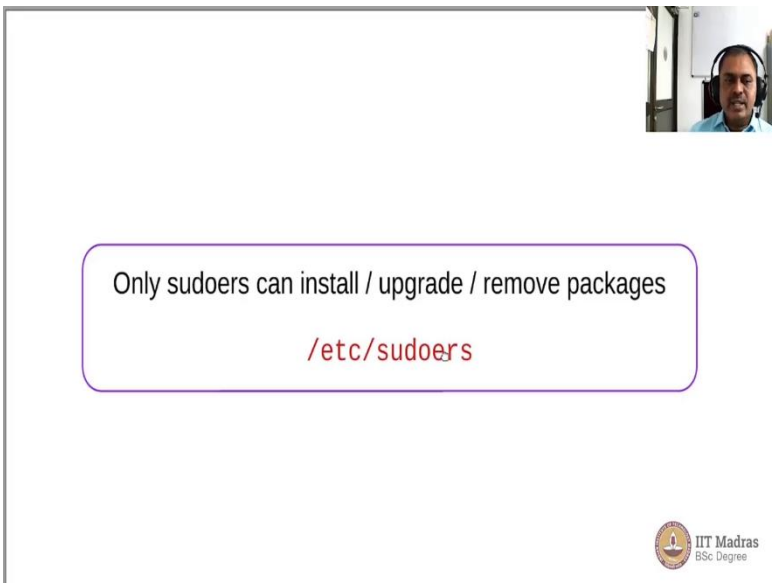
**System Commands**
**Professor Gandham Phanikumar**
**Metallurgical and Material Engineering**
**Indian Institute of Technology, Madras**
**Software Management Part 02**

(Refer Slide Time: 00:14)




Now, who can install the packages in a Linux operating system? The answer is the administrators. And in the case of Ubuntu, it would be called a sudoers, that is, they could run a command as an administrator or a superuser. So, su for super user and do to execute, so sudo a command can be executed by those who are listed in the file called etc sudoers.

Now, even to actually view the file, it is etc sudoers, you must be listed in that particular file. So, let us just check that out, and then, we would go on to try how to install packages by actually running a demo. To install the software updates or new software into the system, you will need to be a super user or an administrator. The superuser privileges are listed in a file called slash etc slash sudoers, let us explored that using an example.

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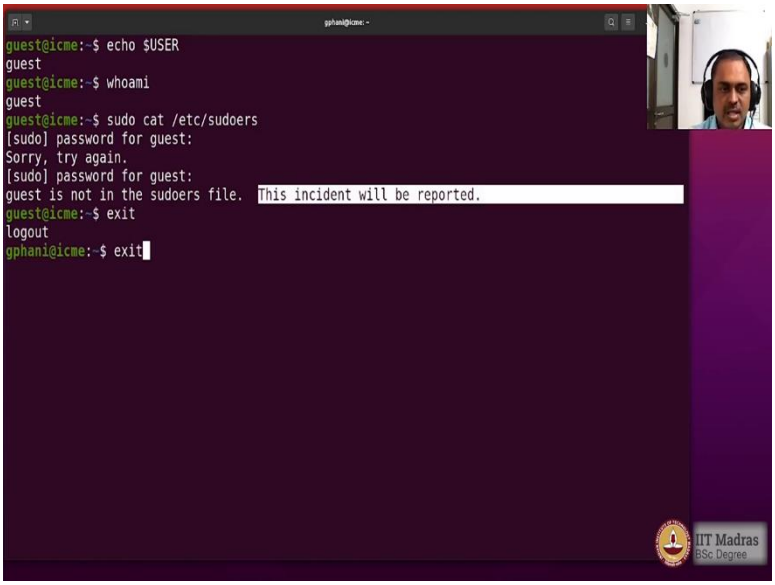


Here I have a terminal in which I am logged in as a guest. So, I check who I am, so I am logged in as a guest and I can view the contents of the etc sudoers file only if I am actually present with those privileges in that particular file, and we can check whether we have those privileges or not.

And when I run this, it would ask for the password and let us say I make a mistake in giving the password so there is a usual error that is for the password failure. But if you give it correctly, then it would go on to check whether the user name is present in the sudoers list or not. And if the privileges are not sufficient, then there will be a message that you cannot actually proceed further.

And there is also a message that the incident will be reported. So, what does it mean? It means that the administrator can find out that a regular user is trying to gain superuser privileges and has failed on a service that belongs to someone else this could be a problem, but if it is on your own machine, there is nothing to worry. Let us check, how does one find out whether such a failure has happened.

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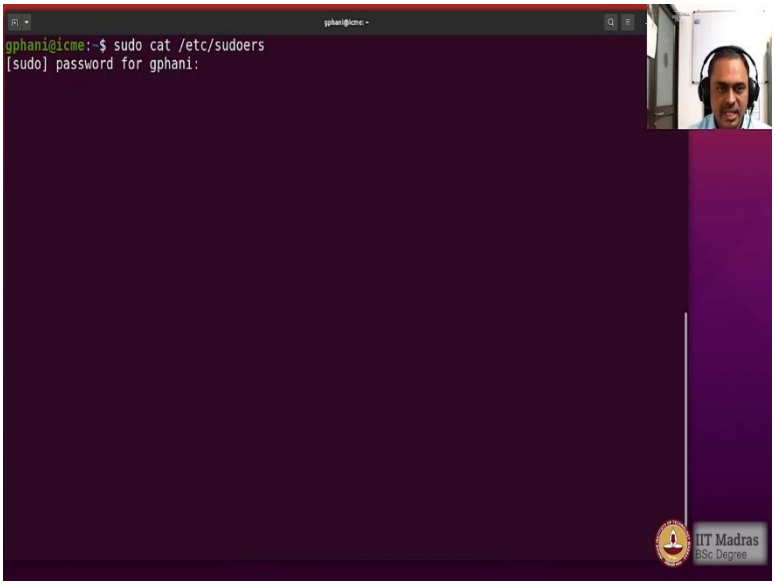


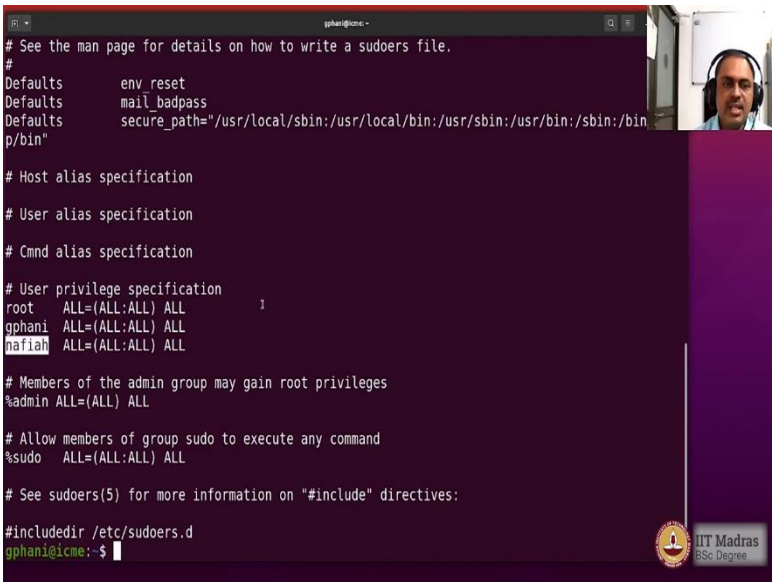


So, I will now come out of this particular terminal and I am now in the terminal where I am logged in as gphani, which is the regular user for this machine, and also present in the sudoers list, and I can verify that now. I am logged into this terminal as gphani which will be the first user for this particular machine, and therefore also present in the sudoers list. So, let me just check that out by looking at the file contents of the sudoers.

And it is asking me for the password, so I give that properly, and then, if I am having that privilege, then it would be showing the contents of the sudoers file, which is available in front of you now. And this file shows that apart from the root user, and myself, there is also one more user who has the superuser privileges. Every other user will be denied permission to install software on this particular mission.

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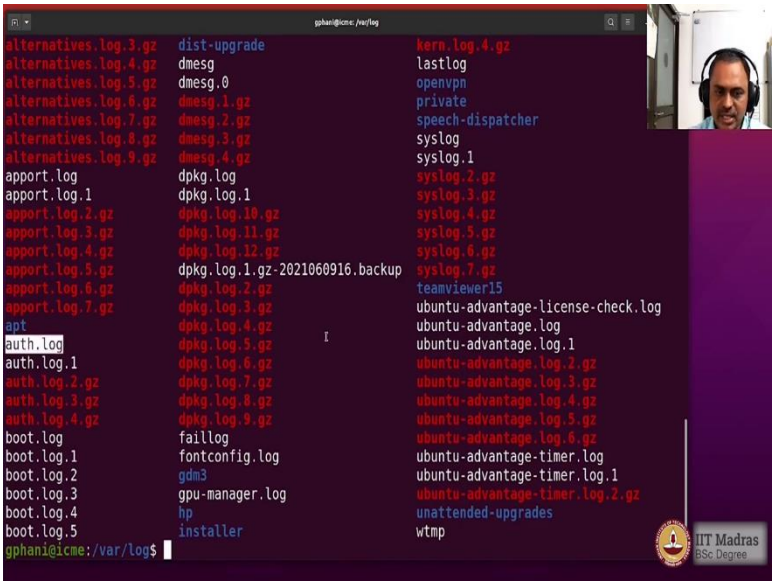


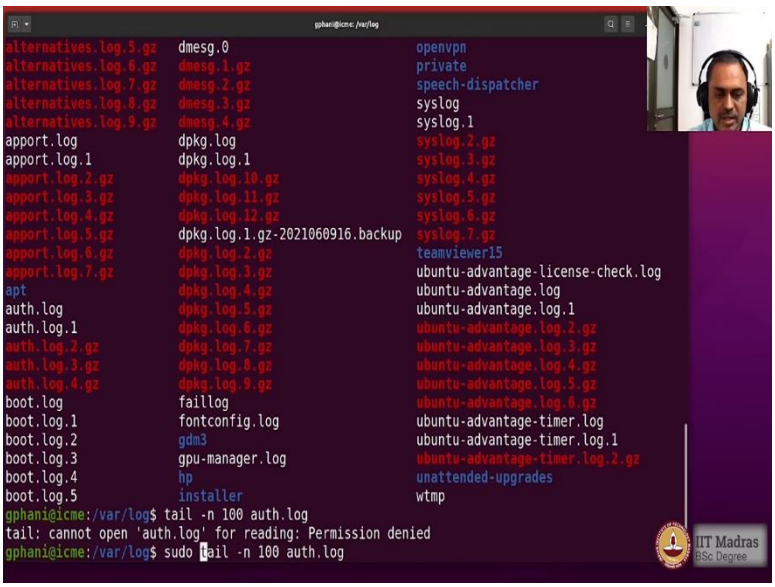

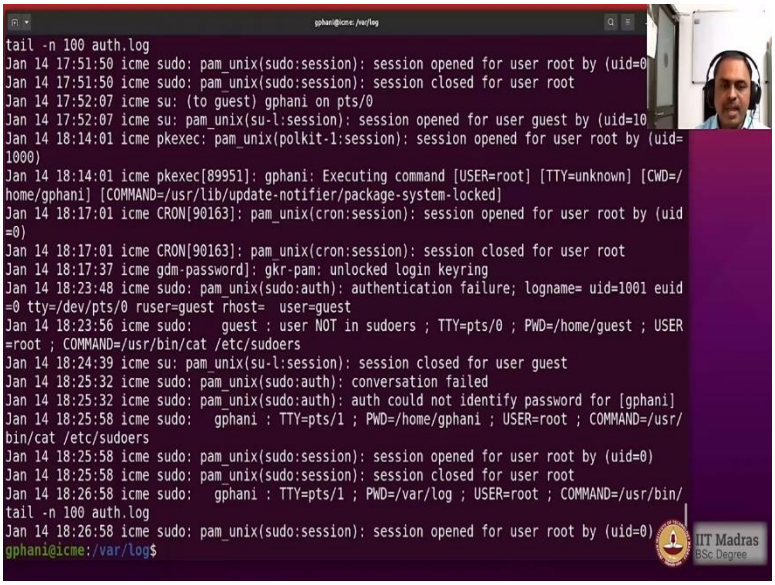


Now, what did we mean when we said that the superuser can find out a failed attempt to have the superuser privileges by any other user, so that would be available in a log file. And we know that most of the logs are kept in slash var slash log and auth dot log is the file where these events are reported so we could look at the last 100 lines of this particular file.

And again, this auth log is also only for super users, so we go ahead and use the superuser privileges for that. And we now see that in the output, there is a entry here saying that there is a authentication failure for the guest user and the message is saying that user is not in the sudoers list.

And later on, I was successful in becoming a super user from the regular account, so you could also see that here, where it opens the superuser permissions for a particular user UID zero. So here you can see that the successful usage of superuser privileges by the user gphani is documented, so the log book also tells you who managed to gain the administrator privileges and who did not, and so one should look at these logs time to time.

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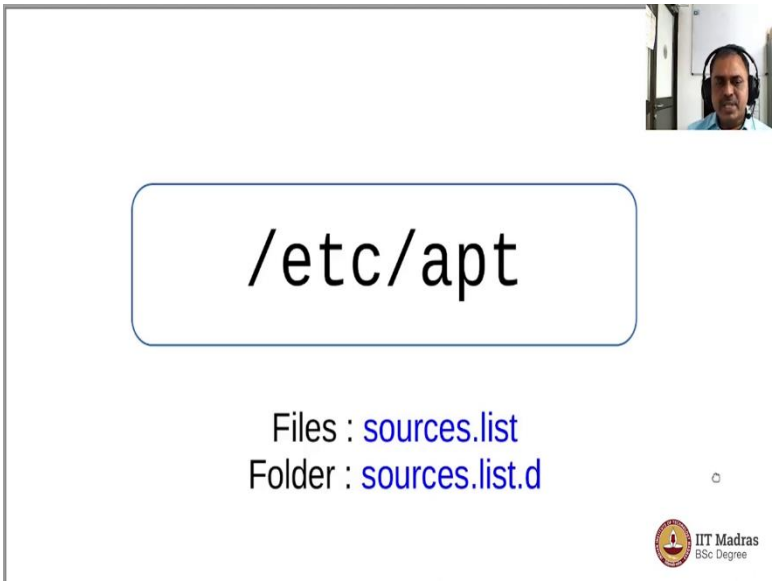


