

Operating Systems Report

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OPERATING SYSTEMS

Computer Architecture and Operating Systems



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Introduction

This report will provide a general overview and the key functions of Operating systems (OS), mainly Windows and Linux, while also giving examples of some basic commands and scripts that can be used and created in each of the mentioned OS's.

Key functions of general Operating Systems

An operating system (OS) is vital software that runs on a computer that allows users to communicate with the device [1].

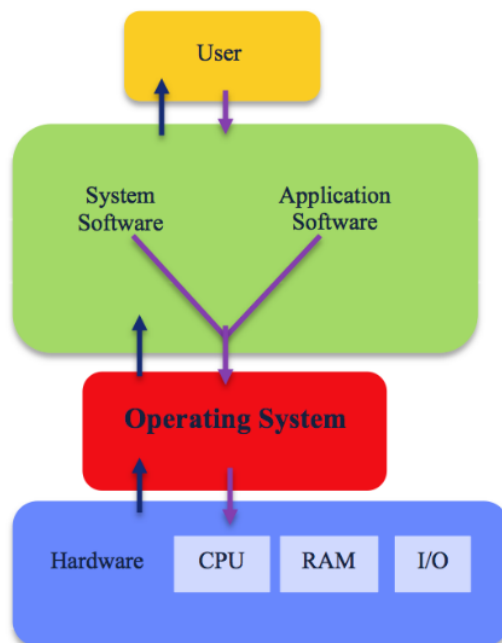


Figure 1: OS process [2]

Some functions of an OS include password protection. Monitoring device health and detecting errors, troubleshooting issues, while keeping a system functionalities record. Managing the processor and memory to decide, coordinate and execute tasks to allow different programs and software to run. Handling the input and output and any programs and processes. Managing the file system and all operations regarding the storage of data and access to files. [3].

A kernel is a core component as it manages the operations of memory and the CPU. Its main tasks are the managements of disks, tasks and memory and it keeps a table of any active processes [4].

A computer uses storage which is where files are permanently saved and memory for the temporary storage of data [5]. The memory of a device or RAM is volatile meaning when the device is turned off, the information is gone. Whereas the storage of a device is for long term data and uses a HDD or SSD [6]. When there is a RAM shortage, a computer can switch to virtual memory. This moves data into a paging file to free up RAM so a device can complete a task. However, can slow a device and so increasing the RAM may be required [7]. A possible error that can occur on a device is a deadlock,

where multiple programs attempt to share the same resources and so block each other from functioning [8].

The process manager handles the smooth running and removal of any CPU processes that are using up the device's memory [9]. The process life cycle follows the stages of a management system or process as it goes through its life [10].

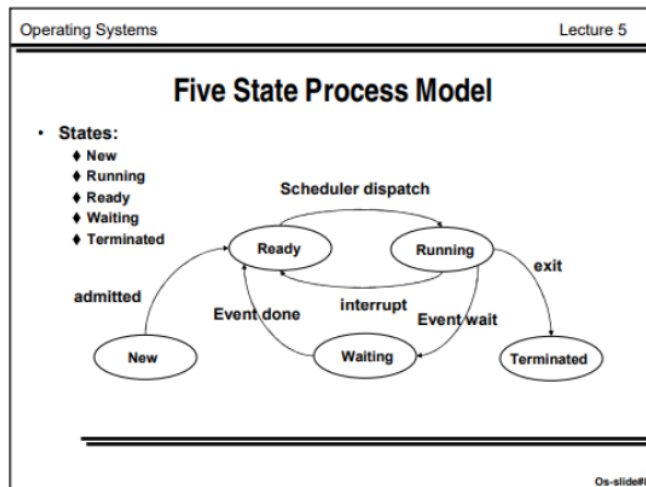


Figure 2: Process Life Cycle [11]

A thread is a unit created during the execution of a process or application. When multiple threads are executed at once, this is called multithreading, which shares resources distributed by the CPU [12]. Context switching allows the CPU to run multiple processes as it stores data of an ongoing process so that it can be reloaded from the same point it was stopped [13].

Another important component to the OS is a device driver. A driver is a software component that allows the communication between an OS and a device.

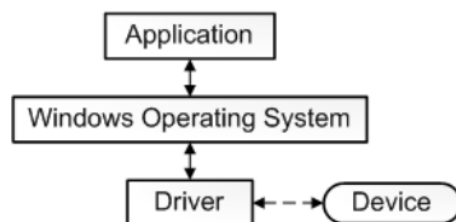


Figure 3: Device Driver Process [14]

A file system manages files and makes it so a user can access and modify data [15]. A few examples include the Resilient File System (ReFS) used with Windows OS [16]. The Linux OS commonly uses the ext4 file system [17] and then the Apple File System (APFS) which is default for Mac users with macOS version 10.13 or later [18]. A Distributed File System (DFS) enables users to access file storage through a network. A DFS is useful for organisations as there is a layer of encryption for security and their users have improved availability of files due to them being able to access everything remotely [19].

There are also server OS. There is the Windows Server which provides support for various devices, allows multitasking, and has a desktop GUI experience. The Linux OS has different distributions

which offer a high level of security, are open-source, but unlike Windows, do not provide long-term support. Also, the macOS which is like Linux but is developed by Apple for their own devices [20].

A server will store, send, and receive data and can provide multiple services. There are different types of servers depending on the task required. A web server that is used for the internet. An email server, used for programs such as Outlook. A game server for connecting to online games. Streaming video servers for applications such as Netflix and a proxy server for whenever there is a third-party between a user's computer and another server [21].

When using an OS there are different directories accessible through command prompt:

- /home – users home directory [22].
- /etc – stores system configuration files [23].
- /usr – contains data such as documentation and libraries [24].
- /boot – everything required for boot process [25].

Each directory and file have three user permission groups, the owner whose permissions apply only to them. The group which has set permissions assigned to the entire group and then all user permissions that apply to everyone using the system. There are also permission types. Read permissions allows a user to read the contents of a file. Write permissions allow a user to write or modify a file and execute permissions allow a user to execute a file and view the directories contents [26].

Linux File Permissions

 blog.bytobytego.com

Binary	Octal	String Representation	Permissions
000	0 (0+0+0)	---	No Permission
001	1 (0+0+1)	--x	Execute
010	2 (0+2+0)	-w-	Write
011	3 (0+2+1)	-wx	Write + Execute
100	4 (4+0+0)	r--	Read
101	5 (4+0+1)	r-x	Read + Execute
110	6 (4+2+0)	rw-	Read + Write
111	7 (4+2+1)	rwX	Read + Write + Execute

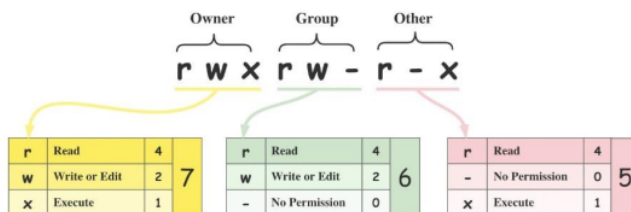


Figure 4: Linux File Permissions [27]

Linux file permissions can be broken down into an Octal method. The octal method uses numeric representation to assign different digits for certain permissions [28]. Whereas there is also a symbolic permissions method that uses letters instead [29].

Use of Windows OS CLI commands

IPCONFIG

```
Command Prompt
Microsoft Windows [Version 10.0.22000.1855]
(c) Microsoft Corporation. All rights reserved.

C:\Users\ojen>ipconfig

Windows IP configuration

Ethernet adapter Ethernet 2:

   Media State . . . . . : Media disconnected
   Connection-specific DNS Suffix . : 

Unknown adapter Local Area Connection:

   Media State . . . . . : Media disconnected
   Connection-specific DNS Suffix . : 

Ethernet adapter Ethernet 3:

   Connection-specific DNS Suffix . : 
   Link-local IPv6 Address . . . . . : fe80::4222:c3fd:bdbec:8305%21
   IPv4 Address. . . . . : 192.168.56.1
   Subnet Mask . . . . . : 255.255.255.0
   Default Gateway . . . . . : 

Wireless LAN adapter Local Area Connection* 1:

   Media State . . . . . : Media disconnected
   Connection-specific DNS Suffix . : 

Wireless LAN adapter Local Area Connection* 2:

   Media State . . . . . : Media disconnected
   Connection-specific DNS Suffix . : 

Wireless LAN adapter WiFi:

   Connection-specific DNS Suffix . : 
   IPv4 Address. . . . . : 2a0c:b381:4e0b:e0b:295b:2f92:7d40:bca4
```

IPCONFIG stands for Internet protocol Configuration and displays the IP address, Subnet Mask, and other network values [30].

NETSTAT

```
Command Prompt

C:\Users\ojen>netstat

Active Connections

Proto Local Address Foreign Address State
TCP 127.0.0.1:51127 DESKTOP-2A3WQSL:51130 ESTABLISHED
TCP 127.0.0.1:51130 DESKTOP-2A3WQSL:51127 ESTABLISHED
TCP 192.168.1.118:40415 20.90.153.243:https ESTABLISHED
TCP 192.168.1.118:51142 20.90.153.243:https ESTABLISHED
TCP 192.168.1.118:51180 52.108.89.13:https ESTABLISHED
TCP 192.168.1.118:51667 52.108.88.1:https ESTABLISHED
TCP 192.168.1.118:51937 192.229.221.95:https CLOSE_WAIT
TCP 192.168.1.118:54442 193.25.182.20:22020 ESTABLISHED
TCP 192.168.1.118:57143 52.108.88.1:https ESTABLISHED
TCP 192.168.1.118:57280 idrv:https ESTABLISHED
TCP 192.168.1.118:57282 idrv:https ESTABLISHED
TCP 192.168.1.118:57391 idrv:https ESTABLISHED
TCP 192.168.1.118:57438 144.2.12.25:https ESTABLISHED
TCP 192.168.1.118:57453 idrv:https TIME_WAIT
TCP 192.168.1.118:57456 idrv:https ESTABLISHED
TCP 192.168.1.118:57481 104.208.16.0:https TIME_WAIT
TCP 192.168.1.118:57482 20.42.72.131:https TIME_WAIT
TCP 192.168.1.118:57492 52.109.8.45:https TIME_WAIT
TCP 192.168.1.118:57504 idrv:https ESTABLISHED
TCP 192.168.1.118:57507 52.113.199.98:https ESTABLISHED
TCP 192.168.1.118:57508 52.109.89.14:https TIME_WAIT
TCP 192.168.1.118:57509 52.109.89.14:https TIME_WAIT
TCP 192.168.1.118:57510 52.109.89.14:https TIME_WAIT
TCP 192.168.1.118:57513 20.42.72.131:https ESTABLISHED
TCP 192.168.1.118:57512 52.109.76.225:https TIME_WAIT
TCP 192.168.1.118:57513 52.109.76.19:https ESTABLISHED
TCP 192.168.1.118:57514 52.109.76.225:https TIME_WAIT
TCP 192.168.1.118:57519 40.70.229.150:https ESTABLISHED
TCP [2a0c:b381:4e0b:e0b:c58a:5c65:0b4b:abfa]:51366 ws-in-f108:5228 ESTABLISHED
TCP [2a0c:b381:4e0b:e0b:c58a:5c65:0b4b:abfa]:57250 [2a01:111:f100:a004:bfeb:8b60]:https ESTABLISHED
TCP [2a0c:b381:4e0b:e0b:c58a:5c65:0b4b:abfa]:57282 [2a01:111:f100:a001:11701:9782]:https ESTABLISHED
TCP [2a0c:b381:4e0b:e0b:c58a:5c65:0b4b:abfa]:57380 [2603:1026:c06:141f:12]:https ESTABLISHED
TCP [2a0c:b381:4e0b:e0b:c58a:5c65:0b4b:abfa]:57505 [2603:1026:c06:141f:12]:https TIME_WAIT
```

NETSTAT stands for Network Statistics and displays network status and protocol statistics of both TCP and UDP connections [31].

SYSTEMINFO

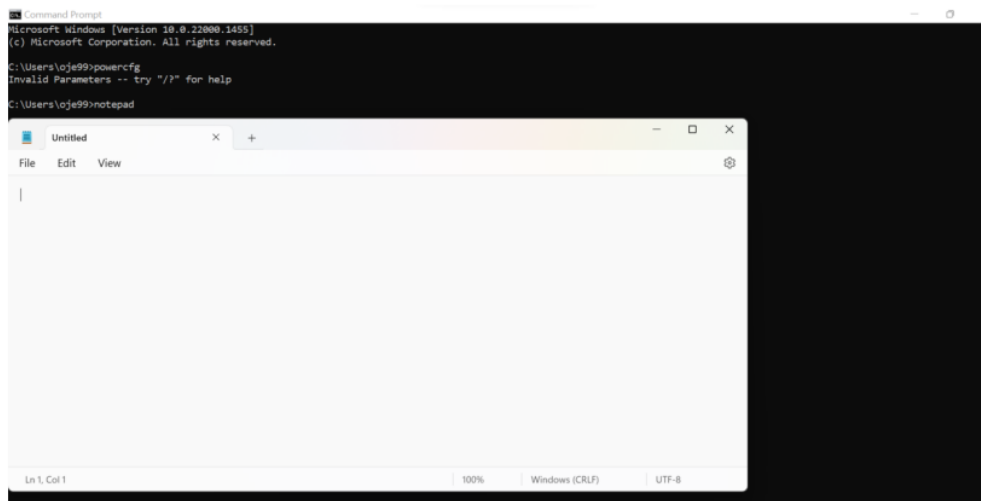
```
Command Prompt
Microsoft Windows [version 10.0.22000.1455]
(c) Microsoft Corporation. All rights reserved.

C:\Users\joje99>systeminfo

Host Name:                DESKTOP-2A3MDS1
OS Name:                  Microsoft Windows 11 Home
OS Version:               10.0.22000 N/A Build 22000
OS Manufacturer:         Microsoft Corporation
OS Configuration:        Standalone Workstation
OS Build Type:             Multiprocessor Free
Registered Owner:         joje99@hotmail.co.uk
Registered Organization:   HP
Product ID:               00342-21911-45684-AADEM
Original Install Date:     31/12/2021, 13:56:31
System Root Time:         07/01/2021, 14:57:18
System Manufacturer:      HP
System Model:              HP Pavilion x360 Convertible 14-dy0xxx
System Type:              x64-based PC
Processor(s):              [01]: Intel(R) Family 6 Model 140 Stepping 1 GenuineIntel ~2803 Mhz
                           Insyde F.16, 17/03/2022
BIOS Version:              Insyde F.16, 17/03/2022
Windows Directory:         C:\Windows
System Directory:          C:\Windows\System32
Boot Device:               \Device\HarddiskVolume1
System Locale:              en-gb;English (United Kingdom)
Input Locale:              en-gb;English (United Kingdom)
Time Zone:                 (UTC+00:00) Dublin, Edinburgh, Lisbon, London
Total Physical Memory:     16,112 MB
Available Physical Memory: 8,702 MB
Virtual Memory: Max Size: 16,584 MB
Virtual Memory: Available: 8,674 MB
Virtual Memory: In Use:    16,510 MB
Page File Location(s):     C:\pagefile.sys
Domain:                    WORKGROUP
Logon Server:               \DESKTOP-2A3MDS1
Hotfix(s):                 [01]: KB5022505
                           [02]: KB5007040
                           [03]: KB5012170
```

SYSTEMINFO displays details about the computer being used, including its operating system and hardware properties [32].

