Introduction to Linux

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History

- In 1969, a team of developers developed a new operating system called “Unix” which was written using C
- Linus Torvalds, a young man studying computer science at the university of Helsinki developed academic version of Unix which is named as Linux.
- Linux is a full UNIX clone.

Linux a powerful OS!

- **Today Linux has joined the desktop market.**
- **On the server side, Linux is well-known as a stable and reliable platform.**
- **Linux provides many applications like:**
  - **Databases (MySQL,Postgresql),**
  - **Network services(Web Servers,DNS, Proxy, firewall etc)**
  - **Software development tools(C, Java, Python,Perl etc.)**
  - **Office automation tools**
  - **And many more…**

Is Linux difficult?

- **There is excellent and free Internet support and documentation available.**
- **The graphical user interface (GUI) is similar in design to that on any other system**
- **A very powerful command line alternative is also available.**
- **Linux *is* user friendly.**

Properties of Linux

- **`It is Open Source`**
  - **Today, Linux is ready to accept the challenge of a fast-changing world.**
- **`Linux is free:`**
  - **If you want to spend absolutely nothing, you don't even have to pay the price of a CD.**
  - **Linux can be downloaded in its entirety from the Internet completely for free.**

Properties of Linux

- **Linux is portable to any hardware platform.**
- **Linux was made to keep on running.**
  - **As with UNIX, a Linux system expects to run without rebooting all the time.**
  - **Tasks can be scheduled to run at suitable times.**

Properties of Linux

- **`Linux is secure and versatile.`**
  - **The security model used in Linux is based on the UNIX idea of security which is robust.**
  - **It is less prone to virus attacks.**
- **`Linux is scalable`**

Commands..

- Let’s have an overview of frequently used commands in Linux.

Note: Some commands can only be executed by super user (example adduser, shutdown etc).

Creating a new user

- **Use the useradd command**
- **Use the passwd command to set password**
- **Try it… logon as root**

```
[root@mukesh]# useradd sdc1
[root@mukesh]# passwd sdc1
Changing password for user sdc1
New UNIX password:
Retype new UNIX password:
passwd: all authentication tokens updated
successfully
[root@mukesh]#
```

What is a Shell?

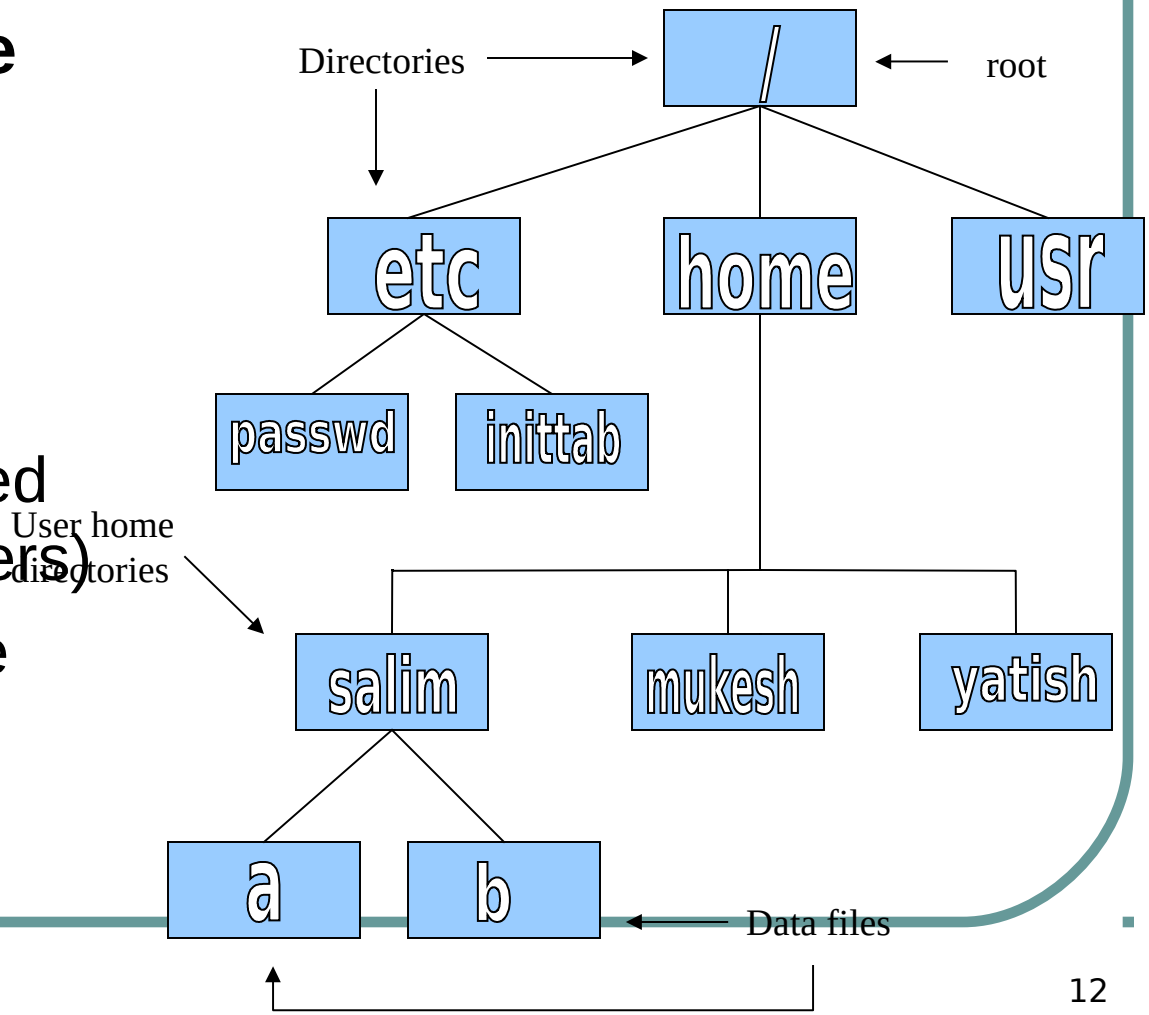
- Is a program that takes your commands from the keyboard and gives them to the operating system to perform
- An interface between the Linux system and the user
- Used to call commands and programs
- Many available (bsh; csh; bash; etc.)

