

OS Assignment

by Kyle Aldridge

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Operating Systems

Computer Architecture and Operating Systems. ACCA4022

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UWTSD - HND Computing (Cyber security and Networking)

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Key functions of general Operating Systems

Introduction

An Operating System (OS) is a fundamental piece of software that manages and controls a system's hardware and allows the user to utilise a computer system using other software [1]. There are many different types of OS, such as mobile and general OS [1]. General OS will be the focus of this task. A general OS is used on hardware such as a laptop or desktop computer and allows the user to perform day-to-day tasks, such as surfing the web and other productive tasks for personal use or office work [2]. Some popular general OS include Windows, MacOS, and Linux. Some key functions are:

- Process management
- Memory management
- File and Directory management
- User interface (UI)
- Device Management
- Security and Access Control
- Error handling

Process management

Process management within an OS means that it makes decisions about programs which have been executed, as well as resource scheduling and prioritisation [2] [3]. This means it controls when and if the CPU processes the instructions and creates, suspends, and terminates each program [3]. It also manages the system's hardware resources, ensuring efficient and effective operation [3]. This can be found in system-monitoring applications, such as task manager or resource monitor.

Memory management

Memory management within the OS monitors and manages how much memory is being utilised and allocates memory according to the demands of the applications/processes that are opened and executed [4]. It also manages any virtual memory created and optimises RAM utilisation to help avoid issues arising from a lack of system memory [5]. To aid this, it may move specific processes to the disk instead of the RAM or page the available space with fixed data segments to track which pages are in the RAM and which are not [5]. This can be viewed in system monitoring applications such as Task Manager or Resource Monitor.

File and Directory management

File and Directory management refers to the OS's ability to access, manipulate, and organise files stored on the storage medium within the computer or on an external device, including the file directory [6]. This allows users to read, write, and edit files, including their properties, within a hierarchical structure [6]. Some file systems may also enable access control in files and folders to aid security [7]. This can be viewed via a command line interface or a graphical interface like File Explorer or Finder.

User interface (UI)

The user interface (UI) is part of the OS, allowing the user to navigate and control the computer [8]. It may be a Graphical User Interface (GUI) or a simple Command Line Interface (CLI). Both allow the user to control the system, but the ease of use can vary. A CLI may be easier and quicker for power users; however, for most people, a GUI system will be easier to pick up and learn to use, as it contains links and buttons to navigate the system [8]. An example of a GUI system is MacOS or Windows 11, and for CLI, there is FreeBSD (text-only mode) or OpenVMS.

Device Management

The Device management part of the OS is responsible for ensuring hardware works together and works with the system correctly by allocating resources appropriately if needed; some examples are monitors, keyboards, and printers [9]. The system may use its drivers or might use third party drivers to ensure that it works correctly and as intended [9]. You can view them using a device manager in Windows to view installed drivers and update or remove them.

Security and Access Control

The security and access part of the OS aids in the security and integrity of the stored system data [10]. This ensures that before a file or folder is accessed, the process or user has the right to access the file (file permissions) and if there are any restrictions on the type of access, for example, read, write, and execute [10] [11]. It also manages user authentication and other security areas, such as access to specific system resources, data, and policies [10] [7]. This can be seen in the property tab for individual files/folders.

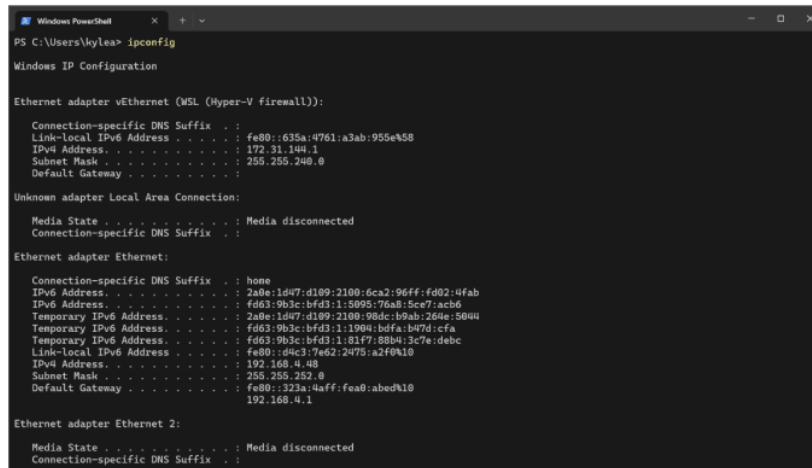
Error handling

Error handling within an OS is a critical part of the OS for the user experience. If implemented successfully, it results in a system which does not crash or corrupt data when something unexpected occurs, resulting in a more reliable system [12] [13]. This is done by detecting, monitoring, managing, and responding to failures in the system processes and applications being run using redundancy checks, virtual memory, exception handling, and recovery routines to ensure it can run error-free [12] [13]. Some of these can be seen using Windows's error system log files.

Use of Windows OS CLI commands.

ipconfig

ipconfig [14] will show all the information regarding any physical or virtual ethernet adapters the system has, along with wireless and Bluetooth adapters. It will also show all the IP addresses, both Ipv4 and Ipv6, if appropriate, the subnet mask, the default gateway, whether the adapter is active, and more.



```
Windows PowerShell
PS C:\Users\Mylea> ipconfig

Windows IP Configuration

Ethernet adapter vEthernet (WSL (Hyper-V firewall)):

    Connection-specific DNS Suffix  . : 
    Link-local IPv6 Address . . . . . : fe80::635a:4761:a3ab:955e%58
    IPv4 Address. . . . . : 172.31.144.1
    Subnet Mask . . . . . : 255.255.240.0
    Default Gateway . . . . . : 

Unknown adapter Local Area Connection:

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

Ethernet adapter Ethernet:

    Connection-specific DNS Suffix  . : home
    IPv6 Address. . . . . : 2a0e:1d47:d109:6ca2:96ff:fd02:4fab
    IPv6 Address. . . . . : fd63:9b3c:bfd3:1:5095:76a8:5ce7:acb6
    Temporary IPv6 Address. . . . . : 2a0e:1d47:d109:2100:98dc:b9ab:26de:5044
    Temporary IPv6 Address. . . . . : fd63:9b3c:bfd3:1:1904:bdfa:b7d1:cfa
    Temporary IPv6 Address. . . . . : fd63:9b3c:bfd3:1:81f7:88b4:3c7e:debc
    Link-local IPv6 Address . . . . . : fe80::d4c3:7e62:2475:a2f0%10
    IPv4 Address. . . . . : 192.168.4.48
    Subnet Mask . . . . . : 255.255.252.0
    Default Gateway . . . . . : fe80::323a:4aff:fea8:abed%10
                                192.168.4.1

Ethernet adapter Ethernet 2:

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

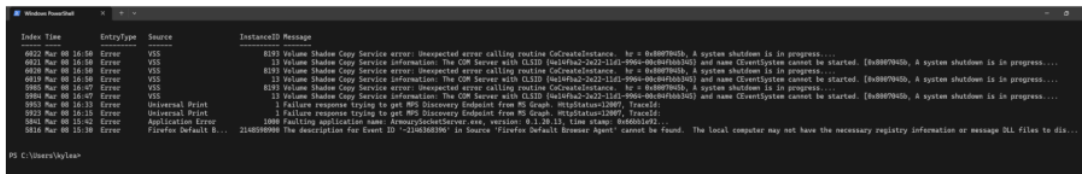
Figure 1 - showing use of the command ipconfig

If you first run the command `telnet telehack.com` and then `starwars`, it will do some ASCII animation of the starwars opening scene [15].



Get-EventLog -LogName Application -EntryType Error -newest 10

This command will bring up the newest 10 errors that Windows has logged to its error log. It will show you the time and day that the error happened, along with the entry type, source of the error, incident number, and message that accompanies it [18] [19].



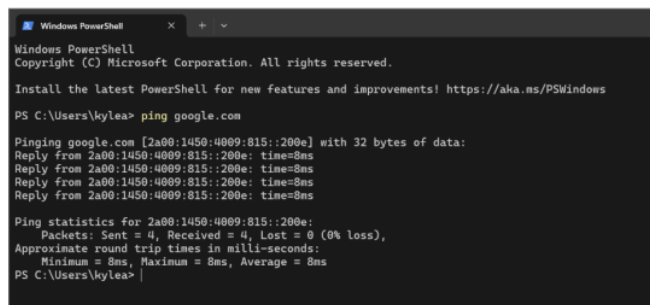
```
Windows PowerShell
Index Time      EntryType Source      InstanceID Message
-----
0822 Mar 08 16:58 Error      VSS          8293 Volume Shadow Copy Service error: Unexpected error calling routine CoCreateInstance. hr = 80007000. A system shutdown is in progress....
0821 Mar 08 16:58 Error      VSS          13 Volume Shadow Copy Service information: The COM Server with CLSID {a14f9a2-2622-11d1-9904-00c04f803000} and name CEventSystem cannot be started. {80007000}. A system shutdown is in progress....
0820 Mar 08 16:58 Error      VSS          8293 Volume Shadow Copy Service error: Unexpected error calling routine CoCreateInstance. hr = 80007000. A system shutdown is in progress....
0819 Mar 08 16:58 Error      VSS          13 Volume Shadow Copy Service information: The COM Server with CLSID {a14f9a2-2622-11d1-9904-00c04f803000} and name CEventSystem cannot be started. {80007000}. A system shutdown is in progress....
0818 Mar 08 16:57 Error      VSS          8293 Volume Shadow Copy Service error: Unexpected error calling routine CoCreateInstance. hr = 80007000. A system shutdown is in progress....
0818 Mar 08 16:47 Error      VSS          13 Volume Shadow Copy Service information: The COM Server with CLSID {a14f9a2-2622-11d1-9904-00c04f803000} and name CEventSystem cannot be started. {80007000}. A system shutdown is in progress....
0817 Mar 08 16:13 Error      Universal Print 1 Failure response trying to get WPS Discovery Endpoint from W3 Graph. HTTPStatus=1007, TraceId:
0817 Mar 08 16:13 Error      Universal Print 1 Failure response trying to get WPS Discovery Endpoint from W3 Graph. HTTPStatus=1007, TraceId:
0816 Mar 08 15:42 Error      Application Error 1000 Failing application name: <empty>Server.exe, version: 9.1.10.13, line stamp: 8d6d1d42.
0816 Mar 08 15:38 Error      Firefox Default B... 2108080808 The description for Event ID '2108080808' in source 'Firefox Default Browser Agent' cannot be found. The local computer may not have the necessary registry information or message DLL files to display...