NOTEPAD



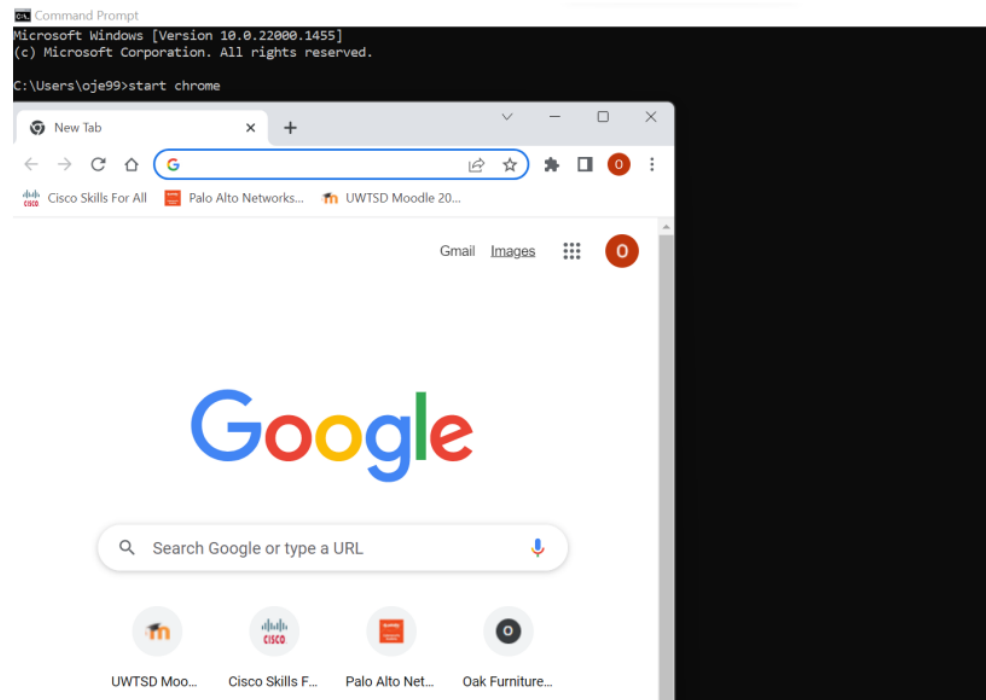
NOTEPAD allows the user to open the notepad application.

COLOR



COLOR allows the user to change the colour of their Command Prompt. By using “color help” a user can see a list of different values that can be used for a range of different colours [33].

START



START allows the user to run a specific program [34].

WHOAMI



WHOAMI displays the current user of the system but can also be used with parameters to display groups and privilege information [35].

TASKLIST

C:\Users\oje99>tasklist

Image Name	PID	Session Name	Session#	Mem Usage
System Idle Process	0	Services	0	8 K
System	4	Services	0	2,792 K
Secure System	104	Services	0	45,804 K
Registry	168	Services	0	31,120 K
lsass.exe	588	Services	0	968 K
csrss.exe	552	Services	0	4,140 K
smss.exe	968	Services	0	3,636 K
services.exe	1048	Services	0	7,604 K
lsass.exe	1072	Services	0	3,532 K
lsass.exe	1084	Services	0	23,676 K
svchost.exe	1272	Services	0	28,416 K
Fontdrvhost.exe	1308	Services	0	2,116 K
UDFHost.exe	1404	Services	0	9,068 K
svchost.exe	1444	Services	0	22,688 K
svchost.exe	1488	Services	0	10,268 K
UDFHost.exe	1652	Services	0	7,452 K
svchost.exe	1764	Services	0	8,156 K
svchost.exe	1772	Services	0	9,900 K
svchost.exe	1780	Services	0	13,764 K
svchost.exe	1864	Services	0	8,712 K
svchost.exe	1888	Services	0	8,164 K
svchost.exe	1896	Services	0	12,116 K
svchost.exe	2024	Services	0	9,764 K
svchost.exe	1104	Services	0	10,500 K
svchost.exe	1284	Services	0	9,940 K
svchost.exe	1192	Services	0	9,176 K
svchost.exe	2172	Services	0	9,396 K
svchost.exe	2184	Services	0	12,028 K
IntelCPDPSPvc.exe	2192	Services	0	3,112 K
svchost.exe	2240	Services	0	9,812 K
svchost.exe	2260	Services	0	15,812 K
svchost.exe	2272	Services	0	8,232 K

igfxCUIServiceN.exe	2024	Services	0	4,824 K
svchost.exe	3348	Services	0	14,728 K
svchost.exe	3384	Services	0	22,140 K
NetworkCap.exe	3392	Services	0	9,196 K
AppHelperCap.exe	3400	Services	0	13,388 K
SysInfoCap.exe	3408	Services	0	15,768 K
DiagsCap.exe	3416	Services	0	4,948 K
TouchpointAnalyticsClient	3520	Services	0	26,628 K
svchost.exe	3612	Services	0	22,268 K
svchost.exe	3860	Services	0	26,628 K
WFSMS.exe	3912	Services	0	8,084 K
WFSMSHOST.exe	4056	Services	0	28,660 K
WFSVPS.exe	2776	Services	0	9,536 K
svchost.exe	3760	Services	0	9,124 K
ProtectedModuleHost.exe	4100	Services	0	6,988 K
svchost.exe	4220	Services	0	7,960 K
svchost.exe	4412	Services	0	19,972 K
svchost.exe	4448	Services	0	8,388 K
svchost.exe	4456	Services	0	12,036 K
svchost.exe	4524	Services	0	8,976 K
svchost.exe	4536	Services	0	10,904 K
Memory Compression	4556	Services	0	276,376 K
svchost.exe	4804	Services	0	13,148 K
svchost.exe	4892	Services	0	8,760 K
svchost.exe	4920	Services	0	15,180 K
svchost.exe	4944	Services	0	10,136 K
spoolsv.exe	5052	Services	0	6,544 K
svchost.exe	5112	Services	0	17,108 K
svchost.exe	4760	Services	0	8,724 K
RTDService.exe	5200	Services	0	3,584 K
svchost.exe	5212	Services	0	1,608 K
svchost.exe	5220	Services	0	22,548 K
msm.exe	5232	Services	0	3,360 K
OfficeClickToRun.exe	5244	Services	0	20,512 K
svchost.exe	5260	Services	0	39,908 K
svchost.exe	5268	Services	0	7,940 K
PNPLicensingService64.exe	5276	Services	0	8,244 K

svchost.exe	2272	Services	0	8,232 K
svchost.exe	2284	Services	0	8,868 K
svchost.exe	2400	Services	0	9,096 K
svchost.exe	2452	Services	0	11,812 K
svchost.exe	2536	Services	0	9,940 K
svchost.exe	2564	Services	0	8,892 K
svchost.exe	2684	Services	0	8,460 K
svchost.exe	2688	Services	0	12,772 K
svchost.exe	2780	Services	0	9,064 K
svchost.exe	2782	Services	0	10,940 K
igfxCUIServiceN.exe	2924	Services	0	4,824 K
svchost.exe	3348	Services	0	14,728 K
svchost.exe	3384	Services	0	22,140 K
NetworkCap.exe	3392	Services	0	9,196 K
AppHelperCap.exe	3400	Services	0	13,388 K
SysInfoCap.exe	3408	Services	0	15,768 K
DiagsCap.exe	3416	Services	0	4,948 K
TouchpointAnalyticsClient	3520	Services	0	26,628 K
svchost.exe	3612	Services	0	22,268 K
svchost.exe	3860	Services	0	26,628 K
WFSMS.exe	3912	Services	0	8,084 K
WFSMSHOST.exe	4056	Services	0	28,660 K
WFSVPS.exe	2776	Services	0	9,536 K
svchost.exe	3760	Services	0	9,124 K
ProtectedModuleHost.exe	4100	Services	0	6,988 K
svchost.exe	4220	Services	0	7,960 K
svchost.exe	4412	Services	0	19,972 K
svchost.exe	4448	Services	0	8,388 K
svchost.exe	4456	Services	0	12,036 K
svchost.exe	4524	Services	0	8,976 K
svchost.exe	4536	Services	0	10,904 K
Memory Compression	4556	Services	0	276,376 K
svchost.exe	4804	Services	0	13,148 K
svchost.exe	4892	Services	0	8,760 K
svchost.exe	4920	Services	0	15,180 K
svchost.exe	4944	Services	0	10,136 K
spoolsv.exe	5052	Services	0	6,544 K
svchost.exe	5112	Services	0	17,108 K

svchost.exe	5288	Services	0	3,856 K
svchost.exe	5312	Services	0	15,748 K
svchost.exe	5348	Services	0	9,900 K
svchost.exe	5376	Services	0	10,000 K
IntelAudioService.exe	5384	Services	0	6,284 K
UIS.exe	5532	Services	0	1,724 K
ModuleCoreService.exe	5564	Services	0	7,092 K
RTDService.exe	5632	Services	0	3,492 K
IntelAudioService4.exe	5656	Services	0	23,236 K
RTDService.exe	5672	Services	0	4,064 K
svchost.exe	5696	Services	0	10,244 K
svchost.exe	5744	Services	0	4,972 K
RTDService.exe	5752	Services	0	18,664 K
svchost.exe	5764	Services	0	8,280 K
svchost.exe	5792	Services	0	17,180 K
svchost.exe	5804	Services	0	244,728 K
svchost.exe	5996	Services	0	9,776 K
svchost.exe	6024	Services	0	3,492 K
svchost.exe	6288	Services	0	3,884 K
svchost.exe	6636	Services	0	3,928 K
svchost.exe	6124	Services	0	4,616 K
svchost.exe	7200	Services	0	15,052 K
ModuleCoreService.exe	7420	Services	0	44,896 K
svchost.exe	7436	Services	0	3,020 K
svchost.exe	8020	Services	0	13,292 K
svchost.exe	8672	Services	0	5,212 K
svchost.exe	8224	Services	0	9,740 K
svchost.exe	8432	Services	0	12,100 K
svchost.exe	9320	Services	0	17,124 K
svchost.exe	9716	Services	0	8,520 K
svchost.exe	9960	Services	0	9,764 K
svchost.exe	10012	Services	0	15,500 K
svchost.exe	10172	Services	0	16,316 K
svchost.exe	2448	Services	0	1,456 K
svchost.exe	8176	Services	0	696 K
svchost.exe	4556	Services	0	16,400 K
svchost.exe	11108	Services	0	40,772 K
svchost.exe	12588	Services	0	15,056 K
svchost.exe	10880	Services	0	1,300 K

HeavySvc.exe	12928	Services	0	11,688 K
hcschild.exe	14352	Services	0	5,244 K
SecurityHealthService.exe	12100	Services	0	7,312 K
svchost.exe	11044	Services	0	9,832 K
svchost.exe	18700	Services	0	15,508 K
svchost.exe	20164	Services	0	18,980 K
svchost.exe	17012	Services	0	8,708 K
svchost.exe	15004	Services	0	10,800 K
svchost.exe	11280	Services	0	14,572 K
svchost.exe	12052	Services	0	16,932 K
SgrmBroker.exe	14672	Services	0	8,688 K
svchost.exe	8700	Services	0	12,460 K
svchost.exe	2852	Services	0	8,560 K
svchost.exe	9660	Services	0	6,720 K
svchost.exe	3184	Services	0	9,836 K
svchost.exe	9424	Services	0	17,128 K
csrss.exe	2160	Console	2	6,068 K
winlogon.exe	2120	Console	2	5,904 K
Fontdrvhost.exe	11492	Console	2	8,736 K
dm.exe	7324	Console	2	208,144 K
svchost.exe	18828	Services	0	8,408 K
ETDCtrl.exe	15688	Console	2	7,668 K
sihost.exe	15824	Console	2	8,764 K
sihost.exe	19932	Console	2	23,756 K
svchost.exe	6784	Console	2	8,960 K
svchost.exe	8724	Console	2	20,256 K
svchost.exe	4604	Console	2	9,344 K
lgf4RM.exe	16044	Console	2	5,876 K
svchost.exe	16948	Console	2	39,548 K
McUICtr.exe	14612	Console	2	13,936 K
taskhostw.exe	17120	Console	2	15,480 K
explorer.exe	2576	Console	2	200,696 K
svchost.exe	13324	Console	2	24,456 K
rundll32.exe	16864	Console	2	4,584 K
SECCL64.exe	21632	Console	2	5,040 K
conhost.exe	16828	Console	2	3,688 K
RtkAudService64.exe	10104	Console	2	6,600 K
SearchHost.exe	15972	Console	2	336,004 K
StartMenuExperienceHost.e	16284	Console	2	35,156 K

