

Virtualization and the Funding Problems in Developing Countries: A Case Study of a Network Simulation of a Hospital Environment Constructed Virtually

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Abstract

A virtual machine utilizes software instead of a computer to install and run programs. Virtualization software establishes an abstract layer on top of the machine hardware, which allows the hardware components of this single machine to be divided into many virtual computers. In this article, a network simulation of a hospital environment is built virtually. With some modifications, it can be adapted elsewhere. Here, the objective is to obtain the best features at the lowest cost. The constructed virtual network will be used by the hospital staff, the IT department, the patients, and the visitors. A hospital network is simulated by hosting two Windows servers on a VMware workstation application, with two Windows 10 clients as virtual machine applications. A VMware virtual switch is used to create a network between them. This virtual network system provides a variety of important and essential network functions needed by any hospital or an emerging organization at low cost, such as data sharing, user access restrictions, system policies resources, a security system, a network monitoring system, a mail server, a backup solution, and a centralized management.

Keywords: Virtualization Technology, Virtual Networks, Virtualization Software, VMware Workstation, Real-Time Monitoring, Centralized Management, Hospital Management System, Hospital Network Simulation Sharing, Security, Low Budget, Small Companies

1. Introduction

A virtual machine utilizes software instead of a computer to install and run programs. Several virtual guest machines can run on the host machine [1]. In this study, 2 servers are used for centralized management to provide services to customers. Using VMware will reduce the implementation costs by substituting 2 physical servers with a server by installing VMware and hosting another server on that server.

Virtualization software establishes an abstract layer on top of the machine hardware, which allows the hardware components of this single machine (like memory, processors) to be divided into many virtual computers (virtual machines). Each virtual computer works its own operating system (OS) and functions as an autonomous device, in spite of the fact that it's running on a portion of the underlying computer. It is a software representation of a physical computer with an operating system (guest OS) [1]-[3]. We use VMware's Workstation because VMware makes virtualization software.

Because it is difficult for small businesses to get started and economize money for initial setup (like hospitals), we decided to utilize a variety of visualization software as follows:

- VMware Workstation: for having several OSs on one machine.
- VMware Fusion: Designed specifically for Mac users, this product provides additional compatibility across all devices and VMware applications.
- VMware Player: This version is for personal use only, as it is completely free for users who do not own a licensed copy of the VMware application.
- There are also many server-oriented programs available under the name Hypervisor that can run directly on servers without the need for a major operating system, including:
 - VMware Server: Free software that can be used on all operating systems such as Linux.
 - VMware ESX Server: an ideal solution for businesses and organizations offering more benefits than the free VMware Server, and later integration with VMware vCenter provides additional solutions for improved server application management and consistency.
 - VMware ESXi Server: Analogous to VMware ESX Server, except it requires less storage space to run, and the service console is replaced by BusyBox.

The work is structured as follows. The second section introduces the construction of the virtual network and the servers used. The third section describes the virtual installation and use of Group Policy. Installing and using Exchange Server 2016 is actually covered in part four. Section five describes the virtual installation and use of the print server. Section six describes how to install and use Spiceworks Network Monitor virtually. Wireshark network monitoring is covered in Section seven. Section eight describes the installation and utilization of virtual replication on virtual machines, restoring and backing up data. Section nine describes how to install and use Remote Support virtually. Share and NTFS permissions are addressed in Section ten. The discussion is in Section eleven. The last section finishes up this work and features potential work for the future.

2. Constructing the Virtual Network

We used a variety of software tools, such as VMware workstation, Windows server, Windows 10, Gns3, Packet tracer, Kaspersky, Apache, Exchange server, Veeam, Wireshark, VNC, and Spiceworks.

A. VMware Workstation's Installation

Installing VMware's Workstation is easy [2]-[3]. Our base OS is Windows 8, so we chose install VMware for Windows. Get Windows Server 2022 virtually by creating a new virtual machine on VMware's Workstation and installing it on this new virtual machine (as described below), which will be created with a blank hard disk of the size we determined during the previous installation (Figure 1).

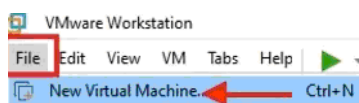


Figure 1. The Virtual Machine

Contrasted to VirtualBox, VMware Workstation's installation of Windows Server is quite quick. Deciding on the guest OS is appeared in Figure 2.

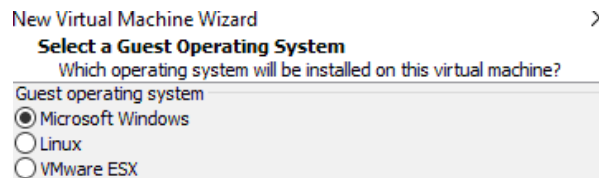


Figure 2. Choosing the Version of Windows Server

Then proceed with the setup as installing a Microsoft product, including setting the maximum disk size. The last window of the setup (Figure 3) displays the hardware settings, where we can get back if any modifications are needed. To change this configuration, click on Edit virtual machine settings. To progress with the setup, click on Power on this virtual machine.



Figure 3. Power on the Virtual Machine

This will launch the setup. Choose the wanted language, keyboard or input method, and time as well as currency format to install. Then, click on Next to continue. Then, click on Install Now to advance with the setup of Windows Server 2022. At that point, select the required OS to set up. Choose Windows Server 2022. We select custom install because we don't need the current settings.

- **Installing Windows 10 on VMware Workstation**

This is done by creating a new virtual machine as described above, and then installing Windows 10. While creating a new virtual machine, there are times when we choose the default option. Typically, the Windows machine may not load well during the boot. To avoid this, choose a custom (advanced) configuration and set up the required hardware. Also, we want the guest window to be able to access the internet. We choose the Network Address Translation (NAT) interface to access the Internet. Then, click Next.

- **Installing VMware Tools on a Windows Computer**

Start the installation of VMware Tools (Figure 4). Then, choose to run setup64.exe, which is the VMware toolkit. At the end of the VMware Tools installation, we restart the computer to complete the installation.

