

# Operating System Basics for Windows

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An operating system is a large, complex collection of software that manages the computer. All communication between the central processor and the keyboard, mouse, screen, computer disk and network is controlled by the operating system. It is the operating system that detects the click of a button or the movement of the mouse. Other programs cannot communicate with these peripheral devices directly. They have to ask the operating system to carry out these tasks.

The newest Windows operating system is **Windows 10**. If you are using Windows 7, consider upgrading as your computer is vulnerable as you do not have up-to-date security features.

This document introduces you to the basics such as managing your files and shortcuts that can improve efficiency when using Windows. To start, these shortcuts may seem uncomfortable but it is worthwhile spending some time practising, as it will allow you to perform tasks faster. It covers:

- Useful Applications (e.g. Free access to Office365) Page 2
- Managing Applications (e.g. Split Screen and Virtual Desktops) Page 6
- Managing your Files (e.g. Organising files/folders and backups) Page 11
- Shells (e.g. Text-based commands to create folders) Page 18

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*Icons throughout sourced from [FlatIcon.com](http://FlatIcon.com), made by [Freepik](https://www.freepik.com), Eucalyp, smashicons, wanicon, icongeek26 and tHose icons.*



## Useful Applications

Your operating system will come bundled with some applications. Departmental computers will already have all the software you need, however if you are working on a personal computer there may be some software you need to install.

### Office 365

Students and staff at the University can access Office 365, which contains many useful applications for University work. The University of Oxford Office 365 system includes a cloud based working environment (called Nexus365). Follow the instructions here to get started: <https://help.it.ox.ac.uk/nexus365/getting-started>

Here you will find :-



**Outlook:** The Microsoft email client to view your University emails.



**One Drive:** A cloud based filing system. You can use this to backup your files and share files with other people.



**Word:** The Microsoft word processor. You can save files as a Word document(.docx) to **One Drive** or your own computer.



**Excel:** The Microsoft spreadsheet. You can save files as an Excel spreadsheet(.xlsx) to **One Drive** or your own computer.



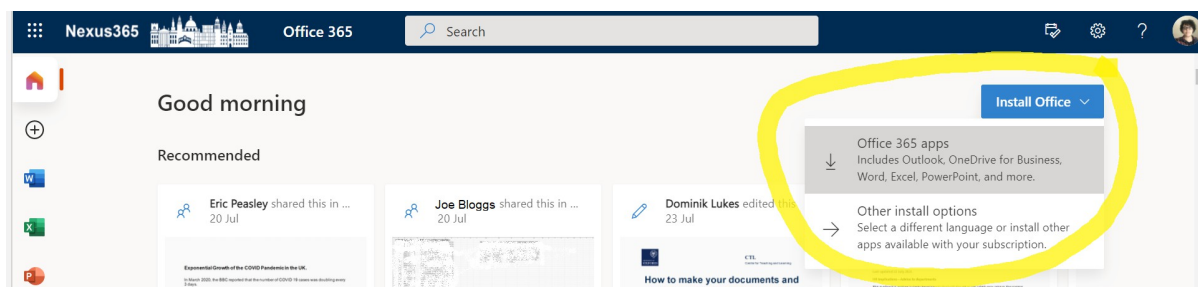
**One Note:** A digital notebook, you can use this for [taking notes](#).



**Powerpoint:** Used for creating presentations.

Each of these can be used online, in your browser. Some browsers work better than others so it may be worth having multiple installed (e.g. [Chrome](#) or [Firefox](#)).

You can only get full functionality by installing the software directly onto your machine, which we recommend. Once you have logged into Nexus365, you will see the **Install Office** button on the right.



## Microsoft Teams App

Another part of Nexus365 is the Application **Teams**. It is an online chat/conferencing tool. Teams lets you message, talk to and see other members of the University. It will be used for the online laboratories. There is a web based version, but for the best functionality install the Teams App.

### Installing the Teams App

Go to the web site: <https://products.office.com/en-gb/microsoft-teams/download-app>

And select **Download for Desktop**. This downloads a **.exe** file that you need to run. Click and run this file to install once the download has finished. You should find it in **Downloads**. Press the Windows Icon + E to open the **File Explorer** to locate it. The installation is very straightforward. You just keep pressing the button in the bottom right hand corner. Then Launch Teams by searching in the Windows menu.

### Logging into the Teams App

Once Teams has launched:

Sign in using **abc123@OX.AC.UK**

Replacing **abc123** with your own Single Sign On (SSO) username.

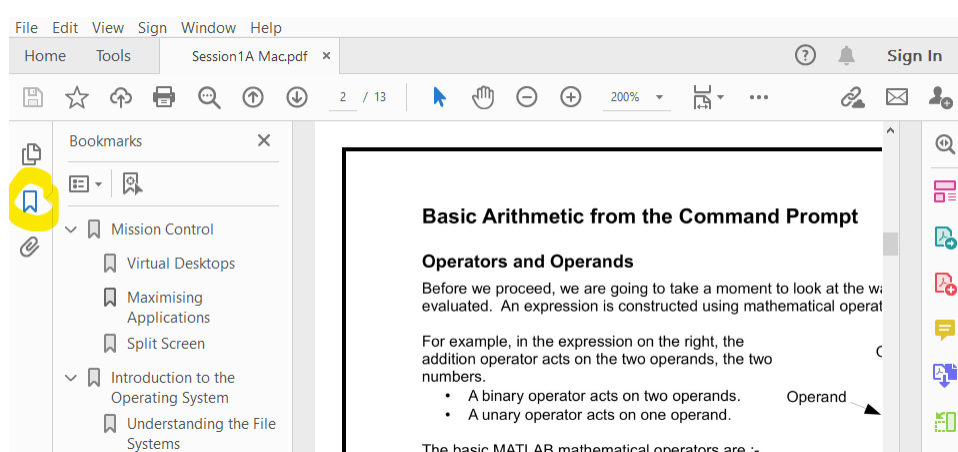
Then log in using your Oxford University SSO and password. Sometimes it capitalizes the first letter of the SSO. If it does this, change it back to lower case.