You need help? Add more

- **In Linux help can be accessed by command `man` (manual)**
  - Use `man <command>` to display help for that command

Linux File System Basics

- **Linux files are stored in a single rooted, hierarchical file system**
  - Data files are stored in directories (folders)
  - Directories may be nested as deep as needed



Some Special File Names

- **Some file names are special:**
  - `/` The root directory (not to be confused with the root user)
  - `.` The current directory
  - `..` The parent (previous) directory
  - `~` My home directory

Special Files

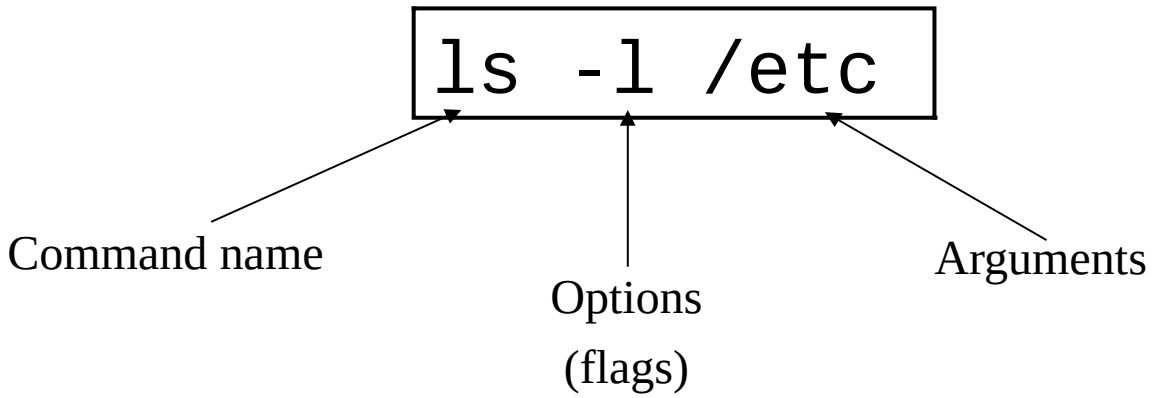
- **/: The root directory where the file system begins.**
- **/boot: This is where the Linux kernel is kept.**
- **/etc: The /etc directory contains the configuration files for the system.**
- **/bin, /usr/bin: These two directories contain most of the programs for the system. The /bin directory has the essential programs that the system requires to operate, while /usr/bin contains applications for the system's users.**