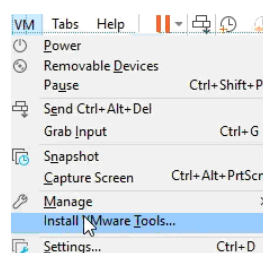


Figure 4. Start Installing VMware Tools

B. Dynamic Host Configuration Protocol (DHCP) Server

The key steps of this configuration on Windows Server are the installation, scope creation, DNS registration, and Active Directory authorization. Network nodes necessitate an IP address configuration, which encompasses the IP address, name server, subnet mask, router's default gateway IP, and other values. If administrators configure manually this information, a static configuration is the result. A Dynamic Host Configuration Protocol server provides information dynamically: routers, network printers, servers, and other such devices. Workstations, tablets, phones, laptops, and other end-user gadgets get their configuration through DHCP.

Configuring DHCP Windows Server 2022: In Server Manager, we chose features and roles (Figure 5). Then, click on the wizard screen.

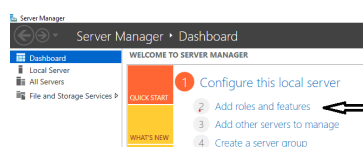


Figure 5. Selecting Add Roles and Features

Select a Role or feature based installation (Figure 6).

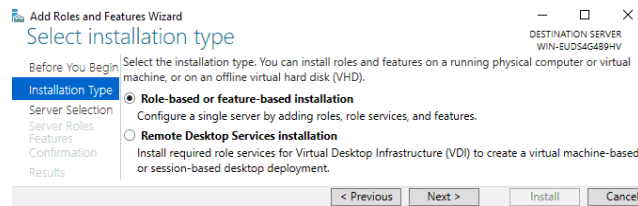


Figure 6. Selecting a Role or Feature based Setup

Choose the server, on which the role will be setup. Then, click Next (Figure 7).

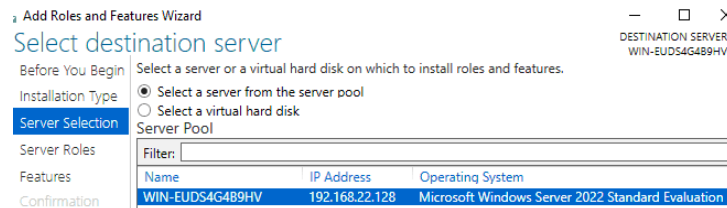


Figure 7. Selecting the Server

In the roles' window, select DHCP Server (Figure 8).

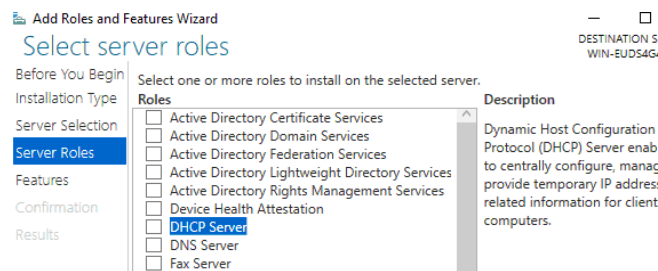


Figure 8. DHCP Server

The following window will be opened, where we click on Add features to add the needed characteristics (Figure 9).

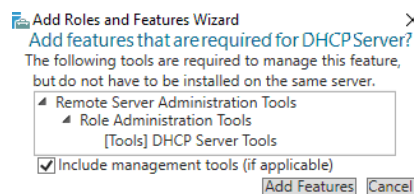


Figure 9. Add Features to Add the Needed Characteristics

Click Next to access the Features section, where we won't alter anything. Then, click Next. Select DHCP Server to see a summary of the roles to install on Windows Server 2022,

and click Next. To progress with the installation, click Install. Then, we will see this message: Complete DHCP configuration (Figure 10).

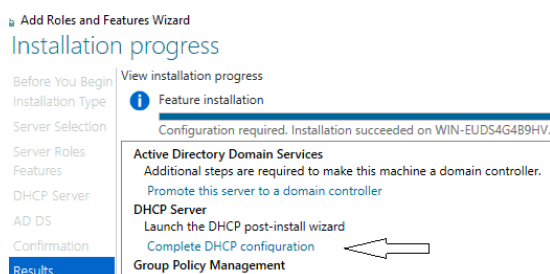


Figure 10. Complete DHCP Configuration

We select the server, and its details will be appeared as in Figure 11.

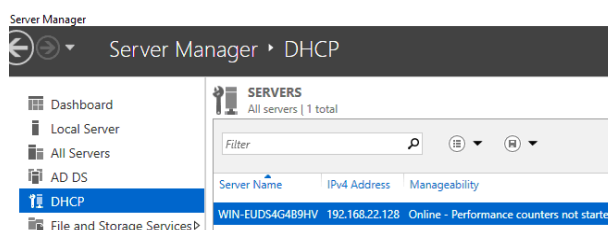


Figure 11. The Details of DHCP Server

Click on DHCP to expand it (Figure 12).

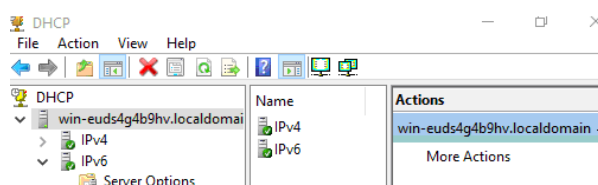


Figure 12. Expanding DHCP Server

Right click on "IPv4" to choose new scope (Figure 13). At that point, click Next to relegate a title to this scope.

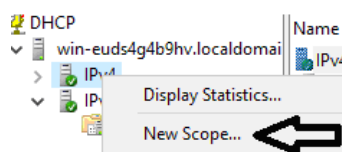


Figure 13. Relegate a Title to New Scope

Click Next to set up the range of IP addresses to communicate to client computers (Figure 14).

New Scope Wizard
IP Address Range
You define the scope address range by identifying a set of consecutive IP addresses.

