

Arnav Surve
CNIT 176
Lab 10
11/2/2022

```
asurve@raspberrypi:~  
File Edit Tabs Help  
Setting up raspberrypi-ui-mods (1.20221102) ...  
Processing triggers for libc-bin:armhf (2.31-13+deb11u1+rpt4) ...  
Processing triggers for libvlc-bin (2.31-13+deb11u1+rpt4) ...  
asurve@raspberrypi:~$ sudo apt-get install x11-apps  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
The following package was automatically installed and is no longer required:  
  libfuse2  
Use 'sudo apt autoremove' to remove it.  
The following additional packages will be installed:  
  xbitmaps  
Suggested packages:  
  mesa-utils  
The following NEW packages will be installed:  
  x11-apps xbitmaps  
0 upgraded, 2 newly installed, 0 to remove and 0 not upgraded.  
Need to get 570 kB of archives.  
After this operation, 2,150 kB of additional disk space will be used.  
Do you want to continue? [Y/n] y  
Get:1 http://raspbrian.raspberrypi.org/raspbian bullseye/main armhf x11-apps armhf 7.7+0 [544 kB]  
Get:2 http://mirrors.gigamonks.com/raspbian/raspbian bullseye/main armhf xbitmaps all 1.1.1-2.1 [25.8 kB]  
Fetched 570 kB in 3s (184 kB/s)  
Selecting previously unselected package x11-apps.  
(Reading database ... 106132 files and directories currently installed.)  
Preparing to unpack .../x11-apps_7.7+0_armhf.deb ...  
Unpacking x11-apps (7.7+0) ...  
Selecting previously unselected package xbitmaps.  
Preparing to unpack .../xbitmaps_1.1.1-2.1_all.deb ...  
Unpacking xbitmaps (1.1.1-2.1) ...  
Setting up x11-apps (7.7+0) ...  
Setting up xbitmaps (1.1.1-2.1) ...  
Processing triggers for man-db (2.9.4-2) ...  
asurve@raspberrypi:~$ sudo apt-get install firefox-esr  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
The following package was automatically installed and is no longer required:  
  libfuse2  
Use 'sudo apt autoremove' to remove it.  
Suggested packages:  
  fonts-stix | etf-stix fonts-lmodern  
The following NEW packages will be installed:  
  firefox-esr  
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.  
Need to get 51.5 MB of archives.  
After this operation, 200 MB of additional disk space will be used.  
Get:1 http://raspbrian.raspberrypi.org/raspbian bullseye/main armhf firefox-esr armhf 102.4.0esr-1-deb11u1+rpi1 [51.5 MB]  
Fetched 51.5 MB in 42s (1,201 kB/s)  
Selecting previously unselected package firefox-esr.  
(Reading database ... 106334 files and directories currently installed.)  
Preparing to unpack .../firefox-esr_102.4.0esr-1-deb11u1+rpi1_armhf.deb ...  
Adding 'diversion of /usr/bin/firefox to /usr/bin/firefox.real by firefox-esr'  
Unpacking firefox-esr (102.4.0esr-1-deb11u1+rpi1) ...  
Setting up firefox-esr (102.4.0esr-1-deb11u1+rpi1) ...  
Processing triggers for hicolor-icon-theme (0.17-2) ...  
Processing triggers for gnome-menus (3.36.0-1) ...  
Processing triggers for man-db (2.9.4-2) ...  
Processing triggers for mailcap (3.60) ...  
Processing triggers for desktop-file-utils (0.26-1) ...  
asurve@raspberrypi:~$
```

