



ABC IT Education

WE'LL TAKE YOU FROM ZERO TO HERO IN A SNAP

Linux Systems Administration

Linux Fundamentals

The Linux Directory Structure

- The Linux directory structure, where you can find different components of the Linux operating system, is what we will be talking about today.
- We will also see how applications employ the same conventions as Linux operating system for their directory structure as well.
- Here are some of the most common top level directories in the Linux operating system.
- Though there are many top level directories to learn and remember these first few ones are the most important and these are the ones that you'll interact with often as a Linux user or systems administrator.
- The Linux directory structure, like most OS, is like a tree.

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- The Linux file system hierarchy starts at the root, then the other directories will branch off this root, which is denoted by “/” i.e. forward slash and it is also the directory separator in Linux.
 - Note that some people will refer to the forward slash simply as slash.
 - Note also that root directory (folder) is referred to as slash, so whenever someone refers to slash they are referring to the root directory (folder)
 - The 'bin' or '/bin' directory is where Linux binary files or executable files are found.
 - Binary files are machine readable files which are files made up of strings of 0s and 1s.

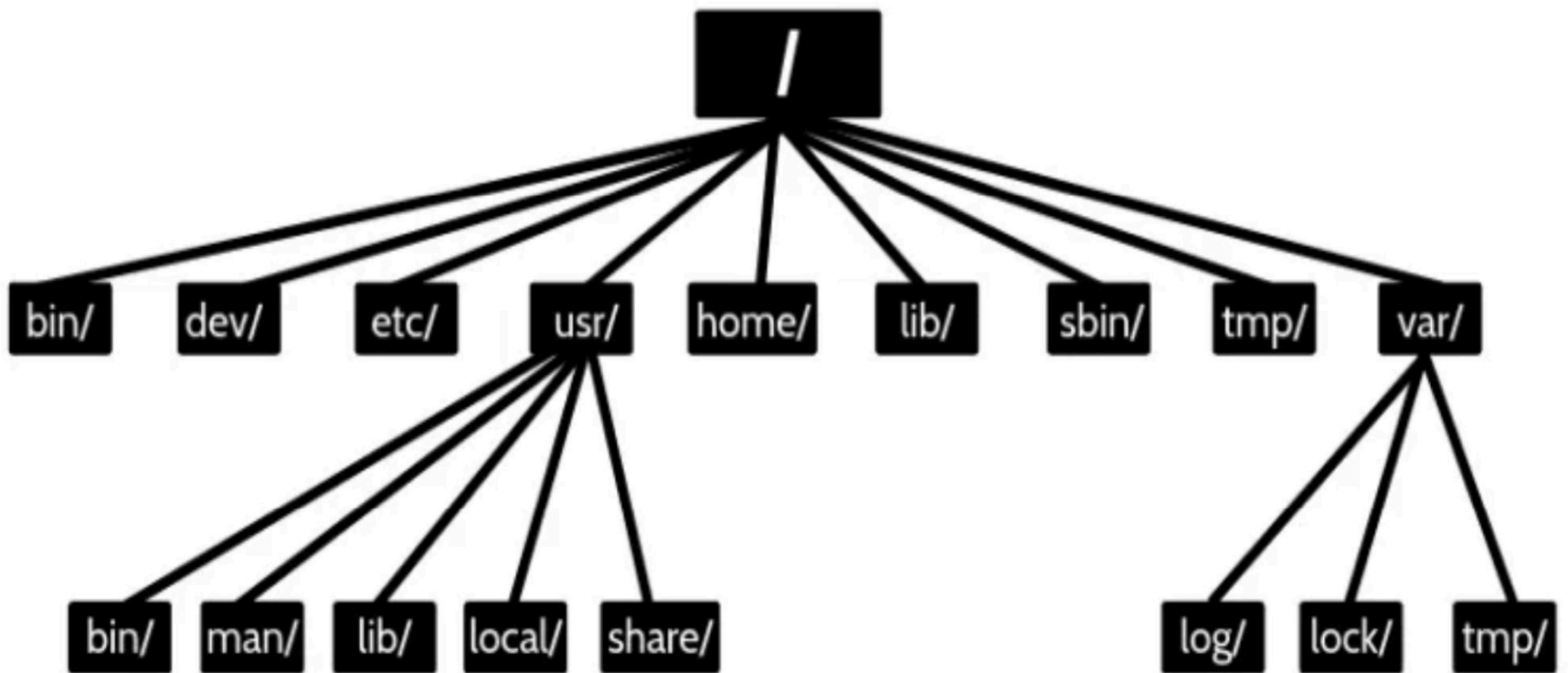
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- Binary files are simply programs that are written in source code (human readable text) and compiled into machine readable code (binaries string of 0s and 1s).
 - Remember that applications that you can run (binaries) are often located in /bin.
 - The '/etc' or 'etsy' directory is where configuration files are located, and these configuration files are the files that determine how the operating system or the applications themselves behave.
 - In '/etc' there is a configuration file that tells the operating system how to boot up i.e. txt mode or GUI mode. There is a file that has all the user information and much more

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- The '/home' directory is where user home directories are found.
 - As an example if a user cwmonie is on the Linux system, their home directory would be '/home/cwmonie'.
 - Linux systems often do have multiple users or multiple user accounts, so the home directory of each user is where the users can separate their data from other user accounts data.
 - Your home directory is yours so you can store anything you want there i.e. documents, music files or even your vacation pictures.

