

Data

Introduction to Unix for HPC

Unit 1: Making a move (using FTP)

Goals:

- Can login via Secure FTP and see home directory.
- Can transfer a file from local machine via FTP to home directory.
- Understands the difference between DOS and UNIX formats.
- Can convert files between DOS and UNIX formats.
- Can transfer a file created on the server back to local machine.

The Problem

- We can interact with the command line over SSH.
- We can create directories (folders), move between them.
- We can create files and move them around, delete them, etc.
- We can run a program and get some output.

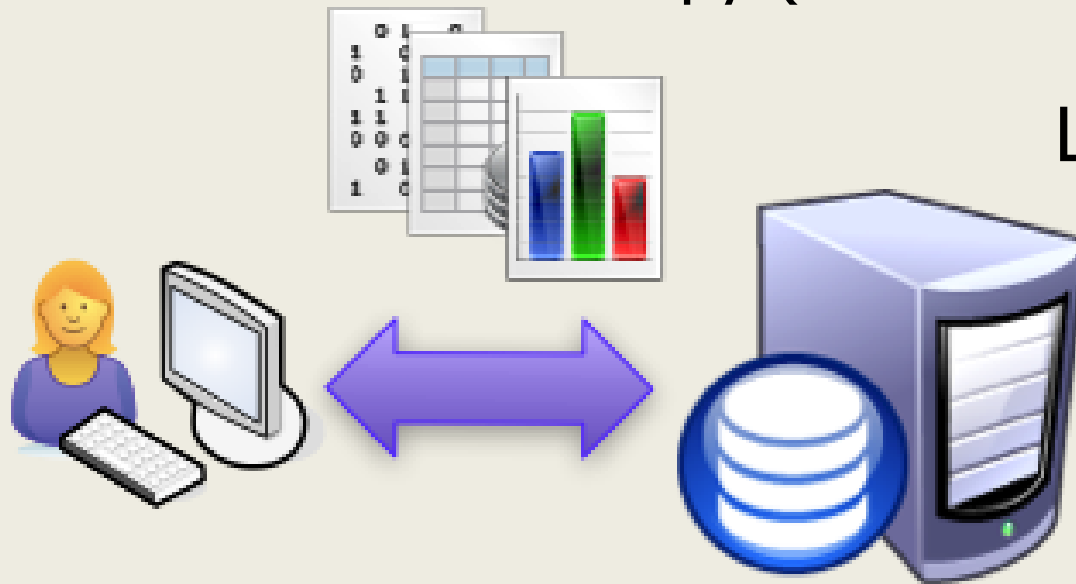
But how can we

- Upload files, say our datasets, to the HPC machine?
- Download files, say the results of our analysis, from the HPC machine for further analysis locally?



The Solution

- Well there are two to choose from:
 - FTP = File Transfer Protocol
 - SCP = Secure Copy (covered later)



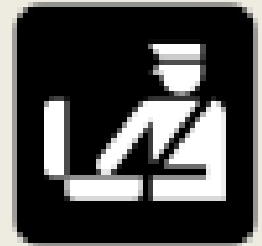
FTP Client

FTP Server

Let's start with FTP

Connecting to an FTP Server

- The HPC training machine runs an FTP server.
- To connect to it you need an FTP client, such as FileZilla.
- You tell the client which server to connect to:
octane.intersect.org.au
- Port: 22
- You authenticate with your username and password.
- All FTP communication to the HPC machine is secure.