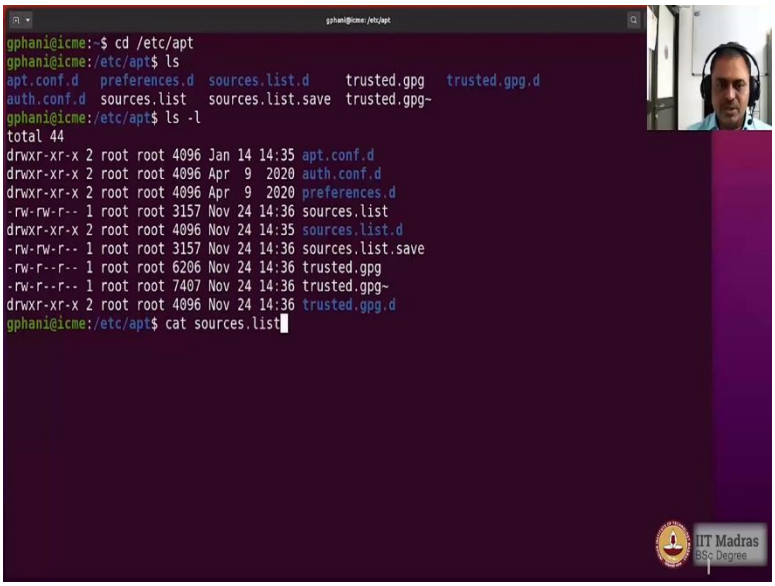


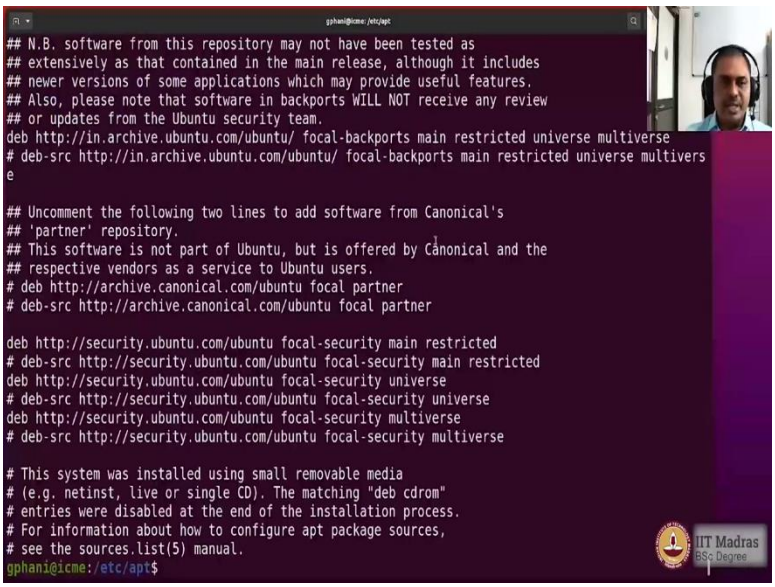

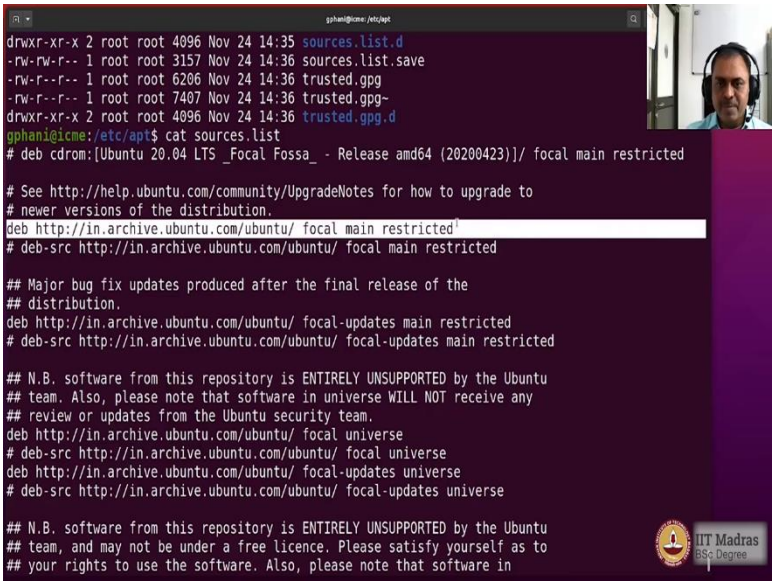
gphani@icme: /etc/apt
drwxr-xr-x 2 root root 4096 Nov 24 14:35 sources.list.d
-rw-rw-r-- 1 root root 3157 Nov 24 14:36 sources.list.save
-rw-r--r-- 1 root root 6206 Nov 24 14:36 trusted.gpg
-rw-r--r-- 1 root root 7407 Nov 24 14:36 trusted.gpg~
drwxr-xr-x 2 root root 4096 Nov 24 14:36 trusted.gpg.d
gphani@icme:/etc/apt$ cat sources.list
# deb cdrom:[Ubuntu 20.04 LTS _Focal Fossa_ - Release amd64 (20200423)]/ focal main restricted
# See http://help.ubuntu.com/community/UpgradeNotes for how to upgrade to
# newer versions of the distribution.
deb http://in.archive.ubuntu.com/ubuntu/ focal main restricted
# deb-src http://in.archive.ubuntu.com/ubuntu/ focal main restricted
## Major bug fix updates produced after the final release of the
## distribution.
deb http://in.archive.ubuntu.com/ubuntu/ focal-updates main restricted
# deb-src http://in.archive.ubuntu.com/ubuntu/ focal-updates main restricted
## N.B. software from this repository is ENTIRELY UNSUPPORTED by the Ubuntu
## team. Also, please note that software in universe WILL NOT receive any
## review or updates from the Ubuntu security team.
deb http://in.archive.ubuntu.com/ubuntu/ focal universe
# deb-src http://in.archive.ubuntu.com/ubuntu/ focal universe
deb http://in.archive.ubuntu.com/ubuntu/ focal-updates universe
# deb-src http://in.archive.ubuntu.com/ubuntu/ focal-updates universe
## N.B. software from this repository is ENTIRELY UNSUPPORTED by the Ubuntu
## team, and may not be under a free licence. Please satisfy yourself as to
## your rights to use the software. Also, please note that software in
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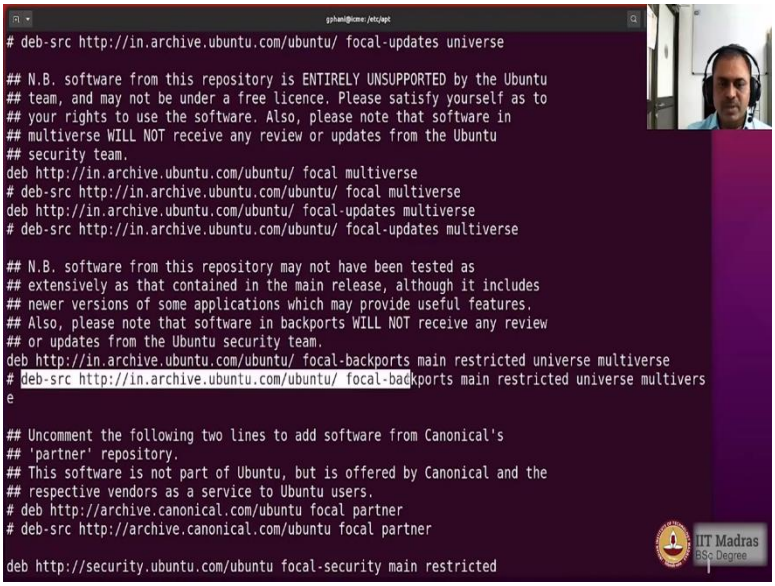
gphani@icme: /etc/apt
# deb-src http://in.archive.ubuntu.com/ubuntu/ focal-updates universe
## N.B. software from this repository is ENTIRELY UNSUPPORTED by the Ubuntu
## team, and may not be under a free licence. Please satisfy yourself as to
## your rights to use the software. Also, please note that software in
## multiverse WILL NOT receive any review or updates from the Ubuntu
## security team.
deb http://in.archive.ubuntu.com/ubuntu/ focal multiverse
# deb-src http://in.archive.ubuntu.com/ubuntu/ focal multiverse
deb http://in.archive.ubuntu.com/ubuntu/ focal-updates multiverse
# deb-src http://in.archive.ubuntu.com/ubuntu/ focal-updates multiverse
## N.B. software from this repository may not have been tested as
## extensively as that contained in the main release, although it includes
## newer versions of some applications which may provide useful features.
## Also, please note that software in backports WILL NOT receive any review
## or updates from the Ubuntu security team.
deb http://in.archive.ubuntu.com/ubuntu/ focal-backports main restricted universe multiverse
# deb-src http://in.archive.ubuntu.com/ubuntu/ focal-backports main restricted universe multivers
e
## Uncomment the following two lines to add software from Canonical's
## 'partner' repository.
## This software is not part of Ubuntu, but is offered by Canonical and the
## respective vendors as a service to Ubuntu users.
# deb http://archive.canonical.com/ubuntu focal partner
# deb-src http://archive.canonical.com/ubuntu focal partner
deb http://security.ubuntu.com/ubuntu focal-security main restricted
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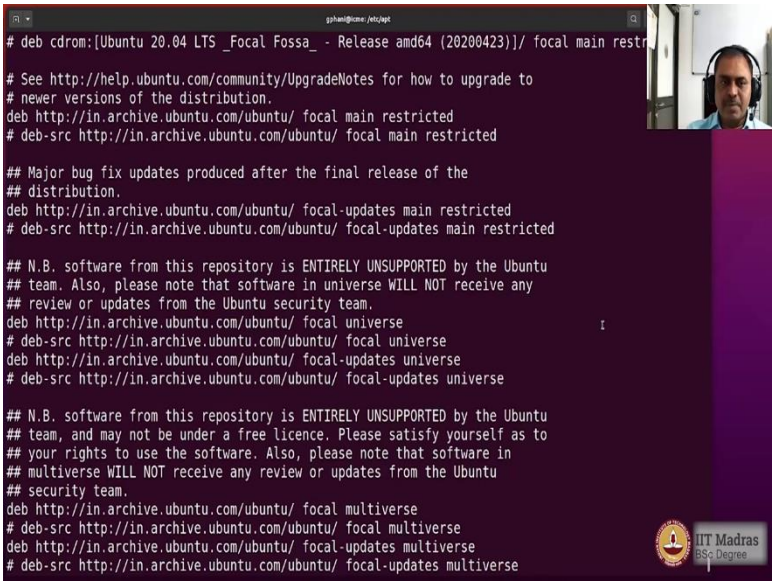
gphani@icme: /etc/apt
# deb cdrom:[Ubuntu 20.04 LTS _Focal Fossa_ - Release amd64 (20200423)]/ focal main restr
# See http://help.ubuntu.com/community/UpgradeNotes for how to upgrade to
# newer versions of the distribution.
deb http://in.archive.ubuntu.com/ubuntu/ focal main restricted
# deb-src http://in.archive.ubuntu.com/ubuntu/ focal main restricted
## Major bug fix updates produced after the final release of the
## distribution.
deb http://in.archive.ubuntu.com/ubuntu/ focal-updates main restricted
# deb-src http://in.archive.ubuntu.com/ubuntu/ focal-updates main restricted
## N.B. software from this repository is ENTIRELY UNSUPPORTED by the Ubuntu
## team. Also, please note that software in universe WILL NOT receive any
## review or updates from the Ubuntu security team.
deb http://in.archive.ubuntu.com/ubuntu/ focal universe
# deb-src http://in.archive.ubuntu.com/ubuntu/ focal universe
deb http://in.archive.ubuntu.com/ubuntu/ focal-updates universe
# deb-src http://in.archive.ubuntu.com/ubuntu/ focal-updates universe
## N.B. software from this repository is ENTIRELY UNSUPPORTED by the Ubuntu
## team, and may not be under a free licence. Please satisfy yourself as to
## your rights to use the software. Also, please note that software in
## multiverse WILL NOT receive any review or updates from the Ubuntu
## security team.
deb http://in.archive.ubuntu.com/ubuntu/ focal multiverse
# deb-src http://in.archive.ubuntu.com/ubuntu/ focal multiverse
deb http://in.archive.ubuntu.com/ubuntu/ focal-updates multiverse
# deb-src http://in.archive.ubuntu.com/ubuntu/ focal-updates multiverse
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So, when you are installing a package, the system knows from which website these packages have to be downloaded for installation. So, where is this information stored? So, it is stored in a folder called a slash etc slash apt, so we will go there and explore that folder shortly. And there are two files that we have to look up. The one is a folder called sources dot list and another is a directory called sources dot list dot d, in which there are different entries, which come because you have added those sources for the Debian packages as a part of a third-party software. For example, Google Chrome, or Microsoft Teams or Zoom etc.

So, let us go to that folder slash etc slash apt. And you can see from here there are these files and sources dot list is a file that we wanted to look at, so cat sources dot list. And you can see here that most of these lines are actually comments because they start with the hash, but the ones with the do not have a comment character are the ones which are active. And you can see that here, the Debian packages are being fetched from a website called in dot archive dot ubuntu dot com. The in this for India, so you would have this particular entry made during the installation of the Ubuntu operating system and it would be different for different countries so that Ubuntu would have a mirror that is closest to your country to fetch the packages.

And here in this particular string, there is also the name of the version that you are going to use, and also certain other fields that would tell you which type of packages are being held by that particular repository. And there are multiple repositories. So, you would have the main packages that are there in one repository, and there is another repository in which updates are being kept.

And then sometimes there are also repositories for source codes, so you could see here that there is a repository for the source code, which is at this moment blocked out because the starting with a hash character, which means, it has been commented out. So, this file is what contains the information about which location the Debian packages are being fetched for installation on the system, when you run commands to either install or update or upgrade the packages on your operating system.

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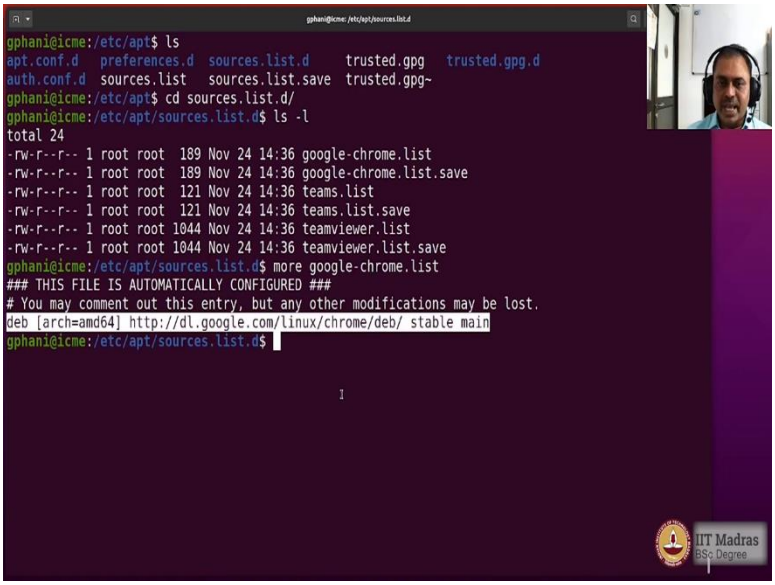


Now, what about the folder sources dot list dot d. So, sources dot list dot d, if you go to that folder, then you can see that there are certain other entries. So, we would go and look at what is in the Google Chrome. And you will see that there is a repository that has been added, which is coming from the Google website. So, dl dot google dot com is a website from which the Debian package meant for the Google Chrome application are being fetched.

So, the advantage of this is that whenever Google upgrades the version of the Google Chrome, then the package management system would automatically know the upgrade is available and would fetch the latest version and install it on your operating system when you do the upgrade of the packages.

So, that also means that you do not have to worry, when is the next version available, it would be pushed to you through the package management system as part of the apt update command that you would run, to fetch the updates of all the packages that are installed on your system from the repositories that are configured in these files. Like source dot list, or google chrome dot list, etc.

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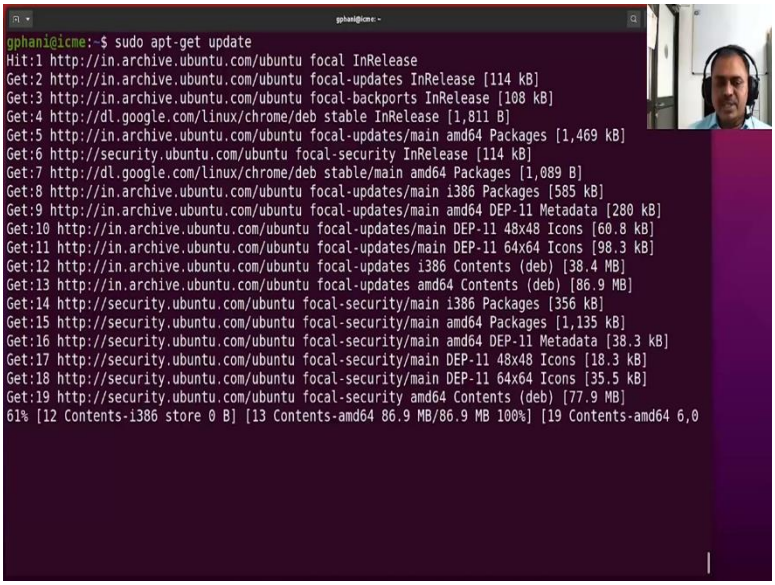


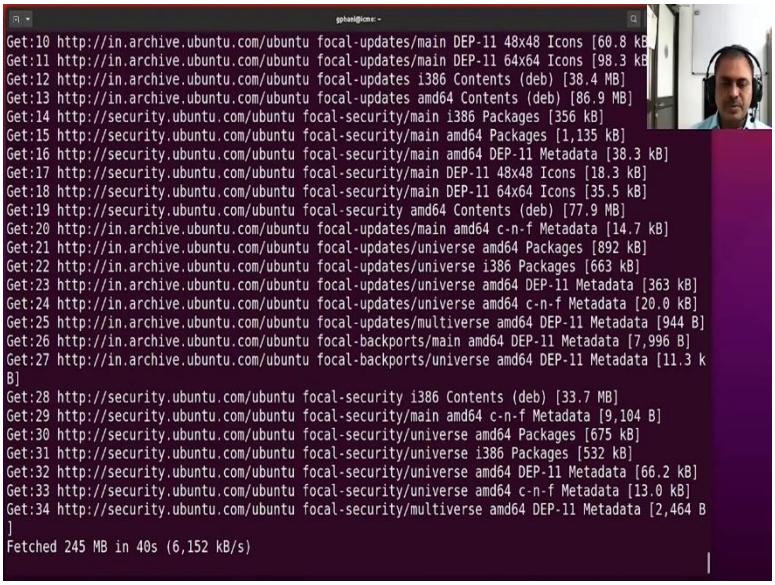


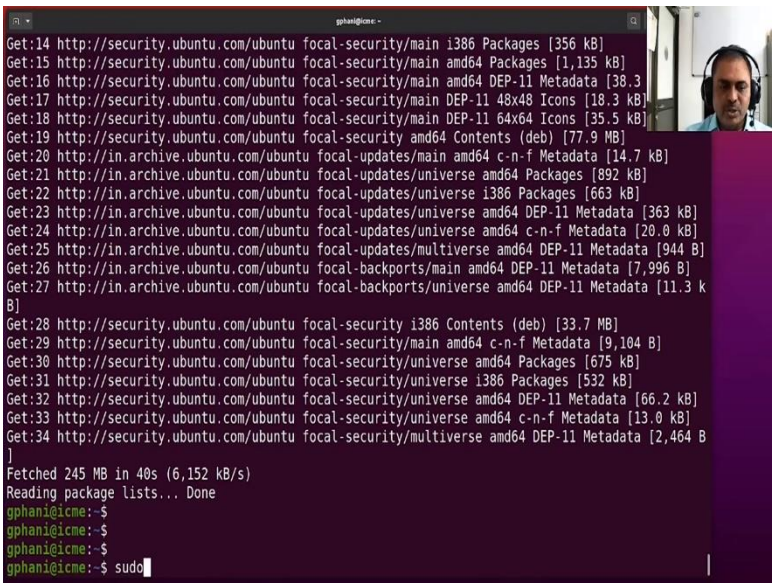

Now, let us see what do we mean by fetching the updates. So, this is a command that you have to run as a superuser, so sudo apt-get update. What does it do when you run this command is that it would actually contact the package management system apt-get would contact the repositories for any updates that are available for any of the packages, and then fetches those updates and keeps them in the cache.

And then when you want to upgrade the packages, these updates are then applied depending upon which packages are actually installed on your system. So, when you run sudo within a few minutes of authenticating, then it will not ask for a password. But if quite some time has been elapsed, then it would ask for the password again.

As you can see that the updates are being fetched from various repositories. And depending upon the network speed or the network connectivity, it could take some time and usually you would wait for it to finish and return control back to you on the prompt.

So, once you are done, it will also tell you how much data has been fetched and at what speed etc. And now the control is back to the prompt. So, what you could do now is to apply all the upgrades that are available for the packages that have been installed till now. So, let us do that, it is a good habit to do that every now and then.

So, what I would do is that I will actually do it every day. So, I try to keep the operating system up to date with respect to all the versions that are given by the Ubuntu so that if there are any security upgrades, then they will be available immediately. So, every now and then it is a good idea to run this command sudo-apt get upgrade.

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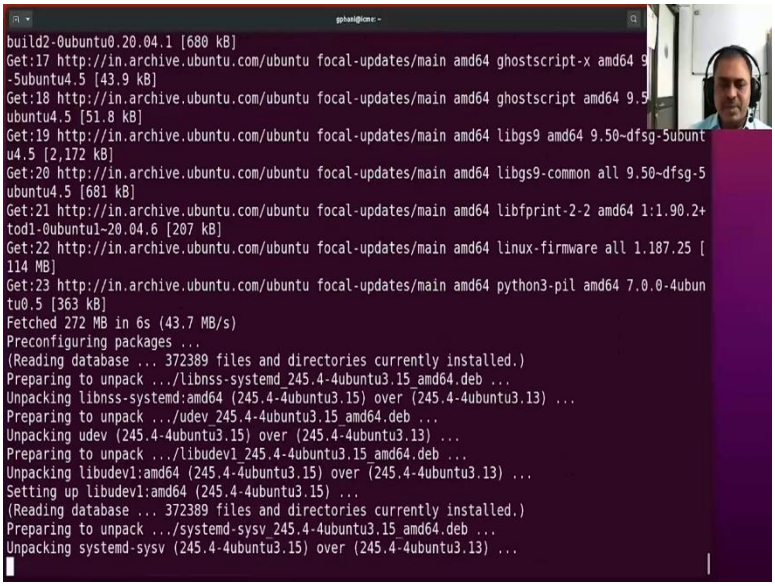
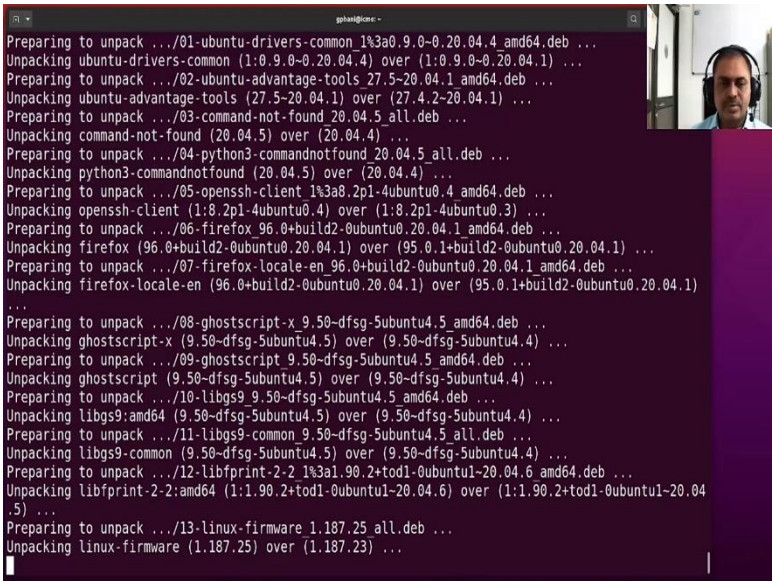
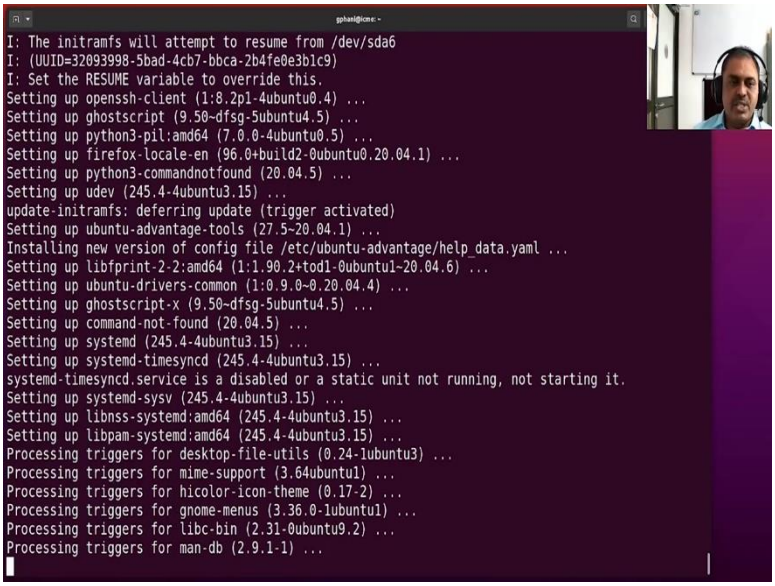
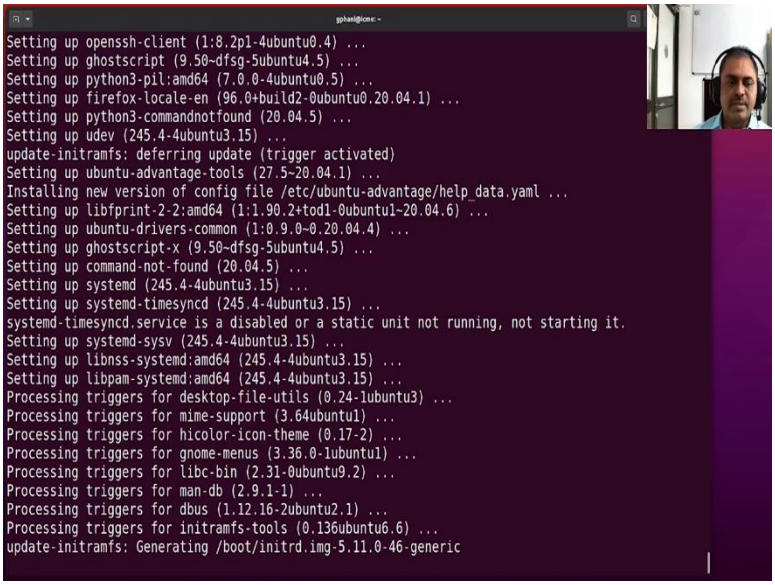
gphani@icne: ~
linux-modules-extra-5.11.0-43-generic
Use 'sudo apt autoremove' to remove them.
The following packages will be upgraded:
command-not-found firefox firefox-locale-en ghostscript ghostscript-x google-chrome-sta
libfprint-2-2 libgs9 libgs9-common libnss-systemd libpam-systemd libsystemd0 libudev1
linux-firmware openssh-client python3-commandnotfound python3-pil systemd systemd-sysv
linux-image-5.11.0-43-generic linux-modules-5.11.0-43-generic
linux-modules-extra-5.11.0-43-generic
Use 'sudo apt autoremove' to remove them.
The following packages will be upgraded:
command-not-found firefox firefox-locale-en ghostscript ghostscript-x google-chrome-stable
libfprint-2-2 libgs9 libgs9-common libnss-systemd libpam-systemd libsystemd0 libudev1
linux-firmware openssh-client python3-commandnotfound python3-pil systemd systemd-sysv
systemd-timesyncd ubuntu-advantage-tools ubuntu-drivers-common udev
23 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
15 standard security updates
Need to get 272 MB of archives.
After this operation, 19.6 MB of additional disk space will be used.
Do you want to continue? [Y/n]
Get:1 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libnss-systemd amd64 245.4-4ub
untu3.15 [95.8 kB]
Get:2 http://dl.google.com/linux/chrome/deb stable/main amd64 google-chrome-stable amd64 97.0.469
2.71-1 [89.9 MB]
Get:3 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 udev amd64 245.4-4ubuntu3.15 [
1,364 kB]
2% [3 udev 8,419 B/1,364 kB 1%] [2 google-chrome-stable 3,131 kB/89.9 MB 3%]


gphani@icne: ~
build2-0ubuntu0.20.04.1 [680 kB]
Get:17 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 ghostscript-x amd64 9
-5ubuntu4.5 [43.9 kB]
Get:18 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 ghostscript amd64 9.5
ubuntu4.5 [51.8 kB]
Get:19 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libgs9 amd64 9.50~dfsg-5ubunt
u4.5 [2,172 kB]
Get:20 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libgs9-common all 9.50~dfsg-5
ubuntu4.5 [681 kB]
Get:21 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libfprint-2-2 amd64 1:1.90.2+
tod1-0ubuntu1~20.04.6 [207 kB]
Get:22 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 linux-firmware all 1.187.25 [
114 MB]
Get:23 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 python3-pil amd64 7.0.0-4ubun
tu0.5 [363 kB]
Fetched 272 MB in 6s (43.7 MB/s)
Preconfiguring packages ...
(Reading database ... 372389 files and directories currently installed.)
Preparing to unpack .../libnss-systemd_245.4-4ubuntu3.15_amd64.deb ...
Unpacking libnss-systemd:amd64 (245.4-4ubuntu3.15) over (245.4-4ubuntu3.13) ...
Preparing to unpack .../udev_245.4-4ubuntu3.15_amd64.deb ...
Unpacking udev (245.4-4ubuntu3.15) over (245.4-4ubuntu3.13) ...
Preparing to unpack .../libudev1_245.4-4ubuntu3.15_amd64.deb ...
Unpacking libudev1:amd64 (245.4-4ubuntu3.15) over (245.4-4ubuntu3.13) ...
Setting up libudev1:amd64 (245.4-4ubuntu3.15) ...
(Reading database ... 372389 files and directories currently installed.)
Preparing to unpack .../systemd-sysv_245.4-4ubuntu3.15_amd64.deb ...
Unpacking systemd-sysv (245.4-4ubuntu3.15) over (245.4-4ubuntu3.13) ...