## PDF Reader

You will need to read many PDFs. Edge can open PDFs in Windows, however the functionality is limited. Free PDF Readers are available, e.g. [Adobe Acrobat](#). This allows you to highlight and make notes too. Make sure your chosen application can:

- **Search within PDFs:** You will often work with many documents, searching for key terms using the Search bar is much faster than scrolling.
- **Viewing Headings for Navigation:** You can save a lot of time by enabling the Navigation Pane to click through Headings, shown here circled in yellow:



## Other Applications

There are other applications available to everyone at the University, for free or at a discounted rate. These are available through the Central IT Pages:

<https://www.it.ox.ac.uk/get-software>

A subscription to Adobe Creative Cloud which includes Photoshop, Lightroom etc is available for £16/month. It is not needed for the Engineering course, but may be of interest.



## Security

Keeping your computer, files and identity safe is hugely important. Sophos Anti-Virus is available for free from the Central IT pages, using the above link. You should also consider [creating strong passwords](#) and using a password manager. Much can be found online, for example from [Reporters without Borders](#).



## Creating Text Files

You will not always want files where the text is formatted. In some cases you will want something very simple: just words as a **.txt** file. This could be because of:

- personal preference (some people prefer the minimalist environment)
- the wider range of compatibility (all operating systems can read a **.txt** or **.rtf** ).

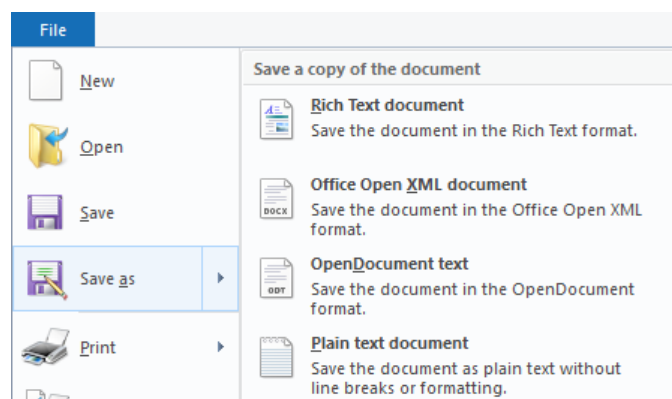
### Example

Follow these instructions to make a **.txt** file:

- Press the **Windows Key**  and type **wordpad**.
- It should find an application WordPad, click to open.



The WordPad App is a basic text editor. We can use it to make simple documentation about our programs. For example, if we want to quickly explain what lots of files are in a folder. When you save a file, you can select from a few formats:



Two important (universally compatible) ones are:

- **Plain Text** format just contains ASCII character codes. You can't change the font. These save to **.txt** files.
- **Rich Text** format contains extra formatting codes for changing the font and size of the text and other formatting commands. These save to **.rtf** files.

**Try the following :-**

- Select **File > New**
- Enter the following text into the document :- ***This is a test text file.***
- Save as **Plain Text Document** named **ReadMe.txt**

## Managing Applications

Often you will need to work with multiple applications (apps) open. For example, if you are coding you may need a PDF of instructions open as well as MATLAB. Or if you are writing a report you may need an internet browser and a Word document.

This section introduces you to different ways to work with multiple apps. It covers making best use of your computer memory, Split Screen, Task View and Virtual Desktops. These are shortcuts that can improve efficiency moving between different applications. To start, these shortcuts may seem uncomfortable but it is worthwhile spending some time practising, as it will allow you to perform tasks faster.

### Minimising, Closing and Quitting

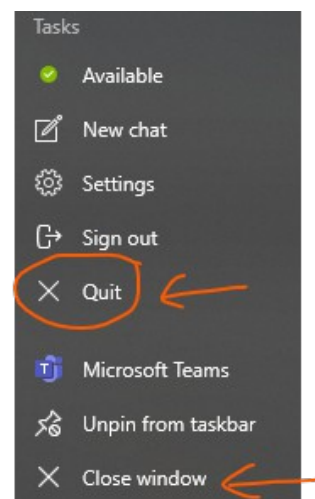
To get the best from your computer, it is important to only have the applications open that you need for your current task. Having too many applications open at once will cause your machine to be slow. You might think you are quitting applications by minimising and closing:

- You can **minimise** an application, by pressing the - minimise button in the top-right corner of the window.
- You can **close** windows of an application, by pressing the X button in the top-left corner of the window. .

However, **minimising or closing windows does not always fully quit the app**. The app may still be using memory, which will slow down your computer.

One way to fully quit an app:

- Right-Click on the open app in the Task Bar.
- You may see both **Close** and **Quit** listed.
- Select **Quit** to full close an application.