Special Files

- **/sbin, /usr/sbin: The sbin directories contain programs for system administration, mostly for use by the superuser.**
- **/usr: The /usr directory contains a variety of things that support user applications**
- **/lib: The shared libraries (similar to DLLs in that other operating system) are kept here.**
- **/home: /home is where users keep their personal work.**
- **/root: This is the superuser's home directory.**

Linux Command Basics

- **To execute a command, type its name and arguments at the command line**



Command Options

- **Command options allow you to control a command to a certain degree**
- **Conventions:**
  - Usually being with a single dash and are a single letter (“`-l`”)
  - Sometimes have double dashes followed by a keyword (“`--help`”)

Navigation and Looking Around

- **pwd - print (display) the working directory**
- **cd <*dir*> - change the current working directory to *dir***

```
cd ..
```

- **ls - list the files in the current working directory**
- **ls -l - list the files in the current working directory in long format**

File and Directory Manipulation

- **`cp <fromfile> <tofile>`**
  - Copy from the <fromfile> to the <tofile>
- **`mv <fromfile> <tofile>`**
  - Move/rename the <fromfile> to the <tofile>
- **`rm <file>`**
  - Remove the file named <file>
- **`mkdir <newdir>`**
  - Make a new directory called <newdir>
- **`rmdir <dir>`**
  - Remove an (empty) directory
- **`cat > <file>`**
  - Create file <file>

Data display from files

- **cat <*file*>**

  Displays contents of the <file>
- **head -n <*fromfile*>**

  Displays n lines from top of the <fromfile>
- **tail –n <*fromfile*>**

  Displays n lines from bottom of <fromfile>

Standard Files

- **`UNIX concept of “standard files”`**
  - standard input (where a command gets its input) - default is the terminal
  - standard output (where a command writes it output) - default is the terminal
  - standard error (where a command writes error messages) - default is the terminal

Redirecting Output

- **The output of a command may be sent (piped) to a file:**

```
ls -l >output
```

