Data

Introduction to Unix for HPC

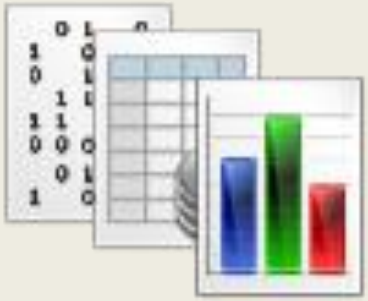
Unit 1: Making a move (using FTP)

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

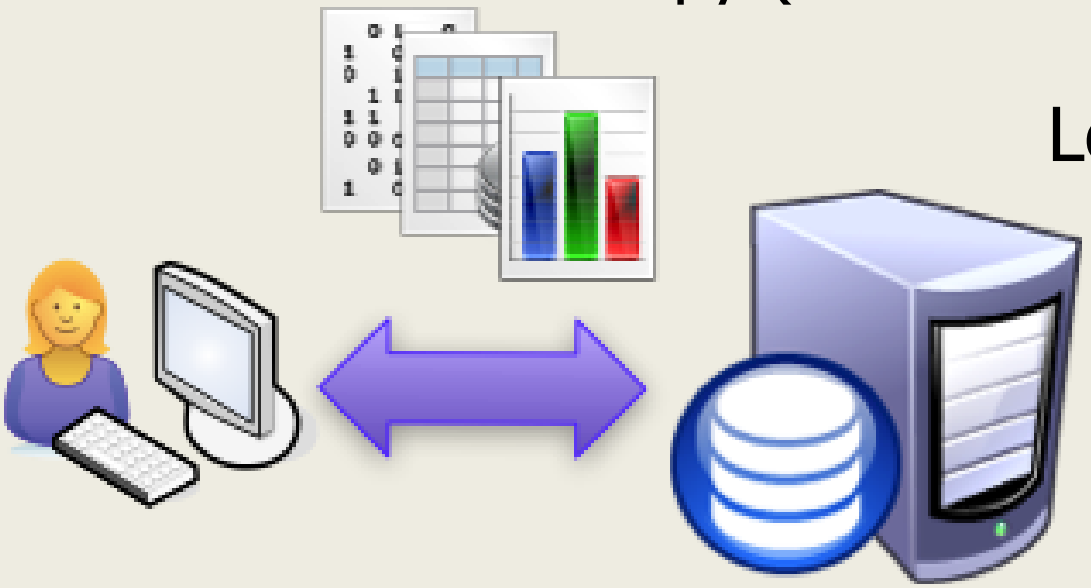
- Upload files, say our datasets, to the HPC machine?
- Download files, say the results of our analysis, from the HPC machine for further analysis locally?

INTERSECT

The Solution

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

Let's start with FTP



FTP Client **FTP Server**

INTERSECT

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.