Configuration settings for DHCP Server
Enter the range of addresses that the scope distributes.
Start IP address: 192.168.1.3
End IP address: 192.168.1.10

Configuration settings that propagate to DHCP Client
Length: 24
Subnet mask: 255.255.255.0

< Back Next > Cancel

Figure 14. Set Up the Range of IP Addresses

Then, we exclude a range of address or addresses, which aren't distrusted by this server (Figure 15).

New Scope Wizard
Add Exclusions and Delay
Exclusions are addresses or a range of addresses that are not distributed by the server. A delay is the time duration by which the server will delay the transmission of a DHCP OFFER message.

Type the IP address range that you want to exclude. If you want to exclude a single address, type an address in Start IP address only.

Start IP address: End IP address: Add

Excluded address range:
192.168.1.5 to 192.168.1.6 Remove

Subnet delay in milli second:
0

< Back Next > Cancel

Figure 15. Exclude a Range of Addresses or Addresses

We determine when the authorization for the delivery address expires (Figure 16). Then, click Next to finish configuring these options.

New Scope Wizard
Lease Duration
The lease duration specifies how long a client can use an IP address from this scope. Lease durations should typically be equal to the average time the computer is connected to the same physical network. For mobile networks that consist mainly of portable computers or dial-up clients, shorter lease durations can be useful. Likewise, for a stable network that consists mainly of desktop computers at fixed locations, longer lease durations are more appropriate. Set the duration for scope leases when distributed by this server.

Limited to:
Days: 8 Hours: 0 Minutes: 0

< Back Next > Cancel

Figure 16: Determining when the authorization for the delivery address expires

Then, we add the router's IP address (Figure 17).

New Scope Wizard
Router (Default Gateway)
You can specify the routers, or default gateways, to be distributed by this scope. To add an IP address for a router used by clients, enter the address below.

IP address:
192.168.1.1 Add Remove Up Down

< Back Next > Cancel

Figure 17. Adding the Router's IP Address

We got the parent domain (Figure 18). We can add additional servers (if we've them). Then, click Next.

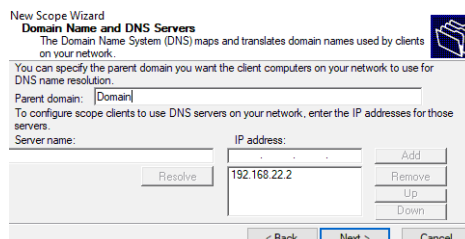


Figure 18. Getting the Main (Parent) Domain

Then, we can configure the IP addresses for NetBIOS (Figure 19). Then, click Next.

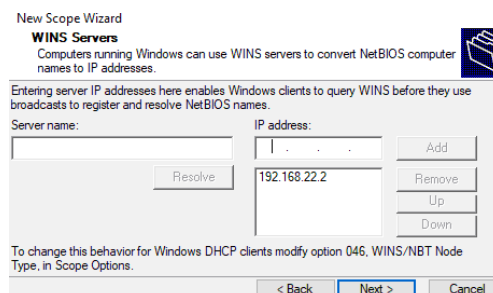


Figure 19. Configuring the IP Addresses for NetBIOS

Click Next to activate it (Figure 20). Then, click on Finish.

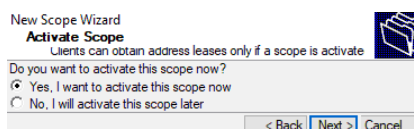


Figure 20. Activate the Scope

We can navigate through the different options (Figure 21).

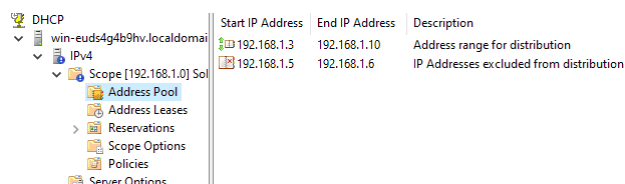
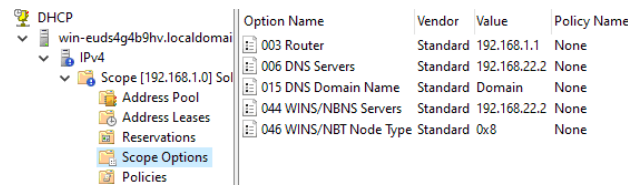


Figure 21. Navigating Through the Different Options

In the Scope Options, we see the established addresses (Figure 22).



Option Name	Vendor	Value	Policy Name
003 Router	Standard	192.168.1.1	None
006 DNS Servers	Standard	192.168.22.2	None
015 DNS Domain Name	Standard	Domain	None
044 WINS/NBNS Servers	Standard	192.168.22.2	None
046 WINS/NBT Node Type	Standard	0x8	None

Figure 22. Scope Options

To verify this, we go to the client computer, which we verify from the change adapter option, which is in the domain and receives an IP address through DHCP. Therefore, we choose Change adapter options (Figure 23) from Network Center.

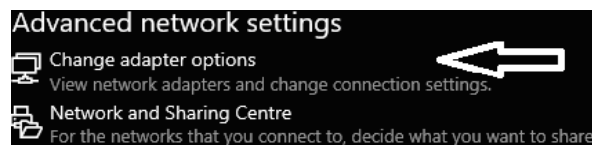


Figure 23. Address Verification from Client Computer from Change Adapter Options

Right press on Ethernet; select Properties (Figure 24).

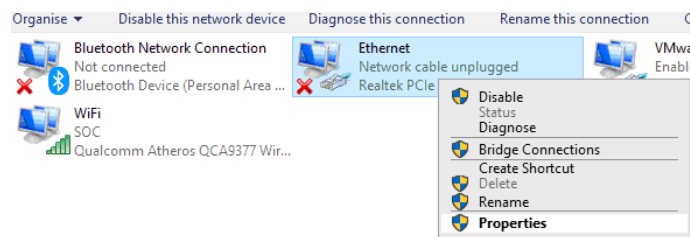


Figure 24. Right Click on Ethernet

This window (Figure 25) will appear, from which we select the IPv4 protocol.