PS C:\Users\kylea>
```

Figure 8 - Showing use of the command get-eventlog

ping

This command will send a ping packet to an IP address and tell you if it was able to communicate with the server and, if so, how many packets were sent and received back, along with the host's IP address and its latency time. You can use both ipv4 and ipv6 addresses and just a website address [14].



```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\kylea> ping google.com

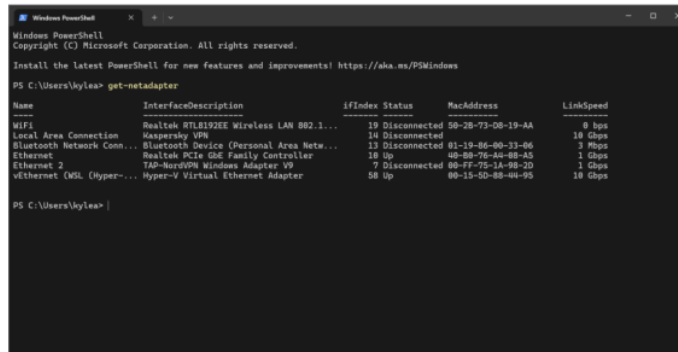
Pinging google.com [2a00:1450:4009:815::200e] with 32 bytes of data:
Reply from 2a00:1450:4009:815::200e: time=8ms
Reply from 2a00:1450:4009:815::200e: time=8ms
Reply from 2a00:1450:4009:815::200e: time=8ms
Reply from 2a00:1450:4009:815::200e: time=8ms

Ping statistics for 2a00:1450:4009:815::200e:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 8ms, Maximum = 8ms, Average = 8ms
PS C:\Users\kylea>
```

Figure 9 - Showing use of the command ping

get-netadapter

This command will list all the network interface cards available in the system (both physical and virtual) along with any Wi-Fi adapters/ cards and any Bluetooth transmitters in the system and will display their Mac address, link speed, interface description, and status on the system [20].



```
Windows PowerShell
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Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\kylea> get-netadapter

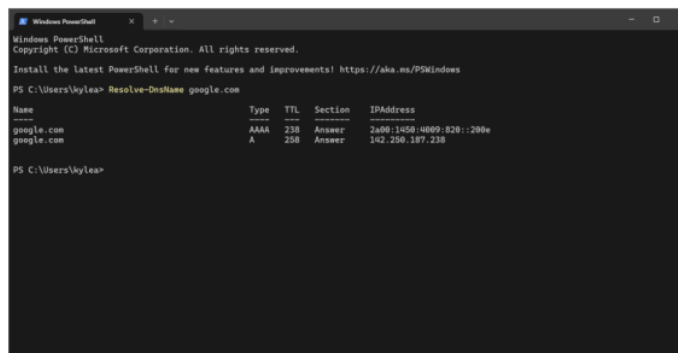
Name                InterfaceDescription      ifIndex Status      MacAddress      LinkSpeed
-----
WiFi                Realtek RTL8192EE Wireless LAN 802.11... 19 Disconnected 50-2B-73-D8-19-AA 8 bps
Local Area Connection Kaspersky VPN              14 Disconnected 01-19-86-00-13-d6 10 Gbps
Bluetooth Network Conn... Bluetooth Device (Personal Area Netw... 13 Disconnected 81-19-86-00-13-d6 3 Mbps
Ethernet            Realtek PCIe GbE Family Controller 18 Up         40-00-76-A0-80-A5 1 Gbps
Ethernet 2          TAP-Windows Adapter V9      7 Disconnected 00-FF-75-1A-90-2D 1 Gbps
Ethernet WSL (Hyper... Hyper-V Virtual Ethernet Adapter 58 Up         00-15-5D-B8-44-95 10 Gbps

PS C:\Users\kylea>
```

Figure 10 - Showing use of the command get-netadapter

Resolve-DnsName google.com

This command will query the Domain Name System (DNS) for an IP address of a particular website that you wish to find the IP address of [21]. It will also provide the TTL port number as well.



```
Windows PowerShell
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PS C:\Users\kylea> Resolve-DnsName google.com

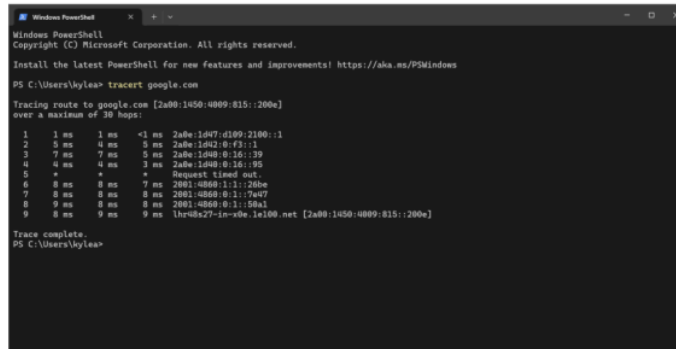
Name                Type      TTL      Section      IPAddress
-----
google.com          AAAA      238      Answer       2a00:1450:4009:820::200e
google.com          A         238      Answer       142.250.187.238

PS C:\Users\kylea>
```

Figure 11 - Showing use of the command Resolve-DnsName

tracert google.com

This command will trace each hop the packet takes over the internet and display the latency along with the IP address of each hop to get to the destination address [22].



```
Windows PowerShell
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PS C:\Users\kylea> tracert google.com

Tracing route to google.com [2a00:1400:4009:815::200e]
over a maximum of 30 hops:
  0  1 ms  1 ms  <1 ms  2a0e:1d47:d100:2100::1
  1  5 ms  4 ms  5 ms  2a0e:1d42:0:f3::1
  2  7 ms  7 ms  5 ms  2a0e:1d40:0:16::39
  3  4 ms  4 ms  3 ms  2a0e:1d40:0:16::35
  4  *      *      *      Request timed out.
  5  8 ms  8 ms  7 ms  2001:4860:1::200e
  6  8 ms  8 ms  8 ms  2001:4860:0:1::7a07
  7  9 ms  8 ms  8 ms  2001:4860:0:1::58a1
  8  8 ms  9 ms  9 ms  192.168.1.1
  9  8 ms  9 ms  9 ms  192.168.1.1

