coding and back-end work is interesting to you, it may be a good idea to purchase a Linux system and get started on manipulating it.

Types of Operating System

- Batch Operating System
- Multitasking / Time sharing OS
- Multiprocessing OS
- Real time OS
- Distributed OS

- Network OS
- Mobile OS

1. Batch Operating System

In a Batch Operating System, the similar jobs are grouped together into batches with the help of some operator and these batches are executed one by one. For example, let us assume that we have 10 programs that need to be executed. Some programs are written in C++, some in C and rest in Java. Now, every time when we run these programmes individually then we will have to load the compiler of that particular language and then execute the code. But what if we make a batch of these 10 programmes. The benefit with this approach is that, for the C++ batch, you need to load the compiler only once. Similarly, for Java and C, the compiler needs to be loaded only once and the whole batch gets executed. The following image describes the working of a Batch Operating System.

Advantages:

- The overall time taken by the system to execute all the programmes will be reduced.
- The Batch Operating System can be shared between multiple users.

Disadvantages:

- Manual interventions are required between two batches.
- The CPU utilization is low because the time taken in loading and unloading of batches is very high as compared to execution time.

2. Time-Sharing Operating System

In a Multi-tasking Operating System, more than one processes are being executed at a particular time with the help of the time-sharing concept. So, in the time-sharing environment, we decide a time that is called time quantum and when the process starts its execution then the execution continues for only that amount of time and after that, other processes will be given chance for that amount of time only. In the next cycle, the first process will again come for its execution and it will be executed for that time quantum only and again next

process will come. This process will continue. The following image describes the working of a Time-Sharing Operating System.

Advantages:

- Since equal time quantum is given to each process, so each process gets equal opportunity to execute.
- The CPU will be busy in most of the cases and this is good to have case.

Disadvantages:

- Process having higher priority will not get the chance to be executed first because the equal opportunity is given to each process.

3. Distributed Operating System

In a Distributed Operating System, we have various systems and all these systems have their own CPU, main memory, secondary memory, and resources. These systems are connected to each other using a shared communication network. Here, each system can perform its task individually. The best part about these Distributed Operating System is remote access i.e. one user can access the data of the other system and can work accordingly. So, remote access is possible in these distributed Operating Systems. The following image shows the working of a Distributed Operating System.

Advantages:

- Since the systems are connected with each other so, the failure of one system can't stop the execution of processes because other systems can do the execution.
- Resources are shared between each other.
- The load on the host computer gets distributed and this, in turn, increases the efficiency.

Disadvantages:

- Since the data is shared among all the computers, so to make the data secure and accessible to few computers, you need to put some extra efforts.

- If there is a problem in the communication network then the whole communication will be broken.

4. Embedded Operating System

An Embedded Operating System is designed to perform a specific task for a particular device which is not a computer. For example, the software used in elevators is dedicated to the working of elevators only and nothing else. So, this can be an example of Embedded Operating System. The Embedded Operating System allows the access of device hardware to the software that is running on the top of the Operating System.

Advantages:

- Since it is dedicated to a particular job, so it is fast.
- Low cost.
- These consume less memory and other resources.

Disadvantages:

- Only one job can be performed.
- It is difficult to upgrade or is nearly scalable.

5. Real-time Operating System

The Real-time Operating Systems are used in the situation where we are dealing with some real-time data. So, as soon as the data comes, the execution of the process should be done and there should be no delay i.e. no buffer delays should be there. Real-time OS is a time-sharing system that is based on the concept of clock interrupt. So, whenever you want to process a large number of request in a very short period of time, then you should use Real-time Operating System. For example, the details of the temperature of the petroleum industry are very crucial and this should be done in real-time and in a very short period of time. A small delay can result in a life-death situation. So, this is done with the help

of Real-time Operating System. There are two types of Real-time Operating System:

- 1) Hard Real-time:** In this type, a small delay can lead to drastic change. So, when the time constraint is very important then we use the Hard Realtime.
- 2) Soft Real-time:** Here, the time constraint is not that important but here also we are dealing with some real-time data.

Advantages:

- There is maximum utilization of devices and resources.
- These systems are almost error-free.

Disadvantages:

- The algorithms used in Real-time Operating System is very complex.
- Specific device drivers are used for responding to the interrupts as soon as possible.

COMPONENTS OF A MOTHERBOARD

1. Mouse & keyboard
2. USB
3. Parallel port
4. CPU Chip
5. RAM slots
6. Floppy controller
7. IDE controller
8. PCI slot
9. ISA slot
10. CMOS Battery
11. AGP slot
12. CPU slot
13. Power supply plug in

1. Mouse & keyboard

Keyboard Connectors are two types basically. All PCs have a Key board port connected directly to the motherboard. The oldest, but still quite common type, is a special DIN, and most PCs until recently retained this style connector. The AT-style keyboard connector is quickly disappearing, being replaced by the smaller mini DIN PS/2style keyboard connector.

You can use an AT-style keyboard with a PS/2-style socket (or the other way around) by using a converter. Although the AT connector is unique in PCs, the PS/2-style mini-DIN is also used in more modern PCs for the mouse. Fortunately , most PCs that use the mini-DIN for both the keyboard and mouse clearly mark each mini-DIN socket as to its correct use. Some keyboards have

a USB connection, but these are fairly rare compared to the PS/2 connection keyboards.

2. USB (Universal serial bus)

USB is the General-purpose connection for PC. You can find USB versions of many different devices, such as mice, keyboards, scanners, cameras, and even printers. a USB connector's distinctive rectangular shape makes it easily recognizable.

USB has a number of features that makes it particularly popular on PCs. First, USB devices are hot swappable. You can insert or remove them without restarting your system.

3. Parallel port

Most printers use a special connector called a parallel port. Parallel port carry data on more than one wire, as opposed to the serial port, which uses only one wire. Parallel ports use a 25-pin female DB connector. Parallel ports are directly supported by the motherboard through a direct connection or through a dangle.

4. CPU Chip

The central processing unit, also called the microprocessor performs all the calculations that take place inside a pc. CPUs come in Variety of shapes and sizes.

Modern CPUs generate a lot of heat and thus require a cooling fan or heat sink. The cooling device (such as a cooling fan) is removable, although some CPU manufactures sell the CPU with a fan permanently attached.

5. RAM slots

Random-Access Memory (RAM) stores programs and data currently being used by the CPU. RAM is measured in units called bytes. RAM has been packaged in many different ways. The most current package is called a 168-pin DIMM (Dual Inline Memory module).

6. Floppy controller

The floppy drive connects to the computer via a 34-pin ribbon cable, which in turn connects to the motherboard. A floppy controller is one that is used to control the floppy drive.

7. IDE controller

Industry standards define two common types of hard drives: EIDE and SCSI. Majority of the PCs use EIDE drives. SCSI drives show up in high end PCs such as network servers or graphical workstations. The EIDE drive connects to the hard drive via a 2-inch-wide, 40-pin ribbon cable, which in turn connects to the motherboard. IDE controller is responsible for controlling the hard drive.

8. PCI slot

Intel introduced the Peripheral component interconnect bus protocol. The PCI bus is used to connect I/O devices (such as NIC or RAID controllers) to the main logic of the computer. PCI bus has replaced the ISA bus.

9. ISA slot (Industry Standard Architecture)

It is the standard architecture of the Expansion bus. Motherboard may contain some slots to connect ISA compatible cards.

10. CMOS Battery

To provide CMOS with the power when the computer is turned off all motherboards comes with a battery. These batteries mount on the motherboard in one of three ways: the obsolete external battery, the most common onboard battery, and built-in battery.

11. AGP slot

If you have a modern motherboard, you will almost certainly notice a single connector that looks like a PCI slot, but is slightly shorter and usually brown. You also probably have a video card inserted into this slot. This is an Advanced Graphics Port (AGP) slot.

12. CPU slot

To install the CPU, just slide it straight down into the slot. Special notches in the slot make it impossible to install them incorrectly. So remember if it does not go easily, it is probably not correct. Be sure to plug in the CPU fan's power.

13. Power supply plug in

The Power supply, as its name implies, provides the necessary electrical power to make the pc operate. the power supply takes standard 110-V AC power and converts into 12-Volt, 5-Volt, and 3.3Volt DC power.

RAM Modules

In computing, a memory module or RAM (random-access memory) stick is a printed circuit board on which memory integrated circuits are mounted. Memory modules permit easy installation and replacement in electronic systems, especially computers such as personal computers, workstations, and servers.

Nearly every computing-capable device needs RAM. Take a look at your favourite device (e.g., smartphones, tablets, desktops, laptops, graphing calculators, HDTVs, handheld gaming systems, etc.), and you should find some information about the RAM. Although all RAM basically serves the same purpose, there are a few different types commonly in use today:

- Static RAM (SRAM)
- Dynamic RAM (DRAM)
- Synchronous Dynamic RAM (SDRAM)
- Single Data Rate Synchronous Dynamic RAM (SDR SDRAM)
- Double Data Rate Synchronous Dynamic RAM (DDR SDRAM, DDR2, DDR3, DDR4)
- Graphics Double Data Rate Synchronous Dynamic RAM (GDDR SDRAM, GDDR2, GDDR3, GDDR4, GDDR5)
- Flash Memory

RAM

RAM stands for Random Access Memory, and it gives computers the virtual space needed to manage information and solve problems in the moment. You can think of it as reusable scratch paper that you would write notes, numbers, or drawings on with a pencil. If you run out of room on the paper, you make more by erasing what you no longer need; RAM behaves similarly when it needs more space to deal with temporary information (i.e. running software/programs). Larger pieces of paper allow you to scribble out more (and bigger) ideas at a time before having to erase; more RAM inside of computers shares a similar effect.

RAM comes in a variety of shapes (i.e. the way it physically connects to or interfaces with computing systems), capacities (measured in MB or GB), speeds (measured in MHz or GHz), and architectures. These and other aspects are important to consider when upgrading systems with RAM, as computer systems (e.g. hardware, motherboards) have to adhere to strict compatibility guidelines.

For example:

- Older-generation computers are unlikely to accommodate the more recent types of RAM technology
- Laptop memory won't fit in desktops (and vice versa)
- RAM is not always backward compatible

- A system generally can't mix and match different types/generations of RAM together

Static RAM (SRAM)

- Time in market: 1990s to present
- Popular products using SRAM: Digital cameras, routers, printers, LCD screens

One of the two basic memory types (the other being DRAM), SRAM requires a constant power flow in order to function. Because of the continuous power, SRAM doesn't need to be 'refreshed' to remember the data being stored. This is why SRAM is called 'static' – no change or action (e.g. refreshing) is needed to keep data intact. However, SRAM is a volatile memory, which means that all the data that had been stored becomes lost once the power is cut off.

The advantages of using SRAM (vs. DRAM) are lower power consumption and faster access speeds. The disadvantages of using SRAM (vs. DRAM) are lesser memory capacities and higher costs of manufacturing. Because of these characteristics, SRAM is typically used in:

- CPU cache (e.g. L1, L2, L3)
- Hard drive buffer/cache
- Digital-to-analog converters (DACs) on video cards

Dynamic RAM (DRAM)

- Time in market: 1970s to mid-1990s
- Popular products using DRAM: Video game consoles, networking hardware

One of the two basic memory types (the other being SRAM), DRAM requires a periodic 'refresh' of power in order to function. The capacitors that store data in DRAM gradually discharge energy; no energy means the data becomes lost. This is why DRAM is called 'dynamic' — constant change or action (e.g. refreshing) is needed to keep data intact. DRAM is also a volatile memory, which means that all the stored data becomes lost once the power is cut off.

The advantages of using DRAM (vs. SRAM) are lower costs of manufacturing and greater memory capacities. The disadvantages of using DRAM (vs. SRAM)

are slower access speeds and higher power consumption. Because of these characteristics, DRAM is typically used in:

- o System memory
- o Video graphics memory

In the 1990s, Extended Data Out Dynamic RAM (EDO DRAM) was developed, followed by its evolution, Burst EDO RAM (BEDO DRAM). These memory types had appeal due to increased performance/efficiency at lower costs. However, the technology was rendered obsolete by the development of SDRAM.

Synchronous Dynamic RAM (SDRAM)

- Time in market: 1993 to present
- Popular products using SDRAM: Computer memory, video game consoles

SDRAM is a classification of DRAM that operates in sync with the CPU clock, which means that it waits for the clock signal before responding to data input (e.g. user interface). By contrast, DRAM is asynchronous, which means it responds immediately to data input. But the benefit of synchronous operation is that a CPU can process overlapping instructions in parallel, also known as ‘pipelining’—the ability to receive (read) a new instruction before the previous instruction has been fully resolved (write).

Although pipelining doesn’t affect the time it takes to process instructions, it does allow more instructions to be completed simultaneously. Processing one read and one write instruction per clock cycle results in higher overall CPU transfer/performance rates.

SDRAM supports pipelining due to the way its memory is divided into separate banks, which is what led to its widespread preference over basic DRAM.

Single Data Rate Synchronous Dynamic RAM (SDR SDRAM)

- Time in market: 1993 to present
- Popular products using SDR SDRAM: Computer memory, video game consoles

SDR SDRAM is the expanded term for SDRAM — the two types are one and the same, but most frequently referred to as just SDRAM. The ‘single data rate’ indicates how the memory processes one read and one write instruction per clock cycle. This labeling helps to clarify comparisons between SDR SDRAM and DDR SDRAM:

- DDR SDRAM is essentially the second-generation development of SDR SDRAM

Double Data Rate Synchronous Dynamic RAM (DDR SDRAM)

- Time in market: 2000 to present
- Popular products using DDR SDRAM: Computer memory

DDR SDRAM operates like SDR SDRAM, only twice as fast. DDR SDRAM is capable of processing two read and two write instructions per clock cycle (hence the ‘double’). Although similar in function, DDR SDRAM has physical differences (184 pins and a single notch on the connector) versus SDR SDRAM (168 pins and two notches on the connector). DDR SDRAM also works at a lower standard voltage (2.5

V from 3.3 V), preventing backward compatibility with SDR SDRAM. ○ DDR2 SDRAM is the evolutionary upgrade to DDR SDRAM. While still double data rate (processing two read and two write instructions per clock cycle), DDR2 SDRAM is faster because it can run at higher clock speeds. Standard (not overclocked) DDR memory modules top out at 200 MHz, whereas standard DDR2 memory modules top out at 533 MHz. DDR2 SDRAM runs at a lower voltage (1.8 V) with more pins (240), which prevents backward compatibility.

- DDR3 SDRAM improves performance over DDR2 SDRAM through advanced signal processing (reliability), greater memory capacity, lower power consumption (1.5 V), and higher standard clock speeds (up to 800

- Mhz). Although DDR3 SDRAM shares the same number of pins as DDR2 SDRAM (240), all other aspects prevent backward compatibility.
- DDR4 SDRAM improves performance over DDR3 SDRAM through more advanced signal processing (reliability), even greater memory capacity, even lower power consumption (1.2 V), and higher standard clock speeds (up to 1600 Mhz). DDR4 SDRAM uses a 288-pin configuration, which also prevents backward compatibility.

Graphics Double Data Rate Synchronous Dynamic RAM (GDDR SDRAM)

- Time in market: 2003 to present
- Popular products using GDDR SDRAM: Video graphics cards, some tablets

GDDR SDRAM is a type of DDR SDRAM that is specifically designed for video graphics rendering, typically in conjunction with a dedicated GPU (graphics processing unit) on a video card. Modern PC games are known to push the envelope with incredibly realistic high-definition environments, often requiring hefty system specs and the best video card hardware in order to play (especially when using 720p or 1080p high-resolution displays).

The 4 Best Graphics Cards of 2021

- Similar to DDR SDRAM, GDDR SDRAM has its own evolutionary line (improving performance and lowering power consumption): GDDR2 SDRAM, GDDR3 SDRAM, GDDR4 SDRAM, and GDDR5 SDRAM.

Despite sharing very similar characteristics with DDR SDRAM, GDDR SDRAM is not exactly the same. There are notable differences with the way GDDR SDRAM operates, particularly regarding how bandwidth is favored over latency. GDDR SDRAM is expected to process massive amounts of data (bandwidth), but not necessarily at the fastest speeds (latency); think of a 16-lane highway set at 55 MPH. Comparatively, DDR SDRAM is expected to have low latency to immediately respond to the CPU; think of a 2-lane highway set at 85 MPH.

Flash Memory

- Time in market: 1984 to present
- Popular products using flash memory: Digital cameras, smartphones/tablets, handheld gaming systems/toys

Flash memory is a type of non-volatile storage medium that retains all data after power has been cut off. Despite the name, flash memory is closer in form and operation (i.e. storage and data transfer) to solidstate drives than the aforementioned types of RAM. Flash memory is most commonly used in:

- o USB flash drives o Printers o Portable media players o Memory cards o Small electronics/toys

Daughter Cards

A daughterboard (or daughter board , daughter card , or daughtercard) is a circuit board that plugs into and extends the circuitry of another circuit board. ... The term is commonly used by manufacturers of wavetable daughterboards that attach to existing sound cards.

The daughter board is a computer hardware. It is also known as the piggyback board, riser card, daughter board, daughtercard or daughter card. A daughter board is a printed circuit board which is connected to the motherboard or expansion card. As compared to the motherboard, it is smaller in size. A daughter board does not act as an expansion card. An expansion card adds extra new functions to the computer. But a daughter board that is connected to the motherboard adds or supports the main functions of the motherboard.

Daughter boards are directly connected to the motherboards. You know that expansion cards are connected to the motherboard by using the bus and other serial interfaces. But daughter board is directly connected to the board by soldering. As an update of the motherboard or expansion card, daughter boards are released to extend the features and services of the motherboard or expansion cards.

Functionalities of a Daughter Board

A daughter board is a circuit board that is directly connected to the motherboard or expansion card by soldering. Sometimes, people think that daughter board and expansion card are same. But this not true.

They have their own functionalities. Daughter board's functionalities are given below:

- It is known as the piggyback board, riser card, daughtercard etcetera.
- A daughter board is smaller than a motherboard and may have some slots like the motherboard.
- A daughter board is a printed circuit board which is connected to the motherboard or expansion card.
- Unlike expansion card, daughter boards are directly connected to the motherboard by soldering.
- Daughter boards do not provide new functions to the circuit like an expansion But they extend the circuitry of the circuit in which they are plugged into.
- Daughter boards are released by the vendors as an update of motherboard or expansion card.

Bus Slots

Alternatively known as a bus slot or expansion port, an expansion slot is a connection or port inside a computer on the motherboard or riser card. It provides an installation point for a hardware expansion card to be connected. For example, if you wanted to install a new video card in the computer, you'd purchase a video expansion card and install that card into the compatible expansion slot.

Computer expansion slots

Below is a listing of expansion slots commonly found in a computer and the devices associated with those slots. Clicking any of the links below provide you with additional details.

- AGP - Video card.
- AMR - Modem, sound card.
- CNR - Modem, network card, sound card.
- EISA - SCSI, network card, video card.
- ISA - Network card, sound card, video card.
- PCI - Network card, SCSI, sound card, video card.
- PCI Express - Video card, modem, sound card, network card.
- VESA - Video card.

Many of the expansion card slots above are obsolete. You're most likely only going to encounter AGP, PCI, and PCI Express when working with computers today. The picture below is an example of what expansion slots may look like on a motherboard. In this picture, there are three different types of expansion slots: PCI Express, PCI, and AGP.

Every computer motherboard is different, to determine how many expansion slots are on your computer motherboard identify the manufacturer and model of the motherboard. Once you've identified the model of motherboard, you can find complete information about the motherboard in its manual.

Computers have expansion slots to give the user the ability to add new devices to their computer. For example, a computer gamer may upgrade their video card to get better performance in their games. An expansion slot allows them to remove the old video card and add a new video card without replacing the motherboard.

Laptops do not have expansion slots like a desktop computer. However, some laptops do have PC Cards that can be inserted into the side of the laptop. They may also have a Cardbus slot for an ExpressCard to be added.

Today, the most commonly used expansion slot used and found on computer motherboards is the PCI Express expansion slot.

PCI

"Peripheral Component Interconnect." PCI is a hardware bus used for adding internal components to a desktop computer. For example, a PCI card can be inserted into a PCI slot on a motherboard, providing additional I/O ports on the back of a computer.

The PCI architecture, also known as "conventional PCI," was designed by Intel and introduced in 1992. Many desktop PCs from the early 1990s to the mid 2000s had room for two to five PCI cards. Each card required an open slot on the motherboard and a removable panel on the back of the system unit. Adding PCI cards was an easy way to upgrade a computer, since you could add a better video card, faster wired or wireless networking, or add new ports, like USB 2.0.

The original 32-bit, 33 MHz PCI standard supported data transfer rates of 133 megabytes per second. An upgraded 64-bit, 66 MHz standard was created a few years later and allowed for much faster data transfer rates up to 533 MHz. In 1998, IBM, HP, and Compaq introduced PCIX (or "PCI eXtended"), which was backwards compatible with PCI. The 133 MHz PCI-X interface supported data transfer rates up to 1064 MHz.

Three types of bus are used.

- Address bus - carries memory addresses from the processor to other components such as primary storage and input/output devices.
- Data bus - carries the data between the processor and other components.
- Control bus - carries control signals from the processor to other components.

SMPS (Switched Mode Power Supply)

A switched-mode power supply (switching-mode power supply, switch-mode power supply, switched power supply, SMPS, or switcher) is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently.

Like other power supplies, an SMPS transfers power from a DC or AC source (often mains power, see AC adapter) to DC loads, such as a personal computer,

while converting voltage and current characteristics. Unlike a linear power supply, the pass transistor of a switching-mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy. A hypothetical ideal switched-mode power supply dissipates no power. Voltage regulation is achieved by varying the ratio of on-to-off time (also known as duty cycles). In contrast, a linear power supply regulates the output voltage by continually dissipating power in the pass transistor. This higher power conversion efficiency is an important advantage of a switched-mode power supply. Switched-mode power supplies can also be substantially smaller and lighter than a linear supply because the transformer can be much smaller. This is because it operates on the switching frequency which ranges from several 100KHz to several MHz in contrast to the 50-60Hz which is typical for the mains AC frequency. Despite the reduction in size, the power supply topology itself and the requirement for electromagnetic interference suppression in commercial designs result in a usually much greater component count and corresponding circuit complexity.

Switching regulators are used as replacements for linear regulators when higher efficiency, smaller size or lighter weight are required. They are, however, more complicated; switching currents can cause electrical noise problems if not carefully suppressed, and simple designs may have a poor power factor.

Advantages and disadvantages

- The main advantage of the switching power supply is greater efficiency (up to 96%) than linear regulators because the switching transistor dissipates little power when acting as a switch.
- Other advantages include smaller size, lower noise, and lighter weight from the elimination of heavy line-frequency transformers, and comparable heat generation. Standby power loss is often much less than transformers. The transformer in a switching power supply is also smaller than a traditional line frequency (50 Hz or 60 Hz depending on region) transformer, and therefore requires smaller amounts of expensive raw materials, like copper.
- Disadvantages include greater complexity, the generation of high-amplitude, high-frequency energy that the low-pass filter must block to

avoid electromagnetic interference (EMI), a ripple voltage at the switching frequency and the harmonic frequencies thereof.

- Very low cost SMPSs may couple electrical switching noise back onto the mains power line, causing interference with devices connected to the same phase, such as A/V equipment. Nonpowerfactor-corrected SMPSs also cause harmonic distortion.

Applications

- Switched-mode power supply units (PSUs) in domestic products such as personal computers often have universal inputs, meaning that they can accept power from mains supplies throughout the world, although a manual voltage range switch may be required. Switch-mode power supplies can tolerate a wide range of power frequencies and voltages.
- Due to their high volumes mobile phone chargers have always been particularly cost sensitive. The first chargers were linear power supplies, but they quickly moved to the cost effective ringing choke converter (RCC) SMPS topology, when new levels of efficiency were required. Recently, the demand for even lower no-load power requirements in the application has meant that flyback topology is being used more widely; primary side sensing flyback controllers are also helping to cut the bill of materials (BOM) by removing secondary-side sensing components such as optocouplers.[citation needed]
- Switched-mode power supplies are used for DC to DC conversion as well. In automobiles where heavy vehicles use a nominal 24 VDC cranking supply, 12 V for accessories may be furnished through a DC/DC switch-mode supply. This has the advantage over tapping the battery at the 12 V position (using half the cells) that all the 12 V load is evenly divided over all cells of the 24 V battery. In industrial settings such as telecommunications racks, bulk power may be distributed at a low DC voltage (from a battery back up system, for example) and individual equipment items will have DC/DC switched-mode converters to supply whatever voltages are needed.
- A common use for switched-mode power supplies is as extralowvoltage sources for lighting, and for this application they are often called "electronic transformers".

Internal Storage Devices

Some storage devices are classed as 'internal' which means they are inside the computer case. Most computers have some form of internal storage. The most common type of internal storage is the hard disk.

At the most basic level, internal storage is needed to hold the operating system so that the computer is able to access the input and output devices. It will also be used to store the applications software that you use and more than likely, the original copies of your data files. Internal storage allows the data and applications to be loaded very rapidly into memory, ready for use. The data can be accessed much faster than data which is stored on an external storage device. This is because internal storage devices are connected directly to the motherboard and its data bus whereas external devices are connected through a hardware interface such as USB, which means they are considerably slower to access. Internal storage also means that if the computer is moved around, it will still retain its most commonly used data.

The main disadvantage of internal storage is that when the hard disk fails (and it will), all the data and applications may be lost. This can be avoided to some extent by using more than one hard disk within the machine. Each hard disk has a copy of all the data, so if one fails the other can carry on. This is called a RAID array. An alternative is to use external drives for backup.

Data Storage Devices for Computers

- Hard Drive Disks
- Floppy Disks
- Tapes
- Compact Discs (CDs)
- DVD and Blu-ray Discs
- USB Flash Drives
- Secure Digital Cards (SD Card)s
- Solid-State Drives (SSDs)
- Cloud Storage
- Punch Cards

1. Hard Disk Drives

A hard disk drive (also known as a hard drive, HD, or HDD) can be found installed in almost every desktop and laptop computer. It stores files for the operating system and software programs as well as user documents, such as photographs, text files, videos, and audio. The hard drive uses magnetic storage to record and retrieve digital information to and from one or more fast-spinning disks.

2. Floppy Disks

Also known as a diskette, floppy, or FD, the floppy disk is another type of storage medium that uses magnetic storage technology to store information. Floppy disks were once a common storage device for computers and were very common from the mid-1970s through to the start of the 21st century. The earliest floppies were 8 inches (203 mm) in size, but these were replaced first by 5.25-inch (133 mm) disk drives and finally by 3.5-inch (90 mm) versions.

3. Tapes

In the past, magnetic tape was often used for digital data storage because of its low cost and ability to store large amounts of data. The technology essentially consisted of a thin, magnetically coated piece of plastic wrapped around wheels. Its relative slowness and unreliability compared to other data storage solutions have resulted in it now being largely abandoned as a storage medium.

4. Compact Discs (CDs)

The compact disc, (or CD for short) is a form of optical storage, a technology that employs lasers and lights to read and write data. Initially, compact discs were used purely for music, but in the late 1980s, they began to be used for computer data storage. Initially, the compact discs that were introduced were CD-ROMs (read-only), but these were followed by CD-Rs (writable compact discs) and CD-RWs (rewritable compact discs).

5. DVD and Blu-ray Discs

The DVD (digital versatile disc) and Blu-ray disc (BD) are formats of digital optical disc data storage which have superseded compact discs, mainly because of their much greater storage capacity. A Blu-ray disc, for example, can store 25 GB (gigabytes) of data on a single-layer disc and 50 GB on a dual-layer disc.

In comparison, a standard CD is the same physical size, but only holds 700 MB (megabytes) of digital data.

6. USB Flash Drives

Also known as a thumb drive, pen drive, flash drive, memory stick, jump drive, and USB stick, the USB flash drive is a flash-memory datastorage device that incorporates an integrated USB interface. Flash memory is generally more efficient and reliable than optical media, being smaller, faster, and possessing much greater storage capacity. Flash drives are also more durable due to a lack of moving parts.

7. Secure Digital Cards (SD Cards)

SD cards are commonly used in multiple electronic devices, including digital cameras and mobile phones. Although there are different sizes, classes, and capacities available, they all use a rectangular design with one side "chipped off" to prevent the card from being inserted into a camera or computer the wrong way.

8. Solid-State Drives (SSDs)

A solid-state drive uses flash memory to store data and is sometimes used in devices such as netbooks, laptops, and desktop computers instead of a traditional hard disk drive. The advantages of an SSD over an HDD include a faster read/write speed, noiseless operation, greater reliability, and lower power consumption. The biggest downside is cost, with an SSD offering lower capacity than an equivalently priced HDD.

9. Cloud Storage

With users increasingly operating multiple devices in multiple places, many are adopting online cloud-computing solutions. Cloud computing basically involves accessing services over a network via a collection of remote servers. Although the idea of a "cloud of computers" may sound rather abstract to those

unfamiliar with this metaphorical concept, in practice, it can provide powerful storage solutions for devices that are connected to the internet.

10. Punch Cards

Punch cards (or punched cards) were a common method of data storage used with early computers. Basically, they consisted of a paper card with punched or perforated holes created by hand or machine. The cards were entered into computers to enable the storage and accessing of information. This data-storage medium pretty much disappeared as new and better technologies were developed.

Interfacing Ports

According to Cisco A connector or outlet on networking device where the media is connected to an end device or another networking device is declared as Physical Port. Because routers are used to interconnect networks, the ports on a router are referred to as Network Interfaces.

A port in a computer network is a communication endpoint whereas, in an operating system, it is a logical construct, recognizes precise method otherwise a network service type. These endpoints recognize the combination of every protocol and its address through 16-bit unsigned numbers, called the port number. The protocols that use port numbers are the TCP (Transmission Control Protocol) and UDP (User Datagram Protocol). The port number in every computer networking uses an IP address of the type of protocol & the host. There are some specific ports used for identifying particular services to transmit an arriving packet to a working application. This article discusses an overview of computer ports & their applications.

Computer Port

A computer port or a communication port is a connection point used as an interface between the computer & the peripherals like keyboard, mouse, printer, display unit, monitor, flash drive and speaker. The computer port transmits the data from any peripheral to the computer. In general, the communication ports are available in two types and the classification of this can be done based on the

protocol used & type for communication like Serial Ports as well as Parallel Ports.

Characteristics of Computer Ports

The characteristics of the computer port include the following.

- It is an interface between external devices as well as a computer.
- Ports on the motherboard can be connected using an external device cable by plugging in.
- The external devices which are connected through via ports are the keyboard, mouse, microphone, monitor, speakers, etc.

Types of Computer Ports

There are different types of ports available in a computer network. Some of them are discussed below.

- PS/02
- Serial Port
- Parallel Port
- Ethernet
- VGA Port
- USB Port
- DVI Port
- HDMI Port
- Display Port

PS/02 Computer Port

It is a DIN connector available with 6-pins. This type of port is used to connect keyboard & mouse. It is developed and introduced by the personal systems of IBM. These ports are available in color-coded. For the keyboard, it is purple whereas, for the mouse, it is green.

The pin configuration of both the keyboard & mouse is the same so, computers do not identify once they connected to the wrong ports.

Serial Port

A serial port is used to connect peripherals with the help of a serial protocol to transmit the 1-bit data at a time over an only communication line. The best example of this port is D-Subminiature otherwise a Dsub connector and the main function of these ports are to carry RS232 signals.

Parallel Port

A parallel port is also used as an interface between a computer & its peripheral device with the help of a wire or above one communication line. The best example of this port is a printer port.

Ethernet Port

This type of port is used to unite the network cable to a PC. Once the cable is plugged into Ethernet port, then it can lead either to a cable modem, network hub, an Internet gateway or DSL modem. Most of the computers built with an Ethernet port. If the port is damaged, then it can be changed by integrating the adapter card.

VGA Port

VGA stands for Video Graphics Array. It is a 3 row with a 15-pin DE15 connector. It is used in many monitors, laptops, video cards, projectors, etc. Sometimes, this port was used on laptops otherwise other portable devices in place of the full-size VGA connector.

The current LCD as well as LED monitors support VGA ports however the quality of the picture can be reduced. This port carries analog video signals up to 648X480.resolution. Some laptops are inbuilt with VGA ports to unite exterior monitors otherwise projectors.

USB Port

There are different types of ports are used in a computer network, in that a USB port is the most commonly used one. The universal serial bus port is very successful. The main function of this port is to connect all the peripherals to PCs like printers, keyboards, external hard drives, mice, scanners, cameras, and

many more. This port is available on all kinds of computers like laptops, desktops, notebooks, tablets, etc.

DVI Port

This port is a digital interface among the display controller of computers as well as video o/p device such as a monitor otherwise projector. This was developed to allow the lossless transmission of digital video signals as well as to change the analog VGA technology.

These ports are classified into three types namely DVI-I, DVI-D & DVI-A. Here, DVI-I port integrates analog & digital signals, DVI-A port supports simply analog signals & DVI-D supports simply digital signals.

HDMI Computer Port

HDMI stands for “High Definition Multimedia Interface”. It works like a digital interface to connect High Definition as well as Ultra High Definition devices like HDTVs, computer monitors, gaming consoles, HD Cameras, Blu-Ray players, etc. This port carries audio signals like compressed/uncompressed & uncompressed video.

This port includes 19-pins and HDMI 2.0 is the latest version, used to carry digital video signal up to 4096×2160 resolution & 32 audio channels.

Display Computer Port

This type of port is one kind of digital display interface including multiple audio channels & other types of data. This port was developed by an association of computers as well as chipmakers. These ports are Sony, Maxell, Philip & Lattice and then it was standardized through the VESA (Video Electronics Standards Association). The main intention of this Port is to replace DVI & VGA ports. It carries audio, video, USB and other types of data. It is scalable with other types of interfaces like DVI & HDMI by using active otherwise passive adapters. The most recent version of this port is Display Port 1.3 that can handle up to 7680 X 4320 resolutions.

BASIC LINUX COMMANDS

1. pwd (Print Working Directory)

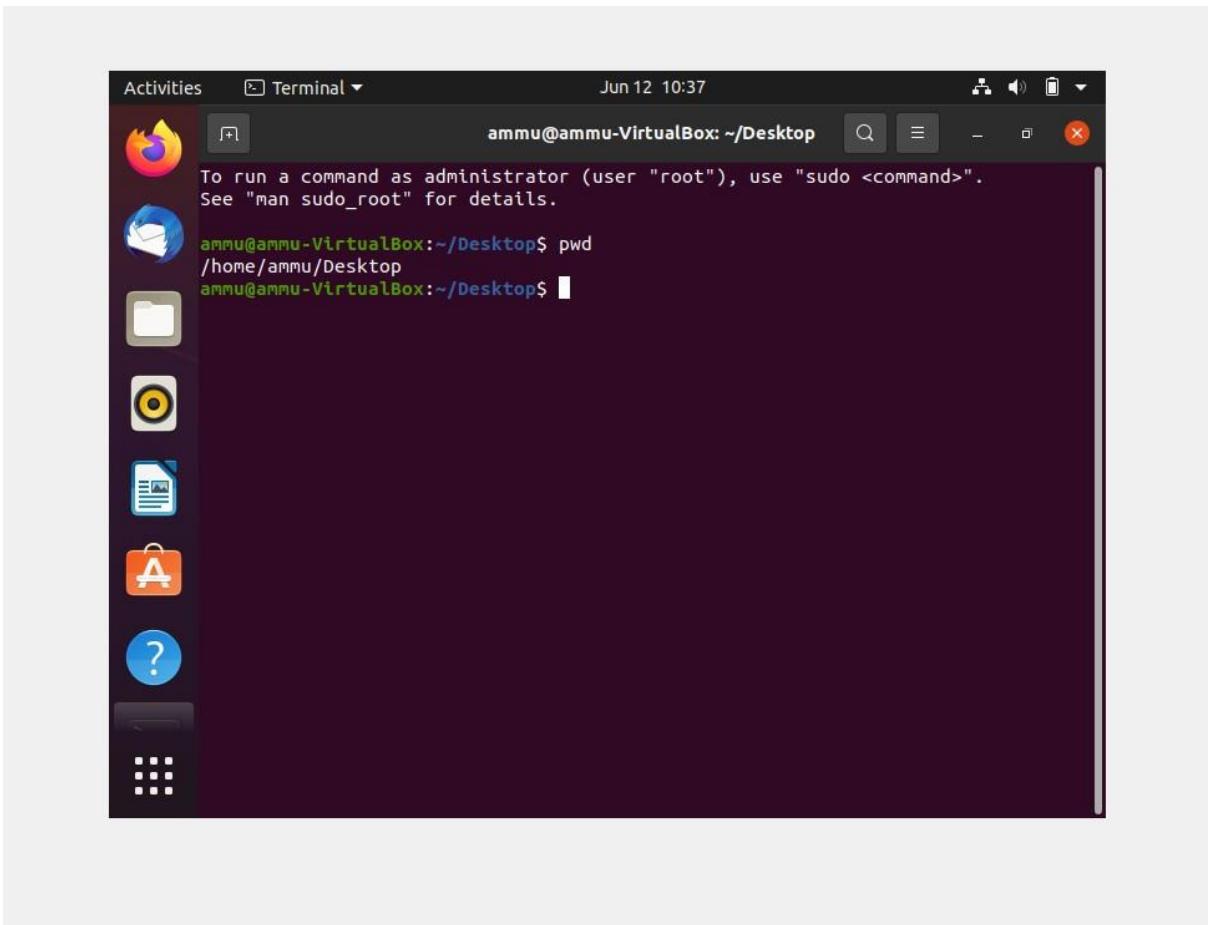
pwd stands for Print Working Directory. It prints the path of the working directory, starting from the root. pwd is shell built-in command(pwd) or an actual binary(/bin/pwd). \$PWD is an environment variable which stores the path of the current directory.

The pwd command is a command line utility for printing the current working directory. It will print the full system path of the current working directory to standard output. By default the pwd command ignores symlinks, although the full physical path of a current directory can be shown with an option.

pwd: pwd [-LP] Print the name of the current working directory. Options: -L print the value of \$PWD if it names the current working directory -P print the physical directory, without any symbolic links By default, pwd' behaves as if -L' were specified.

The PWD command is implemented using the library function GETCWD. This is not part of the Fortran standard, so the PWD command may not be supported on all platforms. It should be available on Unix/Linux systems. It is also supported on Windows implementations built with the Intel compiler.

In the Linux operating system, a shadow password file is a system file in which encryption user password are stored so that they aren't available to people who try to break into the system. Ordinarily, user information, including passwords, is kept in a system file called /etc/passwd .



