

What is an operating system?

It is a system software that manages computer hardware, software resources, and provides common services for computer programs.



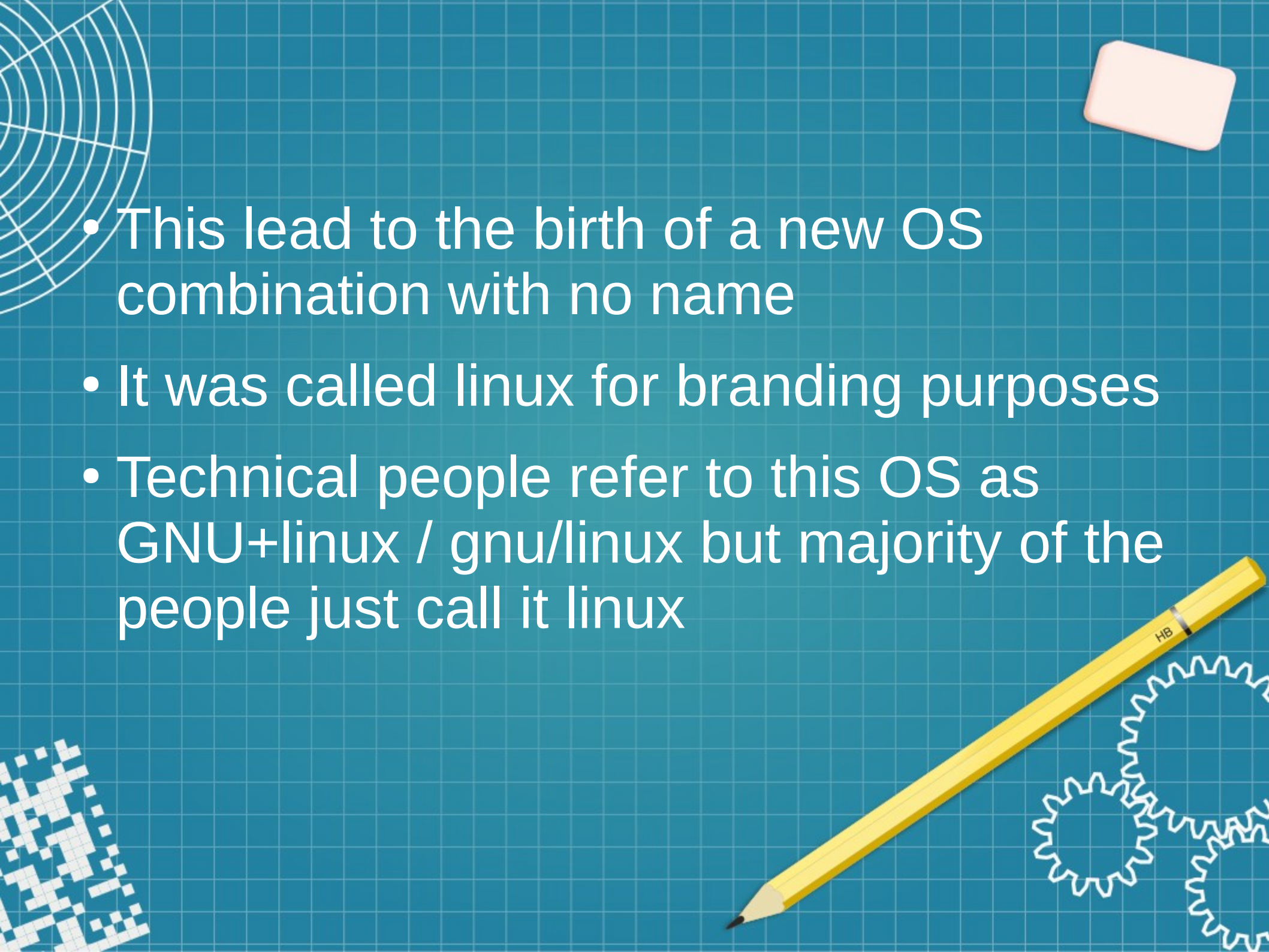
What is linux?

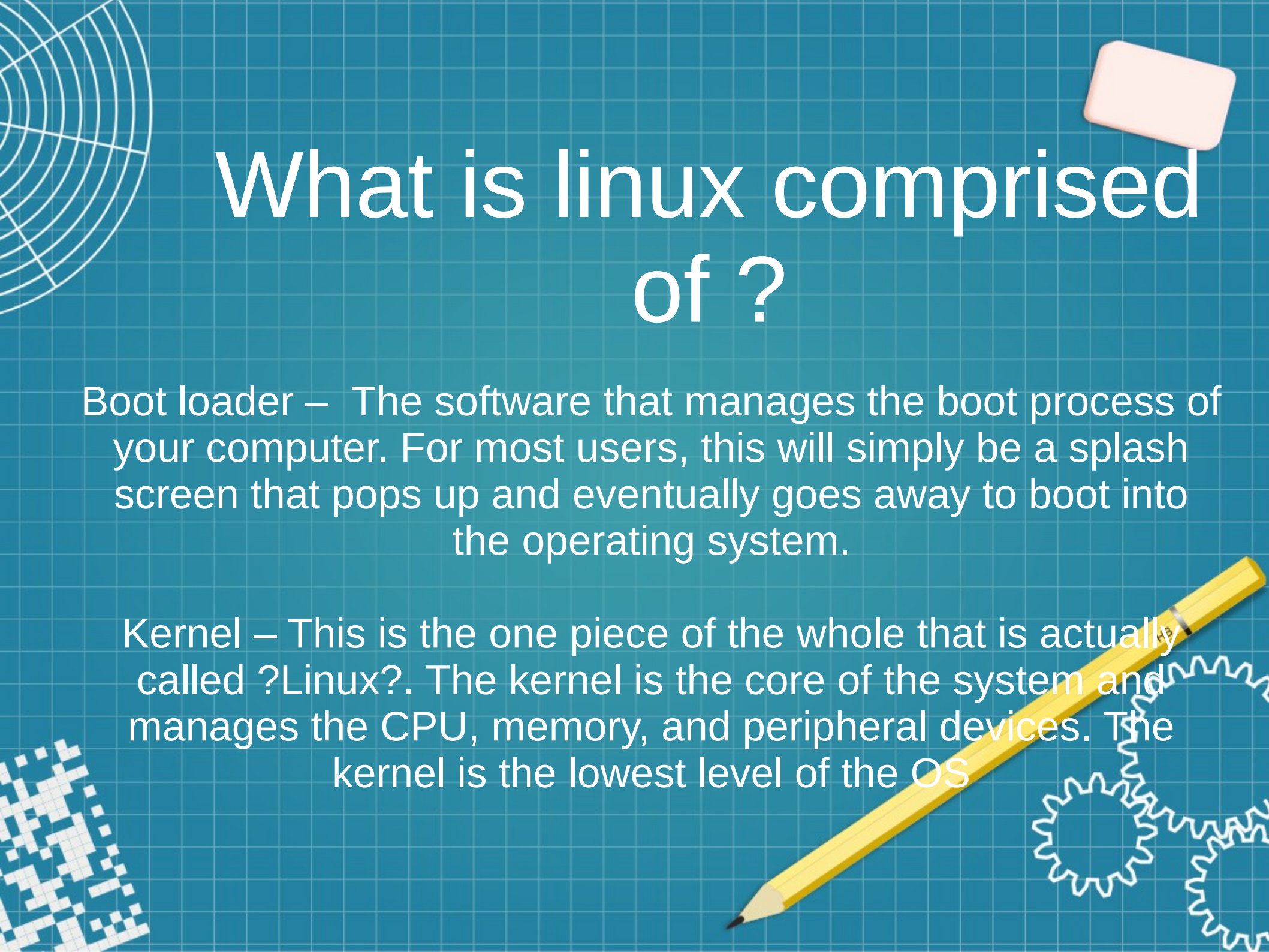
Its the most widely used free and open source kernel on the planet



Not an operating system?

