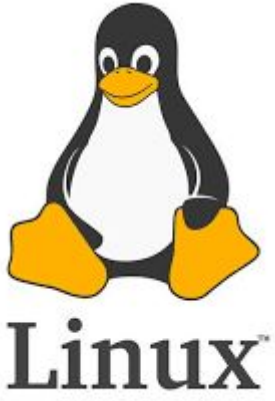

Introduction to Linux

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Why Linux

- It is free
- It runs on top 500 supercomputers
- Most of the servers in the world use Linux
- This course requires you to work on Linux!

Linux

- Linux is a family of open-source Unix-like operating systems
- 1991 - Linus Torvalds, introduced first free and open-source Linux kernel
- Linux is typically packaged as a distribution, which includes the kernel and supporting system software and libraries
- There are many different distributions of Linux available

Ubuntu
Deepin
Mandriva Linux
Bodhi Linux
BlackArch
SolydXK
Void Linux
NixOS
LliureX
Fedora Linux
Mageia
Parrot OS
Ubuntu MATE
Peppermint OS
Garuda Linux
CrunchBang Linux
Caldera OpenLinux
BackBox
Arch Linux
Scientific Linux
Kubuntu
Parsix
Grml
Ubuntu Kylin
Emdebian Grip
Kanotix
VyOS
LiMux
HandyLinux
LEAF Project
Molinux
Sabayon Linux
Caldera Network Desktop
Rockstor
Ufficio Zero
GendBuntu
TurnKey Linux Virtual Appliance Library
Element OS
Pinguy OS
KaOS
Foresight Linux
Exherbo
MakuluLinux
Nitrux
Russian Fedora Remix
SuperGamer
Alpine Linux
Blue Linux
BunsenLabs Linux
Slackel
Siduction

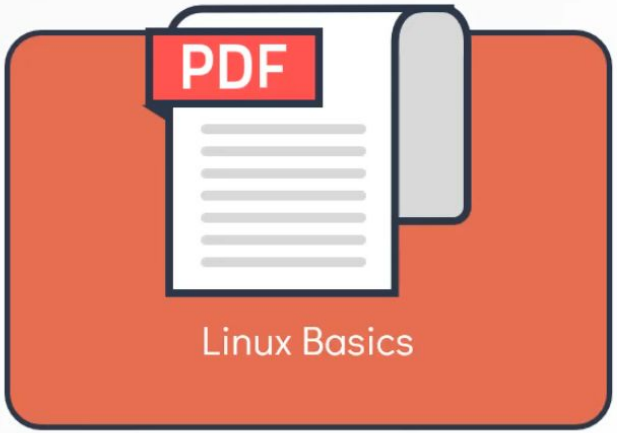
Linux vs Unix

- Unix is an operating system that was developed at AT&T's Bell Labs in the late 1960s and early 1970s. It has various **commercial** versions, including AIX, Solaris, HP-UX, and more.

- Linux, on the other hand, is a free and **open-source** operating system kernel initially created by Linus Torvalds in 1991. Linux distributions (commonly known as Linux distros) combine this kernel with various software packages to create complete operating systems.

Let's have a look at Ubuntu (A Famous Linux Distribution) environment!

Shell



Ubuntu Desktop /
Graphical View

Linux Shell

```
$ echo  Hello
Hello
$
```

Basic Linux Commands: The Home Directory

Basic Linux Commands: Command and Arguments

```
[~]$ echo
[~]$
```

```
[~]$ uptime
19:18:51 up 19:48,  2 users,  load average:
1.18, 0.49, 0.36
```

```
[~]$ echo  Hello
Hello
[~]$
```

```
[~]$ echo -n Hello
Hello[~]$
```

```
command <options> <arguments>
echo = command
option = -n
Hello = argument
```

Basic Linux Commands

pwd (present working directory)

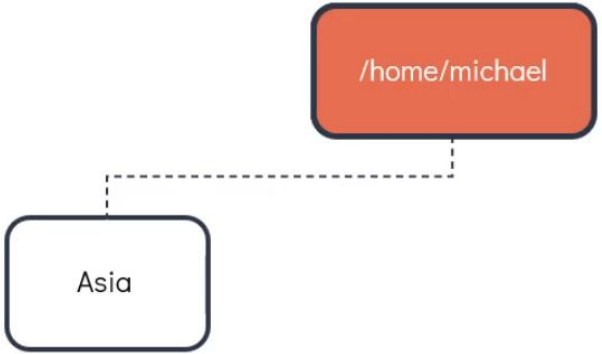
```
[~]$ pwd
/home/michael
```

Ls (List contents)

```
[~]$ ls
```

mkdir (make a new directory)

```
[~]$ mkdir Asia
```



Basic Linux Commands

pwd (present working directory)

```
[~]$ pwd
/home/michael
```

Ls (List contents)

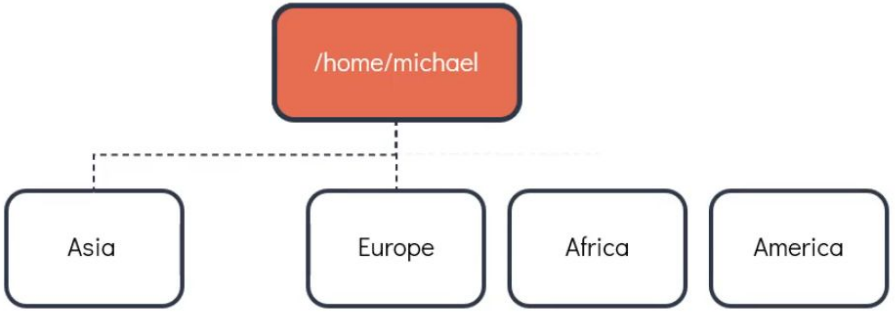
```
[~]$ ls
```

mkdir (make a new directory)

```
[~]$ mkdir Asia
```

mkdir (multiple directories)

```
[~]$ mkdir Europe Africa America
```



Basic Linux Commands

pwd (present working directory)

```
[~]$ pwd
/home/michael
```

Ls (List contents)