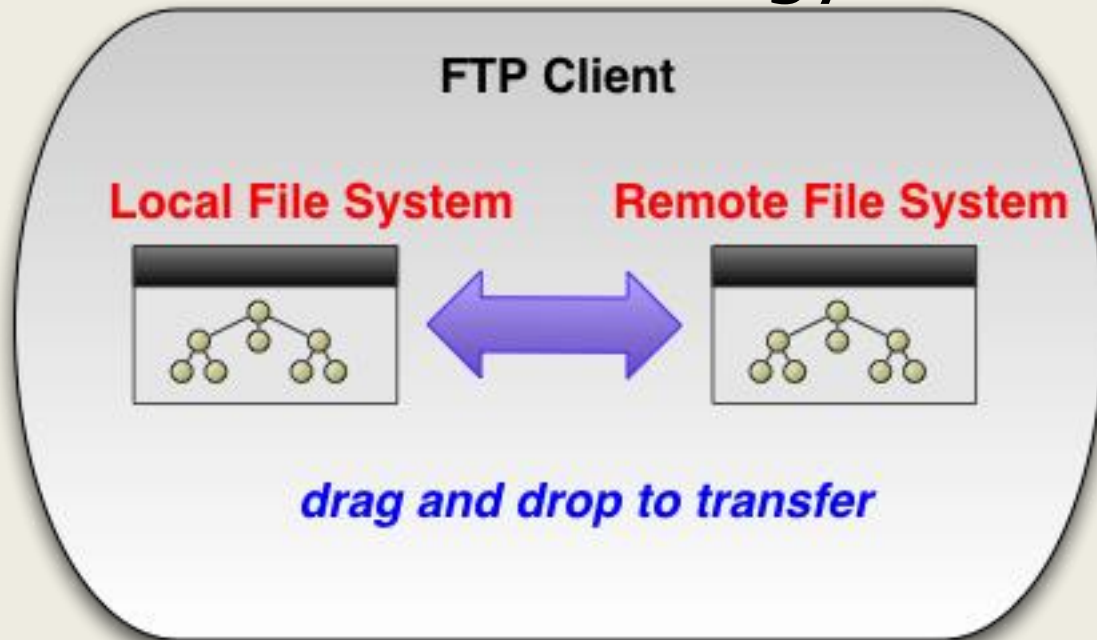


Exercise 1(a)

