



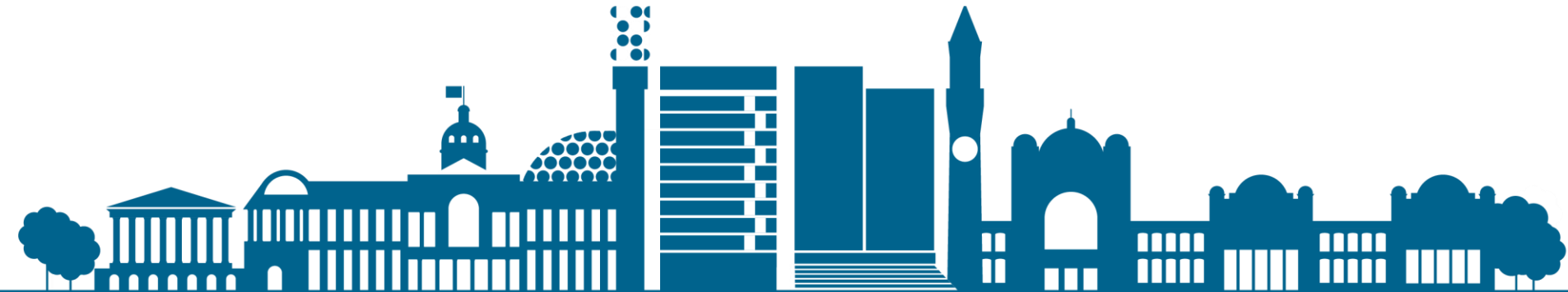
UNIVERSITY OF
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Introduction to Linux



March 2021

<http://intranet.birmingham.ac.uk/bear>



Housekeeping

- Today's workshop – a mixture of us talking and hands-on activities
- Ask questions as we go along via the Chat box or raise your hand
- Refreshment/comfort break during workshop
2
- Feedback – Zoom poll



Overview

□ Section 1

- Using Linux with BlueBEAR
- Understanding the BlueBEAR workflow
- Accessing BlueBEAR

Workshop 1
Logging into BlueBEAR
(10 mins)

□ Section 2

- Creating files

□ Section 3

- Basic Linux commands
- File management

Workshop 2
Directories and files
(20 mins)

Break – 10 mins ~10:50 am

□ Section 4

- File permissions
- Write and run a simple program

Workshop 3
Write & run a program
(20 mins)

□ Section 5

- Next steps and other BEAR services



Courses - Modular

First steps

- Intro to Linux (Canvas)
- Intro to Linux (f2f)
- LinkedIn courses

Intermediate

- Introduction to BlueBEAR
- Python
- R
- Git
- NVIDIA
- MATLAB

Further steps

- C ++





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Introduction to BlueBEAR

- Section 1



What is BEAR?

- <http://intranet.birmingham.ac.uk/bear>
- Birmingham Environment for Academic Research
- BEAR is a collection of services: HPC, storage, fast networking, ...
- BlueBEAR refers to the Linux High Performance Computing (HPC) environment
- BEAR services are FREE at the point of use