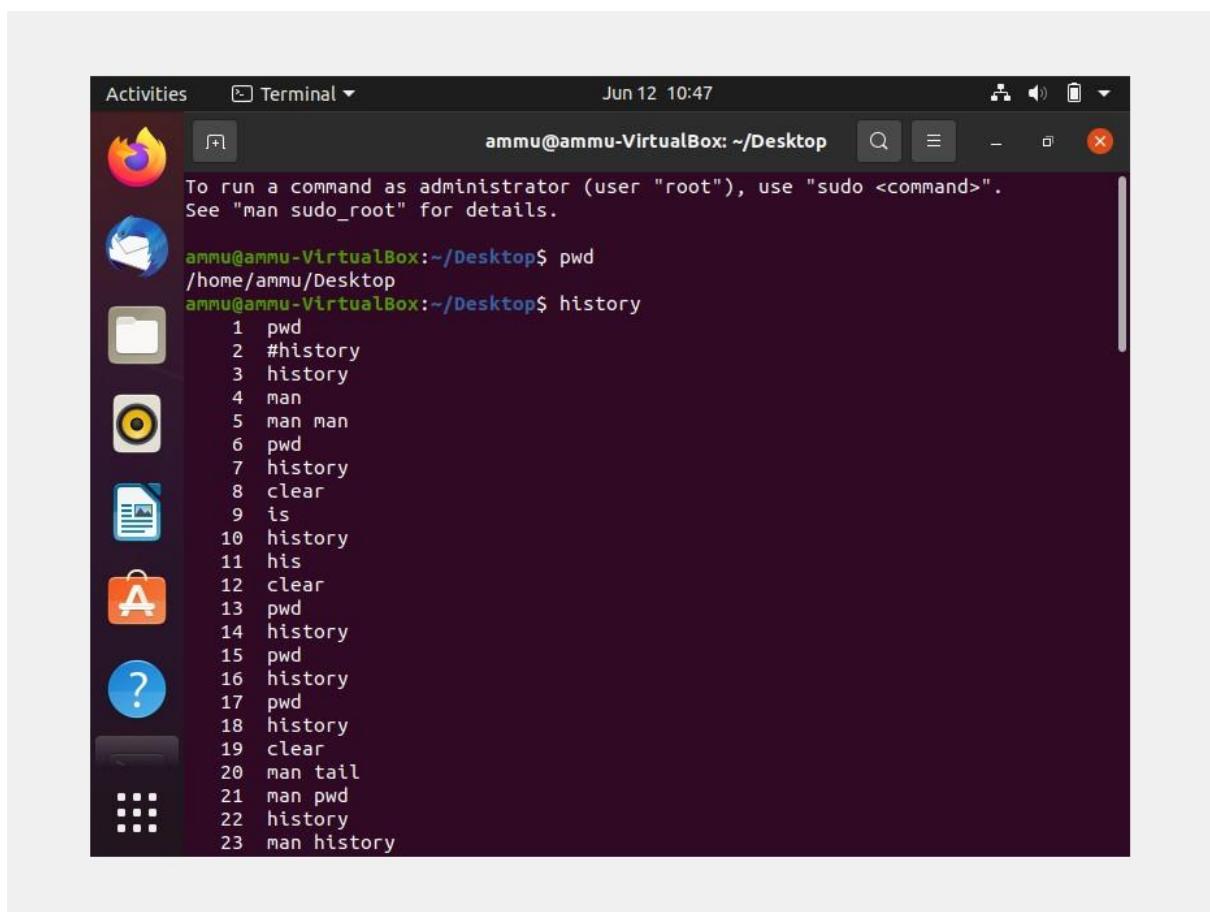
2. history

In Linux, there is a very useful command to show you all of the last commands that have been recently used. The command is simply called `history`.

Another way to get to this search functionality is by typing `Ctrl-R` to invoke a recursive search of your command history. After typing this, the prompt changes to: `(reverse-i-search)`:` Now you can start typing a command, and matching commands will be displayed for you to execute by pressing `Return` or `Enter`.

These are some keys to scroll through the history and jump to either end:

- UP arrow key: Scroll backwards in history
- CTRL-p: Scroll backwards in history
- DOWN arrow key: Scroll forwards in history
- CTRL-n: Scroll forwards in history
- ALT-Shift-.: Jump to the end of the history (most recent)
- ALT-Shift-,: Jump to the beginning of the history (most distant)

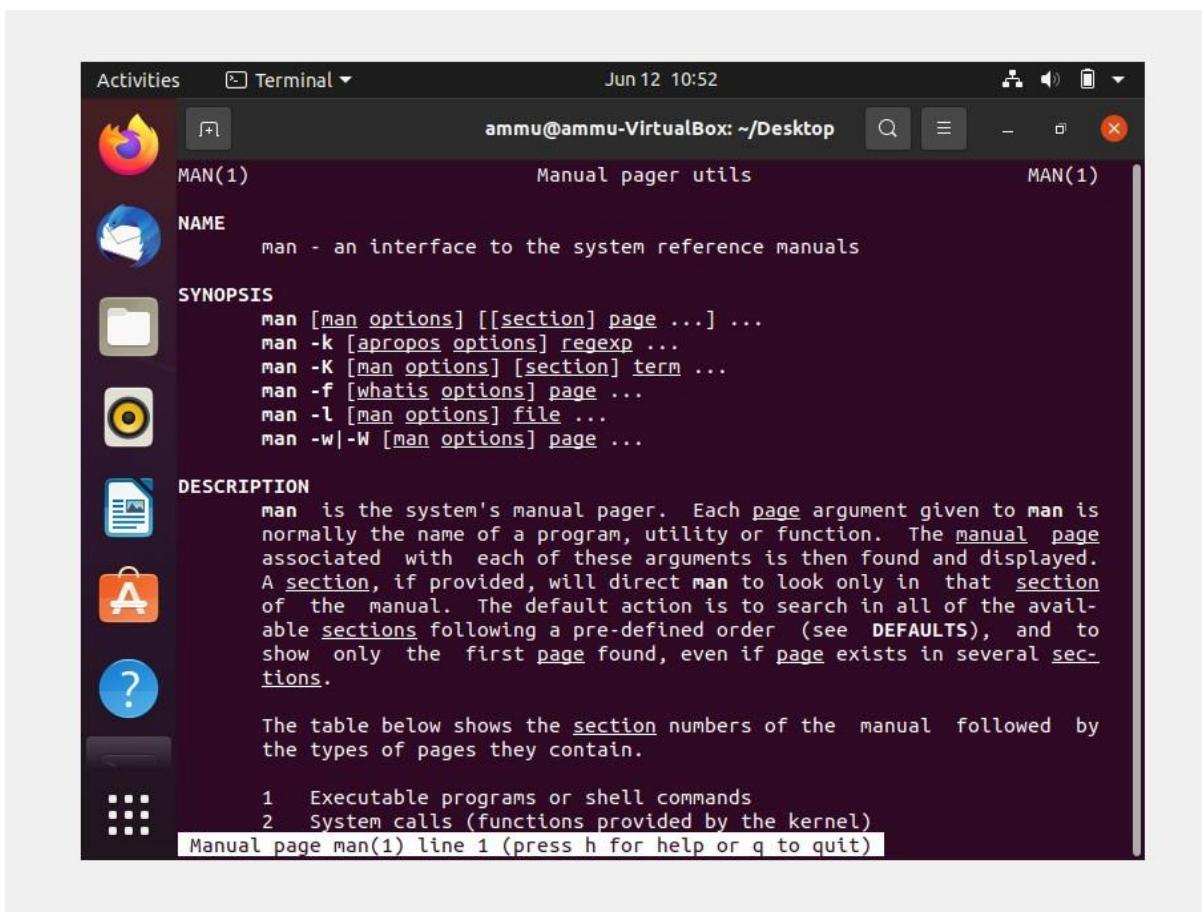


3. man

man command in Linux is used to display the user manual of any command that we can run on the terminal. It provides a detailed view of the command which includes NAME, SYNOPSIS, DESCRIPTION, OPTIONS, EXIT STATUS, RETURN VALUES, ERRORS, FILES, VERSIONS, EXAMPLES, AUTHORS and SEE

ALSO.The man page (short for manual page) includes a command description, applicable options, flags, examples, and other informative sections. In this tutorial, you will learn to use the man command in Linux. Prerequisites. A machine running Linux. Access to the command line.

To use man , you type man on the command line, followed by a space and a Linux command. man opens the Linux manual to the “man page” that describes that command—if it can find it, of course. The man page for man opens.



The screenshot shows a terminal window titled "Terminal" with the command "man man". The output displays the man page for the "man" command. The page is organized into sections: NAME, SYNOPSIS, and DESCRIPTION. The SYNOPSIS section lists several command-line options. The DESCRIPTION section provides a detailed explanation of what "man" does and how it finds manual pages. At the bottom, there is a table of contents for sections 1 and 2.

```
Activities Terminal ▾ Jun 12 10:52
ammu@ammu-VirtualBox: ~/Desktop
MAN(1)                               Manual pager utils
MAN(1)

NAME
    man - an interface to the system reference manuals

SYNOPSIS
    man [man options] [[section] page ...] ...
    man -k [apropos options] regexp ...
    man -K [man options] [section] term ...
    man -f [whatis options] page ...
    man -l [man options] file ...
    man -w|-W [man options] page ...

DESCRIPTION
    man is the system's manual pager. Each page argument given to man is
    normally the name of a program, utility or function. The manual page
    associated with each of these arguments is then found and displayed.
    A section, if provided, will direct man to look only in that section
    of the manual. The default action is to search in all of the available
    sections following a pre-defined order (see DEFAULTS), and to
    show only the first page found, even if page exists in several sections.

    The table below shows the section numbers of the manual followed by
    the types of pages they contain.

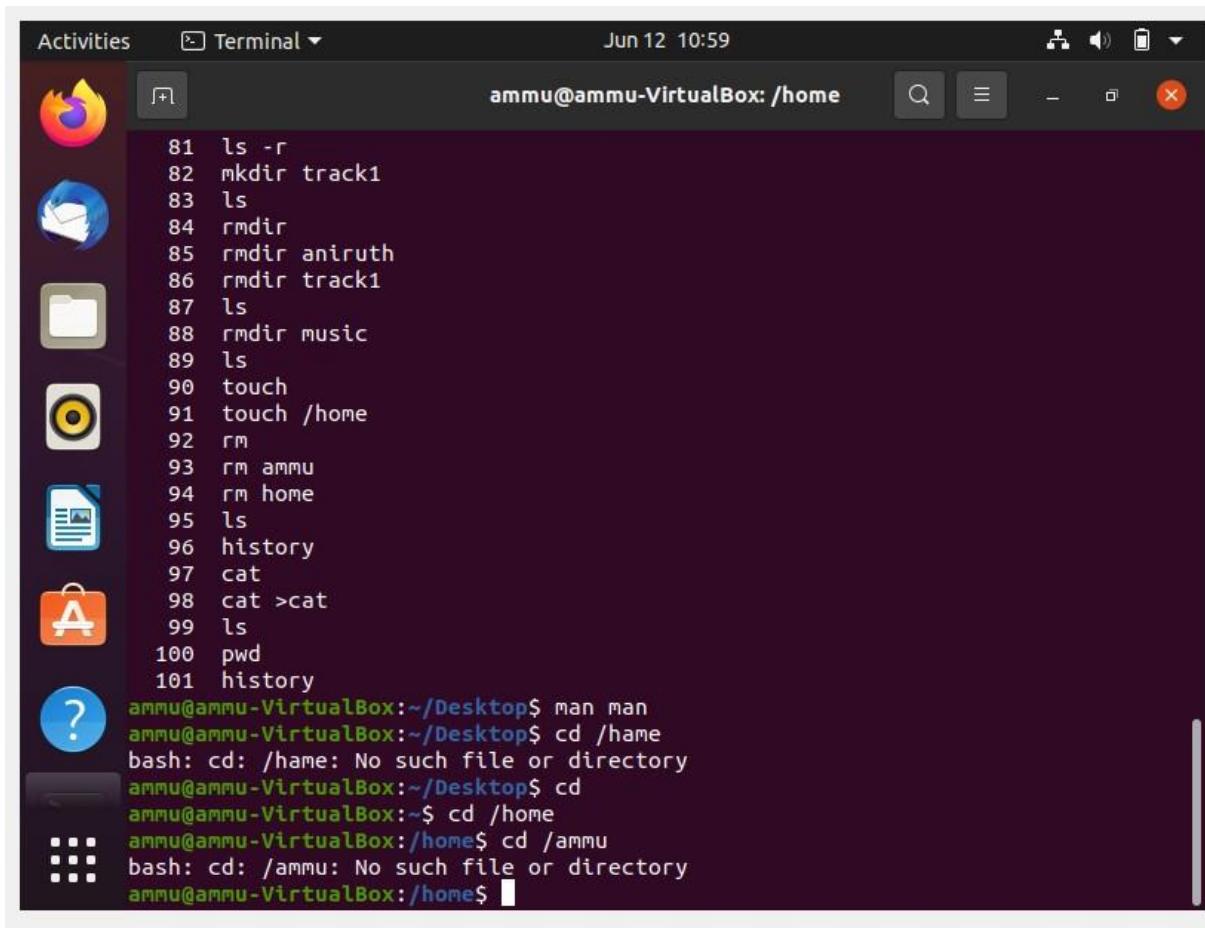
    1 Executable programs or shell commands
    2 System calls (functions provided by the kernel)
Manual page man(1) line 1 (press h for help or q to quit)
```

4. cd

The cd command, also known as chdir (change directory), is a command-line shell command used to change the current working directory in various operating systems. It can be used in shell scripts and batch files.

To navigate into the root directory, use "cd /" To navigate to your home directory, use "cd" or "cd ~" To navigate up one directory level, use "cd .." To navigate to the previous directory (or back), use "cd -"

To change to a directory specified by a path name, type cd followed by a space and the path name (e.g., cd /usr/local/lib) and then press [Enter]. To confirm that you've switched to the directory you wanted, type pwd and press [Enter]. You'll see the path name of the current directory.

A screenshot of a Linux desktop environment showing a terminal window. The terminal window is titled 'Terminal' and has the command 'Terminal' selected in the title bar. The status bar at the top right shows the date and time as 'Jun 12 10:59'. The terminal window contains a history of commands entered by the user. The commands are numbered from 81 to 101. The user has run several commands related to file creation and deletion, and then checked the current directory with 'pwd' and viewed the command history with 'history'. The terminal window is set against a dark background with light-colored text.

```
81 ls -r
82 mkdir track1
83 ls
84 rmdir
85 rmdir aniruth
86 rmdir track1
87 ls
88 rmdir music
89 ls
90 touch
91 touch /home
92 rm
93 rm ammu
94 rm home
95 ls
96 history
97 cat
98 cat >cat
99 ls
100 pwd
101 history
ammu@ammu-VirtualBox:~/Desktop$ man man
ammu@ammu-VirtualBox:~/Desktop$ cd /hame
bash: cd: /hame: No such file or directory
ammu@ammu-VirtualBox:~/Desktop$ cd
ammu@ammu-VirtualBox:~$ cd /home
ammu@ammu-VirtualBox:/home$ cd /ammu
bash: cd: /ammu: No such file or directory
ammu@ammu-VirtualBox:/home$
```

5. ls

ls is a Linux shell command that lists directory contents of files and directories. Some practical examples of ls command are shown below. ls -t : It sorts the file by modification time, showing the last edited file first.

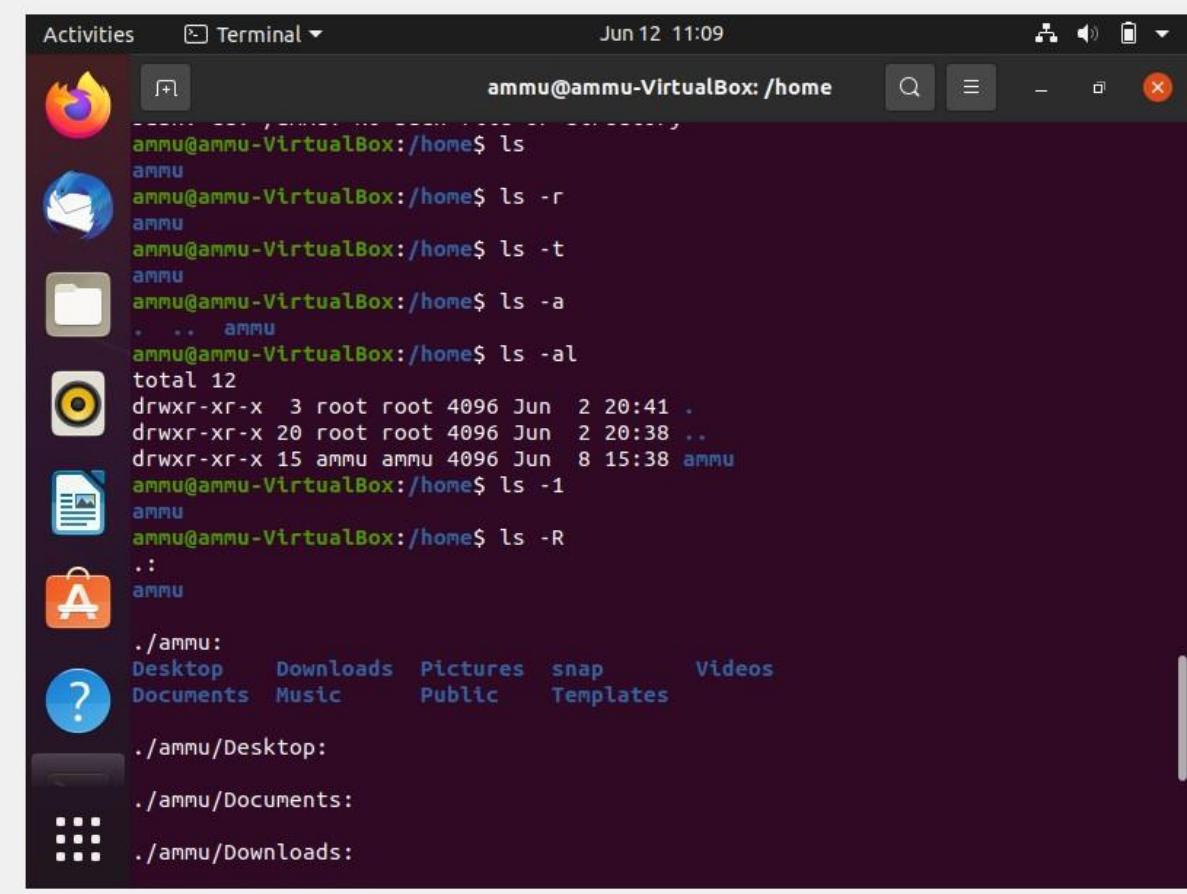
ls -ltr file* : This command just list the contents of the current directory in the long listing format (-l), sorted by modification time (-t) in reverse order (-r) of all files and directories beginning with file* The output format is very simple; only the file/dir paths are printed line by line.

To list the content of a particular directory refer the below command. You can check hidden files and directories by using Linux ls command with argument -a. To check inode number of files and directories use ls command with option -i. OR you can use the -i argument with -l as shown on below command.

The other command, ls / is going to list files and directories under the root directory which is /. ls alone will print your current directory's contents; you can use ls with arguments to display other information. ... ls / is the listing directory (ls) command and / is folder structure that ls will act on.

There are variations you can use with the ls command

- ls -R will list all the files in the sub directories as well
- ls -l long listing
- ls -a will show the hidden files
- ls -al will list the files and directories with detailed information like the permissions, size, owner, etc
- ls -t lists files sorted in the order of “last modified”
- ls -r option will reverse the natural sorting order Usually used in combination with other switches such as ls tr This will reverse the time wise listing



The screenshot shows a terminal window titled "Terminal" with the command "ls" run in the user's home directory. The output lists various files and directories:

```
ammu@ammu-VirtualBox: /home$ ls
ammu
ammu@ammu-VirtualBox: /home$ ls -r
ammu
ammu@ammu-VirtualBox: /home$ ls -t
ammu
ammu@ammu-VirtualBox: /home$ ls -a
. .. ammu
ammu@ammu-VirtualBox: /home$ ls -al
total 12
drwxr-xr-x 3 root root 4096 Jun  2 20:41 .
drwxr-xr-x 20 root root 4096 Jun  2 20:38 ..
drwxr-xr-x 15 ammu ammu 4096 Jun  8 15:38 ammu
ammu@ammu-VirtualBox: /home$ ls -1
ammu
ammu@ammu-VirtualBox: /home$ ls -R
.:
ammu

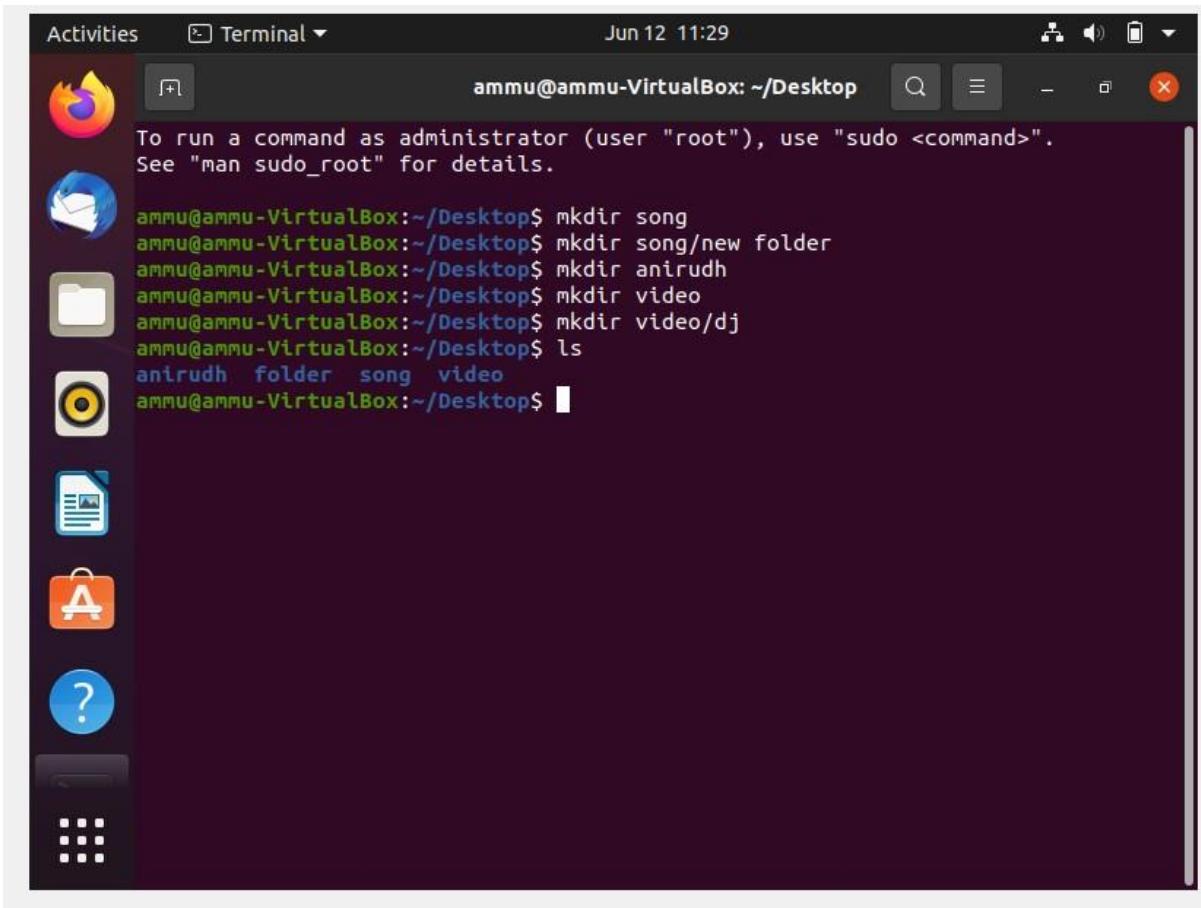
./ammu:
Desktop   Downloads  Pictures  snap      Videos
Documents  Music     Public    Templates

./ammu/Desktop:
./ammu/Documents:
./ammu/Downloads:
```

6. mkdir

mkdir command in Linux allows the user to create directories (also referred to as folders in some operating systems).

The command is easy to use: type the command, add a space and then type the name of the new folder. So if you're inside the "Documents" folder, and you want to make a new folder called "University," type "mkdir University" and then select enter to create the new directory. Use this command to create one or more new directories. Include one or more instances of the “<DIRECTORY” variable (separating each with a whitespace), and set each to the complete path to the new directory to be created. If directories within a named path do not exist, an error will be generated.



The image shows a screenshot of an Ubuntu desktop environment. On the left, there's a vertical dock with icons for various applications: a browser, email, file manager, terminal, system settings, and help. The main area is a terminal window titled "Terminal". The terminal shows the following command history:

```
ammu@ammu-VirtualBox: ~/Desktop$ To run a command as administrator (user "root"), use "sudo <command>".
ammu@ammu-VirtualBox:~/Desktop$ See "man sudo_root" for details.
ammu@ammu-VirtualBox:~/Desktop$ mkdir song
ammu@ammu-VirtualBox:~/Desktop$ mkdir song/new folder
ammu@ammu-VirtualBox:~/Desktop$ mkdir anirudh
ammu@ammu-VirtualBox:~/Desktop$ mkdir video
ammu@ammu-VirtualBox:~/Desktop$ mkdir video/dj
ammu@ammu-VirtualBox:~/Desktop$ ls
anirudh folder song video
ammu@ammu-VirtualBox:~/Desktop$
```

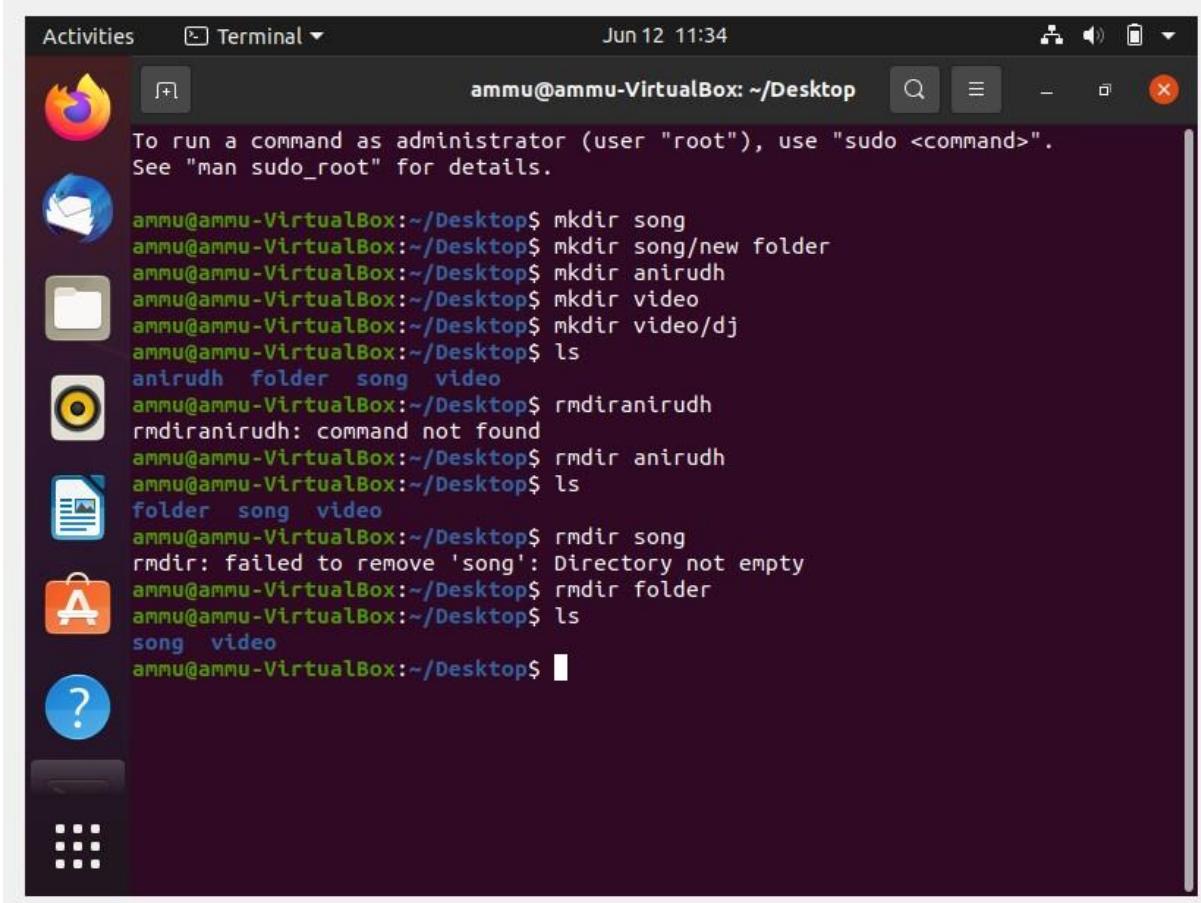
7. rmdir

rmdir command is used remove empty directories from the filesystem in Linux. The rmdir command removes each and every directory specified in the command line only if these directories are empty. So if the specified directory has some directories or files in it then this cannot be removed by rmdir command.

To remove an empty directory, use either rmdir or rm -d followed by the directory name: rm -d dirname rmdir dirname.

To remove non-empty directories and all the files within them, use the rm command with the -r (recursive) option: rm -r dirname.

To remove a directory that is not empty, use the rm command with the -r option for recursive deletion. Be very careful with this command, because using the rm -r command will delete not only everything in the named directory, but also everything in its subdirectories.



The image shows a screenshot of an Ubuntu desktop environment. On the left, there's a dock with various icons: a browser, a file manager, a terminal, a mail client, a folder, a system settings icon, a help icon, and a dash icon. The main area is a terminal window titled "Terminal". The terminal shows the following command-line session:

```
ammu@ammu-VirtualBox: ~/Desktop
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

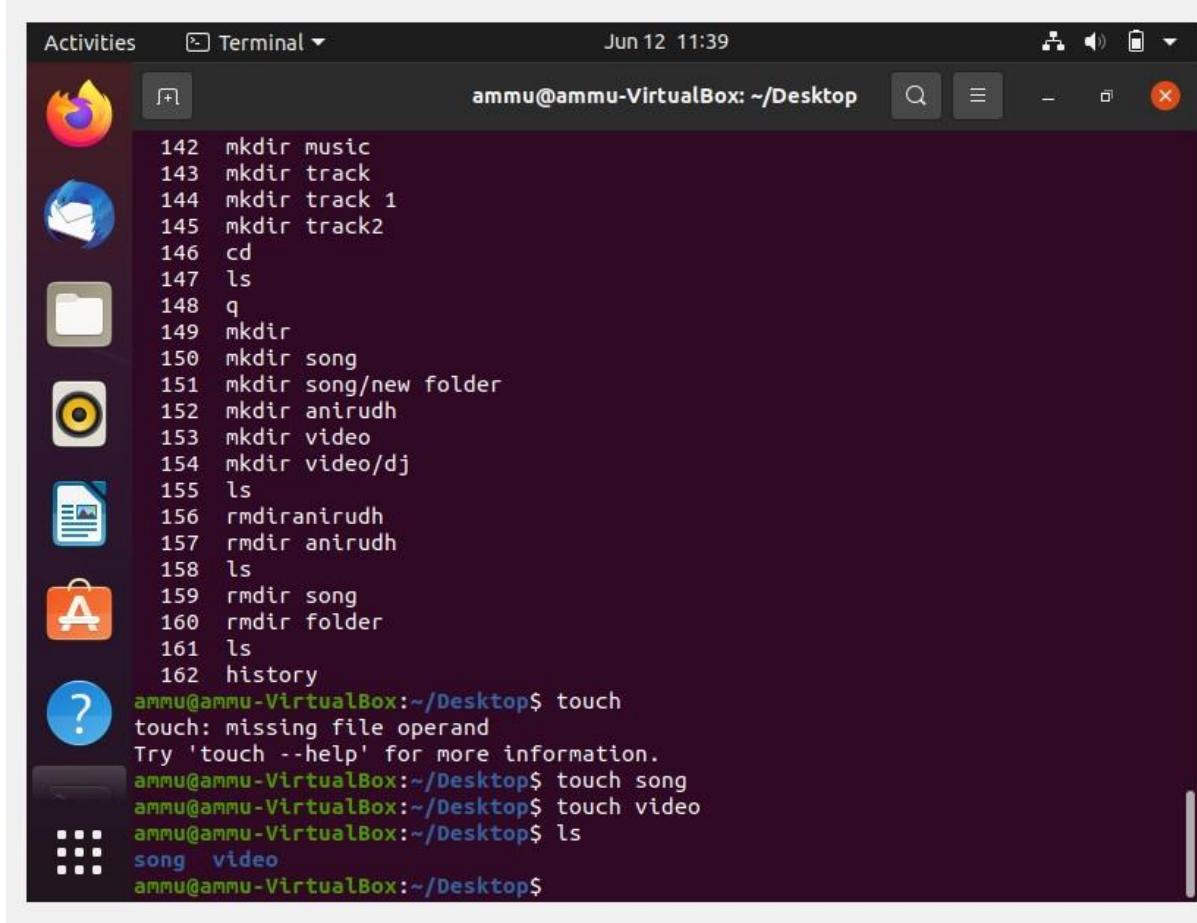
ammu@ammu-VirtualBox:~/Desktop$ mkdir song
ammu@ammu-VirtualBox:~/Desktop$ mkdir song/new folder
ammu@ammu-VirtualBox:~/Desktop$ mkdir anirudh
ammu@ammu-VirtualBox:~/Desktop$ mkdir video
ammu@ammu-VirtualBox:~/Desktop$ mkdir video/dj
ammu@ammu-VirtualBox:~/Desktop$ ls
anirudh folder song video
ammu@ammu-VirtualBox:~/Desktop$ rmdir anirudh
rmdir: command not found
ammu@ammu-VirtualBox:~/Desktop$ rmdir anirudh
ammu@ammu-VirtualBox:~/Desktop$ ls
folder song video
ammu@ammu-VirtualBox:~/Desktop$ rmdir song
rmdir: failed to remove 'song': Directory not empty
ammu@ammu-VirtualBox:~/Desktop$ rmdir folder
ammu@ammu-VirtualBox:~/Desktop$ ls
song video
ammu@ammu-VirtualBox:~/Desktop$
```

8. touch

The touch command is a standard command used in UNIX/Linux operating system which is used to create, change and modify timestamps of a file.

touch avoids opening, saving, and closing the file. Instead it simply updates the dates associated with the file or directory. An updated access or modification date can be important for a variety of other programs such as backup utilities or the make command-line interface programming utility.

The touch command is a standard program for Unix/Linux operating systems, that is used to create, change and modify timestamps of a file.



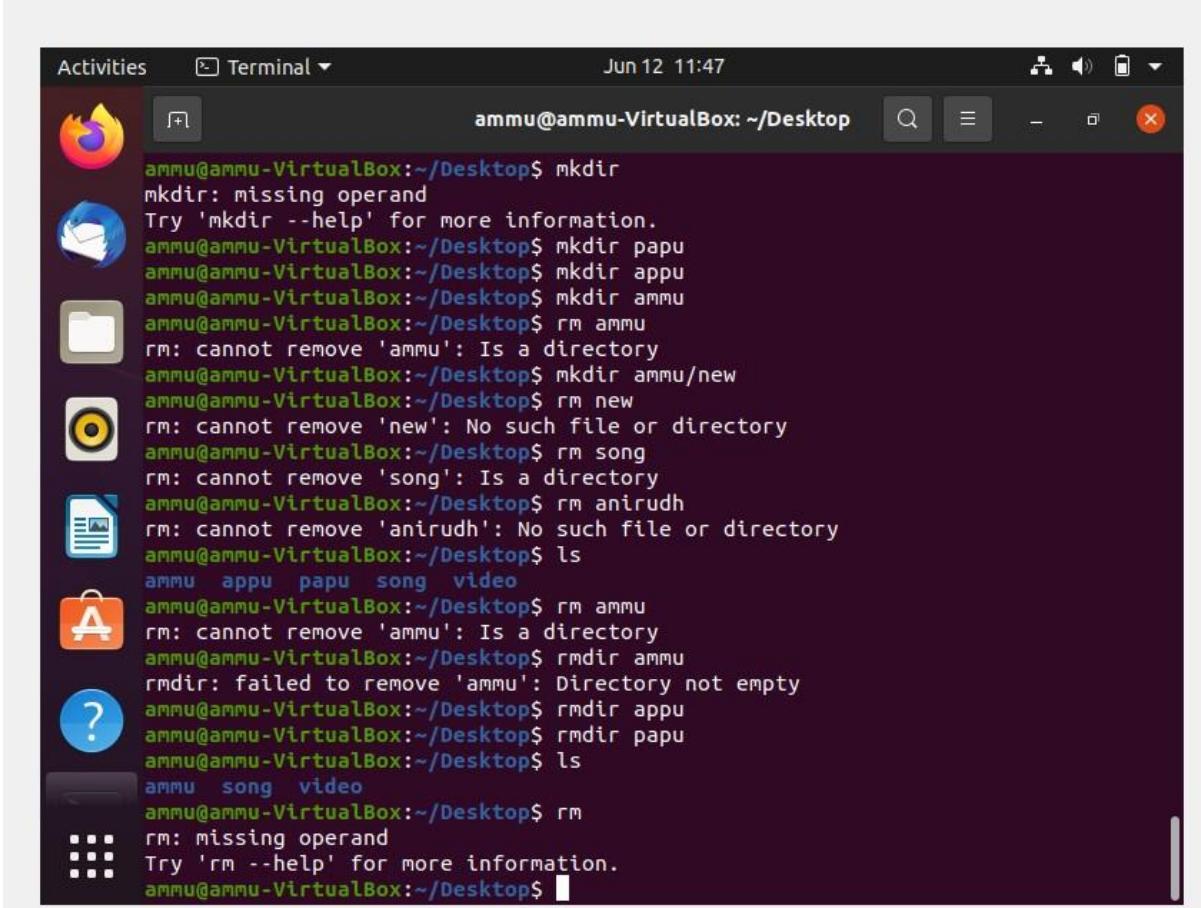
A screenshot of an Ubuntu desktop environment. On the left, there's a dock with various icons: a browser, a mail client, a file manager, a terminal, a system settings gear, and a help/question icon. The main area shows a terminal window titled "Terminal". The terminal has a dark background and displays the following command history:

```
142 mkdir music
143 mkdir track
144 mkdir track 1
145 mkdir track2
146 cd
147 ls
148 q
149 mkdir
150 mkdir song
151 mkdir song/new folder
152 mkdir anirudh
153 mkdir video
154 mkdir video/dj
155 ls
156 rmdir anirudh
157 rmdir anirudh
158 ls
159 rmdir song
160 rmdir folder
161 ls
162 history
ammu@ammu-VirtualBox:~/Desktop$ touch
touch: missing file operand
Try 'touch --help' for more information.
ammu@ammu-VirtualBox:~/Desktop$ touch song
ammu@ammu-VirtualBox:~/Desktop$ touch video
ammu@ammu-VirtualBox:~/Desktop$ ls
song  video
ammu@ammu-VirtualBox:~/Desktop$
```

9. rm

The rm command is used to delete files.