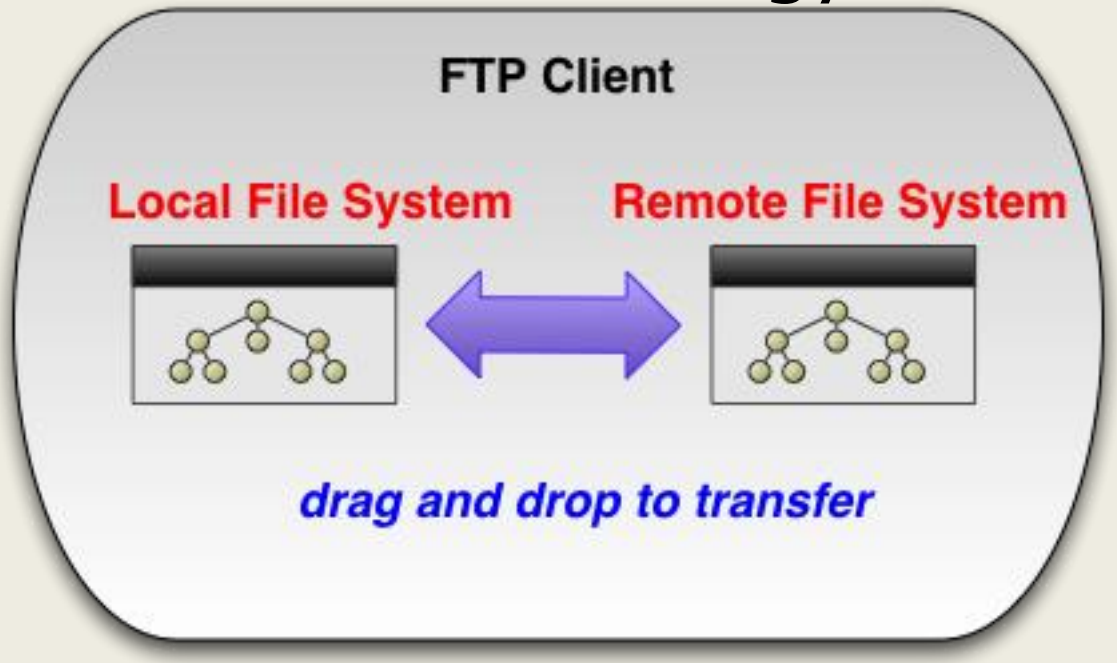
INTERSECT

Exercise 1(a)

