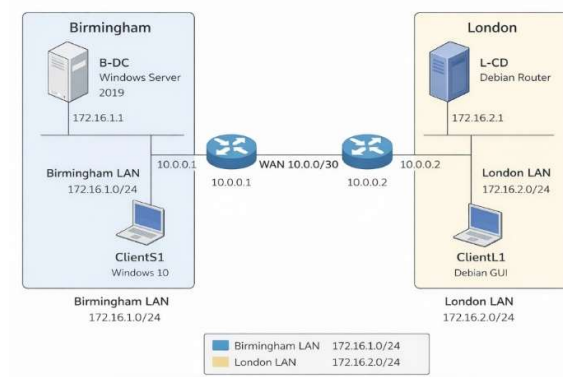

RESEARCH, BUILD AND DEPLOY A VIRTUALISED ENTERPRISE NETWORK

ACCA5023



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2411394

MARCH 27, 2026
NETWORK OPERATING SYSTEM AND SERVICES
UWTSD LONDON

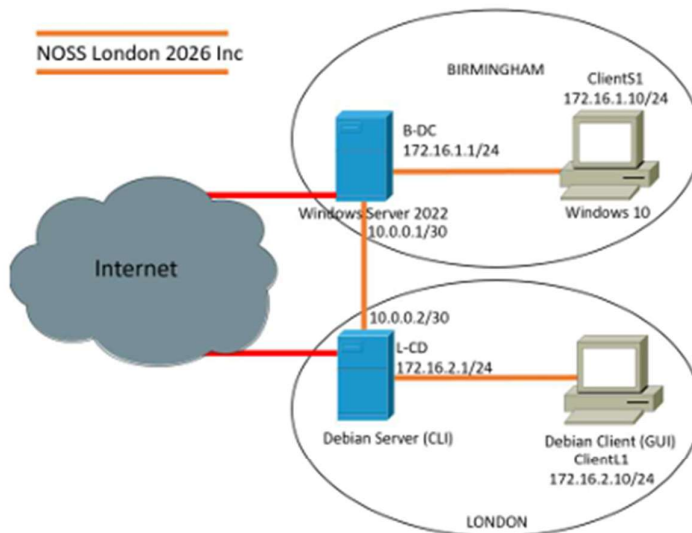
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Scenario:

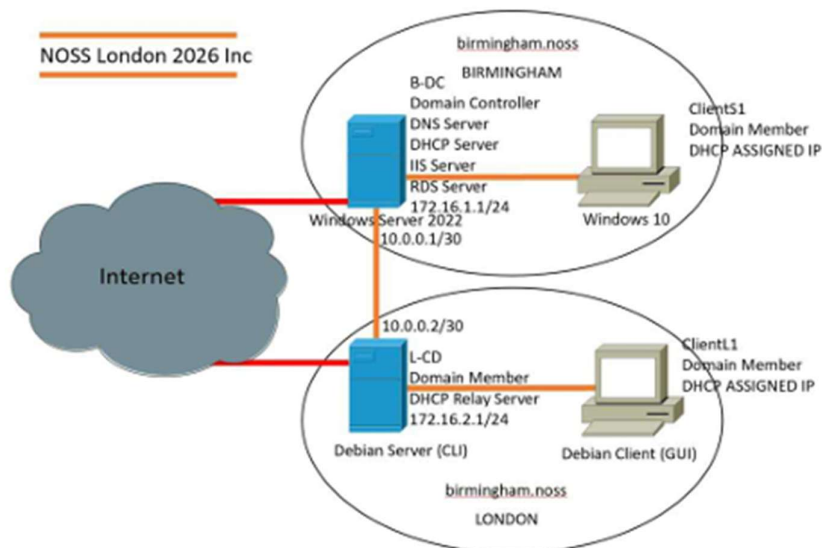
Assume, you have been hired as an IT Tech by a Multinational Corporation called NOSSLONDON2026. NOSSLONDON 2026 operates currently at two locations: Birmingham and London. You are asked to do research and implement the network as given in the topology.

Topology (For Coursework 1)



Topology Enhanced (For Coursework 2)

You won't deploy this topology for your Coursework 1 – This is provided to you to help you for planning purposes.



Critical Details

Birmingham:

Windows Server: Standard Desktop Version

System Configuration: Language (English), Time Format (London UK)

Username: Administrator,

Password: NotebooK@123

London:

Debian Server: CLI

Username: Localadmin

Password: NotebooK@123

Complete the following task:

1. Research on the given topics
2. Build and deploy a virtual network based on the above topology.

Task 1. Research Report

From Lecturer:

Do a research addressing the following

- + **Research on Hypervisor:** (Maximum: 250 Words)
 - o Summarize your understanding of hypervisor types (Type 1 and Type 2) and their architectures
 - o Reflect on which hypervisor type is suitable for this topology (e.g., hosting the Windows Server 2022 and Debian Server) based on features, hardware requirements, advantages, scalability, security, and compatibility.
Consider Enhanced Topology as well!!!
 - o Justify your choice by considering the domain environment (BIRMINGHAM.ACCA) and the need to support both Windows and Debian clients, including specific hardware constraints or security needs in the topology.
- + **Research on IP Addressing:** (Maximum: 250 Words)

Refer to your Group Activity during one of your lectures asking you to discuss in a group about

 - + How does data get from one computer to another on the Internet and what is the role of IP addresses in the transmission of data on the Internet?
 - + How do you think routers and switches work on the Internet to facilitate the flow of data between different networks?
 - o ***Based on the above Group Activity, reflect your understanding on IP Addressing with appropriate and adequate in-text citations.***
 - Explore how IP Addressing contributes to the functionality and effectiveness of the network.
 - You need to address the structure, format, and representation of IPv4, IPv6 addressing, concept of subnetting, efficient utilization of IP addresses.
 - Include diagrams and examples of IP Addressing concepts and their practical applications.
- + **Research on Routing:** (Maximum: 250 Words)
 - o Summarize your understanding of routing protocols, focusing on their purpose, how they operate, and the differences between static and dynamic routing.
 - o Reflect on which routing approach suits the topology's setup, considering the Debian Server's role as a DHCP Relay and the Windows Server's connectivity.
- + **Research on Network Services:** (Maximum: 250 Words)
 - o Summarize your understanding of VPNs, DHCP, Active Directory Domain Services (AD DS), and Certificate Authorities, focusing on their key features and best practices

Note: As stated above, you are not expected to answer "what is what". Review recent academic/industry credible literatures and reflect on your understanding on the above concepts by summarizing and writing critical appraisals. Appropriately in-text cite your work.

a. Research on Hypervisor.

A hypervisor is software that allows multiple operating systems to run on the same physical computer by creating virtual machines (VMs). This technology is widely used in modern IT environments because it improves hardware utilization and makes it possible to run different systems on one machine. Hypervisors are generally divided into two main types: **Type 1** (bare-metal) and **Type 2** (hosted) hypervisors.

Type 1 hypervisors run directly on the physical hardware without needing a host operating system. Because they interact directly with the hardware, they usually offer better performance, security, and scalability. Examples include VMware ESXi and Microsoft Hyper-V. These hypervisors are commonly used in enterprise environments and data centres where many virtual machines need to run at the same time [1].

Type 2 hypervisors run on top of an existing operating system such as Windows or Linux. Examples include Oracle VirtualBox and VMware Workstation. They are easier to install and configure compared to Type 1 hypervisors, which makes them suitable for testing, learning, and small network environments [2].

For the topology in this coursework, the network includes Windows Server 2022, Debian Server, and several client machines located in Birmingham and London. Since the project is implemented in a virtual lab environment, a Type 2 hypervisor such as Oracle VirtualBox is suitable. VirtualBox supports both Windows and Linux operating systems and allows the creation of different virtual network adapters needed to simulate the two sites. It also provides features such as snapshots and network configuration options that help manage the virtual infrastructure effectively.

b. Research on IP Addressing.

IP addressing is an essential part of computer networking because it allows devices to identify each other and communicate across networks. Every device connected to a network must have a unique IP address so that data can be sent to the correct destination. When information is transmitted over the Internet, it is broken into small packets. Each packet contains the source and destination IP addresses, which help routers determine where the data should be delivered [3].

There are two main versions of IP addressing: IPv4 and IPv6. IPv4 uses a 32-bit address format written as four numbers separated by dots, such as 192.168.1.1. However, because the number of available IPv4 addresses is limited, IPv6 was introduced to provide a much larger address space using 128-bit addresses. IPv6 also improves routing efficiency and network performance [4].

Another important concept related to IP addressing is subnetting. Subnetting divides a larger network into smaller logical networks called subnets. This improves network organisation, reduces unnecessary traffic, and helps administrators manage IP addresses more efficiently. For example, in the network topology used in this coursework, the Birmingham site could use the network 172.16.1.0/24, while the London site uses 172.16.2.0/24. This separation allows routers to correctly forward traffic between the two locations.