Trace complete.
PS C:\Users\kylea>
```

Figure 12 - Showing use of the command tracert

Use of Linux OS CLI commands.

ls and ls -a

ls will list all files and folders within the directory it is in. It will not, however, show hidden files. To show hidden files, add `-a` to the end of ls, showing all the files and folders in the directory [23].

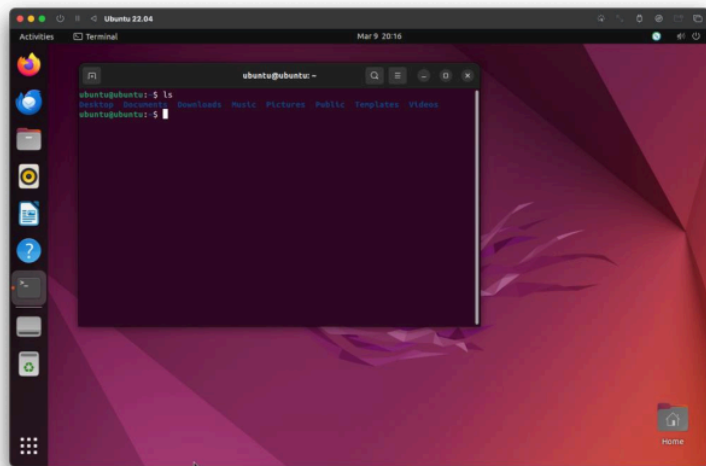


Figure 13 -- Showing use of the command `ls`

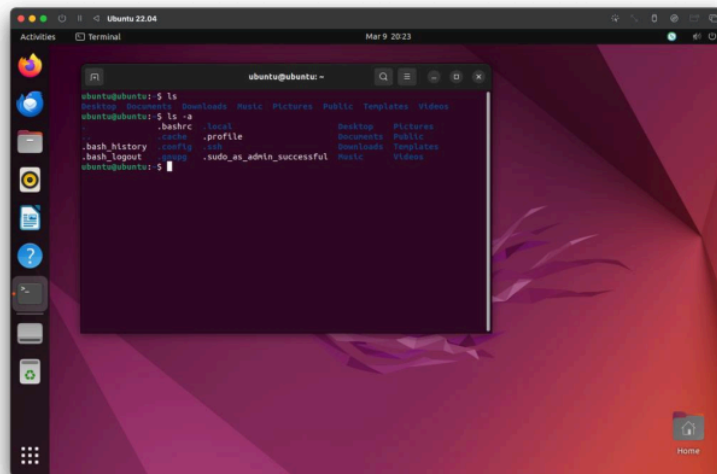


Figure 14 - Showing use of the command `ls -a`

pwd

pwd will show the current directory file path taken [23].

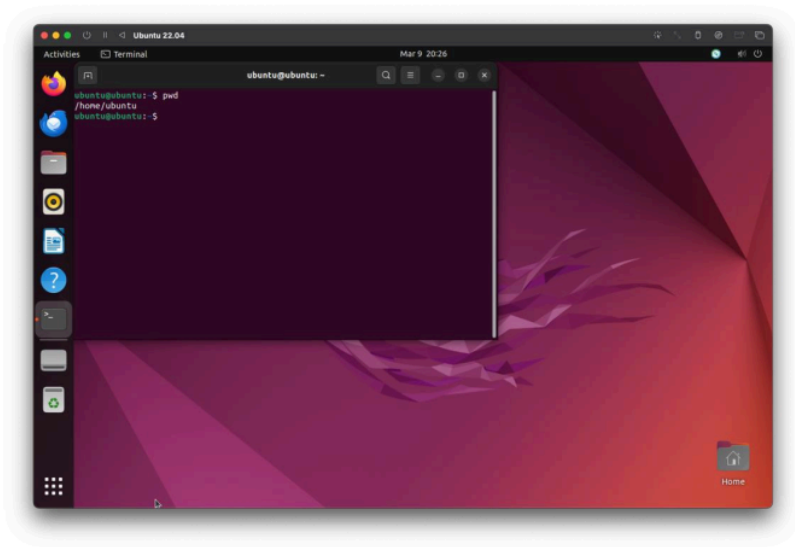
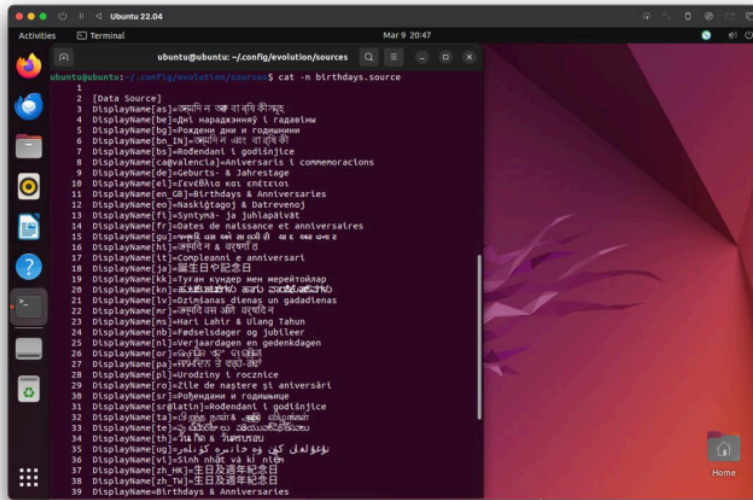


Figure 15 - Showing use of the command pwd

cat

Cat will display the contents of a file, and depending on if -n or -b is selected, it will number each line of the file or all non-blank [23]. It will then have the file path to know what file is needed to be read.

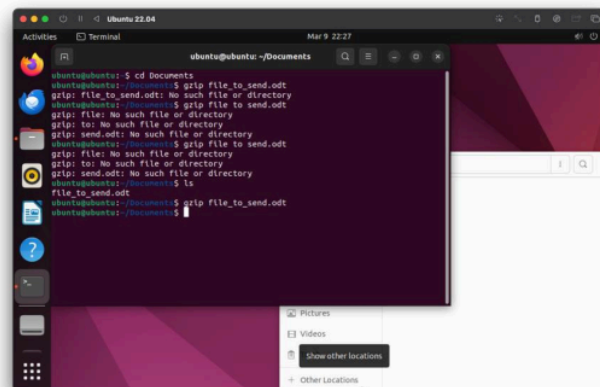


```
ubuntu@ubuntu: ~/config/evolution/sources$ cat -n birthdays.source
1
2 [Data Source]
3 DisplayName[as]=असमि न खर दासि कीमर
4 DisplayName[be]=Jhl wapaxxwxy l ragasluw
5 DisplayName[bg]=Роден ден в роденост
6 DisplayName[bn_IN]=অসমি ন খৰ দাসি কী
7 DisplayName[bs]=Rodendani l godinjice
8 DisplayName[ca]=Data de naixement i commemoracions
9 DisplayName[de]=Geburts- & Jahrestage
10 DisplayName[el]=Ημερήσια και εμνησεία
11 DisplayName[en_GB]=Birthdays & Anniversaries
12 DisplayName[eo]=Naskiĝtagoj & Datrevenoj
13 DisplayName[fi]=Syntymä- ja juhlapäivät
14 DisplayName[fr]=Dates de naissance et anniversaires
15 DisplayName[gu]=વેદી આ ના સહી ડે ના સમાજ
16 DisplayName[hi]=जन्मदिन & वर्षादि
17 DisplayName[it]=Compleanni e anniversari
18 DisplayName[ja]=誕生日と記念日
19 DisplayName[kk]=Туған күні мен мерекелер
20 DisplayName[kn]=ಜನ್ಮ ದಿನಗಳು ಮತ್ತು ವರ್ಷದ ಹಬ್ಬಗಳು
21 DisplayName[lv]=Dzimšanas dienas un gadadienas
22 DisplayName[nr]=Jenalele lele jehle
23 DisplayName[nr_ZA]=Jehle lele jehle
24 DisplayName[nb]=Fødselsdager og jubileer
25 DisplayName[nl]=Verjaardagen en gedenkdagen
26 DisplayName[or]=ଜନ୍ମ ଦିନ ଓ ବର୍ଷାଦି
27 DisplayName[pa]=ਜਨਮ ਦਿਨ ਤੇ ਵਰ੍ਹੇ-ਬਰ
28 DisplayName[pl]=urodziny i rocznice
29 DisplayName[ro]=Zile de nastere si aniversari
30 DisplayName[sr]=Pohovani i rođendani
31 DisplayName[sr_Latn]=Rodendani l godinjice
32 DisplayName[te]=జన్మ దినం మరియు వర్షదినం
33 DisplayName[th]=วันเกิด และ วันครบรอบ
34 DisplayName[th_HK]=วันเกิด และ วันครบรอบ
35 DisplayName[tg]=Розидагонҳо ва ҷишҳо
36 DisplayName[vi]=Sinh nhật và kỉ niệm
37 DisplayName[zh_HK]=生日及週年紀念日
38 DisplayName[zh_TW]=生日及週年紀念日
39 DisplayName=Birthdays & Anniversaries
```

Figure 16 - Showing use of the command cat -n

gzip

The gzip command will compress any file you wish to compress and decompress your add -d between the command and file/ file path [24].