Connecting to the training HPC machine

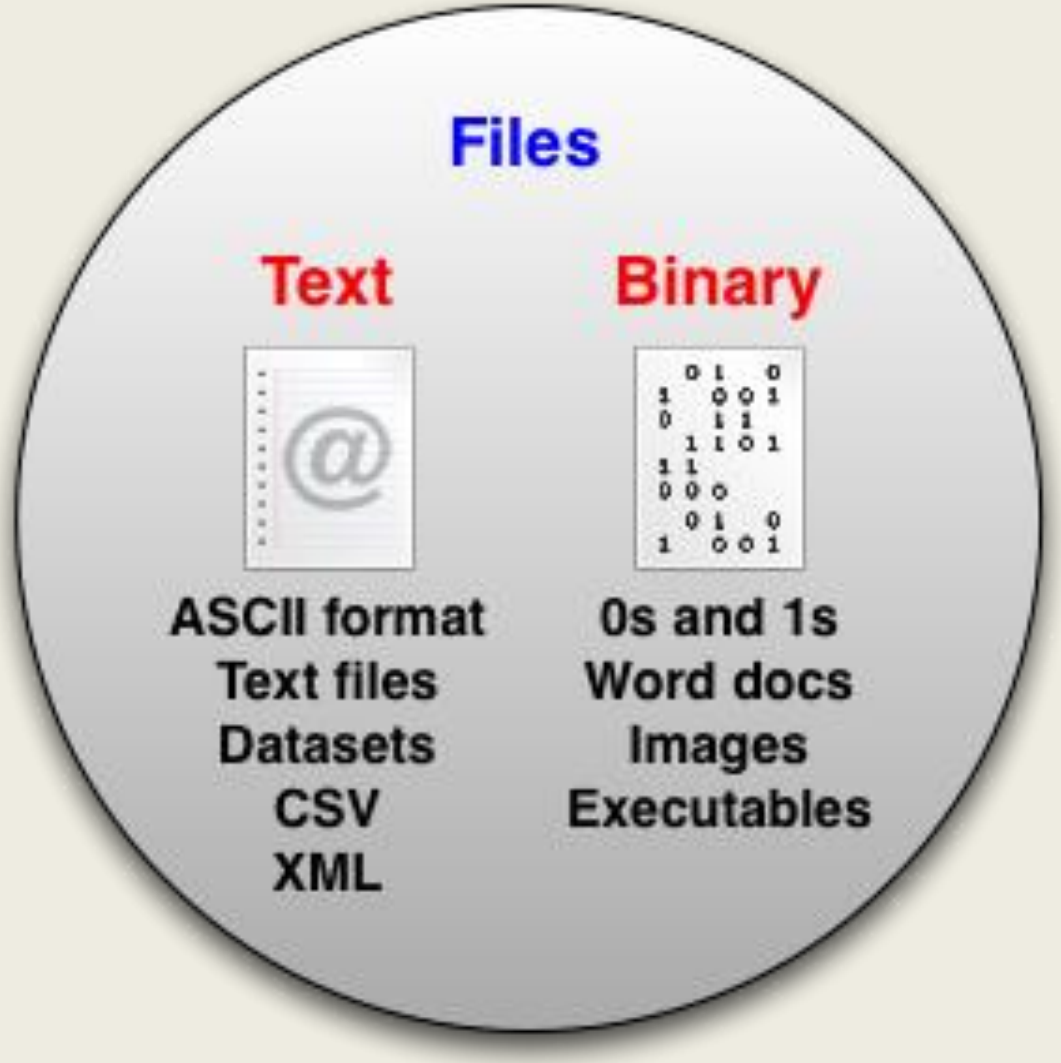
Transferring Files

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



INTERSECT

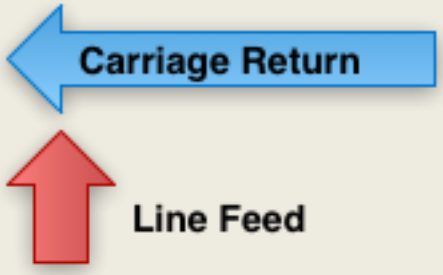
Text Files vs Binary Files



INTERSECT

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)

INTERSECT

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

INTERSECT

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.

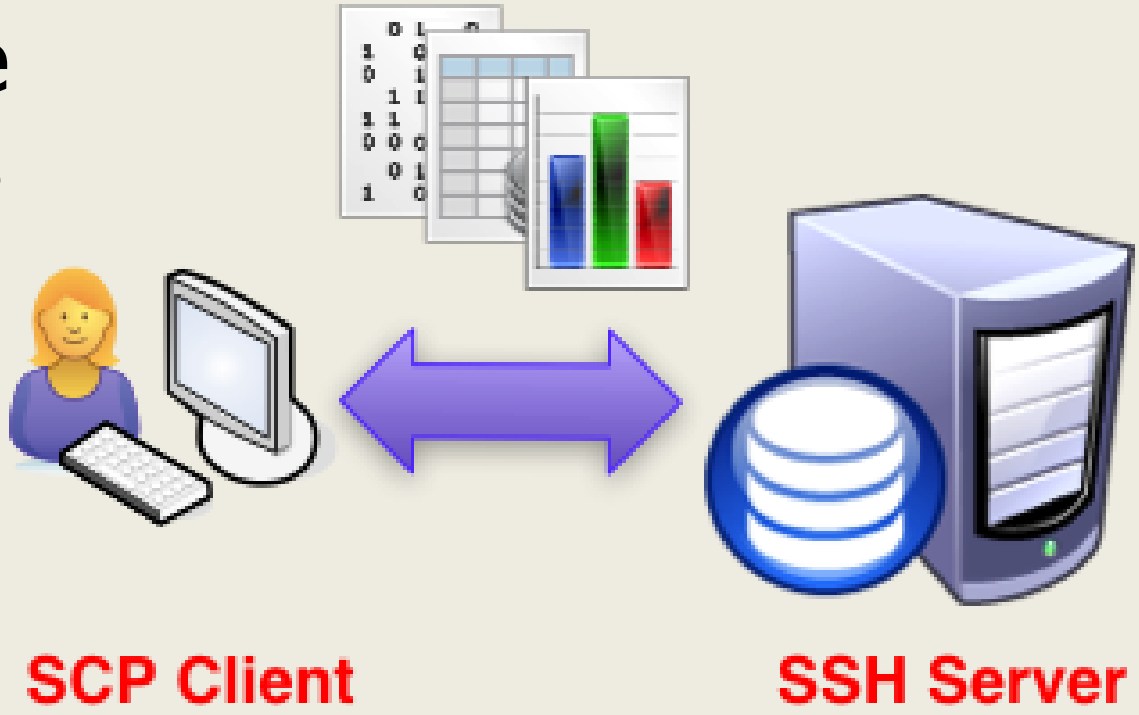
SCP and PSCP

- 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**.

