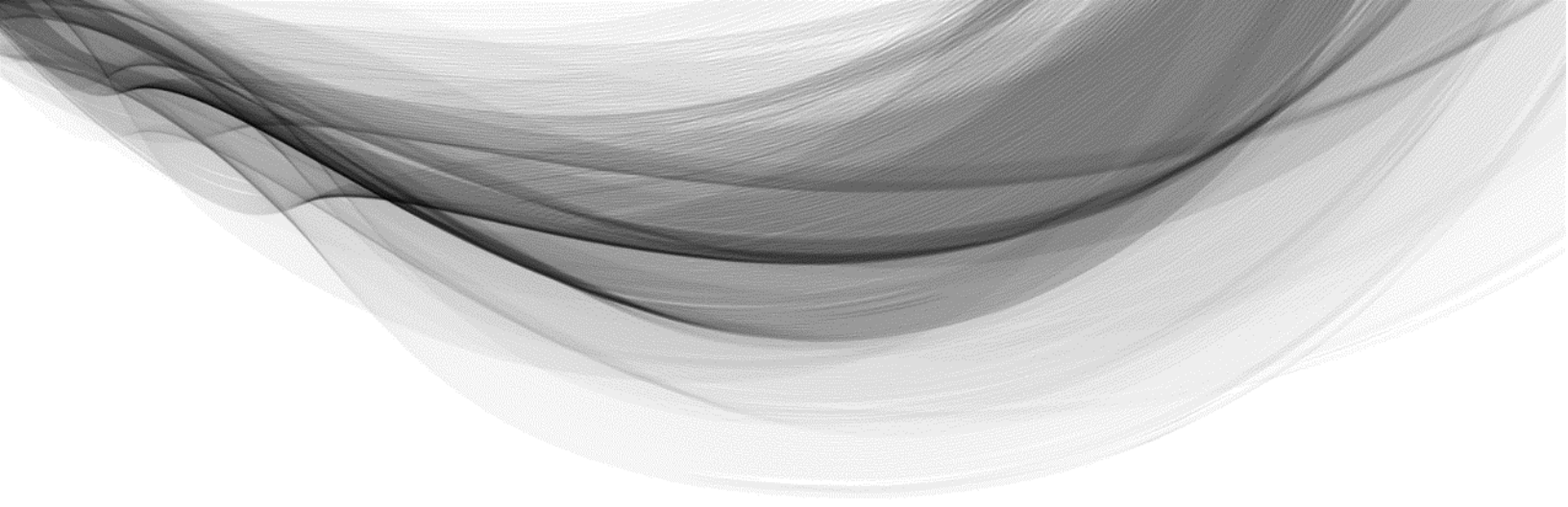




Configure and manage the Virtualised Enterprise Network

L5 – Network Operating Systems

Module Code: ACCB5023

BSc Computing (Software Engineering)

Jacob Moseley (2317034)

2317034@student.uwtsd.ac.uk

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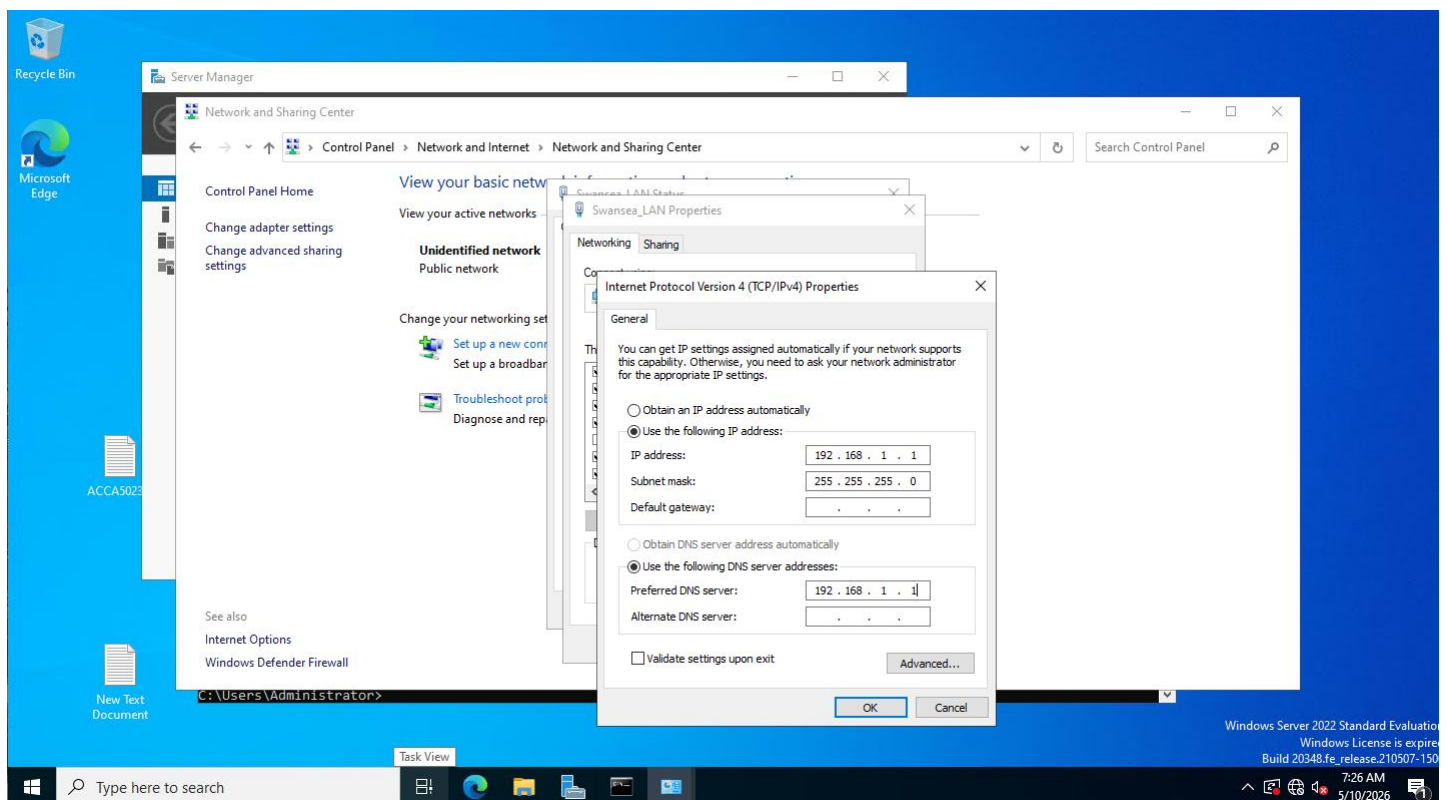
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1. Introduction

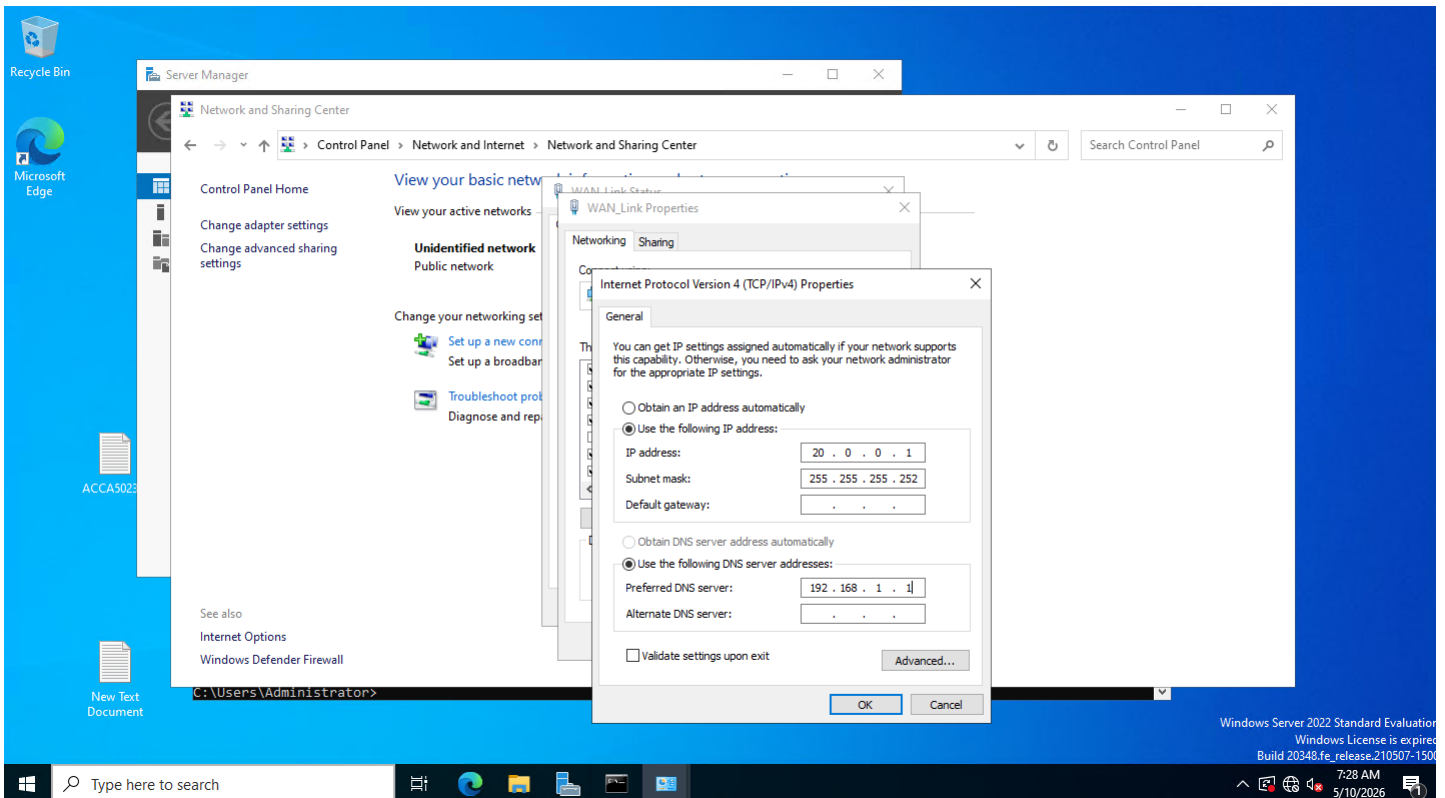
This report documents the configuration of a virtualised enterprise network for NOSS 2026 Inc. The network consists of a Windows server (Swansea) and Debian server (London), connected via a WAN link, using the domain jacob.acca. Both servers are connected to a single client, using Windows 10 and Debian GUI respectively.