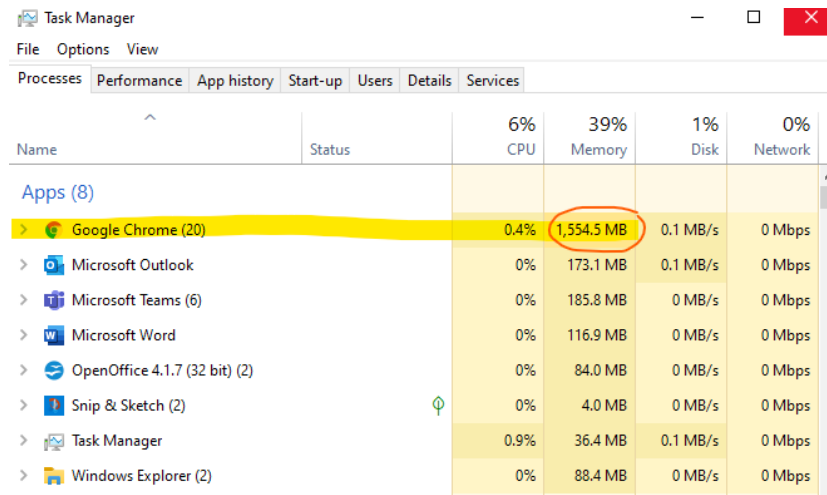


Quit rather than close/minimise any applications you are not using.  
This will free up RAM (a type of computer memory).

## Task Manager

Another way to quit applications, or simply see what is using up the computer memory, is to use the **Task Manager**. Open it by pressing **Ctrl + Shift + Esc**.

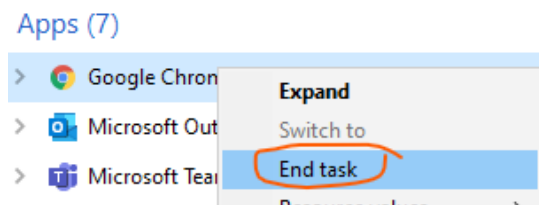
In this example, you can see Chrome is taking up 1.5GB of RAM:



The screenshot shows the Windows Task Manager Performance tab. The 'Memory' column shows that Google Chrome is using 1,554.5 MB of memory, which is circled in red. Other applications listed include Microsoft Outlook, Microsoft Teams (6), Microsoft Word, OpenOffice 4.1.7 (32 bit) (2), Snip & Sketch (2), Task Manager, and Windows Explorer (2).

Name	Status	6% CPU	39% Memory	1% Disk	0% Network
<b>Apps (8)</b>					
> Google Chrome (20)		0.4%	1,554.5 MB	0.1 MB/s	0 Mbps
> Microsoft Outlook		0%	173.1 MB	0.1 MB/s	0 Mbps
> Microsoft Teams (6)		0%	185.8 MB	0 MB/s	0 Mbps
> Microsoft Word		0%	116.9 MB	0 MB/s	0 Mbps
> OpenOffice 4.1.7 (32 bit) (2)		0%	84.0 MB	0 MB/s	0 Mbps
> Snip & Sketch (2)		0%	4.0 MB	0 MB/s	0 Mbps
> Task Manager		0.9%	36.4 MB	0.1 MB/s	0 Mbps
> Windows Explorer (2)		0%	88.4 MB	0 MB/s	0 Mbps

This is why it is best not to keep 30 tabs open at once in your browser. If I decide I want to Quit Chrome, and it is not responding, I can force it to quit by Right-clicking and selecting **End Task**.



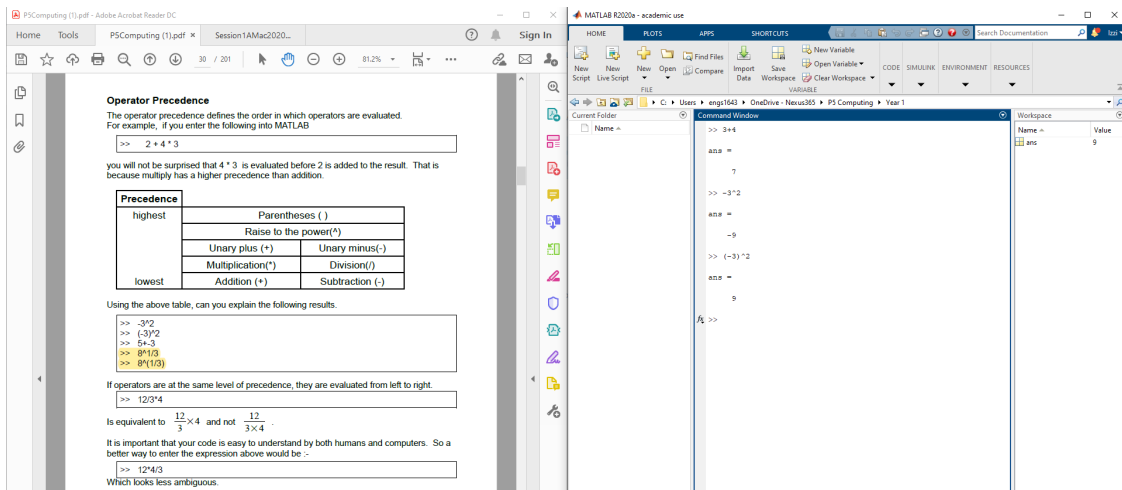
You can find more tips for speeding up your PC from ex-Microsoft engineer [Kevin Stratvert](#), including disabling some of the startup apps and managing storage.