INTERSECT

SCP vs SFTP

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

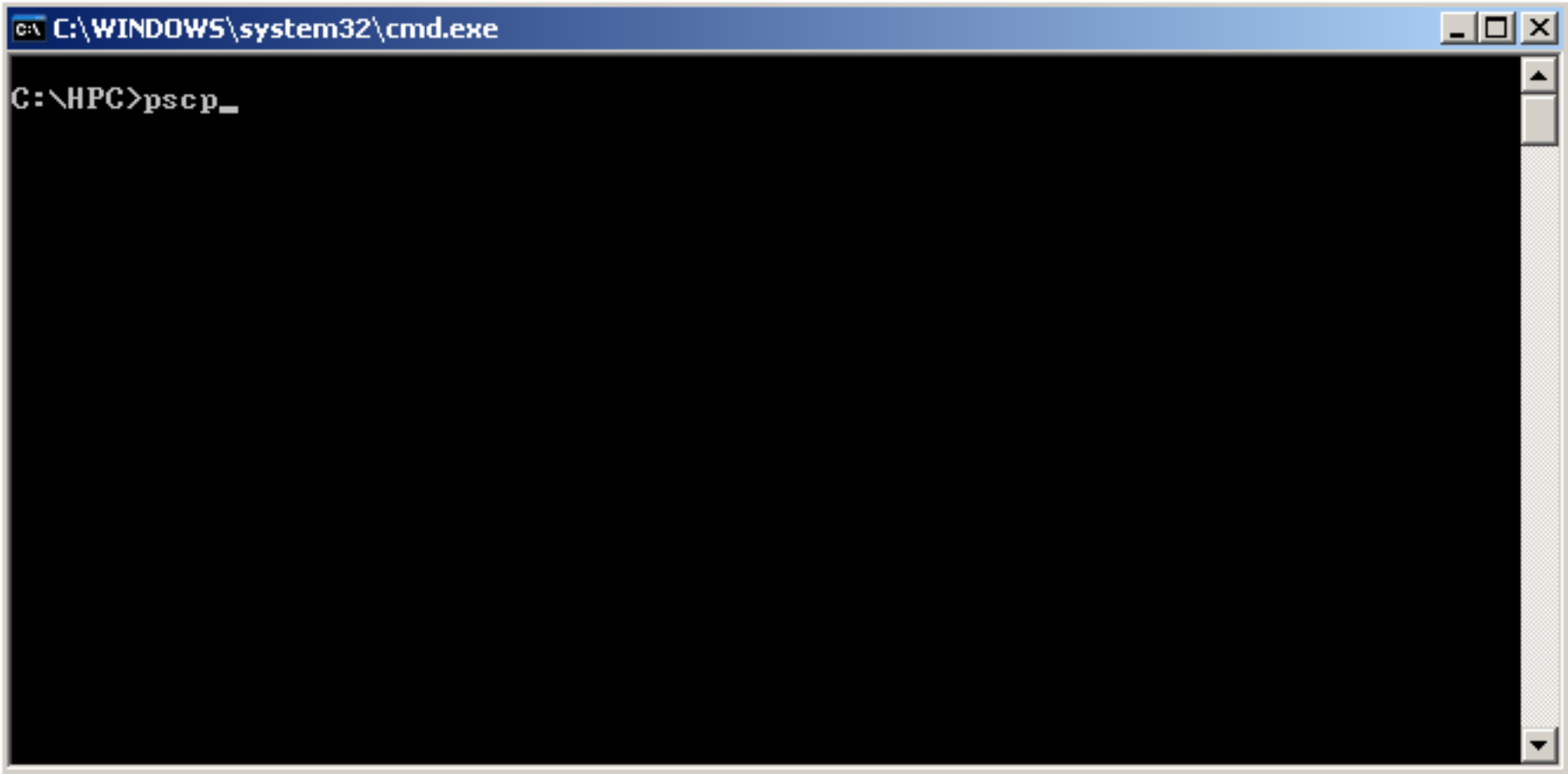


INTERSECT

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



INTERSECT

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

INTERSECT

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>`*

INTERSECT

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

INTERSECT

Exercise 2(b)

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

Command	Description
`mkdir` *`<directory>`*	DOS command to create a directory called *`<directory>`*

INTERSECT

Unit 3: (W)get it on! Using Wget

Goals:

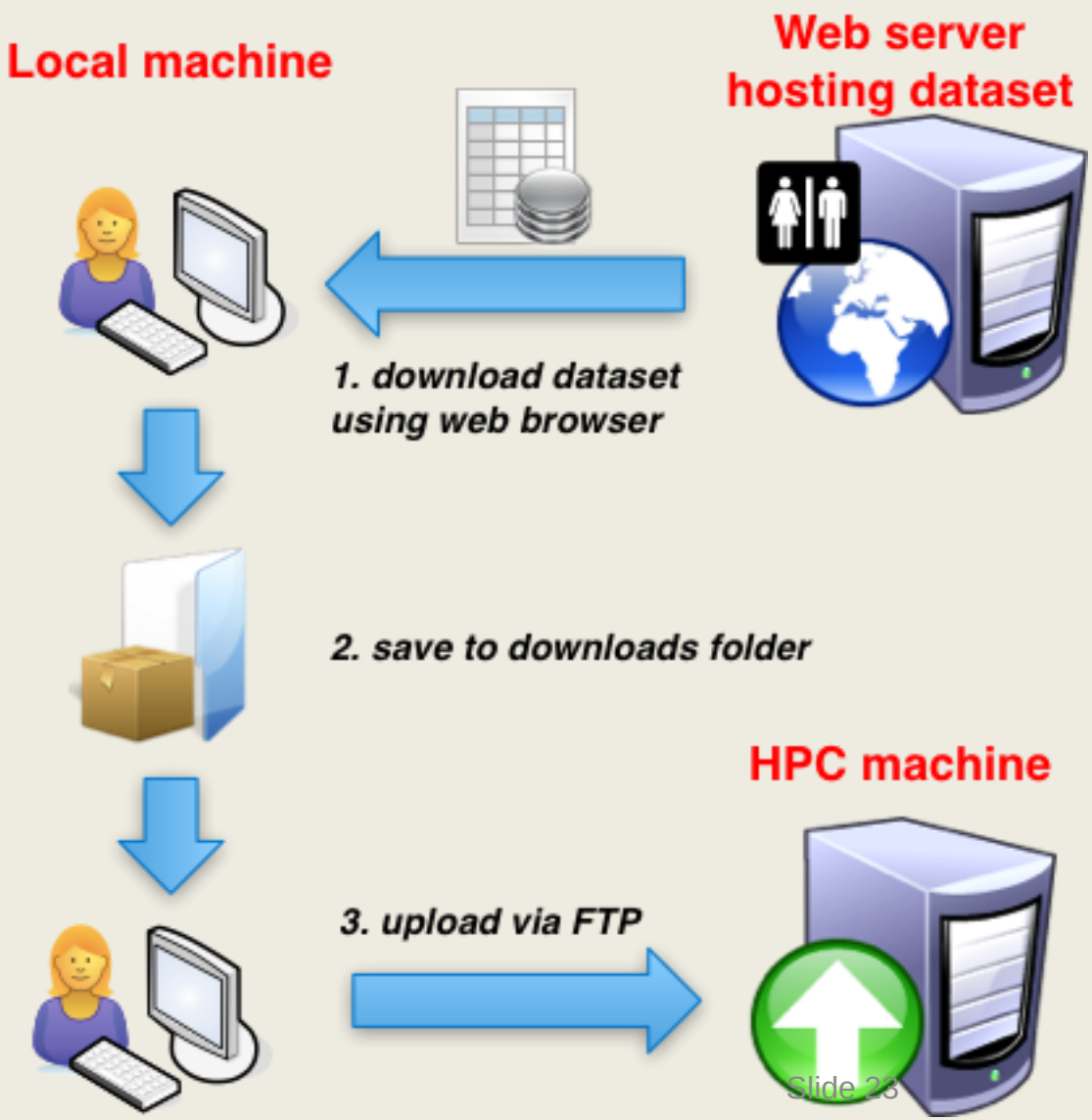
- Can use the basic **`wget`** syntax to download a dataset from the web.

