Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 9 Issue 06, June-2020

Simulation Network System Combination Between GNS3, VMware Workstation Pro 12, Oracle VM Virtualbox in Computer Networking Practice

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Abstract **- Currently with the strong development of information technology. Computers help people optimize their work ... With the current development situation, the computer network can not lack any business organization. The rapid development of computer networks significantly improves labor productivity, increasing work efficiency. Due to the practical needs, meeting the practical needs and approaching new technologies nowadays in building and deploying the network. In this paper, I propose a method of combining two Gns3 , VMware Workstation Pro 12 and Oracle VM VirtualBox emulation software to simulate network performance, enabling students to improve their practicability and access to reality. These types of devices are very expensive, as the Route C7200 costs between 100 million to almost 1 billion, and the ASA5505 firewall costs about 150 millionn.**

Key words- Gns3; C7200; VMware; ASA; VirtualBox..

I. INTRODUCTION

Nowadays, the information technology industry develops at a fast pace. Along with the strong development of global network, the construction of network is becoming increasingly necessary for individuals, businesses, schools .... Therefore, the simulation of network before putting it into practice becomes even more urgent and important.

With strong development of network emulation software, it is necessary to build the system before deploying it in reality. In particular, Gns3, vmware and Oracle VM VirtualBox softwares ensure system simulation.

Gns3 software [1][2][3] allows building netwok system. Simulation of Cisco Router, firewall ASA, Juniper... use real IOS device. Checking the device configuration before entering the real system.

Vmware Workstation software is the one that creates a virtual machine system, helping students build a local network before implementing it.

Oracle VM VirtualBox software is similar to VMware to help students create virtual machine systems that operate in the local network model.

Currently, with the expensive cost of Cisco, Juniper, Server hardware devices.... it is hard for the School to invest in practical equipment system for students to meet the needs of accessing the enterprise system of the school. Therefore, in this lesson I offer a solution to combine the current network emulation software such as Gns3, VMware Workstation, Oracle VM VirtualBox ... to simulate and build a real network to help students approach practice. Performance of simulation system includes:

- Building Network Systems on Gns3 2.1rc software connecting to the Internet and server system via VMware Workstation Pro 15 and Oracle VM VirtualBox 6.
- Building Network Application based on VMware Workstaion and Oracle VM VirtualBox.
- Vmware Workstation builds DC Domain Controller system, manages user account authentication.
- Oracle VM VirtualBox builds a Web Server and FTP Server system on the DMZ domain..

The remainder of the article is organized as follows: Part 2 Describing related issues. Building the virtual system on simulation software described in Part 3. Part 4 describing the actual system implementation and results. Conclusion and further research directions in Part 5.

II. RELATED ISSUES

A. Gns3 2.1rc software

Gns3 is simulation software for learning and research computer network. Gns3 is an indispensable piece of network construction and development and has been in use since 2008.

Gns3 is an open source, free software which can be downloaded from http://gns3.com.

Gns3 is a network emulation software with graphic interface. Gns3 based on Dynamips is part of Dynagen, developed from Python and through PyQt and the graphical interface using the Qt library. Gns3 also uses SVG techniques to design the model.

GNS3 has allowed network engineers to virtualize real hardware devices for over 10 years. Initially only on Cisco devices using Dynamips software, GNS3 developed and supported many devices from network providers including Cisco virtual switches, Cisco ASAs, Brocade vRouters, Cumulus Linux switches, Docker devices, HPE VSRs,

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 9 Issue 06, June-2020

feature-rich Linux devices and more. List of devices that can be configured on gns3 https://gns3.com/marketplace/appliances.

For Gns3 to expand the network connection to virtual machine software.

Gns3 includes two parts

- GNS3-all-in-one (GUI)
- GNS3 virtual machine (VM)

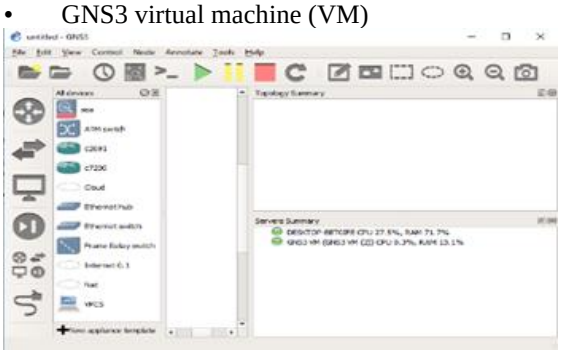

Figure 1. Gns3 software interface

B. Introduction to Vmware Workstation

VMware Workstation is a computer virtualization software that allows us to install multiple operating systems on a single physical machine.

VMware Workstation provides memory optimization and multi-layer device management capabilities. Features of Virtual network, live screen capture, folder sharing and PXE support make VMware Workstation a powerful simulation tool of virtual machine system.