## Split Screen View

To work with two applications at once, a simple option is to split the screen between two applications.

- When using one application, e.g. MATLAB, press **Windows key** and **right arrow key** ►. This maximises on the right hand on the screen.
- On another application, say some notes, press **Windows key** and **left arrow key** ◀. This maximises the Notes on the left-hand side of the screen.



## Maximising Windows

The approach of splitting the screen is not always the best option – particularly if you have a small monitor. Sometimes we need to work with an application which has been maximised to fill the screen.

Any window can be maximised by pressing the square icon in the top right:




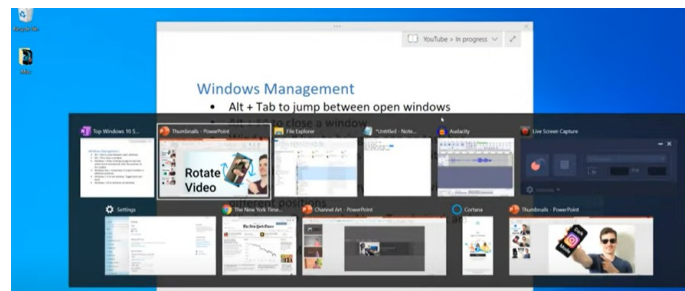
This makes any application full screen. The windows can be resized by dragging any of the corners or sides. Move your mouse until you see an arrow, and then click and drag.







## Task View

Task View offers a quick way to switch between multiple applications. Holding **Alt** and then pressing **Tab**  will allow you to see all the open Windows. If you have windows hidden behind other windows, this view spaces out all the windows so that you can select which window you want in front. Pressing **Tab** will move through each window in turn, or you can select one with the mouse or arrow keys.



This is a quick way to move between different pieces of software.


Other useful shortcuts include:

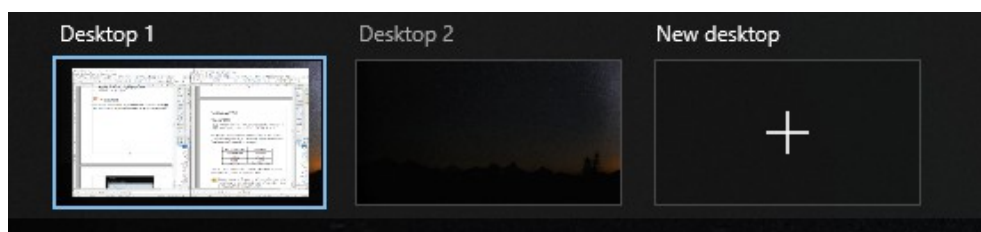
- **Windows key**  and **M** to **minimise** all windows and see the desktop.
- **Windows key**  and **E** to **open the file Explorer**.

You can find more here [in this video](#).





## Virtual Desktops

Another option is Virtual Desktops. Holding **Windows key** and pressing **Tab**  will allow you to open a New Desktop. This is a new desktop with all apps minimised.

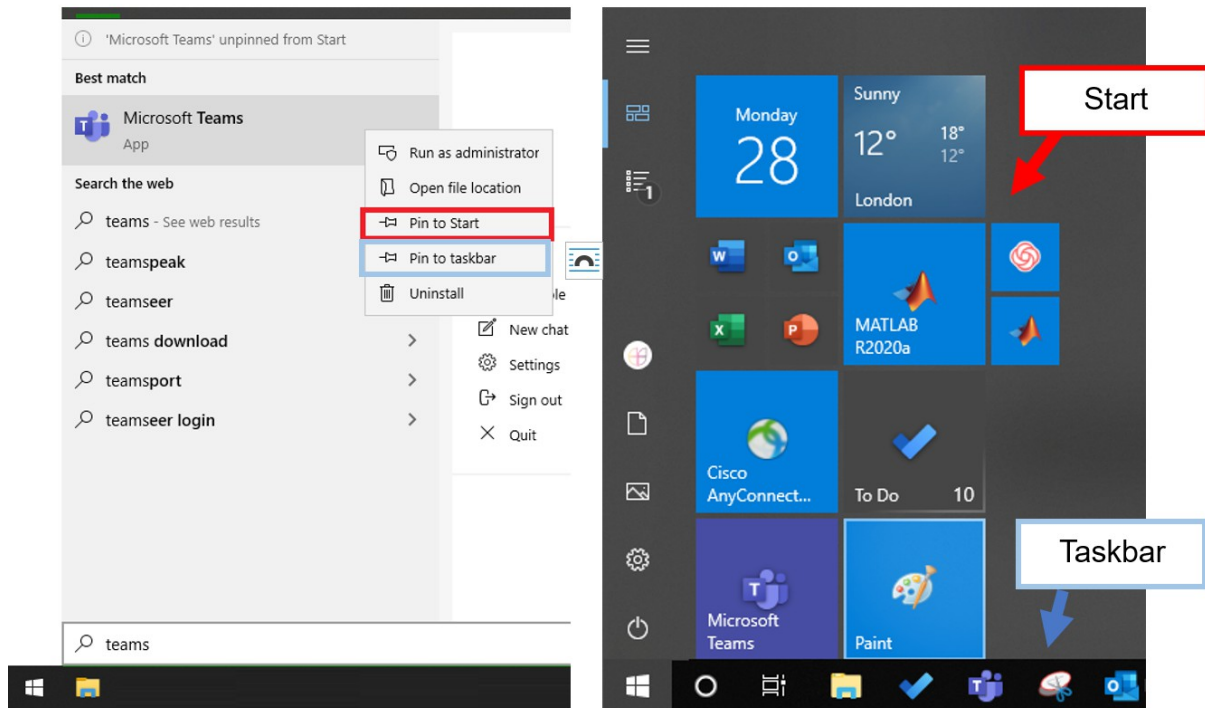


You can have multiple virtual desktops, each with different applications maximised in.