gphani@icne: ~
Preparing to unpack .../01-ubuntu-drivers-common_1%3a0.9.0~0.20.04.4_amd64.deb ...
Unpacking ubuntu-drivers-common (1:0.9.0~0.20.04.4) over (1:0.9.0~0.20.04.1) ...
Preparing to unpack .../02-ubuntu-advantage-tools_27.5~20.04.1_amd64.deb ...
Unpacking ubuntu-advantage-tools (27.5~20.04.1) over (27.4.2~20.04.1) ...
Preparing to unpack .../03-command-not-found_20.04.5_all.deb ...
Unpacking command-not-found (20.04.5) over (20.04.4) ...
Preparing to unpack .../04-python3-commandnotfound_20.04.5_all.deb ...
Unpacking python3-commandnotfound (20.04.5) over (20.04.4) ...
Preparing to unpack .../05-openssh-client_1%3a8.2p1-4ubuntu0.4_amd64.deb ...
Unpacking openssh-client (1:8.2p1-4ubuntu0.4) over (1:8.2p1-4ubuntu0.3) ...
Preparing to unpack .../06-firefox_96.0+build2-0ubuntu0.20.04.1_amd64.deb ...
Unpacking firefox (96.0+build2-0ubuntu0.20.04.1) over (95.0.1+build2-0ubuntu0.20.04.1) ...
Preparing to unpack .../07-firefox-locale-en_96.0+build2-0ubuntu0.20.04.1_amd64.deb ...
Unpacking firefox-locale-en (96.0+build2-0ubuntu0.20.04.1) over (95.0.1+build2-0ubuntu0.20.04.1)
...
Preparing to unpack .../08-ghostscript-x_9.50~dfsg-5ubuntu4.5_amd64.deb ...
Unpacking ghostscript-x (9.50~dfsg-5ubuntu4.5) over (9.50~dfsg-5ubuntu4.4) ...
Preparing to unpack .../09-ghostscript_9.50~dfsg-5ubuntu4.5_amd64.deb ...
Unpacking ghostscript (9.50~dfsg-5ubuntu4.5) over (9.50~dfsg-5ubuntu4.4) ...
Preparing to unpack .../10-libgs9_9.50~dfsg-5ubuntu4.5_amd64.deb ...
Unpacking libgs9:amd64 (9.50~dfsg-5ubuntu4.5) over (9.50~dfsg-5ubuntu4.4) ...
Preparing to unpack .../11-libgs9-common_9.50~dfsg-5ubuntu4.5_all.deb ...
Unpacking libgs9-common (9.50~dfsg-5ubuntu4.5) over (9.50~dfsg-5ubuntu4.4) ...
Preparing to unpack .../12-libfprint-2-2_1%3a1.90.2+tod1-0ubuntu1~20.04.6_amd64.deb ...
Unpacking libfprint-2-2:amd64 (1:1.90.2+tod1-0ubuntu1~20.04.6) over (1:1.90.2+tod1-0ubuntu1~20.04
.5) ...
Preparing to unpack .../13-linux-firmware_1.187.25_all.deb ...
Unpacking linux-firmware (1.187.25) over (1.187.23) ...


gphani@icme: ~
Unpacking firefox-locale-en (96.0+build2-0ubuntu0.20.04.1) over (95.0.1+build2-0ubuntu0.2
...
Preparing to unpack .../08-ghostscript-x_9.50~dfsg-5ubuntu4.5_amd64.deb ...
Unpacking ghostscript-x (9.50~dfsg-5ubuntu4.5) over (9.50~dfsg-5ubuntu4.4) ...
Preparing to unpack .../09-ghostscript_9.50~dfsg-5ubuntu4.5_amd64.deb ...
Unpacking ghostscript (9.50~dfsg-5ubuntu4.5) over (9.50~dfsg-5ubuntu4.4) ...
Preparing to unpack .../10-libgs9_9.50~dfsg-5ubuntu4.5_amd64.deb ...
Unpacking libgs9:amd64 (9.50~dfsg-5ubuntu4.5) over (9.50~dfsg-5ubuntu4.4) ...
Preparing to unpack .../11-libgs9-common_9.50~dfsg-5ubuntu4.5_all.deb ...
Unpacking libgs9-common (9.50~dfsg-5ubuntu4.5) over (9.50~dfsg-5ubuntu4.4) ...
Preparing to unpack .../12-libfprint-2-2_1%3a1.90.2+tod1-0ubuntu1~20.04.6_amd64.deb ...
Unpacking libfprint-2-2:amd64 (1:1.90.2+tod1-0ubuntu1~20.04.6) over (1:1.90.2+tod1-0ubuntu1~20.04
,5) ...
Preparing to unpack .../13-linux-firmware_1.187.25_all.deb ...
Unpacking linux-firmware (1.187.25) over (1.187.23) ...
Preparing to unpack .../14-python3-pil_7.0.0-4ubuntu0.5_amd64.deb ...
Unpacking python3-pil:amd64 (7.0.0-4ubuntu0.5) over (7.0.0-4ubuntu0.4) ...
Setting up libgs9-common (9.50~dfsg-5ubuntu4.5) ...
Setting up google-chrome-stable (97.0.4692.71-1) ...
Setting up libgs9:amd64 (9.50~dfsg-5ubuntu4.5) ...
Setting up firefox (96.0+build2-0ubuntu0.20.04.1) ...
Please restart all running instances of firefox, or you will experience problems.
Setting up linux-firmware (1.187.25) ...
update-initramfs: Generating /boot/initrd.img-5.11.0-46-generic
I: The initramfs will attempt to resume from /dev/sda6
I: (UUID=32093998-5bad-4cb7-bbca-2b4fe0e3b1c9)
I: Set the RESUME variable to override this.
update-initramfs: Generating /boot/initrd.img-5.11.0-44-generic


gphani@icme: ~
I: The initramfs will attempt to resume from /dev/sda6
I: (UUID=32093998-5bad-4cb7-bbca-2b4fe0e3b1c9)
I: Set the RESUME variable to override this.
Setting up openssh-client (1:8.2p1-4ubuntu0.4) ...
Setting up ghostscript (9.50~dfsg-5ubuntu4.5) ...
Setting up python3-pil:amd64 (7.0.0-4ubuntu0.5) ...
Setting up firefox-locale-en (96.0+build2-0ubuntu0.20.04.1) ...
Setting up python3-commandnotfound (20.04.5) ...
Setting up udev (245.4-4ubuntu3.15) ...
update-initramfs: deferring update (trigger activated)
Setting up ubuntu-advantage-tools (27.5~20.04.1) ...
Installing new version of config file /etc/ubuntu-advantage/help_data.yaml ...
Setting up libfprint-2-2:amd64 (1:1.90.2+tod1-0ubuntu1~20.04.6) ...
Setting up ubuntu-drivers-common (1:0.9.0~0.20.04.4) ...
Setting up ghostscript-x (9.50~dfsg-5ubuntu4.5) ...
Setting up command-not-found (20.04.5) ...
Setting up systemd (245.4-4ubuntu3.15) ...
Setting up systemd-timesyncd (245.4-4ubuntu3.15) ...
systemd-timesyncd.service is a disabled or a static unit not running, not starting it.
Setting up systemd-sysv (245.4-4ubuntu3.15) ...
Setting up libnss-systemd:amd64 (245.4-4ubuntu3.15) ...
Setting up libpam-systemd:amd64 (245.4-4ubuntu3.15) ...
Processing triggers for desktop-file-utils (0.24-1ubuntu3) ...
Processing triggers for mime-support (3.64ubuntu1) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...
Processing triggers for gnome-menus (3.36.0-1ubuntu1) ...
Processing triggers for libc-bin (2.31-0ubuntu9.2) ...
Processing triggers for man-db (2.9.1-1) ...


gphani@icme: ~
Setting up openssh-client (1:8.2p1-4ubuntu0.4) ...
Setting up ghostscript (9.50~dfsg-5ubuntu4.5) ...
Setting up python3-pil:amd64 (7.0.0-4ubuntu0.5) ...
Setting up firefox-locale-en (96.0+build2-0ubuntu0.20.04.1) ...
Setting up python3-commandnotfound (20.04.5) ...
Setting up udev (245.4-4ubuntu3.15) ...
update-initramfs: deferring update (trigger activated)
Setting up ubuntu-advantage-tools (27.5~20.04.1) ...
Installing new version of config file /etc/ubuntu-advantage/help_data.yaml ...
Setting up libfprint-2-2:amd64 (1:1.90.2+tod1-0ubuntu1~20.04.6) ...
Setting up ubuntu-drivers-common (1:0.9.0~0.20.04.4) ...
Setting up ghostscript-x (9.50~dfsg-5ubuntu4.5) ...
Setting up command-not-found (20.04.5) ...
Setting up systemd (245.4-4ubuntu3.15) ...
Setting up systemd-timesyncd (245.4-4ubuntu3.15) ...
systemd-timesyncd.service is a disabled or a static unit not running, not starting it.
Setting up systemd-sysv (245.4-4ubuntu3.15) ...
Setting up libnss-systemd:amd64 (245.4-4ubuntu3.15) ...
Setting up libpam-systemd:amd64 (245.4-4ubuntu3.15) ...
Processing triggers for desktop-file-utils (0.24-1ubuntu3) ...
Processing triggers for mime-support (3.64ubuntu1) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...
Processing triggers for gnome-menus (3.36.0-1ubuntu1) ...
Processing triggers for libc-bin (2.31-0ubuntu9.2) ...
Processing triggers for man-db (2.9.1-1) ...
Processing triggers for dbus (1.12.16-2ubuntu2.1) ...
Processing triggers for initramfs-tools (0.136ubuntu6.6) ...
update-initramfs: Generating /boot/initrd.img-5.11.0-46-generic

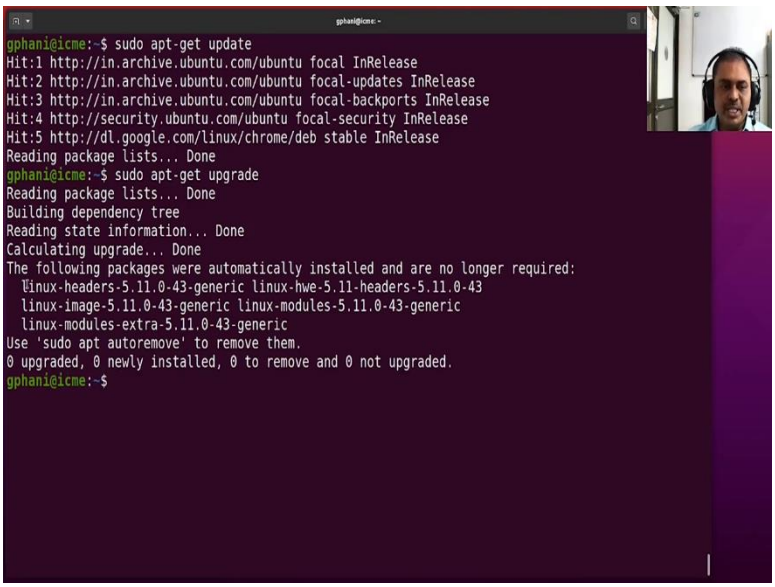
So, first you run update to get the updates and upgrade to upgrade the packages. So, when you run this command, it would actually list how many updates are going to be affected and how much of data is going to be downloaded. So, you could actually see that right now the update is going to fetch 272 megabytes of data.

So sometimes if you are traveling and you do not have a very good network connectivity, you may want to wait before doing the upgrade. So, keep an eye on this particular data. And then if it is okay to download that patch of data then you can go ahead and accept so the capital Y is for the accept which is default, so you can go ahead and just press Enter to accept the fetching all the updates.

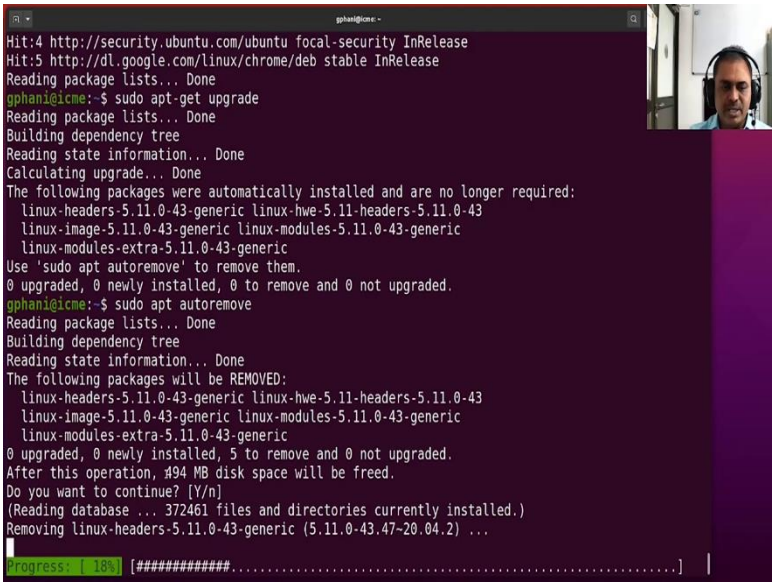
And depending upon the amount of data the patching of updates would take some time. So, wait patiently and let all the updates be done so that your operating system is up to date. Every now and then you will also have the firmware upgrades from the Linux which are very critical to ensure that the hardware compatibility.

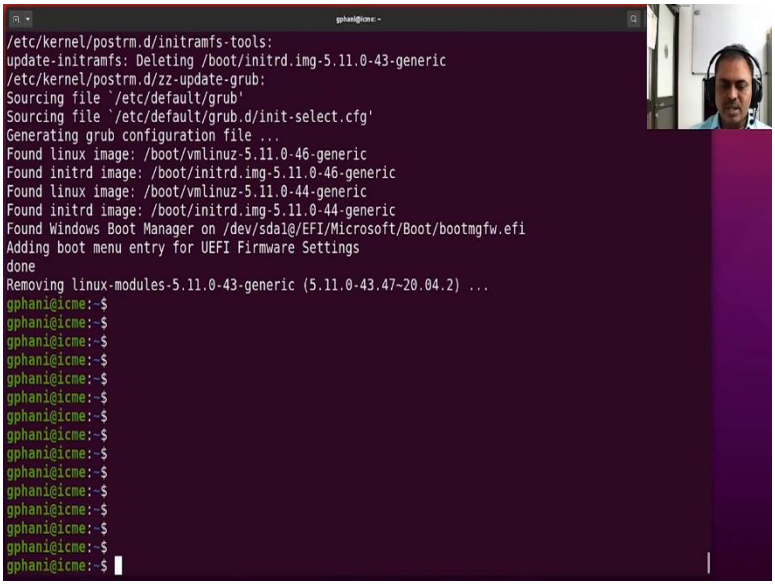
When it says processing triggers, it means that the downloading and installing is complete and it is just finishing up certain actions that are required upon installation of those particular upgrades. So, the control is back to the command prompt, which means that the upgrades are done.

(Refer Slide Time: 12:52)




gphani@icme: ~
gphani@icme:~$ sudo apt-get update
Hit:1 http://in.archive.ubuntu.com/ubuntu focal InRelease
Hit:2 http://in.archive.ubuntu.com/ubuntu focal-updates InRelease
Hit:3 http://in.archive.ubuntu.com/ubuntu focal-backports InRelease
Hit:4 http://security.ubuntu.com/ubuntu focal-security InRelease
Hit:5 http://dl.google.com/linux/chrome/deb stable InRelease
Reading package lists... Done
gphani@icme:~$ sudo apt-get upgrade
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following packages were automatically installed and are no longer required:
linux-headers-5.11.0-43-generic linux-hwe-5.11-headers-5.11.0-43
linux-image-5.11.0-43-generic linux-modules-5.11.0-43-generic
linux-modules-extra-5.11.0-43-generic
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
gphani@icme:~$ sudo apt autoremove
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages will be REMOVED:
linux-headers-5.11.0-43-generic linux-hwe-5.11-headers-5.11.0-43
linux-image-5.11.0-43-generic linux-modules-5.11.0-43-generic
linux-modules-extra-5.11.0-43-generic

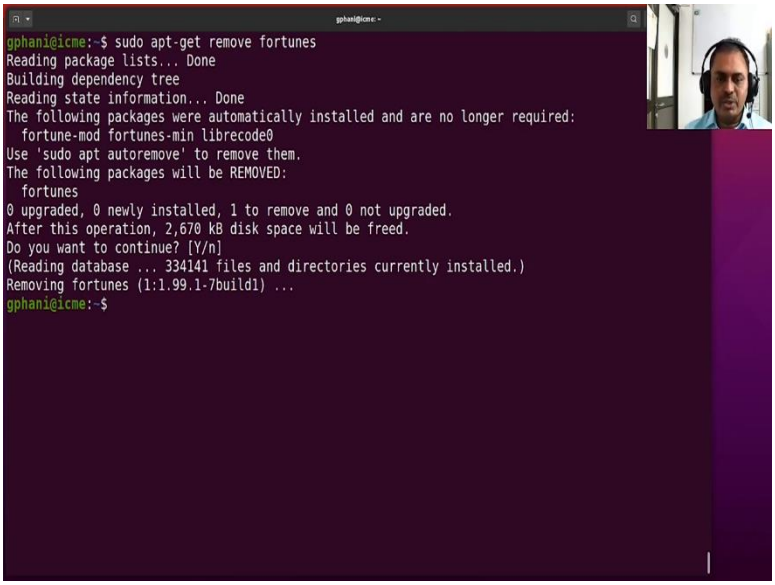

gphani@icme: ~
Hit:4 http://security.ubuntu.com/ubuntu focal-security InRelease
Hit:5 http://dl.google.com/linux/chrome/deb stable InRelease
Reading package lists... Done
gphani@icme:~$ sudo apt-get upgrade
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following packages were automatically installed and are no longer required:
linux-headers-5.11.0-43-generic linux-hwe-5.11-headers-5.11.0-43
linux-image-5.11.0-43-generic linux-modules-5.11.0-43-generic
linux-modules-extra-5.11.0-43-generic
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
gphani@icme:~$ sudo apt autoremove
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages will be REMOVED:
linux-headers-5.11.0-43-generic linux-hwe-5.11-headers-5.11.0-43
linux-image-5.11.0-43-generic linux-modules-5.11.0-43-generic
linux-modules-extra-5.11.0-43-generic
0 upgraded, 0 newly installed, 5 to remove and 0 not upgraded.
After this operation, 494 MB disk space will be freed.
Do you want to continue? [Y/n]
(Reading database ... 372461 files and directories currently installed.)
Removing linux-headers-5.11.0-43-generic (5.11.0-43.47~20.04.2) ...
Progress: [ 18%] [############.....]