```
ubuntu@ubuntu: ~/Documents$ cd Documents
ubuntu@ubuntu:~/Documents$ gzip file_to_send.odt
gzip: file_to_send.odt: No such file or directory
ubuntu@ubuntu:~/Documents$ gzip file_to_send.odt
gzip: file: No such file or directory
gzip: too: No such file or directory
ubuntu@ubuntu:~/Documents$ gzip file_to_send.odt
gzip: file: No such file or directory
gzip: too: No such file or directory
ubuntu@ubuntu:~/Documents$ ls
file_to_send.odt
ubuntu@ubuntu:~/Documents$ gzip file_to_send.odt
ubuntu@ubuntu:~/Documents$
```

Figure 17 - Showing use of the command gzip

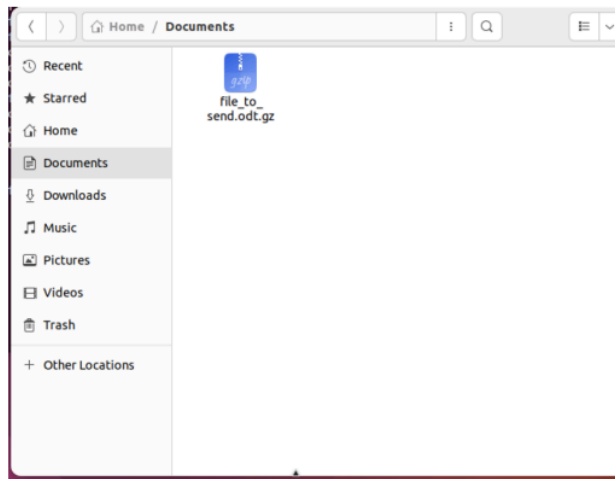


Figure 18 - showing the result from the command `gzip`

history

This command will show all the commands used in the same session in the terminal, and if `-w` is added, it will write them to a file `~/.bash_history` on the system [23].

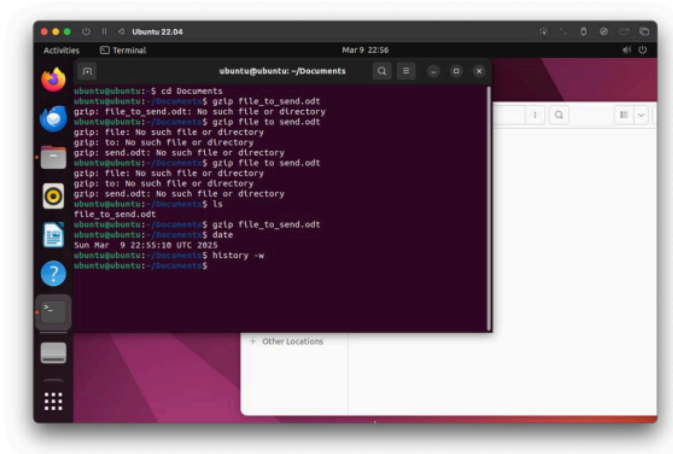


Figure 19 - Showing use of the command `history -w (1)`

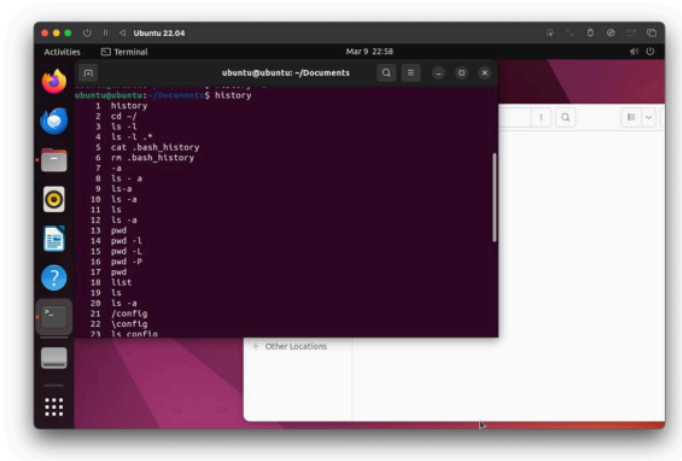


Figure 20 - Showing use of the command history -w (2)

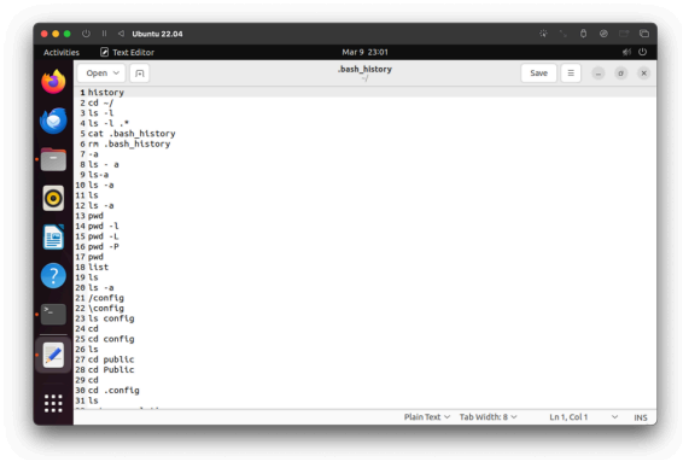


Figure 21 - showing the result from the command history -w

vim +42

This command will read a Linux help file containing information regarding the command line and other parts of the Linux distribution. It also includes an Easter egg reference to the meaning of life [25].

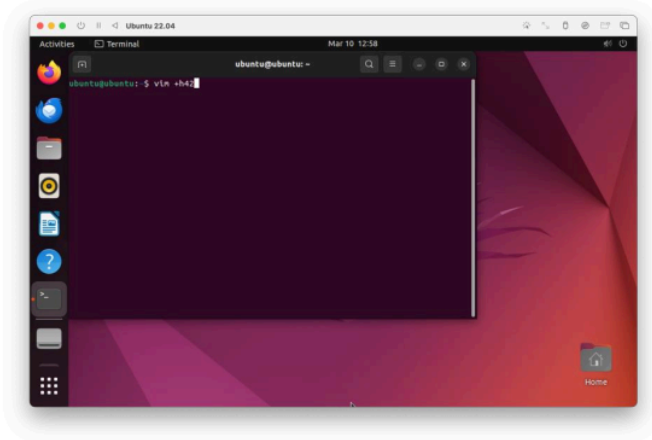


Figure 22 - Showing use of the command vim +42

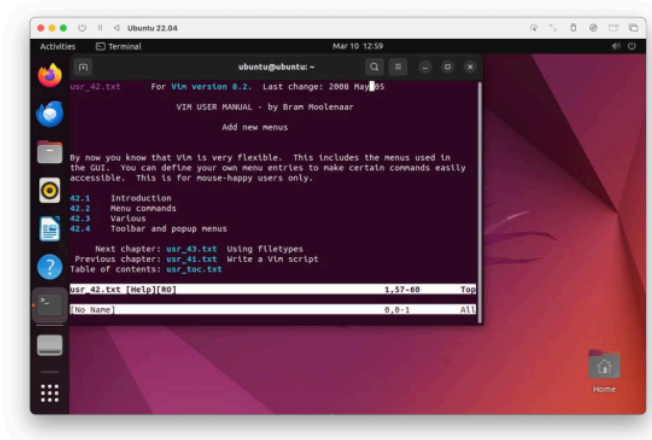


Figure 23 - showing the result from the command vim +42 (1)

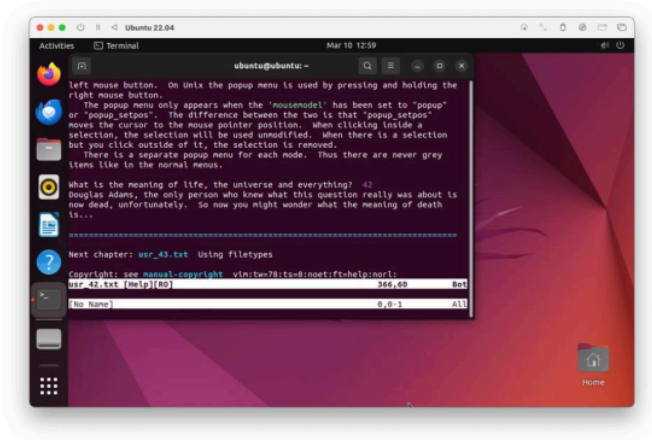


Figure 24 - showing the result from the command vim +42 (2)

sudo apt install

This will install any app you want if it is available on Linux. After installation, you just need to add the app's name, and it will install it [23].

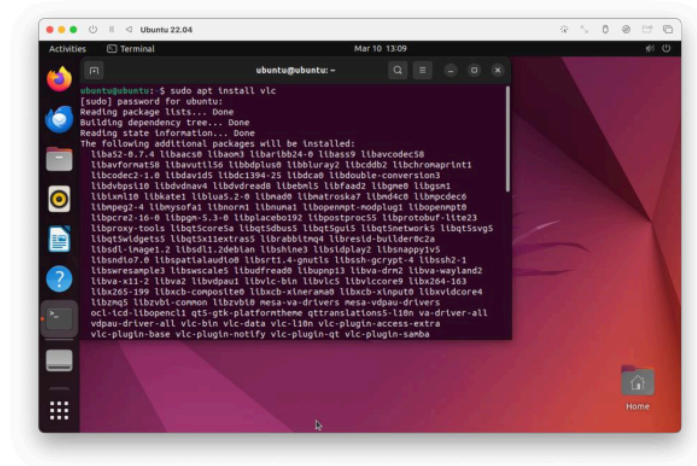


Figure 25 - Showing use of the command sudo apt install

netstat

Netstat will provide a list of information regarding network connections of active processes, the path of the process, and the ports that are in use [23].

