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# THE LINUX COMMAND LINE

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**ORANE LABS**  
SILICIT KANDIJA  
• For starters,  
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- For starters, there are four main parts that make up a Linux system:

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## The Linux k SIIC IT KANPUR — The GNU u — A graphical www.orangeline.com — Application

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# What Is Linux?

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make it a

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– A graphical  
– Application

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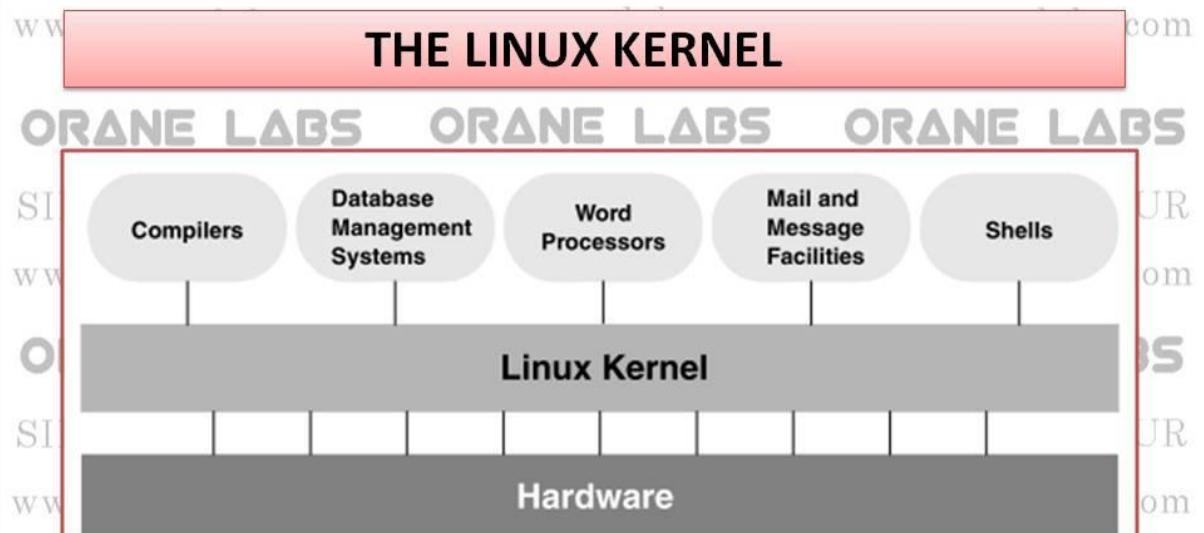
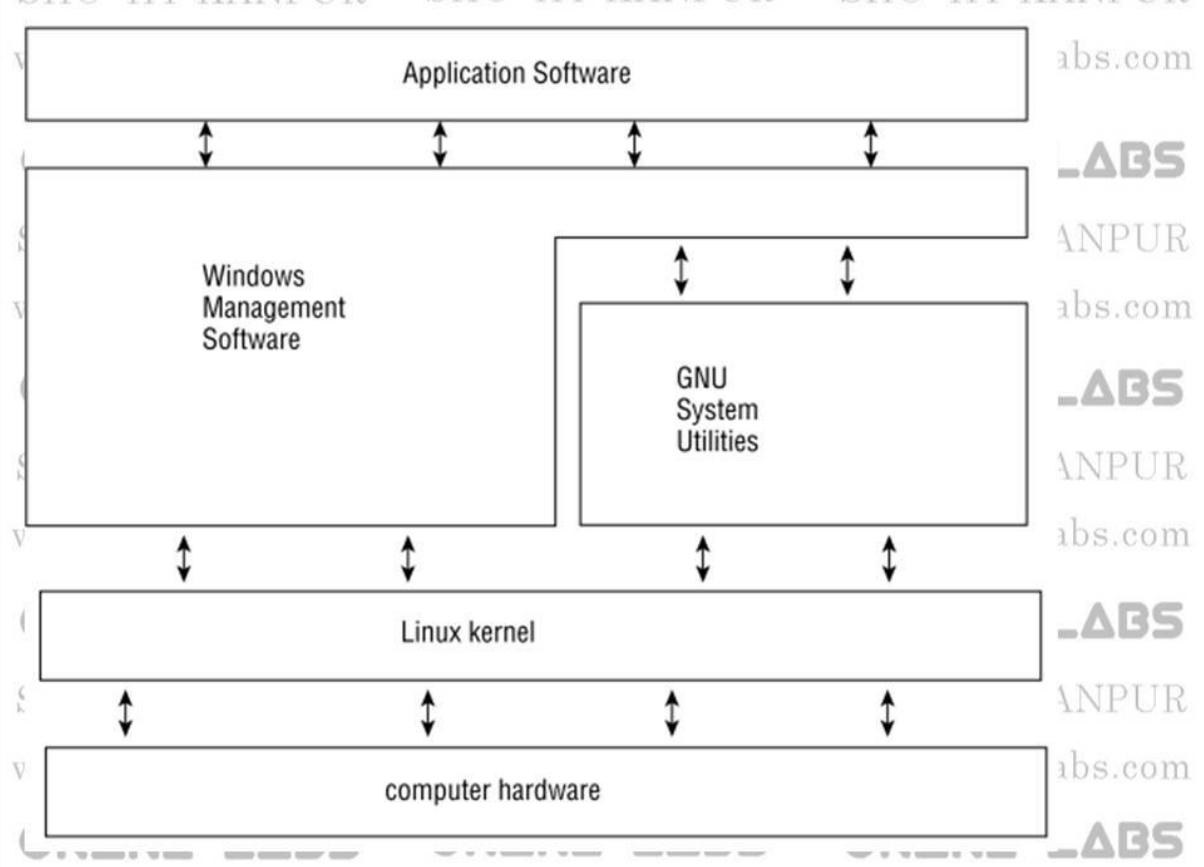
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A Layered View of the Linux Operating System