2. Routing

Routing and Remote Access Service (RRAS) was installed within the Swansea Windows Server 2022 S-DC. Static IP addresses were configured on two network adapters, the Swansea LAN adapter was assigned 192.168.1.1/24 as shown in Figure 1. The WAN link adapter was assigned 20.0.0.1/30 in order to connect the London network as illustrated in Figure 2.

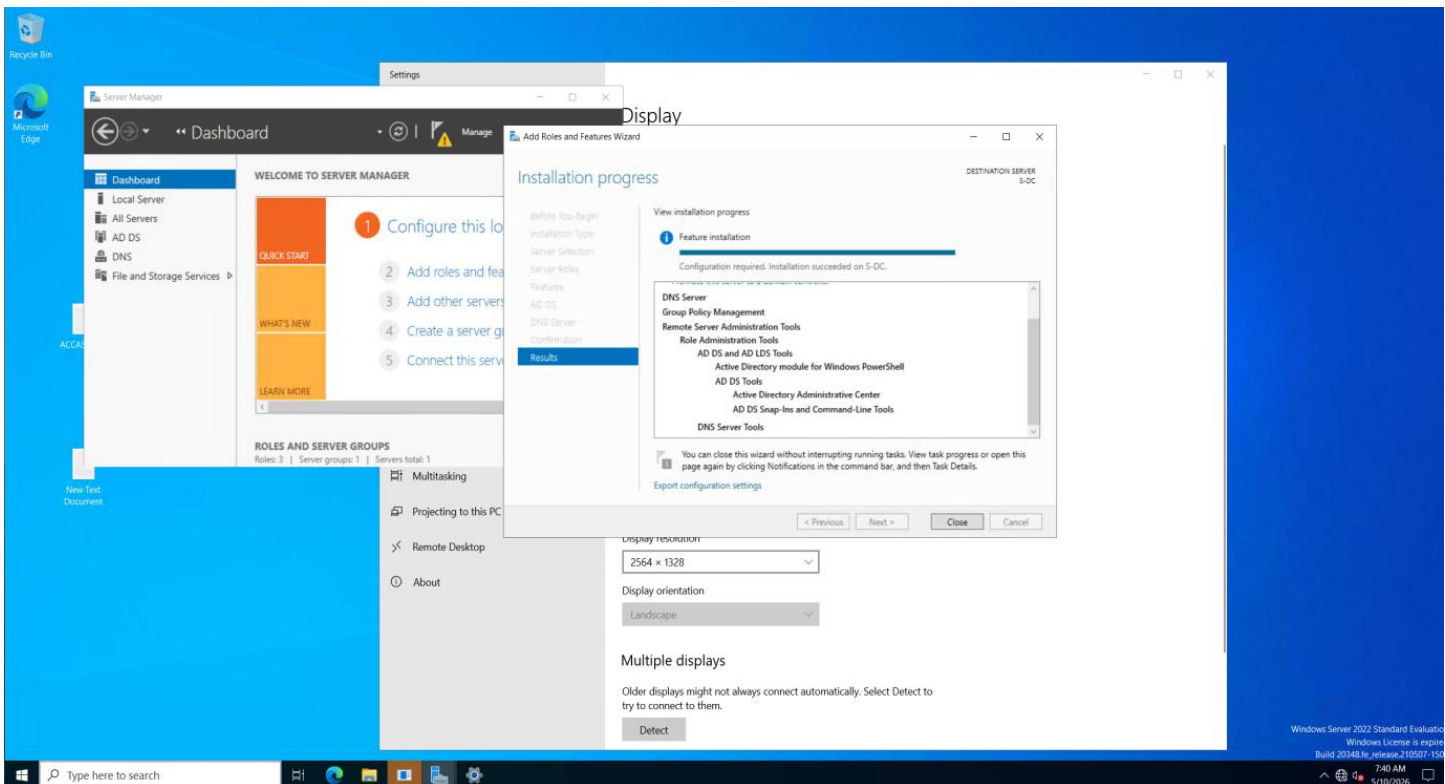


[Figure 1: S-DC LAN IPv4 Configuration]

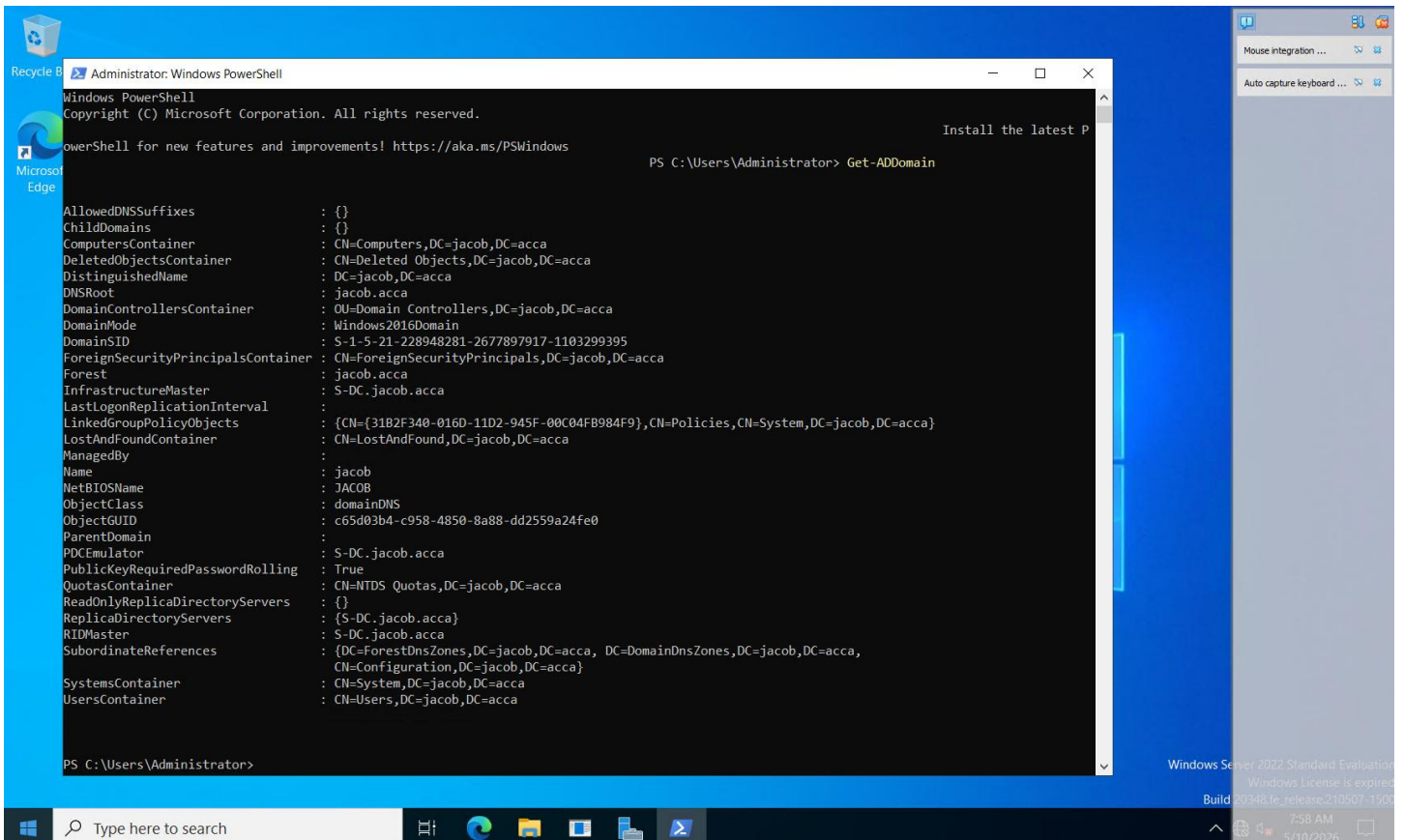


[Figure 2: S-DC WAN Link IPv4 Configuration]

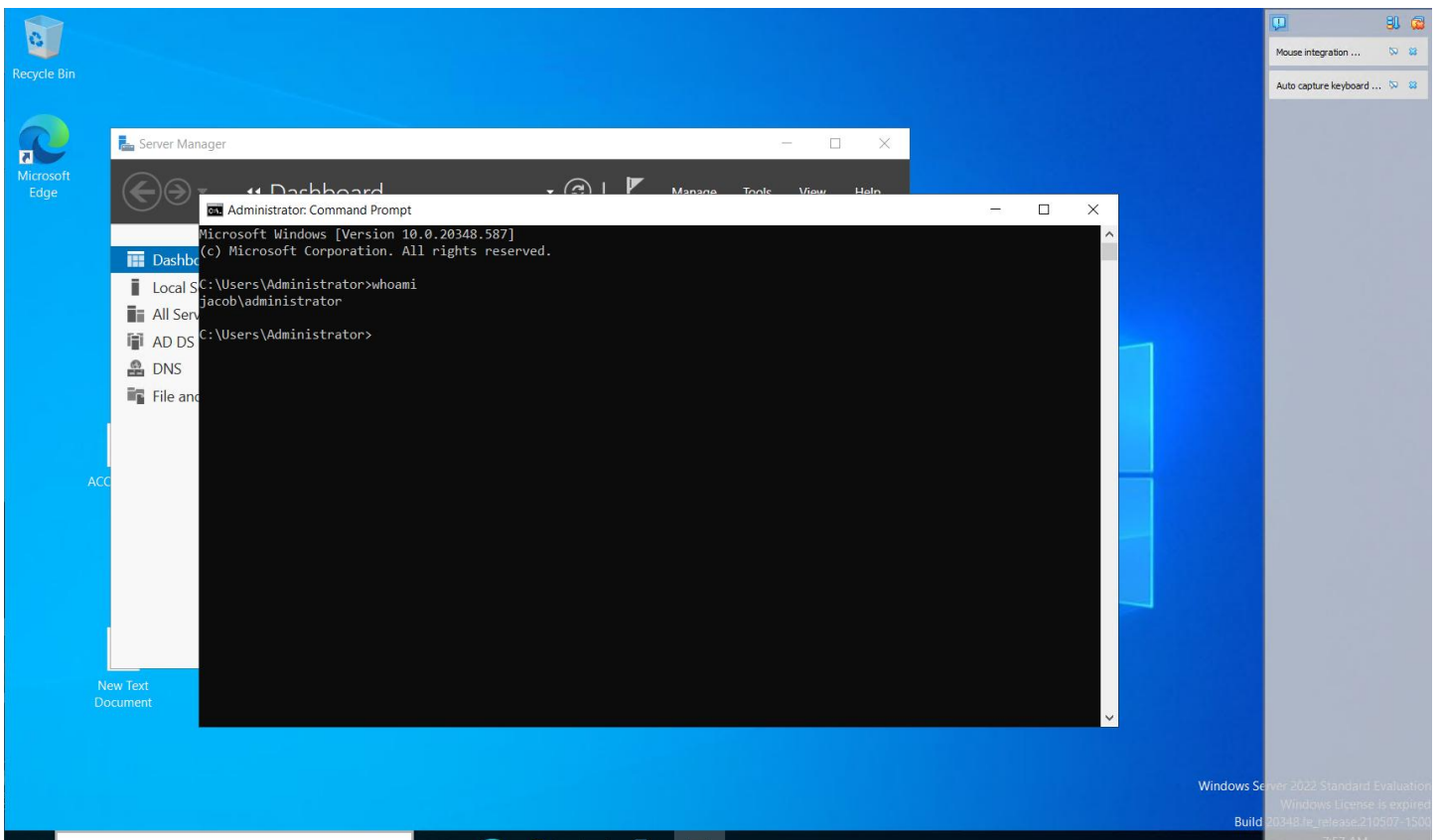
3. Domain Configuration



[Figure 3: S-DC Active Directory Domain Services Installation]