You can quickly switch between virtual desktops by holding down the **Windows** and **Ctrl** keys, then pressing the left arrow key,  or the right arrow key,  to move back and forth. You could have notes open in one Desktop and MATLAB open in another.

## Pinning Apps to Start or Taskbar

You can pin frequently used Apps to the Start Menu or Taskbar. You can Right-click and select **Pin to Start**, this will mean you always have the Apps you need available in the start menu. You can also select **Pin to Taskbar** which will create an icon along the bottom.



It is worth taking some time to arrange these icons in the most useful way to you. Here I have grouped the most common Office365 applications all in a minigrd. To move the items: click, hold and drag. They will snap into available locations.

# Managing your Files

## Files and Folders



A **file** is just a lot of ones and zeros stored in a permanent location on the computer. Each file is used to store a particular type of object.

It could contain a picture, a document, a program or many other types of object.

Each file has a name, which may also include a suffix (ending • something) which helps to show what the file contains. For example:

File name with suffix	Type of File
Lecturenotes.pdf	A document
ReadMe.txt	Plain Text
photo.jpg	A Picture
MyScript.m	A MATLAB Program

There are thousands of files on a typical computer. A **file system** is used to keep track of all the files. The file system is divided into folders.



A **folder**, also known as a **directory**, is a location where all the files related to a particular topic are stored. Folders help keep related files together, so they do not get mixed up with other files on the system.

Files and folders may seem basic, but keeping them organised can be a difficult habit to develop. It is always worth taking a few moments to correctly store your files.



When you download a file, it is usually stored automatically in your **Downloads** folder. If you want to store it long term, **move this file** so it is **stored in a sensible folder elsewhere** in your file system.



As well as storing files on your computer **locally**, it is sensible to **store a copy of your files online too**. e.g. [using OneDrive](#)

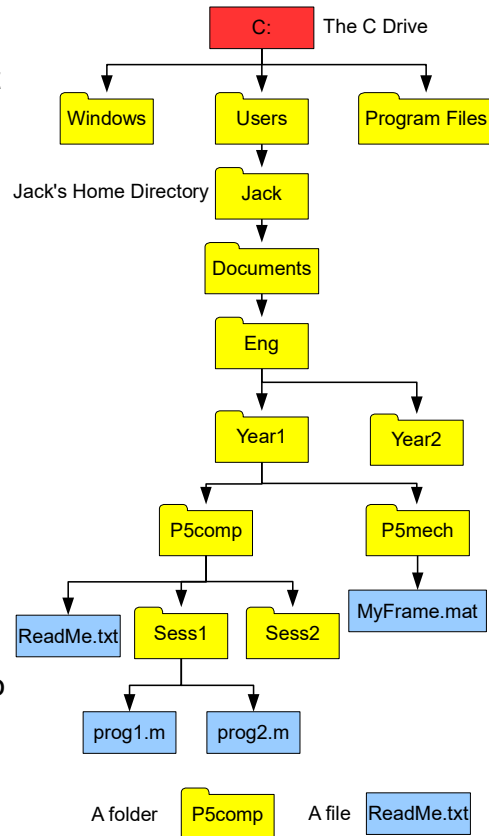


## A File System

The whole file system is organised in a hierarchy of folders within folders. The diagram on the right represents a very small portion of a Windows file system. Another name for a folder is a **directory**.

At the top of the file system is the folder known as the **root directory**, commonly called the **C Drive**. It is specified with a letter “C:\” or \ for short. It contains many folders, more than the three shown here.


The diagram looks a bit like a family tree. The words **parent** and **child** are used in computing to describe the relationship between directories.

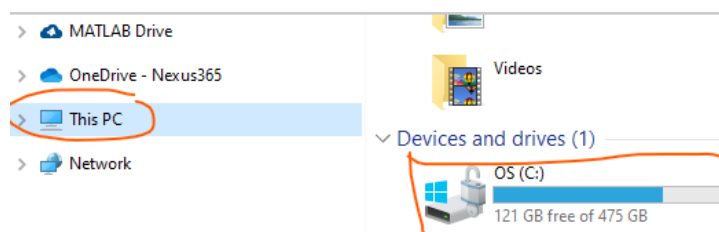


In the diagram:

- The directory **P5comp** is the **parent** of Sess1 and Sess2.
- Sess1 and Sess2 are the **children** of P5comp.

## Viewing Different Drives

From the File Explorer (**Windows key**  and **E** ), you can view all the different drives you have. On the left, you will see **This PC**. Click to show all your drives.