- rm -i will ask before deleting each file. Some people will have rm aliased to do this automatically (type "alias" to check). Consider using rm -I instead, which will only ask once and only if you are trying to delete three or more files.
- rm -r will recursively delete a directory and all its contents (normally rm will not delete directories, while rmdir will only delete empty directories).
- rm -f will forcibly delete files without asking; this is mostly useful if you have rm aliased to ``rm -i" but want to delete lots of files without confirming each one.



The image shows a screenshot of an Ubuntu desktop environment. On the left, there's a dock with various icons: a browser, a file manager, a terminal, a mail client, a folder, a system settings gear, a help question mark, and a dash. The main area is a terminal window titled "Terminal". The terminal shows a command-line session with the user "ammu" at "ammu@ammu-VirtualBox: ~/Desktop\$". The user runs several commands: "mkdir", "rm ammu", "rm new", "rm song", "rm anirudh", "ls", "rm ammu", "rmdir ammu", "rmdir appu", "rmdir papu", and "rm". Each command results in an error message indicating that the target is a directory or that the directory is not empty.

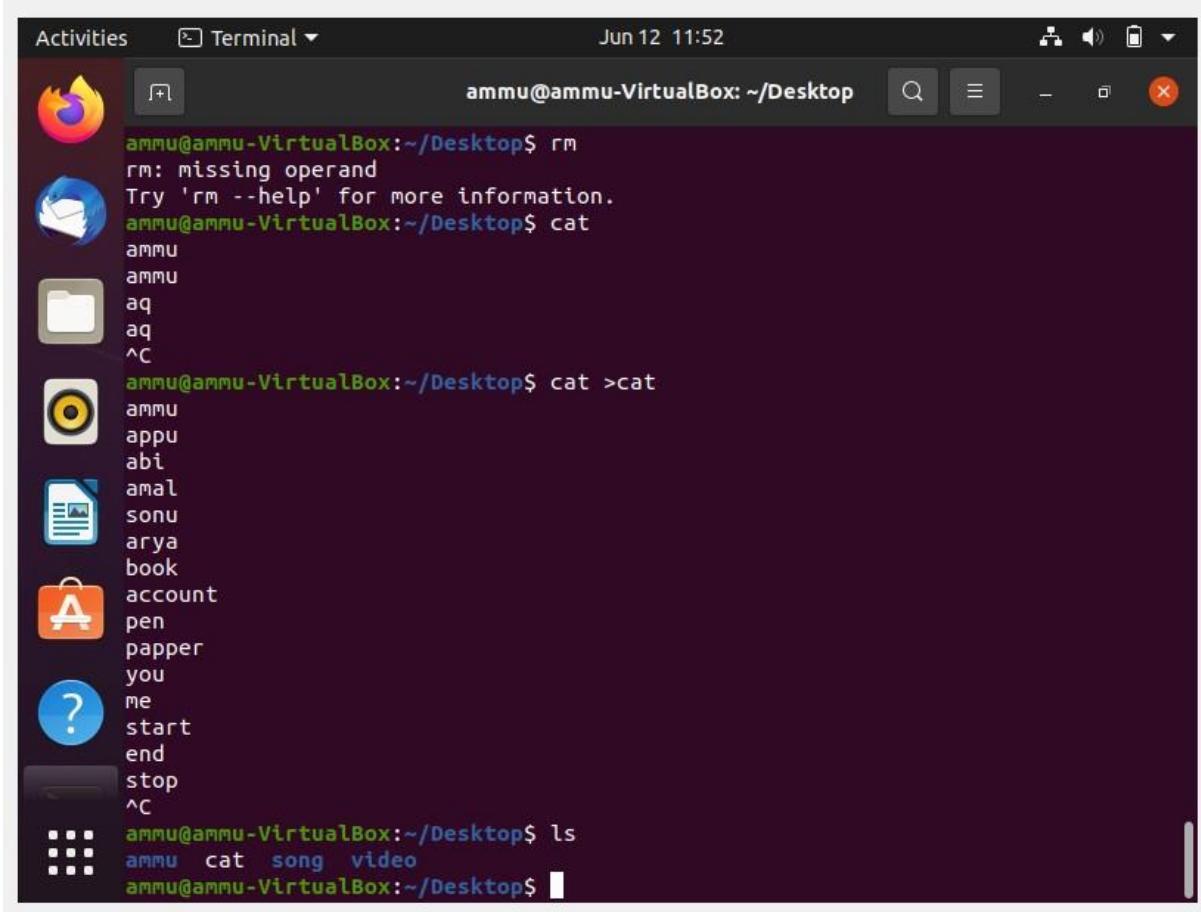
```
ammu@ammu-VirtualBox:~/Desktop$ mkdir
mkdir: missing operand
Try 'mkdir --help' for more information.
ammu@ammu-VirtualBox:~/Desktop$ mkdir papu
ammu@ammu-VirtualBox:~/Desktop$ mkdir appu
ammu@ammu-VirtualBox:~/Desktop$ mkdir ammu
ammu@ammu-VirtualBox:~/Desktop$ rm ammu
rm: cannot remove 'ammu': Is a directory
ammu@ammu-VirtualBox:~/Desktop$ mkdir ammu/new
ammu@ammu-VirtualBox:~/Desktop$ rm new
rm: cannot remove 'new': No such file or directory
ammu@ammu-VirtualBox:~/Desktop$ rm song
rm: cannot remove 'song': Is a directory
ammu@ammu-VirtualBox:~/Desktop$ rm anirudh
rm: cannot remove 'anirudh': No such file or directory
ammu@ammu-VirtualBox:~/Desktop$ ls
ammu appu papu song video
ammu@ammu-VirtualBox:~/Desktop$ rm ammu
rm: cannot remove 'ammu': Is a directory
ammu@ammu-VirtualBox:~/Desktop$ rmdir ammu
rmdir: failed to remove 'ammu': Directory not empty
ammu@ammu-VirtualBox:~/Desktop$ rmdir appu
ammu@ammu-VirtualBox:~/Desktop$ rmdir papu
ammu@ammu-VirtualBox:~/Desktop$ ls
ammu song video
ammu@ammu-VirtualBox:~/Desktop$ rm
rm: missing operand
Try 'rm --help' for more information.
ammu@ammu-VirtualBox:~/Desktop$
```

10. cat

Cat(concatenate) command is very frequently used in Linux. It reads data from the file and gives their content as output. It helps us to create, view, concatenate files. So let us see some frequently used cat commands.

If you want to add a bit of new text to an existing text file, you use the cat command to do it directly from the command line (instead of opening it in a text editor). Type the cat command followed by the double output redirection symbol (>>) and the name of the file you want to add text to.

The “cat” command in Bash stands for “concatenate”. This command is very frequently used for viewing, creating, and appending files in Linux.

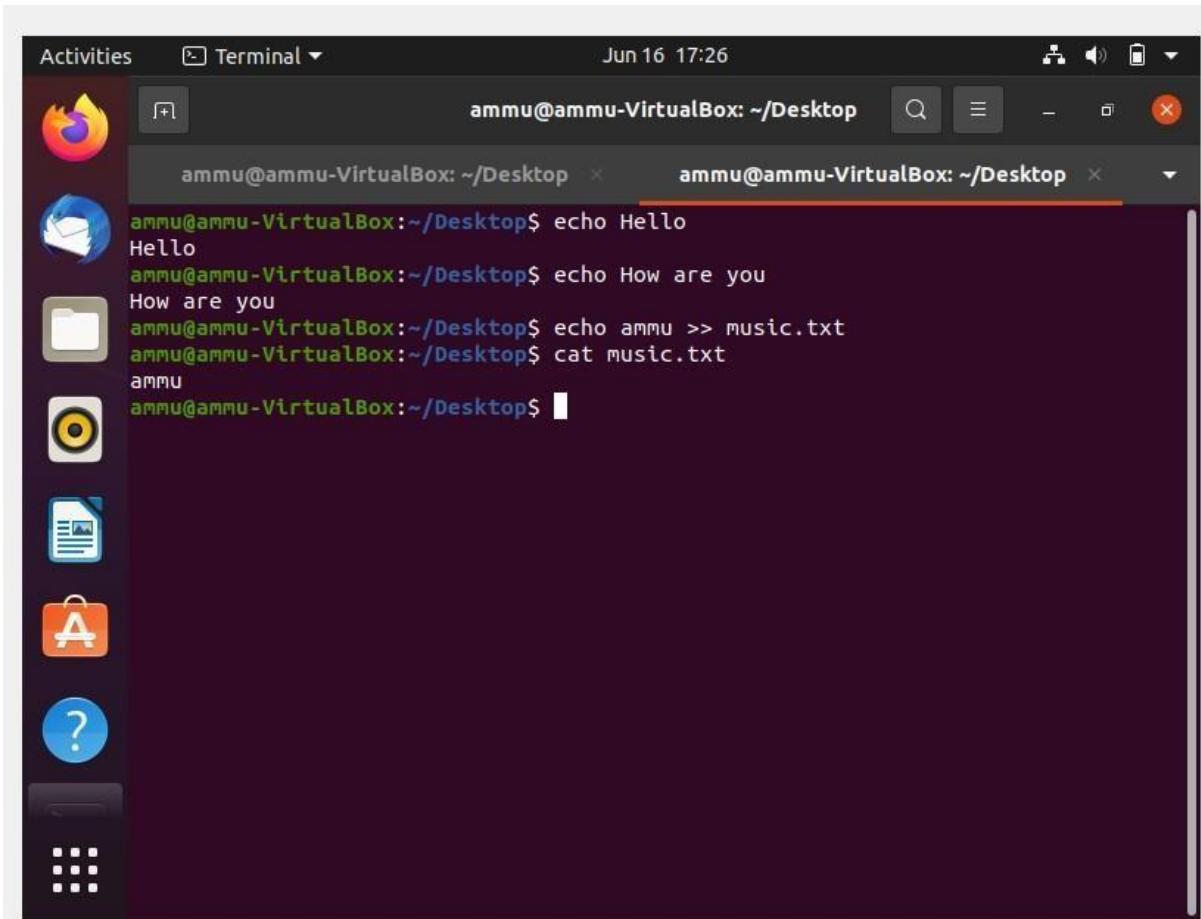


A screenshot of a Linux desktop environment showing a terminal window. The terminal window is titled "Terminal" and has the command "ammu@ammu-VirtualBox: ~/Desktop\$". The terminal shows the following session:

```
ammu@ammu-VirtualBox:~/Desktop$ rm
rm: missing operand
Try 'rm --help' for more information.
ammu@ammu-VirtualBox:~/Desktop$ cat
ammu
ammu
aq
aq
^C
ammu@ammu-VirtualBox:~/Desktop$ cat >cat
ammu
appu
abi
amal
sonu
arya
book
account
pen
papper
you
me
start
end
stop
^C
ammu@ammu-VirtualBox:~/Desktop$ ls
ammu  cat  song  video
ammu@ammu-VirtualBox:~/Desktop$
```

1. echo

echo command in linux is used to display line of text/string that are passed as an argument . This is a built in command that is mostly used in shell scripts and batch files to output status text to the screen or a file. echo is one of the most commonly and widely used built-in command for Linux bash and C shells, that typically used in scripting language and batch files to display a line of text/string on standard output or a file. The echo command writes text to standard output (stdout). The syntax of using the echo command is pretty straightforward: ... Some common usages of the echo command are piping shell variable to other commands, writing text to stdout in a shell script, and redirecting text to a file.



The screenshot shows a Linux desktop environment with a dark theme. On the left is a vertical dock containing icons for various applications: a browser (Firefox), a file manager (Nautilus), a terminal (Konsole), a file viewer (KDE File Manager), a file manager (Nemo), a help center (Manjaro Help), and a system settings icon. The main window is a terminal window titled "Terminal". The title bar also shows the date and time: "Jun 16 17:26". The terminal window has two tabs, both labeled "ammu@ammu-VirtualBox: ~/Desktop". The current tab is active and displays the following command-line session:

```
ammu@ammu-VirtualBox:~/Desktop$ echo Hello
Hello
ammu@ammu-VirtualBox:~/Desktop$ echo How are you
How are you
ammu@ammu-VirtualBox:~/Desktop$ echo ammu >> music.txt
ammu@ammu-VirtualBox:~/Desktop$ cat music.txt
ammu
```

2.

head

The head command is a command-line utility for outputting the first part of files given to it via standard input. It writes results to standard output. By default head returns the first ten lines of each file that it is given. head is used to print the first ten lines (by default) or any other amount specified of a file or files. cat , on the other hand, is used to read a file sequentially and print it to the standard output (that is, it prints out the entire contents of the file).

Enter the head command, followed by the file of which you'd like to view: head /etc/passwd

To change the number of lines displayed, use the -n option: head -n 5 /etc/passwd

Activities Terminal Jun 16 17:33

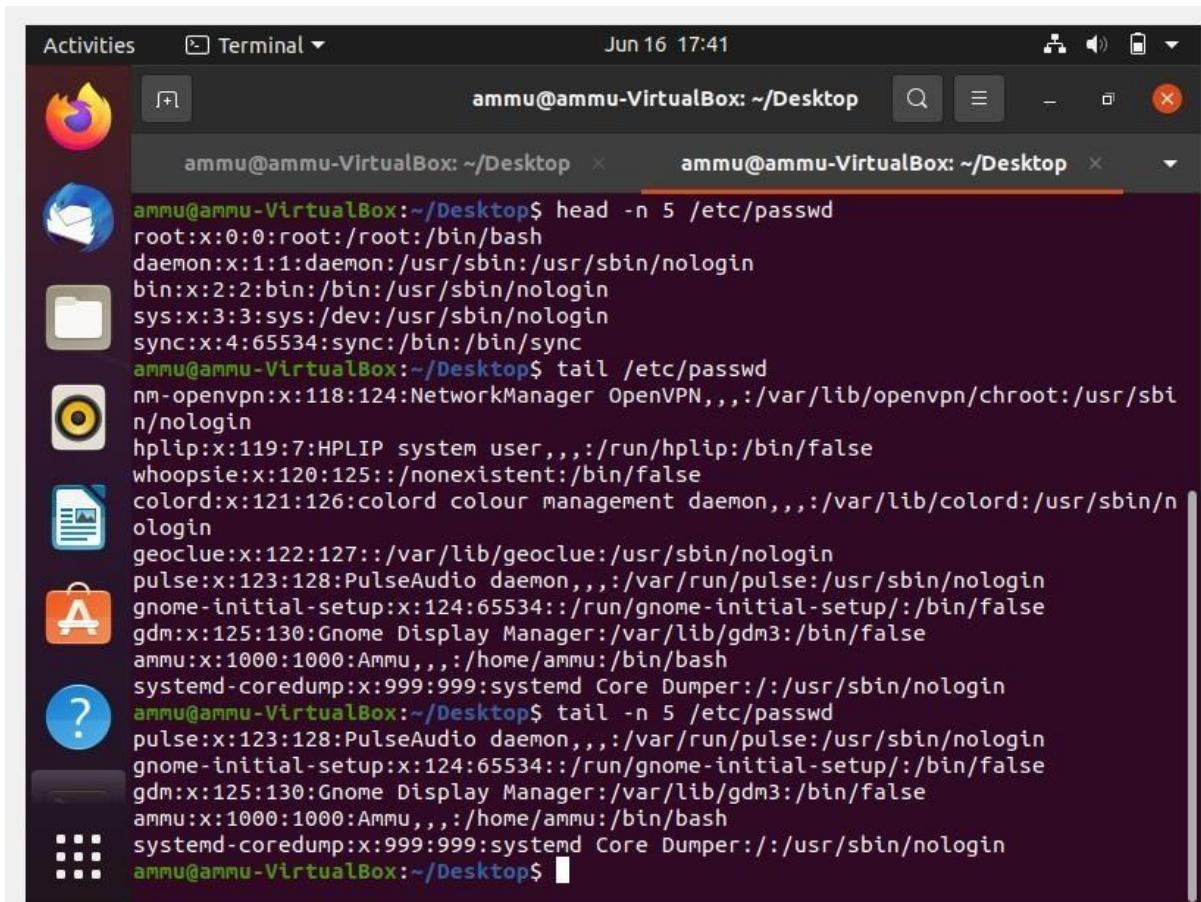
```
ammu@ammu-VirtualBox: ~/Desktop
ammu@ammu-VirtualBox: ~/Desktop × ammu@ammu-VirtualBox: ~/Desktop ×
ammu@ammu-VirtualBox:~/Desktop$ echo Hello
Hello
ammu@ammu-VirtualBox:~/Desktop$ echo How are you
How are you
ammu@ammu-VirtualBox:~/Desktop$ echo ammu >> music.txt
ammu@ammu-VirtualBox:~/Desktop$ cat music.txt
ammu
ammu@ammu-VirtualBox:~/Desktop$ head /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
ammu@ammu-VirtualBox:~/Desktop$ head -n 5 /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
ammu@ammu-VirtualBox:~/Desktop$
```

tail

The tail command, as the name implies, prints the last N number of data of the given input. By default it prints the last 10 lines of the specified files. If more than one file name is provided then data from each file is preceded by its file name. tail has two special command line option -f and -F (follow) that allows a file to be monitored. Instead of just displaying the last few lines and exiting, tail displays the lines and then monitors the file. As new lines are added to the file by another process, tail updates the display.

Enter the tail command, followed by the file you'd like to view: tail /etc/passwd

To change the number of lines displayed, use the -n option: tail -n 5 /etc/passwd



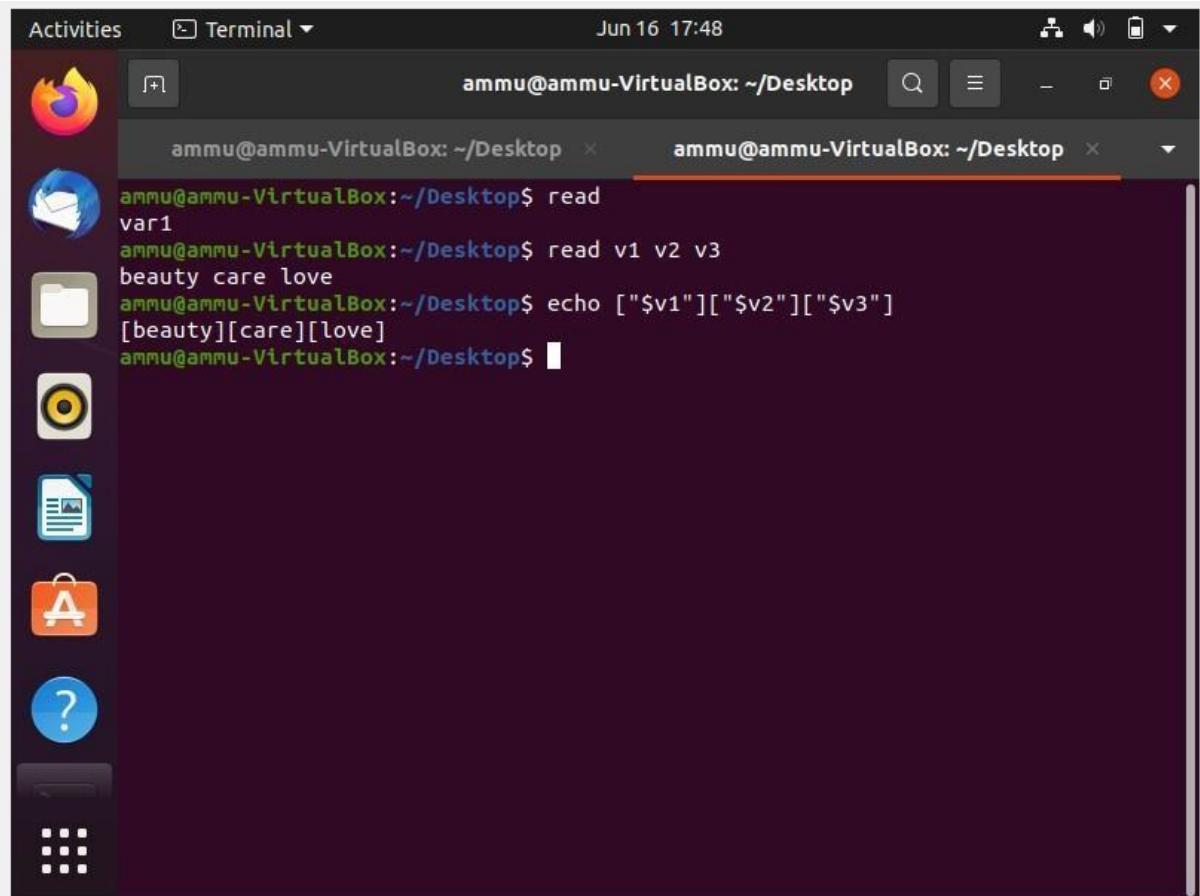
A screenshot of a Linux desktop environment showing a terminal window. The terminal window title is "Terminal". The terminal content shows the output of the "tail" command on the "/etc/passwd" file. The output lists various system users and their details. The terminal window is part of a desktop interface with icons for a browser, email, file manager, and other applications.

```
ammu@ammu-VirtualBox:~/Desktop$ head -n 5 /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
ammu@ammu-VirtualBox:~/Desktop$ tail /etc/passwd
nm-openvpn:x:118:124:NetworkManager OpenVPN,,,:/var/lib/openvpn/chroot:/usr/sbin/nologin
hplip:x:119:7:HPLIP system user,,,:/run/hplip:/bin/false
whoopsie:x:120:125::/nonexistent:/bin/false
colord:x:121:126:colord colour management daemon,,,:/var/lib/colord:/usr/sbin/nologin
geoclue:x:122:127::/var/lib/geoclue:/usr/sbin/nologin
pulse:x:123:128:PulseAudio daemon,,,:/var/run/pulse:/usr/sbin/nologin
gnome-initial-setup:x:124:65534::/run/gnome-initial-setup/:/bin/false
gdm:x:125:130:Gnome Display Manager:/var/lib/gdm3:/bin/false
ammu:x:1000:1000:Ammu,,,:/home/ammu:/bin/bash
systemd-coredump:x:999:999:systemd Core Dumper:/:/usr/sbin/nologin
ammu@ammu-VirtualBox:~/Desktop$ tail -n 5 /etc/passwd
pulse:x:123:128:PulseAudio daemon,,,:/var/run/pulse:/usr/sbin/nologin
gnome-initial-setup:x:124:65534::/run/gnome-initial-setup/:/bin/false
gdm:x:125:130:Gnome Display Manager:/var/lib/gdm3:/bin/false
ammu:x:1000:1000:Ammu,,,:/home/ammu:/bin/bash
systemd-coredump:x:999:999:systemd Core Dumper:/:/usr/sbin/nologin
ammu@ammu-VirtualBox:~/Desktop$
```

read

read command in Linux system is used to read from a file descriptor. Basically, this command read up the total number of bytes from the specified file descriptor into the buffer. If the number or count is zero then this command may detect the errors. But on success, it returns the number of bytes read.

Read is a bash builtin command that reads the contents of a line into a variable. It allows for word splitting that is tied to the special shell variable IFS. It is primarily used for catching user input but can be used to implement functions taking input from standard input.

A screenshot of a Linux desktop environment. On the left is a vertical dock with icons for various applications: a browser, file manager, terminal, system settings, and others. The main window is a terminal titled "Terminal" with the command line "Terminal". The terminal window shows the following bash session:

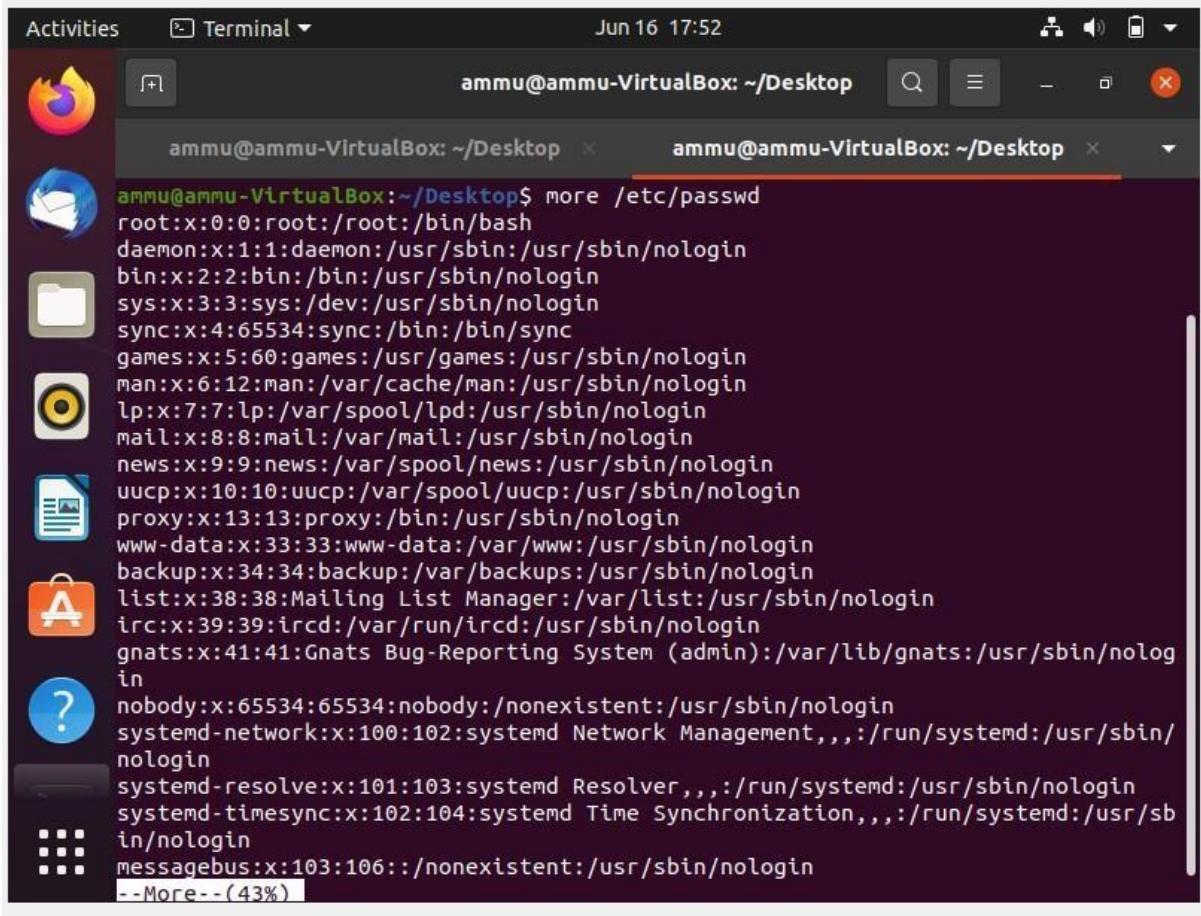
```
ammu@ammu-VirtualBox: ~/Desktop$ read  
var1  
ammu@ammu-VirtualBox: ~/Desktop$ read v1 v2 v3  
beauty care love  
ammu@ammu-VirtualBox: ~/Desktop$ echo ["$v1"] ["$v2"] ["$v3"]  
[beauty][care][love]  
ammu@ammu-VirtualBox: ~/Desktop$
```

more

more command is used to view the text files in the command prompt, displaying one screen at a time in case the file is large (For example log files). The more command also allows the user do scroll up and down through the page. The syntax along with options and command is as follows. Another application of more is to use it with some other command after a pipe. When the output is large, we can use more command to see output one by one.

```
more [-options] [-num] [+pattern] [+linenum] [file_name]
```

- [-options]: any option that you want to use in order to change the way the file is displayed. Choose any one from the followings: (-d, -l, -f, -p, -c, -s, -u)
- [-num]: type the number of lines that you want to display per screen.
- [+pattern]: replace the pattern with any string that you want to find in the text file.
- [+linenum]: use the line number from where you want to start displaying the text content.
- [file_name]: name of the file containing the text that you want to display on the screen.



The screenshot shows a Linux desktop environment with a terminal window open. The terminal window title is "ammu@ammu-VirtualBox: ~/Desktop". The terminal displays the output of the command "more /etc/passwd". The output lists various system users and their details, such as root, daemon, bin, sys, sync, games, man, lp, mail, news, uucp, proxy, www-data, backup, list, irc, gnats, nobody, and several systemd services. The terminal window has a dark background with light-colored text. The desktop interface includes a dock with icons for a browser, file manager, terminal, and other applications.

```
ammu@ammu-VirtualBox:~/Desktop$ more /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
proxy:x:13:13:proxy:/bin:/usr/sbin/nologin
www-data:x:33:33:www-data:/var/www:/usr/sbin/nologin
backup:x:34:34:backup:/var/backups:/usr/sbin/nologin
list:x:38:38:Mailing List Manager:/var/list:/usr/sbin/nologin
irc:x:39:39:ircd:/var/run/ircd:/usr/sbin/nologin
gnats:x:41:41:Gnats Bug-Reporting System (admin):/var/lib/gnats:/usr/sbin/nologin
nobody:x:65534:65534:nobody:/nonexistent:/usr/sbin/nologin
systemd-network:x:100:102:systemd Network Management,,,:/run/systemd:/usr/sbin/nologin
systemd-resolve:x:101:103:systemd Resolver,,,:/run/systemd:/usr/sbin/nologin
systemd-timesync:x:102:104:systemd Time Synchronization,,,:/run/systemd:/usr/sbin/nologin
messagebus:x:103:106::/nonexistent:/usr/sbin/nologin
--More-- (43%)
```

6. less

Less command is linux utility which can be used to read contents of text file one page(one screen) per time. It has faster access because if file is large, it don't access complete file, but access it page by page.

For example, if it's a large file and you are reading it using any text editor, then the complete file will be loaded to main memory, but less command don't load entire file, but load it part by part, which makes it faster.

mostly used Options :

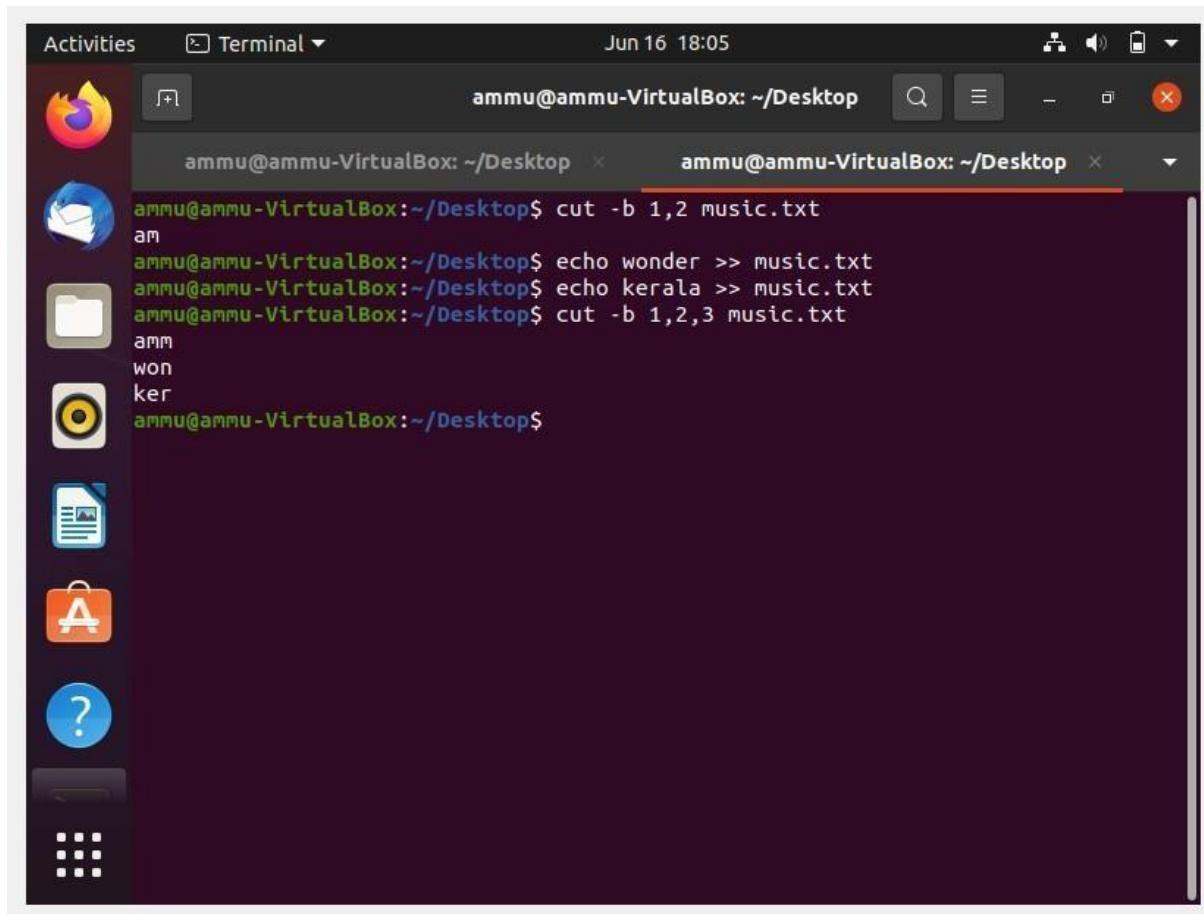
- -E : causes less to automatically exit the first time it reaches end of file.
- -f : forces non-regular file to open.
- -F : causes less to exit if entire file can be displayed on first screen
- -g : highlight the string which was found by last search command

- -G : suppresses all highlighting of strings found by search commands
- -i : cause searches to ignore case
- -n : suppresses line numbers
- -p pattern : it tells less to start at the first occurrence of pattern in the file
- -s : causes consecutive blank lines to be squeezed into a single blank line

```
ammu@ammu-VirtualBox: ~/Desktop
ammu@ammu-VirtualBox: ~/Desktop
tcpdump:x:108:115::/nonexistent:/usr/sbin/nologin
avahi-autoipd:x:109:116:Avahi autoip daemon,,,:/var/lib/avahi-autoipd:/usr/sbin/nologin
usbmux:x:110:46:usbmux daemon,,,:/var/lib/usbmux:/usr/sbin/nologin
rtkit:x:111:117:RealtimeKit,,,:/proc:/usr/sbin/nologin
dnsmasq:x:112:65534:dnsmasq,,,:/var/lib/misc:/usr/sbin/nologin
cups-pk-helper:x:113:120:user for cups-pk-helper service,,,:/home/cups-pk-helper
r:/usr/sbin/nologin
speech-dispatcher:x:114:29:Speech Dispatcher,,,:/run/speech-dispatcher:/bin/false
avahi:x:115:121:Avahi mDNS daemon,,,:/var/run/avahi-daemon:/usr/sbin/nologin
kernoops:x:116:65534:Kernel Oops Tracking Daemon,,,:/:/usr/sbin/nologin
saned:x:117:123::/var/lib/saned:/usr/sbin/nologin
nm-openvpn:x:118:124:NetworkManager OpenVPN,,,:/var/lib/openvpn/chroot:/usr/sbin/nologin
hplip:x:119:7:HPLIP system user,,,:/run/hplip:/bin/false
whoopsie:x:120:125::/nonexistent:/bin/false
colord:x:121:126:colord colour management daemon,,,:/var/lib/colord:/usr/sbin/nologin
geoclue:x:122:127::/var/lib/geoclue:/usr/sbin/nologin
pulse:x:123:128:PulseAudio daemon,,,:/var/run/pulse:/usr/sbin/nologin
gnome-initial-setup:x:124:65534::/run/gnome-initial-setup/:/bin/false
gdm:x:125:130:Gnome Display Manager:/var/lib/gdm3:/bin/false
ammu:x:1000:1000:Ammu,,,:/home/ammu:/bin/bash
systemd-coredump:x:999:999:systemd Core Dumper:/:/usr/sbin/nologin
(END)
```

7. cut

The cut command in linux is a command for cutting out the sections from each line of files and writing the result to standard output. It can be used to cut parts of a line by byte position, character and field. Basically the cut command slices a line and extracts the text. It is necessary to specify option with command otherwise it gives error. If more than one file name is provided then data from each file is not preceded by its file name.



A screenshot of a Linux desktop environment, likely Ubuntu, showing a terminal window. The terminal window has two tabs open, both titled "ammu@ammu-VirtualBox: ~/Desktop". The first tab contains the command history:

```
ammu@ammu-VirtualBox:~/Desktop$ cut -b 1,2 music.txt
am
ammu@ammu-VirtualBox:~/Desktop$ echo wonder >> music.txt
ammu@ammu-VirtualBox:~/Desktop$ echo kerala >> music.txt
ammu@ammu-VirtualBox:~/Desktop$ cut -b 1,2,3 music.txt
amm
won
ker
ammu@ammu-VirtualBox:~/Desktop$
```

8. paste

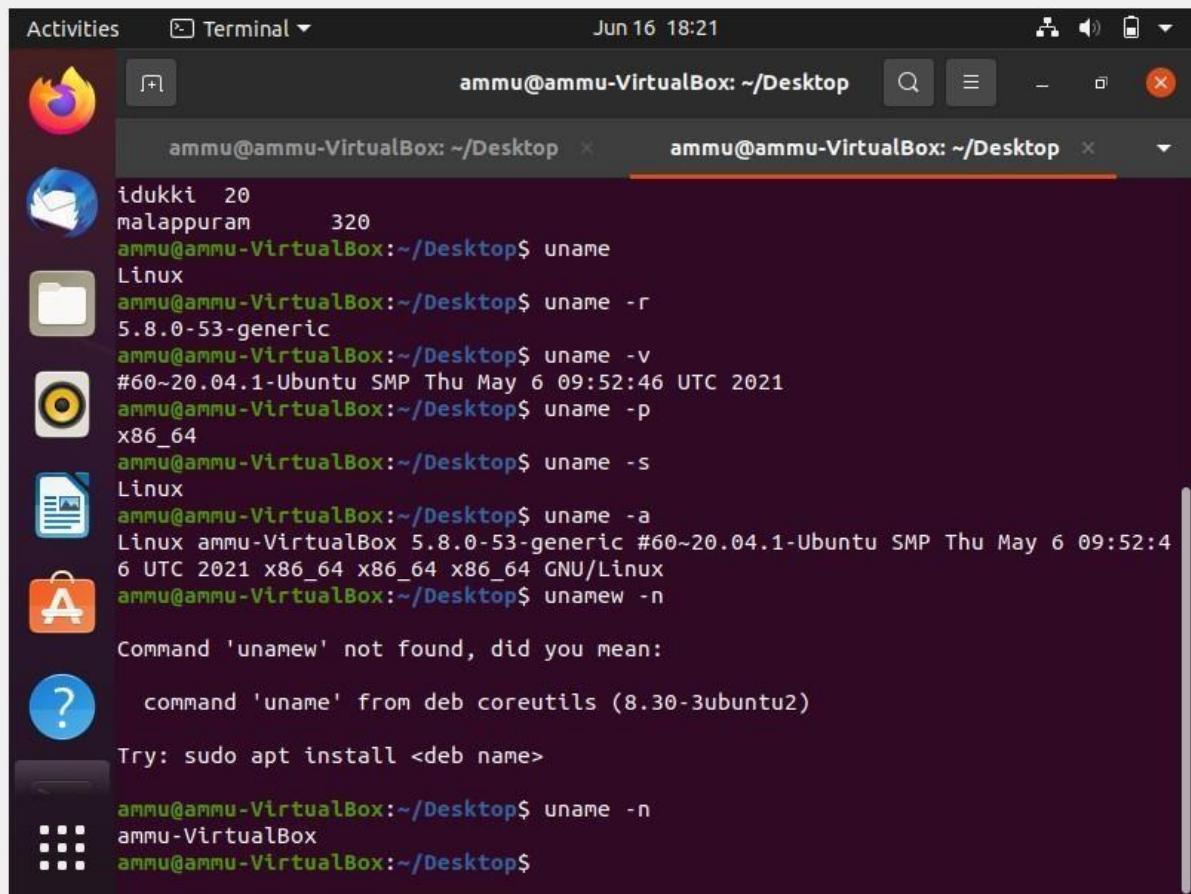
Paste is a command that allows you to insert data from the clipboard into an application. The Paste command is most commonly used to copy text from one area to another. For example, you can copy a paragraph from a text document and paste it into an email message.

```
ammu@ammu-VirtualBox: ~/Desktop$ paste kerala.txt
thrissur
kochi
palakkad
kottayam
idukki
malappuram
ammu@ammu-VirtualBox:~/Desktop$ paste  num.txt
12
50
200
20
320
ammu@ammu-VirtualBox:~/Desktop$ paste kerala.txt num.txt
thrissur
kochi 12
palakkad      50
kottayam      200
idukki 20
malappuram    320
ammu@ammu-VirtualBox:~/Desktop$
```

9. uname

Uname command is used to display basic information about the operating system and hardware. With options, Uname prints kernel details, and system architecture. Uname is the short name for 'UNIX name'. Uname command works on all Linux and Unix like operating systems. uname is a command-line utility that prints basic information about the operating system name and system hardware.