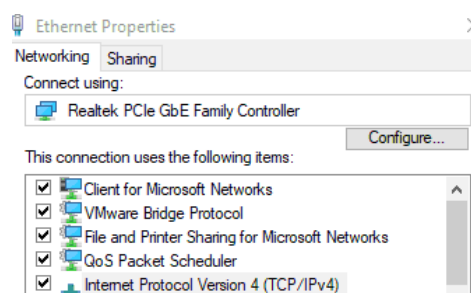


Figure 25. IPv4 Protocol

- **Installing the DNS Server**

Like the setup of the DHCP server.

- **Configure the DNS Server in Windows Server**

Only the steps that differ from the DHCP server are described here. The "Dynamic Update" is a great feature, especially when we have a lot of devices on our network and use DHCP. As the name refers, this feature updates DNS records dynamically, and we don't have to change the records every time when we make changes on a client side. Click "Next" on this screen (Figure 26) and finish on its next screen.

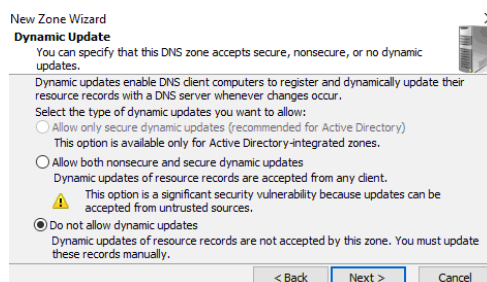


Figure 26. The Dynamic Update Feature

Then, we add a new user (Figure 27).

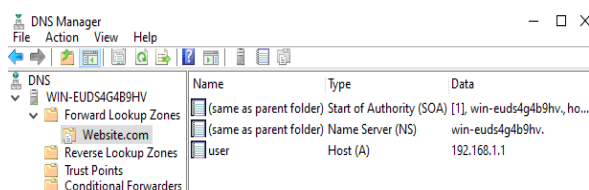


Figure 27. Adding A New User

- **Installing the Active Directory:** It follows the same steps we did with the DHCP server.
- **Installing and configuring the Domain Controller 2022:**

From the Server Manager, we chose to promote the given server to be a domain controller (Figure 28).

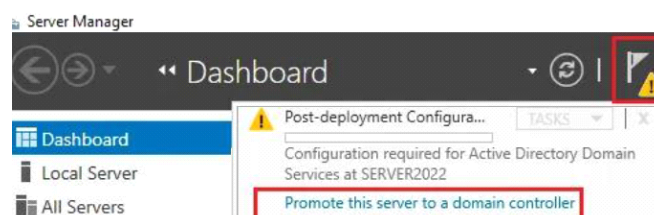


Figure 28. Making the Given Server to be a Domain Controller

To install a novel forest and domain, we choose Add a new forest and determine the domain information. At that point, write the domain caption following to the root domain name and at that point click Next (Figure 29).

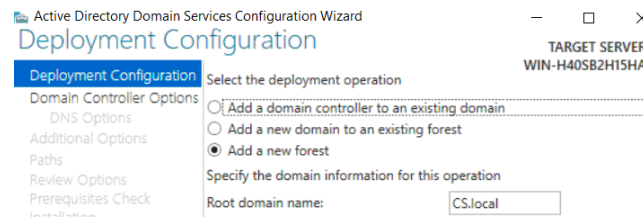


Figure 29. Write Down the Domain Name Following to the Root Domain Name

We chose the Domain Name System server, and the Global Catalog, and typed the password of the Directory Services Restore Mode. Then, we clicked Next (Figure 30).

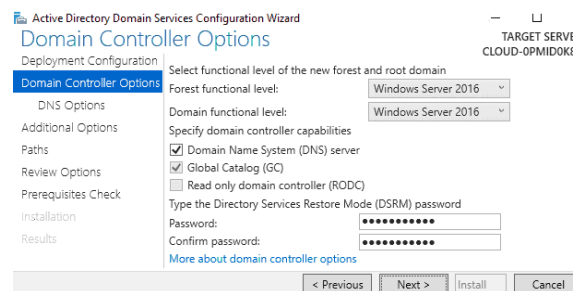


Figure 30. Choose the Domain Name System Server, and the Global Catalog

- **Verify the NetBIOS Domain Name**

In most cases, it is automatically picked from the related domain name. We determined the Active Directory Domain Services (AD DS) database location, SYSVOL location, and log file location. Then, we clicked Next (Figure 31). Then, we verified the settings and clicked Next.

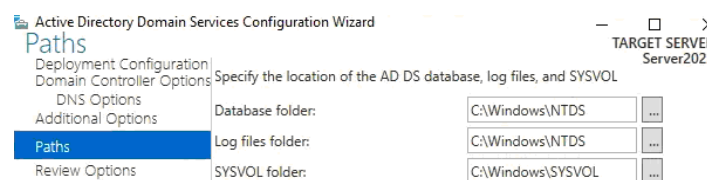


Figure 31. Determine the AD DS Database, SYSVOL, and Log File Locations

We then select the prerequisite check and click Install (Figure 32) to start setting up the Active Directory Domain Controller.

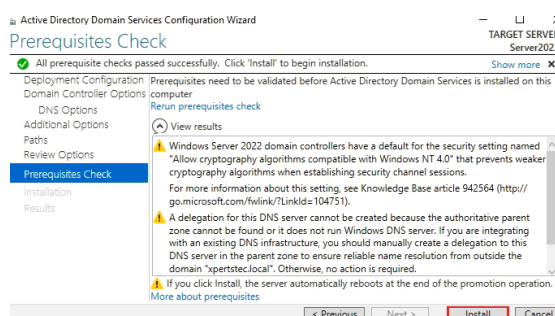


Figure 32. Prerequisite Check

After the configuration is successful, we click Close. Then, the server restarts automatically. On the domain administrator login screen, type your domain controller password.

