Project Student Start-Up Guide

(version of January 29, 2020)

1 Introduction

This document is aimed at getting project students started on their Astrophysics projects. Please keep this document safe, and or find out where you can get a new copy as you will need to refer to it at various stages in your project. Generally you can find a copy on the Astrophysics Group Local pages (URL at the end of this document).

Generally few astrophysicists and professional astronomers use Microsoft Windows for their research. This is because there is a lot of very useful software that was written long ago in languages like Fortran and C that cannot be easily ported to Microsoft Windows. However, the Linux operating system, and in some cases the Apple Mac operating systems can still run these programs. Newer software is written to run on Windows, Mac and Linux and the topcat software that many of you will use, is a good example of this.

We are using a Linux distribution (distro) called Scientific Linux (SL) which is developed at Fermilab and is used extensively at several large scientific labs, most notably CERN. Some aspects of Linux will look familiar to you, there is graphical window system which allows you to run web browsers such as firefox. You should also be able to read your university email from 2.20 machines and many of the software packages you use will have graphical interfaces. But it is still worth learning some Unix commands to make life easier. You may have attended a short course on Linux as part of the preparation for your project work, some of this document will repeat some information from that course. The link to the course can be found at the end of this document.

2 Security

We're mainly concerned with passwords here. Ideally a password should contain mixed case letters and at least one character that is not a letter nor a number. Do not share your password with anyone, not even your project partner. If you wish to change your UoB password, there is a URL a the

end of this document. Note that if you connect to machines using the SSH (secure shell) program, then all your network traffic is encrypted.

3 Disk Space

There is a dedicated disk for project student work and this is where you find yourself when you log in, this is called your home directory. A directory is similar to a folder on a Windows machine. For example, on the Linux machines in room 2.20, if your username is ac6033 then your home directory will be `/usersc/ac6033`. This is where you should store your files, but you are encouraged to create sub-directories, using the `mkdir` command, to organise your files. In the unlikely event that the disk fills up, more disk space may be available, consult the system manager. The command `df -h` will tell you how much space is left on the project disk (df is from disk free) and you can tell how much disk space you are using the `du -h` in your home directory (du is from disk usage).

We generally recommend that you use your home directory for work in progress, things like documents, downloaded papers, images, diagrams and so on. Raw and processed data should be kept on the /data/cluster disk which is much larger. Use a command like the following to create a data area on /data/cluster: `mkdir /data/cluster/Jane_and_Dave` then adjust the permission with `chmod 775 /data/cluster/Jane_and_Dave` to that both Jane and Dave can read and write files.

4 Backups

A backup process should run every night on the home directories. But please keep your own backups of anything important. Save text and diagrams to USB key or email them to your University email account and to any other email accounts you may have. You can also use cloud services such as google drive to keep copies of your data. A very easy way to store files that are accessible on other machines is via a service called Evernote. There is an app, or you can upload files to www.evernote.com.

You should not need to backup the raw data you are given, since that is the responsibility of your supervisor.

5 X Windows and Startup files

The Linux machines run windowing systems which are very configurable. There are two main desktop types which are called Gnome and KDE, you can choose which one to use from the setting button before you log in. The MATE desktop is a popular choice if it is available.

The program which interprets the commands that you type into a terminal is called the shell, and the two main types of shell are the Bourne (aka bash) shell and the C (aka csh) shell. They have different syntax if you write scripts and different setup files. Use the `.bashrc` file for the Bourne shell and the `.cshrc` file for the C shell. Most of the world uses the Bourne or bash shell which is the one you will run by default. Setup files for both types of shell should have been set up for by the system manager. If the command
`ls -al ~/.`
shows you do not have a `.cshrc` or `.bashrc` file, then contact the system manager. These files set sensible defaults for commands such as `rm` forcing it to prompt you before deleting files.

6 Astronomical Applications

Most astronomical applications will need to be started from the command line, for example, you should type `gaia` in a terminal window to start up the gaia tool. Other useful programs are `ds9` and `topcat`. Some applications, such as OpenOffice can be started from the menu button at the bottom left of the screen.

7 Useful Web Pages

The astronomy group run a webserver whose address is given at the end of this document. Some web pages are visible to the whole Internet, some are only visible to machines within the Astro group. The 'Local documentation pages will be useful to you as will the 'Astronomy links' section. One very useful website is the NASA Astrophysics Data System (known as ADS) which allows you to search all the astronomical journals by keyword or author: this will be invaluable for your project research. No other reference tools are required, ADS does it all. Note that you will only be able to download recent papers from computers within the University for subscription reasons. Another useful site is SIMBAD (URL at end) which enables you

to search journals for references to galactic objects by their astronomical coordinates. Similarly IPAC performs a similar function for extragalactic objects (URL at end).

8 Printing

Printing is via the UoB print release service. There may be other printers available, check with your project supervisor. There is a Canon print release printer in the Library. You can print text and postscript documents only from the command line using the command `lpr`. E.g. to send postscript graphics file test.ps to the default printer

```
lpr test.ps
```

Do not send anything other than plain text or postscript files to the printer, you can print PDF files, gif files and so on from the appropriate application.