Output following

```
sudo apt-get update  
sudo apt-get upgrade  
sudo apt-get dist-upgrade  
sudo apt-get install x11-apps  
sudo apt-get install firefox-esr
```

```
asurve@raspberrypi: ~$ sudo apt autoremove
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following package was automatically installed and is no longer required:
  libfuse2
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
  x11-apps xbitmaps
Suggested packages:
  mesa-utils
The following NEW packages will be installed:
  x11-apps xbitmaps
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Get:1 http://rasbian.raspberrypi.org/raspbian bullseye/main armhf x11-apps armhf 7.7+0 [544 kB]
Get:2 http://mirrors.gigamonks.com/raspbian/raspbian bullseye/main armhf xbitmaps all 1.1.1-2.1 [25.8 kB]
Fetched 570 kB in 3s (184 kB/s)
Selecting previously unselected package x11-apps.
(Reading database ... 106132 files and directories currently installed.)
Preparing to unpack .../x11-apps_7.7+0_armhf.deb ...
Unpacking x11-apps (7.7+0) ...
Selecting previously unselected package xbitmaps.
Preparing to unpack .../xbitmaps_1.1.1-2.1_all.deb ...
Unpacking xbitmaps (1.1.1-2.1) ...
Setting up x11-apps (7.7+0) ...
Setting up xbitmaps (1.1.1-2.1) ...
Processing triggers for man-db (2.9.4-2) ...
asurve@raspberrypi:~$ sudo apt-get install firefox-esr
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
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  libfuse2
Use 'sudo apt autoremove' to remove it.
Suggested packages:
  fonts-stix | ttf-stix fonts-lmodern
The following NEW packages will be installed:
  firefox-esr
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 51.5 MB of archives.
After this operation, 200 MB of additional disk space will be used.
Get:1 http://rasbian.raspberrypi.org/raspbian bullseye/main armhf firefox-esr armhf 102.4.0esr-1-deb1ui-rpi1 [51.5 MB]
Fetched 51.5 MB in 43s (1,201 kB/s)
Selecting previously unselected package firefox-esr.
(Reading database ... 106334 files and directories currently installed.)
Preparing to unpack .../firefox-esr_102.4.0esr-1-deb1ui-rpi1_armhf.deb ...
Adding 'diversion of /usr/bin/firefox to /usr/bin/firefox.real by firefox-esr'
Unpacking firefox-esr (102.4.0esr-1-deb1ui-rpi1) ...
Setting up firefox-esr (102.4.0esr-1-deb1ui-rpi1) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...
Processing triggers for gnome-menus (3.36.0-1) ...
Processing triggers for man-db (2.9.4-2) ...
Processing triggers for mailcap (3.60) ...
Processing triggers for desktop-file-utils (0.26-1) ...
asurve@raspberrypi:~$ cat /etc/apt/sources.list
deb http://rasbian.raspberrypi.org/raspbian/ bullseye main contrib non-free rpi
# Uncomment line below then 'apt-get update' to enable 'apt-get source'
#deb-src http://rasbian.raspberrypi.org/raspbian/ bullseye main contrib non-free rpi
asurve@raspberrypi:~$
```

Output following cat /etc/apt/sources.list command

```
asurve@raspberrypi: /$ sudo service ssh start
asurve@raspberrypi: /$ sudo service ssh status
ssh.service - OpenSSH Secure Shell server
Loaded: loaded (/lib/systemd/systemd/ssh.service; enabled; vendor preset: enabled)
Active: active (running) since Thu 2022-11-17 17:48:22 EST; 25min ago
Docs: man:sshd(8)
      man:ssh_config(5)
Process: 1383 ExecStartPre=/usr/sbin/sshd -t (code=exited, status=0/SUCCESS)
Main PID: 1384 (sshd)
Tasks: 1 (limit: 1996)
CPU: 965ms
Group: /system.slice/ssh.service
WantedBy: sshd.service
Nov 17 17:48:22 raspberrypi systemd[1]: Stopped OpenSSH Secure Shell server.
Nov 17 17:48:22 raspberrypi systemd[1]: Starting OpenSSH Secure Shell server...
Nov 17 17:48:22 raspberrypi sshd[1384]: Server listening on 0.0.0.0 port 22.
Nov 17 17:48:22 raspberrypi sshd[1384]: Server listening on :: port 22.
Nov 17 17:48:22 raspberrypi systemd[1]: Started OpenSSH Secure Shell server.
Nov 17 17:48:53 raspberrypi sshd[1391]: Accepted password for fe80::1c09:d37d:7477:178e wlan0 port 58286 ssh2
Nov 17 17:48:53 raspberrypi sshd[1391]: pam_unix(sshd:session): session opened for user asurve(uid=1000) by (uid=0)
asurve@raspberrypi: /$
```