Network devices such as switches and routers also play an important role in IP communication. Switches connect devices within the same network, while routers are responsible for forwarding data between different networks. Together, these technologies ensure that information can travel efficiently from one computer to another across the Internet.

c. Research on Routing

Routing is an important concept in computer networks because it allows devices from different networks to communicate with each other. In this project two different local networks was created: the Birmingham LAN (172.16.1.0/24) and the London LAN (172.16.2.0/24) what use different IP address ranges, they cannot communicate directly without a routing process. The networks are connected through a WAN link network (10.0.0.0/30) between the Birmingham server and the London server.

The Birmingham server (B-DC) is running Windows Server 2019 and provides Active Directory, DNS and DHCP for the Birmingham network. The London server (L-CD) is running Debian Linux and has two network interfaces. The first interface is connected to the London LAN with the IP address 172.16.2.1, which acts as the gateway for the London client (ClientL1). The second interface is connected to the WAN network with the address 10.0.0.2, which allows communication with the Birmingham server that uses the address 10.0.0.1.

In this network topology static routing was used. Static routing means that the network administrator manually defines the routes between networks. In this case, the Debian server must know that traffic for the Birmingham network (172.16.1.0/24) should be sent through the WAN gateway 10.0.0.1. At the same time, the Birmingham server must know that traffic for the London network (172.16.2.0/24) should be sent to 10.0.0.2. Since there are only two connected networks, manually configuring the routes is simple and efficient. This approach demonstrates how routing works in a basic enterprise network environment and how separate network sites can be connected through a routed WAN link

d. Research on Network Services

Modern enterprise networks rely on several key network services to ensure secure communication, user authentication, and efficient management of network resources. Among the most important services are Virtual Private Networks (VPN), Dynamic Host Configuration Protocol (DHCP), Active Directory Domain Services (AD DS), and Certificate Authorities (CA).

A VPN allows users or remote offices to securely connect to a private network through the public Internet. By encrypting the transmitted data, VPNs protect sensitive information from interception and unauthorized access. In a distributed organisation such as the Birmingham and London sites in this topology, VPN technology can be used to establish secure communication between the two locations while maintaining data confidentiality [5].

Another essential service is DHCP, which automatically assigns IP addresses and network configuration parameters to devices on a network. Instead of manually configuring each system, DHCP ensures efficient IP address management and reduces configuration errors. This becomes particularly useful in environments with multiple client machines, as it simplifies network administration and improves scalability [6].

Active Directory Domain Services (AD DS) plays a central role in Windows-based enterprise networks. It provides centralized authentication, user management, and policy control. By using domain controllers, administrators can manage user accounts, security policies, and access permissions across the network. This centralised approach improves both security and administrative efficiency [7].

Certificate Authorities are responsible for issuing digital certificates used to verify the identity of systems and encrypt communications. Certificates are commonly used in secure services such as HTTPS, VPN connections, and internal authentication systems. Together, these services create a reliable and secure network infrastructure capable of supporting enterprise environments.

Task 2. Technical documentation (1250 words)

From lecturer:

- 2.1. Choose your Hypervisor:** Based on the above research, justify with concrete evidence and strong statements that influenced your choice of hypervisor to complete this network. Consider the fact that you will be continuing this topology to manage different network services in Coursework 2.

For below Tasks:

Note: The timestamp must prove that the task was done on a regular basis rather than a last minute work to be considered as excellent work.

Note: Without Timestamp in the screenshots submitted for task 2.2, "Time Management, Planning, Exercise of personal responsibility and decision-making, complete tasks and procedures" will be marked Zero.

2.2. Download and Setup:

2.2.1. Download the chosen Hypervisor and Server, Client Operating Systems for the relevant Sources. *Evidence for downloading from relevant/ appropriate resources will be considered as exceptional work.*

2.2.2. Deploy your network as per the given topology. The setup needs to be taken screenshots with Timestamp

2.3. Configure IP Addressing

2.3.1. Appropriate IP addressing

Fail – No IP Addressing configured

Marginal Fail – Wrong IP Address Configuration

Satisfactory - Good Work: IP Address Configured – However used the IP addresses given in the Topology Diagram.

Very Good – Exceptional: IP Address Configured – Used VLSM IP Addressing Scheme to calculate and assign your own IP Addressing Scheme.

The above topology gives network address for the networks. However, it is up to you to use the same network or a different network/ IP Addressing Scheme. *Designing your own IP Addressing scheme for the network will be considered as exceptional work.*

2.4. Test and Troubleshoot

You need to achieve the following:

2.4.1. Perform Connectivity tests

Outcome 1: Successful connectivity within same networks.

Outcome 2: Unsuccessful connectivity within different networks.

Implementation Overview – Birmingham and London Sites

The Birmingham site was implemented using a virtual machine running Windows Server 2019, which was configured as the domain controller (B-DC). The installation started by setting up the operating system and accessing the Server Manager dashboard. Using the Add Roles and Features Wizard, the required services were installed: Active Directory Domain Services (AD DS), DNS Server, and DHCP Server. The server was then promoted to a domain controller, and a new forest was created with the domain name birmingham.acca.

Next, the network configuration was completed. Two network adapters were used: one connected to the Birmingham LAN (172.16.1.0/24) and the other connected to the WAN link (10.0.0.0/30) used to simulate communication with the London site. The LAN interface was assigned the static IP address 172.16.1.1, which also functions as the DNS server. A DHCP scope was created to automatically assign IP addresses to client devices in the range 172.16.1.10–172.16.1.200.

A Windows 10 workstation (ClientS1) was connected to the Birmingham network and successfully joined to the birmingham.acca domain. After restarting the client, network connectivity and domain membership were verified using the ipconfig and ping commands. The London site was implemented using Debian Linux systems. The London server runs Debian without a graphical interface, while the client machine uses Debian with a graphical desktop environment. These machines were connected through the WAN link, allowing communication between the two sites and demonstrating interoperability between Windows and Linux systems within the same virtual enterprise network.

Fig1. Download the Software what I need:

Oracle Virtual Machine 7.2.6

<https://www.oracle.com/in/virtualization/technologies/vm/downloads/virtualbox-downloads.html>

Oracle VirtualBox Base Packages - 7.2.6
Freely available for Windows, Mac OS X, Linux and Solaris x86 platforms under [GPLv3](#):

Platform	64-bit
Windows	Windows Installer

Windows Server 2019

<https://www.microsoft.com/en-us/evalcenter/download-windows-server-2019?msocid=3fc48e07edb06b3206e598e4ec976a7c>

We use optional cookies to improve your experience on our websites, such as through social media connections, and to display personalized advertising based on your online activity. We use optional cookies, only cookies necessary to provide you the services will be used. You may change your selection by clicking "Manage Cookies" at the bottom of the page. [Statement](#) [Third-Party Cookies](#)

Microsoft | Evaluation Center | Windows | Windows Server | SQL Server | System Center | Microsoft Security | Addi

Please select your Windows Server 2019 download

English (United States)