```
kyle@kylepc:~$ netstat
Active Internet connections (w/o servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 172.31.154.98:51230     ubuntu-mirror-2.ps:80  TIME_WAIT

Active UNIX domain sockets (w/o servers)
Proto Refcnt Flags               Type               State               I-Node      Path
unix  3      [ ]  STREAM             CONNECTED          19738        @021192a83cd429aa/bus/systemd-logind/system
unix  2      [ ]  DGRAM              21798              /run/user/1000/systemd/notify
unix  2      [ ]  DGRAM              21526              /var/run/chrony/chronyd.sock
unix  3      [ ]  DGRAM              19525              /run/systemd/notify
unix  2      [ ]  DGRAM              19539              /run/systemd/journal/syslog
unix  3      [ ]  DGRAM              19541              /run/systemd/journal/dev-log
unix  8      [ ]  DGRAM              19543              /run/systemd/journal/socket
unix  3      [ ]  STREAM             CONNECTED          22789        80b7f5d4c7f18e7d0/bus/systemd-resolve/bus-api-resolve
unix  3      [ ]  STREAM             CONNECTED          22773        81883db8e15073652/bus/systemd-timesyn/bus-api-timesync
unix  3      [ ]  STREAM             CONNECTED          21679        84d97bf5a4dd6d5d2/bus/systemd-timesyn/bus-api-timesync
unix  3      [ ]  STREAM             CONNECTED          25723        84b1d9c5e385c11c/bus/systemd/bus-api-system
unix  3      [ ]  STREAM             CONNECTED          22881        /run/systemd/journal/stdout
unix  2      [ ]  DGRAM              25893              /run/dbus/system_bus_socket
unix  3      [ ]  STREAM             CONNECTED          24759
unix  3      [ ]  DGRAM              21645
unix  3      [ ]  STREAM             CONNECTED          22581
unix  3      [ ]  STREAM             CONNECTED          24642        /run/systemd/journal/stdout
unix  2      [ ]  DGRAM              17844
unix  3      [ ]  STREAM             CONNECTED          22842
unix  2      [ ]  DGRAM              24696
unix  3      [ ]  STREAM             CONNECTED          19485
unix  2      [ ]  DGRAM              25988
unix  3      [ ]  STREAM             CONNECTED          315          /run/dbus/system_bus_socket
unix  3      [ ]  STREAM             CONNECTED          23746
unix  3      [ ]  STREAM             CONNECTED          23575
unix  2      [ ]  STREAM             CONNECTED          22546
unix  3      [ ]  STREAM             CONNECTED          17689
```

Figure 26 - Showing use of the command netstat

ip route show

This will display the IP address of the routing table the system will use [26].

```
kyle@kylepc:~$ ip route show
default via 172.31.144.1 dev eth0 proto kernel
172.31.144.0/24 dev eth0 proto kernel scope link src 172.31.154.98
kyle@kylepc:~$
```

Figure 27 - Showing use of the command ip route show

asciiaquarium

This will display some ascii animation of an aquarium in the command line [27].

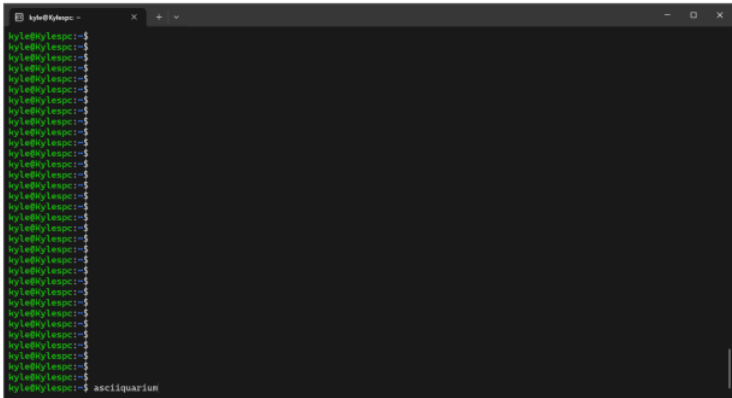


Figure 28 - Showing use of the command asciiaquarium



Figure 29 - showing the result from the command asciiaquarium


```

network script.bat
File Edit View

@echo off
set local enabledelayedexpansion
set ipAddress=1
set ipArray[0]=1
set ipArray[1]=1
set ipArray[2]=1

set /p userInput=Please enter y to run IP Routine.

if "%userInput%" == "y" (
    call :IPRoutine
    goto :EndOfScript
) else (
    goto :EndOfScript
)

:IPRoutine
echo Please enter an IP address
set /p ipAddress=

set ipArray[0]=%ipAddress%
ping %ipAddress%

if !errorLevel! equ 0 (
    set ipArray[1]=1
) else (
    set ipArray[0]=0
)

for /f "tokens==" %a in ('nslookup %ipAddress%') do (
    set ipArray[2]=%ipArray[2]! %a
    nslookup %ipAddress%
)
EXIT /B 0

:EndOfScript
echo Batch script ran successfully
pause

```

Figure 31 - code of networking script

This batch script will ask if the user wants to run the program and will then ask for a Ip address if “y” is entered. Once entered, it will ping the IP address, and if successful, it will perform a nslookup [14] [28] [29] [30].

Windows update script

```
Administrator: Windows PowerShell
PS C:\WINDOWS\system32> cd C:\Users\kylea
PS C:\Users\kylea> .\UpdateWindows.ps1
Attempt 1: Checking for updates...
No updates found. Checking again...
Attempt 2: Checking for updates...
No updates found. Checking again...
_
```

Figure 32 - running the PowerShell Windows update script (1)

```
Administrator: Windows PowerShell
PS C:\WINDOWS\system32> cd C:\Users\kylea
PS C:\Users\kylea> .\UpdateWindows.ps1
Attempt 1: Checking for updates...
No updates found. Checking again...
Attempt 2: Checking for updates...
No updates found. Checking again...
Attempt 3: Checking for updates...
No updates found. Checking again...
Update process completed!
PS C:\Users\kylea> _
```

Figure 33 - running the PowerShell Windows update script (2)

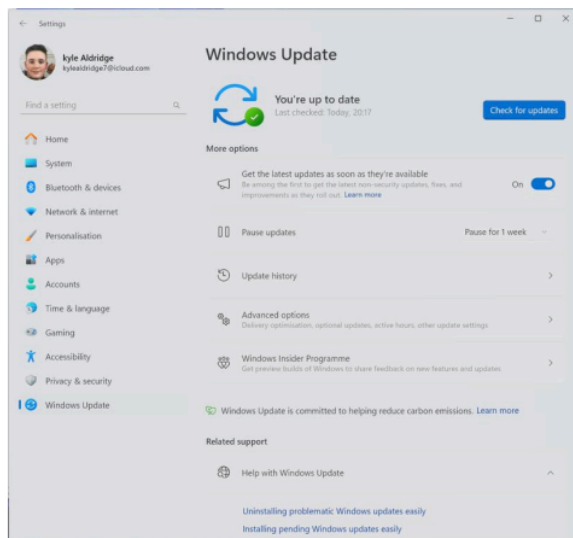
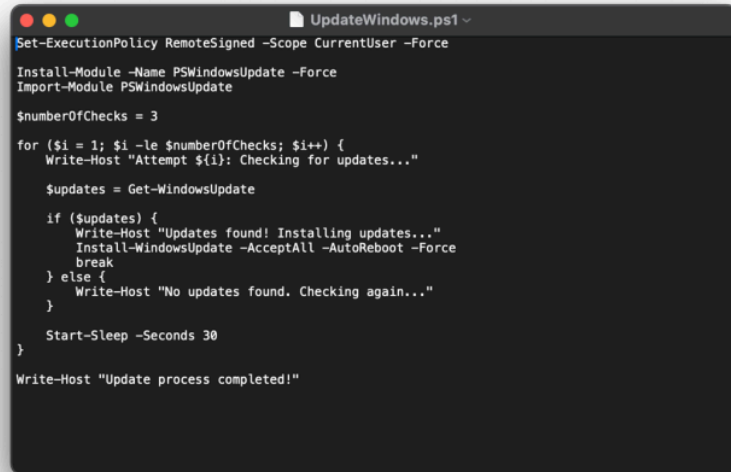


Figure 34 - shows the PowerShell script worked as it has checked for Windows updates.



```
Set-ExecutionPolicy RemoteSigned -Scope CurrentUser -Force
Install-Module -Name PSWindowsUpdate -Force
Import-Module PSWindowsUpdate

$numberOfChecks = 3

for ($i = 1; $i -le $numberOfChecks; $i++) {
    Write-Host "Attempt ${i}: Checking for updates..."
    $updates = Get-WindowsUpdate

    if ($updates) {
        Write-Host "Updates found! Installing updates..."
        Install-WindowsUpdate -AcceptAll -AutoReboot -Force
        break
    } else {
        Write-Host "No updates found. Checking again..."
    }

    Start-Sleep -Seconds 30
}

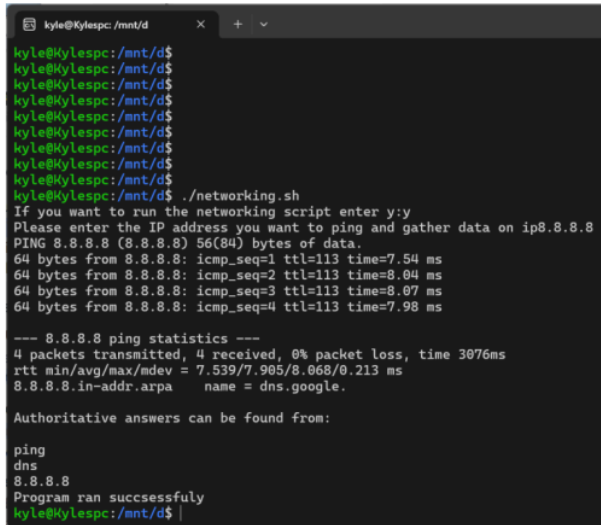
Write-Host "Update process completed!"
```

Figure 35 - shows the code for the windows update script

This PowerShell script, once run, will install a module called PSWindowsUpdate and then will look to see if there are any Windows updates available, and if any are available, it will then install the updates automatically. It will work only on certain Windows 10 and Windows 11 systems [29] [30] [31] [32].

Use of Linux OS scripts.

Linux Networking script