“>” is used to specify the output file

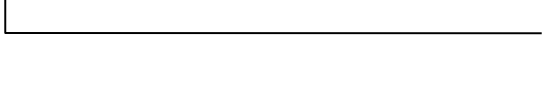
```
ls >>output
```

“>>” is used to append to output

Redirecting Input

- **The input of a command may come (be piped) from a file:**

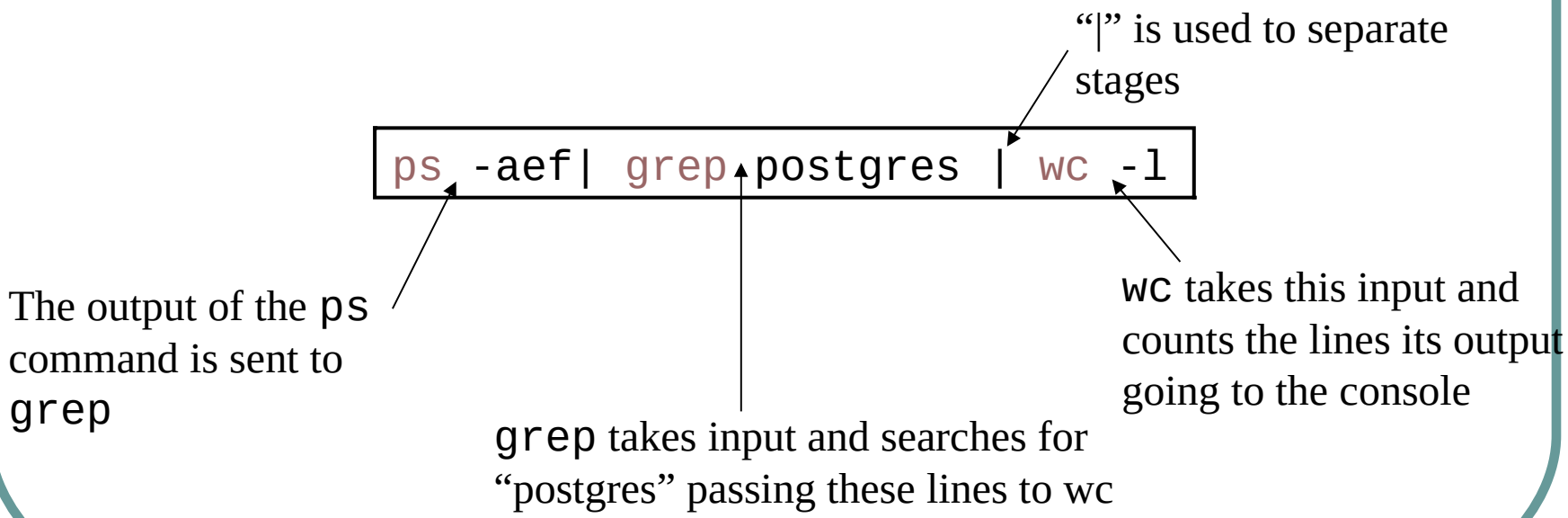
```
wc <input
```



"<" is used to specify the input file

Connecting commands with Pipes

- **The output of one command can become the input of another:**



More Commands

- `who`
  - List who is currently logged on to the system
- `who am i`
  - Report what user you are logged on as
- `ps`
  - List your processes on the system
- `ps -aef`
  - List all the processes on the system
- `echo “A string to be echoed”`
  - Echo a string (or list of arguments) to the terminal

More Commands

- **grep - Searches files for one or more pattern arguments. It does plain string, basic regular expression, and extended regular expression searching**

Example: ls –l |grep “mukesh”

ls command display the listing of files in current directory. And grep command searches for “mukesh” file in that listing.

More Commands

- **kill - sends a signal to a process or process group**
- **You can only kill your own processes unless you are root**

Example:

```
[root@mukesh log]# ps –aef
```

Above command will display result like:

```
[root@mukesh log]#
UID        PID  PPID  C STIME TTY          TIME CMD
root      6715  6692  2 14:34 ttyp0    00:00:00 sleep 10h
root      6716  6692  0 14:34 ttyp0    00:00:00 ps -ef
```

And one can kill the process by following command:

```
[root@mukesh log]# kill 6715
[1]+  Terminated              sleep 10h
```

More Commands

- **`tar` - manipulates archives**
  - An archive is a single file that contains the complete contents of a set of other files; an archive preserves the directory hierarchy that contained the original files.

```
tar -zxvf imap-4.7.tar.gz
imap-4.7/
imap-4.7/src/
imap-4.7/src/c-client/
imap-4.7/src/c-client/env.h
imap-4.7/src/c-client/fs.h
```

Switching Users

- **`su <accountname>`**
  - switch user accounts. You will be prompted for a password. When this command completes, you will be logged into the new account. Type `exit` to return to the previous account
- **`su`**
  - Switch to the root user account. Do not do this lightly

Note: The root user does not need to enter a password when switching users. It may become any user desired. This is part of the power of the root account.

PATH Environment Variable

- **Controls where commands are found**
  - PATH is a list of directory pathnames separated by colons. For example:

    ```
    PATH=/bin:/usr/bin:/usr/X11R6/bin:/usr/local/bin:/home/scully/bin
    ```

  - If a command does not contain a slash, the shell tries finding the command in each directory in PATH. The first match is the command that will run

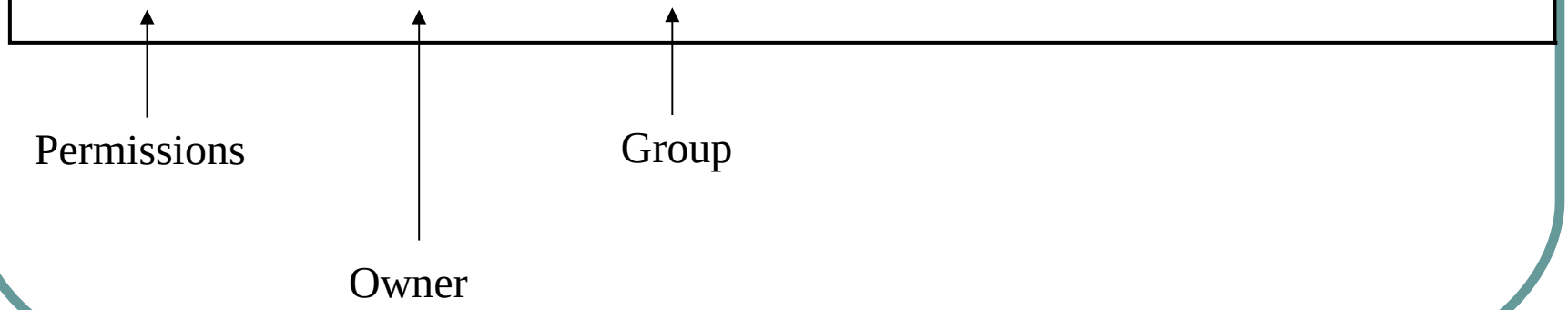
File and Directory Permissions

- **`Every file or directory`**
  - Is owned by someone
  - Belongs to a group
  - Has certain access permissions for owner, group, and others
  - Default permissions determined by `umask`