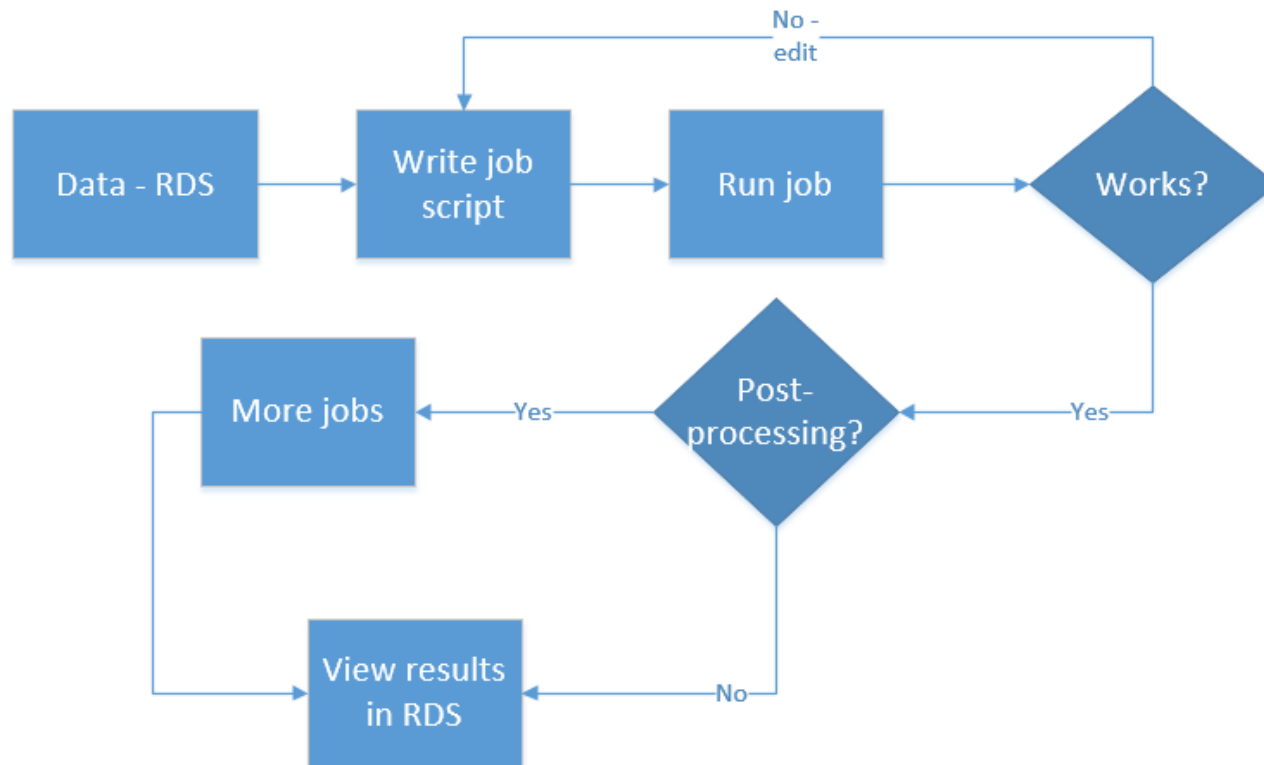
BlueBEAR

- ❑ Users need to register to use the service
- ❑ Users are attached to (multiple) projects
- ❑ Projects are created by staff and are for 5 years
- ❑ Projects are used to account for time on the cluster
- ❑ Registrations are via:

<https://intranet.birmingham.ac.uk/it/teams/infrastucture/research/bear/bluebear/bluebear-registration.aspx>



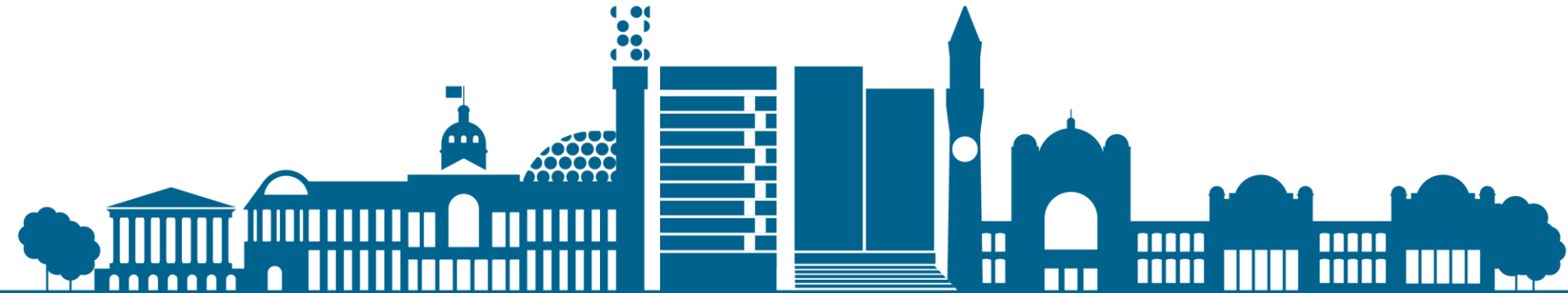
BlueBEAR Workflow





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Accessing and using BlueBEAR



About Linux

- ❑ The interface used for BlueBEAR – how we connect to it and tell it what to do
- ❑ It's a huge subject; we are only covering the basics
- ❑ There are often multiple ways of doing things



Accessing BlueBEAR

- ❑ You must register for access to BlueBEAR
- ❑ You will need an SSH (Secure Shell) client (e.g. PuTTY); Mac users - Terminal
- ❑ You can connect to the cluster from the University network or via Remote Access Service (apply via ServiceDesk)
- ❑ Use your normal University (ADF) username and password
- ❑ Interface is command line
- ❑ X service for graphical applications, e.g. Exceed, XQuartz (Mac)