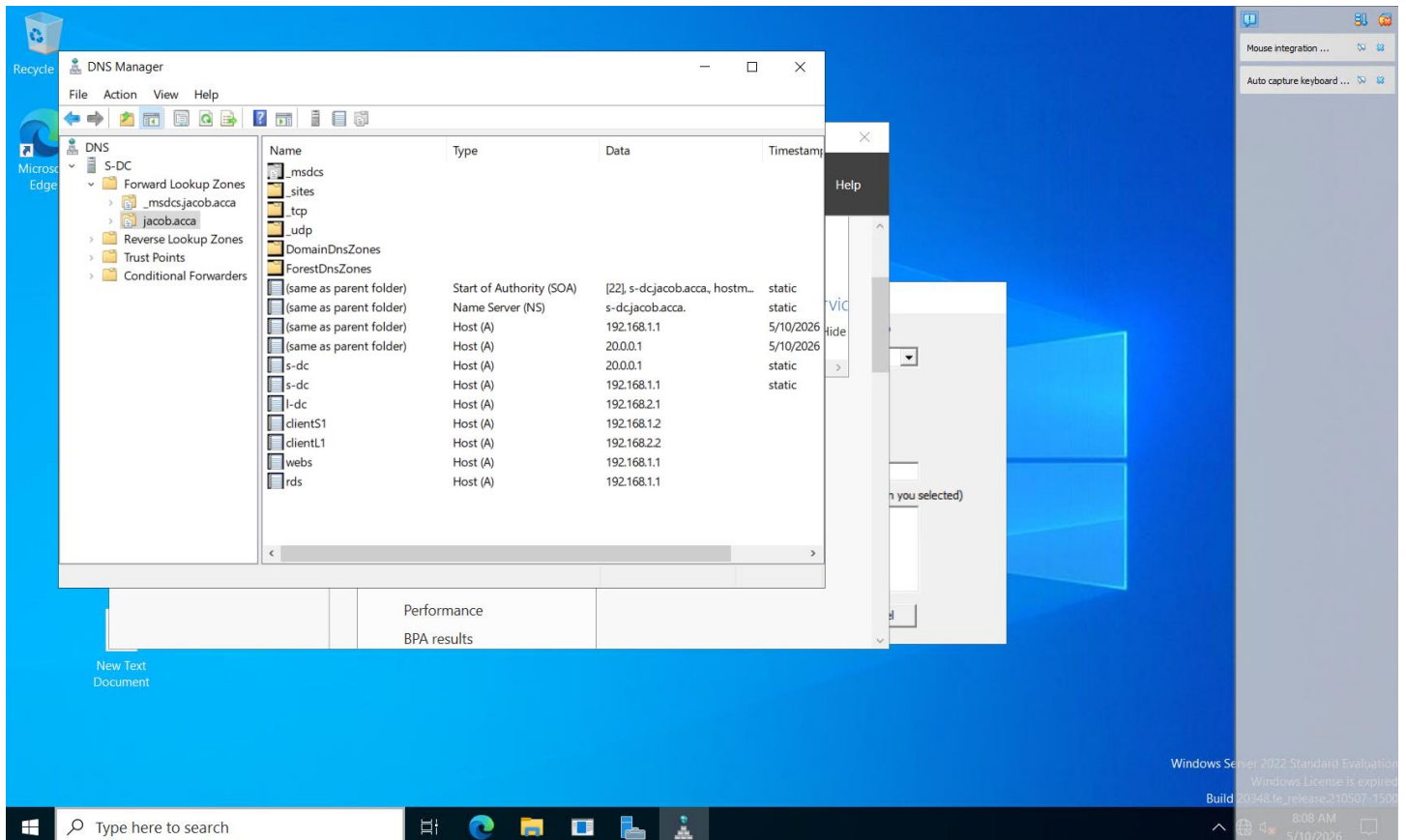
[Figure 4: S-DC PowerShell Domain Configuration]



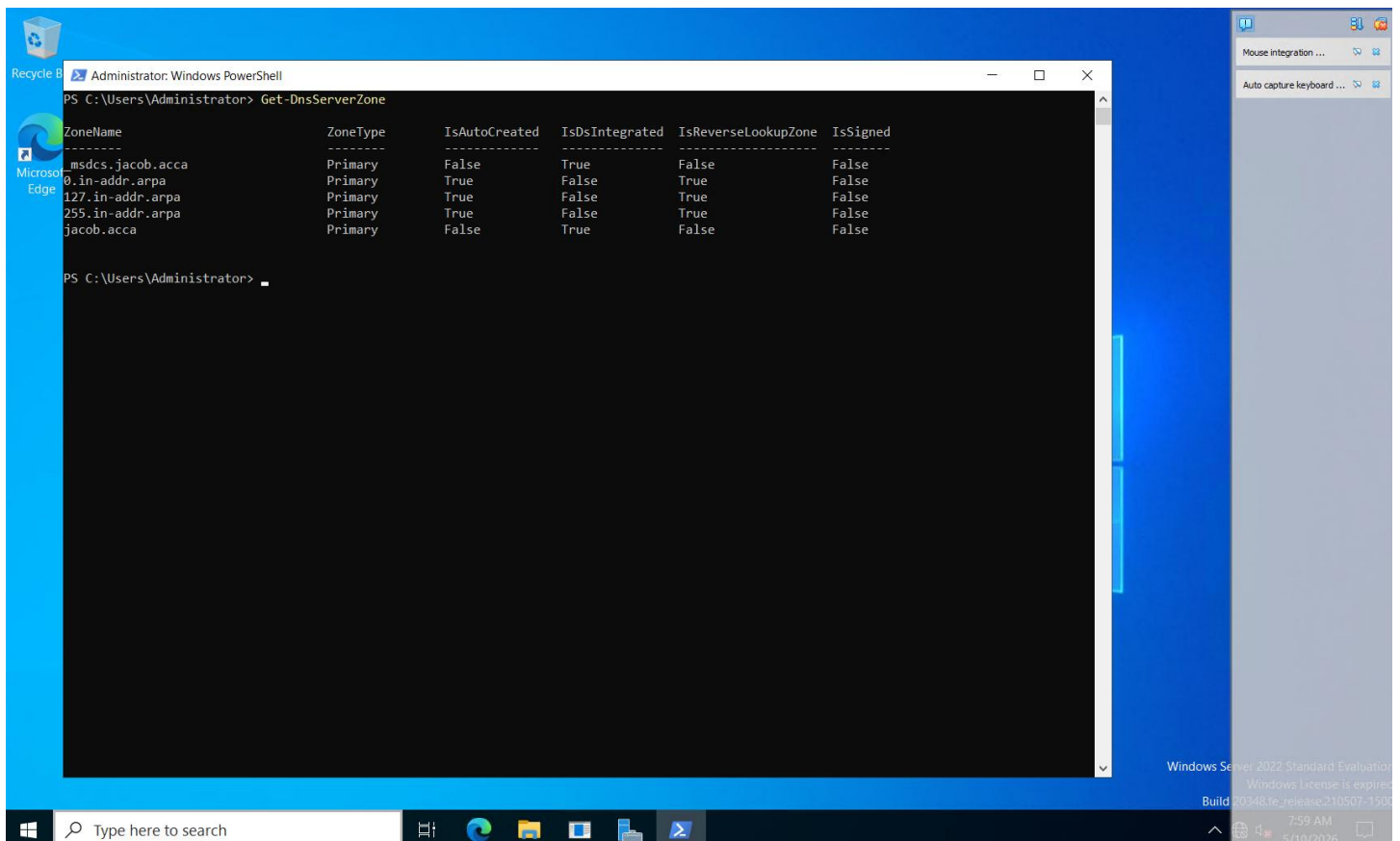
[Figure 5: S-DC Confirmed Login As Domain Administrator]

As illustrated within Figure 3, a new Active Directory forest and domain jacob.acca was created within the S-DC, acting as the primary domain controller for the Swansea network [1]. Figure 4 showcases the domain’s configuration within PowerShell via the Get-ADDomain command, while Figure 5 confirms within the terminal that the user is logged in as the domain administrator [2].