Linux was released in 1991 and after its release developers started combining linux kernel with an open source OS called GNU replacing the then kernel called hurd.

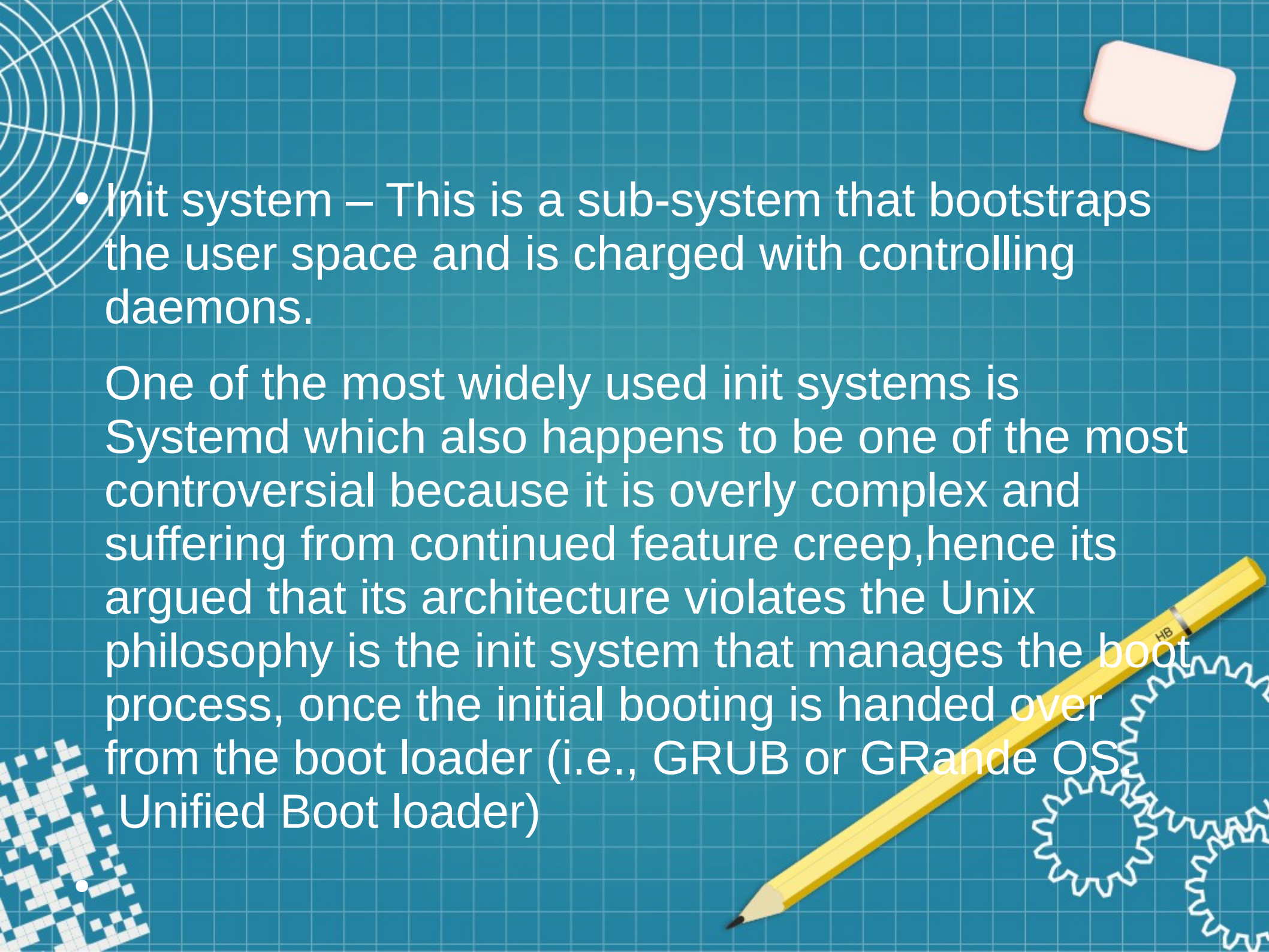
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- This led to the birth of a new OS combination with no name
 - It was called linux for branding purposes
 - Technical people refer to this OS as GNU+linux / gnu/linux but majority of the people just call it linux



What is linux comprised of ?

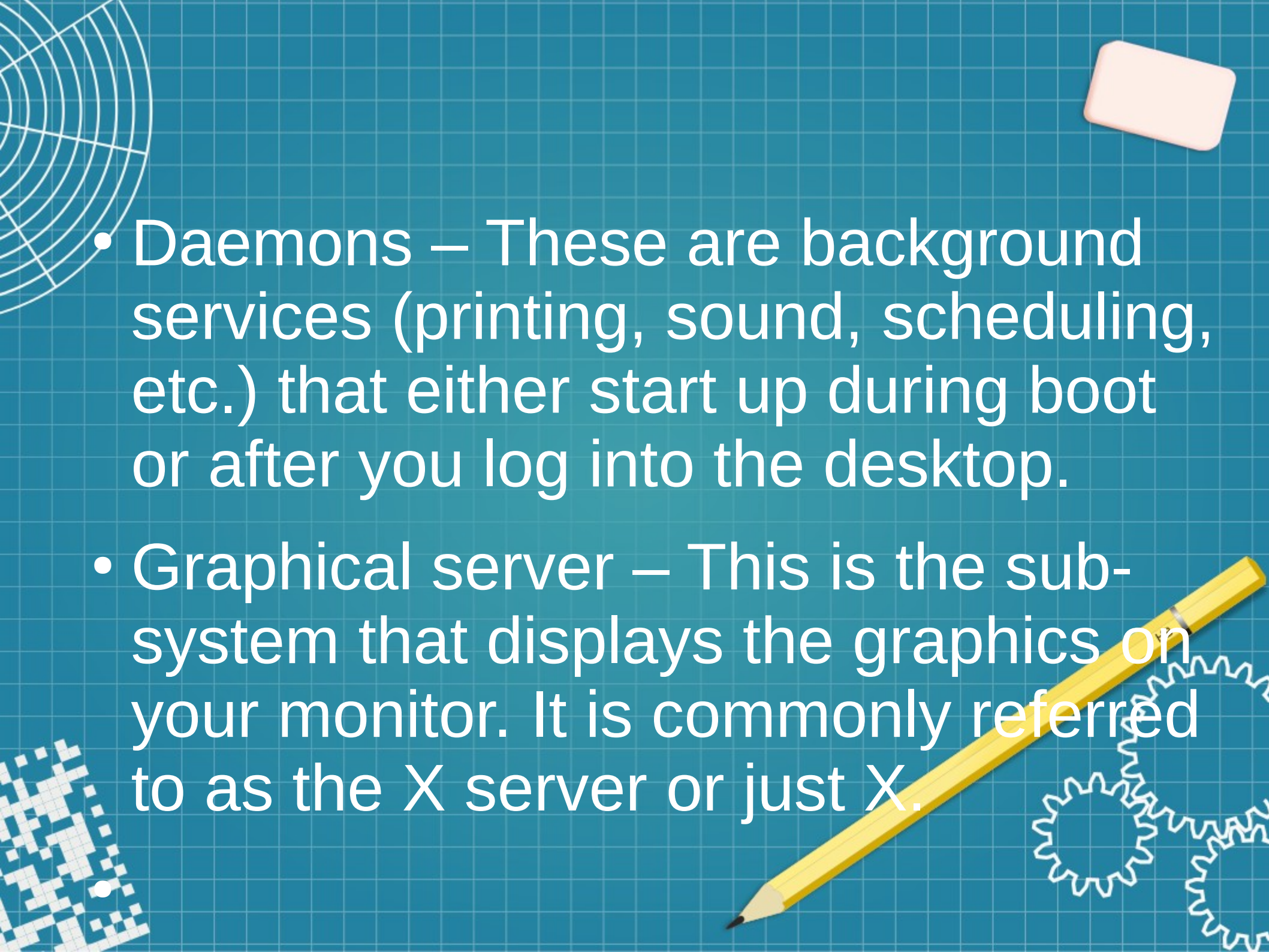
Boot loader – The software that manages the boot process of your computer. For most users, this will simply be a splash screen that pops up and eventually goes away to boot into the operating system.