Output following sudo service ssh start & sudo service ssh status commands

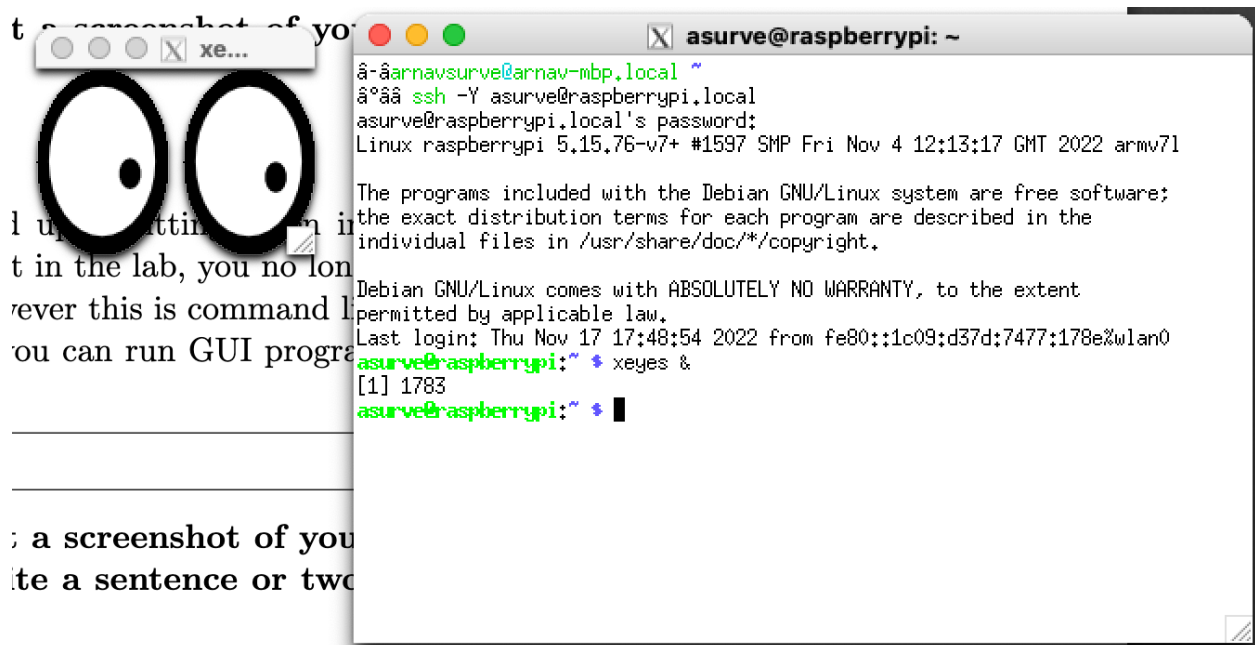
```
asurve@raspberrypi: ~
â-âarnavsurve@arnav-mbp.local ~
â°ââ ssh -Y asurve@raspberrypi.local
asurve@raspberrypi.local's password:
Linux raspberrypi 5.15.76-v7+ #1597 SMP Fri Nov 4 12:13:17 GMT 2022 armv7l

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Thu Nov 17 17:48:54 2022 from fe80::1c09:d37d:7477:178e%wlan0
asurve@raspberrypi:~$
```

Creating connection with X-server with X11 forwarding

t a screenshot of you



```
asurve@raspberrypi: ~
â-âarnavsurve@arnav-mbp.local ~
â°ââ ssh -Y asurve@raspberrypi.local
asurve@raspberrypi.local's password:
Linux raspberrypi 5.15.76-v7+ #1597 SMP Fri Nov 4 12:13:17 GMT 2022 armv7l

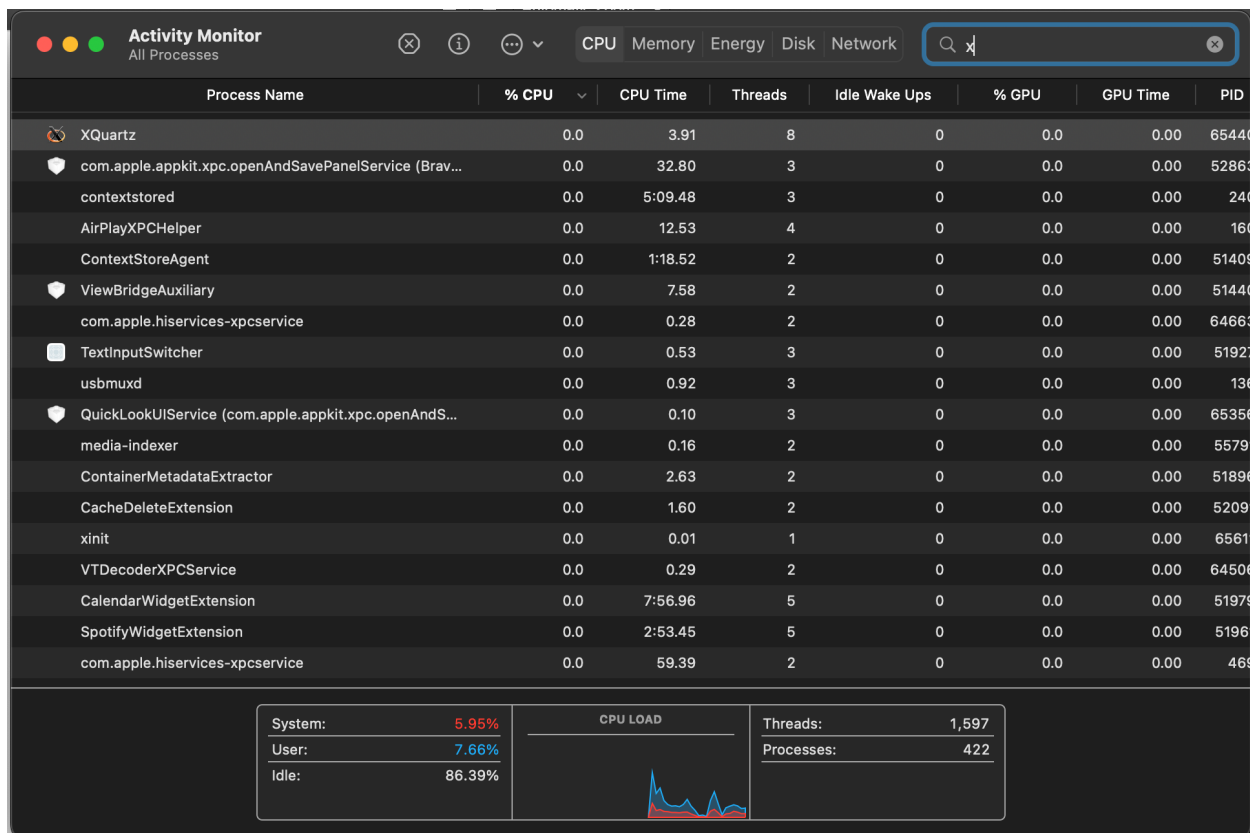
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Thu Nov 17 17:48:54 2022 from fe80::1c09:d37d:7477:178e%wlan0
asurve@raspberrypi:~$ xeyes &
[1] 1783
asurve@raspberrypi:~$
```