RuntimeBroker.exe	18768	Console	2	13,908 K
RuntimeBroker.exe	16292	Console	2	38,536 K
svchost.exe	19992	Console	2	14,748 K
dllhost.exe	12424	Console	2	19,544 K
ctfmon.exe	13176	Console	2	13,424 K
TabTip.exe	17116	Console	2	8,760 K
LockApp.exe	10316	Console	2	4,748 K
RuntimeBroker.exe	5448	Console	2	10,760 K
svchost.exe	2300	Console	2	12,252 K
GameBar.exe	9380	Console	2	5,124 K
svchost.exe	19572	Console	2	12,196 K
GameBarTServer.exe	6900	Console	2	6,148 K
RuntimeBroker.exe	21844	Console	2	6,076 K
HPEnhancedLighting.Bg.exe	18556	Console	2	10,864 K
PhoneExperienceHost.exe	13572	Console	2	17,468 K
SecurityHealthSystray.exe	19488	Console	2	4,616 K
RuntimeBroker.exe	18592	Console	2	5,584 K
Teams.exe	3236	Console	2	70,576 K
Teams.exe	7092	Console	2	31,692 K
Teams.exe	9980	Console	2	17,384 K
Teams.exe	13032	Console	2	6,208 K
Teams.exe	4600	Console	2	7,324 K
DesktopExtension.exe	3056	Console	2	5,956 K
HP.MySP.exe	10524	Console	2	8,192 K
RtkAudService64.exe	13048	Console	2	4,516 K
HPSystemEventUtilityHost.	13296	Console	2	20,648 K
ExpressVPNNotificationSer	2032	Console	2	17,476 K
OneDrive.exe	10236	Console	2	77,008 K
FileSyncHelper.exe	21284	Services	0	10,000 K
ModuleCoreService.exe	10164	Console	2	8,856 K
conhost.exe	480	Console	2	3,600 K
TextInputHost.exe	21996	Console	2	22,184 K
chrome.exe	13404	Console	2	186,308 K
chrome.exe	12568	Console	2	4,764 K
chrome.exe	18804	Console	2	160,792 K
chrome.exe	18004	Console	2	40,228 K
chrome.exe	18000	Console	2	9,868 K
PowerCommandCenterBackgrou	13156	Console	2	61,012 K
HPAudioSwitch.exe	4044	Console	2	7,280 K

chrome.exe	12816	Console	2	59,044 K
chrome.exe	18212	Console	2	50,516 K
svchost.exe	21876	Services	0	6,340 K
mscapp.exe	11644	Console	2	5,428 K
svchost.exe	22372	Console	2	14,212 K
HPAudioSwitch.exe	18076	Console	2	5,572 K
svchost.exe	11792	Services	0	6,176 K
PhotosApp.exe	6676	Console	2	41,192 K
BackgroundTaskHost.exe	14436	Console	2	1,468 K
ShellExperienceHost.exe	14824	Console	2	69,208 K
RuntimeBroker.exe	15156	Console	2	14,308 K
RuntimeBroker.exe	4900	Console	2	5,500 K
BridgeCommunication.exe	15140	Console	2	9,024 K
FileCohort.exe	10896	Console	2	9,980 K
RMCD.exe	17788	Console	2	325,118 K
si.exe	14600	Console	2	6,832 K
Podcastr.exe	3580	Console	2	230,180 K
ApplicationFrameHost.exe	8304	Console	2	10,100 K
McUICtr.exe	20648	Console	2	1,760 K
RuntimeBroker.exe	21780	Console	2	14,168 K
WTr.exe	9240	Console	2	37,932 K
SystemSettings.exe	13352	Console	2	1,782 K
UserOOBBroker.exe	6044	Console	2	4,392 K
dllhost.exe	13352	Console	2	9,948 K
si.exe	8948	Console	2	4,688 K
AdaptiveCoreWorker.exe	6872	Services	0	32,472 K
svchost.exe	1320	Services	0	11,500 K
chrome.exe	14172	Console	2	9,008 K
steam.exe	20932	Console	2	40,020 K
steamhelper.exe	8352	Console	2	25,624 K
steamhelper.exe	18836	Console	2	7,192 K
steamhelper.exe	18160	Console	2	47,076 K
steamhelper.exe	18876	Console	2	131,800 K
steamservice.exe	6096	Services	0	6,116 K
steamhelper.exe	10748	Console	2	94,888 K
steamhelper.exe	11480	Console	2	40,800 K
steamhelper.exe	16124	Console	2	21,612 K
steamhelper.exe	16196	Console	2	14,772 K
BridgeCommunication.exe	17948	Console	2	10,900 K

McUICtr.exe	5080	Services	0	6,580 K
McUICtr.exe	18040	Services	0	7,252 K
BackgroundTaskHost.exe	20060	Console	2	1,588 K
RuntimeBroker.exe	11836	Console	2	5,160 K
Teams.exe	7712	Console	2	237,516 K
Teams.exe	3680	Console	2	70,504 K
Teams.exe	19752	Console	2	62,084 K
svchost.exe	22412	Services	0	11,776 K
svchost.exe	6580	Services	0	8,484 K
audiodg.exe	19144	Services	0	20,896 K
WidgetService.exe	19340	Console	2	10,332 K
svchost.exe	13152	Services	0	6,292 K
svchost.exe	16064	Console	2	14,476 K
svchost.exe	11540	Services	0	27,516 K
cmd.exe	16436	Console	2	4,628 K
conhost.exe	5428	Console	2	19,376 K
cmd.exe	536	Console	2	5,044 K
conhost.exe	5364	Console	2	27,092 K
SearchProtocolHost.exe	22032	Console	2	8,788 K
BackgroundTaskHost.exe	8664	Console	2	18,304 K
cmdPrvDE.exe	2628	Services	0	10,804 K
RuntimeBroker.exe	18308	Console	2	23,104 K
SearchFilterHost.exe	11620	Services	0	12,188 K
SearchFilterHost.exe	13184	Services	0	14,208 K
TrustedInstaller.exe	20312	Services	0	7,964 K
Worker.exe	11704	Services	0	13,664 K
NotificationX.exe	2156	Console	2	17,136 K
chrome.exe	11172	Console	2	20,520 K
RuntimeBroker.exe	11784	Console	2	11,896 K
SearchProtocolHost.exe	7224	Services	0	16,436 K
tasklist.exe	19760	Console	2	10,372 K

TASKLIST reveals a list of all the processes currently running on the device. This command can be used with other parameters to display more detailed or specific information about different processes [36].

MKDIR/DIR/RMDIR

CA Command Prompt

Microsoft Windows [Version 10.0.22000.1455]
(c) Microsoft Corporation. All rights reserved.

C:\Users\oje99>mkdir test

C:\Users\oje99>dir

Volume in drive C is Windows
Volume Serial Number is DA0C-95E3

Directory of C:\Users\oje99

18/03/2023	15:32	<DIR>	.
31/12/2021	15:32	<DIR>	..
01/07/2022	15:01	<DIR>	.ms-ad
28/07/2022	08:51		176 .packettracer
07/03/2023	12:35	<DIR>	.VirtualBox
31/05/2022	09:00	<DIR>	Cisco Packet Tracer 8.1.1
31/12/2021	15:12	<DIR>	Contacts
24/01/2022	11:53	<DIR>	Desktop
31/12/2021	15:14	<DIR>	Documents
18/03/2023	13:33	<DIR>	Downloads
18/09/2021	23:18	<DIR>	Favorites
31/12/2021	15:12	<DIR>	Links
31/12/2021	15:12	<DIR>	Music
18/03/2023	13:03	<DIR>	OneDrive
24/01/2022	12:11	<DIR>	PycharmProjects
31/12/2021	15:12	<DIR>	Saved Games
31/12/2021	15:32	<DIR>	Searches
18/03/2023	15:32	<DIR>	test
31/12/2021	15:23	<DIR>	Videos
		1 File(s)	176 bytes
		18 Dir(s)	400,082,038,784 bytes free

C:\Users\oje99>rmdir test

C:\Users\oje99>dir

Volume in drive C is Windows
Volume Serial Number is DA0C-95E3

Directory of C:\Users\oje99

18/03/2023	15:33	<DIR>	.
31/12/2021	15:32	<DIR>	..
01/07/2022	15:01	<DIR>	.ms-ad
28/07/2022	08:51		176 .packettracer
07/03/2023	12:35	<DIR>	.VirtualBox
31/05/2022	09:00	<DIR>	Cisco Packet Tracer 8.1.1
31/12/2021	15:12	<DIR>	Contacts
24/01/2022	11:53	<DIR>	Desktop
31/12/2021	15:14	<DIR>	Documents
18/03/2023	13:33	<DIR>	Downloads
18/09/2021	23:18	<DIR>	Favorites
31/12/2021	15:12	<DIR>	Links
31/12/2021	15:12	<DIR>	Music
18/03/2023	13:03	<DIR>	OneDrive
24/01/2022	12:11	<DIR>	PycharmProjects
31/12/2021	15:12	<DIR>	Saved Games
31/12/2021	15:32	<DIR>	Searches
31/12/2021	15:23	<DIR>	Videos
		1 File(s)	176 bytes
		17 Dir(s)	400,082,059,264 bytes free

DIR displays a list of directories and their names. Also, showing the number of directories, the number of bytes they use and the remaining free bytes [37]. MKDIR creates a new directory with a name of choice [38]. RMDIR can be used to remove a directory [39].

ECHO

CA: Command Prompt

```
Microsoft Windows [Version 10.0.22000.1455]
(c) Microsoft Corporation. All rights reserved.

C:\Users\oje99>echo Hello
Hello
```

ECHO can be used to display a message. ECHO can be used to complete various tasks on the system [40].

WMIC PRODUCT GET NAME

CA: Administrator: Command Prompt

```
Microsoft Windows [Version 10.0.22000.1455]
(c) Microsoft Corporation. All rights reserved.

C:\windows\system32>wmic product get name
Name
Python 3.10.1 pip Bootstrap (64-bit)
Python 3.10.1 Documentation (64-bit)
Python 3.10.1 Tcl/Tk Support (64-bit)
Python 3.10.1 Test Suite (64-bit)
Python 3.10.1 Utility Scripts (64-bit)
Python 3.10.1 Core Interpreter (64-bit)
Pokémon Trading Card Game Online
Python 3.10.1 Executables (64-bit)
Python 3.10.1 Development Libraries (64-bit)
Python 3.10.1 Standard Library (64-bit)
Office 16 Click-to-Run Extensibility Component
Office 16 Click-to-Run Licensing Component
Python Launcher
psqlODBC_x64
Microsoft Visual C++ 2013 x64 Minimum Runtime - 12.0.40649
Microsoft Visual C++ 2019 X64 Minimum Runtime - 14.27.29016
Microsoft Visual C++ 2019 X64 Additional Runtime - 14.27.29016
ExpressVPN
Adobe Acrobat (64-bit)
Adobe Refresh Manager
Microsoft ODBC Driver 17 for SQL Server

AccessData FTK Imager
Oracle VM VirtualBox 7.0.6
Tableau 2022.3 (20223.22.1108.0821)
Microsoft Update Health Tools
HP Audio Switch
Microsoft Visual C++ 2013 x64 Additional Runtime - 12.0.40649
Autopsy
```

WMIC displays specific information about the system. Product get name displays a list of all the applications that are installed on the device [41].

SFC /SCANNOW

```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.22000.1455]
(c) Microsoft Corporation. All rights reserved.

C:\windows\system32>sfc /scannow

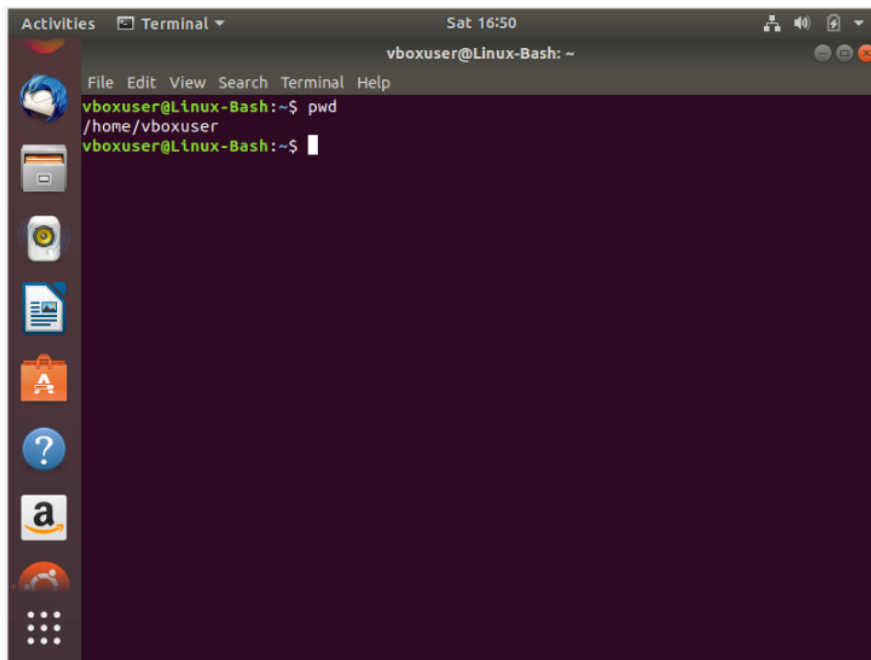
Beginning system scan. This process will take some time.

There is a system repair pending which requires reboot to complete. Restart
Windows and run sfc again.
```

SFC is used to scan and verify the integrity of the protected system files on the device and can fix issues found. The “/scannow” parameter will repair files with problems after the system scan is complete [42].