The uname() function returns a string naming the current system in the character array sysname. The arrays release and version further identify the operating system. The array machine contains a name that identifies the hardware that the system is running on.



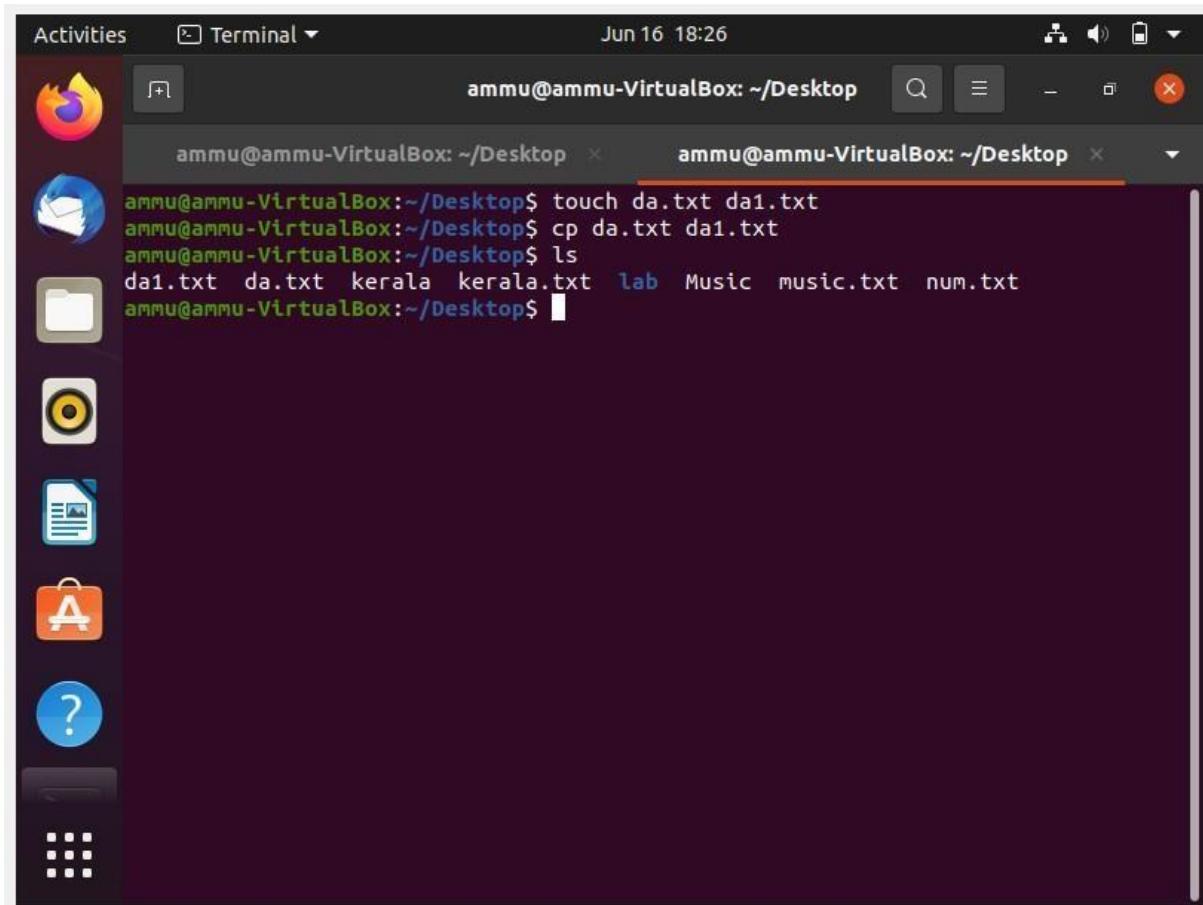
The image shows a screenshot of an Ubuntu desktop environment. In the top left corner, there's an 'Activities' button and a 'Terminal' button with a dropdown arrow. The top right corner displays the date and time as 'Jun 16 18:21'. Below the header, there are two terminal tabs both titled 'ammu@ammu-VirtualBox: ~/Desktop'. The left tab is faded, while the right tab is active and has an orange border. The terminal window contains the following command history:

```
ammu@ammu-VirtualBox: ~/Desktop
ammu@ammu-VirtualBox: ~/Desktop
idukki 20
malappuram 320
ammu@ammu-VirtualBox:~/Desktop$ uname
Linux
ammu@ammu-VirtualBox:~/Desktop$ uname -r
5.8.0-53-generic
ammu@ammu-VirtualBox:~/Desktop$ uname -v
#60~20.04.1-Ubuntu SMP Thu May 6 09:52:46 UTC 2021
ammu@ammu-VirtualBox:~/Desktop$ uname -p
x86_64
ammu@ammu-VirtualBox:~/Desktop$ uname -s
Linux
ammu@ammu-VirtualBox:~/Desktop$ uname -a
Linux ammu-VirtualBox 5.8.0-53-generic #60~20.04.1-Ubuntu SMP Thu May 6 09:52:46
6 UTC 2021 x86_64 x86_64 x86_64 GNU/Linux
ammu@ammu-VirtualBox:~/Desktop$ unamew -n
Command 'unamew' not found, did you mean:
  command 'uname' from deb coreutils (8.30-3ubuntu2)
Try: sudo apt install <deb name>
ammu@ammu-VirtualBox:~/Desktop$ uname -n
ammu-VirtualBox
ammu@ammu-VirtualBox:~/Desktop$
```

10. cp

cp stands for copy. This command is used to copy files or group of files or directory. It creates an exact image of a file on a disk with different file name. cp command require at least two filenames in its arguments. Third syntax is used to copy multiple Sources(files) to Directory.

'cp' means copy. 'cp' command is used to copy a file or a directory. To copy a file into the same directory syntax will be, `cp <existing file name> <new file name>`

A screenshot of an Ubuntu desktop environment. On the left, there's a vertical dock with icons for various applications like the Dash, Home, and System Settings. In the center, a terminal window is open with a dark purple background. The terminal shows a command-line session:

```
ammu@ammu-VirtualBox: ~/Desktop$ touch da.txt da1.txt
ammu@ammu-VirtualBox: ~/Desktop$ cp da.txt da1.txt
ammu@ammu-VirtualBox: ~/Desktop$ ls
da1.txt da.txt kerala kerala.txt lab Music music.txt num.txt
ammu@ammu-VirtualBox: ~/Desktop$
```

The terminal window has a title bar with two tabs, both labeled "ammu@ammu-VirtualBox: ~/Desktop". The status bar at the top right shows the date and time: "Jun 16 18:26".

A terminal window showing a command-line session. The user has created two files, "da.txt" and "da1.txt", copied "da.txt" to "da1.txt", and then listed the contents of the directory, which includes "da1.txt", "da.txt", "kerala", "kerala.txt", "lab", "Music", "music.txt", and "num.txt".

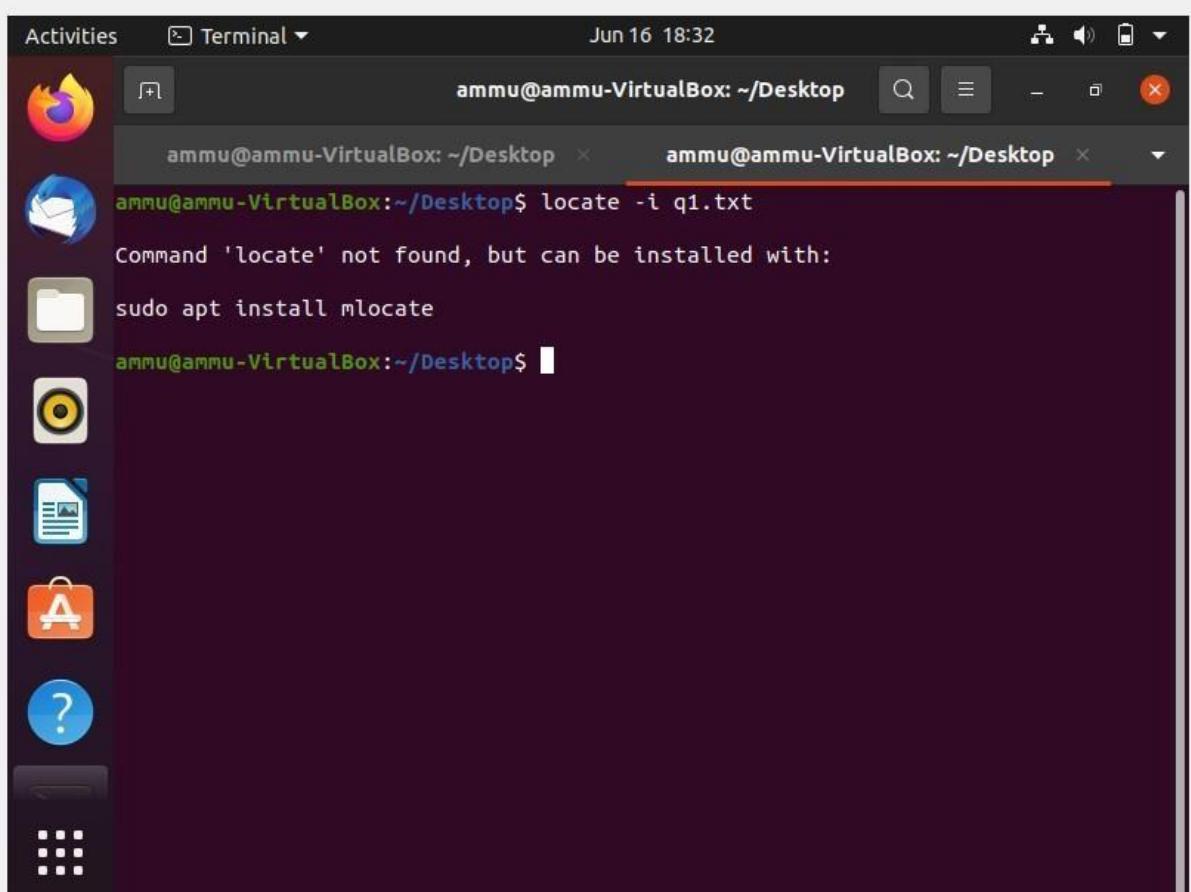
11. locate

To use locate, open a terminal and type locate followed by the file name you are looking for. In this example, I'm searching for files that contain the word 'sunny' in their name. Locate can also tell you how many times a search keyword is matched in the database.

Command. locate is a Unix utility which serves to find files on filesystems. It searches through a prebuilt database of files generated by the updatedb command or by a daemon and compressed using incremental encoding. It operates significantly faster than find , but requires regular updating of the database.

Try using this command: sudo apt-get install locate . – ...

For the future: if you're looking for a program and don't know the package, install apt-file: sudo apt-get install apt-file and search for the program using apt-file: apt-file search /usr/bin/locate .

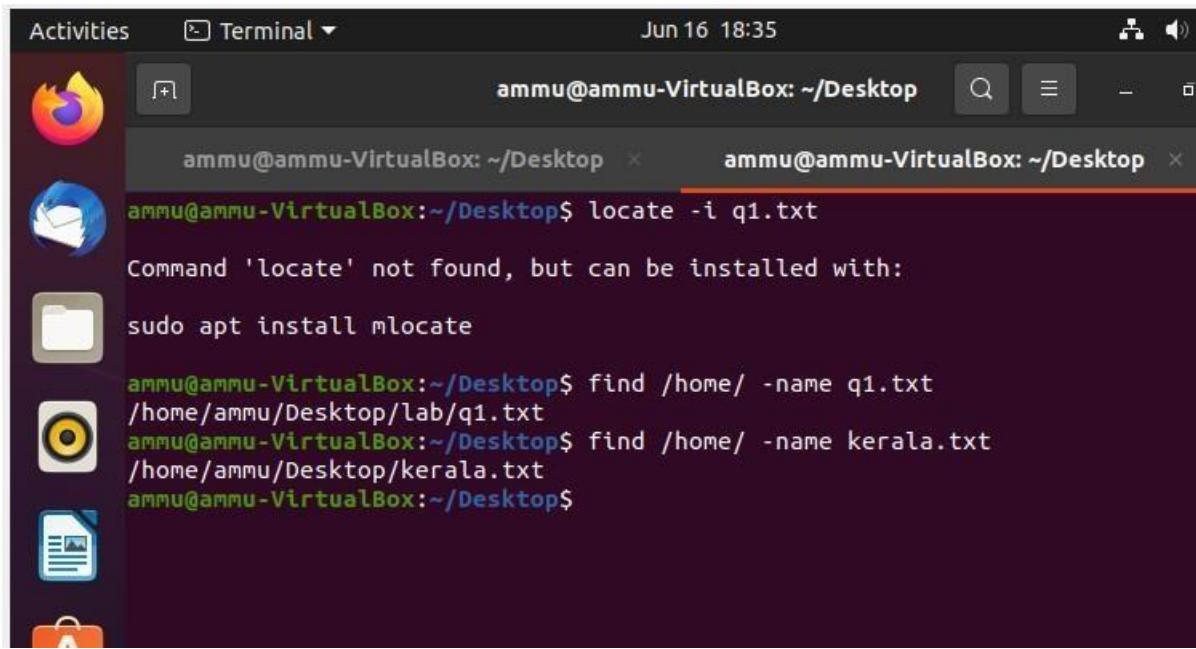


The image shows a screenshot of an Ubuntu desktop environment. On the left, there's a vertical dock with icons for various applications: a browser (Firefox), a file manager (Nautilus), a terminal (Terminal), a mail client (Evolution), a file viewer (Thunar), a file manager (Nautilus), a help center (Ubuntu Help), and a system settings icon. The main area is a terminal window titled "Terminal". The terminal shows the command "locate -i q1.txt" being run, followed by a message indicating that the command was not found but could be installed via "sudo apt install mlocate".

```
ammu@ammu-VirtualBox: ~/Desktop$ locate -i q1.txt
Command 'locate' not found, but can be installed with:
sudo apt install mlocate
ammu@ammu-VirtualBox:~/Desktop$
```

12. find

The `find` command is one of the most powerful tools in the Linux system administrators arsenal. It searches for files and directories in a directory hierarchy based on a user given expression and can perform user-specified action on each matched file.

A screenshot of an Ubuntu desktop environment. The terminal window shows the following command and its results:

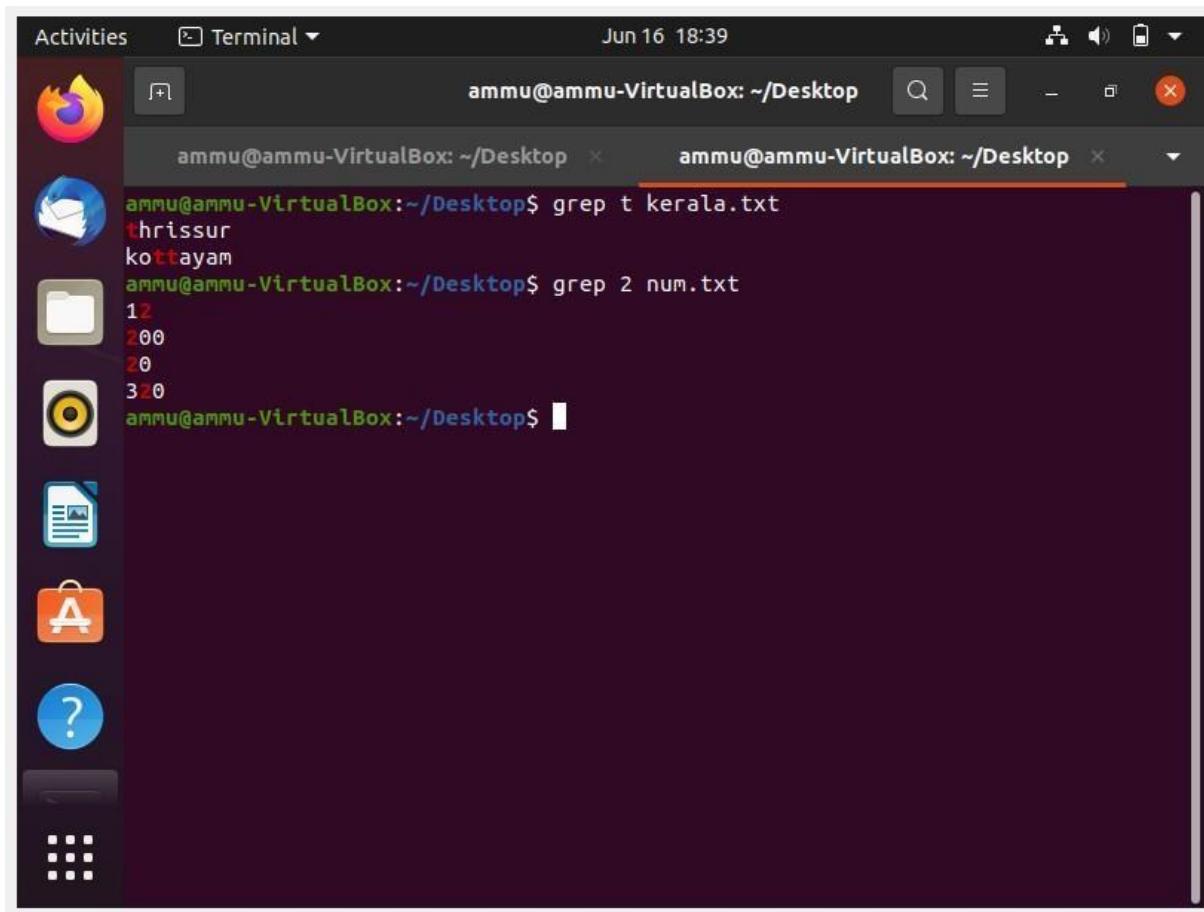
```
ammu@ammu-VirtualBox:~/Desktop$ locate -i q1.txt
Command 'locate' not found, but can be installed with:
sudo apt install mlocate
ammu@ammu-VirtualBox:~/Desktop$ find /home/ -name q1.txt
/home/ammu/Desktop/lab/q1.txt
ammu@ammu-VirtualBox:~/Desktop$ find /home/ -name kerala.txt
/home/ammu/Desktop/kerala.txt
ammu@ammu-VirtualBox:~/Desktop$
```

13. grep

To search multiple files with the grep command, insert the filenames you want to search, separated with a space character. The terminal prints the name of every file that contains the matching lines, and the actual lines that include the required string of characters. You can append as many filenames as needed.

To use the grep command in Linux

- Grep Command Syntax: grep [options] PATTERN [FILE...] ... •
Examples of using 'grep'
 - grep foo /file/name. ...
 - grep -i “foo” /file/name. ...
 - grep 'error 123' /file/name. ...
 - grep -r “192.168.1.5” /etc/ ...
 - grep -w “foo” /file/name. ...
 - egrep -w 'word1|word2' /file/name.

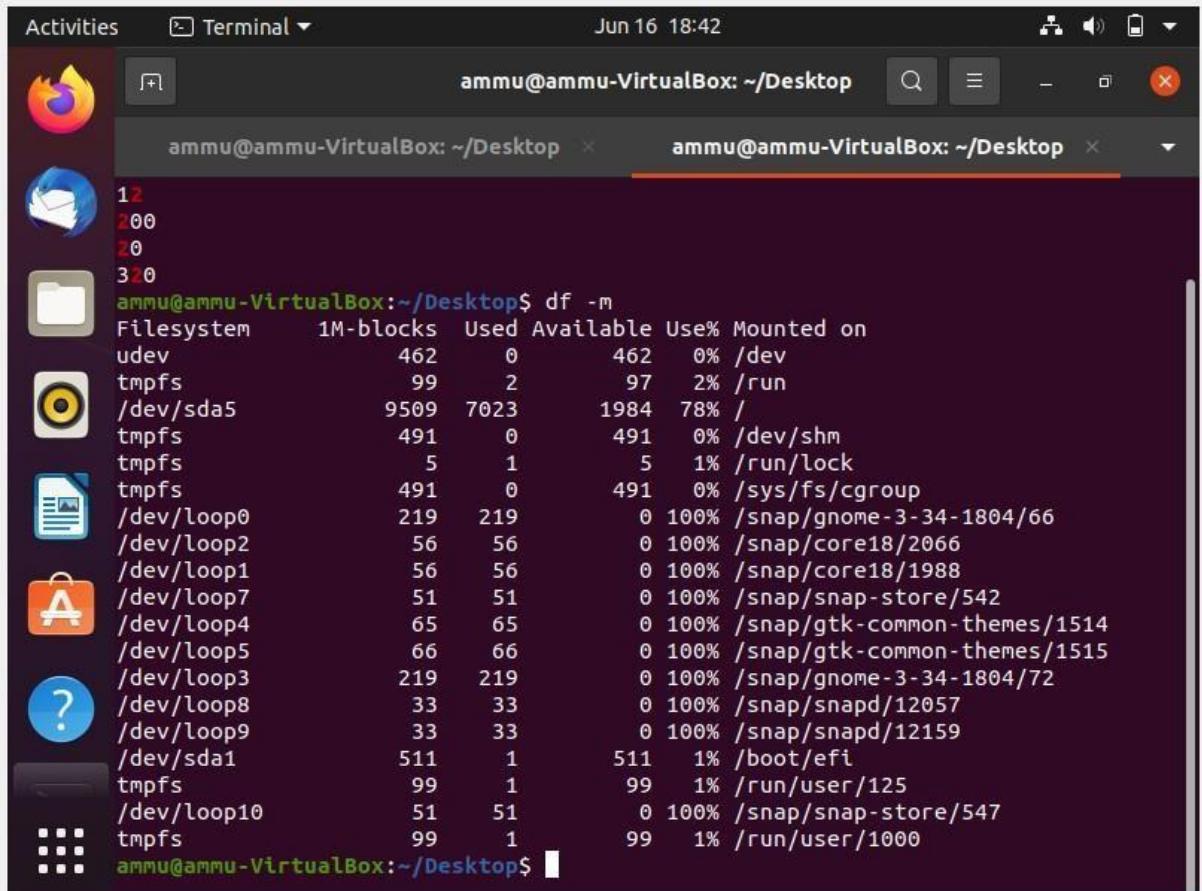


14. df

The df command (short for disk free), is used to display information related to file systems about total space and available space. If no file name is given, it displays the space available on all currently mounted file systems.

df (abbreviation for disk free) is a standard Unix command used to display the amount of available disk space for file systems on which the invoking user has appropriate read access. df is typically implemented using the statfs or statvfs system calls.

To view disk space usage run the df command. This will print a table of information to standard output. This can be useful to discover the amount of free space available on a system or filesystems. Use% - the percentage that the filesystem is in use.



The image shows a screenshot of an Ubuntu desktop environment. In the top left, there's an 'Activities' button and a 'Terminal' button. The top right shows the date 'Jun 16 18:42'. The main area is a terminal window titled 'ammu@ammu-VirtualBox: ~/Desktop'. It contains the following command and output:

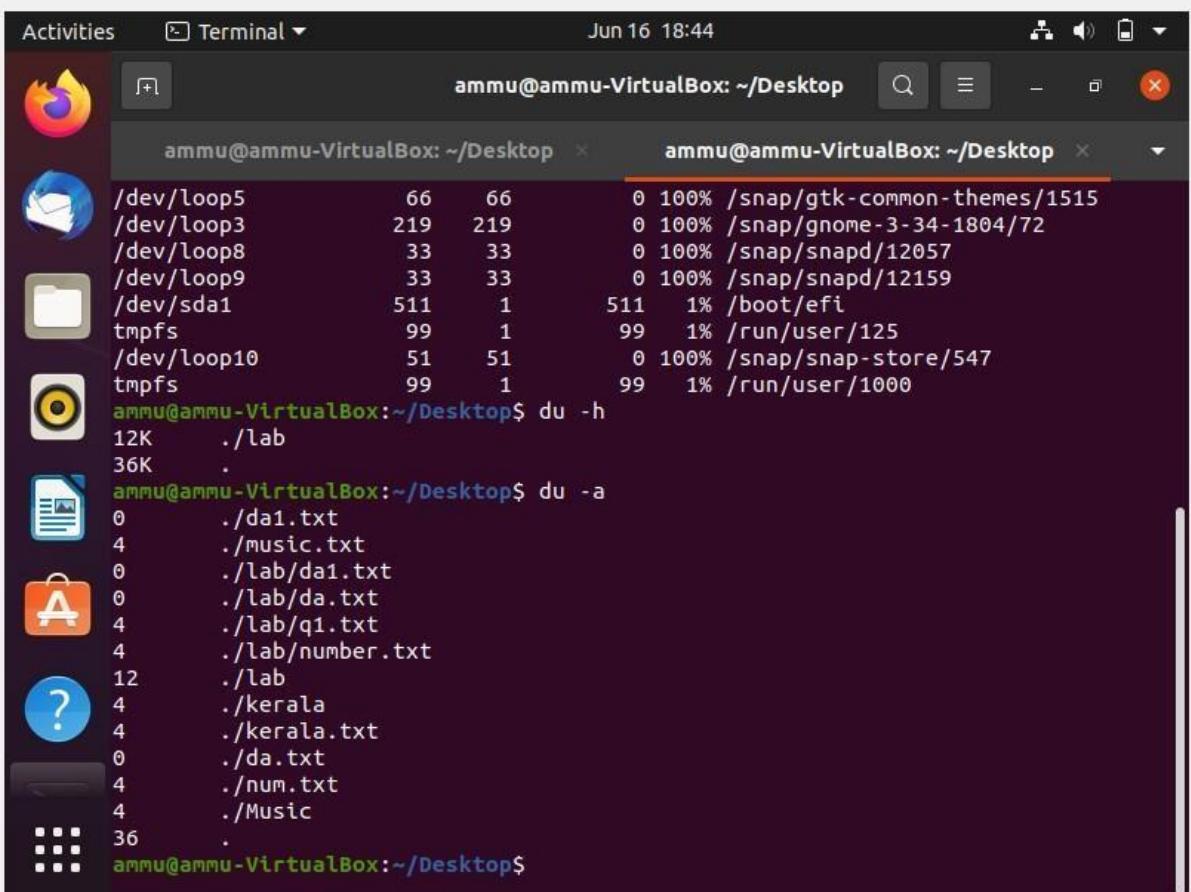
```
ammu@ammu-VirtualBox: ~/Desktop$ du -m
12
200
20
320
ammu@ammu-VirtualBox:~/Desktop$ df -m
Filesystem      1M-blocks  Used Available Use% Mounted on
udev              462     0     462   0% /dev
tmpfs              99     2     97   2% /run
/dev/sda5        9509  7023    1984  78% /
tmpfs              491     0     491   0% /dev/shm
tmpfs                5     1      5   1% /run/lock
tmpfs              491     0     491   0% /sys/fs/cgroup
/dev/loop0          219    219      0 100% /snap/gnome-3-34-1804/66
/dev/loop2           56     56      0 100% /snap/core18/2066
/dev/loop1           56     56      0 100% /snap/core18/1988
/dev/loop7           51     51      0 100% /snap/snap-store/542
/dev/loop4           65     65      0 100% /snap/gtk-common-themes/1514
/dev/loop5           66     66      0 100% /snap/gtk-common-themes/1515
/dev/loop3          219    219      0 100% /snap/gnome-3-34-1804/72
/dev/loop8           33     33      0 100% /snap/snapd/12057
/dev/loop9           33     33      0 100% /snap/snapd/12159
/dev/sda1            511     1     511   1% /boot/efi
tmpfs              99     1     99   1% /run/user/125
/dev/loop10          51     51      0 100% /snap/snap-store/547
tmpfs              99     1     99   1% /run/user/1000
ammu@ammu-VirtualBox:~/Desktop$
```

15. du

The du command is a standard Linux/Unix command that allows a user to gain disk usage information quickly. It is best applied to specific directories and allows many variations for customizing the output to meet your needs.

With no arguments, 'du' reports the disk space for the current directory. Normally the disk space is printed in units of 1024 bytes, but this can be overridden. Options -a --all Show counts for all files, not just directories.

As you may have seen that the du command in Linux outputs all the sizes of all the files. But if all you want to see is the summarized output, then you can use the -s option which stands for a summary. I'm also combining it with the -h option to view human-readable info.



A screenshot of a Linux desktop environment, likely Ubuntu, showing a terminal window. The terminal window has two tabs open, both titled "ammu@ammu-VirtualBox: ~/Desktop". The user is running the du command to check disk usage. The output shows the size of various files and directories, including system partitions like /dev/loop5, /dev/loop3, /dev/loop8, /dev/loop9, /dev/sda1, and tmpfs, as well as user-created files like ./lab, ./da1.txt, ./music.txt, etc.

```
ammu@ammu-VirtualBox: ~/Desktop$ du -h
./ 66M
./lab 12K
./da1.txt 4K
./music.txt 4K
./lab/da1.txt 0B
./lab/da.txt 4K
./lab/q1.txt 4K
./lab/number.txt 4K
./lab/lab 12K
./kerala 4K
./kerala.txt 4K
./da.txt 0B
./num.txt 4K
./Music 4K
.
36K

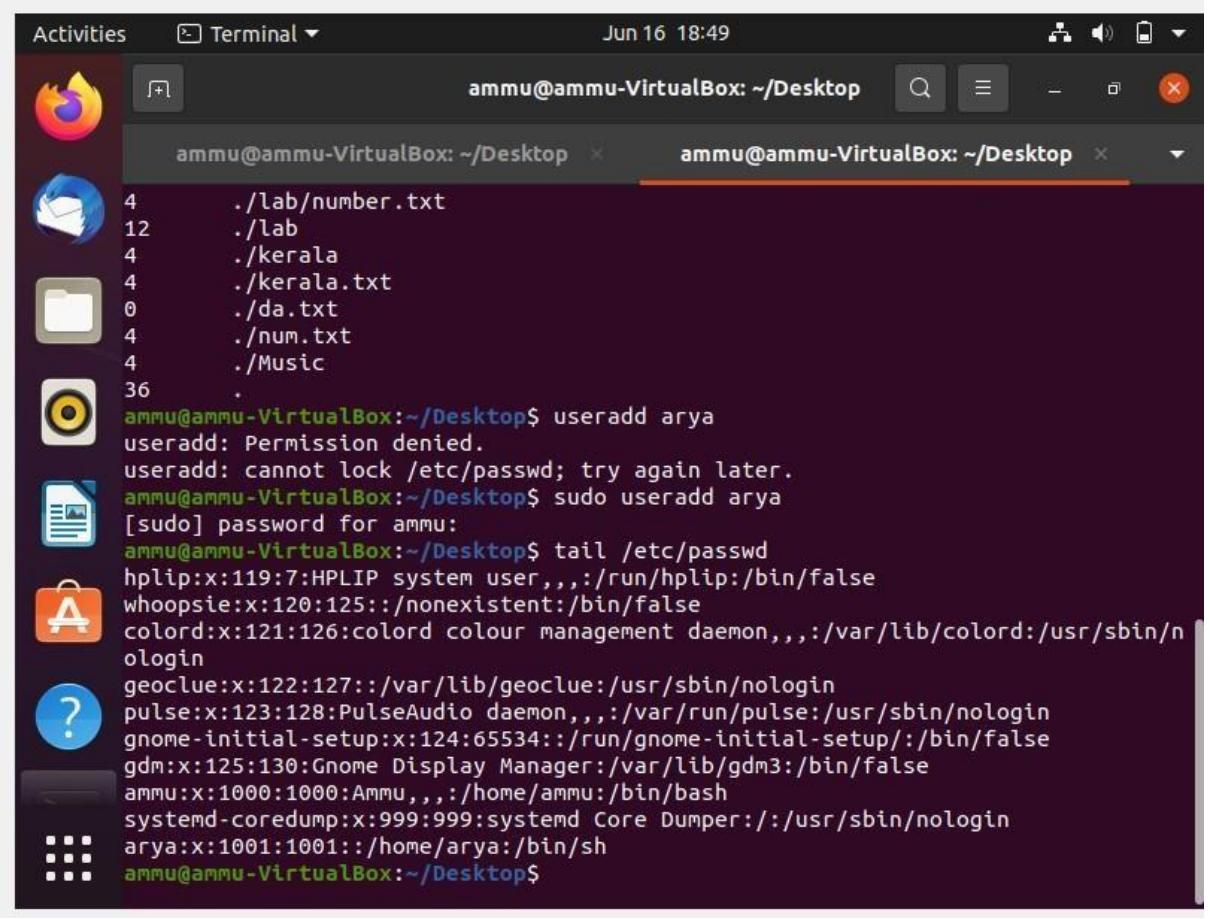
ammu@ammu-VirtualBox: ~/Desktop$ du -a
0 ./da1.txt
4 ./music.txt
0 ./lab/da1.txt
0 ./lab/da.txt
4 ./lab/q1.txt
4 ./lab/number.txt
12 ./lab
4 ./kerala
4 ./kerala.txt
0 ./da.txt
4 ./num.txt
4 ./Music
36 .

ammu@ammu-VirtualBox: ~/Desktop$
```

16. useradd

Only root or users with sudo privileges can use the useradd command to create new user accounts. When invoked, useradd creates a new user account according to the options specified on the command line and the default values set in the /etc/default/useradd file.

In Linux, a 'useradd' command is a low-level utility that is used for adding/creating user accounts in Linux and other Unix-like operating systems. The 'adduser' is much similar to useradd command, because it is just a symbolic link to it.



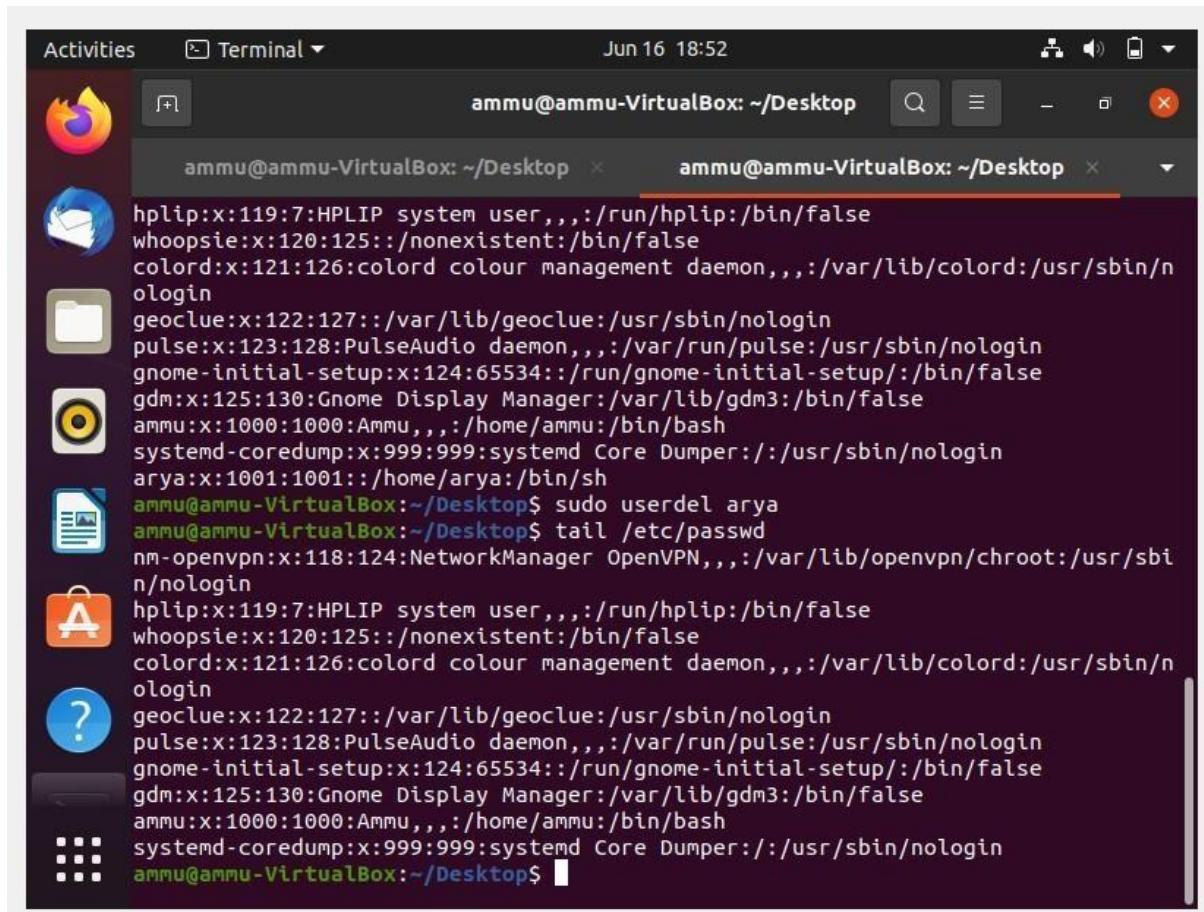
The screenshot shows a Linux desktop environment with a terminal window open. The terminal window has two tabs, both labeled "ammu@ammu-VirtualBox: ~/Desktop". The left tab shows the output of a command that lists several files: ./lab/number.txt, ./lab, ./kerala, ./kerala.txt, ./da.txt, ./num.txt, ./Music, and a final dot. The right tab shows the output of the "useradd" command being run twice. The first attempt fails with "Permission denied" and "cannot lock /etc/passwd; try again later". The second attempt succeeds after entering a password for the user "ammu". The terminal also displays the contents of the "/etc/passwd" file, which includes entries for various system users like hplip, whoopsie, colord, geoclue, pulse, gnome-initial-setup, gdm, ammu, systemd-coredump, and arya. The "ammu" entry is located at the bottom of the list.

```
4      ./lab/number.txt
12     ./lab
4      ./kerala
4      ./kerala.txt
0      ./da.txt
4      ./num.txt
4      ./Music
36     .
ammu@ammu-VirtualBox:~/Desktop$ useradd arya
useradd: Permission denied.
useradd: cannot lock /etc/passwd; try again later.
ammu@ammu-VirtualBox:~/Desktop$ sudo useradd arya
[sudo] password for ammu:
ammu@ammu-VirtualBox:~/Desktop$ tail /etc/passwd
hplip:x:119:7:HPLIP system user,,,:/run/hplip:/bin/false
whoopsie:x:120:125:::nonexistent:/bin/false
colord:x:121:126:colord colour management daemon,,,:/var/lib/colord:/usr/sbin/nologin
geoclue:x:122:127::/var/lib/geoclue:/usr/sbin/nologin
pulse:x:123:128:PulseAudio daemon,,,:/var/run/pulse:/usr/sbin/nologin
gnome-initial-setup:x:124:65534::/run/gnome-initial-setup/:/bin/false
gdm:x:125:130:Gnome Display Manager:/var/lib/gdm3:/bin/false
ammu:x:1000:1000:Ammu,,,:/home/ammu:/bin/bash
systemd-coredump:x:999:999:systemd Core Dumper:/:/usr/sbin/nologin
arya:x:1001:1001::/home/arya:/bin/sh
ammu@ammu-VirtualBox:~/Desktop$
```

17. userdel

userdel command in Linux system is used to delete a user account and related files. This command basically modifies the system account files, deleting all the entries which refer to the username LOGIN. It is a low-level utility for removing the users.