Kernel – This is the one piece of the whole that is actually called ?Linux?. The kernel is the core of the system and manages the CPU, memory, and peripheral devices. The kernel is the lowest level of the OS

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- Init system – This is a sub-system that bootstraps the user space and is charged with controlling daemons.

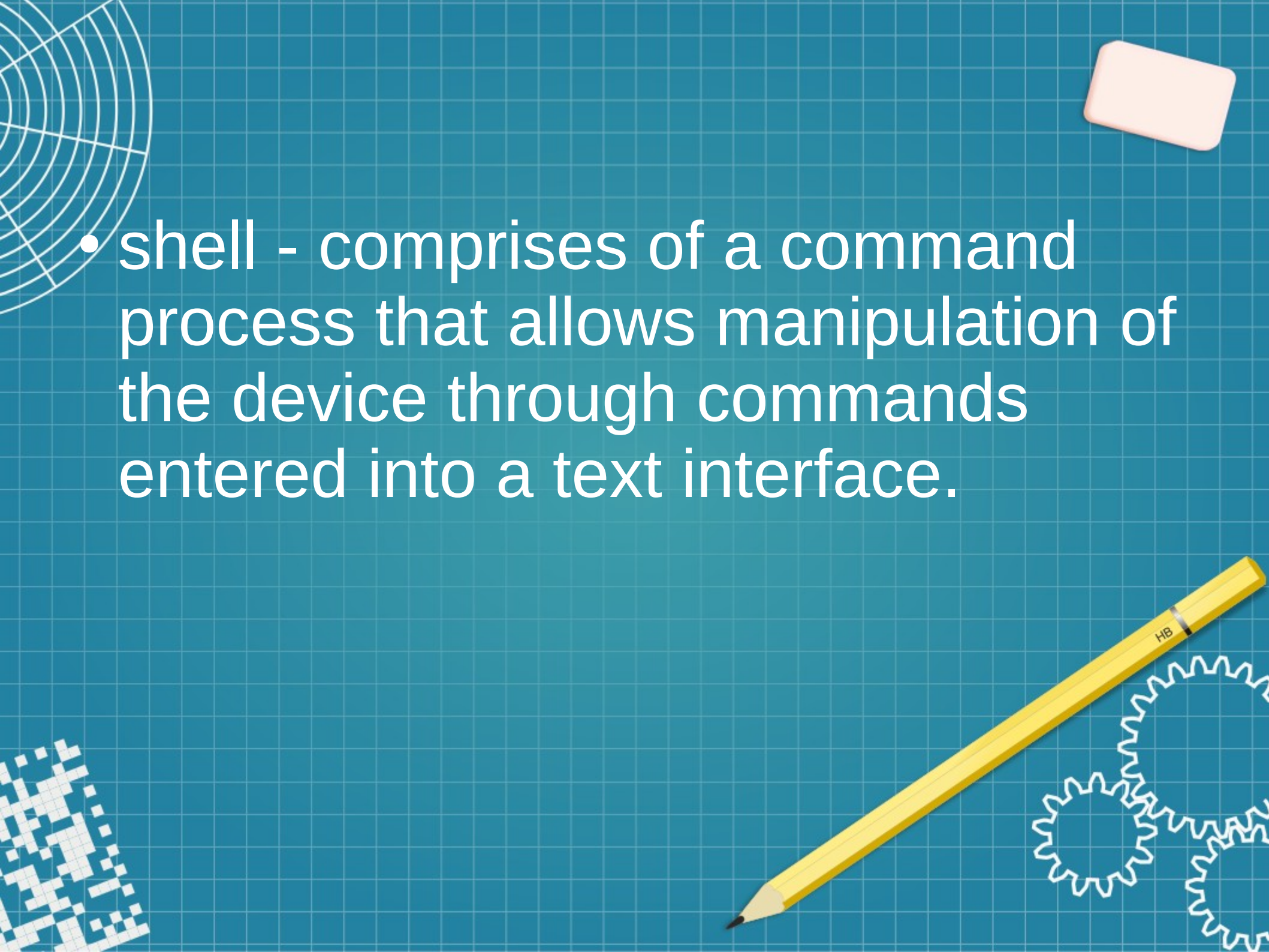
One of the most widely used init systems is Systemd which also happens to be one of the most controversial because it is overly complex and suffering from continued feature creep, hence its argued that its architecture violates the Unix philosophy is the init system that manages the boot process, once the initial booting is handed over from the boot loader (i.e., GRUB or GRand OS Unified Boot loader)

- Desktop environment – This is the piece that the users actually interact with. There are many desktop environments to choose from (GNOME, Cinnamon, Mate etc.). Each desktop environment includes built-in applications (such as file managers, configuration tools, web browsers, and games).

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- Daemons – These are background services (printing, sound, scheduling, etc.) that either start up during boot or after you log into the desktop.
 - Graphical server – This is the subsystem that displays the graphics on your monitor. It is commonly referred to as the X server or just X.



Applications – Desktop environments do not offer the full array of apps. Just like Windows and macOS, Linux offers thousands upon thousands of high-quality software titles that can be easily found and installed. Most modern Linux distributions (more on this below) include App Store-like tools that centralize and simplify application installation. For example, Ubuntu Linux has the Ubuntu Software Center (a re-brand of GNOME Software?) which allows you to quickly search among the thousands of apps and install them from one centralized location.

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- shell - comprises of a command process that allows manipulation of the device through commands entered into a text interface.