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## Implementation Strategies

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### • **Microkernel**

- In these, only the most elementary functions are implemented directly in a central kernel — **the microkernel.**
- All other functions are delegated to autonomous processes that communicate with the central kernel via clearly defined communication interfaces.

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### • **Monolithic Kernels**

- They are the alternative, traditional concept. Here, the entire code of the kernel — including all its subsystems such as memory management, file systems, or device drivers — is packed into a single file.

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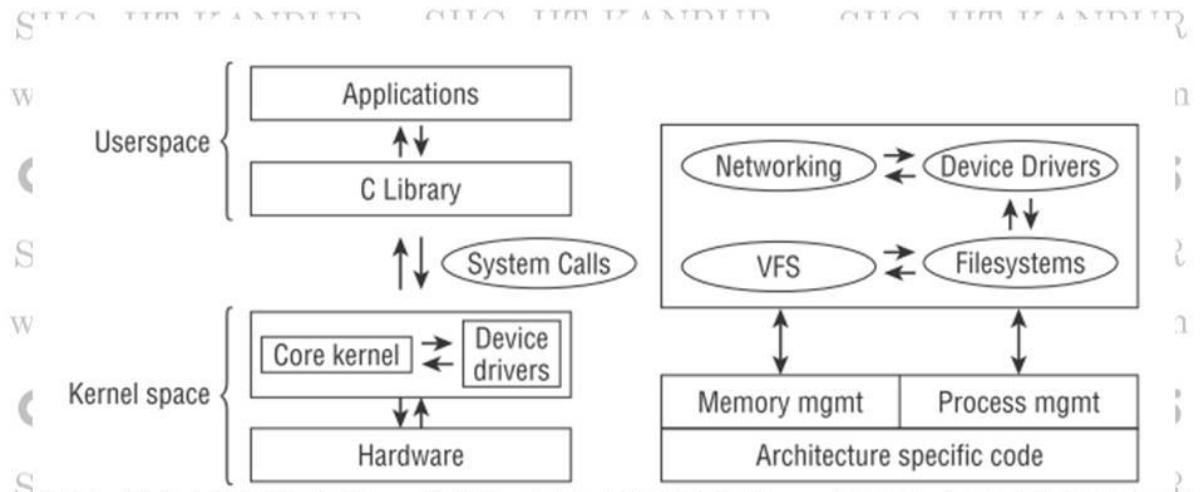
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# High-Level Overview of the Linux

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## Tasks of the Kernel

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- The kernel is primarily responsible for four main functions:

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- System memory management
- Software program management
- Hardware management
- File system management

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# System memory management

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- It does this by using space on the hard disk, called the swap space.