If you have a C: Drive and a D: Drive, this means the operating system can be kept on a completely separate drive to your user data. In this case, you may have your User folder on the D drive instead.

## Home Directory

When using a computer, you don't want to mix up your files with those used by the operating system and other users. Therefore, each user on a system is allocated a **Home Directory**, where they can store their personal files. In Windows, these are all kept in the **Users** folder.




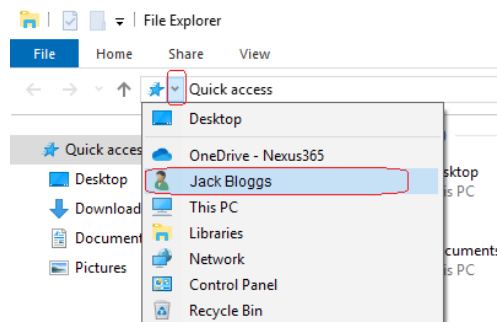
Make sure that your **Home Directory** is always organised.  
This will make it easier to find files, and lead to efficient working.



### Example: Creating Folders in your Home Folder

Follow this example to create the file system structure shown on the previous page.

- Press the **Windows key**  and **E** to **open the File Explorer**.
- You will see some **Quick Access** folders and **Favourites**, but **NOT** your **complete Home Directory**.
- To see your full **Home Directory**, press the down arrow in the path bar



- You will then see the contents of your Home Directory on the right-hand side e.g. folders called **Documents**, **Downloads** and **Desktop**, as well as others.
- Double click on **Documents**, then Right Click on the white background and select **New > Folder**

A new folder will appear. The name will be highlighted, type in a name for the folder:

- Call the Folder **Eng**
- Double Click on the new folder, to view the contents.
- Inside the new folder, create another new folder called **Year1**
- Inside **Year1**, create another folder called **P5computing**

The **Eng** folder is to store all the files that you create for your studies in Engineering Science. The **P5computing** folder is for the Computing Laboratory. The idea is that as you do more work on your computer, you slowly build a hierarchy structure of folders, so that you can easily find the files that you need. If you create files for the mechanics laboratory, you put them into a **P5mechanics** folder in **Year1**.

If you already have some folders, you can move them around [in different ways](#) including **drag-and-drop** and **copy/paste**. These are very useful shortcuts!



## File Paths

The **file path** is a way to describe the location of a file or folder, based on a fixed starting point. Every file/folder will have a unique **absolute path**.



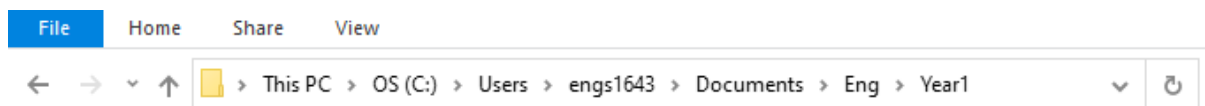
The **Absolute Path of a file/folder** (e.g. fileA) is the path you take from the **top of the system** (root directory) to reach **that file/folder**.

### Example: Absolute Path of ReadMe.txt

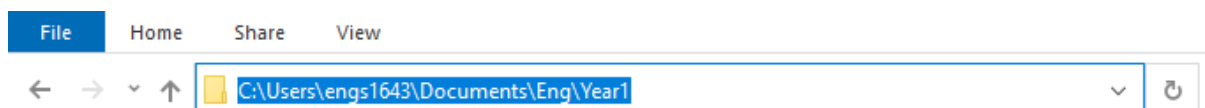
Consider the file **ReadMe.txt** in the diagram on page 12. Starting at the C Drive, you would first have to go into the **Users** directory, then the users home directory (Jack), then **Documents**, **Eng**, **Year1**, **P5comp** until you arrive at **ReadMe.txt**. The Absolute path is **C:/Users/Jack/Documents/Eng/Year1/P5comp/ReadMe.txt**

### Viewing the File Path

When viewing a folder in File Explorer, the bar along the top shows the **file path**:



You can click in the bar to make it editable:



It will sometimes appear shortened if you do not maximise the window:





## Relative Path

The absolute path of a file can be very long. Typing in the whole of the absolute path every time you need to use a file, would get very tedious. A quicker way to specify the path from the **Current Working Directory** to the file or folder you are interested in. This is called the **relative path** to a file.



The **Relative Path of a file/folder** is the path you would have to take from **the Current Working Directory** to the **original file/folder**.

### Example: Relative Path moving Down

Considering our example file structure, if the **Current Working Directory** is

**C:/Users/Jack/Documents/Eng/Year1/P5comp**

- The Relative Path to **ReadMe.txt** is just **ReadMe.txt**
- The Relative Path to **Prog1.m** is **Sess1/prog1.m**

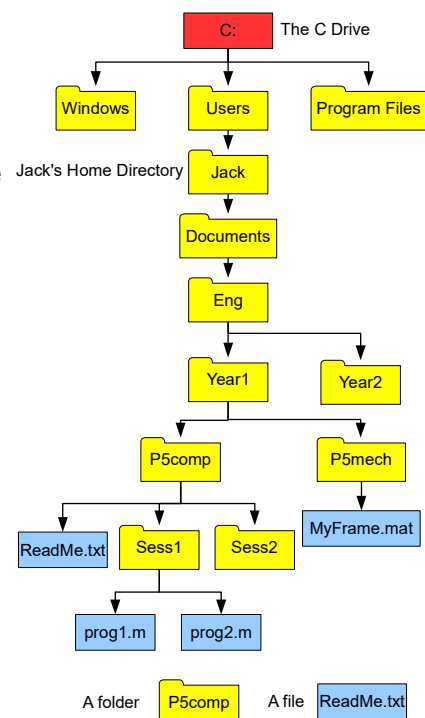
A relative path does NOT start with a forward slash.