Types of shells

- 1. The Bourne Shell: The prompt for this shell is \$ and its derivatives are:-

POSIX shell also is known as sh

Korn Shell also known as sh

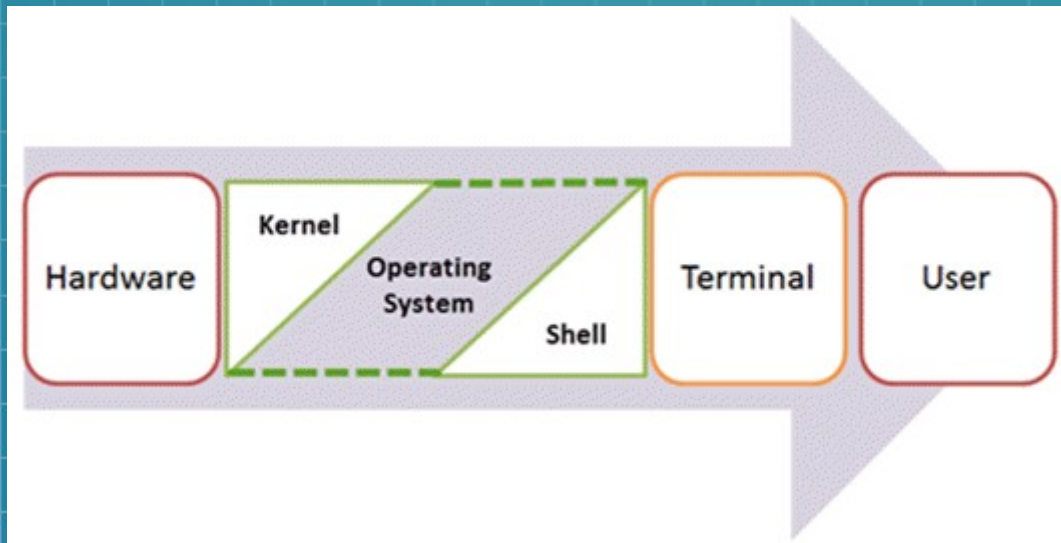
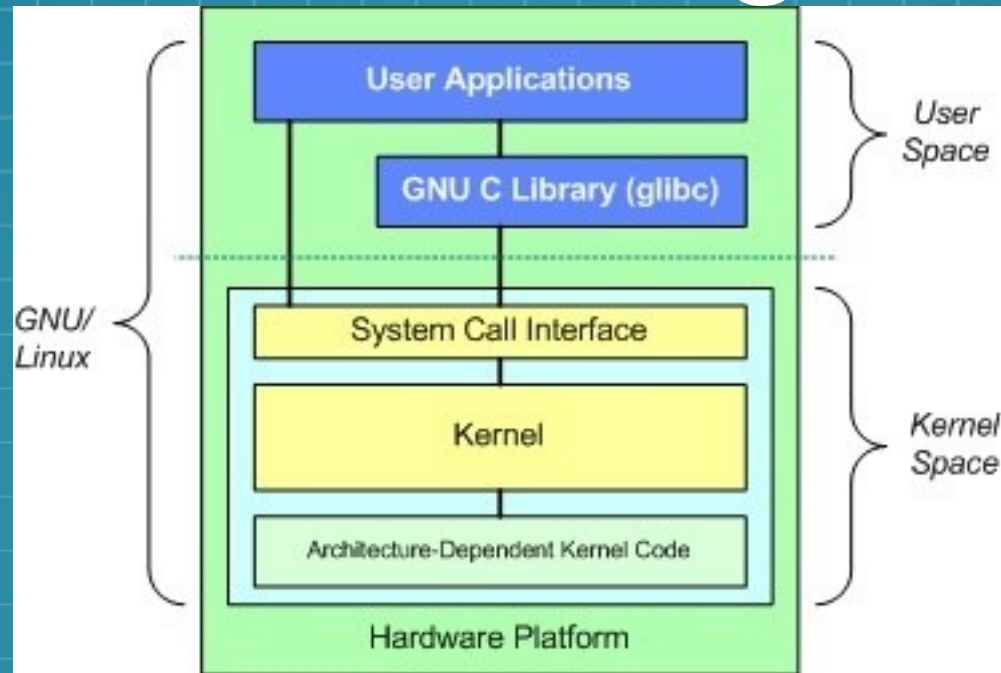
Bourne Again SHell also knew as bash (most popular)

- 2. The C shell: The prompt for this shell is %, and its subcategories are:

C shell also is known as csh

Tops C shell also is known as tcsh

How it looks generally





What is user space

- Executing code has limited access. API calls are used to the kernel to request memory and physical hardware access. Because of the restricted access, malfunctions within user mode are limited only to the system space they are operating within.



What is kernel space

- Executing code that has unrestricted access to any of the memory address space and to any underlying hardware. It is reserved for the highest of trusted functions within a system. Kernel mode is generally reserved for the lowest-level, most trusted functions of the operating system. Due to the amount of access the kernel had, any instability within the kernels executing code can result in complete system failure.



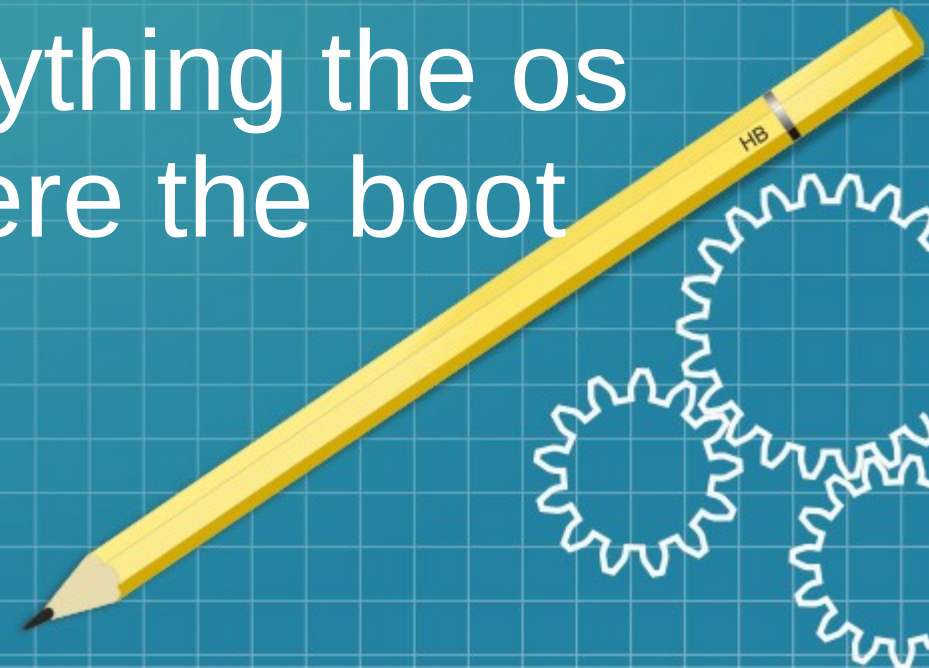
File systems in linux

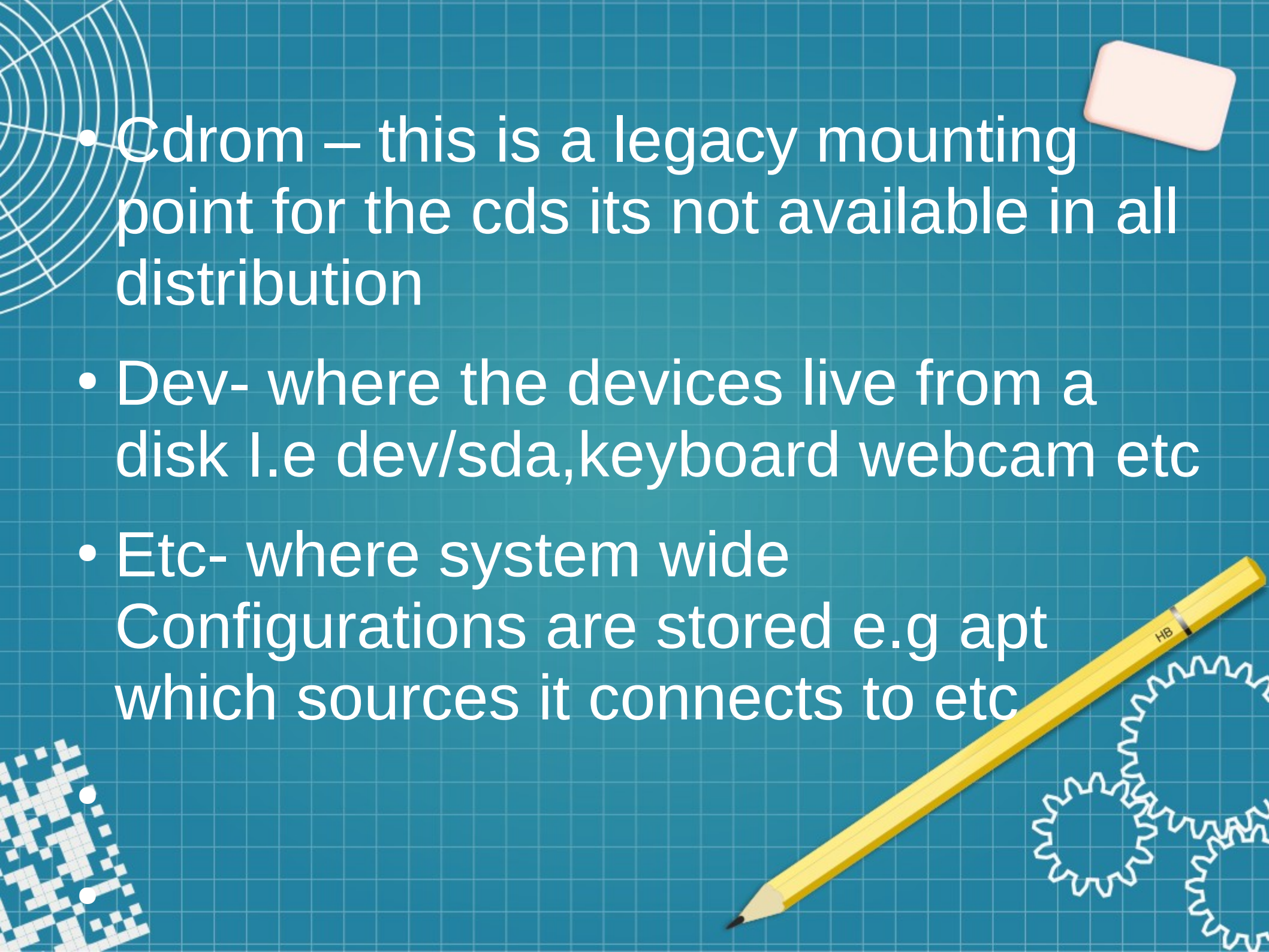
The linux file system follow a standard called the FHS- file system hierarchy standard