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- The kernel swaps the contents of virtual memory locations back and forth from the swap space to the actual physical memory.

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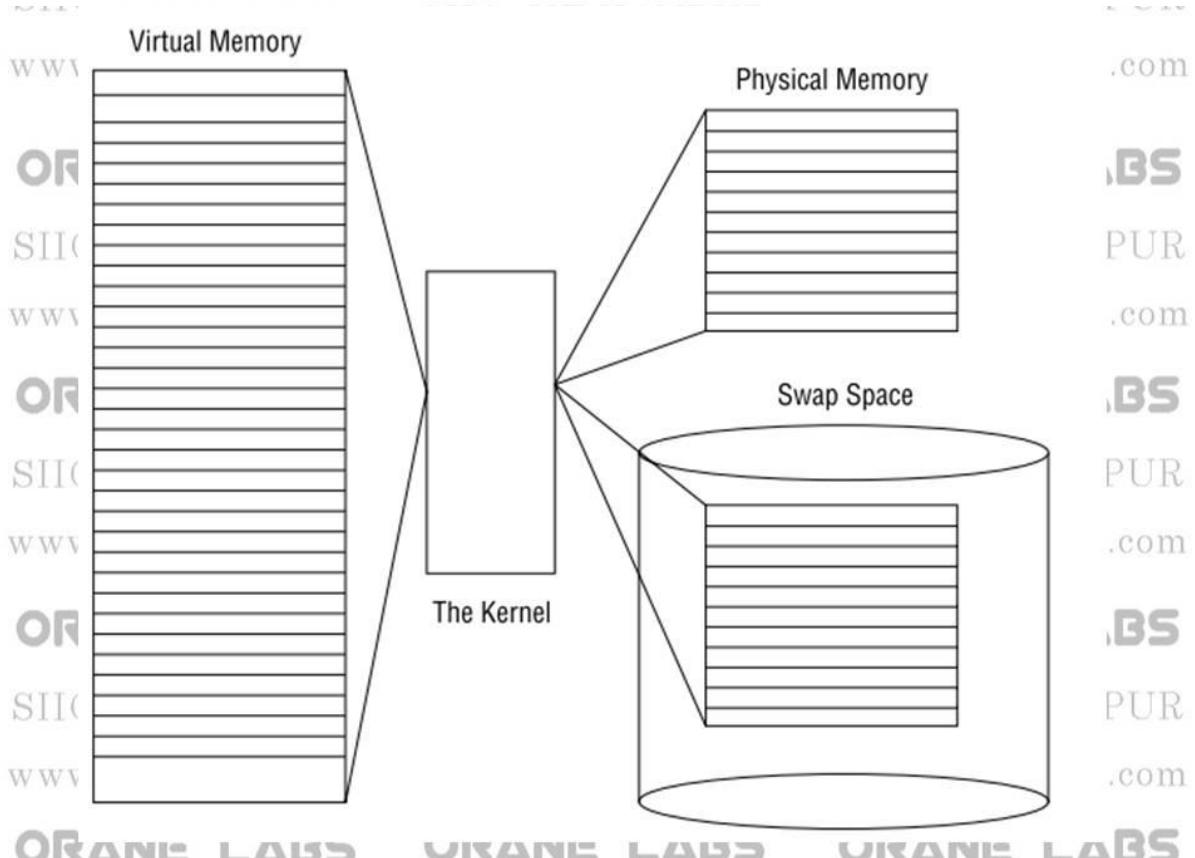
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- The memory locations are grouped into blocks called **pages**.

- The kernel keeps track of which memory pages are in use.

- The swapping technique is used to remove pages that have not been accessed.

- The process of swapping out memory pages for running applications continues for as long as the Linux system is running.

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### Viewing Current Status of Virtual Memory

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- You can see the current status of the virtual memory on your Linux system by viewing the special **/proc/meminfo** file.