### Example: Relative Path moving Up

You can also have a relative path that goes up the tree as well as down. Two full stops in a path indicates the parent directory from wherever you are in the path.

If the Current Working Directory is folder **Sess2**

- The Relative Path to **prog1.m** is **../Sess1/prog1.m**
- The Relative Path to **MyFrame.mat** is **../../P5mech/ MyFrame.mat**

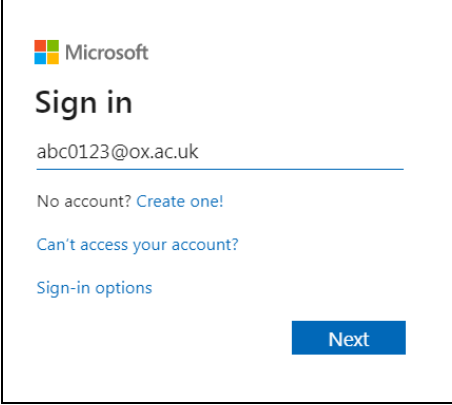


Relative paths take some getting used to, but can be a powerful tool when managing many files.

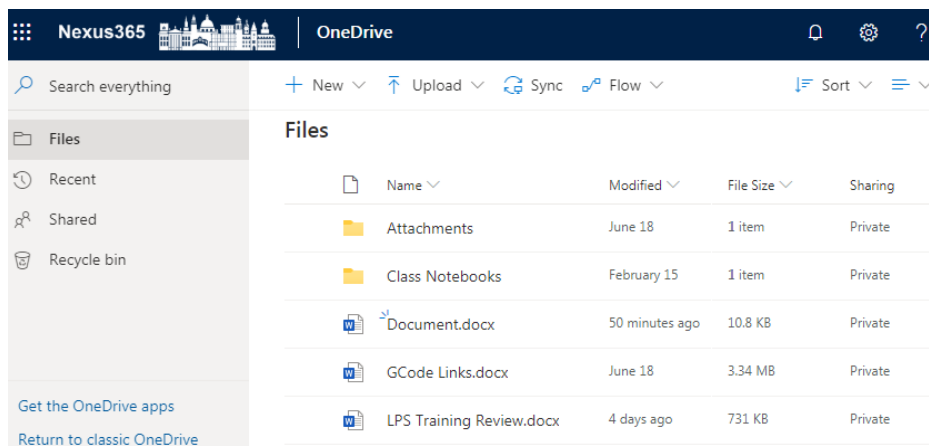
## Manual Backup using OneDrive

It is always a good idea to take a copy of your files, just in case anything happens to your computer. As part of your University Single Sign On (SSO) account, you have access to **One Drive**. This is a file storage area linked to the Microsoft Office Suite available online.

- Visit [Office.com](https://office.com) and click **Sign In**.
- Use your SSO username with ending **@ox.ac.uk**
- At the **Shibboleth SSO Sign In** page, use your SSO username and password.



Once you logged in, select **OneDrive** on your **dashboard** to open your file storage:



- Use the **Upload** button to add files or folders to your storage area. You can also drag and drop. Try uploading a Folder.
- In OneDrive, Right Click any file and select **Download** to download a file.



If you want to avoid manually **uploading a back up to OneDrive**, you can set up a folder on your computer to [sync using OneDrive](#). Using OneDrive as your Home Directory keeps everything automatically stored.





## Using Zip Folders

An easy way to transfer **multiple files** or folders between computers is to use a **zip file**. This stores all the data into a single file. It also uses compression software to reduce the size of the data.

### Zippping Items into a Folder



- Find the file or folder you want to zip in File Explorer
- Right-click it
- Select **Send to > Compressed (Zipped) Folder**.

You will now see a .zip file is created.

### Extracting a Zip File

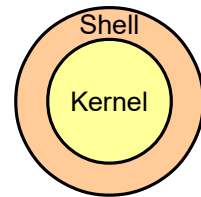
- Right-click on the zipped folder you want to unzip
- Select **Extract All...**

## Shells

So far we have shown the the easiest way of interacting with the operating system: using a **Graphical User Interface** or **GUI**. This is where you interact with the computer using a mouse pointer and click to interact with applications.

Operating systems (OS) are designed like a nut:

- The main part of the OS is called the **Kernel**. This contains all the **programs to manage the computer** and hardware.
- Surrounding the kernel is the **Shell**. The shell contains the **software** that allows you to interact with the kernel.



The GUI that you use to interact with your computer is a part of the Shell. However, this is not the only way of interacting with the Kernel. There are also text based commands that allow you to control the OS without a mouse. This is known as using the **Command Line**.



The program **Powershell** is a **Command Line Interface**, where you can interact with the OS by typing commands.