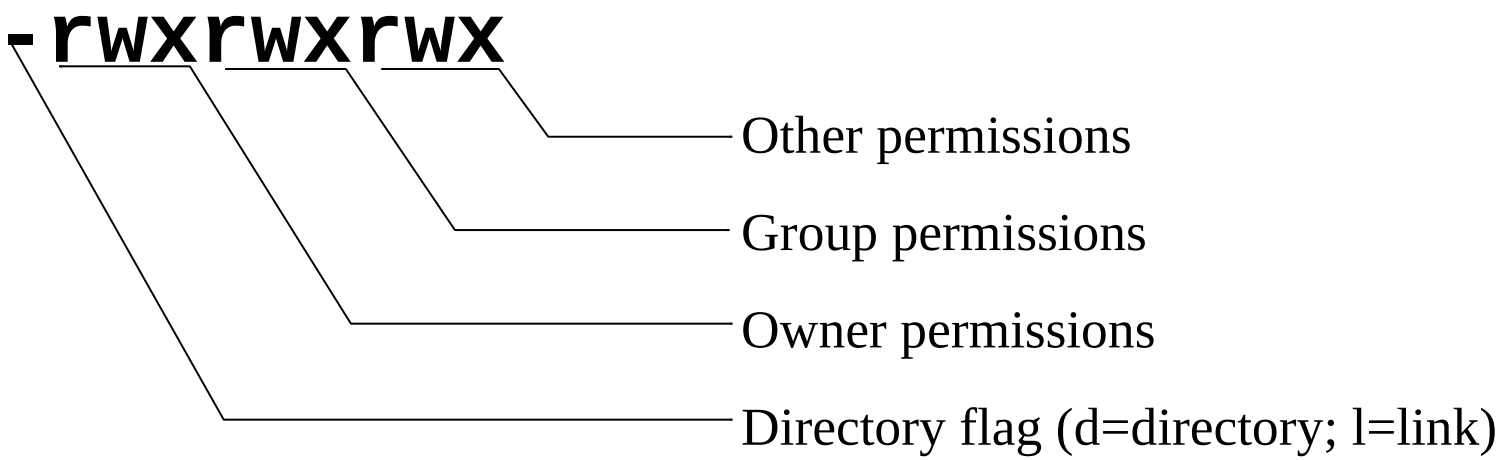
File and Directory Permissions

- **The long version of a listing (ls -l) will display the file permissions:**

```
-rwxrwxr-x   1 rvdheij  rvdheij      5224 Dec 30 03:22 hello
-rw-rw-r--   1 rvdheij  rvdheij       221 Dec 30 03:59 hello.c
-rw-rw-r--   1 rvdheij  rvdheij      1514 Dec 30 03:59 hello.s
drwxrwxr-x   7 rvdheij  rvdheij      1024 Dec 31 14:52 posixuft
```



Interpreting Permissions



Changing Permissions

- **Use the chmod command to change file or directory permissions**

rwx rwx rwx = 111 111 111 = 777
rw- rw- rw- = 110 110 110 = 666
rwx --- --- = 111 000 000 = 700

```
chmod 755 file  # Owner=rwx Group=r-x Other=r-x
chmod 500 file2 # Owner=r-x Group=--- Other=---
chmod 644 file3 # Owner=rw- Group=r-- Other=r--

chmod +x  file  # Add execute permission to file for all
chmod o-r file  # Remove read permission for others
chmod a+w file  # Add write permission for everyone
```

Changing ownership

- **chown - change file ownership**

  chown name some_file

- **chgrp - change a file's group ownership**

  chgrp new_group some_file

Processes

- As with any multitasking operating system, Linux executes multiple, simultaneous processes.
- Processes are created in a hierarchical structure whose depth is limited only by the virtual memory available to the virtual machine
- A process may control the execution of any of its descendants by suspending or resuming it, altering its relative priority, or even terminating it
- Termination of a process by default causes termination of all its descendants; termination of the root process causes termination of the session
- Linux assigns a *process ID* (PID) to the process