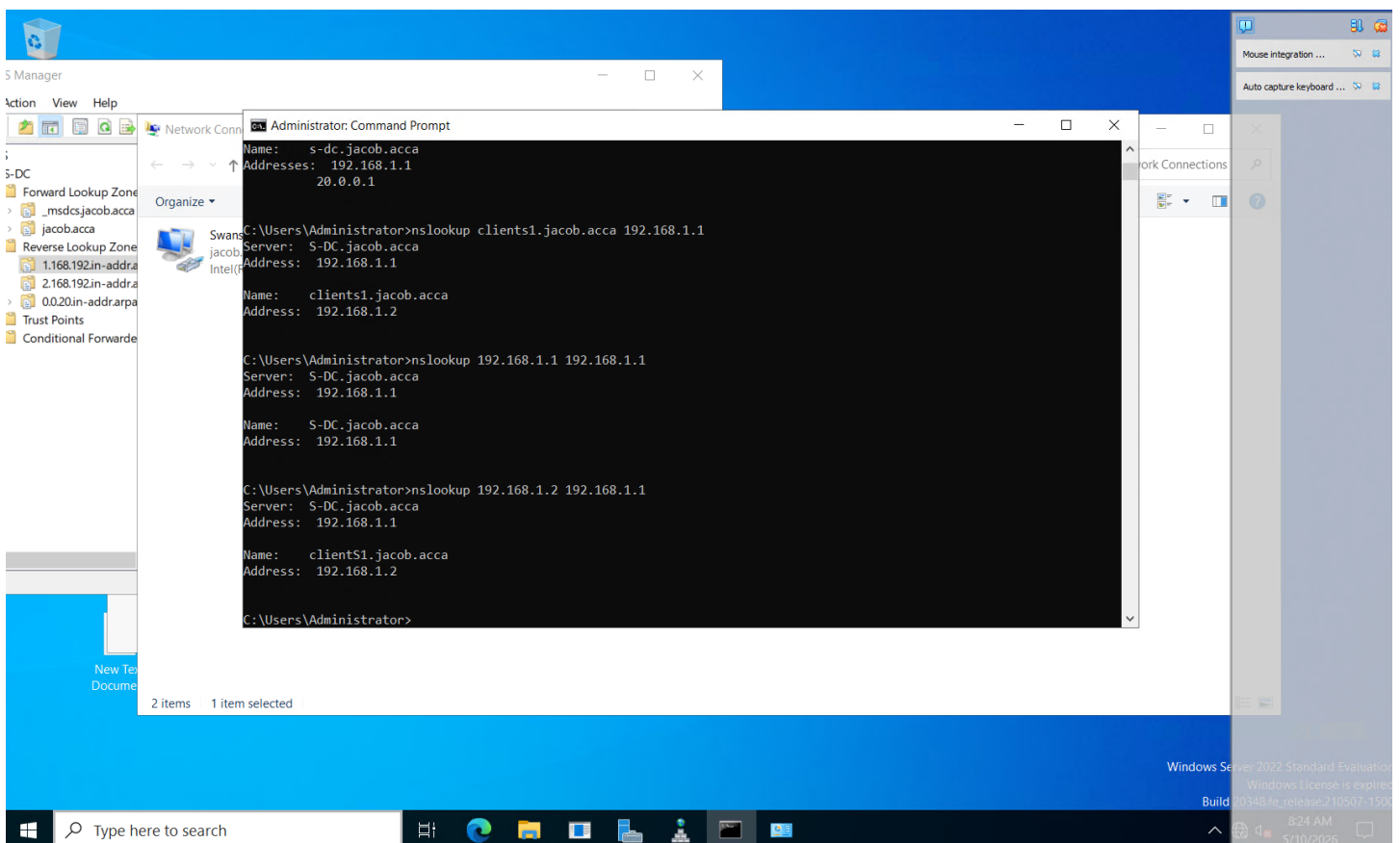
4. DNS



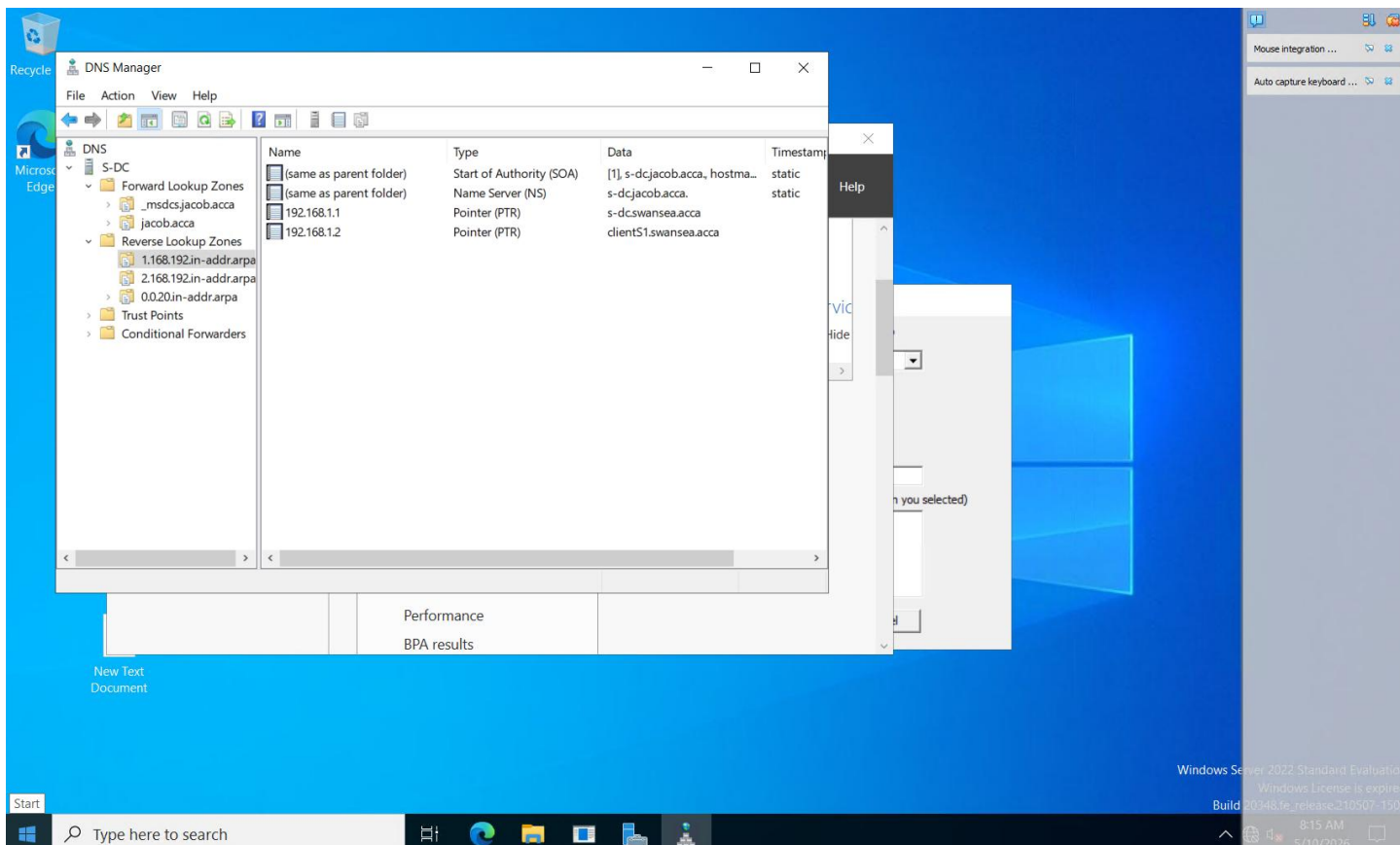
[Figure 6: S-DC A Records Configuration]



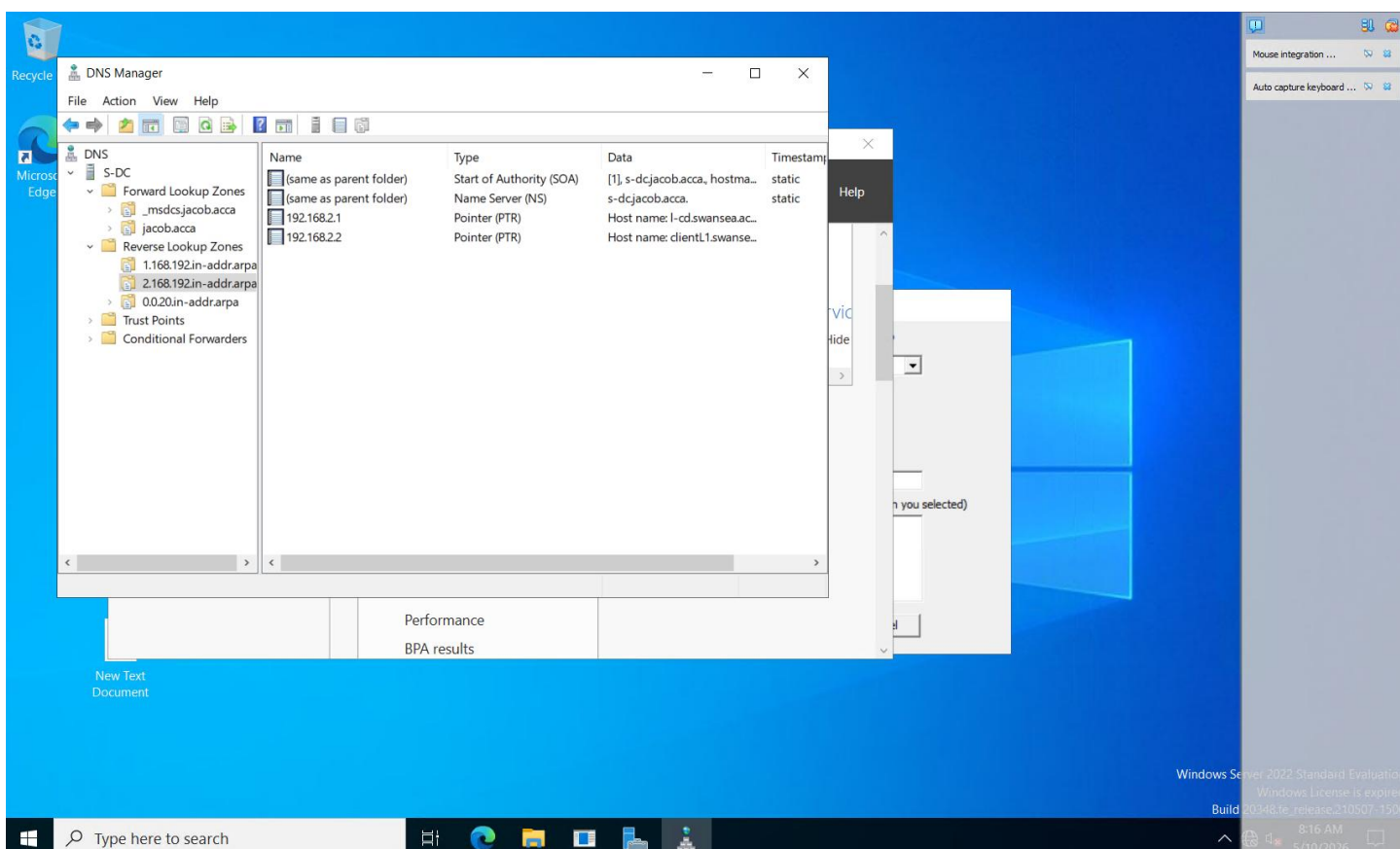
[Figure 7: S-DC DNS Zones]