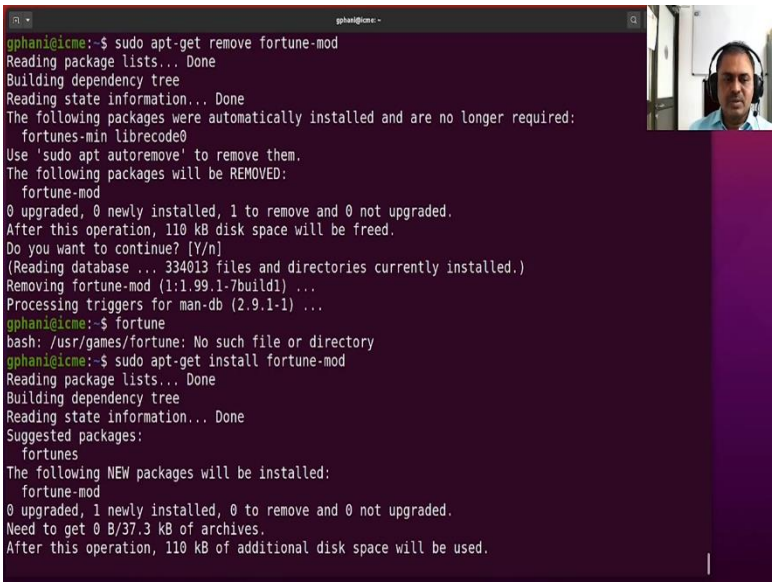

gphani@icme: ~
/etc/kernel/postrm.d/initramfs-tools:
update-initramfs: Deleting /boot/initrd.img-5.11.0-43-generic
/etc/kernel/postrm.d/zz-update-grub:
Sourcing file `/etc/default/grub'
Sourcing file `/etc/default/grub.d/init-select.cfg'
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-5.11.0-46-generic
Found initrd image: /boot/initrd.img-5.11.0-46-generic
Found linux image: /boot/vmlinuz-5.11.0-44-generic
Found initrd image: /boot/initrd.img-5.11.0-44-generic
Found Windows Boot Manager on /dev/sda1@/EFI/Microsoft/Boot/bootmgfw.efi
Adding boot menu entry for UEFI Firmware Settings
done
Removing linux-modules-5.11.0-43-generic (5.11.0-43.47~20.04.2) ...
gphani@icme:~$
gphani@icme:~$
gphani@icme:~$
gphani@icme:~$
gphani@icme:~$
gphani@icme:~$
gphani@icme:~$
gphani@icme:~$
gphani@icme:~$
gphani@icme:~$
gphani@icme:~$
gphani@icme:~$
gphani@icme:~$
gphani@icme:~$

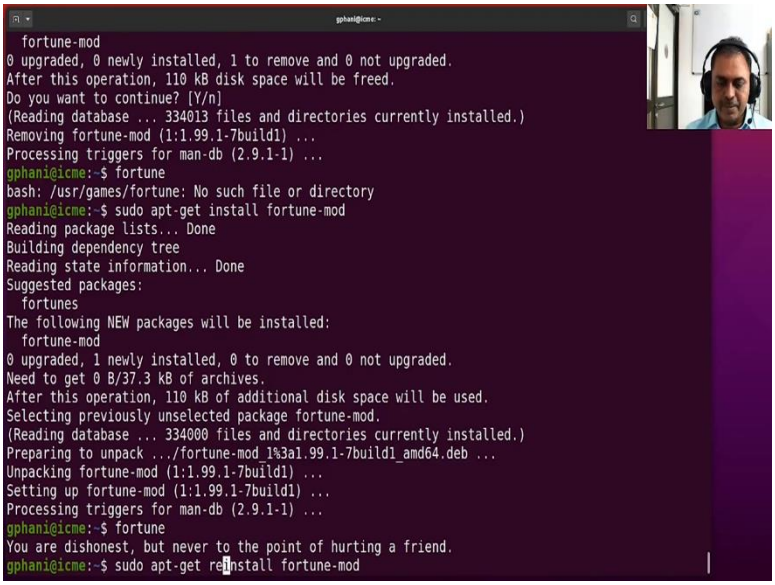
So, you could actually now check whether there are any further updates and upgrades, so you could run the commands once more. Usually, if there are no more updates pending, then it would just be done quite quickly. Now, it is also telling you to do some more action that is to auto remove which means that there are some packages that came as a requirement for some other packages and they are now no longer required because newer versions of those have been already installed, so you can actually save some space by removing those packages.

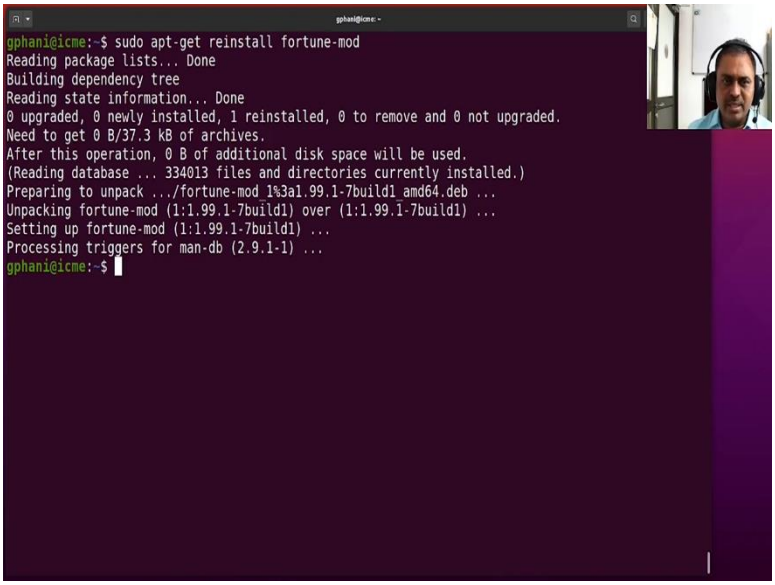
And you are not telling which package to be removed, so you are leaving it to the package management system which is a good idea, and it is saving me 494 megabytes of data on my disk because I am removing the unnecessary packages which are of an older version. So, the control is back to the command prompt. So, the auto remove command has been completed.

(Refer Slide Time: 13:58)





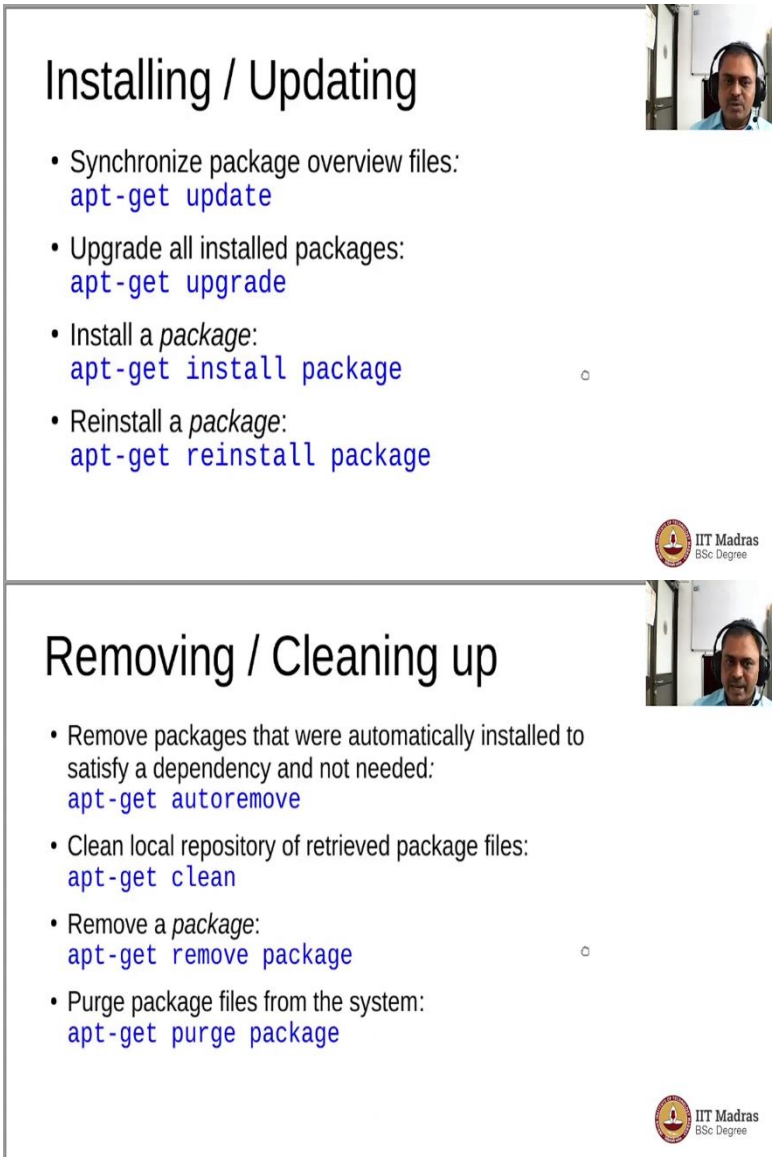

Now, you can actually look at the other operations also. So, to remove a package and to add a package and we would identify the fortunes package as one which we could play with because it is an optional utility which we can remove as our as per our wish, so. So, I am now trying to remove a package, and it is asking me to confirm so we will do that and it goes on to remove that particular package.

And once it removes the package, I should not have access to the command fortune, so let me remove the package called fortune mod which contains the fortune cookies that are being displayed on the screen where I ran the command the fortune. So, I accept it. And now I will try to run the command fortune, and it says there is no such command which means that the utility has been removed from the system.

Now, I want to bring it back, all that I have to do is to install that package. So, I will do that right away, and there are no additional packages required and therefore there is no confirmation being asked, and the utility has been installed. And you could see that if I run the command, then it works and there is some fortune cookie that is being displayed on the screen.

So, you could also do the reinstallation. So, you could also say, apt-get reinstall package, so, it would go ahead and then refresh the version. And sometimes we do it when there is any problem with some of the utilities by mistake, we removed some configuration file of a particular package and we want to just fetch the package once more, and we could also do that using the apt-get command.

(Refer Slide Time: 16:01)

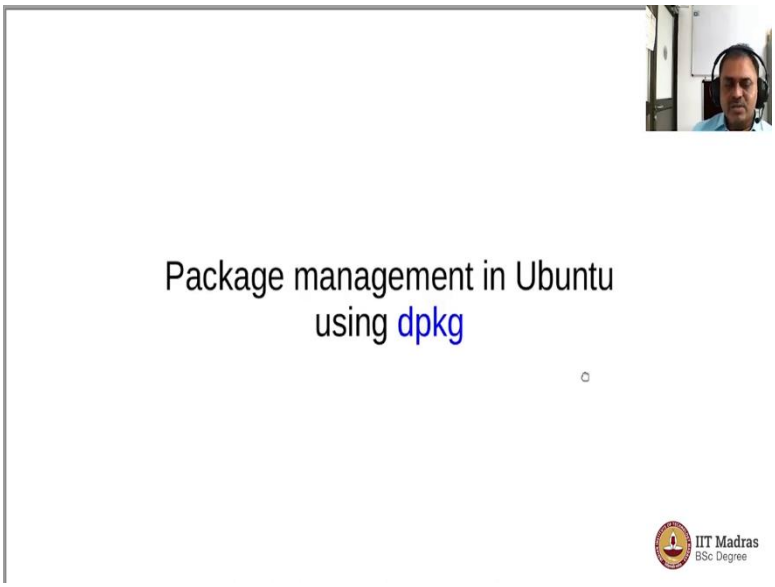


So, here are the utilities that we have tried till now, apt-get update to synchronize the package overview files between the system and the repository. And then to upgrade all the installed packages to their latest versions are taking into account the conflicts etc. apt-get upgrade will do the job. And then you can install a package by simply typing apt-get install package name. And then if you want to reinstall it, you could also do that by using the command reinstall package.

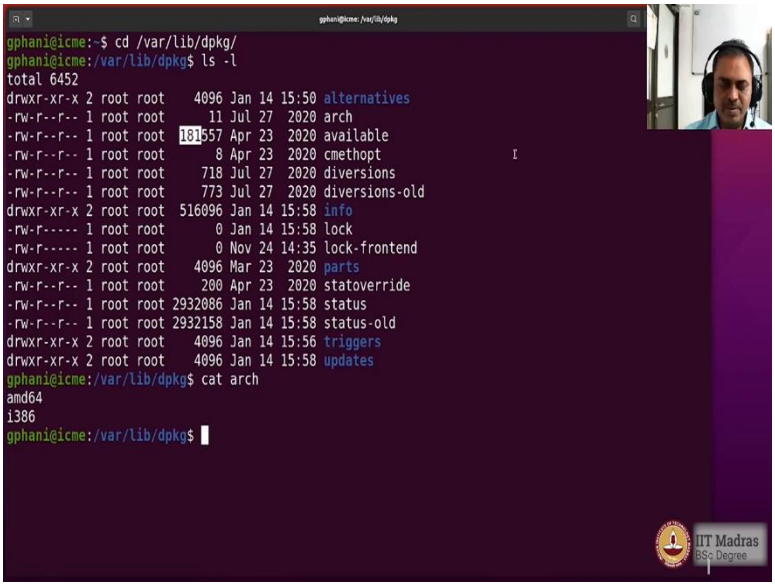
And all these commands will require sudo, as a prefix, because these operations will modify the operating system and therefore they are allowed only for the super users or administrators. So sudo permission is required for you to run these commands. Now, we have also done one more action, namely to remove packages that were automatically installed to satisfy a dependency, and not needed now because the packages have been upgraded beyond those versions, so you could save some disk space by removing those files and apt-get auto remove would do that for you.

Now, you could also do one more action to clean up the disk by running the command apt-get clean. Normally, we do not do that because to revert back a particular version it may be okay to keep the retrieved package files. Sometimes you want to remove the package files and the configuration files, as well as the original Debian package file to install that package from your system, because you are running short of the storage of the hard disk and you could do that by using the purge command. We normally do not do that because we would like to save bandwidth by keeping the package files in the system so that we could install them readily when we need.

(Refer Slide Time: 17:53)




/var/lib/dpkg
Files : arch, available, status
Folder : info
IIT Madras
BSc Degree


gphani@icme:~$ cd /var/lib/dpkg/
gphani@icme:/var/lib/dpkg$ ls -l
total 6452
drwxr-xr-x 2 root root    4096 Jan 14 15:50 alternatives
-rw-r--r-- 1 root root      11 Jul 27  2020 arch
-rw-r--r-- 1 root root  181557 Apr 23  2020 available
-rw-r--r-- 1 root root       8 Apr 23  2020 cmethopt
-rw-r--r-- 1 root root     718 Jul 27  2020 diversions
-rw-r--r-- 1 root root     773 Jul 27  2020 diversions-old
drwxr-xr-x 2 root root  516096 Jan 14 15:58 info
-rw-r----- 1 root root       0 Jan 14 15:58 lock
-rw-r----- 1 root root       0 Nov 24 14:35 lock-frontend
drwxr-xr-x 2 root root    4096 Mar 23  2020 parts
-rw-r--r-- 1 root root     200 Apr 23  2020 statoverride
-rw-r--r-- 1 root root 2932086 Jan 14 15:58 status
-rw-r--r-- 1 root root 2932158 Jan 14 15:58 status-old
drwxr-xr-x 2 root root    4096 Jan 14 15:56 triggers
drwxr-xr-x 2 root root    4096 Jan 14 15:58 updates
gphani@icme:/var/lib/dpkg$ cat arch
amd64
i386
gphani@icme:/var/lib/dpkg$
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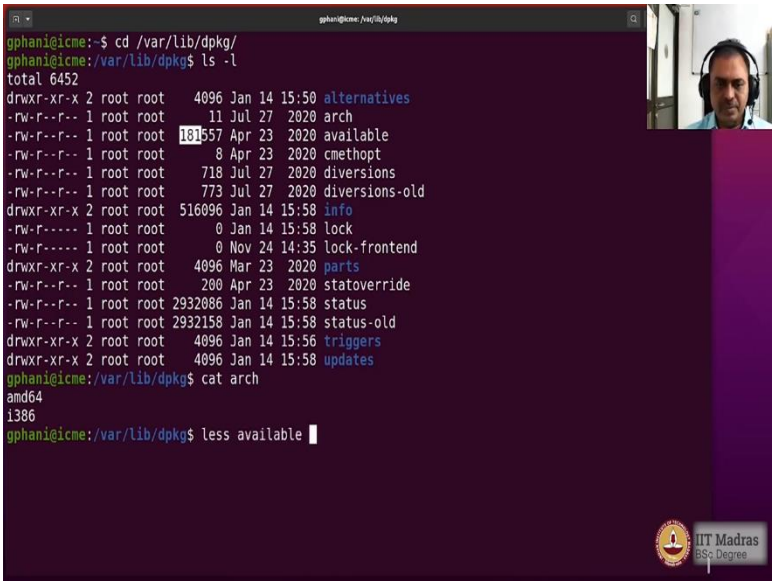
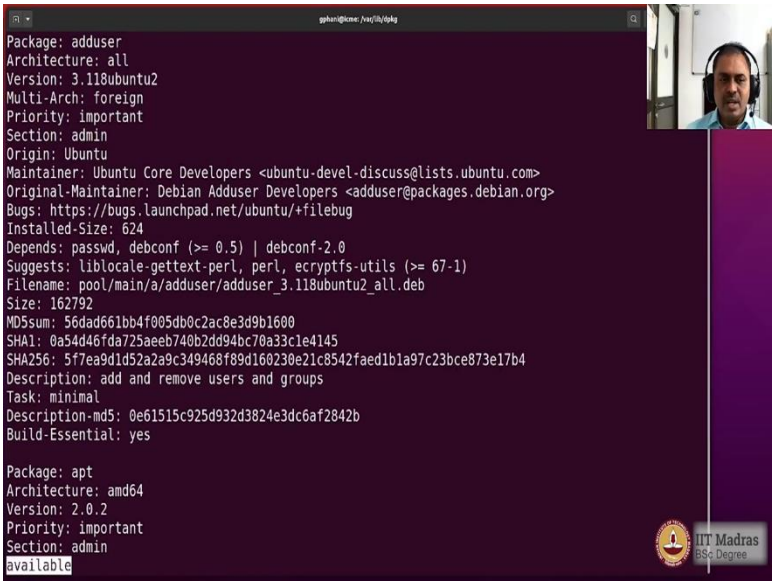
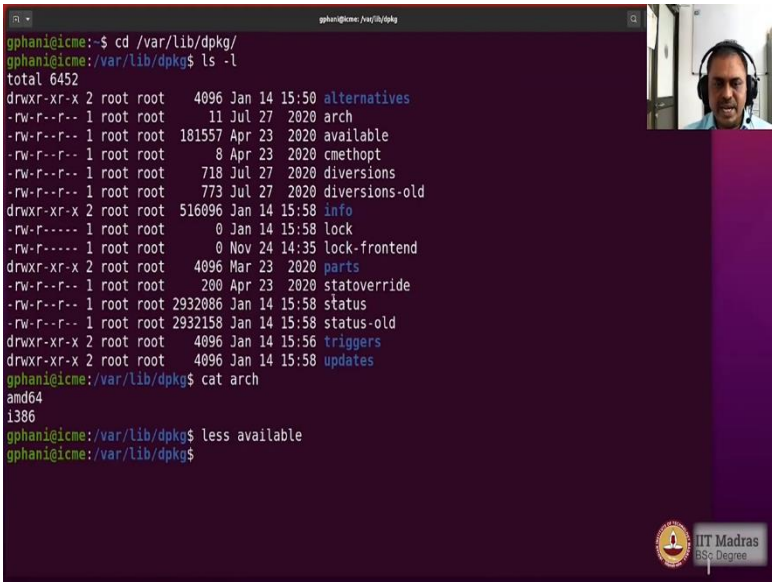

gphani@icme:~$ cd /var/lib/dpkg/
gphani@icme:/var/lib/dpkg$ ls -l
total 6452
drwxr-xr-x 2 root root    4096 Jan 14 15:50 alternatives
-rw-r--r-- 1 root root      11 Jul 27  2020 arch
-rw-r--r-- 1 root root  181557 Apr 23  2020 available
-rw-r--r-- 1 root root       8 Apr 23  2020 cmethopt
-rw-r--r-- 1 root root     718 Jul 27  2020 diversions
-rw-r--r-- 1 root root     773 Jul 27  2020 diversions-old
drwxr-xr-x 2 root root  516096 Jan 14 15:58 info
-rw-r----- 1 root root       0 Jan 14 15:58 lock
-rw-r----- 1 root root       0 Nov 24 14:35 lock-frontend
drwxr-xr-x 2 root root    4096 Mar 23  2020 parts
-rw-r--r-- 1 root root     200 Apr 23  2020 statoverride
-rw-r--r-- 1 root root 2932086 Jan 14 15:58 status
-rw-r--r-- 1 root root 2932158 Jan 14 15:58 status-old
drwxr-xr-x 2 root root    4096 Jan 14 15:56 triggers
drwxr-xr-x 2 root root    4096 Jan 14 15:58 updates
gphani@icme:/var/lib/dpkg$ cat arch
amd64
i386
gphani@icme:/var/lib/dpkg$ less available
IIT Madras
BSc Degree



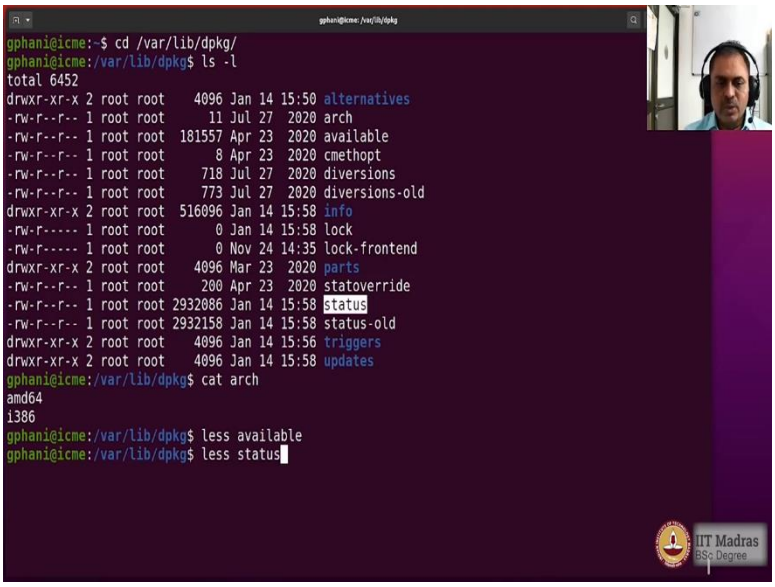

Now, let us explore the dpkg package management system, which is at a lower level allows for installation of a package directly when you download a deb file from the Internet. It is not recommended unless you know what you are doing. Now, there is a directory that you would like to explore to see some information about the packages, so we would go there and have a look. So, var lib dpkg is a folder where text information is available about various packages that are there on your system, so let us go there and explore what is out there.