there is no `c:/` directory like windows

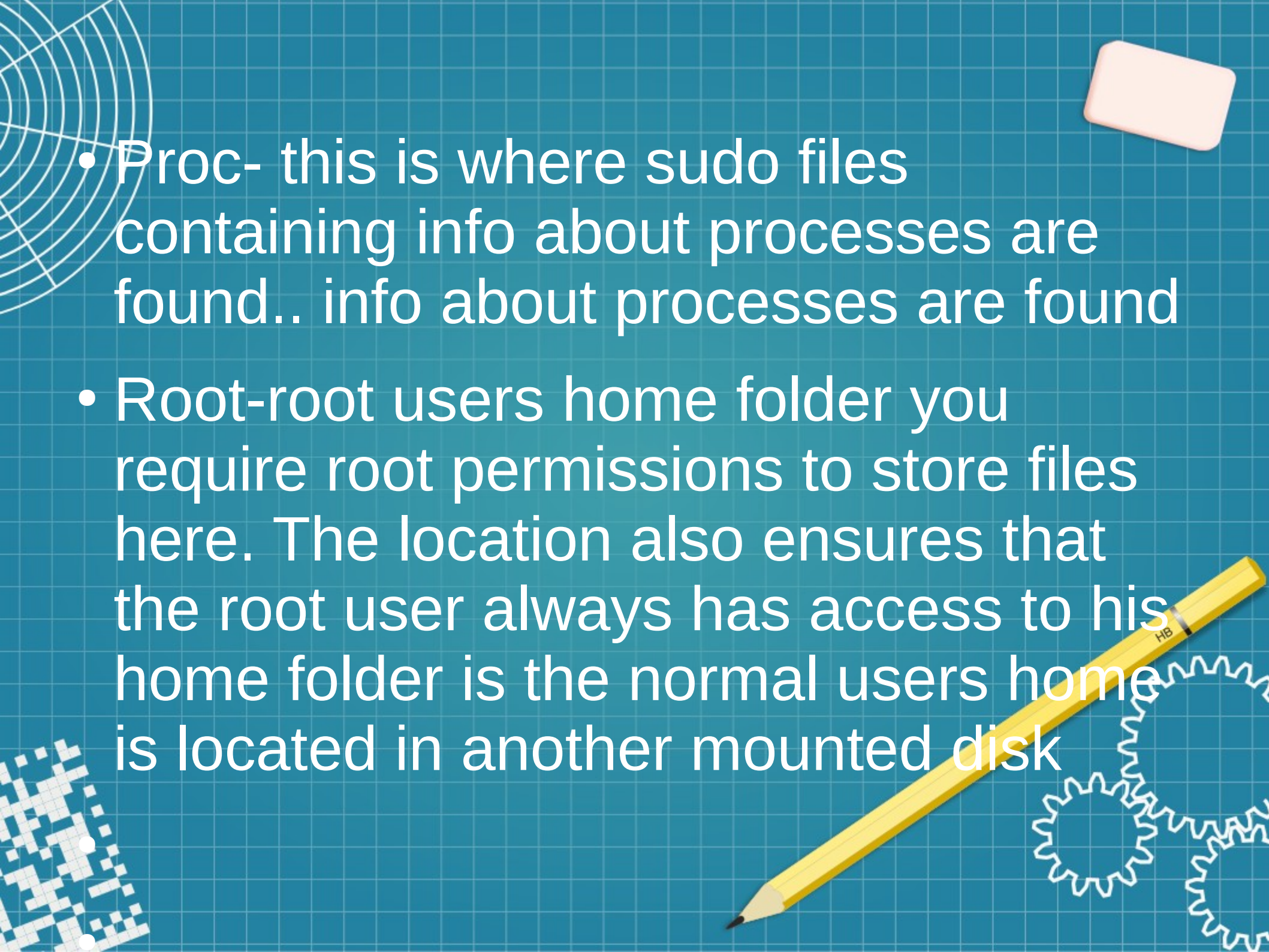
- Linux following UNIX has a standard where it was decided everything is a file