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- The '/opt' directory is the location for optional or third party software i.e. software that is not bundled with the operating system.
 - The '/tmp' (temp) directory is a temporary storage space, which is often cleared at boot time.
 - If you want to save files for later use , you will definitely not put them in /tmp. If you do and the Linux server or desktop is rebooted your files will be gone.
 - '/usr' is called user directory and this is where user related programs live.
 - All top level directories in Linux can have subdirectories, like we say in the case of /home (/home/cwmonie). 'usr' is no different,

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- There will be a sub directory structure within user like `/user/bin` where all user binary programs and executables are located.
 - The `/var`, often called, `var`, is for variable data, things that change often like log files that are generated either by the operating system itself or applications.
 - In Linux we usually talk of directories but that can be used interchangeably with folders, so saying `/bin` directory is the same as saying `/bin` folder.
 - As indicated earlier, each directory can have many subdirectories as shown in the graphic below. You will see that the `/var` directory has 3 subdirectories `log`, `lock` and `tmp` i.e. `/var/log`, `/var/lock` and `/var/tmp`

- The Linux directory structure showing that directories can have many subdirectories.



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- We have looked a few top level directories but those are not all because when you actually get on a Linux system, you will see that there are several other top level directories.
 - One such top level directory that you may sometimes see is /cdrom (also used as a Linux mount point).
 - Whenever you insert a CD-ROM in your Linux system, it gets mounted on /cdrom, giving you access to the files on the CDROM.
 - In some other Linux distributions /cdrom is referred to as /media.
 - Again, this is where you could find files that are located on CD-ROMs or DVDs that you place inside your Linux system.

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- Some Linux operating systems use /srv as a location to place data that is served by the Linux server, for example web files would be in /srv/www or if it's an FTP server, the files would be located in /srv/ftp.
 - We mentioned earlier that the user directory has subdirectories,
 - /usr/bin, /usr/lib, etc.
 - There is also a /usr/local and this is another location where some applications that are not bundled with the Linux operating system are installed, often in /usr/local/programming from where, they all have their own sub directory structure.

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- Crashplan is backup software that's not bundled with the Linux operating system.
 - If you were to install it from their website, it would install it in `/usr/local/crashplan`.
 - To find the binary for this program, you would look in `/usr/local/crashplan/bin`, to configure how the program behaves at runtime, you would modify configuration file center located in
 - `/usr/local/crashplan/etc`, and the log files generated by the program would be in log sub directory - `/usr/local/crashplan/log`.

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- We mentioned earlier that applications can be installed on /opt.
 - 'avg' an anti virus software, that is not bundled with the Linux operating system installs in opt, /opt/avg.
 - The common pattern for the installation of applications is - /opt/program name/bin, though you'll sometimes see a slight variation that applications will follow.
 - Consider an application called, 'gamer' for example, even though the main 'gamer' program
 - gets installed in /opt/ gamer where the binaries and the libraries live, but you'll also see that you can install files in /etc/opt/ gamer and that is where you will find the configuration files.

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- The log files will be in `/var/opt/myapp`.
 - Often times when applications get installed, they are not given their own directory structure, they are installed in the shared manner where maybe, my app gets installed in `/usr/local`.
 - In this case, it would be `/usr/local/bin/myapp` and the configuration file could be `/usr/local/etc/myapp.conf`.
 - Note that `/usr/local/bin` will not only contain my app, but other applications that were installed in this same shared manner.
 - Another common practice is to use `/opt/company_name` or `/opt/organization_name`.

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- If you work for the monie corporation and you logged onto one of their Linux servers, you may see something like - `/opt/monie/bin`, where the software that was written for monie company or by monie company is installed.
 - Yet another slight variation is `opt/company_name/product_name` for example Google. When you install Google chrome online, it installs into `/opt/google/chrome` and Google earth installs in `/opt/google/earth`.
 - Another variation - `/opt/organization_name` or `/opt/company/organization_name` or even `/usr/local/company_name/organization_name`.

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- The take home message about applications is that applications that are not shipped with the Linux operating system are typically found in /opt, called opt, or in /usr called, user.
 - When these applications are installed, they are typically installed in /usr/local.
 - The most common top level directories that you'll interact with on a Linux system are '/', also called, root, then, /etc, /home, /opt, /tmp, /usr, and /var.