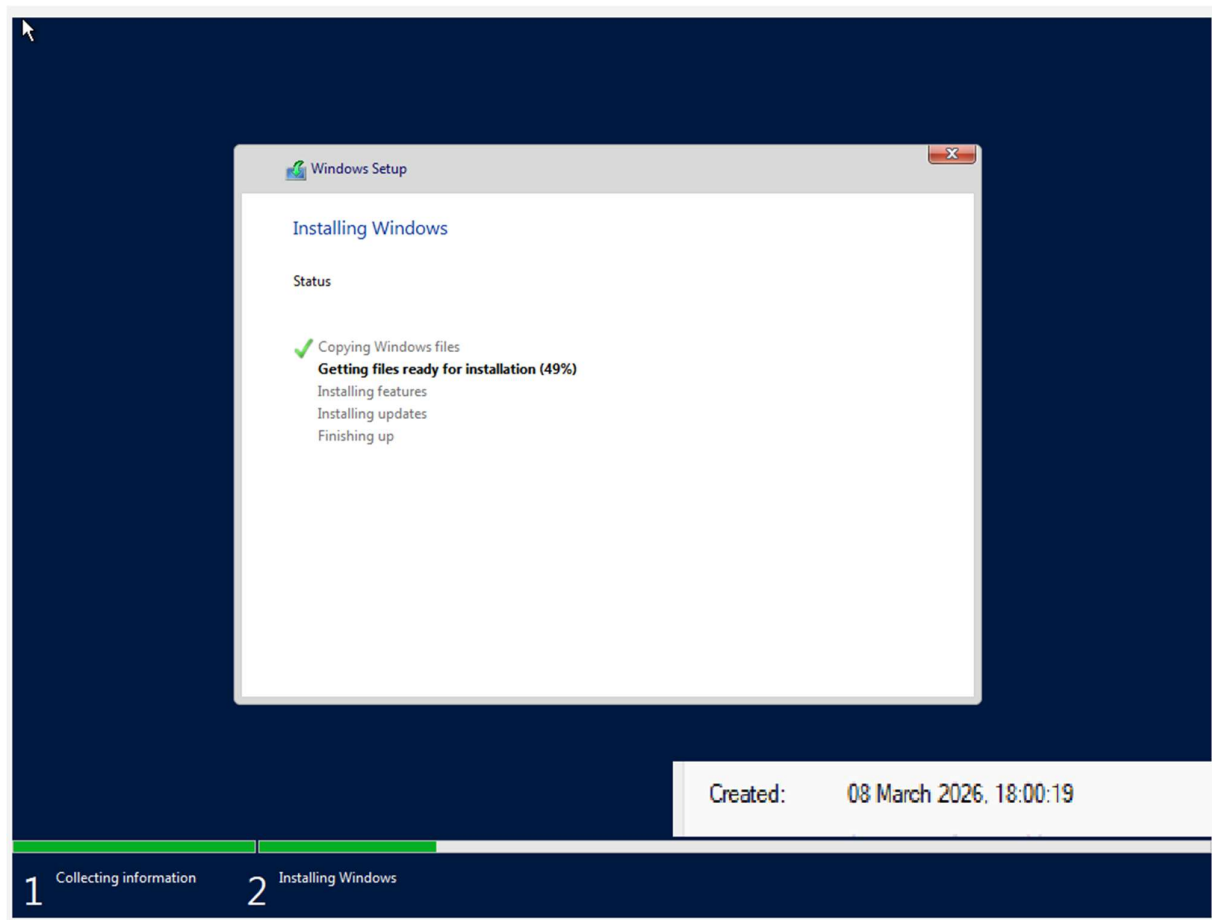
ISO downloads
64-bit edition >

VHD download
64-bit edition >



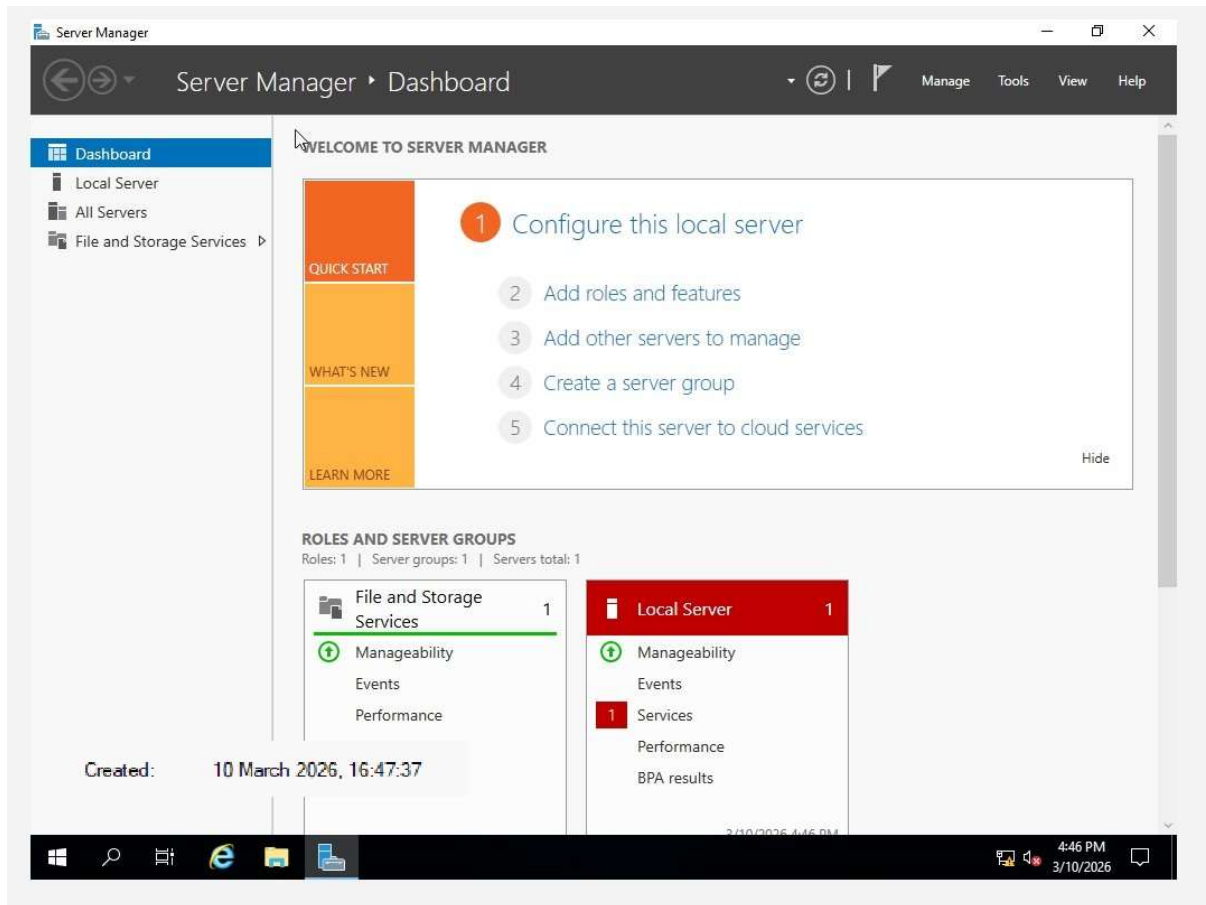
A. Birmingham Site Network

Fig.2 Installing Windows Server 2019 on the B-DC Server



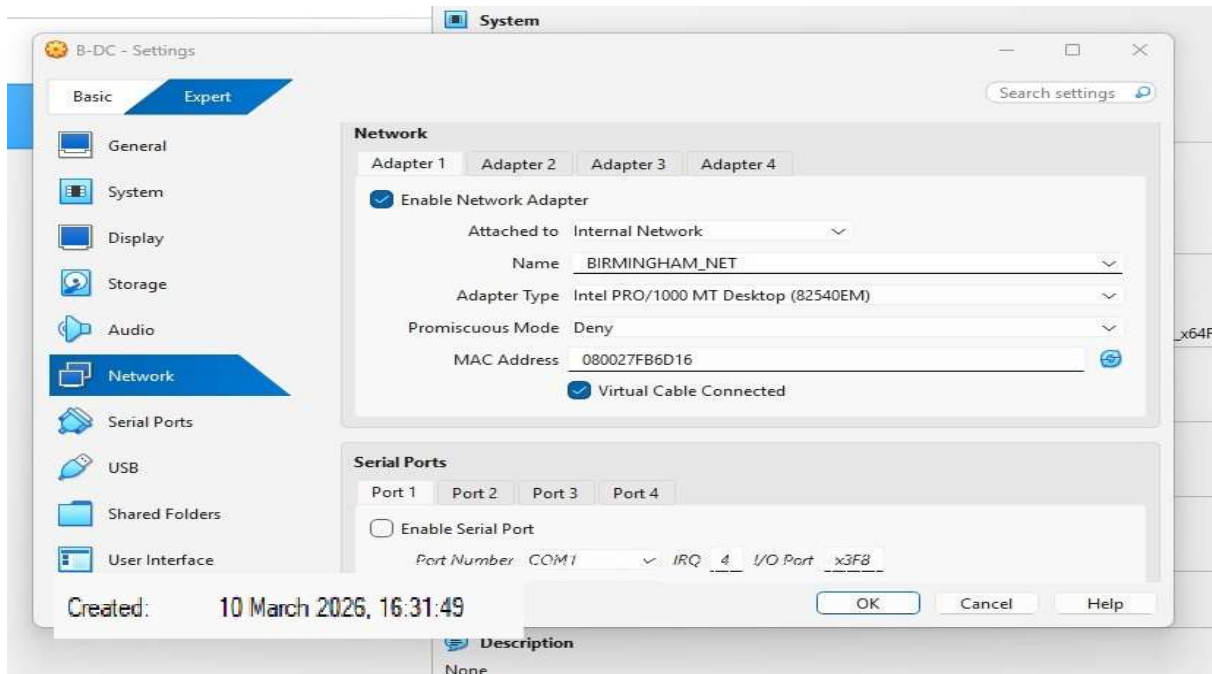
This screenshot shows the installation process of Windows Server 2019 on the virtual machine that will become the Birmingham Domain Controller (B-DC). The system is currently copying Windows files and preparing features required for installation. This stage establishes the base operating system before configuring network roles such as Active Directory, DNS, and DHCP for the Birmingham site.