Logging in from a Mac

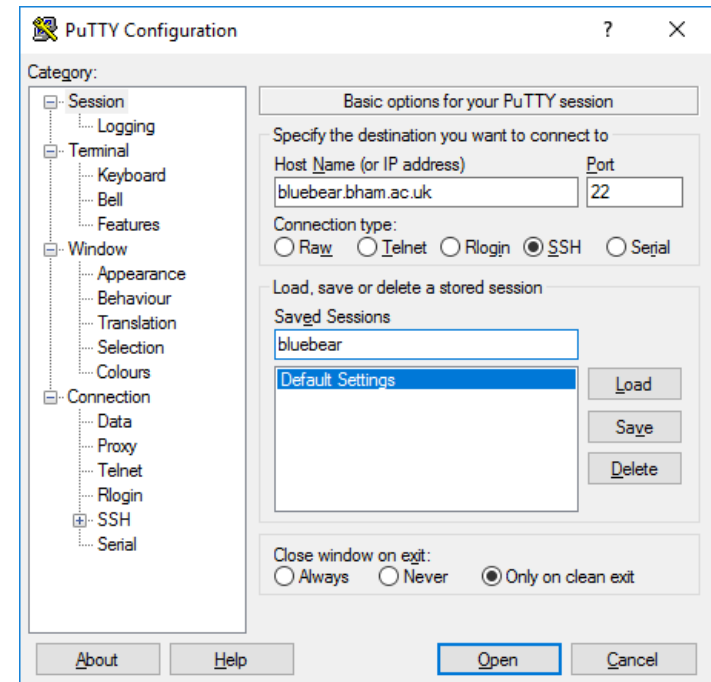
- ❑ Open iTerm or Terminal
 - Finder window – Applications>Utilities
- ❑ To connect to the training VM type:
- ❑ For connecting to BlueBEAR after the course type:

```
ssh <username>@172.31.11.62
```

```
ssh <username>@bluebear.bham.ac.uk
```



Setting up PuTTY



❑ **Host name:** 172.31.11.62 (training server)

❑ **Saved Sessions:** bluebear training

❑ **Instructions here:**

<https://intranet.birmingham.ac.uk/it/teams/infrastructure/research/bear/bluebear/accessing-bluebear-using-putty-and-exceed.aspx>



Workshop 1 – setting up and logging in

Time: 10 minutes

- Log in to the Remote Access Service
- Open and set up PuTTY
- Log in to BlueBEAR training - 172.31.11.62



Section 2 -

Creating files



The Command Line

- ❑ Type in commands
- ❑ Commands, Files and programs are Case-Sensitive
- ❑ Spaces are key – get them in the right place
- ❑ You type commands into a program called the “shell” – `bash` is the default
- ❑ Text can be copied from other sources, e.g. Notepad



Directories and files

- ❑ Unlike Windows there are no “drives” (i.e. no ‘C:\’, ‘D:\’, ‘U:\’ etc.)
- ❑ Everything exists under a directory, ‘/’, called the root directory.
- ❑ Useful directories to know:
 - ‘`/rds/homes/u/username`’ – each user usually has a directory here with their own files in it, known as their ‘home directory’. 20 GB. For settings, user environment files (files that start with a dot).
 - RDS (`/rds/projects/p/project_title`)
 - ❑ Should be used for all data, job scripts, output etc.



Finding Applications

- ❑ A path is where the system looks to find programs (Not where you walk!)
`echo $PATH`
- ❑ These are already set up on BlueBEAR
- ❑ Command not found means the program isn't in your path



Creating a file - nano

- ❑ From the command prompt type `nano`
- ❑ Runs in the terminal window
- ❑ Enter text
- ❑ Commands are at the bottom of the screen –
`ctrl+letter`, e.g. `ctrl+w` to find (“Where
Is”), `ctrl+x` to exit
- ❑ `ctrl+o` to save (“WriteOut”), enter a file
name, press enter
- ❑ Alphanumeric filenames
- ❑ See Canvas course for graphical interface -
Exceed



nano

carterdj@trainingvm-ghumraak-bear-training:~

GNU nano 2.3.1 New Buffer

^G Get Help ^O WriteOut ^R Read File ^Y Prev Page ^K Cut Text ^C Cur Pos
 ^X Exit ^J Justify ^W Where Is ^V Next Page ^U UnCut Text ^T To Spell



Section 3 – Commands



Basic file commands:

- `ls`

list files

(don't delete
ones starting with . !)