3. Group Policy

It's a framework in the Windows operating system whose components reside on AD DS, domain controllers, and every Windows server and client. By using these components, we can manage the configuration in the AD DS domain. We set the Group Policy settings to apply to one or more configuration settings for a computer/user [4]. In Group Policy Management Editor, identify the desired policy settings and press Enter to display Policy Setting Properties (Figure 33).

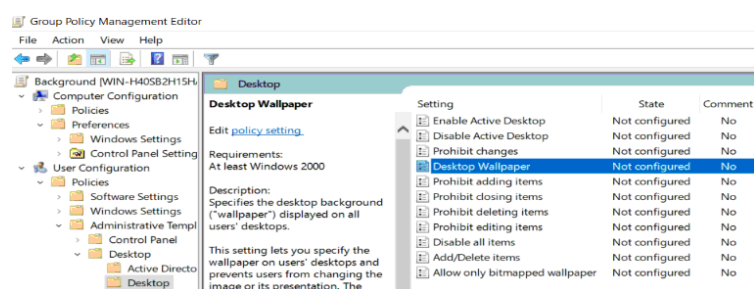


Figure 33. Identify the Desired Policy Setting

Write the group policy' name (Figure 34).

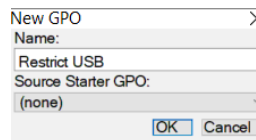


Figure 34. Write the Name of the Group Policy

Change the policy status to Enabled or Disabled. Most settings have 3 states: Enabled, Not Configured, and Disabled (Figure 35).

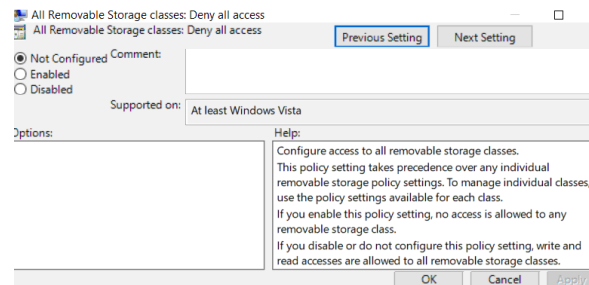


Figure 35. The Policy Status

4. Exchange Server 2016

We initiate the installation, and click Next. The installer is initialized, and the introduction page opens, providing information about the installation process. Read the content, and click Next. At that point, check on "I accept the terms in the license agreement". Then, click Next. The Recommended Settings page opens, we select whether we want the Exchange Server to use the recommended settings or to configure manually these settings after the installation is complete. Select Use recommended settings. Then, click Next.

- From the Server Role Choice, select set up the Mailbox or the Edge Server role. When the former is selected, by default the "Administrative Tools" option is selected. We chose to automatically install Windows Server roles and features, which are required to set up Exchange Server. Then, click "Next".
- On the Installation Space and Location page, identify the setup path for the Exchange Server.
- We then decide to disable or enable the settings of the Malware protection.
- Then, the system performs a readiness check to determine whether the server role prerequisites have been successfully completed. If unsuccessful, we click Back to execute the needed procedure. If successful, we click Install.

- After completing the installation, the Installation Complete page appears. We click Finish.
- **Create user mailboxes in Exchange Server:** User mailboxes are exchange mailboxes that are related to people, usually one per a person. Each user mailbox has an associated Active Directory account that allows the user to access the mailbox to send and receive e-mail and to create meetings and appointments. When we create a new user mailbox in Exchange, we also build a corresponding Active Directory user. Alternatively, we can build a novel mailbox for a current Active Directory account, which doesn't have a mailbox (mailbox-enabling a current user) [5]. We employ the Exchange admin center for creating Mailboxes. From Recipients > Mailboxes. Click + and select User mailbox (Figure 36).

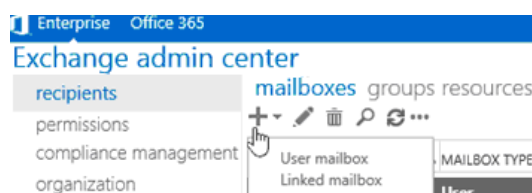


Figure 36. Selecting User Mailbox

On the New User Mailbox page, set the settings as shown in Figure 37. When we finish, we click Save.

Figure 37. New User Mailbox Page

5. Print Server

It's for building Windows Print Server involving the Print Management Console snap-in, that's beneficial for administrating many print servers or printers and migrating printers from or to other Windows print servers.

Add the Print and Document Services role from Server Roles and press Next (Figure 38).

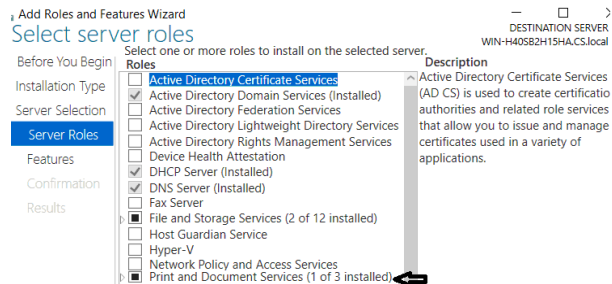


Figure 38. Adding the Print and Document Services Role

From Tools, we press on Print Management (Figure 39).

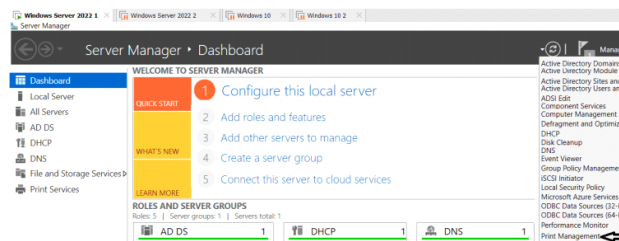


Figure 39. Print Management

Right click on Printers. Then, choose Add Printer (Figure 40).