Another option is to use the -f (--force) option that tells userdel to forcefully remove the user account, even if the user is still logged in or if there are running processes that belong to the user.



A screenshot of a Linux desktop environment, likely Ubuntu, showing a terminal window. The terminal window title is "ammu@ammu-VirtualBox: ~/Desktop". The terminal displays a list of users and their logins:

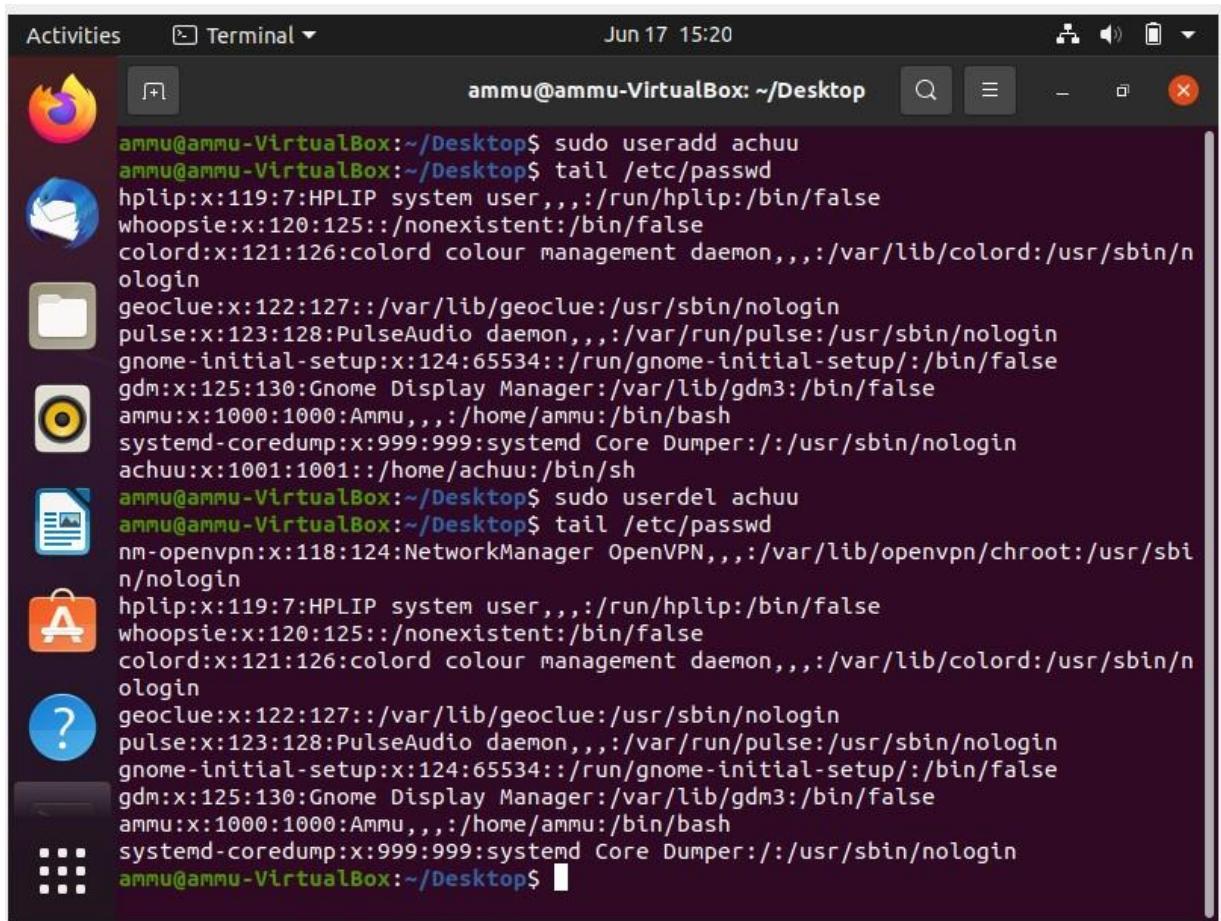
```
hplip:x:119:7:HPLIP system user,,,:/run/hplip:/bin/false
whoopsie:x:120:125::/nonexistent:/bin/false
colord:x:121:126:colord colour management daemon,,,:/var/lib/colord:/usr/sbin/nologin
geoclue:x:122:127::/var/lib/geoclue:/usr/sbin/nologin
pulse:x:123:128:PulseAudio daemon,,,:/var/run/pulse:/usr/sbin/nologin
gnome-initial-setup:x:124:65534::/run/gnome-initial-setup/:/bin/false
gdm:x:125:130:Gnome Display Manager:/var/lib/gdm3:/bin/false
ammu:x:1000:1000:Ammu,,,:/home/ammu:/bin/bash
systemd-coredump:x:999:999:systemd Core Dumper:/:/usr/sbin/nologin
arya:x:1001:1001:/home/arya:/bin/sh
ammu@ammu-VirtualBox:~/Desktop$ sudo userdel arya
ammu@ammu-VirtualBox:~/Desktop$ tail /etc/passwd
nm-openvpn:x:118:124:NetworkManager OpenVPN,,,:/var/lib/openvpn/chroot:/usr/sbin/nologin
hplip:x:119:7:HPLIP system user,,,:/run/hplip:/bin/false
whoopsie:x:120:125::/nonexistent:/bin/false
colord:x:121:126:colord colour management daemon,,,:/var/lib/colord:/usr/sbin/nologin
geoclue:x:122:127::/var/lib/geoclue:/usr/sbin/nologin
pulse:x:123:128:PulseAudio daemon,,,:/var/run/pulse:/usr/sbin/nologin
gnome-initial-setup:x:124:65534::/run/gnome-initial-setup/:/bin/false
gdm:x:125:130:Gnome Display Manager:/var/lib/gdm3:/bin/false
ammu:x:1000:1000:Ammu,,,:/home/ammu:/bin/bash
systemd-coredump:x:999:999:systemd Core Dumper:/:/usr/sbin/nologin
ammu@ammu-VirtualBox:~/Desktop$
```

18. sudo

The sudo command allows you to run programs with the security privileges of another user (by default, as the superuser). It prompts you for your personal password and confirms your request to execute a command by checking a file, called sudoers , which the system administrator configures

Use the visudo command to edit the configuration file: sudo visudo. This will open /etc/sudoers for editing. To add a user and grant full sudo privileges, add the following line: [username] ALL=(ALL:ALL) ALL.

Save and exit the file.



The image shows a screenshot of an Ubuntu desktop environment. In the top left corner, there's an 'Activities' button and a 'Terminal' button. The top right corner displays the date and time as 'Jun 17 15:20'. The main window is a terminal window titled 'ammu@ammu-VirtualBox: ~/Desktop'. The terminal output lists various system users:

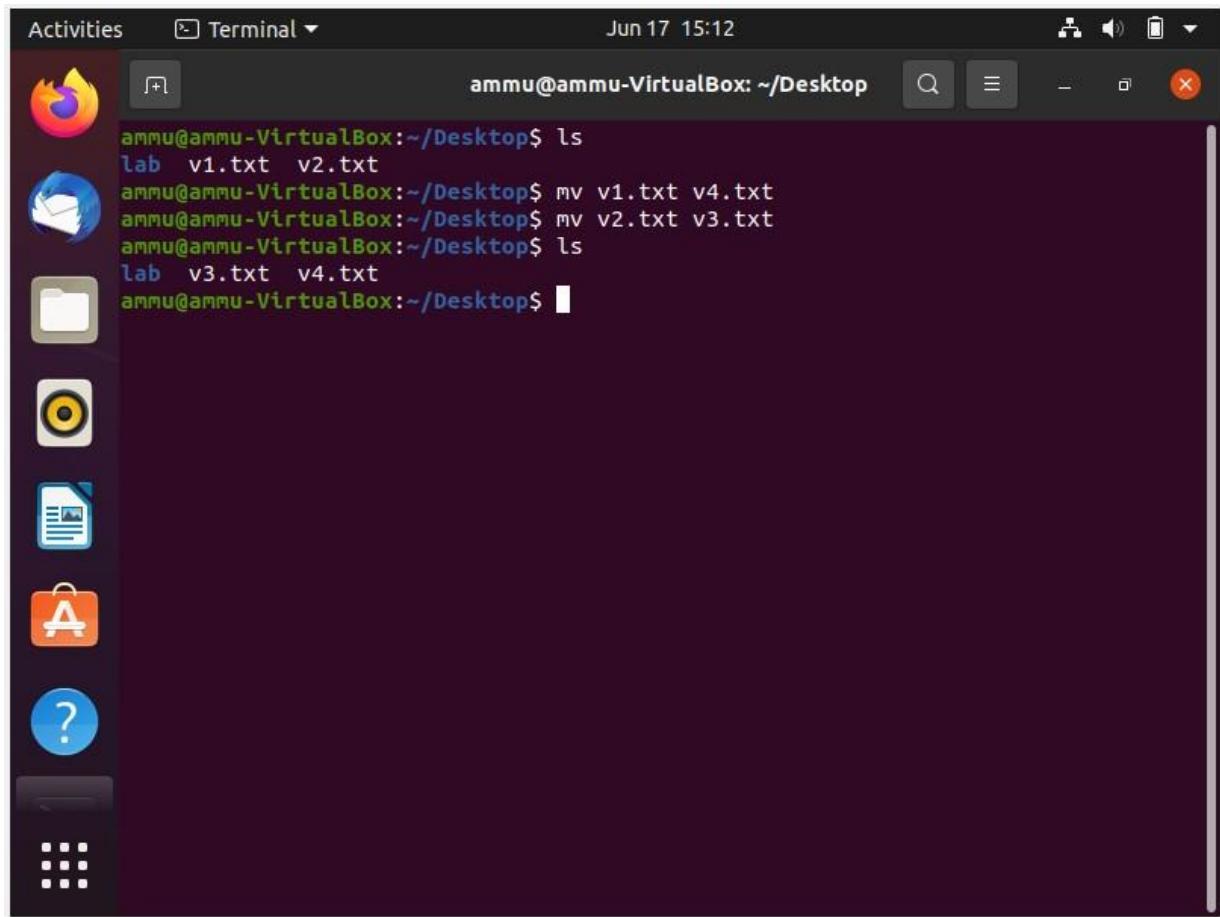
```
ammu@ammu-VirtualBox:~/Desktop$ sudo useradd achuu
ammu@ammu-VirtualBox:~/Desktop$ tail /etc/passwd
hplip:x:119:7:HPLIP system user,,,:/run/hplip:/bin/false
whoopsie:x:120:125::/nonexistent:/bin/false
colord:x:121:126:colord colour management daemon,,,:/var/lib/colord:/usr/sbin/nologin
geoclue:x:122:127::/var/lib/geoclue:/usr/sbin/nologin
pulse:x:123:128:PulseAudio daemon,,,:/var/run/pulse:/usr/sbin/nologin
gnome-initial-setup:x:124:65534::/run/gnome-initial-setup/:/bin/false
gdm:x:125:130:Gnome Display Manager:/var/lib/gdm3:/bin/false
ammu:x:1000:1000:Ammu,,,:/home/ammu:/bin/bash
systemd-coredump:x:999:999:systemd Core Dumper:/:/usr/sbin/nologin
achuu:x:1001:1001::/home/achuu:/bin/sh
ammu@ammu-VirtualBox:~/Desktop$ sudo userdel achuu
ammu@ammu-VirtualBox:~/Desktop$ tail /etc/passwd
nm-openvpn:x:118:124:NetworkManager OpenVPN,,,:/var/lib/openvpn/chroot:/usr/sbin/nologin
hplip:x:119:7:HPLIP system user,,,:/run/hplip:/bin/false
whoopsie:x:120:125::/nonexistent:/bin/false
colord:x:121:126:colord colour management daemon,,,:/var/lib/colord:/usr/sbin/nologin
geoclue:x:122:127::/var/lib/geoclue:/usr/sbin/nologin
pulse:x:123:128:PulseAudio daemon,,,:/var/run/pulse:/usr/sbin/nologin
gnome-initial-setup:x:124:65534::/run/gnome-initial-setup/:/bin/false
gdm:x:125:130:Gnome Display Manager:/var/lib/gdm3:/bin/false
ammu:x:1000:1000:Ammu,,,:/home/ammu:/bin/bash
systemd-coredump:x:999:999:systemd Core Dumper:/:/usr/sbin/nologin
ammu@ammu-VirtualBox:~/Desktop$
```

19. mv

mv stands for move. mv is used to move one or more files or directories from one place to another in a file system like UNIX. It has two distinct functions:

- (i) It renames a file or folder.
- (ii) It moves a group of files to a different directory.

No additional space is consumed on a disk during renaming. This command normally works silently means no prompt for confirmation.

A screenshot of an Ubuntu desktop environment. On the left is a vertical dock with icons for the Dash, Home, Applications, and Help. The main area shows a terminal window titled "Terminal" with the command-line history:

```
ammu@ammu-VirtualBox:~/Desktop$ ls
lab v1.txt v2.txt
ammu@ammu-VirtualBox:~/Desktop$ mv v1.txt v4.txt
ammu@ammu-VirtualBox:~/Desktop$ mv v2.txt v3.txt
ammu@ammu-VirtualBox:~/Desktop$ ls
lab v3.txt v4.txt
ammu@ammu-VirtualBox:~/Desktop$
```

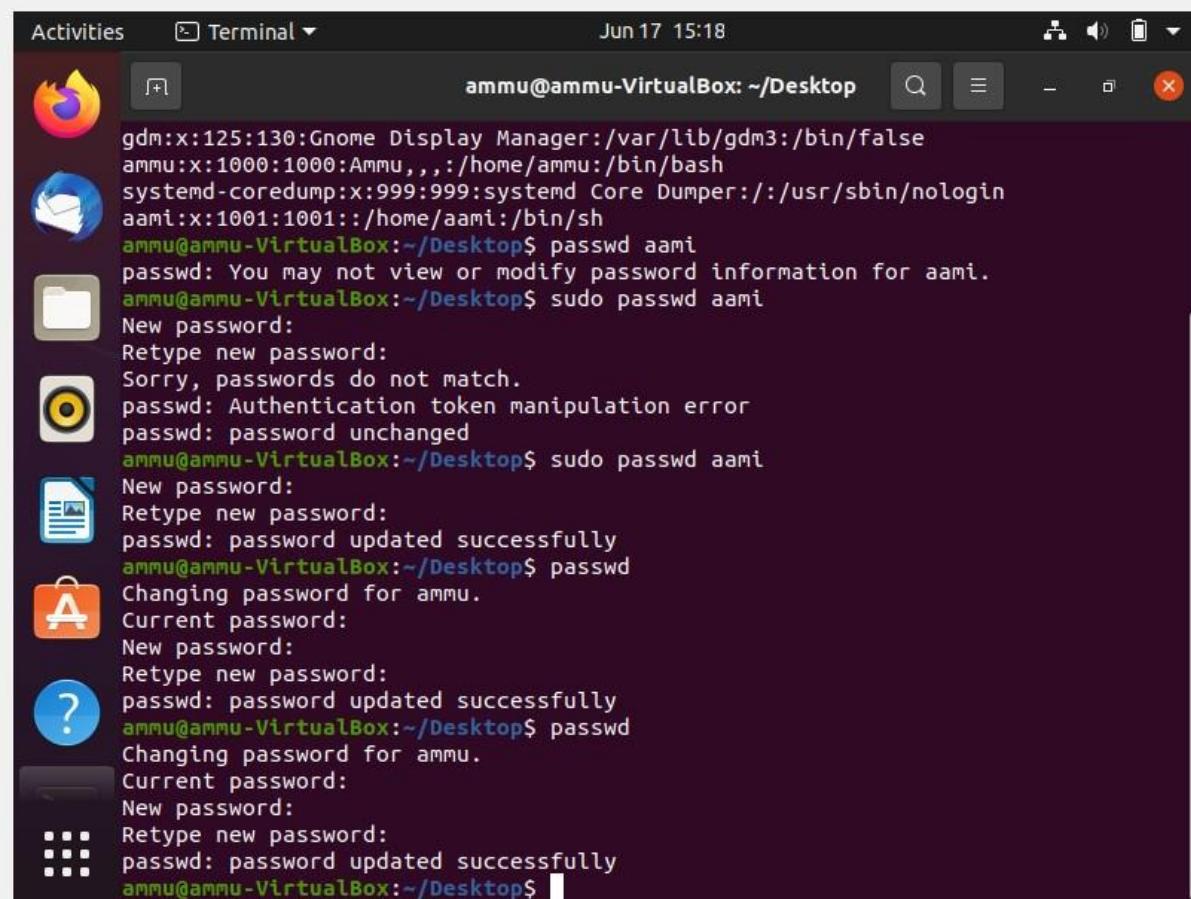
20. passwd

The passwd command changes passwords for user accounts. A normal user may only change the password for their own account, while the superuser may change the password for any account. passwd also changes the account or associated password validity period.

Creates a password definition, without a password value, that prompts users for a password while a script is running. To display password status information of a user , use -S option in passwd command.

-d, --delete: This option deletes the user password and makes the account password-less. -e, --expire: This option immediately expires the account password and forces the user to change password on their next login. -h, --help: Display help related to the passwd command.

The passwd command sets and changes passwords for users. Use this command to change your own password or another user's password. You can also use the passwd command to change the full name (gecos) associated with your login name and the shell you use as an interface to the operating system.



The screenshot shows a terminal window titled "Terminal" with the command-line interface. The user "ammu" is logged in at the prompt "ammu@ammu-VirtualBox: ~/Desktop\$". The terminal displays the following sequence of commands and outputs:

```
gdm:x:125:130:Gnome Display Manager:/var/lib/gdm3:/bin/false
ammu:x:1000:1000:Ammu,,,:/home/ammu:/bin/bash
systemd-coredump:x:999:999:systemd Core Dumper:/:/usr/sbin/nologin
aami:x:1001:1001::/home/aami:/bin/sh
ammu@ammu-VirtualBox:~/Desktop$ passwd aami
passwd: You may not view or modify password information for aami.
ammu@ammu-VirtualBox:~/Desktop$ sudo passwd aami
New password:
Retype new password:
Sorry, passwords do not match.
passwd: Authentication token manipulation error
passwd: password unchanged
ammu@ammu-VirtualBox:~/Desktop$ sudo passwd aami
New password:
Retype new password:
passwd: password updated successfully
ammu@ammu-VirtualBox:~/Desktop$ passwd
Changing password for ammu.
Current password:
New password:
Retype new password:
passwd: password updated successfully
ammu@ammu-VirtualBox:~/Desktop$ passwd
Changing password for ammu.
Current password:
New password:
Retype new password:
passwd: password updated successfully
ammu@ammu-VirtualBox:~/Desktop$
```

21. usermod

usermod command or modify user is a command in Linux that is used to change the properties of a user in Linux through the command line. After creating a user we have to sometimes change their attributes like password or login directory etc. so in order to do that we use the Usermod command. The infomration of a user is stored in the following files:

- /etc/passwd
- /etc/group
- /etc/shadow
- /etc/login.defs
- /etc/gshadow
- /etc/login.defs

When we execute usermod command in temrinal the command make the changes in these files itself. usermod command needs to be executed only as a root user.

The screenshot shows two terminal windows side-by-side. The top window displays the usage information for the `usermod` command:

```
ammu@ammu-VirtualBox:~/Desktop$ usermod ammu /etc/passwd
Usage: usermod [options] LOGIN

Options:
  -b, --badnames          allow bad names
  -c, --comment COMMENT   new value of the GECOS field
  -d, --home HOME_DIR     new home directory for the user account
  -e, --expiredate EXPIRE_DATE  set account expiration date to EXPIRE_DATE
  -f, --inactive INACTIVE  set password inactive after expiration
                           to INACTIVE
  -g, --gid GROUP          force use GROUP as new primary group
  -G, --groups GROUPS      new list of supplementary GROUPS
  -a, --append              append the user to the supplemental GROUPS
                           mentioned by the -G option without removing
                           the user from other groups
  -h, --help                display this help message and exit
  -l, --login NEW_LOGIN    new value of the login name
  -L, --lock                lock the user account
  -m, --move-home           move contents of the home directory to the
                           new location (use only with -d)
  -o, --non-unique          allow using duplicate (non-unique) UID
  -p, --password PASSWORD   use encrypted password for the new password
  -R, --root CHROOT_DIR     directory to chroot into
  -P, --prefix PREFIX_DIR   prefix directory where are located the /etc/* f
iles
  -s, --shell SHELL         new login shell for the user account
  -u, --uid UID             new UID for the user account
  -U, --unlock              unlock the user account
  -v, --add-subuids FIRST-LAST  add range of subordinate uids
```

The bottom window shows an attempt to change the user's ID, which fails because the user is currently in use:

```
ammu@ammu-VirtualBox:~/Desktop$ usermod -u 2000 ammu
usermod: user ammu is currently used by process 5846
ammu@ammu-VirtualBox:~/Desktop$
```

22. groupadd

The `groupadd` command creates a new group account using the values specified on the command line and the default values from the system. The new group will be entered into the system files as needed. The numerical value of the group's ID. This value must be unique, unless the `-o` option is used.

- `-g, --gid GID`: The numerical value of the group's ID. This value must be unique, unless the `-o` option is used. The value must be non-negative.
- `-h, --help`: Display help message and exit.
- `-o, --non-unique`: This option permits to add a group with a non-unique GID.
- `-p, --password PASSWORD`: The encrypted password, as returned by crypt. The default is to disable the password.

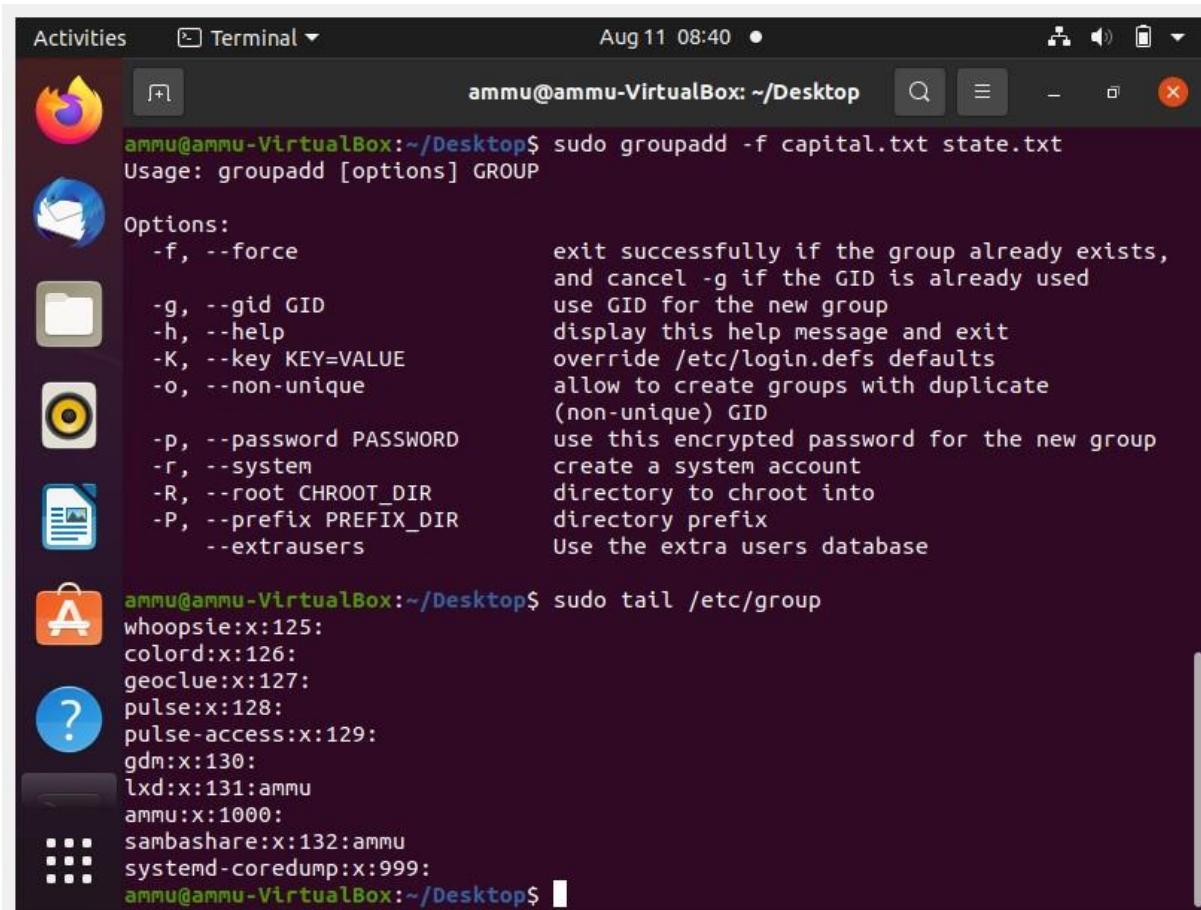
- **-f, --force:** This is the force flag. This will cause groupadd to exit with an error when the group about to be added already exists on the system. If that is the case, the group won't be altered (or added again).

This option also modifies the way -g option works. When you request a gid that it is not unique and you don't specify the -o option too, the group creation will fall back to the standard behavior (adding a group as if neither -g or -o options were specified).

- **-K, --key KEY=VALUE:** Overrides /etc/login.defs defaults (GID_MIN, GID_MAX and others). Multiple -K options can be specified. Example: K GID_MIN=100 -K GID_MAX=499

The following configuration variables in /etc/login.defs change the behavior of this tool:

- **GID_MAX (number), GID_MIN (number):** Range of group IDs used for the creation of regular groups by useradd, groupadd, or newusers. The default value for GID_MIN (resp. GID_MAX) is 1000 (resp. 60000).
- **MAX_MEMBERS_PER_GROUP (number):** Maximum members per group entry. When the maximum is reached, a new group entry (line) is started in /etc/group (with the same name, same password, and same GID). The default value is 0, meaning that there are no limits in the number of members in a group. This feature (split group) permits to limit the length of lines in the group file. This is useful to make sure that lines for NIS groups are not larger than 1024 characters. If you need to enforce such limit, you can use 25.

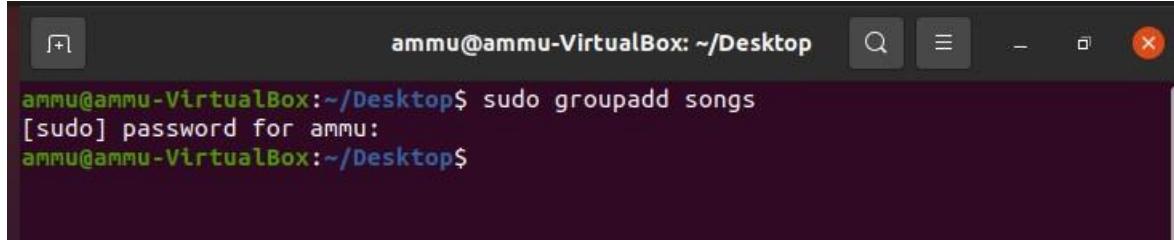


A screenshot of a Linux desktop environment, likely Ubuntu, showing a terminal window. The terminal window has a dark background and contains the following text:

```
ammu@ammu-VirtualBox:~/Desktop$ sudo groupadd -f capital.txt state.txt
Usage: groupadd [options] GROUP

Options:
  -f, --force          exit successfully if the group already exists,
                       and cancel -g if the GID is already used
  -g, --gid GID        use GID for the new group
  -h, --help            display this help message and exit
  -K, --key KEY=VALUE  override /etc/login.defs defaults
  -o, --non-unique      allow to create groups with duplicate
                       (non-unique) GID
  -p, --password PASSWORD  use this encrypted password for the new group
  -r, --system          create a system account
  -R, --root CHROOT_DIR  directory to chroot into
  -P, --prefix PREFIX_DIR  directory prefix
  --extrausers          Use the extra users database

ammu@ammu-VirtualBox:~/Desktop$ sudo tail /etc/group
whoops:x:125:
colord:x:126:
geoclue:x:127:
pulse:x:128:
pulse-access:x:129:
gdm:x:130:
lxd:x:131:ammu
ammu:x:1000:
sambashare:x:132:ammu
systemd-coredump:x:999:
ammu@ammu-VirtualBox:~/Desktop$
```



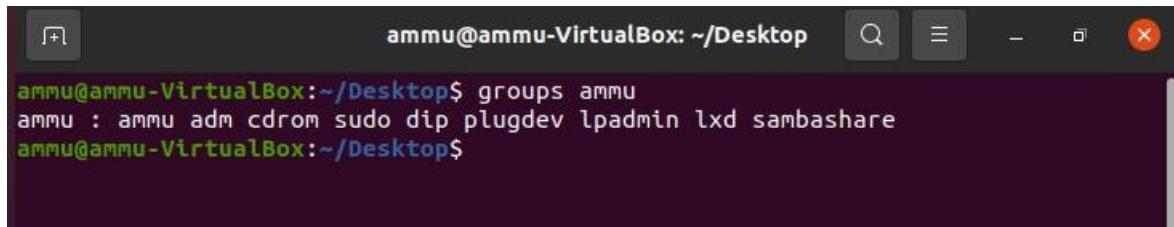
A screenshot of a Linux desktop environment, likely Ubuntu, showing a terminal window. The terminal window has a dark background and contains the following text:

```
ammu@ammu-VirtualBox:~/Desktop$ sudo groupadd songs
[sudo] password for ammu:
ammu@ammu-VirtualBox:~/Desktop$
```

23. groups

In linux, there can be multiple users(those who use/operate the system), and groups are nothing but the collection of users. Groups make it easy to manage users with the same security and access privileges. A user can be part of different groups.

- Groups command prints the names of the primary and any supplementary groups for each given username, or the current process if no names are given.
- If more than one name is given, the name of each user is printed before the list of that user's groups and the username is separated from the group list by a colon.



```
ammu@ammu-VirtualBox:~/Desktop$ groups ammu
ammu : ammu adm cdrom sudo dip plugdev lpadmin lxd sambashare
ammu@ammu-VirtualBox:~/Desktop$
```

24. groupdel

groupdel command is used to delete a existing group. It will delete all entry that refers to the group, modifies the system account files, and it is handled by superuser or root user.

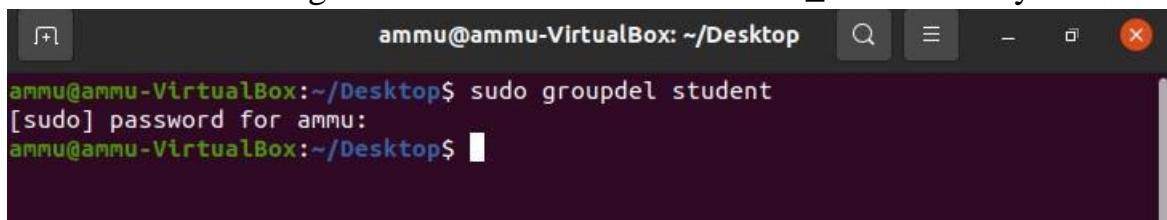
Syntax: groupdel [options] GROUP

Files:

- /etc/group : It contains the account information of the Group.
- /etc/gshadow : It contains the secure group account information.

Exit values: This command exits with the following values.

- 0: Success
- 2: Invalid Command Syntax.
- 6: Specified group doesn't exist.
- 8: Can't remove users primary group.
- 10: Can't update group file. **Options:**
 - -f –force: It used to delete a group even if it is the primary group of a user.
 - -h –help: It displays the help message and exit.
 - -R –root: It apply the changes in the CHROOT_DIR directory. Also, it uses the configuration files from the CHROOT_DIR directory.



```
ammu@ammu-VirtualBox:~/Desktop$ sudo groupdel student
[sudo] password for ammu:
ammu@ammu-VirtualBox:~/Desktop$
```

25. groupmod

groupmod command in Linux is used to modify or change the existing group on Linux system. It can be handled by superuser or root user.

Basically, it modifies a group definition on the system by modifying the right entry in the database of the group.

Syntax: groupmod [option] GROUP

Files: The groupmod command has following files.

- /etc/group: Group Account Information.
- /etc/gshadow: Secured group account information.
- /etc/login.def: Shadow passwd suite configuration.
- /etc/passwd: User account information.

Exit Values:

- 0: Success.
- 2: Invalid command Syntax.
- 3: Invalid argument to option.
- 4: specified group doesn't exist. • 6: specified group doesn't exist.
- 9: group name already in use. • 10: can't update group file.

Options: There are following option available in groupmod command.

- -g, --gid GID: The group ID of the given GROUP will be changed to GID.
- -n, --new-name NEW_GROUP: The name of group will change into newname.
- -h, --help: This option display help message and exist.
- -o, --non-unique: This option used with the -g option that allow to change the group GID to a non-unique value.
- -p, --password PASSWORD: This gives the encrypted password.
- -R, --root CHROOT_DIR: Apply changes in the CHROOT_DIR directory and use the configuration files from the CHROOT_DIR directory.

```
ammu@ammu-VirtualBox:~/Desktop$ sudo groupmod -n v1 v2 v3
Usage: groupmod [options] GROUP

Options:
  -g, --gid GID          change the group ID to GID
  -h, --help              display this help message and exit
  -n, --new-name NEW_GROUP  change the name to NEW_GROUP
  -o, --non-unique        allow to use a duplicate (non-unique) GID
  -p, --password PASSWORD  change the password to this (encrypted)
                           PASSWORD
  -R, --root CHROOT_DIR    directory to chroot into
  -P, --prefix PREFIX_DIR   prefix directory where are located the /etc/* f
                           iles
```

26. chmod

In Unix-like operating systems, the chmod command is used to change the access mode of a file. The name is an abbreviation of change mode.

Syntax : chmod [reference][operator][mode] file...

The references are used to distinguish the users to whom the permissions apply i.e. they are list of letters that specifies whom to give permissions. The references are represented by one or more of the following letters:

Reference	Class	Description
u		owner
file's owner	g	group
members of		users who are members of the file's group
others		users who are neither the file's owner nor members of the file's group
the file's group	a	all
above, same as ugo		All three of the above

The operator is used to specify how the modes of a file should be adjusted. The following operators are accepted:

Operator	Description
+	Adds the specified modes to the specified classes
-	Removes the specified modes from the specified classes
=	The modes specified are to be made the exact modes for the specified classes

```
ammu@ammu-VirtualBox:~/Desktop$ cd lab  
ammu@ammu-VirtualBox:~/Desktop/lab$ chmod +rwx name.txt
```

27. chown

Different users in the operating system have ownership and permission to ensure that the files are secure and put restrictions on who can modify the contents of the files. In Linux there are different users who use the system:

- Each user has some properties associated with them, such as a user ID and a home directory. We can add users into a group to make the process of managing users easier.
- A group can have zero or more users. A specified user can be associated with a “default group”. It can also be a member of other groups on the system as well.

Ownership and Permissions: To protect and secure files and directory in Linux we use permissions to control what a user can do with a file or directory. Linux uses three types of permissions:

- Read: This permission allows the user to read files and in directories, it lets the user read directories and subdirectories stores in it.
- Write: This permission allows a user to modify and delete a file. Also it allows a user to modify its contents (create, delete and rename files in it) for the directories. Unless the execute permission is not given to directories changes does do affect them.
- Execute: The write permission on a file allows it to get executed. For example, if we have a file named php.sh so unless we don't give it execute permission it won't run.

Types of file Permissions:

- User: These type of file permission affect the owner of the file.
- Group: These type of file permission affect the group which owns the file. Instead of the group permissions, the user permissions will apply if the owner user is in this group.

- Other: These type of file permission affect all other users on the system.

```
ammu@ammu-VirtualBox:~/Desktop/lab$ chown ammu num.txt
ammu@ammu-VirtualBox:~/Desktop/lab$ id
```

28. id

id command in Linux is used to find out user and group names and numeric ID's (UID or group ID) of the current user or any other user in the server. This command is useful to find out the following information as listed below:

- User name and real user id.
- Find out the specific Users UID.
- Show the UID and all groups associated with a user.
- List out all the groups a user belongs to.
- Display security context of the current user.

Synopsis: id [OPTION]... [USER]

Options:

- -g : Print only the effective group id.
- -G : Print all Group ID's.
- -n : Prints name instead of number.
- -r : Prints real ID instead of numbers.
- -u : Prints only the effective user ID.
- –help : Display help messages and exit.
- –version : Display the version information and exit.

```
ammu@ammu-VirtualBox:~/Desktop/lab$ id
uid=1000(ammu) gid=1000(ammu) groups=1000(ammu),4(adm),24(cdrom),27(sudo),30(dip),46(plugdev),120(lpadmin),131(lxd),132(sambashare)
ammu@ammu-VirtualBox:~/Desktop/lab$
```

29. ps

As we all know Linux is a multitasking and multi-user systems. So, it allows multiple processes to operate simultaneously without interfering with each other. Process is one of the important fundamental concept of the Linux OS. A process is an executing instance of a program and carry out different tasks within the operating system.