8.1 Transparencies

It is unlikely that you will need these but... Laser printing is a heat based process. Do not try to use inkjet printer transparencies in a laser printer, they will melt and an expensive printer repair will be required. Laser printer transparencies should be clearly marked as such, inkjet ones often have one rough side and one smooth side. If in any doubt, check with the system manager

9 Removable Media

All machines have DVD/CD drives and USB sockets (which are sometimes on the back of the machine). To see the contents of a CD or USB device, an icon should appear on your desktop when you insert the CD or USB device. If the folder does not appear on your desktop, look in the `/media` directory to see if your device is there. You may have to use the commands

```
ls /media
mount /media/usbdisk
```

or similar to mount the device. You can then use the file manager or `ls, cp, mv` and `rm` commands to manipulate your files. If the folder did appear, don't

forget to right click on the icon that appears on you desktop and selecting 'umount' to unmount it before unplugging it, or you risk data corruption. To do this manually,

```
umount /media/usbdisk
```

or whatever your device was called, to flush your data to the USB device before unplugging it.

10 Editing Files

There are many, many editors available, a good one to get started on is `gedit`. The most popular and powerful are `emacs` and `vi`. Other editors include `nedit`, `gedit` and `pico`.

11 Programming and Running Programs

The Python and Perl languages are installed on all the computers in 2.20 and compilers are also available for `FORTRAN`, `FORTRAN90`, `C`, `C++` and `java`. The Astronomy group has access to a language called `IDL` which is a commercial language designed for image processing. You can find tutorials using a search engine.

Most programs you run will take a few seconds. Occasionally you will need to run a program for longer periods. Before running a program, check how busy your machine is by using the `top` command and looking at the load level numbers. Each running program is called a process. You can stop programs running using the `kill` command. You need the process id (the PID) of the program to do this. A useful example is Firefox. When Firefox behaves oddly, it is often because there are other defunct instances of the program running on the machine. Use the `ps` command to find the PIDs of processes belonging to Firefox, then type `kill 7938 26879 6517` or whatever the process numbers were to terminate those processes. Sometimes, stubborn processes will require `kill -9`. Note that for obvious reasons you will only be able to kill your own processes. If you spot rogue processes belonging to other users, please inform the system manager.

12 Specialist software

The Starlink Software Collection (SSC) contains many programs that may be useful for data reduction (see google for documentation). The latest versions of IRAF (optical/X-ray data analysis) and AIPS (radio data analysis) are also installed. A large variety of other software is available, consult your project supervisor or the system manager for details. We also have access to commercial packages such as Mathematica, Maple and Matlab.

13 Remote Access

One of the great advantages of Unix is remote access. For security reasons, every machine is not visible to everybody on the open internet. If you want to remotely run commands on the Calgary machines in room 2.20, then you can use a ssh client to log on to `seis.bris.ac.uk` with your UoB credentials then ssh from seis to calgary.phy.bris.ac.uk. If you are running a VPN program (URL at end), you can login directly to calgary from outside the University. This allows you to type commands as if you were sitting at one of the machines in 2.20. If you want to use graphical programs, then this is possible too using a technique knows as 'X forwarding', or you could run a remote desktop.

If there are no spare computers in room 2.20, you can use Windows computers to access the calgary server. There is link to a web page explaining this at the end of this document. You can also do remote desktopping to our systems, see the local notes on (and google) x2go.

14 File Transfer

You can copy programs and data back and forth to Windows machine using the `winscp` program (URL at end). You may have to copy files via seis.bris.ac.uk if you are not using the VPN. The command to copy files to another Linux machine from the command line is `scp`

You can also copy your files to a cloud service like google drive or icloud which makes them accessible from everywhere. You could also use a program such as evernote to export images and text.

15 Reading Email

You can read your University email using `firefox`, possibly `chrome` using the webmail system.

16 Writing Reports

Astronomers tend to use an editor such as `xemacs` to create a document which is run through a processor called LaTeX and guides and cookbooks are available. However, project students may prefer to use departmental or home machines running Windows to write reports. This should not be a problem as diagrams, text and data can be exported from Linux to Windows, as explained previously. Please don't try to learn latex the night before your final report submission, this is not a wise thing to do. If you're going to use a new system for writing up your report, make sure you allow plenty of time to learn it.

17 Obtaining Help

Your project supervisor should be able to help with astronomical questions. For computing problems, you should contact the Starlink system manager Dr Rhys Morris preferably using using email (`R.Morris@bristol.ac.uk`). Please also send suggestions for improvements to this document to the same address.

18 Useful URLs

```
Astro Group Home Page
http://www.star.bris.ac.uk

Astro Group Local Pages (visible within the University and via VPN)
http://www.star.bris.ac.uk/local/

Unix/Linux tutorial:
//www.star.bris.ac.uk/unixtut

Uob Password Change:
```

```
http://www.bris.ac.uk/password

putty:
http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html

Winscp
http://www.winscp.net

Xming
http://sourceforge.net/projects/xming/

x2go:
http://www.x2go.org

Astrophysics Data Service (ADS)
http://adsabs.harvard.edu/abstract_service.html
or
http://ukads.nottingham.ac.uk/abstract_service.html

SIMBAD (all known galactic objects)
http://simbad.u-strasbg.fr/Simbad

NASA/IPAC Extragalactic Database - NED
http://nedwww.ipac.caltech.edu/

University of Bristol VPN software:
https://www.bris.ac.uk/it-services/advice/homeusers/uobonly/uobvpn/howto

Using xming and putty to display graphics from a remote Linux machine
to a windows desktop:
https://www.bris.ac.uk/it-services/locations/fits/science/putty_xming
https://www.youtube.com/watch?v=YLAYfwUPj7s

Using x2go remote desktop:
https://www.youtube.com/watch?v=7fgHDflEKL0
```

Finally, enjoy your project!

Last update by Rhys Morris on January 29, 2020.