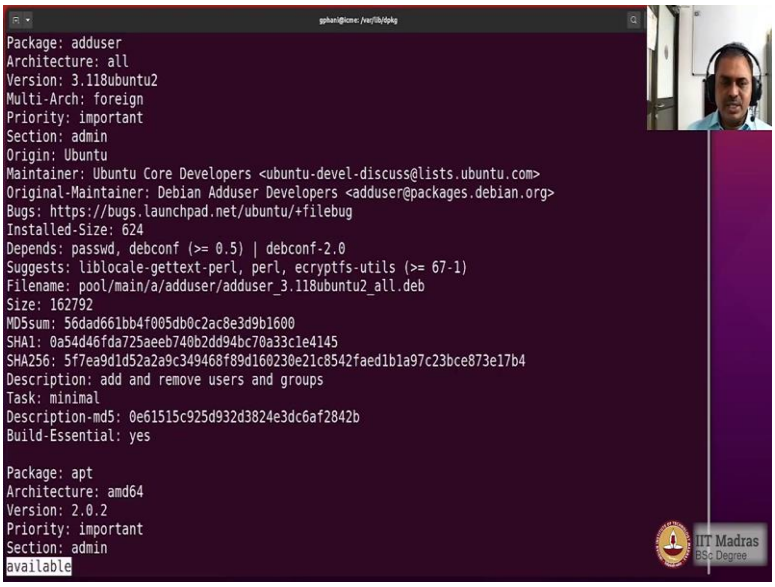
So, we are here in var lib dpkg, and you see that there are some files, so let us first look arch file. So, it tells what are the architectures for which the packages have been installed on this system. So, you could see that though my computer is a 64-bit machine, I also have some 32-bit executables installed. This is for some library files that may be required for compatibility reasons.

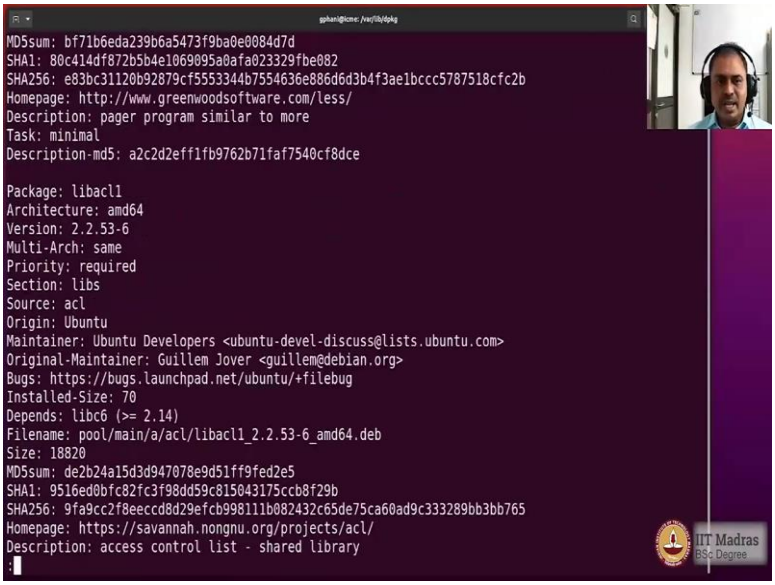
And then there is a large file 181 kilobytes which is called the available, so we would look at that by the less command. And you can see that it actually has a list of the packages along with its full information one after the other and this is one place from where when you ask for information about a package, it will be taken out and shown to you on the screen.

You also have a file called status which tells you whether a particular package has been installed or not. Obviously, this file will be much larger than available because the number of packages that you have installed will always be much less than what are possible from the open to repository.

(Refer Slide Time: 19:47)




gphari@icme: /var/lib/dpkg
MD5sum: bf71b6eda239b6a5473f9ba0e0084d7d
SHA1: 80c414df872b5b4e1069095a0afa023329fbe082
SHA256: e83bc31120b92879cf5553344b7554636e886d6d3b4f3ae1bccc5787518cfc2b
Homepage: http://www.greenwoodsoftware.com/less/
Description: pager program similar to more
Task: minimal
Description-md5: a2c2d2eff1fb9762b71faf7540cf8dce
Package: libacl1
Architecture: amd64
Version: 2.2.53-6
Multi-Arch: same
Priority: required
Section: libs
Source: acl
Origin: Ubuntu
Maintainer: Ubuntu Developers <ubuntu-devel-discuss@lists.ubuntu.com>
Original-Maintainer: Guillem Jover <guillem@debian.org>
Bugs: https://bugs.launchpad.net/ubuntu/+filebug
Installed-Size: 70
Depends: libc6 (>= 2.14)
Filename: pool/main/a/acl/libacl1_2.2.53-6_amd64.deb
Size: 18820
MD5sum: de2b24a15d3d947078e9d51ff9fed2e5
SHA1: 9516ed0bfc82fc3f98dd59c815043175ccb8f29b
SHA256: 9fa9cc2f8eeccd8d29efcb998111b082432c65de75ca60ad9c333289bb3bb765
Homepage: https://savannah.nongnu.org/projects/acl/
Description: access control list - shared library
:
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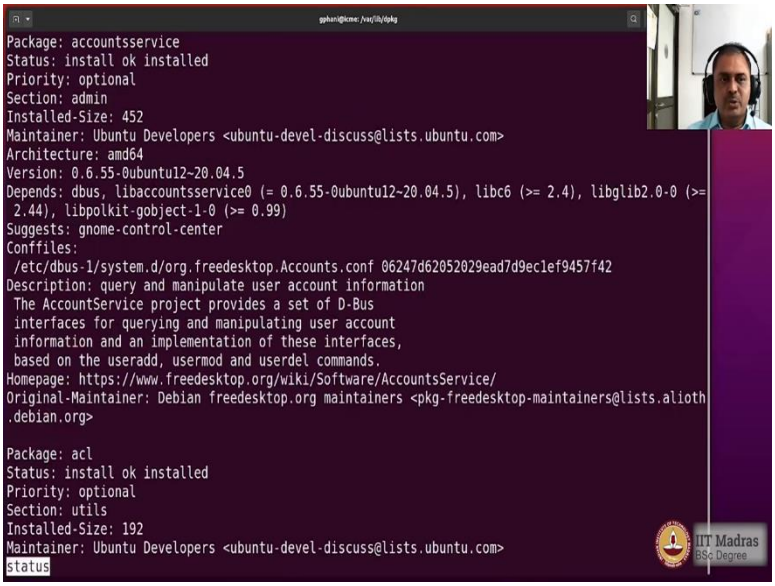
gphari@icme: /var/lib/dpkg
Package: accountsservice
Status: install ok installed
Priority: optional
Section: admin
Installed-Size: 452
Maintainer: Ubuntu Developers <ubuntu-devel-discuss@lists.ubuntu.com>
Architecture: amd64
Version: 0.6.55-0ubuntu12~20.04.5
Depends: dbus, libaccountsservice0 (= 0.6.55-0ubuntu12~20.04.5), libc6 (>= 2.4), libglib2.0-0 (>=
2.44), libpolkit-gobject-1-0 (>= 0.99)
Suggests: gnome-control-center
Conffiles:
/etc/dbus-1/system.d/org.freedesktop.Accounts.conf 06247d62052029ead7d9ec1ef9457f42
Description: query and manipulate user account information
The AccountService project provides a set of D-Bus
interfaces for querying and manipulating user account
information and an implementation of these interfaces,
based on the useradd, usermod and userdel commands.
Homepage: https://www.freedesktop.org/wiki/Software/AccountsService/
Original-Maintainer: Debian freedesktop.org maintainers <pkg-freedesktop-maintainers@lists.alioth
.debian.org>
Package: acl
Status: install ok installed
Priority: optional
Section: utils
Installed-Size: 192
Maintainer: Ubuntu Developers <ubuntu-devel-discuss@lists.ubuntu.com>
status
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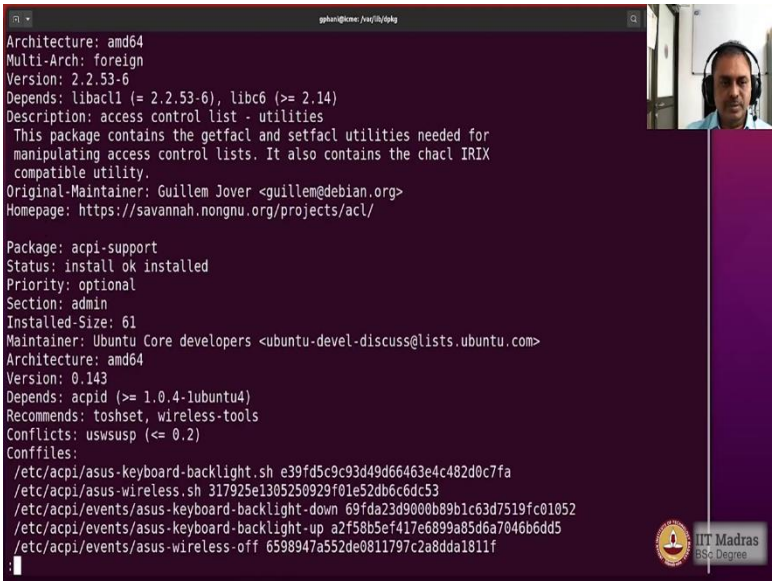
gphari@icme: /var/lib/dpkg
Architecture: amd64
Multi-Arch: foreign
Version: 2.2.53-6
Depends: libacl1 (= 2.2.53-6), libc6 (>= 2.14)
Description: access control list - utilities
This package contains the getfacl and setfacl utilities needed for
manipulating access control lists. It also contains the chacl IRIX
compatible utility.
Original-Maintainer: Guillem Jover <guillem@debian.org>
Homepage: https://savannah.nongnu.org/projects/acl/
Package: acpi-support
Status: install ok installed
Priority: optional
Section: admin
Installed-Size: 61
Maintainer: Ubuntu Core developers <ubuntu-devel-discuss@lists.ubuntu.com>
Architecture: amd64
Version: 0.143
Depends: acpid (>= 1.0.4-1ubuntu4)
Recommends: toshset, wireless-tools
Conflicts: uswsusp (<= 0.2)
Conffiles:
/etc/acpi/asus-keyboard-backlight.sh e39fd5c9c93d49d66463e4c482d0c7fa
/etc/acpi/asus-wireless.sh 317925e1305250929f01e52db6c6dc53
/etc/acpi/events/asus-keyboard-backlight-down 69fda23d9000b89b1c63d7519fc01052
/etc/acpi/events/asus-keyboard-backlight-up a2f58b5ef417e6899a85d6a7046b6dd5
/etc/acpi/events/asus-wireless-off 6598947a552de0811797c2a8dda1811f
:
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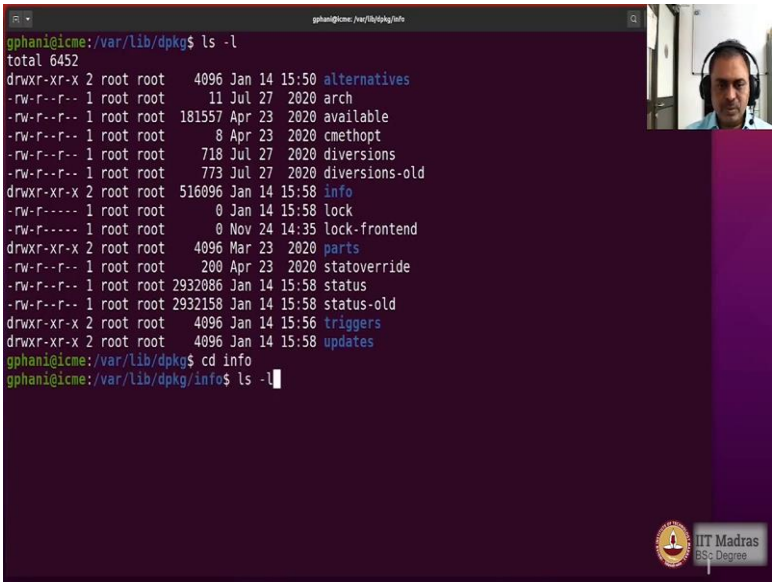
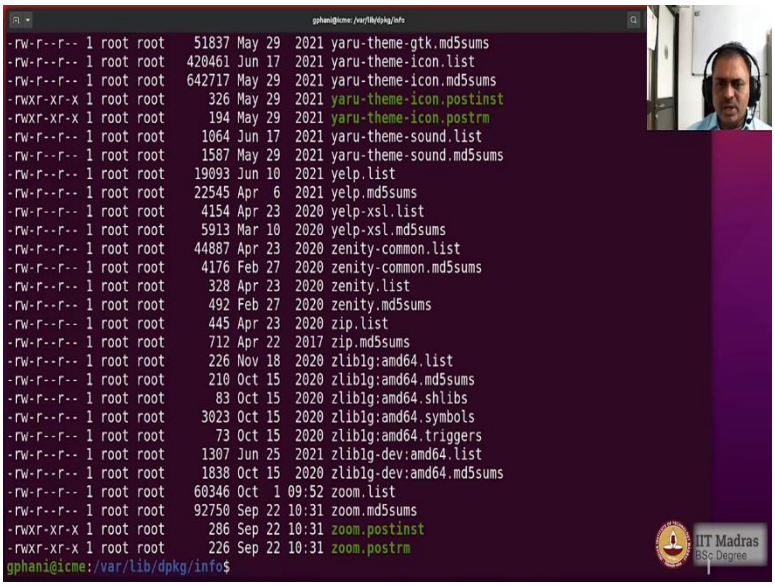
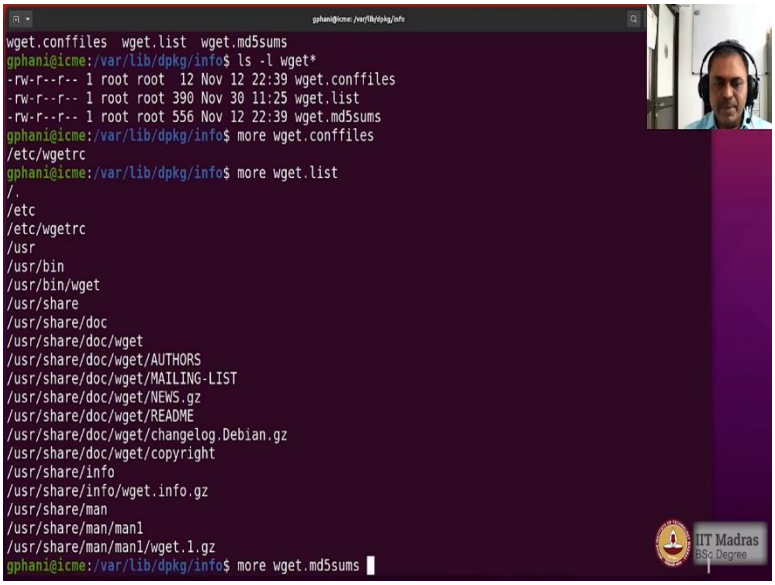
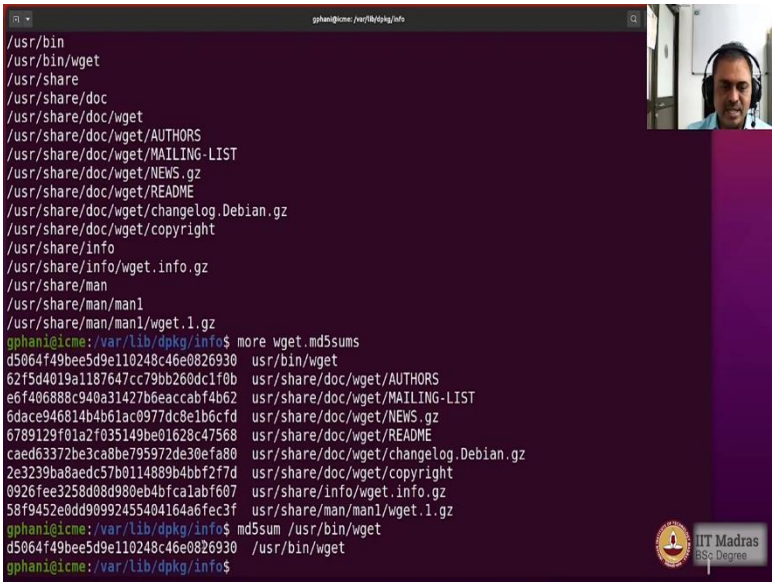
So, let us look at the status file and you will see that whether it is installed or not. So, you can see the status here tells you whether it has been installed or not.

(Refer Slide Time: 20:02)






And there is also a directory called info, and there you have got a set of files for each of the packages that are installed and it would actually have also some information about the md5sum and such signatures that you may want to verify.

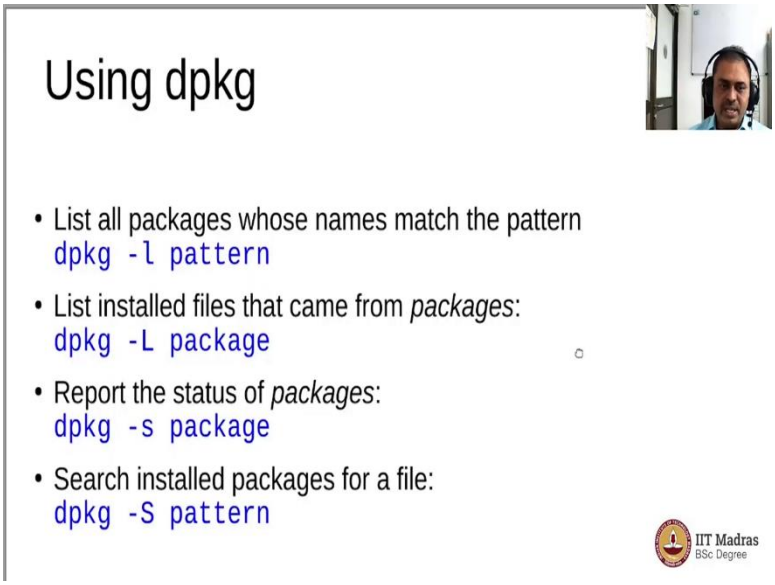
So, let us explore files for a particular package let us say wget, so, ls wget star and you could see that there are three files. So, ls minus l, wget, so, you can then see what are those pieces of information that we have. So, more wget dot con files, and it will show you that there is one configuration file that comes along with the wget, which would be etc wget rc.