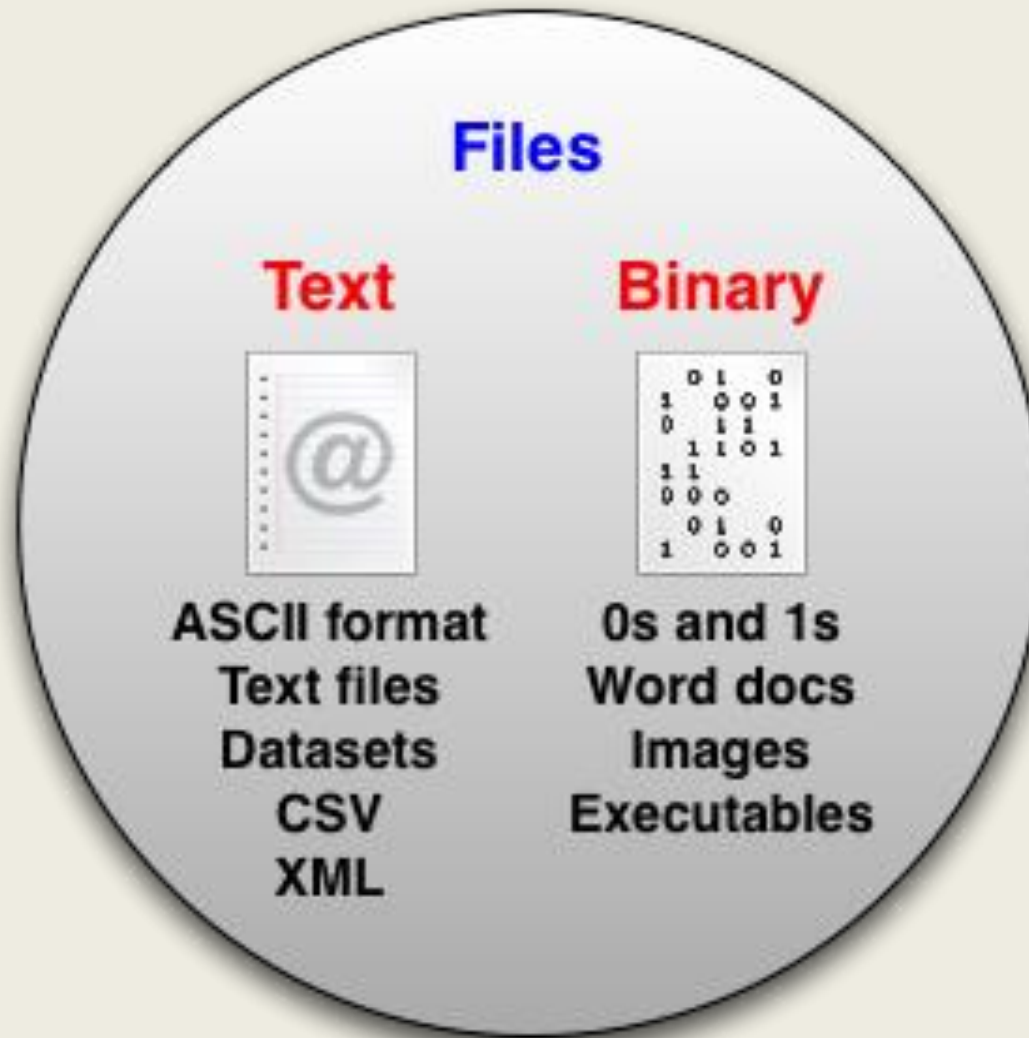
Connecting to the training HPC machine

Transferring Files

- In the exercise to follow, we'll stick to using FileZilla, but most graphical FTP programs follow this analogy:



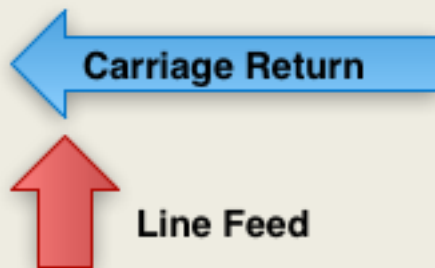
Text Files vs Binary Files



Text Files



Teletype Machine



- Text files contain special **non-printing** characters to signify new lines.
- Some systems use two characters:
 - Carriage Return (CR)
 - Line Feed (LF)
- Others use just one:
 - Line Feed (LF)

CR + LF

Line 1	<CR><LF>
Line 2	<CR><LF>
Line 3	<CR><LF>
Line 4	<CR><LF>
Line 5	<CR><LF>

**DOS
Windows**

LF

Line 1	<LF>
Line 2	<LF>
Line 3	<LF>
Line 4	<LF>
Line 5	<LF>

**Unix
Linux
Mac OS X**

- Because the training HPC machine is a Linux machine and our local machines run Windows, we need to convert our text files.

Exercise 1(b)

Creating and Transferring files

Command	Description
file <file>	Determines the file type of <file>
dos2unix <file>	Converts files from DOS/MAC to UNIX text file format
recode <file>	Converts files between various character sets and surfaces, e.g. from UNIX to DOS
recode latin1..dos <file>	Converts file <file> to DOS format

Unit 2: The Second Date (using SCP)

Goals:

- Can use `pscp` to upload multiple files at once.
- Can use `pscp` to download multiple files at once.