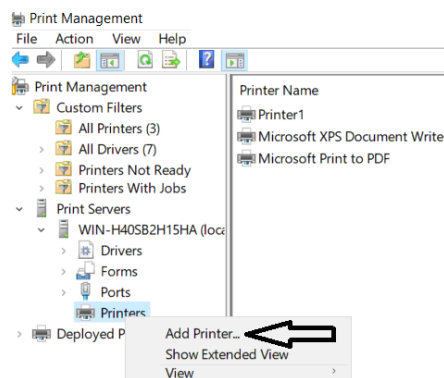


Figure 40. Choosing Add Printer

Write the IP of the printer server and then click on Next (Figure 41).

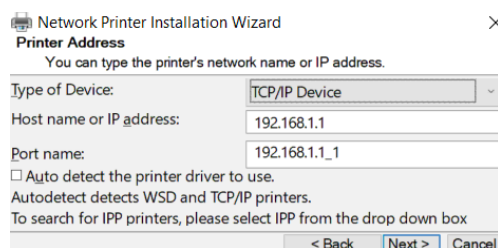


Figure 41. Write the IP of the Printer Server

Press on the standard option and then click on Next. We select Install a new driver and click Next (Figure 42). And then, select its type.

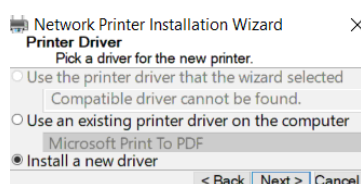


Figure 42. Install a New Driver

If we want to share the printer driver, we write the share name and click Next (Figure 43). Then, press Finish to verify the installation.

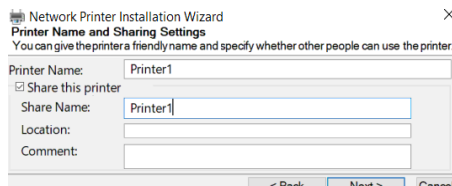


Figure 43. Share The Printer Driver

6. Spiceworks Network Monitor

Network monitoring acts as your eyes and ears, alerting you to any problems on your network. We can keep track of anything happens in the network, such as contract due dates, hard drive space, software installations. The ideal monitoring systems will alert to any changes in the network, as well as help troubleshoot the current problem by allowing comparing the current state of the network with what it looked like before the change. This alert can be through text message or email. So, we can deal with these issues rapidly [6]-[7]. We initiate the installation process. Select the path to install and click “Next”. Then, write the port number that the program will use and click Next (Figure 44).

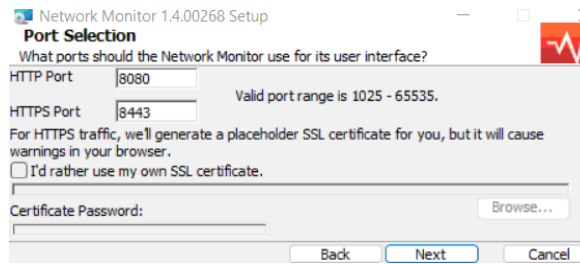


Figure 44. Write the Port Number that the Program will Use

Then, press Install to complete the installation process. Sign up with email to reach the program interface. Press Add Device to add the target device to be monitored (Figure 45), and then enter the IP address and device credentials.

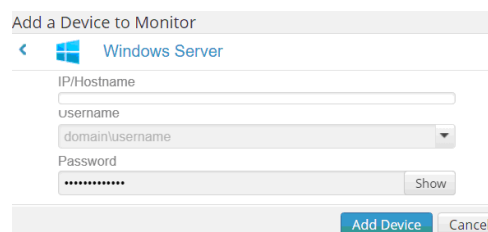


Figure 45. Add Device to Add the Target Device to be Monitored

Finally, we will find the target device and the details of its use (Figure 46).

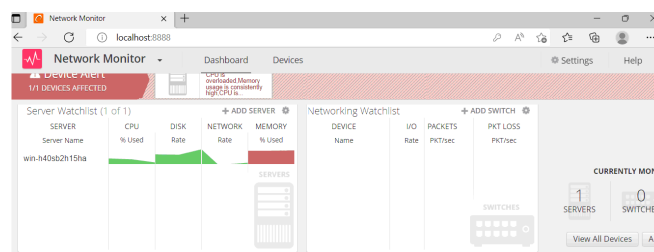


Figure 46. The Target Device and the Details of Its Use

7. Wireshark Network Monitoring

It's a network packet analyzer, which displays the captured packet data in as much detail as possible. It is employed to checking what's happening inside a network cable. It's considered one of the ideal packet analyzers. Moreover, it's free [8]-[9].

Double-click the Wireshark setup file, click Next. Choose the components needed for installation and click Next (Figure 47). Then, if you want to create a shortcut and associate a file extension, click Next.

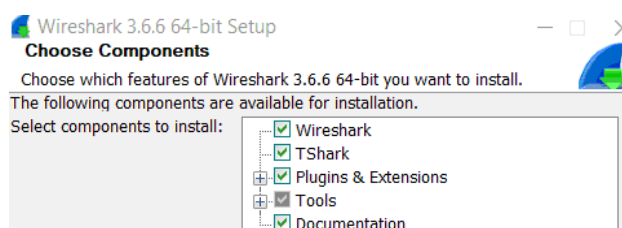


Figure 47. Select the Components Needed for Installation

Select the path to where to install, and click “Next”. Install Npcap (Figure 48), which is required to complete the installation of Wireshark.

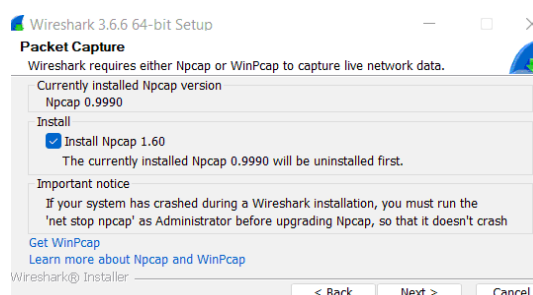


Figure 48. Installing the Npcap

Install USBcap (Figure 49), which is required to complete the installation of Wireshark.