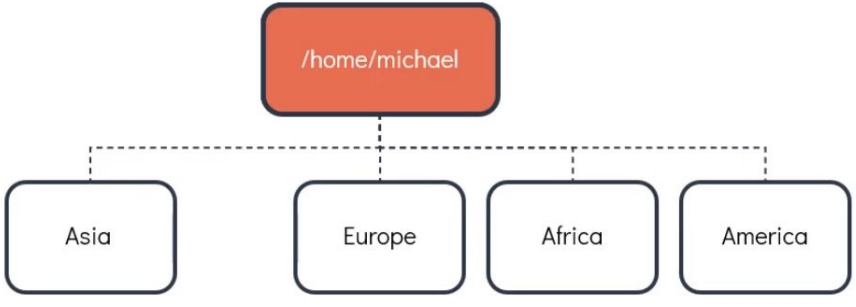
```
[~]$ ls
```

mkdir (make a new directory)

```
[~]$ mkdir Asia
```

mkdir (multiple directories)

```
[~]$ mkdir Europe Africa America
```



Ls (List contents)

```
[~]$ ls
Asia Europe Africa America
```

Basic Linux Commands

cd (change directory)

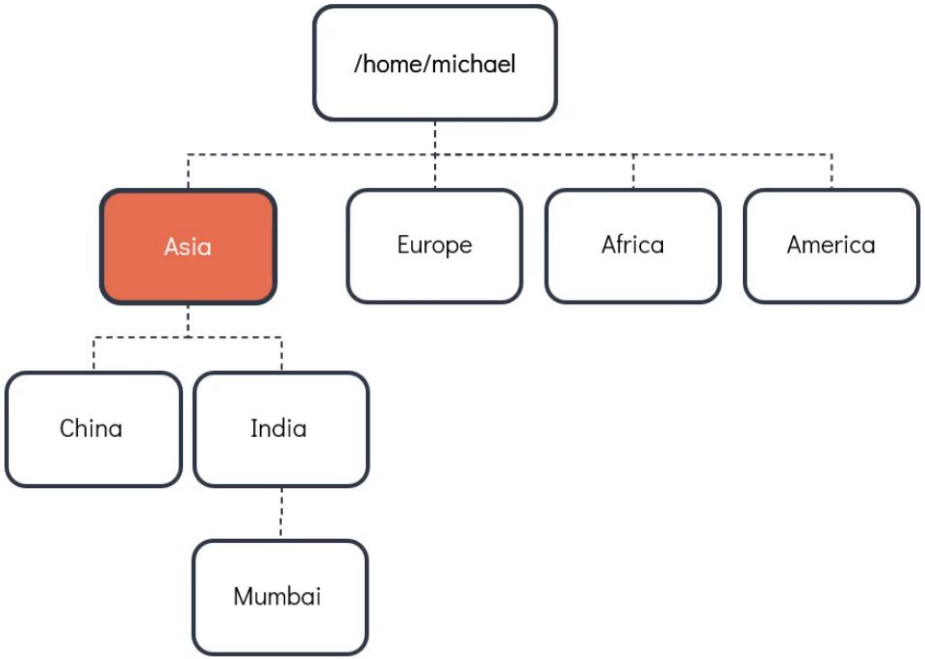
```
[~]$ cd Asia
[~/Asia]$
```

```
[~/Asia]$ pwd
/home/michael/Asia
```

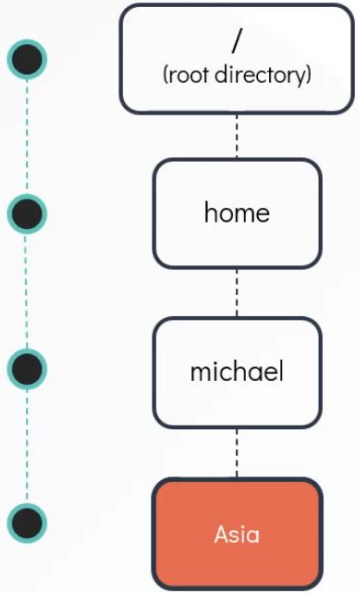
```
[~/Asia]$ mkdir China India
```

```
[~/Asia]$ mkdir India/Mumbai
```

```
[~/Asia]$ mkdir -p India/Mumbai
```



Absolute and Relative Path




```
[~] pwd
/home/michael
```

Absolute Path

```
[~]$ cd /home/michael/Asia
```

Relative Path

```
[~] cd Asia
```

```
cd =  change directory
```

```
pwd =  print present working directory
```

Basic Linux Commands: Reading Files

Let's practice few command for text reading:

- cat: output the entire file on your shell
- head: output the file from beginning for a specific number of lines
- tail: output the file from end for a specific number of lines

```
root@wiqbal-HP-Pavilion-Gaming-Laptop-15-ec2xxx:~# cat myfile.txt
this is line 1
this is line 2
this is line 3
this is line 4
this is line 5
this is line 6
this is line 7
this is line 8
this is line 9
this is line 10
this is line 11
this is line 12
this is line 13
this is line 14
this is line 15
this is line 16
this is line 17
this is line 18
this is line 19
this is line 20
```

```
root@wiqbal-HP-Pavilion-Gaming-Laptop-15-ec2xxx:~# head myfile.txt
this is line 1
this is line 2
this is line 3
this is line 4
this is line 5
this is line 6
this is line 7
this is line 8
this is line 9
this is line 10
root@wiqbal-HP-Pavilion-Gaming-Laptop-15-ec2xxx:~# tail myfile.txt
this is line 11
this is line 12
this is line 13
this is line 14
this is line 15
this is line 16
this is line 17
this is line 18
this is line 19
this is line 20
root@wiqbal-HP-Pavilion-Gaming-Laptop-15-ec2xxx:~# tail -2 myfile.txt
this is line 19
this is line 20
root@wiqbal-HP-Pavilion-Gaming-Laptop-15-ec2xxx:~# head -2 myfile.txt
this is line 1
this is line 2
```

Basic Linux Commands: Pager

```
[~]$ more new_file.txt
```

[Space] - scrolls the display, one screenful of data at a time
[Enter] - scrolls the display one line
[b] - scrolls the display backwards one screenful of data
[/] – search text

```
[~]$ less new_file.txt
```

[Up Arrow] - scrolls up the display one line
[Down Arrow] – scrolls down the display one line
[/] – search text

Basic Linux Commands: ls

ls –l (long list)

```
[~]$ ls -l
total 0
-rw-rw-r-- 1 bob bob 0 Mar 13 11:30 File.txt
-rw-rw-r-- 1 bob bob 0 Mar 13 11:30 index.html
-rw-rw-r-- 1 bob bob 0 Mar 13 11:30 caleston
```

ls –lt (long list files in order created)

```
[~]$ ls -lt
total 0
-rw-rw-r-- 1 bob bob 0 Mar 13 11:30 File.txt
-rw-rw-r-- 1 bob bob 0 Mar 13 11:28 index.html
-rw-rw-r-- 1 bob bob 0 Mar 13 11:27 caleston
```

ls –a (list all files including hidden)

```
[~]$ ls -a
.  ..  File.txt  index.html  caleston  .test
```

ls –ltr (long list files in the reverse order created)

```
 [~]$ ls -ltr
total 0
-rw-rw-r-- 1 bob bob 0 Mar 13 11:27 caleston
-rw-rw-r-- 1 bob bob 0 Mar 13 11:28 index.html
-rw-rw-r-- 1 bob bob 0 Mar 13 11:30 File.txt
```

Command Line Help

```
[~]$ whatis date
date (1)              - print or set the system date and time2
```

```
[~]$ man date
DATE(1)                          User Commands
DATE(1)

NAME
       date - print or set the system date and time

SYNOPSIS
       date [OPTION]... [+FORMAT]
       date [-u|--utc|--universal] [MMDDhhmm[[CC]YY][.ss]]

DESCRIPTION
       Display the current time in the given FORMAT, or set the system date.
```

```
[~]$ date --help
Usage: date [OPTION]... [+FORMAT]
  or:  date [-u|--utc|--universal] [MMDDhhmm[[CC]YY][.ss]]
Display the current time in the given FORMAT, or set the system date.
```

Most used commands

- `cd`
- `ls`
- `pwd`
- `whoami`
- `which`
- `man`
- `touch`
- `gedit`
- `nano`
- `mkdir`
- `cp`
- `rm`
- `mv`
- `find`
- `history`
- `wc`
- `top`