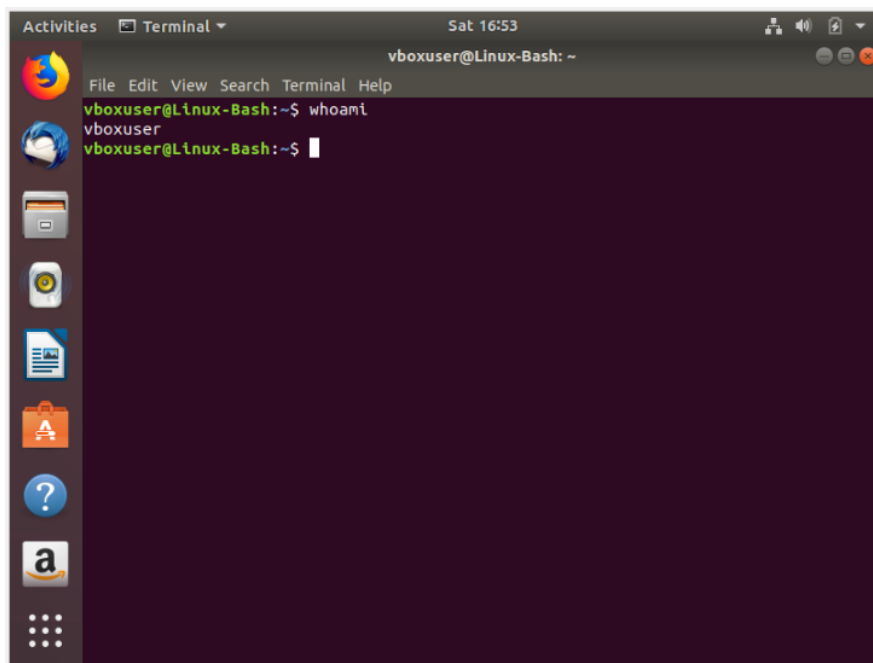
Use of Linux OS CLI commands

PWD



PWD stands for Print Working Directory and when used will display the name of the current working directories path name [43].

WHOAMI

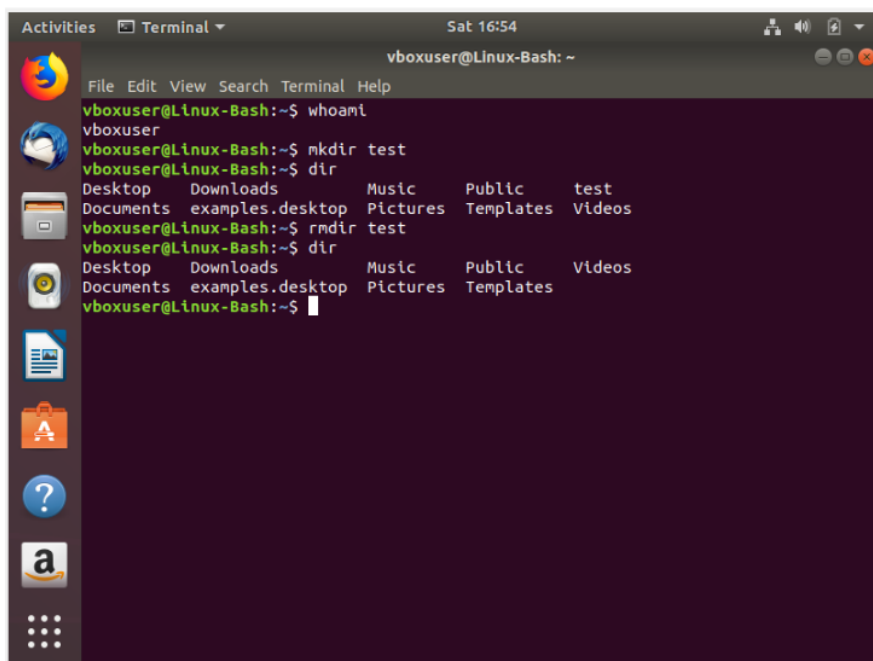


A terminal window titled 'Terminal' with a dark purple background. The window shows the command 'whoami' being executed, which returns the output 'vboxuser'. The prompt 'vboxuser@Linux-Bash: ~\$' is visible at the top of the terminal area.

```
vboxuser@Linux-Bash: ~$ whoami
vboxuser
vboxuser@Linux-Bash: ~$
```

WHOAMI displays the username of the user currently using the system [44].

MKDIR/DIR/RMDIR

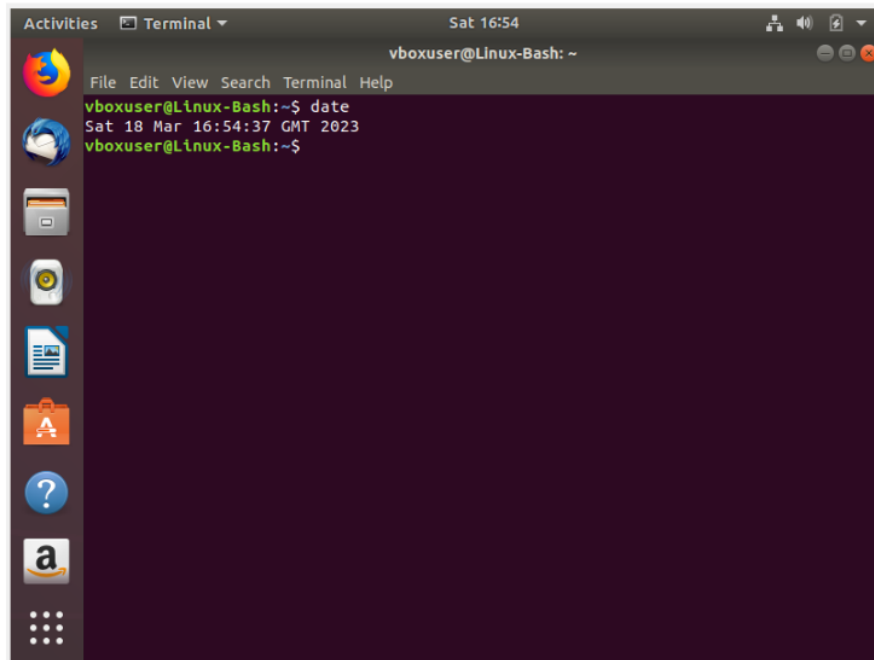


A terminal window titled 'Terminal' with a dark purple background. The window shows a sequence of commands: 'mkdir test', 'dir', 'rmdir test', and 'dir'. The output of 'dir' shows a list of directories including Desktop, Downloads, Music, Public, test, Documents, examples.desktop, Pictures, Templates, and Videos. The prompt 'vboxuser@Linux-Bash: ~\$' is visible at the top of the terminal area.

```
vboxuser@Linux-Bash: ~$ mkdir test
vboxuser@Linux-Bash: ~$ dir
Desktop  Downloads  Music      Public     test
Documents examples.desktop Pictures    Templates  Videos
vboxuser@Linux-Bash: ~$ rmdir test
vboxuser@Linux-Bash: ~$ dir
Desktop  Downloads  Music      Public     Videos
Documents examples.desktop Pictures    Templates
vboxuser@Linux-Bash: ~$
```

DIR shows the directories, MKDIR can make a new directory and RMDIR can remove a directory [45].

DATE

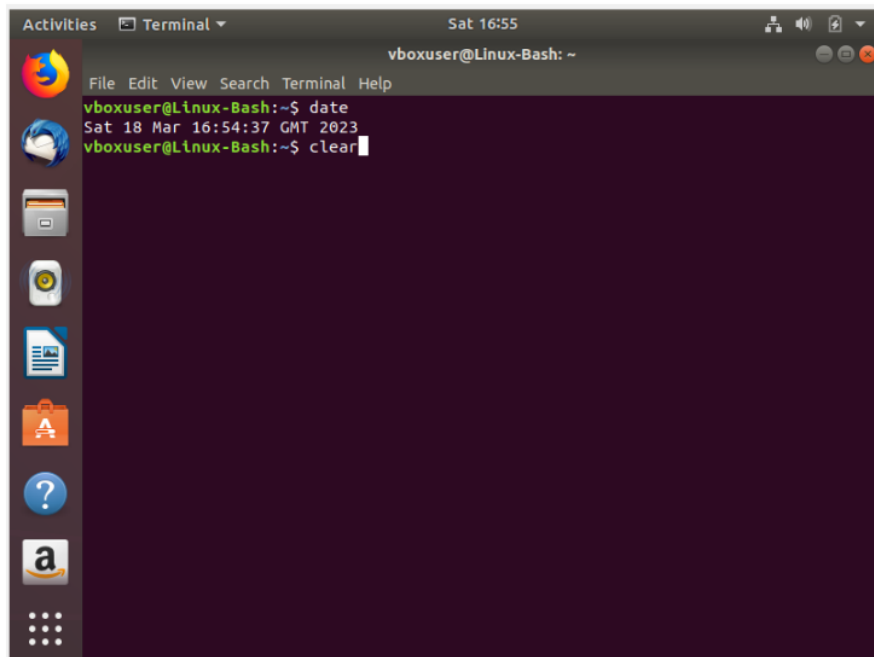


A terminal window titled "Terminal" with a dark purple background. The window shows the command prompt "vboxuser@Linux-Bash: ~" and the command "date" being executed. The output of the command is "Sat 18 Mar 16:54:37 GMT 2023". The terminal window has a menu bar with "File", "Edit", "View", "Search", "Terminal", and "Help". The window title bar shows "Sat 16:54".

```
vboxuser@Linux-Bash: ~  
File Edit View Search Terminal Help  
vboxuser@Linux-Bash:~$ date  
Sat 18 Mar 16:54:37 GMT 2023  
vboxuser@Linux-Bash:~$
```

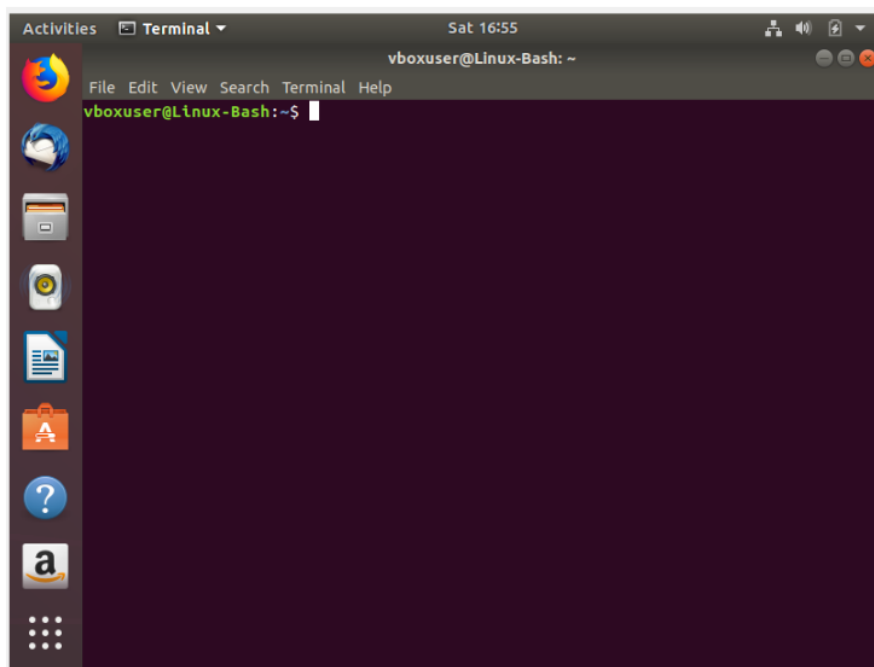
DATE displays the current date, time, and time zone.

CLEAR



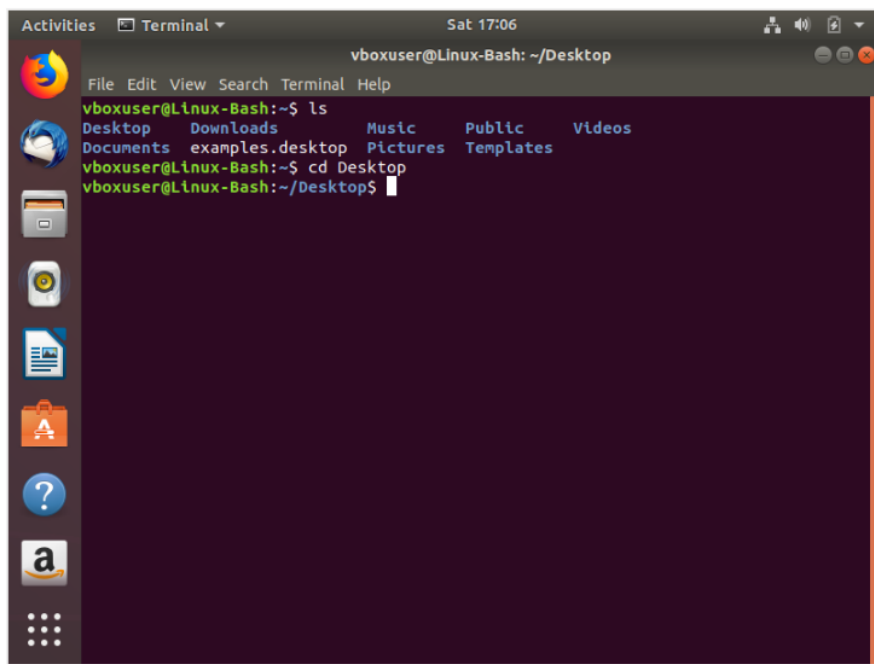
A terminal window titled "Terminal" with a dark purple background. The window shows the command prompt "vboxuser@Linux-Bash: ~" and the command "date" being executed. The output of the command is "Sat 18 Mar 16:54:37 GMT 2023". The terminal window has a menu bar with "File", "Edit", "View", "Search", "Terminal", and "Help". The window title bar shows "Sat 16:55".

```
vboxuser@Linux-Bash: ~  
File Edit View Search Terminal Help  
vboxuser@Linux-Bash:~$ date  
Sat 18 Mar 16:54:37 GMT 2023  
vboxuser@Linux-Bash:~$ clear
```



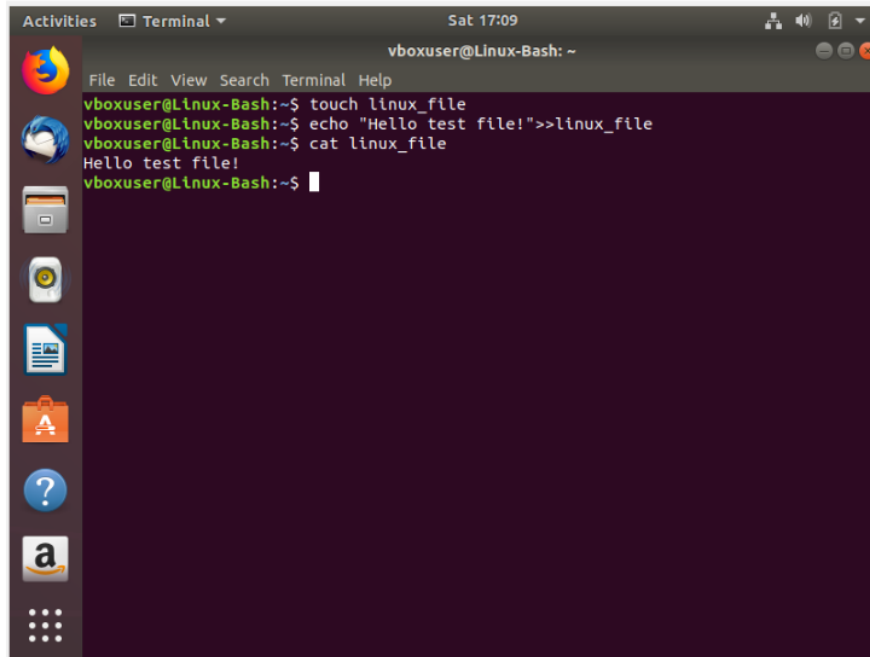
CLEAR removes all commands, giving the user an almost empty screen.