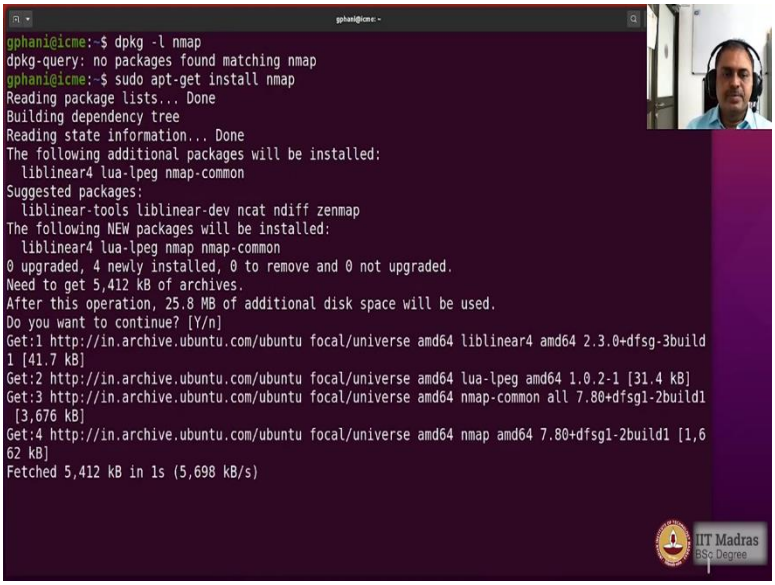
And then wget dot list will tell you information of what all the files that would get copied onto the system when you install this package called wget. And wget dot m5sums will actually show you what all the md5sums of that of the files that have been installed on your

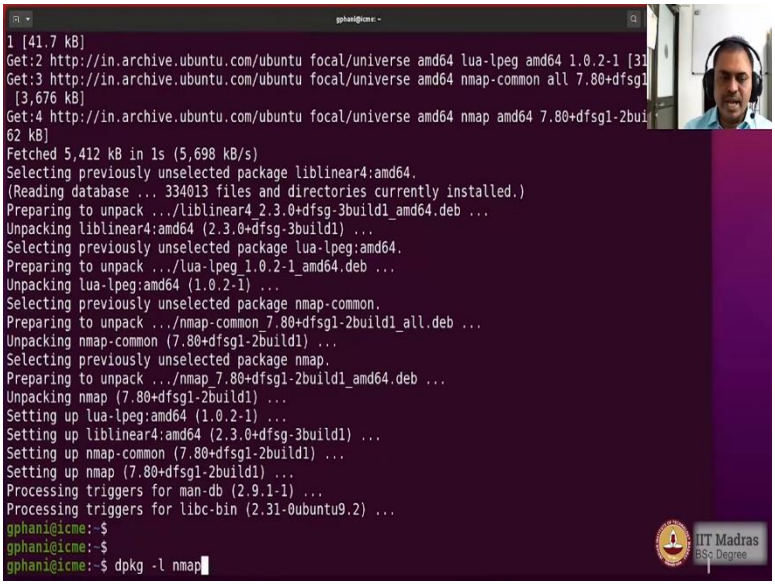
system and you could actually now confirm whether some of them have been tampered by the system because of unauthorized access to your system.

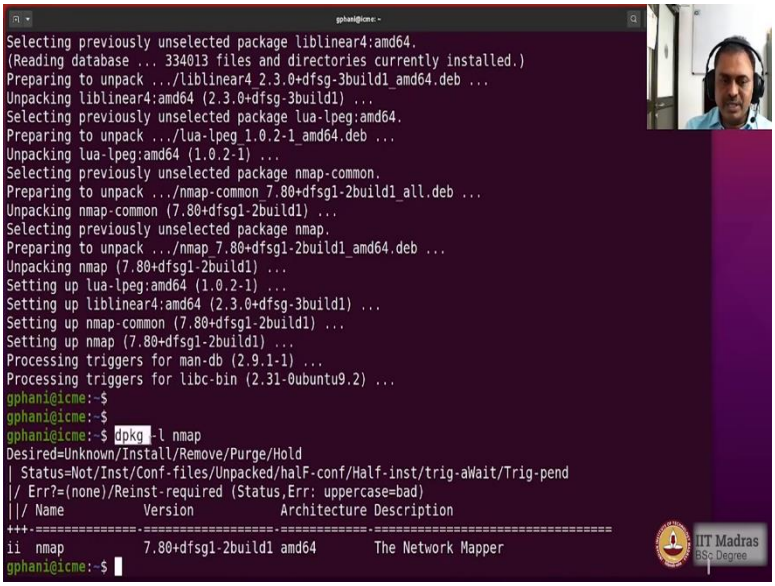
And let us do that now. So, user bin wget has a particular md5sum so we would write md5sum some user bin wget and you see that it matches with what is there here. And this is something that we could actually do to ensure that no executable or library in the system has been tampered compared to file originally sent by the Ubuntu as a vendor of that particular software package.

(Refer Slide Time: 21:43)





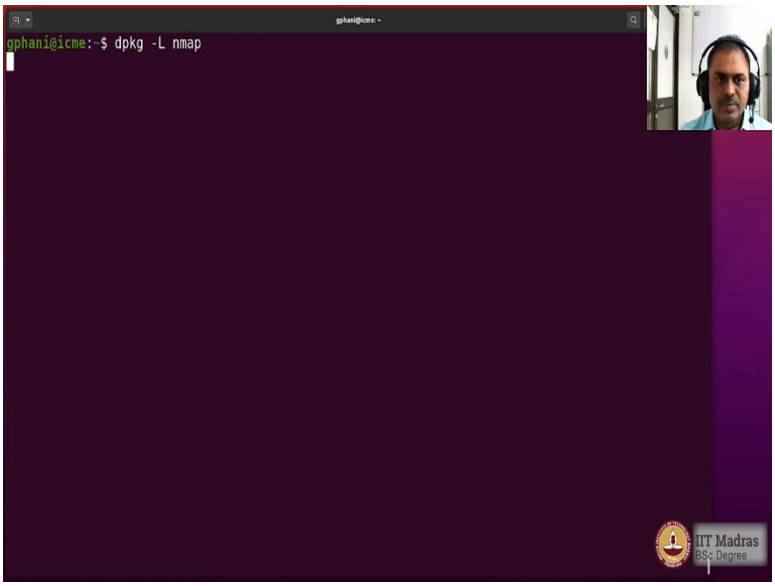



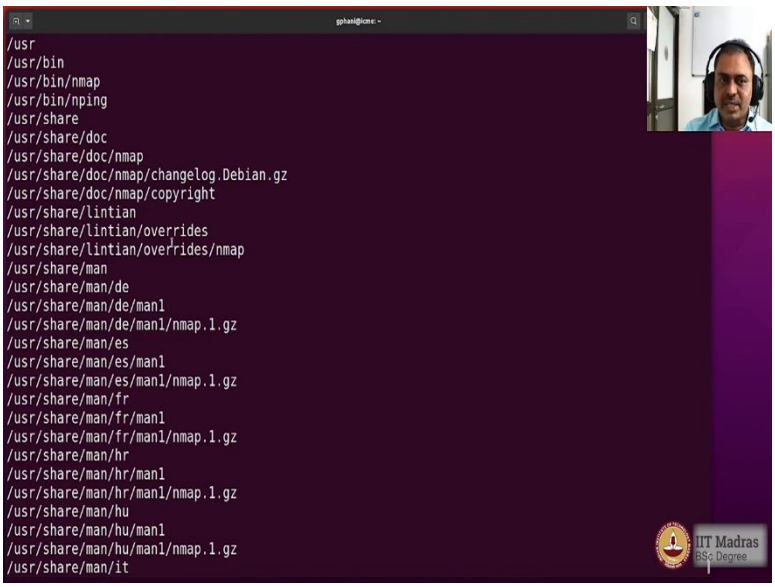

So, here are some utilities that we could try by using the dpkg command where we could list all the packages, which match a particular pattern because we are looking for the name of the package. We do not know the name exactly, so we start with few characters and look for the names. Also, we can see what all the files that came with a particular package or we can also see the status of a particular package, and we can also search for a particular package from where a file has been installed.

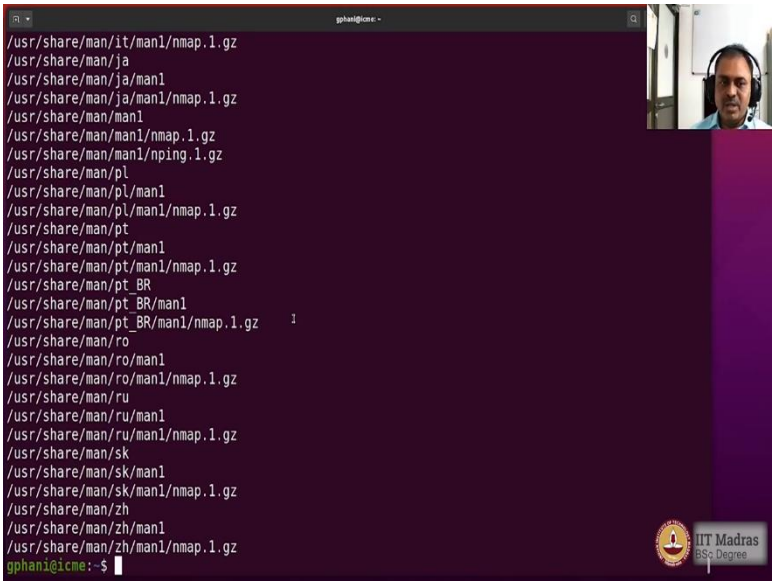
So, you know the name of the file, but you do not know the name of the package from where it came, so you could also look up that by using the minus capital S option of the dpkg command. So, let us look at these using a demo. So, dpkg with the minus option minus l let us say and nmap as a keyword would actually see that there are no packages that have been installed with that particular command. So, that means, that I have not installed that particular package yet. So, I will go ahead and install it. Now, that it is installed, I would go ahead and

run it again, and now you see that there is some information that comes up which tells that this particular package has been installed, and it has some information about the architecture and the description etc. The version, the name, and the revision etc. So, all this information are available from the dpkg command with a minus l option.

(Refer Slide Time: 23:25)

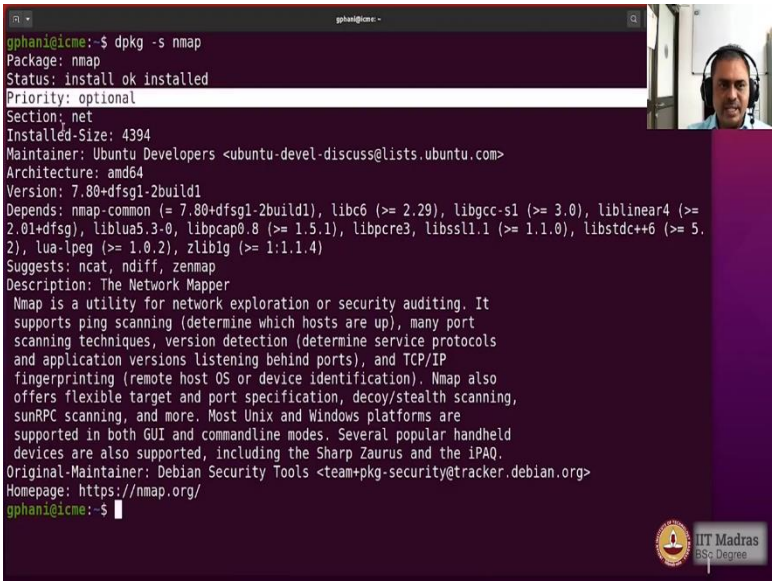


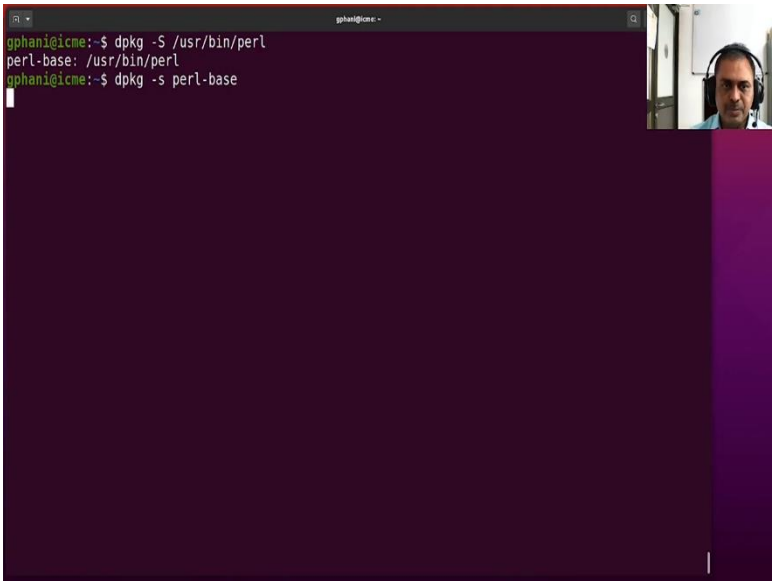



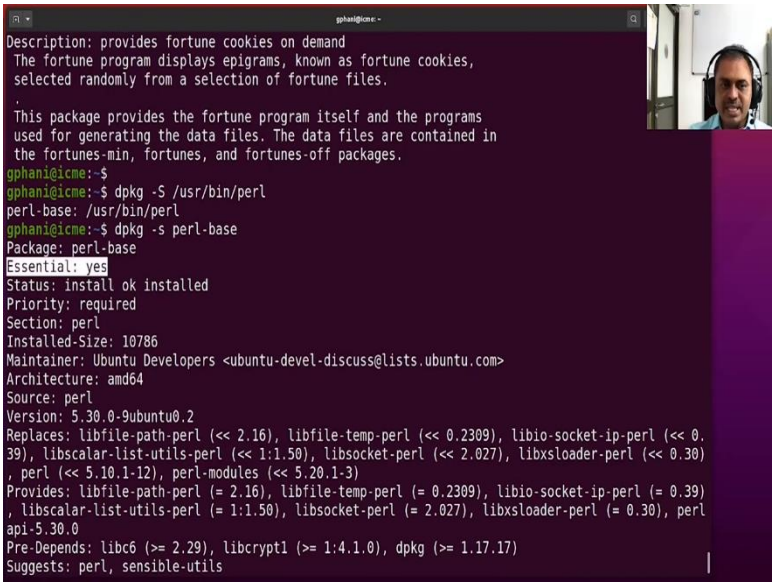


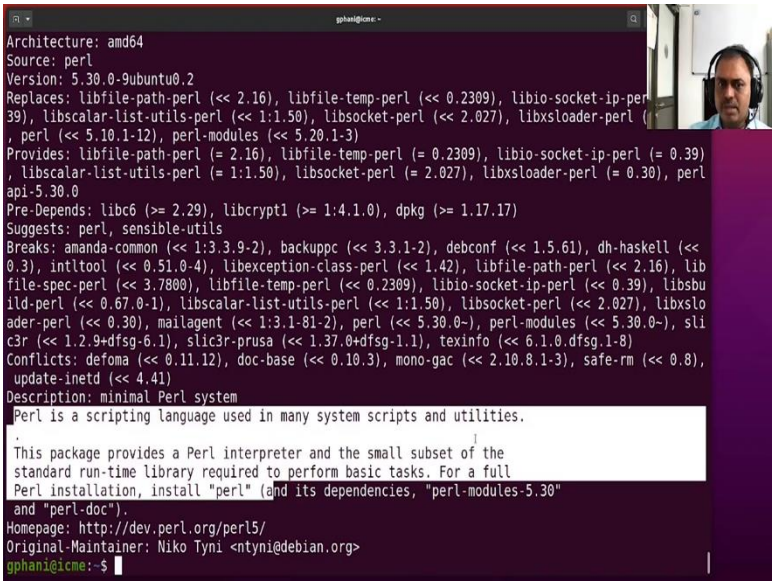

Now, what are the various files that are provided by this you can actually check. So, you see that the nmap when you install this package, these are all the various files that are being added to the system. So, you could see that user bin nmap is actually coming from this package, but also nping for example or the man file coming from the nmap also is here for example. So, when you install a package, the manpage is coming in and also certain other utilities bundled along with the particular main executable. And you would also see that the manpage is coming with the multiple languages also.

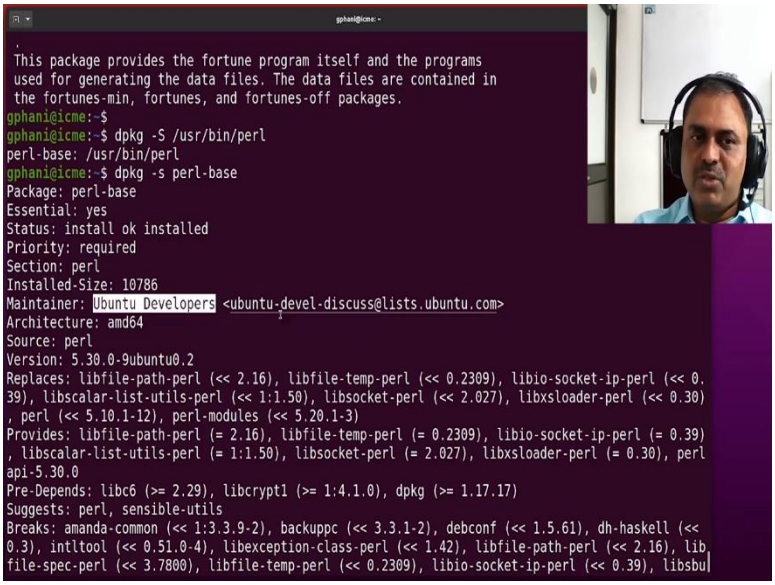
(Refer Slide Time: 24:12)




gphani@icme: ~
gphani@icme:~$ dpkg -S /usr/bin/perl
perl-base: /usr/bin/perl
gphani@icme:~$ dpkg -s perl-base


gphani@icme: ~
Description: provides fortune cookies on demand
The fortune program displays epigrams, known as fortune cookies,
selected randomly from a selection of fortune files.
.
This package provides the fortune program itself and the programs
used for generating the data files. The data files are contained in
the fortunes-min, fortunes, and fortunes-off packages.
gphani@icme:~$
gphani@icme:~$ dpkg -S /usr/bin/perl
perl-base: /usr/bin/perl
gphani@icme:~$ dpkg -s perl-base
Package: perl-base
Essential: yes
Status: install ok installed
Priority: required
Section: perl
Installed-Size: 10786
Maintainer: Ubuntu Developers <ubuntu-devel-discuss@lists.ubuntu.com>
Architecture: amd64
Source: perl
Version: 5.30.0-9ubuntu0.2
Replaces: libfile-path-perl (<< 2.16), libfile-temp-perl (<< 0.2309), libio-socket-ip-perl (<< 0.
39), libscalar-list-utils-perl (<< 1:1.50), libsocket-perl (<< 2.027), libxsloader-perl (<< 0.30)
, perl (<< 5.10.1-12), perl-modules (<< 5.20.1-3)
Provides: libfile-path-perl (= 2.16), libfile-temp-perl (= 0.2309), libio-socket-ip-perl (= 0.39)
, libscalar-list-utils-perl (= 1:1.50), libsocket-perl (= 2.027), libxsloader-perl (= 0.30), perl
api-5.30.0
Pre-Depends: libc6 (>= 2.29), libcrypt1 (>= 1:4.1.0), dpkg (>= 1.17.17)
Suggests: perl, sensible-utils


gphani@icme: ~
Architecture: amd64
Source: perl
Version: 5.30.0-9ubuntu0.2
Replaces: libfile-path-perl (<< 2.16), libfile-temp-perl (<< 0.2309), libio-socket-ip-per
39), libscalar-list-utils-perl (<< 1:1.50), libsocket-perl (<< 2.027), libxsloader-perl (
, perl (<< 5.10.1-12), perl-modules (<< 5.20.1-3)
Provides: libfile-path-perl (= 2.16), libfile-temp-perl (= 0.2309), libio-socket-ip-perl (= 0.39)
, libscalar-list-utils-perl (= 1:1.50), libsocket-perl (= 2.027), libxsloader-perl (= 0.30), perl
api-5.30.0
Pre-Depends: libc6 (>= 2.29), libcrypt1 (>= 1:4.1.0), dpkg (>= 1.17.17)
Suggests: perl, sensible-utils
Breaks: amanda-common (<< 1:3.3.9-2), backuppc (<< 3.3.1-2), debconf (<< 1.5.61), dh-haskell (<<
0.3), intltool (<< 0.51.0-4), libexception-class-perl (<< 1.42), libfile-path-perl (<< 2.16), lib
file-spec-perl (<< 3.7800), libfile-temp-perl (<< 0.2309), libio-socket-ip-perl (<< 0.39), libsbu
ild-perl (<< 0.67.0-1), libscalar-list-utils-perl (<< 1:1.50), libsocket-perl (<< 2.027), libxslo
ader-perl (<< 0.30), mailagent (<< 1:3.1-81-2), perl (<< 5.30.0~), perl-modules (<< 5.30.0~), sli
c3r (<< 1.2.9+dfsg-6.1), slic3r-prusa (<< 1.37.0+dfsg-1.1), texinfo (<< 6.1.0.dfsg.1-8)
Conflicts: defoma (<< 0.11.12), doc-base (<< 0.10.3), mono-gac (<< 2.10.8.1-3), safe-rm (<< 0.8),
update-inetd (<< 4.41)
Description: minimal Perl system
Perl is a scripting language used in many system scripts and utilities.
.
This package provides a Perl interpreter and the small subset of the
standard run-time library required to perform basic tasks. For a full
Perl installation, install "perl" (and its dependencies, "perl-modules-5.30"
and "perl-doc").
Homepage: http://dev.perl.org/perl5/
Original-Maintainer: Niko Tyni <ntyni@debian.org>
gphani@icme:~$




Now, you can actually find out the status of a particular package by typing the minus s option. So, it now says that yes, it is installed, and what is the priority and etc. So, this is the same output which comes from apt-cache show command, and it is actually asking it to via the dpkg command on the backend. And it also gives you a very detailed information about that particular utility. And if you have asked that about any other package, you will also know whether it has been installed or not.