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/

INTERSECT

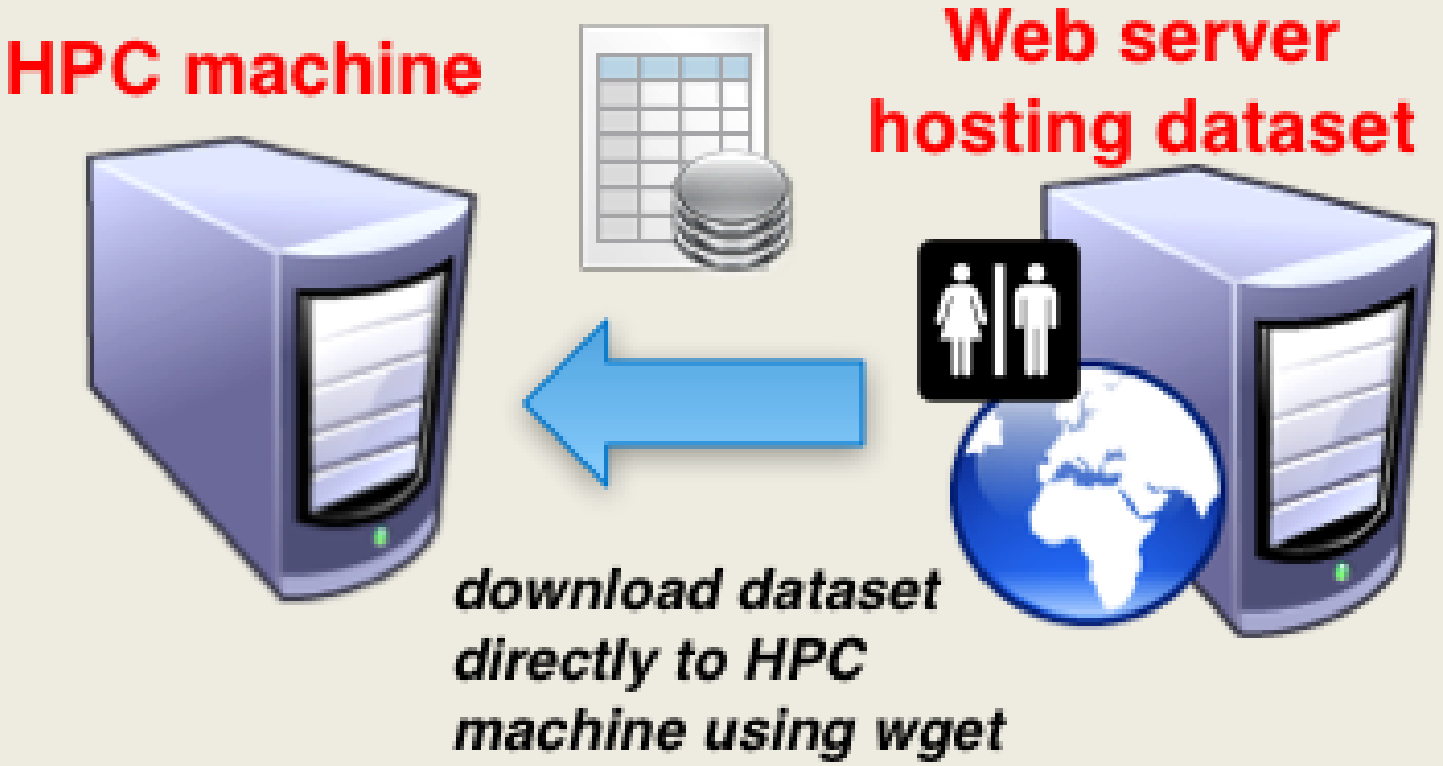
We could, of course, do this:



Entirely legitimate, just a bit involved

INTERSECT

But this is better



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

INTERSECT

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

INTERSECT

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 <file_name>.zip`
`.tar`	`tar xvf <file_name>.tar`
`.tgz`	`tar xzvf <file_name>.tgz`
`.gz`	`gunzip <file_name>.gz`
`.bz2`	`bunzip2 <file_name>.bz2`