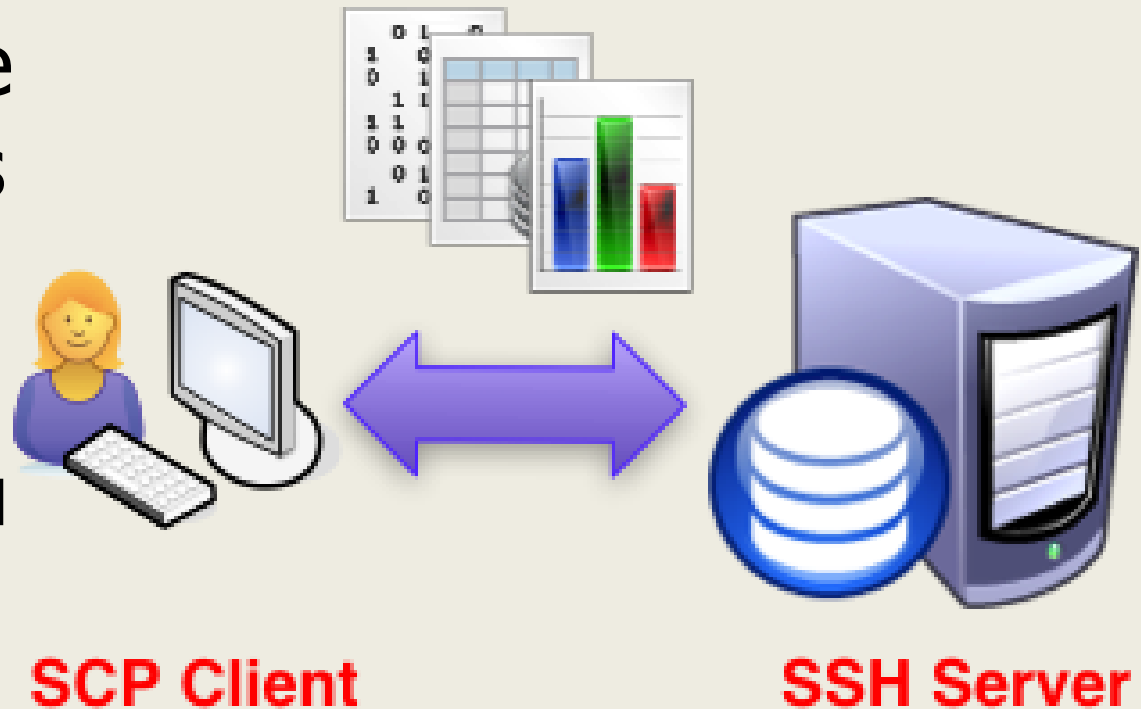
SCP and PSCP

- Secure Copy (**scp**) is another way to transfer files to and from the HPC machine.
- Like SFTP, it is secure.
- Unlike SFTP, we'll be invoking it from the Windows command line
- SCP is non-interactive and, therefore, it can be **scripted**.



SCP vs SFTP

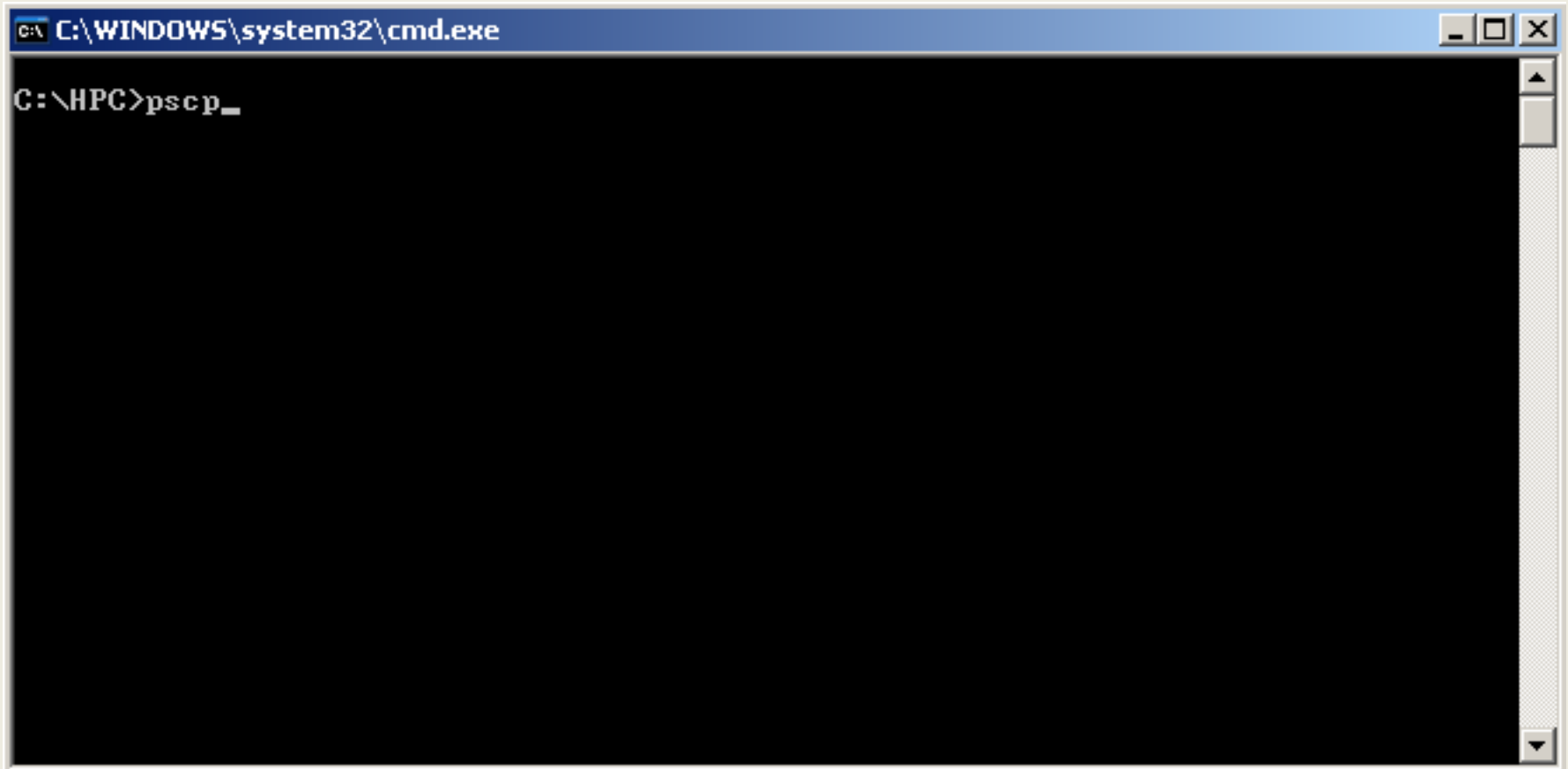
- SCP does the same task as SFTP.
- Use whichever tool you feel more comfortable with.