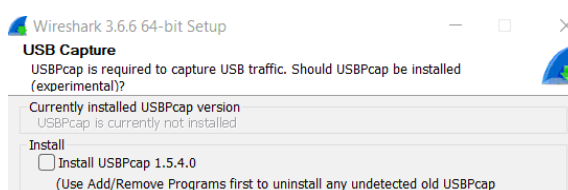


Figure 49. Installing the USBcap

Then, press Finish. Start the program and select the network interface (Figure 50).

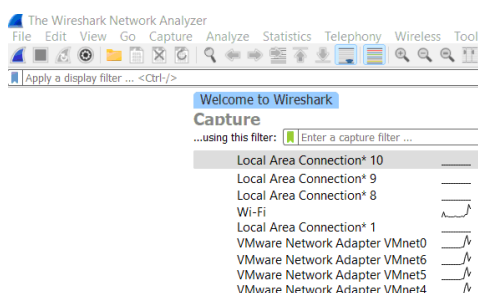


Figure 50. Selecting the Network Interface to Open

Now, we can see the packets going in and out of the network interface (Figure 51).

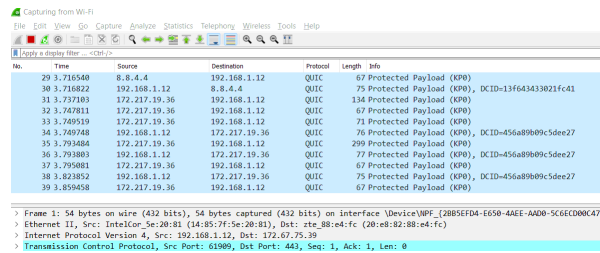


Figure 51 shows a Wireshark packet capture interface. The top menu bar includes File, Edit, View, Go, Capture, Analyze, Statistics, Telephony, Wireless, Tools, and Help. Below the menu is a toolbar with icons for various functions. The main display area shows a list of captured packets. The first packet is selected, and its details are shown in the bottom pane. The details pane shows the following information:

No.	Time	Source	Destination	Protocol	Length	Info
29	3.716540	8.8.4.4	192.168.1.12	QUIC	67	Protected Payload (X90)
30	3.716822	192.168.1.12	8.8.4.4	QUIC	75	Protected Payload (X90), DCID=13f643433821fc41
31	3.727185	172.217.19.36	192.168.1.12	QUIC	134	Protected Payload (X90)
32	3.747811	172.217.19.36	192.168.1.12	QUIC	67	Protected Payload (X90)
33	3.749519	172.217.19.36	192.168.1.12	QUIC	71	Protected Payload (X90)
34	3.760748	192.168.1.12	172.217.19.36	QUIC	76	Protected Payload (X90), DCID=456a89b9c5dee27
35	3.793484	172.217.19.36	192.168.1.12	QUIC	299	Protected Payload (X90)
36	3.793801	192.168.1.12	172.217.19.36	QUIC	77	Protected Payload (X90), DCID=456a89b9c5dee27
37	3.795081	172.217.19.36	192.168.1.12	QUIC	67	Protected Payload (X90)
38	3.823852	192.168.1.12	172.217.19.36	QUIC	75	Protected Payload (X90), DCID=456a89b9c5dee27
39	3.859458	172.217.19.36	192.168.1.12	QUIC	67	Protected Payload (X90)

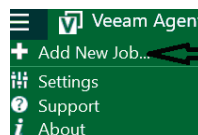
The bottom pane shows the packet details for the selected packet (Frame 1):

- Frame 1: 54 bytes on wire (432 bits), 54 bytes captured (432 bits) on interface \Device\NPF{28B5FD4-E650-44EE-AA00-5C6ECDD00C47A}
- Ethernet II, Src: IntelCor_Se:20:81 (14:85:F7:5e:20:81), Dst: zte_88:e4:fc (28:e8:82:88:e4:fc)
- Internet Protocol Version 4, Src: 192.168.1.12, Dst: 172.67.75.39
- Transmission Control Protocol, Src Port: 63909, Dst Port: 443, Seq: 1, Ack: 1, Len: 0

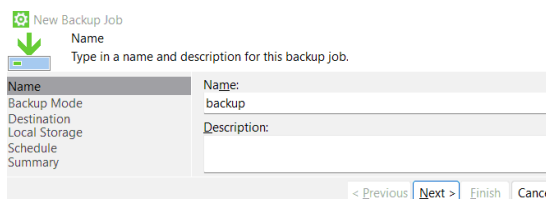
Figure 51. The Packets Going in and out of the Network Interface

8. Replicating, Restoring, and Backing Up Data on Virtual Computers

This is using Veeam Backup Solution that was first released in 2008 as a part of the Veeam Availability Suite [10]-[11]. We press on the program setup file to install it, then accept the terms and press Install to start the installation. Press Add New Job to start the backup process (Figure 52).

**Figure 52.** Add New Job to Start the Backup Process

Write down the backup name and description, and press Next (Figure 53).



The image shows the 'New Backup Job' dialog box in Veeam Agent. It has a green header bar with the text 'New Backup Job'. Below the header is a form with the following fields:

- Name:** A text box with the value 'backup'.
- Description:** A text box with the value 'backup'.
- Backup Mode:** A dropdown menu with the value 'Local Storage'.
- Destination:** A text box with the value 'Local Storage'.
- Schedule:** A text box with the value 'Summary'.

At the bottom of the dialog box are four buttons: '< Previous', 'Next >', 'Finish', and 'Cancel'. The 'Next >' button is highlighted with a mouse cursor.

Figure 53. Write Down the Backup Name and Description

Select the data to back up and press Next (Figure 54). Choose a destination for the backup and click Next

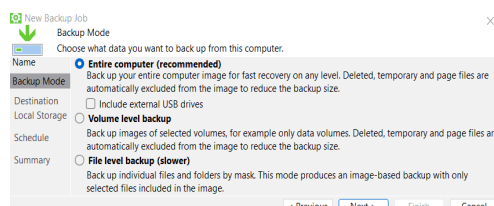


Figure 54. Select the Data to Backup

Select a locally attached drive for the backup (Figure 55).