Linux Package Management

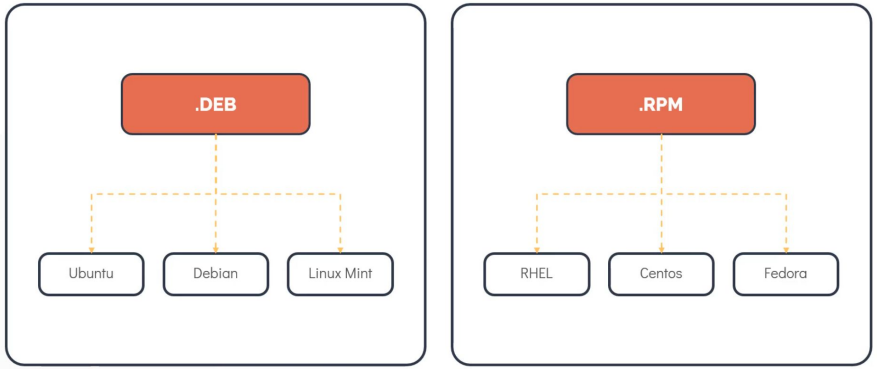
DPKG / APT

RPM

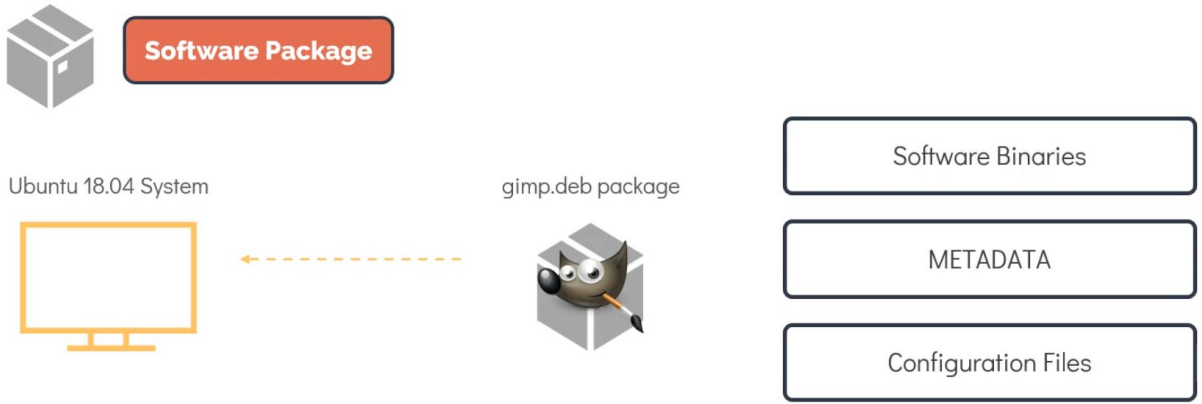
debian

Red Hat

CentOS



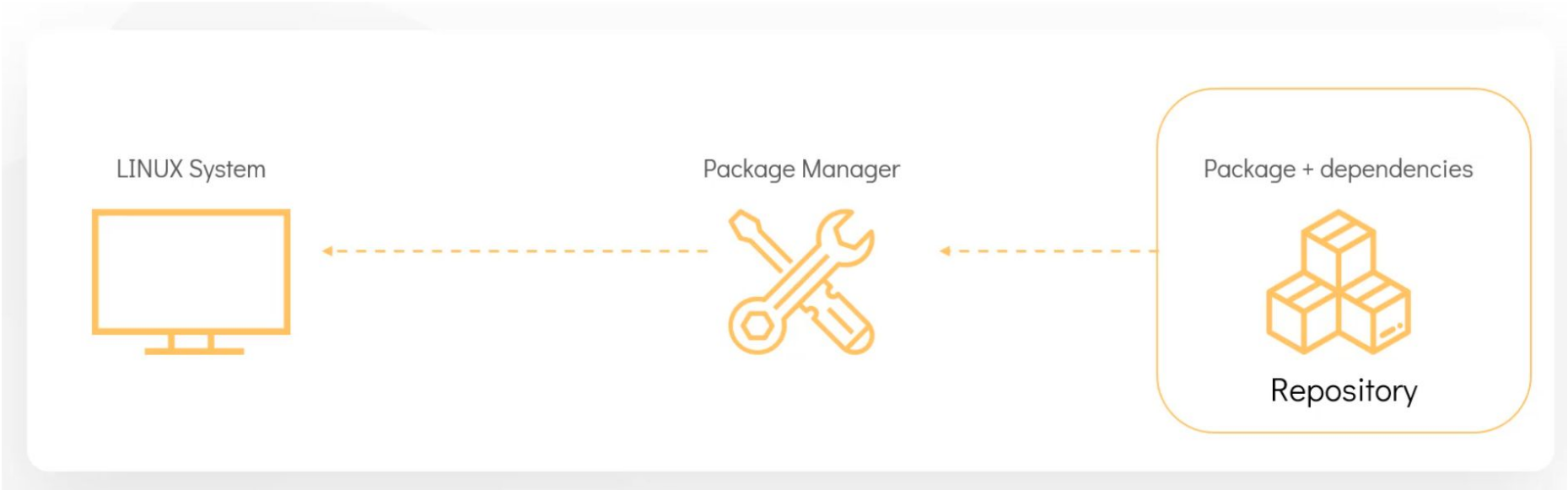
Linux Package Management (Cont.)



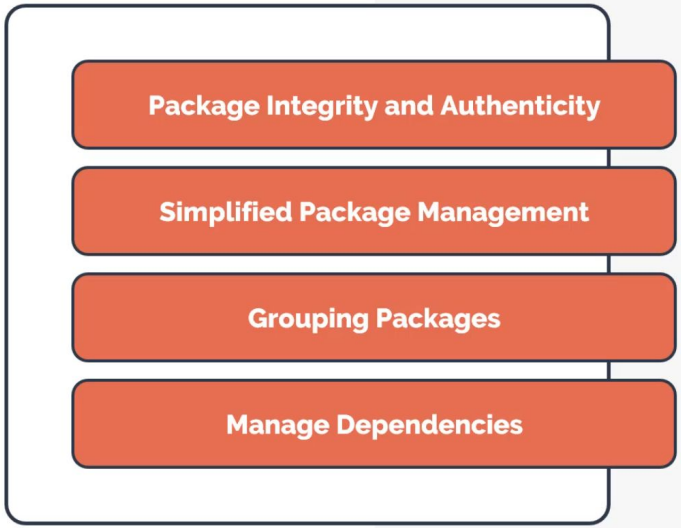
Linux Package Management (Cont.)


```
[~]$ dpkg –i gimp.deb
(Reading database ... 419857 files and directories
currently installed.)
Preparing to unpack gimp.deb ...
Unpacking gimp (2.10.8-2) over (2.10.8-2) ...
dpkg: dependency problems prevent configuration of
gimp:
 gimp depends on libgimp2.0 (>= 2.10.8); however:
  Version of libgimp2.0 on system is 2.8.22-1.
dpkg: error processing package gimp (--install):
 dependency problems - leaving unconfigured
Processing triggers for gnome-menus (3.13.3-
11ubuntu1.1) ...
Processing triggers for desktop-file-utils
(0.23+linuxmint6) ...
Processing triggers for mime-support (3.60ubuntu1)
...
Processing triggers for man-db (2.8.3-2ubuntu0.1)
...
Errors were encountered while processing:
 gimp
```

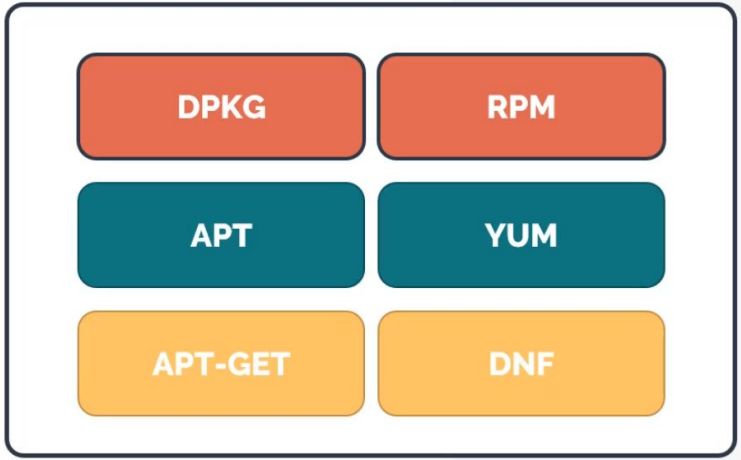
Linux Package Management (Cont.)