PSCP – An SCP Client

- Putty comes with an SCP client `pscp.exe` – Putty Secure Copy.
- We'll be using PSCP in the exercises.
- To use it we need to open a **Windows Command Prompt**.
- An easy way to do this is to select *Run...* from the Start menu and type `cmd`. Then click *OK*.

Windows command prompt



PSCP Syntax

- Transfer file from local machine to the HPC machine:

```
pscp <file_name.ext> <user_name>@octane.intersect.org.au:<dest_dir>
```



The local file
you want to
copy



Your training account user
name



Where you
want the file to
go on the HPC
machine

Exercise 2(a)

Transferring files from your local machine to the training HPC machine using PSCP

Command	Description
echo %PATH%	DOS command to show the value for the PATH variable
set PATH=<path>	DOS command to set the value for the PATH variable equal to <path>
cd <directory>	DOS command to change the directory to <directory>

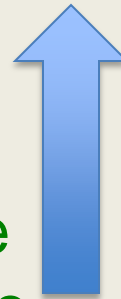
PSCP Syntax

- Transfer file from the HPC machine to your local machine:

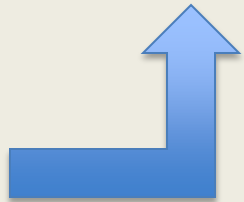
```
pscp <user_name>@octane.intersect.org.au: <path/to/file_name.txt> .
```



Your training
account
user name



The path on the
HPC machine to
the file you want to
copy



Where to put
the file locally.
In this case "."
for the current
working
directory

Exercise 2(b)

Transferring files from the training HPC machine to your local machine using PSCP

Command	Description
<code>mkdir <directory></code>	DOS command to create a directory called <directory>

Unit 3: (W)get it on!

Using Wget

Goals:

- Can use the basic `wget` syntax to download a dataset from the web.