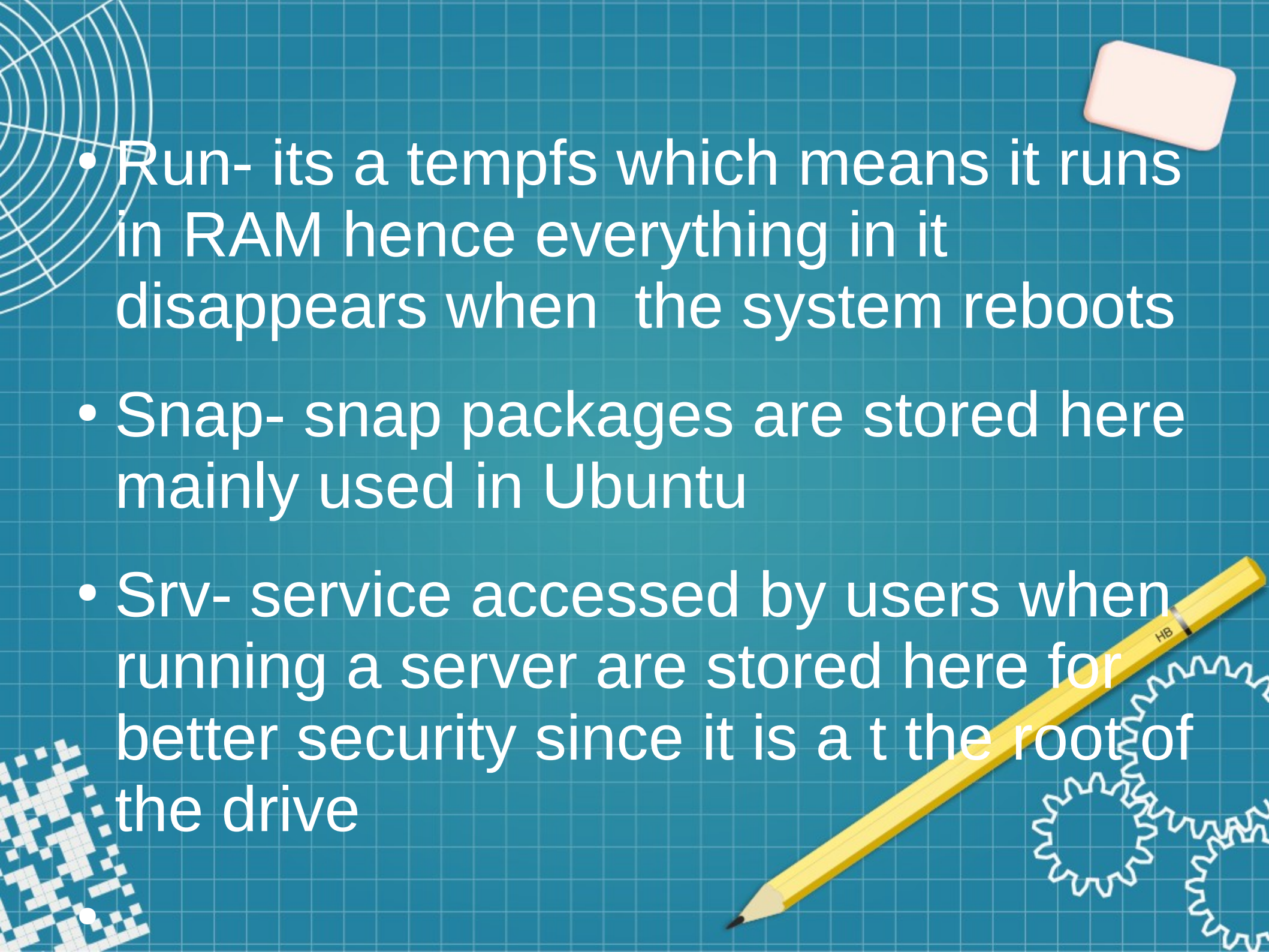
- Bin- contain the most basic binaries/ programs/apps eg functions like ls or cat
- Sbin- system binaries that are available only for admins
- Boot -contains everything the os needs to boot . Where the boot loader lives

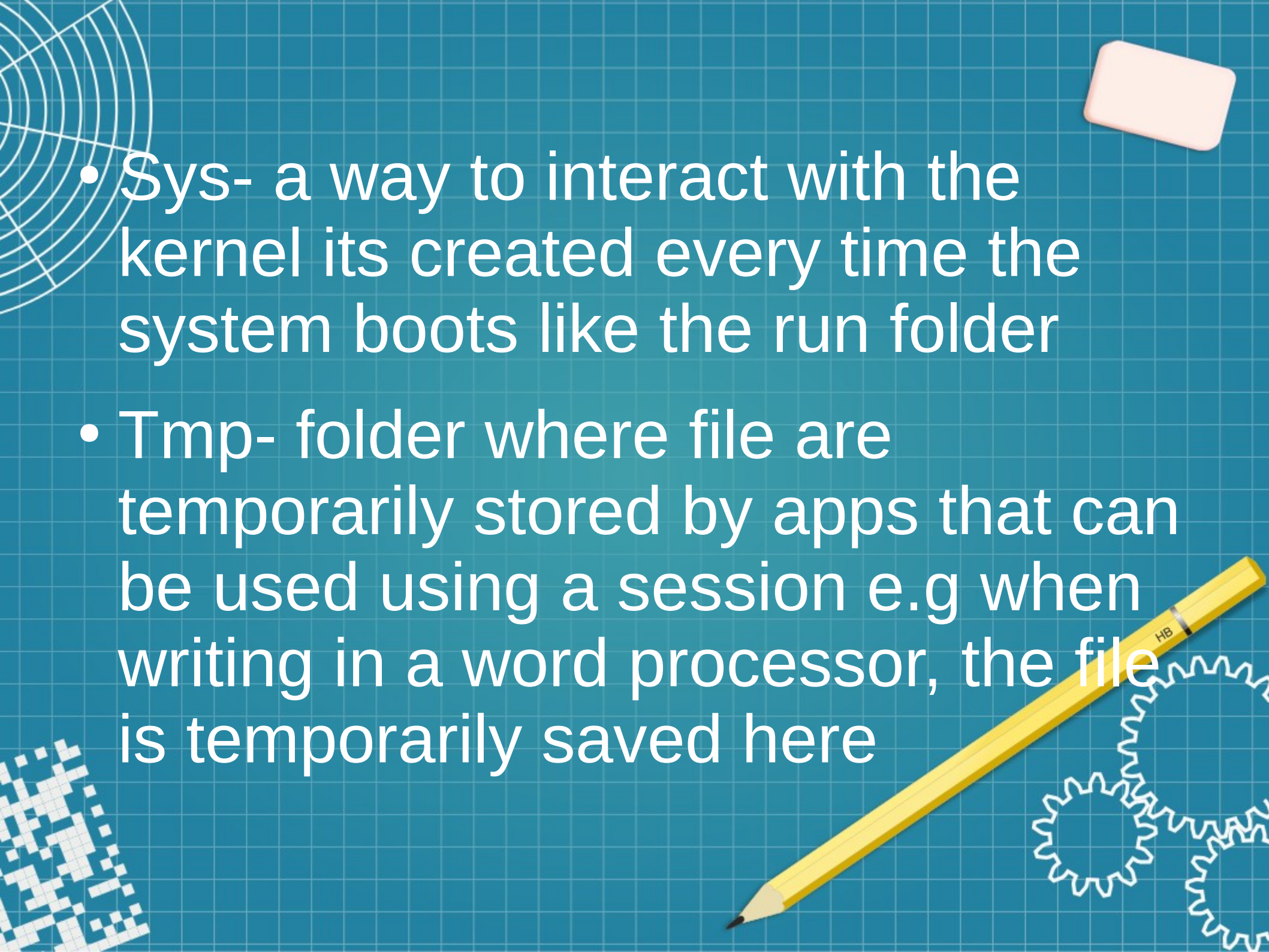



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- Cdrom – this is a legacy mounting point for the cds its not available in all distribution
 - Dev- where the devices live from a disk I.e dev/sda,keyboard webcam etc
 - Etc- where system wide Configurations are stored e.g apt which sources it connects to etc

- Lib- libraries are stores here..
libraries are files that apps used to perform various functions
- Media and mnt – where other mounted drives are found from hard disk to floppy disk.. the media file is for the OS to manage while mnt is for manual mounting
- Opt-optional folder,Manually installed software from vendors are found

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- Proc- this is where sudo files containing info about processes are found.. info about processes are found
 - Root-root users home folder you require root permissions to store files here. The location also ensures that the root user always has access to his home folder is the normal users home is located in another mounted disk

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- Run- its a tempfs which means it runs in RAM hence everything in it disappears when the system reboots
 - Snap- snap packages are stored here mainly used in Ubuntu
 - Srv- service accessed by users when running a server are stored here for better security since it is at the root of the drive

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- Sys- a way to interact with the kernel its created every time the system boots like the run folder
 - Tmp- folder where file are temporarily stored by apps that can be used using a session e.g when writing in a word processor, the file is temporarily saved here

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- Usr- user application space app installed here are non essential for the running of the system
 - Var-contains files and directories expected to grow in size
 - Home- where you store your personal files and documents has hidden files that are generally hidden by the system

Basic linux commands

- These are basic commands that will help you
- Navigate and manipulate the Linux File system using the command line interface (Manage files from the command line.)
- Manage the memory and processes running on Linux
- Manage local Linux users and groups.