VMware Workstation allows multiple operating systems and applications to run at the same time on physical machines. These operating systems and applications run independently in virtual machines. Virtual machines also have a separate hardware system; the layers on VMware will connect to the physical hardware of the virtual machines, so each machine will have its own CPU, RAM, HDD, CD-rom ...

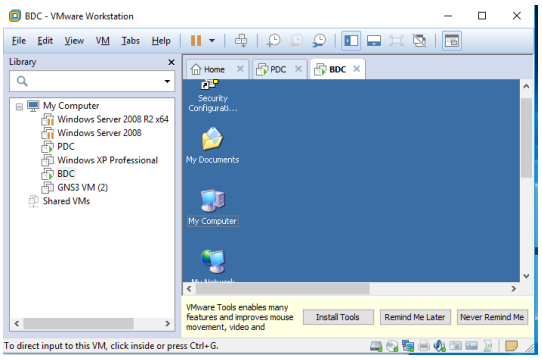

Figure 2. Virtual machine system interface on VMware

Key features of VMware

- Setting up and testing network applications
- Easily recovering and sharing emulated environments. Minimizing duplicate devices and set time.
- Being favorable for students to study and experiment with new environments. Safe and independent application of computer tools.
- Support for multiple screens. Each virtual machine runs on a separate screen.

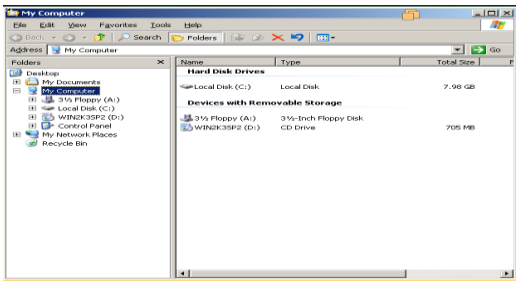

Figure 3. Unity interface virtual machine system on VMware

Advantages and disadvantages of VMware

- Advantages

- High security between virtual machines running independently of each other

- Physical resources are fully protected because virtual machines have virtual devices

- It is possible to get unsafe data sources on the internet for testing without affecting the real machine.

- Reducing costs for users

- Disadvantages

- If losing control of real computer, it is possible to lose control of all virtual computers

- Low-configuration machines with multiple virtual machines installed will make the processor run slowly and affect other programs.

C. Introduction to Oracle VM VirtualBox

Like VMware Workstation, the software creates a virtual machine on a physical machine.

Oracle VM VirtualBox [4] is freeware and slighter to use than VMware.

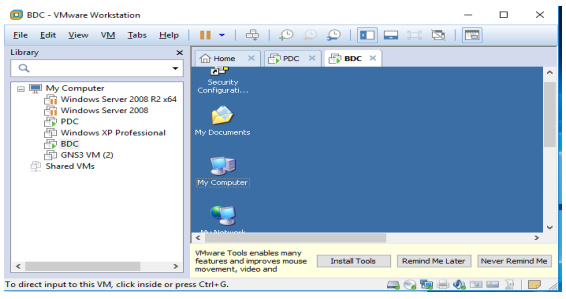

Figure 4. Virtual machine interface on Virtual

- Portability:

No requirement for hardware features

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ISSN: 2278-0181
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Guest Additions: folder share, 3D virtualization. The virtual machine automatically adjusts the resolution according to the video.

- Maximum support hardware:

Guest multiprocessing (SMP) supports up to 32 CPUs per virtual machine; Hardware compatibility; Full support for ACPI; Multiscreen solution: VirtualBox virtual machine supports screen resolution many times compared to a physical screen; Built-in supports iSCSI; Starting PXE network.

VM Groups: VirtualBox allows users to organize and control virtual machines, as well as individuals.

Multigeneration branched snapshots: VirtualBox can store arbitrary snapshots of virtual machine states.

Remote machine display: allows remote to any virtual machine. Supporting Remote Desktop Protocol (RDP); besides it also supports USB for clients when connected to the virtual machine.

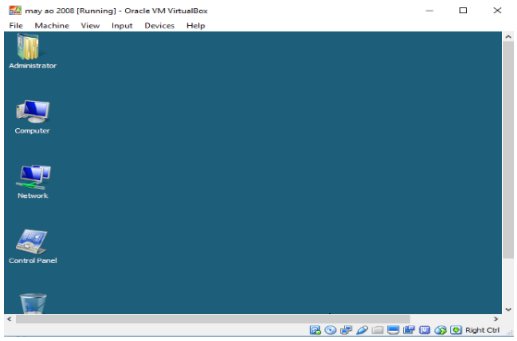

Figure 5. RDP feature on VirtualBox

- Advantages

Advantages; VirtualBox is open source, free software; Slight to use; Maximum support hardware.

- Disadvantages

VirtualBox is free software with no drag and drop feature between real and virtual machines.