LS / CD



LS is used to show a list of contents in the current directory [46]. CD can change the current directory they are working in. To change the root directory, use the “cd /” command [47].

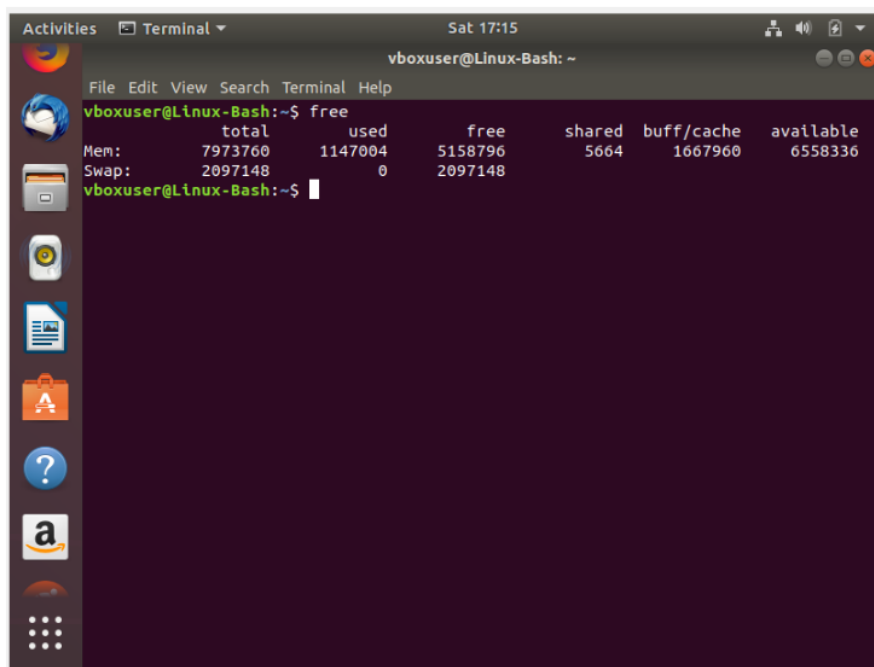
TOUCH/ECHO/CAT

A screenshot of a Linux terminal window titled "Terminal" with a subtitle "vboxuser@Linux-Bash: ~". The window shows a series of commands and their outputs. The first command is "touch linux_file", which creates a file. The second command is "echo 'Hello test file!'" followed by a redirection operator ">>" and the filename "linux_file", which appends the text "Hello test file!" to the file. The third command is "cat linux_file", which displays the contents of the file, showing "Hello test file!". The terminal has a dark purple background and a light-colored text. On the left side of the terminal window, there is a vertical dock with several application icons, including Firefox, a file manager, and others. The top of the window shows the system clock as "Sat 17:09".

```
vboxuser@Linux-Bash: ~  
vboxuser@Linux-Bash:~$ touch linux_file  
vboxuser@Linux-Bash:~$ echo "Hello test file!">>linux_file  
vboxuser@Linux-Bash:~$ cat linux_file  
Hello test file!  
vboxuser@Linux-Bash:~$
```

TOUCH can be used to create a file without any content [48]. To append text to the file you can use the ECHO command along with the operator “>>”. The CAT command calls the file and the text within will be displayed [49].

FREE

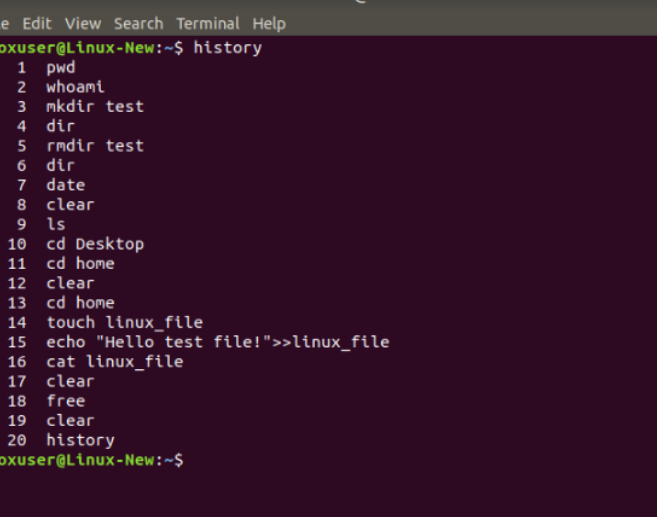


The image shows a terminal window titled 'Terminal' with a menu bar containing 'File', 'Edit', 'View', 'Search', 'Terminal', and 'Help'. The window title bar also shows 'Sat 17:15' and system icons. The terminal content shows the user 'vboxuser@Linux-Bash: ~' running the 'free' command. The output is a table of memory statistics.

```
vboxuser@Linux-Bash:~$ free
              total        used        free      shared  buff/cache   available
Mem:          7973760      1147004       5158796         5664       1667960       6558336
Swap:          2097148           0         2097148
```

FREE will display the RAM usage of the system. This includes total RAM, how much is being used, how much is free, available RAM, swap space, shared amount, and cache amount [50].

HISTORY

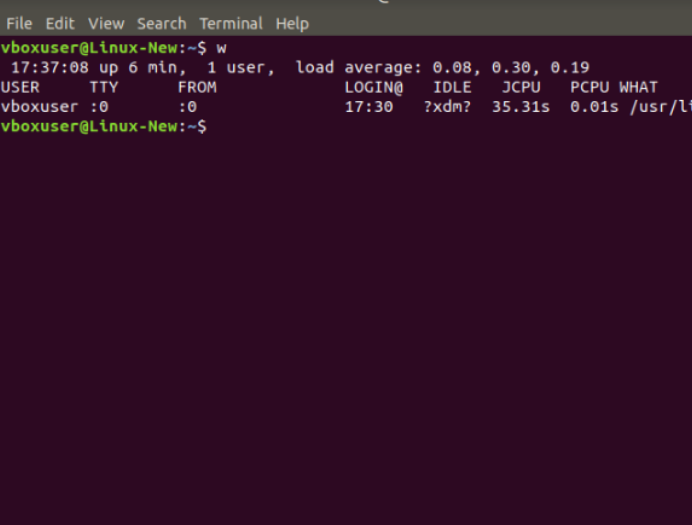


The screenshot shows a Linux terminal window with a dark purple background. The title bar at the top indicates the date and time as 'Sat 17:34'. The terminal prompt is 'vboxuser@Linux-New: ~'. The user has entered the command 'history', which has produced a list of 20 commands numbered 1 through 20. The commands are: 1 pwd, 2 whoami, 3 mkdir test, 4 dir, 5 rmdir test, 6 dir, 7 date, 8 clear, 9 ls, 10 cd Desktop, 11 cd home, 12 clear, 13 cd home, 14 touch linux_file, 15 echo "Hello test file!">linux_file, 16 cat linux_file, 17 clear, 18 free, 19 clear, and 20 history. The terminal window has a standard Ubuntu-style interface with a sidebar on the left containing application icons and a top bar with system status icons.

```
Sat 17:34
vboxuser@Linux-New: ~
File Edit View Search Terminal Help
vboxuser@Linux-New:~$ history
 1  pwd
 2  whoami
 3  mkdir test
 4  dir
 5  rmdir test
 6  dir
 7  date
 8  clear
 9  ls
10  cd Desktop
11  cd home
12  clear
13  cd home
14  touch linux_file
15  echo "Hello test file!">linux_file
16  cat linux_file
17  clear
18  free
19  clear
20  history
vboxuser@Linux-New:~$
```

HISTORY will display a list of usually the last 500 commands a user has attempted. This can be adjusted to show less commands or can be used as a search feature to find a recent match [51].

W



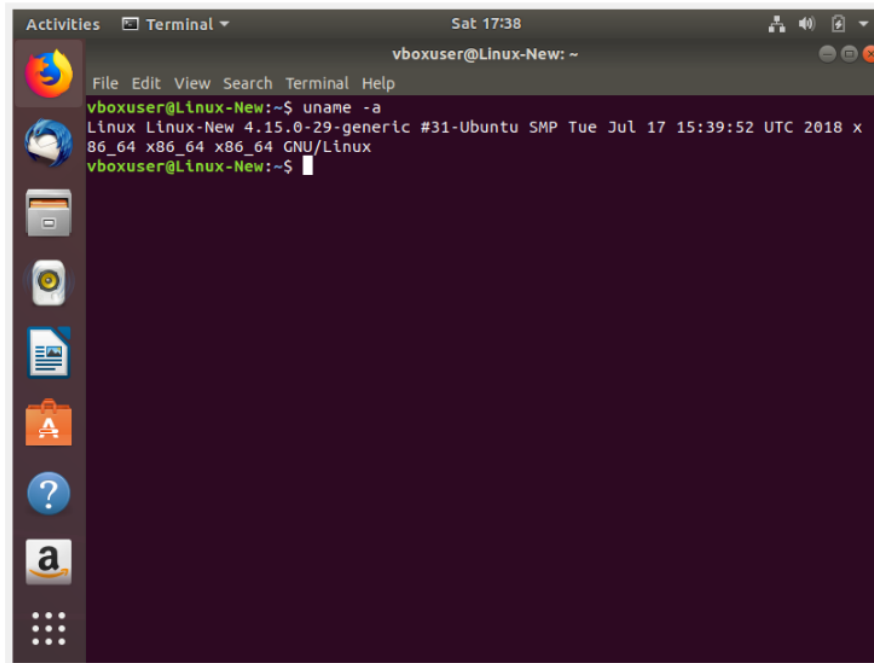
The screenshot shows a Linux terminal window with a dark purple background. The title bar at the top reads "Activities Terminal" and "Sat 17:37". The terminal prompt is "vboxuser@Linux-New: ~". The user has entered the command "w", and the output shows system statistics: "17:37:08 up 6 min, 1 user, load average: 0.08, 0.30, 0.19". Below this, a table of active users is displayed:

USER	TTY	FROM	LOGIN@	IDLE	JCPU	PCPU	WHAT
vboxuser	:0	:0	17:30	?xdm?	35.31s	0.01s	/usr/lib/gdm3/

The terminal prompt is now "vboxuser@Linux-New:~\$". On the left side of the screen, there is a vertical dock with several application icons: a Firefox browser icon, a file manager icon, a terminal icon, a document icon, a shopping bag icon, a question mark icon, and an Amazon logo icon.

The W command will display the current time, how long the system has been running, the username of who is logged onto the system and what they are currently doing [52].

UNAME

A screenshot of a Linux terminal window. The window title is 'vboxuser@Linux-New: ~'. The terminal shows the command 'uname -a' being executed, which outputs the following system information: 'Linux Linux-New 4.15.0-29-generic #31-Ubuntu SMP Tue Jul 17 15:39:52 UTC 2018 x86_64 x86_64 x86_64 GNU/Linux'. The terminal has a dark purple background and a light blue cursor. The window's top bar shows 'Activities', 'Terminal', and the date 'Sat 17:38'. The left sidebar contains various application icons like Firefox, Files, and the Dash icon.

UNAME displays the general system information. The command along with -A will display all the system information including the kernel name, version, release date, network node name, the name of the device hardware, the platform, and the operating system [53].