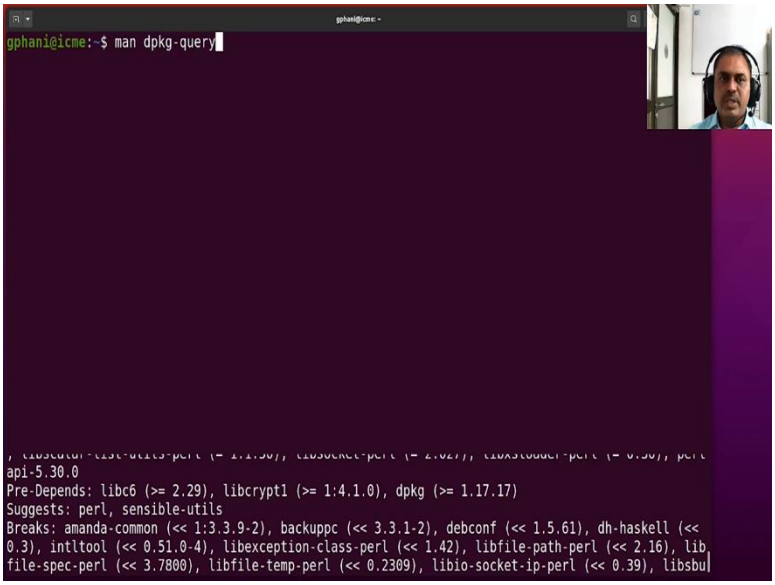
Now, let us say there is a particular executable which you want to know which package has led to that particular executable being made available. And so, you could search for that by the commander with a minus capital S option, and let us say the executable I want to look up is user bin perl.

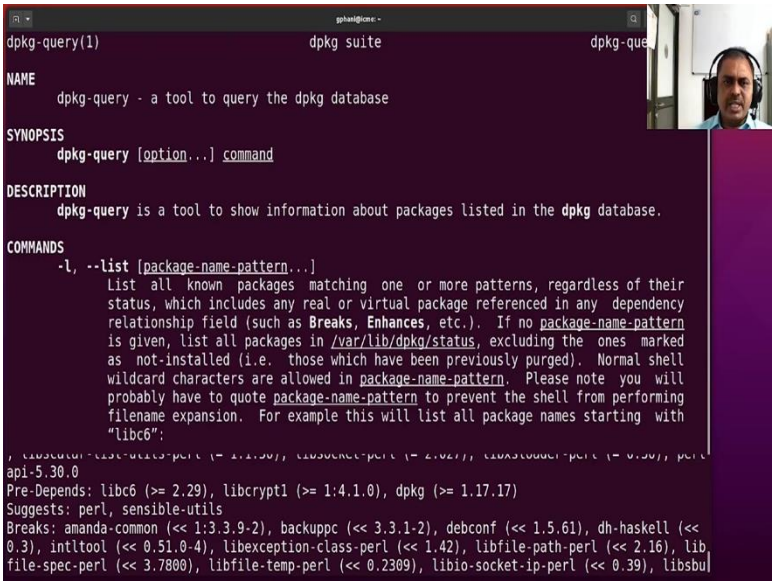
So, it says that the perl base is the name of the package from where this particular executable has come. So, which means that, I could now go and look at some more information about that particular package name because the package name is available. So, dpkg minus the small s to show about the package, and then here you see that information is available. It is an essential package comes into the section called pearl.

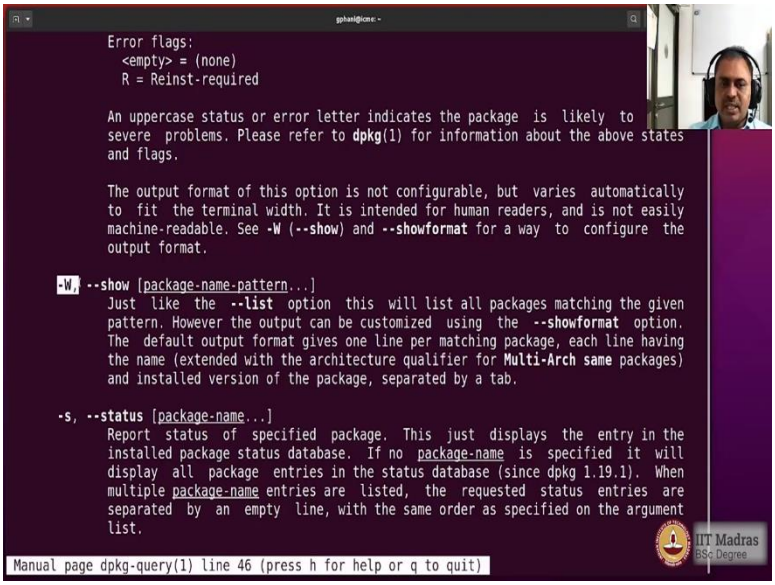
And you would see information about the particular package, that is a scripting language used in many systems, scripts and utilities, so you should not remove this particular executable or the package. And you would also see that it is maintained by the Ubuntu developers directly. So, now you can see that we have learnt about how to install packages, how to upgrade them, how to remove the packages, and how to fetch updates about the packages and do an nmass updation of the packages on the system etc, using two major systems apt as well as dpkg.

Now, if we may want to search for all the packages under a particular section or package section, and that for that we would actually look up a very low-level command, and I will show that using a demo.

(Refer Slide Time: 26:28)




gphani@icme: ~
Error flags:
<empty> = (none)
R = Reinst-required
An uppercase status or error letter indicates the package is likely to severe problems. Please refer to dpkg(1) for information about the above states and flags.
The output format of this option is not configurable, but varies automatically to fit the terminal width. It is intended for human readers, and is not easily machine-readable. See -W (--show) and --showformat for a way to configure the output format.
-W, --show [package-name-pattern...]
Just like the --list option this will list all packages matching the given pattern. However the output can be customized using the --showformat option. The default output format gives one line per matching package, each line having the name (extended with the architecture qualifier for Multi-Arch same packages) and installed version of the package, separated by a tab.
-s, --status [package-name...]
Report status of specified package. This just displays the entry in the installed package status database. If no package-name is specified it will display all package entries in the status database (since dpkg 1.19.1). When multiple package-name entries are listed, the requested status entries are separated by an empty line, with the same order as specified on the argument list.
Manual page dpkg-query(1) line 46 (press h for help or q to quit)
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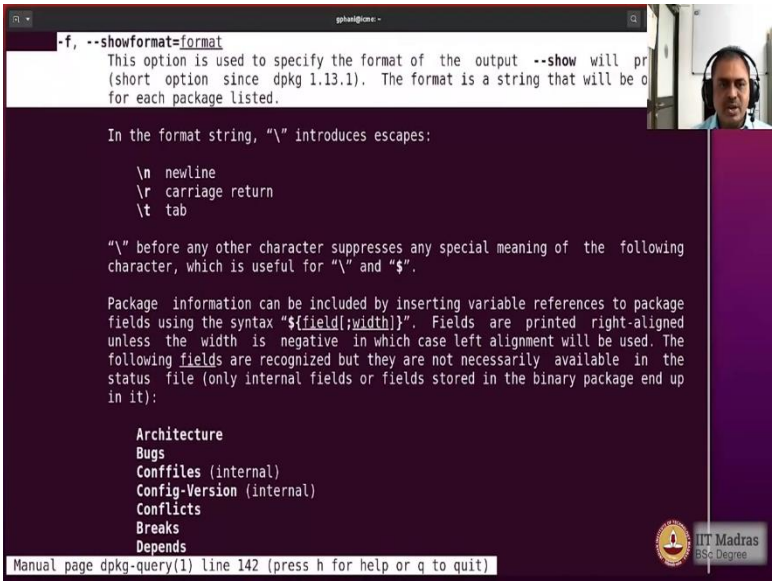
gphani@icme: ~
-f, --showformat=format
This option is used to specify the format of the output --show will pr
(short option since dpkg 1.13.1). The format is a string that will be o
for each package listed.
In the format string, "\" introduces escapes:
\n newline
\r carriage return
\t tab
"\" before any other character suppresses any special meaning of the following character, which is useful for "\" and "$".
Package information can be included by inserting variable references to package fields using the syntax "${field[;width]}". Fields are printed right-aligned unless the width is negative in which case left alignment will be used. The following fields are recognized but they are not necessarily available in the status file (only internal fields or fields stored in the binary package end up in it):
Architecture
Bugs
Conffiles (internal)
Config-Version (internal)
Conflicts
Breaks
Depends
Manual page dpkg-query(1) line 142 (press h for help or q to quit)
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gphani@icme: ~
Architecture
Bugs
Conffiles (internal)
Config-Version (internal)
Conflicts
Breaks
Depends
Description
Enhances
Essential
Filename (internal, front-end related)
Homepage
Installed-Size
MD5sum (internal, front-end related)
MSDOS-Filename (internal, front-end related)
Maintainer
Origin
Package
Pre-Depends
Priority
Provides
Recommends
Replaces
Revision (obsolete)
Section
Size (internal, front-end related)
Source
Status (internal)
Manual page dpkg-query(1) line 163 (press h for help or q to quit)
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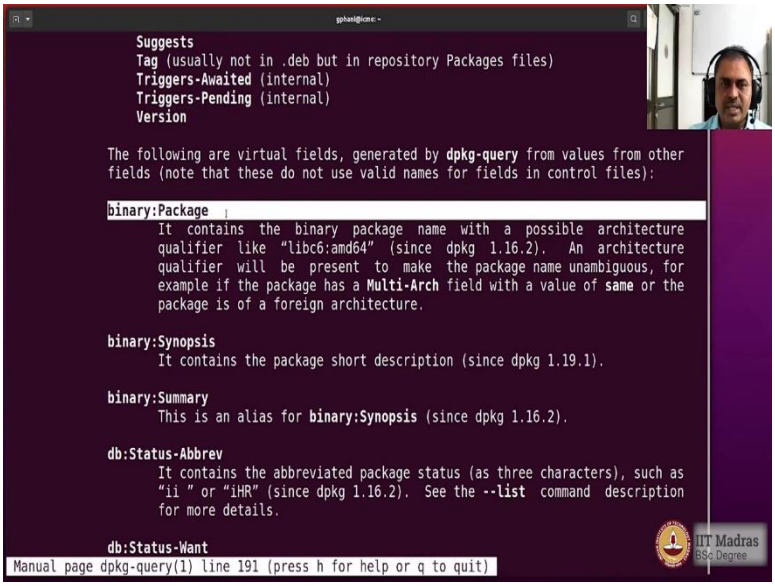


So, let us look at the manual page for dpkg-query. So, this is a low-level tool which we do not normally use, but it is basically to query the dpkg database about all the packages. And here is something that we would like to learn minus w, minus w is to show the list of packages, and let us also see one more option that we will be finding of use minus f that is a format in which we want the information to be shown.

And what are the kinds of formats that are possible, you will also look at the fields which has, for example the section, so section is one of the fields that we could use, and some more fields are like for example, the name of the package, binary colon package. So, by combining these pieces of information, we can actually ask the system to list the packages as well as their sections in a particular format by directly posing that query.

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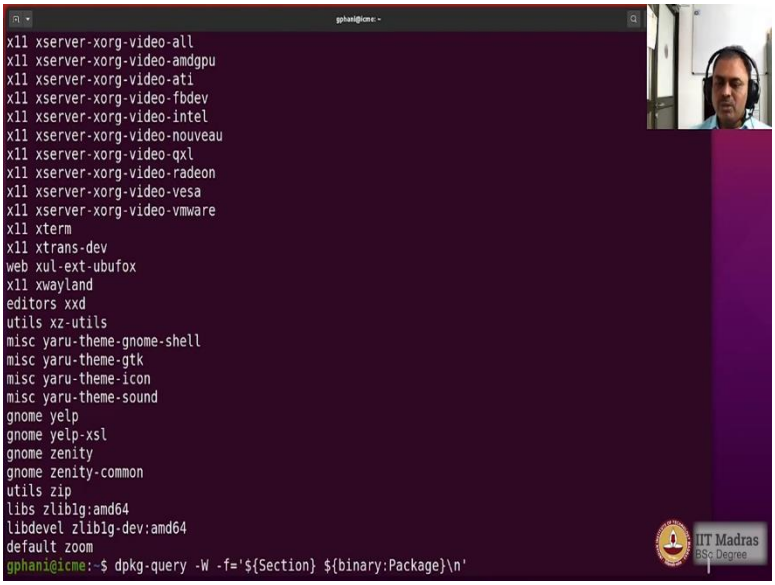


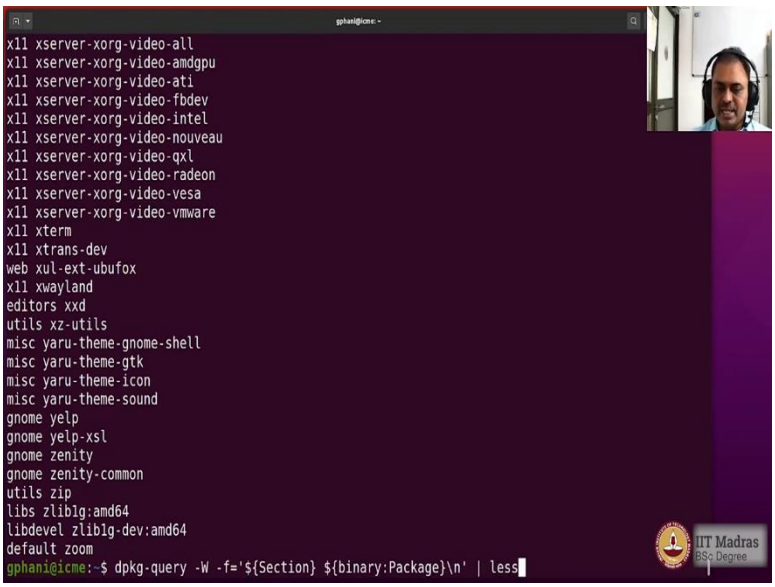

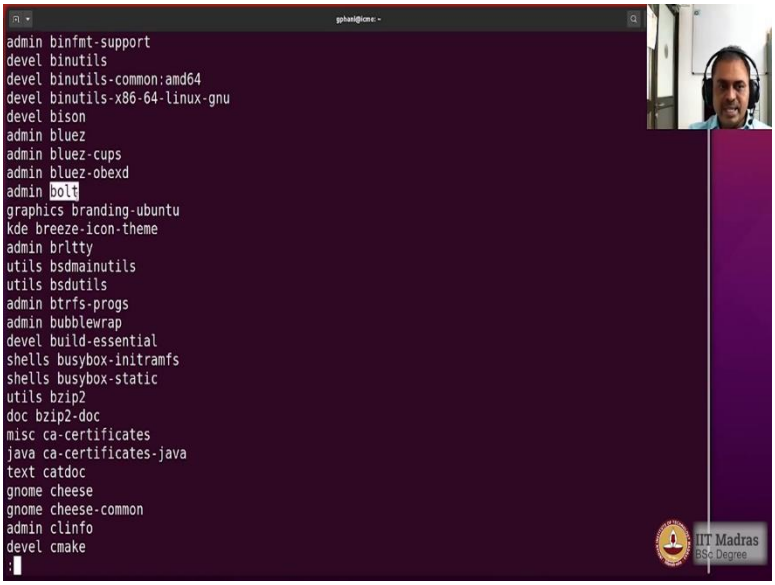


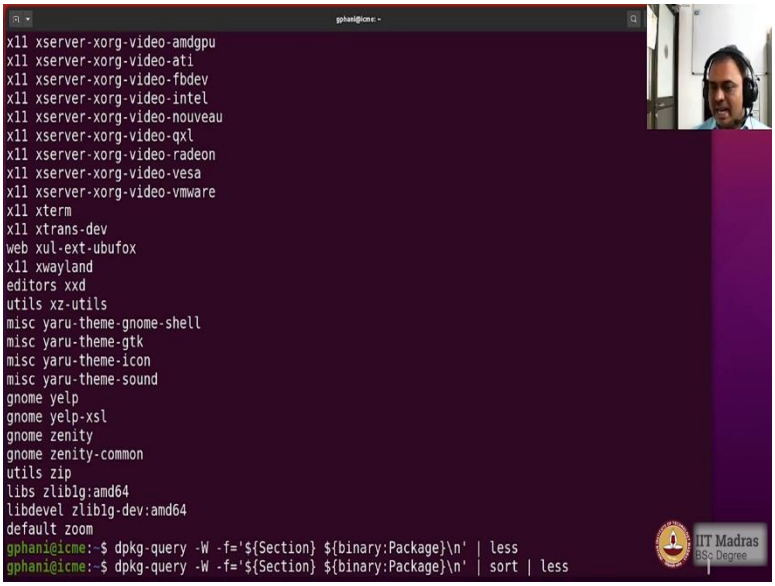


So, let us do that here minus f is giving the format, and the format I would give as follows. So, I would like the section name to be there, and then, I would also like the field, which is basically the binary colon package to be there. And after that, I would like a enter symbol to go to the next line. And if I run that, now, I would actually see a list of all the sections and within each section, what are all the binary packages that are installed in my system. So, you can see that the list is quite long.

Now, whenever the list is quite long, you know what to do. So, you can pipe it to less and then you can go through them one by one. So, the first field is the name of the section under which that particular package has been categorized by Ubuntu, and the next item is the name of the package that has come under the particular section into the system upon installation. Now, what we do is that we would like to go through section by so that we need sort so let us sort it and after that go by page by page.

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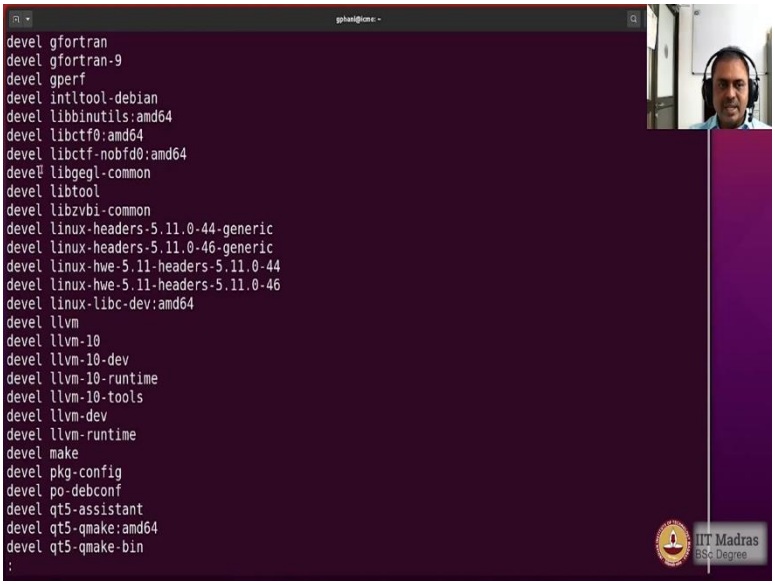