- `ls -l`

list files with detail

- `cd`

change directory

- `pwd`

print current (working) directory

```
carterdj@trainingvm-ghumraak-bear-training:~/testing
login as: carterdj
carterdj@172.31.11.62's password:
Last login: Sun Mar  4 12:39:41 2018 from f5vpn-staff-snat.bham.ac.uk
Welcome to training VM!
You will learn to use Linux here.
[carterdj@trainingvm-ghumraak-bear-training ~]$ ls
ls.output  script  simple_script  testfile.txt  testing  welcome
[carterdj@trainingvm-ghumraak-bear-training ~]$ cd testing
[carterdj@trainingvm-ghumraak-bear-training testing]$ ls
bearcloud  bluebear  README  storage  test1
[carterdj@trainingvm-ghumraak-bear-training testing]$ pwd
/rds/homes/c/carterdj/testing
[carterdj@trainingvm-ghumraak-bear-training testing]$
```



Basic file commands:

```
[carterdj@trainingvm-ghumraak-bear-training testing]$ ls
bearcloud bluebear README storage test1
[carterdj@trainingvm-ghumraak-bear-training testing]$ cat README

Welcome to the Introduction to Linux course!

This course is designed to give you the basic Linux knowledge to use BlueBEAR and
prepare you for the Bear Necessities training course.
I hope you will find the course useful. Please log a call with the ServiceDesk if
you have any queries.

Debbie
BEAR Team
[carterdj@trainingvm-ghumraak-bear-training testing]$
```

□ Basic file commands:

`cat filename`

view the contents of a file, better for smaller files

`head filename`

watch the start of file as it grows

`tail -f filename`

watch the end of file as it grows



Command syntax

- Commands are used to tell the computer what you want it to do, e.g.
ls [option(s)] [file(s)]
- Use the manual (man) or Google to see options

Command	Options	Arguments
What you want to do	Information that alters the behaviour of the command	File name or other data that is needed by the command
ls	-l	filename

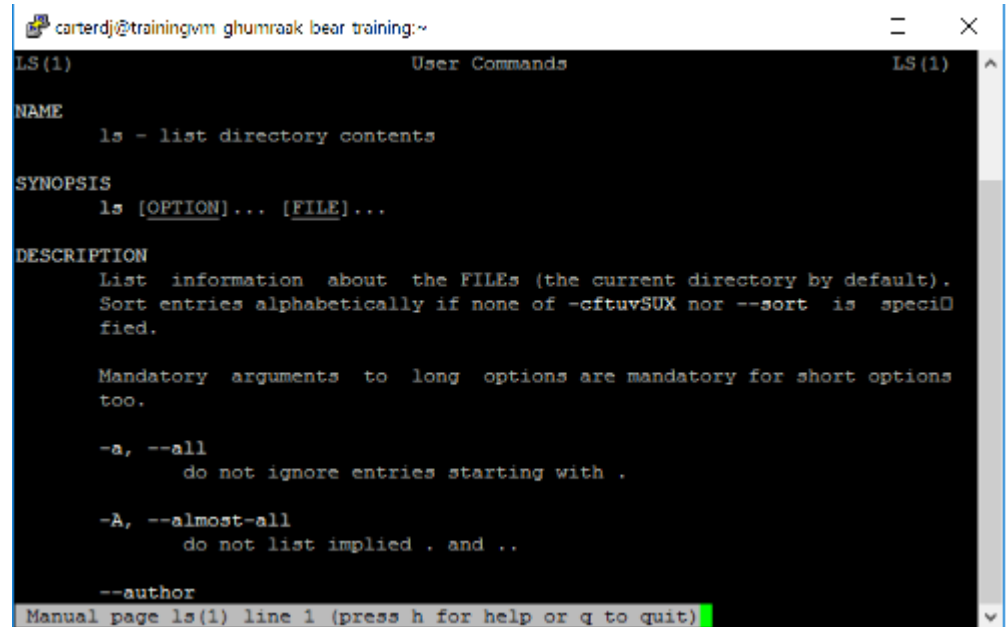


Help? How do I use this command?