The Problem

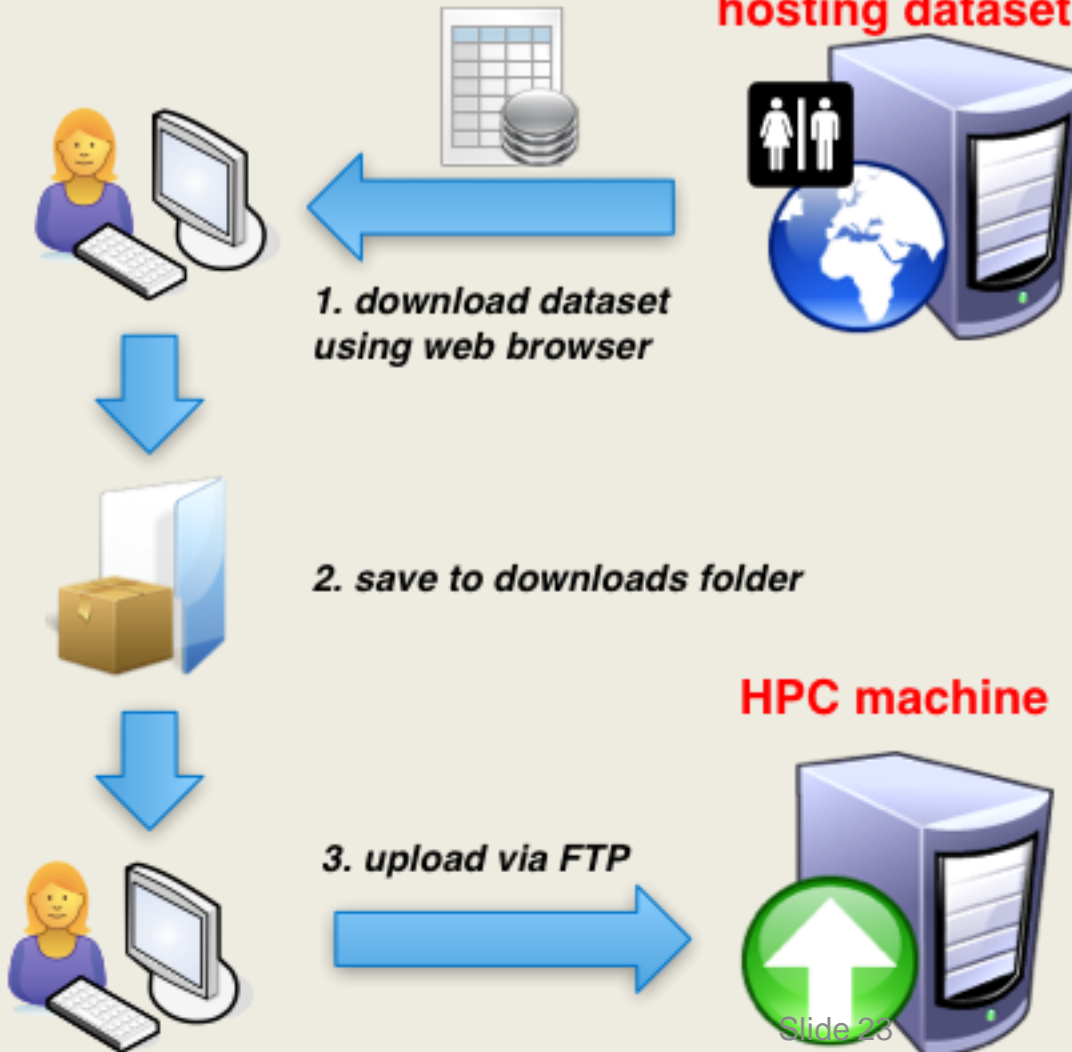
- We want to use a dataset that's available on the web.
- How do we get it on to the HPC machine?
- By way of example, let's use a dataset about public toilet locations!
- It's available here:
 - <http://data.gov.au/dataset/national-public-toilet-map/>



We could, of course, do this:

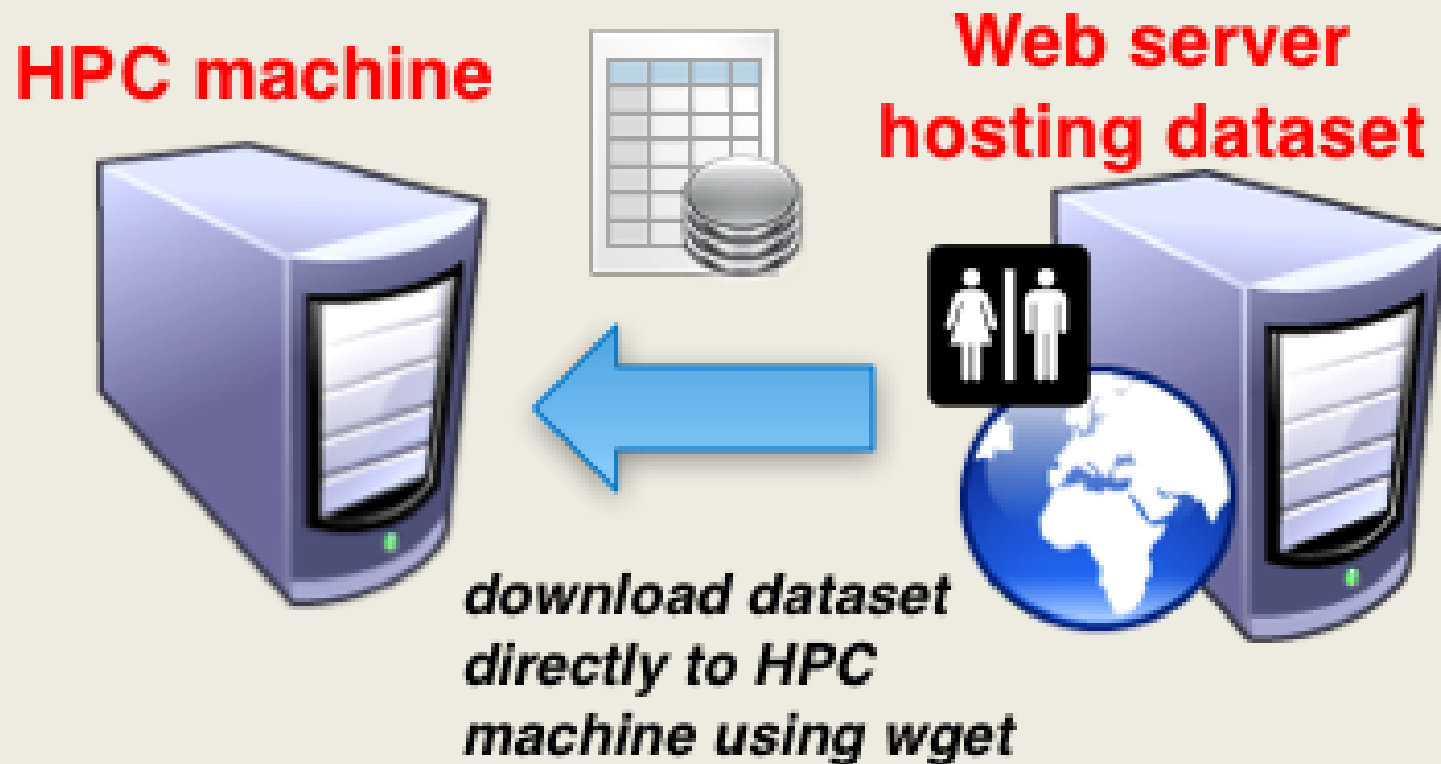
Local machine

**Web server
hosting dataset**



Entirely
legitimate,
just a bit
involved

But this is better



Download the file directly from the web server to the HPC machine

To do this:

- We need to be at the command line (i.e. logged into the HPC machine by SSH)
- Type:
wget *<URL_to_file>*
- For example:
wget <http://raw.data.gov.au/610/Toiletmap.zip>
- This will download the dataset to your current working directory

Unzip it!

- You'll notice that this file has a **zip** extension.
- This signifies that the file actually contains one or more files bundled for convenience and then (sometimes) compressed. It's called an archive.
- Other common archive formats have extensions **tar**, **tgz**, **gz**, **bz2**.
- It sounds confusing, but try these simple recipes...

Recipes

File Extension	Command to unzip
.zip	unzip <i><file_name>.zip</i>
.tar	tar xvf <i><file_name>.tar</i>
.tgz	tar xzvf <i><file_name>.tgz</i>
.gz	gunzip <i><file_name>.gz</i>
.bz2	bunzip2 <i><file_name>.bz2</i>

If the file ends with an extension in the left column, use the corresponding command in the right column.

Exercise 3(a)

Downloading and unzipping a dataset

Command	Description
wget <i><URL></i>	WGET will download the file stored at the location <i><URL></i>
unzip <i><file.zip></i>	Will unzip (unpack) the file <i><file.zip></i> into the current location
du <i><file></i>	The du command will show the disk space being used by file <i><file></i>
du -h <i><file></i>	The -h parameter to the du command will print the file size in human readable format (e.g., 1K 234M 2G)
du -s <i><file></i>	The -s parameter to the du command will display only a total for each argument

Unit 4: Things need to change, and quick! (Editing files in place)

Goals:

- Can edit a file, save changes, and exit editor.

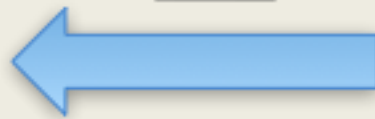
The Problem

- We want to make a quick change to a
 - Dataset
 - Script

We could, of course, do this:

Local machine

HPC machine



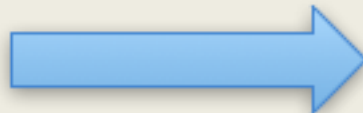
**1. download dataset
using SFTP, SCP**



2. modify the file



3. upload via SFTP, SCP



HPC machine



But it can get
cumbersome...

Instead we can edit in-situ using Nano

- Invoke with:

```
nano <file_name.txt>
```

- Use the arrow keys to navigate your document
- Update the text by typing, backspace, etc.
- Use **Control**+**O** to save the file (^O).
- Use **Control**+**X** to quit (^X).