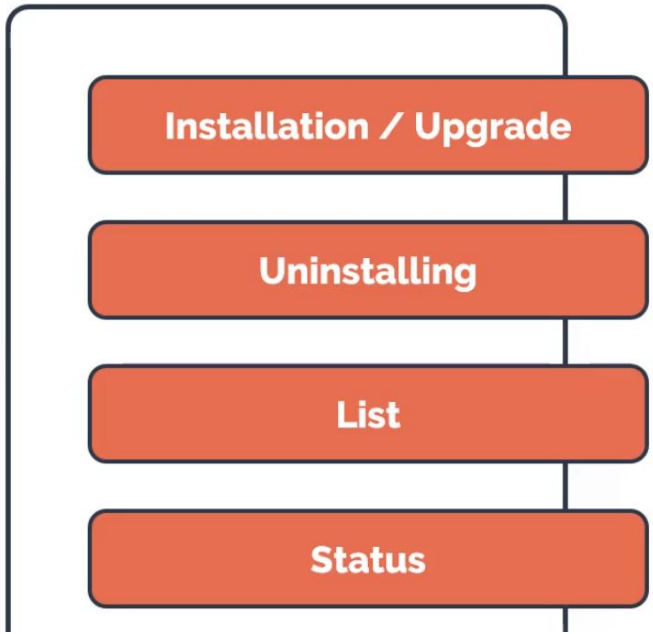
Functions of Package Manager



Type of Package Manager



Working with DPKG




```
[~]$ dpkg -i telnet.deb
```

```
[~]$ dpkg -r telnet.deb
```

```
[~]$ dpkg -l telnet
```

```
[~]$ dpkg -s telnet
```

apt

```
[~]$ apt install telnet
```

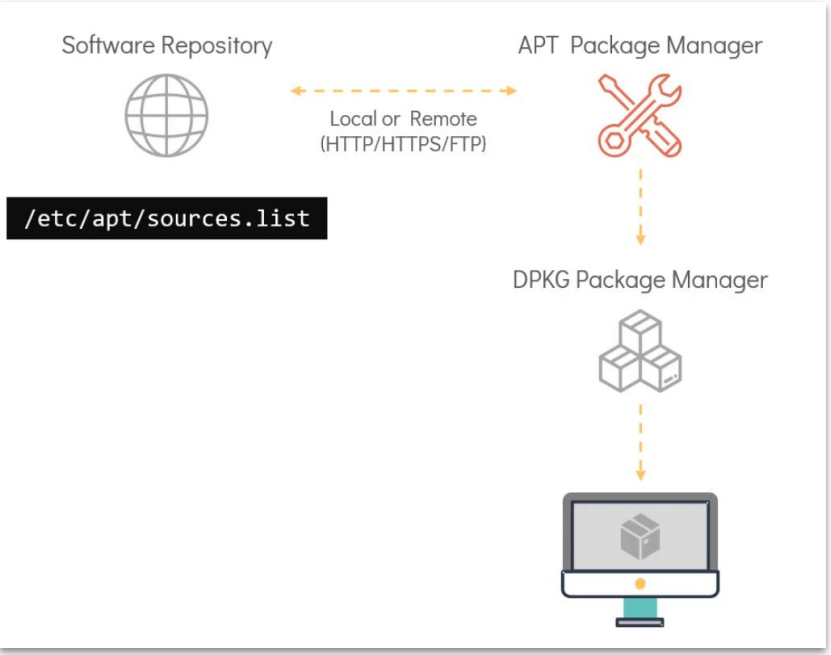
```
[~]$ apt remove telnet
```

```
[~]$ apt search telnet
```

```
[~]$ apt list | grep telnet
```

apt and apt-get

- apt is more friendly than apt-get!




```
[~]$ apt install firefox
Recommended packages:
  xul-ext-ubufox
The following NEW packages will be installed:
  firefox
0 upgraded, 1 newly installed, 0 to remove and 36 not
upgraded.
Need to get 0 B/52.0 MB of archives.
After this operation, 202 MB of additional disk space will
be used.
Selecting previously unselected package firefox.
(Reading database ... 416280 files and directories currently
installed.)
Preparing to unpack
.../firefox_74.0+linuxmint2+tricia_amd64.deb ...
Unpacking firefox (74.0+linuxmint2+tricia) ...

Progress: [ 17%]
[##########.....................................................
.....]
```