TOP

```
Activities Terminal Sat 17:39
vboxuser@Linux-New: ~
File Edit View Search Terminal Help
vboxuser@Linux-New:~$ top
top - 17:39:44 up 9 min, 1 user, load average: 0.00, 0.17, 0.15
Tasks: 220 total, 1 running, 175 sleeping, 0 stopped, 0 zombie
%Cpu(s): 0.7 us, 0.3 sy, 0.0 ni, 98.9 id, 0.1 wa, 0.0 hi, 0.0 si, 0.0 st
KiB Mem : 8636940 total, 5875908 free, 1157996 used, 1603036 buff/cache
KiB Swap: 2097148 total, 2097148 free, 0 used, 7207340 avail Mem

  PID USER      PR  NI  VIRT  RES  SHR  S  %CPU  %MEM    TIME+  COMMAND
 2088 vboxuser  20   0 4201768 350492 94332 S   3.6   4.1   0:28.13 gnome-she+
 1850 vboxuser  20   0 647172 63248 35324 S   2.0   0.7   0:09.34 Xorg
 2916 vboxuser  20   0 805824 39680 28764 S   0.7   0.5   0:03.86 gnome-ter+
    1 root      20   0 225568 9164 6556 S   0.3   0.1   0:02.28 systemd
 2278 vboxuser  20   0 668992 23456 18372 S   0.3   0.3   0:00.20 gsd-color
 2393 vboxuser  20   0 220940 8344 7632 S   0.3   0.1   0:00.32 ibus-engi+
 2536 root      20   0 588608 44896 15264 S   0.3   0.5   0:00.29 fwupd
    2 root      20   0 0 0 0 S   0.0   0.0   0:00.01 kthreadd
    4 root      0 -20 0 0 0 I   0.0   0.0   0:00.00 kworker/0+
    5 root      20   0 0 0 0 I   0.0   0.0   0:00.13 kworker/u+
    6 root      0 -20 0 0 0 I   0.0   0.0   0:00.00 mm_percpu+
    7 root      20   0 0 0 0 S   0.0   0.0   0:00.03 ksoftirqd+
    8 root      20   0 0 0 0 I   0.0   0.0   0:00.42 rcu_sched
    9 root      20   0 0 0 0 I   0.0   0.0   0:00.00 rcu_bh
   10 root      rt    0 0 0 0 S   0.0   0.0   0:00.01 migration+
   11 root      rt    0 0 0 0 S   0.0   0.0   0:00.01 watchdog/0
   12 root      20   0 0 0 0 S   0.0   0.0   0:00.00 cpuhp/0
   13 root      20   0 0 0 0 S   0.0   0.0   0:00.00 cpuhp/1
   14 root      rt    0 0 0 0 S   0.0   0.0   0:00.01 watchdog/1
   15 root      rt    0 0 0 0 S   0.0   0.0   0:00.00 migration+
```

The TOP command shows a real time, interactive mode where a user can view statistics of processes and the processes that are currently running on the system [54].

Scripts – Definitions of key elements

For both the Windows and Linux OS scripts, multiple elements were included:

Windows OS can use batch files even though they are years old and are less powerful than PowerShell and bash files [55].

The Linux OS script runs using the bash scripting language.

Variables store and allow a script to call a particular piece of code, that can be from user input or already set [56].

Goto commands - A labelled piece of code that direct the script to another labelled piece of code at a different section of the script [57].

If statement - Creates conditions that when met will echo out a specific output. If there are multiple conditions, there will be an else if (elif) statement and an else statement as the final condition [58].

Case statement - Used when there are multiple choices within a script and are usually used instead of if statements to keep a script easier to read. There will be multiple choices and the script will echo a specific output depending on the user's choice [59].

While loop - Runs a piece of code for as long as the user input matches the set control. Until loop - Runs a piece of code until the user input matches the set control. For loop - Iterates over a series of numbers or words within a set string [60].

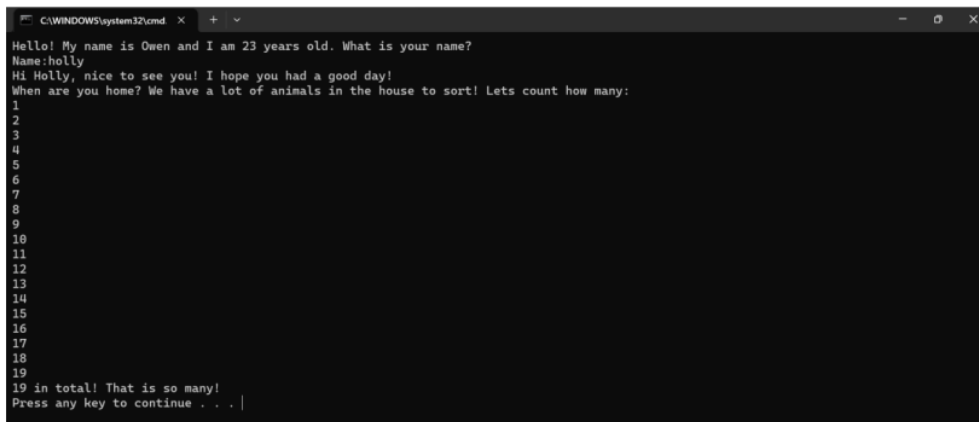
Array - Like a variable as it is used to store and call upon either pre-set or user inputted data. However, an array can be used to store multiple values in one place [61].

Functions - Used to contain code that can be recalled without having to continuously write the same piece of code [62].

Use of Windows OS scripts

For a copy of the script see [Appendix C](#).

Initial script uses a function containing variables and an array. This is called to the main script and the user inputs a name. If the user enters Holly as their name an if statement directs the code using a goto command to echo out a set output that includes a for loop.



```
C:\WINDOWS\system32\cmd  x  +  v  -  o  x
Hello! My name is Owen and I am 23 years old. What is your name?
Name:holly
Hi Holly, nice to see you! I hope you had a good day!
When are you home? We have a lot of animals in the house to sort! Lets count how many:
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
19 in total! That is so many!
Press any key to continue . . . |
```

When the user inputs Owen, the script uses an else if condition, has a different output and goes to a different section of code that calls upon the array and has another user input with more if statement conditions.



```
C:\WINDOWS\system32\cmd  x  +  v  -  o  x
Hello! My name is Owen and I am 23 years old. What is your name?
Name:Owen
Oh weird! We have the same name! Anyway
I have lots of animals in my home! They are:
dogs
rabbits
guinea pigs
rats
hamster
chinchillas
Choose an animal from the list to learn their names:Chinchillas
You chose chinchillas! They are brothers and are named Otto and Toto
Press any key to continue . . . |
```

The else condition echoes out a more basic output but is like the Owen example.

```
C:\WINDOWS\system32\cmd x + v
Hello! My name is Owen and I am 23 years old. What is your name?
Name:James
Hi James
I have lots of animals in my home! They are:
dogs
rabbits
guinea pigs
rats
hamster
chinchillas
Choose an animal from the list to learn their names:dogs
You chose dogs! I have 2 corgis and they are named Winnie and Willow.
Press any key to continue . . . |
```

```
C:\WINDOWS\system32\cmd x + v
Hello! My name is Owen and I am 23 years old. What is your name?
Name:Winnie
Hi Winnie
I have lots of animals in my home! They are:
dogs
rabbits
guinea pigs
rats
hamster
chinchillas
Choose an animal from the list to learn their names:rabbits
You chose rabbits! I have a boy named Sox and 3 girls named Hunni, Nala and Sasa.
Press any key to continue . . . |
```

```
C:\WINDOWS\system32\cmd x + v
Hello! My name is Owen and I am 23 years old. What is your name?
Name:Willow
Hi Willow
I have lots of animals in my home! They are:
dogs
rabbits
guinea pigs
rats
hamster
chinchillas
Choose an animal from the list to learn their names:guinea pigs
You chose guinea pigs! I have 8! They are Bucky, Barney, Wilma, Choobs, Cersei, Peggy, Polly and Ginny.
Press any key to continue . . . |
```

```
C:\WINDOWS\system32\cmd x + v
Hello! My name is Owen and I am 23 years old. What is your name?
Name:Otto
Hi Otto
I have lots of animals in my home! They are:
dogs
rabbits
guinea pigs
rats
hamster
chinchillas
Choose an animal from the list to learn their names:rats
You chose rats! I have 2 named Norman and Sheldon.
Press any key to continue . . . |
```

```
C:\WINDOWS\system32\cmd x + v
Hello! My name is Owen and I am 23 years old. What is your name?
Name:Toto
Hi Toto
I have lots of animals in my home! They are:
dogs
rabbits
guinea pigs
rats
hamster
chinchillas
Choose an animal from the list to learn their names:hamster
You chose hamster! Her name is Colette.
Press any key to continue . . . |
```

If the user inputs an animal that is not listed, the output will echo that there was an invalid choice and loop until the user enters an animal listed.

```
C:\WINDOWS\system32\cmd. x + v
Hello! My name is Owen and I am 23 years old. What is your name?
Name:Steve
Hi Steve
I have lots of animals in my home! They are:
dogs
rabbits
guinea pigs
rats
hamster
chinchillas
Choose an animal from the list to learn their names:cat
Invalid choice. Please try again.
I have lots of animals in my home! They are:
dogs
rabbits
guinea pigs
rats
hamster
chinchillas
Choose an animal from the list to learn their names:horse
Invalid choice. Please try again.
I have lots of animals in my home! They are:
dogs
rabbits
guinea pigs
rats
hamster
chinchillas
Choose an animal from the list to learn their names:dogs
You chose dogs! I have 2 corgis and they are named Winnie and Willow.
Press any key to continue . . . |
```

Use of Linux OS scripts

For a copy of the script see [Appendix D](#). To create, test and run this script, Replit was used [63].

```
> bash main.sh
Hello, I am Winnie and I am 1 years old. My favourite food is duck. What is your name?
|
```

The script begins with the same sentence, but the food is randomised. The initial code is included within a function, so the start of the script calls the function and then asks for user input.

If Holly is entered the script uses an If statement to take you to the correct part of the code. Another user input is required with a simple Yes/No. One example shows the output when yes is entered straight away. The second example shows when the user inputs no multiple times. The case statement is used so if the input is yes or no it will run a specific section of code. The if statement and until loop are used if the user enters no initially so that the code will continuously loop until the answer is yes.

```
> bash main.sh
Hello, I am Winnie and I am 1 years old. My favourite food is chicken. What is your name?
Holly
Hi Mam, do you know where my sister is?
Yes/No?y
Awesome, lets go find her
> |
```

```

> bash main.sh
Hello, I am Winnie and I am 1 years old. My favourite food is lamb. What is your name?
holly
Hi Mam, do you know where my sister is?
Yes/No?No
Oh no, that is not good! Lets find her!
Come on we have to!
Yes/No?no
Come on we have to!
Yes/No?n
Come on we have to!
Yes/No?N
Come on we have to!
Yes/No?Yes
Yay! Lets go!
>

```

If Owen is the input, the script is similar, other than different wording.

```

> bash main.sh
Hello, I am Winnie and I am 1 years old. My favourite food is beef. What is your name?
Owen
Hi Dad, have you seen my sister?
Yes/No?y
Awesome, lets go find her
>

```

```

> bash main.sh
Hello, I am Winnie and I am 1 years old. My favourite food is lamb. What is your name?
owen
Hi Dad, have you seen my sister?
Yes/No?no
Oh no, that is not good! Lets find her!
Come on we have to!
Yes/No?No
Come on we have to!
Yes/No?Yes
Yay! Lets go!
>

```

If Willow is the name entered. If the user enters yes, the script runs code that has a specific output. The second example uses the case statement, while loop and if statement so the script loops until the user enters yes.

```

> bash main.sh
Hello, I am Winnie and I am 1 years old. My favourite food is beef. What is your name?
Willow
Wooo Willow I found you! Do you know where Mam and Dad are?
Yes/No?y
Awesome, lets go find them
>

```

```

> bash main.sh
Hello, I am Winnie and I am 1 years old. My favourite food is lamb. What is your name?
Willow
Wooo Willow I found you! Do you know where Mam and Dad are?
Yes/No?No
Oh no, that is not good! Shall we go find them?
Come on we have to!
Yes/No?n
Come on we have to!
Yes/No?Y
Yay! Lets go!
>

```

If the user enters a name other than those mentioned then it matches the else condition, the script runs a completely different section of the code. If the user enters yes, then the script uses a for loop to output a simple 10 count. If no is selected, then the script simply ends.

```
> bash main.sh
Hello, I am Winnie and I am 1 years old. My favourite food is fish. What is your name?
James
Oh hi James, you are not my sister! But do you want to hear me count to 10?
Yes/No? y
1
2
3
4
5
6
7
8
9
10
>
```

```
> bash main.sh
Hello, I am Winnie and I am 1 years old. My favourite food is lamb. What is your name?
James
Oh hi James, you are not my sister! But do you want to hear me count to 10?
Yes/No? No
Oh okay, goodbye!
>
```

Conclusion

To conclude, there are multiple different OS available to use, but Windows and Linux are possibly the most well-known. Windows OS was used through Command Prompt and Notepad++ which are more familiar applications, whereas Linux tasks were conducted through a virtual machine and Replit, both of which were less familiar. Having said this, they were easier to get familiar with due to their simplified view and the error checking.

Overall, both OS are useful and can benefit a user in different ways, depending on how they plan to use a device.

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Appendices

Appendix A – Tutorial Activity

There are multiple different types of OS being used today, some of which include Batch, Time-sharing/Multitasking, Distributed, Network, Real-time, and Mobile [64].

A Batch OS is typically used for payroll systems, data entries and banking statements due to the system dividing up all the tasks so that everything processes faster and easier, this is beneficial for more time-consuming tasks. However, they can be costly, and any failures can be challenging to debug and can create backlogs.

Time-sharing/Multitasking OS can include Unix and differ from Batch as they allocate a task with a set time before switching to another task. This OS has a quick response time and low idle time, while also reducing the risk of duplicating software, but there is a possible problem with the security of the user's data and the integrity of their programs.

A Distributed OS has multiple computers communicating together over a shared network meaning it will serve multiple applications and users which makes it useful for airline controls and some different networks. This allows for faster data exchanges, more scalability and makes remote working possible. If one site fails then the entire system should not suffer much disruption, but if the primary network fails then the entire system will shut down. They are also expensive and require high levels of expertise.

Network OS are installed on servers which allows a user to manage the data, groups, and applications. Network OS are used by Microsoft Windows, Linux and macOS X and it allows users to access and share files and devices. This OS is typically upgraded regularly and are expensive, but the security issues are usually easier to handle, and the upgrades allow for new technology to be integrated.

Real-time OS are used for systems that are usually highly sensitive and are under strict time constraints, so are used for scientific and medical tasks and military situations. Due to the time constraints, the systems are usually free of issues and quickly shift between tasks to make sure everything is completed on time, but due to the complexity they are expensive and difficult to understand, while not having much capacity to simultaneously run tasks.