Exercise 4(a)

Editing a file in-situ

Command	Description
nano <i><file></i>	Will open file <i><file></i> in a text file editor
CTRL+O	Using CTRL+O within the nano editor will cause any changes made to the file while editing to be saved to the file
CTRL+X	Using CTRL+X within the nano editor will cause the editor to close. If you have not already saved your changes you will be asked if you wish to save those changes by answering Y or N

A word of caution —

- As a matter of process it might be better to avoid editing in-situ on the HPC machine.
- There is a good chance your scripts and datasets will get out of sync with your local copies.
- This could generate confusion.
- Generally better to have a **single point of truth**.

Unit 5: What's mine is yours (Permissions and Ownership)

Goals:

- Can make a file private.
- Can allow another to read and write to a file.
- Can make a script executable.

Security

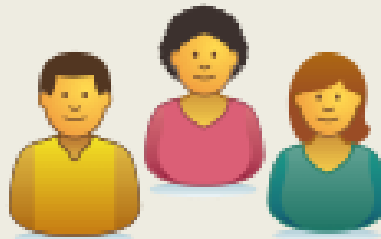
- Security is baked right into Unix
 - All **files** and **directories** have security attributes
 - Access can be limited by **Read**, **Write**, and **Execute** permissions
 - Based on **Owner** – **Group** – **World** model:



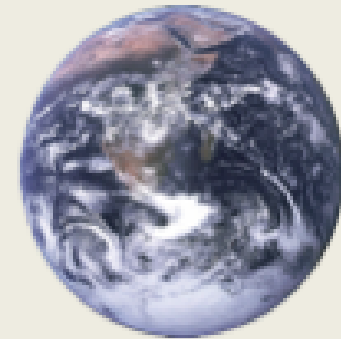
For every file and directory:



Owner



Group



World

Can?



Can't?



eXecute
Write
Read



eXecute
Write
Read



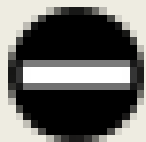
eXecute
Write
Read

Checking file permissions

`ls -ls` reveals all:

Permissions for file:

	World	Group	Owner									
4	-rw-r--r--		hpc20	hpc20	24	Jun	3	14:09	data-out.txt			
4	-rw-r--r--		hpc20	hpc20	28	Jun	3	14:09	data.txt			
4	-rw-r--r--		hpc20	hpc20	28	Jun	3	14:09	data1.txt			
4	-rw-r--r--		hpc20	hpc20	28	Jun	3	14:09	data2.txt			
4	-rw-r--r--		hpc20	hpc20	28	Jun	3	14:09	data3.txt			
4	-rw-r--r--		hpc20	hpc20	28	Jun	3	14:09	data4.txt			
4	-rw-r--r--		hpc20	hpc20	28	Jun	3	14:09	data5.txt			



It may come as a surprise, but by default the text files I created are “world readable”!

Handy commands

- **Change Owner** (chown)

`chown` *<new_owner>* *<file_name>*

- **Change Group** (chgrp)

`chgrp` *<new_group>* *<file_name>*

- **Change Mode** (chmod)

`chmod` *<new_mode>* *<file_name>*

- We'll concentrate on the last one.

Chmod <new_mode> format:

chmod *<new_mode>* *<file_name>*

References

Who's to be affected?

u

u = user (the file's owner)
g = group
o = others (the world)
a = ugo = all

Operator

How affected?

+

+ = add specified modes
- = remove specified modes
= = set these exact modes

Modes

What affected?

x

r = read
w = write
x = execute

Chmod Recipes

Command	Result
<code>chmod o-rwx <file_name></code>	Forbid others (the world) to read, write and execute.
<code>chmod u+rwx,g-rwx,o-rwx <file_name></code>	Grant owner full permissions; deny all others access.
<code>chmod a+w <file_name></code>	Allow everyone (owner, group, and the world) write access.
<code>chmod u+x <file_name></code>	Allow the owner the execute permission.
<code>chmod go-w <file_name></code>	Forbid members of group and the world to write to file.
<code>chmod a=r <file_name></code>	Grant everyone read access (only)

Exercise 5(a)

Changing ownership and file permissions

Command	Description
chmod <i><arguments></i> <i><file></i>	Will change the file permissions of <i><file></i> to the permissions specified in the <i>arguments</i>

Exercise 5(b)

Making a script executable

Sample Answers

- Sample answers to all exercises in this course are available on GitHub - <https://github.com/IntersectAustralia/TrainingMaterials/blob/master/IntroToUnixHPC/Answers.pdf>