Pwd cd and ls commands

- Pwd - returns the path of your working directory
- Cd – used to navigate through directories
- 1.with (..) mean navigate one folder up the tree
- 2. with(-) means navigate to the previous directory
- 3. with no appending means navigate to home
- ls- used to list the contents of the current directory
- 1.with (-R) lists the contents of the sub-folders as well including the files
- 2.with(-a) lists the hidden files
- 3. with(-al) lists the detailed info about the files and folders including permissions and size



Cat command

- cat (short for concatenate) is one of the most frequently used commands in Linux. It is used to list the contents of a file on the standard output (stdout). To run this command, type cat followed by the file's name and its extension. For instance: cat file.txt.
- Here are other ways to use the cat command:
- cat > filename creates a new file
- cat filename1 filename2>filename3 joins two files (1 and 2) and stores the output of them in a new file (3)
- to convert a file to upper or lower case use, cat filename | tr a-z A-Z >output.txt



cp and mv commands

- cp command to copy files from the current directory to a different directory. For instance, the command `cp scenery.jpg /home/username/Pictures` would create a copy of scenery.jpg (from your current directory) into the Pictures directory.
- mv command is to move files, although it can also be used to rename files.
- The arguments in mv are similar to the cp command. You need to type mv, the file's name, and the destination's directory. For example: `mv file.txt /home/username/Documents`.
- To rename files, the Linux command is `mv oldname.ext newname.ext`



Mkdir rmdir and rm

- mkdir command to make a new directory — if you type mkdir Music it will create a directory called Music.

There are extra mkdir commands as well:

- To generate a new directory inside another directory, use this Linux basic command mkdir Music/Newfile
- use the p (parents) option to create a directory in between two existing directories. For example, mkdir -p Music/2020/Newfile will create the new “2020” folder.
- rmdir command is used to delete a directory. However, rmdir only allows you to delete empty directories.
- The rm command is used to delete directories and the contents within them. If you only want to delete the directory as an alternative to rmdir use rm -r



Touch and locate commands

- The touch command allows you to create a blank new file through the Linux command line.
- locate is used to search for a file, using the -i argument along with this command will make it case-insensitive, so you can search for a file even if you don't remember its exact name.
- To search for a file that contains two or more words, use an asterisk (*). For example, `locate -i school*note` command will search for any file that contains the word "school" and "note", whether it is uppercase or lowercase



find and grep commands

- find also searches for files and directories. The difference is, you use the find command to locate files within a given directory.
- As an example, `find /home/ -name notes.txt` command will search for a file called notes.txt within the home directory and its sub directories.
- Other variations when using the find are
 - To find files in the current directory use, `find . -name notes.txt`
 - To look for directories use, `/ -type d -name notes. Txt`
- Grep lets you search through all the text in a given file.
- To illustrate, `grep blue notepad.txt` will search for the word blue in the notepad file. Lines that contain the searched word will be displayed fully.



Sudo command

- Short for “SuperUser Do”, this command enables you to perform tasks that require administrative or root permissions. However, it is not advisable to use this command for daily use because it might be easy for an error to occur if you did something wrong.



df and du commands

- Use df command to get a report on the system's disk space usage, shown in percentage and KBs. If you want to see the report in megabytes, type df -m.
- If you want to check how much space a file or a directory takes, the du (Disk Usage) command is the answer. However, the disk usage summary will show disk block numbers instead of the usual size format. If you want to see it in bytes, kilobytes, and megabytes, add the -h argument to the command line.



head and tail commands

- The head command is used to view the first lines of any text file. By default, it will show the first ten lines, but you can change this number to your liking. For example, if you only want to show the first five lines, type `head -n 5 filename.ext`.
- This one has a similar function to the head command, but instead of showing the first lines, the tail command will display the last ten lines of a text file. For example, `tail -n filename.ext`.



diff command

- Short for difference, the diff command compares the contents of two files line by line. After analyzing the files, it will output the lines that do not match. Programmers often use this command when they need to make program alterations instead of rewriting the entire source code.
- The simplest form of this command is `diff file1.ext file2.ext`.



tar command

The tar command is the most used command to archive multiple files into a tarball — a common Linux file format that is similar to zip format, with compression being optional.

- This command is quite complex with a long list of functions such as adding new files into an existing archive, listing the content of an archive, extracting the content from an archive, and many more. Check out some practical examples here

<https://www.linuxtechi.com/17-tar-command-examples-in-linux/>



chmod command

- chmod is another Linux command, used to change the read, write, and execute permissions of files and directories. As this command is rather complicated, you can see the link below in order to execute it properly.
- <https://www.computerhope.com/unix/uchmod.htm>



chown command

- In Linux, all files are owned by a specific user. The chown command enables you to change or transfer the ownership of a file to the specified username. For instance, `chown linuxuser2 file.ext` will make linuxuser2 as the owner of the file.ext.



job command

- jobs command will display all current jobs along with their statuses. A job is basically a process that is started by the shell

kill command

If you have an unresponsive program, you can terminate it manually by using the kill command. It will send a certain signal to the misbehaving app and instructs the app to terminate itself.

- There is a total of sixty-four signals that you can use, but people usually only use two signals: <https://linoxide.com/linux-how-to/linux-signals-part-1/>
- SIGTERM (15) — requests a program to stop running and gives it some time to save all of its progress. If you don't specify the signal when entering the kill command, this signal will be used.
- SIGKILL (9) — forces programs to stop immediately. Unsaved progress will be lost.
- Besides knowing the signals, you also need to know the process identification number (PID) of the program you want to kill. If you don't know the PID, simply run the command `ps ux`.
- After knowing what signal you want to use and the PID of the program, enter the following syntax:
 - `kill [signal option] PID.`



Ping and wget commands

- ping command to check your connectivity status to a server. For example, by simply entering ping google.com, the command will check whether you're able to connect to Google and also measure the response time.
- The Linux command line is super useful — you can even download files from the internet with the help of the wget command. To do so, simply type wget followed by the download link.



uname and top commands

- `uname` command, short for Unix Name, will print detailed information about your Linux system like the machine name, operating system, kernel, and so on.
- `top` command will display a list of running processes and how much CPU each process uses. It's very useful to monitor system resource usage, especially knowing which process needs to be terminated because it consumes too many resources.



history and man commands

- When you've been using Linux for a certain period of time, you'll quickly notice that you can run hundreds of commands every day. As such, running history command is particularly useful if you want to review the commands you've entered before.
- Confused about the function of certain Linux commands? Don't worry, you can easily learn how to use them right from Linux's shell by using the man command. For instance, entering man tail will show the manual instruction of the tail command.



echo command

- This command is used to move some data into a file. For example, if you want to add the text, “Hello, my name is John” into a file called name.txt, you would type echo Hello, my name is John >> name.txt



Useradd and userdel command

- Since Linux is a multi-user system, this means more than one person can interact with the same system at the same time. `useradd` is used to create a new user, while `passwd` is adding a password to that user's account. To add a new person named John type, `useradd John` and then to add his password type, `passwd 123456789`.
- To remove a user is very similar to adding a new user. To delete the users account type, `userdel UserName`



What is shell scripting?

- writing a series of commands for the shell to execute. It can combine lengthy and repetitive sequences of commands into a single and simple script that can be stored and executed anytime which, reduces programming efforts.



How to create a shell script

- Create a file using a vi editor(or any other editor). Name script file with extension .sh
- Start the script with `#!/bin/sh`
- Write some code.
- Save the script file as filename.sh
- For executing the script type `bash filename.sh` or `. filename.sh`



Comments and variables when shell scripting

- Commenting is important in any program. In Shell programming, the syntax to add a comment is `#comment`
- Shell variables are used to store information and they can be used by the shell only.