gphani@icme: ~
libs libcolorhug2:amd64
libs libcombblas1.16.0:amd64
libs libcom-err2:amd64
libs libcrack2:amd64
libs libcroco3:amd64
libs libcrypt1:amd64
libs libcryptsetup12:amd64
libs libcue2:amd64
libs libcups2:amd64
libs libcupsfilters1:amd64
libs libcupsimage2:amd64
libs libcurl3-gnutls:amd64
libs libcurl4:amd64
libs libcxsparse3:amd64
libs libdaemon0:amd64
libs libdatrie1:amd64
libs libdazzle-1.0-0:amd64
libs libdb5.3:amd64
libs libdbus-1-3:amd64
libs libdbusmenu-glib4:amd64
libs libdbusmenu-gtk3-4:amd64
libs libdbusmenu-qt5-2:amd64
libs libdc1394-22:amd64
libs libdca0:amd64
libs libdconf1:amd64
libs libde265-0:amd64
libs libdebconfclient0:amd64
libs libdebian-installer4:amd64
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gphani@icme: ~
libs libhwloc15:amd64
libs libhwloc-plugins:amd64
libs libhx509-5-heimdal:amd64
libs libhyphen0:amd64
libs libhypre:amd64
libs libibus-1.0-5:amd64
libs libibverbs1:amd64
libs libical3:amd64
libs libice6:amd64
libs libicu66:amd64
libs libidn11:amd64
libs libidn2-0:amd64
libs libiec61883-0:amd64
libs libieee1284-3:amd64
libs libigdgmm11:amd64
libs libijs-0.35:amd64
libs libilmbase24:amd64
libs libimagequant0:amd64
libs libimobiledevice6:amd64
libs libinput10:amd64
libs libinput-bin
libs libip4tc2:amd64
libs libip6tc2:amd64
libs libisc-export1105:amd64
libs libisl22:amd64
libs libitm1:amd64
libs libiw30:amd64
libs libixml10:amd64
:
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gphani@icme: ~
libs libpcre16-3:amd64
libs libpcre2-16-0:amd64
libs libpcre2-32-0:amd64
libs libpcre2-8-0:amd64
libs libpcre32-3:amd64
libs libpcre3:amd64
libs libpcrecpp0v5:amd64
libs libpcsclite1:amd64
libs libpeas-1.0-0:amd64
libs libpeas-common
libs libperl5.30:amd64
libs libpetsc-real3.12:amd64
libs libpfm4:amd64
libs libpgm-5.2-0:amd64
libs libphonenumber7:amd64
libs libphonon4qt5-4:amd64
libs libpipeline1:amd64
libs libpixman-1-0:amd64
libs libpkcs11-helper1:amd64
libs libplacebo7:amd64
libs libplist3:amd64
libs libplot2c2:amd64
libs libplymouth5:amd64
libs libpmix2:amd64
libs libpng16-16:amd64
libs libpolkit-agent-1-0:amd64
libs libpolkit-gobject-1-0:amd64
libs libpolkit-qt5-1-1:amd64
:
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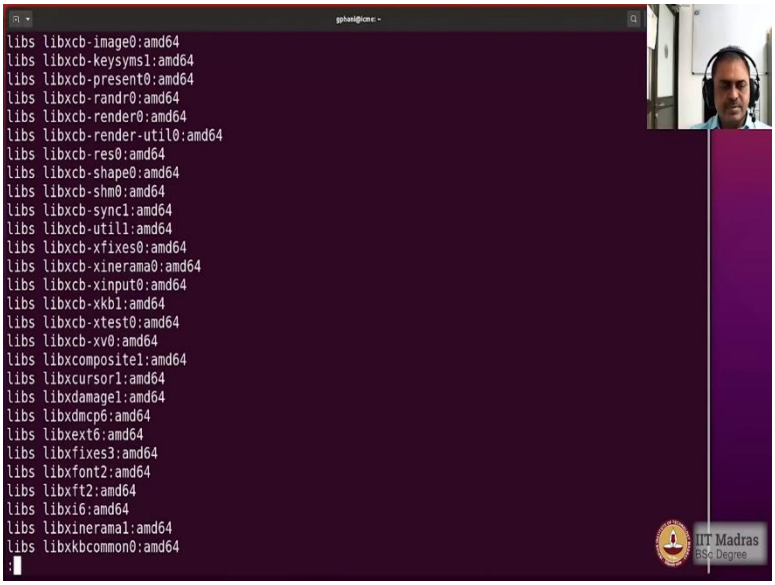
gphani@icme: ~
libs libxcb-image0:amd64
libs libxcb-keysyms1:amd64
libs libxcb-present0:amd64
libs libxcb-randr0:amd64
libs libxcb-render0:amd64
libs libxcb-render-util0:amd64
libs libxcb-res0:amd64
libs libxcb-shape0:amd64
libs libxcb-shm0:amd64
libs libxcb-sync1:amd64
libs libxcb-util1:amd64
libs libxcb-xfixes0:amd64
libs libxcb-xinerama0:amd64
libs libxcb-xinput0:amd64
libs libxcb-xkb1:amd64
libs libxcb-xtest0:amd64
libs libxcb-xv0:amd64
libs libxcomposite1:amd64
libs libxcursor1:amd64
libs libxdamage1:amd64
libs libxdmcp6:amd64
libs libxext6:amd64
libs libxfixes3:amd64
libs libxfont2:amd64
libs libxft2:amd64
libs libxi6:amd64
libs libxinerama1:amd64
libs libxkbcommon0:amd64
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gphani@icme: ~
perl perl-openssl-defaults:amd64
python libpython3.8-minimal:amd64
python libpython3.8-stdlib:amd64
python libpython3-stdlib:amd64
python python3
python python3.8
python python3.8-minimal
python python3-apport
python python3-apt
python python3-aptdaemon
python python3-aptdaemon.gtk3widgets
python python3-bcrypt
python python3-blinker
python python3-brlapi:amd64
python python3-cairo:amd64
python python3-certifi
python python3-cffi-backend
python python3-chardet
python python3-click
python python3-colorama
python python3-commandnotfound
python python3-cryptography
python python3-cups
python python3-cupshelpers
python python3-dateutil
python python3-dbus
python python3-debconf
python python3-debian
:
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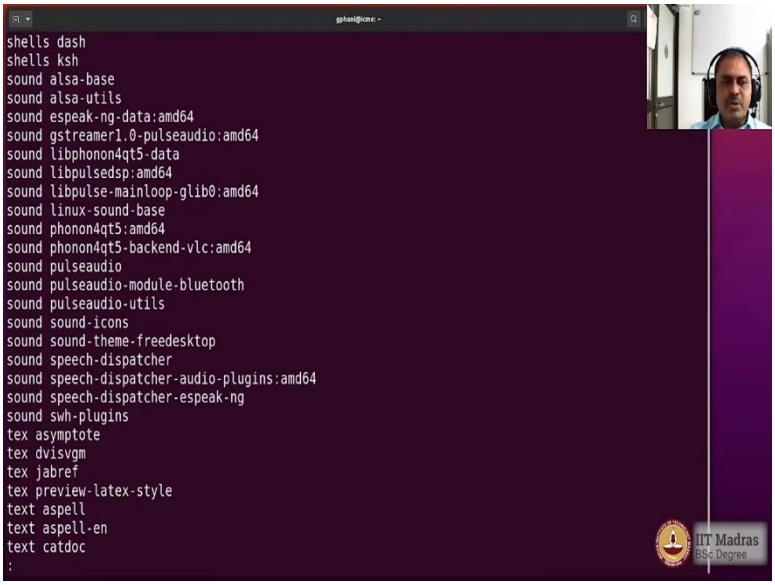
gphani@icme: ~
shells dash
shells ksh
sound alsa-base
sound alsa-utils
sound espeak-ng-data:amd64
sound gstreamer1.0-pulseaudio:amd64
sound libphonon4qt5-data
sound libpulsedsp:amd64
sound libpulse-mainloop-glib0:amd64
sound linux-sound-base
sound phonon4qt5:amd64
sound phonon4qt5-backend-vlc:amd64
sound pulseaudio
sound pulseaudio-module-bluetooth
sound pulseaudio-utils
sound sound-icons
sound sound-theme-freedesktop
sound speech-dispatcher
sound speech-dispatcher-audio-plugins:amd64
sound speech-dispatcher-espeak-ng
sound swh-plugins
tex asymptote
tex dvisvgm
tex jabref
tex preview-latex-style
text aspell
text aspell-en
text catdoc
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So, what are we doing here? So, we are running a query to list all the packages with a particular format, namely, the section has to be given after that the name of the package has to be given, after that a after that a new line. And this listing has to be sorted, and then it has to be displayed page by page. So, you can see how we are actually using the terminal environment to look at the list of packages under the sections, as done by the Ubuntu operating system and we are looking at it page by page.

So, you can see that under the admin section these are the various utilities that have been installed, and then under the developer section, these are the utilities. And you can see that there is a bunch of editors that have been installed. So, the liberoffice tools are all coming under the editors category, and the whole bunch of fonts that have been installed. And there is a Java utilities that have been installed on my machine, and you could also see that there are lot of library files that have come into the system because they come along with the utilities that we installed.

(Refer Slide Time: 30:01)


gphani@icme: ~
tex texlive-plain-generic
tex texlive-pstricks
tex texlive-publishers
tex texlive-science
tex texmaker
tex texmaker-data
text foomatic-db-compressed-ppds
text ghostscript
text ghostscript-x
text groff-base
text gsfonts
text hunspell-en-us
text hyphen-en-us
tex tipa
text less
text libexttextcat-data
text liblouis-data
text liblouisutdml-bin
text liblouisutdml-data
text mythes-en-us
text openprinting-ppds
text pdftk-java
text printer-driver-brlaser
text printer-driver-c2esp
text printer-driver-foo2zjs
text printer-driver-foo2zjs-common
text printer-driver-hpcups
text printer-driver-m2300w
:
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gphani@icme: ~
utils coreutils
utils cpio
utils cups-ppdc
utils dconf-cli
utils dctrl-tools
utils debianutils
utils deja-dup
utils diffutils
utils dirmngr
utils dmidecode
utils dpkg-dev
utils duplicity
utils dvipng
utils eject
utils fakeroot
utils fdisk
utils file
utils findutils
utils fuse
utils fwupd-signed
utils geoclue-2.0
utils gettext-base
utils gnupg
utils gnupg-utils
utils gpg
utils gpg-agent
utils gpgconf
utils gpgsm
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gphani@icme: ~
utils rfkill
utils sbsigntool
utils secureboot-db
utils sed
utils sensible-utils
utils shim-signed
utils sshfs
utils ssl-cert
utils strace
utils syslinux-legacy
utils tar
utils time
utils tracker
utils tracker-extract
utils tracker-miner-fs
utils ubuntu-report
utils ucf
utils unzip
utils usbmuxd
utils usbutils
utils util-linux
utils uuid-runtime
utils whiptail
utils whoopsie
utils whoopsie-preferences
utils xdg-user-dirs
utils xdg-user-dirs-gtk
utils xdg-utils
:
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gphani@icme: ~
x11 remmina-plugin-vnc:amd64
x11 spice-vdagent
x11 ubuntu-settings
x11 ubuntu-wallpapers-focal
x11 x11-apps
x11 x11-common
x11 x11proto-dev
x11 x11-session-utils
x11 x11-utils
x11 x11-xkb-utils
x11 x11-xserver-utils
x11 xauth
x11 xbitmaps
x11 xcursor-themes
x11 xfonts-encodings
x11 xfonts-utils
x11 xinit
x11 xinput
x11 xkb-data
x11 xorg
x11 xorg-sgml-doctools
x11 xournal
x11 xserver-common
x11 xserver-xephyr
x11 xserver-xorg
x11 xserver-xorg-core
x11 xserver-xorg-input-all
x11 xserver-xorg-input-libinput
:
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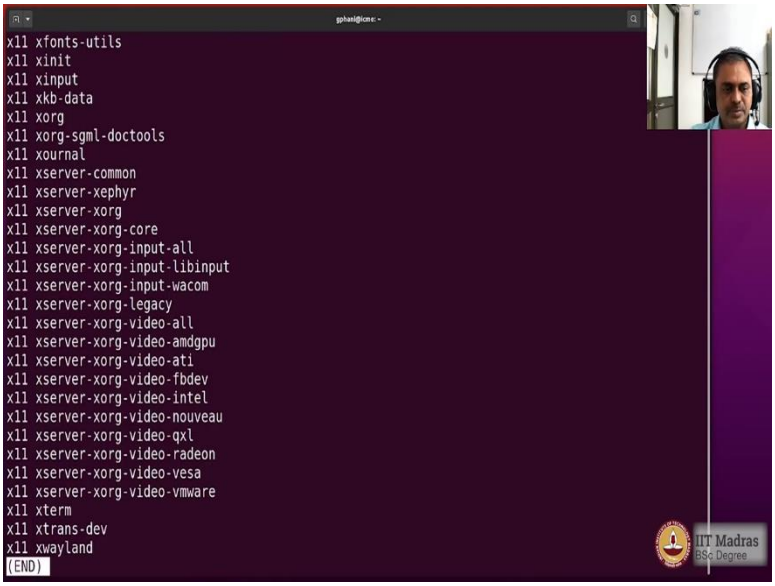
gphani@icme: ~
x11 xfonts-utils
x11 xinit
x11 xinput
x11 xkb-data
x11 xorg
x11 xorg-sgml-doctools
x11 xournal
x11 xserver-common
x11 xserver-xephyr
x11 xserver-xorg
x11 xserver-xorg-core
x11 xserver-xorg-input-all
x11 xserver-xorg-input-libinput
x11 xserver-xorg-input-wacom
x11 xserver-xorg-legacy
x11 xserver-xorg-video-all
x11 xserver-xorg-video-amdgpu
x11 xserver-xorg-video-ati
x11 xserver-xorg-video-fbdev
x11 xserver-xorg-video-intel
x11 xserver-xorg-video-nouveau
x11 xserver-xorg-video-qxl
x11 xserver-xorg-video-radeon
x11 xserver-xorg-video-vesa
x11 xserver-xorg-video-vmware
x11 xterm
x11 xtrans-dev
x11 xwayland
(END)
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gphani@icme: ~
gphani@icme:~$ dpkg-query -W -f='${Section} ${binary:Package}\n' | sort | less
gphani@icme:~$ dpkg-query -W -f='${Section} ${binary:Package}\n' | grep shells
shells bash
shells bash-completion
shells busybox-initramfs
shells busybox-static
shells csh
shells dash
shells ksh
gphani@icme:~$
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So, now, you see that there are also some shells that have come up. So, you can see that apart from the bash shell, we also have other shells like csh, dash and ksh also have been installed. So, now you can see that you are looking at the utility names under the categories, so you want to learn more shells, then you can see how many shells have been installed and then go on to explore them separately that is how you can actually explore tools, so, that you have not been looking for consciously. But now that they are available for you under each category, then you can go through them to be thorough about all the utilities that come under a particular category.

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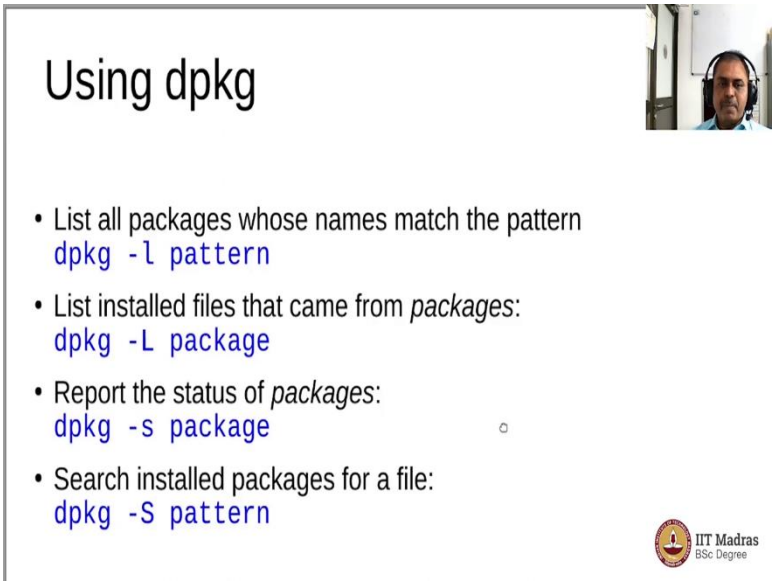
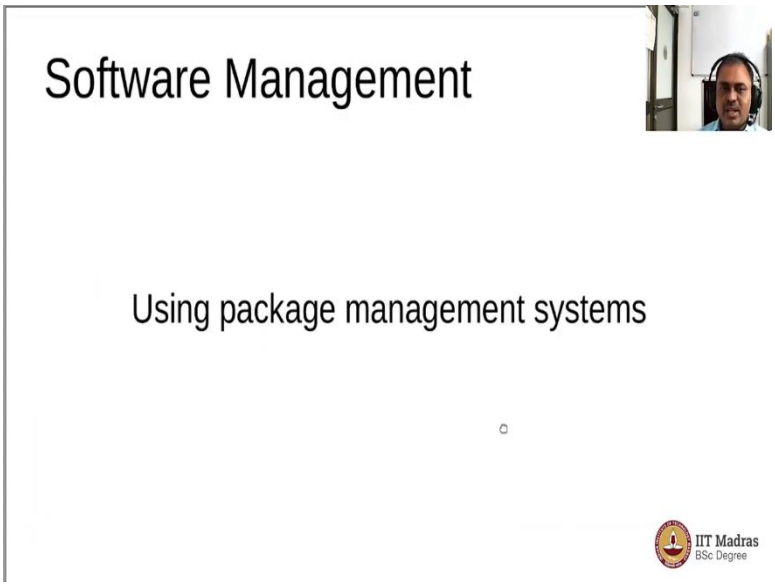
Now, we would like to also look at only those sections, which let us say command or a particular category, so, let us say shells. So, the way to do that is to filter the output. And for filtering the output there is a command called a grep, which we will be learning shortly. But for now, I will just illustrate how nice it is actually giving you the output as.

Now, you can see that we have filtered the output to only choose to display those lines which contain the word shells. And you could see that the list of utilities that come out of the category called shells are displayed. So, you can see that this grep command is quite powerful in filtering the output that is coming in to the pipe, and we will learn more about that shortly.

(Refer Slide Time: 31:30)




So, here is what we have done using the dpkg minus a small l for looking up a pattern by which the packages are going to be looked up. Then minus capital L to list the files that came when you install the package. Minus small s to look at the status of the particular package and minus capital S to look at which package has brought that particular file that you are looking for.

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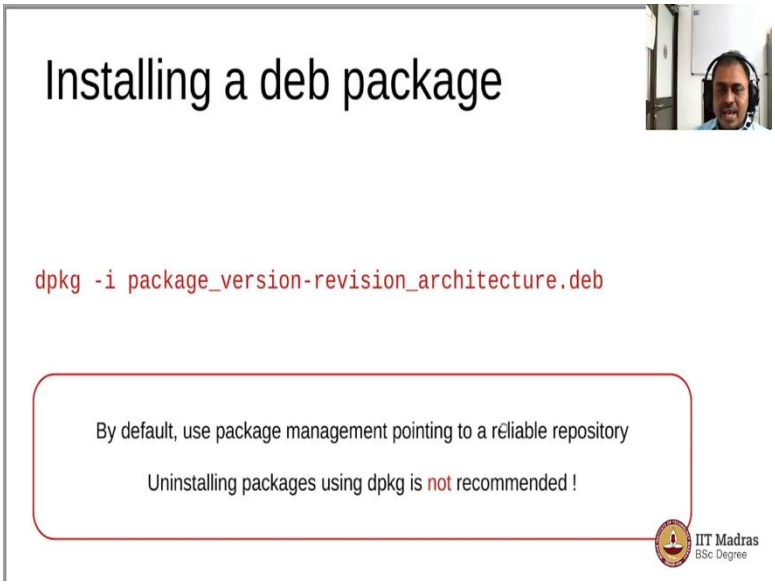


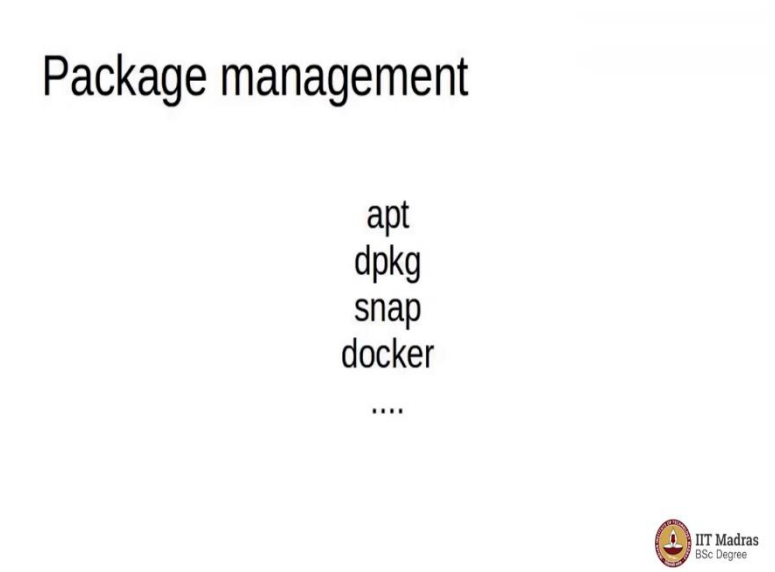


Now, if you have downloaded a deb file, you could also install it using the minus i option directly, but this is not a good idea because it may have some dependencies which you will have to bother about yourselves. By default use package management system pointing to a reliable repository such as the Ubuntu itself or a reputed company, say Google, but do not download Deb files from the internet from unknown sources and install them on your system because in the worst case it could actually damage the operating system, and sometimes it may also not just work because there are dependencies which may have conflicts with existing libraries and utilities on your system so always leave these decisions to the packaged management system, so that, the process of installation upgradation will happen smoothly.

And it is not a good idea to remove a package using this command because you maybe removing a package that is required by many other packages and therefore, removing packages should be also done using a package management system like for example apt or synaptic or aptitude.

With that we come to the end of this session on software management. Please do read the documentation for the package management that is relevant for your operating system say apt or dpkg for Ubuntu or maybe RPM or DNF for Red Hat Linux or OpenSuSE Linux etc, and make yourself comfortable with various options so that you are on top of the software management of your computer.

One of the important things about the stability of Linux operating system is that almost everything that you would like is available from the original maintainer of that particular flavor of Linux operating system and in many ways when you install a package the checks are done to ensure the compatibility with the existing libraries and therefore, the operating system is generally stable if you follow the standard practices for installation or upgradation of software packages. So, enjoy expanding your operating system to have all the tools that you would ever want to have on your system to learn various tools that are required for your work without having to worry about the compatibility issues.

In situations when the compatibility issues cannot be resolved there are also alternative methods available on a Linux operating system such as through the snap or docker ad you could explore them as alternatives whenever you are unable to install a particular version of a package, but usually that problem does not arise as long as you are using a stable software management system such as apt.