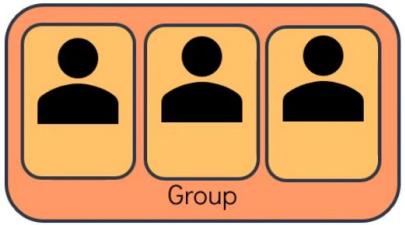
```
[~]$ apt-get install firefox
The following NEW packages will be installed:
  firefox
0 upgraded, 1 newly installed, 0 to remove and 36 not
upgraded.
Need to get 0 B/52.0 MB of archives.
After this operation, 202 MB of additional disk space will
be used.
Selecting previously unselected package firefox.
(Reading database ... 416280 files and directories currently
installed.)
Preparing to unpack
.../firefox_74.0+linuxmint2+tricia_amd64.deb ...
Unpacking firefox (74.0+linuxmint2+tricia) ...
Setting up firefox (74.0+linuxmint2+tricia) ...
Please restart all running instances of firefox, or you will
experience problems.
Processing triggers for gnome-menus (3.13.3-11ubuntu1.1) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...
Processing triggers for mime-support (3.60ubuntu1) ...
Processing triggers for desktop-file-utils (0.23+linuxmint8)
...
Processing triggers for mintsystem (8.4.6) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
```

```
[~]$ apt search telnet
p   dcap-tunnel-telnet                - telnet tunnel for
                                        dCache
p   dcap-tunnel-telnet:i386           - telnet tunnel for
                                        dCache
p   inetutils-telnet                  - telnet client
p   inetutils-telnet:i386             - telnet client
p   inetutils-telnetd                 - telnet server
p   inetutils-telnetd:i386            - telnet server
i   telnet                            - basic telnet
                                        client
p   telnet:i386                       - basic telnet
                                        client
```

```
[~]$ apt-cache search telnet
curl - command line tool for transferring data with URL
syntax
libcurl3-gnutls - easy-to-use client-side URL transfer
library (GnuTLS flavour)
libcurl3-nss - easy-to-use client-side URL transfer library
(NSS flavour)
libcurl4-doc - documentation for libcurl
libcurl4-gnutls-dev - development files and documentation
for libcurl (GnuTLS flavour)
libcurl4-nss-dev - development files and documentation for
libcurl (NSS flavour)
libcurl4-openssl-dev - development files and documentation
for libcurl (OpenSSL flavour)
redir - Redirect TCP connections
ser2net - Serial port to network proxy
socks4-clients - Socks4 enabled clients as rtelnet and rftp
sredird - RFC 2217 compliant Telnet serial port redirector
swaks - SMTP command-line test tool
telnet-ssl - telnet client with SSL encryption support
telnetd - basic telnet server
telnetd-ssl - telnet server with SSL encryption support
```

Linux User, Group, and File Permissions

User and Groups in Linux

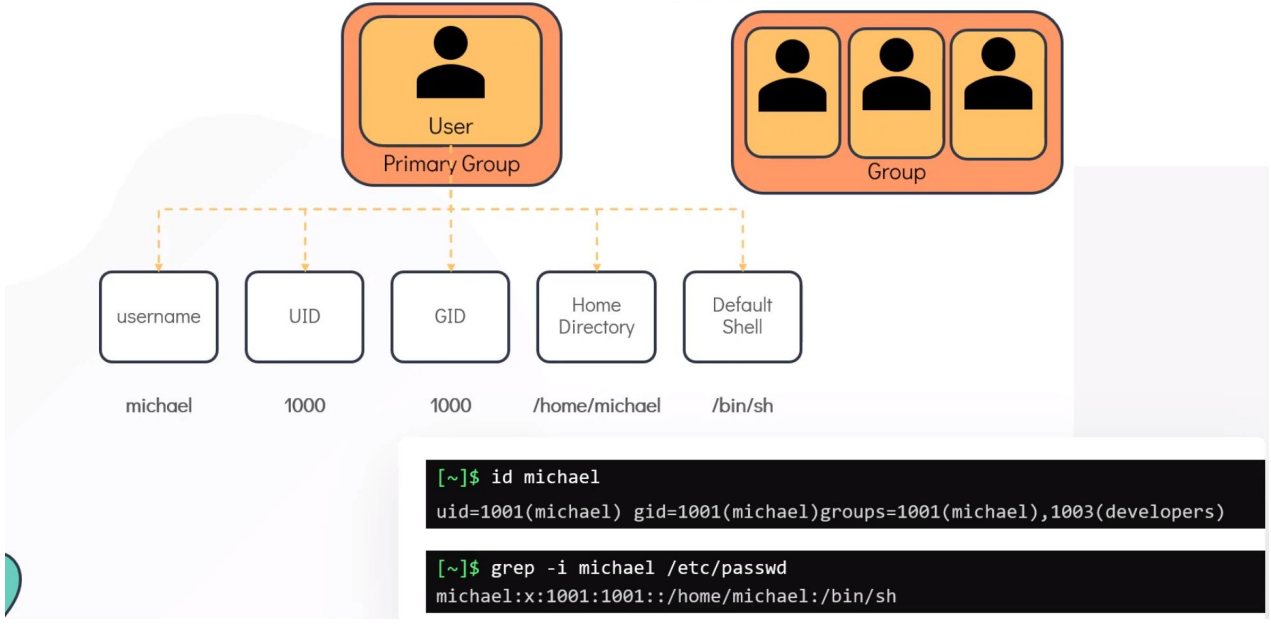



```
[~]$ cat /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
www-data:x:33:33:www-
data:/var/www:/usr/sbin/nologin
bob:1000:1000:Bob Kingsley,,,:/home/bob:/bin/bash
```