Linux provides us a utility called ps for viewing information related with the processes on a system which stands as abbreviation for “Process Status”. ps

command is used to list the currently running processes and their PIDs along with some other information depends on different options. It reads the process information from the virtual files in /proc file-system. /proc contains virtual files, this is the reason it's referred as a virtual file system. ps provides numerous options for manipulating the output according to our need.

```
ammu@ammu-VirtualBox:~/Desktop/lab$ ps -a
 PID TTY      TIME CMD
 6019 tty2    00:00:06 Xorg
 6330 tty2    00:00:00 gnome-session-b
 18087 pts/0    00:00:00 ps
ammu@ammu-VirtualBox:~/Desktop/lab$
```

30. top

top command is used to show the Linux processes. It provides a dynamic realtime view of the running system. Usually, this command shows the summary information of the system and the list of processes or threads which are currently managed by the Linux Kernel.

As soon as you will run this command it will open an interactive command mode where the top half portion will contain the statistics of processes and resource usage. And Lower half contains a list of the currently running processes. Pressing q will simply exit the command mode.

- PID: Shows task's unique process id.
- PR: Stands for priority of the task.
- SHR: Represents the amount of shared memory used by a task.
- VIRT: Total virtual memory used by the task.
- USER: User name of owner of task.
- %CPU: Represents the CPU usage.
- TIME+: CPU Time, the same as 'TIME', but reflecting more granularity through hundredths of a second.
- SHR: Represents the Shared Memory size (kb) used by a task.
- NI: Represents a Nice Value of task. A Negative nice value implies higher priority, and positive Nice value means lower priority.
- %MEM: Shows the Memory usage of task.

```

ammu@ammu-VirtualBox:~/Desktop/lab$ top -u ammu

top - 20:23:19 up 28 min,  1 user,  load average: 0.05, 0.18, 0.40
Tasks: 180 total,   3 running, 176 sleeping,   0 stopped,   1 zombie
%Cpu(s): 3.1 us, 2.4 sy, 0.0 ni, 52.4 id, 41.0 wa, 0.0 hi, 1.0 si, 0.0 st
MiB Mem : 980.8 total,   65.0 free, 581.0 used, 334.8 buff/cache
MiB Swap: 448.5 total,   58.4 free, 390.1 used. 248.7 avail Mem

      PID USER      PR  NI    VIRT    RES    SHR S %CPU %MEM     TIME+ COMMAND
  5846 ammu      20   0  19280   5824  4544 S  0.0  0.6  0:00.35 systemd
  5850 ammu      20   0 104660    280     0 S  0.0  0.0  0:00.00 (sd-pa+
  5914 ammu      9 -11 1416884   5516  4744 S  0.0  0.5  0:00.17 pulsea+
  5916 ammu     39  19 519996  10388  8388 S  0.0  1.0  0:00.15 tracke+
  5945 ammu      20   0 248816   4368  3872 S  0.0  0.4  0:00.07 gnome-+
  5964 ammu      20   0   8272   4260  3104 S  0.0  0.4  0:00.39 dbus-d+
  5980 ammu      20   0 248320   4104  3604 S  0.0  0.4  0:00.05 gvfsd

```

31. wc

wc stands for word count. As the name implies, it is mainly used for counting purpose.

- It is used to find out number of lines, word count, byte and characters count in the files specified in the file arguments.
- By default it displays four-columnar output.
- First column shows number of lines present in a file specified, second column shows number of words present in the file, third column shows number of characters present in file and fourth column itself is the file name which are given as argument.

-l: This option prints the number of lines present in a file. With this option wc command displays two-columnar output, 1st column shows number of lines present in a file and 2nd itself represent the file name.

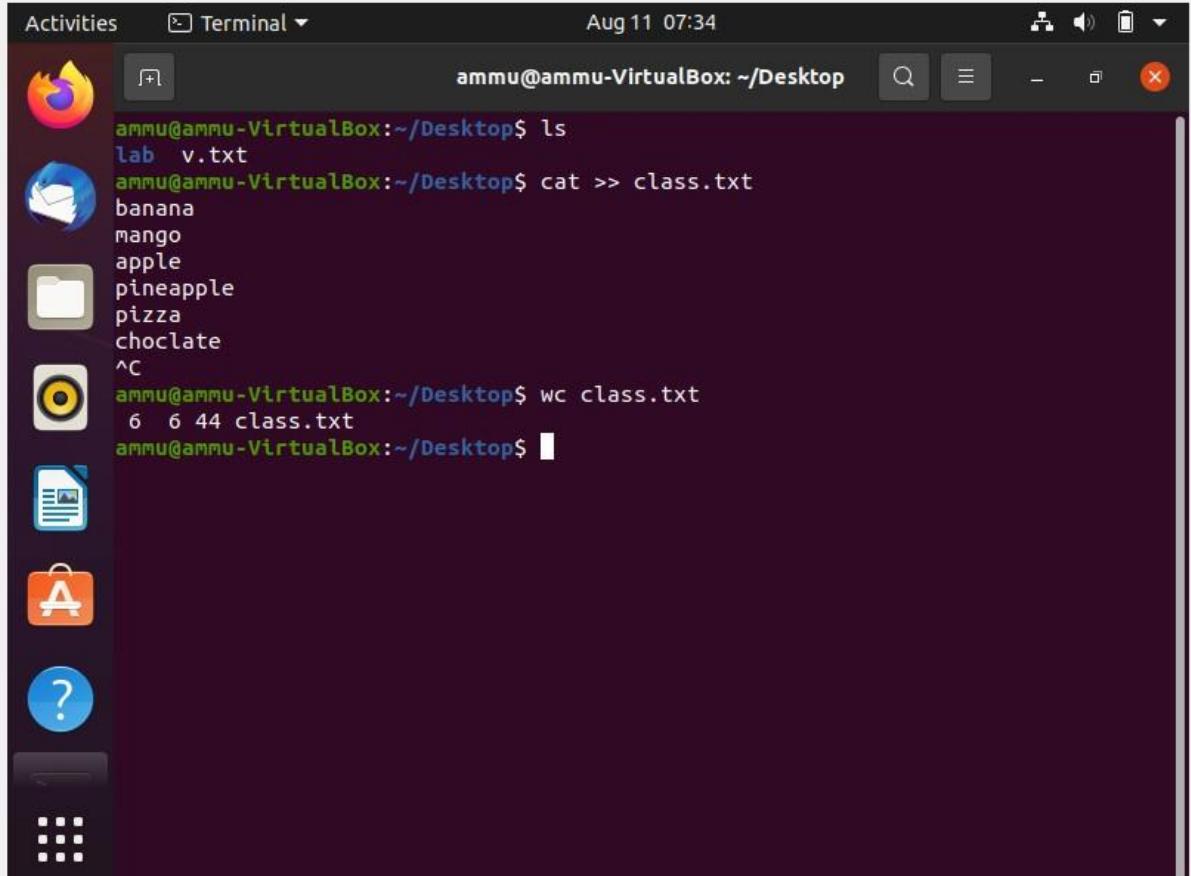
-w: This option prints the number of words present in a file. With this option wc command displays two-columnar output, 1st column shows number of words present in a file and 2nd is the file name.

-c: This option displays count of bytes present in a file. With this option it display two-columnar output, 1st column shows number of bytes present in a file and 2nd is the file name.

-m: Using -m option ‘wc’ command displays count of characters from a file.

-L: The ‘wc’ command allow an argument -L, it can be used to print out the length of longest (number of characters) line in a file. So, we have the longest character line Arunachal Pradesh in a file state.txt and Hyderabad in the file

capital.txt. But with this option if more than one file name is specified then the last row i.e. the extra row, doesn't display total but it display the maximum of all values displaying in the first column of individual files.



The screenshot shows a Linux desktop environment with a terminal window open. The terminal window title is "Terminal" and the date and time are "Aug 11 07:34". The terminal content is as follows:

```
ammu@ammu-VirtualBox:~/Desktop$ ls
lab  v.txt
ammu@ammu-VirtualBox:~/Desktop$ cat >> class.txt
banana
mango
apple
pineapple
pizza
choclate
^C
ammu@ammu-VirtualBox:~/Desktop$ wc class.txt
 6  6 44 class.txt
ammu@ammu-VirtualBox:~/Desktop$
```

32. tar

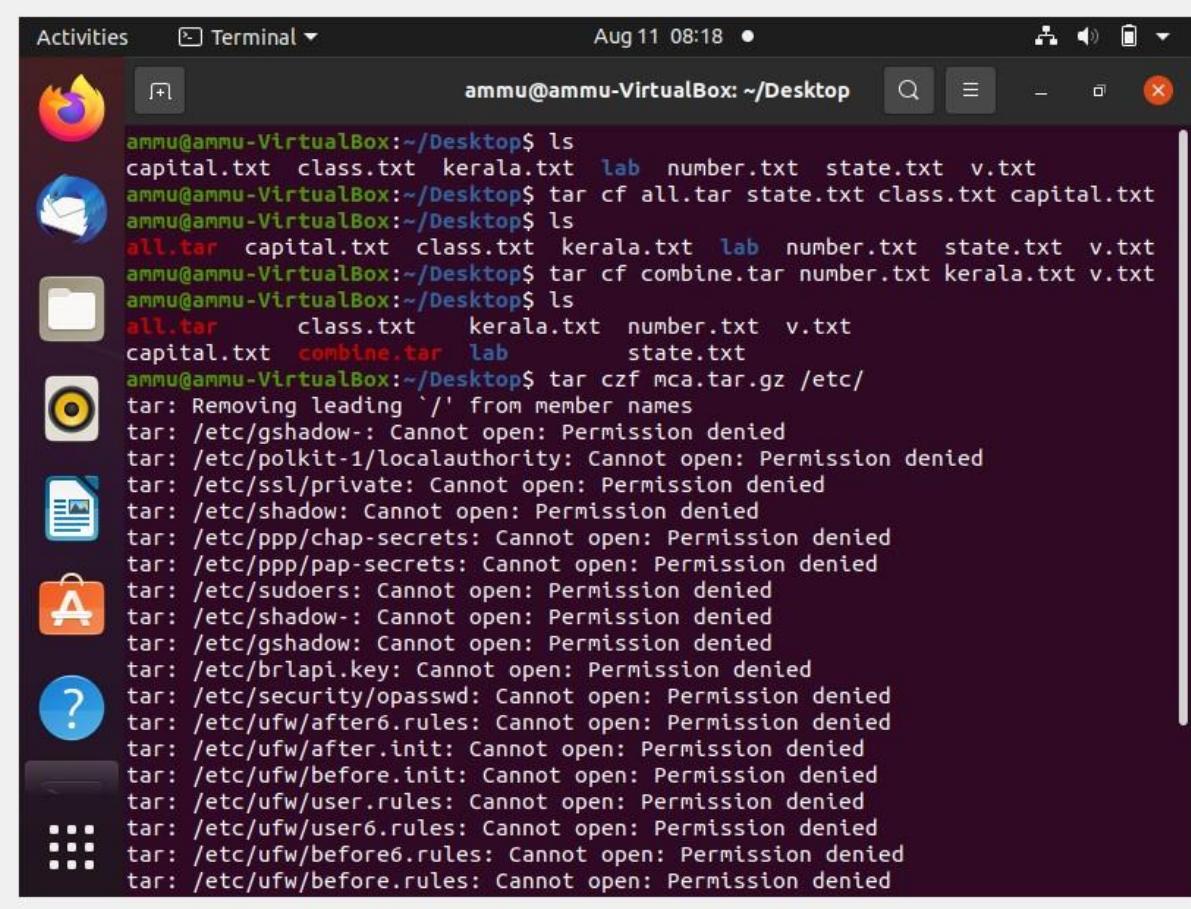
The Linux ‘tar’ stands for tape archive, is used to create Archive and extract the Archive files. tar command in Linux is one of the important command which provides archiving functionality in Linux. We can use Linux tar command to create compressed or uncompressed Archive files and also maintain and modify them.

Syntax: tar [options] [archive-file] [file or directory to be archived]

Options:

- -c : Creates Archive
- -x : Extract the archive
- -f : creates archive with given filename
- -t : displays or lists files in archived file
- -u : archives and adds to an existing archive file

- -v : Displays Verbose Information
- -A : Concatenates the archive files
- -z : zip, tells tar command that creates tar file using gzip
- -j : filter archive tar file using tbzip
- -W : Verify a archive file
- -r : update or add file or directory in already existed .tar file



The screenshot shows a terminal window titled "Terminal" with the command line interface. The user is in their home directory (~). They first list files with "ls", then create a tar archive named "all.tar" containing "state.txt", "class.txt", and "capital.txt". They then list files again, showing the newly created "all.tar" file. Next, they create another tar archive named "combine.tar" containing "number.txt", "kerala.txt", and "v.txt". They list files again, showing the "combine.tar" file. Finally, they attempt to extract all files from both tar archives into the "/etc" directory using "tar czf mca.tar.gz /etc". This results in numerous errors because many files in "/etc" require root permission, which the user does not have.

```

ammu@ammu-VirtualBox:~/Desktop$ ls
capital.txt class.txt kerala.txt lab number.txt state.txt v.txt
ammu@ammu-VirtualBox:~/Desktop$ tar cf all.tar state.txt class.txt capital.txt
ammu@ammu-VirtualBox:~/Desktop$ ls
all.tar capital.txt class.txt kerala.txt lab number.txt state.txt v.txt
ammu@ammu-VirtualBox:~/Desktop$ tar cf combine.tar number.txt kerala.txt v.txt
ammu@ammu-VirtualBox:~/Desktop$ ls
all.tar class.txt kerala.txt number.txt v.txt
capital.txt combine.tar lab state.txt
ammu@ammu-VirtualBox:~/Desktop$ tar czf mca.tar.gz /etc/
tar: Removing leading `/' from member names
tar: /etc/gshadow-: Cannot open: Permission denied
tar: /etc/polkit-1/localauthority: Cannot open: Permission denied
tar: /etc/ssl/private: Cannot open: Permission denied
tar: /etc/shadow: Cannot open: Permission denied
tar: /etc/ppp/chap-secrets: Cannot open: Permission denied
tar: /etc/ppp/pap-secrets: Cannot open: Permission denied
tar: /etc/sudoers: Cannot open: Permission denied
tar: /etc/shadow-: Cannot open: Permission denied
tar: /etc/gshadow: Cannot open: Permission denied
tar: /etc/brlapi.key: Cannot open: Permission denied
tar: /etc/security/opasswd: Cannot open: Permission denied
tar: /etc/ufw/after6.rules: Cannot open: Permission denied
tar: /etc/ufw/after.init: Cannot open: Permission denied
tar: /etc/ufw/before.init: Cannot open: Permission denied
tar: /etc/ufw/user.rules: Cannot open: Permission denied
tar: /etc/ufw/user6.rules: Cannot open: Permission denied
tar: /etc/ufw/before6.rules: Cannot open: Permission denied
tar: /etc/ufw/before.rules: Cannot open: Permission denied

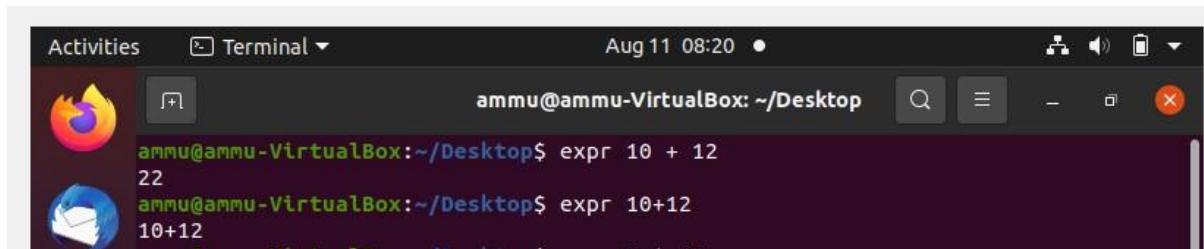
```

33. expr

The expr command in Unix evaluates a given expression and displays its corresponding output. It is used for:

- Basic operations like addition, subtraction, multiplication, division, and modulus on integers.
- Evaluating regular expressions, string operations like substring, length of strings etc.

Syntax: \$expr expression



```
ammu@ammu-VirtualBox: ~/Desktop$ expr 10 + 12
22
ammu@ammu-VirtualBox: ~/Desktop$ expr 10+12
10+12
```

34. Redirections and Piping

A **pipe** is a form of redirection (transfer of standard output to some other destination) that is used in Linux and other Unix-like operating systems to send the output of one command/program/process to another command/program/process for further processing. The Unix/Linux systems allow stdout of a command to be connected to stdin of another command. You can make it do so by using the pipe character '|'.

Pipe is used to combine two or more commands, and in this, the output of one command acts as input to another command, and this command's output may act as input to the next command and so on. It can also be visualized as a temporary connection between two or more commands/ programs/ processes. The command line programs that do the further processing are referred to as filters.

This direct connection between commands/ programs/ processes allows them to operate simultaneously and permits data to be transferred between them continuously rather than having to pass it through temporary text files or through the display screen. Pipes are unidirectional i.e data flows from left to right through the pipeline.

Redirection can be defined as changing the way from where commands read input to where commands sends output. You can redirect input and output of a command.

For redirection, meta characters are used. Redirection can be into a file (shell meta characters are angle brackets '<', '>') or a program (shell meta characters are pipesymbol '|').

The bash shell has three standard streams in I/O redirection:

- standard input (stdin) : The stdin stream is numbered as stdin (0). The bash shell takes input from stdin. By default, keyboard is used as input.
- standard output (stdout) : The stdout stream is numbered as stdout (1). The bash shell sends output to stdout. Output goes to display.
- standard error (stderr) : The stderr stream is numbered as stderr (2). The bash shell sends error message to stderr. Error message goes to display.

```
ammu@ammu-VirtualBox:~/Desktop$ ls -l
total 1232
-rw-rw-r-- 1 ammu ammu 10240 Aug 11 08:16 all.tar
-rw-rw-r-- 1 ammu ammu 104 Aug 11 07:45 capital.txt
-rw-rw-r-- 1 ammu ammu 44 Aug 11 07:33 class.txt
-rw-rw-r-- 1 ammu ammu 10240 Aug 11 08:17 combine.tar
-rw-rw-r-- 1 ammu ammu 51 Jun 16 18:11 kerala.txt
drwxrwxr-x 2 ammu ammu 4096 Aug 11 08:15 lab
-rw-rw-r-- 1 ammu ammu 1207324 Aug 11 08:18 mca.tar.gz
-rw-rw-r-- 1 ammu ammu 23 Jun 15 15:40 number.txt
-rw-rw-r-- 1 ammu ammu 76 Aug 11 07:41 state.txt
-rw-rw-r-- 1 ammu ammu 5 Jun 21 21:38 v.txt
ammu@ammu-VirtualBox:~/Desktop$ wc -l
^C
ammu@ammu-VirtualBox:~/Desktop$ wc -l
^C
ammu@ammu-VirtualBox:~/Desktop$ ls -l | wc -l
11
ammu@ammu-VirtualBox:~/Desktop$
```

35. ssh

ssh stands for “Secure Shell”. It is a protocol used to securely connect to a remote server/system. ssh is secure in the sense that it transfers the data in encrypted form between the host and the client. It transfers inputs from the client to the host and relays back the output. ssh runs at TCP/IP port 22.

Syntax: ssh user_name@host(IP/Domain_name)

```
ammu@ammu-VirtualBox:~/Desktop/lab$ ssh --help
unknown option -- -
usage: ssh [-46AaCfGgKkMNnqsTtVvXxYy] [-B bind_interface]
           [-b bind_address] [-c cipher_spec] [-D [bind_address:]port]
           [-E log_file] [-e escape_char] [-F configfile] [-I pkcs11]
           [-i identity_file] [-J [user@]host[:port]] [-L address]
           [-l login_name] [-m mac_spec] [-O ctl_cmd] [-o option] [-p port]
           [-Q query_option] [-R address] [-S ctl_path] [-W host:port]
           [-w local_tun[:remote_tun]] destination [command]
ammu@ammu-VirtualBox:~/Desktop/lab$
```

36. scp

scp (secure copy) command in Linux system is used to copy file(s) between servers in a secure way. The SCP command or secure copy allows secure transferring of files in between the local host and the remote host or between two remote hosts. It uses the same authentication and security as it is used in the Secure Shell (SSH) protocol. SCP is known for its simplicity, security and preinstalled availability.

Syntax: scp [-346BCpqrTv] [-c cipher] [-F ssh_config] [-i identity_file] [-l limit]

```
[-o ssh_option] [-P port] [-S program] [[user@]host1:]file1 ...
[[user@]host2:]file2
```

Options:

- scp -P port: Specifies the port to connect on the remote host.
- scp -p: Preserves modification times, access times, and modes from the original file.
- scp -q: Disables the progress meter.
- scp -r: Recursively copy entire directories.
- scp -S program: Name of program to use for the encrypted connection. The program must understand ssh(1) options.
- scp -v: Verbose mode. Causes scp and ssh to print debugging messages about their progress. This is helpful in debugging connection, authentication, and configuration problems.

```
ammu@ammu-VirtualBox:~/Desktop/lab$ scp ammu@ammu-virtualBox
usage: scp [-346BCpqrv] [-c cipher] [-F ssh_config] [-i identity_file]
           [-J destination] [-l limit] [-o ssh_option] [-P port]
           [-S program] source ... target
ammu@ammu-VirtualBox:~/Desktop/lab$
```

37. ssh-keygen

Use the ssh-keygen command to generate a public/private authentication key pair. Authentication keys allow a user to connect to a remote system without supplying a password. Keys must be generated for each user separately. If you generate key pairs as the root user, only the root can use the keys. Use the -t option to specify the type of key to create. Possible values are “rsa1” for protocol version 1, and “dsa”, “ecdsa”, or “rsa” for protocol version 2.

```
ammu@ammu-VirtualBox:~/Desktop/lab$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/ammu/.ssh/id_rsa): rsa
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in rsa
Your public key has been saved in rsa.pub
The key fingerprint is:
SHA256:mYN3W1xYzEU7nDePcFTLZzHu0UsA288UTCUuDjJthKw ammu@ammu-VirtualBox
The key's randomart image is:
+---[RSA 3072]---+
|   . . +o+B*+|
|   oo o=++=*|
|   .. + o.+.B0=|
|   E + * + +*=*|
|   . S = . .=.|
|   . o . |
|   . . . |
+---[SHA256]---+
ammu@ammu-VirtualBox:~/Desktop/lab$
```

38. ssh-copy-id

ssh-copy-id uses the SSH protocol to connect to the target host and upload the SSH user key. The command edits the authorized_keys file on the server. It creates the .ssh directory if it doesn't exist. It creates the authorized keys file if it doesn't exist. Effectively, ssh key copied to server.

It also checks if the key already exists on the server. Unless the -f option is given, each key is only added to the authorized keys file once.

It further ensures that the key files have appropriate permissions. Generally, the user's home directory or any file or directory containing keys files should not be writable by anyone else. Otherwise someone else could add new authorized keys for the user and gain access. Private key files should not be readable by anyone else.

```
ammu@ammu-VirtualBox:~/Desktop/lab$ ssh-copy-id
Usage: /usr/bin/ssh-copy-id [-h|-?|-f|-n] [-i [identity_file]] [-p port] [[-o <
ssh -o options>] ...] [user@]hostname
      -f: force mode -- copy keys without trying to check if they are already
      installed
      -n: dry run    -- no keys are actually copied
      -h|-?: print this help
ammu@ammu-VirtualBox:~/Desktop/lab$
```

Lab Assignment Managing Files, Creating Users and Groups Using Command-line tools

1.

- a) Create six files with name of the form songX.mp3

```
ammu@ammu-VirtualBox:~/Desktop$ cat >> song1.mp3
^C
ammu@ammu-VirtualBox:~/Desktop$ ^C
ammu@ammu-VirtualBox:~/Desktop$ cat >> song2.mp3
^C
ammu@ammu-VirtualBox:~/Desktop$ cat >> song3.mp3
^C
ammu@ammu-VirtualBox:~/Desktop$ cat >> song4.mp3
^C
ammu@ammu-VirtualBox:~/Desktop$ cat >> song5.mp3
^C
ammu@ammu-VirtualBox:~/Desktop$ cat >> song6.mp3
^C
```

- b) Create six files with name of the form snapX.mp3

```
ammu@ammu-VirtualBox:~/Desktop$ cat >> snap1.mp3
^C
ammu@ammu-VirtualBox:~/Desktop$ cat >> snap2.mp3
^C
ammu@ammu-VirtualBox:~/Desktop$ cat >> snap3.mp3
^C
ammu@ammu-VirtualBox:~/Desktop$ cat >> snap4.mp3
^C
ammu@ammu-VirtualBox:~/Desktop$ cat >> snap5.mp3
^C
ammu@ammu-VirtualBox:~/Desktop$ cat >> snap6.mp3
^C
```

- c) Create six files with name of the form filmX.mp3

```
ammu@ammu-VirtualBox:~/Desktop$ cat >> film1.mp3
^C
ammu@ammu-VirtualBox:~/Desktop$ cat >> film2.mp3
^C
ammu@ammu-VirtualBox:~/Desktop$ cat >> film3.mp3
^C
ammu@ammu-VirtualBox:~/Desktop$ cat >> film4.mp3
^C
ammu@ammu-VirtualBox:~/Desktop$ cat >> film5.mp3
^C
ammu@ammu-VirtualBox:~/Desktop$ cat >> film6.mp3
^C
```

```
ammu@ammu-VirtualBox:~/Desktop$ ls
all.tar    film2.mp3  kerala.txt  snap2.mp3  song1.mp3  song6.mp3
capital.txt  film3.mp3  lab        snap3.mp3  song2.mp3  state.txt
class.txt   film4.mp3  mca.tar.gz  snap4.mp3  song3.mp3  v.txt
combine.tar  film5.mp3  number.txt  snap5.mp3  song4.mp3
film1.mp3   film6.mp3  snap1.mp3  snap6.mp3  song5.mp3
```

2. From your home directory, move the song files into your music subdirectory, the snapshot files into your pictures subdirectory, and the movie files into videos subdirectory.

```
ammu@ammu-VirtualBox:~/Desktop$ mkdir music
ammu@ammu-VirtualBox:~/Desktop$ mkdir picture
ammu@ammu-VirtualBox:~/Desktop$ mkdir videos
ammu@ammu-VirtualBox:~/Desktop$ ls
all.tar    film2.mp3  kerala.txt  picture  snap5.mp3  song4.mp3  v.txt
capital.txt  film3.mp3  lab        snap1.mp3  snap6.mp3  song5.mp3
class.txt   film4.mp3  mca.tar.gz  snap2.mp3  song1.mp3  song6.mp3
combine.tar  film5.mp3  music      snap3.mp3  song2.mp3  state.txt
film1.mp3   film6.mp3  number.txt snap4.mp3  song3.mp3  videos
```

```
ammu@ammu-VirtualBox:~/Desktop$ mv song2.mp3 music/
ammu@ammu-VirtualBox:~/Desktop$ mv song3.mp3 music/
ammu@ammu-VirtualBox:~/Desktop$ mv song4.mp3 music/
ammu@ammu-VirtualBox:~/Desktop$ mv song5.mp3 music/
ammu@ammu-VirtualBox:~/Desktop$ mv song6.mp3 music/
ammu@ammu-VirtualBox:~/Desktop$ ls music/
song1.mp3  song2.mp3  song3.mp3  song4.mp3  song5.mp3  song6.mp3
```

```
ammu@ammu-VirtualBox:~/Desktop$ mv snap1.mp3 picture/
ammu@ammu-VirtualBox:~/Desktop$ mv snap2.mp3 picture/
ammu@ammu-VirtualBox:~/Desktop$ mv snap3.mp3 picture/
ammu@ammu-VirtualBox:~/Desktop$ mv snap4.mp3 picture/
ammu@ammu-VirtualBox:~/Desktop$ mv snap5.mp3 picture/
ammu@ammu-VirtualBox:~/Desktop$ mv snap6.mp3 picture/
ammu@ammu-VirtualBox:~/Desktop$ ls picture/
snap1.mp3  snap2.mp3  snap3.mp3  snap4.mp3  snap5.mp3  snap6.mp3
```

```
ammu@ammu-VirtualBox:~/Desktop$ mv film1.mp3 videos/
ammu@ammu-VirtualBox:~/Desktop$ mv film2.mp3 videos/
ammu@ammu-VirtualBox:~/Desktop$ mv film3.mp3 videos/
ammu@ammu-VirtualBox:~/Desktop$ mv film4.mp3 videos/
ammu@ammu-VirtualBox:~/Desktop$ mv film5.mp3 videos/
ammu@ammu-VirtualBox:~/Desktop$ mv film6.mp3 videos/
ammu@ammu-VirtualBox:~/Desktop$ ls videos/
film1.mp3  film2.mp3  film3.mp3  film4.mp3  film5.mp3  film6.mp3
ammu@ammu-VirtualBox:~/Desktop$ ls
all.tar    class.txt  kerala.txt  mca.tar.gz  number.txt  state.txt  v.txt
capital.txt  combine.tar  lab        music      picture      videos
```

3. In your home directory, create three subdirectories for organizing your files. Call these directories friends, family, and work. Create all three with one command.

```
ammu@ammu-VirtualBox:~/Desktop$ mkdir friends family work
ammu@ammu-VirtualBox:~/Desktop$ ls
all.tar    combine.tar  kerala.txt  music      state.txt  work
capital.txt  family      lab        number.txt  videos
class.txt   friends     mca.tar.gz  picture    v.txt
```

4. Copy song files to the friends folder and snap files to family folder

```

ammu@ammu-VirtualBox:~/Desktop$ cp -r music friends/
ammu@ammu-VirtualBox:~/Desktop$ cp -r picture family/
ammu@ammu-VirtualBox:~/Desktop$ ls
all.tar      combine.tar  kerala.txt  music      state.txt  work
capital.txt  family       lab          number.txt  videos
class.txt    friends     mca.tar.gz  picture    v.txt
ammu@ammu-VirtualBox:~/Desktop$ ls friends
music
ammu@ammu-VirtualBox:~/Desktop$ ls family
picture

```

5. Attempt to delete both family and friends projects with a single rmdir command

```

ammu@ammu-VirtualBox:~/Desktop$ rmdir friends family
rmdir: failed to remove 'friends': Directory not empty
rmdir: failed to remove 'family': Directory not empty

```

6. Use another command that will succeed in deleting both the family and friends folder

```

ammu@ammu-VirtualBox:~/Desktop$ rm -r friends family
ammu@ammu-VirtualBox:~/Desktop$ ls
all.tar      class.txt   kerala.txt  mca.tar.gz  number.txt  state.txt  v.txt
capital.txt  combine.tar lab          music      picture    videos    work

```

7. Redirect a long listing of all home directory files, including hidden, into a file named allfiles.txt. Confirm that the file contains the listing.

```

ammu@ammu-VirtualBox:~/Desktop$ ls -al >allfiles.txt
ammu@ammu-VirtualBox:~/Desktop$ ls
allfiles.txt  class.txt   lab          number.txt  videos
all.tar       combine.tar mca.tar.gz  picture    v.txt
capital.txt   kerala.txt  music      state.txt  work
ammu@ammu-VirtualBox:~/Desktop$ ls -A
all.tar       class.txt   kerala.txt  mca.tar.gz  number.txt  state.txt  v.txt
capital.txt   combine.tar lab          music      picture    videos    work
ammu@ammu-VirtualBox:~/Desktop$ ls -l
total 1248
-rw-rw-r--  1 ammu ammu   10240 Aug 11 08:16 all.tar
-rw-rw-r--  1 ammu ammu      104 Aug 11 07:45 capital.txt
-rw-rw-r--  1 ammu ammu      44 Aug 11 07:33 class.txt
-rw-rw-r--  1 ammu ammu   10240 Aug 11 08:17 combine.tar
-rw-rw-r--  1 ammu ammu      51 Jun 16 18:11 kerala.txt
drwxrwxr-x  2 ammu ammu    4096 Aug 12 20:29 lab
-rw-rw-r--  1 ammu ammu 1207324 Aug 11 08:18 mca.tar.gz
drwxrwxr-x  2 ammu ammu    4096 Aug 17 14:56 music
-rw-rw-r--  1 ammu ammu     23 Jun 15 15:40 number.txt
drwxrwxr-x  2 ammu ammu    4096 Aug 17 15:00 picture
-rw-rw-r--  1 ammu ammu      76 Aug 11 07:41 state.txt
drwxrwxr-x  2 ammu ammu    4096 Aug 17 15:03 videos
-rw-rw-r--  1 ammu ammu      5 Jun 21 21:38 v.txt
drwxrwxr-x  2 ammu ammu    4096 Aug 17 15:08 work
ammu@ammu-VirtualBox:~/Desktop$ wc -l
^C
ammu@ammu-VirtualBox:~/Desktop$ ls -l | wc -l
15

```

8. In the command window, display today's date with day of the week, month, date and year

```
ammu@ammu-VirtualBox:~/Desktop$ date
Tuesday 17 August 2021 03:51:12 PM IST
```

9. Add the user Juliet

```
ammu@ammu-VirtualBox:~/Desktop$ sudo useradd juliet
[sudo] password for ammu:
```

10. Confirm that Juliet has been added by examining the /etc/passwd file

```
ammu@ammu-VirtualBox:~/Desktop$ tail /etc/passwd
hplip:x:119:7:HPLIP system user,,,:/run/hplip:/bin/false
whoopsie:x:120:125::/nonexistent:/bin/false
colord:x:121:126:colord colour management daemon,,,:/var/lib/colord:/usr/sbin/n
ologin
geoclue:x:122:127::/var/lib/geoclue:/usr/sbin/nologin
pulse:x:123:128:PulseAudio daemon,,,:/var/run/pulse:/usr/sbin/nologin
gnome-initial-setup:x:124:65534::/run/gnome-initial-setup/:/bin/false
gdm:x:125:130:Gnome Display Manager:/var/lib/gdm3:/bin/false
ammu:x:1000:1000:Ammu,,,:/home/ammu:/bin/bash
systemd-coredump:x:999:999:systemd Core Dumper:/:/usr/sbin/nologin
juliet:x:1001:1001::/home/juliet:/bin/sh
```

11. Use the passwd command to initialize Juliet's password

```
ammu@ammu-VirtualBox:~/Desktop$ sudo passwd juliet
New password:
Retype new password:
passwd: password updated successfully
```

12. Create a supplementary group called Shakespeare with a group id of 30000

```
ammu@ammu-VirtualBox:~/Desktop$ sudo groupadd shakespeare
ammu@ammu-VirtualBox:~/Desktop$ sudo groupadd -g 30000 shakespeare
```

```
ammu@ammu-VirtualBox:~/Desktop$ cat /etc/group
root:x:0:
daemon:x:1:
bin:x:2:
sys:x:3:
adm:x:4:syslog,ammu
tty:x:5:syslog
disk:x:6:
lp:x:7:
mail:x:8:
news:x:9:
uucp:x:10:
man:x:12:
proxy:x:13:
kmem:x:15:
dialout:x:20:
ammu:x:1000:
juliet:x:1001:
shakespeare:x:30000:
ammu@ammu-VirtualBox:~/Desktop$
```

13. Create a supplementary group called artists.

```
ammu@ammu-VirtualBox:~/Desktop$ sudo groupadd artists
ammu@ammu-VirtualBox:~/Desktop$ cat /etc/group
root:x:0:
daemon:x:1:
bin:x:2:
sys:x:3:
adm:x:4:syslog,ammu
tty:x:5:syslog
disk:x:6:
lp:x:7:
mail:x:8:

```

```
ammu:x:1000:
sambashare:x:132:ammu
systemd-coredump:x:999:
music:x:1002:
songs:x:1003:
juliet:x:1001:
shakespeare:x:30000:
artists:x:30001:
ammu@ammu-VirtualBox:~/Desktop$
```

14. Confirm that Shakespeare and artists have been added by examining the /etc/group file.

```
ammu@ammu-VirtualBox:~/Desktop$ cat /etc/group
root:x:0:
daemon:x:1:
bin:x:2:
sys:x:3:
adm:x:4:syslog,ammu
scanner:x:122:saned
saned:x:123:
nm-openvpn:x:124:
whoopsie:x:125:
colord:x:126:
geoclue:x:127:
pulse:x:128:
pulse-access:x:129:
gdm:x:130:
lxd:x:131:ammu
ammu:x:1000:
sambashare:x:132:ammu
systemd-coredump:x:999:
music:x:1002:
songs:x:1003:
juliet:x:1001:
shakespeare:x:30000:
artists:x:30001:
ammu@ammu-VirtualBox:~/Desktop$
```

15. Add the Juliet user to the Shakespeare group as a supplementary group.

```
ammu@ammu-VirtualBox:~/Desktop$ sudo usermod -G shakespeare juliet
ammu@ammu-VirtualBox:~/Desktop$ cat /etc/group
root:x:0:
daemon:x:1:
bin:x:2:
sys:x:3:
adm:x:4:syslog,ammu
tty:x:5:syslog
disk:x:6:
lp:x:7:
mail:x:8:
news:x:9:
uucp:x:10:
man:x:12:
```

```
geoclue:x:127:
pulse:x:128:
pulse-access:x:129:
gdm:x:130:
lxd:x:131:ammu
ammu:x:1000:
sambashare:x:132:ammu
systemd-coredump:x:999:
music:x:1002:
songs:x:1003:
juliet:x:1001:
shakespeare:x:30000:juliet
artists:x:30001:
ammu@ammu-VirtualBox:~/Desktop$ █
```

16. Confirm that Juliet has been added using the id command.

```
ammu@ammu-VirtualBox:~/Desktop$ id -u juliet
1001
ammu@ammu-VirtualBox:~/Desktop$ id -g juliet
30000
ammu@ammu-VirtualBox:~/Desktop$
```

17. Add Romeo and Hamlet to the Shakespeare group.

```
ammu@ammu-VirtualBox:~/Desktop$ sudo useradd romeo
ammu@ammu-VirtualBox:~/Desktop$ sudo useradd hamlet
ammu@ammu-VirtualBox:~/Desktop$ sudo usermod -G shakespeare romeo
ammu@ammu-VirtualBox:~/Desktop$ sudo usermod -G shakespeare hamlet
ammu@ammu-VirtualBox:~/Desktop$ cat /etc/group
root:x:0:
daemon:x:1:
bin:x:2:
sys:x:3:
adm:x:4:syslog,ammu
tty:x:5:syslog
disk:x:6:
lp:x:7:
mail:x:8:
news:x:9:

x86.x.151.ammu
ammu:x:1000:
sambashare:x:132:ammu
systemd-coredump:x:999:
music:x:1002:
songs:x:1003:
juliet:x:1001:
shakespeare:x:30000:juliet,romeo,hamlet
artists:x:30001:
romeo:x:30002:
hamlet:x:30003:
ammu@ammu-VirtualBox:~/Desktop$
```

18. Add Reba, Dolly and Elvis to the artists group.

```
ammu@ammu-VirtualBox:~/Desktop$ sudo useradd reba
ammu@ammu-VirtualBox:~/Desktop$ sudo useradd dolly
ammu@ammu-VirtualBox:~/Desktop$ sudo useradd elvis
ammu@ammu-VirtualBox:~/Desktop$ sudo usermod -G artists reba
ammu@ammu-VirtualBox:~/Desktop$ sudo usermod -G artists dolly
ammu@ammu-VirtualBox:~/Desktop$ sudo usermod -G artists elvis
ammu@ammu-VirtualBox:~/Desktop$ cat /etc/group
root:x:0:
daemon:x:1:
bin:x:2:
sys:x:3:
adm:x:4:syslog,ammu
tty:x:5:syslog
disk:x:6:
lp:x:7:
mail:x:8:
news:x:9:
uucp:x:10:
man:x:12:
sambashare:x:132:ammu
systemd-coredump:x:999:
music:x:1002:
songs:x:1003:
juliet:x:1001:
shakespeare:x:30000:juliet,romeo,hamlet
artists:x:30001:reba,dolly,elvis
romeo:x:30002:
hamlet:x:30003:
reba:x:1004:
dolly:x:1005:
elvis:x:1006:
ammu@ammu-VirtualBox:~/Desktop$
```

19. Verify the supplemental group memberships by examining the /etc/group file.

```
sambashare:x:132:ammu
systemd-coredump:x:999:
music:x:1002:
songs:x:1003:
juliet:x:1001:
shakespeare:x:30000:juliet,romeo,hamlet
artists:x:30001:reba,dolly,elvis
romeo:x:30002:
hamlet:x:30003:
reba:x:1004:
dolly:x:1005:
elvis:x:1006:
ammu@ammu-VirtualBox:~/Desktop$
```

20. Attempt to remove user Dolly.

```
ammu@ammu-VirtualBox:~/Desktop$ sudo userdel dolly
ammu@ammu-VirtualBox:~/Desktop$ cat /etc/group
root:x:0:
daemon:x:1:
bin:x:2:
sys:x:3:
adm:x:4:syslog,ammu
tty:x:5:syslog
disk:x:6:
lp:x:7:

music:x:1002:
songs:x:1003:
juliet:x:1001:
shakespeare:x:30000:juliet,romeo,hamlet
artists:x:30001:reba,elvis
romeo:x:30002:
hamlet:x:30003:
reba:x:1004:
elvis:x:1006:
ammu@ammu-VirtualBox:~/Desktop$
```

1. Try out these network commands in Window as well as in Linux and perform at least 4 options with each command: ping route traceroute, nslookup, Ip Config, NetStat .