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

INTERSECT

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

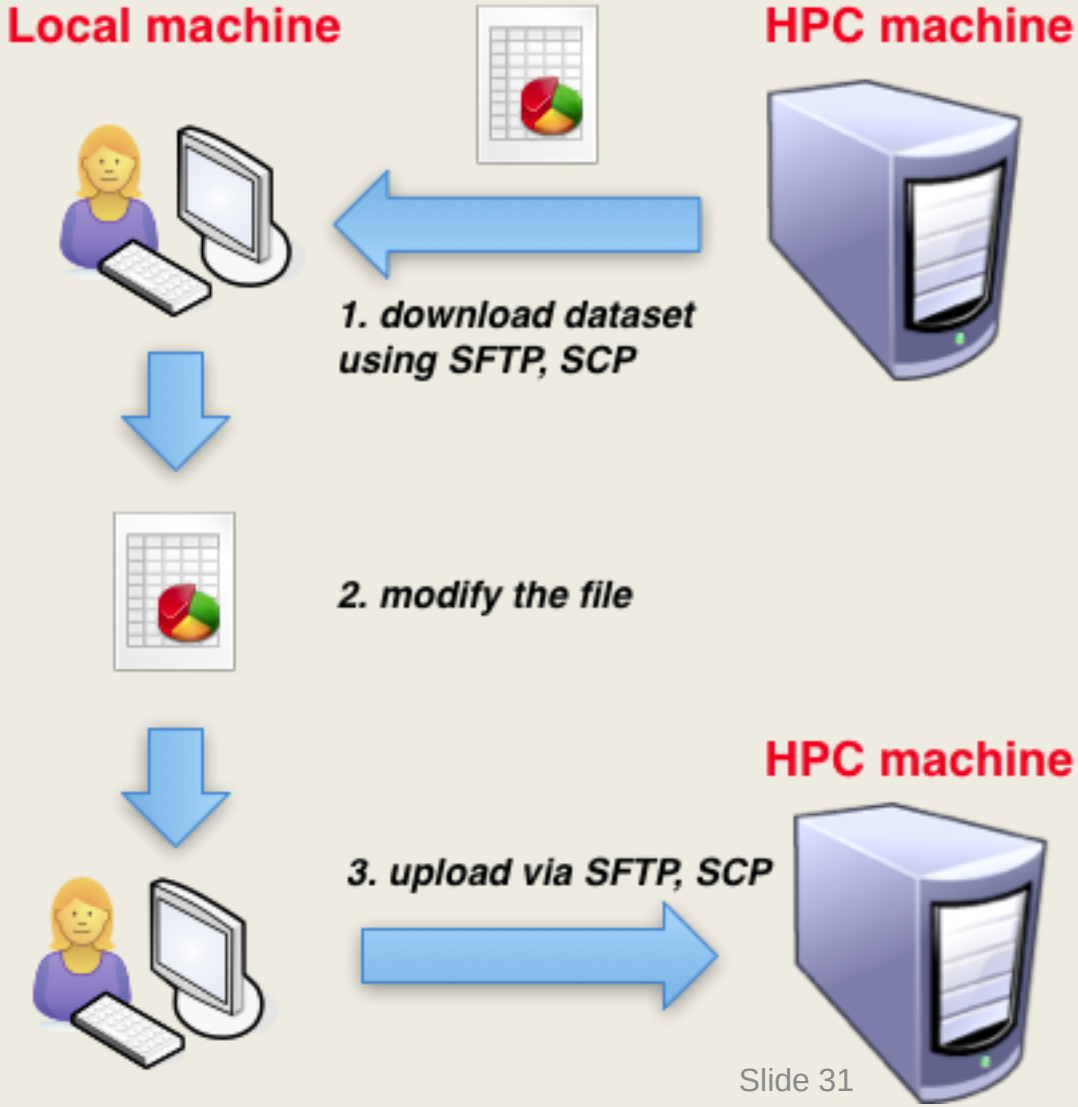
Goals:

- 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:



But it can get cumbersome…

INTERSECT

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` *`<file>`*	Will open file *`<file>`* 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**.

INTERSECT

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

Goals:

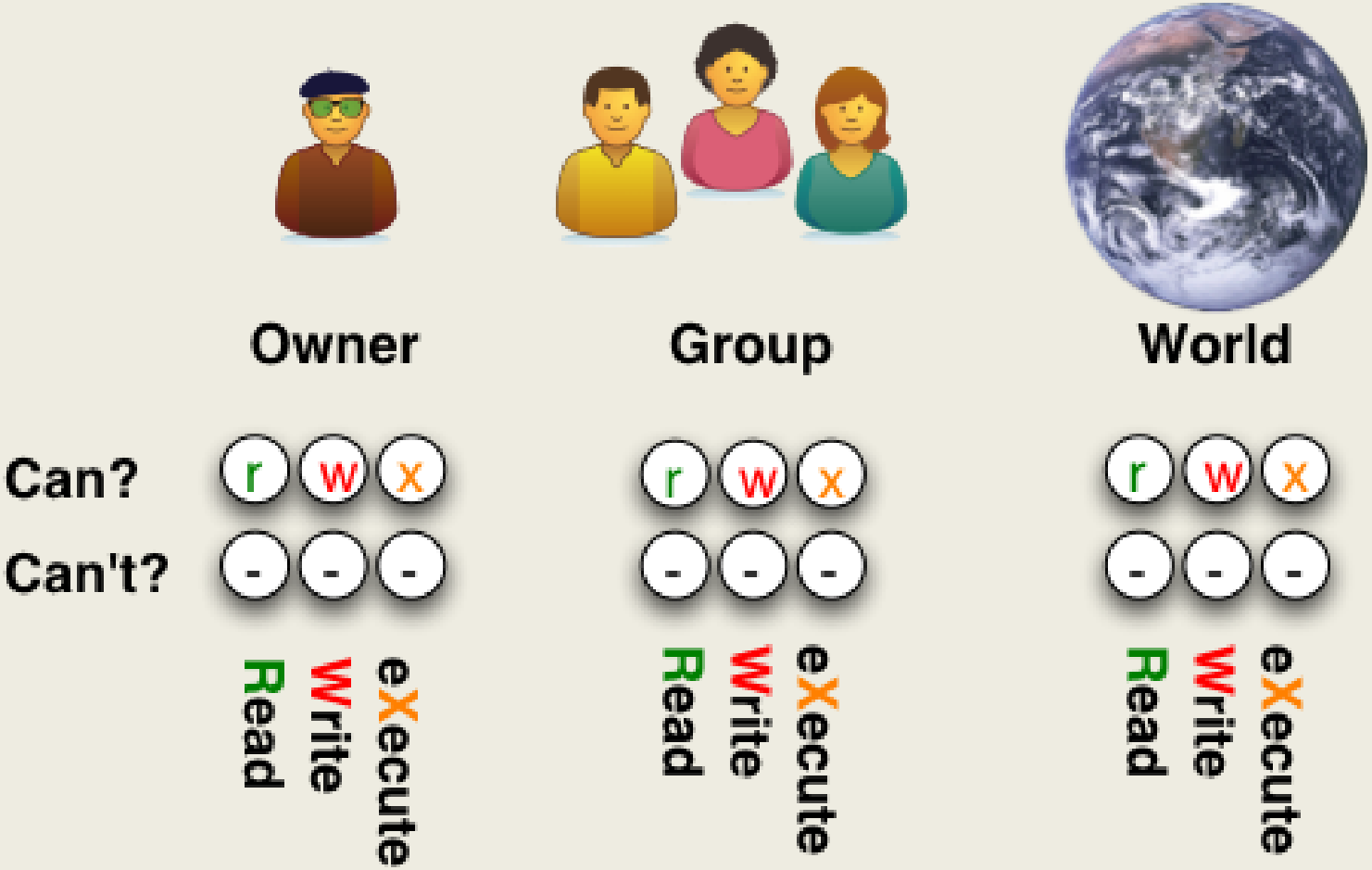
- Can make a file private.
- Can allow another to read and write to a file.
- Can make a script executable.

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:

INTERSECT

For every file and directory:



INTERSECT

Checking file permissions

`ls -ls` reveals all:

Permissions for file:

	Owner	Group	World		Owner	Group						
4	-rw-	r--	r--	1	hpc20	hpc20	24	Jun	3	14:09	data-out.txt
4	-rw-	r--	r--	1	hpc20	hpc20	28	Jun	3	14:09	data.txt
4	-rw-	r--	r--	1	hpc20	hpc20	28	Jun	3	14:09	data1.txt
4	-rw-	r--	r--	1	hpc20	hpc20	28	Jun	3	14:09	data2.txt
4	-rw-	r--	r--	1	hpc20	hpc20	28	Jun	3	14:09	data3.txt
4	-rw-	r--	r--	1	hpc20	hpc20	28	Jun	3	14:09	data4.txt
4	-rw-	r--	r--	1	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”!

INTERSECT

Handy commands

- **Ch**ange **Own**er (chown)

  chown *<new_owner>* *<file_name>*

- **Ch**ange **Gr**ou**p** (chgrp)

  chgrp *<new_group>* *<file_name>*

- **Ch**ange **Mod**e (chmod)

  chmod *<new_mode>* *<file_name>*

- We'll concentrate on the last one.

Chmod <new_mode> format:

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

References	Operator	Modes
Who's to be affected?	How affected?	What affected?
u	+	x
u = user (the file's owner)	**+** = add specified modes	**r** = read
g = group	**-** = remove specified modes	**w** = write
o = others (the world)	**=** = set these exact modes	**x** = execute
a = **ugo** = all		

INTERSECT

Chmod Recipes

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

Exercise 5(a)

Changing ownership and file permissions

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

INTERSECT

Exercise 5(b)

Making a script executable