Processes

- **Foreground**
  - When a command is executed from the prompt and runs to completion at which time the prompt returns is said to run in the foreground
- **Background**
  - When a command is executed from the prompt with the token “&” at the end of the command line, the prompt immediately returns while the command continues is said to run in the background

Process Control Commands

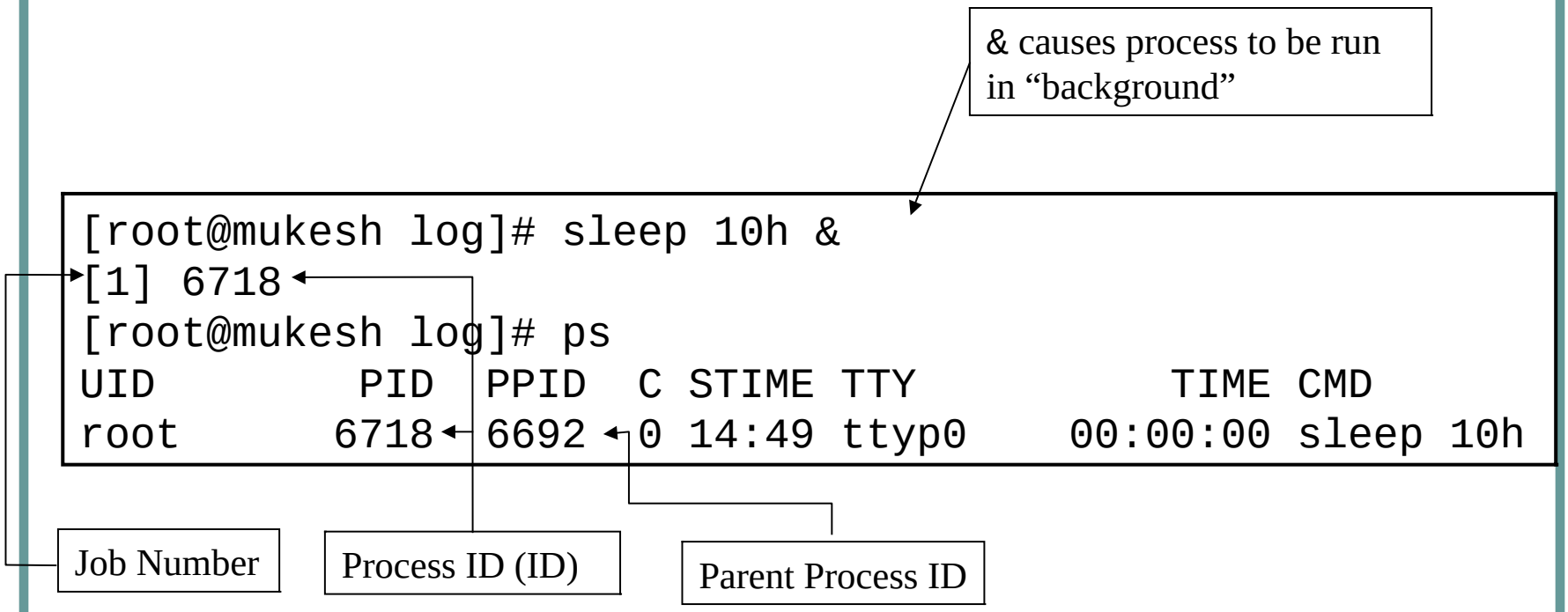
- **ps - list the processes running on the system**
- **kill - send a signal to one or more processes (usually to "kill" a process)**

Process Control Commands

```
$ ps
  PID TTY TIME CMD
  1280 pts/5 00:00:00 bash
  1293 pts/5 00:00:00 xload
  1294 pts/5 00:00:00 ps

$ kill  -9 1293
  [2]+ Terminated xload
```

Processes


& causes process to be run in “background”
[root@mukesh log]# sleep 10h &
[1] 6718
[root@mukesh log]# ps
UID PID PPID C STIME TTY TIME CMD
root 6718 6692 0 14:49 ttyp0 00:00:00 sleep 10h
Job Number
Process ID (ID)
Parent Process ID

Editors

- **`Several choices available:`**
  - `vi` Standard UNIX editor
  - `xedit` X windows text editor
  - `emacs` Extensible, Customizable Self-Documenting Display Editor
  - `pico` Simple display-oriented text editor


Thanks