- ❑ Each command *should* have a manual page for it.
 - To view it type `man command`, e.g. to view the manual for the `man` command type:

`man man`

- ❑ Press `q` to quit, use the arrow keys to scroll



The screenshot shows a terminal window titled 'carterdj@trainingvm ghumraak bear training:~'. The terminal displays the manual page for the 'ls' command. The content is as follows:

```
LS(1)                                User Commands                                LS(1)
NAME
    ls - list directory contents

SYNOPSIS
    ls [OPTION]... [FILE]...

DESCRIPTION
    List information about the FILES (the current directory by default).
    Sort entries alphabetically if none of -cftuvSUX nor --sort is speci0
    fied.

    Mandatory arguments to long options are mandatory for short options
    too.

    -a, --all
        do not ignore entries starting with .

    -A, --almost-all
        do not list implied . and ..

    --author
```

At the bottom of the terminal, a status bar reads: 'Manual page ls(1) line 1 (press h for help or q to quit)'.



Tips and tricks on the command line

- ❑ Press the **up arrow** and you will see your previous commands, so can use them again
- ❑ Type `history` at the command prompt and you will see the history of what you have typed and re-run commands
- ❑ The '**tab**' key is magic, pressing it:
 - once: complete the current command or filename if there is one match
 - twice: list all the matching options if there is more than one match
- ❑ `CTRL+c` or `q` will return you to the command (\$) prompt
- ❑ `cd ~` returns to home directory
- ❑ `clear` clears screen and returns to \$ prompt
- ❑ to **paste text into PuTTY**, copy it from the source location, then right click in PuTTY and the text will be pasted



File management:

- Basic directory management commands:

`mkdir newdirectory`

create directory

- `rmdir directory`

remove directory (only works if directory is empty). Note there is no warning/confirmation message!

```
[carterdj@trainingvm-ghumraak-bear-training ~]$ ls
ls.output  script  simple_script  testfile.txt  testing  welcome
[carterdj@trainingvm-ghumraak-bear-training ~]$ mkdir matlab
[carterdj@trainingvm-ghumraak-bear-training ~]$
```



Organising files:

□ Basic file management commands:

- `touch file`
create an empty file
- `rm file`
remove a file (there is no recycle bin!)
- `cp file newfile`
copy a file (creates a duplicate)
- `mv file newfile`
move a file (renames the file)



Editing files

- If a file has been created in Windows, you can use dos2unix to make it Linux-friendly
 - Windows files use different line endings

```
dos2unix ~/filename
```

- Lots of editors under Linux
 - nano is a basic, easy to use one
 - Others – joe, vim, emacs



Editing files

□ View and edit a file:

- Check the contents of the file:

```
cat filename
```

- Edit the file in nano:

try CTRL+k, CTRL+u, CTRL+w to
see what they do



A useful tool

□ **grep string filename** –

to search for alphanumeric or numeric characters in a specific file

- Look for number of occurrences in the file

e.g. bear

```
grep bear README
```

- What does

```
grep -ic bear README do?
```



A cautionary tale....

How Toy Story 2 almost got deleted!



Workshop 2 – directories and files

Time: 30 minutes (including break)

- ❑ Copy some existing directories/files using this:

```
cp -r /rds/projects/2017/ghumraak-bear-training/testing/ .
```

- ❑ View the example file **bearcloud** (in `testing` directory)
- ❑ Create a directory called **username_test**
- ❑ Create a file in nano or your preferred editor, add some content, save and close
- ❑ Edit the file
- ❑ List your files
- ❑ View the contents of the file(s) you created
- ❑ Advanced exercises – in Canvas



Section 4 –

File permissions



File permissions:

- Files (and directories) can have different permission sets for groups and users

Files	Directory
r – read the file	r – list contents of directory
w – write to the file	w – create new files/folders
x – execute (run)	x – traverse (e.g. cd to directory)