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```
[ankur@localhost ~]$ cat /proc/meminfo
MemTotal:       2069680 kB
MemFree:        1423432 kB
Buffers:         32424 kB
Cached:          271968 kB
SwapCached:      0 kB
Active:          331648 kB
Inactive:        258992 kB
Active(anon):   286780 kB
Inactive(anon):  668 kB
Active(file):   44868 kB
Inactive(file): 258324 kB
Unevictable:     0 kB
Mlocked:         0 kB
HighTotal:      1204168 kB
```

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## Current Shared Memory Spaces

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- The special **ipcs** command allows you to view the current shared memory pages on the system.

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The screenshot shows a terminal window titled "ankur : bash <3>". The command "ipcs -m" is run, displaying information about shared memory segments. The output is as follows:

```
[ankur@localhost ~]$ ipcs -m
----- Shared Memory Segments -----
key      shmid   owner      perms      bytes
nattch   status
[ankur@localhost ~]$
```

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## Software program management

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- The Linux operating system calls a running program a **process**.
  - A process can run in background or in foreground displaying output.
  - The kernel creates the first process, called the **init process**, to start all other processes on the system.
  - When the kernel starts, it loads the init process into virtual memory.
    - After that, all the other processes start.

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## Hardware management

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- Any device that the Linux system must communicate with needs driver code inserted inside the kernel code.

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## Two Methods for adding Driver code

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Drivers compiled  
in the kernel

- Requires recompilation of the kernel whenever a driver needs to be added

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SIIC IIT  
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WY  
Character

Block

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WY  
Network

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Device Files  
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- Character device files are for devices that can only handle data one character at a time.
- Modems and terminals are created as character files

- Block files are for devices that can handle data in large blocks at a time, such as disk drives.

- The network file types are used for devices that use packets to send and receive data.

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## The GNU utilities

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- The GNU is responsible for adding system utilities to the Linux environment.

- These utilities were developed under a software philosophy called **open source software (OSS)**.

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**The Shell**  
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- This interface interprets the commands that users enter and translates them to machine code.

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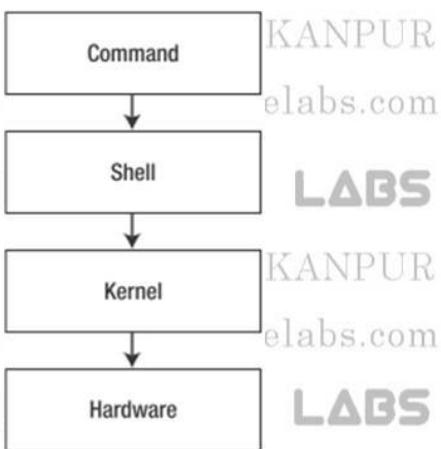
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- *Bourne Shell*: The very first shell created.

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**Types of Shell**

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## Three Types of Commands

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# Finding Your Way in the File System

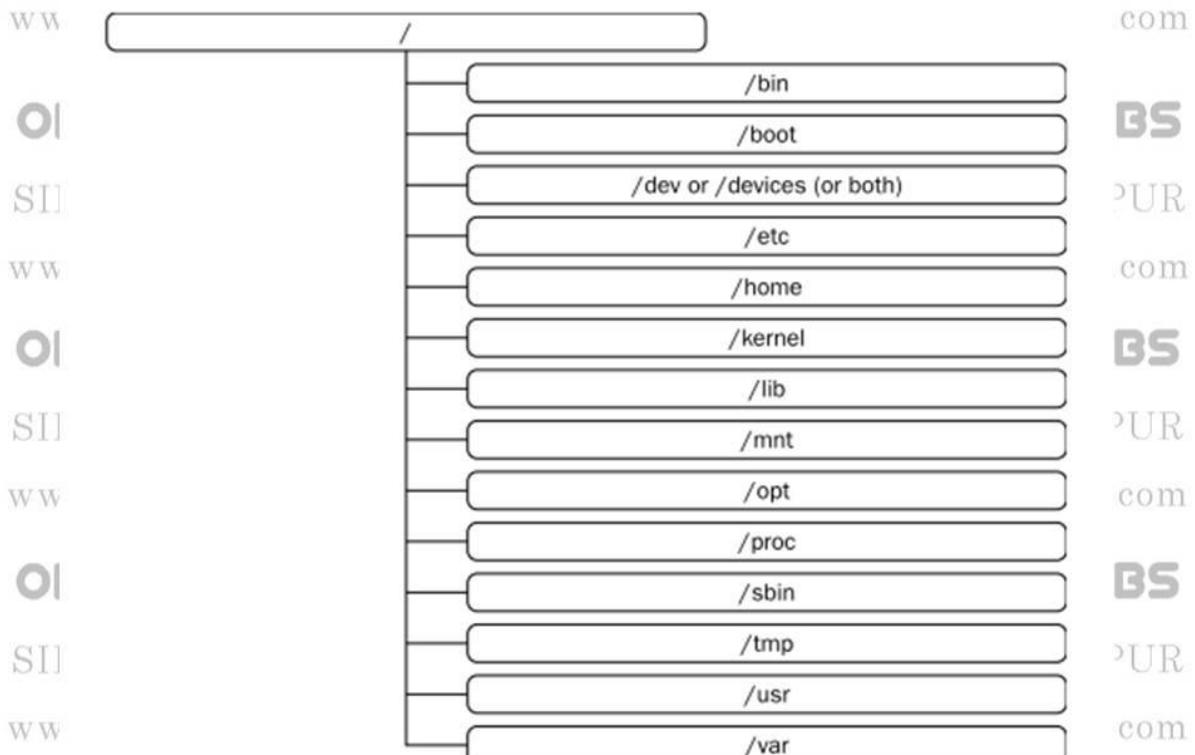
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## • Default Directories      SIIC IIT KANPUR      SIIC IIT KANPUR

- **/**: The root directory is the starting point of your Linux file system. All other directories on your system exist in the root directory.
- **/bin** : This is the location where you find program files (binaries) accessible to all users.