A Mobile OS are used for phones, tablets, and other small smart devices. They allow a user to access applications installed on the device and can manage wireless network connections. They are usually easy to operate, however, they can put a strain on the device's battery life [65].

Appendix B – Evidence of engagement with certified course

The screenshot shows a LinkedIn Learning video player. The video title is "What is PowerShell?". The video content displays a circular diagram with five segments, each representing a feature of PowerShell:

- Object Oriented
- Rich script environment
- Bulk Operations
- Interactive Shell
- Task Automation

The video player interface includes a sidebar with a table of contents, a progress bar at the bottom, and a LinkedIn logo in the bottom right corner.

Contents

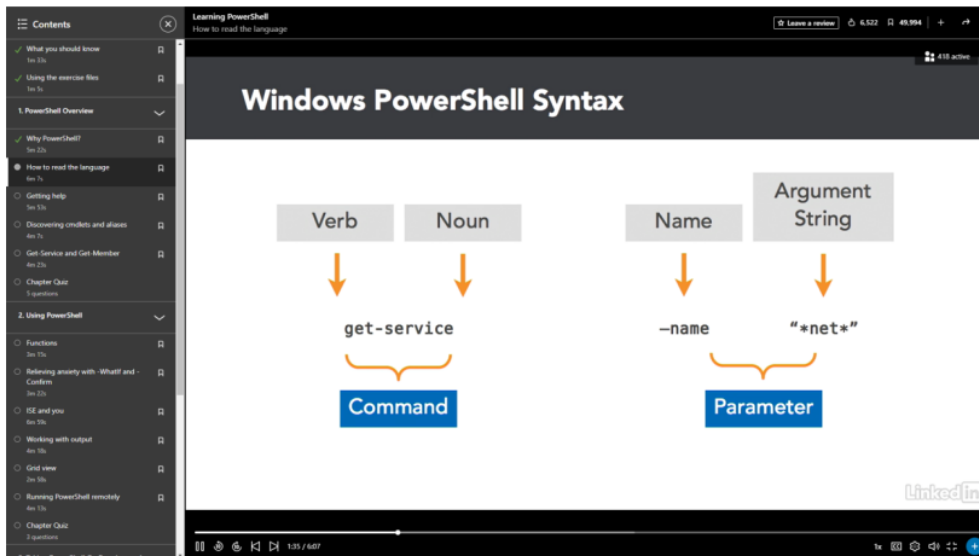
- What you should know
- Using the exercise files
- 1. PowerShell Overview
 - Why PowerShell?
 - How to read the language
 - Getting help
 - Discovering cmdlets and aliases
 - Get Service and Get-Member
 - Chapter Quiz
- 2. Using PowerShell
 - Functions
 - Referencing assembly with -Whatif and -Confirm
 - ISE and you
 - Working with output
 - Grid view
 - Running PowerShell remotely
 - Chapter Quiz
- 3. Taking PowerShell On Remotely and...

```
PS C:\> Get-ChildItem

Directory: C:\

Mode                LastWriteTime         Length Name
----                -
d-----          3/8/2016 12:13 AM             Autodesk
d-----          4/11/2016 10:39 AM              dsc
d-----          4/13/2016 1:39 PM          DscDiagnostics
d-----          4/8/2016 6:53 PM            inetpub
d-----         12/16/2015 2:33 AM              Intel
d-----          7/10/2015 4:04 AM          PerfLogs
d-r-----         4/14/2016 9:40 AM        Program Files
d-r-----         4/14/2016 9:40 AM        Program Files (x86)
d-r-----          3/7/2016 7:59 PM          Scripts
d-r-----          3/7/2016 7:54 PM         SWSETUP
d-r-----         4/11/2016 8:03 AM          users
d-----          4/8/2016 6:07 PM        windows
d-----          4/8/2016 6:58 PM       windows.old

PS C:\>
```



Contents

- What you should know
- Using the exercise files
- 1. PowerShell Overview
 - Why PowerShell?
 - How to read the language
 - Getting help
 - Discovering cmdlets and aliases
 - Get Service and Get-Member
 - Chapter Quiz
- 2. Using PowerShell
 - Functions
 - Relaying anxiety with -WhatIf and -Confirm
 - IE and you
 - Working with output
 - Grid view
 - Running PowerShell remotely
 - Chapter Quiz
- 3. Taking PowerShell On Premises and Online
 - Finding and installing modules
 - Server cmdlets

Administration: Windows PowerShell

```
PS C:\> get-service | get-member
```

TypeName: System.ServiceProcess.ServiceController

Name	MemberType	Definition
Name	AliasProperty	Name = ServiceName
RequiredServices	AliasProperty	RequiredServices = ServicesDependedOn
Disposed	Event	System.EventHandler Disposed(System...
Close	Method	void Close()
Continue	Method	void Continue()
CreateObjRef	Method	System.Runtime.Remoting.ObjRef Cre...
Dispose	Method	void Dispose(), void IDisposable.D...
Equals	Method	bool Equals(System.Object obj)
ExecuteCommand	Method	void ExecuteCommand(int command)
GetHashCode	Method	int GetHashCode()
GetLifetimeService	Method	System.Object GetLifetimeService()
GetType	Method	type GetType()
InitializeLifetimeService	Method	System.Object InitializeLifetimeSe...
Pause	Method	void Pause()
Refresh	Method	void Refresh()
Start	Method	void Start(), void Start(string[] ...
Stop	Method	void Stop()
WaitForStatus	Method	void WaitForStatus(System.ServiceP...
CanPauseAndContinue	Property	bool CanPauseAndContinue {get;} Linked
Catchdown	Property	bool Catchdown {get;} Linked

Contents

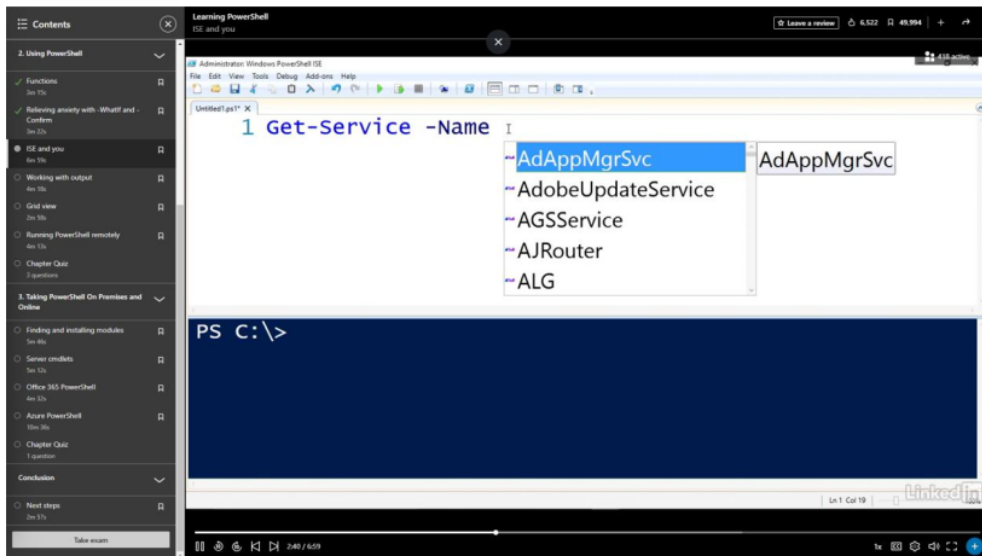
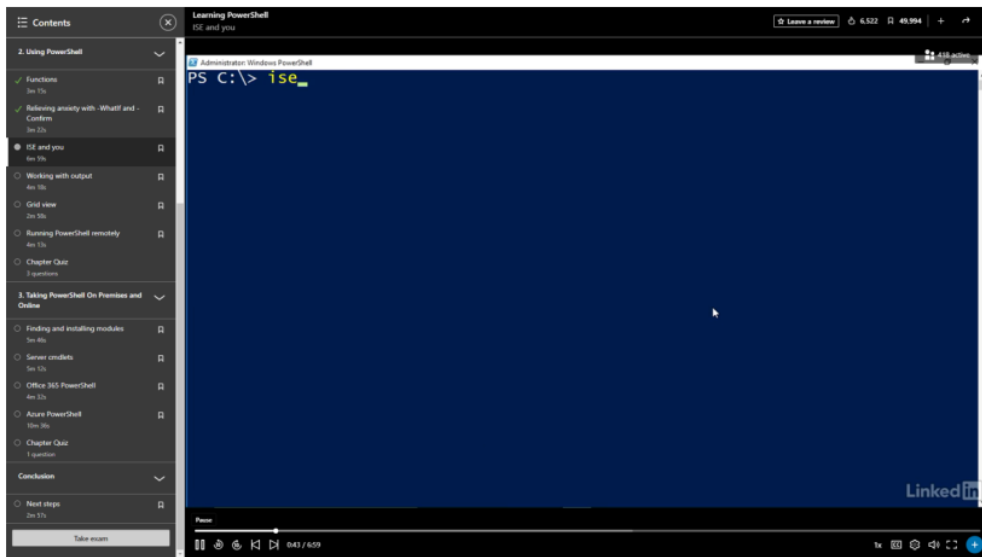
- Why PowerShell?
- How to read the language
- Getting help
- Discovering cmdlets and aliases
- Get Service and Get-Member
- Chapter Quiz
- 2. Using PowerShell
 - Functions
 - Relaying anxiety with -WhatIf and -Confirm
 - IE and you
 - Working with output
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- 3. Taking PowerShell On Premises and Online
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Learning PowerShell
Relaying anxiety with -WhatIf and -Confirm

Administration: Windows PowerShell

```
PS C:\> Get-Service | Stop-Service -whatif
```

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Learning PowerShell
Grid view

2. Using PowerShell

- Functions
- Relaying priority with Whatif and Confirm
- ISE and you
- Working with output
- Grid view
- Running PowerShell remotely
- Chapter Quiz

3. Taking PowerShell On Premises and Online

- Finding and installing modules
- Server cmdlets
- Office 365 PowerShell
- Azure PowerShell
- Chapter Quiz

Conclusion

- Next steps

Take exam

Administrator: Windows PowerShell ISE

```
1 ##Pipe GridView
2 get-service | out-gridview
3 get-service | format-table displayname, status, require
4 get-service | select-object displayname, status, require
5 get-service | select-object * | out-gridview
```

+ CategoryInfo : InvalidType: (:) [out-GridView]
+ FullyQualifiedErrorId : DataNotQualifiedForGridView,Microsoft.PowerShell.Commands.OutGridViewCommand

PS C:\>

Completed

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Learning PowerShell
Grid view

2. Using PowerShell

- Functions
- Relaying priority with Whatif and Confirm
- ISE and you
- Working with output
- Grid view
- Running PowerShell remotely
- Chapter Quiz

3. Taking PowerShell On Premises and Online

- Finding and installing modules
- Server cmdlets
- Office 365 PowerShell
- Azure PowerShell
- Chapter Quiz

Conclusion

- Next steps

Take exam

Administrator: Windows PowerShell ISE

```
get-service | select-object displayname, status, requiredservices | out-gridview
```

Display Name	Status	Required Services
Active Directory Web Services	Running	0
Application Experience	Stopped	0
Application Layer Gateway...	Stopped	0
Application Identity	Stopped	(RpcSs, CryptS...
Application Information	Stopped	(RpcSs, ProfSvc)
Application Management	Running	0
App Readiness	Stopped	0
AppX Deployment Service (L...	Stopped	(RpcSs)
Windows Audio Endpoint S...	Stopped	0
Windows Audio	Stopped	(MMCSS, RpcSs...
Base Filtering Engine	Running	(RpcSs, WpLanH...
Background Intelligent Tra...	Running	(RpcSs, EventTr...
Background Tasks Infrastruc...	Running	(DcomLaunch...
Computer Browser	Stopped	(LanmanServer...
Certificate Propagation	Running	(RpcSs)
CDM4 - System Application	Stopped	(EventSystem, S...
Cryptographic Services	Running	(RpcSs)
DCOM Server Process Laun...	Running	0
Optimizer drives	Stopped	(RPCSS)
Device Association Service	Stopped	0
Device Install Service	Stopped	0
DPS Namespace	Running	(Map, RemoteF...