Comments and variables when shell scripting

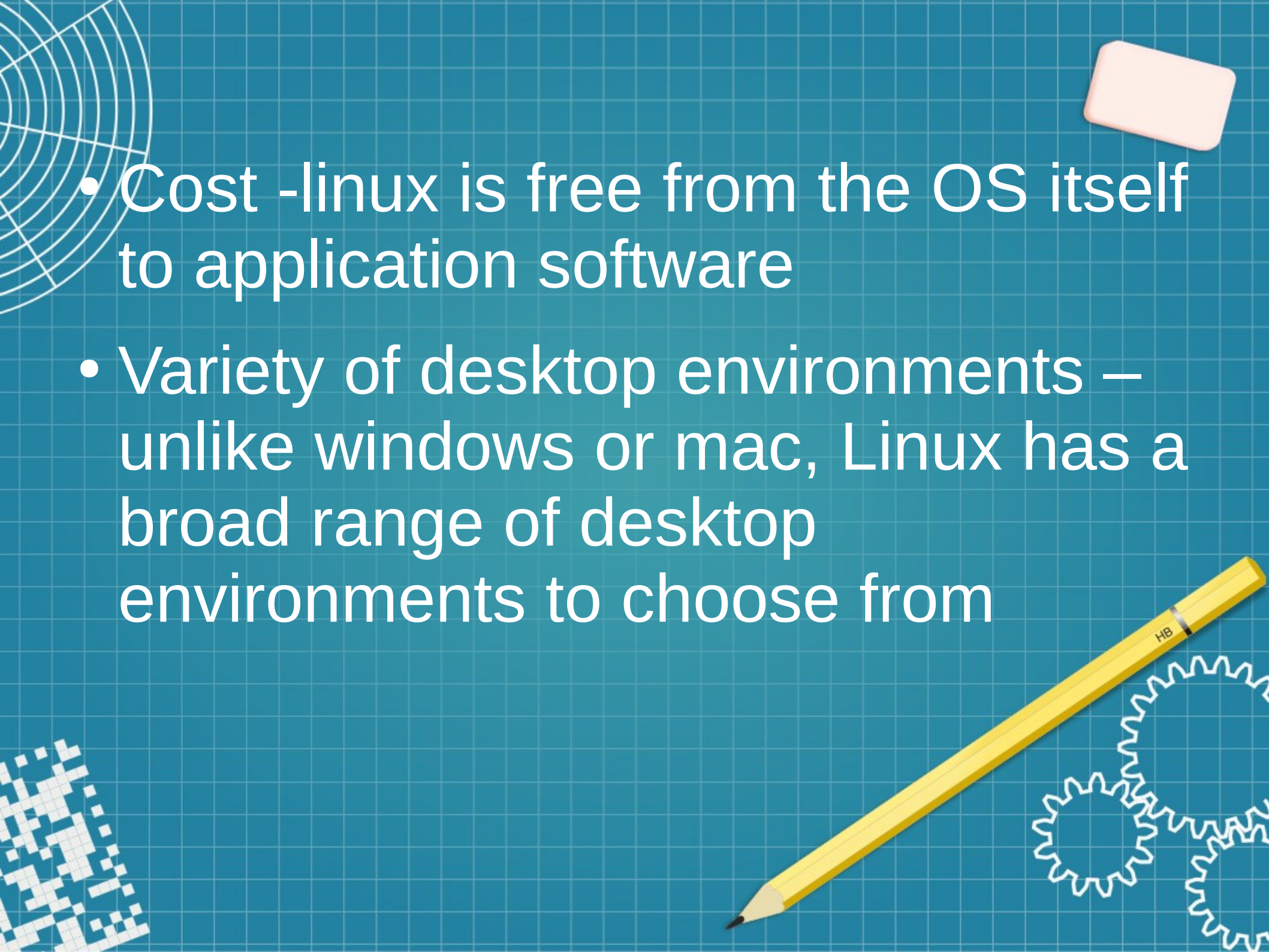
Using task handlers

- I will use crontab for my demonstration
- Crontab -l to see if you have it installed
- If not run crontab -e
- Specify the minute hour date, month and day, interpreter to use and path to the script and you are done

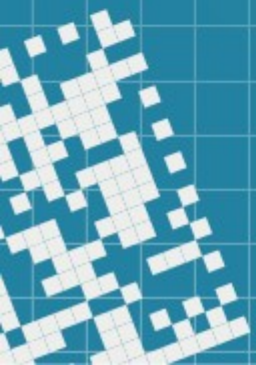
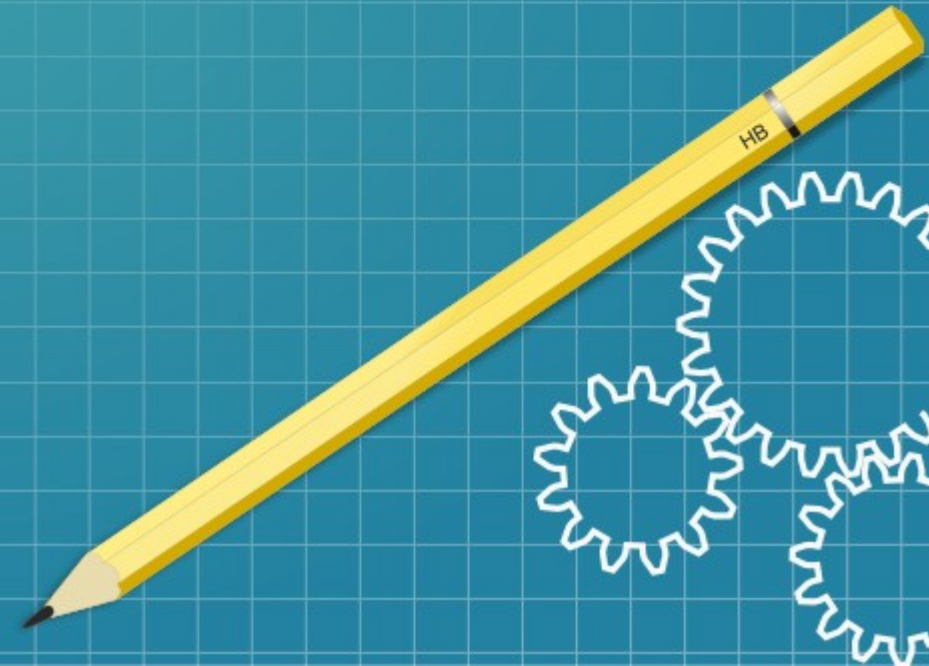


Why linux

- Linux is open source software hence it can be changed to suit one's needs thus many distributions of linux exist
- Debian Linux.
- Gentoo Linux.
- Ubuntu Linux.
- Linux Mint Desktop.
- RHEL Linux Distribution.
- CentOS Linux Distribution.
- Fedora Linux Distribution.
- Kali Linux Distribution .

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- Cost -linux is free from the OS itself to application software
 - Variety of desktop environments – unlike windows or mac, Linux has a broad range of desktop environments to choose from

- To summarize Linux means **FREEDOM**- to use your computer the way you want





For more info

<https://opensource.com/resources/linux>

<https://www.linux.org/>

<http://index-of.es/Varios-2/How Linux Works What Every Superuser Should Know.pdf>

<http://www.linuxfromscratch.org/>

Brilliant YouTube series (Hacker Tools and The Missing Semester)

<https://www.youtube.com/watch?v=qw2c6ffSVOM&list=PLyzOVJj3bHQuiujH1lpn8cA9dsyulbYRv>

<https://www.youtube.com/watch?v=Z56Jmr9Z34Q&list=PLyzOVJj3bHQuloKGG59rS43e29ro7l57J>