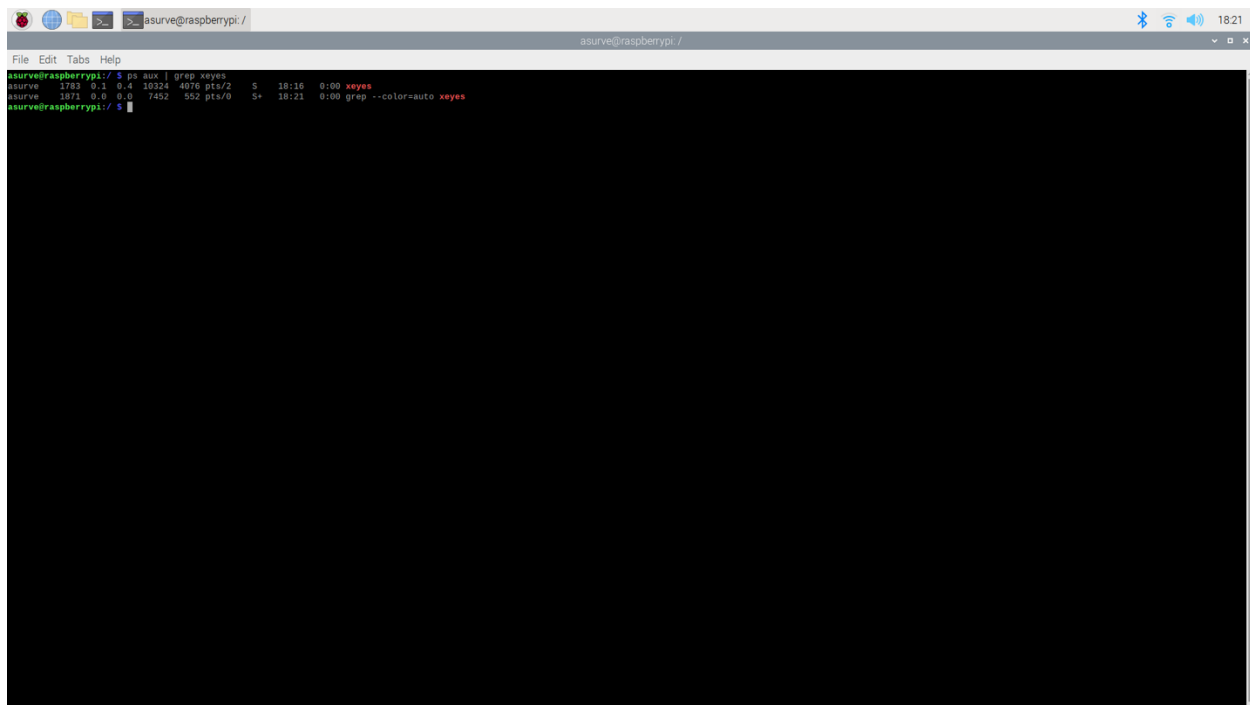
l up sitting in in
t in the lab, you no lon
rever this is command l
ou can run GUI progr

a screenshot of you
te a sentence or two

X11 terminal and xeyes application.