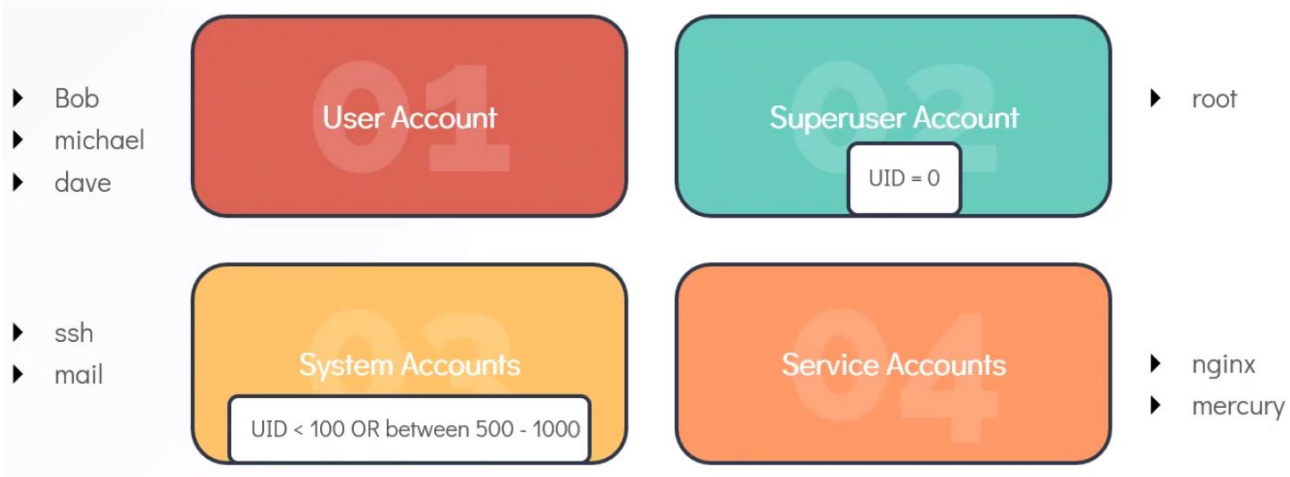
```
[~]$ cat /etc/group
ssh:x:118:
lpadmin:x:119:
scanner:x:120:saned
avahi:x:121:
saned:x:122:
colord:x:123:
geoclue:x:124:
pulse:x:125:
pulse-access:x:126:
gdm:x:127:
systemd-coredump:x:999:
bob:x:1000:
developers:x:1003:bob,michael
```

User and Groups in Linux (Cont.)

- Every created user in the Linux will have username, UID, GID, Home Directory, and Default Shell.



User and Groups in Linux (Cont.)



User and Groups in Linux (Cont.)

```
[~]$ id
uid=1000(michael) gid=1000(michael) groups=1000(michael)
```

```
[~]$ who
bob      pts/2        Apr 28 06:48 (172.16.238.187)
```

```
[~]$ last
michael   :1    :1                  Tue May 12 20:00  still logged in
sarah     :1    :1                  Tue May 12 12:00  still running
reboot   system boot 5.3.0-758-gen   Mon May 11 13:00  - 19:00 (06:00)
```

SuperUser DO (sudo)

- SuperUser DO (sudo) and is used to access restricted files and operations.
- By default, Linux restricts access to certain parts of the system preventing sensitive files from being compromised.
- The sudo command temporarily elevates privileges allowing users to complete sensitive tasks without logging in as the root user.

```
[michael@ubuntu-server ~]$ sudo apt-get install nginx
[sudo] password for michael:
```

User and Group Management

- useradd bob: create a user bob
- useradd -m bob: create a user bob and also create its home directory
- groupadd will create a group
- groupdel will delete group
- userdel will delete user
- passwd will allow to change password

```
[~]$ useradd bob
```

```
[~]$ grep -i  bob /etc/passwd
bob:x:1002:1002::/home/bob:/bin/sh
```

```
[~]$ userdel bob
```

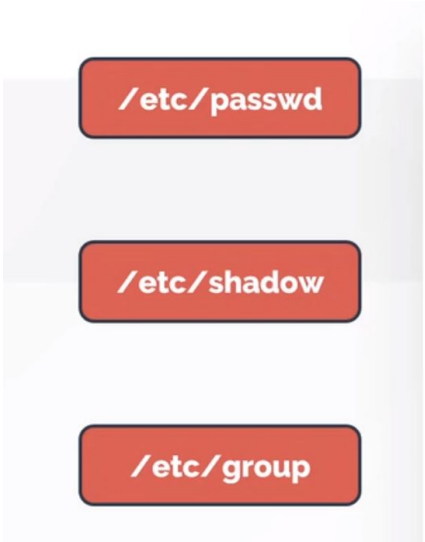
```
[~]$ groupadd -g 1011 developer
```

```
[~]$ groupdel developer
```

```
[~]$ passwd bob
Changing password for user bob.
New UNIX password:
Retype new UNIX password:
passwd: all authentication tokens updated
successfully.
```

Access Control Files in Linux

- /etc/passwd contains users information
- /etc/shadow contains hashed password
- /etc/group contain group information




```
[~]$ grep -i  ^bob /etc/passwd
/bob:x:1001:1001::/home/bob:/bin/bash
```