Fig.3 First Server Manager Dashboard on B-DC



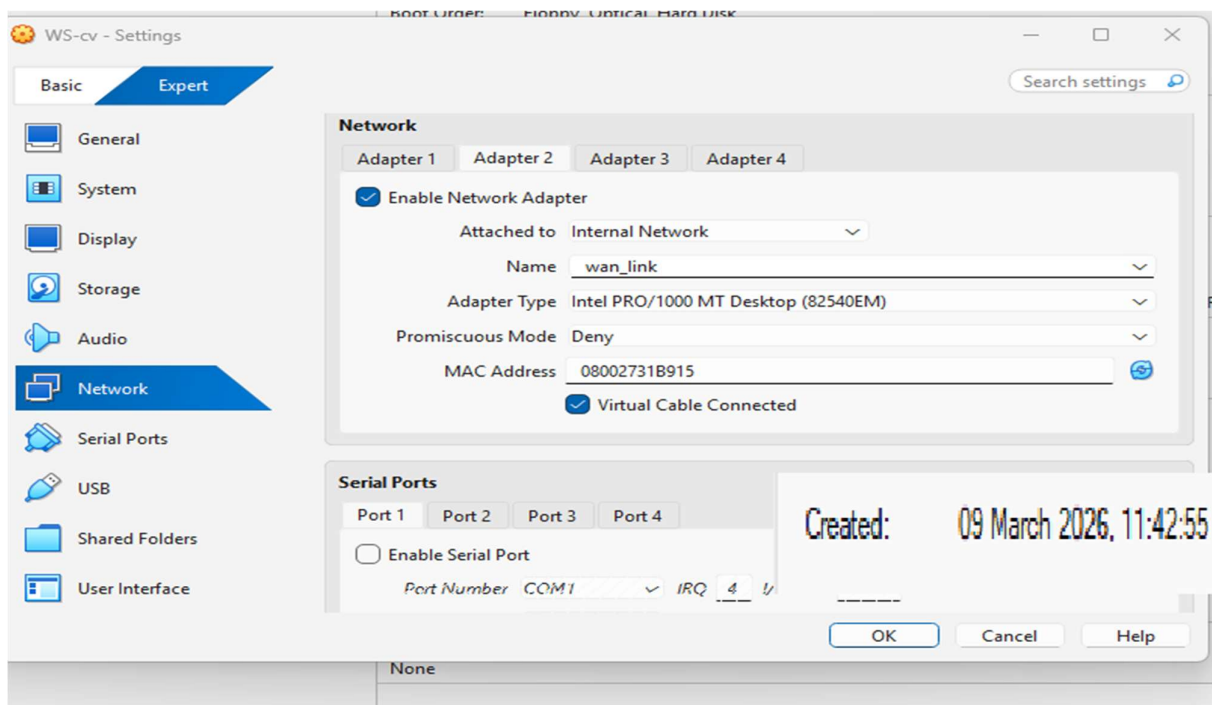
This screenshot shows the Server Manager dashboard after the installation of Windows Server 2019 on the B-DC server for the Birmingham site. Server Manager is the main administrative interface used to configure system roles and services. At this stage the server is running correctly, but Active Directory, DNS, and DHCP roles have not yet been installed.

Fig.4 Configuring Network Adapter 1 for the Birmingham LAN



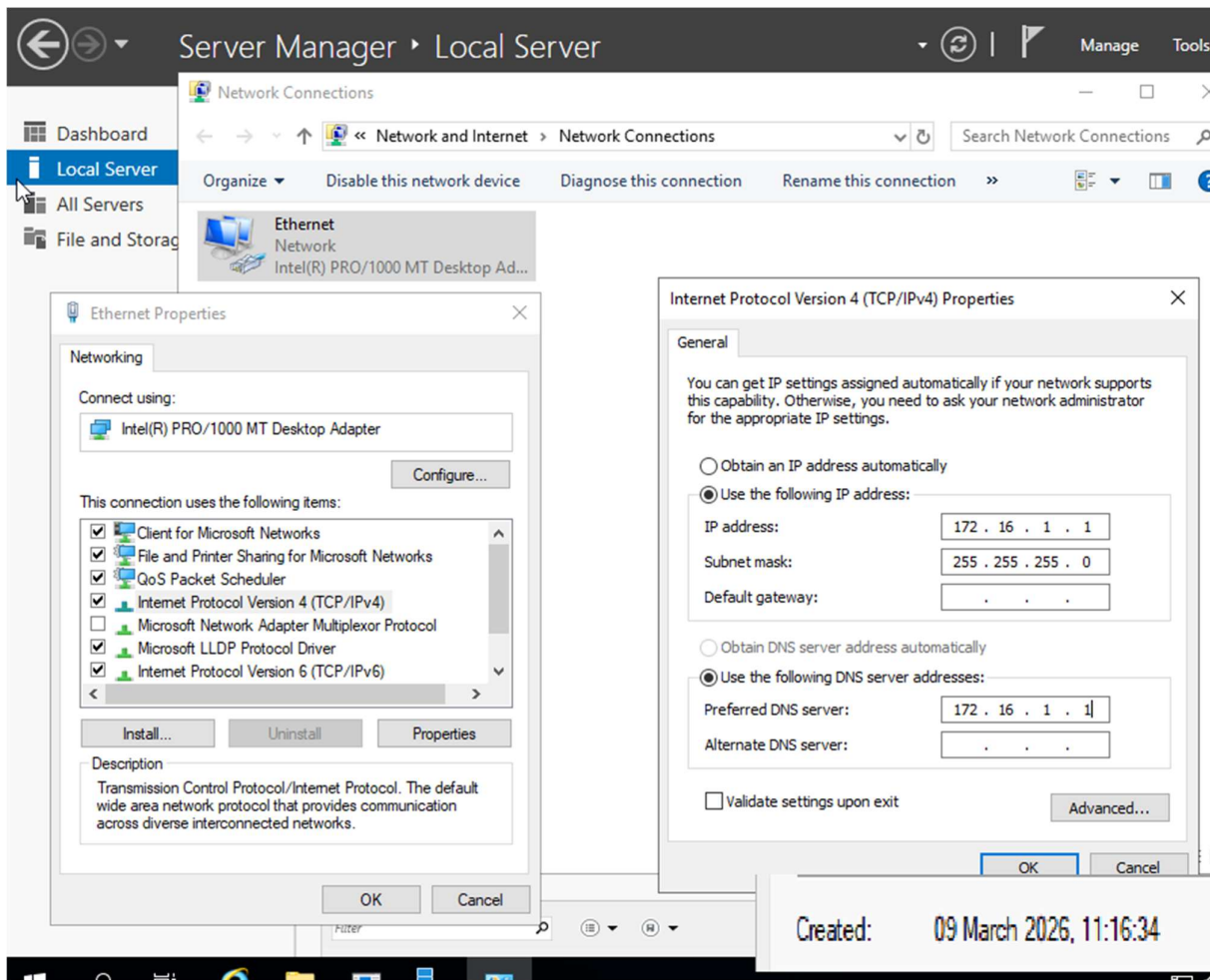
This screenshot shows the VirtualBox network configuration for Adapter 1 of the B-DC Windows Server 2019 virtual machine. The adapter is connected to the internal network BIRMINGHAM_NET, which represents the local LAN of the Birmingham site. This interface enables communication between the domain controller and the ClientS1 Windows 10 workstation.

Fig.5 Configuring Network Adapter 2 for the WAN Link



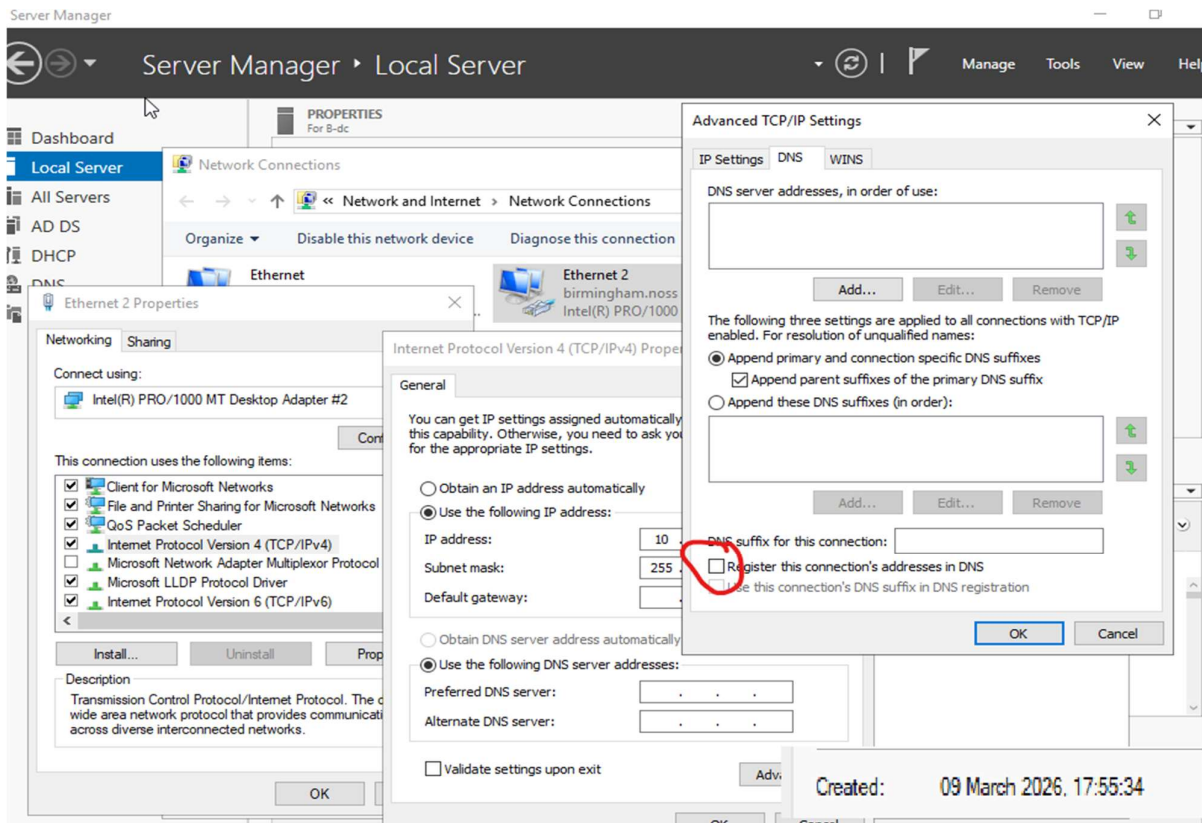
This screenshot shows the configuration of Adapter 2 in the VirtualBox settings of the B-DC Windows Server 2019 virtual machine. The adapter is connected to the internal network wan_link, which represents the WAN connection between the Birmingham site and the London site in the project topology. This interface enables communication between the two separate networks.