Windows

Ping

```
C:\Users\hp>ping google.com

Pinging google.com [2404:6800:4007:817::200e] with 32 bytes of data:
Reply from 2404:6800:4007:817::200e: time=1084ms
Reply from 2404:6800:4007:817::200e: time=1327ms
Request timed out.
Reply from 2404:6800:4007:817::200e: time=863ms

Ping statistics for 2404:6800:4007:817::200e:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
        Minimum = 863ms, Maximum = 1327ms, Average = 1091ms
```

Route

```
C:\Users\hp>route print
=====
Interface List
 10...30 24 a9 9c de 2b ....Realtek PCIe GbE Family Controller
  5...0a 00 27 00 00 05 ....VirtualBox Host-Only Ethernet Adapter
 13...22 4e f6 b5 1f eb ....Microsoft Wi-Fi Direct Virtual Adapter
  6...a2 4e f6 b5 1f eb ....Microsoft Wi-Fi Direct Virtual Adapter #2
 16...20 4e f6 b5 1f eb ....Realtek RTL8821CE 802.11ac PCIe Adapter
  4...20 4e f6 b5 1f ea ....Bluetooth Device (Personal Area Network)
  1.....Software Loopback Interface 1
=====

IPv4 Route Table
=====
Active Routes:
Network Destination      Netmask        Gateway       Interface Metric
          0.0.0.0        0.0.0.0    192.168.43.1  192.168.43.68    55
         127.0.0.0      255.0.0.0   On-link        127.0.0.1    331
         127.0.0.1      255.255.255.255  On-link        127.0.0.1    331
 127.255.255.255      255.255.255.255  On-link        127.0.0.1    331
         192.168.43.0    255.255.255.0   On-link      192.168.43.68    311
 192.168.43.68        255.255.255.255  On-link      192.168.43.68    311
 192.168.43.255      255.255.255.255  On-link      192.168.43.68    311
         192.168.56.0    255.255.255.0   On-link      192.168.56.1    281
 192.168.56.1         255.255.255.255  On-link      192.168.56.1    281
 192.168.56.255      255.255.255.255  On-link      192.168.56.1    281
         224.0.0.0        240.0.0.0   On-link        127.0.0.1    331
         224.0.0.0        240.0.0.0   On-link      192.168.56.1    281
         224.0.0.0        240.0.0.0   On-link      192.168.43.68    311
 255.255.255.255      255.255.255.255  On-link        127.0.0.1    331
 255.255.255.255      255.255.255.255  On-link      192.168.56.1    281
 255.255.255.255      255.255.255.255  On-link      192.168.43.68    311
=====
Persistent Routes:
  None
```

```
IPv6 Route Table
=====
Active Routes:
 If Metric Network Destination      Gateway
 16     71 ::/0                    fe80::22a6:cff:fe:fb:d362
  1     331 ::1/128                On-link
 16     71 2409:4073:4e1f:9f88::/64  On-link
 16     311 2409:4073:4e1f:9f88:5180:c557:e21:f35f/128
                                         On-link
 16     311 2409:4073:4e1f:9f88:7096:c163:3201:b52c/128
                                         On-link
  5     281 fe80::/64               On-link
 16     311 fe80::/64               On-link
 16     311 fe80::5180:c557:e21:f35f/128
                                         On-link
  5     281 fe80::6d80:68be:4c9f:98d6/128
                                         On-link
  1     331 ff00::/8                On-link
  5     281 ff00::/8                On-link
 16     311 ff00::/8                On-link
=====
Persistent Routes:
  None
```

Tracert

```
C:\Users\hp>tracert 192.168.1.1

Tracing route to 192.168.1.1 over a maximum of 30 hops

 1   3 ms    2 ms    2 ms  192.168.43.1
 2   *         *         * Request timed out.
 3   88 ms   80 ms   101 ms  56.8.126.89
 4   507 ms  157 ms  522 ms  172.26.104.196
 5   710 ms  507 ms  246 ms  172.26.104.210
 6   269 ms  300 ms  106 ms  192.168.14.32
 7   427 ms  204 ms  202 ms  192.168.14.33
 8   125 ms  202 ms  203 ms  172.16.21.21
 9   263 ms  167 ms  203 ms  172.16.81.4
10   218 ms  102 ms  137 ms  172.16.3.91
11   350 ms  204 ms  203 ms  172.16.21.20
12   228 ms  403 ms  248 ms  172.16.2.9
13   *         *         * Request timed out.
14   *         *         * Request timed out.
15   *         *         * Request timed out.
16   *         *         * Request timed out.
17   *         *         * Request timed out.
18   *         *         * Request timed out.
19   *         *         * Request timed out.
20   *         *         * Request timed out.
21   *         *         * Request timed out.
22   *         *         * Request timed out.
23   *         *         * Request timed out.
24   *         *         * Request timed out.
25   *         *         * Request timed out.
26   *         *         * Request timed out.
27   *         *         * Request timed out.
28   *         *         * Request timed out.
29   *         *         * Request timed out.
30   *         *         * Request timed out.

Trace complete.
```

```
C:\Users\hp>tracert www.google.com

Tracing route to www.google.com [2404:6800:4007:829::2004]
over a maximum of 30 hops:

 1   742 ms   154 ms    1 ms  2409:4073:4e1f:9f88::1e
 2   *         *         * Request timed out.
 3   662 ms   278 ms   407 ms  2405:200:365:eeee:20::352
 4   124 ms   347 ms   115 ms  2405:200:801:1100::3de
 5   362 ms   613 ms   210 ms  2405:200:801:1100::3df
 6   899 ms   669 ms   211 ms  2405:200:100::1:0:37e
 7   417 ms   319 ms   499 ms  2001:4860:1:1::171
 8   668 ms   270 ms   315 ms  2001:4860:1:1::170
 9   249 ms   165 ms   627 ms  2404:6800:810c::1
10   *         *         * Request timed out.
11   *         761 ms    *  2001:4860:0:e00::3
12   *         214 ms    *  2001:4860::12:0:c004
13   819 ms   452 ms   671 ms  2001:4860:0:1::55b7
14   165 ms   760 ms   298 ms  maa03s44-in-x04.1e100.net [2404:6800:4007:829::2004]

Trace complete.
```

Nslookup

```
C:\Users\hp>nslookup  
Default Server: UnKnown  
Address: 192.168.43.1
```

```
C:\Users\hp>nslookup google.com  
Server: UnKnown  
Address: 192.168.43.1  
  
Non-authoritative answer:  
Name: google.com  
Addresses: 2404:6800:4002:820::200e  
          142.250.182.174
```

Ipconfig

```
C:\Users\hp>ipconfig  
  
Windows IP Configuration  
  
Ethernet adapter Ethernet:  
  
  Media State . . . . . : Media disconnected  
  Connection-specific DNS Suffix . :  
  
Ethernet adapter VirtualBox Host-Only Network:  
  
  Connection-specific DNS Suffix . :  
  Link-local IPv6 Address . . . . . : fe80::6d80:68be:4c9f:98d6%5  
  IPv4 Address . . . . . : 192.168.56.1  
  Subnet Mask . . . . . : 255.255.255.0  
  Default Gateway . . . . . :  
  
Wireless LAN adapter Local Area Connection* 1:  
  
  Media State . . . . . : Media disconnected  
  Connection-specific DNS Suffix . :  
  
Wireless LAN adapter Local Area Connection* 2:  
  
  Media State . . . . . : Media disconnected  
  Connection-specific DNS Suffix . :  
  
Wireless LAN adapter Wi-Fi:  
  
  Connection-specific DNS Suffix . :  
  IPv6 Address . . . . . : 2409:4073:4e1f:9f88:5180:c557:e21:f35f  
  Temporary IPv6 Address . . . . . : 2409:4073:4e1f:9f88:7096:c163:3201:b52c  
  Link-local IPv6 Address . . . . . : fe80::5180:c557:e21:f35f%16  
  IPv4 Address . . . . . : 192.168.43.68  
  Subnet Mask . . . . . : 255.255.255.0  
  Default Gateway . . . . . : fe80::22a6:cff:fe:fb:d362%16  
                           192.168.43.1  
  
Ethernet adapter Bluetooth Network Connection:  
  
  Media State . . . . . : Media disconnected  
  Connection-specific DNS Suffix . :
```

Netstat

```
C:\Users\hp>netstat
```

```
Active Connections
```

Proto	Local Address	Foreign Address	State
TCP	192.168.43.68:49688	20.197.71.89:https	ESTABLISHED
TCP	192.168.43.68:50960	52.109.76.30:https	TIME_WAIT
TCP	192.168.43.68:50966	117.18.232.200:https	CLOSE_WAIT
TCP	192.168.43.68:50971	52.168.117.169:https	ESTABLISHED
TCP	192.168.43.68:50972	52.109.8.19:https	ESTABLISHED
TCP	192.168.43.68:51429	20.197.71.89:https	ESTABLISHED
TCP	192.168.43.68:51444	49.44.145.124:https	CLOSE_WAIT
TCP	[2409:4073:4e1f:9f88:7096:c163:3201:b52c]:51437	[2405:200:1630:486::4106]:https	CLOSE_WAIT
TCP	[2409:4073:4e1f:9f88:7096:c163:3201:b52c]:51438	[2405:200:1630:486::4106]:https	CLOSE_WAIT
TCP	[2409:4073:4e1f:9f88:7096:c163:3201:b52c]:51441	[2405:200:1630:1400::b854:b05a]:https	CLOSE_WAIT
TCP	[2409:4073:4e1f:9f88:7096:c163:3201:b52c]:51442	[2405:200:1630:1400::b854:b05a]:https	CLOSE_WAIT
TCP	[2409:4073:4e1f:9f88:7096:c163:3201:b52c]:59609	sb-in-f188:5228	ESTABLISHED

Linux

Ping

```
ammu@ammu-VirtualBox:~/Desktop$ ping google.com
PING google.com (142.250.195.142) 56(84) bytes of data.
64 bytes from maa03s40-in-f14.1e100.net (142.250.195.142): icmp_seq=1 ttl=111 time=98.3 ms
64 bytes from maa03s40-in-f14.1e100.net (142.250.195.142): icmp_seq=2 ttl=111 time=82.7 ms
64 bytes from maa03s40-in-f14.1e100.net (142.250.195.142): icmp_seq=3 ttl=111 time=98.1 ms
64 bytes from maa03s40-in-f14.1e100.net (142.250.195.142): icmp_seq=4 ttl=111 time=225 ms
64 bytes from maa03s40-in-f14.1e100.net (142.250.195.142): icmp_seq=5 ttl=111 time=146 ms
64 bytes from maa03s40-in-f14.1e100.net (142.250.195.142): icmp_seq=6 ttl=111 time=170 ms
64 bytes from maa03s40-in-f14.1e100.net (142.250.195.142): icmp_seq=7 ttl=111 time=194 ms
64 bytes from maa03s40-in-f14.1e100.net (142.250.195.142): icmp_seq=8 ttl=111 time=117 ms
64 bytes from maa03s40-in-f14.1e100.net (142.250.195.142): icmp_seq=9 ttl=111 time=140 ms
64 bytes from maa03s40-in-f14.1e100.net (142.250.195.142): icmp_seq=10 ttl=111 time=125 ms
64 bytes from maa03s40-in-f14.1e100.net (142.250.195.142): icmp_seq=11 ttl=111 time=187 ms
64 bytes from maa03s40-in-f14.1e100.net (142.250.195.142): icmp_seq=12 ttl=111 time=202 ms
64 bytes from maa03s40-in-f14.1e100.net (142.250.195.142): icmp_seq=13 ttl=111 time=133 ms
64 bytes from maa03s40-in-f14.1e100.net (142.250.195.142): icmp_seq=14 ttl=111
```

Route

```
ammu@ammu-VirtualBox:~/Desktop$ route
Kernel IP routing table
Destination     Gateway         Genmask        Flags Metric Ref    Use Iface
default         _gateway       0.0.0.0       UG    100    0        0 enp0s3
10.0.2.0        0.0.0.0       255.255.255.0   U     100    0        0 enp0s3
link-local      0.0.0.0       255.255.0.0     U     1000   0        0 enp0s3
```

Traceroute

```
ammu@ammu-VirtualBox:~/Desktop$ traceroute google.com
traceroute to google.com (142.250.194.238), 30 hops max, 60 byte packets
 1 _gateway (10.0.2.2)  0.462 ms  0.421 ms  0.404 ms
 2 * * *
 3 * * *
 4 * * *
 5 * * *
 6 * * *
 7 * * *
 8 * * *
 9 * * *
10 * * *
11 * * *
12 * * *
13 * * *
14 * * *
15 * * *
```

Nslookup

```
ammu@ammu-VirtualBox:~/Desktop$ nslookup google.com
Server:      127.0.0.53
Address:     127.0.0.53#53

Non-authoritative answer:
Name:   google.com
Address: 142.250.77.142
Name:   google.com
Address: 2404:6800:4007:817::200e
```

Ifconfig

```
ammu@ammu-VirtualBox:~/Desktop$ ifconfig
enp0s3: 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::123a:4b4:7b06:77d2  prefixlen 64  scopeid 0x20<link>
          ether 08:00:27:ce:05:8c  txqueuelen 1000  (Ethernet)
            RX packets 2336  bytes 2534093 (2.5 MB)
            RX errors 0  dropped 0  overruns 0  frame 0
            TX packets 1469  bytes 152263 (152.2 KB)
            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 366  bytes 36741 (36.7 KB)
            RX errors 0  dropped 0  overruns 0  frame 0
            TX packets 366  bytes 36741 (36.7 KB)
            TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0
```

Netstat

Active Internet connections (w/o servers)						
Proto	Recv-Q	Send-Q	Local Address	Foreign Address	State	
udp	0	0	ammu-VirtualBox:bootpc	_gateway:bootps	ESTABLISHED	
Active UNIX domain sockets (w/o servers)						
Proto	RefCnt	Flags	Type	State	I-Node	Path
unix	2	[]	DGRAM		31839	/run/user/1000/systemd/notify
md/notify						
unix	2	[]	DGRAM		15144	/run/systemd/journal
/syslog						
unix	16	[]	DGRAM		15154	/run/systemd/journal
/dev-log						
unix	8	[]	DGRAM		15158	/run/systemd/journal
/socket						
unix	3	[]	DGRAM		15130	/run/systemd/notify
unix	3	[]	STREAM	CONNECTED	37354	/run/dbus/system_bus
_socket						
unix	3	[]	STREAM	CONNECTED	70328	@/tmp/.X11-unix/X0
unix	3	[]	STREAM	CONNECTED	38464	
unix	3	[]	STREAM	CONNECTED	38253	/run/systemd/journal
/stdout						
unix	3	[]	STREAM	CONNECTED	37332	/run/systemd/journal
/stdout						
unix	3	[]	STREAM	CONNECTED	32972	/run/dbus/system_bus
_socket						
unix	3	[]	STREAM	CONNECTED	21885	
unix	3	[]	STREAM	CONNECTED	35876	
unix	3	[]	STREAM	CONNECTED	35736	
unix	3	[]	STREAM	CONNECTED	35667	

2. Identify and perform 5 more network commands and it's working.

a. ARP

The ARP command corresponds to the Address Resolution Protocol. Although it is easy to think of network communications in terms of IP addressing, packet delivery is ultimately dependent on the Media Access Control (MAC) address of the device's network adapter. This is where the Address Resolution Protocol comes into play. Its job is to map IP addresses to MAC addresses. Windows devices maintain an ARP cache, which contains the results of recent ARP queries. You can see the contents of this cache by using the ARP -A command. If you are having problems communicating with one specific host, you can append the remote host's IP address to the ARP -A command.

```
C:\Users\hp>arp -a

Interface: 192.168.56.1 --- 0x5
  Internet Address      Physical Address      Type
  192.168.56.255        ff-ff-ff-ff-ff-ff    static
  224.0.0.22             01-00-5e-00-00-16    static
  224.0.0.251            01-00-5e-00-00-fb    static
  224.0.0.252            01-00-5e-00-00-fc    static
  239.255.255.250        01-00-5e-7f-ff-fa    static
  255.255.255.255        ff-ff-ff-ff-ff-ff    static

Interface: 192.168.43.68 --- 0x10
  Internet Address      Physical Address      Type
  192.168.43.1          20-a6-0c-fb-d3-62    dynamic
  192.168.43.255        ff-ff-ff-ff-ff-ff    static
  224.0.0.22             01-00-5e-00-00-16    static
  224.0.0.251            01-00-5e-00-00-fb    static
  224.0.0.252            01-00-5e-00-00-fc    static
  239.255.255.250        01-00-5e-7f-ff-fa    static
  255.255.255.255        ff-ff-ff-ff-ff-ff    static
```

b. NbtStat

As I am sure you probably know, computers that are running a Windows operating system are assigned a computer name. Oftentimes, there is a domain name or a workgroup name that is also assigned to the computer. The computer name is sometimes referred to as the NetBIOS name. Windows uses several different methods to map NetBIOS names to IP addresses, such as broadcast, LMHost lookup, or even using the nearly extinct method of querying a WINS server. Of course, NetBIOS over TCP/IP can occasionally break down. The

NbtStat command can help you to diagnose and correct such problems. The NbtStat -n command for example, shows the NetBIOS names that are in use by a device. The NbtStat -r command shows how many NetBIOS names the device has been able to resolve recently.

```
C:\Users\hp>nbtstat -r

NetBIOS Names Resolution and Registration Statistics
-----
Resolving names via broadcast = 0
Resolving names via Name Server = 0

Registered names via broadcast = 6
Registered names via Name Server = 0
```

c. Hostname

The previously discussed NbtStat command can provide you with the host name that has been assigned to a Windows device, if you know which switch

to use with the command. However, if you're just looking for a fast and easy way of verifying a computer's name, then try using the Hostname command. Typing Hostname at the command prompt returns the local computer name.

```
C:\Users\hp>hostname  
DESKTOP-BAQTEQI
```

d. PathPing

Earlier, I talked about the Ping utility and the Tracert utility, and the similarities between them. As you might have guessed, the PathPing tool is a utility that combines the best aspects of Tracert and Ping. Entering the PathPing command followed by a host name initiates what looks like a somewhat standard Tracert process. Once this process completes however, the tool takes 300 seconds (five minutes) to gather statistics, and then reports latency and packet loss statistics that are more detailed than those provided by Ping or Tracert.

```
C:\Users\hp>pathping www.google.com  
  
Tracing route to www.google.com [2404:6800:4002:818::2004]  
over a maximum of 30 hops:  
  0  DESKTOP-BAQTEQI [2409:4073:4e1f:9f88:7096:c163:3201:b52c]  
  1  2409:4073:4e1f:9f88::1e  
  2  *       *       *  
  
Computing statistics for 25 seconds...  
          Source to Here   This Node/Link  
Hop  RTT    Lost/Sent = Pct  Lost/Sent = Pct  Address  
  0           0/ 100 =  0%          0/ 100 =  0%  DESKTOP-BAQTEQI [2409:4073:4e1f:9f88:7096:c163:3201:b52c]  
                                0/ 100 =  0%  |  
  1    4ms     0/ 100 =  0%     0/ 100 =  0%  2409:4073:4e1f:9f88::1e  
  
Trace complete.
```

e. getmac

Command Another very simple command that shows the MAC address of your network interfaces

```
C:\Users\hp>getmac  
  
Physical Address      Transport Name  
=====  ======  
30-24-A9-9C-DE-2B    Media disconnected  
20-4E-F6-B5-1F-EB    \Device\Tcpip_{B36F7A11-7341-42D1-9CE2-164A721ECC40}  
20-4E-F6-B5-1F-EA    Media disconnected  
0A-00-27-00-00-05    \Device\Tcpip_{45FF8A82-9788-4C01-B522-5206D1F57E46}
```

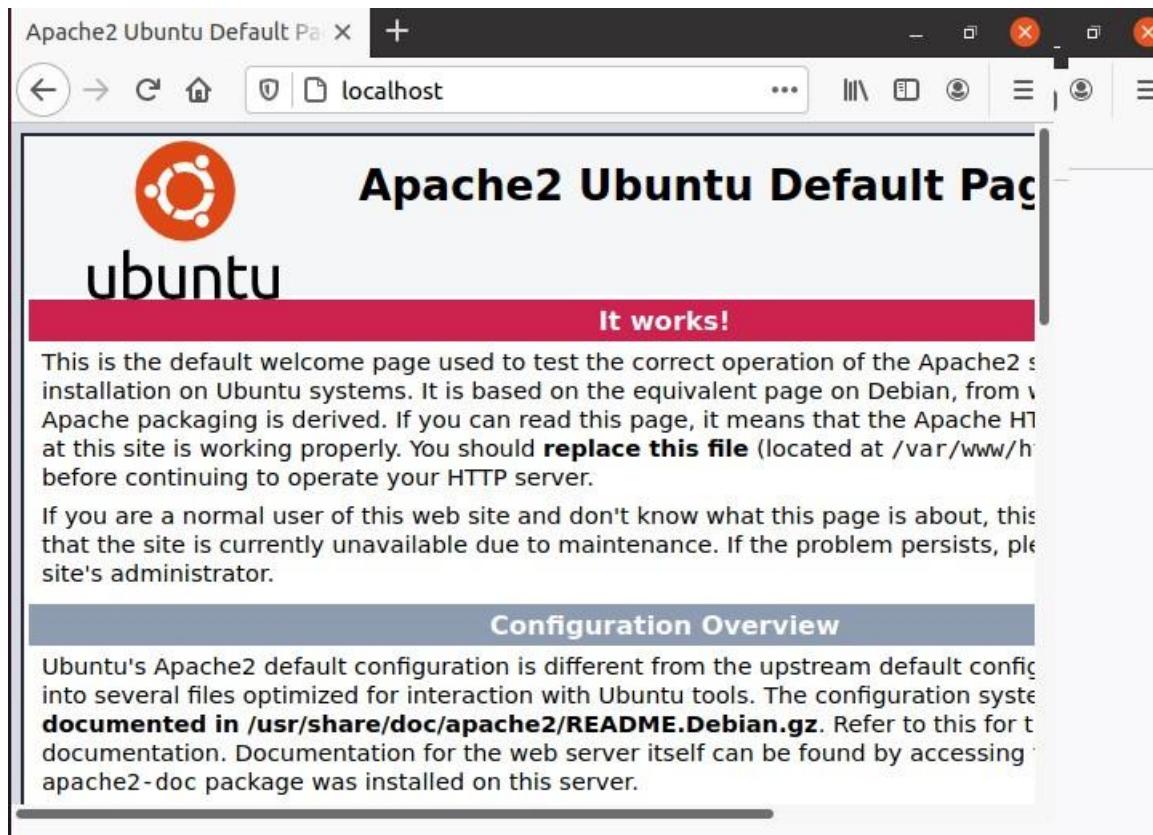
Install Apache

- Update your system sudo apt update
- Install Apache using apt: sudo apt install apache2
- Confirm that Apache is now running with the following command: sudo systemctl status apache2
- if it is not working sudo systemctl start apache2

```
ammu@ammu-VirtualBox:~/Desktop$ sudo systemctl status apache2
● apache2.service - The Apache HTTP Server
   Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor pres>
   Active: active (running) since Tue 2021-09-28 22:00:43 IST; 4min 33s ago
     Docs: https://httpd.apache.org/docs/2.4/
   Process: 621 ExecStart=/usr/sbin/apachectl start (code=exited, status=0/SU>
 Main PID: 786 (apache2)
    Tasks: 6 (limit: 1107)
   Memory: 6.3M
      CPU: 0.000 CPU(s) since start
         CGrou:
           ├─786 /usr/sbin/apache2 -k start
           ├─876 /usr/sbin/apache2 -k start
           ├─877 /usr/sbin/apache2 -k start
           ├─878 /usr/sbin/apache2 -k start
           ├─879 /usr/sbin/apache2 -k start
           └─880 /usr/sbin/apache2 -k start

Sep 28 22:00:38 ammu-VirtualBox systemd[1]: Starting The Apache HTTP Server...
Sep 28 22:00:43 ammu-VirtualBox apachectl[662]: [Tue Sep 28 22:00:43.204936 20>
Sep 28 22:00:43 ammu-VirtualBox apachectl[662]: AH00558: apache2: Could not re>
Sep 28 22:00:43 ammu-VirtualBox systemd[1]: Started The Apache HTTP Server.
Lines 1-20/20 (END)
```

- Once installed, test by accessing your server's IP in your browser:
<http://youripaddress>
(find out your ip address using ifconfig)



Install MariaDB

- Install mariadb `sudo apt install mariadb-server mariadb-client`
 - Check mariadb Installation `sudo systemctl status mysql`
(if it is not working `sudo systemctl start mysql`)

```

ammu@ammu-VirtualBox:~/Desktop$ sudo systemctl status mariadb
[sudo] password for ammu:
● mariadb.service - MariaDB 10.3.31 database server
   Loaded: loaded (/lib/systemd/system/mariadb.service; enabled; vendor pres>
   Active: active (running) since Tue 2021-09-28 22:00:46 IST; 8min ago
     Docs: man:mysqld(8)
           https://mariadb.com/kb/en/library/systemd/
  Process: 622 ExecStartPre=/usr/bin/install -m 755 -o mysql -g root -d /var>
  Process: 636 ExecStartPre=/bin/sh -c systemctl unset-environment _WSREP_ST>
  Process: 638 ExecStartPre=/bin/sh -c [ ! -e /usr/bin/galera_recovery ] && >
  Process: 857 ExecStartPost=/bin/sh -c systemctl unset-environment _WSREP_S>
  Process: 859 ExecStartPost=/etc/mysql/debian-start (code=exited, status=0/>
 Main PID: 725 (mysqld)
   Status: "Taking your SQL requests now..."
      Tasks: 30 (limit: 1107)
     Memory: 8.0M
        CGroup: /system.slice/mariadb.service
                  └─725 /usr/sbin/mysqld

Sep 28 22:00:42 ammu-VirtualBox mysqld[725]: 2021-09-28 22:00:42 0 [Note] /usr>
Sep 28 22:00:46 ammu-VirtualBox systemd[1]: Started MariaDB 10.3.31 database s>
Sep 28 22:00:46 ammu-VirtualBox /etc/mysql/debian-start[861]: Upgrading MySQL >
Sep 28 22:00:48 ammu-VirtualBox /etc/mysql/debian-start[864]: Looking for 'mys>
Sep 28 22:00:48 ammu-VirtualBox /etc/mysql/debian-start[864]: Looking for 'mys>
Sep 28 22:00:48 ammu-VirtualBox /etc/mysql/debian-start[864]: Version check fa>
Sep 28 22:00:48 ammu-VirtualBox /etc/mysql/debian-start[864]: ERROR 1045 (2800>
Sep 28 22:00:48 ammu-VirtualBox /etc/mysql/debian-start[864]: FATAL ERROR: Upg>
Sep 28 22:00:48 ammu-VirtualBox /etc/mysql/debian-start[893]: Checking for ins>
Sep 28 22:00:48 ammu-VirtualBox debian-start[896]: ERROR 1045 (28000): Access >

```

Install PHP and commonly used modules

- sudo apt install php libapache2-mod-php php-xmlcache php-cli php-gd php-curl php-mysql
- Restart apache2
 - sudo systemctl restart apache2
- Now you can check php installation
 - sudo echo "" | sudo tee -a /var/www/html/phpinfo.php > /dev/null
- Open a browser
 - http://127.0.0.1/phpinfo.php

```

ammu@ammu-VirtualBox:~/Desktop$ php -v
PHP 7.4.3 (cli) (built: Jul  5 2021 15:13:35) ( NTS )
Copyright (c) The PHP Group
Zend Engine v3.4.0, Copyright (c) Zend Technologies
    with Zend OPcache v7.4.3, Copyright (c), by Zend Technologies
ammu@ammu-VirtualBox:~/Desktop$ 

```

The screenshot shows a web browser window with two tabs: "Apache2 Ubuntu Default Pa" and "PHP 7.4.3 - phpinfo()". The active tab is "PHP 7.4.3 - phpinfo()", which displays the output of the `phpinfo()` function. The title bar of the browser shows the URL as "localhost/phpinfo.php". The main content area is titled "PHP Version 7.4.3" and contains a table with various PHP configuration parameters and their values.

System	Linux ammu-VirtualBox 5.8.0-53-generic #60~20.04 x86_64
Build Date	Jul 5 2021 15:13:35
Server API	Apache 2.0 Handler
Virtual Directory Support	disabled
Configuration File (php.ini) Path	/etc/php/7.4/apache2
Loaded Configuration File	/etc/php/7.4/apache2/php.ini
Scan this dir for additional .ini files	/etc/php/7.4/apache2/conf.d
Additional .ini files parsed	/etc/php/7.4/apache2/conf.d/10-mysqli.ini, /etc/php/7.4/apache2/conf.d/10-pdo.ini, /etc/php/7.4/apache2/conf.d/20-bz2.ini, /etc/php/7.4/apache2/conf.d/20-calendar.ini, /etc/php/7.4/apache2/conf.d/20-curl.ini, /etc/php/7.4/apache2/conf.d/20-exif.ini, /etc/php/7.4/apache2/conf.d/20-finfo.ini, /etc/php/7.4/apache2/conf.d/20-ftp.ini, /etc/php/7.4/apache2/conf.d/20-gettext.ini, /etc/php/7.4/apache2/conf.d/20-json.ini, /etc/php/7.4/apache2/conf.d/20-mysqli.ini, /etc/php/7.4/apache2/conf.d/20-ndb-mysqli.ini

Install phpmyadmin

sudo apt install phpmyadmin php-mbstring php-zip phpgd php-json php-curl
(It asks for webserver select apache2, select dbconfiguration and set password)

- Restart apache2 sudo systemctl restart apache2
- Check phpmyadmin

Open a browser <http://localhost/phpmyadmin>

username : root password : yourpassword

The screenshot shows the 'Databases' section of the PHPMyAdmin interface. At the top, there are tabs for 'Databases', 'SQL', 'Status', 'User accounts', 'Export', and 'Create'. Below the tabs, there is a search bar with 'Database name' and a dropdown menu set to 'utf8mb4_general_ci'. A large 'Create' button is visible. The main area displays a table with columns: Database, Collation, and Action. The table lists the following databases:

Database	Collation	Action
example	utf8mb4_general_ci	<input type="button" value="Check privileges"/>
information_schema	utf8_general_ci	<input type="button" value="Check privileges"/>
mysql	utf8mb4_general_ci	<input type="button" value="Check privileges"/>
performance_schema	utf8_general_ci	<input type="button" value="Check privileges"/>
phpmyadmin	utf8mb4_general_ci	<input type="button" value="Check privileges"/>
sample	utf8mb4_general_ci	<input type="button" value="Check privileges"/>

Total: 6

At the bottom, there are buttons for 'Check all' and 'Drop'.

A screenshot of a web browser window titled "localhost / localhost | ph" with a "+" icon. The address bar shows "localhost/phpmyadmin/index.php?tar...". The main content is the "phpMyAdmin" logo and a toolbar with icons for home, export, import, and others. Below is a navigation bar with "Recent" and "Favorites" tabs. The main area displays a hierarchical tree of databases: "New", "example", "information_schema", "mysql", "performance_schema", "phpmyadmin", and "sample". The "sample" database is currently selected, as indicated by the highlighted row in the tree.

```
ammu@ammu-VirtualBox:~$ sudo mysql -p
Enter password:
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MariaDB connection id is 51
Server version: 10.3.31-MariaDB-0ubuntu0.20.04.1 Ubuntu 20.04

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MariaDB [(none)]> create database example
      -> create database example;
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that
corresponds to your MariaDB server version for the right syntax to use near 'c
reate database example' at line 2
MariaDB [(none)]> create database sample;
Query OK, 1 row affected (0.102 sec)

MariaDB [(none)]> show databases;
+-----+
| Database |
+-----+
| information_schema |
| mysql |
| performance_schema |
| phpmyadmin |
| sample |
+-----+
5 rows in set (0.002 sec)
```

```
MariaDB [(none)]> create database example;
Query OK, 1 row affected (0.000 sec)

MariaDB [(none)]> show databases;
+-----+
| Database |
+-----+
| example |
| information_schema |
| mysql |
| performance_schema |
| phpmyadmin |
| sample |
+-----+
6 rows in set (0.001 sec)

MariaDB [(none)]> █
```

ANSIBLE INSTALLATION

```
ammu@ammu-VirtualBox:~/Desktop$ sudo apt-get install ansible
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  ieee-data python3-argcomplete python3-crypto python3-distutils
  python3-dnspython python3-jinja2 python3-jmespath python3-kerberos
  python3-lib2to3 python3-libcloud python3-netaddr python3-ntlm-auth
  python3-requests-kerberos python3-requests-ntlm python3-selinux
  python3-winrm python3-xmldict
Suggested packages:
  cowsay sshpass python-jinja2-doc ipython3 python-netaddr-docs
The following NEW packages will be installed:
  ansible ieee-data python3-argcomplete python3-crypto python3-distutils
  python3-dnspython python3-jinja2 python3-jmespath python3-kerberos
  python3-libcloud python3-netaddr python3-ntlm-auth
  python3-requests-kerberos python3-requests-ntlm python3-selinux
  python3-winrm python3-xmldict
The following packages will be upgraded:
  python3-lib2to3
  1 upgraded, 17 newly installed, 0 to remove and 327 not upgraded.
Need to get 237 kB/9,942 kB of archives.
After this operation, 92.0 MB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 http://in.archive.ubuntu.com/ubuntu focal/main amd64 python3-crypto amd64
  2.6.1-13ubuntu2 [237 kB]
Fetched 237 kB in 20s (12.1 kB/s)
Selecting previously unselected package python3-jinja2.
(Reading database ... 187805 files and directories currently installed.)

Selecting previously unselected package python3-libcloud.
Preparing to unpack .../11-python3-libcloud_2.8.0-1_all.deb ...
Unpacking python3-libcloud (2.8.0-1) ...
Selecting previously unselected package python3-ntlm-auth.
Preparing to unpack .../12-python3-ntlm-auth_1.1.0-1_all.deb ...
Unpacking python3-ntlm-auth (1.1.0-1) ...
Selecting previously unselected package python3-requests-kerberos.
Preparing to unpack .../13-python3-requests-kerberos_0.12.0-2_all.deb ...
Unpacking python3-requests-kerberos (0.12.0-2) ...
Selecting previously unselected package python3-requests-ntlm.
Preparing to unpack .../14-python3-requests-ntlm_1.1.0-1_all.deb ...
Unpacking python3-requests-ntlm (1.1.0-1) ...
Selecting previously unselected package python3-selinux.
Preparing to unpack .../15-python3-selinux_3.0-1build2_amd64.deb ...
Unpacking python3-selinux (3.0-1build2) ...
Selecting previously unselected package python3-xmldict.
Preparing to unpack .../16-python3-xmldict_0.12.0-1_all.deb ...
Unpacking python3-xmldict (0.12.0-1) ...
Selecting previously unselected package python3-winrm.
Preparing to unpack .../17-python3-winrm_0.3.0-2_all.deb ...
Unpacking python3-winrm (0.3.0-2) ...
Setting up python3-ntlm-auth (1.1.0-1) ...
Setting up python3-kerberos (1.1.14-3.1build1) ...
Setting up python3-xmldict (0.12.0-1) ...
Setting up python3-jinja2 (2.10.1-2) ...
Setting up python3-jmespath (0.9.4-2) ...
/usr/lib/python3/dist-packages/jmespath/visitor.py:32: SyntaxWarning: "is" with
 a literal. Did you mean "=="?
  if x is 0 or x is 1:
```

```
a literal. Did you mean "=="?
  if x is 0 or x is 1:
/usr/lib/python3/dist-packages/jmespath/visitor.py:34: SyntaxWarning: "is" with
a literal. Did you mean "=="?
  elif y is 0 or y is 1:
/usr/lib/python3/dist-packages/jmespath/visitor.py:34: SyntaxWarning: "is" with
a literal. Did you mean "=="?
  elif y is 0 or y is 1:
/usr/lib/python3/dist-packages/jmespath/visitor.py:260: SyntaxWarning: "is" wit
h a literal. Did you mean "=="?
  if original_result is 0:
Setting up python3-requests-kerberos (0.12.0-2) ...
Setting up ieee-data (20180805.1) ...
Setting up python3-dnspython (1.16.0-1build1) ...
Setting up python3-selinux (3.0-1build2) ...
Setting up python3-crypto (2.6.1-13ubuntu2) ...
Setting up python3-argcomplete (1.8.1-1.3ubuntu1) ...
Setting up python3-lib2to3 (3.8.10-0ubuntu1~20.04) ...
Setting up python3-distutils (3.8.10-0ubuntu1~20.04) ...
Setting up python3-requests-ntlm (1.1.0-1) ...
Setting up python3-libcloud (2.8.0-1) ...
Setting up python3-netaddr (0.7.19-3) ...
/usr/lib/python3/dist-packages/netaddr/strategy/__init__.py:189: SyntaxWarning:
  "is not" with a literal. Did you mean "!="?
  if word_sep is not '':
Setting up python3-winrm (0.3.0-2) ...
Setting up ansible (2.9.6+dfsg-1) ...
Processing triggers for man-db (2.9.1-1) ...
ammu@ammu-VirtualBox:~/Desktop$
```

ANSIBLE VERSION

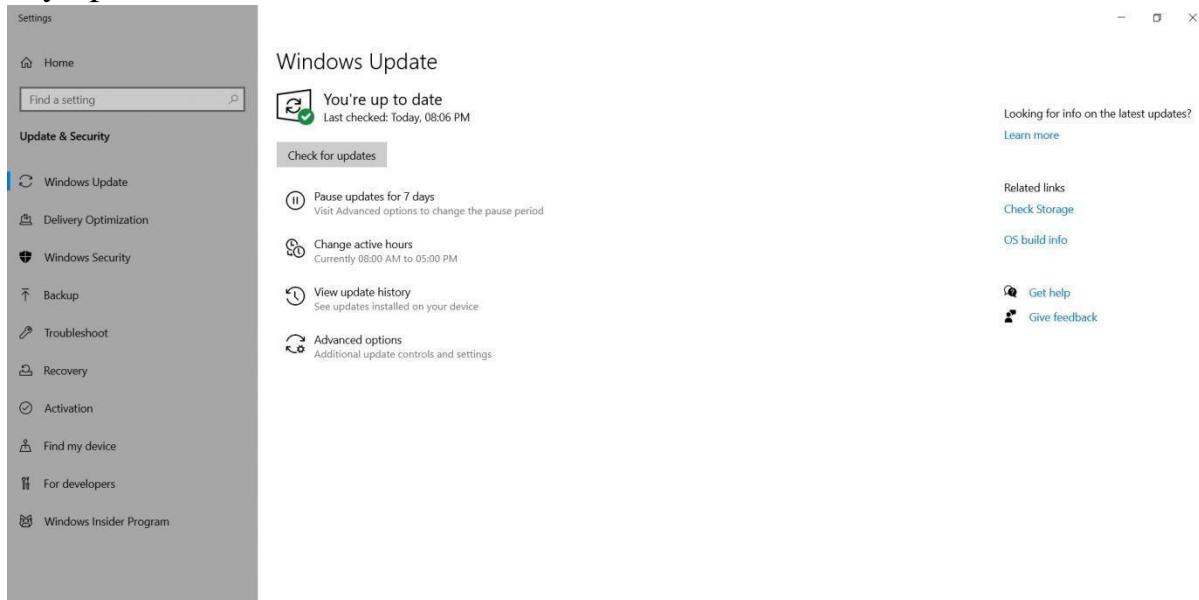
```
ammu@ammu-VirtualBox:~/Desktop$ ansible --version
ansible 2.9.6
  config file = /etc/ansible/ansible.cfg
  configured module search path = ['/home/ammu/.ansible/plugins/modules', '/usr
/share/ansible/plugins/modules']
  ansible python module location = /usr/lib/python3/dist-packages/ansible
  executable location = /usr/bin/ansible
  python version = 3.8.10 (default, Jun  2 2021, 10:49:15) [GCC 9.4.0]
```

Installing Docker on Windows 10

First make sure Windows is up to date.