VirtualBox lacks support more than paid software).

III. BUILDING SIMULATION VIRTUAL NETWORK SYSTEM ON NETWORK EMULATION SOFTWARE

In this section, I will describe how to build a virtual network.

The Network Systems system on Gns3 2.0.3 combines the Network Application system on VMware and VirtualBox virtual machine software

A. *Aimed solution*

Building Network Systems based on Gns3 2.1rc system including a router cisco 7200 and a CiscoASAv9.7.1-1 to build Application system with:

- Web Server and FTP Server running on Oracle VM VirtualBox software in the DMZ domain on ASA firewall.
- Server Domain controlle runs on VMware Workstation 12 virtual machine software which is located in the internal domain on ASA firewall.

The above solutions are aimed to:

- Saving investment costs in practical equipment for students.
- Building a network to help students approach practice.
- Increasing the ability to practice to ensure the system completion before actual implementation

B. *Application model*

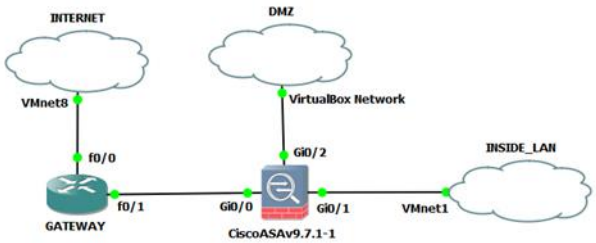

Figure 6. System model on Gns3 2.1rc

The system includes in Figure 6 :

- 01 GATEWAY router routes to the internet.
- 01 CiscoASAv9.7.1-1 configures the DMZ and INTERNAL zones to connect to the internet
- DMZ connects to Web server and FTP server on Oracle VM VirtualBox.
- INSIDE_LAN connects to the server on VMware Workstation Pro 12.5

C. *System deployment.*

Network System Router C7200 Configuration

C7200(config)#hostname GATEWAY

GATEWAY(config)#interface fastEthernet 0/0

GATEWAY(config-if)#ip address dhcp

GATEWAY(config-if)#no shutdown

GATEWAY(config)#interface fastEthernet 0/1

GATEWAY(config-if)#ip address 192.168.10.1 255.255.255.0

GATEWAY(config-if)#no shutdown

Configuration on ASA

ASA(config)#interface Gi0/0

ASA(config-if)#ip address 192.168.10.2 255.255.255.0

ASA(config-if)#nameif outside

ASA (config-if)#no shutdown

ASA(config)#interface Gi0/1

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ASA(config-if)#ip address 192.168.100.1 255.255.255.0

ASA(config-if)#nameif inside

ASA (config-if)#no shutdown

ASA(config)#interface G 0/2

ASA(config-if)#ip address 192.168.110.1 255.255.255.0

ASA(config-if)#nameif DMZ

ASA (config-if)#no shutdown

Configure routing on ASA

ASA(config)#route outside 0 0 192.168.10.1

Configure NaT on ASA

ASA(config)#object network lantonet

ASA(config-network-object)#subnet 192.168.100.0 255.255.255.0

ASA(config-network-object)#nat (inside,outside) dynamic interface

ASA(config)#static (DMZ,outside) 192.168.10.10 192.168.110.10

Configure access to the DMZ area

ASA(config)#access-list web_ftp permit tcp any host 192.168.10.10 eq 80

ASA(config)#access-list web_ftp permit tcp any host 192.168.10.10 eq 21

ASA(config)#access-group web_ftp in interface outside.

D. Network Application System

Installing IIS and FTP server on Oracle VM VirtualBox in figure 7.

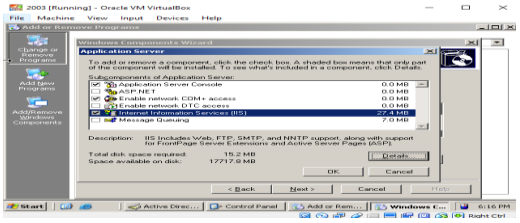

Figure 7. IIS, FTP installation on VirtualBox server

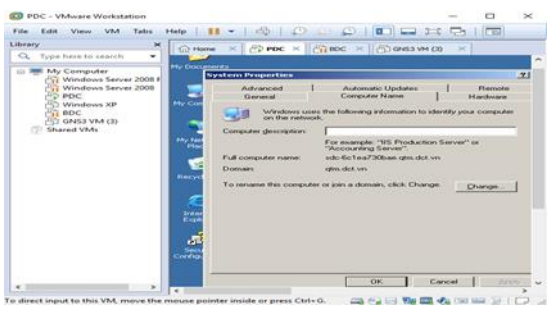

Figure 8. Upgrading Domain controller system on VMware

IV. RESULTS OF SYSTEM SIMULATION

A. Network system

Checking ip on GATEWAY router in figure 9.