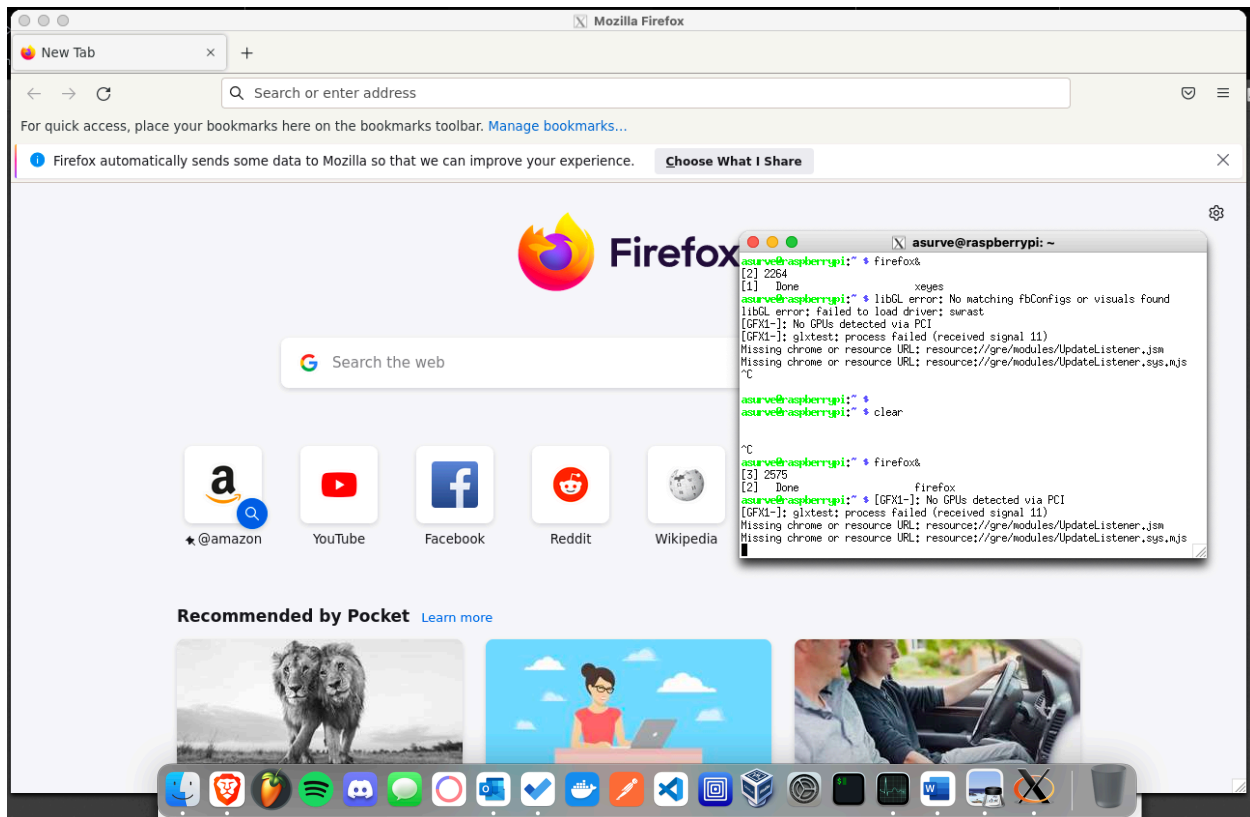


Activity monitor on my personal computer; the only process related to xeyes executing is XQuartz



Result of running `ps aux | grep xeyes` on raspberry pi. We can see that the xeyes process is originally running on the raspberry pi but is able to be displayed on my personal computer through XQuartz.

The xeyes application seems to display a pair of eyes that track the desktop cursor. Xeyes is executing on the raspberry pi, so the only process required to run on my personal computer is the XQuartz terminal.



Firefox ESR application displaying on personal computer, running through XQuartz

The taskbar does not show that Firefox is running because it is not natively running on my computer, instead the Firefox process running on my raspberry pi is being virtualized to be used on my computer. At the end of the xeyes and firefox commands, the '&' character indicated to keep the terminal available for additional commands after launching the X11 application.

Bonus question:

Client	Server	Server
Windows laptop	Raspberry Pi	Linux Apache Web Server
Broadcast on port 80	Port 80 forwarded to Pi	Listening on port 80