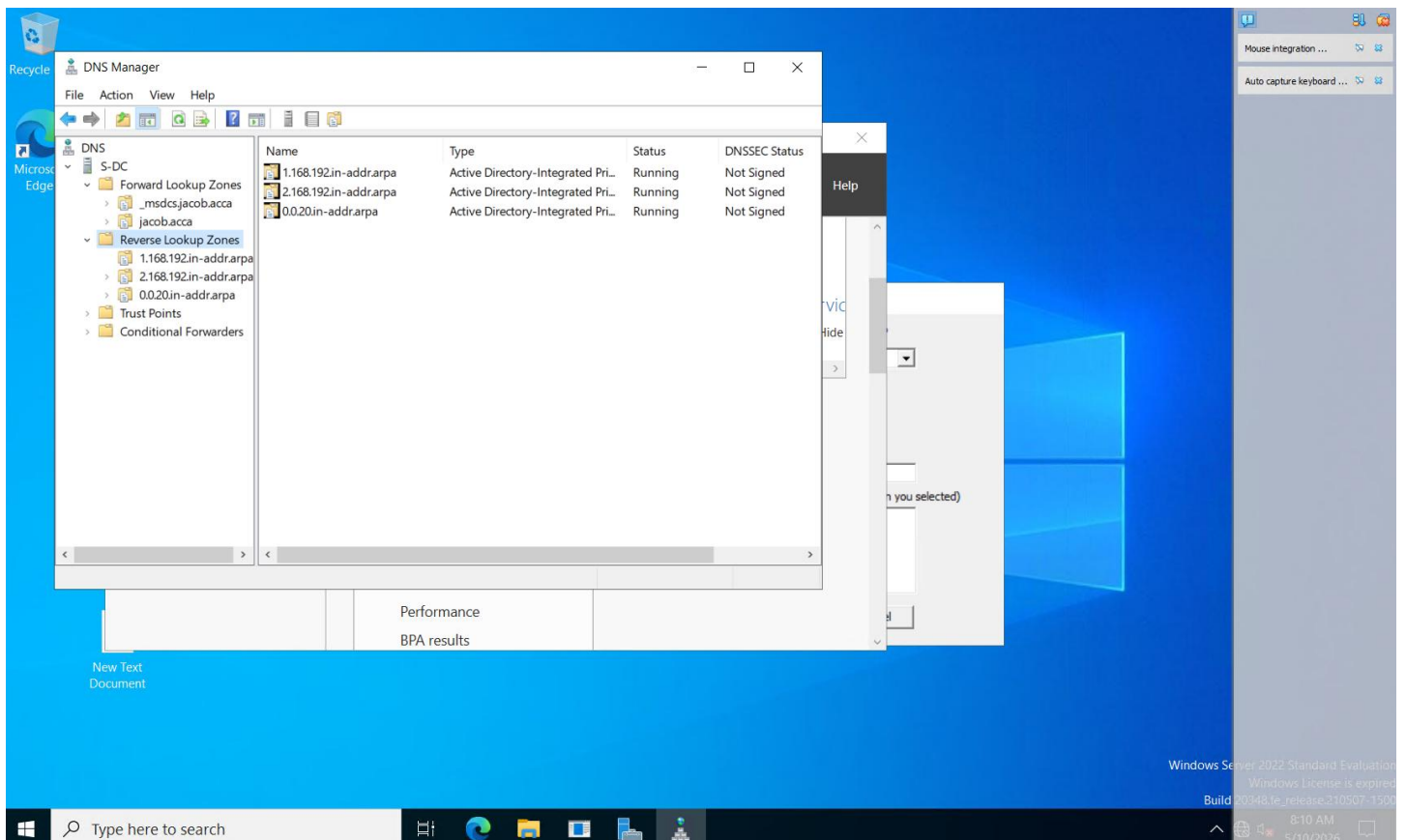
[Figure 8: S-DC DNS Lookup Results]



[Figure 9: S-DC Swansea PTR Records]



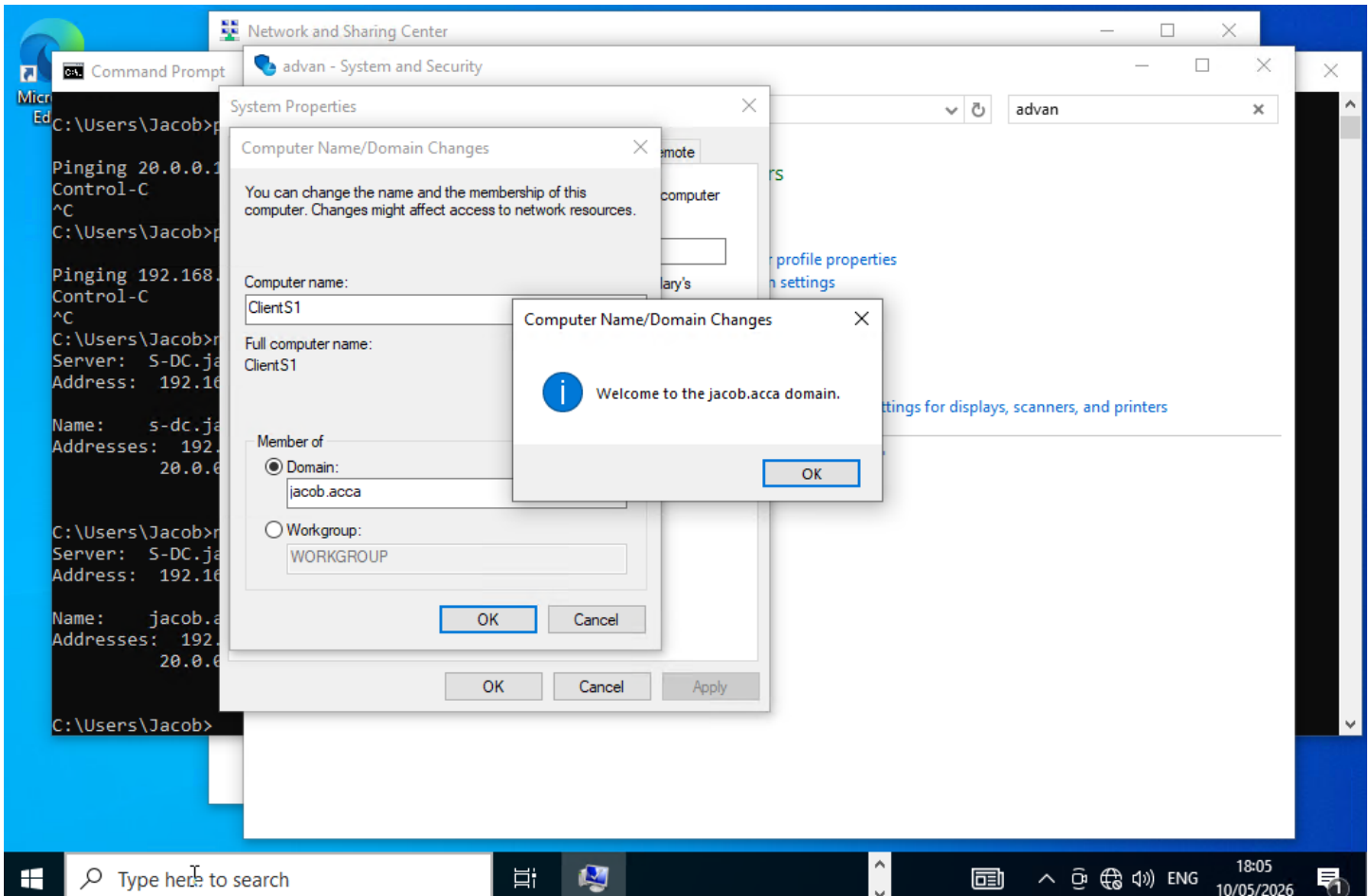
[Figure 10: S-DC London PTR Records]



[Figure 11. S-DC Reverse Lookup Zones]

Figures 6 - 11 illustrate the Domain Name System (DNS) configuration within S-DC Server Manager, with both forward and reverse lookup zones for the jacob.acca domain. Records were created for all clients and servers across both networks, while Pointer Records (PTR) were configured for reverse lookups in both the Swansea and London subnets [3].

5. Domain Membership



[Figure 12: ClientS1 Joins Domain]

```
nameserver 8.8.8.8
root@L-CD:~# cat /etc/resolv.conf
root@L-CD:~# echo "nameserver 192.168.1.1" > /etc/resolv.conf
root@L-CD:~# realm discover jacob.acca
jacob.acca
type: kerberos
realm-name: JACOB.ACCA
domain-name: jacob.acca
configured: no
server-software: active-directory
client-software: sssd
required-package: sssd-tools
required-package: sssd
required-package: libnss-sss
required-package: libpam-sss
required-package: adcli
required-package: samba-common-bin
root@L-CD:~# realm join jacob.acca -U Administrator
Password for Administrator:
root@L-CD:~# realm list
jacob.acca
type: kerberos
realm-name: JACOB.ACCA
domain-name: jacob.acca
configured: kerberos-member
server-software: active-directory
client-software: sssd
required-package: sssd-tools
required-package: sssd
required-package: libnss-sss
required-package: libpam-sss
required-package: adcli
required-package: samba-common-bin
login-formats: %U@jacob.acca
login-policy: allow-realm-logins
root@L-CD:~# id administrator@jacob.acca
uid=330200500(administrator@jacob.acca) gid=330200513(domain users@jacob.acca) groups=330200513(domain users@jacob.acca),330200512(domain admins@jacob.acca),330200519(enterprise admins@jacob.acca),330200518(schema admins@jacob.acca),330200572(denied rodc password replication group@jacob.acca),330200520(group policy creator owners@jacob.acca)
```

[Figure 13: L-CD Joins Domain and Domain List]

```
Administrator: Windows PowerShell
>> Unlock-ADAccount -Identity Administrator
PS C:\Users\Administrator> net user Administrator
User name           Administrator
Full Name
Comment             Built-in account for administering the computer/domain
User's comment
Country/region code  000 (System Default)
Account active       Yes
Account expires      Never

Password last set    5/10/2026 2:41:00 PM
Password expires     Never
Password changeable  5/11/2026 2:41:00 PM
Password required    Yes
User may change password Yes

Workstations allowed All
Logon script
User profile
Home directory
Last logon           5/10/2026 2:41:12 PM

Logon hours allowed  All

Local Group Memberships  *Administrators
Global Group memberships *Enterprise Admins *Domain Users
                        *Group Policy Creator *Schema Admins
                        *Domain Admins

The command completed successfully.

PS C:\Users\Administrator> Get-ADComputer -Filter * | Select Name, DNSHostName, Enabled

Name      DNSHostName      Enabled
-----
S-DC      S-DC.jacob.acca   True
CLIENTS1 ClientS1.jacob.acca True
L-CD      L-CD              True
CLIENTL1 ClientL1           True

PS C:\Users\Administrator>
```

[Figure 14: S-DC jacob.acca Domain Members]

ClientS1 (Windows 10), L-CD (Debian CLI) and Client L1 (Debian GUI) were all successfully joined to the jacob.acca domain. As shown in Figure 14. Client S1 was joined via System Properties, while both Debian machines utilised the realmd and sssd dependencies as illustrated in Figures 12 and 13.