```
kyle@kylespc: /mnt/d$
kyle@kylespc: /mnt/d$
kyle@kylespc: /mnt/d$
kyle@kylespc: /mnt/d$
kyle@kylespc: /mnt/d$
kyle@kylespc: /mnt/d$
kyle@kylespc: /mnt/d$
kyle@kylespc: /mnt/d$
kyle@kylespc: /mnt/d$ ./networking.sh
If you want to run the networking script enter y:y
Please enter the IP address you want to ping and gather data on ip8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data:
64 bytes from 8.8.8.8: icmp_seq=1 ttl=113 time=7.54 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=113 time=8.04 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=113 time=8.07 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=113 time=7.98 ms

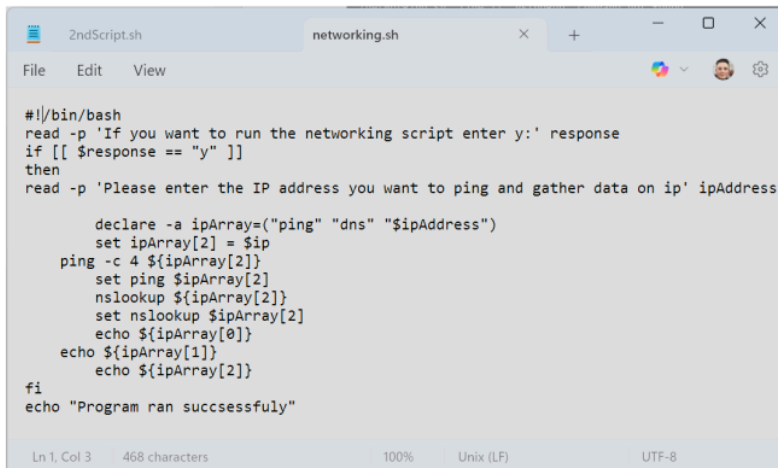
--- 8.8.8.8 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3076ms
rtt min/avg/max/mdev = 7.539/7.905/8.068/0.213 ms
8.8.8.8.in-addr.arpa    name = dns.google.

Authoritative answers can be found from:

ping
dns
8.8.8.8
Program ran successfully
kyle@kylespc: /mnt/d$
```

Figure 36 - running a Networking Linux script

This script will ask if you wish to run it. If “y” is entered, it will ask for an IP address to run a ping command and a DNS lookup, and then it will provide the results to the user. [33] [34]



```
#!/bin/bash
read -p 'If you want to run the networking script enter y:' response
if [[ $response == "y" ]]
then
read -p 'Please enter the IP address you want to ping and gather data on ip' ipAddress

    declare -a ipArray=("ping" "dns" "$ipAddress")
    set ipArray[2] = $ip
    ping -c 4 ${ipArray[2]}
    set ping ${ipArray[2]}
    nslookup ${ipArray[2]}
    set nslookup ${ipArray[2]}
    echo ${ipArray[0]}
    echo ${ipArray[1]}
    echo ${ipArray[2]}
fi
echo "Program ran successfully"
```

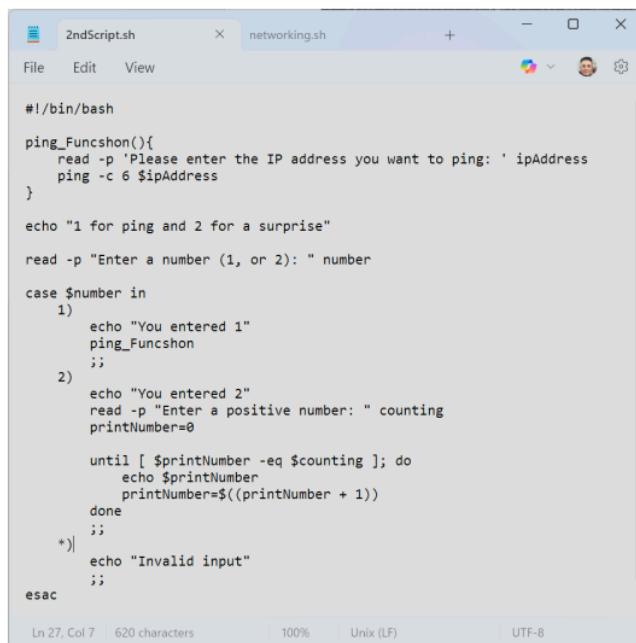
Figure 37 - showing the code for the networking script

2nd Linux script

```
kyle@Kylespc:/mnt/d$ ./2ndScript.sh
1 for ping and 2 for a surprise
Enter a number (1, or 2): 1
You entered 1
Please enter the IP address you want to ping: 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=113 time=8.21 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=113 time=8.36 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=113 time=8.12 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=113 time=8.27 ms
64 bytes from 8.8.8.8: icmp_seq=5 ttl=113 time=8.31 ms
64 bytes from 8.8.8.8: icmp_seq=6 ttl=113 time=8.01 ms

--- 8.8.8.8 ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5007ms
rtt min/avg/max/mdev = 8.010/8.215/8.363/0.118 ms
kyle@Kylespc:/mnt/d$ ./2ndScript.sh
1 for ping and 2 for a surprise
Enter a number (1, or 2): 2
You entered 2
Enter a positive number: 20
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
kyle@Kylespc:/mnt/d$
```

Figure 38 - running another Linux script with both options

A screenshot of a text editor window titled '2ndScript.sh' with a tab for 'networking.sh'. The editor shows a bash script with a function 'ping_Funcshon()' that takes an IP address and pings it for 6 seconds. The script then prompts the user to enter a number (1 or 2). If the user enters 1, it calls the ping function. If the user enters 2, it prompts for a positive number and enters a counting loop. If the user enters anything else, it prints 'Invalid input'.

```
#!/bin/bash

ping_Funcshon(){
    read -p "Please enter the IP address you want to ping: " ipAddress
    ping -c 6 $ipAddress
}

echo "1 for ping and 2 for a surprise"
read -p "Enter a number (1, or 2): " number

case $number in
    1)
        echo "You entered 1"
        ping_Funcshon
        ;;
    2)
        echo "You entered 2"
        read -p "Enter a positive number: " counting
        printNumber=0