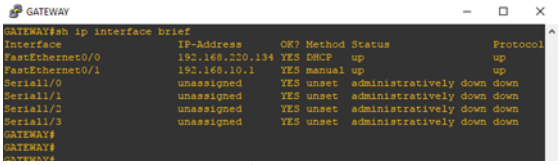

Figure 9: Ip address information on GATEWAY router

Figure 10, Checking the network connection on the GATEWAY router with the ping command to the server goolge.com

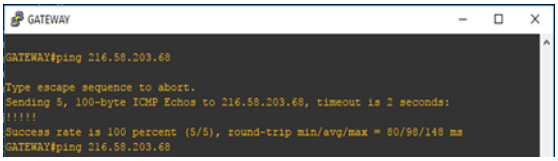

Figure 10. Checking connection from GATEWAY to the internet

Checking the address on ASA in Figure 11.

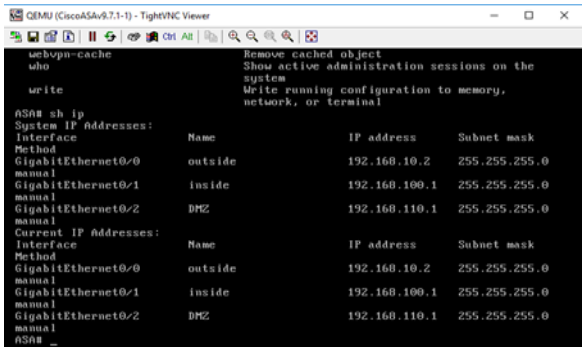

Figure 11. Information of ip address on ASA Firewall

B. Network Application System

Checking on the jointed work domain and internet domain

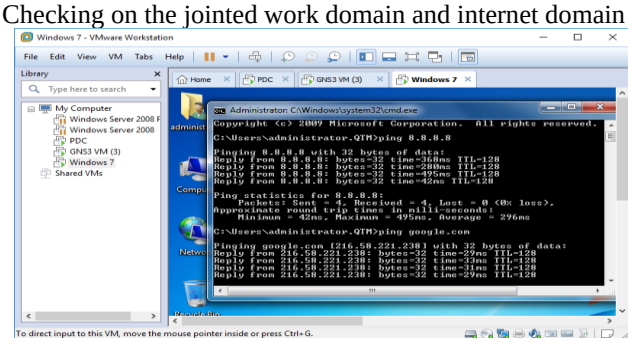

Figure 12. Check connection from INSIDE to INTERNET

Checking the ping of network traffic between the Inside area on VMware to the DMZ area on the Oracle VM VirtualBox.

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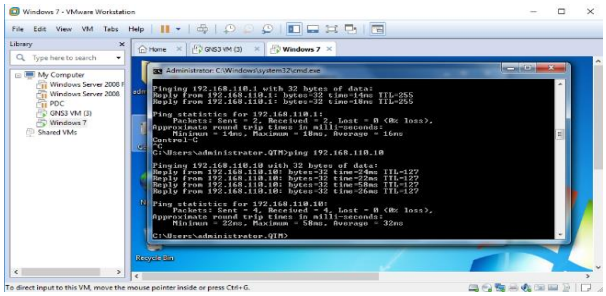

Figure 13. Checking connection from INSIDE to DMZ

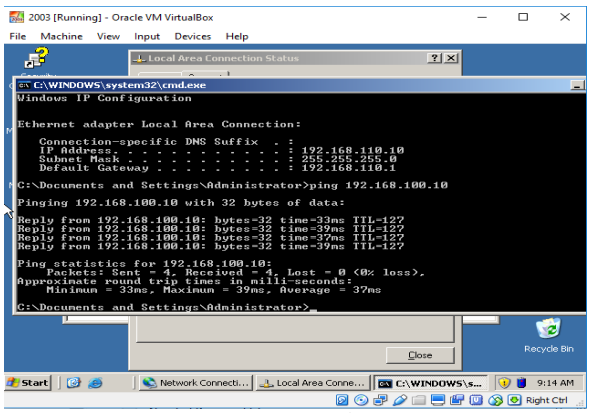

Figure 14. Checking connection from DMZ to INSIDE

The system simulation results show that the combination of network simulation software allows us to build a complete network

V. CONCLUSION AND DIRECTION FOR PROSPECTIVE DEVELOPMENT

Through this article, we see the combination of system simulation software and applications.

Help students have more learning environment. Building and deploying network systems to meet social needs.

Quick access to new types of equipment from many manufacturers: Cisco, Juniper.... with expensive equipment. Quick update of new operating systems.

By building and evaluating the results of the system, we will develop a connection system between the Network System GNS3 software and the computer system in the real system.

Building server systems based on Vmware Pro or VirtaulBox connected to the computer system in the real system.

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