Fig.6 Static IPv4 Configuration of the B-DC Server



This screenshot shows the manual IPv4 configuration of the LAN interface on the B-DC Windows Server 2019 machine. The server is assigned the static IP address 172.16.1.1 with subnet mask 255.255.255.0. The DNS server is also set to 172.16.1.1, allowing the server to provide DNS resolution for the Birmingham domain birmingham.acca.

Fig.7. Configuring DNS Settings for the WAN Interface



This step shows the Advanced TCP/IP configuration of the WAN interface on the B-DC Windows Server 2019. The option “Register this connection’s addresses in DNS” is disabled to prevent the WAN adapter from registering DNS records. This ensures that only the LAN interface (172.16.1.1) is used for Active Directory communication, allowing ClientS1 to successfully join the domain.

Fig.8 Verifying ClientS1 Network Configuration and Connectivity

```

Microsoft Windows [Version 10.0.17134.1] (c) 2016 Microsoft Corporation. All rights reserved.
C:\Users\Administrator.Birmingham>ipconfig /all

Ethernet adapter Ethernet:

    Connection-specific DNS Suffix  . : birmingham.acca
    Description . . . . . : Intel(R) PRO/1000 MT Desktop Adapter
    Physical Address. . . . . : 08-00-27-5B-C7-CE
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes
    Link-local IPv6 Address . . . . . : fe80::88d:4ab1:f406:1cb4%10(Preferred)
    IPv4 Address. . . . . : 172.16.1.10(Preferred)
    Subnet Mask . . . . . : 255.255.255.0
    Lease Obtained. . . . . : 11 March 2026 02:44:07
    Lease Expires . . . . . : 19 March 2026 02:44:07
    Default Gateway . . . . . : 172.16.1.1
    DHCP Server . . . . . : 172.16.1.1
    DHCPv6 IAID . . . . . : 101187623
    DHCPv6 Client DUID. . . . . : 00-01-00-01-31-40-A7-86-00-00-27-5B-C7-CE
    DNS Servers . . . . . : 172.16.1.1
    NetBIOS over Tcpip. . . . . : Enabled

C:\Users\Administrator.Birmingham>ping 172.16.1.1

Pinging 172.16.1.1 with 32 bytes of data:
Reply from 172.16.1.1: bytes=32 time=2ms TTL=128
Reply from 172.16.1.1: bytes=32 time=1ms TTL=128
Reply from 172.16.1.1: bytes=32 time=2ms TTL=128
Reply from 172.16.1.1: bytes=32 time=1ms TTL=128

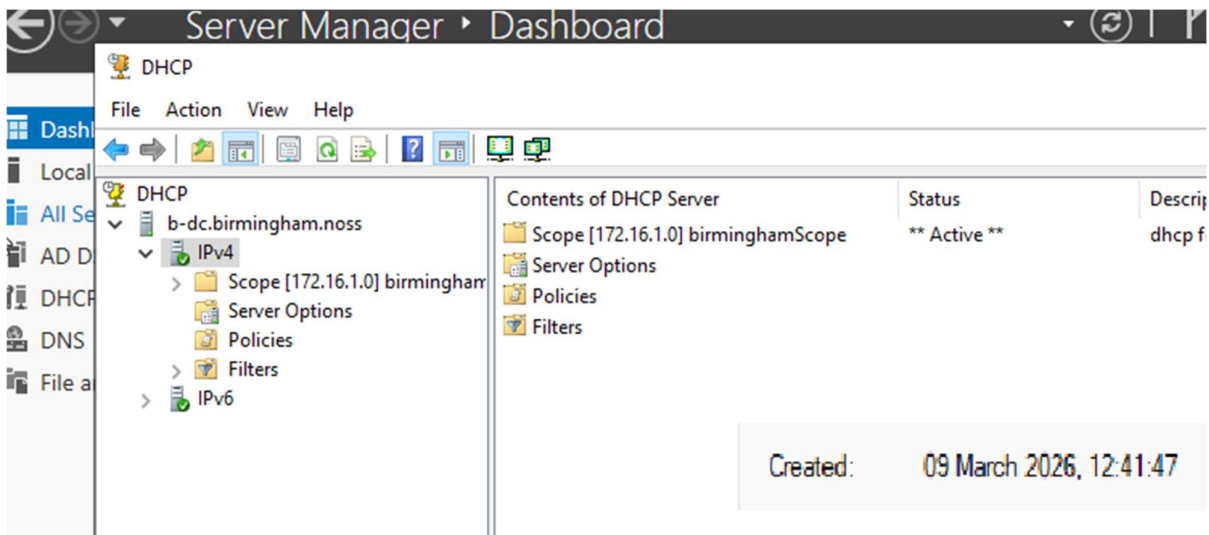
Ping statistics for 172.16.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 2ms, Average = 1ms

C:\Users\Administrator.Birmingham>

```

This screenshot shows ClientS1 (Windows 10) verifying its network configuration using the ipconfig command. The client receives an IP address 172.16.1.10 from the DHCP server and the DNS suffix birmingham.acca. A ping test to 172.16.1.1 (B-DC) confirms successful communication with the Windows Server 2019 domain controller.

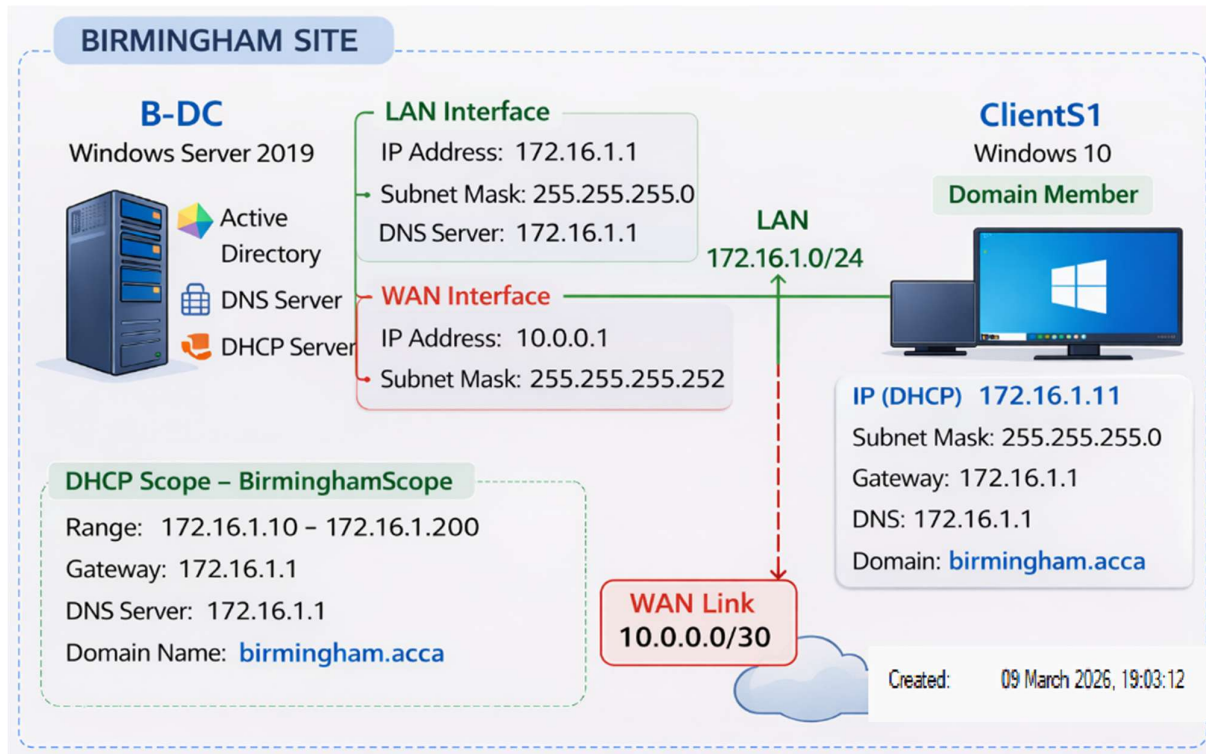
Fig.9 DHCP Scope Configuration for the Birmingham Network



This screenshot shows the DHCP management console on the B-DC Windows Server 2019. The scope birminghamScope (172.16.1.0) is configured and active. This scope automatically

assigns IP addresses to client devices connected to the Birmingham LAN, allowing workstations such as ClientS1 (Windows 10) to receive network settings without manual configuration.