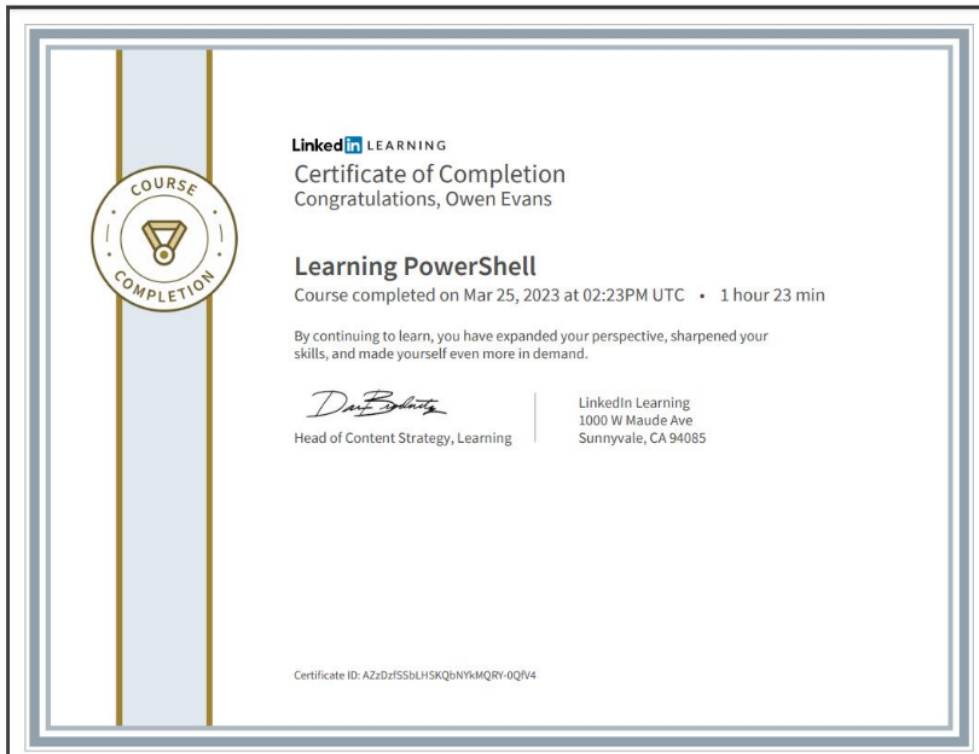
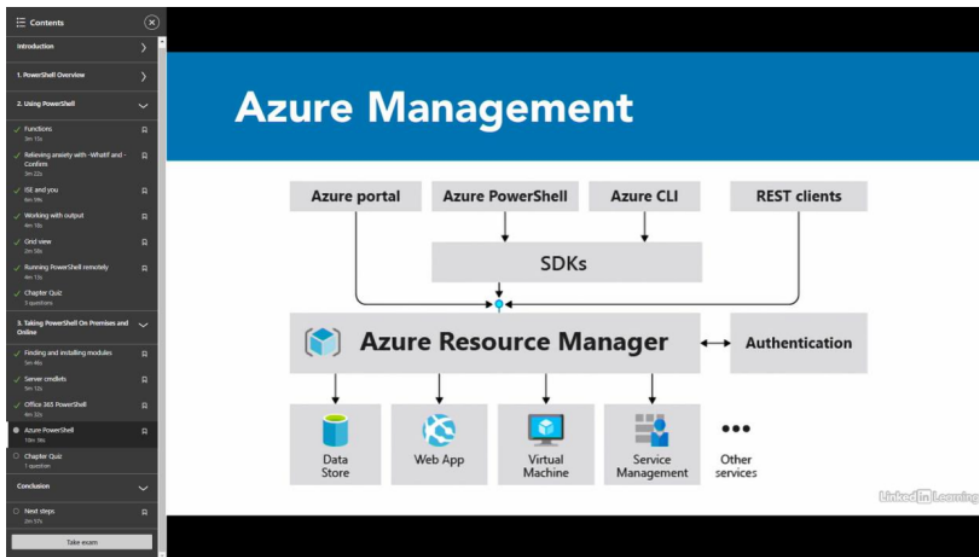
PS C:\> get-service | select-object displayname, status, require

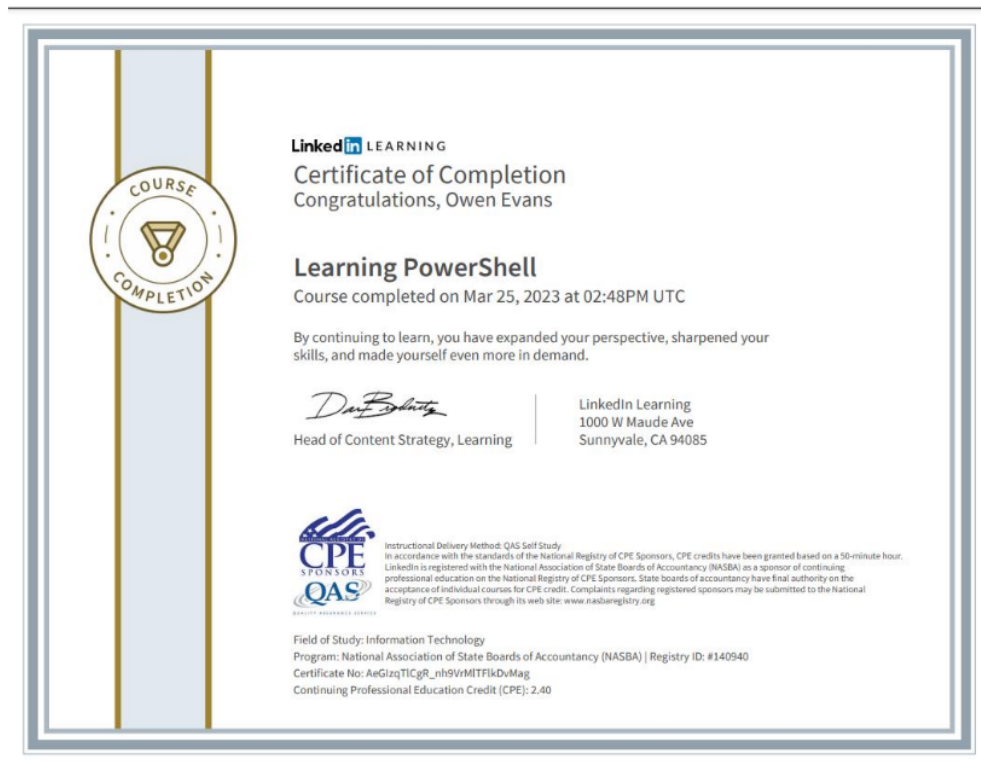
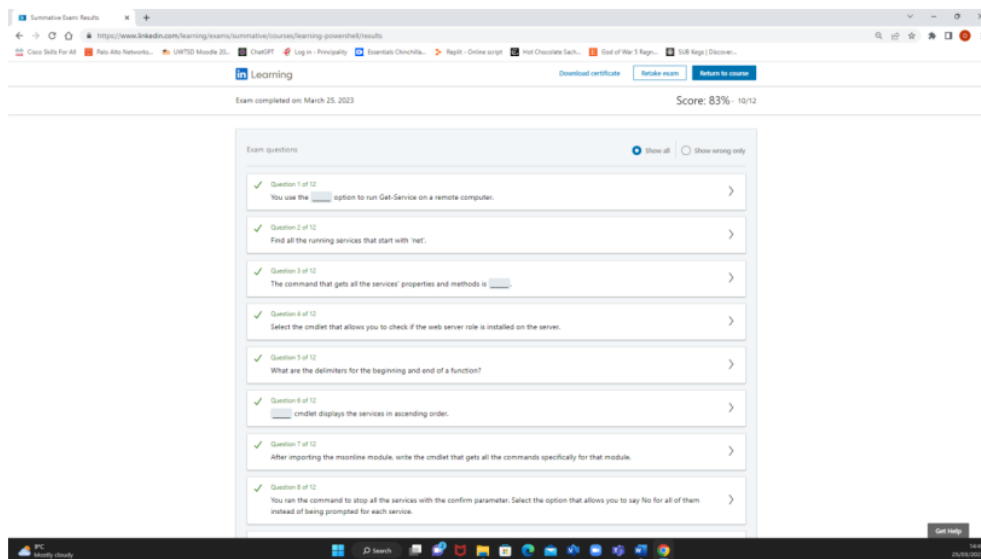
PS C:\>

Completed

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Appendix C – Batch Script

@echo off

```
set Name1=Owen
```

```
set /A Age=23
```

```
set Farm[0]=dogs
```

```
set Farm[1]=rabbits
```

```
set Farm[2]=guinea pigs
```

```
set Farm[3]=rats
```

```
set Farm[4]=hamster
```

```
set Farm[5]=chinchillas
```

```
:Greetings
```

```
echo Hello! My name is %Name1% and I am %Age% years old. What is your name?
```

```
set /p input=Name:
```

```
if /i "%input%"=="Holly" (
```

```
    echo Hi Holly, nice to see you! I hope you had a good day!
```

```
    goto Animals
```

```
) else (
```

```
    echo Hi %input%
```

```
    goto Animals1
```

```
)
```

```
call :Greetings
```

```
:Animals
```

```
echo When are you home? We have a lot of animals in the house to sort! Lets count how many:
```

```
for /L %%i in (1,1,19) do (
```

```
    echo %%i
```

```
)
```

```
echo 19 in total! That is so many!
```

```
goto End
```

```
:Animals1
```

echo I have lots of animals in my home! They are:

echo %Farm[0]%

echo %Farm[1]%

echo %Farm[2]%

echo %Farm[3]%

echo %Farm[4]%

echo %Farm[5]%

set /p choice=Choose an animal from the list to learn their names:

if "%choice%"=="dogs" (

 echo You chose dogs! I have 2 corgis and they are named Winnie and Willow.

) else if "%choice%"=="rabbits" (

 echo You chose rabbits! I have a boy named Sox and 3 girls named Hunni, Nala and Sasa.

) else if "%choice%"=="guinea pigs" (

 echo You chose guinea pigs! I have 8! They are Bucky, Barney, Wilma, Choobs, Cersei, Peggy, Polly and Ginny.

) else if "%choice%"=="rats" (

 echo You chose rats! I have 2 named Norman and Sheldon.

) else if "%choice%"=="hamster" (

 echo You chose hamster! Her name is Colette.

) else if "%choice%"=="chinchillas" (

 echo You chose chinchillas! They are brothers and are named Otto and Toto

) else (

 echo Invalid choice. Please try again.

 goto Animals1

)

goto End

:End

Pause

Appendix D – Bash Script

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

```
Winnie () {  
    Welcome="Hello, I am"  
    Name="Winnie"  
    Age="1"  
    Food=("chicken" "lamb" "beef" "duck" "fish")  
    FavouriteFood=${Food[$RANDOM % ${#Food[@]} ]}  
    echo "$Welcome $Name and I am $Age years old. My favourite food is $FavouriteFood. What is  
your name?"  
}
```

```
Winnie  
read Name  
if [ "$Name" == "Willow" ] || [ "$Name" == "willow" ]  
then  
    echo "Wooo Willow I found you! Do you know where Mam and Dad are?"  
    read -p "Yes/No?" Answer  
    case $Answer in  
        Yes|yes|Y|y)  
            echo "Awesome, lets go find them";;  
        No|no|N|n)  
            echo "Oh no, that is not good! Shall we go find them?"  
            while [ "$Answer" == "No" ] || [ "$Answer" == "no" ] || [ "$Answer" == "N" ] || [ "$Answer" ==  
"n" ]  
            do  
                echo "Come on we have to!"  
                read -p "Yes/No?" Answer
```

```

        if [ "$Answer" == "Yes" ] || [ "$Answer" == "yes" ] || [ "$Answer" == "Y" ] || [ "$Answer" == "y" ]
    ]

    then

        echo "Yay! Lets go!"

    fi

done;;

esac

```

```

elif [ "$Name" == "Owen" ] || [ "$Name" == "owen" ]
then

    echo "Hi Dad, have you seen my sister?"

    read -p "Yes/No?" Answer

    case $Answer in

        Yes|yes|Y|y)

            echo "Awesome, lets go find her";;

        No|no|N|n)

            echo "Oh no, that is not good! Lets find her!"

            until [ "$Answer" == "Yes" ] || [ "$Answer" == "yes" ] || [ "$Answer" == "Y" ] || [ "$Answer" == "y" ]
        ]
            do

                echo "Come on we have to!"

                read -p "Yes/No?" Answer

                if [ "$Answer" == "Yes" ] || [ "$Answer" == "yes" ] || [ "$Answer" == "Y" ] || [ "$Answer" == "y" ]
            ]
        ]

    then

        echo "Yay! Lets go!"

    fi

done;;

esac

```

```

elif [ "$Name" == "Holly" ] || [ "$Name" == "holly" ]
then

```

```

echo "Hi Mam, do you know where my sister is?"

read -p "Yes/No?" Answer

case $Answer in
    Yes|yes|Y|y)
        echo "Awesome, lets go find her";;
    No|no|N|n)
        echo "Oh no, that is not good! Lets find her!"
        until [ "$Answer" == "Yes" ] || [ "$Answer" == "yes" ] || [ "$Answer" == "Y" ] || [ "$Answer" ==
"y" ]
        do
            echo "Come on we have to!"
            read -p "Yes/No?" Answer
            if [ "$Answer" == "Yes" ] || [ "$Answer" == "yes" ] || [ "$Answer" == "Y" ] || [ "$Answer" == "y"
]
            then
                echo "Yay! Lets go!"
            fi
        done;;
esac

else
    echo "Oh hi $Name, you are not my sister! But do you want to hear me count to 10?"
    read -p "Yes/No? " Answer
    case $Answer in
        Yes|yes|Y|y)
            for Number in {1..10..1}
            do
                echo $Number
            done;;
        No|no|N|n)
            echo "Oh okay, goodbye!";;
    esac

```

fi

Operating Systems Report

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

94/100

Total:		94
1. Engagement with Literature Skills:		
+ Very good use of citations. + formatted reference list.	20	
2. Knowledge and Understanding Skills: 4e		
Key functions: + Very good overview of key OS functions documented. – security aspect could be extended. + Supported by citations. Win Commands: + V. good overview of relevant commands that demonstrates an understanding of the language. Bash Commands: + Good overview of relevant commands that demonstrates an understanding of the language. Win Scripts: + Good overview of the syntax that demonstrates an understanding of the scripting aspect of the language. - could be extended to include 1/2 additional areas. Bash Scripts: + Good overview of the syntax that demonstrates an understanding of the scripting aspect of the language. – Additional syntax implementations (such as a Bash array) could be used.	20	18
3. Cognitive and Intellectual Skills: 2e		

Evidence of some good analysis and understanding of OS functions and the relevant languages is clearly documented. – could be extended in one area as mentioned above, to gain the extra marks in this category. + Conclusion.	10	9
4. Practical Application Skills: 10e		
1. Bat Commands: + V. good use of relevant Bat commands. 2. Bash Commands: + V. good use of relevant Bash commands. 3. Win Scripts: + Good use of Win scripts to demonstrate knowledge of the core syntax. 4. Bash Scripts: + Good use of Bash scripts to demonstrate knowledge of the core syntax. - could be extended in 1 area as mentioned above.	40	38
5. Transferable Skills for Life and Professional Practice: 5+1+2+2		
+ Good report format, structure, and presentation. - Report sections could be numbered. + Tutorial Activity 1 – OS Types: relevant supplementary information on OS types is included in the Appendix of the report. + Evidence of engagement with a relevant CPD course documented in the appendix.	10	9

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