- **/sbin** : in this directory you will find binaries for the system administrator.
- **/dev**: On a Linux system, all hardware you work with corresponds with a file on your system.
- **/etc** : Most services running on Linux use an ASCII text file to store all necessary configuration. These text files are kept in the directory etc.
- **/home** : personal files of a user are stored in this directory.
- **/usr** : This directory is probably the largest directory on your system. Here you can find almost all user-accessible files.
- **/root**: Ordinary users have their home directories in /usr. A system administrator has the /root directory.

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## Managing Bash with Key Sequences

- **Ctrl+C:** use this key sequence to quit a command that is not responding (or simply takes too long to complete).
- **Ctrl + D:** This key sequence is used to send the end of file signal to a command.
- **Ctrl + Z:** To stop a command that is interactively running on the console.

## The Linux filesystem

- In Windows you may be used to seeing the file paths such as:
  - c:\ Documents and Settings \ Ankur \ My Documents \ test.doc
- Linux stores files within a single directory structure, called a **virtual directory**.
  - The virtual directory contains file paths from all the storage devices installed on the PC, merged into a single directory structure.
    - /home/Ankur/Documents/test.doc

# Working with the Linux File System

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- **Directory Commands:**

- `pwd`: use this to show your current directory. It

- will display the complete directory path reference, which always starts at the root directory.

- `cd`: This allows you to change to a different directory. Directory names are case sensitive.

- `mkdir`: used for creating a new directory.

- `rmdir`: Used for removing directories.

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## Traversing directories

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- The format of the `cd` command is pretty

- simplistic:

- `cd destination`

- The destination parameter, though, can be expressed using two different methods:

- An absolute filepath

- A relative filepath

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# Absolute filepaths

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- The absolute filepath defines exactly where the directory is in the virtual directory structure, starting at the root of the virtual directory.

- Example: **/usr/lib/apache**
  - ankur@1[~]\$ cd /usr/lib/apache
  - ankur@1[apache]\$

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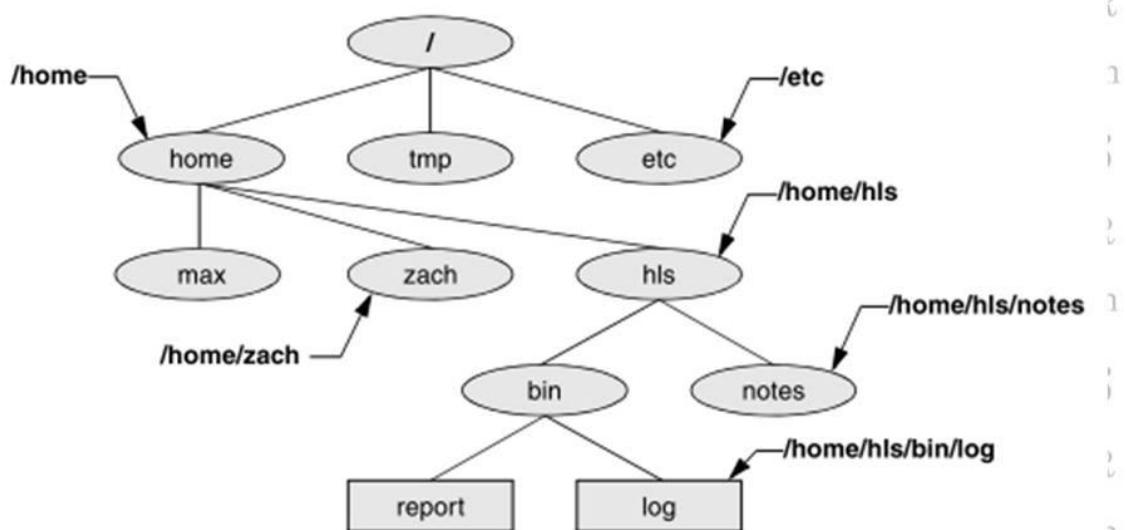
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# Relative filepaths

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- Relative file paths allow you to specify a destination filepath relative to your current location, without having to start at the root.
- A relative filepath doesn't start with a forward slash, indicating the root directory.
  - Instead, a relative filepath starts with either a **directory name**.
  - The two special characters used for this are:
    - The dot (.) to represent the current directory
    - The double dot (..) to represent the parent directory

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## Example

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- if you are in the Documents directory under your home directory and need to go to your Desktop directory, also under your home directory, you can do this:
  - ankur@1[Documents]\$ cd ../Desktop
  - ankur@1[Desktop]\$

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## File Permissions

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S The Linux file permissions

w -rwxrwxr-x 1 rich rich 4882 2007-09-18 13:58 myprog com  
C permissions for everyone else  
S permissions for group members  
W permissions for the file owner

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## Using file-matching metacharacters

- Here are some useful meta characters for matching filenames:

- \* — Matches any number of characters.