6. DHCP

```
Windows IP Configuration

Host Name . . . . . : ClientS1
Primary Dns Suffix . . . . . : jacob.acca
Node Type . . . . . : Hybrid
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No
DNS Suffix Search List. . . . . : jacob.acca

Ethernet adapter Ethernet:

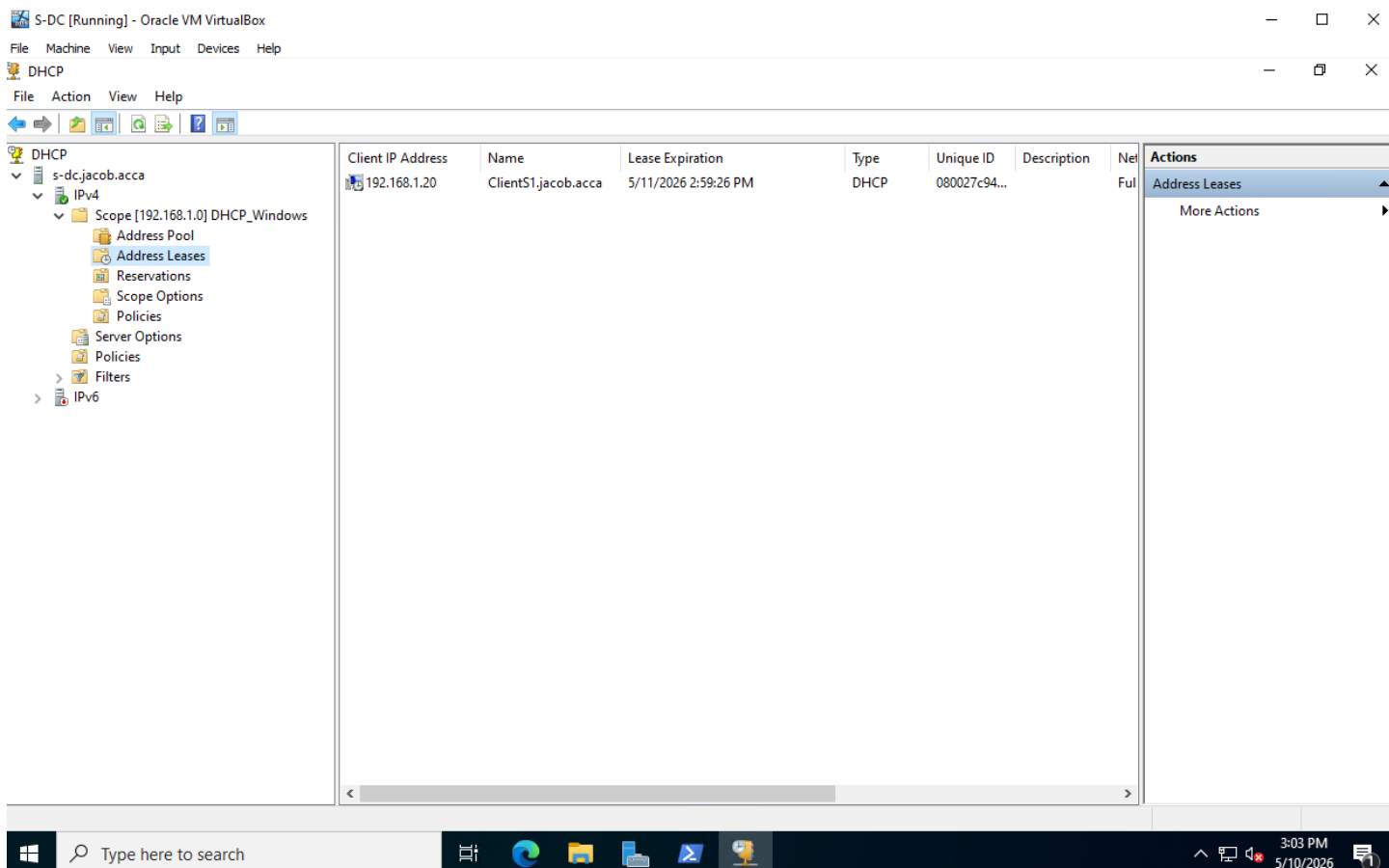
Connection-specific DNS Suffix . : jacob.acca
Description . . . . . : Intel(R) PRO/1000 MT Desktop Adapter
Physical Address. . . . . : 08-00-27-C9-4E-26
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . : Yes
Link-local IPv6 Address . . . . . : fe80::1cc7:abab:56ed:d865%4(Preferred)
IPv4 Address. . . . . : 192.168.1.20(Preferred)
Subnet Mask . . . . . : 255.255.255.0
Lease Obtained. . . . . : 10 May 2026 14:59:26
Lease Expires . . . . . : 11 May 2026 14:59:26
Default Gateway . . . . . : 192.168.1.1
DHCP Server . . . . . : 192.168.1.1
DHCPv6 IAID . . . . . : 101187623
DHCPv6 Client DUID. . . . . : 00-01-00-01-31-92-DF-9E-08-00-27-C9-4E-26
DNS Servers . . . . . : 192.168.1.1
NetBIOS over Tcpip. . . . . : Enabled

C:\Users\Administrator>
```

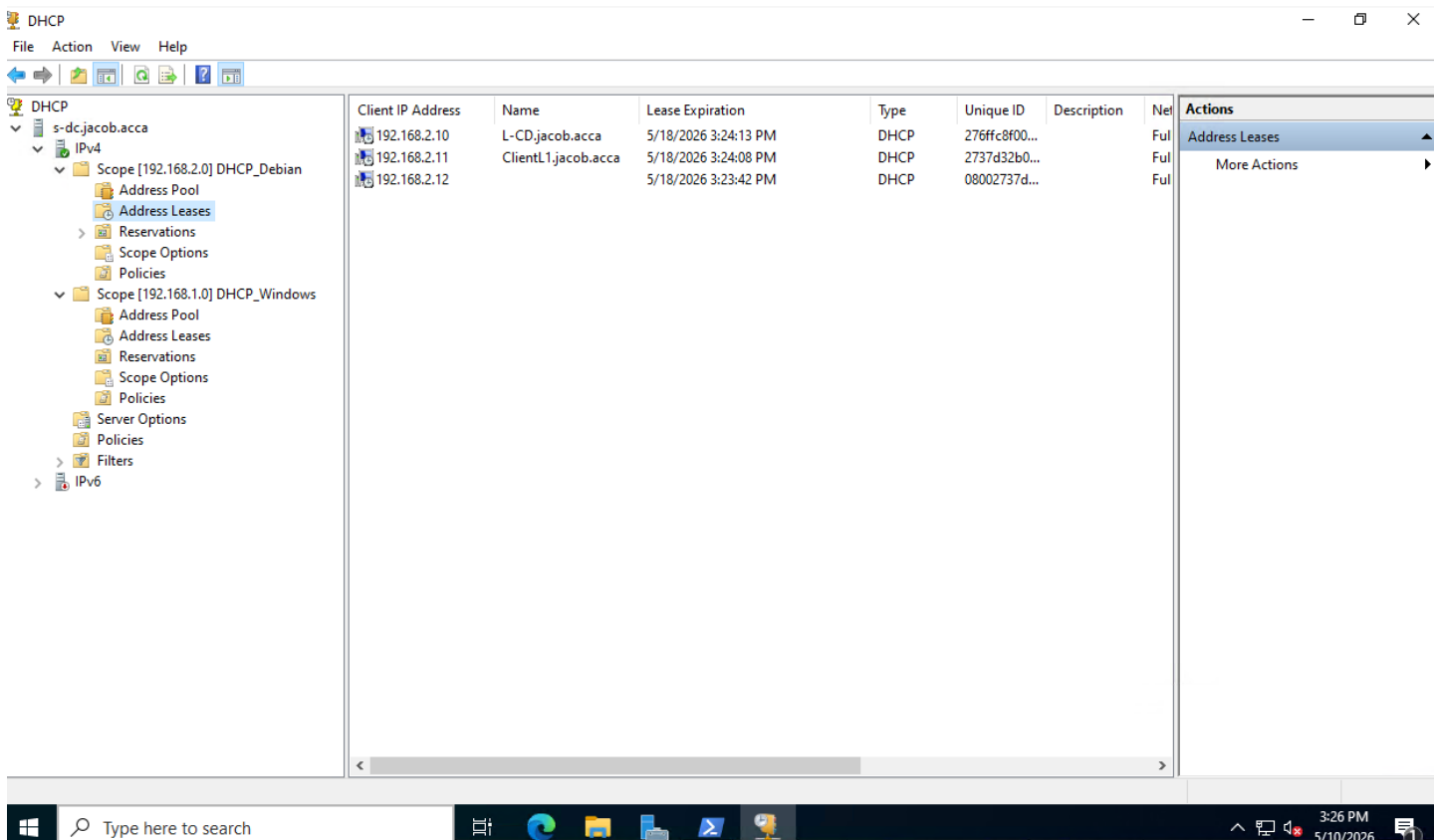
[Figure 15: ClientS1 DHCP Enabled]

```
localadmin@ClientL1: ~
udhcpd: broadcasting discover
udhcpd: broadcasting discover
udhcpd: broadcasting discover
udhcpd: broadcasting discover
udhcpd: broadcasting discover
udhcpd: broadcasting discover
^C
root@ClientL1:~# busybox udhcpd -i enp0s3
udhcpd: started, v1.37.0
udhcpd: broadcasting discover
udhcpd: broadcasting select for 192.168.2.12, server 192.168.1.1
udhcpd: lease of 192.168.2.12 obtained from 192.168.1.1, lease time 691200
root@ClientL1:~# ip a show enp0s3
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:37:d3:2b brd ff:ff:ff:ff:ff:ff
    altname enx08002737d32b
    inet 192.168.2.2/24 brd 192.168.2.255 scope global enp0s3
        valid_lft forever preferred_lft forever
    inet 169.254.119.241/16 brd 169.254.255.255 scope global noprefixroute enp0s3
        valid_lft forever preferred_lft forever
    inet6 fe80::f2ba:fd0d:a67e:b3fd/64 scope link
        valid_lft forever preferred_lft forever
root@ClientL1:~#
```

[Figure 16: ClientL1 DHCP Enabled]



[Figure 17: S-DC DHCP Address Leases Windows]