        until [ $printNumber -eq $counting ]; do
            echo $printNumber
            printNumber=$((printNumber + 1))
        done
        ;;
    *)
        echo "Invalid input"
        ;;
esac
```

Figure 39 - showing the code for another Linux script

This script will ask the user to input 1 or 2 from a menu, and from that, it will do 1 or 2 things. If one is chosen, it will ask for an IP address and then run a ping on it. If two is selected, it will ask for a number and count to that number. [33] [23]

Conclusion

This report aimed to provide a comprehensive overview of Operating systems and some of the commands that are utilised within Windows and Linux OS and within bat, shell, and batch scripting. This was explored by researching and discussing key functions of operating systems, CLI commands, and scripting languages. This provided valuable insights into the diverse range of tools and functions offered by the different scripting languages and parts of the operating systems.

The research and analysis under the Key Functions of General Operating Systems section revealed that the fundamental components underpin both Windows OS and Linux OS, which include process management, memory management, and file handling. However, there are differences in implementation, such as the fundamental file system used. For example, Windows uses NTFS, whereas Linux uses the ext file system format. Furthermore, Windows is mostly a graphical user interface, whereas Linux is popular in graphical and command-line user interfaces.

This report also explored what was possible with Windows CLI commands and Linux CLI commands. It was evident that both platforms were slimly capable of a wide range of commands and options to automate tasks or speed up task completion by utilising the command-line interface of both systems.

Both systems also have very capable scripting features/ languages. They utilise the commands from the Command line interface and then incorporate this within a scripting language. This resulted in a powerful language where tasks could be completed automatically, such as setting up a new user, testing, and diagnosing a network, just by running a script.

Overall, this report has demonstrated the crucial role scripting languages play in operating systems for users, especially in heavy 'Power users' / system administration tasks, along with demonstrations of how they can be implemented. Further, it also demonstrated the useability of the command line interface for Windows and Linux systems and how they can be used, along with a brief overview of the components of the Operating system.

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Appendices

Evidence of engagement with a certified course.

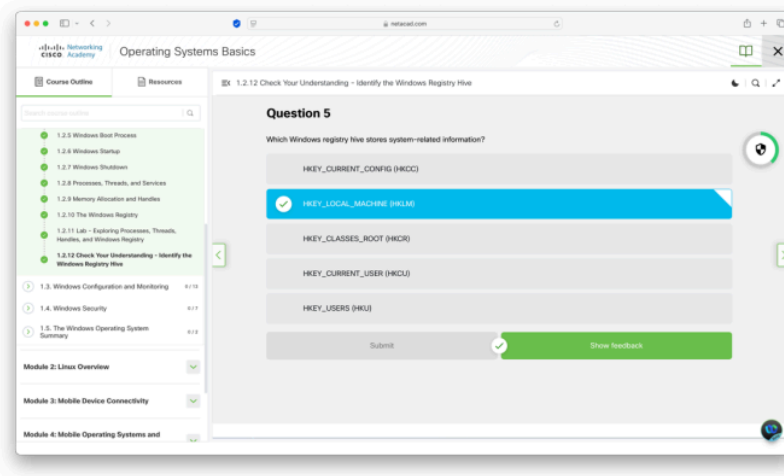


Figure 40 - showing some progress with an OS Cisco course (1)

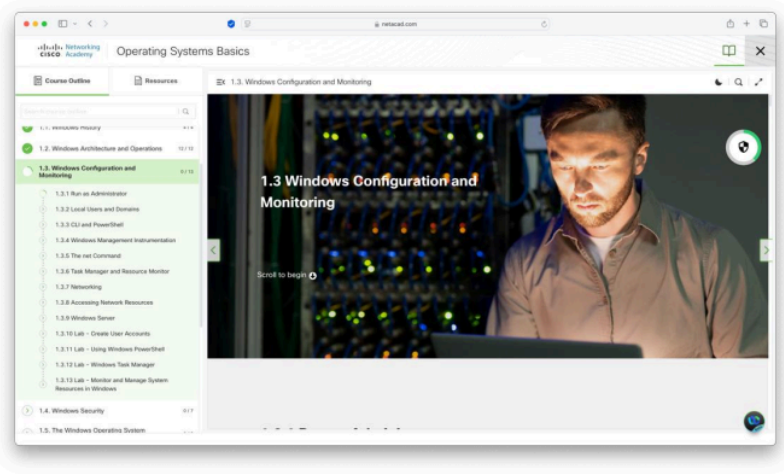


Figure 41 - showing some progress with an OS Cisco course (2)

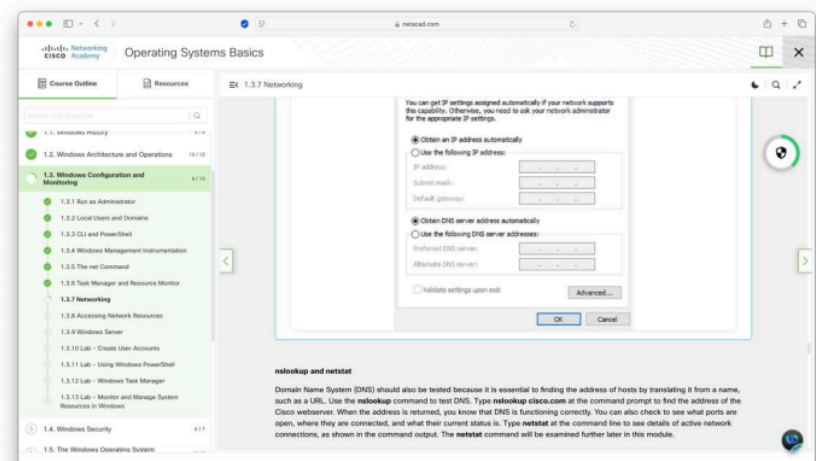


Figure 42 - showing some progress with an OS Cisco course (3)

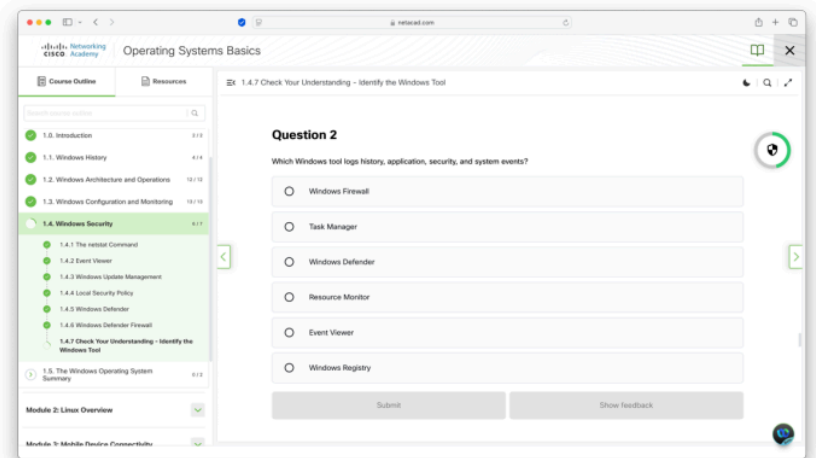


Figure 43 - showing some progress with an OS Cisco course (4)

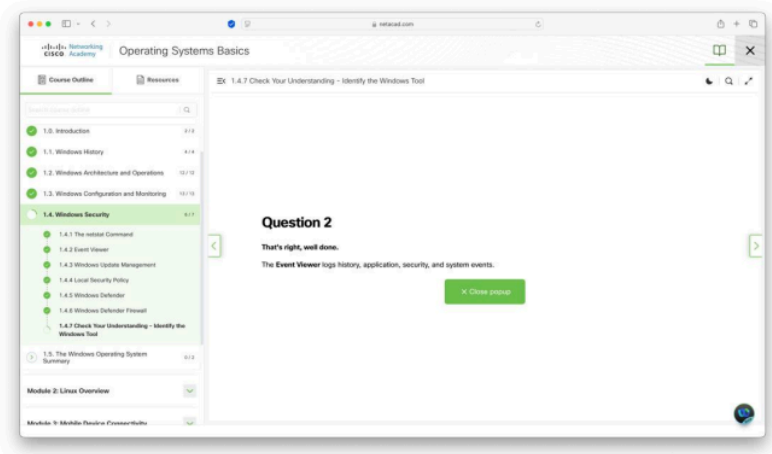


Figure 44 - showing some progress with a OS Cisco course (5)

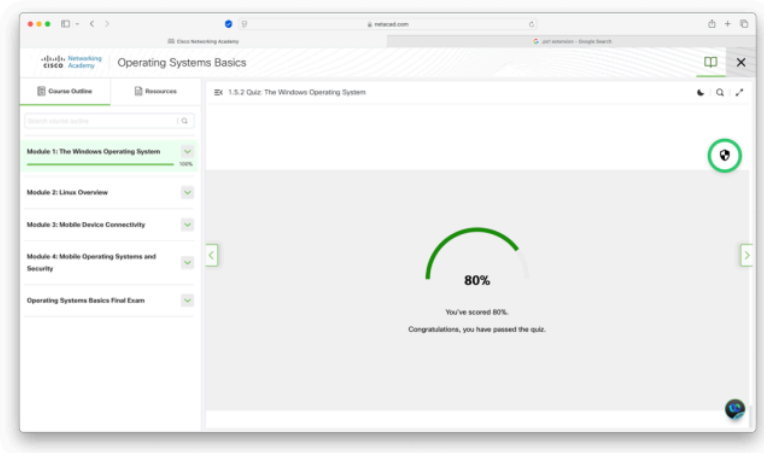


Figure 45 - showing completion of part 1 of a OS Cisco course

Network script code

```
@echo off
set local enabledelayedexpansion
set ipAddress=1
set ipArray[0]=1
set ipArray[1]=1
set ipArray[2]=1
```