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The Shell

- In this section, you will learn about the Linux shell and how to access it.
- I'll also talk about root, the super user or do all account.
- The Linux shell is the default user interface of any Linux system, whenever you log into a Linux system, the shell is a program that is started and it acts as your default interface to the Linux system.
- Additionally, if you are shown a text login prompt, you are also interacting with the shell by default.
- Logging into a GUI (graphical User Interface), you will need to start the terminal application to access to the shell.
- The terminal can be accessed in CentOS by going to the Applications menu then to System Tools and then to Terminal.

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- In the case of Ubuntu, click on the bottom icon (Show Applications) in the launcher which is on the left hand side of your screen.
 - Then in the search field type terminal and you will see the terminal application, then click to start it
 - For the GUI (graphical user interface) on a Linux system it is also called a shell, but this time it is a graphical shell.
 - Often times some people think of the command line interface (CLI) and they say shell, but the shell is actually an application that takes user commands and executes the commands.
 - Sometimes you will hear people call the shell a command line interpreter.

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- In Linux there is a command line interface CLI and a graphical interface GUI, and the command line interface in most cases is more powerful than the graphical interface.
 - To see the power of the shell (CLI), imagine that you have 200 files and you need to perform the same operation on those files, the shell will be your best option.
 - For example, take 100 documents that need to be renamed, you could run a command at the shell to do all 100 at once, but if you use the graphical user interface you will have to do it one at a time, so you will have to do the same operation 100 times.
 - The command line is always there even if you are running Linux in graphical mode, so learn it well and use it often.

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- Most server editions of Linux distributions do not include a graphical interface, so they rely solely on the shell or command line interface
 - In addition, connecting to Linux system over the network will typically be done via SSH (secured shell) and maybe even telnet (discouraged) and when this happened it gives you access to the command line interface.
 - Desktop Linux distributions, on the other hand, have both the graphical user interface and the command line interface giving you access to any interface of your choice to use as you see fit.
 - Though there are command line web browsers that come with Linux and can be used to surf the WWW, a graphical browser makes more sense to use anytime.

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- When you start the shell, it a prompt, also called shell prompt, is displayed.
 - The displayed prompt will just sit there waiting for you to give it a command to do something.
 - Linux shell prompts usually gives the user some useful information, and it can give as much information as we please.
 - The simple default prompt will look something like `<user name>@<server name>`, where server is actually the name of the Linux system that you are connected to.
 - As a normal user, the prompt terminates with a \$ sign but if you login as a super user, then the prompt terminates with the # sign.

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- The root account, or simply root, is the super user on a Linux system.
 - In a previous lesson we saw the root of the Linux file system, the slash (/) or simply called root.
 - Note that the root (/) of the file system is different from the root (super user) account, so when some says root we have to differentiate the directory from the user.
 - For those familiar with Windows, the Windows administrator account is similar to the root account on a Linux system
 - In a Linux system, the root account can do any and all things, whereas a normal user account can only do a fraction of the things the root account can do, and thus is used to do the day to day activities in a Linux system.

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- Root account access is reserved for Linux system administrators, and these are the people who are responsible for keeping the Linux systems up and running i.e. they are responsible for the maintenance and configuration of the Linux systems.
 - If you are running Linux on your desktop, you will most likely going to have both normal user and root, The root user will be needed to do things outside of the normal user's home directory, like install applications, change systems configuration or run services or even servers.
 - To start the web server on the Linux system will require root access but running other applications like a web browser, the terminal and similar applications only require normal user access, because no special privileges are needed to do that.

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- Linux prompts vary appearance, from as simple as a simple \$ (one character) or can contain more useful information like the account you're using, the name of the server that you're connected to, and the directory that you're currently in.
 - In some of these prompts, you'll notice a Tilde (~) which is a shorthand way of representing a user's home directory.
 - The Tilde by itself represents the current user's home directory.
 - or the current accounts home directory that you're using.
 - If user cwmonie is logged into a Linux system the Tilde (~) will represent the - /home/cwmonie directory.
 - When the tilde (~) is appended to a user name, it will expand to that user's home directory so ~cwmonie expands to /home/cwmonie

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- The root user's home directory is /root, so ~root = /root.
 - Note that not all accounts on a Linux system are associated with an individual user. Services often have their own accounts like
 - in the case of ~ftp it will expand to the home directory of the ftp service account which lives in /srv/ftp.
 - Linux prompts are usually on a single line, but prompts can span multiple lines.
 - You'll learn how to customize your shell prompt just the way you like

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- In summary, the shell is a default user interface for the Linux system, and you're automatically presented with a shell prompt if you connect to Linux over the network using SSH or telnet.
 - If you log into the graphical user environment, you can start the terminal application to gain access to the command line.
 - Root is a special user on a Linux system.
 - It's the all powerful super user.
 - Your day to day activities will be performed using your regular user account.