- ? — Matches any one character.

- [...] — Matches any one of the characters between the brackets, which can include a hyphen-separated range of letters or numbers.

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- First, creating some empty files: PUR
  - \$ touch apple banana grape grapefruit watermelon
- Trying some commands:

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\$ ls a\*

apple

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grape grapefruit

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grapefruit

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\$ ls \*e\*

apple grape grapefruit watermelon

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apple grape

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- Use the
- -l and -a options to ls

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S drwxrwxrwx 2 joe sales 4096 May 12 13:55 .

drwxr-xr-x 3 root root 4096 May 10 01:49 ..

-rw----- 1 joe sales 2204 May 18 21:30 .bash\_history

-rw-r--r-- 1 joe sales 24 May 10 01:50 .bash\_logout

-rw-r--r-- 1 joe sales 230 May 10 01:50 .bash\_profile

-rw-r--r-- 1 joe sales 124 May 10 01:50 .bashrc

S drw-r--r-- 1 joe sales 4096 May 10 01:50 .kde

-rw-rw-r-- 1 joe sales 149872 May 11 22:49 letter

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**Examples**

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- \$ touch apple banana grape grapefruit watermelon
- Trying some commands:

**ORANE LABS**

\$ ls a\*

apple

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grape grapefruit

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grapefruit

**ORANE LABS**

\$ ls \*e\*

apple grape grapefruit watermelon

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apple grape

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- Use the
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S drwxrwxrwx 2 joe sales 4096 May 12 13:55 .

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-rw-r--r-- 1 joe sales 230 May 10 01:50 .bash\_profile

-rw-r--r-- 1 joe sales 124 May 10 01:50 .bashrc

S drw-r--r-- 1 joe sales 4096 May 10 01:50 .kde

-rw-rw-r-- 1 joe sales 149872 May 11 22:49 letter

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- \$ touch apple banana grape grapefruit watermelon
- Trying some commands:

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\$ ls a\*

apple

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grape grapefruit

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grapefruit

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\$ ls \*e\*

apple grape grapefruit watermelon

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apple grape

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- Use the
- -l and -a options to ls

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S drwxrwxrwx 2 joe sales 4096 May 12 13:55 .

drwxr-xr-x 3 root root 4096 May 10 01:49 ..

-rw----- 1 joe sales 2204 May 18 21:30 .bash\_history

-rw-r--r-- 1 joe sales 24 May 10 01:50 .bash\_logout

-rw-r--r-- 1 joe sales 230 May 10 01:50 .bash\_profile

-rw-r--r-- 1 joe sales 124 May 10 01:50 .bashrc

S drw-r--r-- 1 joe sales 4096 May 10 01:50 .kde

-rw-rw-r-- 1 joe sales 149872 May 11 22:49 letter

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## Identifying Directories

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- When you need to identify your home directory on a shell command line, you can use the following:
  - \$HOME** — This environment variable stores your home directory name.
  - ~** — The tilde (~) represents your home directory on the command line.
- Other special ways of identifying directories in the shell include the following:
  - .** — A single dot (.) refers to the current directory.
  - ..** — Two dots (..) refer to a directory directly above the current directory.
  - \$PWD** — This environment variable refers to the current working directory.

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## Options that can be used with ls

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- To show hidden and non-hidden files:
  - \$ ls -a**
- To list all files by time most recently modified:
  - \$ ls -at**

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- To not include any files beginning with the letter g in the list:

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- \$ ls --hide=g\*

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watermelon

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- To list info about a directory instead of the files it contains:

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- \$ ls -ld \$HOME/test/

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## Recursive Listing

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- To list all files and directories recursively from current directory down:

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**ORA**The cp command line uses the following syntax to specify source and destination files:

- **cp source-file destination-file**

**ORANE LABS****ORANE LABS****ORANE LABS****cp can destroy a file**

If the destination-file exists before you give a cp command, cp overwrites it without any warning. Use cp -i for an interactive copying.

## **mv: Changes the Name of a File**

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- The mv (move) utility can rename a file without making a copy of it.

**ORANE LABS****ORANE LABS****ORANE LABS****ORANE LABS****ORANE LABS****ORANE LABS****mv can destroy a file**

caution Just as cp can destroy a file, so can mv. Also like cp, mv has a -i (interactive) option.

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- rm command is used for removing files.
- The rm command also has some useful options:

- n: Recursive, removes files from all subdirectories as well
- b: Force, doesn't ask anything, just removes what the user asks to remove
- e: Interactive, asks before removing a file
- r: Verbose, shows what is happening

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## uniq: Removes Duplicate Lines from a File

- The uniq (unique) utility displays a file, skipping adjacent duplicate lines, but does not change the original file.

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```
$ cat dups
Cathy
Fred
Joe
John
Mary
Mary
Paula
```

```
$ uniq dups
Cathy
Fred
Joe
John
Mary
Paula
```

JR

om

S

JR

om

S

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## diff: Compares Two Files

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- The diff (difference) utility compares two files and displays a list of the differences between them.
- The diff -u command breaks long, multiline text into hunks.
- The two files being compared are differentiated by a **plus and minus sign**.

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```
w $ diff -u colors.1 colors.2
--- colors.1      2009-07-29 16:41:11.000000000 -0700
+++ colors.2      2009-07-29 16:41:17.000000000 -0700
@@ -1,6 +1,5 @@
red
+blue
green
yellow
-pink
-purple
orange
```

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## Directory Handling

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### Creating directories

- There's not much to creating a new directory in Linux, just use the mkdir command:

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## Removing a Directory

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- The basic command for removing a directory is `rmdir`:

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• \$ rmdir dir3

• \$ rmdir dir1

• rmdir: dir1: Directory not empty

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- By default, the `rmdir` command only works for

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removing empty directories.

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Who will then come to rescue

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- Our friend the `rm` command can also help us

out some when handling directories.

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• The ultimate solution for removing an entire

directory, contents and all, is the `rm` command

with both the `-r` and `-f` parameters:

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– \$ rm -rf dir2

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