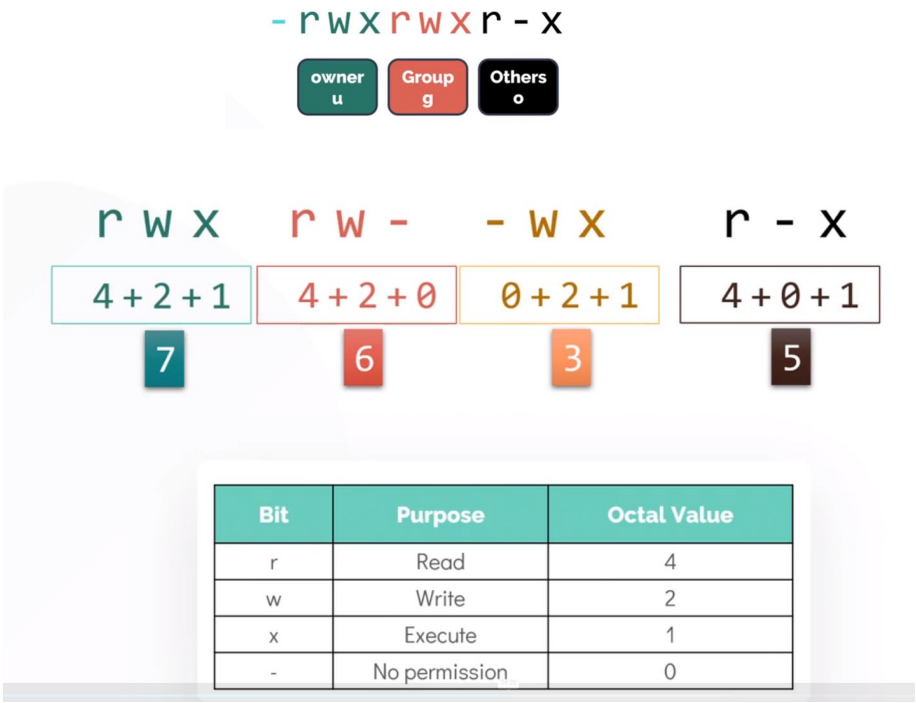
```
[~]$ grep -i  ^bob /etc/shadow
/bob:$6$0h0utOtO$5JcuRxR7y72LLQk4Kdog7u09LsNFS0yZPkIC8pV9tgD0wXCHut
YcWF/7.eJ3TfGfG0lj4JF63PyuPwKC18tJS.:18188:0:99999:7:::
```

```
[~]$ grep -i  ^bob /etc/group
developer:x:1001:bob,michael
```

File Permissions

```
[~]$ ls -l bash-script.sh
-rwxrwxr-x 1 bob bob 89 Mar 17 01:35 bash-script.sh
```

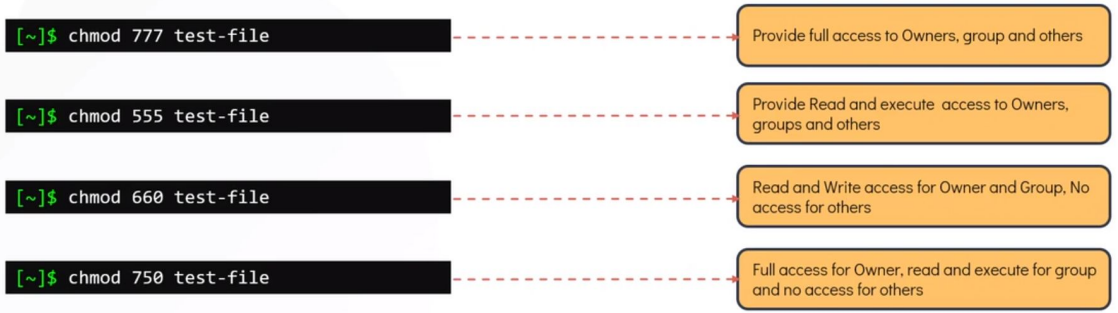
File Type	Identifier
DIRECTORY	d
REGULAR FILE	-
CHARACTER DEVICE	c
LINK	l
SOCKET FILE	s
PIPE	p
BLOCK DEVICE	b



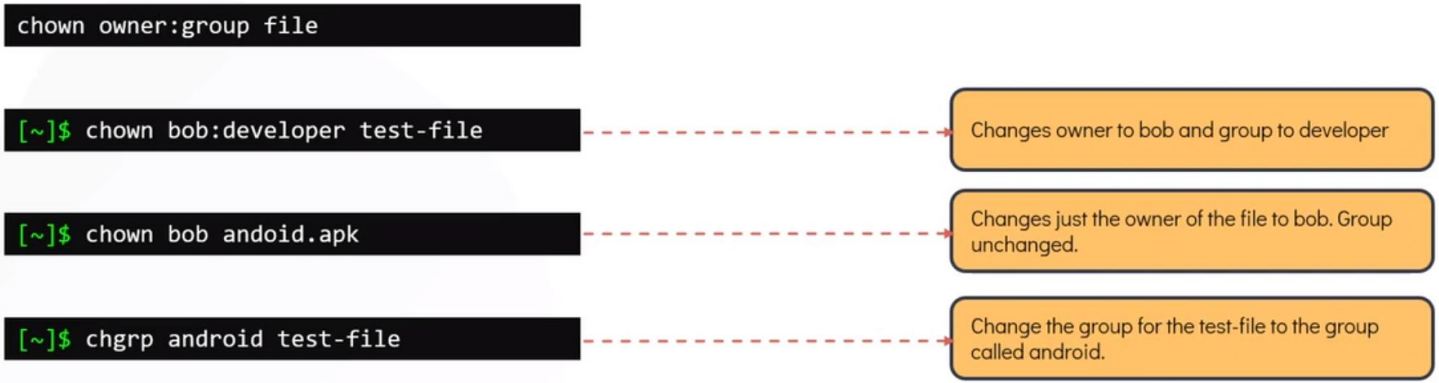
Bit	Purpose	Octal Value
r	Read	4
w	Write	2
x	Execute	1
-	No permission	0

File Permissions: chmod

chmod: use to change the permission of the file



File Permissions: chown



Home Work

- Install Ubuntu on your laptop
- Practice different command and get comfortable with linux environment.
- Install packages, and play with files and folders.
- Install apache server and identify different configuration file of apache on the file system

Next

- GIT - Version Control System

Credit

These slides use material from kodekloud.com