## Why use the Command Line?

Imagine Errol the Engineer has just returned from a six-month survey of materials in different off-shore structures. The 1430 samples have been run through a testing machine, resulting in 1430 data files. The research group has worked with files from this machine before, and know before they can graph the results the files need to be put through a program called **reformatData.sh**. In the past, they only had 20 files, so this script was run 20 times by hand. If Errol has to run **reformatData.sh** by hand using a GUI, they will have to **select and open a file 1430 times!** If it takes even 30 seconds to run each file, the whole process will take more than 12 hours. With the shell, Errol can instead assign the computer this mundane task!

It is important to **know the shell exists and what it can do**. The next few pages give a brief introduction. For a full introduction to shell, see this [online course](#).

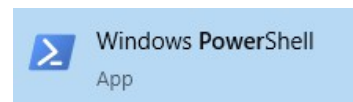
## Navigating Files using the Command Line

You cannot do anything in Powershell without knowing some commands. It expects commands in a language known as **bash** (for Bourne Again Shell). This section will introduce some key commands for looking at your files, like you would using **File Explorer**. The tasks covered will be: Launching Powershell, Checking the starting location, moving to new folder, listing the folders contents and then creating a folder.



### 1. Launch Powershell

- Press the **Windows Key** and type **powershell**
- Select the **Powershell** app from the search results.



### 2. Check Starting Location

You have a **Current Working Directory**, that is your current location within the file system. This is like when you open File Explorer and have a particular Folder open.

In Powershell, type the command:

```
pwd
```

and press Enter.

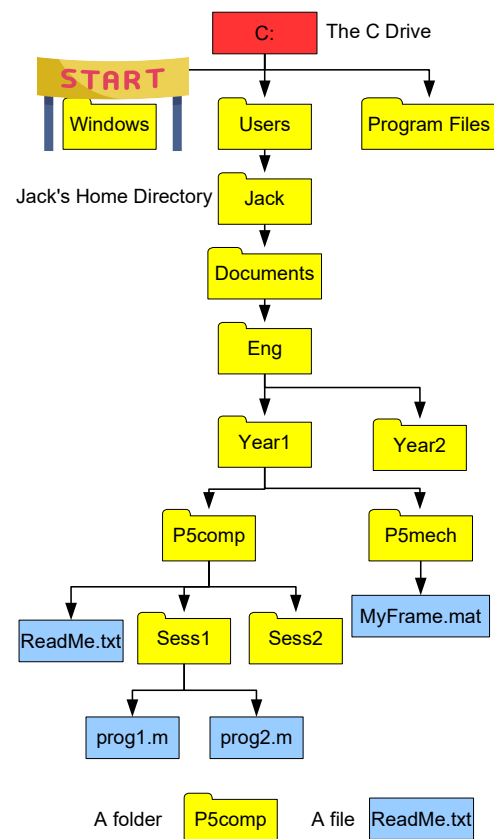
**All commands are case sensitive!**

This **P**rints your **C**urrent **W**orking **D**irectory, your current location in the file system.

To start with, the Current Working Directory is set to **C:\Windows\system32**

This is where the operating system files are.

We do not want to change any of these files, so instead let us move to our Home Directory in Users.





### 3. Move to a different Folder

To **move around** to look at other files/folders, use the command **cd** with a space, then a path. It changes the current working **directory**. To move to the **Users** folder:

```
cd C:\Users
```

Now you can check if it has changed:

```
pwd
```

You should see a message showing the current Path, or Working Directory, is **C:\Users**:

```
Path
----
C:\Users
```



### 4. List contents of Folder

To list the content of the Current Working Directory enter

```
ls This is a lower case L followed by a lower case s
```

You should see a list of all the files/folders in this directory (e.g. one folder for each user). You should see **your login name** listed.

```
Directory: C:\Users
```

Mode	LastWriteTime	Length	Name
d----	20/06/2019 15:12		admin
d----	24/06/2019 14:12		Jack

The **ls** command lists the contents of any folder on the file system, not just those in the current path. The command is the word **ls**, a **space**, then a folder **path**.

We can specify a folder **using its absolute path**:

```
ls / This lists all files and folders in the C Drive
ls /Windows This lists all files and folders in the location C:\Windows
```

Or **relative path** (that is not listing the path from the start, but from you current working directory). Assuming we are in **Users** still:

```
ls Jack
ls Jack/Documents
```

## Special notation: ~ for Home Directory

As a short hand, you can use the tilde ~ to indicate your Home directory. So instead of typing:

```
ls Jack
ls Jack/Documents
```

You could type the equivalent:

```
ls ~
ls ~/Documents
```

This saves time. Particularly when you first open Powershell, remember we start in the Windows system folder. With three characters we can be in our Home Directory:

```
PS C:\WINDOWS\system32> cd ~
PS C:\Users\engs1643>
```

```
cd ~           Makes your Home Directory the current working directory
```



## 5. Create a new folder

To **create a new folder**, use the command **mkdir** followed by the **new folder name**. This stands for **make directory**. This example changes the current directory to be the Eng folder, then creates a new folder and checks the results by using list:

```
cd ~/Documents/Eng
mkdir Year3
ls
```

## Special notation: .. for Parent Folder

Two full stops .. indicates the parent folder. The folder one level above.

Let us move to the folder Year1, then use the parent notation to move into Year3:

```
cd Year1
cd ../Year3   Relative path: move up to parent directory first, then down to Year3
```

There are many more commands that you can use, see <https://ss64.com/ps/>  
For a comprehensive introduction to shell, see this [self-paced online course](#).