Fig.10 Final Birmingham Site Network Topology

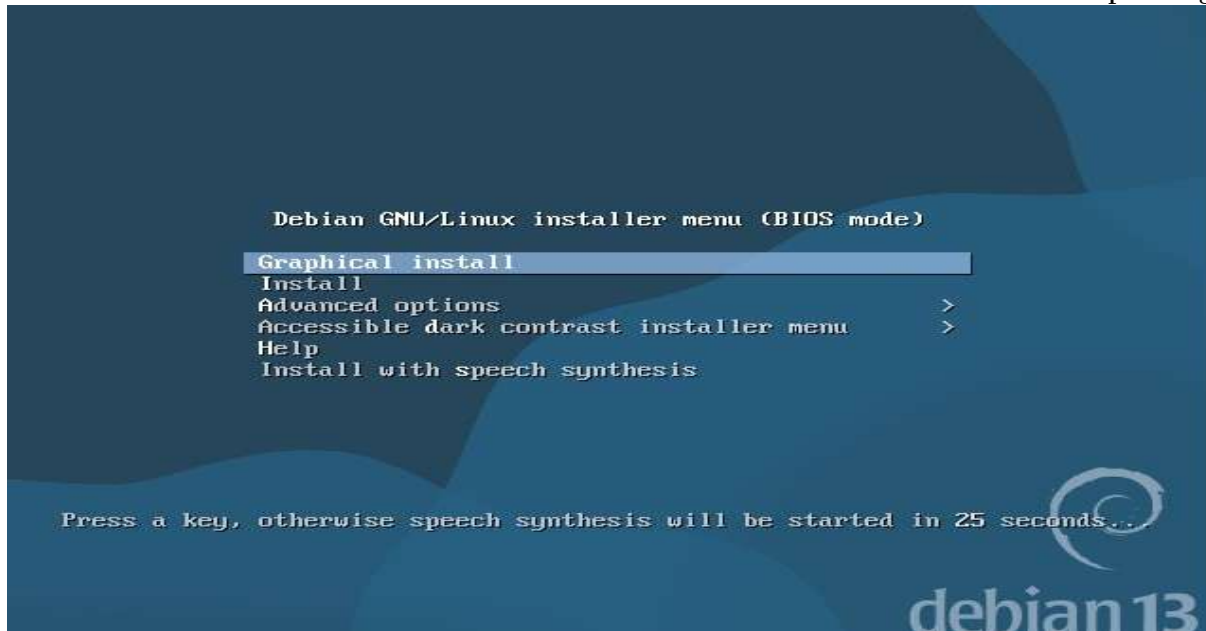


This diagram illustrates the final architecture of the Birmingham site network. The B-DC server running Windows Server 2019 provides Active Directory, DNS, and DHCP services. The ClientS1 Windows 10 workstation receives its IP configuration automatically from the DHCP scope 172.16.1.10–172.16.1.200 and communicates within the 172.16.1.0/24 LAN network.

B. London Site Network

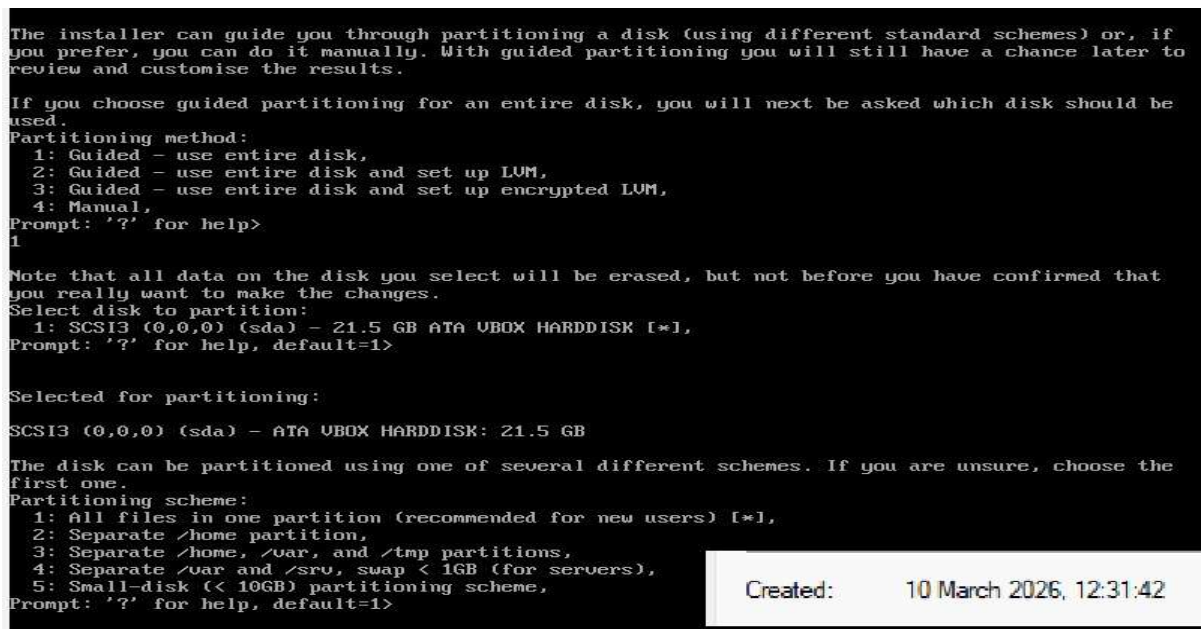
Fig.11 Installing Debian Linux for the London Server

This screenshot shows the Debian GNU/Linux installer menu used to install the operating



system for the London server.

Fig.12 Disk Partition Configuration During Debian Installation



This screenshot shows the disk partition configuration step during the Debian installation for the London server.

Fig.13 Network Interface Configuration During Debian Installation

```

58: Norwegian,          59: Persian,             60: Philippines,
61: Polish,              62: Portuguese,         63: Punjabi,
64: Romanian,           65: Russian,            66: Serbian (Cyrillic),
67: Sindhi,             68: Sinhala,            69: Slovak,
70: Slovenian,          71: Spanish,            72: Swedish,
73: Swiss French,       74: Swiss German,       75: Tajik,
76: Tamil,              77: Telugu,             78: Thai,
79: Tibetan,            80: Turkish (F layout), 81: Turkish (Q layout),
82: Taiwanese,          83: Ukrainian,
84: Uyghur,             85: Vietnamese,

Prompt: '?' for help, default=1>
1

Detecting hardware to find installation media ... 2%... 95%... 100%
Scanning installation media ... 1%... 11%... 21%... 30%... 40%... 50%... 61%... 71%... 80%... 90%...
... 100%
Loading additional components ... 0%... 10%... 20%... 30%... 40%... 50%... 60%... 70%... 80%... 90%
... 100%
Detecting network hardware ... 2%... 95%... 100%
Detecting link on enp0s3: please wait... ... 0%... 16%... 25%... 33%... 41%... 50%... 66%
Configure the network
=====

Your system has multiple network interfaces. Choose the one to use as the primary network interface
during the installation. If possible, the first connected network interface found has been
selected.
Primary network interface:
  1: enp0s3: Intel Corporation 82540EM Gigabit Ethernet Controller [*],
  2: enp0s8: Intel Corporation 82540EM Gigabit Ethernet Controller,
Prompt: '?' for help, default=1>
1

Detecting link on enp0s3: please wait... ... 0%
Waiting for link-local address... ... 16%... 25%... 33%... 41%... 50%... 100%
Attempting IPv6 autoconfiguration... ... 8%... 16%... 25%... 33%... 41%... 50%... 66%... 75%... 83%
... 91%... 100%
Configuring the network with DHCP ... 4%... 12%_

```

This screenshot shows the network configuration stage during the Debian installation for the London server. The installer detects multiple network interfaces (enp0s3 and enp0s8) and prompts the user to select the primary interface. The selected interface is automatically configured using DHCP, allowing the system to establish network connectivity during the installation process.