In the Windows search type "Windows Update" and select Windows Update setting.

You should see a green check and "You're up to date". If not click "Check for updates". You will need to repeat this process until you no longer have any updates to install.



Next install WSL2

- From the Windows Search Type "powershell" then right-click on Windows PowerShell and then Run as administrator.
- Click 'Yes' to allow PowerShell to make changes to your device.
- In the Administrator: Windows PowerShell window run (copy and past) "wsl –install" to install Windows Services for Linux (wsl).

```
        Display usage information.  
PS C:\Windows\system32> wsl --install  
Installing: Virtual Machine Platform  
Virtual Machine Platform has been installed.  
Installing: Windows Subsystem for Linux  
Windows Subsystem for Linux has been installed.  
Downloading: WSL Kernel  
Installing: WSL Kernel  
WSL Kernel has been installed.  
Downloading: Ubuntu  
The requested operation is successful. Changes will not be effective until the system is rebooted.  
PS C:\Windows\system32>
```

Next enable the Virtual Machine Platform. In the Administrator:

Windows PowerShell run (copy and past) "dism.exe /online /enable-feature /featurename:VirtualMachinePlatform /all /norestart".

```
PS C:\Windows\system32> dism.exe /online /enable-feature /featurename:VirtualMachinePlatform /all /norestart  
Deployment Image Servicing and Management tool  
Version: 10.0.19041.844  
Image Version: 10.0.19043.1266  
Enabling feature(s)  
[=====100.0%=====]  
The operation completed successfully.  
PS C:\Windows\system32>
```

- Download and install the WSL2 Linux kernel update package for x64 machines



set up a Linux user



```

Retype new password:
passwd: password updated successfully
Installation successful!
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

Welcome to Ubuntu 20.04 LTS (GNU/Linux 5.10.16.3-microsoft-standard-WSL2 x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

 System information as of Fri Oct  1 11:50:30 IST 2021

 System load:  0.16           Processes:          8
 Usage of /:   0.4% of 250.98GB  Users logged in:    0
 Memory usage: 2%            IPv4 address for eth0: 172.24.46.235
 Swap usage:   0%

0 updates can be installed immediately.
0 of these updates are security updates.

The list of available updates is more than a week old.
To check for new updates run: sudo apt update

This message is shown once once a day. To disable it please create the
/home/sam/.hushlogin file.

```

- Reboot Windows.
- Again, from the Windows Search Type "powershell" then rightclick on Windows PowerShell and then Run as administrator.

In the PowerShell window run "**wsl --set-default-version 2**".

```

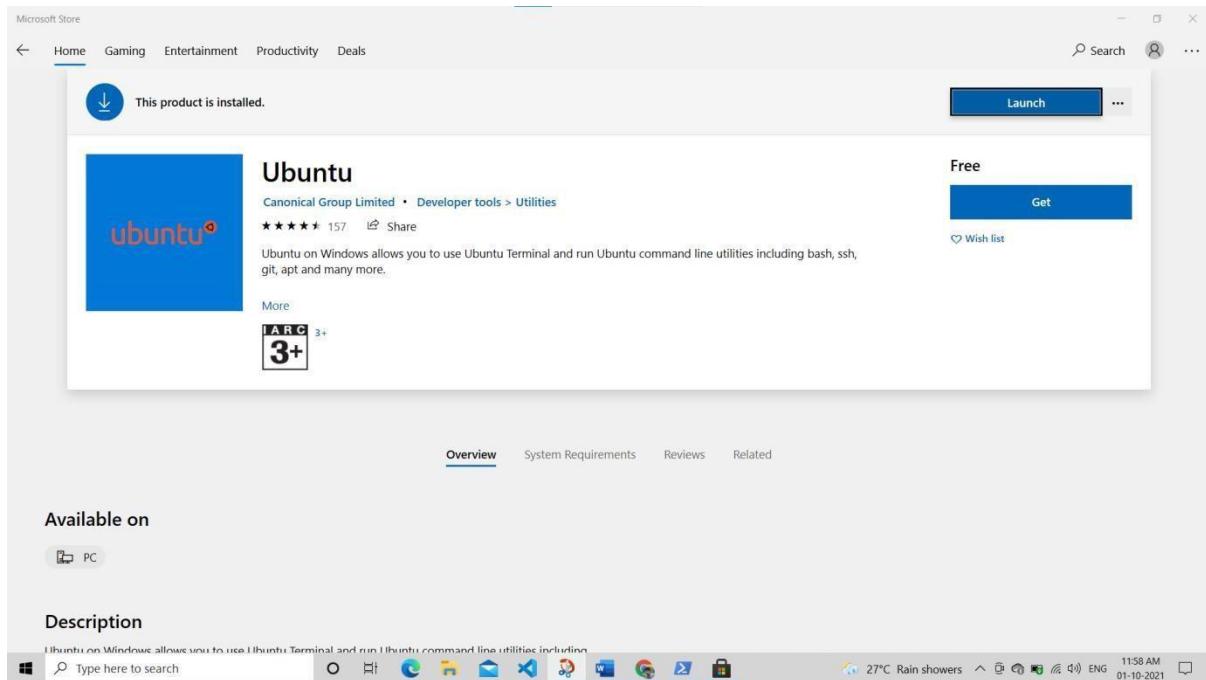
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\Windows\system32> wsl --set-default-version 2
For information on key differences with WSL 2 please visit https://aka.ms/wsl2
The operation completed successfully.
PS C:\Windows\system32>

```

- Next install a Linux distribution from the [Microsoft Store](#)



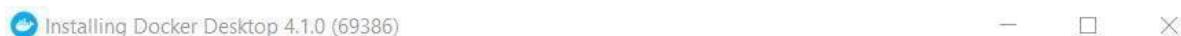
- You will now be able to run Linux commands in the Ubuntu terminal window.

```
un a command as administrator (user "root"), use "sudo <command>".  
"man sudo_root" for details.  
  
LAPTOP-2S6KTBFB:~$ ls  
LAPTOP-2S6KTBFB:~$ exit
```

Now you can install Docker Desktop for Windows

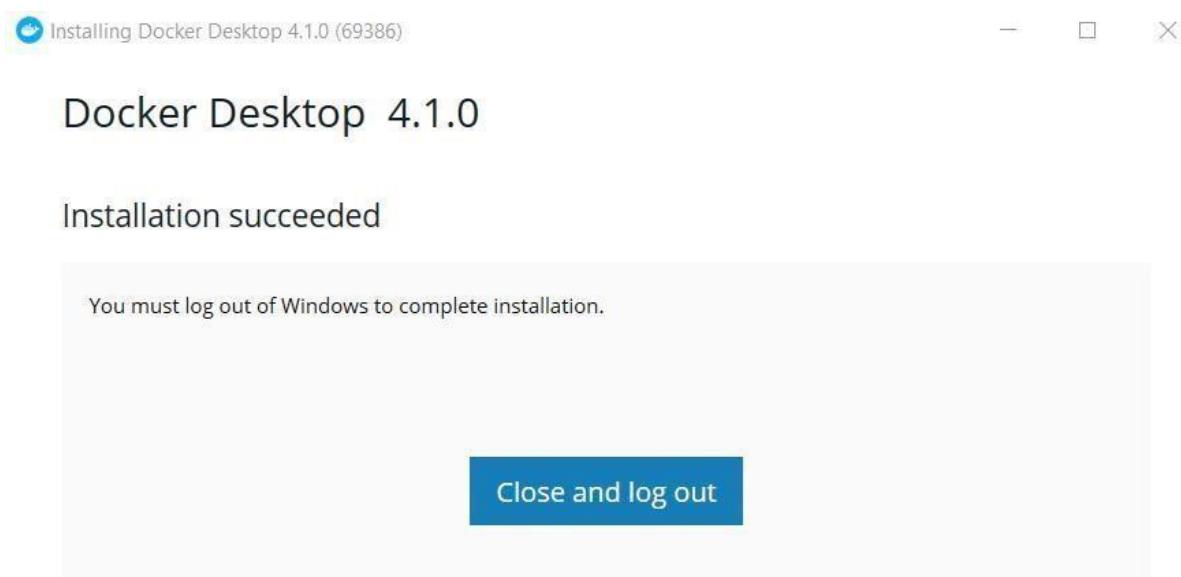
Download the Docker Desktop for Windows installer from <https://www.docker.com/products/docker-desktop>

- Run the installer.

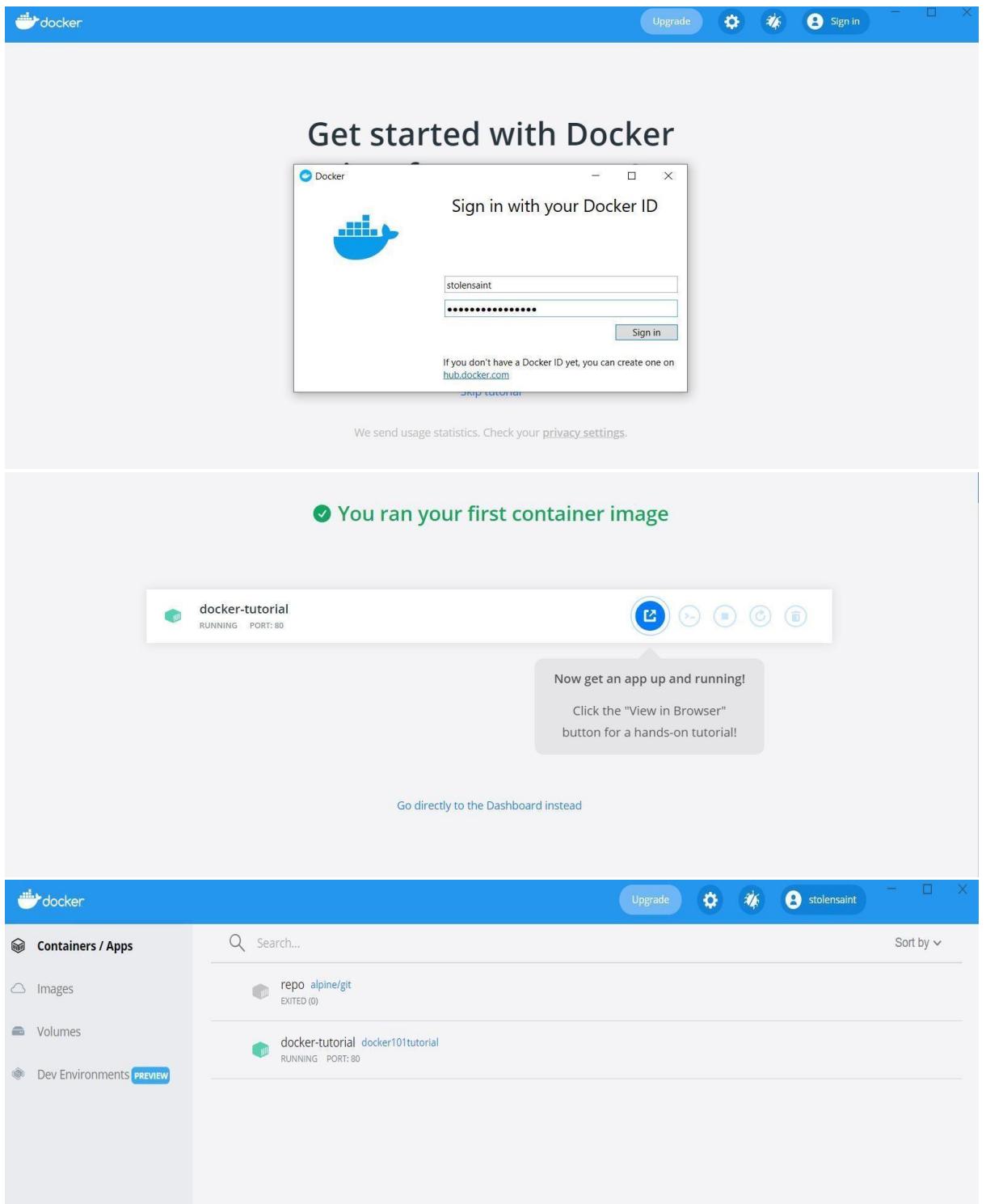


Configuration

- Install required Windows components for WSL 2
- Add shortcut to desktop



- Login to Windows and let Docker finish setting up. This can take a few minutes depending on your machine.



Run the docker “Hello World” from an Ubuntu Terminal
run "**docker run hello-world**".

```

Unable to find image 'hello-world:latest' locally
latest: Pulling from library/hello-world
2db29710123e: Pull complete
Digest: sha256:9ade9cc2e26189a19c2e8854b9c8f1e14829b51c55a630ee675a5a9540ef6ccf
Status: Downloaded newer image for hello-world:latest

Hello from Docker!
This message shows that your installation appears to be working correctly.

To generate this message, Docker took the following steps:
1. The Docker client contacted the Docker daemon.
2. The Docker daemon pulled the "hello-world" image from the Docker Hub.
   (amd64)
3. The Docker daemon created a new container from that image which runs the
   executable that produces the output you are currently reading.
4. The Docker daemon streamed that output to the Docker client, which sent it
   to your terminal.

To try something more ambitious, you can run an Ubuntu container with:
$ docker run -it ubuntu bash

Share images, automate workflows, and more with a free Docker ID:
https://hub.docker.com/

For more examples and ideas, visit:
https://docs.docker.com/get-started/

```

Running Ubuntu Machine □ Run the command “**docker run -t -i ubuntu /bin/bash**” in powershell

- This is a Linux root bash, try some commands

```

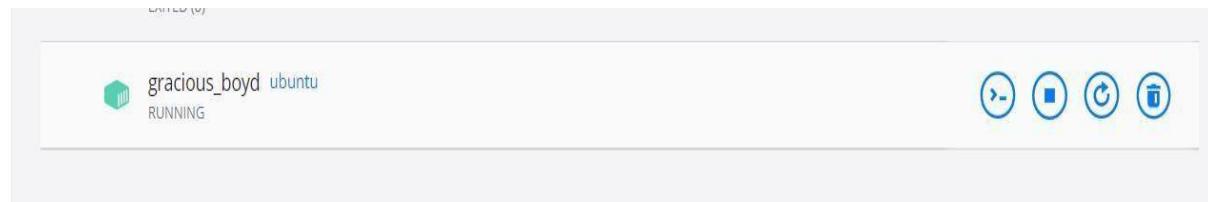
root@afab3919c935:/
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\Windows\system32> docker run -t -i ubuntu /bin/bash
root@afab3919c935:/# ls
bin lib lib32 lib64 libx32 media mnt opt proc root run sbin srv sys tmp var vmlin
root@afab3919c935:/# pwd
/
root@afab3919c935:/# cat >> demo.txt
Hi I'm Sam
^C
root@afab3919c935:/# cat demo.txt
Hi I'm Sam
root@afab3919c935:/# mkdir demo
root@afab3919c935:/# mv demo.txt demo
root@afab3919c935:/# cd demo
root@afab3919c935:/demo# ls
demo.txt
root@afab3919c935:/demo# rm demo.txt
root@afab3919c935:/demo# ls
root@afab3919c935:/demo# cd ..
root@afab3919c935:/# rmdir demo
root@afab3919c935:/# ls
bin lib lib32 lib64 libx32 media mnt opt proc root run sbin srv sys tmp var vmlin
root@afab3919c935:/#

```

Docker GUI-Containers



Removing All Containers

```

root@afab3919c935:/# exit
exit
PS C:\Windows\system32> docker ps -a
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
aciou_boyd 8d21c1d81c22 ubuntu:latest "bash" 6 hours ago Exited (255) 8 minutes ago
busy_maxwell 1b0186a069a3 ubuntu "bash" 6 hours ago Exited (0) 6 hours ago
serene_dubinsky 48ab9a4423d5 ubuntu "bash" 7 hours ago Exited (0) 7 hours ago
serene_bhaskara fd9061619454 ubuntu "bash" 7 hours ago Exited (0) 7 hours ago
beautiful_tereshkova 398156a697cc hello-world "/hello" 8 hours ago Exited (0) 8 hours ago
jolly_torvalds a7e83e3eeda docker101tutorial "/docker-entrypoint..." 8 hours ago Exited (0) 7 hours ago
docker-tutorial e750d0f55bb4 alpine/git "git clone https://g..." 8 hours ago Exited (0) 8 hours ago
repo

PS C:\Windows\system32> docker rm -f busy_maxwell
busy_maxwell
PS C:\Windows\system32> docker ps -a
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
gracious_boyd afab3919c935 ubuntu "/bin/bash" 7 minutes ago Exited (0) 2 minutes ago
serene_dubinsky 1b0186a069a3 ubuntu "bash" 6 hours ago Exited (0) 6 hours ago
serene_bhaskara 48ab9a4423d5 ubuntu "bash" 8 hours ago Exited (0) 7 hours ago
beautiful_tereshkova fd9061619454 ubuntu "bash" 8 hours ago Exited (0) 7 hours ago
jolly_torvalds 398156a697cc hello-world "/hello" 8 hours ago Exited (0) 8 hours ago
docker-tutorial a7e83e3eeda docker101tutorial "/docker-entrypoint..." 8 hours ago Exited (0) 8 hours ago
repo

PS C:\Windows\system32> docker rm -f gracious_boyd
gracious_boyd
PS C:\Windows\system32> docker rm -f serene_dubinsky
serene_dubinsky
PS C:\Windows\system32> docker rm -f serene_bhaskara
serene_bhaskara
PS C:\Windows\system32> docker rm -f beautiful_tereshkova
beautiful_tereshkova
PS C:\Windows\system32> docker rm -f jolly_torvalds
jolly_torvalds
PS C:\Windows\system32> docker rm -f docker-tutorial
docker-tutorial
PS C:\Windows\system32> docker rm -f repo
repo
PS C:\Windows\system32> docker ps -a
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
PS C:\Windows\system32>

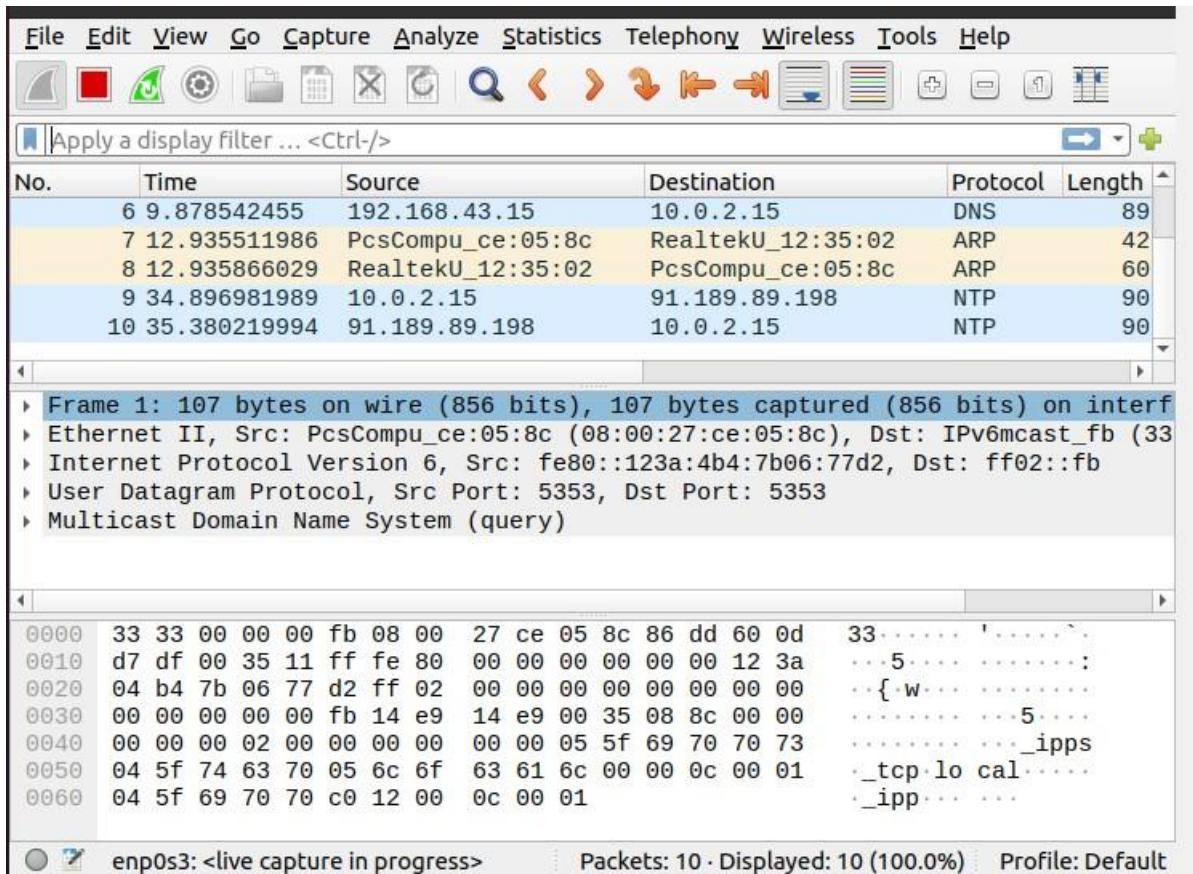
```

The screenshot shows the Docker desktop application running on a Windows system. The main interface has a blue header bar with the Docker logo and some user account icons. Below the header, there's a sidebar with a 'Containers / Apps' tab selected. Underneath the sidebar, there are three icons: 'Images' (cloud icon), 'Volumes' (disk icon), and 'Dev Environments' (cube icon with a preview badge). The main content area is titled 'No containers running' and features a large blue cube icon. Below this, there's a dark terminal-like window containing the command: `docker run -d -p 80:80 docker/getting-started`. At the bottom of the screen, there's a green progress bar.

WIRESHARK INSTALLATION

```
ammu@ammu-VirtualBox:~/Desktop$ sudo apt-get install wireshark
[sudo] password for ammu:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
libc-ares2 libdouble-conversion3 libpcre2-16-0 libqt5core5a libqt5dbus5
libqt5gui5 libqt5multimedia5 libqt5multimedia5-plugins
libqt5multimeddiagsttools5 libqt5multimedialogs5 libqt5network5
libqt5opengl5 libqt5printsupport5 libqt5svg5 libqt5widgets5 libsmi2ldbl
libspandsp2 libssh-gcrypt-4 libwireshark-data libwireshark13 libwiredtap10
libwsutil11 libxcb-xinerama0 libxcb-xinput0 qt5-gtk-platformtheme
qttranslations5-l10n wireshark-common wireshark-qt
Suggested packages:
qt5-image-formats-plugins qtwayland5 snmp-mibs-downloader geoipupdate
geoip-database geoip-database-extra libjs-leaflet
libjs-leaflet.markercluster wireshark-doc
The following NEW packages will be installed:
libc-ares2 libdouble-conversion3 libpcre2-16-0 libqt5core5a libqt5dbus5
libqt5gui5 libqt5multimedia5 libqt5multimedia5-plugins
libqt5multimeddiagsttools5 libqt5multimedialogs5 libqt5network5
libqt5opengl5 libqt5printsupport5 libqt5svg5 libqt5widgets5 libsmi2ldbl
libspandsp2 libssh-gcrypt-4 libwireshark-data libwireshark13 libwiredtap10
libwsutil11 libxcb-xinerama0 libxcb-xinput0 qt5-gtk-platformtheme
qttranslations5-l10n wireshark wireshark-common wireshark-qt
0 upgraded, 29 newly installed, 0 to remove and 326 not upgraded.
Need to get 32.8 MB of archives.
After this operation, 163 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Processing triggers for desktop-base-libs (0.24-1ubuntu2) ...
ammu@ammu-VirtualBox:~/Desktop$ sudo dpkg-reconfigure wireshark-common
ammu@ammu-VirtualBox:~/Desktop$ sudo adduser $USER wireshark
adduser: The user 'SUSER' does not exist.
ammu@ammu-VirtualBox:~/Desktop$ sudo adduser $USER wireshark
Adding user `ammu' to group `wireshark' ...
Adding user ammu to group wireshark
Done.
```

```
ammu@ammu-VirtualBox:~/Desktop$
```



NETCAT

```
ammu@ammu-VirtualBox:~/Desktop$ sudo apt-get install netcat
[sudo] password for ammu:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  netcat
0 upgraded, 1 newly installed, 0 to remove and 326 not upgraded.
Need to get 2,172 B of archives.
After this operation, 15.4 kB of additional disk space will be used.
Get:1 http://in.archive.ubuntu.com/ubuntu focal/universe amd64 netcat all 1.206-1ubuntu1 [2,172 B]
Fetched 2,172 B in 3s (844 B/s)
Selecting previously unselected package netcat.
(Reading database ... 198267 files and directories currently installed.)
Preparing to unpack .../netcat_1.206-1ubuntu1_all.deb ...
Unpacking netcat (1.206-1ubuntu1) ...
Setting up netcat (1.206-1ubuntu1) ...
```

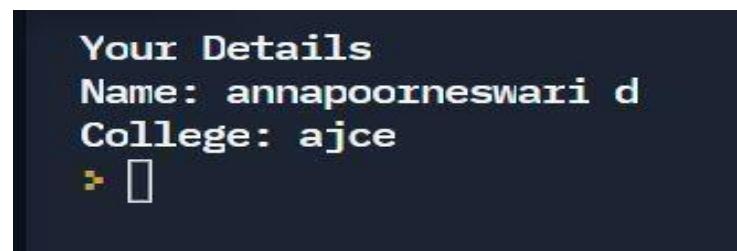
NC

```
ammu@ammu-VirtualBox:~/Desktop$ nc -h
OpenBSD netcat (Debian patchlevel 1.206-1ubuntu1)
usage: nc [-46CdhklNnrStUuvZz] [-I length] [-i interval] [-M ttl]
          [-m minttl] [-O length] [-P proxy_username] [-p source_port]
          [-q seconds] [-s source] [-T keyword] [-V rtable] [-W recvlimit] [-w
timeout]
          [-X proxy_protocol] [-x proxy_address[:port]] [destination]
[port]
Command Summary:
  -4           Use IPv4
  -6           Use IPv6
  -b           Allow broadcast
  -C           Send CRLF as line-ending
  -D           Enable the debug socket option
  -d           Detach from stdin
  -F           Pass socket fd
  -h           This help text
  -I length    TCP receive buffer length
  -i interval   Delay interval for lines sent, ports scanned
  -k           Keep inbound sockets open for multiple connects
  -l           Listen mode, for inbound connects
  -M ttl        Outgoing TTL / Hop Limit
  -m minttl     Minimum incoming TTL / Hop Limit
  -N           Shutdown the network socket after EOF on stdin
  -n           Suppress name/port resolutions
  -O length    TCP send buffer length
  -P proxyuser  Username for proxy authentication
  -p port       Specify local port for remote connects
  -q secs       quit after EOF on stdin and delay of secs
```

Shell Script

1. Write a shell script to ask your name, and college name and print it on the screen.

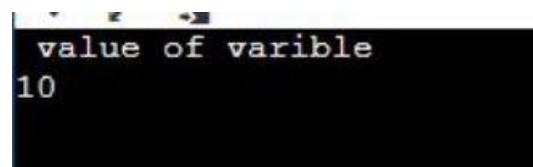
```
#!/bin/bash echo " Enter  
Details " echo  
"*****" echo  
Enter your NAME read  
NAME  
echo Enter your College name  
read college clear  
echo Your Details  
echo Name:  
$NAME  
echo College: $college
```



```
Your Details  
Name: annapoorneswari d  
College: ajce  
▶ □
```

2. Write a shell script to set a value for a variable and display it on command line interface.

```
#!/bin/bash echo "  
value of varible "  
x=10  
echo "$x"
```



```
value of varible  
10
```

- 3. Write a shell script to perform addition, subtraction, multiplication, division with two numbers that is accepted from user.**

```
#!/bin/bash

echo "arithmetic operations"

echo "Enter a number"
read x

echo "Enter another number"
read y

echo      "Select      operation"          echo
"\n1.Addition\n2.Subtraction\n3.Multiplication\n4.Divisi
on"

read op case "$op" in
"1") echo "x+y=\"$((x+y))";;
"2") echo "x-y=\"$((x-y))";;
"3") echo "x*y=\"$((x*y))";;
"4") echo "x/y=\"$((x/y))";;

Esac
```

```
user@user-VirtualBox:~$ gedit
^C
user@user-VirtualBox:~$ chmod u+x bash2.txt
user@user-VirtualBox:~$ ./bash2.txt
arithmetic operations
Enter a number
5
Enter another number
3
Select operation
\1.Addition\2.Subtraction\3.Multiplication\4.Division
1
x+y=8
user@user-VirtualBox:~$
```

- 4. Write a shell script to check the value of a given number and display whether the number is found or not.**

```
#!/bin/bash echo "Finding a number" echo "Enter a number" read a if [ $a == 5 ]; then echo "Number is found ;)" else echo "Number is NOT found !" fi
```

```
user@user-VirtualBox:~$ chmod u+x bash3.txt
user@user-VirtualBox:~$ ./bash3.txt
Finding a number
Enter a number
3
Number is NOT found !
user@user-VirtualBox:~$ ./bash3.txt
Finding a number
Enter a number
5
Number is found ;)
user@user-VirtualBox:~$
```

5. Write a shell script to display current date, calendar.

```
#!/bin/bash echo "Time and Calendar" echo "Today is $(date)" echo "" echo "Calendar :" cal
```

```
^C
user@user-VirtualBox:~$ chmod u+x bash4.txt
user@user-VirtualBox:~$ ./bash4.txt
Time and Calendar
Today is Sunday 03 October 2021 01:54:31 PM IST
Calendar :
```

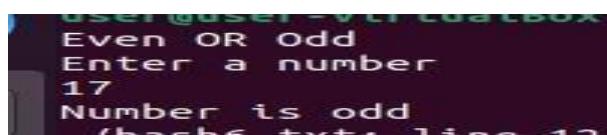
6. Write a shell script to check a number is even or odd.

```
#!/bin/bash echo "Even OR Odd" echo "Enter a number" read n
x=$((n%2))
```

```

if [ $x -eq 0 ]; then
echo "Number is
Even" else echo
"Number is
odd"
fi

```



```

USER@USER-VirtualBox:~$ Even OR Odd
Enter a number
17
Number is odd
(USER@USER-VirtualBox:~$)

```

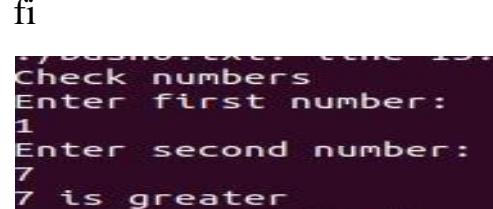
- 7. Write a shell script to check a number is greater than, less than or equal to another number.**

```

#!/bin/bash      echo
"Check      numbers"
echo "Enter first
number:" read a
echo "Enter second number:"
read b

if [ $a -gt $b ]; then
echo "$a is greater"
elif [ $b -gt $a ];then
echo "$b is greater"
else echo "Both are
Equal"
fi

```



```

~/Desktop/exe/line 13:
Check numbers
Enter first number:
1
Enter second number:
7
7 is greater
(USER@USER-VirtualBox:~$)

```

8. Write a shell script to find the sum of first 10 numbers.

```
#!/bin/bash echo "Sum  
of Numbers " t=0  
  
for (( i=1;i<=10;i++ ))  
do t=`expr $t + $i` done echo  
"sum of first 10 numbers = $t"
```

```
user@user-VirtualBox:~$ ./bash8.  
Sum of Numbers  
"sum of first 10 numbers = 55"
```

9. Write a shell script to find the sum, the average and the product of the four integers entered.

```
#!/bin/bash echo "AVG, SUM &  
Product of 4 No:"  
  
echo "enter first number: " read a  
echo "Second number: "  
read b  
  
echo "Third number: "  
read c  
  
echo "Fourth number: "  
read d  
  
sum=$(($a + $b + $c + $d))  
avg=$(echo $sum / 4 | bc -l )  
prod=$(($a * $b * $c * $d))  
  
echo "The sum of these numbers is: " $sum echo  
"The average of these numbers is: " $avg echo  
"The product of these numbers is: " $prod
```

```

AVG, SUM & Product of 4 No:
enter first number:
67
Second number:
78
Third number:
89
Fourth number:
34
The sum of these numbers is: 268
The average of these numbers is: 67.000000000000000000000000000000
The product of these numbers is: 15813876

```

10. Write a shell script to find the smallest of three numbers.

```

echo "enter a: "
read a echo
"enter b : "
read b echo
"enter c : " read
c s=$a if [ $b -
lt $s ] then
s=$b
fi if [ $c -lt
$s ] then
s=$c
fi
echo Smallest of $a $b $c is $s

```

```

enter a:
3
enter b :
4
enter c :
2
Smallest of 3 4 2 is 2

```

11. Write a shell program to find factorial of given number.

```

#!/bin/bash echo
"Factorial"      echo
"Enter a number"
read num fact=1
for((i=2;i<=num;i++))

```

```

{
    fact=$((fact * i)) #fact = fact * i
}
echo "Factorial is $fact"

```

```

user@user-VirtualBox:~/Desktop$ ./factorial.sh
Factorial
Enter a number
3
Factorial is 6
user@user-VirtualBox:~/Desktop$ 

```

12. Write a shell program to check a number is palindrome or not.

```

#!/bin/bash      echo
"Palindrome or Not"
echo "Enter number to check"
read n rev=$(echo $n | rev) if [
$n -eq $rev ]; then      echo
"Number is Palindrome" else
echo "Number is not Palindrome"
fi

```

```

user@user-VirtualBox:~/Desktop$ ./palindrome.sh
Palindrome or Not
Enter number to check
3673
Number is not Palindrome
user@user-VirtualBox:~/Desktop$ 

```

13. Write a shell script to find the average of the numbers entered in command line.

```

#!/bin/bash
echo "Average of N numbers"
echo "Enter Size"
read n
i=1 sum=0 echo "Enter
Numbers" while [ $i
le $n ]
do read num

```

```

sum=$((sum + num))
i=$((i + 1)) done
avg=$(echo $sum / $n | bc
-l) echo $avg

```

```

user@user-VirtualBox:~$ ./bas
Average of N numbers
Enter Size
2
Enter Numbers
3
3
3.000000000000000000000000000000
user@user-VirtualBox:~$ 

```

14. Write a shell program to find the sum of all the digits in a number.

```

#!/bin/bash echo "Sum
of all digits" echo
"Enter a number:"
read num sum=0

while [ $num -gt 0 ] do
mod=$((num % 10))

sum=$((sum + mod))

num=$((num / 10)) done
echo "Sum of digits is
$sum"

```

```

user@user-VirtualBox:~$ chmod u+
user@user-VirtualBox:~$ ./bash14
Sum of all digits
Enter a number:
11
Sum of digits is 2
user@user-VirtualBox:~$ 

```

15. Write a shell Script to check whether given year is leap year or not.

```

#!/bin/bash

echo "LEAP YEAR OR NOT"
echo "Enter the year"
read y a=`expr $y %
4` b=`expr $y %

```

```
100` c=`expr $y %
400` if [ $a -eq 0 -a $b -ne 0 -o
$c -eq 0 ];
```

then

```
echo "$y is leap year" else
echo "$y is not leap year"
```

fi

```
user@user-VirtualBox:~$ LEAP YEAR OR NOT
Enter the year
2004
2004 is leap year
user@user-VirtualBox:~$
```