[Figure 18: S-DC DHCP Address Leases Debian]

```

Selecting previously unselected package isc-dhcp-common.
(Reading database ... 36691 files and directories currently installed.)
Preparing to unpack .../isc-dhcp-common_4.4.3-P1-8_amd64.deb ...
Unpacking isc-dhcp-common (4.4.3-P1-8) ...
Selecting previously unselected package isc-dhcp-relay.
Preparing to unpack .../isc-dhcp-relay_4.4.3-P1-8_amd64.deb ...
Unpacking isc-dhcp-relay (4.4.3-P1-8) ...
Setting up isc-dhcp-relay (4.4.3-P1-8) ...
Generating /etc/default/isc-dhcp-relay...
Setting up isc-dhcp-common (4.4.3-P1-8) ...
Processing triggers for man-db (2.13.1-1) ...
root@L-CD:~# systemctl status isc-dhcp-relay
• isc-dhcp-relay.service - LSB: DHCP relay
   Loaded: loaded (/etc/init.d/isc-dhcp-relay; generated)
   Active: active (running) since Sun 2026-05-10 23:09:44 BST; 15s ago
  Invocation: c5efd7ec47594c2ca81d5589bae908b2
     Docs: man:systemd-sysv-generator(8)
  Process: 1028 ExecStart=/etc/init.d/isc-dhcp-relay start (code=exited, status=0/SUCCESS)
    Tasks: 1 (limit: 2317)
  Memory: 1016K (peak: 1.9M)
    CPU: 9ms
  CGroup: /system.slice/isc-dhcp-relay.service
          └─1032 /usr/sbin/dhcrelay -q -i enp0s3 192.168.1.1

May 10 23:09:44 L-CD systemd[1]: Starting isc-dhcp-relay.service - LSB: DHCP relay...
May 10 23:09:44 L-CD isc-dhcp-relay[1032]: Requesting: enp0s3 as upstream: Y downstream: Y
May 10 23:09:44 L-CD systemd[1]: Started isc-dhcp-relay.service - LSB: DHCP relay.
root@L-CD:~#

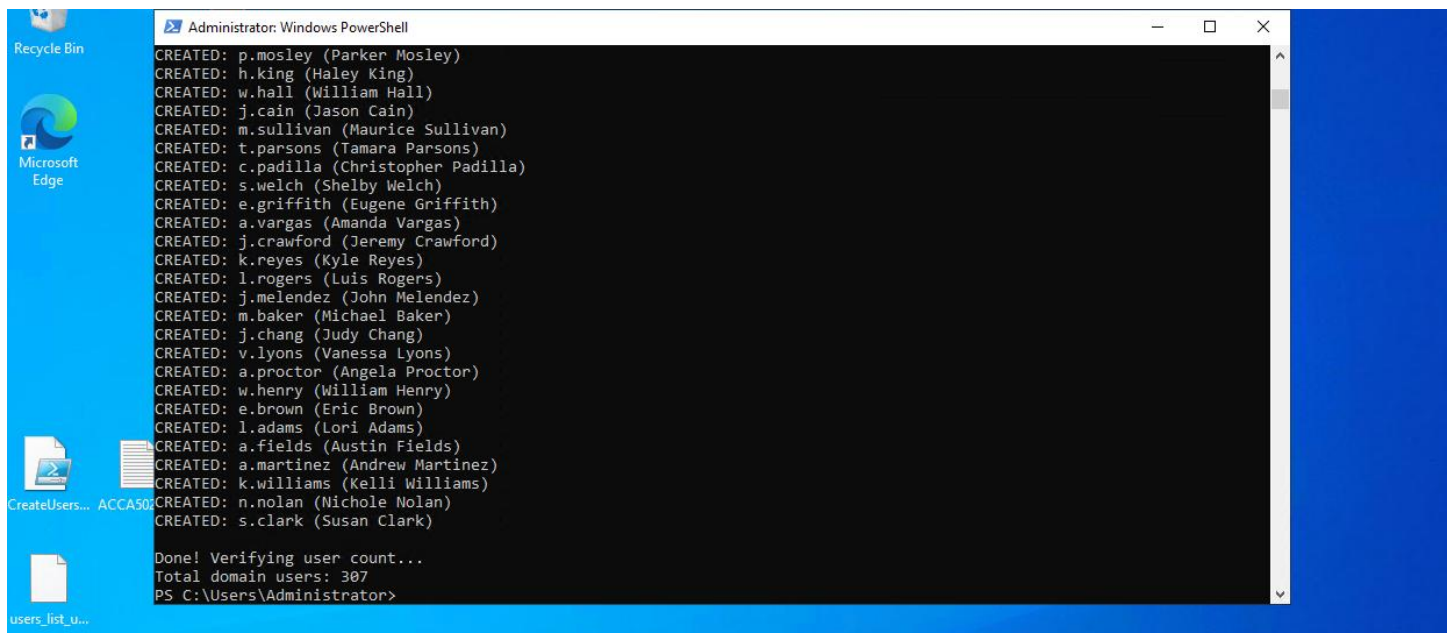
```

[Figure 19: L-CD DHCP Relay Install]

As illustrated within Figures 15 - 19, S-DC was configured as the DHCP server for both the London and Swansea Networks, with addresses ranging from 192.168.2.10-20 and 192.168.1.10-20 respectively. L-CD was configured as the DHCP relay server to forward requests from the London network to the Windows Server 2022 [4].

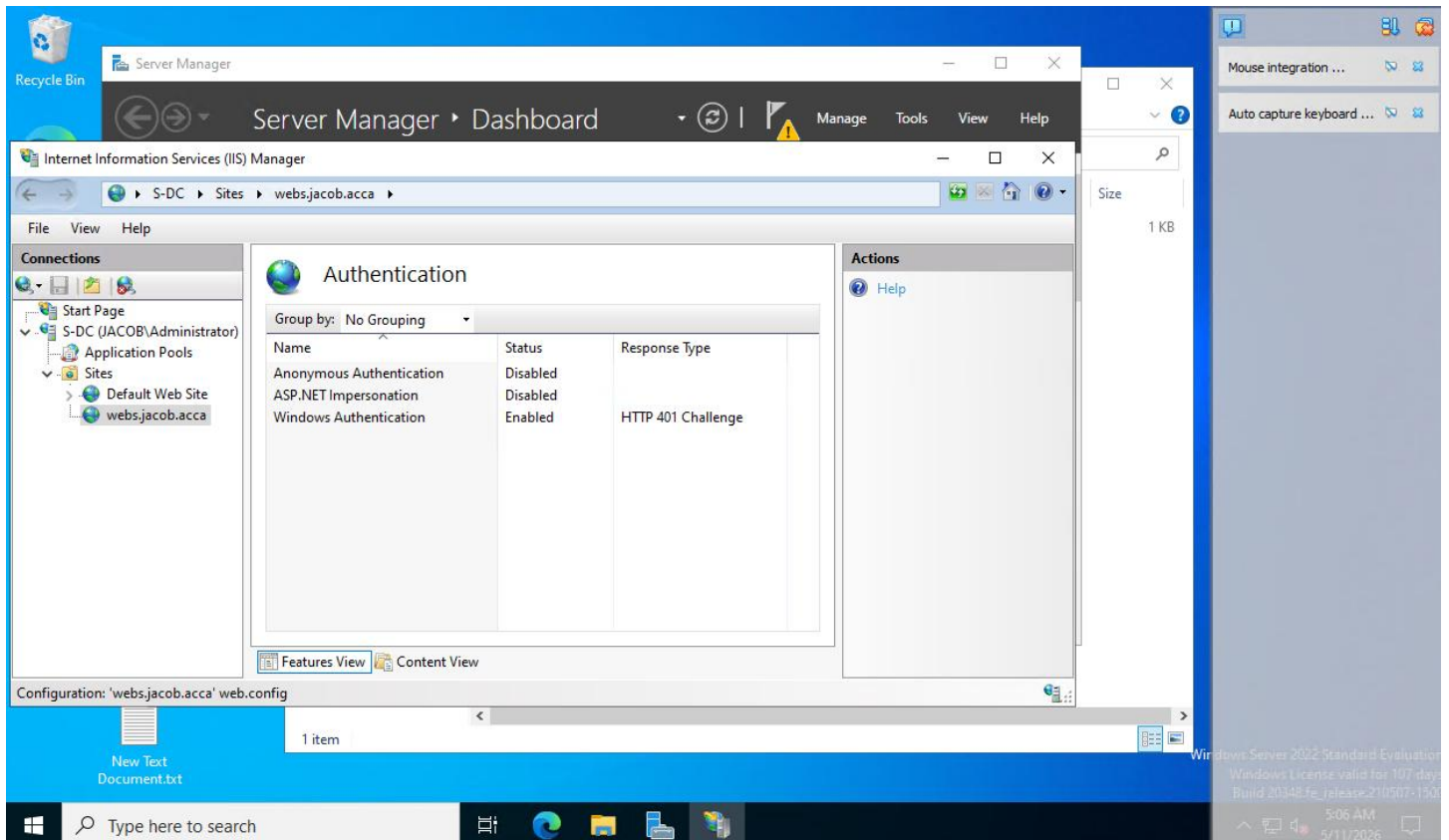
7. Users

As shown within Figure 20, 307 domain user accounts were created using a PowerShell Script and the provided CSV file. The script can be found within Appendix 1. Each account was formatted with the first letter of the first name followed by a full stop and the last name, for example, j.moseley@jacob.acca.