Fig.14 Installation of OpenSSH Server on the Debian London Server

```

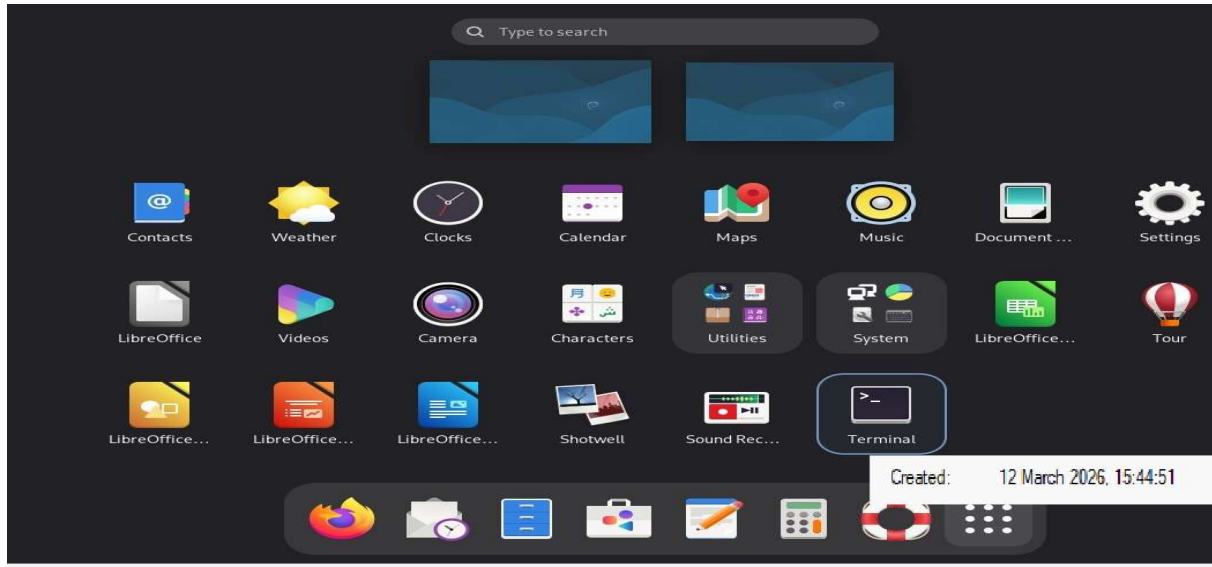
Continues? [Y/n] y
Get:1 http://deb.debian.org/debian trixie/main amd64 openssh-sftp-server amd64 1:10.0p1-7 [65.3 kB]
Get:2 http://deb.debian.org/debian trixie/main amd64 runit-helper all 2.16.4 [7,296 B]
Get:3 http://deb.debian.org/debian trixie/main amd64 liburp0 amd64 7.6.q-36 [55.3 kB]
Get:4 http://deb.debian.org/debian trixie/main amd64 openssh-server amd64 1:10.0p1-7 [601 kB]
Fetched 729 kB in 0s (1,852 kB/s)
Preconfiguring packages ...
Selecting previously unselected package openssh-sftp-server.
(Reading database ... 36154 files and directories currently installed.)
Preparing to unpack .../openssh-sftp-server_1%3a10.0p1-7_amd64.deb ...
Unpacking openssh-sftp-server (1:10.0p1-7) ...
Selecting previously unselected package runit-helper.
Preparing to unpack .../runit-helper_2.16.4_all.deb ...
Unpacking runit-helper (2.16.4) ...
Selecting previously unselected package liburp0:amd64.
Preparing to unpack .../liburp0_7.6.q-36_amd64.deb ...
Unpacking liburp0:amd64 (7.6.q-36) ...
Selecting previously unselected package openssh-server.
Preparing to unpack .../openssh-server_1%3a10.0p1-7_amd64.deb ...
Unpacking openssh-server (1:10.0p1-7) ...
Setting up runit-helper (2.16.4) ...
Setting up openssh-sftp-server (1:10.0p1-7) ...
Setting up liburp0:amd64 (7.6.q-36) ...
Setting up openssh-server (1:10.0p1-7) ...
Creating config file /etc/ssh/sshd_config with new version
Creating SSH2 RSA key; this may take some time ...
3072 SHA256:o0GK2y0K7k3J02hy6pN5GNVHEJddU9d12ERVbk5u/aH root@l-cd (RSA)
Creating SSH2 ED25519 key; this may take some time ...
256 SHA256:voZpR8A6rdb795+nEP0p01kQVRnn+dyuVSSZ8auGw root@l-cd (ED25519)
Creating SSH2 ED25519 key; this may take some time ...
256 SHA256:188QdQdVdJVHbzRFRUP/ltw0Uc0hbxsc89la6g01PzkI root@l-cd (ED25519)
Creating user 'sshd' (sshd user) with UID 909 and GID 65534.
Created symlink '/etc/systemd/system/ssh.service' → '/usr/lib/systemd/system/ssh.service'.
Created symlink '/etc/systemd/system/multi-user.target.wants/ssh.service' → '/usr/lib/systemd/system/ssh.service'.
ssh.socket is a disabled or a static unit, not starting it.
Created symlink '/etc/systemd/system/ssh.service.wants/ssh-keygen.service' → '/usr/lib/systemd/system/ssh-keygen.service'.
Created symlink '/etc/systemd/system/ssh.service.wants/ssh-keygen.service' → '/usr/lib/systemd/system/ssh-keygen.service'.
Created symlink '/etc/systemd/system/ssh.service.wants/ssh-keygen.service' → '/usr/lib/systemd/system/ssh-keygen.service'.
Created symlink '/etc/systemd/system/ssh.socket.wants/ssh-keygen.service' → '/usr/lib/systemd/system/ssh-keygen.service'.
Processing triggers for man-db (2.13.1-1) ...
Processing triggers for libc-bin (2.41-12+deb13u1) ...
root@l-cd:~#

```

This figure shows the installation of the OpenSSH server package on the London server running Debian Linux without a graphical interface. The terminal output confirms that several packages such as openssh-server, openssh-sftp-server, and related dependencies were downloaded

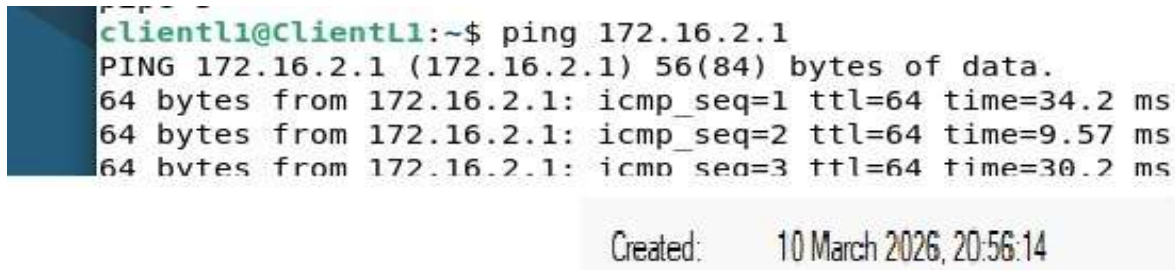
and installed successfully. During the installation process, SSH host keys were automatically generated and the sshd service was configured.

Fig.15 Debian Desktop Environment on London Client (ClientL1)



This figure shows the Debian 13 graphical desktop environment running on the London client machine (ClientL1) after the installation process was completed successfully.

Fig.16 Connectivity Test from London Client (ClientL1) to London Server



This figure shows a network connectivity test performed from the London client machine (ClientL1) using the terminal. The command `ping 172.16.2.1` was executed to verify communication with the London server in the same local network. The successful replies confirm that the network configuration is correct and that the client device can reach the server.