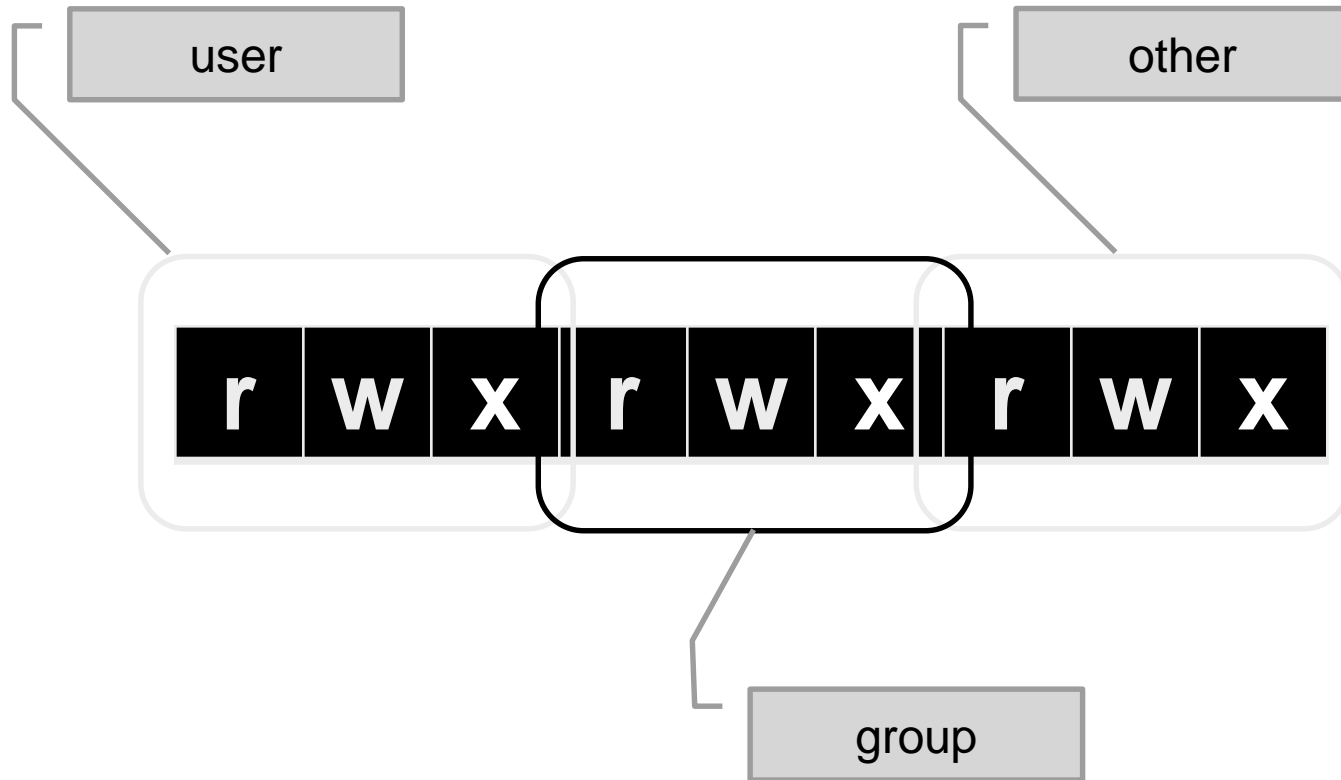


Example file permissions:

- Try doing
`ls -ld ~/`
- The command (`ls -l`) shows permissions on home directory

Permissions			Size of file				File or directory name
drwxr-xr-x	2	ghumraak users	4096	Nov	8	12:22	bearwiki
d---r-xr-x	2	ghumraak users	4096	Jan	4	2016	Documentation
-rw-r--r--	1	ghumraak users	83	Nov	12	15:42	file1
drwxr-xr-x	6	ghumraak users	16384	Jan	30	2016	jre1.8.0_73
-rw-r--r--	1	ghumraak users	71759339	Feb	23	2016	jre-8u73-linux-x64.gz
drwxr-xr-x	2	ghumraak users	4096	Nov	16	08:38	matlab
-rw-r--r--	1	ghumraak users	482322	Jun	9	2015	Research Data Storage v1.4.docx
-rw-r--r--	1	ghumraak users	14	Jul	21	2015	test-01.txt
-rw-r--r--	1	ghumraak users	0	Aug	20	2015	test-02.txt
-rw-r--r--	1	ghumraak users	58	Nov	12	14:20	test.sh





Scripts

- Allow series of commands to be repeated
- Can pass arguments in, use variables etc.
- Need to be “executable” to run from command line
- First line shows the “interpreter” (or shell) to use, e.g.
 `#!/bin/bash`
- Objective is to get it to run!



Scripts

1. Use a text editor, e.g. nano to create a new script file:
 - Set the shell in the first line `#!/bin/bash`
 - Use the echo command to print some text on screen eg. `echo "Hello Linux world"`
 - Save the file
2. Make it executable (`chmod`) – to get the right permissions to run it – e.g. `chmod u+x scriptname`
3. Run the script
`./scriptname`



Workshop 3 – writing a program, running a script

Time: 20 minutes

- ❑ `cd /rds/projects/2017/ghumraak-bear-training/`
- ❑ View the example program **simple_script**
- ❑ Return to home directory `cd ~`
- ❑ Write a basic program to say “Hello ‘[your name]’, welcome to the Introduction to Linux workshop”
- ❑ Run the program
- ❑ Look at file permissions for the program