```
set /p userInput=Please enter y to run IP Routine.
```

```
if "%userInput%" == "y" (
```

```
    call :IpRoutine
```

```
    goto :EndOfScript
```

```
) else (
```

```
    goto :EndOfScript
```

```
)
```

```
:IpRoutine
```

```
echo Please enter an IP address
```

```
set /p ipAddress=
```

```
set ipArray[0]=%ipAddress%
```

```
ping %ipAddress%
```

```
if !errorlevel! equ 0 (
```

```
    set ipArray[1]=1
```

```
) else (
```

```
    set ipArray[0]=0
```

```
)
```

```
for /f "tokens=*" %%A in ('nslookup %ipAddress%') do (
```

```
    set ipArray[2]=!ipArray[2]! %%A
```

```
    nslookup %ipAddress%
```

```
)
```

```
EXIT /B 0
```

```
:EndOfScript
```

```
echo Batch script ran successfully
```

```
pause
```

Windows system update script

```
Set-ExecutionPolicy RemoteSigned -Scope CurrentUser -Force
```

```
Install-Module -Name PSWindowsUpdate -Force
```

```
Import-Module PSWindowsUpdate
```

```
$numberOfChecks = 3
```

```
for ($i = 1; $i -le $numberOfChecks; $i++) {
```

```
    Write-Host "Attempt ${i}: Checking for updates..."
```

```
    $updates = Get-WindowsUpdate
```

```
    if ($updates) {
```

```
        Write-Host "Updates found! Installing updates..."
```

```
        Install-WindowsUpdate -AcceptAll -AutoReboot -Force
```

```
        break
```

```
    } else {
```

```
        Write-Host "No updates found. Checking again..."
```

```
    }
```

```
    Start-Sleep -Seconds 30
```

```
}
```

```
Write-Host "Update process completed!"
```

Tutorial Activity

An OS is a software program which controls the hardware components and allows a user to control the hardware.

An OS controls the hardware resources, manages software and apps, security, I/O devices, etc.

There are currently 6 different types of Operating systems (OS), which include:

- General purpose OS - Linux, Windows, macOS
- Mobile OS - Android and Apple IOS
- Network OS - Unix, FreeBSD, Ubuntu server, Windows Server
- Real-time specialised OS's - ATMs, Airplane systems, Medical devices
- Embedded Specialised OS's - Retail terminals, electric vehicles, Smart metres
- AI & Quantum computing OS - Kaba AI OS, Riverlane

General purpose OS are used for day-to-day tasks on a computer like a PC or Laptop. They use software that can be downloaded and do a broad range of functions; therefore, they are versatile and readily available [35]. Mobile OSs are similar to general purpose OSs but are instead run on smaller and less powerful hardware due to them running off a battery that must last for most of a day and be easily portable. They can run most applications on a PC or laptop, except for some features or power-hungry apps such as database software [36]. However, they can use a SIM card to make and receive calls, texts and data. Network OS is more specific software that runs on networking hardware, allowing it to manage network devices and facilitate sharing information and resources. [37] It provides security, scalability and fault tolerance. Real-time OS are specialised OS that critical processes rely on, such as Airplanes and medical devices [37]. They are created for a specific reason to do a particular task well and without error. Embedded specialised OS are similar to Real-time OS in that they do 1 task and 1 task well, but these aren't for critical safety systems where failure is life-threatening [38]. However, these systems, such as electric meters or retail terminals, form the backbone of a company or county [38].

AI is a unique OS utilised to enhance the user experience within the system. It could be an interface only through voice or traditional methods such as a keyboard and mouse. Still, it will allow the user to perform tasks similar to the general OS [39]. Quantum OS is identical to Real-time and embedded specialised OS as it is specific to quantum computing hardware and will perform specific functions that aren't mission-critical but will aid in scientific and mathematical breakthroughs [40].

Lecture Activities

OS typical components and functions include:

- Process & Memory Management
 - System & Performance Management
 - Device Management (Manages I/O devices)
 - Error detection and System recovery
 - System Security Management
-
- File & Directory Management
 - The kernel program is the core program of the Operating System.
 - It manages communication between the computer's software and hardware.
 - It is an OS program, and the most essential part of the OS is always in memory, from boot-up to shutdown.
 - It monitors how much memory each process uses and manages which method is the next to be processed by the CPU, for how long, and what hardware resources it needs to use.
 - Controlling hardware. Components.
 - Providing a platform for software to run on.
 - Providing a user interface.
 - Managing processes.
 - Managing the computer's memory.
 - Managing input and output devices.
 - Managing applications.
 - Managing security.

Memory Management: Process Scheduler

- The OS creates, schedules, assigns & terminates processes that are used by the CPU.
- The OS controls which process is being executed by the CPU at any time.
- The OS decides the best way to swap between running, runnable and waiting processes.
- The job of working out when to swap processes is known as scheduling / job-scheduling / process scheduling.
- The OS's 'Process Scheduler' program (aka resource scheduler or job controller) determines which job/processes are admitted to the CPU for processing.
- Traditionally, one way the OS can prevent a system crash is to use some of the secondary memory / hard drive as RAM.
- This is called Virtual memory. Virtual memory is slower than main memory because processing is taken up by moving data between primary and secondary memory. But it can be very useful until more RAM is free or installed.
- When a computer runs many processes, and RAM runs low, a memory section is created on the hard drive, called VRAM / Virtual RAM or Virtual Memory.

- When RAM is low, the OS spits the processes not being actively used into blocks called 'pages' and moves them to the hard disk/secondary memory to free up RAM for other active processes.
 - This method is called 'swapping'. It ensures that the system does not run out of memory and crashes.
-
- Windows: New Technology File system (NTFS)
 - Unix: Unix File System (UFS)
 - Linux: Extended File System (The EXT family, e.g. xt2, ext3,ext4 & ReiserFS)

Macs: Apple File System (APFS).

.bat = batch file type

Linux

bin - contains essential executables

etc. - stores configuration files

home - contains user home directorates

lib - contains shared files

var - contains files and directories that grow in size over time (Dynamic data)

tmp - temporary files that are removed when the system restarts

sbin - Contains essential system administration binaries

srv - Contains site-specific data for the Linux distribution

usr/lib - Contains object files and libraries that are not designed to be directly used by shell scripts or users

boot – The boot directory contains files for booting up the system

sbin - contains superuser applications for managing and configuring the system that only the superuser/admin can run

dev - device drivers

opt - where software we create and compile is often based.

Bat:

echo

pause

set - variables

%% tells it a variable

/A is a number

Goto - moves what is executed next around the bat file

if [] do []

if [] [] else []

/p user input

variable in a for loop %%[]

For [] in [] do(

)

/r goes to the root

bash

****Variables****

var1="Tommy"

****read command**** takes ****user input**** from the keyboard

****read**** variable_name -p (same line)

declare Array1=(element1 element2 element3)

- In bash, we use the lowercase -o option to create a numerically indexed Array:

declare -a ArrayName=([1]=element1 [2]=element2)

- And an uppercase -A option to create an Associative array: declare A
ArrayName=([Wales]="Sunny" [Scotland]="Snowy")
- Associative arrays use words instead of numbers as the keys to access values.

- To echo out an element of an Array, we wrap the array name up in curly braces and include the array element in square brackets: `echo ${Array1[2]}`
- `cd`: Change the directory to a different location.
- `Ls`: List the contents of the current directory.
- `mkdir`: Create a new directory.
- `Touch`: Create a new file.
- `Rm`: Remove a file or directory.
- `Cp`: Copy a file or directory.

`Get-Help <CmdletName>`: Displays help information for a specific cmdlet.

Example: `Get-Help Get-Process`

Navigating the File System:

`Get-ChildItem` (alias: `ls`, `dir`): Lists files and directories.

`Set-Location` (alias: `cd`, `chdir`): Changes the current directory.

`Get-Content` (alias: `cat`, `gc`, `type`): Displays the content of a file.

`Copy-Item` (alias: `copy`, `cp`, `cp`): Copies files or directories.

`Move-Item` (alias: `move`): Moves files or directories.

`Remove-Item` (alias: `del`, `erase`, `rd`, `ri`, `rm`, `rmdir`): Deletes files or directories.

`Test-Path`: Determines whether a path exists

Working with Processes:

`Get-Process`: Lists running processes.

`Stop-Process`: Stops a running process.

Working with Services:

`Get-Service`: Lists running services.

`Start-Service`, `Stop-Service`, `Restart-Service`: Control the state of services.

Working with Modules:

`Get-Module`: Lists loaded modules.

`Import-Module`: Imports a module into the current session.

Working with Objects:

`Select-Object`: Selects properties of objects.

`Where-Object`: Filters objects based on a condition.

`ForEach-Object`: Iterates through a collection of objects.

Working with Strings:

Select-String: Finds text in files or strings.

Working with the Pipeline:

| (pipe): Sends the output of one command as input to the next.

Example: Get-ChildItem | Where-Object {\$_.Name -like "*.txt"} | Remove-Item

Other Useful Commands:

Clear-Host (alias: cls): Clears the PowerShell console screen.

Out-File: Sends output to a file.

Invoke-Item: Opens a file using the application associated with its extension.

Test-Connection (alias: ping): Checks if a remote host is reachable.

ConvertTo-HTML: Converts output to HTML format.

ConvertTo-Xml: Converts output to XML format.

Aliases:

PowerShell uses aliases (shorthand names) for many cmdlets.

Example: ls is an alias for Get-ChildItem.

Syntax:

Cmdlet Name [ParameterName] [ParameterValue]

Example: Get-ChildItem -Path "C:\Users\..."

OS Assignment

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

97 / 100

Total:		97
1. Engagement with Literature Skills:		
+ Very good use of citations. + formatted reference list.	20	
2. Knowledge and Understanding Skills:		
Key functions: + Very good overview of key OS functions documented. + Screenshots showing where some of the functions can be seen/monitored/managed. + Supported by citations. Win Commands: + V. good overview of relevant commands that demonstrates an understanding of the language. Bash Commands: + V. good overview of relevant commands that demonstrates a sound understanding of the language. Win Scripts: + V. good overview of the syntax that demonstrates an understanding of the scripting aspect of the language. Bash Scripts: + V. good overview of the syntax that demonstrates a clear understanding of the scripting aspect of the language.	20	

3. Cognitive and Intellectual Skills:		
+ Evidence of good analysis and understanding of OS functions; + Where some of the functions can be seen/monitored/managed is stated. - Several screenshots showing where some of the functions can be seen/monitored/managed not documented. + Conclusion.	10	7
4. Practical Application Skills:		
1. Win Commands: + V. good use of relevant Win. language commands. 2. Bash Commands: + V. good use of relevant Bash commands. 3. Win Scripts: + V. good use of Win scripts to demonstrate applied knowledge of the core syntax. 4. Bash Scripts: + V. good use of Bash scripts to demonstrate applied knowledge of the core syntax.	40	40
5. Transferable Skills for Life and Professional Practice:		
+ V. Good report format, structure, and presentation. + 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	10	10

appendix.		
+ Lecture activity document.		
Excellent submission.		
Plagiarism & On-time check:		/

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