Fig.17 Network Interface Configuration and Initial Connectivity Test on London Server

```
Debian GNU/Linux 13 l-cd tty1
l-cd login: cristinel
Password:
Linux l-cd 6.12.73+deb13-amd64 #1 SMP PREEMPT_DYNAMIC Debian 6.12.73-1 (2026-02-17) x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
cristinel@l-cd:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host noprefixroute
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:db:bb:d3 brd ff:ff:ff:ff:ff:ff
    altname enx080027dbbbd3
    inet 172.16.2.1/24 brd 172.16.2.255 scope global enp0s3
        valid_lft forever preferred_lft forever
    inet6 fe80::a00:27ff:fe0b:bbd3/64 scope link proto kernel ll
        valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:72:e8:6d brd ff:ff:ff:ff:ff:ff
    altname enx08002772e86d
    inet 10.0.0.2/30 brd 10.0.0.3 scope global enp0s8
        valid_lft forever preferred_lft forever
    inet6 fe80::a00:27ff:fe72:e86d/64 scope link proto kernel ll
        valid_lft forever preferred_lft forever
cristinel@l-cd:~$ ping
ping: usage error: Destination address required
cristinel@l-cd:~$ ping 10.0.0.1
PING 10.0.0.1 (10.0.0.1) 56(84) bytes of data.
From 10.0.0.2 icmp_seq=1 Destination Host Unreachable
From 10.0.0.2 icmp_seq=2 Destination Host Unreachable
From 10.0.0.2 icmp_seq=3 Destination Host Unreachable

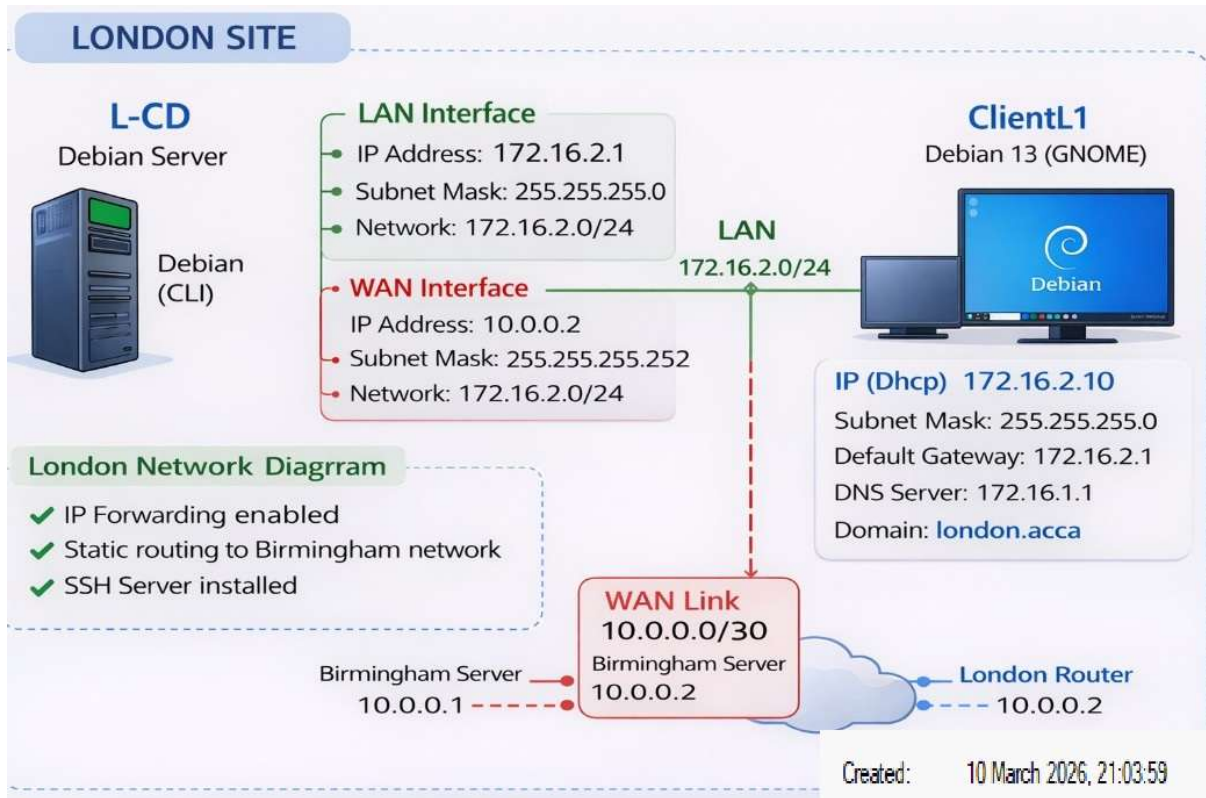
--- 10.0.0.1 ping statistics ---
5 packets transmitted, 0 received, +3 errors, 100% packet loss, time 4174ms
pipe 3
cristinel@l-cd:~$
```

In the final stage of the project, connectivity between the Birmingham server (B-DC) and the London server was tested using the WAN link. Both systems were configured with the correct IP addresses, and the network interfaces were verified.

When performing the ping test, the servers were still unable to communicate.

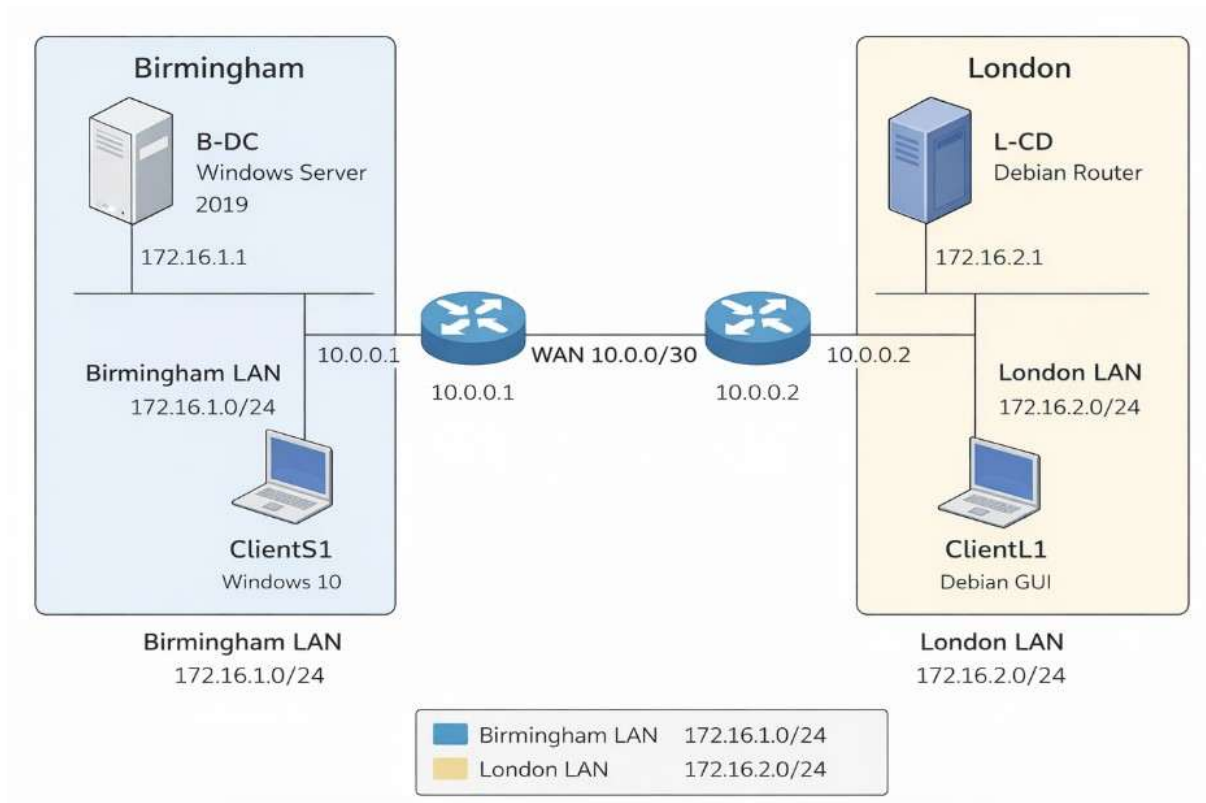
After checking the network configuration on both machines, no clear configuration errors were identified. Because of this, I believed that the problem may be related to the Oracle VirtualBox virtual networking environment rather than the operating system configuration itself.

Fig.18 London Site Network Topology



This figure illustrates the final network topology of the London site implemented in the virtual environment

Fig.19 Complete Network Topology of the Birmingham and London Sites



This figure presents the complete topology of the virtual enterprise network implemented in the project. The infrastructure is divided into two sites: Birmingham and London, each containing a server and a client machine connected through their respective local area networks.

Task. 3 Personal and Technical reflection

3.1 Reflection

3.1.1 Technical Reflection

During the deployment of the network environment several configuration steps were completed including installation of the operating systems, configuration of network interfaces, and deployment of services such as Active Directory, DNS and DHCP on the Birmingham server. The Birmingham client was successfully joined to the birmingham.acca domain and received its IP configuration automatically from the DHCP server.

During the implementation of the London site some challenges was. The London server required manual configuration of two network interfaces, one for the LAN network (172.16.2.0/24) and another for the WAN link (10.0.0.0/30) connecting to the Birmingham server. Connectivity tests using the ping command , ipconfig and ip a, verifying network adapters ,IP configuration appeared correct, communication between the two servers was not successful. After reviewing the configuration, it was assumed that the issue might be related to the virtual network in Oracle VirtualBox rather than the operating system .

3.1.2 Personal Reflection

This project helped me better understand how enterprise networks are deployed and tested in a virtual environment. I obtain practical experience working with Windows Server, Debian Linux, DHCP, DNS, and Active Directory services. I also improved my troubleshooting skills by analysing network configurations and testing connectivity between different machines. Working with virtual machines and network interfaces showed how small configuration errors can affect communication between systems. Overall, the project helped me develop practical knowledge of network administration and gave me experience in building and managing a small multi-site network infrastructure.

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