Example script – input1

```
#!/bin/bash
```

```
read -p 'Enter Your Name:' name  
echo  "Hello $name, Welcome to the  
Introduction to Linux (for using  
BlueBEAR)  workshop"
```



Example script – input2

```
#!/bin/bash
```

```
echo -e "What do you think of Bash?"
```

```
read reply
```

```
echo "You said $reply"
```

```
echo
```

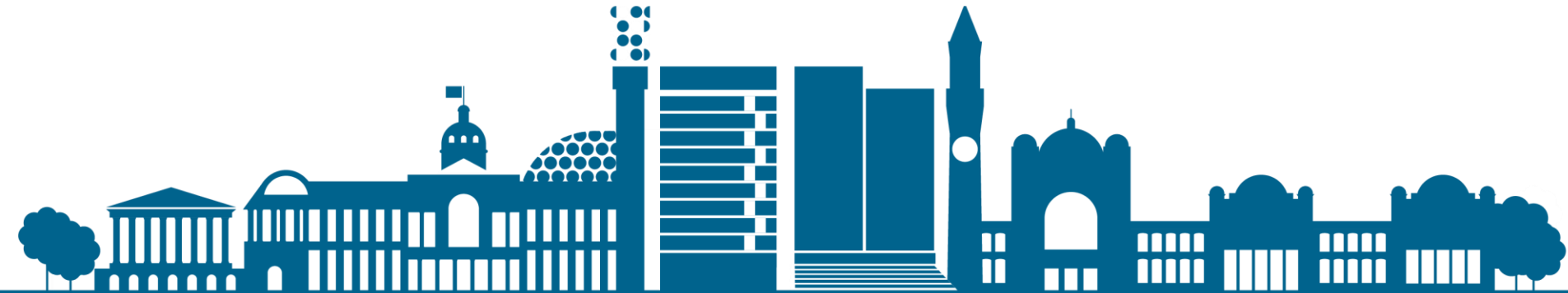




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Section 5 -

Other BEAR services and further information



Next steps – further Linux

- ❑ Online resources - LinkedIn Learning Linux:
 - ❑ <https://www.w3resource.com/linux-system-administration/linux-commands-introduction.php>
- ❑ Software Carpentries Linux course:
<https://bham-carpentries.github.io/shell-novice/>
- ❑ Introduction to BlueBEAR:
<https://intranet.birmingham.ac.uk/it/teams/infrastructure/research/bear/bear-training/necessities.aspx>
- ❑ BEAR Training Page:
<https://intranet.birmingham.ac.uk/bear-training>



Other BEAR Services

- ❑ **Research Data Store (RDS):** FREE storage for research projects (up to 3TB per project)
- ❑ **BEAR DataShare:** file synchronisation and sharing service – like Dropbox
- ❑ **BEAR Large Data Transfer:** Ability to share and receive large amounts of data
- ❑ **BEAR GitLab:** version control
- ❑ **BEAR Cloud:** local high-performance cloud computing integrated with campus services
- ❑ **BEAR Software:** free advice/help from BEAR Research Software Engineers
- ❑ **Training:** Software Carpentry – Python, R, MATLAB; deep learning, C++
- ❑ ... and more at <https://intranet.birmingham.ac.uk/bear>



BlueBEAR Portal

- <https://intranet.birmingham.ac.uk/bear/portal>
- Pilot service allowing web-based, graphical interface access to a limited but expanding no. of applications including:
 - JupyterLab
 - RStudio
 - MATLAB
 - Stata
- Still need access to a BlueBEAR project
- Needs Remote Access VPN when off-campus

BlueBEAR OnDemand Files Jobs Clusters Interactive Apps My Interactive Sessions

Home / My Interactive Sessions / RStudio Server

Interactive Apps

- Data Science
- JupyterLab
- RStudio Server**
- GUIs
- ANSYS Workbench
- Abaqus
- MATLAB
- ParaView
- Stata
- Servers
- Code Server

RStudio Server version: f786dfc

This app will launch **RStudio Server** an IDE for R on the **BlueBEAR cluster**.

BEAR Project

ghumraak-rescomp-engagement

Please select the BEAR Project to which the job will be attached to.

Number of hours

1

Queue

bbdefault

- Please select the Queue/QoS where your job will run. If you have multiple BEAR projects, only some of them may have access to the resources listed.
- **bbdefault (1-40 cores)** Use any available standard BlueBEAR node. This reduces the wait time as there are no node requirements.

Number of cores

1

Number of cores on node type (4 GB per core unless requesting whole node).