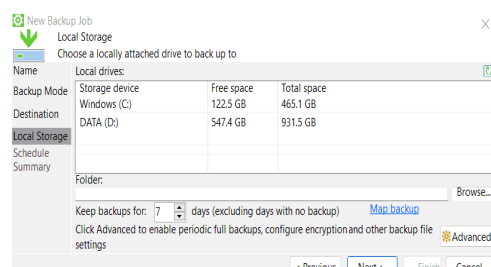


Figure 55. Select a Locally Attached Drive for the Backup

To complete the backup process, schedule the backup (Figure 56).

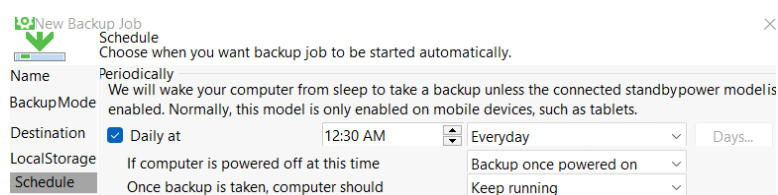


Figure 56. Schedule the Backup

9. Remote Support

This is utilizing VNC Viewer for nearby computers and portable gadgets we desire to control. A viewer shows a file's substance on the screen. A device (such as a tablet, smartphone, or computer) having VNC Viewer installed is able to access and control a computer located in another location. It's a sharing graphical desktop system, which permits a user to remotely control the desktop of a remote computer (running VNC Server). It transfers the mouse and keyboard or touch events to the VNC Server, i.e., controlling the accessed computer. We used it rather than RDP for the following reasons.

- RDP can constrain the ability to supply IT assistance.
- RDP has restricted platform capabilities, whereas VNC works over numerous OSs.

- The level of security between the two protocols can vary significantly.
- RDP connects to a shared server, but VNC connects directly to the computer.

Their point is to give remote graphical desktop capabilities to machines. The contrast lies in the way they realize this [12]-[13]. We press the VNC setup file to begin the installation process, and then press Next. Select VNC Server for user computers and VNC Viewer for IT administrator computers (Figure 57).

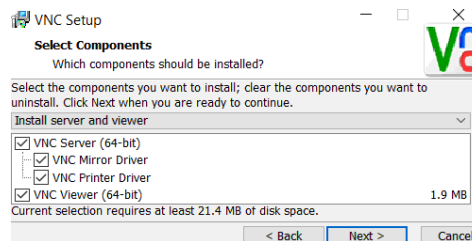


Figure 57. Selecting VNC Server for User Computers and VNC Viewer for IT Administrator Computers

Select a destination for the installation files. Then, choose either a shortcut icon or not. Then, press Install to complete the installation process. Open the program and write the IP of the target computer you want to access and the password created (Figure 58). Then, the connection screen will appear.

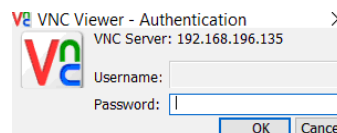


Figure 58. Writing the IP of the Target Computer

10. Share and NTFS Permissions

File server permissions must be carefully enforced to provide proper access to the content. This includes locking down consents on shared and physical folders as follows [14]. Right-click on the folder we need to share and select Properties (Figure 59).

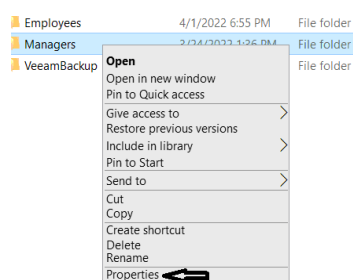


Figure 59. Right-Click on the Folder and Choose Properties

Select Advanced Sharing from Sharing (Figure 60). Select Share this folder and the user we have to give permissions to. Then, specify them and press ok.

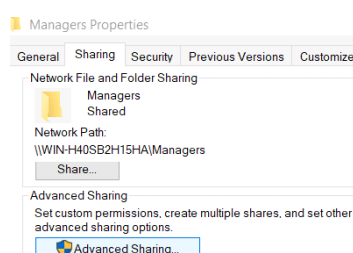


Figure 60. Select Advanced Sharing from Sharing

11. Discussion

In this research, we only used one physical server to construct a complete network consisting of multiple servers and required connection tools. That is, all used hardware networks are performed virtually by virtualization software, but the functions are the same. Examples are:

- Data sharing and user access restrictions to deny unauthorized users.
- System policies to deny operations that are not supported for the user, such as allowing users to attach USBs and denying other users to put USBs, allowing administrators to configure time slots of several seconds to avoid being notified every time there is a usage spike, and any exe files will be rejected by the system.
- Resources sharing like the utilization of printers.
- A security system, which will be an Antivirus management interface on the server and endpoints for user and network monitoring through the use of Kaspersky antivirus software.

- Hospital Management System (Web Content Management System), which will be hosted on a Windows server using Apache.
- A network monitoring system to control the use of the devices.
- A mail server, which is Microsoft's Exchange server.
- A backup solution through Veeam software. With it, the system has backup and restore properties.
- A centralized management.
- The system accesses user data to the system for internal booking.
- Data is brought from the service regularly.
- A real-time monitoring system is provided.
- The system permits the server to make alterations.

12. Conclusion and Future Work

This paper is considered a complete reference on how to use virtualization in small companies (that don't have the budget) to build networks and tools virtually instead of buying equipment, such as servers, routers, and switches. We are keen to detail the necessary steps along with illustrative figures. We show that virtualization software can replace all necessary hardware for any start-up company and at the same time perform the same functions with the same quality, for example: mail server, antivirus server, print server and file server, though we only have one server. The point was to focus on delivering a variety of important and needed systems running on a few equipments.

As a research direction, more services should be included for the benefit of users. Another point to consider in future work is to add comparisons of virtualization software that perform the same functions.

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