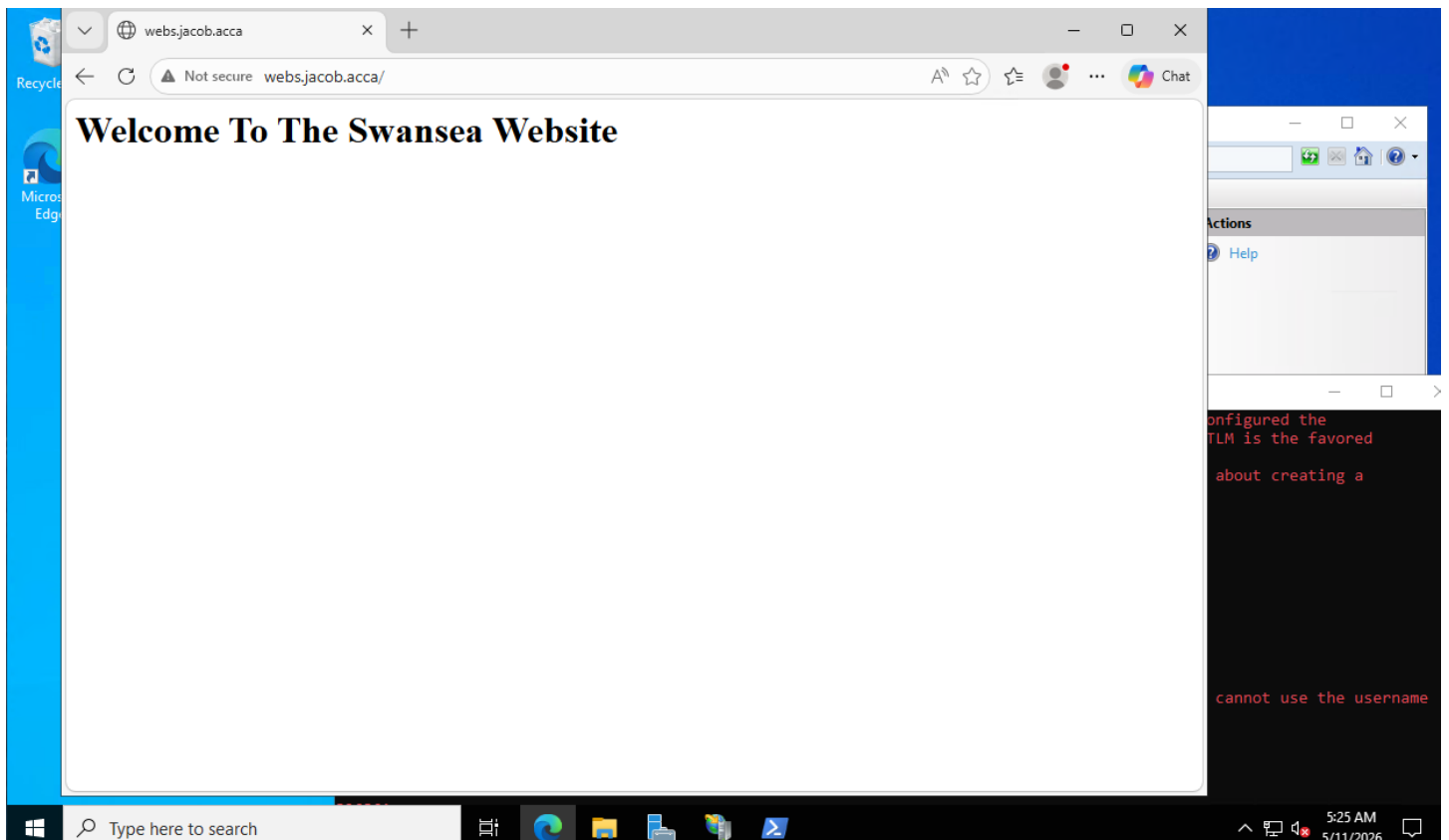


[Figure 20: S-DC User Creation PowerShell Script Output]

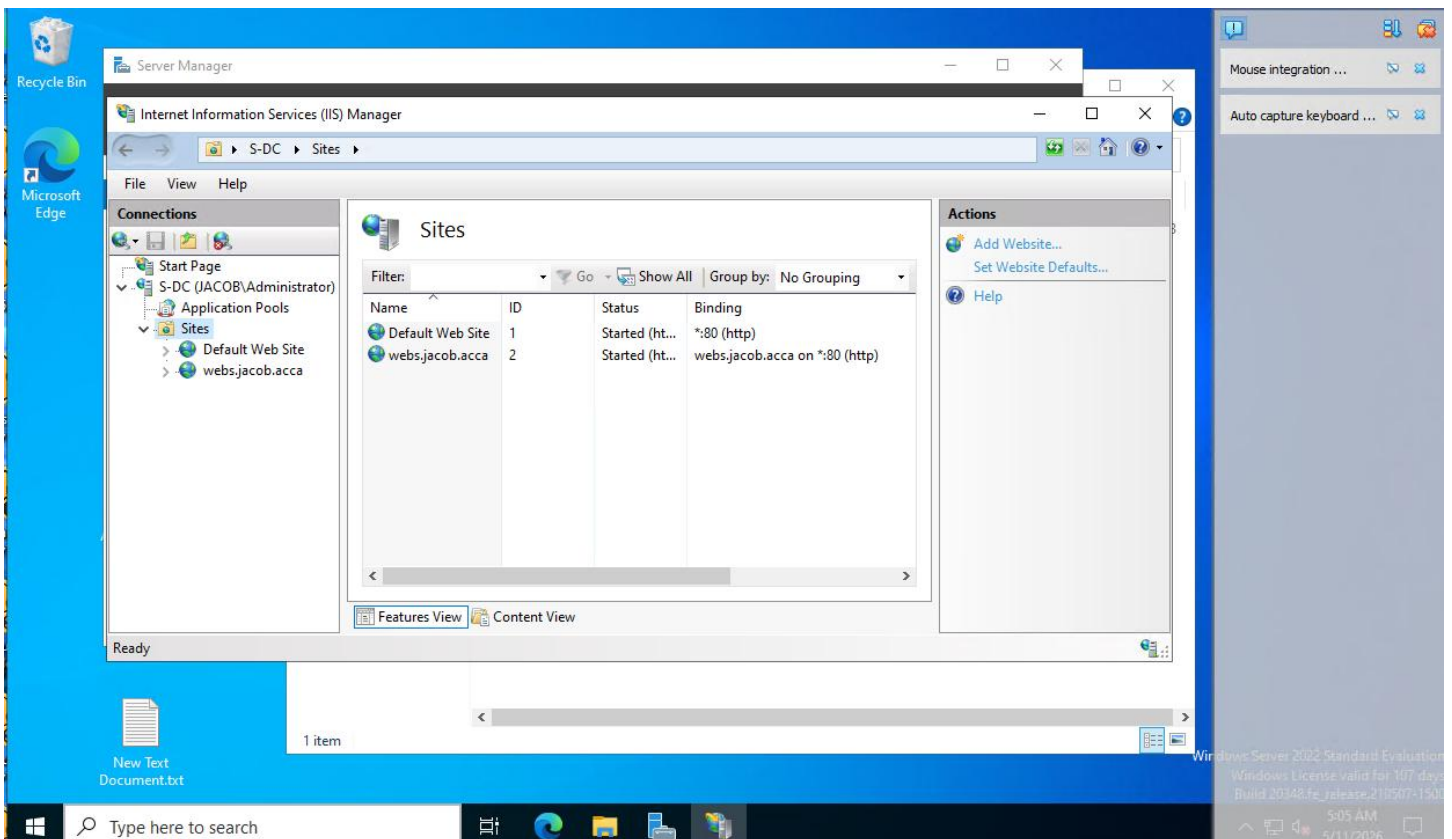
8. IIS Web Server



[Figure 21: S-DC IIS Authentication Configuration]



[Figure 22: S-DC webs.jacob.acca Welcome Message]



[Figure 23: S-DC IIS Manager Sites]

Internet Information Services (IIS) was installed on S-DC and a website named webs.jacob.acca was created within the C:\inetpub\webs directory. As shown within Figure 21, Anonymous Authentication was disabled and Windows Authentication was enabled in order to ensure only domain users are able to access the site [5].

9. References

- [1] "Domain Controller Roles: Active Directory," *learn.microsoft.com*, Nov. 19, 2014. [https://learn.microsoft.com/en-us/previous-versions/windows/it-pro/windows-server-2003/cc786438\(v=ws.10\)](https://learn.microsoft.com/en-us/previous-versions/windows/it-pro/windows-server-2003/cc786438(v=ws.10)) (Accessed May. 11)
- [2] Microsoft, "Active directory domain services overview," *Microsoft*, Mar. 11, 2025. <https://learn.microsoft.com/en-us/windows-server/identity/ad-ds/get-started/virtual-dc/active-directory-domain-services-overview> (Accessed May. 11)
- [3] "Domain Name System (DNS) in Windows and Windows Server," *Microsoft.com*, Jan. 23, 2025. <https://learn.microsoft.com/en-us/windows-server/networking/dns/dns-overview> (Accessed May. 11)
- [4] Microsoft, "Dynamic Host Configuration Protocol (DHCP)," *learn.microsoft.com*, May 13, 2025. <https://learn.microsoft.com/en-us/windows-server/networking/technologies/dhcp/dhcp-top> (Accessed May. 11)
- [5] M. Volodarsky, "IIS Web Server Overview," *learn.microsoft.com*, Aug. 23, 2022. <https://learn.microsoft.com/en-us/iis/get-started/introduction-to-iis/iis-web-server-overview> (Accessed May. 11)

10. Appendix

Appendix 1:

ACCA5023 – Bulk Create AD Users from CSV

Run on S-DC as Administrator

\$csvPath = "C:\Users\Administrator\Desktop\users_list_updated.csv"

\$domain = "jacob.acca"

\$password = ConvertTo-SecureString "NotebookK@123" -AsPlainText -Force

\$users = Import-Csv \$csvPath | Where-Object { \$_.domain -eq "YOURNAME.ACCA" }

foreach (\$user in \$users) {

 \$firstName = \$user.first_name.Trim()

 \$lastName = \$user.last_name.Trim()

 \$samAccount = (\$firstName.Substring(0,1) + "." + \$lastName).ToLower()

 \$email = "\$samAccount@\$domain"

 \$displayName = "\$firstName \$lastName"

 \$department = \$user.department.Trim()

 \$city = \$user.city.Trim()

 \$company = \$user.company.Trim()

 \$title = \$user.job.Trim()

 if (Get-ADUser -Filter { SamAccountName -eq \$samAccount } -ErrorAction SilentlyContinue) {

 Write-Output "SKIP: \$samAccount already exists"

 continue

 }

try {

```
New-ADUser `
```

```
-GivenName $firstName `
```

```
-Surname $lastName `
```

```
-Name $displayName `
```

```
-SamAccountName $samAccount `
```

```
-UserPrincipalName "$samAccount@$domain" `
```

```
-EmailAddress $email `
```

```
-Department $department `
```

```
-City $city `
```

```
-Company $company `
```

```
-Title $title `
```

```
-AccountPassword $password `
```

```
-Enabled $true `
```

```
-PasswordNeverExpires $true
```

```
Write-Output "CREATED: $samAccount ($displayName)"
```

```
}
```

```
catch {
```

```
Write-Output "ERROR: $samAccount - $_"
```

```
}
```

```
}
```

```
Write-Output ""
```

```
Write-Output "Done! Verifying user count..."
```

```
$count = (Get-ADUser -Filter * | Where-Object { $_.SamAccountName -notin @("Administrator",  
"krbtgt", "Guest") } | Measure-Object).Count
```

```
Write-Output "Total domain users: $count"
```