R version

3.6.2

This defines the version of R you want to load.

☐ Include Bioconductor?

Should the **Bioconductor** module be included in the R environment.

☐ Include Cellassign?

Should the **Cellassign** module be included in the R environment.

☒ I would like to receive an email when the session starts

Launch



Special Interest Groups

- SIGs for (currently):
 - CCB Seminar (Bioinformatics)
 - Computational Fluid Dynamics (CFD)
 - Finite Element Method (FEM)
 - MATLAB
 - Stata
 - Materials Simulation and Modelling

<https://intranet.birmingham.ac.uk/collaboration/hpc-research/index.aspx>



Help is available

If you're having any problems visit the IT Service Desk in a web browser:

<https://universityofbirmingham.service-now.com/>

Canvas course – self-register –

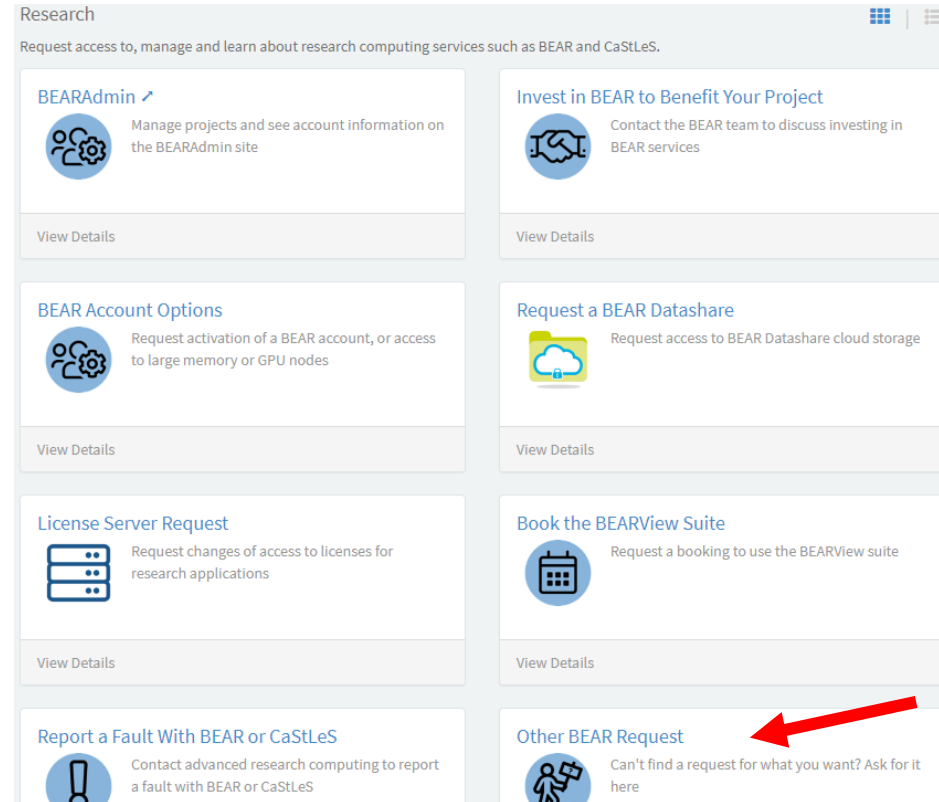
<https://canvas.bham.ac.uk/enroll/6MPPJW>

Regular drop-in sessions –

<https://intranet.birmingham.ac.uk/bear-drop-in>

Join our mailing list –

Email bearinfo@contacts.bham.ac.uk



The screenshot displays a web portal titled "Research" with a subtitle "Request access to, manage and learn about research computing services such as BEAR and CaStLeS." The portal is organized into a grid of service tiles, each with an icon, a title, a brief description, and a "View Details" link. A red arrow points to the "Other BEAR Request" tile in the bottom right corner.

Service	Description
BEARAdmin	Manage projects and see account information on the BEARAdmin site
Invest in BEAR to Benefit Your Project	Contact the BEAR team to discuss investing in BEAR services
BEAR Account Options	Request activation of a BEAR account, or access to large memory or GPU nodes
Request a BEAR Dataspace	Request access to BEAR Dataspace cloud storage
License Server Request	Request changes of access to licenses for research applications
Book the BEARView Suite	Request a booking to use the BEARView suite
Report a Fault With BEAR or CaStLeS	Contact advanced research computing to report a fault with BEAR or CaStLeS
Other BEAR Request	Can't find a request for what you want? Ask for it here



Questions?

